Appendixes

A. Traffic Analysis
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Appendix A

Traffic Analysis

Note to Reader:

The original Traffic and Air Quality analyses were prepared to evaluate three action alternatives that were based on different roadway alignments from the new bridge to Folsom-Auburn Road. Subsequent to preparation of the resulting reports, the alternatives were reformulated based on different roadway and intersection designs, using only one roadway alignment from East Natoma to Folsom-Auburn Road. While the original Traffic and Air Quality analyses/reports were modified slightly to try and address the new designs, the basic analyses still reflect the earlier approach. However, the information in both reports is still applicable to the current three alternatives based on alignment.

Existing Conditions

Level of Service Technical Calculations

HCM Signalized Intersection Capacity Analysis
1: Douglas Blvd & Folsom-Auburn Rd

6/24/2005

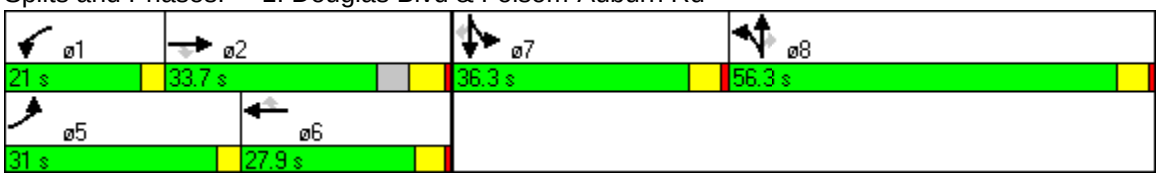
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98	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	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1554	1770	3539	1536	3433	1863	1555	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1554	1770	3539	1536	3433	1863	1555	1770	3539	1563
Volume (vph)	143	136	510	97	302	76	940	254	32	73	469	366
Peak-hour factor, PHF	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84
Adj. Flow (vph)	170	162	607	115	360	90	1119	302	38	87	558	436
RTOR Reduction (vph)	0	0	500	0	0	77	0	0	23	0	0	235
Lane Group Flow (vph)	170	162	107	115	360	13	1119	302	15	87	558	201
Confl. Peds. (#/hr)						2			4			
Confl. Bikes (#/hr)			5			2			1			1
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	11.6	16.6	16.6	8.7	14.5	14.5	39.3	39.3	39.3	20.2	20.2	20.2
Effective Green, g (s)	10.6	18.3	18.3	7.7	15.4	15.4	40.6	40.6	40.6	21.5	21.5	21.5
Actuated g/C Ratio	0.10	0.18	0.18	0.07	0.15	0.15	0.39	0.39	0.39	0.21	0.21	0.21
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	180	622	273	131	524	227	1339	727	606	366	731	323
v/s Ratio Prot	c0.10	0.05		0.06	c0.10		c0.33	0.16		0.05	c0.16	
v/s Ratio Perm			c0.07			0.01			0.01			0.13
v/c Ratio	0.94	0.26	0.39	0.88	0.69	0.06	0.84	0.42	0.02	0.24	0.76	0.62
Uniform Delay, d1	46.5	37.1	38.0	47.7	42.1	38.1	28.7	23.1	19.6	34.5	38.9	37.6
Progression 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
Incremental Delay, d2	50.3	0.1	0.3	42.6	3.0	0.0	4.5	0.1	0.0	0.1	4.3	2.7
Delay (s)	96.8	37.1	38.3	90.3	45.0	38.2	33.2	23.3	19.6	34.6	43.2	40.3
Level of Service	F	D	D	F	D	D	C	C	B	C	D	D
Approach Delay (s)		48.7			53.2			30.8			41.3	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	40.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	104.1	Sum of lost time (s)	20.0
Intersection Capacity Utilization	70.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	21	33.7	31	27.9	36.3	56.3
Maximum Split (%)	13.9%	22.2%	20.5%	18.4%	24.0%	37.2%
Minimum Split (s)	8	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	21	0	31	58.9	95.2
End Time (s)	21	58.9	31	58.9	95.2	0
Yield/Force Off (s)	18	53.2	28	54	89.9	146.2
Yield/Force Off 170(s)	18	43.2	28	44	79.9	146.2
Local Start Time (s)	130.5	0	130.5	10	37.9	74.2
Local Yield (s)	148.5	32.2	7	33	68.9	125.2
Local Yield 170(s)	148.5	22.2	7	23	58.9	125.2

Intersection Summary	
Cycle Length	151.5
Control Type	Actuated-Uncoordinated
Natural Cycle	105

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	1.00			1.00	1.00
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				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)		1770	1547				1770	1863			1863	1551
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1547				1770	1863			1863	1551
Volume (vph)	142	0	98	0	0	0	48	1073	0	0	1041	105
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	161	0	111	0	0	0	55	1219	0	0	1183	119
RTOR Reduction (vph)	0	0	97	0	0	0	0	0	0	0	0	11
Lane Group Flow (vph)	0	161	14	0	0	0	55	1219	0	0	1183	108
Confl. Bikes (#/hr)			1			1						1
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		17.0	17.0				6.8	111.2			100.4	100.4
Effective Green, g (s)		17.0	17.0				6.8	112.7			101.9	101.9
Actuated g/C Ratio		0.12	0.12				0.05	0.82			0.74	0.74
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		219	191				87	1525			1379	1148
v/s Ratio Prot		c0.09					0.03	c0.65			c0.64	
v/s Ratio Perm			0.01									0.07
v/c Ratio		0.74	0.07				0.63	0.80			0.86	0.09
Uniform Delay, d1		58.2	53.4				64.2	6.6			12.7	5.0
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		12.1	0.2				10.5	2.9			5.4	0.0
Delay (s)		70.2	53.5				74.7	9.5			18.2	5.0
Level of Service		E	D				E	A			B	A
Approach Delay (s)		63.4			0.0			12.3			17.0	
Approach LOS		E			A			B			B	

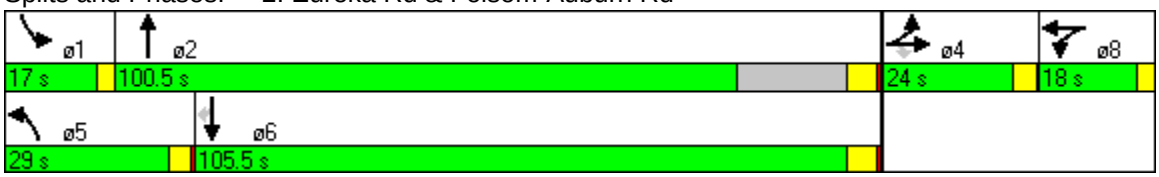
Intersection Summary			
HCM Average Control Delay	19.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	137.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



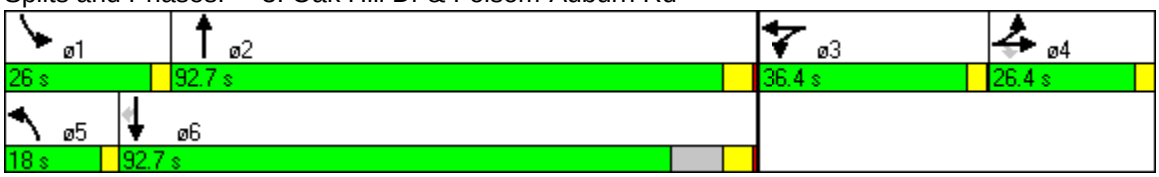
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.94		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
Frt		1.00	0.85		0.99		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1785	1495		1767		1770	1862		1770	1863	1583
Flt Permitted		0.96	1.00		0.97		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1785	1495		1767		1770	1862		1770	1863	1583
Volume (vph)	19	3	52	7	2	1	27	1081	2	4	1117	23
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	20	3	55	7	2	1	29	1150	2	4	1188	24
RTOR Reduction (vph)	0	0	53	0	1	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	23	2	0	9	0	29	1152	0	4	1188	22
Confl. Peds. (#/hr)			3			2						
Confl. Bikes (#/hr)			3			1			3			
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		5.8	5.8		2.9		3.7	91.0		3.9	91.2	91.2
Effective Green, g (s)		5.2	5.2		2.3		2.7	92.7		2.9	92.9	92.9
Actuated g/C Ratio		0.04	0.04		0.02		0.02	0.78		0.02	0.78	0.78
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		78	65		34		40	1449		43	1453	1235
v/s Ratio Prot		c0.01			c0.01		c0.02	0.62		0.00	c0.64	
v/s Ratio Perm			0.00									0.01
v/c Ratio		0.29	0.04		0.27		0.72	0.80		0.09	0.82	0.02
Uniform Delay, d1		55.2	54.6		57.6		57.8	7.7		56.8	8.0	2.9
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.8	0.1		1.5		42.4	2.9		0.3	3.5	0.0
Delay (s)		55.9	54.6		59.1		100.2	10.6		57.2	11.5	2.9
Level of Service		E	D		E		F	B		E	B	A
Approach Delay (s)		55.0			59.1			12.8			11.4	
Approach LOS		E			E			B			B	

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	119.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



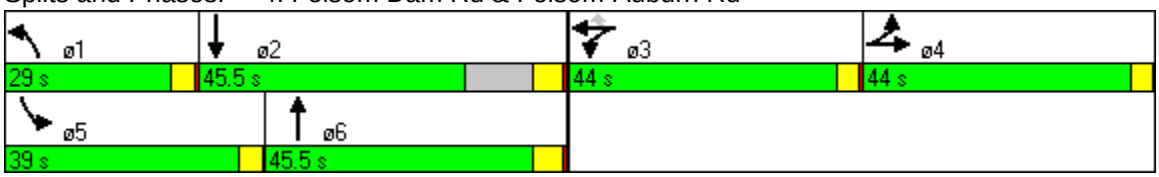
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	0.95		1.00	0.95	
Frt		0.94			1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.97			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1709			1770	1583	1770	3528		1770	3528	
Flt Permitted		0.97			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1709			1770	1583	1770	3528		1770	3528	
Volume (vph)	39	1	29	13	0	4	17	1100	24	9	1184	25
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	43	1	32	14	0	4	19	1222	27	10	1316	28
RTOR Reduction (vph)	0	18	0	0	0	4	0	0	0	0	0	0
Lane Group Flow (vph)	0	58	0	0	14	0	19	1249	0	10	1344	0
Turn Type	Split			Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases						3						
Actuated Green, G (s)		8.7			3.3	3.3	2.3	64.9		1.1	63.7	
Effective Green, g (s)		8.7			3.3	3.3	2.3	66.4		1.1	65.2	
Actuated g/C Ratio		0.09			0.03	0.03	0.02	0.70		0.01	0.68	
Clearance Time (s)		4.0			4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0			1.0	1.0	1.0	4.7		1.5	5.4	
Lane Grp Cap (vph)		156			61	55	43	2453		20	2409	
v/s Ratio Prot		c0.03			c0.01		c0.01	0.35		0.01	c0.38	
v/s Ratio Perm						0.00						
v/c Ratio		0.37			0.23	0.00	0.44	0.51		0.50	0.56	
Uniform Delay, d1		40.8			44.9	44.5	46.0	6.9		46.9	7.8	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.5			0.7	0.0	2.6	0.3		7.0	0.5	
Delay (s)		41.4			45.6	44.5	48.6	7.2		53.9	8.3	
Level of Service		D			D	D	D	A		D	A	
Approach Delay (s)		41.4			45.3			7.8			8.6	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	9.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	95.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	NBL	SBT	WBTL	EBTL	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	45.5	44	44	39	45.5
Maximum Split (%)	16.8%	26.4%	25.5%	25.5%	22.6%	26.4%
Minimum Split (s)	5	23.5	12	28	6	12.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1
Minimum Initial (s)	1	7	8	2	2	7
Vehicle Extension (s)	1	5.4	1	1	1.5	4.7
Minimum Gap (s)	1	3.8	1	1	1.5	3.1
Time Before Reduce (s)	0	10	0	0	0	10
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)		7		7		
Flash Dont Walk (s)		11		17		
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	84.5	128.5	0	39
End Time (s)	29	84.5	128.5	0	39	84.5
Yield/Force Off (s)	25	79	124.5	168.5	35	79
Yield/Force Off 170(s)	25	79	124.5	151.5	35	79
Local Start Time (s)	133.5	162.5	45.5	89.5	133.5	0
Local Yield (s)	158.5	40	85.5	129.5	168.5	40
Local Yield 170(s)	158.5	40	85.5	112.5	168.5	40

Intersection Summary	
Cycle Length	172.5
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		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	
Frt		0.88			0.97		1.00	1.00		1.00	0.99	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1632			1738		1770	3535		1770	3517	
Flt Permitted		0.96			0.42		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1568			747		1770	3535		1770	3517	
Volume (vph)	66	5	517	40	4	13	183	1155	9	5	1300	50
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	69	5	544	42	4	14	193	1216	9	5	1368	53
RTOR Reduction (vph)	0	161	0	0	7	0	0	0	0	0	2	0
Lane Group Flow (vph)	0	457	0	0	53	0	193	1225	0	5	1419	0
Confl. Bikes (#/hr)						1						2
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4			4								
Actuated Green, G (s)		40.6			40.6		18.8	80.8		1.1	63.1	
Effective Green, g (s)		42.3			42.3		19.5	83.0		1.8	65.3	
Actuated g/C Ratio		0.30			0.30		0.14	0.60		0.01	0.47	
Clearance Time (s)		5.7			5.7		4.7	6.2		4.7	6.2	
Vehicle Extension (s)		3.0			3.0		2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)		477			227		248	2109		23	1651	
v/s Ratio Prot							c0.11	0.35		0.00	c0.40	
v/s Ratio Perm		c0.29			0.07							
v/c Ratio		0.96			0.23		0.78	0.58		0.22	0.86	
Uniform Delay, d1		47.5			36.3		57.7	17.3		68.0	32.8	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		30.2			0.5		13.1	0.5		1.7	4.9	
Delay (s)		77.7			36.8		70.8	17.8		69.7	37.7	
Level of Service		E			D		E	B		E	D	
Approach Delay (s)		77.7			36.8			25.0			37.8	
Approach LOS		E			D			C			D	

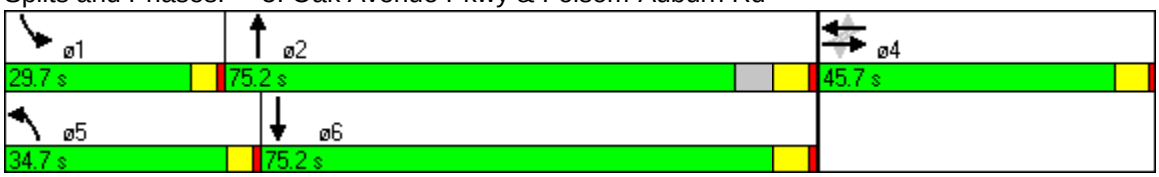
Intersection Summary			
HCM Average Control Delay	39.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	139.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	92.7%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6
Movement	SBL	NBT	EBWB	NBL	SBT
Lead/Lag	Lead	Lag		Lead	Lag
Lead-Lag Optimize	Yes	Yes		Yes	Yes
Recall Mode	None	Min	None	None	Min
Maximum Split (s)	29.7	75.2	45.7	34.7	75.2
Maximum Split (%)	19.1%	48.3%	29.4%	22.3%	48.3%
Minimum Split (s)	6.7	13.2	32.7	6.7	13.2
Yellow Time (s)	3.5	5	4.5	3.5	5
All-Red Time (s)	1.2	1.2	1.2	1.2	1.2
Minimum Initial (s)	2	7	3	2	7
Vehicle Extension (s)	2	3.8	3	2	3.8
Minimum Gap (s)	2	2.4	3	2	2.4
Time Before Reduce (s)	0	10	0	0	10
Time To Reduce (s)	0	20	0	0	20
Walk Time (s)			7		
Flash Dont Walk (s)			20		
Dual Entry	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.7	109.9	0	34.7
End Time (s)	29.7	109.9	0	34.7	109.9
Yield/Force Off (s)	25	103.7	149.9	30	103.7
Yield/Force Off 170(s)	25	103.7	129.9	30	103.7
Local Start Time (s)	120.9	150.6	75.2	120.9	0
Local Yield (s)	145.9	69	115.2	150.9	69
Local Yield 170(s)	145.9	69	95.2	150.9	69

Intersection Summary	
Cycle Length	155.6
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



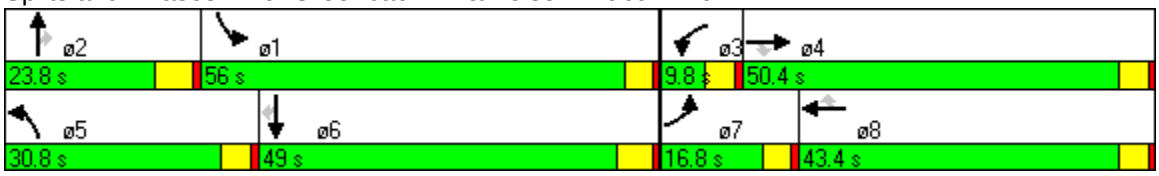
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	106	688	959	11	732	622	296	488	1	427	1494	47
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	118	764	1066	12	813	691	329	542	1	474	1660	52
RTOR Reduction (vph)	0	0	241	0	0	479	0	0	1	0	0	14
Lane Group Flow (vph)	118	764	825	12	813	212	329	542	0	474	1660	38
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	11.5	51.8	51.8	2.1	42.4	42.4	17.3	15.6	15.6	51.5	49.8	49.8
Effective Green, g (s)	12.0	52.3	52.3	2.6	42.9	42.9	17.8	17.1	17.1	52.0	51.3	51.3
Actuated g/C Ratio	0.09	0.37	0.37	0.02	0.31	0.31	0.13	0.12	0.12	0.37	0.37	0.37
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	152	1322	591	33	1084	485	436	432	193	657	1297	580
v/s Ratio Prot	c0.07	0.22		0.01	0.23		0.10	c0.15		0.27	c0.47	
v/s Ratio Perm			c0.52			0.13			0.00			0.02
v/c Ratio	0.78	0.58	1.40	0.36	0.75	0.44	0.75	1.25	0.00	0.72	1.28	0.07
Uniform Delay, d1	62.7	35.0	43.8	67.9	43.7	38.9	59.0	61.4	53.9	37.8	44.4	28.8
Progression 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
Incremental Delay, d2	19.9	0.4	188.7	2.5	2.6	0.2	6.5	132.4	0.0	3.3	132.0	0.2
Delay (s)	82.6	35.4	232.5	70.4	46.3	39.1	65.5	193.8	54.0	41.1	176.3	29.0
Level of Service	F	D	F	E	D	D	E	F	D	D	F	C
Approach Delay (s)		146.1			43.2			145.2			143.5	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	121.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.32		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	114.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	56	23.8	9.8	50.4	30.8	49	16.8	43.4
Maximum Split (%)	40.0%	17.0%	7.0%	36.0%	22.0%	35.0%	12.0%	31.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
End Time (s)	61.5	5.5	71.3	121.7	12.5	61.5	78.3	121.7
Yield/Force Off (s)	57	0	66.8	117.2	8	56	73.8	117.2
Yield/Force Off 170(s)	57	117	66.8	92.2	8	37	73.8	92.2
Local Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
Local Yield (s)	57	0	66.8	117.2	8	56	73.8	117.2
Local Yield 170(s)	57	117	66.8	92.2	8	37	73.8	92.2

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	125
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1831	1545	1681	1681	1561	1770	4956		1770	3539	1550
Flt Permitted		0.98	1.00	0.95	0.95	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1831	1545	1681	1681	1561	1770	4956		1770	3539	1550
Volume (vph)	8	15	20	161	0	148	4	654	133	262	2214	3
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	9	17	22	179	0	164	4	727	148	291	2460	3
RTOR Reduction (vph)	0	0	21	0	0	113	0	11	0	0	0	1
Lane Group Flow (vph)	0	26	1	90	89	51	4	864	0	291	2460	2
Confl. Bikes (#/hr)			2			1						2
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		4.1	4.1	12.7	12.7	12.7	0.9	67.6		23.9	90.6	90.6
Effective Green, g (s)		4.6	4.6	13.2	13.2	13.2	1.4	70.1		24.4	93.1	93.1
Actuated g/C Ratio		0.04	0.04	0.10	0.10	0.10	0.01	0.55		0.19	0.73	0.73
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		66	55	173	173	161	19	2708		337	2568	1125
v/s Ratio Prot		c0.01		c0.05	0.05		0.00	0.17		c0.16	c0.70	
v/s Ratio Perm			0.00			0.03						0.00
v/c Ratio		0.39	0.01	0.52	0.51	0.32	0.21	0.32		0.86	0.96	0.00
Uniform Delay, d1		60.5	59.7	54.5	54.5	53.4	62.9	16.0		50.3	15.8	4.8
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.4	0.0	1.3	1.1	0.4	2.0	0.1		19.2	10.0	0.0
Delay (s)		61.9	59.7	55.8	55.6	53.8	64.9	16.1		69.6	25.8	4.8
Level of Service		E	E	E	E	D	E	B		E	C	A
Approach Delay (s)		60.9			54.8			16.3			30.4	
Approach LOS		E			D			B			C	

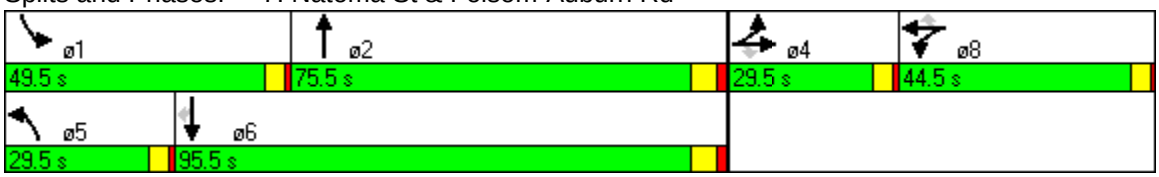
Intersection Summary			
HCM Average Control Delay	29.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	128.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	149.5	0	75.5	149.5	179	105
Local Yield (s)	194.5	69	100.5	174.5	69	145
Local Yield 170(s)	194.5	69	100.5	174.5	69	122

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



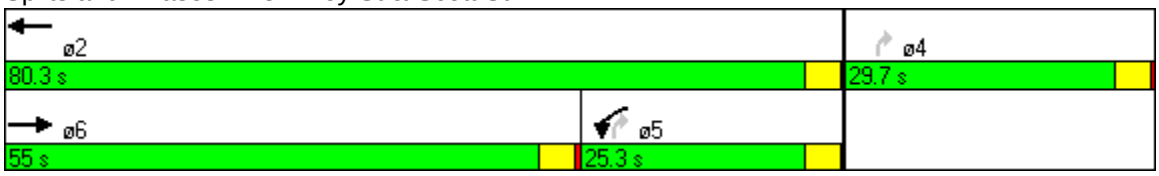
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	0.95		1.00	1.00		1.00
Frt	1.00		1.00	1.00		0.86
Flt Protected	1.00		0.95	1.00		1.00
Satd. Flow (prot)	3538		1770	1863		1611
Flt Permitted	1.00		0.95	1.00		1.00
Satd. Flow (perm)	3538		1770	1863		1611
Volume (vph)	1376	3	9	1107	0	4
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1529	3	10	1230	0	4
RTOR Reduction (vph)	0	0	0	0	0	3
Lane Group Flow (vph)	1532	0	10	1230	0	1
Turn Type			Prot			custom
Protected Phases	6		5	2		
Permitted Phases						4 5
Actuated Green, G (s)	85.9		8.5	98.4		16.1
Effective Green, g (s)	85.9		8.5	98.4		16.1
Actuated g/C Ratio	0.78		0.08	0.89		0.15
Clearance Time (s)	4.0		4.0	4.0		
Vehicle Extension (s)	2.8		2.4	2.8		
Lane Grp Cap (vph)	2763		137	1667		236
v/s Ratio Prot	0.43		0.01	c0.66		
v/s Ratio Perm						c0.00
v/c Ratio	0.55		0.07	0.74		0.00
Uniform Delay, d1	4.7		47.1	1.8		40.1
Progression Factor	0.58		1.00	1.00		1.00
Incremental Delay, d2	0.7		0.1	3.0		0.0
Delay (s)	3.4		47.2	4.8		40.1
Level of Service	A		D	A		D
Approach Delay (s)	3.4			5.1	40.1	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	4.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	WBT	NBR	WBL	EBT
Lead/Lag			Lag	Lead
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	80.3	29.7	25.3	55
Maximum Split (%)	73.0%	27.0%	23.0%	50.0%
Minimum Split (s)	11	22	22	21
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	8	4	7
Vehicle Extension (s)	2.8	2.5	2.4	2.8
Minimum Gap (s)	2.4	2.4	2.4	2.4
Time Before Reduce (s)	18	18	18	18
Time To Reduce (s)	25	25	25	25
Walk Time (s)		7	7	7
Flash Dont Walk (s)		11	11	10
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	73	43.3	18	73
End Time (s)	43.3	73	43.3	18
Yield/Force Off (s)	39.3	69	39.3	14
Yield/Force Off 170(s)	39.3	58	28.3	4
Local Start Time (s)	59	29.3	4	59
Local Yield (s)	25.3	55	25.3	0
Local Yield 170(s)	25.3	44	14.3	100

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 14 (13%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



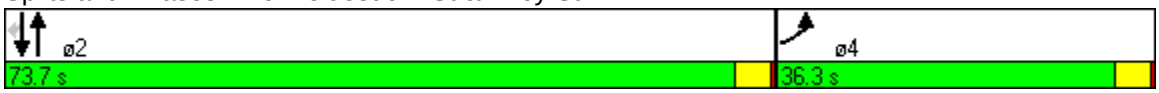
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.96			1.00	1.00	0.85
Flt Protected	0.97			1.00	1.00	1.00
Satd. Flow (prot)	3337			3539	1863	1583
Flt Permitted	0.97			1.00	1.00	1.00
Satd. Flow (perm)	3337			3539	1863	1583
Volume (vph)	31	13	0	1348	1038	69
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	34	14	0	1498	1153	77
RTOR Reduction (vph)	13	0	0	0	0	8
Lane Group Flow (vph)	35	0	0	1498	1153	69
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	6.0			96.0	96.0	96.0
Effective Green, g (s)	6.0			96.0	96.0	96.0
Actuated g/C Ratio	0.05			0.87	0.87	0.87
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	182			3089	1626	1382
v/s Ratio Prot	c0.01			0.42	c0.62	
v/s Ratio Perm						0.04
v/c Ratio	0.19			0.48	0.71	0.05
Uniform Delay, d1	49.7			1.5	2.3	0.9
Progression Factor	1.00			0.21	0.90	1.52
Incremental Delay, d2	0.5			0.0	1.9	0.0
Delay (s)	50.1			0.4	4.0	1.5
Level of Service	D			A	A	A
Approach Delay (s)	50.1			0.4	3.8	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	2.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.68		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	73.7	36.3
Maximum Split (%)	67.0%	33.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	54.3	18
End Time (s)	18	54.3
Yield/Force Off (s)	14	50.3
Yield/Force Off 170(s)	6	40.3
Local Start Time (s)	40.3	4
Local Yield (s)	0	36.3
Local Yield 170(s)	102	26.3

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 14 (13%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



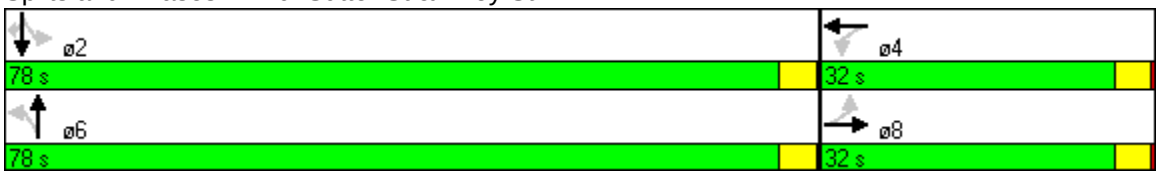
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1710	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		1.00			1.00			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.99			0.97			1.00			1.00	0.85
Flt Protected		0.99			0.97			1.00			1.00	1.00
Satd. Flow (prot)		1815			1745			1545			1816	1512
Flt Permitted		0.91			0.80			1.00			1.00	1.00
Satd. Flow (perm)		1667			1448			1544			1811	1512
Volume (vph)	6	16	2	8	2	3	2	1339	7	3	1046	2
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	7	18	2	9	2	3	2	1488	8	3	1162	2
RTOR Reduction (vph)	0	2	0	0	3	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	25	0	0	11	0	0	1498	0	0	1165	2
Confl. Peds. (#/hr)			8			2						
Confl. Bikes (#/hr)						1			2			1
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		5.5			5.5			96.5			96.5	96.5
Effective Green, g (s)		5.5			5.5			96.5			96.5	96.5
Actuated g/C Ratio		0.05			0.05			0.88			0.88	0.88
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		83			72			1355			1589	1326
v/s Ratio Prot												
v/s Ratio Perm		c0.02			0.01			c0.97			0.64	0.00
v/c Ratio		0.30			0.15			1.11			0.73	0.00
Uniform Delay, d1		50.4			50.0			6.7			2.3	0.8
Progression Factor		1.00			1.00			1.00			0.37	0.67
Incremental Delay, d2		0.8			0.4			58.7			2.2	0.0
Delay (s)		51.1			50.4			65.5			3.1	0.6
Level of Service		D			D			E			A	A
Approach Delay (s)		51.1			50.4			65.5			3.1	
Approach LOS		D			D			E			A	

Intersection Summary			
HCM Average Control Delay	38.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.06		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	99.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



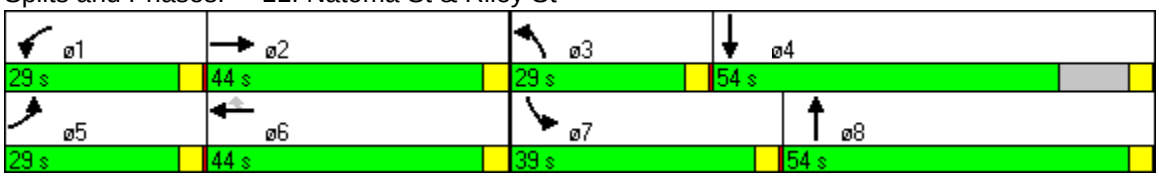
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1810		1770	1863	1583	1770	1856		1770	1862	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1810		1770	1863	1583	1770	1856		1770	1862	
Volume (vph)	12	301	70	48	292	729	16	607	15	410	707	3
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	13	334	78	53	324	810	18	674	17	456	786	3
RTOR Reduction (vph)	0	5	0	0	0	402	0	1	0	0	0	0
Lane Group Flow (vph)	13	407	0	53	324	408	18	690	0	456	789	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	2.7	40.4		7.7	45.4	45.4	4.1	51.8		35.1	82.8	
Effective Green, g (s)	2.7	40.4		7.7	45.4	45.4	4.1	51.8		35.1	82.8	
Actuated g/C Ratio	0.02	0.27		0.05	0.30	0.30	0.03	0.34		0.23	0.55	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	32	484		90	560	476	48	637		411	1021	
v/s Ratio Prot	0.01	0.22		c0.03	0.17		0.01	c0.37		c0.26	0.42	
v/s Ratio Perm						c0.26						
v/c Ratio	0.41	0.84		0.59	0.58	0.86	0.38	1.08		1.11	0.77	
Uniform Delay, d1	73.4	52.3		70.1	44.7	49.7	72.2	49.6		58.0	26.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.0	13.0		6.2	1.8	14.7	1.8	60.5		77.5	4.0	
Delay (s)	76.4	65.3		76.3	46.5	64.4	74.0	110.1		135.4	30.7	
Level of Service	E	E		E	D	E	E	F		F	C	
Approach Delay (s)		65.6			60.1			109.2			69.1	
Approach LOS		E			E			F			E	

Intersection Summary			
HCM Average Control Delay	73.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	151.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	92.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	69	98	150	25	69	108	151
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	40	69	121	162	40	79	122

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	140

Splits and Phases: 11: Natoma St & Riley St



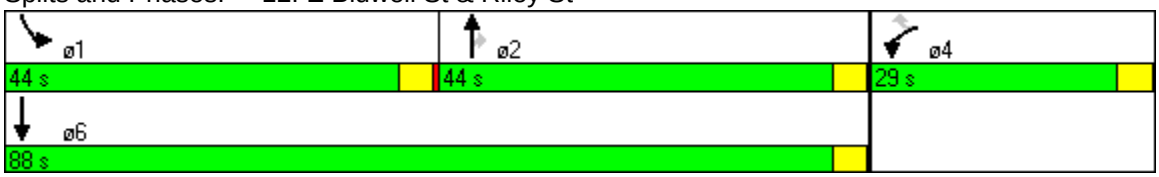
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98	1.00	0.97	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1546	3539	1540	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1546	3539	1540	1770	1863
Volume (vph)	251	443	357	126	412	428
Peak-hour factor, PHF	0.86	0.86	0.86	0.86	0.86	0.86
Adj. Flow (vph)	292	515	415	147	479	498
RTOR Reduction (vph)	0	395	0	119	0	0
Lane Group Flow (vph)	292	120	415	28	479	498
Confl. Peds. (#/hr)		6		7		
Confl. Bikes (#/hr)		7		7		
Turn Type		Perm		Perm	Prot	
Protected Phases	4		2		1	6
Permitted Phases		4		2		
Actuated Green, G (s)	13.6	13.6	11.2	11.2	21.6	36.8
Effective Green, g (s)	13.6	13.6	11.2	11.2	21.6	36.8
Actuated g/C Ratio	0.23	0.23	0.19	0.19	0.37	0.63
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	412	360	679	295	655	1174
v/s Ratio Prot	c0.17		c0.12		c0.27	0.27
v/s Ratio Perm		0.08		0.02		
v/c Ratio	0.71	0.33	0.61	0.10	0.73	0.42
Uniform Delay, d1	20.6	18.6	21.6	19.4	15.9	5.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.5	0.2	1.2	0.1	4.2	0.3
Delay (s)	25.1	18.8	22.8	19.5	20.1	5.7
Level of Service	C	B	C	B	C	A
Approach Delay (s)	21.1		21.9			12.8
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	17.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	58.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize	Yes	Yes		
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	70

Splits and Phases: 12: E Bidwell St & Riley St



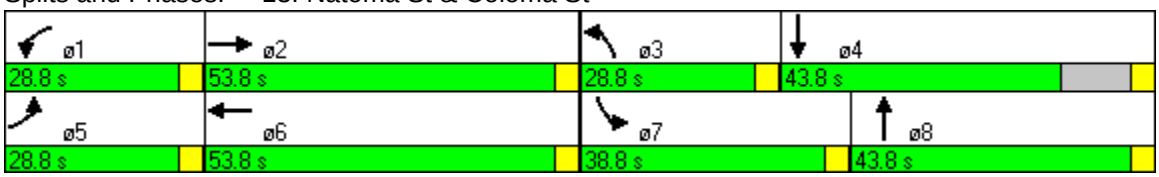
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.91		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1852		1770	1857		1770	1702		1770	1806	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1852		1770	1857		1770	1702		1770	1806	
Volume (vph)	9	671	28	31	930	19	62	26	35	18	40	10
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	10	722	30	33	1000	20	67	28	38	19	43	11
RTOR Reduction (vph)	0	0	0	0	0	0	0	34	0	0	7	0
Lane Group Flow (vph)	10	752	0	33	1020	0	67	32	0	19	47	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.2	55.8		3.2	54.8		4.4	8.5		1.9	6.0	
Effective Green, g (s)	4.0	55.6		3.0	54.6		4.2	8.3		1.7	5.8	
Actuated g/C Ratio	0.05	0.66		0.04	0.65		0.05	0.10		0.02	0.07	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	84	1217		63	1198		88	167		36	124	
v/s Ratio Prot	0.01	0.41		c0.02	c0.55		c0.04	0.02		0.01	c0.03	
v/s Ratio Perm												
v/c Ratio	0.12	0.62		0.52	0.85		0.76	0.19		0.53	0.38	
Uniform Delay, d1	38.6	8.4		40.1	11.8		39.7	35.1		41.1	37.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	1.0		3.6	6.0		28.8	0.2		6.3	0.7	
Delay (s)	38.8	9.3		43.7	17.8		68.5	35.3		47.3	38.4	
Level of Service	D	A		D	B		E	D		D	D	
Approach Delay (s)		9.7			18.6			52.0			40.7	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	84.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.9%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	Min	None	None
Maximum Split (s)	28.8	53.8	28.8	43.8	28.8	53.8	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	17.4%	32.6%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	1	1	7	1	1
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	3	2.4	3	3	3	2.4	3	3
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	28.8	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	28.8	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	25	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	25	78.8	117.6	151.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	0	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	161.4	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	161.4	50	88.8	122.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 13: Natoma St & Coloma St



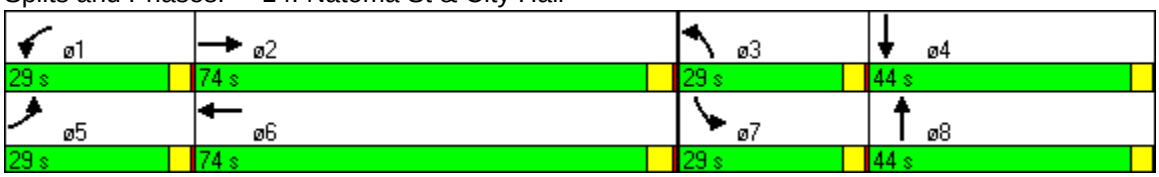
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0			4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00			1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99			0.99	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Frt	1.00	1.00		1.00	1.00		1.00	0.86			0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (prot)	1770	3523		1770	3536		1770	1574			1707	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00			1.00	
Satd. Flow (perm)	1770	3523		1770	3536		1770	1574			1707	
Volume (vph)	2	640	17	73	942	5	82	5	83	0	2	2
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	2	703	19	80	1035	5	90	5	91	0	2	2
RTOR Reduction (vph)	0	1	0	0	0	0	0	75	0	0	2	0
Lane Group Flow (vph)	2	721	0	80	1040	0	90	21	0	0	2	0
Confl. Peds. (#/hr)			1			1			1			1
Confl. Bikes (#/hr)			3			3			2			1
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	0.6	39.7		5.3	44.4		5.5	12.3			2.8	
Effective Green, g (s)	0.6	40.7		5.3	45.4		5.5	12.3			2.8	
Actuated g/C Ratio	0.01	0.58		0.08	0.65		0.08	0.17			0.04	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0			4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0			2.0	
Lane Grp Cap (vph)	15	2040		133	2284		138	275			68	
v/s Ratio Prot	0.00	0.20		c0.05	c0.29		c0.05	c0.01			0.00	
v/s Ratio Perm												
v/c Ratio	0.13	0.35		0.60	0.46		0.65	0.08			0.03	
Uniform Delay, d1	34.6	7.8		31.5	6.2		31.5	24.2			32.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	1.5	0.1		5.2	0.2		8.1	0.0			0.1	
Delay (s)	36.1	7.9		36.6	6.4		39.6	24.3			32.5	
Level of Service	D	A		D	A		D	C			C	
Approach Delay (s)		8.0			8.6			31.7			32.5	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	70.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 14: Natoma St & City Hall



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	0.98	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	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3524		1770	1863	1550		1770	1546	1681	1470	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3524		1770	1863	1550		1770	1546	1681	1470	
Volume (vph)	1	504	13	7	928	2	69	0	8	2	0	2
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	1	536	14	7	987	2	73	0	9	2	0	2
RTOR Reduction (vph)	0	0	0	0	0	0	0	0	8	0	2	0
Lane Group Flow (vph)	1	550	0	7	987	2	0	73	1	2	0	0
Confl. Peds. (#/hr)			1			2			3			1
Turn Type	Prot			Prot		Perm	Split		Perm	Split		
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases						2			3			
Actuated Green, G (s)	1.0	87.8		1.2	88.0	88.0		8.8	8.8	1.0	1.0	
Effective Green, g (s)	1.0	89.3		1.2	89.5	89.5		8.8	8.8	1.5	1.5	
Actuated g/C Ratio	0.01	0.76		0.01	0.77	0.77		0.08	0.08	0.01	0.01	
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5		4.0	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		3.0	3.0	2.0	2.0	
Lane Grp Cap (vph)	15	2694		18	1428	1188		133	116	22	19	
v/s Ratio Prot	0.00	0.16		c0.00	c0.53			c0.04		c0.00	0.00	
v/s Ratio Perm						0.00			0.00			
v/c Ratio	0.07	0.20		0.39	0.69	0.00		0.55	0.01	0.09	0.00	
Uniform Delay, d1	57.4	3.8		57.4	6.8	3.2		52.1	50.0	57.0	56.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.7	0.0		5.0	1.5	0.0		4.6	0.0	0.7	0.0	
Delay (s)	58.1	3.9		62.4	8.2	3.2		56.7	50.0	57.6	56.9	
Level of Service	E	A		E	A	A		E	D	E	E	
Approach Delay (s)		4.0			8.6			55.9			57.3	
Approach LOS		A			A			E			E	

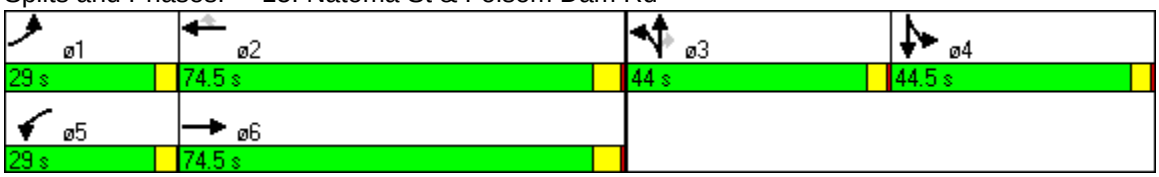
Intersection Summary			
HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	116.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	EBL	WBT	NBTL	SBTL	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	74.5	44	44.5	29	74.5
Maximum Split (%)	15.1%	38.8%	22.9%	23.2%	15.1%	38.8%
Minimum Split (s)	6	12.5	6	25.5	6	28.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	1	0.5	1
Minimum Initial (s)	2	7	2	2	2	7
Vehicle Extension (s)	2	3	3	2	2	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4
Time Before Reduce (s)	0	18	0	0	0	18
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)				7		7
Flash Dont Walk (s)				14		16
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103.5	147.5	0	29
End Time (s)	29	103.5	147.5	0	29	103.5
Yield/Force Off (s)	25	98	143.5	187.5	25	98
Yield/Force Off 170(s)	25	98	143.5	173.5	25	98
Local Start Time (s)	163	0	74.5	118.5	163	0
Local Yield (s)	188	69	114.5	158.5	188	69
Local Yield 170(s)	188	69	114.5	144.5	188	69

Intersection Summary	
Cycle Length	192
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 15: Natoma St & Folsom Dam Rd



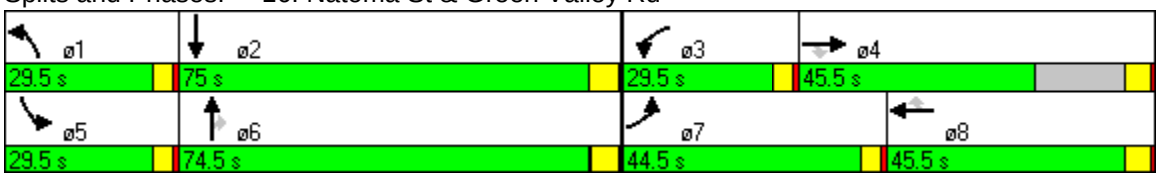
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Volume (vph)	272	94	32	143	172	39	56	168	114	82	702	683
Peak-hour factor, PHF	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Adj. Flow (vph)	320	111	38	168	202	46	66	198	134	96	826	804
RTOR Reduction (vph)	0	0	30	0	0	38	0	0	78	0	0	0
Lane Group Flow (vph)	320	111	8	168	202	8	66	198	56	96	826	804
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	9.0	13.4	13.4	6.5	10.9	10.9	3.3	29.1	29.1	3.7	29.0	72.7
Effective Green, g (s)	9.5	14.9	14.9	7.0	12.4	12.4	3.8	30.6	30.6	4.2	31.0	72.7
Actuated g/C Ratio	0.13	0.20	0.20	0.10	0.17	0.17	0.05	0.42	0.42	0.06	0.43	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	449	725	324	331	604	270	179	1490	666	198	1509	1583
v/s Ratio Prot	c0.09	0.03		0.05	0.06		0.02	0.06		0.03	0.23	
v/s Ratio Perm			0.00			0.00			0.04			c0.51
v/c Ratio	0.71	0.15	0.02	0.51	0.33	0.03	0.37	0.13	0.08	0.48	0.55	0.51
Uniform Delay, d1	30.3	23.7	23.1	31.2	26.5	25.1	33.3	12.9	12.6	33.2	15.6	0.0
Progression 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
Incremental Delay, d2	4.4	0.1	0.0	0.4	0.6	0.1	0.5	0.1	0.1	0.7	0.5	1.2
Delay (s)	34.7	23.9	23.1	31.7	27.1	25.2	33.8	13.0	12.7	33.9	16.1	1.2
Level of Service	C	C	C	C	C	C	C	B	B	C	B	A
Approach Delay (s)		31.2			28.7			16.3			10.1	
Approach LOS		C			C			B			B	

Intersection Summary			
HCM Average Control Delay	16.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	72.7	Sum of lost time (s)	4.0
Intersection Capacity Utilization	49.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	95

Splits and Phases: 16: Natoma St & Green Valley Rd



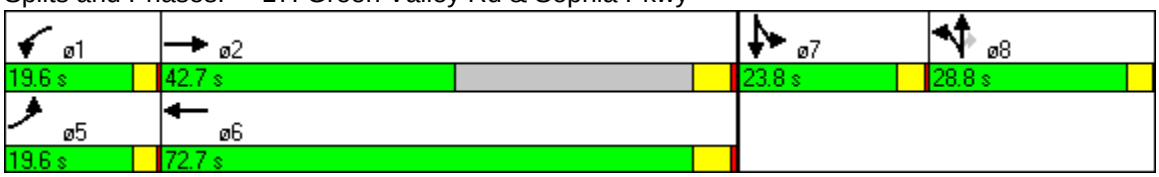
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85		1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)	1770	3477		1770	3539		1681	1681	1583		1817	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)	1770	3477		1770	3539		1681	1681	1583		1817	
Volume (vph)	2	421	56	17	1411	1	56	0	15	1	1	0
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	2	434	58	18	1455	1	58	0	15	1	1	0
RTOR Reduction (vph)	0	6	0	0	0	0	0	0	14	0	0	0
Lane Group Flow (vph)	2	486	0	18	1456	0	29	29	1	0	2	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	6.1	31.4		6.7	32.0		5.2	5.2	5.2		0.6	
Effective Green, g (s)	5.7	33.1		6.3	33.7		5.0	5.0	5.0		0.4	
Actuated g/C Ratio	0.09	0.54		0.10	0.55		0.08	0.08	0.08		0.01	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	166	1893		183	1962		138	138	130		12	
v/s Ratio Prot	0.00	0.14		c0.01	c0.41		c0.02	0.02			c0.00	
v/s Ratio Perm									0.00			
v/c Ratio	0.01	0.26		0.10	0.74		0.21	0.21	0.01		0.17	
Uniform Delay, d1	25.0	7.3		24.7	10.3		26.1	26.1	25.6		30.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.0	0.1		0.1	1.6		0.8	0.8	0.0		6.7	
Delay (s)	25.0	7.4		24.8	11.8		26.8	26.8	25.7		36.8	
Level of Service	C	A		C	B		C	C	C		D	
Approach Delay (s)		7.5			12.0			26.6			36.8	
Approach LOS		A			B			C			D	

Intersection Summary			
HCM Average Control Delay	11.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	60.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Min	Min	Min	Min	None	None
Maximum Split (s)	19.6	42.7	19.6	72.7	23.8	28.8
Maximum Split (%)	13.5%	29.5%	13.5%	50.2%	16.4%	19.9%
Minimum Split (s)	4.6	34.7	4.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



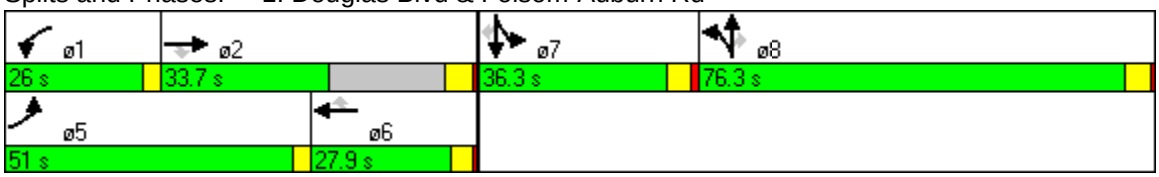
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.98	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1552	1770	3539	1524	3433	1863	1550	1770	3539	1553
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1552	1770	3539	1524	3433	1863	1550	1770	3539	1553
Volume (vph)	343	348	792	101	273	65	769	435	88	135	341	246
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	357	362	825	105	284	68	801	453	92	141	355	256
RTOR Reduction (vph)	0	0	485	0	0	58	0	0	64	0	0	216
Lane Group Flow (vph)	357	362	340	105	284	10	801	453	28	141	355	40
Confl. Peds. (#/hr)			5			2			7			
Confl. Bikes (#/hr)			2			5						5
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	24.2	28.2	28.2	8.2	13.0	13.0	28.5	28.5	28.5	14.0	14.0	14.0
Effective Green, g (s)	23.2	29.9	29.9	7.2	13.9	13.9	29.8	29.8	29.8	15.3	15.3	15.3
Actuated g/C Ratio	0.24	0.30	0.30	0.07	0.14	0.14	0.30	0.30	0.30	0.16	0.16	0.16
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	418	1078	473	130	501	216	1042	565	470	276	551	242
v/s Ratio Prot	c0.20	0.10		0.06	0.08		0.23	c0.24		0.08	c0.10	
v/s Ratio Perm			c0.22			0.01			0.02			0.03
v/c Ratio	0.85	0.34	0.72	0.81	0.57	0.04	0.77	0.80	0.06	0.51	0.64	0.16
Uniform Delay, d1	35.9	26.5	30.4	44.8	39.3	36.4	31.1	31.5	24.3	38.0	38.9	35.9
Progression 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
Incremental Delay, d2	15.0	0.1	4.3	28.1	0.9	0.0	3.1	7.6	0.0	0.7	1.9	0.1
Delay (s)	50.9	26.5	34.7	72.9	40.2	36.4	34.2	39.1	24.3	38.7	40.8	36.0
Level of Service	D	C	C	E	D	D	C	D	C	D	D	D
Approach Delay (s)		36.5			47.2			35.2			38.8	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM Average Control Delay	37.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	98.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	26	33.7	51	27.9	36.3	76.3
Maximum Split (%)	13.6%	17.6%	26.6%	14.6%	19.0%	39.8%
Minimum Split (s)	6	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	0	51	78.9	115.2
End Time (s)	26	78.9	51	78.9	115.2	0
Yield/Force Off (s)	23	73.2	48	74	109.9	186.2
Yield/Force Off 170(s)	23	63.2	48	64	99.9	186.2
Local Start Time (s)	165.5	0	165.5	25	52.9	89.2
Local Yield (s)	188.5	47.2	22	48	83.9	160.2
Local Yield 170(s)	188.5	37.2	22	38	73.9	160.2

Intersection Summary	
Cycle Length	191.5
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	1.00			1.00	1.00
Frpb, ped/bikes		1.00	0.97				1.00	1.00			1.00	1.00
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)		1770	1533				1770	1863			1863	1583
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1533				1770	1863			1863	1583
Volume (vph)	83	0	101	0	0	0	45	1178	0	0	1049	88
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	91	0	111	0	0	0	49	1295	0	0	1153	97
RTOR Reduction (vph)	0	0	101	0	0	0	0	0	0	0	0	8
Lane Group Flow (vph)	0	91	10	0	0	0	49	1295	0	0	1153	89
Confl. Bikes (#/hr)			3			11						
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		12.3	12.3				6.3	111.4			101.1	101.1
Effective Green, g (s)		12.3	12.3				6.3	112.9			102.6	102.6
Actuated g/C Ratio		0.09	0.09				0.05	0.85			0.77	0.77
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		163	142				84	1579			1435	1219
v/s Ratio Prot		c0.05					0.03	c0.70			0.62	
v/s Ratio Perm			0.01									0.06
v/c Ratio		0.56	0.07				0.58	0.82			0.80	0.07
Uniform Delay, d1		57.9	55.2				62.2	5.1			9.2	3.7
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		4.1	0.2				6.5	3.5			3.3	0.0
Delay (s)		62.0	55.5				68.7	8.5			12.5	3.7
Level of Service		E	E				E	A			B	A
Approach Delay (s)		58.4			0.0			10.7			11.8	
Approach LOS		E			A			B			B	

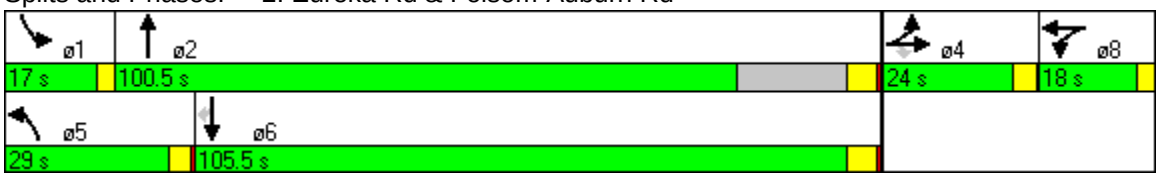
Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	133.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	140

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.88		0.94		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
Frt		1.00	0.85		0.94		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1779	1396		1602		1770	1860		1770	1863	1549
Flt Permitted		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1779	1396		1602		1770	1860		1770	1863	1549
Volume (vph)	15	1	52	16	3	16	43	1202	11	8	1080	20
Peak-hour factor, 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 (vph)	16	1	57	17	3	17	47	1307	12	9	1174	22
RTOR Reduction (vph)	0	0	55	0	17	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	17	2	0	20	0	47	1319	0	9	1174	20
Confl. Bikes (#/hr)			11			9			9			3
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		5.6	5.6		4.1		5.7	91.4		4.2	89.9	89.9
Effective Green, g (s)		5.0	5.0		3.5		4.7	93.1		3.2	91.6	91.6
Actuated g/C Ratio		0.04	0.04		0.03		0.04	0.77		0.03	0.76	0.76
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		74	58		46		69	1433		47	1413	1175
v/s Ratio Prot		c0.01			c0.01		c0.03	c0.71		0.01	0.63	
v/s Ratio Perm			0.00									0.01
v/c Ratio		0.23	0.04		0.45		0.68	0.92		0.19	0.83	0.02
Uniform Delay, d1		56.0	55.6		57.7		57.3	10.9		57.5	9.5	3.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.6	0.1		2.5		19.8	9.8		0.7	4.1	0.0
Delay (s)		56.6	55.7		60.2		77.1	20.7		58.3	13.7	3.6
Level of Service		E	E		E		E	C		E	B	A
Approach Delay (s)		55.9			60.2			22.6			13.8	
Approach LOS		E			E			C			B	

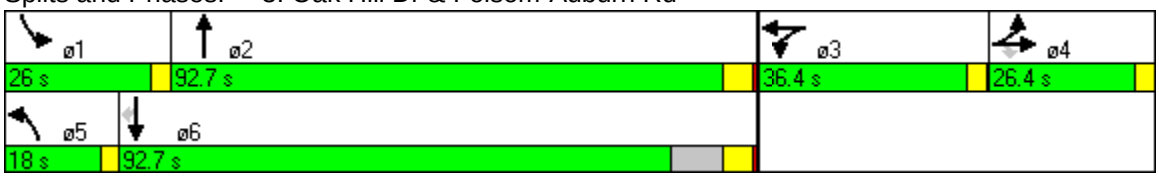
Intersection Summary			
HCM Average Control Delay	20.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	120.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



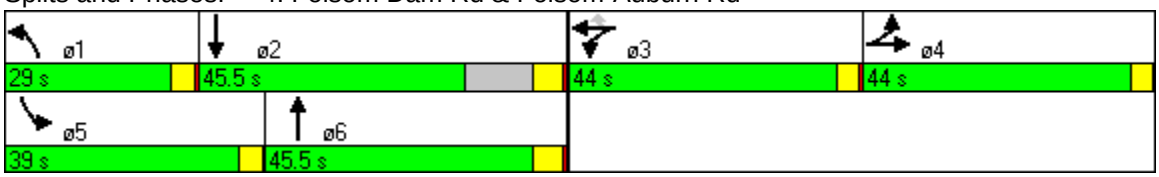
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00	1.00	0.95		1.00	0.95	
Frt		0.91			1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.98			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1665			1770	1583	1770	3538		1770	3532	
Flt Permitted		0.98			0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1665			1770	1583	1770	3538		1770	3532	
Volume (vph)	16	0	35	6	0	5	27	1169	4	1	1093	15
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	18	0	38	7	0	5	30	1285	4	1	1201	16
RTOR Reduction (vph)	0	35	0	0	0	5	0	0	0	0	0	0
Lane Group Flow (vph)	0	21	0	0	7	0	30	1289	0	1	1217	0
Turn Type	Split			Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases						3						
Actuated Green, G (s)		7.7			1.5	1.5	2.9	68.2		0.8	66.1	
Effective Green, g (s)		7.7			1.5	1.5	2.9	69.7		0.8	67.6	
Actuated g/C Ratio		0.08			0.02	0.02	0.03	0.73		0.01	0.71	
Clearance Time (s)		4.0			4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0			1.0	1.0	1.0	4.7		1.5	5.4	
Lane Grp Cap (vph)		134			28	25	54	2577		15	2495	
v/s Ratio Prot		c0.01			c0.00		c0.02	c0.36		0.00	0.34	
v/s Ratio Perm						0.00						
v/c Ratio		0.16			0.25	0.00	0.56	0.50		0.07	0.49	
Uniform Delay, d1		41.0			46.5	46.4	45.8	5.6		47.1	6.3	
Progression Factor		1.00			1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.2			1.7	0.0	6.8	0.3		0.7	0.4	
Delay (s)		41.2			48.2	46.4	52.6	5.8		47.8	6.7	
Level of Service		D			D	D	D	A		D	A	
Approach Delay (s)		41.2			47.5			6.9			6.7	
Approach LOS		D			D			A			A	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.45		
Actuated Cycle Length (s)	95.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	NBL	SBT	WBTL	EBTL	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	45.5	44	44	39	45.5
Maximum Split (%)	16.8%	26.4%	25.5%	25.5%	22.6%	26.4%
Minimum Split (s)	5	23.5	12	28	6	12.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1
Minimum Initial (s)	1	7	8	2	2	7
Vehicle Extension (s)	1	5.4	1	1	1.5	4.7
Minimum Gap (s)	3	3.8	3	3	3	3.1
Time Before Reduce (s)	0	10	0	0	0	10
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)		7		7		
Flash Dont Walk (s)		11		17		
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	84.5	128.5	0	39
End Time (s)	29	84.5	128.5	0	39	84.5
Yield/Force Off (s)	25	79	124.5	168.5	35	79
Yield/Force Off 170(s)	25	79	124.5	151.5	35	79
Local Start Time (s)	133.5	162.5	45.5	89.5	133.5	0
Local Yield (s)	158.5	40	85.5	129.5	168.5	40
Local Yield 170(s)	158.5	40	85.5	112.5	168.5	40

Intersection Summary	
Cycle Length	172.5
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



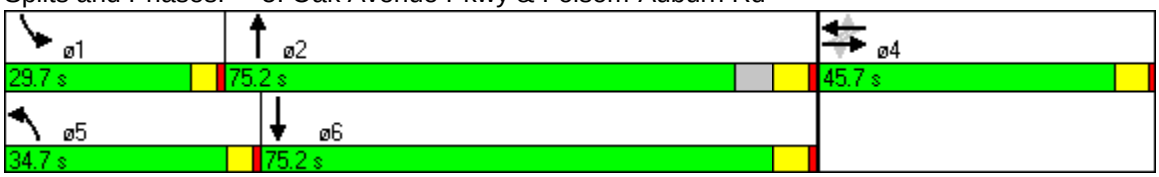
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00		1.00	0.95		1.00	0.95	
Frpb, ped/bikes		0.99			1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.89			0.98		1.00	1.00		1.00	0.99	
Flt Protected		0.99			0.97		0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1619			1779		1770	3522		1770	3507	
Flt Permitted		0.95			0.45		0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1554			830		1770	3522		1770	3507	
Volume (vph)	41	9	288	26	17	7	489	1283	38	10	1122	62
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	44	10	306	28	18	7	520	1365	40	11	1194	66
RTOR Reduction (vph)	0	146	0	0	4	0	0	1	0	0	3	0
Lane Group Flow (vph)	0	214	0	0	49	0	520	1404	0	11	1257	0
Confl. Peds. (#/hr)									1			
Confl. Bikes (#/hr)			2			1			2			4
Turn Type	Perm			Perm			Prot			Prot		
Protected Phases		4			4		5	2		1	6	
Permitted Phases	4			4								
Actuated Green, G (s)		19.8			19.8		31.5	79.7		2.1	50.3	
Effective Green, g (s)		21.5			21.5		32.2	81.9		2.8	52.5	
Actuated g/C Ratio		0.18			0.18		0.27	0.69		0.02	0.44	
Clearance Time (s)		5.7			5.7		4.7	6.2		4.7	6.2	
Vehicle Extension (s)		3.0			3.0		2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)		283			151		482	2440		42	1558	
v/s Ratio Prot							c0.29	0.40		0.01	c0.36	
v/s Ratio Perm		c0.14			0.06							
v/c Ratio		0.75			0.32		1.08	0.58		0.26	0.81	
Uniform Delay, d1		45.8			42.0		43.0	9.3		56.7	28.5	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		10.9			1.3		63.9	0.4		1.2	3.3	
Delay (s)		56.7			43.3		106.9	9.7		57.9	31.8	
Level of Service		E			D		F	A		E	C	
Approach Delay (s)		56.7			43.3			35.9			32.0	
Approach LOS		E			D			D			C	

Intersection Summary			
HCM Average Control Delay	36.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	118.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6
Movement	SBL	NBT	EBWB	NBL	SBT
Lead/Lag	Lead	Lag		Lead	Lag
Lead-Lag Optimize	Yes	Yes		Yes	Yes
Recall Mode	None	Min	None	None	Min
Maximum Split (s)	29.7	75.2	45.7	34.7	75.2
Maximum Split (%)	19.1%	48.3%	29.4%	22.3%	48.3%
Minimum Split (s)	6.7	13.2	32.7	6.7	13.2
Yellow Time (s)	3.5	5	4.5	3.5	5
All-Red Time (s)	1.2	1.2	1.2	1.2	1.2
Minimum Initial (s)	2	7	3	2	7
Vehicle Extension (s)	2	3.8	3	2	3.8
Minimum Gap (s)	0.2	2.4	0.2	0.2	2.4
Time Before Reduce (s)	0	10	0	0	10
Time To Reduce (s)	0	20	0	0	20
Walk Time (s)			7		
Flash Dont Walk (s)			20		
Dual Entry	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.7	109.9	0	34.7
End Time (s)	29.7	109.9	0	34.7	109.9
Yield/Force Off (s)	25	103.7	149.9	30	103.7
Yield/Force Off 170(s)	25	103.7	129.9	30	103.7
Local Start Time (s)	120.9	150.6	75.2	120.9	0
Local Yield (s)	145.9	69	115.2	150.9	69
Local Yield 170(s)	145.9	69	95.2	150.9	69

Intersection Summary	
Cycle Length	155.6
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



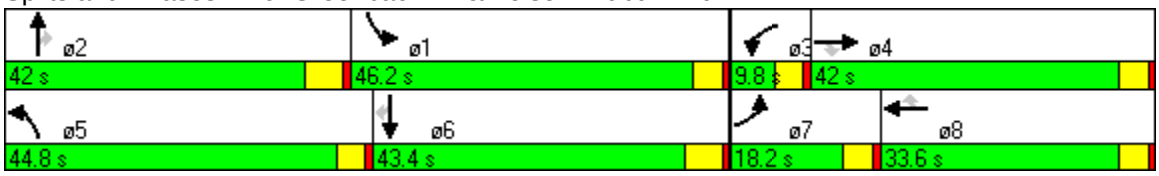
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	178	584	611	6	797	714	1037	1128	7	536	745	175
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	189	621	650	6	848	760	1103	1200	7	570	793	186
RTOR Reduction (vph)	0	0	384	0	0	386	0	0	4	0	0	103
Lane Group Flow (vph)	189	621	266	6	848	374	1103	1200	3	570	793	83
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	13.7	45.3	45.3	1.1	32.7	32.7	40.3	32.9	32.9	41.7	34.3	34.3
Effective Green, g (s)	14.2	45.8	45.8	1.6	33.2	33.2	40.8	34.4	34.4	42.2	35.8	35.8
Actuated g/C Ratio	0.10	0.33	0.33	0.01	0.24	0.24	0.29	0.25	0.25	0.30	0.26	0.26
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	180	1158	518	20	839	375	1000	870	389	534	905	405
v/s Ratio Prot	c0.11	0.18		0.00	c0.24		c0.32	c0.34		c0.32	0.22	
v/s Ratio Perm			0.17			0.24			0.00			0.05
v/c Ratio	1.05	0.54	0.51	0.30	1.01	1.00	1.10	1.38	0.01	1.07	0.88	0.20
Uniform Delay, d1	62.9	38.4	38.1	68.6	53.4	53.4	49.6	52.8	39.9	48.9	50.0	40.9
Progression 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
Incremental Delay, d2	80.9	0.2	0.4	3.1	33.7	45.4	61.0	177.9	0.0	58.2	11.6	1.1
Delay (s)	143.8	38.7	38.4	71.7	87.1	98.7	110.6	230.7	39.9	107.1	61.6	42.0
Level of Service	F	D	D	E	F	F	F	F	D	F	E	D
Approach Delay (s)		52.2			92.6			172.8			76.0	
Approach LOS		D			F			F			E	

Intersection Summary			
HCM Average Control Delay	107.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.11		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	46.2	42	9.8	42	44.8	43.4	18.2	33.6
Maximum Split (%)	33.0%	30.0%	7.0%	30.0%	32.0%	31.0%	13.0%	24.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
End Time (s)	51.7	5.5	61.5	103.5	8.3	51.7	69.9	103.5
Yield/Force Off (s)	47.2	0	57	99	3.8	46.2	65.4	99
Yield/Force Off 170(s)	47.2	117	57	74	3.8	27.2	65.4	74
Local Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
Local Yield (s)	47.2	0	57	99	3.8	46.2	65.4	99
Local Yield 170(s)	47.2	117	57	74	3.8	27.2	65.4	74

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	145
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		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	0.85
Flt Protected		0.98	1.00	0.95	0.97	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1823	1553	1681	1715	1560	1770	5034		1770	3539	1549
Flt Permitted		0.98	1.00	0.95	0.97	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1823	1553	1681	1715	1560	1770	5034		1770	3539	1549
Volume (vph)	10	13	9	99	23	483	19	1715	107	406	961	15
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	14	10	105	24	514	20	1824	114	432	1022	16
RTOR Reduction (vph)	0	0	10	0	0	467	0	3	0	0	0	4
Lane Group Flow (vph)	0	25	0	63	66	47	20	1935	0	432	1022	12
Confl. Bikes (#/hr)			1			1			1			4
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		4.4	4.4	12.7	12.7	12.7	4.1	71.5		45.4	112.8	112.8
Effective Green, g (s)		4.9	4.9	13.2	13.2	13.2	4.6	74.0		45.9	115.3	115.3
Actuated g/C Ratio		0.03	0.03	0.09	0.09	0.09	0.03	0.48		0.30	0.75	0.75
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		58	49	144	147	134	53	2419		528	2650	1160
v/s Ratio Prot		c0.01		0.04	c0.04		0.01	c0.38		c0.24	0.29	
v/s Ratio Perm			0.00			0.03						0.01
v/c Ratio		0.43	0.01	0.44	0.45	0.35	0.38	0.80		0.82	0.39	0.01
Uniform Delay, d1		73.2	72.2	66.9	66.9	66.4	73.3	33.8		50.2	6.8	4.9
Progression Factor		1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.9	0.0	0.8	0.8	0.6	1.6	2.2		9.1	0.2	0.0
Delay (s)		75.0	72.2	67.6	67.7	66.9	74.9	36.0		59.3	7.0	4.9
Level of Service		E	E	E	E	E	E	D		E	A	A
Approach Delay (s)		74.2			67.1			36.4			22.4	
Approach LOS		E			E			D			C	

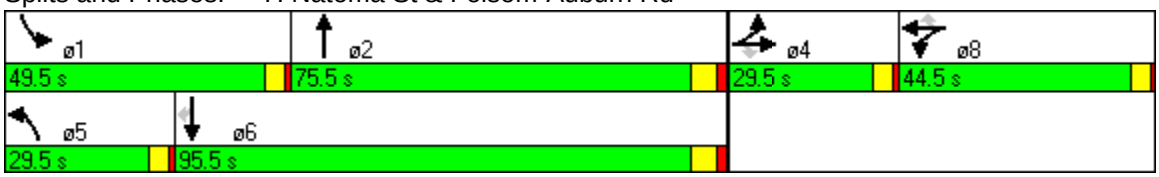
Intersection Summary			
HCM Average Control Delay	36.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	154.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize	Yes	Yes		Yes	Yes	
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	149.5	0	75.5	149.5	179	105
Local Yield (s)	194.5	69	100.5	174.5	69	145
Local Yield 170(s)	194.5	69	100.5	174.5	69	122

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



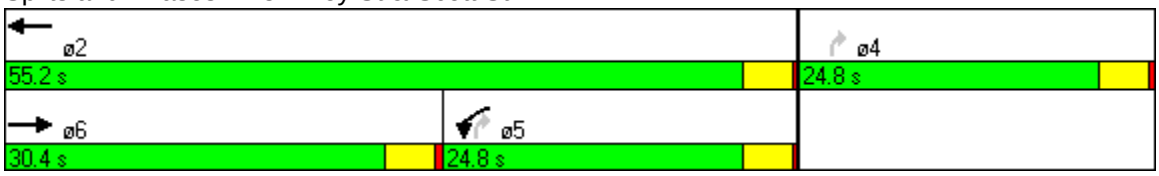
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0		4.0
Lane Util. Factor	0.95		1.00	1.00		1.00
Frt	1.00		1.00	1.00		0.86
Flt Protected	1.00		0.95	1.00		1.00
Satd. Flow (prot)	3534		1770	1863		1611
Flt Permitted	1.00		0.95	1.00		1.00
Satd. Flow (perm)	3534		1770	1863		1611
Volume (vph)	1516	16	14	1111	0	16
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	1613	17	15	1182	0	17
RTOR Reduction (vph)	0	0	0	0	0	1
Lane Group Flow (vph)	1630	0	15	1182	0	16
Turn Type			Prot			custom
Protected Phases	6		5	2		
Permitted Phases						4 5
Actuated Green, G (s)	56.1		8.3	68.4		15.9
Effective Green, g (s)	56.1		8.3	68.4		15.9
Actuated g/C Ratio	0.70		0.10	0.86		0.20
Clearance Time (s)	4.0		4.0	4.0		
Vehicle Extension (s)	2.8		2.4	2.8		
Lane Grp Cap (vph)	2478		184	1593		320
v/s Ratio Prot	0.46		0.01	c0.63		
v/s Ratio Perm						c0.01
v/c Ratio	0.66		0.08	0.74		0.05
Uniform Delay, d1	6.6		32.4	2.3		25.9
Progression Factor	0.85		1.00	1.00		1.00
Incremental Delay, d2	1.2		0.1	3.2		0.0
Delay (s)	6.8		32.5	5.5		26.0
Level of Service	A		C	A		C
Approach Delay (s)	6.8			5.8	26.0	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	61.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	WBT	NBR	WBL	EBT
Lead/Lag			Lag	Lead
Lead-Lag Optimize			Yes	Yes
Recall Mode	C-Max	None	None	C-Max
Maximum Split (s)	55.2	24.8	24.8	30.4
Maximum Split (%)	69.0%	31.0%	31.0%	38.0%
Minimum Split (s)	21	22	8	21
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	8	4	7
Vehicle Extension (s)	2.8	2.5	2.4	2.8
Minimum Gap (s)	2.4	2.4	2.4	2.4
Time Before Reduce (s)	18	18	0	18
Time To Reduce (s)	25	25	0	25
Walk Time (s)	7	7		7
Flash Dont Walk (s)	10	11		10
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	67.6	42.8	18	67.6
End Time (s)	42.8	67.6	42.8	18
Yield/Force Off (s)	38.8	63.6	38.8	14
Yield/Force Off 170(s)	28.8	52.6	38.8	4
Local Start Time (s)	53.6	28.8	4	53.6
Local Yield (s)	24.8	49.6	24.8	0
Local Yield 170(s)	14.8	38.6	24.8	70

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 14 (18%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



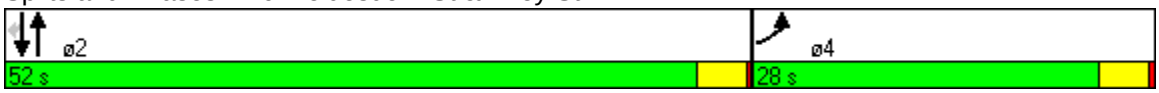
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.98			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3400			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3400			3539	1863	1583
Volume (vph)	163	22	0	1369	1075	36
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	173	23	0	1456	1144	38
RTOR Reduction (vph)	17	0	0	0	0	9
Lane Group Flow (vph)	179	0	0	1456	1144	29
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	10.0			62.0	62.0	62.0
Effective Green, g (s)	10.0			62.0	62.0	62.0
Actuated g/C Ratio	0.12			0.78	0.78	0.78
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	425			2743	1444	1227
v/s Ratio Prot	c0.05			0.41	c0.61	
v/s Ratio Perm						0.02
v/c Ratio	0.42			0.53	0.79	0.02
Uniform Delay, d1	32.3			3.4	5.2	2.1
Progression Factor	1.00			1.00	1.13	1.73
Incremental Delay, d2	0.6			0.7	3.3	0.0
Delay (s)	32.9			4.2	9.2	3.6
Level of Service	C			A	A	A
Approach Delay (s)	32.9			4.2	9.1	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	52	28
Maximum Split (%)	65.0%	35.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	46	18
End Time (s)	18	46
Yield/Force Off (s)	14	42
Yield/Force Off 170(s)	6	32
Local Start Time (s)	32	4
Local Yield (s)	0	28
Local Yield 170(s)	72	18

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	75
Offset: 14 (18%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



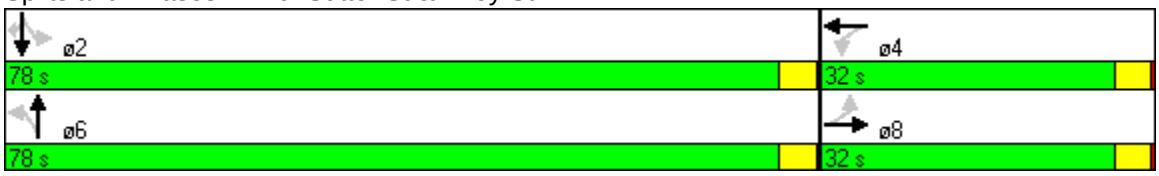
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1610	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.98			0.99			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.96			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1740			1728			1452			1815	1512
Flt Permitted		0.93			0.72			1.00			0.99	1.00
Satd. Flow (perm)		1628			1272			1451			1790	1512
Volume (vph)	27	85	43	39	38	37	2	1305	21	9	1062	26
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	29	90	46	41	40	39	2	1388	22	10	1130	28
RTOR Reduction (vph)	0	14	0	0	18	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	151	0	0	102	0	0	1412	0	0	1140	22
Confl. Peds. (#/hr)			18			19						
Confl. Bikes (#/hr)									14			1
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		16.4			16.4			85.6			85.6	85.6
Effective Green, g (s)		16.4			16.4			85.6			85.6	85.6
Actuated g/C Ratio		0.15			0.15			0.78			0.78	0.78
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		243			190			1129			1393	1177
v/s Ratio Prot												
v/s Ratio Perm		c0.09			0.08			c0.97			0.64	0.01
v/c Ratio		0.62			0.54			1.25			0.82	0.02
Uniform Delay, d1		43.9			43.3			12.2			7.5	2.7
Progression Factor		1.00			1.00			1.00			1.00	1.00
Incremental Delay, d2		3.3			1.5			120.1			5.5	0.0
Delay (s)		47.2			44.8			132.3			12.9	2.8
Level of Service		D			D			F			B	A
Approach Delay (s)		47.2			44.8			132.3			12.7	
Approach LOS		D			D			F			B	

Intersection Summary			
HCM Average Control Delay	75.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	110.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



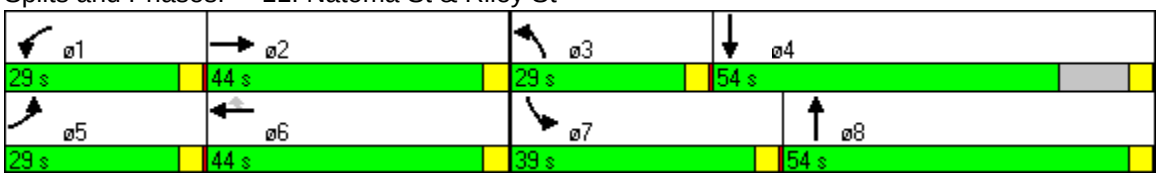
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1560	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1796		1770	1863	1583	1770	1525		1770	1857	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1796		1770	1863	1583	1770	1525		1770	1857	
Volume (vph)	20	348	109	96	268	522	42	786	14	407	585	12
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	370	116	102	285	555	45	836	15	433	622	13
RTOR Reduction (vph)	0	7	0	0	0	371	0	1	0	0	0	0
Lane Group Flow (vph)	21	479	0	102	285	184	45	850	0	433	635	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.4	41.6		13.2	50.4	50.4	7.3	50.9		35.0	78.6	
Effective Green, g (s)	4.4	41.6		13.2	50.4	50.4	7.3	50.9		35.0	78.6	
Actuated g/C Ratio	0.03	0.27		0.08	0.32	0.32	0.05	0.32		0.22	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	50	477		149	599	509	82	495		395	931	
v/s Ratio Prot	0.01	c0.27		c0.06	0.15		0.03	c0.56		c0.24	0.34	
v/s Ratio Perm						0.12						
v/c Ratio	0.42	1.01		0.68	0.48	0.36	0.55	1.72		1.10	0.68	
Uniform Delay, d1	74.9	57.6		69.7	42.6	40.8	73.1	52.9		60.8	29.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	42.5		9.9	0.9	0.6	4.0	331.5		73.8	2.3	
Delay (s)	77.0	100.0		79.6	43.4	41.4	77.1	384.4		134.6	31.9	
Level of Service	E	F		E	D	D	E	F		F	C	
Approach Delay (s)		99.0			46.2			369.0			73.5	
Approach LOS		F			D			F			E	

Intersection Summary			
HCM Average Control Delay	147.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	156.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	117.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	57	98	162	25	58	108	162
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	28	69	133	162	29	79	133

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 11: Natoma St & Riley St



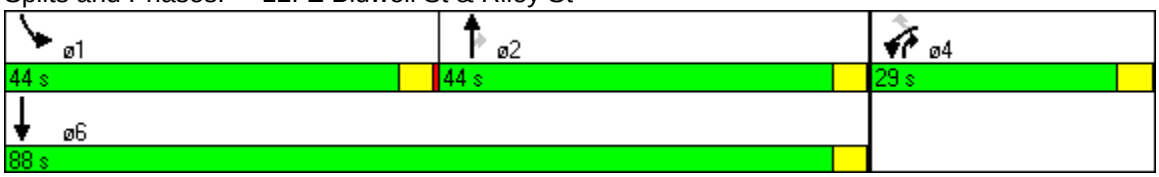
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1538	3539	1568	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1538	3539	1568	1770	1863
Volume (vph)	147	391	490	174	386	621
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	150	399	500	178	394	634
RTOR Reduction (vph)	0	329	0	105	0	0
Lane Group Flow (vph)	150	70	500	73	394	634
Confl. Peds. (#/hr)		2		2		
Confl. Bikes (#/hr)		12		6		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	8.3	8.3	11.0	19.3	16.0	31.0
Effective Green, g (s)	8.3	8.3	11.0	19.3	16.0	31.0
Actuated g/C Ratio	0.18	0.18	0.23	0.41	0.34	0.66
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	311	270	823	772	599	1221
v/s Ratio Prot	c0.08		0.14	0.02	c0.22	c0.34
v/s Ratio Perm		0.05		0.03		
v/c Ratio	0.48	0.26	0.61	0.09	0.66	0.52
Uniform Delay, d1	17.6	16.8	16.2	8.6	13.3	4.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.2	0.9	0.0	2.6	0.4
Delay (s)	18.0	17.0	17.1	8.6	16.0	4.6
Level of Service	B	B	B	A	B	A
Approach Delay (s)	17.3		14.9			9.0
Approach LOS	B		B			A

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	47.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize	Yes	Yes		
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 12: E Bidwell St & Riley St



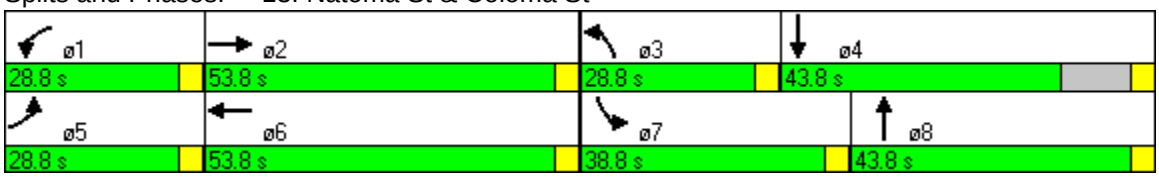
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1855		1770	1843		1770	1707		1770	1792	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1855		1770	1843		1770	1707		1770	1792	
Volume (vph)	9	726	22	54	710	55	200	89	113	27	42	14
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	9	764	23	57	747	58	211	94	119	28	44	15
RTOR Reduction (vph)	0	0	0	0	1	0	0	29	0	0	10	0
Lane Group Flow (vph)	9	787	0	57	804	0	211	184	0	28	49	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.2	53.2		5.6	54.6		15.1	19.7		3.4	8.0	
Effective Green, g (s)	4.0	53.0		5.4	54.4		14.9	19.5		3.2	7.8	
Actuated g/C Ratio	0.04	0.55		0.06	0.56		0.15	0.20		0.03	0.08	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	73	1013		98	1033		272	343		58	144	
v/s Ratio Prot	0.01	0.42		c0.03	c0.44		c0.12	c0.11		0.02	0.03	
v/s Ratio Perm												
v/c Ratio	0.12	0.78		0.58	0.78		0.78	0.54		0.48	0.34	
Uniform Delay, d1	44.9	17.4		44.7	16.7		39.5	34.8		46.1	42.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	3.8		5.6	3.8		11.9	0.8		2.3	0.5	
Delay (s)	45.1	21.2		50.3	20.4		51.4	35.6		48.4	42.7	
Level of Service	D	C		D	C		D	D		D	D	
Approach Delay (s)		21.5			22.4			43.4			44.6	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	27.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	97.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	Min	Min	None	Min
Maximum Split (s)	28.8	53.8	28.8	43.8	28.8	53.8	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	17.4%	32.6%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	7	1	7	1	7
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	28.8	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	28.8	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	25	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	25	78.8	117.6	161.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	0	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	161.4	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	161.4	50	88.8	132.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 13: Natoma St & Coloma St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		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	0.99		1.00	1.00		1.00	0.86		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3502		1770	3532		1770	1580		1770	1852	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3502		1770	3532		1770	1580		1770	1852	
Volume (vph)	5	754	49	93	627	7	107	14	160	16	25	1
Peak-hour factor, 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 (vph)	5	820	53	101	682	8	116	15	174	17	27	1
RTOR Reduction (vph)	0	2	0	0	1	0	0	151	0	0	1	0
Lane Group Flow (vph)	5	871	0	101	689	0	116	38	0	17	27	0
Confl. Bikes (#/hr)			2			1			3			2
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	0.5	22.4		4.3	26.2		5.9	7.5		5.3	6.9	
Effective Green, g (s)	0.5	23.4		4.3	27.2		5.9	7.5		5.3	6.9	
Actuated g/C Ratio	0.01	0.41		0.08	0.48		0.10	0.13		0.09	0.12	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	16	1450		135	1700		185	210		166	226	
v/s Ratio Prot	0.00	c0.25		c0.06	c0.20		c0.07	c0.02		0.01	0.01	
v/s Ratio Perm												
v/c Ratio	0.31	0.60		0.75	0.41		0.63	0.18		0.10	0.12	
Uniform Delay, d1	27.8	12.9		25.6	9.4		24.2	21.8		23.4	22.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.0	0.7		17.8	0.2		4.7	0.2		0.1	0.1	
Delay (s)	31.9	13.6		43.4	9.6		29.0	21.9		23.5	22.2	
Level of Service	C	B		D	A		C	C		C	C	
Approach Delay (s)		13.7			13.9			24.6			22.7	
Approach LOS		B			B			C			C	

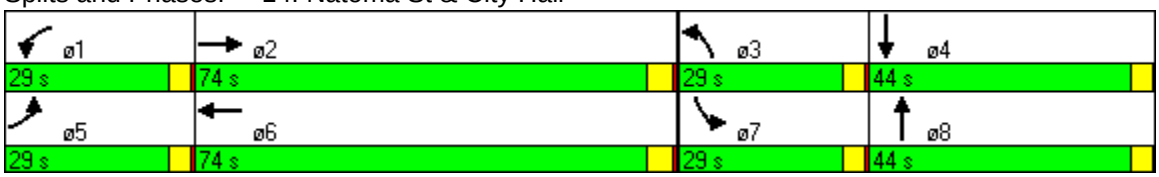
Intersection Summary			
HCM Average Control Delay	15.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	56.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min	Min	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 14: Natoma St & City Hall



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	1.00	1.00		1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	0.97	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	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3524		1770	1863	1550		1770	1543	1681	1541	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3524		1770	1863	1550		1770	1543	1681	1541	
Volume (vph)	3	826	24	12	725	2	44	0	9	3	1	3
Peak-hour factor, 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 (vph)	3	898	26	13	788	2	48	0	10	3	1	3
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	9	0	3	0
Lane Group Flow (vph)	3	923	0	13	788	2	0	48	1	3	1	0
Confl. Peds. (#/hr)						2			3			2
Turn Type	Prot			Prot		Perm	Split		Perm	Split		
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases						2			3			
Actuated Green, G (s)	1.1	74.2		1.3	74.4	74.4		6.7	6.7	1.1	1.1	
Effective Green, g (s)	1.1	75.7		1.3	75.9	75.9		6.7	6.7	1.6	1.6	
Actuated g/C Ratio	0.01	0.75		0.01	0.75	0.75		0.07	0.07	0.02	0.02	
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5		4.0	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	19	2633		23	1396	1161		117	102	27	24	
v/s Ratio Prot	0.00	0.26		c0.01	c0.42			c0.03		c0.00	0.00	
v/s Ratio Perm						0.00			0.00			
v/c Ratio	0.16	0.35		0.57	0.56	0.00		0.41	0.01	0.11	0.04	
Uniform Delay, d1	49.6	4.4		49.7	5.5	3.2		45.4	44.2	49.1	49.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	1.4	0.1		17.6	0.5	0.0		0.9	0.0	0.7	0.3	
Delay (s)	51.1	4.5		67.3	6.0	3.2		46.3	44.2	49.8	49.4	
Level of Service	D	A		E	A	A		D	D	D	D	
Approach Delay (s)		4.6			7.0			45.9			49.6	
Approach LOS		A			A			D			D	

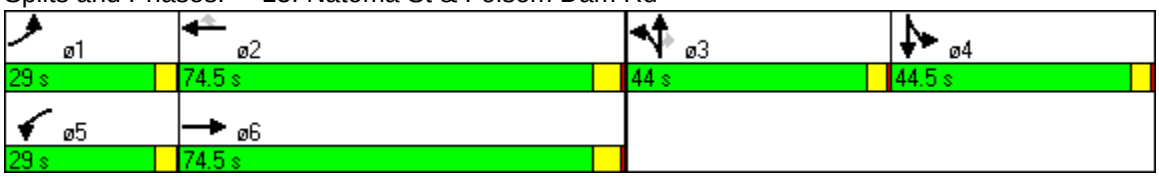
Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	101.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	EBL	WBT	NBTL	SBTL	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	74.5	44	44.5	29	74.5
Maximum Split (%)	15.1%	38.8%	22.9%	23.2%	15.1%	38.8%
Minimum Split (s)	6	12.5	6	25.5	6	28.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	1	0.5	1
Minimum Initial (s)	2	7	2	2	2	7
Vehicle Extension (s)	2	3	2	2	2	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4
Time Before Reduce (s)	0	18	0	0	0	18
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)				7		7
Flash Dont Walk (s)				14		16
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103.5	147.5	0	29
End Time (s)	29	103.5	147.5	0	29	103.5
Yield/Force Off (s)	25	98	143.5	187.5	25	98
Yield/Force Off 170(s)	25	98	143.5	173.5	25	98
Local Start Time (s)	163	0	74.5	118.5	163	0
Local Yield (s)	188	69	114.5	158.5	188	69
Local Yield 170(s)	188	69	114.5	144.5	188	69

Intersection Summary	
Cycle Length	192
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 15: Natoma St & Folsom Dam Rd



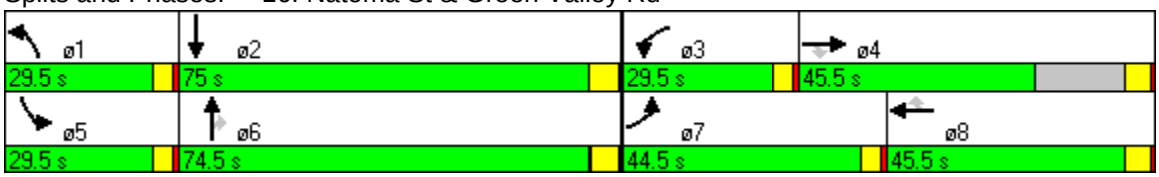
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Volume (vph)	610	128	31	135	107	102	43	724	113	72	328	356
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	678	142	34	150	119	113	48	804	126	80	364	396
RTOR Reduction (vph)	0	0	23	0	0	98	0	0	82	0	0	0
Lane Group Flow (vph)	678	142	11	150	119	15	48	804	44	80	364	396
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	25.2	28.6	28.6	6.8	10.2	10.2	3.3	29.8	29.8	5.2	31.2	90.4
Effective Green, g (s)	25.7	30.1	30.1	7.3	11.7	11.7	3.8	31.3	31.3	5.7	33.2	90.4
Actuated g/C Ratio	0.28	0.33	0.33	0.08	0.13	0.13	0.04	0.35	0.35	0.06	0.37	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	976	1178	527	277	458	205	144	1225	548	216	1300	1583
v/s Ratio Prot	c0.20	0.04		0.04	0.03		0.01	c0.23		c0.02	0.10	
v/s Ratio Perm			0.01			0.01			0.03			c0.25
v/c Ratio	0.69	0.12	0.02	0.54	0.26	0.07	0.33	0.66	0.08	0.37	0.28	0.25
Uniform Delay, d1	28.9	21.0	20.3	39.9	35.4	34.6	42.1	25.0	19.9	40.6	20.2	0.0
Progression 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
Incremental Delay, d2	1.7	0.1	0.0	1.2	0.5	0.3	0.5	1.6	0.1	0.4	0.1	0.4
Delay (s)	30.6	21.0	20.3	41.1	36.0	34.8	42.6	26.6	20.0	41.0	20.3	0.4
Level of Service	C	C	C	D	D	C	D	C	B	D	C	A
Approach Delay (s)		28.6			37.6			26.5			12.9	
Approach LOS		C			D			C			B	

Intersection Summary			
HCM Average Control Delay	24.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	90.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	115

Splits and Phases: 16: Natoma St & Green Valley Rd



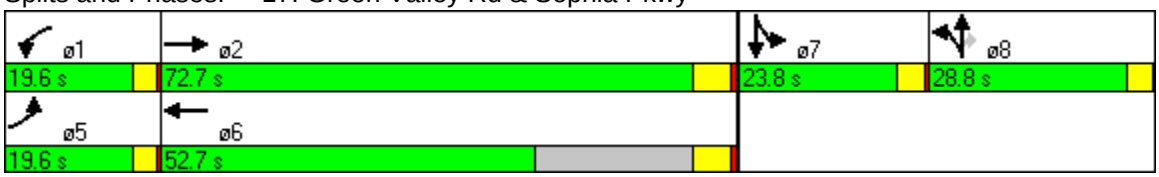
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor		0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt		0.99		1.00	1.00		1.00	1.00	0.85		0.93	
Flt Protected		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (prot)		3521		1770	3539		1681	1681	1583		1695	
Flt Permitted		1.00		0.95	1.00		0.95	0.95	1.00		0.98	
Satd. Flow (perm)		3521		1770	3539		1681	1681	1583		1695	
Volume (vph)	0	1387	49	8	718	1	37	0	26	1	0	1
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	0	1476	52	9	764	1	39	0	28	1	0	1
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	26	0	1	0
Lane Group Flow (vph)	0	1527	0	9	765	0	20	19	2	0	1	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)		36.0		6.4	46.0		5.1	5.1	5.1		0.6	
Effective Green, g (s)		37.7		6.0	47.7		4.9	4.9	4.9		0.4	
Actuated g/C Ratio		0.58		0.09	0.73		0.08	0.08	0.08		0.01	
Clearance Time (s)		5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)		3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)		2042		163	2597		127	127	119		10	
v/s Ratio Prot		c0.43		0.01	c0.22		c0.01	0.01			c0.00	
v/s Ratio Perm									0.00			
v/c Ratio		0.75		0.06	0.29		0.16	0.15	0.02		0.10	
Uniform Delay, d1		10.1		26.9	2.9		28.1	28.1	27.8		32.1	
Progression Factor		1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2		1.6		0.1	0.1		0.6	0.6	0.1		4.5	
Delay (s)		11.7		27.0	3.0		28.7	28.7	27.9		36.7	
Level of Service		B		C	A		C	C	C		D	
Approach Delay (s)		11.7			3.3			28.4			36.7	
Approach LOS		B			A			C			D	

Intersection Summary			
HCM Average Control Delay	9.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	58.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	Min	Min	None	Min	None	None
Maximum Split (s)	19.6	72.7	19.6	52.7	23.8	28.8
Maximum Split (%)	13.5%	50.2%	13.5%	36.4%	16.4%	19.9%
Minimum Split (s)	4.6	34.7	7.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	4	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



2007 Conditions – Alternative 1

Level of Service Technical Calculations

HCM Signalized Intersection Capacity Analysis
1: Douglas Blvd & Folsom-Auburn Rd

6/24/2005

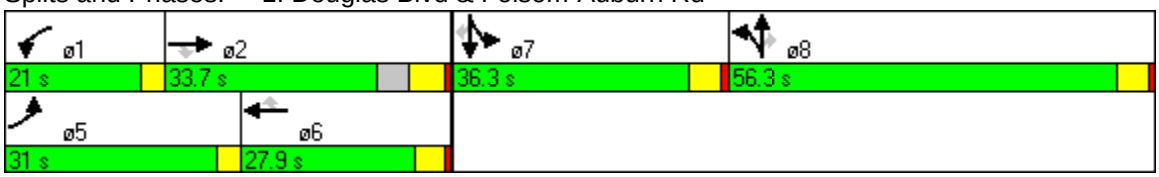
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98	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	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1553	1770	3539	1535	3433	1863	1550	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1553	1770	3539	1535	3433	1863	1550	1770	3539	1563
Volume (vph)	160	160	590	110	370	100	1080	290	40	80	540	420
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	178	178	656	122	411	111	1200	322	44	89	600	467
RTOR Reduction (vph)	0	0	503	0	0	95	0	0	26	0	0	231
Lane Group Flow (vph)	178	178	153	122	411	16	1200	322	18	89	600	236
Confl. Peds. (#/hr)						2			5			
Confl. Bikes (#/hr)			6			2			1			1
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	15.7	20.5	20.5	11.6	17.2	17.2	49.0	49.0	49.0	23.8	23.8	23.8
Effective Green, g (s)	14.7	22.2	22.2	10.6	18.1	18.1	50.3	50.3	50.3	25.1	25.1	25.1
Actuated g/C Ratio	0.12	0.18	0.18	0.09	0.15	0.15	0.40	0.40	0.40	0.20	0.20	0.20
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	209	633	278	151	516	224	1390	755	628	358	715	316
v/s Ratio Prot	c0.10	0.05		0.07	c0.12		c0.35	0.17		0.05	c0.17	
v/s Ratio Perm			0.10			0.01			0.01			0.15
v/c Ratio	0.85	0.28	0.55	0.81	0.80	0.07	0.86	0.43	0.03	0.25	0.84	0.75
Uniform Delay, d1	53.7	44.1	46.5	55.8	51.3	45.8	33.8	26.6	22.2	41.6	47.6	46.6
Progression 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
Incremental Delay, d2	26.0	0.1	1.3	24.9	7.8	0.1	5.6	0.1	0.0	0.1	8.2	8.2
Delay (s)	79.7	44.2	47.8	80.7	59.1	45.9	39.4	26.7	22.2	41.8	55.8	54.8
Level of Service	E	D	D	F	E	D	D	C	C	D	E	D
Approach Delay (s)		52.8			60.9			36.3			54.3	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	48.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	124.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	21	33.7	31	27.9	36.3	56.3
Maximum Split (%)	13.9%	22.2%	20.5%	18.4%	24.0%	37.2%
Minimum Split (s)	8	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	21	0	31	58.9	95.2
End Time (s)	21	58.9	31	58.9	95.2	0
Yield/Force Off (s)	18	53.2	28	54	89.9	146.2
Yield/Force Off 170(s)	18	43.2	28	44	79.9	146.2
Local Start Time (s)	130.5	0	130.5	10	37.9	74.2
Local Yield (s)	148.5	32.2	7	33	68.9	125.2
Local Yield 170(s)	148.5	22.2	7	23	58.9	125.2

Intersection Summary	
Cycle Length	151.5
Control Type	Actuated-Uncoordinated
Natural Cycle	115

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	1.00			1.00	1.00
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				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)		1770	1547				1770	1863			1863	1551
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1547				1770	1863			1863	1551
Volume (vph)	160	0	110	0	0	0	160	1230	0	0	1200	120
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	178	0	122	0	0	0	178	1367	0	0	1333	133
RTOR Reduction (vph)	0	0	107	0	0	0	0	0	0	0	0	14
Lane Group Flow (vph)	0	178	15	0	0	0	178	1367	0	0	1333	119
Confl. Bikes (#/hr)			1			1						1
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		18.7	18.7				18.2	122.5			100.3	100.3
Effective Green, g (s)		18.7	18.7				18.2	124.0			101.8	101.8
Actuated g/C Ratio		0.12	0.12				0.12	0.82			0.68	0.68
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		220	192				214	1533			1258	1048
v/s Ratio Prot		c0.10					0.10	c0.73			c0.72	
v/s Ratio Perm			0.01									0.08
v/c Ratio		0.81	0.08				0.83	0.89			1.06	0.11
Uniform Delay, d1		64.3	58.4				64.8	8.9			24.4	8.6
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		19.3	0.2				22.3	7.0			42.8	0.0
Delay (s)		83.5	58.6				87.0	15.8			67.2	8.6
Level of Service		F	E				F	B			E	A
Approach Delay (s)		73.4			0.0			24.0			61.9	
Approach LOS		E			A			C			E	

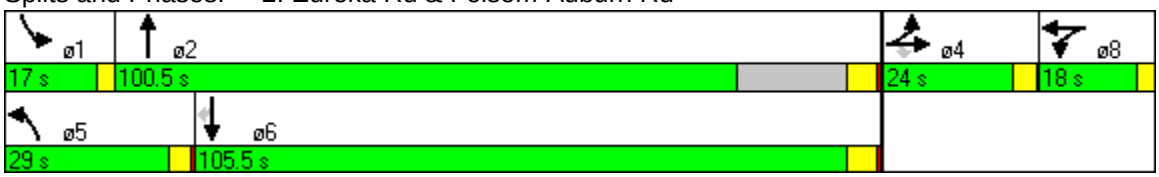
Intersection Summary			
HCM Average Control Delay	45.3	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	150.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



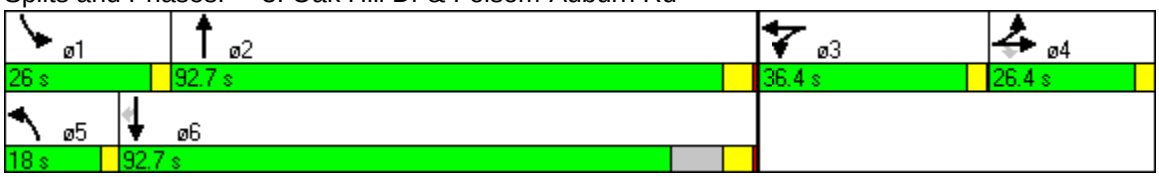
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.94		0.99		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	0.85		0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1804	1496		1725		1770	1860		1770	1863	1583
Flt Permitted		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1804	1496		1725		1770	1860		1770	1863	1583
Volume (vph)	20	10	70	10	10	10	100	1240	10	10	1280	30
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	11	74	11	11	11	106	1319	11	11	1362	32
RTOR Reduction (vph)	0	0	71	0	11	0	0	0	0	0	0	3
Lane Group Flow (vph)	0	32	3	0	22	0	106	1330	0	11	1362	29
Confl. Peds. (#/hr)			3			2						
Confl. Bikes (#/hr)			3			1			3			
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		6.2	6.2		4.2		10.8	94.8		4.4	88.4	88.4
Effective Green, g (s)		5.6	5.6		3.6		9.8	96.5		3.4	90.1	90.1
Actuated g/C Ratio		0.04	0.04		0.03		0.08	0.77		0.03	0.72	0.72
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		81	67		50		139	1435		48	1342	1140
v/s Ratio Prot		c0.02			c0.01		c0.06	0.72		0.01	c0.73	
v/s Ratio Perm			0.00									0.02
v/c Ratio		0.40	0.05		0.45		0.76	0.93		0.23	1.01	0.03
Uniform Delay, d1		58.1	57.2		59.8		56.5	11.5		59.6	17.5	5.0
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.2	0.1		2.3		19.7	10.3		0.9	28.3	0.0
Delay (s)		59.3	57.3		62.1		76.2	21.8		60.5	45.8	5.0
Level of Service		E	E		E		E	C		E	D	A
Approach Delay (s)		57.9			62.1			25.8			45.0	
Approach LOS		E			E			C			D	

Intersection Summary			
HCM Average Control Delay	36.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	125.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	91.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



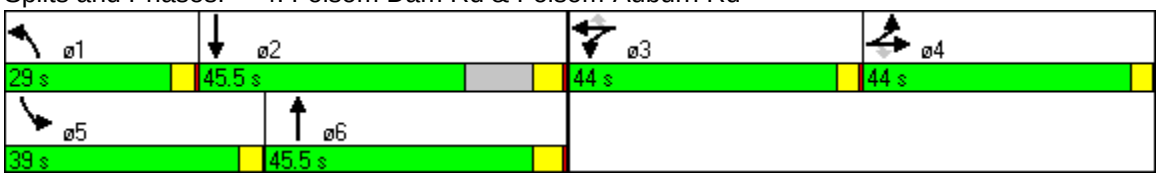
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3527		1770	3516	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3527		1770	3516	
Volume (vph)	100	0	60	20	0	10	40	1260	30	10	1340	60
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	111	0	67	22	0	11	44	1400	33	11	1489	67
RTOR Reduction (vph)	0	0	60	0	0	11	0	0	0	0	1	0
Lane Group Flow (vph)	0	111	7	0	22	0	44	1433	0	11	1555	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						
Actuated Green, G (s)		9.9	9.9		3.1	3.1	4.2	60.3		1.1	57.2	
Effective Green, g (s)		9.9	9.9		3.1	3.1	4.2	61.8		1.1	58.7	
Actuated g/C Ratio		0.11	0.11		0.03	0.03	0.05	0.67		0.01	0.64	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.0	4.7		1.5	5.4	
Lane Grp Cap (vph)		191	171		60	53	81	2372		21	2246	
v/s Ratio Prot		c0.06			c0.01		c0.02	c0.41		0.01	c0.44	
v/s Ratio Perm			0.00			0.00						
v/c Ratio		0.58	0.04		0.37	0.01	0.54	0.60		0.52	0.69	
Uniform Delay, d1		39.0	36.8		43.4	42.9	42.9	8.3		45.1	10.8	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.9	0.0		1.4	0.0	3.9	0.6		10.4	1.3	
Delay (s)		41.9	36.8		44.8	42.9	46.9	8.9		55.6	12.0	
Level of Service		D	D		D	D	D	A		E	B	
Approach Delay (s)		40.0			44.2			10.0			12.3	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM Average Control Delay	13.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	91.9	Sum of lost time (s)	20.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	NBL	SBT	WBTL	EBTL	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	45.5	44	44	39	45.5
Maximum Split (%)	16.8%	26.4%	25.5%	25.5%	22.6%	26.4%
Minimum Split (s)	5	23.5	12	28	6	12.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1
Minimum Initial (s)	1	7	8	2	2	7
Vehicle Extension (s)	1	5.4	1	1	1.5	4.7
Minimum Gap (s)	1	3.8	1	1	1.5	3.1
Time Before Reduce (s)	0	10	0	0	0	10
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)		7		7		
Flash Dont Walk (s)		11		17		
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	84.5	128.5	0	39
End Time (s)	29	84.5	128.5	0	39	84.5
Yield/Force Off (s)	25	79	124.5	168.5	35	79
Yield/Force Off 170(s)	25	79	124.5	151.5	35	79
Local Start Time (s)	133.5	162.5	45.5	89.5	133.5	0
Local Yield (s)	158.5	40	85.5	129.5	168.5	40
Local Yield 170(s)	158.5	40	85.5	112.5	168.5	40

Intersection Summary	
Cycle Length	172.5
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



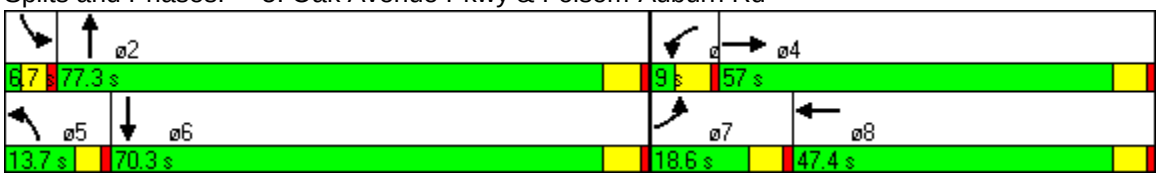
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		0.97	0.95		1.00	0.95	
Frpb, ped/bikes	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	
Frt	1.00	0.85		1.00	0.92		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1588		1770	1712		3433	3535		1770	3517	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1588		1770	1712		3433	3535		1770	3517	
Volume (vph)	80	10	610	50	10	10	210	1340	10	10	1500	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	84	11	642	53	11	11	221	1411	11	11	1579	63
RTOR Reduction (vph)	0	50	0	0	9	0	0	1	0	0	2	0
Lane Group Flow (vph)	84	603	0	53	13	0	221	1421	0	11	1640	0
Confl. Peds. (#/hr)									1			
Confl. Bikes (#/hr)						1						2
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	31.8	53.6		3.3	25.1		9.0	71.1		2.0	64.1	
Effective Green, g (s)	33.5	55.3		5.0	26.8		9.7	73.3		2.7	66.3	
Actuated g/C Ratio	0.22	0.36		0.03	0.18		0.06	0.48		0.02	0.44	
Clearance Time (s)	5.7	5.7		5.7	5.7		4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	389	577		58	301		219	1701		31	1531	
v/s Ratio Prot	0.05	c0.38		c0.03	0.01		c0.06	0.40		0.01	c0.47	
v/s Ratio Perm												
v/c Ratio	0.22	1.04		0.91	0.04		1.01	0.84		0.35	1.07	
Uniform Delay, d1	48.6	48.5		73.4	52.1		71.3	34.3		73.9	43.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	49.6		86.9	0.1		63.2	3.9		2.5	44.8	
Delay (s)	48.9	98.1		160.3	52.2		134.5	38.1		76.5	87.8	
Level of Service	D	F		F	D		F	D		E	F	
Approach Delay (s)		92.5			128.6			51.1			87.7	
Approach LOS		F			F			D			F	

Intersection Summary			
HCM Average Control Delay	74.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	152.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.9%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize			Yes	Yes			Yes	Yes
Recall Mode	Min	Min	None	None	None	Min	None	None
Maximum Split (s)	6.7	77.3	9	57	13.7	70.3	18.6	47.4
Maximum Split (%)	4.5%	51.5%	6.0%	38.0%	9.1%	46.9%	12.4%	31.6%
Minimum Split (s)	6.7	13.2	8.7	30.7	6.7	13.2	8.7	27.7
Yellow Time (s)	3.5	5	4.5	4.5	3.5	5	4.5	4.5
All-Red Time (s)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Minimum Initial (s)	2	7	3	3	2	7	3	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	2	2.4	3	3	2	2.4	3	3
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	6.7	84	93	0	13.7	84	102.6
End Time (s)	6.7	84	93	0	13.7	84	102.6	0
Yield/Force Off (s)	2	77.8	87.3	144.3	9	77.8	96.9	144.3
Yield/Force Off 170(s)	2	77.8	87.3	126.3	9	77.8	96.9	129.3
Local Start Time (s)	136.3	143	70.3	79.3	136.3	0	70.3	88.9
Local Yield (s)	138.3	64.1	73.6	130.6	145.3	64.1	83.2	130.6
Local Yield 170(s)	138.3	64.1	73.6	112.6	145.3	64.1	83.2	115.6

Intersection Summary	
Cycle Length	150
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



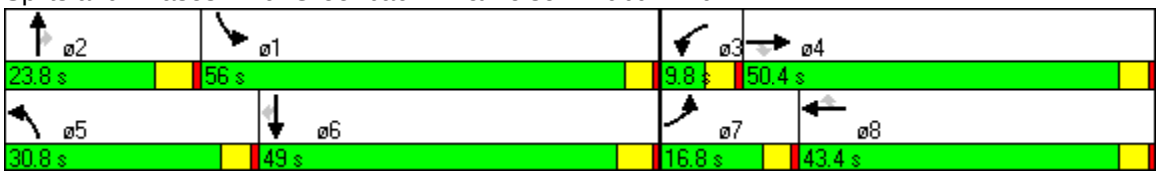
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	120	790	1100	20	840	720	430	610	10	490	1720	50
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	133	878	1222	22	933	800	478	678	11	544	1911	56
RTOR Reduction (vph)	0	0	236	0	0	502	0	0	10	0	0	14
Lane Group Flow (vph)	133	878	986	22	933	298	478	678	1	544	1911	42
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	11.9	49.8	49.8	3.2	41.1	41.1	22.8	16.5	16.5	51.5	45.2	45.2
Effective Green, g (s)	12.4	50.3	50.3	3.7	41.6	41.6	23.3	18.0	18.0	52.0	46.7	46.7
Actuated g/C Ratio	0.09	0.36	0.36	0.03	0.30	0.30	0.17	0.13	0.13	0.37	0.33	0.33
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	157	1272	569	47	1052	470	571	455	204	657	1181	528
v/s Ratio Prot	c0.08	0.25		0.01	0.26		c0.14	c0.19		0.31	c0.54	
v/s Ratio Perm			c0.62			0.19			0.00			0.03
v/c Ratio	0.85	0.69	1.73	0.47	0.89	0.63	0.84	1.49	0.01	0.83	1.62	0.08
Uniform Delay, d1	62.9	38.2	44.9	67.2	47.0	42.6	56.5	61.0	53.2	39.9	46.6	31.9
Progression 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
Incremental Delay, d2	31.1	1.3	337.3	2.7	8.9	2.1	9.9	232.0	0.1	8.1	282.1	0.3
Delay (s)	94.0	39.5	382.1	69.8	55.9	44.7	66.4	293.0	53.3	48.0	328.7	32.2
Level of Service	F	D	F	E	E	D	E	F	D	D	F	C
Approach Delay (s)		230.3			51.0			197.9			261.3	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	194.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.59		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	129.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	56	23.8	9.8	50.4	30.8	49	16.8	43.4
Maximum Split (%)	40.0%	17.0%	7.0%	36.0%	22.0%	35.0%	12.0%	31.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
End Time (s)	61.5	5.5	71.3	121.7	12.5	61.5	78.3	121.7
Yield/Force Off (s)	57	0	66.8	117.2	8	56	73.8	117.2
Yield/Force Off 170(s)	57	117	66.8	92.2	8	37	73.8	92.2
Local Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
Local Yield (s)	57	0	66.8	117.2	8	56	73.8	117.2
Local Yield 170(s)	57	117	66.8	92.2	8	37	73.8	92.2

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	105
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1832	1549	1681	1693	1561	1770	4972		1770	3539	1550
Flt Permitted		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1832	1549	1681	1693	1561	1770	4972		1770	3539	1550
Volume (vph)	10	20	20	190	10	180	10	860	150	300	2550	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	22	22	211	11	200	11	956	167	333	2833	11
RTOR Reduction (vph)	0	0	21	0	0	107	0	10	0	0	0	2
Lane Group Flow (vph)	0	33	1	108	114	93	11	1113	0	333	2833	9
Confl. Bikes (#/hr)			2			1						2
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		5.8	5.8	14.4	14.4	14.4	2.3	63.8		29.0	90.5	90.5
Effective Green, g (s)		6.3	6.3	14.9	14.9	14.9	2.8	66.3		29.5	93.0	93.0
Actuated g/C Ratio		0.05	0.05	0.11	0.11	0.11	0.02	0.50		0.22	0.70	0.70
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		87	73	188	190	175	37	2479		393	2475	1084
v/s Ratio Prot		c0.02		0.06	c0.07		0.01	0.22		c0.19	c0.80	
v/s Ratio Perm			0.00			0.06						0.01
v/c Ratio		0.38	0.01	0.57	0.60	0.53	0.30	0.45		0.85	1.14	0.01
Uniform Delay, d1		61.5	60.4	56.0	56.2	55.8	64.1	21.6		49.6	20.0	6.1
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		1.0	0.0	2.6	3.6	1.6	1.6	0.2		14.9	70.4	0.0
Delay (s)		62.5	60.4	58.7	59.8	57.3	65.8	21.8		64.5	90.4	6.1
Level of Service		E	E	E	E	E	E	C		E	F	A
Approach Delay (s)		61.6			58.4			22.2			87.4	
Approach LOS		E			E			C			F	

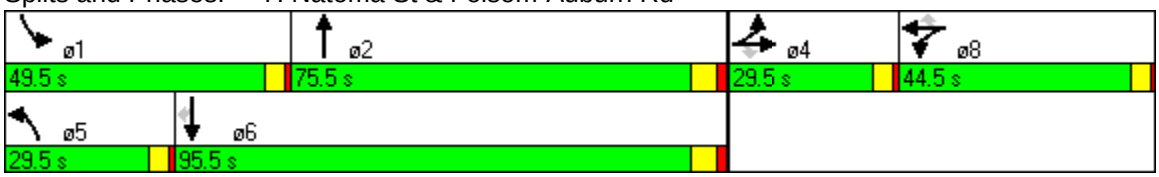
Intersection Summary			
HCM Average Control Delay	69.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	133.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.0%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



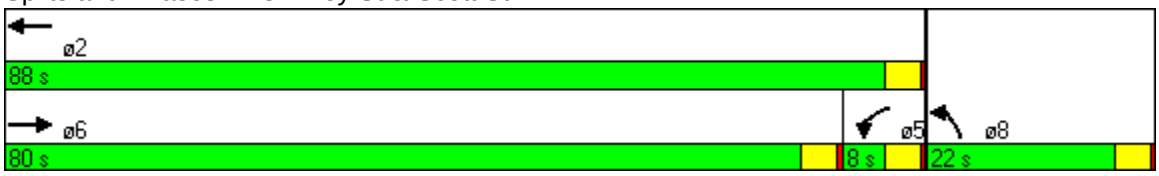
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3536		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3536		1770	1863	1695	
Volume (vph)	1580	10	10	1280	10	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1756	11	11	1422	11	11
RTOR Reduction (vph)	0	0	0	0	10	0
Lane Group Flow (vph)	1767	0	11	1422	12	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	88.8		4.0	96.8	5.2	
Effective Green, g (s)	88.8		4.0	96.8	5.2	
Actuated g/C Ratio	0.81		0.04	0.88	0.05	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2855		64	1639	80	
v/s Ratio Prot	0.50		0.01	c0.76	c0.01	
v/s Ratio Perm						
v/c Ratio	0.62		0.17	0.87	0.14	
Uniform Delay, d1	4.1		51.4	3.3	50.3	
Progression Factor	0.53		1.00	1.00	1.00	
Incremental Delay, d2	0.9		0.8	6.5	0.8	
Delay (s)	3.0		52.2	9.8	51.1	
Level of Service	A		D	A	D	
Approach Delay (s)	3.0			10.2	51.1	
Approach LOS	A			B	D	

Intersection Summary			
HCM Average Control Delay	6.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	80.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	8	80	22
Maximum Split (%)	80.0%	7.3%	72.7%	20.0%
Minimum Split (s)	11	8	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	8
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	18	18	0
Time To Reduce (s)	25	25	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	45	15	45	23
End Time (s)	23	23	15	45
Yield/Force Off (s)	19	19	11	41
Yield/Force Off 170(s)	19	19	1	28
Local Start Time (s)	34	4	34	12
Local Yield (s)	8	8	0	30
Local Yield 170(s)	8	8	100	17

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	110
Offset: 11 (10%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



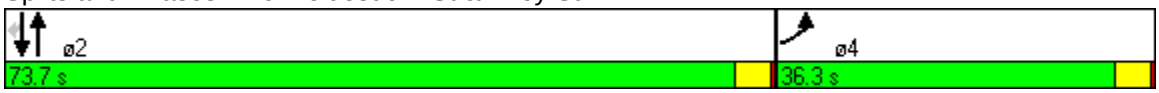
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.95			1.00	1.00	0.85
Flt Protected	0.97			1.00	1.00	1.00
Satd. Flow (prot)	3322			3539	1863	1583
Flt Permitted	0.97			1.00	1.00	1.00
Satd. Flow (perm)	3322			3539	1863	1583
Volume (vph)	40	20	0	1550	1210	80
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	44	22	0	1722	1344	89
RTOR Reduction (vph)	21	0	0	0	0	9
Lane Group Flow (vph)	45	0	0	1722	1344	80
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	7.3			94.7	94.7	94.7
Effective Green, g (s)	7.3			94.7	94.7	94.7
Actuated g/C Ratio	0.07			0.86	0.86	0.86
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	220			3047	1604	1363
v/s Ratio Prot	c0.01			0.49	c0.72	
v/s Ratio Perm						0.05
v/c Ratio	0.21			0.57	0.84	0.06
Uniform Delay, d1	48.6			2.1	3.8	1.1
Progression Factor	1.00			0.17	0.51	0.98
Incremental Delay, d2	0.4			0.1	3.0	0.0
Delay (s)	49.0			0.4	5.0	1.1
Level of Service	D			A	A	A
Approach Delay (s)	49.0			0.4	4.7	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	3.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	73.7	36.3
Maximum Split (%)	67.0%	33.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	54.3	18
End Time (s)	18	54.3
Yield/Force Off (s)	14	50.3
Yield/Force Off 170(s)	6	40.3
Local Start Time (s)	40.3	4
Local Yield (s)	0	36.3
Local Yield 170(s)	102	26.3

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 14 (13%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



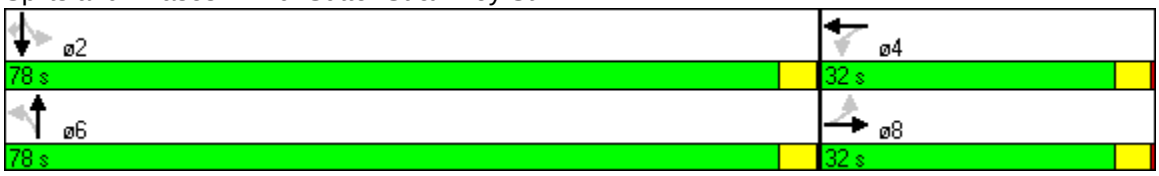
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1710	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.99			0.99			1.00			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.97			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1764			1741			1544			1815	1471
Flt Permitted		0.92			0.93			0.99			0.98	1.00
Satd. Flow (perm)		1638			1641			1529			1781	1471
Volume (vph)	10	20	10	10	10	10	10	1530	10	10	1210	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	22	11	11	11	11	11	1700	11	11	1344	11
RTOR Reduction (vph)	0	10	0	0	10	0	0	0	0	0	0	1
Lane Group Flow (vph)	0	34	0	0	23	0	0	1722	0	0	1355	10
Confl. Peds. (#/hr)									2			9
Confl. Bikes (#/hr)			2			1			1			
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		7.0			7.0			95.0			95.0	95.0
Effective Green, g (s)		7.0			7.0			95.0			95.0	95.0
Actuated g/C Ratio		0.06			0.06			0.86			0.86	0.86
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		104			104			1321			1538	1270
v/s Ratio Prot												
v/s Ratio Perm		c0.02			0.01			c1.13			0.76	0.01
v/c Ratio		0.32			0.22			1.30			0.88	0.01
Uniform Delay, d1		49.2			48.9			7.5			4.3	1.0
Progression Factor		1.00			1.00			1.00			0.34	0.60
Incremental Delay, d2		0.7			0.4			142.2			4.4	0.0
Delay (s)		49.9			49.3			149.7			5.9	0.6
Level of Service		D			D			F			A	A
Approach Delay (s)		49.9			49.3			149.7			5.8	
Approach LOS		D			D			F			A	

Intersection Summary			
HCM Average Control Delay	85.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	119.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



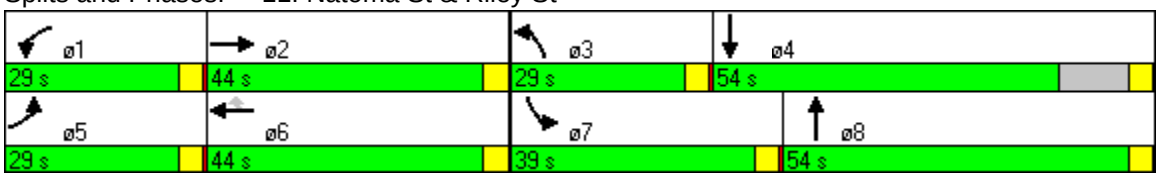
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1596	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1787		1770	1863	1583	1770	1557		1770	1859	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1787		1770	1863	1583	1770	1557		1770	1859	
Volume (vph)	20	350	130	60	340	920	100	610	20	480	740	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	389	144	67	378	1022	111	678	22	533	822	11
RTOR Reduction (vph)	0	8	0	0	0	390	0	1	0	0	0	0
Lane Group Flow (vph)	22	525	0	67	378	632	111	699	0	533	833	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.4	40.9		8.8	45.3	45.3	13.6	50.1		35.1	71.6	
Effective Green, g (s)	4.4	40.9		8.8	45.3	45.3	13.6	50.1		35.1	71.6	
Actuated g/C Ratio	0.03	0.27		0.06	0.30	0.30	0.09	0.33		0.23	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	52	484		103	559	475	160	517		412	882	
v/s Ratio Prot	0.01	0.29		c0.04	0.20		0.06	c0.45		c0.30	0.45	
v/s Ratio Perm						c0.40						
v/c Ratio	0.42	1.08		0.65	0.68	1.33	0.69	1.35		1.29	0.94	
Uniform Delay, d1	72.0	55.0		69.5	46.4	52.8	66.6	50.4		57.9	37.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.0	65.7		10.7	3.6	162.2	10.0	171.1		149.2	18.4	
Delay (s)	74.0	120.7		80.2	50.0	215.0	76.7	221.5		207.1	56.1	
Level of Service	E	F		F	D	F	E	F		F	E	
Approach Delay (s)		118.9			166.3			201.7			115.0	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	150.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	150.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	110.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	69	98	150	25	69	108	151
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	40	69	121	162	40	79	122

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 11: Natoma St & Riley St



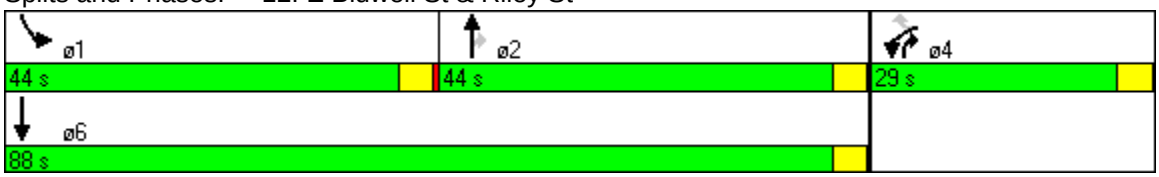
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1543	3539	1568	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1543	3539	1568	1770	1863
Volume (vph)	290	460	380	140	450	470
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	322	511	422	156	500	522
RTOR Reduction (vph)	0	383	0	88	0	0
Lane Group Flow (vph)	322	128	422	68	500	522
Confl. Peds. (#/hr)		7		8		
Confl. Bikes (#/hr)		8		8		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	15.9	15.9	11.7	27.6	23.8	39.5
Effective Green, g (s)	15.9	15.9	11.7	27.6	23.8	39.5
Actuated g/C Ratio	0.25	0.25	0.18	0.44	0.38	0.62
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	444	387	653	782	664	1161
v/s Ratio Prot	c0.18		c0.12	0.02	c0.28	0.28
v/s Ratio Perm		0.08		0.02		
v/c Ratio	0.73	0.33	0.65	0.09	0.75	0.45
Uniform Delay, d1	21.7	19.4	23.9	10.5	17.2	6.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.9	0.2	1.7	0.0	4.9	0.3
Delay (s)	26.7	19.6	25.6	10.5	22.1	6.5
Level of Service	C	B	C	B	C	A
Approach Delay (s)	22.3		21.5			14.2
Approach LOS	C		C			B

Intersection Summary			
HCM Average Control Delay	18.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.72		
Actuated Cycle Length (s)	63.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	70

Splits and Phases: 12: E Bidwell St & Riley St



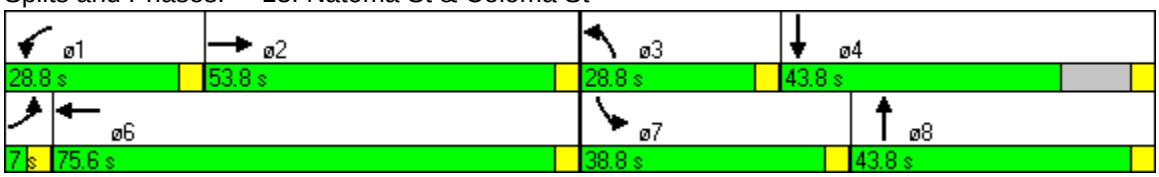
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.91		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1849		1770	1858		1770	1687		1770	1815	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1849		1770	1858		1770	1687		1770	1815	
Volume (vph)	10	770	40	40	1150	20	70	30	50	20	50	10
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	11	828	43	43	1237	22	75	32	54	22	54	11
RTOR Reduction (vph)	0	1	0	0	0	0	0	43	0	0	6	0
Lane Group Flow (vph)	11	870	0	43	1259	0	75	43	0	22	59	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	3.2	73.1		4.3	74.2		6.9	10.5		4.9	8.5	
Effective Green, g (s)	3.0	72.9		4.1	74.0		6.7	10.3		4.7	8.3	
Actuated g/C Ratio	0.03	0.68		0.04	0.69		0.06	0.10		0.04	0.08	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	49	1248		67	1273		110	161		77	139	
v/s Ratio Prot	0.01	0.47		c0.02	c0.68		c0.04	0.03		0.01	c0.03	
v/s Ratio Perm												
v/c Ratio	0.22	0.70		0.64	0.99		0.68	0.26		0.29	0.43	
Uniform Delay, d1	51.4	10.8		51.2	16.6		49.6	45.3		50.0	47.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	1.7		14.6	22.3		13.0	0.3		0.7	0.8	
Delay (s)	52.2	12.5		65.9	38.9		62.6	45.7		50.8	48.4	
Level of Service	D	B		E	D		E	D		D	D	
Approach Delay (s)		13.0			39.8			53.5			49.0	
Approach LOS		B			D			D			D	

Intersection Summary			
HCM Average Control Delay	31.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	108.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	28.8	53.8	28.8	43.8	7	75.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	4.2%	45.8%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	1	1	7	1	1
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	3	2.4	3	3	3	2.4	3	3
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	7	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	7	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	3.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	3.2	78.8	117.6	151.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	143.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	139.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	139.6	50	88.8	122.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 13: Natoma St & Coloma St



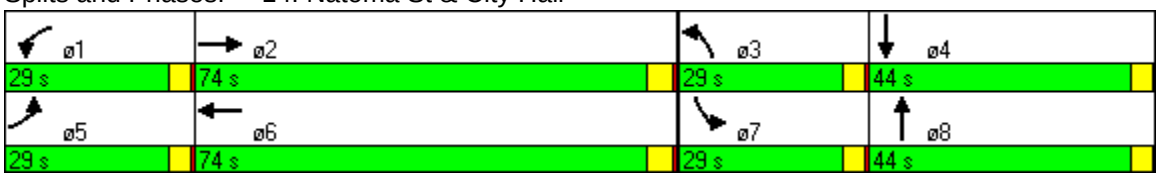
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		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	0.99		1.00	1.00		1.00	0.86		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3510		1770	3534		1770	1582		1770	1706	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3510		1770	3534		1770	1582		1770	1706	
Volume (vph)	10	790	40	90	1110	10	90	10	100	10	10	10
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	11	868	44	99	1220	11	99	11	110	11	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	97	0	0	10	0
Lane Group Flow (vph)	11	910	0	99	1230	0	99	24	0	11	12	0
Confl. Peds. (#/hr)			1			1			1			1
Confl. Bikes (#/hr)			2			1			3			3
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.6	29.3		6.0	30.7		6.2	7.5		4.6	5.9	
Effective Green, g (s)	4.6	30.3		6.0	31.7		6.2	7.5		4.6	5.9	
Actuated g/C Ratio	0.07	0.47		0.09	0.49		0.10	0.12		0.07	0.09	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	126	1651		165	1740		170	184		126	156	
v/s Ratio Prot	0.01	0.26		c0.06	c0.35		c0.06	c0.02		0.01	0.01	
v/s Ratio Perm												
v/c Ratio	0.09	0.55		0.60	0.71		0.58	0.13		0.09	0.08	
Uniform Delay, d1	27.9	12.2		28.0	12.7		27.9	25.5		27.9	26.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.4		4.2	1.3		3.3	0.1		0.1	0.1	
Delay (s)	28.0	12.6		32.2	14.1		31.1	25.6		28.0	26.8	
Level of Service	C	B		C	B		C	C		C	C	
Approach Delay (s)		12.8			15.4			28.1			27.2	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	15.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.54		
Actuated Cycle Length (s)	64.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	70

Splits and Phases: 14: Natoma St & City Hall



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	0.98	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	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3519		1770	3539	1549		1770	1549	1681	1484	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3519		1770	3539	1549		1770	1549	1681	1484	
Volume (vph)	10	580	20	10	1280	10	80	0	10	10	0	10
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	617	21	11	1362	11	85	0	11	11	0	11
RTOR Reduction (vph)	0	1	0	0	0	2	0	0	10	0	10	0
Lane Group Flow (vph)	11	637	0	11	1362	9	0	85	1	11	1	0
Confl. Peds. (#/hr)			1			2			3			1
Turn Type	Prot			Prot		Perm	Split		Perm	Split		
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases						2			3			
Actuated Green, G (s)	5.4	49.5		5.4	49.5	49.5		7.9	7.9	3.8	3.8	
Effective Green, g (s)	5.4	51.0		5.4	51.0	51.0		7.9	7.9	4.3	4.3	
Actuated g/C Ratio	0.06	0.60		0.06	0.60	0.60		0.09	0.09	0.05	0.05	
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5		4.0	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		3.0	3.0	2.0	2.0	
Lane Grp Cap (vph)	113	2121		113	2133	934		165	145	85	75	
v/s Ratio Prot	c0.01	0.18		0.01	c0.38			c0.05		c0.01	0.00	
v/s Ratio Perm						0.01			0.00			
v/c Ratio	0.10	0.30		0.10	0.64	0.01		0.52	0.01	0.13	0.01	
Uniform Delay, d1	37.3	8.1		37.3	10.8	6.7		36.5	34.8	38.4	38.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	0.1		0.1	0.6	0.0		2.7	0.0	0.3	0.0	
Delay (s)	37.4	8.2		37.4	11.5	6.7		39.2	34.8	38.6	38.1	
Level of Service	D	A		D	B	A		D	C	D	D	
Approach Delay (s)		8.7			11.7			38.7			38.4	
Approach LOS		A			B			D			D	

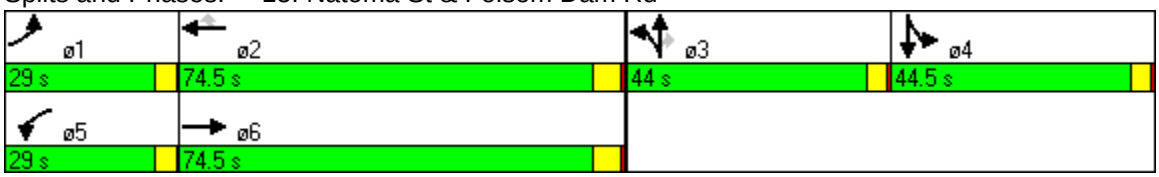
Intersection Summary			
HCM Average Control Delay	12.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	84.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	EBL	WBT	NBTL	SBTL	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	Min	Min
Maximum Split (s)	29	74.5	44	44.5	29	74.5
Maximum Split (%)	15.1%	38.8%	22.9%	23.2%	15.1%	38.8%
Minimum Split (s)	6	12.5	6	25.5	6	28.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	1	0.5	1
Minimum Initial (s)	2	7	2	2	2	7
Vehicle Extension (s)	2	3	3	2	2	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4
Time Before Reduce (s)	0	18	0	0	0	18
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)				7		7
Flash Dont Walk (s)				14		16
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103.5	147.5	0	29
End Time (s)	29	103.5	147.5	0	29	103.5
Yield/Force Off (s)	25	98	143.5	187.5	25	98
Yield/Force Off 170(s)	25	98	143.5	173.5	25	98
Local Start Time (s)	163	0	74.5	118.5	163	0
Local Yield (s)	188	69	114.5	158.5	188	69
Local Yield 170(s)	188	69	114.5	144.5	188	69

Intersection Summary	
Cycle Length	192
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 15: Natoma St & Folsom Dam Rd



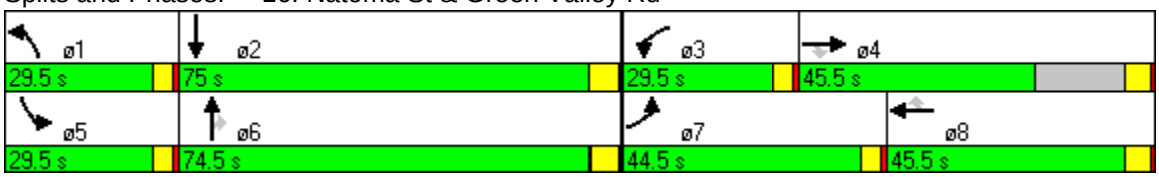
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Volume (vph)	360	110	40	160	200	60	60	190	130	100	810	780
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	400	122	44	178	222	67	67	211	144	111	900	867
RTOR Reduction (vph)	0	0	32	0	0	56	0	0	94	0	0	0
Lane Group Flow (vph)	400	122	12	178	222	11	67	211	50	111	900	867
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	14.4	18.8	18.8	6.9	11.3	11.3	3.4	25.1	25.1	5.7	26.9	76.5
Effective Green, g (s)	14.9	20.3	20.3	7.4	12.8	12.8	3.9	26.6	26.6	6.2	28.9	76.5
Actuated g/C Ratio	0.19	0.27	0.27	0.10	0.17	0.17	0.05	0.35	0.35	0.08	0.38	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	669	939	420	332	592	265	175	1231	550	278	1337	1583
v/s Ratio Prot	0.12	0.03		0.05	0.06		0.02	0.06		0.03	c0.25	
v/s Ratio Perm			0.01			0.01			0.03			c0.55
v/c Ratio	0.60	0.13	0.03	0.54	0.38	0.04	0.38	0.17	0.09	0.40	0.67	0.55
Uniform Delay, d1	28.1	21.4	20.8	32.9	28.3	26.7	35.1	17.3	16.8	33.4	19.9	0.0
Progression 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
Incremental Delay, d2	1.0	0.1	0.0	0.8	0.7	0.1	0.5	0.1	0.1	0.3	1.4	1.4
Delay (s)	29.0	21.5	20.8	33.8	29.0	26.8	35.6	17.4	16.9	33.7	21.3	1.4
Level of Service	C	C	C	C	C	C	D	B	B	C	C	A
Approach Delay (s)		26.8			30.5			20.1			12.8	
Approach LOS		C			C			C			B	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	76.5	Sum of lost time (s)	0.0
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	105

Splits and Phases: 16: Natoma St & Green Valley Rd



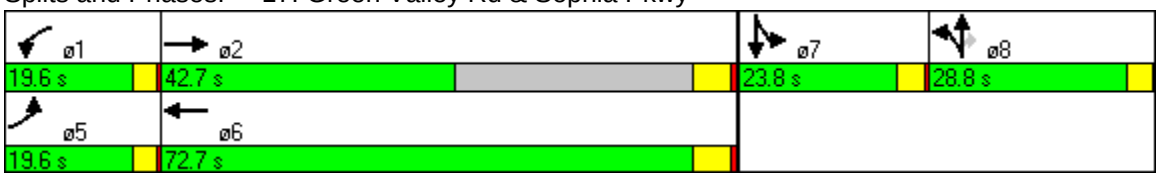
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.98		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)	1770	3477		1770	3536		1681	1703	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)	1770	3477		1770	3536		1681	1703	1583		1750	
Volume (vph)	10	530	70	30	1600	10	80	10	50	10	10	10
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	10	546	72	31	1649	10	82	10	52	10	10	10
RTOR Reduction (vph)	0	5	0	0	0	0	0	0	47	0	10	0
Lane Group Flow (vph)	10	613	0	31	1659	0	45	47	5	0	20	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	6.0	55.6		3.7	53.3		8.0	8.0	8.0		3.8	
Effective Green, g (s)	5.6	57.3		3.3	55.0		7.8	7.8	7.8		3.6	
Actuated g/C Ratio	0.06	0.65		0.04	0.62		0.09	0.09	0.09		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	113	2264		66	2210		149	151	140		72	
v/s Ratio Prot	0.01	0.18		c0.02	c0.47		0.03	c0.03			c0.01	
v/s Ratio Perm									0.00			
v/c Ratio	0.09	0.27		0.47	0.75		0.30	0.31	0.03		0.28	
Uniform Delay, d1	38.8	6.5		41.5	11.7		37.6	37.6	36.7		40.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.2	0.1		2.7	1.5		1.2	1.2	0.1		2.2	
Delay (s)	39.0	6.6		44.2	13.1		38.7	38.8	36.8		43.2	
Level of Service	D	A		D	B		D	D	D		D	
Approach Delay (s)		7.1			13.7			38.0			43.2	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	13.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	88.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	59.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	42.7	19.6	72.7	23.8	28.8
Maximum Split (%)	13.5%	29.5%	13.5%	50.2%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	7.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	4	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



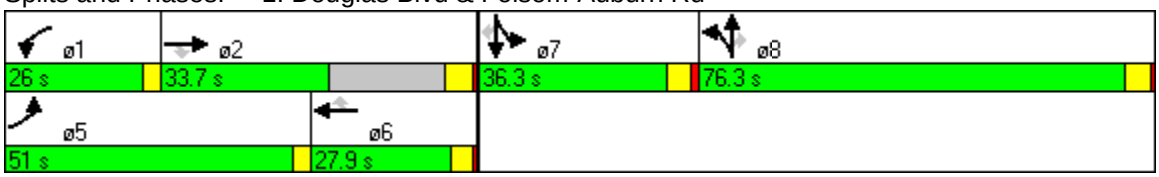
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.97	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1545	1770	3539	1517	3433	1863	1542	1770	3539	1551
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1545	1770	3539	1517	3433	1863	1542	1770	3539	1551
Volume (vph)	390	400	910	120	310	80	880	500	100	160	420	280
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	406	417	948	125	323	83	917	521	104	167	438	292
RTOR Reduction (vph)	0	0	457	0	0	72	0	0	71	0	0	216
Lane Group Flow (vph)	406	417	491	125	323	11	917	521	33	167	438	76
Confl. Peds. (#/hr)			6			2			8			
Confl. Bikes (#/hr)			2			6						6
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	35.5	41.1	41.1	11.0	17.4	17.4	41.2	41.2	41.2	19.7	19.7	19.7
Effective Green, g (s)	34.5	42.8	42.8	10.0	18.3	18.3	42.5	42.5	42.5	21.0	21.0	21.0
Actuated g/C Ratio	0.26	0.32	0.32	0.08	0.14	0.14	0.32	0.32	0.32	0.16	0.16	0.16
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	462	1145	500	134	490	210	1103	598	495	281	562	246
v/s Ratio Prot	c0.23	0.12		0.07	0.09		0.27	c0.28		0.09	c0.12	
v/s Ratio Perm			c0.32			0.01			0.02			0.05
v/c Ratio	0.88	0.36	0.98	0.93	0.66	0.05	0.83	0.87	0.07	0.59	0.78	0.31
Uniform Delay, d1	46.9	34.3	44.4	60.8	54.0	49.5	41.6	42.3	31.2	51.7	53.4	49.2
Progression 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
Incremental Delay, d2	16.6	0.1	35.2	56.7	2.4	0.0	5.2	12.8	0.0	2.2	6.2	0.3
Delay (s)	63.5	34.4	79.5	117.5	56.5	49.5	46.8	55.1	31.2	53.9	59.6	49.5
Level of Service	E	C	E	F	E	D	D	E	C	D	E	D
Approach Delay (s)		65.2			69.8			48.6			55.3	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM Average Control Delay	58.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	132.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	26	33.7	51	27.9	36.3	76.3
Maximum Split (%)	13.6%	17.6%	26.6%	14.6%	19.0%	39.8%
Minimum Split (s)	6	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	0	51	78.9	115.2
End Time (s)	26	78.9	51	78.9	115.2	0
Yield/Force Off (s)	23	73.2	48	74	109.9	186.2
Yield/Force Off 170(s)	23	63.2	48	64	99.9	186.2
Local Start Time (s)	165.5	0	165.5	25	52.9	89.2
Local Yield (s)	188.5	47.2	22	48	83.9	160.2
Local Yield 170(s)	188.5	37.2	22	38	73.9	160.2

Intersection Summary	
Cycle Length	191.5
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	1.00			1.00	1.00
Frpb, ped/bikes		1.00	0.97				1.00	1.00			1.00	1.00
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)		1770	1534				1770	1863			1863	1583
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1534				1770	1863			1863	1583
Volume (vph)	100	0	160	0	0	0	50	1350	0	0	1210	110
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	110	0	176	0	0	0	55	1484	0	0	1330	121
RTOR Reduction (vph)	0	0	158	0	0	0	0	0	0	0	0	9
Lane Group Flow (vph)	0	110	18	0	0	0	55	1484	0	0	1330	112
Confl. Bikes (#/hr)			3			13						
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		13.5	13.5				6.7	111.7			101.0	101.0
Effective Green, g (s)		13.5	13.5				6.7	113.2			102.5	102.5
Actuated g/C Ratio		0.10	0.10				0.05	0.84			0.76	0.76
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		177	154				88	1566			1418	1205
v/s Ratio Prot		c0.06					0.03	c0.80			0.71	
v/s Ratio Perm			0.01									0.07
v/c Ratio		0.62	0.11				0.62	0.95			0.94	0.09
Uniform Delay, d1		58.1	55.2				62.8	8.4			13.4	4.1
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		6.6	0.3				9.6	12.3			11.9	0.0
Delay (s)		64.8	55.5				72.3	20.8			25.4	4.2
Level of Service		E	E				E	C			C	A
Approach Delay (s)		59.1			0.0			22.6			23.6	
Approach LOS		E			A			C			C	

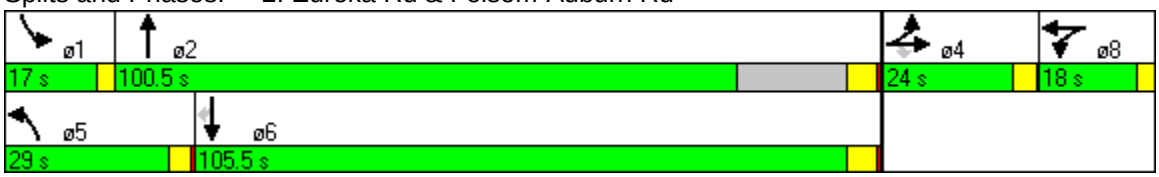
Intersection Summary			
HCM Average Control Delay	26.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	134.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.89		0.95		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
Frt		1.00	0.85		0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1803	1404		1650		1770	1860		1770	1863	1549
Flt Permitted		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1803	1404		1650		1770	1860		1770	1863	1549
Volume (vph)	20	10	140	20	10	20	120	1380	10	10	1240	20
Peak-hour factor, 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 (vph)	22	11	152	22	11	22	130	1500	11	11	1348	22
RTOR Reduction (vph)	0	0	144	0	15	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	33	8	0	40	0	130	1511	0	11	1348	20
Confl. Bikes (#/hr)			13			10			10			3
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		7.3	7.3		5.8		13.8	97.1		4.4	87.7	87.7
Effective Green, g (s)		6.7	6.7		5.2		12.8	98.8		3.4	89.4	89.4
Actuated g/C Ratio		0.05	0.05		0.04		0.10	0.76		0.03	0.69	0.69
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		93	72		66		174	1413		46	1280	1064
v/s Ratio Prot		c0.02			c0.02		c0.07	c0.81		0.01	0.72	
v/s Ratio Perm			0.01									0.01
v/c Ratio		0.35	0.11		0.60		0.75	1.07		0.24	1.05	0.02
Uniform Delay, d1		59.6	58.9		61.4		57.1	15.6		62.1	20.3	6.5
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.8	0.2		10.1		14.1	44.9		1.0	40.4	0.0
Delay (s)		60.5	59.1		71.5		71.2	60.5		63.1	60.8	6.5
Level of Service		E	E		E		E	E		E	E	A
Approach Delay (s)		59.3			71.5			61.4			59.9	
Approach LOS		E			E			E			E	

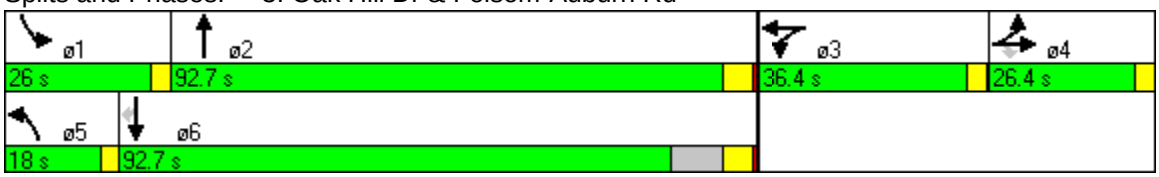
Intersection Summary			
HCM Average Control Delay	60.8	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	130.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	96.1%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



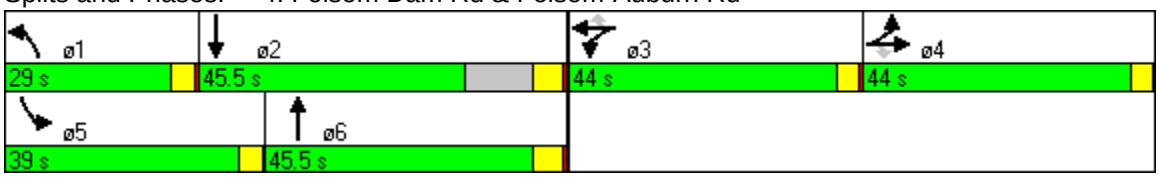
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3535		1770	3515	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3535		1770	3515	
Volume (vph)	100	0	80	20	0	10	70	1320	10	10	1240	60
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	110	0	88	22	0	11	77	1451	11	11	1363	66
RTOR Reduction (vph)	0	0	79	0	0	11	0	0	0	0	1	0
Lane Group Flow (vph)	0	110	9	0	22	0	77	1462	0	11	1428	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						
Actuated Green, G (s)		9.9	9.9		3.0	3.0	6.8	61.8		1.0	56.0	
Effective Green, g (s)		9.9	9.9		3.0	3.0	6.8	63.3		1.0	57.5	
Actuated g/C Ratio		0.11	0.11		0.03	0.03	0.07	0.68		0.01	0.62	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.0	4.7		1.5	5.4	
Lane Grp Cap (vph)		188	168		57	51	129	2401		19	2169	
v/s Ratio Prot		c0.06			c0.01		c0.04	0.41		0.01	c0.41	
v/s Ratio Perm			0.01			0.00						
v/c Ratio		0.59	0.06		0.39	0.01	0.60	0.61		0.58	0.66	
Uniform Delay, d1		39.7	37.4		44.2	43.7	41.9	8.2		45.9	11.5	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		3.0	0.1		1.6	0.0	4.9	0.6		23.8	1.1	
Delay (s)		42.7	37.5		45.8	43.7	46.7	8.8		69.7	12.6	
Level of Service		D	D		D	D	D	A		E	B	
Approach Delay (s)		40.4			45.1			10.7			13.0	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM Average Control Delay	13.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	93.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	NBL	SBT	WBTL	EBTL	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	45.5	44	44	39	45.5
Maximum Split (%)	16.8%	26.4%	25.5%	25.5%	22.6%	26.4%
Minimum Split (s)	5	23.5	12	28	6	12.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1
Minimum Initial (s)	1	7	8	2	2	7
Vehicle Extension (s)	1	5.4	1	1	1.5	4.7
Minimum Gap (s)	3	3.8	3	3	3	3.1
Time Before Reduce (s)	0	10	0	0	0	10
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)		7		7		
Flash Dont Walk (s)		11		17		
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	84.5	128.5	0	39
End Time (s)	29	84.5	128.5	0	39	84.5
Yield/Force Off (s)	25	79	124.5	168.5	35	79
Yield/Force Off 170(s)	25	79	124.5	151.5	35	79
Local Start Time (s)	133.5	162.5	45.5	89.5	133.5	0
Local Yield (s)	158.5	40	85.5	129.5	168.5	40
Local Yield 170(s)	158.5	40	85.5	112.5	168.5	40

Intersection Summary	
Cycle Length	172.5
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



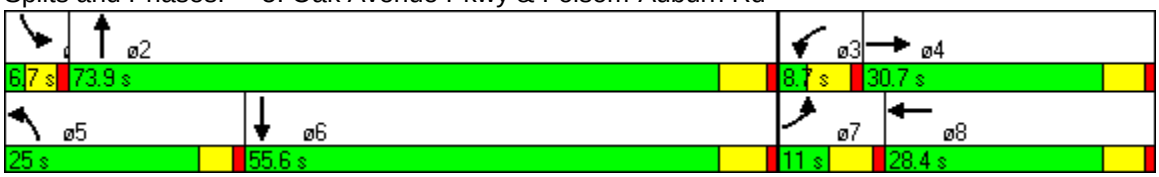
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		0.97	0.95		1.00	0.95	
Frpb, ped/bikes	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	
Frt	1.00	0.85		1.00	0.95		1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1568		1770	1758		3433	3523		1770	3501	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1568		1770	1758		3433	3523		1770	3501	
Volume (vph)	60	10	330	30	20	10	560	1480	40	10	1290	90
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	64	11	351	32	21	11	596	1574	43	11	1372	96
RTOR Reduction (vph)	0	238	0	0	10	0	0	1	0	0	4	0
Lane Group Flow (vph)	64	124	0	32	22	0	596	1616	0	11	1464	0
Confl. Peds. (#/hr)									1			
Confl. Bikes (#/hr)			2			1			2			5
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	4.4	12.7		1.6	9.9		20.2	64.2		2.1	46.1	
Effective Green, g (s)	6.1	14.4		3.3	11.6		20.9	66.4		2.8	48.3	
Actuated g/C Ratio	0.06	0.14		0.03	0.11		0.20	0.65		0.03	0.47	
Clearance Time (s)	5.7	5.7		5.7	5.7		4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	105	219		57	198		697	2273		48	1643	
v/s Ratio Prot	c0.04	c0.08		0.02	0.01		c0.17	0.46		0.01	c0.42	
v/s Ratio Perm												
v/c Ratio	0.61	0.57		0.56	0.11		0.86	0.71		0.23	0.89	
Uniform Delay, d1	47.2	41.3		49.1	41.0		39.5	12.0		49.0	24.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.6	3.3		12.0	0.3		9.7	1.1		0.9	6.7	
Delay (s)	56.9	44.6		61.1	41.3		49.2	13.1		49.9	31.6	
Level of Service	E	D		E	D		D	B		D	C	
Approach Delay (s)		46.5			51.2			22.8			31.7	
Approach LOS		D			D			C			C	

Intersection Summary			
HCM Average Control Delay	28.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	102.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize			Yes	Yes			Yes	Yes
Recall Mode	Min	Min	None	None	None	Min	None	None
Maximum Split (s)	6.7	73.9	8.7	30.7	25	55.6	11	28.4
Maximum Split (%)	5.6%	61.6%	7.3%	25.6%	20.8%	46.3%	9.2%	23.7%
Minimum Split (s)	6.7	13.2	8.7	30.7	6.7	13.2	8.7	27.7
Yellow Time (s)	3.5	5	4.5	4.5	3.5	5	4.5	4.5
All-Red Time (s)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Minimum Initial (s)	2	7	3	3	2	7	3	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	6.7	80.6	89.3	0	25	80.6	91.6
End Time (s)	6.7	80.6	89.3	0	25	80.6	91.6	0
Yield/Force Off (s)	2	74.4	83.6	114.3	20.3	74.4	85.9	114.3
Yield/Force Off 170(s)	2	74.4	83.6	96.3	20.3	74.4	85.9	99.3
Local Start Time (s)	95	101.7	55.6	64.3	95	0	55.6	66.6
Local Yield (s)	97	49.4	58.6	89.3	115.3	49.4	60.9	89.3
Local Yield 170(s)	97	49.4	58.6	71.3	115.3	49.4	60.9	74.3

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



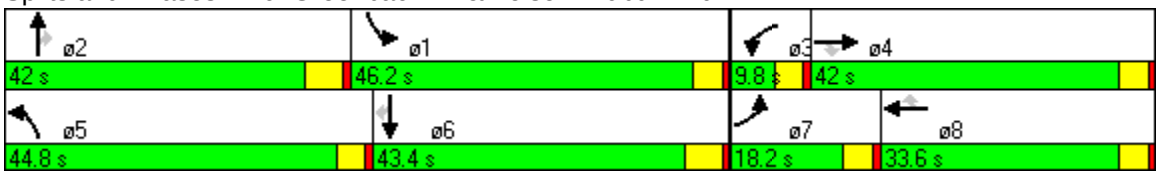
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	200	670	730	10	920	820	1220	1300	10	620	930	200
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	213	713	777	11	979	872	1298	1383	11	660	989	213
RTOR Reduction (vph)	0	0	381	0	0	386	0	0	5	0	0	100
Lane Group Flow (vph)	213	713	396	11	979	486	1298	1383	6	660	989	113
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	13.7	43.4	43.4	2.1	31.8	31.8	40.3	33.8	33.8	41.7	35.2	35.2
Effective Green, g (s)	14.2	43.9	43.9	2.6	32.3	32.3	40.8	35.3	35.3	42.2	36.7	36.7
Actuated g/C Ratio	0.10	0.31	0.31	0.02	0.23	0.23	0.29	0.25	0.25	0.30	0.26	0.26
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	180	1110	496	33	816	365	1000	892	399	534	928	415
v/s Ratio Prot	c0.12	0.20		0.01	0.28		c0.38	c0.39		c0.37	0.28	
v/s Ratio Perm			0.25			c0.31			0.00			0.07
v/c Ratio	1.18	0.64	0.80	0.33	1.20	1.33	1.30	1.55	0.01	1.24	1.07	0.27
Uniform Delay, d1	62.9	41.3	44.0	67.8	53.8	53.8	49.6	52.4	39.3	48.9	51.6	41.0
Progression 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
Incremental Delay, d2	125.1	1.0	8.2	2.2	101.6	166.7	141.5	253.3	0.1	121.6	48.7	1.6
Delay (s)	188.0	42.3	52.2	70.0	155.5	220.5	191.1	305.6	39.4	170.5	100.3	42.6
Level of Service	F	D	D	E	F	F	F	F	D	F	F	D
Approach Delay (s)		65.0			185.4			249.3			118.6	
Approach LOS		E			F			F			F	

Intersection Summary			
HCM Average Control Delay	166.0	HCM Level of Service	F
HCM Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	120.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	46.2	42	9.8	42	44.8	43.4	18.2	33.6
Maximum Split (%)	33.0%	30.0%	7.0%	30.0%	32.0%	31.0%	13.0%	24.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
End Time (s)	51.7	5.5	61.5	103.5	8.3	51.7	69.9	103.5
Yield/Force Off (s)	47.2	0	57	99	3.8	46.2	65.4	99
Yield/Force Off 170(s)	47.2	117	57	74	3.8	27.2	65.4	74
Local Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
Local Yield (s)	47.2	0	57	99	3.8	46.2	65.4	99
Local Yield 170(s)	47.2	117	57	74	3.8	27.2	65.4	74

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	145
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		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	0.85
Flt Protected		0.98	1.00	0.95	0.97	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1831	1556	1681	1720	1561	1770	5036		1770	3539	1548
Flt Permitted		0.98	1.00	0.95	0.97	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1831	1556	1681	1720	1561	1770	5036		1770	3539	1548
Volume (vph)	10	20	10	110	30	520	20	2000	120	470	1210	20
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	21	11	117	32	553	21	2128	128	500	1287	21
RTOR Reduction (vph)	0	0	11	0	0	443	0	3	0	0	0	6
Lane Group Flow (vph)	0	32	0	73	76	110	21	2253	0	500	1287	15
Confl. Bikes (#/hr)			1			1			1			5
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		6.1	6.1	16.5	16.5	16.5	4.3	71.7		45.5	112.9	112.9
Effective Green, g (s)		6.6	6.6	17.0	17.0	17.0	4.8	74.2		46.0	115.4	115.4
Actuated g/C Ratio		0.04	0.04	0.11	0.11	0.11	0.03	0.46		0.29	0.72	0.72
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		76	64	179	183	166	53	2338		510	2556	1118
v/s Ratio Prot		c0.02		0.04	0.04		0.01	c0.45		c0.28	0.36	
v/s Ratio Perm			0.00			c0.07						0.01
v/c Ratio		0.42	0.01	0.41	0.42	0.66	0.40	0.96		0.98	0.50	0.01
Uniform Delay, d1		74.7	73.5	66.7	66.8	68.6	76.1	41.5		56.5	9.7	6.2
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		1.4	0.0	0.6	0.6	7.4	1.8	11.5		34.6	0.3	0.0
Delay (s)		76.1	73.5	67.3	67.3	76.1	77.8	53.0		91.0	10.0	6.2
Level of Service		E	E	E	E	E	E	D		F	B	A
Approach Delay (s)		75.4			74.2			53.2			32.4	
Approach LOS		E			E			D			C	

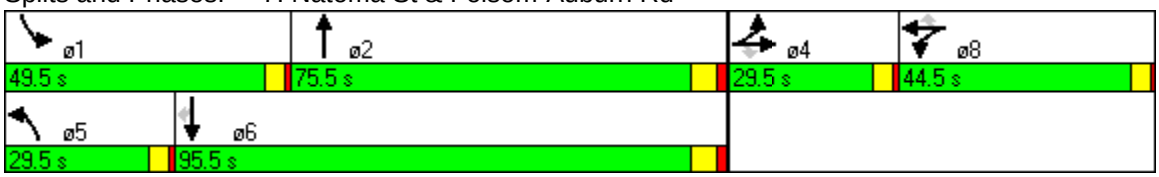
Intersection Summary			
HCM Average Control Delay	48.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	159.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	87.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



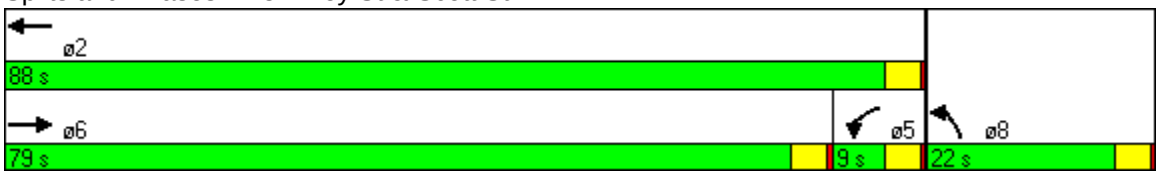
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3533		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3533		1770	1863	1695	
Volume (vph)	1740	20	20	1280	20	20
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	1851	21	21	1362	21	21
RTOR Reduction (vph)	0	0	0	0	20	0
Lane Group Flow (vph)	1872	0	21	1362	22	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	86.5		5.0	95.5	6.5	
Effective Green, g (s)	86.5		5.0	95.5	6.5	
Actuated g/C Ratio	0.79		0.05	0.87	0.06	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2778		80	1617	100	
v/s Ratio Prot	0.53		0.01	c0.73	c0.01	
v/s Ratio Perm						
v/c Ratio	0.67		0.26	0.84	0.22	
Uniform Delay, d1	5.3		50.7	3.6	49.3	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.3		1.1	5.5	1.1	
Delay (s)	6.7		51.9	9.1	50.5	
Level of Service	A		D	A	D	
Approach Delay (s)	6.7			9.7	50.5	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	8.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	9	79	22
Maximum Split (%)	80.0%	8.2%	71.8%	20.0%
Minimum Split (s)	11	8	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	35	4	35	13
End Time (s)	13	13	4	35
Yield/Force Off (s)	9	9	0	31
Yield/Force Off 170(s)	9	9	100	18
Local Start Time (s)	35	4	35	13
Local Yield (s)	9	9	0	31
Local Yield 170(s)	9	9	100	18

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



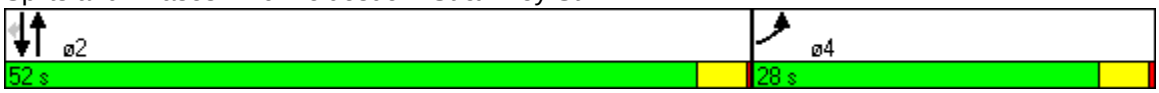
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.98			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3393			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3393			3539	1863	1583
Volume (vph)	190	30	0	1570	1230	70
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	202	32	0	1670	1309	74
RTOR Reduction (vph)	20	0	0	0	0	16
Lane Group Flow (vph)	214	0	0	1670	1309	58
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	10.6			61.4	61.4	61.4
Effective Green, g (s)	10.6			61.4	61.4	61.4
Actuated g/C Ratio	0.13			0.77	0.77	0.77
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	450			2716	1430	1215
v/s Ratio Prot	c0.06			0.47	c0.70	
v/s Ratio Perm						0.04
v/c Ratio	0.48			0.61	0.92	0.05
Uniform Delay, d1	32.1			4.1	7.3	2.2
Progression Factor	1.00			1.00	1.00	1.00
Incremental Delay, d2	0.7			1.1	10.6	0.1
Delay (s)	32.8			5.1	17.9	2.3
Level of Service	C			A	B	A
Approach Delay (s)	32.8			5.1	17.1	
Approach LOS	C			A	B	

Intersection Summary			
HCM Average Control Delay	12.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	52	28
Maximum Split (%)	65.0%	35.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	46	18
End Time (s)	18	46
Yield/Force Off (s)	14	42
Yield/Force Off 170(s)	6	32
Local Start Time (s)	32	4
Local Yield (s)	0	28
Local Yield 170(s)	72	18

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 14 (18%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



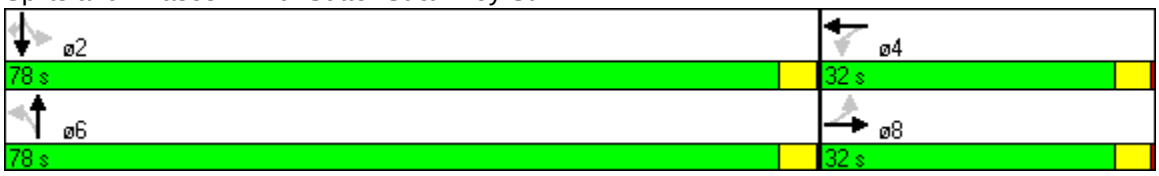
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1610	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.98			0.98			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.96			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1737			1723			1453			1815	1512
Flt Permitted		0.92			0.69			0.85			0.98	1.00
Satd. Flow (perm)		1616			1204			1234			1783	1512
Volume (vph)	30	100	50	40	40	40	10	1500	20	10	1220	30
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	32	106	53	43	43	43	11	1596	21	11	1298	32
RTOR Reduction (vph)	0	14	0	0	19	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	177	0	0	110	0	0	1628	0	0	1309	26
Confl. Peds. (#/hr)			21			22						
Confl. Bikes (#/hr)									16			1
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		17.2			17.2			84.8			84.8	84.8
Effective Green, g (s)		17.2			17.2			84.8			84.8	84.8
Actuated g/C Ratio		0.16			0.16			0.77			0.77	0.77
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		253			188			951			1375	1166
v/s Ratio Prot												
v/s Ratio Perm		c0.11			0.09			c1.32			0.73	0.02
v/c Ratio		0.70			0.59			1.71			0.95	0.02
Uniform Delay, d1		43.9			43.1			12.6			10.8	2.9
Progression Factor		1.00			1.00			1.00			1.00	1.00
Incremental Delay, d2		6.6			3.0			324.7			15.2	0.0
Delay (s)		50.6			46.1			337.3			26.1	3.0
Level of Service		D			D			F			C	A
Approach Delay (s)		50.6			46.1			337.3			25.5	
Approach LOS		D			D			F			C	

Intersection Summary			
HCM Average Control Delay	182.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.54		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	126.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



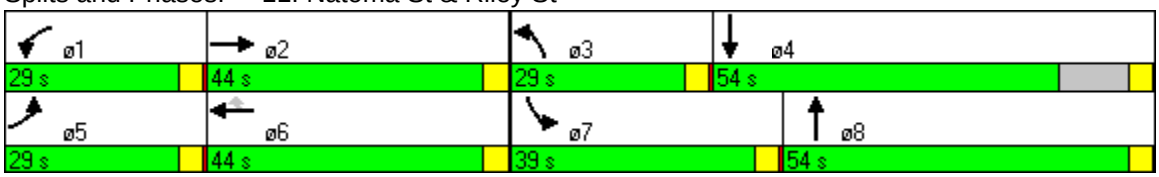
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1560	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1800		1770	1863	1583	1770	1524		1770	1855	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1800		1770	1863	1583	1770	1524		1770	1855	
Volume (vph)	30	450	130	120	380	690	70	810	20	600	690	20
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	32	479	138	128	404	734	74	862	21	638	734	21
RTOR Reduction (vph)	0	6	0	0	0	359	0	1	0	0	1	0
Lane Group Flow (vph)	32	611	0	128	404	375	74	882	0	638	754	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	6.3	40.8		15.6	50.1	50.1	10.9	50.1		35.0	74.2	
Effective Green, g (s)	6.3	40.8		15.6	50.1	50.1	10.9	50.1		35.0	74.2	
Actuated g/C Ratio	0.04	0.26		0.10	0.32	0.32	0.07	0.32		0.22	0.47	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	71	466		175	593	504	122	485		393	874	
v/s Ratio Prot	0.02	c0.34		c0.07	0.22		0.04	c0.58		c0.36	0.41	
v/s Ratio Perm						0.24						
v/c Ratio	0.45	1.31		0.73	0.68	0.74	0.61	1.82		1.62	0.86	
Uniform Delay, d1	73.9	58.4		68.9	46.7	48.0	71.2	53.7		61.3	37.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.7	154.8		12.7	3.6	6.4	5.7	376.7		292.0	9.2	
Delay (s)	75.6	213.2		81.6	50.3	54.3	76.9	430.4		353.2	46.3	
Level of Service	E	F		F	D	D	E	F		F	D	
Approach Delay (s)		206.4			55.8			403.1			186.9	
Approach LOS		F			E			F			F	

Intersection Summary			
HCM Average Control Delay	199.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.50		
Actuated Cycle Length (s)	157.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	138.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	57	98	162	25	58	108	162
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	28	69	133	162	29	79	133

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 11: Natoma St & Riley St



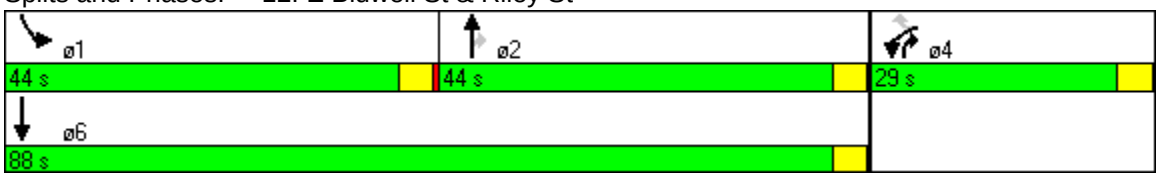
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1535	3539	1568	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1535	3539	1568	1770	1863
Volume (vph)	170	420	520	200	400	630
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	173	429	531	204	408	643
RTOR Reduction (vph)	0	352	0	119	0	0
Lane Group Flow (vph)	173	77	531	85	408	643
Confl. Peds. (#/hr)		2		2		
Confl. Bikes (#/hr)		14		7		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	8.9	8.9	11.7	20.6	16.9	32.6
Effective Green, g (s)	8.9	8.9	11.7	20.6	16.9	32.6
Actuated g/C Ratio	0.18	0.18	0.24	0.42	0.34	0.66
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	318	276	836	779	604	1227
v/s Ratio Prot	c0.10		0.15	0.02	c0.23	c0.35
v/s Ratio Perm		0.05		0.03		
v/c Ratio	0.54	0.28	0.64	0.11	0.68	0.52
Uniform Delay, d1	18.5	17.5	17.0	8.8	14.0	4.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.0	0.2	1.2	0.0	3.0	0.4
Delay (s)	19.5	17.7	18.2	8.9	17.0	4.8
Level of Service	B	B	B	A	B	A
Approach Delay (s)	18.2		15.6			9.5
Approach LOS	B		B			A

Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	49.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 12: E Bidwell St & Riley St



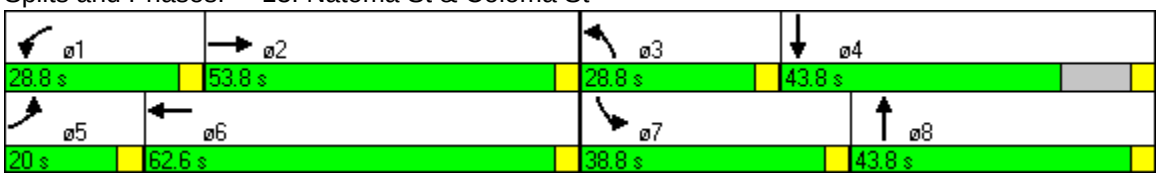
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1855		1770	1846		1770	1705		1770	1783	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1855		1770	1846		1770	1705		1770	1783	
Volume (vph)	10	1050	30	60	920	60	230	100	130	30	50	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1105	32	63	968	63	242	105	137	32	53	21
RTOR Reduction (vph)	0	0	0	0	1	0	0	29	0	0	11	0
Lane Group Flow (vph)	11	1137	0	63	1030	0	242	213	0	32	63	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.3	58.7		6.2	60.6		19.2	24.1		3.7	8.6	
Effective Green, g (s)	4.1	58.5		6.0	60.4		19.0	23.9		3.5	8.4	
Actuated g/C Ratio	0.04	0.54		0.06	0.56		0.18	0.22		0.03	0.08	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	67	1006		98	1033		312	378		57	139	
v/s Ratio Prot	0.01	c0.61		c0.04	0.56		c0.14	c0.13		0.02	0.04	
v/s Ratio Perm												
v/c Ratio	0.16	1.13		0.64	1.00		0.78	0.56		0.56	0.45	
Uniform Delay, d1	50.2	24.7		49.9	23.7		42.4	37.4		51.4	47.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	71.2		10.3	27.1		10.5	1.2		7.3	0.9	
Delay (s)	50.7	95.9		60.2	50.8		52.9	38.5		58.8	48.4	
Level of Service	D	F		E	D		D	D		E	D	
Approach Delay (s)		95.4			51.3			45.7			51.5	
Approach LOS		F			D			D			D	

Intersection Summary			
HCM Average Control Delay	68.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	107.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	Min
Maximum Split (s)	28.8	53.8	28.8	43.8	20	62.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	12.1%	37.9%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	7	1	7	1	7
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	20	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	20	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	16.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	16.2	78.8	117.6	161.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	156.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	152.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	152.6	50	88.8	132.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 13: Natoma St & Coloma St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		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	0.99		1.00	1.00		1.00	0.87		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3498		1770	3532		1770	1588		1770	1784	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3498		1770	3532		1770	1588		1770	1784	
Volume (vph)	10	1110	80	110	890	10	160	20	180	20	30	10
Peak-hour factor, 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 (vph)	11	1207	87	120	967	11	174	22	196	22	33	11
RTOR Reduction (vph)	0	2	0	0	0	0	0	164	0	0	8	0
Lane Group Flow (vph)	11	1292	0	120	978	0	174	54	0	22	36	0
Confl. Bikes (#/hr)			2			1			3			2
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	6.0	43.1		7.6	44.7		9.7	13.4		1.7	5.4	
Effective Green, g (s)	6.0	44.1		7.6	45.7		9.7	13.4		1.7	5.4	
Actuated g/C Ratio	0.07	0.53		0.09	0.55		0.12	0.16		0.02	0.07	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	128	1863		162	1949		207	257		36	116	
v/s Ratio Prot	0.01	c0.37		c0.07	0.28		c0.10	0.03		0.01	c0.02	
v/s Ratio Perm												
v/c Ratio	0.09	0.69		0.74	0.50		0.84	0.21		0.61	0.31	
Uniform Delay, d1	35.8	14.3		36.6	11.5		35.8	30.1		40.2	36.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	1.1		14.7	0.2		24.4	0.1		19.6	0.5	
Delay (s)	35.9	15.5		51.3	11.7		60.2	30.3		59.9	37.5	
Level of Service	D	B		D	B		E	C		E	D	
Approach Delay (s)		15.7			16.0			43.5			44.9	
Approach LOS		B			B			D			D	

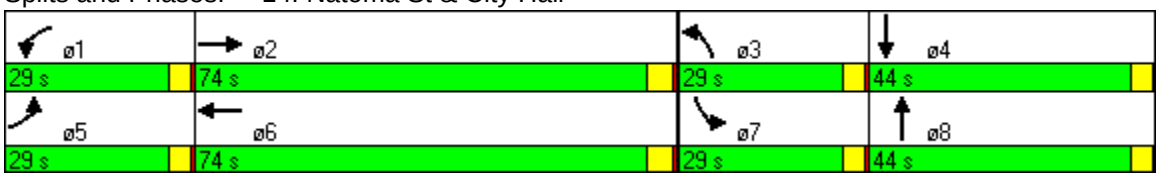
Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	82.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	65.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 14: Natoma St & City Hall



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	0.98	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	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3525		1770	3539	1549		1770	1546	1681	1482	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3525		1770	3539	1549		1770	1546	1681	1482	
Volume (vph)	10	1100	30	10	830	20	50	0	10	10	0	10
Peak-hour factor, 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 (vph)	11	1196	33	11	902	22	54	0	11	11	0	11
RTOR Reduction (vph)	0	1	0	0	0	4	0	0	10	0	10	0
Lane Group Flow (vph)	11	1228	0	11	902	18	0	54	1	11	1	0
Confl. Peds. (#/hr)						2			3			2
Turn Type	Prot			Prot		Perm	Split		Perm	Split		
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases						2			3			
Actuated Green, G (s)	1.1	62.3		1.1	62.3	62.3		7.1	7.1	5.1	5.1	
Effective Green, g (s)	1.1	63.8		1.1	63.8	63.8		7.1	7.1	5.6	5.6	
Actuated g/C Ratio	0.01	0.68		0.01	0.68	0.68		0.08	0.08	0.06	0.06	
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5		4.0	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	21	2403		21	2412	1056		134	117	101	89	
v/s Ratio Prot	c0.01	c0.35		0.01	0.25			c0.03		c0.01	0.00	
v/s Ratio Perm						0.01			0.00			
v/c Ratio	0.52	0.51		0.52	0.37	0.02		0.40	0.01	0.11	0.01	
Uniform Delay, d1	46.0	7.3		46.0	6.4	4.8		41.2	40.0	41.6	41.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	10.4	0.2		10.4	0.1	0.0		0.7	0.0	0.2	0.0	
Delay (s)	56.4	7.5		56.4	6.5	4.8		42.0	40.0	41.8	41.4	
Level of Service	E	A		E	A	A		D	D	D	D	
Approach Delay (s)		7.9			7.0			41.6			41.6	
Approach LOS		A			A			D			D	

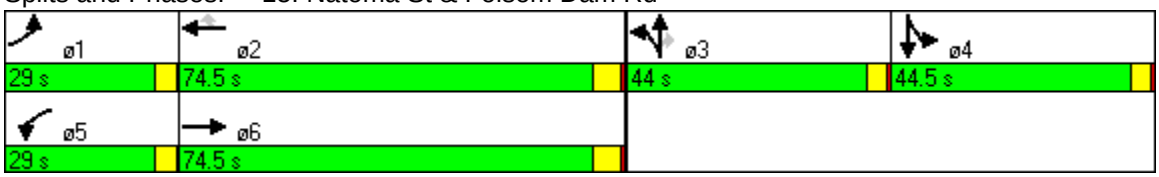
Intersection Summary			
HCM Average Control Delay	8.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.47		
Actuated Cycle Length (s)	93.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	49.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	EBL	WBT	NBTL	SBTL	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	74.5	44	44.5	29	74.5
Maximum Split (%)	15.1%	38.8%	22.9%	23.2%	15.1%	38.8%
Minimum Split (s)	6	12.5	6	25.5	6	28.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	1	0.5	1
Minimum Initial (s)	2	7	2	2	2	7
Vehicle Extension (s)	2	3	2	2	2	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4
Time Before Reduce (s)	0	18	0	0	0	18
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)				7		7
Flash Dont Walk (s)				14		16
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103.5	147.5	0	29
End Time (s)	29	103.5	147.5	0	29	103.5
Yield/Force Off (s)	25	98	143.5	187.5	25	98
Yield/Force Off 170(s)	25	98	143.5	173.5	25	98
Local Start Time (s)	163	0	74.5	118.5	163	0
Local Yield (s)	188	69	114.5	158.5	188	69
Local Yield 170(s)	188	69	114.5	144.5	188	69

Intersection Summary	
Cycle Length	192
Control Type	Actuated-Uncoordinated
Natural Cycle	70

Splits and Phases: 15: Natoma St & Folsom Dam Rd



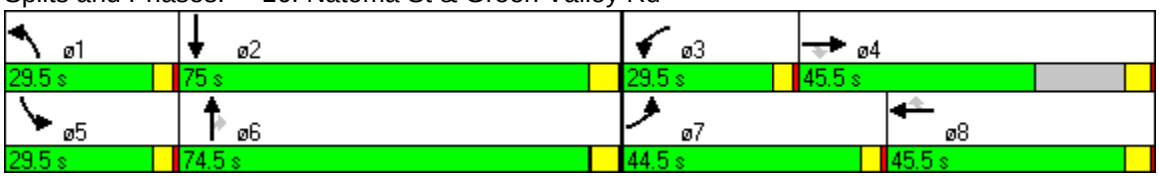
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Volume (vph)	770	160	40	160	120	120	50	830	130	100	380	420
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	856	178	44	178	133	133	56	922	144	111	422	467
RTOR Reduction (vph)	0	0	28	0	0	116	0	0	95	0	0	0
Lane Group Flow (vph)	856	178	16	178	133	17	56	922	49	111	422	467
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	41.3	45.0	45.0	10.8	14.5	14.5	5.4	40.8	40.8	8.4	43.3	125.0
Effective Green, g (s)	41.8	46.5	46.5	11.3	16.0	16.0	5.9	42.3	42.3	8.9	45.3	125.0
Actuated g/C Ratio	0.33	0.37	0.37	0.09	0.13	0.13	0.05	0.34	0.34	0.07	0.36	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	1148	1317	589	310	453	203	162	1198	536	244	1283	1583
v/s Ratio Prot	c0.25	0.05		0.05	0.04		0.02	c0.26		c0.03	0.12	
v/s Ratio Perm			0.01			0.01			0.03			c0.29
v/c Ratio	0.75	0.14	0.03	0.57	0.29	0.08	0.35	0.77	0.09	0.45	0.33	0.30
Uniform Delay, d1	36.9	26.0	24.9	54.5	49.4	48.0	57.7	37.0	28.2	55.7	28.8	0.0
Progression 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
Incremental Delay, d2	2.3	0.1	0.0	1.6	0.6	0.3	0.5	3.4	0.1	0.5	0.2	0.5
Delay (s)	39.2	26.0	24.9	56.1	50.0	48.3	58.1	40.4	28.4	56.2	29.0	0.5
Level of Service	D	C	C	E	D	D	E	D	C	E	C	A
Approach Delay (s)		36.5			52.0			39.7			18.7	
Approach LOS		D			D			D			B	

Intersection Summary			
HCM Average Control Delay	34.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	125.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	125

Splits and Phases: 16: Natoma St & Green Valley Rd



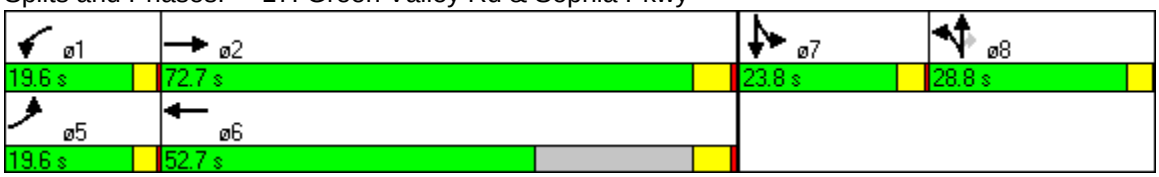
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97	1.00		0.98	
Satd. Flow (prot)	1770	3521		1770	3533		1681	1713	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97	1.00		0.98	
Satd. Flow (perm)	1770	3521		1770	3533		1681	1713	1583		1750	
Volume (vph)	10	1650	60	70	840	10	50	10	70	10	10	10
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	1755	64	74	894	11	53	11	74	11	11	11
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	68	0	11	0
Lane Group Flow (vph)	11	1818	0	74	905	0	31	33	6	0	22	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	5.6	69.7		7.5	71.6		8.2	8.2	8.2		4.4	
Effective Green, g (s)	5.2	71.4		7.1	73.3		8.0	8.0	8.0		4.2	
Actuated g/C Ratio	0.05	0.67		0.07	0.69		0.07	0.07	0.07		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	86	2356		118	2427		126	128	119		69	
v/s Ratio Prot	0.01	c0.52		c0.04	0.26		0.02	c0.02			c0.01	
v/s Ratio Perm									0.00			
v/c Ratio	0.13	0.77		0.63	0.37		0.25	0.26	0.05		0.33	
Uniform Delay, d1	48.6	12.1		48.5	7.0		46.5	46.5	45.8		49.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.3	1.6		7.8	0.1		1.1	1.1	0.2		2.8	
Delay (s)	48.9	13.7		56.4	7.1		47.6	47.7	46.0		52.7	
Level of Service	D	B		E	A		D	D	D		D	
Approach Delay (s)		13.9			10.9			46.7			52.7	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	106.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	72.7	19.6	52.7	23.8	28.8
Maximum Split (%)	13.5%	50.2%	13.5%	36.4%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	7.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	4	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	100

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



2007 Conditions – Alternatives 2-4

Level of Service Technical Calculations

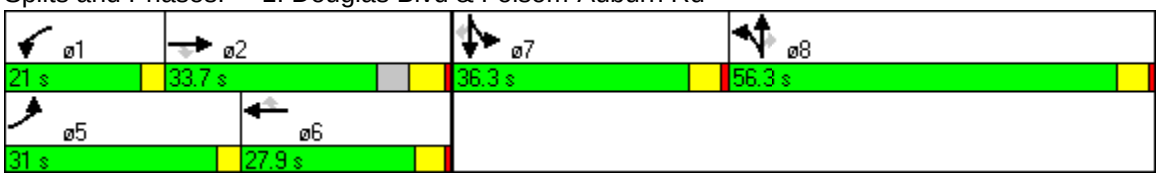
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.97	1.00	1.00	0.98	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	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1552	1770	3539	1535	3433	1863	1550	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1552	1770	3539	1535	3433	1863	1550	1770	3539	1563
Volume (vph)	160	160	590	110	360	100	1080	310	40	80	540	420
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	178	178	656	122	400	111	1200	344	44	89	600	467
RTOR Reduction (vph)	0	0	504	0	0	95	0	0	26	0	0	231
Lane Group Flow (vph)	178	178	152	122	400	16	1200	344	18	89	600	236
Confl. Peds. (#/hr)						2			5			
Confl. Bikes (#/hr)			6			2			1			1
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	15.6	20.2	20.2	11.5	16.9	16.9	48.9	48.9	48.9	23.7	23.7	23.7
Effective Green, g (s)	14.6	21.9	21.9	10.5	17.8	17.8	50.2	50.2	50.2	25.0	25.0	25.0
Actuated g/C Ratio	0.12	0.18	0.18	0.08	0.14	0.14	0.41	0.41	0.41	0.20	0.20	0.20
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	209	627	275	150	510	221	1394	757	630	358	716	316
v/s Ratio Prot	c0.10	0.05		0.07	c0.11		c0.35	0.18		0.05	c0.17	
v/s Ratio Perm			0.10			0.01			0.01			0.15
v/c Ratio	0.85	0.28	0.55	0.81	0.78	0.07	0.86	0.45	0.03	0.25	0.84	0.75
Uniform Delay, d1	53.4	44.1	46.4	55.6	51.0	45.8	33.5	26.7	22.0	41.4	47.4	46.3
Progression 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
Incremental Delay, d2	26.0	0.1	1.4	26.2	7.2	0.1	5.5	0.2	0.0	0.1	8.1	8.1
Delay (s)	79.4	44.1	47.8	81.8	58.2	45.8	39.0	26.9	22.1	41.5	55.5	54.4
Level of Service	E	D	D	F	E	D	D	C	C	D	E	D
Approach Delay (s)		52.7			60.6			35.9			54.0	
Approach LOS		D			E			D			D	

Intersection Summary			
HCM Average Control Delay	48.1	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	123.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	21	33.7	31	27.9	36.3	56.3
Maximum Split (%)	13.9%	22.2%	20.5%	18.4%	24.0%	37.2%
Minimum Split (s)	8	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	21	0	31	58.9	95.2
End Time (s)	21	58.9	31	58.9	95.2	0
Yield/Force Off (s)	18	53.2	28	54	89.9	146.2
Yield/Force Off 170(s)	18	43.2	28	44	79.9	146.2
Local Start Time (s)	130.5	0	130.5	10	37.9	74.2
Local Yield (s)	148.5	32.2	7	33	68.9	125.2
Local Yield 170(s)	148.5	22.2	7	23	58.9	125.2

Intersection Summary	
Cycle Length	151.5
Control Type	Actuated-Uncoordinated
Natural Cycle	115

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	1.00			1.00	1.00
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				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)		1770	1547				1770	1863			1863	1551
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1547				1770	1863			1863	1551
Volume (vph)	160	0	120	0	0	0	150	1230	0	0	1200	120
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	178	0	133	0	0	0	167	1367	0	0	1333	133
RTOR Reduction (vph)	0	0	116	0	0	0	0	0	0	0	0	14
Lane Group Flow (vph)	0	178	17	0	0	0	167	1367	0	0	1333	119
Confl. Bikes (#/hr)			1			1						1
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		18.7	18.7				17.3	121.6			100.3	100.3
Effective Green, g (s)		18.7	18.7				17.3	123.1			101.8	101.8
Actuated g/C Ratio		0.12	0.12				0.12	0.82			0.68	0.68
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		221	193				204	1531			1266	1054
v/s Ratio Prot		c0.10					0.09	c0.73			c0.72	
v/s Ratio Perm			0.01									0.08
v/c Ratio		0.81	0.09				0.82	0.89			1.05	0.11
Uniform Delay, d1		63.8	58.0				64.7	8.9			24.0	8.3
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		18.9	0.2				20.9	7.0			40.5	0.0
Delay (s)		82.6	58.2				85.6	16.0			64.5	8.4
Level of Service		F	E				F	B			E	A
Approach Delay (s)		72.2			0.0			23.5			59.4	
Approach LOS		E			A			C			E	

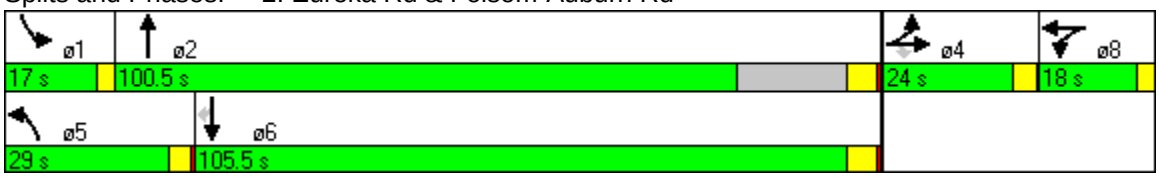
Intersection Summary			
HCM Average Control Delay	44.0	HCM Level of Service	D
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	149.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	90.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



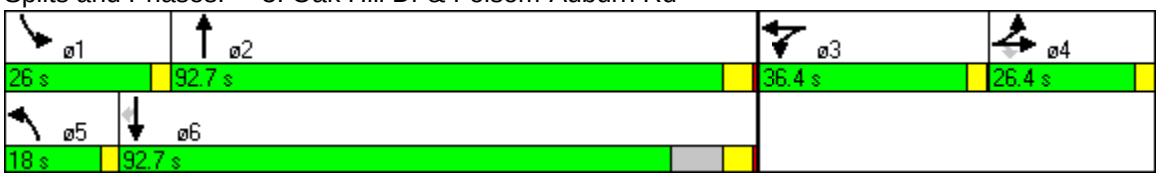
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.96		0.99		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	0.85		0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1804	1516		1724		1770	1860		1770	1863	1583
Flt Permitted		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1804	1516		1724		1770	1860		1770	1863	1583
Volume (vph)	20	10	430	10	10	10	350	1310	10	10	1280	30
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	11	457	11	11	11	372	1394	11	11	1362	32
RTOR Reduction (vph)	0	0	338	0	11	0	0	0	0	0	0	3
Lane Group Flow (vph)	0	32	119	0	22	0	372	1405	0	11	1362	29
Confl. Peds. (#/hr)			3			2						
Confl. Bikes (#/hr)			3			1			3			
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		14.7	14.7		4.4		15.1	98.5		4.5	87.9	87.9
Effective Green, g (s)		14.1	14.1		3.8		14.1	100.2		3.5	89.6	89.6
Actuated g/C Ratio		0.10	0.10		0.03		0.10	0.73		0.03	0.65	0.65
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		185	155		48		181	1354		45	1213	1031
v/s Ratio Prot		0.02			c0.01		c0.21	0.76		0.01	c0.73	
v/s Ratio Perm			c0.08									0.02
v/c Ratio		0.17	0.77		0.46		2.06	1.04		0.24	1.12	0.03
Uniform Delay, d1		56.4	60.1		65.9		61.7	18.7		65.8	24.0	8.5
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.2	18.1		2.6		493.5	34.8		1.0	66.5	0.0
Delay (s)		56.6	78.2		68.5		555.2	53.5		66.8	90.5	8.5
Level of Service		E	E		E		F	D		E	F	A
Approach Delay (s)		76.8			68.5			158.5			88.5	
Approach LOS		E			E			F			F	

Intersection Summary			
HCM Average Control Delay	120.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.17		
Actuated Cycle Length (s)	137.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	108.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



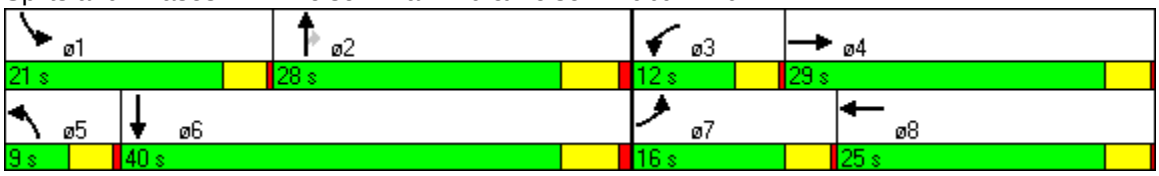
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1676		3433	1863	1583	1770	3539	1583	3433	3504	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1676		3433	1863	1583	1770	3539	1583	3433	3504	
Volume (vph)	100	20	40	160	20	940	30	670	290	790	850	60
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	111	22	44	178	22	1044	33	744	322	878	944	67
RTOR Reduction (vph)	0	40	0	0	0	0	0	0	239	0	4	0
Lane Group Flow (vph)	111	26	0	178	22	1044	33	744	83	878	1007	0
Turn Type	Prot			Prot		Free	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	10.9	8.7		8.0	5.8	90.0	3.4	21.7	21.7	34.1	52.4	
Effective Green, g (s)	10.9	8.7		8.0	5.8	90.0	3.4	23.2	23.2	34.1	53.9	
Actuated g/C Ratio	0.12	0.10		0.09	0.06	1.00	0.04	0.26	0.26	0.38	0.60	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	1.0	1.0		1.0	1.0		1.5	5.4	5.4	1.5	5.4	
Lane Grp Cap (vph)	214	162		305	120	1583	67	912	408	1301	2099	
v/s Ratio Prot	0.06	0.02		0.05	0.01		0.02	c0.21		0.26	0.29	
v/s Ratio Perm						c0.66			0.05			
v/c Ratio	0.52	0.16		0.58	0.18	0.66	0.49	0.82	0.20	0.67	0.48	
Uniform Delay, d1	37.1	37.3		39.4	39.9	0.0	42.5	31.4	26.2	23.3	10.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.14	
Incremental Delay, d2	0.9	0.2		1.8	0.3	2.2	2.1	8.0	1.1	0.9	0.6	
Delay (s)	38.0	37.5		41.2	40.1	2.2	44.5	39.4	27.3	23.9	12.3	
Level of Service	D	D		D	D	A	D	D	C	C	B	
Approach Delay (s)		37.8			8.4			36.0			17.7	
Approach LOS		D			A			D			B	

Intersection Summary			
HCM Average Control Delay	20.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	63.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	21	28	12	29	9	40	16	25
Maximum Split (%)	23.3%	31.1%	13.3%	32.2%	10.0%	44.4%	17.8%	27.8%
Minimum Split (s)	6	27.5	12	29	6	21.5	6	12
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	2	7	8	2	2	7	2	8
Vehicle Extension (s)	1.5	5.4	1	1	1.5	5.4	1	1
Minimum Gap (s)	1.5	3.8	1	1	1.5	3.8	1	1
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		
Flash Dont Walk (s)		15		18		9		
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	1.5	22.5	50.5	62.5	1.5	10.5	50.5	66.5
End Time (s)	22.5	50.5	62.5	1.5	10.5	50.5	66.5	1.5
Yield/Force Off (s)	18.5	45	58.5	87.5	6.5	45	62.5	87.5
Yield/Force Off 170(s)	18.5	30	58.5	69.5	6.5	36	62.5	87.5
Local Start Time (s)	46.5	67.5	5.5	17.5	46.5	55.5	5.5	21.5
Local Yield (s)	63.5	0	13.5	42.5	51.5	0	17.5	42.5
Local Yield 170(s)	63.5	75	13.5	24.5	51.5	81	17.5	42.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 45 (50%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



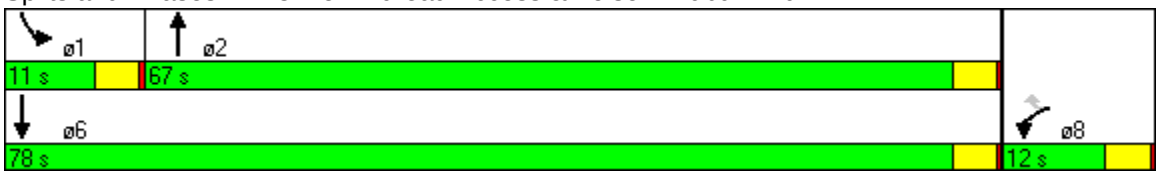
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3530		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3530		1770	3539
Volume (vph)	20	10	1680	30	10	1680
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	11	1867	33	11	1867
RTOR Reduction (vph)	0	10	1	0	0	0
Lane Group Flow (vph)	22	1	1899	0	11	1867
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	4.4	4.4	72.2		1.4	77.6
Effective Green, g (s)	4.4	4.4	72.2		1.4	77.6
Actuated g/C Ratio	0.05	0.05	0.80		0.02	0.86
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)	87	77	2832		28	3051
v/s Ratio Prot	c0.01		c0.54		0.01	c0.53
v/s Ratio Perm		0.00				
v/c Ratio	0.25	0.01	0.67		0.39	0.61
Uniform Delay, d1	41.2	40.7	3.8		43.9	1.8
Progression Factor	1.00	1.00	0.77		1.00	1.00
Incremental Delay, d2	1.5	0.0	0.9		8.9	0.9
Delay (s)	42.8	40.8	3.8		52.7	2.7
Level of Service	D	D	A		D	A
Approach Delay (s)	42.1		3.8			3.0
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	3.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	11	67	78	12
Maximum Split (%)	12.2%	74.4%	86.7%	13.3%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	16	27	16	4
End Time (s)	27	4	4	16
Yield/Force Off (s)	23	0	0	12
Yield/Force Off 170(s)	23	0	0	12
Local Start Time (s)	16	27	16	4
Local Yield (s)	23	0	0	12
Local Yield 170(s)	23	0	0	12

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	5085	5058	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	5085	5058	
Volume (vph)	70	30	20	1640	1640	60
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	78	33	22	1822	1822	67
RTOR Reduction (vph)	0	31	0	0	5	0
Lane Group Flow (vph)	78	2	22	1822	1884	0
Turn Type		Perm	Prot			
Protected Phases	4		5	2	6	
Permitted Phases		4				
Actuated Green, G (s)	4.0	4.0	1.8	31.5	51.7	
Effective Green, g (s)	4.0	4.0	1.8	33.0	53.2	
Actuated g/C Ratio	0.05	0.05	0.02	0.41	0.66	
Clearance Time (s)	4.0	4.0	4.0	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	1.5	5.4	5.4	
Lane Grp Cap (vph)	89	79	40	2098	3364	
v/s Ratio Prot	c0.04		c0.01	c0.36	c0.37	
v/s Ratio Perm		0.00				
v/c Ratio	0.88	0.02	0.55	0.87	0.56	
Uniform Delay, d1	37.8	36.1	38.7	21.5	7.2	
Progression Factor	1.00	1.00	0.98	0.68	1.24	
Incremental Delay, d2	56.4	0.1	8.2	4.8	0.6	
Delay (s)	94.2	36.2	46.2	19.4	9.4	
Level of Service	F	D	D	B	A	
Approach Delay (s)	76.9			19.7	9.4	
Approach LOS	E			B	A	

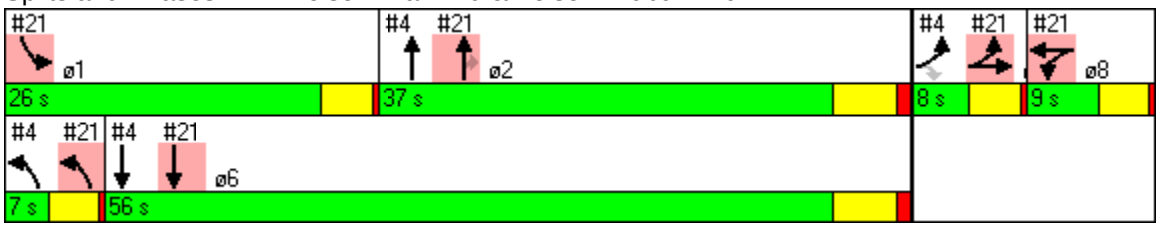
Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	25.0
Intersection Capacity Utilization	43.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Node Number	21	4	4	4	4	21
Movement	SBL	NBT	EBL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	26	37	8	7	56	9
Maximum Split (%)	32.5%	46.3%	10.0%	8.8%	70.0%	11.3%
Minimum Split (s)	8	21.5	8	6	12.5	8
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	4	7	4	2	7	4
Vehicle Extension (s)	3	5.4	3	1.5	5.4	3
Minimum Gap (s)	3	3.8	3	1.5	3.8	3
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7				
Flash Dont Walk (s)		9				
Dual Entry	No	No	Yes	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	64.5	10.5	47.5	64.5	71.5	55.5
End Time (s)	10.5	47.5	55.5	71.5	47.5	64.5
Yield/Force Off (s)	6.5	42	51.5	67.5	42	60.5
Yield/Force Off 170(s)	6.5	33	51.5	67.5	42	60.5
Local Start Time (s)	22.5	48.5	5.5	22.5	29.5	13.5
Local Yield (s)	44.5	0	9.5	25.5	0	18.5
Local Yield 170(s)	44.5	71	9.5	25.5	0	18.5

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	80

Offset: 42 (53%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1695		1681	1703	2787	1770	3539	1583	3433	3527	
Flt Permitted	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1695		1681	1703	2787	1770	3539	1583	3433	3527	
Volume (vph)	30	20	30	160	20	940	20	690	290	790	860	20
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	33	22	33	178	22	1044	22	767	322	878	956	22
RTOR Reduction (vph)	0	31	0	0	0	0	0	0	178	0	2	0
Lane Group Flow (vph)	33	24	0	97	103	1044	22	767	144	878	976	0
Turn Type	Split			Split		Free	Prot		Perm	Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	4.0	4.0		5.0	5.0	80.0	1.8	31.5	31.5	22.0	51.7	
Effective Green, g (s)	4.0	4.0		5.0	5.0	80.0	1.8	33.0	33.0	22.0	53.2	
Actuated g/C Ratio	0.05	0.05		0.06	0.06	1.00	0.02	0.41	0.41	0.28	0.66	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		1.5	5.4	5.4	3.0	5.4	
Lane Grp Cap (vph)	89	85		105	106	2787	40	1460	653	944	2345	
v/s Ratio Prot	0.02	0.01		0.06	c0.06		0.01	c0.22		c0.26	0.28	
v/s Ratio Perm						c0.37			0.09			
v/c Ratio	0.37	0.28		0.92	0.97	0.37	0.55	0.53	0.22	0.93	0.42	
Uniform Delay, d1	36.8	36.6		37.3	37.4	0.0	38.7	17.6	15.2	28.3	6.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.10	0.43	
Incremental Delay, d2	2.6	1.8		63.5	77.9	0.4	9.0	1.4	0.8	13.4	0.5	
Delay (s)	39.4	38.4		100.8	115.4	0.4	47.7	19.0	16.0	44.6	3.1	
Level of Service	D	D		F	F	A	D	B	B	D	A	
Approach Delay (s)		38.8			17.7			18.7			22.8	
Approach LOS		D			B			B			C	

Intersection Summary			
HCM Average Control Delay	20.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Alternative 3 - AM

DELAY

4. Folsom Bridge (Auto Spa)/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	78	94.2	7,348
EBR	33	36.2	1,195
NBL	22	46.2	1,016
NBT	1,822	19.4	35,347
SBT	1,822	9.4	17,127
SBR	67	9.4	630
total	3,844	215	62,662

Reported Delay

EBL	EBR	NBL	NBT	SBT	SBR
94.2	36.2	46.2	19.4	9.4	

Reported Adj Flow

EBL	EBR	NBL	NBT	SBT	SBR
78	33	22	1,822	1,822	67

21. Existing Folsom Dam Road/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	33	39.4	1,300
EBT	22	38.4	845
EBR	33	38.4	1,267
WBL	178	100.8	17,942
WBT	22	115.4	2,539
WBR	1,044	0.4	418
NBL	22	47.7	1,049
NBT	767	19.0	14,573
NBR	322	16.0	5,152
SBL	878	44.6	39,159
SBT	956	3.1	2,964
SBR	22	3.1	68
total	4,299	466	87,276

total Adj. Volume	8,143
Int. Delay	**18.4**

Reported Delay

EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
39.4	38.4	100.8	115.4	0.4	47.7	19	16	44.6	3.1

Reported Adj Flow

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
33	22	33	178	22	1,044	22	767	322	878	956	22

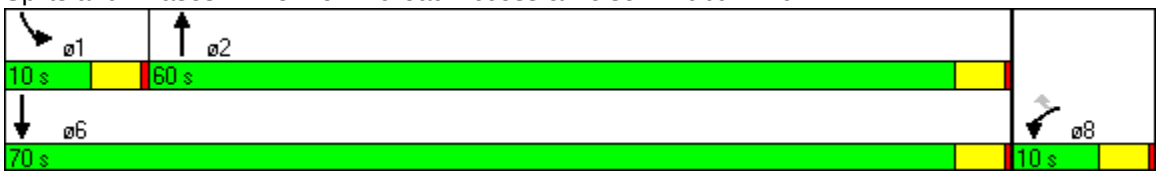
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3530		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3530		1770	3539
Volume (vph)	20	10	1680	30	10	1680
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	11	1867	33	11	1867
RTOR Reduction (vph)	0	11	1	0	0	0
Lane Group Flow (vph)	22	0	1899	0	11	1867
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	2.6	2.6	64.2		1.2	69.4
Effective Green, g (s)	2.6	2.6	64.2		1.2	69.4
Actuated g/C Ratio	0.03	0.03	0.80		0.02	0.87
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)	58	51	2833		27	3070
v/s Ratio Prot	c0.01		c0.54		0.01	c0.53
v/s Ratio Perm		0.00				
v/c Ratio	0.38	0.01	0.67		0.41	0.61
Uniform Delay, d1	37.9	37.5	3.4		39.0	1.5
Progression Factor	1.00	1.00	2.02		1.00	1.00
Incremental Delay, d2	4.1	0.1	0.6		9.7	0.9
Delay (s)	42.0	37.5	7.4		48.8	2.4
Level of Service	D	D	A		D	A
Approach Delay (s)	40.5		7.4			2.7
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	5.4	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	57.4%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	10	60	70	10
Maximum Split (%)	12.5%	75.0%	87.5%	12.5%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	14	24	14	4
End Time (s)	24	4	4	14
Yield/Force Off (s)	20	0	0	10
Yield/Force Off 170(s)	20	0	0	10
Local Start Time (s)	14	24	14	4
Local Yield (s)	20	0	0	10
Local Yield 170(s)	20	0	0	10

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



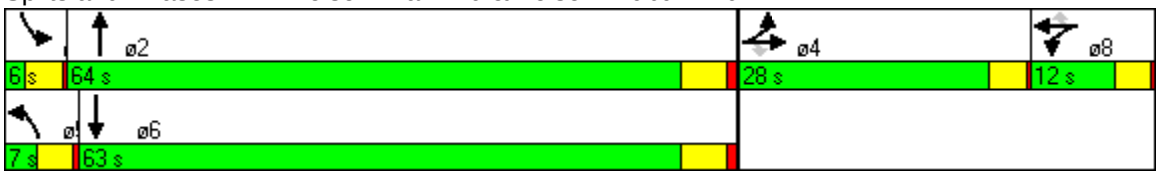
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3529		1770	3520	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3529		1770	3520	
Volume (vph)	100	0	60	20	0	10	40	1580	30	10	1620	60
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	111	0	67	22	0	11	44	1756	33	11	1800	67
RTOR Reduction (vph)	0	0	60	0	0	11	0	1	0	0	2	0
Lane Group Flow (vph)	0	111	7	0	22	0	44	1788	0	11	1865	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)		11.8	11.8		4.8	4.8	6.7	75.5		0.4	69.2	
Effective Green, g (s)		11.8	11.8		4.8	4.8	6.7	77.0		0.4	70.7	
Actuated g/C Ratio		0.11	0.11		0.04	0.04	0.06	0.70		0.00	0.64	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.5	5.4		1.5	5.4	
Lane Grp Cap (vph)		190	170		77	69	108	2470		6	2262	
v/s Ratio Prot		c0.06			c0.01		c0.02	c0.51		0.01	c0.53	
v/s Ratio Perm			0.00			0.00						
v/c Ratio		0.58	0.04		0.29	0.01	0.41	0.72		1.83	0.82	
Uniform Delay, d1		46.8	44.0		50.9	50.3	49.7	10.0		54.8	14.9	
Progression Factor		1.00	1.00		1.00	1.00	0.94	0.87		1.00	1.00	
Incremental Delay, d2		2.9	0.0		0.7	0.0	0.7	1.5		719.2	3.6	
Delay (s)		49.7	44.1		51.7	50.3	47.3	10.2		774.0	18.5	
Level of Service		D	D		D	D	D	B		F	B	
Approach Delay (s)		47.6			51.2			11.1			22.9	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	18.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	6	64	28	7	63	12
Maximum Split (%)	5.5%	58.2%	25.5%	6.4%	57.3%	10.9%
Minimum Split (s)	6	23.5	28	6	23.5	12
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	2	7	2	2	7	8
Vehicle Extension (s)	1.5	5.4	1	1.5	5.4	1
Minimum Gap (s)	1.5	3.8	1	1.5	3.8	1
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7	7		7	
Flash Dont Walk (s)		11	17		11	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	76.5	82.5	36.5	76.5	83.5	64.5
End Time (s)	82.5	36.5	64.5	83.5	36.5	76.5
Yield/Force Off (s)	78.5	31	60.5	79.5	31	72.5
Yield/Force Off 170(s)	78.5	20	43.5	79.5	20	72.5
Local Start Time (s)	45.5	51.5	5.5	45.5	52.5	33.5
Local Yield (s)	47.5	0	29.5	48.5	0	41.5
Local Yield 170(s)	47.5	99	12.5	48.5	99	41.5

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	110
Offset: 31 (28%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



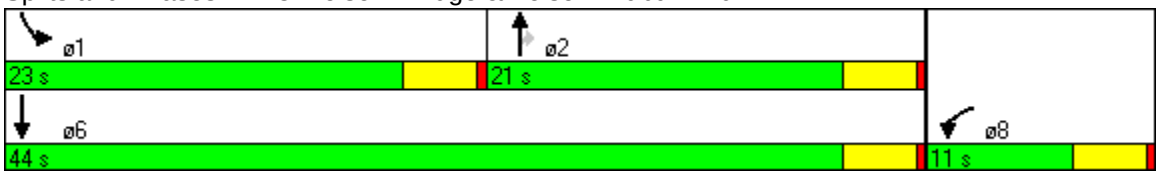
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.95	1.00	0.97	0.95
Frt	0.92	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.98	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3256	1441	3539	1583	3433	3539
Flt Permitted	0.98	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3256	1441	3539	1583	3433	3539
Volume (vph)	160	960	710	290	810	890
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	178	1067	789	322	900	989
RTOR Reduction (vph)	165	0	0	197	0	0
Lane Group Flow (vph)	201	879	789	125	900	989
Turn Type		Free		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		Free		2		
Actuated Green, G (s)	6.7	55.0	20.8	20.8	15.5	40.3
Effective Green, g (s)	6.7	55.0	20.8	20.8	15.5	40.3
Actuated g/C Ratio	0.12	1.00	0.38	0.38	0.28	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)	397	1441	1338	599	967	2593
v/s Ratio Prot	0.06		0.22		c0.26	0.28
v/s Ratio Perm		c0.61		0.08		
v/c Ratio	0.51	0.61	0.59	0.21	0.93	0.38
Uniform Delay, d1	22.6	0.0	13.7	11.5	19.2	2.7
Progression Factor	1.00	1.00	1.00	1.00	1.40	1.18
Incremental Delay, d2	1.0	1.9	1.9	0.8	10.2	0.3
Delay (s)	23.6	1.9	15.6	12.3	37.0	3.5
Level of Service	C	A	B	B	D	A
Approach Delay (s)	8.3		14.7			19.5
Approach LOS	A		B			B

Intersection Summary			
HCM Average Control Delay	14.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	55.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	67.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	23	21	44	11
Maximum Split (%)	41.8%	38.2%	80.0%	20.0%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	Yes	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	15	38	15	4
End Time (s)	38	4	4	15
Yield/Force Off (s)	34	0	0	11
Yield/Force Off 170(s)	34	0	0	11
Local Start Time (s)	15	38	15	4
Local Yield (s)	34	0	0	11
Local Yield 170(s)	34	0	0	11

Intersection Summary	
Cycle Length	55
Control Type	Actuated-Coordinated
Natural Cycle	50
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: Folsom Bridge & Folsom-Auburn Rd



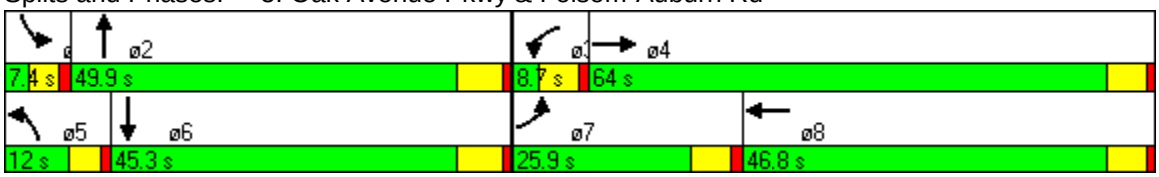
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		0.97	0.95		1.00	0.95	
Frpb, ped/bikes	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	
Frt	1.00	0.85		1.00	0.92		1.00	1.00		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1587		1770	1711		3433	3532		1770	3481	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1587		1770	1711		3433	3532		1770	3481	
Volume (vph)	170	10	790	40	10	10	190	840	10	10	980	110
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	179	11	832	42	11	11	200	884	11	11	1032	116
RTOR Reduction (vph)	0	50	0	0	10	0	0	1	0	0	7	0
Lane Group Flow (vph)	179	793	0	42	12	0	200	894	0	11	1141	0
Confl. Peds. (#/hr)									1			
Confl. Bikes (#/hr)						1						2
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	46.7	60.5		2.4	16.2		7.3	48.2		1.1	42.0	
Effective Green, g (s)	48.4	62.2		4.1	17.9		8.0	50.4		1.8	44.2	
Actuated g/C Ratio	0.36	0.46		0.03	0.13		0.06	0.37		0.01	0.33	
Clearance Time (s)	5.7	5.7		5.7	5.7		4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	637	734		54	228		204	1324		24	1144	
v/s Ratio Prot	0.10	c0.50		c0.02	0.01		c0.06	0.25		0.01	c0.33	
v/s Ratio Perm												
v/c Ratio	0.28	1.08		0.78	0.05		0.98	0.68		0.46	1.00	
Uniform Delay, d1	30.7	36.2		64.7	50.9		63.2	35.2		65.9	45.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	57.1		49.7	0.1		57.0	1.5		5.0	25.9	
Delay (s)	30.9	93.2		114.5	51.0		120.2	36.7		70.8	71.0	
Level of Service	C	F		F	D		F	D		E	E	
Approach Delay (s)		82.3			92.7			51.9			71.0	
Approach LOS		F			F			D			E	

Intersection Summary			
HCM Average Control Delay	68.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.03		
Actuated Cycle Length (s)	134.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	95.4%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize			Yes	Yes			Yes	Yes
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	7.4	49.9	8.7	64	12	45.3	25.9	46.8
Maximum Split (%)	5.7%	38.4%	6.7%	49.2%	9.2%	34.8%	19.9%	36.0%
Minimum Split (s)	6.7	13.2	8.7	30.7	6.7	13.2	8.7	27.7
Yellow Time (s)	3.5	5	4.5	4.5	3.5	5	4.5	4.5
All-Red Time (s)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Minimum Initial (s)	2	7	3	3	2	7	3	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	2	2.4	3	3	2	2.4	3	3
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	7.4	57.3	66	0	12	57.3	83.2
End Time (s)	7.4	57.3	66	0	12	57.3	83.2	0
Yield/Force Off (s)	2.7	51.1	60.3	124.3	7.3	51.1	77.5	124.3
Yield/Force Off 170(s)	2.7	51.1	60.3	106.3	7.3	51.1	77.5	109.3
Local Start Time (s)	118	125.4	45.3	54	118	0	45.3	71.2
Local Yield (s)	120.7	39.1	48.3	112.3	125.3	39.1	65.5	112.3
Local Yield 170(s)	120.7	39.1	48.3	94.3	125.3	39.1	65.5	97.3

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



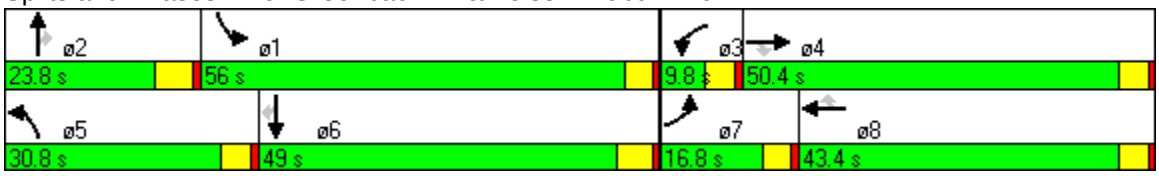
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	210	770	830	20	740	470	300	320	10	290	1510	160
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	233	856	922	22	822	522	333	356	11	322	1678	178
RTOR Reduction (vph)	0	0	236	0	0	368	0	0	10	0	0	47
Lane Group Flow (vph)	233	856	686	22	822	154	333	356	1	322	1678	131
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	12.3	49.8	49.8	3.2	40.7	40.7	17.5	16.5	16.5	51.5	50.5	50.5
Effective Green, g (s)	12.8	50.3	50.3	3.7	41.2	41.2	18.0	18.0	18.0	52.0	52.0	52.0
Actuated g/C Ratio	0.09	0.36	0.36	0.03	0.29	0.29	0.13	0.13	0.13	0.37	0.37	0.37
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	162	1272	569	47	1041	466	441	455	204	657	1314	588
v/s Ratio Prot	c0.13	0.24		0.01	0.23		0.10	c0.10		0.18	c0.47	
v/s Ratio Perm			c0.43			0.10			0.00			0.08
v/c Ratio	1.44	0.67	1.21	0.47	0.79	0.33	0.76	0.78	0.01	0.49	1.28	0.22
Uniform Delay, d1	63.6	37.9	44.9	67.2	45.4	38.6	58.9	59.1	53.2	33.8	44.0	30.1
Progression 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
Incremental Delay, d2	228.7	1.1	108.5	2.7	3.7	0.2	6.4	12.6	0.1	0.2	130.7	0.9
Delay (s)	292.3	39.0	153.4	69.8	49.2	38.8	65.3	71.7	53.3	34.0	174.7	31.0
Level of Service	F	D	F	E	D	D	E	E	D	C	F	C
Approach Delay (s)		120.8			45.5			68.4			142.1	
Approach LOS		F			D			E			F	

Intersection Summary			
HCM Average Control Delay	105.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	106.5%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	56	23.8	9.8	50.4	30.8	49	16.8	43.4
Maximum Split (%)	40.0%	17.0%	7.0%	36.0%	22.0%	35.0%	12.0%	31.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
End Time (s)	61.5	5.5	71.3	121.7	12.5	61.5	78.3	121.7
Yield/Force Off (s)	57	0	66.8	117.2	8	56	73.8	117.2
Yield/Force Off 170(s)	57	117	66.8	92.2	8	37	73.8	92.2
Local Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
Local Yield (s)	57	0	66.8	117.2	8	56	73.8	117.2
Local Yield 170(s)	57	117	66.8	92.2	8	37	73.8	92.2

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	145
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1832	1549	1681	1693	1561	1770	4854		1770	3539	1550
Flt Permitted		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1832	1549	1681	1693	1561	1770	4854		1770	3539	1550
Volume (vph)	10	20	20	200	10	160	10	460	200	110	2260	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	22	22	222	11	178	11	511	222	122	2511	11
RTOR Reduction (vph)	0	0	21	0	0	90	0	23	0	0	0	2
Lane Group Flow (vph)	0	33	1	114	119	88	11	710	0	122	2511	9
Confl. Bikes (#/hr)			2			1						2
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		5.8	5.8	14.7	14.7	14.7	2.3	79.7		13.1	90.5	90.5
Effective Green, g (s)		6.3	6.3	15.2	15.2	15.2	2.8	82.2		13.6	93.0	93.0
Actuated g/C Ratio		0.05	0.05	0.11	0.11	0.11	0.02	0.62		0.10	0.70	0.70
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		87	73	192	193	178	37	2993		181	2469	1081
v/s Ratio Prot		c0.02		0.07	c0.07		0.01	0.15		c0.07	c0.71	
v/s Ratio Perm			0.00			0.06						0.01
v/c Ratio		0.38	0.01	0.59	0.62	0.49	0.30	0.24		0.67	1.02	0.01
Uniform Delay, d1		61.6	60.5	56.1	56.3	55.4	64.3	11.5		57.7	20.2	6.1
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		1.0	0.0	3.3	4.1	0.8	1.6	0.1		7.5	22.5	0.0
Delay (s)		62.6	60.6	59.4	60.3	56.2	65.9	11.5		65.3	42.6	6.1
Level of Service		E	E	E	E	E	E	B		E	D	A
Approach Delay (s)		61.8			58.3			12.3			43.5	
Approach LOS		E			E			B			D	

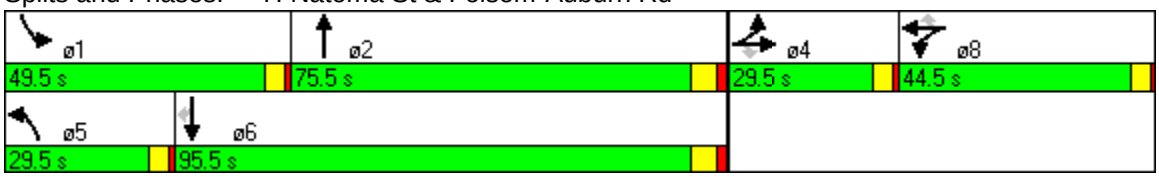
Intersection Summary			
HCM Average Control Delay	39.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	133.3	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.3%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



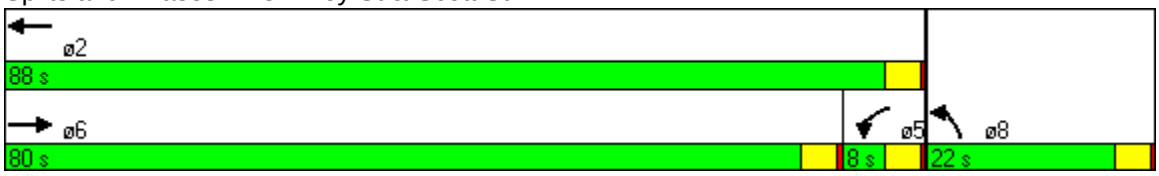
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3535		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3535		1770	1863	1695	
Volume (vph)	1220	10	10	1060	10	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1356	11	11	1178	11	11
RTOR Reduction (vph)	0	0	0	0	11	0
Lane Group Flow (vph)	1367	0	11	1178	12	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	89.0		4.0	97.0	5.0	
Effective Green, g (s)	89.0		4.0	97.0	5.0	
Actuated g/C Ratio	0.81		0.04	0.88	0.05	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2860		64	1643	77	
v/s Ratio Prot	0.39		0.01	c0.63	c0.01	
v/s Ratio Perm						
v/c Ratio	0.48		0.17	0.72	0.15	
Uniform Delay, d1	3.3		51.4	2.1	50.5	
Progression Factor	0.61		1.00	1.00	1.00	
Incremental Delay, d2	0.5		0.8	2.7	0.9	
Delay (s)	2.5		52.2	4.8	51.4	
Level of Service	A		D	A	D	
Approach Delay (s)	2.5			5.2	51.4	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	4.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	65.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	8	80	22
Maximum Split (%)	80.0%	7.3%	72.7%	20.0%
Minimum Split (s)	11	22	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	18	18	0
Time To Reduce (s)	25	25	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	45	15	45	23
End Time (s)	23	23	15	45
Yield/Force Off (s)	19	19	11	41
Yield/Force Off 170(s)	19	19	1	28
Local Start Time (s)	34	4	34	12
Local Yield (s)	8	8	0	30
Local Yield 170(s)	8	8	100	17

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 11 (10%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



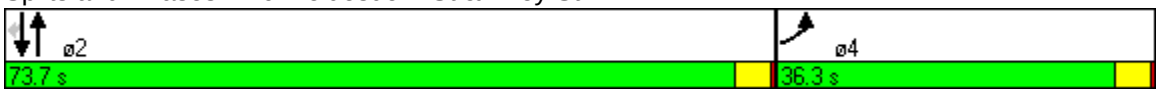
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.96			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3352			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3352			3539	1863	1583
Volume (vph)	30	10	0	1200	990	80
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	33	11	0	1333	1100	89
RTOR Reduction (vph)	10	0	0	0	0	10
Lane Group Flow (vph)	34	0	0	1333	1100	79
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	6.0			96.0	96.0	96.0
Effective Green, g (s)	6.0			96.0	96.0	96.0
Actuated g/C Ratio	0.05			0.87	0.87	0.87
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	183			3089	1626	1382
v/s Ratio Prot	c0.01			0.38	c0.59	
v/s Ratio Perm						0.05
v/c Ratio	0.18			0.43	0.68	0.06
Uniform Delay, d1	49.7			1.4	2.2	0.9
Progression Factor	1.00			0.09	0.50	0.99
Incremental Delay, d2	0.4			0.0	1.7	0.1
Delay (s)	50.1			0.2	2.7	1.0
Level of Service	D			A	A	A
Approach Delay (s)	50.1			0.2	2.6	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	2.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	73.7	36.3
Maximum Split (%)	67.0%	33.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	54.3	18
End Time (s)	18	54.3
Yield/Force Off (s)	14	50.3
Yield/Force Off 170(s)	6	40.3
Local Start Time (s)	40.3	4
Local Yield (s)	0	36.3
Local Yield 170(s)	102	26.3

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	70
Offset: 14 (13%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



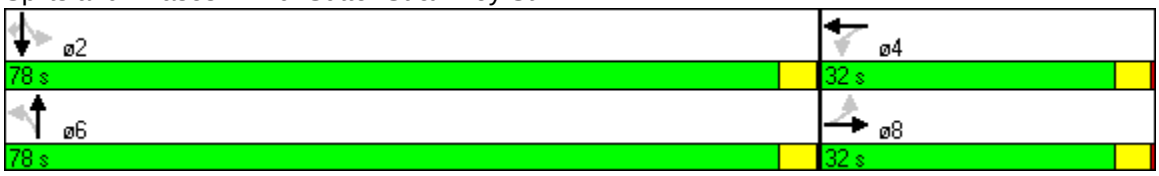
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1710	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.99			0.99			1.00			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.97			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1764			1741			1544			1815	1471
Flt Permitted		0.92			0.93			0.99			0.98	1.00
Satd. Flow (perm)		1638			1641			1529			1788	1471
Volume (vph)	10	20	10	10	10	10	10	1180	10	10	980	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	11	22	11	11	11	11	11	1311	11	11	1089	11
RTOR Reduction (vph)	0	10	0	0	10	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	34	0	0	23	0	0	1333	0	0	1100	10
Confl. Peds. (#/hr)									2			9
Confl. Bikes (#/hr)			2			1			1			
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		7.0			7.0			95.0			95.0	95.0
Effective Green, g (s)		7.0			7.0			95.0			95.0	95.0
Actuated g/C Ratio		0.06			0.06			0.86			0.86	0.86
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		104			104			1321			1544	1270
v/s Ratio Prot												
v/s Ratio Perm		c0.02			0.01			c0.87			0.62	0.01
v/c Ratio		0.32			0.22			1.01			0.71	0.01
Uniform Delay, d1		49.2			48.9			7.5			2.7	1.0
Progression Factor		1.00			1.00			1.00			0.35	0.53
Incremental Delay, d2		0.7			0.4			27.0			2.1	0.0
Delay (s)		49.9			49.3			34.5			3.1	0.6
Level of Service		D			D			C			A	A
Approach Delay (s)		49.9			49.3			34.5			3.1	
Approach LOS		D			D			C			A	

Intersection Summary			
HCM Average Control Delay	21.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	98.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



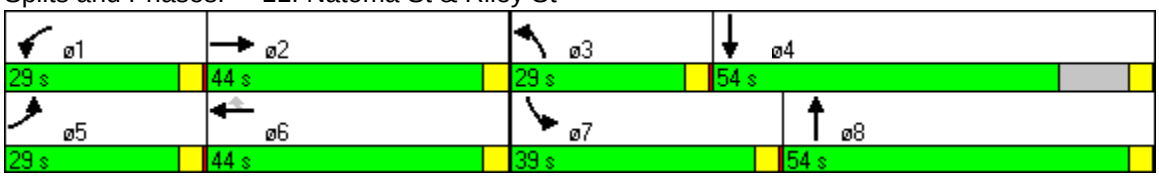
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1596	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	0.99		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1813		1770	1863	1583	1770	1553		1770	1859	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1813		1770	1863	1583	1770	1553		1770	1859	
Volume (vph)	20	370	80	50	330	800	20	380	20	320	670	10
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	22	411	89	56	367	889	22	422	22	356	744	11
RTOR Reduction (vph)	0	4	0	0	0	423	0	1	0	0	0	0
Lane Group Flow (vph)	22	496	0	56	367	466	22	443	0	356	755	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.2	41.7		7.6	45.1	45.1	4.2	47.2		32.1	75.1	
Effective Green, g (s)	4.2	41.7		7.6	45.1	45.1	4.2	47.2		32.1	75.1	
Actuated g/C Ratio	0.03	0.29		0.05	0.31	0.31	0.03	0.33		0.22	0.52	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	51	523		93	581	494	51	507		393	965	
v/s Ratio Prot	0.01	0.27		c0.03	0.20		0.01	c0.29		c0.20	0.41	
v/s Ratio Perm						c0.29						
v/c Ratio	0.43	0.95		0.60	0.63	0.94	0.43	0.87		0.91	0.78	
Uniform Delay, d1	69.0	50.4		67.0	42.6	48.5	69.0	45.9		54.8	28.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	26.8		7.3	2.6	27.0	2.1	15.8		23.3	4.5	
Delay (s)	71.2	77.2		74.3	45.2	75.5	71.2	61.6		78.1	32.6	
Level of Service	E	E		E	D	E	E	E		E	C	
Approach Delay (s)		76.9			67.0			62.1			47.2	
Approach LOS		E			E			E			D	

Intersection Summary			
HCM Average Control Delay	61.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	144.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	88.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	69	98	150	25	69	108	151
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	40	69	121	162	40	79	122

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 11: Natoma St & Riley St



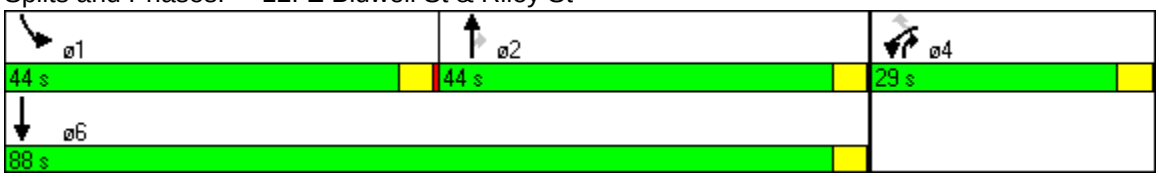
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1546	3539	1571	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1546	3539	1571	1770	1863
Volume (vph)	300	240	180	140	390	400
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	333	267	200	156	433	444
RTOR Reduction (vph)	0	191	0	89	0	0
Lane Group Flow (vph)	333	76	200	67	433	444
Confl. Peds. (#/hr)		7		8		
Confl. Bikes (#/hr)		8		8		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	15.1	15.1	7.8	22.9	18.3	30.1
Effective Green, g (s)	15.1	15.1	7.8	22.9	18.3	30.1
Actuated g/C Ratio	0.28	0.28	0.15	0.43	0.34	0.57
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	502	439	519	794	609	1054
v/s Ratio Prot	c0.19		0.06	0.02	c0.24	c0.24
v/s Ratio Perm		0.05		0.02		
v/c Ratio	0.66	0.17	0.39	0.08	0.71	0.42
Uniform Delay, d1	16.8	14.3	20.5	9.0	15.2	6.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.6	0.1	0.2	0.0	3.9	0.3
Delay (s)	19.4	14.4	20.7	9.0	19.1	6.9
Level of Service	B	B	C	A	B	A
Approach Delay (s)	17.2		15.6			12.9
Approach LOS	B		B			B

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	53.2	Sum of lost time (s)	8.0
Intersection Capacity Utilization	55.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 12: E Bidwell St & Riley St



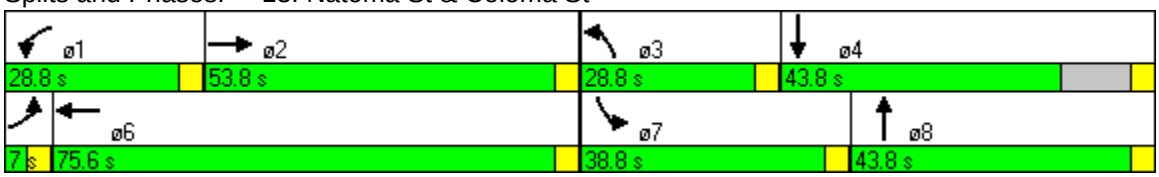
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.91		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1847		1770	1858		1770	1687		1770	1815	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1847		1770	1858		1770	1687		1770	1815	
Volume (vph)	10	650	40	50	1100	20	90	30	50	20	50	10
Peak-hour factor, PHF	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Adj. Flow (vph)	11	699	43	54	1183	22	97	32	54	22	54	11
RTOR Reduction (vph)	0	1	0	0	0	0	0	43	0	0	6	0
Lane Group Flow (vph)	11	741	0	54	1205	0	97	43	0	22	59	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	3.2	70.8		5.9	73.5		8.1	11.7		4.9	8.5	
Effective Green, g (s)	3.0	70.6		5.7	73.3		7.9	11.5		4.7	8.3	
Actuated g/C Ratio	0.03	0.65		0.05	0.68		0.07	0.11		0.04	0.08	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	49	1202		93	1255		129	179		77	139	
v/s Ratio Prot	0.01	0.40		c0.03	c0.65		c0.05	c0.03		0.01	c0.03	
v/s Ratio Perm												
v/c Ratio	0.22	0.62		0.58	0.96		0.75	0.24		0.29	0.43	
Uniform Delay, d1	51.6	11.1		50.2	16.2		49.3	44.5		50.3	47.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	1.0		5.8	16.5		19.5	0.3		0.7	0.8	
Delay (s)	52.5	12.0		56.1	32.8		68.8	44.7		51.0	48.6	
Level of Service	D	B		E	C		E	D		D	D	
Approach Delay (s)		12.6			33.8			57.5			49.2	
Approach LOS		B			C			E			D	

Intersection Summary			
HCM Average Control Delay	29.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	108.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	77.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	28.8	53.8	28.8	43.8	7	75.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	4.2%	45.8%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	1	1	7	1	1
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	3	2.4	3	3	3	2.4	3	3
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	7	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	7	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	3.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	3.2	78.8	117.6	151.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	143.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	139.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	139.6	50	88.8	122.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 13: Natoma St & Coloma St



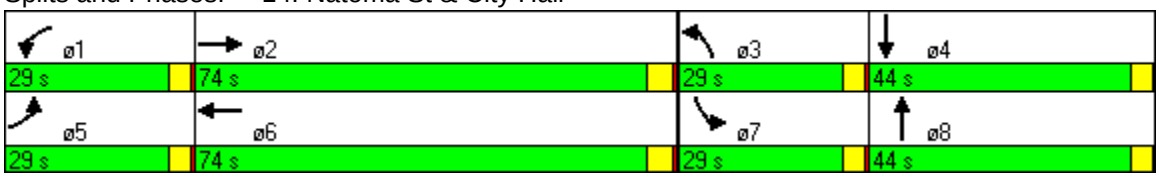
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		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	0.99		1.00	1.00		1.00	0.86		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3514		1770	3534		1770	1581		1770	1706	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3514		1770	3534		1770	1581		1770	1706	
Volume (vph)	10	700	30	90	1080	10	80	10	100	10	10	10
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	11	769	33	99	1187	11	88	11	110	11	11	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	97	0	0	10	0
Lane Group Flow (vph)	11	800	0	99	1197	0	88	24	0	11	12	0
Confl. Peds. (#/hr)			1			1			1			1
Confl. Bikes (#/hr)			2			1			3			3
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.5	27.8		5.9	29.2		5.9	7.2		4.5	5.8	
Effective Green, g (s)	4.5	28.8		5.9	30.2		5.9	7.2		4.5	5.8	
Actuated g/C Ratio	0.07	0.46		0.09	0.48		0.09	0.12		0.07	0.09	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	128	1622		167	1710		167	182		128	159	
v/s Ratio Prot	0.01	0.23		c0.06	c0.34		c0.05	c0.01		0.01	0.01	
v/s Ratio Perm												
v/c Ratio	0.09	0.49		0.59	0.70		0.53	0.13		0.09	0.08	
Uniform Delay, d1	27.0	11.7		27.1	12.6		26.9	24.8		27.0	25.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.2		3.7	1.3		1.4	0.1		0.1	0.1	
Delay (s)	27.1	12.0		30.8	13.9		28.3	24.9		27.1	25.9	
Level of Service	C	B		C	B		C	C		C	C	
Approach Delay (s)		12.2			15.2			26.3			26.3	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	15.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	62.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	70

Splits and Phases: 14: Natoma St & City Hall



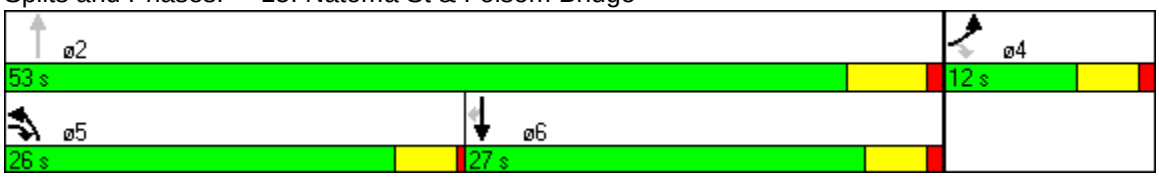
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	3539	1583
Volume (vph)	340	530	1010	780	820	280
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	362	564	1074	830	872	298
RTOR Reduction (vph)	0	20	0	0	0	196
Lane Group Flow (vph)	362	544	1074	830	872	102
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	7.6	28.6	21.0	42.7	18.7	18.7
Effective Green, g (s)	8.1	29.1	21.0	44.2	19.2	19.2
Actuated g/C Ratio	0.13	0.48	0.35	0.73	0.32	0.32
Clearance Time (s)	4.5	4.0	4.0	5.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0	2.0	3.0	2.0	2.0
Lane Grp Cap (vph)	461	869	1196	2594	1127	504
v/s Ratio Prot	c0.11	0.22	c0.31		c0.25	
v/s Ratio Perm		0.13		0.23		0.06
v/c Ratio	0.79	0.63	0.90	0.32	0.77	0.20
Uniform Delay, d1	25.3	11.6	18.6	2.8	18.6	15.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.9	1.0	8.9	0.1	3.1	0.1
Delay (s)	33.2	12.6	27.5	2.9	21.7	15.0
Level of Service	C	B	C	A	C	B
Approach Delay (s)	20.6			16.8	20.0	
Approach LOS	C			B	B	

Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	60.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	None	None	None	None
Maximum Split (s)	53	12	26	27
Maximum Split (%)	81.5%	18.5%	40.0%	41.5%
Minimum Split (s)	12.5	6.5	6	26.5
Yellow Time (s)	4.5	3.5	3.5	3.5
All-Red Time (s)	1	1	0.5	1
Minimum Initial (s)	7	2	2	2
Vehicle Extension (s)	3	2	2	2
Minimum Gap (s)	2.4	0.2	0.2	0.2
Time Before Reduce (s)	18	0	0	0
Time To Reduce (s)	25	0	0	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	53	0	26
End Time (s)	53	0	26	53
Yield/Force Off (s)	47.5	60.5	22	48.5
Yield/Force Off 170(s)	47.5	60.5	22	33.5
Local Start Time (s)	39	27	39	0
Local Yield (s)	21.5	34.5	61	22.5
Local Yield 170(s)	21.5	34.5	61	7.5

Intersection Summary	
Cycle Length	65
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 15: Natoma St & Folsom Bridge



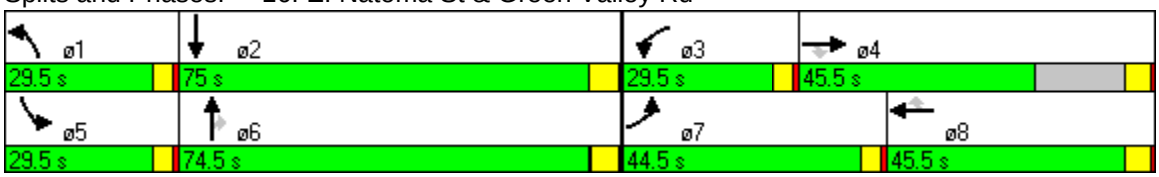
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Volume (vph)	720	110	50	160	220	60	90	190	130	100	810	1020
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	800	122	56	178	244	67	100	211	144	111	900	1133
RTOR Reduction (vph)	0	0	39	0	0	56	0	0	100	0	0	0
Lane Group Flow (vph)	800	122	17	178	244	11	100	211	44	111	900	1133
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	41.5	35.8	35.8	24.3	18.6	18.6	6.6	36.4	36.4	6.9	36.2	123.4
Effective Green, g (s)	42.0	37.3	37.3	24.8	20.1	20.1	7.1	37.9	37.9	7.4	38.2	123.4
Actuated g/C Ratio	0.34	0.30	0.30	0.20	0.16	0.16	0.06	0.31	0.31	0.06	0.31	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	1168	1070	478	690	576	258	198	1087	486	206	1096	1583
v/s Ratio Prot	0.23	0.03		0.05	0.07		0.03	0.06		0.03	c0.25	
v/s Ratio Perm			0.01			0.01			0.03			c0.72
v/c Ratio	0.68	0.11	0.04	0.26	0.42	0.04	0.51	0.19	0.09	0.54	0.82	0.72
Uniform Delay, d1	35.0	31.1	30.4	41.5	46.4	43.5	56.4	31.5	30.5	56.3	39.4	0.0
Progression 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
Incremental Delay, d2	1.3	0.1	0.0	0.1	0.9	0.1	0.7	0.2	0.1	1.4	5.2	2.8
Delay (s)	36.3	31.2	30.4	41.6	47.3	43.7	57.2	31.6	30.6	57.7	44.7	2.8
Level of Service	D	C	C	D	D	D	E	C	C	E	D	A
Approach Delay (s)		35.4			44.7			36.9			23.2	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM Average Control Delay	30.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	123.4	Sum of lost time (s)	0.0
Intersection Capacity Utilization	65.7%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	115

Splits and Phases: 16: E. Natoma St & Green Valley Rd



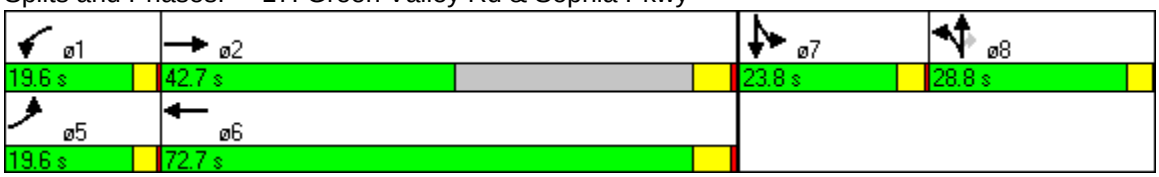
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)	1770	3501		1770	3536		1681	1703	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)	1770	3501		1770	3536		1681	1703	1583		1750	
Volume (vph)	10	890	70	30	1840	10	80	10	50	10	10	10
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	10	918	72	31	1897	10	82	10	52	10	10	10
RTOR Reduction (vph)	0	2	0	0	0	0	0	0	48	0	10	0
Lane Group Flow (vph)	10	988	0	31	1907	0	45	47	4	0	20	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	5.5	71.4		4.2	70.1		8.9	8.9	8.9		4.4	
Effective Green, g (s)	5.1	73.1		3.8	71.8		8.7	8.7	8.7		4.2	
Actuated g/C Ratio	0.05	0.69		0.04	0.68		0.08	0.08	0.08		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	85	2419		64	2400		138	140	130		69	
v/s Ratio Prot	0.01	0.28		c0.02	c0.54		0.03	c0.03			c0.01	
v/s Ratio Perm									0.00			
v/c Ratio	0.12	0.41		0.48	0.79		0.33	0.34	0.03		0.30	
Uniform Delay, d1	48.2	7.0		50.0	11.9		45.8	45.8	44.7		49.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.3	0.1		2.9	1.9		1.4	1.5	0.1		2.5	
Delay (s)	48.5	7.2		53.0	13.8		47.2	47.3	44.8		51.8	
Level of Service	D	A		D	B		D	D	D		D	
Approach Delay (s)		7.6			14.4			46.4			51.8	
Approach LOS		A			B			D			D	

Intersection Summary			
HCM Average Control Delay	14.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	105.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	42.7	19.6	72.7	23.8	28.8
Maximum Split (%)	13.5%	29.5%	13.5%	50.2%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	7.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	4	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	100

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: JDG
Agency/Co.: Fehr & Peers
Date Performed: 6/3/2005
Analysis Time Period: AM Peak
Intersection: E. Natoma/Briggs Ranch
Jurisdiction: Folsom, California
Units: U. S. Customary
Analysis Year: 2007
Project ID: Folsom Bridge (RS05 2106)
East/West Street: E. Natoma St.
North/South Street: Briggs Ranch
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		670	20		1290	
Peak-Hour Factor, PHF		0.94	0.94		0.94	
Hourly Flow Rate, HFR		712	21		1372	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0		2	
Configuration		T	TR		T	
Upstream Signal?		No			Yes	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			200			
Peak Hour Factor, PHF			0.94			
Hourly Flow Rate, HFR			212			
Percent Heavy Vehicles			0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes			1			
Configuration			R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config					R			
v (vph)					212			
C(m) (vph)					637			
v/c					0.33			
95% queue length					1.46			
Control Delay					13.4			
LOS					B			
Approach Delay				13.4				
Approach LOS				B				

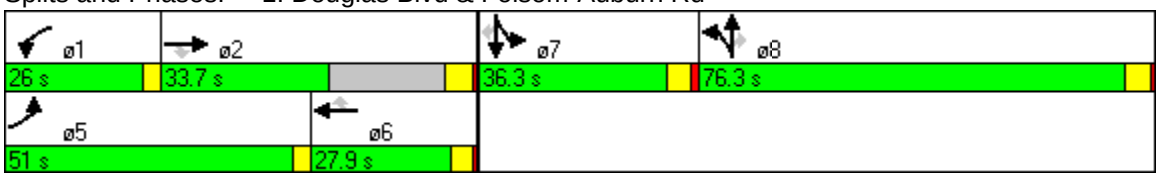
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.97	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1545	1770	3539	1516	3433	1863	1542	1770	3539	1551
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1545	1770	3539	1516	3433	1863	1542	1770	3539	1551
Volume (vph)	390	400	910	120	310	80	880	500	100	160	440	280
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	406	417	948	125	323	83	917	521	104	167	458	292
RTOR Reduction (vph)	0	0	461	0	0	72	0	0	70	0	0	206
Lane Group Flow (vph)	406	417	487	125	323	11	917	521	34	167	458	86
Confl. Peds. (#/hr)			6			2			8			
Confl. Bikes (#/hr)			2			6						6
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	36.2	41.1	41.1	11.1	16.8	16.8	42.4	42.4	42.4	20.8	20.8	20.8
Effective Green, g (s)	35.2	42.8	42.8	10.1	17.7	17.7	43.7	43.7	43.7	22.1	22.1	22.1
Actuated g/C Ratio	0.26	0.32	0.32	0.07	0.13	0.13	0.32	0.32	0.32	0.16	0.16	0.16
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	463	1124	491	133	465	199	1114	604	500	290	581	254
v/s Ratio Prot	c0.23	0.12		0.07	0.09		0.27	c0.28		0.09	c0.13	
v/s Ratio Perm			c0.32			0.01			0.02			0.06
v/c Ratio	0.88	0.37	0.99	0.94	0.69	0.05	0.82	0.86	0.07	0.58	0.79	0.34
Uniform Delay, d1	47.7	35.5	45.8	62.0	55.9	51.2	41.9	42.7	31.4	52.0	54.1	49.8
Progression 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
Incremental Delay, d2	16.4	0.1	38.5	58.5	3.6	0.0	4.8	11.8	0.0	1.7	6.5	0.3
Delay (s)	64.0	35.6	84.3	120.5	59.5	51.2	46.7	54.4	31.4	53.7	60.5	50.1
Level of Service	E	D	F	F	E	D	D	D	C	D	E	D
Approach Delay (s)		68.2			72.6			48.3			56.0	
Approach LOS		E			E			D			E	

Intersection Summary			
HCM Average Control Delay	59.9	HCM Level of Service	E
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	134.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	85.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	26	33.7	51	27.9	36.3	76.3
Maximum Split (%)	13.6%	17.6%	26.6%	14.6%	19.0%	39.8%
Minimum Split (s)	6	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	0	51	78.9	115.2
End Time (s)	26	78.9	51	78.9	115.2	0
Yield/Force Off (s)	23	73.2	48	74	109.9	186.2
Yield/Force Off 170(s)	23	63.2	48	64	99.9	186.2
Local Start Time (s)	165.5	0	165.5	25	52.9	89.2
Local Yield (s)	188.5	47.2	22	48	83.9	160.2
Local Yield 170(s)	188.5	37.2	22	38	73.9	160.2

Intersection Summary	
Cycle Length	191.5
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	1.00			1.00	1.00
Frpb, ped/bikes		1.00	0.97				1.00	1.00			1.00	1.00
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)		1770	1534				1770	1863			1863	1583
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1534				1770	1863			1863	1583
Volume (vph)	100	0	200	0	0	0	130	1350	0	0	1210	100
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	110	0	220	0	0	0	143	1484	0	0	1330	110
RTOR Reduction (vph)	0	0	199	0	0	0	0	0	0	0	0	10
Lane Group Flow (vph)	0	110	21	0	0	0	143	1484	0	0	1330	100
Confl. Bikes (#/hr)			3			13						
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		13.9	13.9				14.8	119.2			100.4	100.4
Effective Green, g (s)		13.9	13.9				14.8	120.7			101.9	101.9
Actuated g/C Ratio		0.10	0.10				0.10	0.85			0.71	0.71
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		173	150				184	1577			1331	1131
v/s Ratio Prot		c0.06					0.08	c0.80			c0.71	
v/s Ratio Perm			0.01									0.06
v/c Ratio		0.64	0.14				0.78	0.94			1.00	0.09
Uniform Delay, d1		61.9	58.9				62.3	8.3			20.3	6.2
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		7.4	0.4				16.9	11.5			24.3	0.0
Delay (s)		69.4	59.3				79.2	19.8			44.6	6.2
Level of Service		E	E				E	B			D	A
Approach Delay (s)		62.7			0.0			25.0			41.7	
Approach LOS		E			A			C			D	

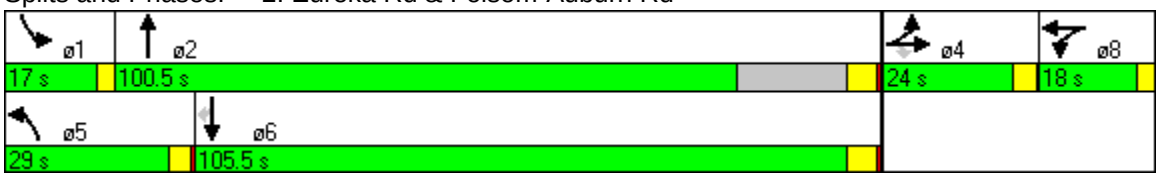
Intersection Summary			
HCM Average Control Delay	35.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	142.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes		1.00	0.91		0.95		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
Frt		1.00	0.85		0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1803	1433		1649		1770	1860		1770	1863	1549
Flt Permitted		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1803	1433		1649		1770	1860		1770	1863	1549
Volume (vph)	20	10	350	20	10	20	440	1380	10	10	1260	20
Peak-hour factor, 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 (vph)	22	11	380	22	11	22	478	1500	11	11	1370	22
RTOR Reduction (vph)	0	0	336	0	15	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	33	44	0	40	0	478	1511	0	11	1370	20
Confl. Bikes (#/hr)			13			10			10			3
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		9.2	9.2		5.9		15.1	98.4		4.5	87.8	87.8
Effective Green, g (s)		8.6	8.6		5.3		14.1	100.1		3.5	89.5	89.5
Actuated g/C Ratio		0.06	0.06		0.04		0.11	0.75		0.03	0.67	0.67
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		116	92		65		187	1395		46	1249	1038
v/s Ratio Prot		0.02			c0.02		c0.27	c0.81		0.01	0.74	
v/s Ratio Perm			c0.03									0.01
v/c Ratio		0.28	0.48		0.61		2.56	1.08		0.24	1.10	0.02
Uniform Delay, d1		59.5	60.3		63.1		59.7	16.7		63.7	22.0	7.3
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.5	1.4		10.6		715.7	50.0		1.0	56.2	0.0
Delay (s)		60.0	61.7		73.7		775.4	66.7		64.7	78.2	7.3
Level of Service		E	E		E		F	E		E	E	A
Approach Delay (s)		61.6			73.7			237.0			77.0	
Approach LOS		E			E			F			E	

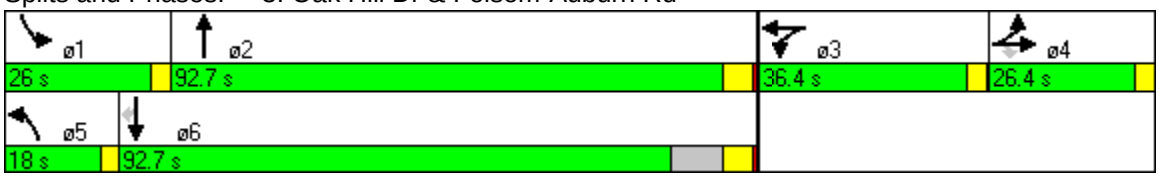
Intersection Summary			
HCM Average Control Delay	157.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	133.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	110.2%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.88		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1645		3433	1863	1583	1770	3539	1583	3433	3490	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1645		3433	1863	1583	1770	3539	1583	3433	3490	
Volume (vph)	100	20	70	370	20	890	60	810	230	960	590	60
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	110	22	77	407	22	978	66	890	253	1055	648	66
RTOR Reduction (vph)	0	70	0	0	0	0	0	0	178	0	4	0
Lane Group Flow (vph)	110	29	0	407	22	978	66	890	75	1055	710	0
Turn Type	Prot			Prot		Free	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	20.6	11.3		16.6	7.3	130.0	7.2	36.9	36.9	47.7	77.4	
Effective Green, g (s)	20.6	11.3		16.6	7.3	130.0	7.2	38.4	38.4	47.7	78.9	
Actuated g/C Ratio	0.16	0.09		0.13	0.06	1.00	0.06	0.30	0.30	0.37	0.61	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	1.0	1.0		1.0	1.0		1.5	5.4	5.4	1.5	5.4	
Lane Grp Cap (vph)	280	143		438	105	1583	98	1045	468	1260	2118	
v/s Ratio Prot	0.06	0.02		c0.12	0.01		0.04	c0.25		c0.31	0.20	
v/s Ratio Perm						c0.62			0.05			
v/c Ratio	0.39	0.20		0.93	0.21	0.62	0.67	0.85	0.16	0.84	0.34	
Uniform Delay, d1	49.1	55.2		56.1	58.6	0.0	60.2	43.1	33.9	37.6	12.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.97	0.98	
Incremental Delay, d2	0.3	0.3		25.6	0.4	1.8	13.4	8.7	0.7	4.1	0.4	
Delay (s)	49.4	55.4		81.7	59.0	1.8	73.6	51.9	34.6	40.8	12.7	
Level of Service	D	E		F	E	A	E	D	C	D	B	
Approach Delay (s)		52.3			25.8			49.4			29.4	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	34.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	44	36	21	29	14	66	21	29
Maximum Split (%)	33.8%	27.7%	16.2%	22.3%	10.8%	50.8%	16.2%	22.3%
Minimum Split (s)	6	27.5	12	29	6	21.5	6	12
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	2	7	8	2	2	7	2	8
Vehicle Extension (s)	1.5	5.4	1	1	1.5	5.4	1	1
Minimum Gap (s)	3	3.8	3	3	3	3.8	3	3
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		
Flash Dont Walk (s)		15		18		9		
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	99.5	13.5	49.5	70.5	99.5	113.5	49.5	70.5
End Time (s)	13.5	49.5	70.5	99.5	113.5	49.5	70.5	99.5
Yield/Force Off (s)	9.5	44	66.5	95.5	109.5	44	66.5	95.5
Yield/Force Off 170(s)	9.5	29	66.5	77.5	109.5	35	66.5	95.5
Local Start Time (s)	55.5	99.5	5.5	26.5	55.5	69.5	5.5	26.5
Local Yield (s)	95.5	0	22.5	51.5	65.5	0	22.5	51.5
Local Yield 170(s)	95.5	115	22.5	33.5	65.5	121	22.5	51.5

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Coordinated
Natural Cycle	130
Offset: 44 (34%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd

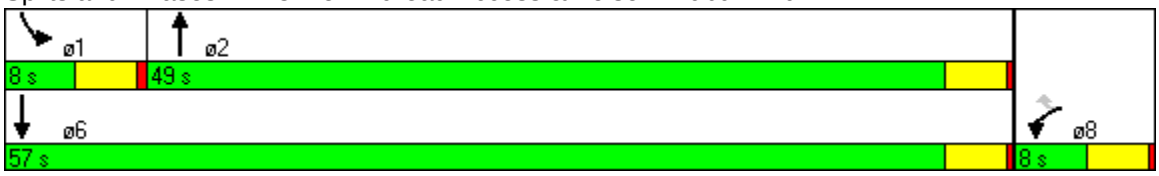
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3536		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3536		1770	3539
Volume (vph)	20	10	1790	10	10	1590
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	22	11	1967	11	11	1747
RTOR Reduction (vph)	0	11	0	0	0	0
Lane Group Flow (vph)	22	0	1978	0	11	1747
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	1.6	1.6	50.6		0.8	55.4
Effective Green, g (s)	1.6	1.6	50.6		0.8	55.4
Actuated g/C Ratio	0.02	0.02	0.78		0.01	0.85
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)	44	39	2753		22	3016
v/s Ratio Prot	c0.01		c0.56		0.01	c0.49
v/s Ratio Perm		0.00				
v/c Ratio	0.50	0.01	0.72		0.50	0.58
Uniform Delay, d1	31.3	30.9	3.6		31.9	1.4
Progression Factor	1.00	1.00	2.45		1.00	1.00
Incremental Delay, d2	8.7	0.1	1.2		16.8	0.8
Delay (s)	40.0	31.0	10.0		48.7	2.2
Level of Service	D	C	B		D	A
Approach Delay (s)	37.0		10.0			2.5
Approach LOS	D		B			A

Intersection Summary			
HCM Average Control Delay	6.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	8	49	57	8
Maximum Split (%)	12.3%	75.4%	87.7%	12.3%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	12	20	12	4
End Time (s)	20	4	4	12
Yield/Force Off (s)	16	0	0	8
Yield/Force Off 170(s)	16	0	0	8
Local Start Time (s)	12	20	12	4
Local Yield (s)	16	0	0	8
Local Yield 170(s)	16	0	0	8

Intersection Summary	
Cycle Length	65
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	0.99	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	5085	5057	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	5085	5057	
Volume (vph)	50	60	60	1750	1550	60
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	55	66	66	1923	1703	66
RTOR Reduction (vph)	0	63	0	0	4	0
Lane Group Flow (vph)	55	3	66	1923	1765	0
Turn Type		Perm	Prot			
Protected Phases	4		1	6	2	
Permitted Phases		4				
Actuated Green, G (s)	4.0	4.0	30.0	61.9	35.5	
Effective Green, g (s)	4.0	4.0	30.0	63.4	37.0	
Actuated g/C Ratio	0.04	0.04	0.30	0.63	0.37	
Clearance Time (s)	4.0	4.0	4.0	5.5	5.5	
Vehicle Extension (s)	3.0	3.0	1.5	5.4	5.4	
Lane Grp Cap (vph)	71	63	531	3224	1871	
v/s Ratio Prot	c0.03		c0.04	c0.38	c0.35	
v/s Ratio Perm		0.00				
v/c Ratio	0.77	0.04	0.12	0.60	0.94	
Uniform Delay, d1	47.6	46.2	25.4	10.8	30.5	
Progression Factor	1.00	1.00	1.39	0.58	0.94	
Incremental Delay, d2	39.9	0.3	0.0	0.7	9.9	
Delay (s)	87.5	46.4	35.4	6.9	38.7	
Level of Service	F	D	D	A	D	
Approach Delay (s)	65.1			7.9	38.7	
Approach LOS	E			A	D	

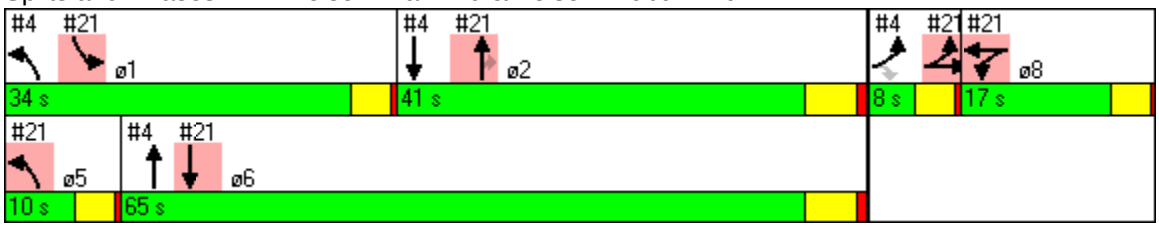
Intersection Summary			
HCM Average Control Delay	23.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	33.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Node Number	4	4	4	21	4	21
Movement	NBL	SBT	EBL	NBL	NBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize				Yes		
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	34	41	8	10	65	17
Maximum Split (%)	34.0%	41.0%	8.0%	10.0%	65.0%	17.0%
Minimum Split (s)	6	21.5	8	8	12.5	8
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	2	7	4	4	7	4
Vehicle Extension (s)	1.5	5.4	3	3	5.4	3
Minimum Gap (s)	3	3.8	3	3	3.8	3
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7				
Flash Dont Walk (s)		9				
Dual Entry	No	No	Yes	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	99.5	33.5	74.5	99.5	9.5	82.5
End Time (s)	33.5	74.5	82.5	9.5	74.5	99.5
Yield/Force Off (s)	29.5	69	78.5	5.5	69	95.5
Yield/Force Off 170(s)	29.5	60	78.5	5.5	69	95.5
Local Start Time (s)	30.5	64.5	5.5	30.5	40.5	13.5
Local Yield (s)	60.5	0	9.5	36.5	0	26.5
Local Yield 170(s)	60.5	91	9.5	36.5	0	26.5

Intersection Summary	
Cycle Length	100
Control Type	Actuated-Coordinated
Natural Cycle	100

Offset: 69 (69%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1676		1681	1693	2787	1770	3539	1583	3433	3507	
Flt Permitted	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1676		1681	1693	2787	1770	3539	1583	3433	3507	
Volume (vph)	50	20	40	370	20	890	30	870	230	960	610	40
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	55	22	44	407	22	978	33	956	253	1055	670	44
RTOR Reduction (vph)	0	42	0	0	0	0	0	0	159	0	4	0
Lane Group Flow (vph)	55	24	0	209	220	978	33	956	94	1055	710	0
Turn Type	Split			Split		Free	Prot		Perm	Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	4.0	4.0		13.0	13.0	100.0	3.6	35.5	35.5	30.0	61.9	
Effective Green, g (s)	4.0	4.0		13.0	13.0	100.0	3.6	37.0	37.0	30.0	63.4	
Actuated g/C Ratio	0.04	0.04		0.13	0.13	1.00	0.04	0.37	0.37	0.30	0.63	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	5.4	5.4	1.5	5.4	
Lane Grp Cap (vph)	71	67		219	220	2787	64	1309	586	1030	2223	
v/s Ratio Prot	c0.03	0.01		0.12	c0.13		0.02	c0.27		c0.31	0.20	
v/s Ratio Perm						0.35			0.06			
v/c Ratio	0.77	0.35		0.95	1.00	0.35	0.52	0.73	0.16	1.02	0.32	
Uniform Delay, d1	47.6	46.7		43.2	43.5	0.0	47.3	27.2	21.1	35.0	8.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.63	0.56	
Incremental Delay, d2	39.9	3.2		47.6	60.7	0.3	6.9	3.6	0.6	23.4	0.1	
Delay (s)	87.5	50.0		90.8	104.2	0.3	54.2	30.8	21.7	80.5	4.9	
Level of Service	F	D		F	F	A	D	C	C	F	A	
Approach Delay (s)		67.0			30.0			29.6			49.9	
Approach LOS		E			C			C			D	

Intersection Summary			
HCM Average Control Delay	38.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Alternative 3 - PM

DELAY

4. Folsom Bridge (Auto Spa)/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	55	87.5	4,813
EBR	66	46.4	3,062
NBL	66	35.4	2,336
NBT	1,923	6.9	13,269
SBT	1,703	38.7	65,906
SBR	66	38.7	2,554
total	3,879	254	91,940

Reported Delay

EBL	EBR	NBL	NBT	SBT	SBR
87.5	46.4	35.4	6.9	38.7	

Reported Adj Flow

EBL	EBR	NBL	NBT	SBT	SBR
55	66	66	1,923	1,703	66

21. Existing Folsom Dam Road/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	55	87.5	4,813
EBT	22	50.0	1,100
EBR	44	50.0	2,200
WBL	407	90.8	36,956
WBT	22	104.2	2,292
WBR	978	0.3	293
NBL	33	54.2	1,789
NBT	956	30.8	29,445
NBR	253	21.7	5,490
SBL	1,055	80.5	84,928
SBT	670	4.9	3,283
SBR	44	4.9	216
total	4,539	580	172,804

total Adj. Volume	8,418
Int. Delay	**31.4**

Reported Delay

EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
87.5	50	90.8	104.2	0.3	54.2	30.8	21.7	80.5	4.9

Reported Adj Flow

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
55	22	44	407	22	978	33	956	253	1055	670	44

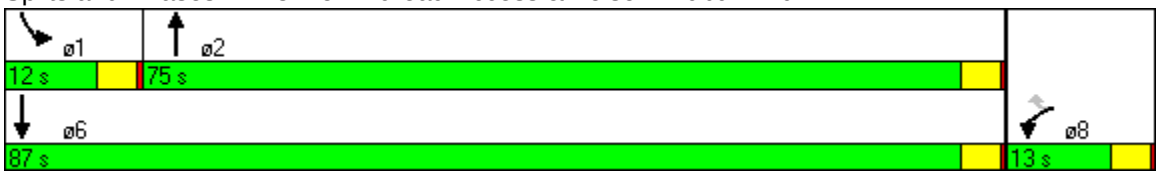
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3536		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3536		1770	3539
Volume (vph)	20	10	1790	10	10	1590
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	22	11	1967	11	11	1747
RTOR Reduction (vph)	0	11	0	0	0	0
Lane Group Flow (vph)	22	0	1978	0	11	1747
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	4.5	4.5	82.0		1.5	87.5
Effective Green, g (s)	4.5	4.5	82.0		1.5	87.5
Actuated g/C Ratio	0.04	0.04	0.82		0.02	0.88
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)	80	71	2900		27	3097
v/s Ratio Prot	c0.01		c0.56		0.01	c0.49
v/s Ratio Perm		0.00				
v/c Ratio	0.28	0.01	0.68		0.41	0.56
Uniform Delay, d1	46.2	45.6	3.7		48.8	1.5
Progression Factor	1.00	1.00	0.67		1.00	1.00
Incremental Delay, d2	1.9	0.0	1.1		9.7	0.7
Delay (s)	48.0	45.7	3.5		58.5	2.3
Level of Service	D	D	A		E	A
Approach Delay (s)	47.2		3.5			2.6
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	3.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	12	75	87	13
Maximum Split (%)	12.0%	75.0%	87.0%	13.0%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	17	29	17	4
End Time (s)	29	4	4	17
Yield/Force Off (s)	25	0	0	13
Yield/Force Off 170(s)	25	0	0	13
Local Start Time (s)	17	29	17	4
Local Yield (s)	25	0	0	13
Local Yield 170(s)	25	0	0	13

Intersection Summary	
Cycle Length	100
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



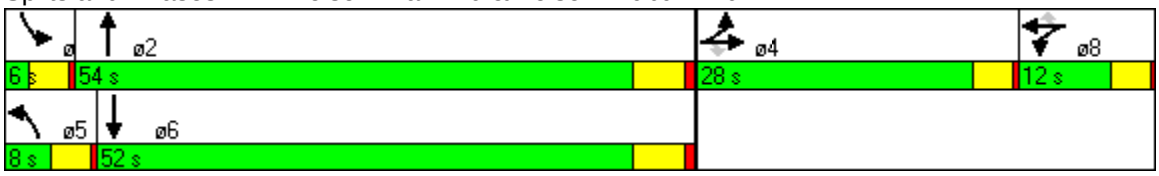
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3536		1770	3519	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3536		1770	3519	
Volume (vph)	100	0	80	20	0	10	70	1690	10	10	1530	60
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	110	0	88	22	0	11	77	1857	11	11	1681	66
RTOR Reduction (vph)	0	0	78	0	0	10	0	0	0	0	2	0
Lane Group Flow (vph)	0	110	10	0	22	1	77	1868	0	11	1745	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)		11.3	11.3		4.8	4.8	9.0	66.0		0.4	57.4	
Effective Green, g (s)		11.3	11.3		4.8	4.8	9.0	67.5		0.4	58.9	
Actuated g/C Ratio		0.11	0.11		0.05	0.05	0.09	0.68		0.00	0.59	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.5	5.4		1.5	5.4	
Lane Grp Cap (vph)		200	179		85	76	159	2387		7	2073	
v/s Ratio Prot		c0.06			c0.01		c0.04	c0.53		0.01	c0.50	
v/s Ratio Perm			0.01			0.00						
v/c Ratio		0.55	0.06		0.26	0.01	0.48	0.78		1.57	0.84	
Uniform Delay, d1		41.9	39.6		45.9	45.3	43.3	11.2		49.8	16.8	
Progression Factor		1.00	1.00		1.00	1.00	1.32	0.63		1.00	1.00	
Incremental Delay, d2		1.9	0.0		0.6	0.0	0.6	1.8		574.0	4.4	
Delay (s)		43.8	39.6		46.5	45.3	57.9	8.9		623.8	21.1	
Level of Service		D	D		D	D	E	A		F	C	
Approach Delay (s)		41.9			46.1			10.8			24.9	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	19.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	72.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	6	54	28	8	52	12
Maximum Split (%)	6.0%	54.0%	28.0%	8.0%	52.0%	12.0%
Minimum Split (s)	6	23.5	28	6	23.5	12
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	2	7	2	2	7	8
Vehicle Extension (s)	1.5	5.4	1	1.5	5.4	1
Minimum Gap (s)	3	3.8	3	3	3.8	3
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7	7		7	
Flash Dont Walk (s)		11	17		11	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	82.5	88.5	42.5	82.5	90.5	70.5
End Time (s)	88.5	42.5	70.5	90.5	42.5	82.5
Yield/Force Off (s)	84.5	37	66.5	86.5	37	78.5
Yield/Force Off 170(s)	84.5	26	49.5	86.5	26	78.5
Local Start Time (s)	45.5	51.5	5.5	45.5	53.5	33.5
Local Yield (s)	47.5	0	29.5	49.5	0	41.5
Local Yield 170(s)	47.5	89	12.5	49.5	89	41.5

Intersection Summary	
Cycle Length	100
Control Type	Actuated-Coordinated
Natural Cycle	100
Offset: 37 (37%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.95	1.00	0.97	0.95
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3433	1441	3539	1583	3433	3539
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3433	1441	3539	1583	3433	3539
Volume (vph)	370	910	900	230	980	650
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	407	1000	989	253	1077	714
RTOR Reduction (vph)	0	0	0	156	0	0
Lane Group Flow (vph)	407	1000	989	97	1077	714
Turn Type		Free		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		Free		2		
Actuated Green, G (s)	15.0	100.0	38.5	38.5	34.5	77.0
Effective Green, g (s)	15.0	100.0	38.5	38.5	34.5	77.0
Actuated g/C Ratio	0.15	1.00	0.38	0.38	0.34	0.77
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)	515	1441	1363	609	1184	2725
v/s Ratio Prot	0.12		0.28		c0.31	0.20
v/s Ratio Perm		c0.69		0.06		
v/c Ratio	0.79	0.69	0.73	0.16	0.91	0.26
Uniform Delay, d1	41.0	0.0	26.2	20.2	31.3	3.3
Progression Factor	1.00	1.00	1.00	1.00	0.50	1.43
Incremental Delay, d2	8.1	2.8	3.4	0.6	6.6	0.1
Delay (s)	49.1	2.8	29.6	20.7	22.2	4.9
Level of Service	D	A	C	C	C	A
Approach Delay (s)	16.2		27.8			15.3
Approach LOS	B		C			B

Intersection Summary			
HCM Average Control Delay	19.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	83.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	41	40	81	19
Maximum Split (%)	41.0%	40.0%	81.0%	19.0%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	23	64	23	4
End Time (s)	64	4	4	23
Yield/Force Off (s)	60	0	0	19
Yield/Force Off 170(s)	60	0	0	19
Local Start Time (s)	23	64	23	4
Local Yield (s)	60	0	0	19
Local Yield 170(s)	60	0	0	19

Intersection Summary	
Cycle Length	100
Control Type	Actuated-Coordinated
Natural Cycle	65
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: Folsom Bridge & Folsom-Auburn Rd

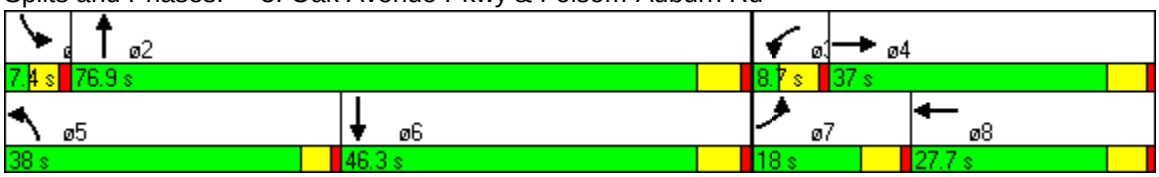
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		0.97	0.95		1.00	0.95	
Frpb, ped/bikes	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	
Frt	1.00	0.85		1.00	0.95		1.00	0.99		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1566		1770	1758		3433	3516		1770	3388	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1566		1770	1758		3433	3516		1770	3388	
Volume (vph)	140	10	560	30	20	10	760	1000	40	10	710	250
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	149	11	596	32	21	11	809	1064	43	11	755	266
RTOR Reduction (vph)	0	386	0	0	10	0	0	2	0	0	25	0
Lane Group Flow (vph)	149	221	0	32	22	0	809	1105	0	11	996	0
Confl. Peds. (#/hr)									1			
Confl. Bikes (#/hr)			2			1			2			5
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases												
Actuated Green, G (s)	11.4	18.5		1.5	8.6		26.9	63.2		0.8	37.1	
Effective Green, g (s)	13.1	20.2		3.2	10.3		27.6	65.4		1.5	39.3	
Actuated g/C Ratio	0.12	0.19		0.03	0.10		0.26	0.62		0.01	0.37	
Clearance Time (s)	5.7	5.7		5.7	5.7		4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	218	298		53	170		891	2163		25	1253	
v/s Ratio Prot	c0.08	c0.14		0.02	0.01		c0.24	0.31		0.01	c0.29	
v/s Ratio Perm												
v/c Ratio	0.68	0.74		0.60	0.13		0.91	0.51		0.44	0.79	
Uniform Delay, d1	44.6	40.6		50.9	43.9		38.1	11.5		52.0	29.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.5	9.5		17.9	0.3		12.5	0.3		4.4	3.7	
Delay (s)	53.2	50.1		68.8	44.2		50.7	11.7		56.4	33.6	
Level of Service	D	D		E	D		D	B		E	C	
Approach Delay (s)		50.7			56.5			28.2			33.9	
Approach LOS		D			E			C			C	

Intersection Summary			
HCM Average Control Delay	34.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	106.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.5%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize			Yes	Yes			Yes	Yes
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	7.4	76.9	8.7	37	38	46.3	18	27.7
Maximum Split (%)	5.7%	59.2%	6.7%	28.5%	29.2%	35.6%	13.8%	21.3%
Minimum Split (s)	6.7	13.2	8.7	30.7	6.7	13.2	8.7	27.7
Yellow Time (s)	3.5	5	4.5	4.5	3.5	5	4.5	4.5
All-Red Time (s)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
Minimum Initial (s)	2	7	3	3	2	7	3	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	7.4	84.3	93	0	38	84.3	102.3
End Time (s)	7.4	84.3	93	0	38	84.3	102.3	0
Yield/Force Off (s)	2.7	78.1	87.3	124.3	33.3	78.1	96.6	124.3
Yield/Force Off 170(s)	2.7	78.1	87.3	106.3	33.3	78.1	96.6	109.3
Local Start Time (s)	92	99.4	46.3	55	92	0	46.3	64.3
Local Yield (s)	94.7	40.1	49.3	86.3	125.3	40.1	58.6	86.3
Local Yield 170(s)	94.7	40.1	49.3	68.3	125.3	40.1	58.6	71.3

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Uncoordinated
Natural Cycle	100

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



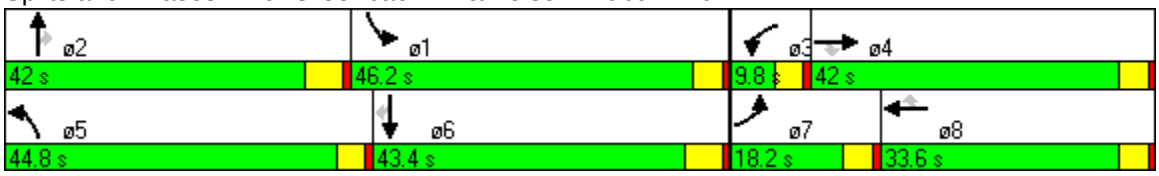
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	330	640	550	10	880	750	960	1000	10	470	610	300
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	351	681	585	11	936	798	1021	1064	11	500	649	319
RTOR Reduction (vph)	0	0	395	0	0	383	0	0	7	0	0	103
Lane Group Flow (vph)	351	681	190	11	936	415	1021	1064	4	500	649	216
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	13.7	43.4	43.4	2.1	31.8	31.8	40.3	33.8	33.8	41.7	35.2	35.2
Effective Green, g (s)	14.2	43.9	43.9	2.6	32.3	32.3	40.8	35.3	35.3	42.2	36.7	36.7
Actuated g/C Ratio	0.10	0.31	0.31	0.02	0.23	0.23	0.29	0.25	0.25	0.30	0.26	0.26
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	180	1110	496	33	816	365	1000	892	399	534	928	415
v/s Ratio Prot	c0.20	0.19		0.01	c0.26		c0.30	c0.30		c0.28	0.18	
v/s Ratio Perm			0.12			0.26			0.00			0.14
v/c Ratio	1.95	0.61	0.38	0.33	1.15	1.14	1.02	1.19	0.01	0.94	0.70	0.52
Uniform Delay, d1	62.9	40.8	37.5	67.8	53.8	53.8	49.6	52.4	39.3	47.6	46.7	44.1
Progression 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
Incremental Delay, d2	447.1	0.7	0.2	2.2	80.3	89.7	33.9	97.8	0.0	23.7	4.4	4.6
Delay (s)	510.0	41.6	37.7	70.0	134.2	143.5	83.5	150.2	39.3	71.3	51.0	48.8
Level of Service	F	D	D	E	F	F	F	F	D	E	D	D
Approach Delay (s)		141.8			138.0			117.1			57.4	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM Average Control Delay	115.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	109.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	46.2	42	9.8	42	44.8	43.4	18.2	33.6
Maximum Split (%)	33.0%	30.0%	7.0%	30.0%	32.0%	31.0%	13.0%	24.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
End Time (s)	51.7	5.5	61.5	103.5	8.3	51.7	69.9	103.5
Yield/Force Off (s)	47.2	0	57	99	3.8	46.2	65.4	99
Yield/Force Off 170(s)	47.2	117	57	74	3.8	27.2	65.4	74
Local Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
Local Yield (s)	47.2	0	57	99	3.8	46.2	65.4	99
Local Yield 170(s)	47.2	117	57	74	3.8	27.2	65.4	74

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	145
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1831	1556	1681	1704	1562	1770	4990		1770	3539	1548
Flt Permitted		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1831	1556	1681	1704	1562	1770	4990		1770	3539	1548
Volume (vph)	10	20	10	150	20	420	20	1540	190	430	750	20
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	21	11	160	21	447	21	1638	202	457	798	21
RTOR Reduction (vph)	0	0	11	0	0	286	0	7	0	0	0	6
Lane Group Flow (vph)	0	32	0	88	93	161	21	1833	0	457	798	15
Confl. Bikes (#/hr)			1			1			1			5
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		6.2	6.2	20.3	20.3	20.3	4.3	71.4		45.5	112.6	112.6
Effective Green, g (s)		6.7	6.7	20.8	20.8	20.8	4.8	73.9		46.0	115.1	115.1
Actuated g/C Ratio		0.04	0.04	0.13	0.13	0.13	0.03	0.45		0.28	0.70	0.70
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		75	64	214	217	199	52	2257		498	2493	1090
v/s Ratio Prot		c0.02		0.05	0.05		0.01	c0.37		c0.26	0.23	
v/s Ratio Perm			0.00			c0.10						0.01
v/c Ratio		0.43	0.01	0.41	0.43	0.81	0.40	0.81		0.92	0.32	0.01
Uniform Delay, d1		76.5	75.2	65.7	65.8	69.4	77.9	38.7		56.9	9.2	7.2
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		1.4	0.0	0.5	0.5	19.8	1.9	2.6		21.4	0.2	0.0
Delay (s)		77.9	75.2	66.1	66.3	89.2	79.8	41.3		78.3	9.4	7.2
Level of Service		E	E	E	E	F	E	D		E	A	A
Approach Delay (s)		77.2			82.5			41.8			34.0	
Approach LOS		E			F			D			C	

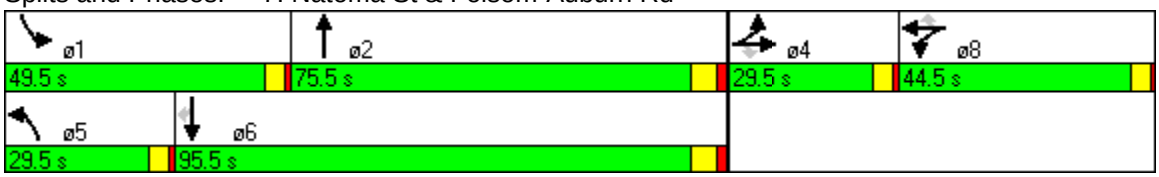
Intersection Summary			
HCM Average Control Delay	46.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	163.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



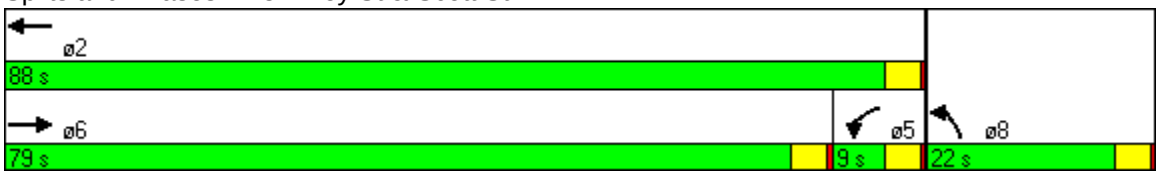
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3533		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3533		1770	1863	1695	
Volume (vph)	1620	20	10	1110	20	20
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	1723	21	11	1181	21	21
RTOR Reduction (vph)	0	0	0	0	20	0
Lane Group Flow (vph)	1744	0	11	1181	22	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	86.5		5.0	95.5	6.5	
Effective Green, g (s)	86.5		5.0	95.5	6.5	
Actuated g/C Ratio	0.79		0.05	0.87	0.06	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2778		80	1617	100	
v/s Ratio Prot	0.49		0.01	c0.63	c0.01	
v/s Ratio Perm						
v/c Ratio	0.63		0.14	0.73	0.22	
Uniform Delay, d1	5.0		50.4	2.6	49.3	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.1		0.5	2.9	1.1	
Delay (s)	6.0		50.9	5.6	50.5	
Level of Service	A		D	A	D	
Approach Delay (s)	6.0			6.0	50.5	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	6.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	9	79	22
Maximum Split (%)	80.0%	8.2%	71.8%	20.0%
Minimum Split (s)	21	5	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	1	7	4
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	35	4	35	13
End Time (s)	13	13	4	35
Yield/Force Off (s)	9	9	0	31
Yield/Force Off 170(s)	9	9	100	18
Local Start Time (s)	35	4	35	13
Local Yield (s)	9	9	0	31
Local Yield 170(s)	9	9	100	18

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



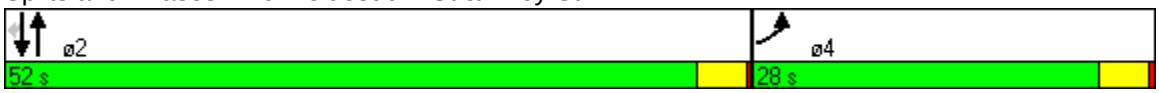
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.99			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3408			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3408			3539	1863	1583
Volume (vph)	190	20	0	1450	1060	70
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	202	21	0	1543	1128	74
RTOR Reduction (vph)	12	0	0	0	0	17
Lane Group Flow (vph)	211	0	0	1543	1128	57
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	10.5			61.5	61.5	61.5
Effective Green, g (s)	10.5			61.5	61.5	61.5
Actuated g/C Ratio	0.13			0.77	0.77	0.77
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	447			2721	1432	1217
v/s Ratio Prot	c0.06			0.44	c0.61	
v/s Ratio Perm						0.04
v/c Ratio	0.47			0.57	0.79	0.05
Uniform Delay, d1	32.2			3.8	5.4	2.2
Progression Factor	1.00			1.00	1.00	1.00
Incremental Delay, d2	0.7			0.9	4.5	0.1
Delay (s)	32.9			4.7	9.9	2.3
Level of Service	C			A	A	A
Approach Delay (s)	32.9			4.7	9.4	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	8.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	68.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	52	28
Maximum Split (%)	65.0%	35.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	46	18
End Time (s)	18	46
Yield/Force Off (s)	14	42
Yield/Force Off 170(s)	6	32
Local Start Time (s)	32	4
Local Yield (s)	0	28
Local Yield 170(s)	72	18

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	75
Offset: 14 (18%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



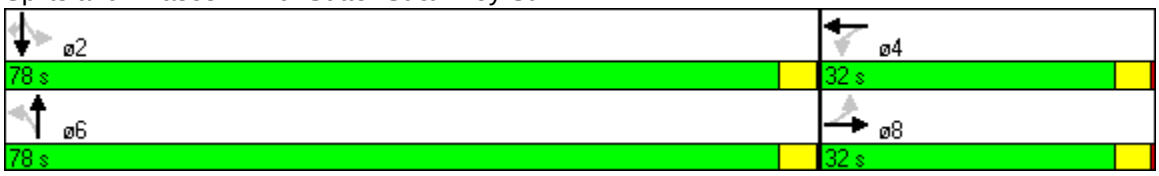
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1610	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.98			0.98			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.96			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1737			1723			1452			1815	1512
Flt Permitted		0.92			0.69			0.99			0.98	1.00
Satd. Flow (perm)		1616			1204			1440			1782	1512
Volume (vph)	30	100	50	40	40	40	10	1380	20	10	1040	30
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	32	106	53	43	43	43	11	1468	21	11	1106	32
RTOR Reduction (vph)	0	14	0	0	19	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	177	0	0	110	0	0	1500	0	0	1117	25
Confl. Peds. (#/hr)			21			22						
Confl. Bikes (#/hr)									16			1
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		17.2			17.2			84.8			84.8	84.8
Effective Green, g (s)		17.2			17.2			84.8			84.8	84.8
Actuated g/C Ratio		0.16			0.16			0.77			0.77	0.77
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		253			188			1110			1374	1166
v/s Ratio Prot												
v/s Ratio Perm		c0.11			0.09			c1.04			0.63	0.02
v/c Ratio		0.70			0.59			1.35			0.81	0.02
Uniform Delay, d1		43.9			43.1			12.6			7.7	2.9
Progression Factor		1.00			1.00			1.00			1.00	1.00
Incremental Delay, d2		6.6			3.0			164.0			5.4	0.0
Delay (s)		50.6			46.1			176.6			13.1	3.0
Level of Service		D			D			F			B	A
Approach Delay (s)		50.6			46.1			176.6			12.8	
Approach LOS		D			D			F			B	

Intersection Summary			
HCM Average Control Delay	99.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.24		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	118.6%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



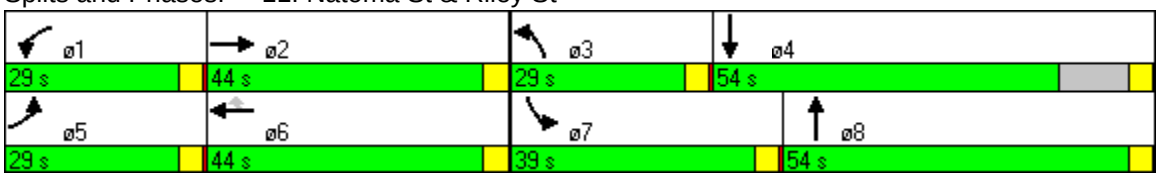
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1560	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1807		1770	1863	1583	1770	1526		1770	1854	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1807		1770	1863	1583	1770	1526		1770	1854	
Volume (vph)	20	440	110	100	340	670	40	720	10	500	610	20
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	468	117	106	362	713	43	766	11	532	649	21
RTOR Reduction (vph)	0	5	0	0	0	373	0	0	0	0	0	0
Lane Group Flow (vph)	21	580	0	106	362	340	43	777	0	532	670	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.4	41.6		13.6	50.8	50.8	7.2	50.9		35.0	78.7	
Effective Green, g (s)	4.4	41.6		13.6	50.8	50.8	7.2	50.9		35.0	78.7	
Actuated g/C Ratio	0.03	0.26		0.09	0.32	0.32	0.05	0.32		0.22	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	50	478		153	602	512	81	494		394	929	
v/s Ratio Prot	0.01	c0.32		c0.06	0.19		0.02	c0.51		c0.30	0.36	
v/s Ratio Perm						0.21						
v/c Ratio	0.42	1.21		0.69	0.60	0.66	0.53	1.57		1.35	0.72	
Uniform Delay, d1	75.1	57.8		69.7	44.6	45.8	73.3	53.1		61.0	30.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	113.9		10.4	2.0	3.6	3.3	267.4		173.6	3.0	
Delay (s)	77.2	171.7		80.1	46.7	49.4	76.6	320.5		234.7	33.6	
Level of Service	E	F		F	D	D	E	F		F	C	
Approach Delay (s)		168.4			51.3			307.7			122.6	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	147.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.33		
Actuated Cycle Length (s)	157.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	123.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	57	98	162	25	58	108	162
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	28	69	133	162	29	79	133

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 11: Natoma St & Riley St



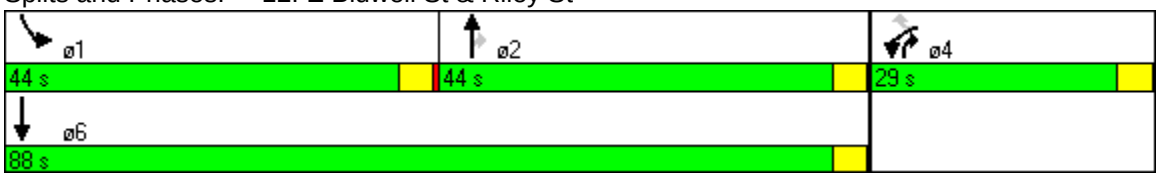
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1537	3539	1569	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1537	3539	1569	1770	1863
Volume (vph)	170	340	410	230	320	480
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	173	347	418	235	327	490
RTOR Reduction (vph)	0	279	0	139	0	0
Lane Group Flow (vph)	173	68	418	96	327	490
Confl. Peds. (#/hr)		2		2		
Confl. Bikes (#/hr)		14		7		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	8.5	8.5	9.3	17.8	13.6	26.9
Effective Green, g (s)	8.5	8.5	9.3	17.8	13.6	26.9
Actuated g/C Ratio	0.20	0.20	0.21	0.41	0.31	0.62
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	347	301	758	788	555	1155
v/s Ratio Prot	c0.10		c0.12	0.02	c0.18	0.26
v/s Ratio Perm		0.04		0.04		
v/c Ratio	0.50	0.23	0.55	0.12	0.59	0.42
Uniform Delay, d1	15.6	14.7	15.2	7.9	12.5	4.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.4	0.1	0.5	0.0	1.6	0.3
Delay (s)	16.0	14.8	15.7	8.0	14.2	4.5
Level of Service	B	B	B	A	B	A
Approach Delay (s)	15.2		12.9			8.4
Approach LOS	B		B			A

Intersection Summary			
HCM Average Control Delay	11.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	43.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	49.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	60

Splits and Phases: 12: E Bidwell St & Riley St



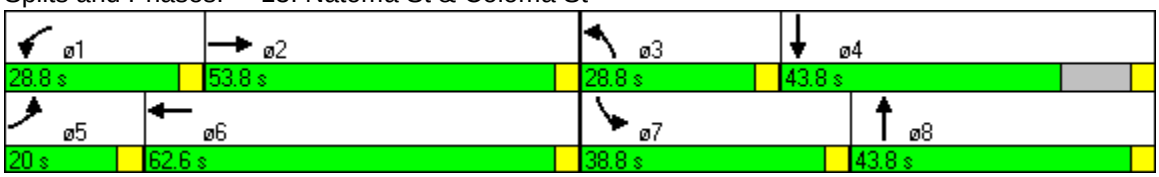
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1854		1770	1845		1770	1705		1770	1815	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1854		1770	1845		1770	1705		1770	1815	
Volume (vph)	10	910	30	60	860	60	140	100	130	30	50	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	958	32	63	905	63	147	105	137	32	53	11
RTOR Reduction (vph)	0	0	0	0	1	0	0	31	0	0	5	0
Lane Group Flow (vph)	11	990	0	63	967	0	147	211	0	32	59	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.3	58.7		6.1	60.5		12.1	17.9		3.6	9.4	
Effective Green, g (s)	4.1	58.5		5.9	60.3		11.9	17.7		3.4	9.2	
Actuated g/C Ratio	0.04	0.58		0.06	0.59		0.12	0.17		0.03	0.09	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	71	1069		103	1096		208	297		59	165	
v/s Ratio Prot	0.01	c0.53		c0.04	0.52		c0.08	c0.12		0.02	0.03	
v/s Ratio Perm												
v/c Ratio	0.15	0.93		0.61	0.88		0.71	0.71		0.54	0.35	
Uniform Delay, d1	47.0	19.5		46.7	17.6		43.1	39.5		48.3	43.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	13.2		7.3	8.6		8.6	6.6		5.4	0.5	
Delay (s)	47.4	32.7		54.0	26.2		51.7	46.1		53.6	43.8	
Level of Service	D	C		D	C		D	D		D	D	
Approach Delay (s)		32.9			27.9			48.2			47.1	
Approach LOS		C			C			D			D	

Intersection Summary			
HCM Average Control Delay	33.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	101.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	Min
Maximum Split (s)	28.8	53.8	28.8	43.8	20	62.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	12.1%	37.9%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	7	1	7	1	7
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	20	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	20	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	16.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	16.2	78.8	117.6	161.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	156.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	152.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	152.6	50	88.8	132.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	100

Splits and Phases: 13: Natoma St & Coloma St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.99		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	0.99		1.00	1.00		1.00	0.86		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3504		1770	3531		1770	1575		1770	1785	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3504		1770	3531		1770	1575		1770	1785	
Volume (vph)	10	970	60	90	770	10	180	10	180	20	30	10
Peak-hour factor, 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 (vph)	11	1054	65	98	837	11	196	11	196	22	33	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	159	0	0	8	0
Lane Group Flow (vph)	11	1117	0	98	847	0	196	48	0	22	36	0
Confl. Bikes (#/hr)			2			1			3			2
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	5.9	36.3		4.7	35.1		10.1	13.7		1.6	5.2	
Effective Green, g (s)	5.9	37.3		4.7	36.1		10.1	13.7		1.6	5.2	
Actuated g/C Ratio	0.08	0.51		0.06	0.49		0.14	0.19		0.02	0.07	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	142	1783		113	1739		244	294		39	127	
v/s Ratio Prot	0.01	c0.32		c0.06	0.24		c0.11	0.03		0.01	c0.02	
v/s Ratio Perm												
v/c Ratio	0.08	0.63		0.87	0.49		0.80	0.16		0.56	0.28	
Uniform Delay, d1	31.2	13.0		34.0	12.4		30.6	25.0		35.5	32.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.7		44.6	0.2		16.3	0.1		10.7	0.4	
Delay (s)	31.3	13.7		78.6	12.6		46.9	25.1		46.2	32.7	
Level of Service	C	B		E	B		D	C		D	C	
Approach Delay (s)		13.9			19.5			35.7			37.2	
Approach LOS		B			B			D			D	

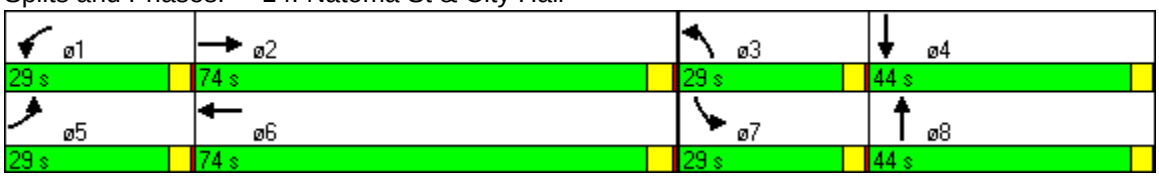
Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	73.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.3%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 14: Natoma St & City Hall



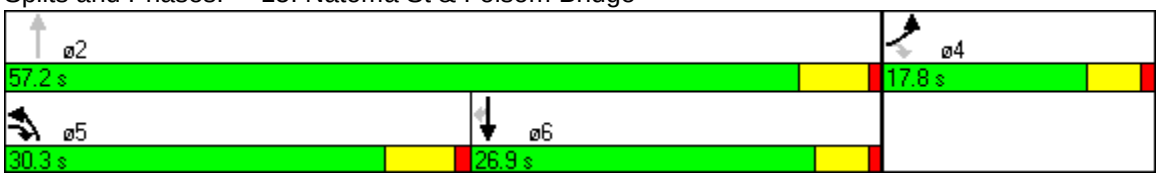
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	3539	1583
Volume (vph)	540	870	740	740	920	290
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	587	946	804	804	1000	315
RTOR Reduction (vph)	0	6	0	0	0	219
Lane Group Flow (vph)	587	940	804	804	1000	96
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	13.3	38.1	24.8	51.5	22.2	22.2
Effective Green, g (s)	13.8	40.1	26.3	53.0	22.7	22.7
Actuated g/C Ratio	0.18	0.54	0.35	0.71	0.30	0.30
Clearance Time (s)	4.5	5.5	5.5	5.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	3.0	2.0	2.0
Lane Grp Cap (vph)	633	933	1207	2508	1074	480
v/s Ratio Prot	0.17	c0.35	0.23		c0.28	
v/s Ratio Perm		0.24		0.23		0.06
v/c Ratio	0.93	1.01	0.67	0.32	0.93	0.20
Uniform Delay, d1	30.0	17.3	20.5	4.1	25.3	19.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	19.5	31.4	1.4	0.1	13.7	0.1
Delay (s)	49.5	48.8	21.9	4.2	39.0	19.4
Level of Service	D	D	C	A	D	B
Approach Delay (s)	49.0			13.1	34.3	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay	31.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	74.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	None	None	None	None
Maximum Split (s)	57.2	17.8	30.3	26.9
Maximum Split (%)	76.3%	23.7%	40.4%	35.9%
Minimum Split (s)	12.5	6.5	12.5	26.5
Yellow Time (s)	4.5	3.5	4.5	3.5
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	7	2	7	2
Vehicle Extension (s)	3	2	3	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	57.2	0	30.3
End Time (s)	57.2	0	30.3	57.2
Yield/Force Off (s)	51.7	70.5	24.8	52.7
Yield/Force Off 170(s)	51.7	70.5	24.8	37.7
Local Start Time (s)	44.7	26.9	44.7	0
Local Yield (s)	21.4	40.2	69.5	22.4
Local Yield 170(s)	21.4	40.2	69.5	7.4

Intersection Summary	
Cycle Length	75
Control Type	Actuated-Uncoordinated
Natural Cycle	75

Splits and Phases: 15: Natoma St & Folsom Bridge



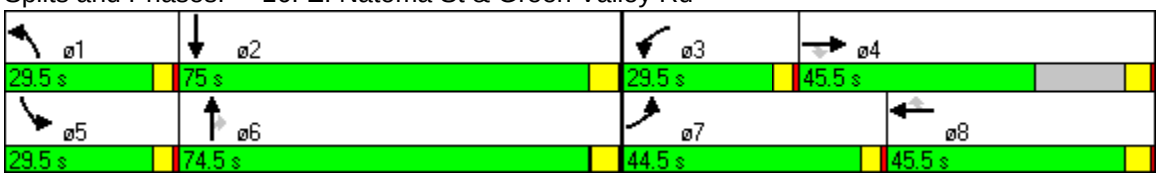
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Volume (vph)	1000	180	60	160	140	120	80	830	130	100	380	790
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1111	200	67	178	156	133	89	922	144	111	422	878
RTOR Reduction (vph)	0	0	42	0	0	115	0	0	95	0	0	0
Lane Group Flow (vph)	1111	200	25	178	156	18	89	922	49	111	422	878
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	41.3	45.6	45.6	10.8	15.1	15.1	6.4	41.0	41.0	8.4	42.5	125.8
Effective Green, g (s)	41.8	47.1	47.1	11.3	16.6	16.6	6.9	42.5	42.5	8.9	44.5	125.8
Actuated g/C Ratio	0.33	0.37	0.37	0.09	0.13	0.13	0.05	0.34	0.34	0.07	0.35	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	1141	1325	593	308	467	209	188	1196	535	243	1252	1583
v/s Ratio Prot	c0.32	0.06		0.05	0.04		0.03	c0.26		0.03	0.12	
v/s Ratio Perm			0.02			0.01			0.03			c0.55
v/c Ratio	0.97	0.15	0.04	0.58	0.33	0.08	0.47	0.77	0.09	0.46	0.34	0.55
Uniform Delay, d1	41.5	26.1	25.0	55.0	49.6	47.9	57.7	37.3	28.5	56.1	29.8	0.0
Progression 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
Incremental Delay, d2	20.3	0.1	0.0	1.6	0.7	0.3	0.7	3.5	0.1	0.5	0.2	1.4
Delay (s)	61.8	26.2	25.1	56.6	50.3	48.2	58.4	40.8	28.6	56.6	30.0	1.4
Level of Service	E	C	C	E	D	D	E	D	C	E	C	A
Approach Delay (s)		54.8			52.1			40.6			14.3	
Approach LOS		D			D			D			B	

Intersection Summary			
HCM Average Control Delay	37.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	125.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 16: E. Natoma St & Green Valley Rd



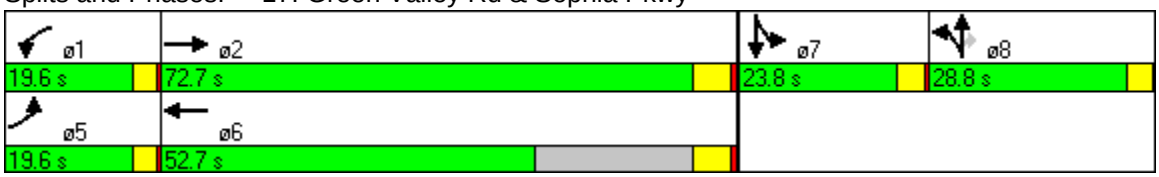
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	1.00		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.97	1.00		0.98	
Satd. Flow (prot)	1770	3523		1770	3535		1681	1713	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.97	1.00		0.98	
Satd. Flow (perm)	1770	3523		1770	3535		1681	1713	1583		1750	
Volume (vph)	10	1880	60	70	1210	10	50	10	70	10	10	10
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	11	2000	64	74	1287	11	53	11	74	11	11	11
RTOR Reduction (vph)	0	1	0	0	0	0	0	0	68	0	11	0
Lane Group Flow (vph)	11	2063	0	74	1298	0	31	33	6	0	22	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	5.6	69.7		7.5	71.6		8.2	8.2	8.2		4.4	
Effective Green, g (s)	5.2	71.4		7.1	73.3		8.0	8.0	8.0		4.2	
Actuated g/C Ratio	0.05	0.67		0.07	0.69		0.07	0.07	0.07		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	86	2357		118	2428		126	128	119		69	
v/s Ratio Prot	0.01	c0.59		c0.04	0.37		0.02	c0.02			c0.01	
v/s Ratio Perm									0.00			
v/c Ratio	0.13	0.88		0.63	0.53		0.25	0.26	0.05		0.33	
Uniform Delay, d1	48.6	14.1		48.5	8.3		46.5	46.5	45.8		49.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.3	4.0		7.8	0.2		1.1	1.1	0.2		2.8	
Delay (s)	48.9	18.1		56.4	8.5		47.6	47.7	46.0		52.7	
Level of Service	D	B		E	A		D	D	D		D	
Approach Delay (s)		18.3			11.1			46.7			52.7	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	106.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	73.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	72.7	19.6	52.7	23.8	28.8
Maximum Split (%)	13.5%	50.2%	13.5%	36.4%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	7.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	4	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: JDG
Agency/Co.: Fehr & Peers
Date Performed: 6/3/2005
Analysis Time Period: PM Peak
Intersection: E. Natoma/Briggs Ranch
Jurisdiction: Folsom, California
Units: U. S. Customary
Analysis Year: 2007
Project ID: Folsom Bridge (RS05 2106)
East/West Street: E. Natoma St.
North/South Street: Briggs Ranch
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		1050	30		1030	
Peak-Hour Factor, PHF		0.92	0.92		0.92	
Hourly Flow Rate, HFR		1141	32		1119	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0		2	
Configuration		T	TR		T	
Upstream Signal?		No			Yes	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			360			
Peak Hour Factor, PHF			0.92			
Hourly Flow Rate, HFR			391			
Percent Heavy Vehicles			0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes			1			
Configuration			R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config					R			
v (vph)					391			
C(m) (vph)					459			
v/c					0.85			
95% queue length					8.58			
Control Delay					43.7			
LOS					E			
Approach Delay				43.7				
Approach LOS				E				

2007 Conditions – Mitigation

Level of Service Technical Calculations

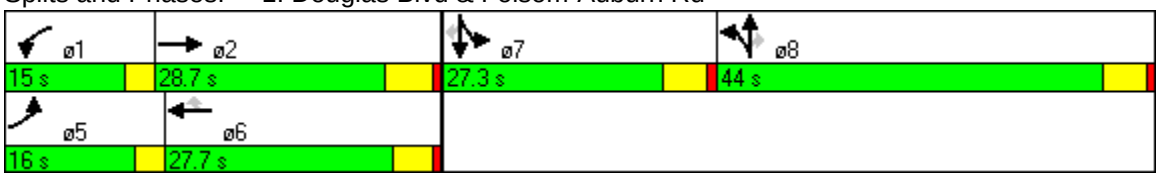
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.97	1.00	1.00	0.98	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	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1562	1770	3539	1537	3433	1863	1552	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1562	1770	3539	1537	3433	1863	1552	1770	3539	1563
Volume (vph)	160	160	590	110	360	100	1080	310	40	80	540	420
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	178	178	656	122	400	111	1200	344	44	89	600	467
RTOR Reduction (vph)	0	0	0	0	0	94	0	0	27	0	0	165
Lane Group Flow (vph)	178	178	656	122	400	17	1200	344	17	89	600	302
Confl. Peds. (#/hr)						2			5			
Confl. Bikes (#/hr)			6			2			1			1
Turn Type	Prot		Free	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			Free			6			8			7
Actuated Green, G (s)	12.8	17.6	106.8	10.0	15.6	15.6	38.8	38.8	38.8	21.1	21.1	21.1
Effective Green, g (s)	11.8	19.3	106.8	9.0	16.5	16.5	40.1	40.1	40.1	22.4	22.4	22.4
Actuated g/C Ratio	0.11	0.18	1.00	0.08	0.15	0.15	0.38	0.38	0.38	0.21	0.21	0.21
Clearance Time (s)	3.0	5.7		3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	196	640	1562	149	547	237	1289	699	583	371	742	328
v/s Ratio Prot	c0.10	0.05		0.07	c0.11		c0.35	0.18		0.05	0.17	
v/s Ratio Perm			c0.42			0.01			0.01			c0.19
v/c Ratio	0.91	0.28	0.42	0.82	0.73	0.07	0.93	0.49	0.03	0.24	0.81	0.92
Uniform Delay, d1	47.0	37.7	0.0	48.1	43.0	38.6	32.0	25.5	21.1	35.1	40.2	41.3
Progression 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
Incremental Delay, d2	38.5	0.1	0.8	27.0	4.3	0.0	11.9	0.2	0.0	0.1	6.1	29.7
Delay (s)	85.5	37.8	0.8	75.1	47.4	38.7	43.9	25.7	21.1	35.2	46.3	71.0
Level of Service	F	D	A	E	D	D	D	C	C	D	D	E
Approach Delay (s)		22.2			51.2			39.4			55.4	
Approach LOS		C			D			D			E	

Intersection Summary			
HCM Average Control Delay	41.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	106.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	15	28.7	16	27.7	27.3	44
Maximum Split (%)	13.0%	25.0%	13.9%	24.1%	23.7%	38.3%
Minimum Split (s)	8	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	15	0	16	43.7	71
End Time (s)	15	43.7	16	43.7	71	0
Yield/Force Off (s)	12	38	13	38.8	65.7	109.7
Yield/Force Off 170(s)	12	28	13	28.8	55.7	109.7
Local Start Time (s)	100	0	100	1	28.7	56
Local Yield (s)	112	23	113	23.8	50.7	94.7
Local Yield 170(s)	112	13	113	13.8	40.7	94.7

Intersection Summary	
Cycle Length	115
Control Type	Actuated-Uncoordinated
Natural Cycle	115

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



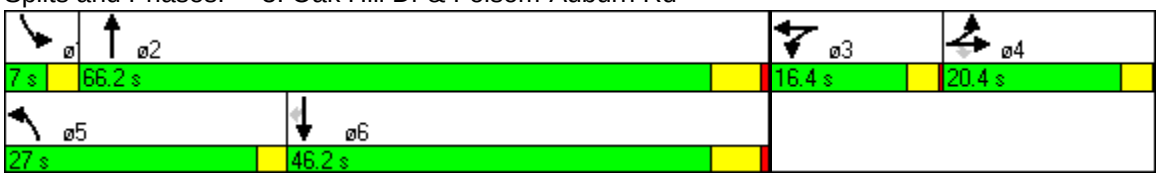
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.96		0.99		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	0.85		0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1804	1516		1728		1770	3534		1770	3539	1583
Flt Permitted		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1804	1516		1728		1770	3534		1770	3539	1583
Volume (vph)	20	10	430	10	10	10	350	1310	10	10	1280	30
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	21	11	457	11	11	11	372	1394	11	11	1362	32
RTOR Reduction (vph)	0	0	423	0	11	0	0	0	0	0	0	11
Lane Group Flow (vph)	0	32	34	0	22	0	372	1405	0	11	1362	21
Confl. Peds. (#/hr)			3			2						
Confl. Bikes (#/hr)			3			1			3			
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		7.2	7.2		3.8		23.3	57.5		3.9	38.1	38.1
Effective Green, g (s)		6.6	6.6		3.2		22.3	59.2		2.9	39.8	39.8
Actuated g/C Ratio		0.08	0.08		0.04		0.25	0.67		0.03	0.45	0.45
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		135	114		63		449	2380		58	1602	717
v/s Ratio Prot		0.02			c0.01		c0.21	0.40		0.01	c0.38	
v/s Ratio Perm			c0.02									0.01
v/c Ratio		0.24	0.30		0.36		0.83	0.59		0.19	0.85	0.03
Uniform Delay, d1		38.3	38.5		41.3		31.0	7.8		41.4	21.4	13.3
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.3	0.5		1.3		11.4	0.3		0.6	4.4	0.0
Delay (s)		38.6	39.0		42.6		42.4	8.0		41.9	25.8	13.3
Level of Service		D	D		D		D	A		D	C	B
Approach Delay (s)		39.0			42.6			15.2			25.6	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	22.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	87.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	7	66.2	16.4	20.4	27	46.2
Maximum Split (%)	6.4%	60.2%	14.9%	18.5%	24.5%	42.0%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	7	73.2	89.6	0	27
End Time (s)	7	73.2	89.6	0	27	73.2
Yield/Force Off (s)	4	67.5	86.2	106.6	24	67.5
Yield/Force Off 170(s)	4	67.5	77.2	93.6	24	67.5
Local Start Time (s)	83	90	46.2	62.6	83	0
Local Yield (s)	87	40.5	59.2	79.6	107	40.5
Local Yield 170(s)	87	40.5	50.2	66.6	107	40.5

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	3539	1583
Volume (vph)	340	530	1010	780	820	280
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	362	564	1074	830	872	298
RTOR Reduction (vph)	0	18	0	0	0	207
Lane Group Flow (vph)	362	546	1074	830	872	91
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	10.9	32.6	21.7	44.1	19.4	19.4
Effective Green, g (s)	11.4	33.1	21.7	45.6	19.9	19.9
Actuated g/C Ratio	0.18	0.51	0.33	0.70	0.31	0.31
Clearance Time (s)	4.5	4.0	4.0	5.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0	2.0	3.0	2.0	2.0
Lane Grp Cap (vph)	602	904	1146	2483	1083	485
v/s Ratio Prot	0.11	c0.20	c0.31		c0.25	
v/s Ratio Perm		0.14		0.23		0.06
v/c Ratio	0.60	0.60	0.94	0.33	0.81	0.19
Uniform Delay, d1	24.7	11.3	21.0	3.8	20.8	16.6
Progression Factor	0.95	1.33	1.00	1.00	1.00	1.00
Incremental Delay, d2	4.3	0.8	13.8	0.1	4.2	0.1
Delay (s)	27.7	15.8	34.8	3.9	25.0	16.7
Level of Service	C	B	C	A	C	B
Approach Delay (s)	20.5			21.3	22.8	
Approach LOS	C			C	C	

Intersection Summary			
HCM Average Control Delay	21.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	Min	C-Min	None	Min
Maximum Split (s)	52.5	12.5	26	26.5
Maximum Split (%)	80.8%	19.2%	40.0%	40.8%
Minimum Split (s)	12.5	6.5	6	26.5
Yellow Time (s)	4.5	3.5	3.5	3.5
All-Red Time (s)	1	1	0.5	1
Minimum Initial (s)	7	2	2	2
Vehicle Extension (s)	3	2	2	2
Minimum Gap (s)	2.4	0.2	0.2	0.2
Time Before Reduce (s)	18	0	0	0
Time To Reduce (s)	25	0	0	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	42.5	30	42.5	3.5
End Time (s)	30	42.5	3.5	30
Yield/Force Off (s)	24.5	38	64.5	25.5
Yield/Force Off 170(s)	24.5	38	64.5	25.5
Local Start Time (s)	4.5	57	4.5	30.5
Local Yield (s)	51.5	0	26.5	52.5
Local Yield 170(s)	51.5	0	26.5	52.5

Intersection Summary	
Cycle Length	65
Control Type	Actuated-Coordinated
Natural Cycle	65
Offset: 38 (58%), Referenced to phase 4:EBL, Start of Yellow	

Splits and Phases: 15: Natoma St & Folsom Bridge

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		1.00
Frt	1.00			1.00		0.86
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3524			3539		1611
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3524			3539		1611
Volume (vph)	670	20	0	1290	0	200
Peak-hour factor, PHF	0.94	0.94	0.94	0.94	0.94	0.94
Adj. Flow (vph)	713	21	0	1372	0	213
RTOR Reduction (vph)	2	0	0	0	0	190
Lane Group Flow (vph)	732	0	0	1372	0	23
Turn Type						custom
Protected Phases	4			8		
Permitted Phases						2
Actuated Green, G (s)	50.0			50.0		7.0
Effective Green, g (s)	50.0			50.0		7.0
Actuated g/C Ratio	0.77			0.77		0.11
Clearance Time (s)	4.0			4.0		4.0
Vehicle Extension (s)	3.0			3.0		3.0
Lane Grp Cap (vph)	2711			2722		173
v/s Ratio Prot	0.21			c0.39		
v/s Ratio Perm						c0.01
v/c Ratio	0.27			0.50		0.13
Uniform Delay, d1	2.2			2.8		26.3
Progression Factor	1.00			0.38		1.00
Incremental Delay, d2	0.2			0.4		0.3
Delay (s)	2.4			1.5		26.6
Level of Service	A			A		C
Approach Delay (s)	2.4			1.5	26.6	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	4.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	39.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	8
Movement	NBR	EBT	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	None	C-Min	C-Min
Maximum Split (s)	23	42	42
Maximum Split (%)	35.4%	64.6%	64.6%
Minimum Split (s)	8	8	8
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	40	63	63
End Time (s)	63	40	40
Yield/Force Off (s)	59	36	36
Yield/Force Off 170(s)	59	36	36
Local Start Time (s)	4	27	27
Local Yield (s)	23	0	0
Local Yield 170(s)	23	0	0

Intersection Summary	
Cycle Length	65
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 36 (55%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	

Splits and Phases: 19: Natoma St & Briggs Ranch

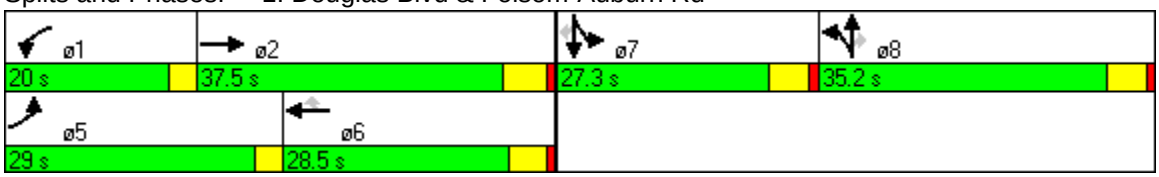
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.96	1.00	1.00	0.98	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1561	1770	3539	1519	3433	1863	1547	1770	3539	1552
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1561	1770	3539	1519	3433	1863	1547	1770	3539	1552
Volume (vph)	390	400	910	120	310	80	880	500	100	160	440	280
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	406	417	948	125	323	83	917	521	104	167	458	292
RTOR Reduction (vph)	0	0	0	0	0	72	0	0	73	0	0	242
Lane Group Flow (vph)	406	417	948	125	323	11	917	521	31	167	458	50
Confl. Peds. (#/hr)			6			2			8			
Confl. Bikes (#/hr)			2			6						6
Turn Type	Prot		Free	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			Free			6			8			7
Actuated Green, G (s)	26.2	28.2	104.8	10.7	13.5	13.5	30.1	30.1	30.1	16.5	16.5	16.5
Effective Green, g (s)	25.2	29.9	104.8	9.7	14.4	14.4	31.4	31.4	31.4	17.8	17.8	17.8
Actuated g/C Ratio	0.24	0.29	1.00	0.09	0.14	0.14	0.30	0.30	0.30	0.17	0.17	0.17
Clearance Time (s)	3.0	5.7		3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	426	1010	1561	164	486	209	1029	558	464	301	601	264
v/s Ratio Prot	c0.23	0.12		0.07	0.09		0.27	c0.28		0.09	c0.13	
v/s Ratio Perm			c0.61			0.01			0.02			0.03
v/c Ratio	0.95	0.41	0.61	0.76	0.66	0.05	0.89	0.93	0.07	0.55	0.76	0.19
Uniform Delay, d1	39.2	30.3	0.0	46.4	42.9	39.3	35.1	35.7	26.2	39.9	41.5	37.3
Progression 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
Incremental Delay, d2	31.4	0.1	1.8	17.0	2.7	0.0	9.6	22.6	0.0	1.3	5.1	0.1
Delay (s)	70.6	30.4	1.8	63.4	45.6	39.3	44.7	58.3	26.3	41.1	46.6	37.4
Level of Service	E	C	A	E	D	D	D	E	C	D	D	D
Approach Delay (s)		24.3			48.8			48.0			42.7	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM Average Control Delay	38.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	104.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	20	37.5	29	28.5	27.3	35.2
Maximum Split (%)	16.7%	31.3%	24.2%	23.8%	22.8%	29.3%
Minimum Split (s)	6	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	20	0	29	57.5	84.8
End Time (s)	20	57.5	29	57.5	84.8	0
Yield/Force Off (s)	17	51.8	26	52.6	79.5	114.7
Yield/Force Off 170(s)	17	41.8	26	42.6	69.5	114.7
Local Start Time (s)	100	0	100	9	37.5	64.8
Local Yield (s)	117	31.8	6	32.6	59.5	94.7
Local Yield 170(s)	117	21.8	6	22.6	49.5	94.7

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	1.00			1.00	1.00
Frpb, ped/bikes		1.00	0.98				1.00	1.00			1.00	1.00
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)		1770	1553				1770	1863			1863	1583
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1553				1770	1863			1863	1583
Volume (vph)	100	0	200	0	0	0	130	1350	0	0	1210	100
Peak-hour factor, PHF	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Adj. Flow (vph)	110	0	220	0	0	0	143	1484	0	0	1330	110
RTOR Reduction (vph)	0	0	199	0	0	0	0	0	0	0	0	11
Lane Group Flow (vph)	0	110	21	0	0	0	143	1484	0	0	1330	99
Confl. Bikes (#/hr)			3			13						
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		14.2	14.2				15.0	124.3			105.3	105.3
Effective Green, g (s)		14.2	14.2				15.0	125.8			106.8	106.8
Actuated g/C Ratio		0.10	0.10				0.10	0.85			0.72	0.72
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		170	149				179	1584			1344	1142
v/s Ratio Prot		c0.06					0.08	c0.80			c0.71	
v/s Ratio Perm			0.01									0.06
v/c Ratio		0.65	0.14				0.80	0.94			0.99	0.09
Uniform Delay, d1		64.5	61.3				65.0	8.2			20.1	6.1
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		8.2	0.4				20.2	10.8			21.8	0.0
Delay (s)		72.7	61.8				85.3	19.0			41.9	6.1
Level of Service		E	E				F	B			D	A
Approach Delay (s)		65.4			0.0			24.8			39.1	
Approach LOS		E			A			C			D	

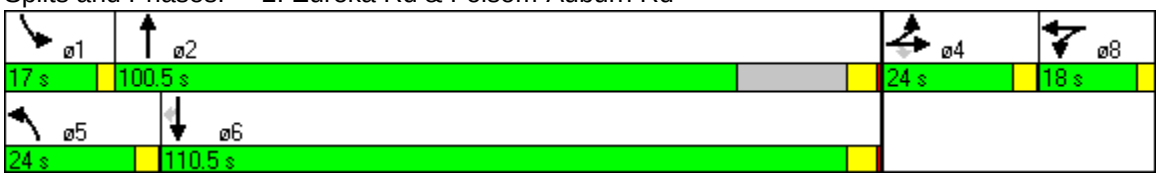
Intersection Summary			
HCM Average Control Delay	34.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	148.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	24	110.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	13.6%	62.6%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	24	158.5
End Time (s)	17	134.5	158.5	24	134.5	0
Yield/Force Off (s)	14	129	154.5	20	129	173.5
Yield/Force Off 170(s)	14	129	140.5	20	129	173.5
Local Start Time (s)	152.5	169.5	110.5	152.5	0	134.5
Local Yield (s)	166.5	105	130.5	172.5	105	149.5
Local Yield 170(s)	166.5	105	116.5	172.5	105	149.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.90		0.96		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
Frt		1.00	0.85		0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1803	1431		1654		1770	3535		1770	3539	1548
Flt Permitted		0.97	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1803	1431		1654		1770	3535		1770	3539	1548
Volume (vph)	20	10	350	20	10	20	440	1380	10	10	1260	20
Peak-hour factor, 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 (vph)	22	11	380	22	11	22	478	1500	11	11	1370	22
RTOR Reduction (vph)	0	0	356	0	19	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	33	24	0	36	0	478	1511	0	11	1370	15
Confl. Bikes (#/hr)			13			10			10			3
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		7.5	7.5		5.3		34.7	77.3		3.9	46.5	46.5
Effective Green, g (s)		6.9	6.9		4.7		33.7	79.0		2.9	48.2	48.2
Actuated g/C Ratio		0.06	0.06		0.04		0.31	0.72		0.03	0.44	0.44
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		114	90		71		545	2550		47	1558	681
v/s Ratio Prot		c0.02			c0.02		c0.27	0.43		0.01	c0.39	
v/s Ratio Perm			0.02									0.01
v/c Ratio		0.29	0.27		0.51		0.88	0.59		0.23	0.88	0.02
Uniform Delay, d1		49.0	48.9		51.3		35.9	7.4		52.2	28.0	17.3
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		0.5	0.6		2.1		14.3	0.2		0.9	5.8	0.0
Delay (s)		49.5	49.5		53.3		50.3	7.7		53.1	33.8	17.3
Level of Service		D	D		D		D	A		D	C	B
Approach Delay (s)		49.5			53.3			17.9			33.7	
Approach LOS		D			D			B			C	

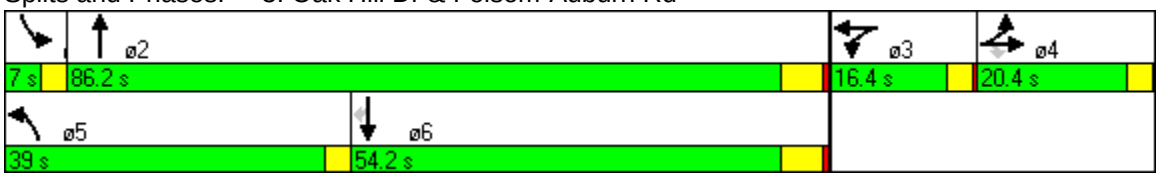
Intersection Summary			
HCM Average Control Delay	27.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	109.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	7	86.2	16.4	20.4	39	54.2
Maximum Split (%)	5.4%	66.3%	12.6%	15.7%	30.0%	41.7%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	7	93.2	109.6	0	39
End Time (s)	7	93.2	109.6	0	39	93.2
Yield/Force Off (s)	4	87.5	106.2	126.6	36	87.5
Yield/Force Off 170(s)	4	87.5	97.2	113.6	36	87.5
Local Start Time (s)	91	98	54.2	70.6	91	0
Local Yield (s)	95	48.5	67.2	87.6	127	48.5
Local Yield 170(s)	95	48.5	58.2	74.6	127	48.5

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



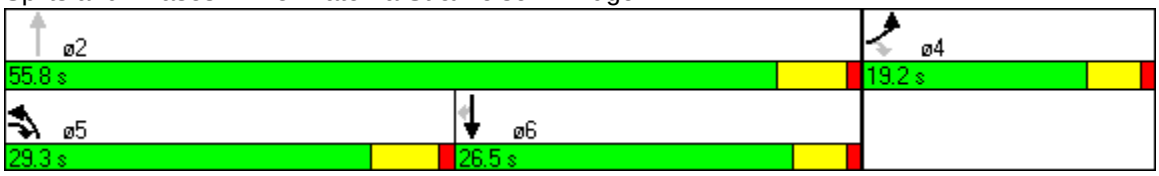
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	3539	1583
Volume (vph)	540	870	740	740	920	290
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	587	946	804	804	1000	315
RTOR Reduction (vph)	0	5	0	0	0	221
Lane Group Flow (vph)	587	941	804	804	1000	95
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	14.4	38.5	24.1	50.6	22.0	22.0
Effective Green, g (s)	14.9	40.5	25.6	52.1	22.5	22.5
Actuated g/C Ratio	0.20	0.54	0.34	0.69	0.30	0.30
Clearance Time (s)	4.5	5.5	5.5	5.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	3.0	2.0	2.0
Lane Grp Cap (vph)	682	939	1172	2458	1062	475
v/s Ratio Prot	0.17	c0.34	0.23		c0.28	
v/s Ratio Perm		0.25		0.23		0.06
v/c Ratio	0.86	1.00	0.69	0.33	0.94	0.20
Uniform Delay, d1	29.0	17.2	21.2	4.5	25.6	19.5
Progression Factor	1.09	0.95	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.7	27.6	1.7	0.1	15.4	0.1
Delay (s)	43.3	44.0	22.9	4.6	41.0	19.6
Level of Service	D	D	C	A	D	B
Approach Delay (s)	43.7			13.8	35.9	
Approach LOS	D			B	D	

Intersection Summary			
HCM Average Control Delay	30.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.98		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	86.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	Min	C-Min	None	Min
Maximum Split (s)	55.8	19.2	29.3	26.5
Maximum Split (%)	74.4%	25.6%	39.1%	35.3%
Minimum Split (s)	12.5	6.5	12.5	26.5
Yellow Time (s)	4.5	3.5	4.5	3.5
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	7	2	7	2
Vehicle Extension (s)	3	2	3	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	36.5	17.3	36.5	65.8
End Time (s)	17.3	36.5	65.8	17.3
Yield/Force Off (s)	11.8	32	60.3	12.8
Yield/Force Off 170(s)	11.8	32	60.3	12.8
Local Start Time (s)	4.5	60.3	4.5	33.8
Local Yield (s)	54.8	0	28.3	55.8
Local Yield 170(s)	54.8	0	28.3	55.8

Intersection Summary	
Cycle Length	75
Control Type	Actuated-Coordinated
Natural Cycle	75
Offset: 32 (43%), Referenced to phase 4:EBL, Start of Yellow	

Splits and Phases: 15: Natoma St & Folsom Bridge



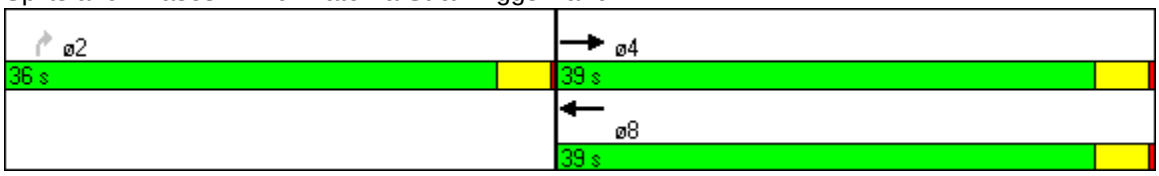
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		1.00
Frt	1.00			1.00		0.86
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3524			3539		1611
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3524			3539		1611
Volume (vph)	1050	30	0	1030	0	360
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	1141	33	0	1120	0	391
RTOR Reduction (vph)	2	0	0	0	0	30
Lane Group Flow (vph)	1172	0	0	1120	0	361
Turn Type						custom
Protected Phases	4			8		
Permitted Phases						2
Actuated Green, G (s)	46.5			46.5		20.5
Effective Green, g (s)	46.5			46.5		20.5
Actuated g/C Ratio	0.62			0.62		0.27
Clearance Time (s)	4.0			4.0		4.0
Vehicle Extension (s)	3.0			3.0		3.0
Lane Grp Cap (vph)	2185			2194		440
v/s Ratio Prot	c0.33			0.32		
v/s Ratio Perm						c0.22
v/c Ratio	0.54			0.51		0.82
Uniform Delay, d1	8.1			7.9		25.5
Progression Factor	1.00			0.41		1.00
Incremental Delay, d2	0.9			0.7		11.7
Delay (s)	9.1			3.9		37.2
Level of Service	A			A		D
Approach Delay (s)	9.1			3.9	37.2	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	11.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	8
Movement	NBR	EBT	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	None	C-Max	C-Max
Maximum Split (s)	36	39	39
Maximum Split (%)	48.0%	52.0%	52.0%
Minimum Split (s)	8	8	8
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	3	39	39
End Time (s)	39	3	3
Yield/Force Off (s)	35	74	74
Yield/Force Off 170(s)	35	74	74
Local Start Time (s)	4	40	40
Local Yield (s)	36	0	0
Local Yield 170(s)	36	0	0

Intersection Summary	
Cycle Length	75
Control Type	Actuated-Coordinated
Natural Cycle	45
Offset: 74 (99%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	

Splits and Phases: 19: Natoma St & Briggs Ranch



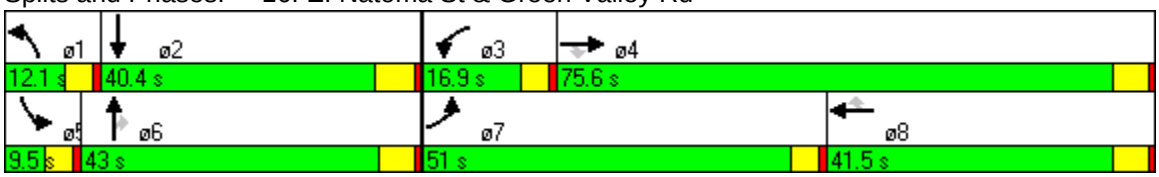
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	1583	3433	3539	1583
Volume (vph)	1000	180	60	160	140	120	80	830	130	100	380	790
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	1111	200	67	178	156	133	89	922	144	111	422	878
RTOR Reduction (vph)	0	0	39	0	0	65	0	0	99	0	0	0
Lane Group Flow (vph)	1111	200	28	178	156	68	89	922	45	111	422	878
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	45.3	50.8	50.8	10.1	15.6	15.6	5.7	37.5	37.5	5.1	36.4	123.5
Effective Green, g (s)	45.8	52.3	52.3	10.6	17.1	17.1	6.2	39.0	39.0	5.6	38.4	123.5
Actuated g/C Ratio	0.37	0.42	0.42	0.09	0.14	0.14	0.05	0.32	0.32	0.05	0.31	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	1273	1499	670	295	490	219	172	1118	500	156	1100	1583
v/s Ratio Prot	c0.32	0.06		0.05	0.04		0.03	c0.26		0.03	0.12	
v/s Ratio Perm			0.02			0.04			0.03			c0.55
v/c Ratio	0.87	0.13	0.04	0.60	0.32	0.31	0.52	0.82	0.09	0.71	0.38	0.55
Uniform Delay, d1	36.1	21.8	20.9	54.4	47.9	47.9	57.2	39.1	29.8	58.2	33.3	0.0
Progression 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
Incremental Delay, d2	6.7	0.1	0.0	2.4	0.7	1.4	1.1	5.5	0.1	12.0	0.3	1.4
Delay (s)	42.8	21.8	20.9	56.8	48.6	49.3	58.3	44.6	29.9	70.1	33.6	1.4
Level of Service	D	C	C	E	D	D	E	D	C	E	C	A
Approach Delay (s)		38.7			51.9			43.8			16.4	
Approach LOS		D			D			D			B	

Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	123.5	Sum of lost time (s)	4.0
Intersection Capacity Utilization	74.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	12.1	40.4	16.9	75.6	9.5	43	51	41.5
Maximum Split (%)	8.3%	27.9%	11.7%	52.1%	6.6%	29.7%	35.2%	28.6%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	12.1	52.5	69.4	0	9.5	52.5	103.5
End Time (s)	12.1	52.5	69.4	0	9.5	52.5	103.5	0
Yield/Force Off (s)	7.6	46.5	64.9	139.5	5	47	99	139.5
Yield/Force Off 170(s)	7.6	46.5	64.9	111.5	5	47	99	110.5
Local Start Time (s)	132.9	0	40.4	57.3	132.9	142.4	40.4	91.4
Local Yield (s)	140.5	34.4	52.8	127.4	137.9	34.9	86.9	127.4
Local Yield 170(s)	140.5	34.4	52.8	99.4	137.9	34.9	86.9	98.4

Intersection Summary	
Cycle Length	145
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 16: E. Natoma St & Green Valley Rd



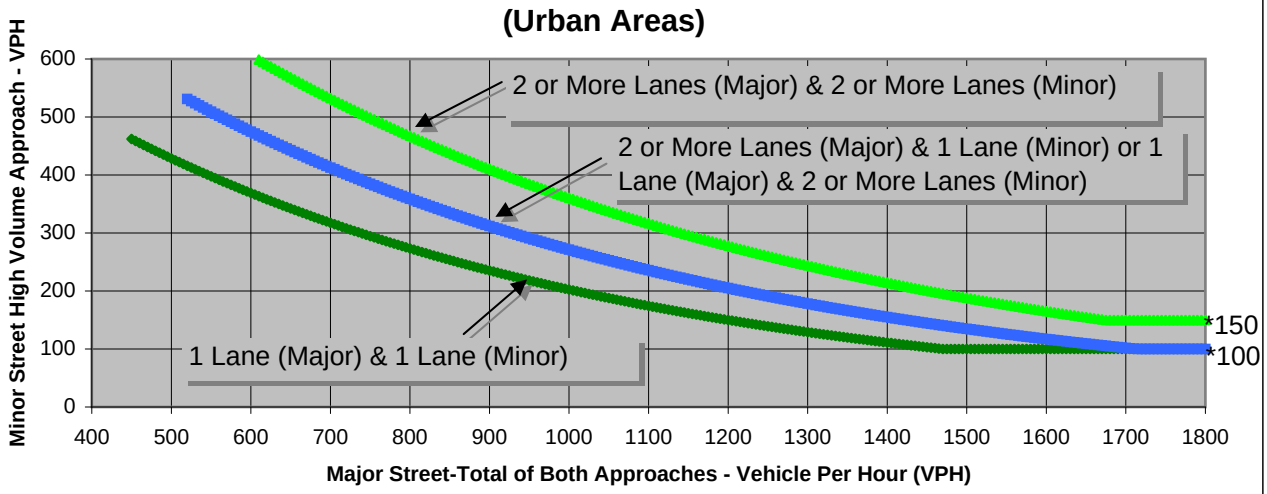
2007 Conditions – Alternatives 2-4

Signal Warrant Analysis

FEHR & PEERS
TRANSPORTATION CONSULTANTS

				Project No	RS05 2106	Page No	1/1
				Subject	E. Natoma St/Briggs Ranch		
Computed by	JDG	Date	6.10.05		AM Peak		
Checked by		Date			2007 Alternatives 2-4		
Approved by		Date		Sheet No	1	of	1

Figure 9-8
PEAK HOUR VOLUME WARRANT
(Urban Areas)



*Note: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.
Source: Traffic Manual, Caltrans 1996.

Name of Street		Major Street	Minor Street	Warrant Met
Number of Lanes	Two or More Lane (Y/N)	y		YES
	One Lane (Y/N)		y	
Traffic Volume (VPH) *		1980	200	

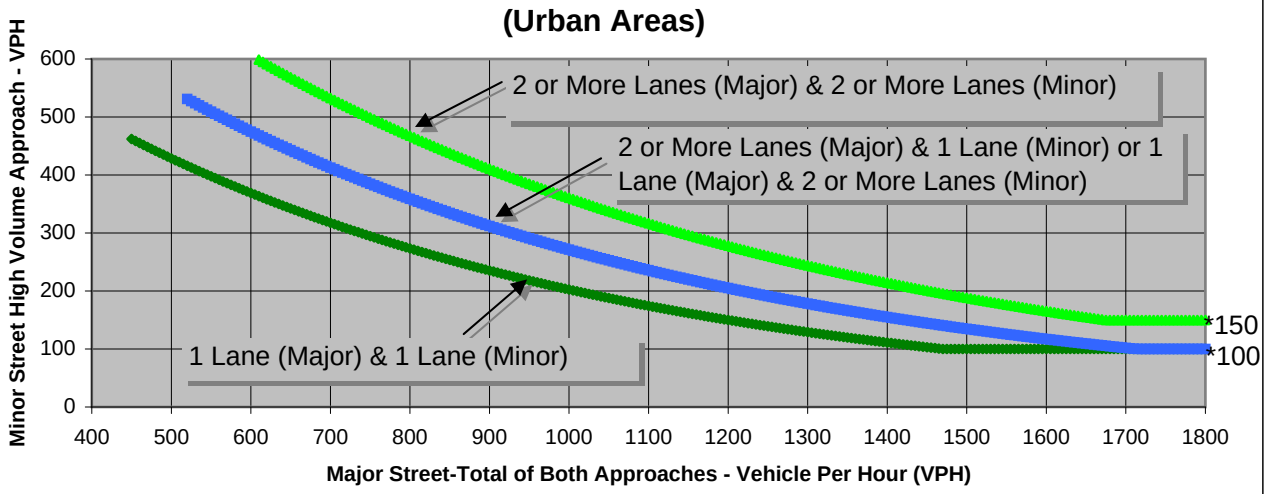
*Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

- ☐ Existing Conditions
- ☐ Existing Plus Project Conditions
- ☐ Cumulative No Project Conditions
- ☑ Cumulative Plus Project Conditions

FEHR & PEERS
TRANSPORTATION CONSULTANTS

			Project No	RS05 2106	Page No 1/1
			Subject	E. Natoma St/Briggs Ranch	
Computed by	JDG	Date 6.10.05		PM Peak	
Checked by		Date		2007 Alternatives 2-4	
Approved by		Date	Sheet No	1	of 1

Figure 9-8
PEAK HOUR VOLUME WARRANT
(Urban Areas)



*Note: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.
Source: Traffic Manual, Caltrans 1996.

Name of Street		Major Street	Minor Street	Warrant Met
Number of Lanes	Two or More Lane (Y/N)	y		YES
	One Lane (Y/N)		y	
Traffic Volume (VPH) *		2110	360	

*Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

- ☐ Existing Conditions
- ☐ Existing Plus Project Conditions
- ☐ Cumulative No Project Conditions
- ☑ Cumulative Plus Project Conditions

2025 Conditions – Alternative 1

Level of Service Technical Calculations

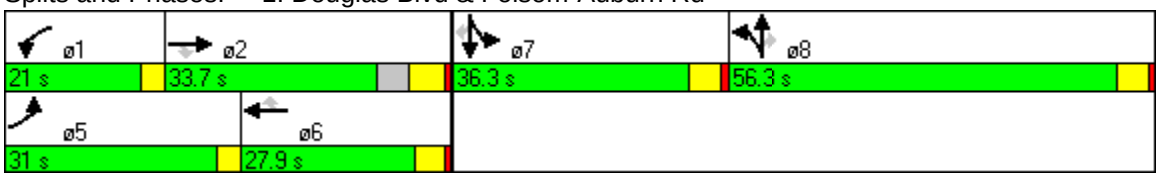
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.98	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	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1553	1770	3539	1526	3433	1863	1548	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1553	1770	3539	1526	3433	1863	1548	1770	3539	1563
Volume (vph)	190	220	850	130	400	170	1340	580	50	90	700	480
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	232	895	137	421	179	1411	611	53	95	737	505
RTOR Reduction (vph)	0	0	472	0	0	148	0	0	34	0	0	223
Lane Group Flow (vph)	200	232	423	137	421	31	1411	611	19	95	737	282
Confl. Peds. (#/hr)						3			5			
Confl. Bikes (#/hr)			7			3			1			1
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	19.6	28.8	28.8	14.0	24.0	24.0	51.1	51.1	51.1	30.6	30.6	30.6
Effective Green, g (s)	18.6	30.5	30.5	13.0	24.9	24.9	52.4	52.4	52.4	31.9	31.9	31.9
Actuated g/C Ratio	0.13	0.21	0.21	0.09	0.17	0.17	0.36	0.36	0.36	0.22	0.22	0.22
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	229	751	329	160	613	264	1251	679	564	393	785	347
v/s Ratio Prot	c0.11	0.07		0.08	0.12		c0.41	0.33		0.05	c0.21	
v/s Ratio Perm			c0.27			0.02			0.01			0.18
v/c Ratio	0.87	0.31	1.29	0.86	0.69	0.12	1.13	0.90	0.03	0.24	0.94	0.81
Uniform Delay, d1	61.4	47.8	56.6	64.5	55.8	50.2	45.7	43.2	29.4	46.0	55.0	53.1
Progression 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
Incremental Delay, d2	27.9	0.1	149.8	32.5	2.6	0.1	68.3	14.5	0.0	0.1	18.4	12.9
Delay (s)	89.3	47.8	206.4	97.0	58.3	50.2	114.0	57.7	29.4	46.1	73.4	66.1
Level of Service	F	D	F	F	E	D	F	E	C	D	E	E
Approach Delay (s)		161.1			63.6			95.2			68.7	
Approach LOS		F			E			F			E	

Intersection Summary			
HCM Average Control Delay	100.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	143.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	93.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	21	33.7	31	27.9	36.3	56.3
Maximum Split (%)	13.9%	22.2%	20.5%	18.4%	24.0%	37.2%
Minimum Split (s)	8	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	21	0	31	58.9	95.2
End Time (s)	21	58.9	31	58.9	95.2	0
Yield/Force Off (s)	18	53.2	28	54	89.9	146.2
Yield/Force Off 170(s)	18	43.2	28	44	79.9	146.2
Local Start Time (s)	130.5	0	130.5	10	37.9	74.2
Local Yield (s)	148.5	32.2	7	33	68.9	125.2
Local Yield 170(s)	148.5	22.2	7	23	58.9	125.2

Intersection Summary	
Cycle Length	151.5
Control Type	Actuated-Uncoordinated
Natural Cycle	135

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	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		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)		1770	1562				1770	3539			3539	1551
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1562				1770	3539			3539	1551
Volume (vph)	180	0	130	0	0	0	230	1830	0	0	1680	230
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	189	0	137	0	0	0	242	1926	0	0	1768	242
RTOR Reduction (vph)	0	0	116	0	0	0	0	0	0	0	0	48
Lane Group Flow (vph)	0	189	21	0	0	0	242	1926	0	0	1768	194
Confl. Bikes (#/hr)			1			1						1
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		18.5	18.5				22.0	95.5			69.5	69.5
Effective Green, g (s)		18.5	18.5				22.0	97.0			71.0	71.0
Actuated g/C Ratio		0.15	0.15				0.18	0.79			0.57	0.57
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		265	234				315	2780			2035	892
v/s Ratio Prot		c0.11					c0.14	0.54			c0.50	
v/s Ratio Perm			0.01									0.13
v/c Ratio		0.71	0.09				0.77	0.69			0.87	0.22
Uniform Delay, d1		50.0	45.2				48.3	6.2			22.3	12.8
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		8.8	0.2				9.7	0.7			4.2	0.1
Delay (s)		58.7	45.4				58.0	6.9			26.5	12.8
Level of Service		E	D				E	A			C	B
Approach Delay (s)		53.1			0.0			12.6			24.9	
Approach LOS		D			A			B			C	

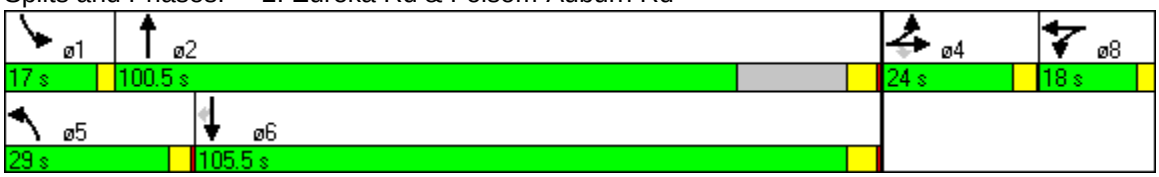
Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	123.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.2%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



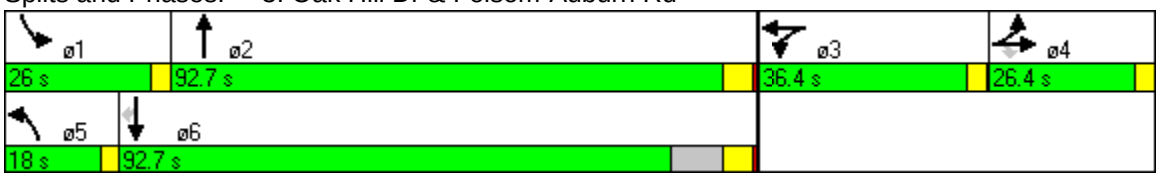
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.96		0.99		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	0.85		0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1796	1523		1734		1770	3536		1770	3539	1583
Flt Permitted		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1796	1523		1734		1770	3536		1770	3539	1583
Volume (vph)	30	10	90	10	10	10	40	2020	10	10	1770	50
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	11	95	11	11	11	42	2126	11	11	1863	53
RTOR Reduction (vph)	0	0	90	0	11	0	0	0	0	0	0	5
Lane Group Flow (vph)	0	43	5	0	22	0	42	2137	0	11	1863	48
Confl. Peds. (#/hr)			4			3						
Confl. Bikes (#/hr)			4			1			4			
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		6.6	6.6		4.1		4.4	90.3		4.4	90.3	90.3
Effective Green, g (s)		6.0	6.0		3.5		3.4	92.0		3.4	92.0	92.0
Actuated g/C Ratio		0.05	0.05		0.03		0.03	0.76		0.03	0.76	0.76
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		89	76		50		50	2691		50	2693	1205
v/s Ratio Prot		c0.02			c0.01		c0.02	c0.60		0.01	0.53	
v/s Ratio Perm			0.00									0.03
v/c Ratio		0.48	0.06		0.45		0.84	0.79		0.22	0.69	0.04
Uniform Delay, d1		55.9	54.8		57.7		58.5	8.7		57.5	7.3	3.6
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.5	0.1		2.3		68.8	1.6		0.8	0.6	0.0
Delay (s)		57.4	54.9		60.0		127.3	10.3		58.3	7.9	3.6
Level of Service		E	D		E		F	B		E	A	A
Approach Delay (s)		55.7			60.0			12.6			8.1	
Approach LOS		E			E			B			A	

Intersection Summary			
HCM Average Control Delay	12.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	120.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	71.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



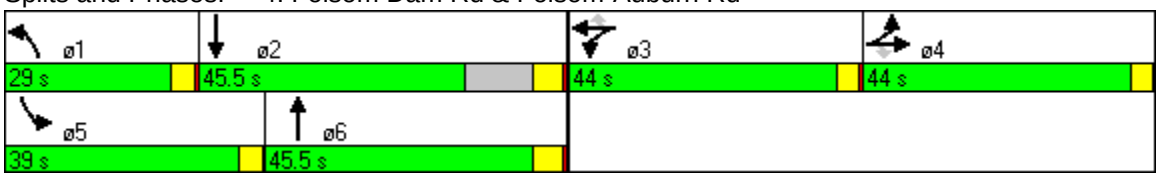
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3531		1770	3522	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3531		1770	3522	
Volume (vph)	100	0	60	20	0	10	40	1960	30	10	1770	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	0	63	21	0	11	42	2063	32	11	1863	63
RTOR Reduction (vph)	0	0	56	0	0	11	0	0	0	0	1	0
Lane Group Flow (vph)	0	105	7	0	21	0	42	2095	0	11	1925	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						
Actuated Green, G (s)		9.8	9.8		3.1	3.1	4.1	60.5		1.1	57.5	
Effective Green, g (s)		9.8	9.8		3.1	3.1	4.1	62.0		1.1	59.0	
Actuated g/C Ratio		0.11	0.11		0.03	0.03	0.04	0.67		0.01	0.64	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.0	4.7		1.5	5.4	
Lane Grp Cap (vph)		189	169		60	53	79	2380		21	2259	
v/s Ratio Prot		c0.06			c0.01		c0.02	c0.59		0.01	0.55	
v/s Ratio Perm			0.00			0.00						
v/c Ratio		0.56	0.04		0.35	0.01	0.53	0.88		0.52	0.85	
Uniform Delay, d1		39.0	36.9		43.5	43.0	43.0	12.0		45.2	13.1	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.0	0.0		1.3	0.0	3.4	4.4		10.4	3.7	
Delay (s)		41.0	36.9		44.8	43.0	46.4	16.5		55.6	16.8	
Level of Service		D	D		D	D	D	B		E	B	
Approach Delay (s)		39.5			44.1			17.0			17.0	
Approach LOS		D			D			B			B	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	92.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	NBL	SBT	WBTL	EBTL	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	45.5	44	44	39	45.5
Maximum Split (%)	16.8%	26.4%	25.5%	25.5%	22.6%	26.4%
Minimum Split (s)	5	23.5	12	28	6	12.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1
Minimum Initial (s)	1	7	8	2	2	7
Vehicle Extension (s)	1	5.4	1	1	1.5	4.7
Minimum Gap (s)	1	3.8	1	1	1.5	3.1
Time Before Reduce (s)	0	10	0	0	0	10
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)		7		7		
Flash Dont Walk (s)		11		17		
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	84.5	128.5	0	39
End Time (s)	29	84.5	128.5	0	39	84.5
Yield/Force Off (s)	25	79	124.5	168.5	35	79
Yield/Force Off 170(s)	25	79	124.5	151.5	35	79
Local Start Time (s)	133.5	162.5	45.5	89.5	133.5	0
Local Yield (s)	158.5	40	85.5	129.5	168.5	40
Local Yield 170(s)	158.5	40	85.5	112.5	168.5	40

Intersection Summary	
Cycle Length	172.5
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	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	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1563	3433	3431		1770	3519	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1563	3433	3431		1770	3519	
Volume (vph)	100	1250	820	210	980	960	530	980	250	750	1080	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	1316	863	221	1032	1011	558	1032	263	789	1137	42
RTOR Reduction (vph)	0	0	250	0	0	341	0	15	0	0	2	0
Lane Group Flow (vph)	105	1316	613	221	1032	670	558	1280	0	789	1177	0
Confl. Bikes (#/hr)						1						3
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	7.0	40.3	40.3	12.0	45.3	45.3	24.7	36.8		40.3	52.4	
Effective Green, g (s)	7.0	42.0	42.0	12.0	47.0	47.0	25.4	39.0		41.0	54.6	
Actuated g/C Ratio	0.05	0.28	0.28	0.08	0.31	0.31	0.17	0.26		0.27	0.36	
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	83	991	443	142	1109	490	581	892		484	1281	
v/s Ratio Prot	0.06	0.37		c0.12	0.29		0.16	c0.37		c0.45	0.33	
v/s Ratio Perm			0.39			c0.43						
v/c Ratio	1.27	1.33	1.38	1.56	0.93	1.37	0.96	1.44		1.63	0.92	
Uniform Delay, d1	71.5	54.0	54.0	69.0	49.9	51.5	61.8	55.5		54.5	45.6	
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	185.7	154.6	186.4	281.9	13.5	178.4	27.5	202.3		292.9	10.7	
Delay (s)	257.2	208.6	240.4	350.9	63.4	229.9	89.3	257.8		347.4	56.3	
Level of Service	F	F	F	F	E	F	F	F		F	E	
Approach Delay (s)		222.9			165.8			207.0			173.0	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	192.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.47		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	136.1%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	45	43	16	46	29.4	58.6	11	51
Maximum Split (%)	30.0%	28.7%	10.7%	30.7%	19.6%	39.1%	7.3%	34.0%
Minimum Split (s)	6.7	13.2	8	30.7	6.7	13.2	8	27.7
Yellow Time (s)	3.5	5	3.5	4.5	3.5	5	3.5	4.5
All-Red Time (s)	1.2	1.2	0.5	1.2	1.2	1.2	0.5	1.2
Minimum Initial (s)	2	7	4	3	2	7	4	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	2	2.4	3	3	2	2.4	3	0.2
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	45	88	104	0	29.4	88	99
End Time (s)	45	88	104	0	29.4	88	99	0
Yield/Force Off (s)	40.3	81.8	100	144.3	24.7	81.8	95	144.3
Yield/Force Off 170(s)	40.3	81.8	100	126.3	24.7	81.8	95	129.3
Local Start Time (s)	105	0	43	59	105	134.4	43	54
Local Yield (s)	145.3	36.8	55	99.3	129.7	36.8	50	99.3
Local Yield 170(s)	145.3	36.8	55	81.3	129.7	36.8	50	84.3

Intersection Summary	
Cycle Length	150
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd

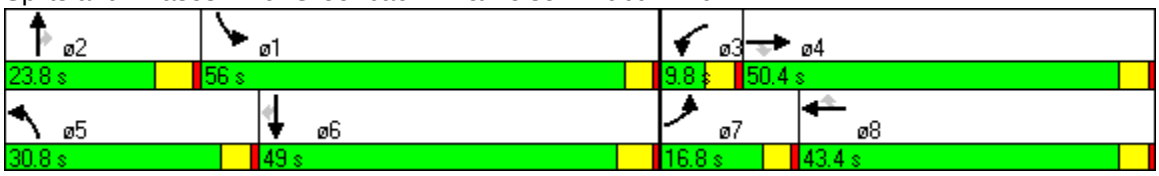
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	210	780	960	20	800	620	300	540	10	430	1650	160
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	221	821	1011	21	842	653	316	568	11	453	1737	168
RTOR Reduction (vph)	0	0	237	0	0	461	0	0	10	0	0	42
Lane Group Flow (vph)	221	821	774	21	842	192	316	568	1	453	1737	126
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	12.3	49.8	49.8	3.2	40.7	40.7	16.8	16.5	16.5	51.5	51.2	51.2
Effective Green, g (s)	12.8	50.3	50.3	3.7	41.2	41.2	17.3	18.0	18.0	52.0	52.7	52.7
Actuated g/C Ratio	0.09	0.36	0.36	0.03	0.29	0.29	0.12	0.13	0.13	0.37	0.38	0.38
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	162	1272	569	47	1041	466	424	455	204	657	1332	596
v/s Ratio Prot	c0.12	0.23		0.01	0.24		0.09	c0.16		0.26	c0.49	
v/s Ratio Perm			c0.49			0.12			0.00			0.08
v/c Ratio	1.36	0.65	1.36	0.45	0.81	0.41	0.75	1.25	0.01	0.69	1.30	0.21
Uniform Delay, d1	63.6	37.4	44.9	67.1	45.8	39.7	59.2	61.0	53.2	37.2	43.6	29.6
Progression 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
Incremental Delay, d2	198.3	0.9	173.3	2.5	4.5	0.2	6.1	129.0	0.1	2.4	142.4	0.8
Delay (s)	261.9	38.3	218.1	69.6	50.2	39.9	65.4	190.0	53.3	39.6	186.0	30.4
Level of Service	F	D	F	E	D	D	E	F	D	D	F	C
Approach Delay (s)		150.9			46.0			144.3			146.8	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	125.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.27		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	118.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	56	23.8	9.8	50.4	30.8	49	16.8	43.4
Maximum Split (%)	40.0%	17.0%	7.0%	36.0%	22.0%	35.0%	12.0%	31.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
End Time (s)	61.5	5.5	71.3	121.7	12.5	61.5	78.3	121.7
Yield/Force Off (s)	57	0	66.8	117.2	8	56	73.8	117.2
Yield/Force Off 170(s)	57	117	66.8	92.2	8	37	73.8	92.2
Local Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
Local Yield (s)	57	0	66.8	117.2	8	56	73.8	117.2
Local Yield 170(s)	57	117	66.8	92.2	8	37	73.8	92.2

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	145
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.97	1.00	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		1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1831	1542	1681	1695	1561	1770	4914		1770	3539	1549
Flt Permitted		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1831	1542	1681	1695	1561	1770	4914		1770	3539	1549
Volume (vph)	10	20	20	160	10	150	10	690	200	260	2360	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	21	21	168	11	158	11	726	211	274	2484	11
RTOR Reduction (vph)	0	0	20	0	0	105	0	19	0	0	0	2
Lane Group Flow (vph)	0	32	1	87	92	53	11	918	0	274	2484	9
Confl. Bikes (#/hr)			3			1						3
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		5.7	5.7	13.1	13.1	13.1	2.3	69.4		23.5	90.6	90.6
Effective Green, g (s)		6.2	6.2	13.6	13.6	13.6	2.8	71.9		24.0	93.1	93.1
Actuated g/C Ratio		0.05	0.05	0.10	0.10	0.10	0.02	0.55		0.18	0.71	0.71
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		86	73	174	175	161	38	2683		323	2502	1095
v/s Ratio Prot		c0.02		0.05	c0.05		0.01	0.19		c0.15	c0.70	
v/s Ratio Perm			0.00			0.03						0.01
v/c Ratio		0.37	0.01	0.50	0.53	0.33	0.29	0.34		0.85	0.99	0.01
Uniform Delay, d1		60.9	59.8	55.8	56.0	54.8	63.5	16.7		52.1	19.0	5.7
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		1.0	0.0	0.8	1.3	0.4	1.5	0.1		17.6	16.3	0.0
Delay (s)		61.9	59.9	56.7	57.3	55.3	65.0	16.8		69.7	35.3	5.7
Level of Service		E	E	E	E	E	E	B		E	D	A
Approach Delay (s)		61.1			56.2			17.4			38.6	
Approach LOS		E			E			B			D	

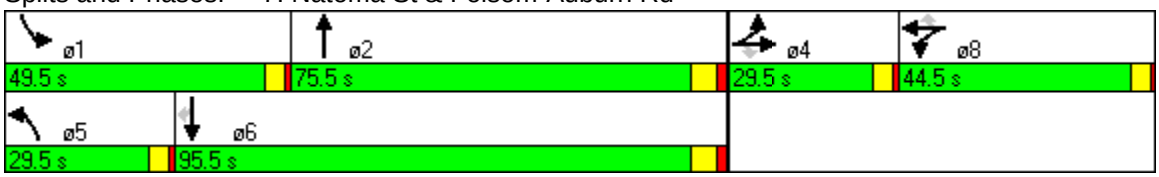
Intersection Summary			
HCM Average Control Delay	35.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	131.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



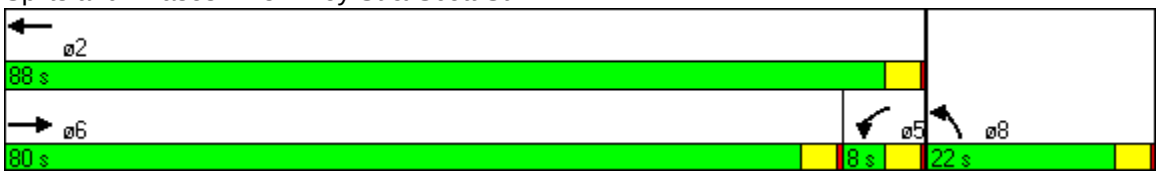
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3535		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3535		1770	1863	1695	
Volume (vph)	1430	10	10	1210	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1505	11	11	1274	11	11
RTOR Reduction (vph)	0	0	0	0	11	0
Lane Group Flow (vph)	1516	0	11	1274	12	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	89.0		4.0	97.0	5.0	
Effective Green, g (s)	89.0		4.0	97.0	5.0	
Actuated g/C Ratio	0.81		0.04	0.88	0.05	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2860		64	1643	77	
v/s Ratio Prot	0.43		0.01	c0.68	c0.01	
v/s Ratio Perm						
v/c Ratio	0.53		0.17	0.78	0.15	
Uniform Delay, d1	3.5		51.4	2.4	50.5	
Progression Factor	0.58		1.00	1.00	1.00	
Incremental Delay, d2	0.6		0.8	3.7	0.9	
Delay (s)	2.7		52.2	6.1	51.4	
Level of Service	A		D	A	D	
Approach Delay (s)	2.7			6.5	51.4	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	4.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	8	80	22
Maximum Split (%)	80.0%	7.3%	72.7%	20.0%
Minimum Split (s)	11	8	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	18	18	0
Time To Reduce (s)	25	25	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	45	15	45	23
End Time (s)	23	23	15	45
Yield/Force Off (s)	19	19	11	41
Yield/Force Off 170(s)	19	19	1	28
Local Start Time (s)	34	4	34	12
Local Yield (s)	8	8	0	30
Local Yield 170(s)	8	8	100	17

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 11 (10%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



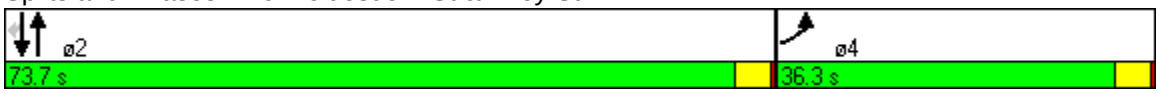
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.96			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3350			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3350			3539	1863	1583
Volume (vph)	30	10	0	1410	1150	70
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	11	0	1484	1211	74
RTOR Reduction (vph)	10	0	0	0	0	8
Lane Group Flow (vph)	33	0	0	1484	1211	66
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	6.0			96.0	96.0	96.0
Effective Green, g (s)	6.0			96.0	96.0	96.0
Actuated g/C Ratio	0.05			0.87	0.87	0.87
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	183			3089	1626	1382
v/s Ratio Prot	c0.01			0.42	c0.65	
v/s Ratio Perm						0.04
v/c Ratio	0.18			0.48	0.74	0.05
Uniform Delay, d1	49.6			1.5	2.5	0.9
Progression Factor	1.00			0.08	0.45	0.99
Incremental Delay, d2	0.4			0.0	2.1	0.0
Delay (s)	50.1			0.2	3.2	1.0
Level of Service	D			A	A	A
Approach Delay (s)	50.1			0.2	3.1	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	2.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	73.7	36.3
Maximum Split (%)	67.0%	33.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	54.3	18
End Time (s)	18	54.3
Yield/Force Off (s)	14	50.3
Yield/Force Off 170(s)	6	40.3
Local Start Time (s)	40.3	4
Local Yield (s)	0	36.3
Local Yield 170(s)	102	26.3

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 14 (13%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



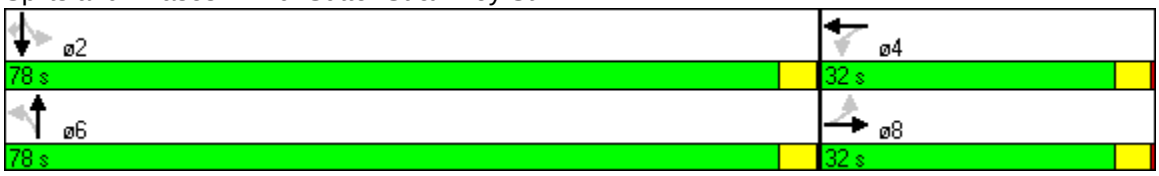
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1710	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.99			0.99			1.00			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.97			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1759			1741			1544			1815	1467
Flt Permitted		0.92			0.93			0.99			0.98	1.00
Satd. Flow (perm)		1631			1641			1529			1786	1467
Volume (vph)	10	20	10	10	10	10	10	1390	10	10	1140	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	21	11	11	11	11	11	1463	11	11	1200	11
RTOR Reduction (vph)	0	10	0	0	10	0	0	0	0	0	0	1
Lane Group Flow (vph)	0	33	0	0	23	0	0	1485	0	0	1211	10
Confl. Peds. (#/hr)									3			10
Confl. Bikes (#/hr)			3			1			1			
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		7.0			7.0			95.0			95.0	95.0
Effective Green, g (s)		7.0			7.0			95.0			95.0	95.0
Actuated g/C Ratio		0.06			0.06			0.86			0.86	0.86
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		104			104			1321			1542	1267
v/s Ratio Prot												
v/s Ratio Perm		c0.02			0.01			c0.97			0.68	0.01
v/c Ratio		0.31			0.22			1.12			0.79	0.01
Uniform Delay, d1		49.2			48.9			7.5			3.2	1.0
Progression Factor		1.00			1.00			1.00			0.34	0.55
Incremental Delay, d2		0.6			0.4			66.2			2.8	0.0
Delay (s)		49.8			49.3			73.7			3.9	0.6
Level of Service		D			D			E			A	A
Approach Delay (s)		49.8			49.3			73.7			3.9	
Approach LOS		D			D			E			A	

Intersection Summary			
HCM Average Control Delay	42.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	110.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



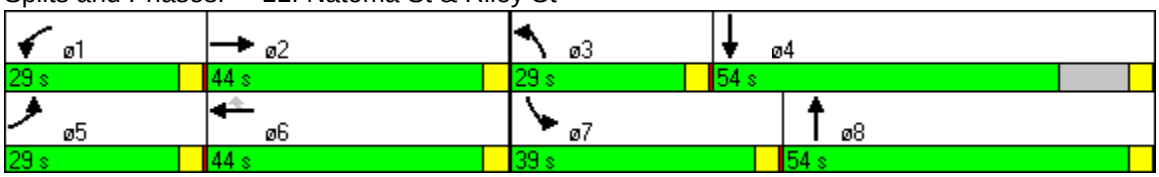
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1596	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1810		1770	1863	1583	1770	1557		1770	1855	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1810		1770	1863	1583	1770	1557		1770	1855	
Volume (vph)	30	300	70	50	290	770	20	610	20	420	720	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	316	74	53	305	811	21	642	21	442	758	21
RTOR Reduction (vph)	0	5	0	0	0	392	0	1	0	0	0	0
Lane Group Flow (vph)	32	385	0	53	305	419	21	662	0	442	779	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.9	39.4		7.7	42.2	42.2	4.3	51.8		35.1	82.6	
Effective Green, g (s)	4.9	39.4		7.7	42.2	42.2	4.3	51.8		35.1	82.6	
Actuated g/C Ratio	0.03	0.26		0.05	0.28	0.28	0.03	0.35		0.23	0.55	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	58	475		91	524	445	51	538		414	1021	
v/s Ratio Prot	0.02	0.21		c0.03	0.16		0.01	c0.43		c0.25	0.42	
v/s Ratio Perm						c0.26						
v/c Ratio	0.55	0.81		0.58	0.58	0.94	0.41	1.23		1.07	0.76	
Uniform Delay, d1	71.5	51.8		69.6	46.3	52.7	71.6	49.1		57.4	26.1	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.3	10.7		6.0	2.0	28.8	2.0	119.5		63.4	3.7	
Delay (s)	77.8	62.5		75.6	48.3	81.5	73.6	168.6		120.8	29.8	
Level of Service	E	E		E	D	F	E	F		F	C	
Approach Delay (s)		63.6			72.6			165.7			62.7	
Approach LOS		E			E			F			E	

Intersection Summary			
HCM Average Control Delay	86.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	100.7%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	69	98	150	25	69	108	151
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	40	69	121	162	40	79	122

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 11: Natoma St & Riley St



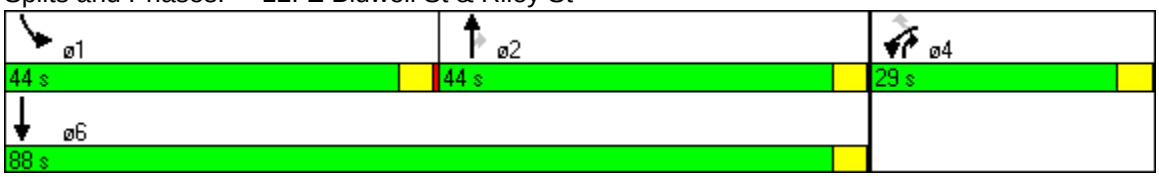
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1543	3539	1570	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1543	3539	1570	1770	1863
Volume (vph)	330	330	320	160	400	430
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	347	347	337	168	421	453
RTOR Reduction (vph)	0	244	0	90	0	0
Lane Group Flow (vph)	347	103	337	78	421	453
Confl. Peds. (#/hr)		8		9		
Confl. Bikes (#/hr)		9		9		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	16.9	16.9	9.5	26.4	18.8	32.3
Effective Green, g (s)	16.9	16.9	9.5	26.4	18.8	32.3
Actuated g/C Ratio	0.30	0.30	0.17	0.46	0.33	0.56
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	523	456	588	834	582	1052
v/s Ratio Prot	c0.20		c0.10	0.03	c0.24	0.24
v/s Ratio Perm		0.07		0.02		
v/c Ratio	0.66	0.22	0.57	0.09	0.72	0.43
Uniform Delay, d1	17.7	15.2	22.0	8.7	16.9	7.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	2.5	0.1	0.8	0.0	4.5	0.3
Delay (s)	20.1	15.3	22.8	8.7	21.4	7.5
Level of Service	C	B	C	A	C	A
Approach Delay (s)	17.7		18.1			14.2
Approach LOS	B		B			B

Intersection Summary			
HCM Average Control Delay	16.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	57.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	60.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 12: E Bidwell St & Riley St



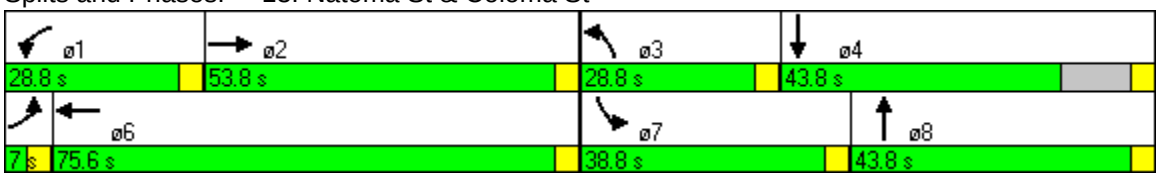
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	1.00		1.00	0.91		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1851		1770	1857		1770	1704		1770	1805	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1851		1770	1857		1770	1704		1770	1805	
Volume (vph)	10	700	30	30	1030	20	60	30	40	20	40	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	737	32	32	1084	21	63	32	42	21	42	11
RTOR Reduction (vph)	0	0	0	0	0	0	0	34	0	0	7	0
Lane Group Flow (vph)	11	769	0	32	1105	0	63	40	0	21	46	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	3.2	74.1		3.7	74.6		6.2	12.5		2.3	8.6	
Effective Green, g (s)	3.0	73.9		3.5	74.4		6.0	12.3		2.1	8.4	
Actuated g/C Ratio	0.03	0.69		0.03	0.69		0.06	0.11		0.02	0.08	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	49	1269		57	1282		99	194		34	141	
v/s Ratio Prot	0.01	0.42		c0.02	c0.59		c0.04	c0.02		0.01	c0.03	
v/s Ratio Perm												
v/c Ratio	0.22	0.61		0.56	0.86		0.64	0.21		0.62	0.32	
Uniform Delay, d1	51.3	9.1		51.4	12.8		49.8	43.3		52.5	47.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.8	0.8		7.3	6.2		9.4	0.2		21.2	0.5	
Delay (s)	52.1	9.9		58.7	19.0		59.3	43.5		73.6	47.5	
Level of Service	D	A		E	B		E	D		E	D	
Approach Delay (s)		10.5			20.1			50.8			54.9	
Approach LOS		B			C			D			D	

Intersection Summary			
HCM Average Control Delay	19.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	107.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.1%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	None
Maximum Split (s)	28.8	53.8	28.8	43.8	7	75.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	4.2%	45.8%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	1	1	7	1	1
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	3	2.4	3	3	3	2.4	3	3
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	7	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	7	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	3.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	3.2	78.8	117.6	151.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	143.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	139.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	139.6	50	88.8	122.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 13: Natoma St & Coloma St



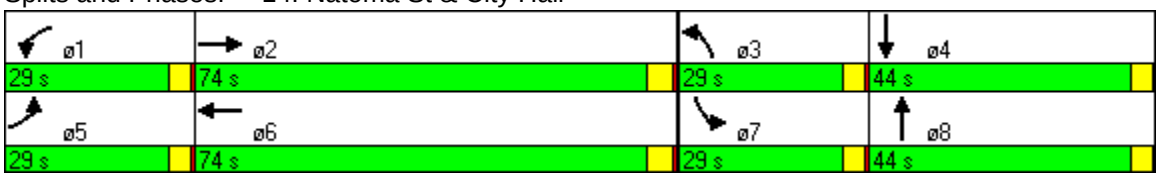
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		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	0.99		1.00	1.00		1.00	0.87		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3498		1770	3533		1770	1585		1770	1703	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3498		1770	3533		1770	1585		1770	1703	
Volume (vph)	10	700	50	100	980	10	80	10	80	10	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	737	53	105	1032	11	84	11	84	11	11	11
RTOR Reduction (vph)	0	3	0	0	1	0	0	76	0	0	10	0
Lane Group Flow (vph)	11	787	0	105	1042	0	84	19	0	11	12	0
Confl. Peds. (#/hr)			1			1			1			1
Confl. Bikes (#/hr)			3			1			4			4
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.5	25.8		4.4	25.7		5.4	5.7		4.5	4.8	
Effective Green, g (s)	4.5	26.8		4.4	26.7		5.4	5.7		4.5	4.8	
Actuated g/C Ratio	0.08	0.47		0.08	0.47		0.09	0.10		0.08	0.08	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	139	1633		136	1643		167	157		139	142	
v/s Ratio Prot	0.01	0.23		c0.06	c0.30		c0.05	c0.01		0.01	0.01	
v/s Ratio Perm												
v/c Ratio	0.08	0.48		0.77	0.63		0.50	0.12		0.08	0.08	
Uniform Delay, d1	24.5	10.5		26.0	11.6		24.7	23.6		24.5	24.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.2		21.5	0.8		0.9	0.1		0.1	0.1	
Delay (s)	24.6	10.8		47.5	12.5		25.6	23.7		24.6	24.4	
Level of Service	C	B		D	B		C	C		C	C	
Approach Delay (s)		11.0			15.7			24.6			24.4	
Approach LOS		B			B			C			C	

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	57.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	52.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	65

Splits and Phases: 14: Natoma St & City Hall



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	0.98	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	1.00		1.00	1.00	0.85		1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3526		1770	3539	1548		1770	1545	1681	1484	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3526		1770	3539	1548		1770	1545	1681	1484	
Volume (vph)	10	1420	30	10	1940	10	90	0	10	10	0	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1495	32	11	2042	11	95	0	11	11	0	11
RTOR Reduction (vph)	0	0	0	0	0	1	0	0	10	0	11	0
Lane Group Flow (vph)	11	1527	0	11	2042	10	0	95	1	11	0	0
Confl. Peds. (#/hr)			1			3			4			1
Turn Type	Prot			Prot		Perm	Split		Perm	Split		
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases						2			3			
Actuated Green, G (s)	1.2	82.4		1.2	82.4	82.4		11.3	11.3	4.8	4.8	
Effective Green, g (s)	1.2	83.9		1.2	83.9	83.9		11.3	11.3	5.3	5.3	
Actuated g/C Ratio	0.01	0.71		0.01	0.71	0.71		0.10	0.10	0.05	0.05	
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5		4.0	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		3.0	3.0	2.0	2.0	
Lane Grp Cap (vph)	18	2513		18	2523	1103		170	148	76	67	
v/s Ratio Prot	c0.01	0.43		0.01	c0.58			c0.05		c0.01	0.00	
v/s Ratio Perm						0.01			0.00			
v/c Ratio	0.61	0.61		0.61	0.81	0.01		0.56	0.01	0.14	0.01	
Uniform Delay, d1	58.0	8.6		58.0	11.5	4.9		50.8	48.1	54.0	53.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	36.2	0.4		36.2	2.0	0.0		3.9	0.0	0.3	0.0	
Delay (s)	94.2	9.0		94.2	13.5	4.9		54.8	48.1	54.3	53.7	
Level of Service	F	A		F	B	A		D	D	D	D	
Approach Delay (s)		9.6			13.9			54.1			54.0	
Approach LOS		A			B			D			D	

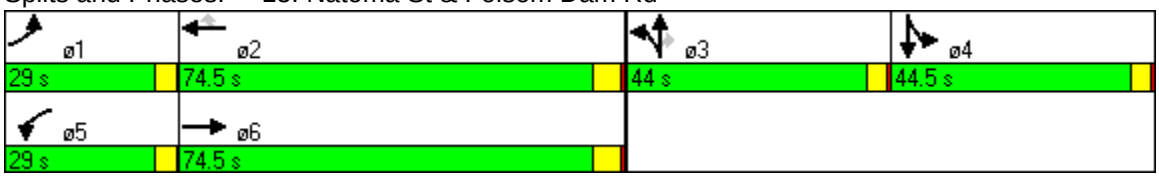
Intersection Summary			
HCM Average Control Delay	13.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	117.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	EBL	WBT	NBTL	SBTL	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	74.5	44	44.5	29	74.5
Maximum Split (%)	15.1%	38.8%	22.9%	23.2%	15.1%	38.8%
Minimum Split (s)	6	12.5	6	25.5	6	28.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	1	0.5	1
Minimum Initial (s)	2	7	2	2	2	7
Vehicle Extension (s)	2	3	3	2	2	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4
Time Before Reduce (s)	0	18	0	0	0	18
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)				7		7
Flash Dont Walk (s)				14		16
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103.5	147.5	0	29
End Time (s)	29	103.5	147.5	0	29	103.5
Yield/Force Off (s)	25	98	143.5	187.5	25	98
Yield/Force Off 170(s)	25	98	143.5	173.5	25	98
Local Start Time (s)	163	0	74.5	118.5	163	0
Local Yield (s)	188	69	114.5	158.5	188	69
Local Yield 170(s)	188	69	114.5	144.5	188	69

Intersection Summary	
Cycle Length	192
Control Type	Actuated-Uncoordinated
Natural Cycle	100

Splits and Phases: 15: Natoma St & Folsom Dam Rd



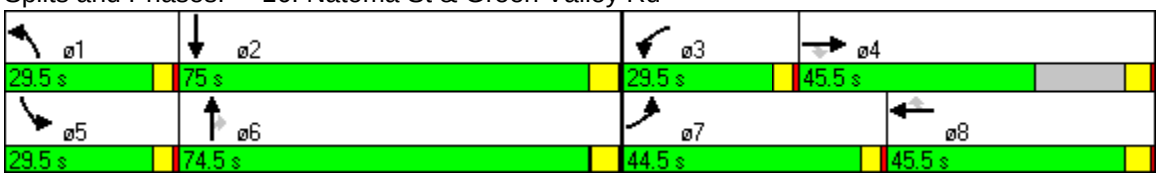
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Volume (vph)	670	720	50	390	680	50	70	260	160	150	1230	1010
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	705	758	53	411	716	53	74	274	168	158	1295	1063
RTOR Reduction (vph)	0	0	34	0	0	27	0	0	121	0	0	0
Lane Group Flow (vph)	705	758	19	411	716	26	74	274	47	158	1295	1063
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	35.3	49.3	49.3	21.0	35.0	35.0	6.0	37.4	37.4	10.9	41.8	138.6
Effective Green, g (s)	35.8	50.8	50.8	21.5	36.5	36.5	6.5	38.9	38.9	11.4	43.8	138.6
Actuated g/C Ratio	0.26	0.37	0.37	0.16	0.26	0.26	0.05	0.28	0.28	0.08	0.32	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	887	1297	580	533	932	417	161	1427	444	282	1607	1583
v/s Ratio Prot	c0.21	0.21		0.12	c0.20		0.02	0.05		0.05	c0.25	
v/s Ratio Perm			0.01			0.02			0.03			c0.67
v/c Ratio	0.79	0.58	0.03	0.77	0.77	0.06	0.46	0.19	0.11	0.56	0.81	0.67
Uniform Delay, d1	48.0	35.4	28.2	56.2	47.1	38.2	64.3	37.9	37.0	61.2	43.5	0.0
Progression 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
Incremental Delay, d2	4.6	0.8	0.0	6.2	4.3	0.1	0.8	0.1	0.2	1.5	3.2	2.3
Delay (s)	52.6	36.2	28.2	62.4	51.5	38.3	65.1	38.0	37.1	62.7	46.7	2.3
Level of Service	D	D	C	E	D	D	E	D	D	E	D	A
Approach Delay (s)		43.6			54.7			41.6			28.9	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM Average Control Delay	39.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	138.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	115

Splits and Phases: 16: Natoma St & Green Valley Rd



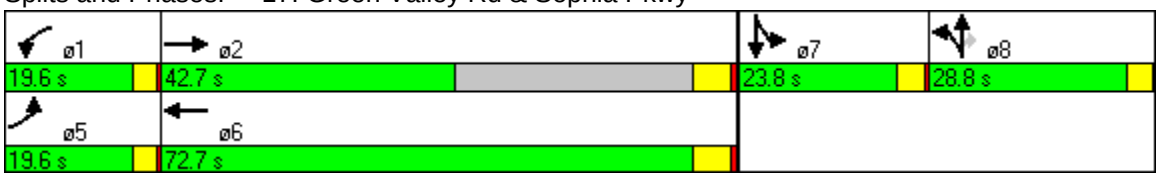
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)	1770	3496		1770	3537		1681	1694	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)	1770	3496		1770	3537		1681	1694	1583		1750	
Volume (vph)	10	890	80	220	2220	10	160	10	100	10	10	10
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	10	918	82	227	2289	10	165	10	103	10	10	10
RTOR Reduction (vph)	0	4	0	0	0	0	0	0	92	0	10	0
Lane Group Flow (vph)	10	996	0	227	2299	0	85	90	11	0	20	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	5.4	57.1		16.2	67.9		12.1	12.1	12.1		4.4	
Effective Green, g (s)	5.0	58.8		15.8	69.6		11.9	11.9	11.9		4.2	
Actuated g/C Ratio	0.05	0.55		0.15	0.65		0.11	0.11	0.11		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	83	1927		262	2307		187	189	177		69	
v/s Ratio Prot	0.01	0.28		c0.13	c0.65		0.05	c0.05			c0.01	
v/s Ratio Perm									0.01			
v/c Ratio	0.12	0.52		0.87	1.00		0.45	0.48	0.06		0.30	
Uniform Delay, d1	48.7	15.0		44.4	18.4		44.4	44.5	42.4		49.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.3	0.3		24.1	17.8		1.8	2.0	0.2		2.5	
Delay (s)	49.1	15.3		68.5	36.2		46.2	46.4	42.6		52.3	
Level of Service	D	B		E	D		D	D	D		D	
Approach Delay (s)		15.6			39.1			44.9			52.3	
Approach LOS		B			D			D			D	

Intersection Summary			
HCM Average Control Delay	33.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	106.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	86.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	42.7	19.6	72.7	23.8	28.8
Maximum Split (%)	13.5%	29.5%	13.5%	50.2%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	7.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	4	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	140

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



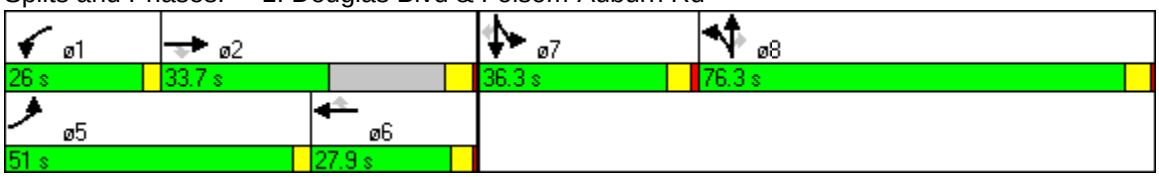
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.95	1.00	1.00	0.97	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1533	1770	3539	1497	3433	1863	1528	1770	3539	1550
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1533	1770	3539	1497	3433	1863	1528	1770	3539	1550
Volume (vph)	450	450	1170	130	350	90	1220	620	110	180	660	320
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	469	469	1219	135	365	94	1271	646	115	188	688	333
RTOR Reduction (vph)	0	0	478	0	0	83	0	0	72	0	0	155
Lane Group Flow (vph)	469	469	741	135	365	11	1271	646	43	188	688	178
Confl. Peds. (#/hr)			7			3			9			
Confl. Bikes (#/hr)			3			7						7
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	48.0	51.3	51.3	17.2	21.3	21.3	69.9	69.9	69.9	31.0	31.0	31.0
Effective Green, g (s)	47.0	53.0	53.0	16.2	22.2	22.2	71.2	71.2	71.2	32.3	32.3	32.3
Actuated g/C Ratio	0.25	0.28	0.28	0.09	0.12	0.12	0.38	0.38	0.38	0.17	0.17	0.17
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	441	994	431	152	416	176	1295	703	577	303	606	265
v/s Ratio Prot	c0.27	0.13		0.08	0.10		c0.37	0.35		0.11	c0.19	
v/s Ratio Perm			c0.48			0.01			0.03			0.11
v/c Ratio	1.06	0.47	1.72	0.89	0.88	0.06	0.98	0.92	0.08	0.62	1.14	0.67
Uniform Delay, d1	70.8	56.2	67.8	85.4	81.9	74.0	58.1	56.0	37.7	72.5	78.2	73.2
Progression 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
Incremental Delay, d2	60.7	0.1	333.9	40.7	17.9	0.1	20.5	16.7	0.0	2.8	79.9	5.2
Delay (s)	131.6	56.4	401.7	126.1	99.8	74.1	78.6	72.7	37.7	75.3	158.1	78.4
Level of Service	F	E	F	F	F	E	E	E	D	E	F	E
Approach Delay (s)		267.9			101.7			74.4			123.3	
Approach LOS		F			F			E			F	

Intersection Summary			
HCM Average Control Delay	156.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.25		
Actuated Cycle Length (s)	188.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	108.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	26	33.7	51	27.9	36.3	76.3
Maximum Split (%)	13.6%	17.6%	26.6%	14.6%	19.0%	39.8%
Minimum Split (s)	6	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	0	51	78.9	115.2
End Time (s)	26	78.9	51	78.9	115.2	0
Yield/Force Off (s)	23	73.2	48	74	109.9	186.2
Yield/Force Off 170(s)	23	63.2	48	64	99.9	186.2
Local Start Time (s)	165.5	0	165.5	25	52.9	89.2
Local Yield (s)	188.5	47.2	22	48	83.9	160.2
Local Yield 170(s)	188.5	37.2	22	38	73.9	160.2

Intersection Summary	
Cycle Length	191.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	1.00
Frpb, ped/bikes		1.00	0.98				1.00	1.00			1.00	1.00
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)		1770	1555				1770	3539			3539	1583
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1555				1770	3539			3539	1583
Volume (vph)	160	0	180	0	0	0	60	1850	0	0	1780	110
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	0	189	0	0	0	63	1947	0	0	1874	116
RTOR Reduction (vph)	0	0	159	0	0	0	0	0	0	0	0	17
Lane Group Flow (vph)	0	168	30	0	0	0	63	1947	0	0	1874	99
Confl. Bikes (#/hr)			4			14						
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		15.0	15.0				4.5	70.5			62.0	62.0
Effective Green, g (s)		15.0	15.0				4.5	72.0			63.5	63.5
Actuated g/C Ratio		0.16	0.16				0.05	0.76			0.67	0.67
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		279	246				84	2682			2366	1058
v/s Ratio Prot		c0.09					0.04	c0.55			c0.53	
v/s Ratio Perm			0.02									0.06
v/c Ratio		0.60	0.12				0.75	0.73			0.79	0.09
Uniform Delay, d1		37.2	34.3				44.7	6.2			11.1	5.6
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		3.6	0.2				27.8	0.9			1.8	0.0
Delay (s)		40.9	34.6				72.5	7.1			12.9	5.6
Level of Service		D	C				E	A			B	A
Approach Delay (s)		37.5			0.0			9.2			12.5	
Approach LOS		D			A			A			B	

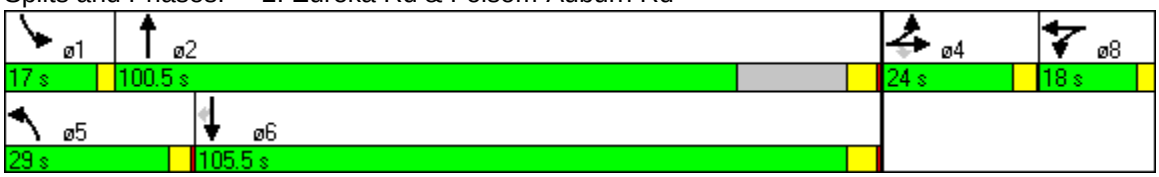
Intersection Summary			
HCM Average Control Delay	13.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	95.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	67.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.94		0.97		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
Frt		1.00	0.85		0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1792	1483		1676		1770	3536		1770	3539	1548
Flt Permitted		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1792	1483		1676		1770	3536		1770	3539	1548
Volume (vph)	40	10	160	20	10	20	60	1830	10	10	1850	30
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	11	168	21	11	21	63	1926	11	11	1947	32
RTOR Reduction (vph)	0	0	158	0	15	0	0	0	0	0	0	3
Lane Group Flow (vph)	0	53	10	0	38	0	63	1937	0	11	1947	29
Confl. Bikes (#/hr)			14			12			12			4
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		7.8	7.8		5.5		6.7	85.3		4.4	83.0	83.0
Effective Green, g (s)		7.2	7.2		4.9		5.7	87.0		3.4	84.7	84.7
Actuated g/C Ratio		0.06	0.06		0.04		0.05	0.73		0.03	0.71	0.71
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		109	90		69		85	2596		51	2530	1106
v/s Ratio Prot		c0.03			c0.02		c0.04	0.55		0.01	c0.55	
v/s Ratio Perm			0.01									0.02
v/c Ratio		0.49	0.11		0.55		0.74	0.75		0.22	0.77	0.03
Uniform Delay, d1		53.9	52.6		55.7		55.7	9.3		56.2	10.7	4.9
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.2	0.2		4.7		25.8	1.1		0.8	1.3	0.0
Delay (s)		55.1	52.8		60.4		81.5	10.3		57.0	12.0	4.9
Level of Service		E	D		E		F	B		E	B	A
Approach Delay (s)		53.4			60.4			12.6			12.2	
Approach LOS		D			E			B			B	

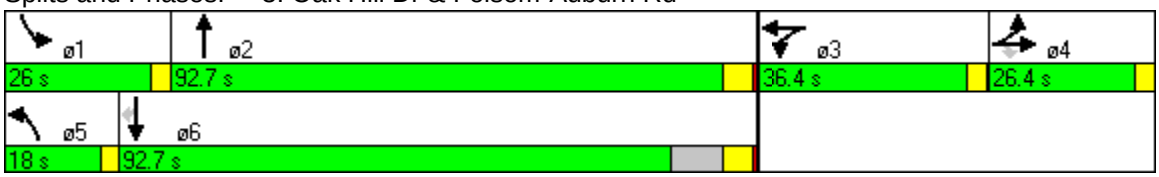
Intersection Summary			
HCM Average Control Delay	15.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	118.5	Sum of lost time (s)	16.0
Intersection Capacity Utilization	74.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



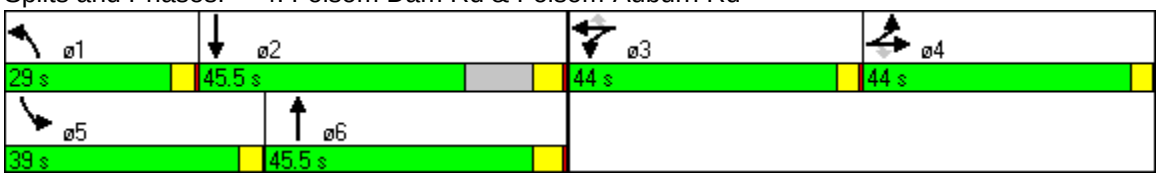
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3536		1770	3523	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3536		1770	3523	
Volume (vph)	100	0	80	20	0	10	70	1700	10	10	1900	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	0	84	21	0	11	74	1789	11	11	2000	63
RTOR Reduction (vph)	0	0	75	0	0	11	0	0	0	0	1	0
Lane Group Flow (vph)	0	105	9	0	21	0	74	1800	0	11	2062	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		3	3		1	6		5	2	
Permitted Phases			4			3						
Actuated Green, G (s)		9.7	9.7		3.0	3.0	5.3	61.0		1.0	56.7	
Effective Green, g (s)		9.7	9.7		3.0	3.0	5.3	62.5		1.0	58.2	
Actuated g/C Ratio		0.11	0.11		0.03	0.03	0.06	0.68		0.01	0.63	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.0	4.7		1.5	5.4	
Lane Grp Cap (vph)		186	167		58	52	102	2397		19	2224	
v/s Ratio Prot		c0.06			c0.01		c0.04	0.51		0.01	c0.59	
v/s Ratio Perm			0.01			0.00						
v/c Ratio		0.56	0.05		0.36	0.01	0.73	0.75		0.58	0.93	
Uniform Delay, d1		39.2	37.1		43.7	43.2	42.7	9.7		45.4	15.1	
Progression Factor		1.00	1.00		1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2		2.3	0.0		1.4	0.0	19.4	1.6		23.8	7.8	
Delay (s)		41.6	37.2		45.1	43.2	62.1	11.3		69.2	22.9	
Level of Service		D	D		D	D	E	B		E	C	
Approach Delay (s)		39.6			44.4			13.3			23.1	
Approach LOS		D			D			B			C	

Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	92.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	NBL	SBT	WBTL	EBTL	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	45.5	44	44	39	45.5
Maximum Split (%)	16.8%	26.4%	25.5%	25.5%	22.6%	26.4%
Minimum Split (s)	5	23.5	12	28	6	12.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1
Minimum Initial (s)	1	7	8	2	2	7
Vehicle Extension (s)	1	5.4	1	1	1.5	4.7
Minimum Gap (s)	3	3.8	3	3	3	3.1
Time Before Reduce (s)	0	10	0	0	0	10
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)		7		7		
Flash Dont Walk (s)		11		17		
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	84.5	128.5	0	39
End Time (s)	29	84.5	128.5	0	39	84.5
Yield/Force Off (s)	25	79	124.5	168.5	35	79
Yield/Force Off 170(s)	25	79	124.5	151.5	35	79
Local Start Time (s)	133.5	162.5	45.5	89.5	133.5	0
Local Yield (s)	158.5	40	85.5	129.5	168.5	40
Local Yield 170(s)	158.5	40	85.5	112.5	168.5	40

Intersection Summary	
Cycle Length	172.5
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



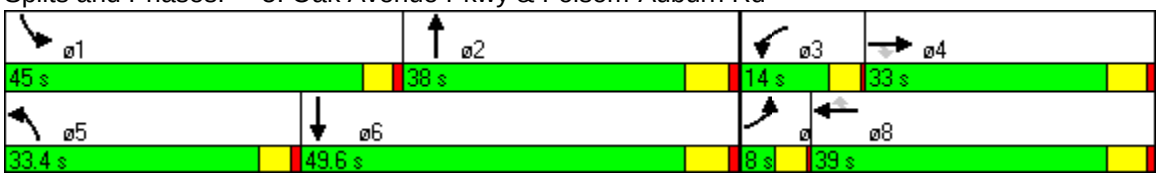
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	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	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1560	1770	3539	1563	3433	3400		1770	3519	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3539	1560	1770	3539	1563	3433	3400		1770	3519	
Volume (vph)	70	870	680	190	1130	750	750	960	300	890	1100	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	916	716	200	1189	789	789	1011	316	937	1158	42
RTOR Reduction (vph)	0	0	338	0	0	384	0	23	0	0	2	0
Lane Group Flow (vph)	74	916	378	200	1189	405	789	1304	0	937	1198	0
Confl. Peds. (#/hr)									1			
Confl. Bikes (#/hr)			3			1			3			5
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	4.0	27.3	27.3	10.0	33.3	33.3	28.7	31.8		40.3	43.4	
Effective Green, g (s)	4.0	29.0	29.0	10.0	35.0	35.0	29.4	34.0		41.0	45.6	
Actuated g/C Ratio	0.03	0.22	0.22	0.08	0.27	0.27	0.23	0.26		0.32	0.35	
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	54	789	348	136	953	421	776	889		558	1234	
v/s Ratio Prot	0.04	0.26		c0.11	c0.34		0.23	c0.38		c0.53	0.34	
v/s Ratio Perm			0.24			0.26						
v/c Ratio	1.37	1.16	1.09	1.47	1.25	0.96	1.02	1.47		1.68	0.97	
Uniform Delay, d1	63.0	50.5	50.5	60.0	47.5	46.9	50.3	48.0		44.5	41.5	
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	249.2	86.3	73.3	247.2	120.3	34.1	36.6	216.3		313.4	19.0	
Delay (s)	312.2	136.8	123.8	307.2	167.8	81.0	86.9	264.3		357.9	60.6	
Level of Service	F	F	F	F	F	F	F	F		F	E	
Approach Delay (s)		138.9			149.1			198.1			190.9	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	170.7	HCM Level of Service	F
HCM Volume to Capacity ratio	1.46		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	133.9%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	45	38	14	33	33.4	49.6	8	39
Maximum Split (%)	34.6%	29.2%	10.8%	25.4%	25.7%	38.2%	6.2%	30.0%
Minimum Split (s)	6.7	13.2	8	30.7	6.7	13.2	8	27.7
Yellow Time (s)	3.5	5	3.5	4.5	3.5	5	3.5	4.5
All-Red Time (s)	1.2	1.2	0.5	1.2	1.2	1.2	0.5	1.2
Minimum Initial (s)	2	7	4	3	2	7	4	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	0.2	2.4	3	0.2	0.2	2.4	3	0.2
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	45	83	97	0	33.4	83	91
End Time (s)	45	83	97	0	33.4	83	91	0
Yield/Force Off (s)	40.3	76.8	93	124.3	28.7	76.8	87	124.3
Yield/Force Off 170(s)	40.3	76.8	93	106.3	28.7	76.8	87	109.3
Local Start Time (s)	85	0	38	52	85	118.4	38	46
Local Yield (s)	125.3	31.8	48	79.3	113.7	31.8	42	79.3
Local Yield 170(s)	125.3	31.8	48	61.3	113.7	31.8	42	64.3

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



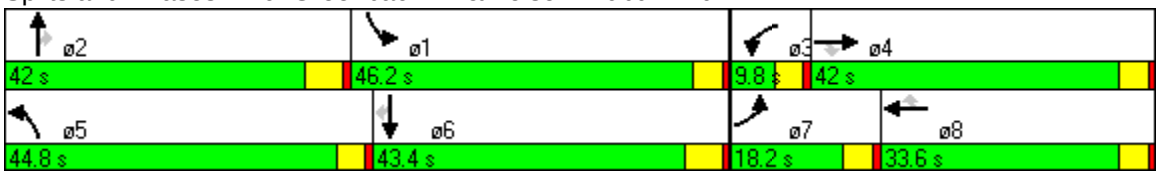
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	330	710	610	10	970	710	1040	1040	10	540	750	300
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	347	747	642	11	1021	747	1095	1095	11	568	789	316
RTOR Reduction (vph)	0	0	386	0	0	382	0	0	7	0	0	102
Lane Group Flow (vph)	347	747	256	11	1021	365	1095	1095	4	568	789	214
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	13.7	43.4	43.4	2.1	31.8	31.8	40.3	33.8	33.8	41.7	35.2	35.2
Effective Green, g (s)	14.2	43.9	43.9	2.6	32.3	32.3	40.8	35.3	35.3	42.2	36.7	36.7
Actuated g/C Ratio	0.10	0.31	0.31	0.02	0.23	0.23	0.29	0.25	0.25	0.30	0.26	0.26
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	180	1110	496	33	816	365	1000	892	399	534	928	415
v/s Ratio Prot	c0.20	0.21		0.01	c0.29		c0.32	c0.31		c0.32	0.22	
v/s Ratio Perm			0.16			0.23			0.00			0.14
v/c Ratio	1.93	0.67	0.52	0.33	1.25	1.00	1.10	1.23	0.01	1.06	0.85	0.52
Uniform Delay, d1	62.9	41.8	39.3	67.8	53.8	53.8	49.6	52.4	39.3	48.9	49.0	44.1
Progression 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
Incremental Delay, d2	437.3	1.3	0.4	2.2	123.1	46.5	58.0	112.3	0.0	57.0	9.6	4.5
Delay (s)	500.2	43.1	39.7	70.0	177.0	100.3	107.6	164.7	39.3	105.9	58.7	48.6
Level of Service	F	D	D	E	F	F	F	F	D	F	E	D
Approach Delay (s)		133.2			144.1			135.7			72.8	
Approach LOS		F			F			F			E	

Intersection Summary			
HCM Average Control Delay	122.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.23		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	117.1%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	46.2	42	9.8	42	44.8	43.4	18.2	33.6
Maximum Split (%)	33.0%	30.0%	7.0%	30.0%	32.0%	31.0%	13.0%	24.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
End Time (s)	51.7	5.5	61.5	103.5	8.3	51.7	69.9	103.5
Yield/Force Off (s)	47.2	0	57	99	3.8	46.2	65.4	99
Yield/Force Off 170(s)	47.2	117	57	74	3.8	27.2	65.4	74
Local Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
Local Yield (s)	47.2	0	57	99	3.8	46.2	65.4	99
Local Yield 170(s)	47.2	117	57	74	3.8	27.2	65.4	74

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	145
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		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	0.85
Flt Protected		0.98	1.00	0.95	0.97	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1831	1556	1681	1723	1560	1770	5025		1770	3539	1547
Flt Permitted		0.98	1.00	0.95	0.97	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1831	1556	1681	1723	1560	1770	5025		1770	3539	1547
Volume (vph)	10	20	10	100	30	480	20	1600	120	430	920	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	21	11	105	32	505	21	1684	126	453	968	21
RTOR Reduction (vph)	0	0	11	0	0	448	0	4	0	0	0	6
Lane Group Flow (vph)	0	32	0	67	70	57	21	1806	0	453	968	15
Confl. Bikes (#/hr)			1			1			1			6
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		6.0	6.0	13.0	13.0	13.0	4.2	67.4		45.7	108.9	108.9
Effective Green, g (s)		6.5	6.5	13.5	13.5	13.5	4.7	69.9		46.2	111.4	111.4
Actuated g/C Ratio		0.04	0.04	0.09	0.09	0.09	0.03	0.46		0.30	0.73	0.73
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		78	66	149	153	138	55	2309		538	2592	1133
v/s Ratio Prot		c0.02		0.04	c0.04		0.01	c0.36		c0.26	0.27	
v/s Ratio Perm			0.00			0.04						0.01
v/c Ratio		0.41	0.01	0.45	0.46	0.41	0.38	0.78		0.84	0.37	0.01
Uniform Delay, d1		70.9	69.7	65.8	65.8	65.5	72.3	34.7		49.5	7.5	5.5
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		1.3	0.0	0.8	0.8	0.7	1.6	2.0		11.0	0.2	0.0
Delay (s)		72.2	69.7	66.6	66.6	66.3	73.9	36.7		60.5	7.7	5.5
Level of Service		E	E	E	E	E	E	D		E	A	A
Approach Delay (s)		71.6			66.3			37.1			24.3	
Approach LOS		E			E			D			C	

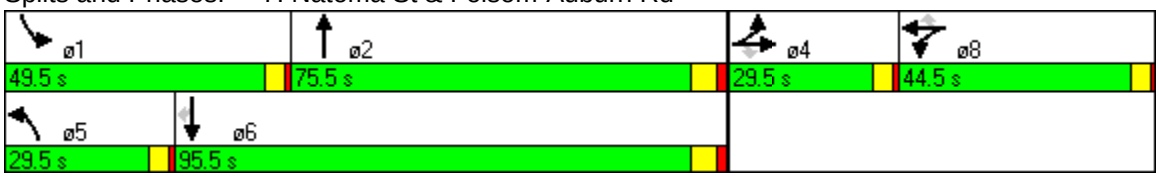
Intersection Summary			
HCM Average Control Delay	37.6	HCM Level of Service	D
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	152.1	Sum of lost time (s)	16.0
Intersection Capacity Utilization	77.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	130

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



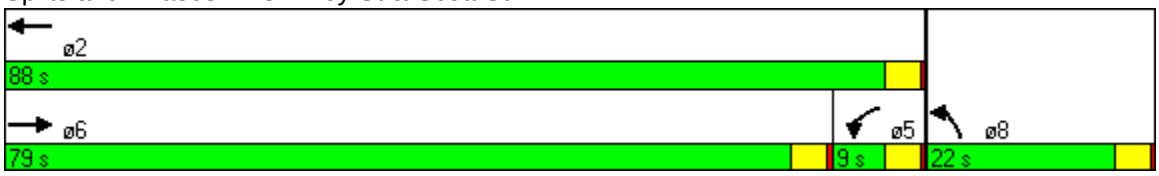
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3533		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3533		1770	1863	1695	
Volume (vph)	1670	20	20	1240	20	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1758	21	21	1305	21	21
RTOR Reduction (vph)	0	0	0	0	20	0
Lane Group Flow (vph)	1779	0	21	1305	22	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	86.5		5.0	95.5	6.5	
Effective Green, g (s)	86.5		5.0	95.5	6.5	
Actuated g/C Ratio	0.79		0.05	0.87	0.06	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2778		80	1617	100	
v/s Ratio Prot	0.50		0.01	c0.70	c0.01	
v/s Ratio Perm						
v/c Ratio	0.64		0.26	0.81	0.22	
Uniform Delay, d1	5.1		50.7	3.2	49.3	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	1.1		1.1	4.4	1.1	
Delay (s)	6.2		51.9	7.6	50.5	
Level of Service	A		D	A	D	
Approach Delay (s)	6.2			8.3	50.5	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	7.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	75.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	9	79	22
Maximum Split (%)	80.0%	8.2%	71.8%	20.0%
Minimum Split (s)	21	8	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	35	4	35	13
End Time (s)	13	13	4	35
Yield/Force Off (s)	9	9	0	31
Yield/Force Off 170(s)	9	9	100	18
Local Start Time (s)	35	4	35	13
Local Yield (s)	9	9	0	31
Local Yield 170(s)	9	9	100	18

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



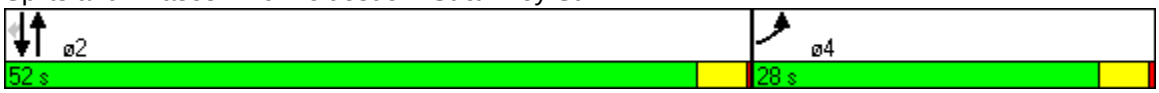
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.98			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3402			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3402			3539	1863	1583
Volume (vph)	160	20	0	1530	1220	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	21	0	1611	1284	42
RTOR Reduction (vph)	16	0	0	0	0	9
Lane Group Flow (vph)	173	0	0	1611	1284	33
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	9.9			62.1	62.1	62.1
Effective Green, g (s)	9.9			62.1	62.1	62.1
Actuated g/C Ratio	0.12			0.78	0.78	0.78
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	421			2747	1446	1229
v/s Ratio Prot	c0.05			0.46	c0.69	
v/s Ratio Perm						0.02
v/c Ratio	0.41			0.59	0.89	0.03
Uniform Delay, d1	32.4			3.7	6.4	2.0
Progression Factor	1.00			1.00	1.00	1.00
Incremental Delay, d2	0.6			0.9	8.5	0.0
Delay (s)	32.9			4.6	14.9	2.1
Level of Service	C			A	B	A
Approach Delay (s)	32.9			4.6	14.5	
Approach LOS	C			A	B	

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	52	28
Maximum Split (%)	65.0%	35.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	46	18
End Time (s)	18	46
Yield/Force Off (s)	14	42
Yield/Force Off 170(s)	6	32
Local Start Time (s)	32	4
Local Yield (s)	0	28
Local Yield 170(s)	72	18

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	90
Offset: 14 (18%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



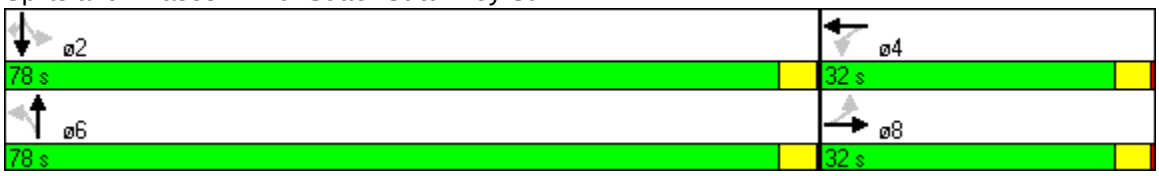
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1610	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.98			0.98			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.97			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1744			1720			1452			1815	1512
Flt Permitted		0.91			0.72			0.95			0.98	1.00
Satd. Flow (perm)		1603			1264			1373			1784	1512
Volume (vph)	30	90	40	40	40	40	10	1460	20	10	1200	30
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	95	42	42	42	42	11	1537	21	11	1263	32
RTOR Reduction (vph)	0	13	0	0	19	0	0	0	0	0	0	6
Lane Group Flow (vph)	0	156	0	0	107	0	0	1569	0	0	1274	26
Confl. Peds. (#/hr)			23			25						
Confl. Bikes (#/hr)									18			1
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		16.5			16.5			85.5			85.5	85.5
Effective Green, g (s)		16.5			16.5			85.5			85.5	85.5
Actuated g/C Ratio		0.15			0.15			0.78			0.78	0.78
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		240			190			1067			1387	1175
v/s Ratio Prot												
v/s Ratio Perm		c0.10			0.08			c1.14			0.71	0.02
v/c Ratio		0.65			0.56			1.47			0.92	0.02
Uniform Delay, d1		44.0			43.4			12.3			9.5	2.8
Progression Factor		1.00			1.00			1.00			1.00	1.00
Incremental Delay, d2		4.8			2.3			216.8			11.2	0.0
Delay (s)		48.8			45.7			229.0			20.7	2.8
Level of Service		D			D			F			C	A
Approach Delay (s)		48.8			45.7			229.0			20.3	
Approach LOS		D			D			F			C	

Intersection Summary			
HCM Average Control Delay	126.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.34		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	123.5%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



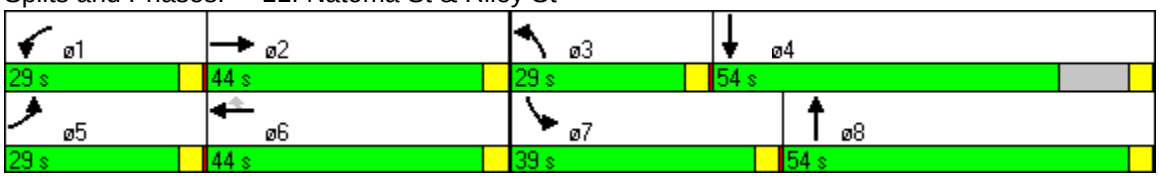
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1560	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1796		1770	1863	1583	1770	1527		1770	1855	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1796		1770	1863	1583	1770	1527		1770	1855	
Volume (vph)	20	350	110	100	370	580	40	890	10	600	660	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	368	116	105	389	611	42	937	11	632	695	21
RTOR Reduction (vph)	0	7	0	0	0	367	0	0	0	0	0	0
Lane Group Flow (vph)	21	477	0	105	389	244	42	948	0	632	716	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.4	41.6		13.5	50.7	50.7	7.1	50.9		35.0	78.8	
Effective Green, g (s)	4.4	41.6		13.5	50.7	50.7	7.1	50.9		35.0	78.8	
Actuated g/C Ratio	0.03	0.26		0.09	0.32	0.32	0.05	0.32		0.22	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	50	476		152	602	511	80	495		395	931	
v/s Ratio Prot	0.01	c0.27		c0.06	0.21		0.02	c0.62		c0.36	0.39	
v/s Ratio Perm						0.15						
v/c Ratio	0.42	1.00		0.69	0.65	0.48	0.52	1.92		1.60	0.77	
Uniform Delay, d1	75.0	57.7		69.7	45.5	42.5	73.3	53.0		61.0	31.7	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	42.0		10.4	2.7	1.0	2.8	419.3		281.6	4.1	
Delay (s)	77.1	99.7		80.1	48.2	43.6	76.1	472.3		342.6	35.9	
Level of Service	E	F		F	D	D	E	F		F	D	
Approach Delay (s)		98.7			48.7			455.5			179.7	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	201.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.45		
Actuated Cycle Length (s)	157.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	135.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	57	98	162	25	58	108	162
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	28	69	133	162	29	79	133

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 11: Natoma St & Riley St



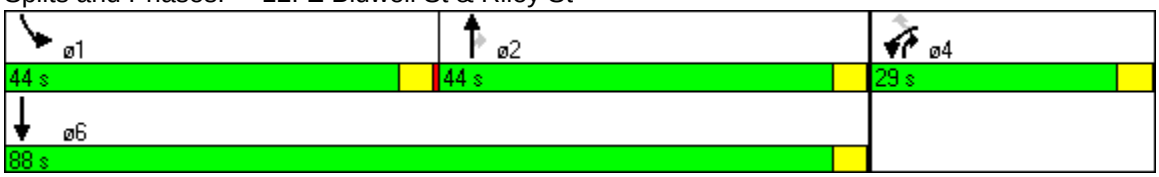
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1533	3539	1568	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1533	3539	1568	1770	1863
Volume (vph)	190	440	500	230	330	520
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	194	449	510	235	337	531
RTOR Reduction (vph)	0	361	0	134	0	0
Lane Group Flow (vph)	194	88	510	101	337	531
Confl. Peds. (#/hr)		3		3		
Confl. Bikes (#/hr)		16		8		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	9.1	9.1	10.8	19.9	14.4	29.2
Effective Green, g (s)	9.1	9.1	10.8	19.9	14.4	29.2
Actuated g/C Ratio	0.20	0.20	0.23	0.43	0.31	0.63
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	348	301	826	809	550	1175
v/s Ratio Prot	c0.11		c0.14	0.02	c0.19	0.29
v/s Ratio Perm		0.06		0.04		
v/c Ratio	0.56	0.29	0.62	0.12	0.61	0.45
Uniform Delay, d1	16.8	15.9	15.9	8.0	13.6	4.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.1	0.2	1.0	0.0	2.0	0.3
Delay (s)	17.9	16.1	16.9	8.0	15.6	4.7
Level of Service	B	B	B	A	B	A
Approach Delay (s)	16.6		14.1			8.9
Approach LOS	B		B			A

Intersection Summary			
HCM Average Control Delay	12.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	46.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	60

Splits and Phases: 12: E Bidwell St & Riley St



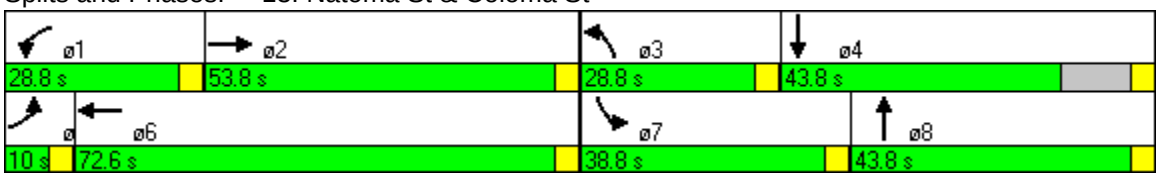
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1857		1770	1844		1770	1709		1770	1805	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1857		1770	1844		1770	1709		1770	1805	
Volume (vph)	10	930	20	50	840	60	200	90	110	30	40	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	979	21	53	884	63	211	95	116	32	42	11
RTOR Reduction (vph)	0	0	0	0	1	0	0	29	0	0	7	0
Lane Group Flow (vph)	11	1000	0	53	946	0	211	182	0	32	46	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.3	69.0		5.9	70.6		17.0	21.4		3.8	8.2	
Effective Green, g (s)	4.1	68.8		5.7	70.4		16.8	21.2		3.6	8.0	
Actuated g/C Ratio	0.04	0.60		0.05	0.61		0.15	0.18		0.03	0.07	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	63	1108		88	1126		258	314		55	125	
v/s Ratio Prot	0.01	c0.54		c0.03	0.51		c0.12	c0.11		0.02	0.03	
v/s Ratio Perm												
v/c Ratio	0.17	0.90		0.60	0.84		0.82	0.58		0.58	0.36	
Uniform Delay, d1	54.0	20.3		53.7	17.9		47.8	43.0		55.1	51.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	10.3		7.7	5.7		17.1	1.8		9.7	0.7	
Delay (s)	54.4	30.6		61.4	23.6		64.8	44.8		64.8	51.9	
Level of Service	D	C		E	C		E	D		E	D	
Approach Delay (s)		30.8			25.6			54.8			56.7	
Approach LOS		C			C			D			E	

Intersection Summary			
HCM Average Control Delay	33.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	115.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.1%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	Min
Maximum Split (s)	28.8	53.8	28.8	43.8	10	72.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	6.1%	43.9%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	7	1	7	1	7
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	10	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	10	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	6.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	6.2	78.8	117.6	161.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	146.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	142.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	142.6	50	88.8	132.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 13: Natoma St & Coloma St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		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	0.99		1.00	1.00		1.00	0.87		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3487		1770	3532		1770	1589		1770	1783	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3487		1770	3532		1770	1589		1770	1783	
Volume (vph)	10	970	90	120	830	10	110	20	160	20	30	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1021	95	126	874	11	116	21	168	21	32	11
RTOR Reduction (vph)	0	4	0	0	0	0	0	143	0	0	8	0
Lane Group Flow (vph)	11	1112	0	126	885	0	116	46	0	21	35	0
Confl. Bikes (#/hr)			3			1			4			3
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	5.6	32.9		7.0	34.3		5.1	10.3		1.6	6.8	
Effective Green, g (s)	5.6	33.9		7.0	35.3		5.1	10.3		1.6	6.8	
Actuated g/C Ratio	0.08	0.49		0.10	0.51		0.07	0.15		0.02	0.10	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	144	1718		180	1812		131	238		41	176	
v/s Ratio Prot	0.01	c0.32		c0.07	0.25		c0.07	c0.03		0.01	0.02	
v/s Ratio Perm												
v/c Ratio	0.08	0.65		0.70	0.49		0.89	0.19		0.51	0.20	
Uniform Delay, d1	29.2	13.0		29.9	10.9		31.6	25.6		33.2	28.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.9		9.6	0.2		44.6	0.1		4.4	0.2	
Delay (s)	29.3	13.9		39.5	11.1		76.2	25.8		37.6	28.7	
Level of Service	C	B		D	B		E	C		D	C	
Approach Delay (s)		14.0			14.6			44.9			31.6	
Approach LOS		B			B			D			C	

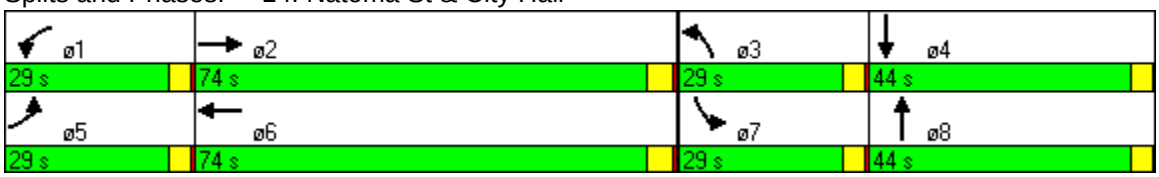
Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	68.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	62.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 14: Natoma St & City Hall



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00	0.95	0.95	
Frpb, ped/bikes	1.00	1.00		1.00	1.00	0.98		1.00	0.97	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	0.99		1.00	1.00	0.85		1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (prot)	1770	3509		1770	3539	1549		1770	1534	1681	1478	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.95	1.00	0.95	1.00	
Satd. Flow (perm)	1770	3509		1770	3539	1549		1770	1534	1681	1478	
Volume (vph)	10	1660	100	30	1600	10	60	0	10	10	0	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1747	105	32	1684	11	63	0	11	11	0	11
RTOR Reduction (vph)	0	1	0	0	0	1	0	0	10	0	11	0
Lane Group Flow (vph)	11	1851	0	32	1684	10	0	63	1	11	0	0
Confl. Peds. (#/hr)						3			4			3
Turn Type	Prot			Prot		Perm	Split		Perm	Split		
Protected Phases	1	6		5	2		3	3		4	4	
Permitted Phases						2			3			
Actuated Green, G (s)	1.2	86.4		4.7	89.9	89.9		7.5	7.5	4.9	4.9	
Effective Green, g (s)	1.2	87.9		4.7	91.4	91.4		7.5	7.5	5.4	5.4	
Actuated g/C Ratio	0.01	0.72		0.04	0.75	0.75		0.06	0.06	0.04	0.04	
Clearance Time (s)	4.0	5.5		4.0	5.5	5.5		4.0	4.0	4.5	4.5	
Vehicle Extension (s)	2.0	3.0		2.0	3.0	3.0		2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	17	2539		68	2662	1165		109	95	75	66	
v/s Ratio Prot	0.01	c0.53		c0.02	c0.48			c0.04		c0.01	0.00	
v/s Ratio Perm						0.01			0.00			
v/c Ratio	0.65	0.73		0.47	0.63	0.01		0.58	0.01	0.15	0.01	
Uniform Delay, d1	59.9	9.8		57.2	7.1	3.8		55.5	53.5	55.8	55.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00	1.00	1.00	
Incremental Delay, d2	49.2	1.1		1.9	0.5	0.0		4.6	0.0	0.3	0.0	
Delay (s)	109.1	10.9		59.0	7.6	3.8		60.0	53.5	56.2	55.5	
Level of Service	F	B		E	A	A		E	D	E	E	
Approach Delay (s)		11.5			8.5			59.0			55.8	
Approach LOS		B			A			E			E	

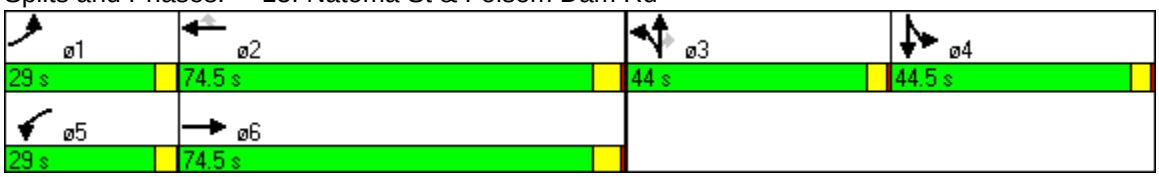
Intersection Summary			
HCM Average Control Delay	11.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	121.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	68.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	EBL	WBT	NBTL	SBTL	WBL	EBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	None	Min
Maximum Split (s)	29	74.5	44	44.5	29	74.5
Maximum Split (%)	15.1%	38.8%	22.9%	23.2%	15.1%	38.8%
Minimum Split (s)	6	12.5	6	25.5	6	28.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5
All-Red Time (s)	0.5	1	0.5	1	0.5	1
Minimum Initial (s)	2	7	2	2	2	7
Vehicle Extension (s)	2	3	2	2	2	3
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4
Time Before Reduce (s)	0	18	0	0	0	18
Time To Reduce (s)	0	25	0	0	0	25
Walk Time (s)				7		7
Flash Dont Walk (s)				14		16
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103.5	147.5	0	29
End Time (s)	29	103.5	147.5	0	29	103.5
Yield/Force Off (s)	25	98	143.5	187.5	25	98
Yield/Force Off 170(s)	25	98	143.5	173.5	25	98
Local Start Time (s)	163	0	74.5	118.5	163	0
Local Yield (s)	188	69	114.5	158.5	188	69
Local Yield 170(s)	188	69	114.5	144.5	188	69

Intersection Summary	
Cycle Length	192
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 15: Natoma St & Folsom Dam Rd



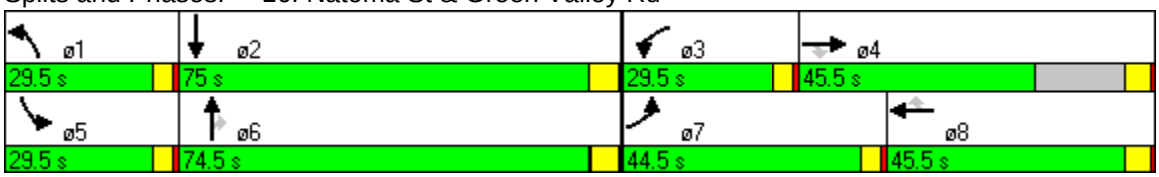
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Volume (vph)	1040	590	50	180	780	130	60	1040	320	100	470	610
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1095	621	53	189	821	137	63	1095	337	105	495	642
RTOR Reduction (vph)	0	0	29	0	0	61	0	0	239	0	0	0
Lane Group Flow (vph)	1095	621	24	189	821	76	63	1095	98	105	495	642
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	40.2	67.8	67.8	12.6	40.2	40.2	6.1	42.6	42.6	9.0	45.0	152.0
Effective Green, g (s)	40.7	69.3	69.3	13.1	41.7	41.7	6.6	44.1	44.1	9.5	47.0	152.0
Actuated g/C Ratio	0.27	0.46	0.46	0.09	0.27	0.27	0.04	0.29	0.29	0.06	0.31	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	919	1614	722	296	971	434	149	1475	459	215	1572	1583
v/s Ratio Prot	c0.32	0.18		0.06	c0.23		0.02	c0.22		0.03	0.10	
v/s Ratio Perm			0.02			0.05			0.06			c0.41
v/c Ratio	1.19	0.38	0.03	0.64	0.85	0.18	0.42	0.74	0.21	0.49	0.31	0.41
Uniform Delay, d1	55.7	27.3	22.8	67.2	52.1	42.0	70.8	48.8	40.8	68.9	40.2	0.0
Progression 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
Incremental Delay, d2	97.0	0.2	0.0	3.3	7.4	0.3	0.7	2.3	0.4	0.6	0.1	0.8
Delay (s)	152.7	27.5	22.9	70.5	59.5	42.4	71.5	51.1	41.2	69.5	40.3	0.8
Level of Service	F	C	C	E	E	D	E	D	D	E	D	A
Approach Delay (s)		104.8			59.3			49.8			22.3	
Approach LOS		F			E			D			C	

Intersection Summary			
HCM Average Control Delay	62.9	HCM Level of Service	E
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	152.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	88.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	135

Splits and Phases: 16: Natoma St & Green Valley Rd



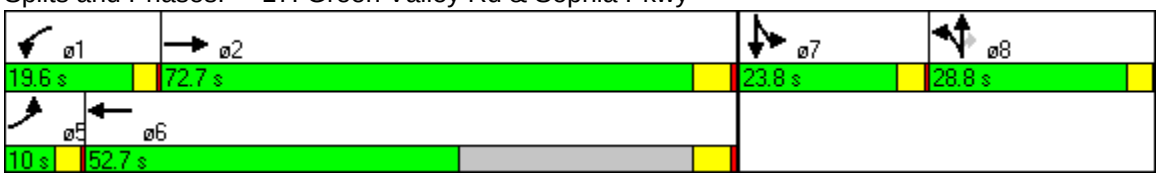
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)	1770	3498		1770	3534		1681	1704	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)	1770	3498		1770	3534		1681	1704	1583		1750	
Volume (vph)	10	2030	170	120	1090	10	80	10	290	10	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	2137	179	126	1147	11	84	11	305	11	11	11
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	277	0	11	0
Lane Group Flow (vph)	11	2313	0	126	1158	0	46	49	28	0	22	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	5.4	68.2		11.7	74.5		10.5	10.5	10.5		4.6	
Effective Green, g (s)	5.0	69.9		11.3	76.2		10.3	10.3	10.3		4.4	
Actuated g/C Ratio	0.04	0.62		0.10	0.68		0.09	0.09	0.09		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	79	2185		179	2407		155	157	146		69	
v/s Ratio Prot	0.01	c0.66		c0.07	0.33		0.03	c0.03			c0.01	
v/s Ratio Perm									0.02			
v/c Ratio	0.14	1.06		0.70	0.48		0.30	0.31	0.19		0.33	
Uniform Delay, d1	51.4	21.0		48.7	8.5		47.4	47.5	47.0		52.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.4	37.0		10.3	0.2		1.1	1.2	0.7		2.8	
Delay (s)	51.8	58.0		59.0	8.6		48.5	48.7	47.6		55.1	
Level of Service	D	E		E	A		D	D	D		E	
Approach Delay (s)		57.9			13.6			47.9			55.1	
Approach LOS		E			B			D			E	

Intersection Summary			
HCM Average Control Delay	42.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	111.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	93.7%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	72.7	10	52.7	23.8	28.8
Maximum Split (%)	13.5%	50.2%	6.9%	36.4%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	4.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	1	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	10	92.3	116.1
End Time (s)	19.6	92.3	10	92.3	116.1	0
Yield/Force Off (s)	16	86.6	6.4	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	6.4	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	135.3	72.7	96.5
Local Yield (s)	141.3	67	131.7	67	92.7	121.5
Local Yield 170(s)	141.3	67	131.7	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



2025 Conditions – Alternatives 2-4

Level of Service Technical Calculations

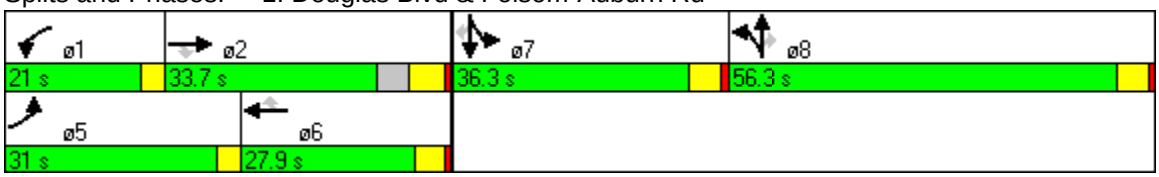
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.98	1.00	1.00	0.96	1.00	1.00	0.98	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	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1553	1770	3539	1526	3433	1863	1548	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1553	1770	3539	1526	3433	1863	1548	1770	3539	1563
Volume (vph)	190	220	890	130	400	180	1450	640	50	90	730	480
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	232	937	137	421	189	1526	674	53	95	768	505
RTOR Reduction (vph)	0	0	472	0	0	156	0	0	34	0	0	221
Lane Group Flow (vph)	200	232	465	137	421	33	1526	674	19	95	768	284
Confl. Peds. (#/hr)						3			5			
Confl. Bikes (#/hr)			7			3			1			1
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	19.6	28.8	28.8	14.0	24.0	24.0	51.1	51.1	51.1	31.0	31.0	31.0
Effective Green, g (s)	18.6	30.5	30.5	13.0	24.9	24.9	52.4	52.4	52.4	32.3	32.3	32.3
Actuated g/C Ratio	0.13	0.21	0.21	0.09	0.17	0.17	0.36	0.36	0.36	0.22	0.22	0.22
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	228	749	328	160	611	264	1247	677	563	396	793	350
v/s Ratio Prot	c0.11	0.07		0.08	0.12		c0.44	0.36		0.05	c0.22	
v/s Ratio Perm			c0.30			0.02			0.01			0.18
v/c Ratio	0.88	0.31	1.42	0.86	0.69	0.12	1.22	1.00	0.03	0.24	0.97	0.81
Uniform Delay, d1	61.7	48.0	56.8	64.7	56.0	50.4	45.9	45.8	29.6	45.9	55.4	53.1
Progression 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
Incremental Delay, d2	28.5	0.1	204.6	32.5	2.6	0.1	108.0	33.2	0.0	0.1	24.0	12.6
Delay (s)	90.2	48.1	261.5	97.2	58.6	50.5	153.9	79.0	29.6	46.0	79.5	65.7
Level of Service	F	D	F	F	E	D	F	E	C	D	E	E
Approach Delay (s)		200.3			63.6			128.6			72.1	
Approach LOS		F			E			F			E	

Intersection Summary			
HCM Average Control Delay	123.8	HCM Level of Service	F
HCM Volume to Capacity ratio	1.18		
Actuated Cycle Length (s)	144.2	Sum of lost time (s)	16.0
Intersection Capacity Utilization	97.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	21	33.7	31	27.9	36.3	56.3
Maximum Split (%)	13.9%	22.2%	20.5%	18.4%	24.0%	37.2%
Minimum Split (s)	8	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	21	0	31	58.9	95.2
End Time (s)	21	58.9	31	58.9	95.2	0
Yield/Force Off (s)	18	53.2	28	54	89.9	146.2
Yield/Force Off 170(s)	18	43.2	28	44	79.9	146.2
Local Start Time (s)	130.5	0	130.5	10	37.9	74.2
Local Yield (s)	148.5	32.2	7	33	68.9	125.2
Local Yield 170(s)	148.5	22.2	7	23	58.9	125.2

Intersection Summary	
Cycle Length	151.5
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	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		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (prot)		1770	1562				1770	3539			3539	1551
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1562				1770	3539			3539	1551
Volume (vph)	180	0	220	0	0	0	220	2010	0	0	1750	290
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	189	0	232	0	0	0	232	2116	0	0	1842	305
RTOR Reduction (vph)	0	0	198	0	0	0	0	0	0	0	0	55
Lane Group Flow (vph)	0	189	34	0	0	0	232	2116	0	0	1842	250
Confl. Bikes (#/hr)			1			1						1
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		18.6	18.6				20.9	99.8			74.9	74.9
Effective Green, g (s)		18.6	18.6				20.9	101.3			76.4	76.4
Actuated g/C Ratio		0.15	0.15				0.16	0.79			0.60	0.60
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		257	227				289	2803			2114	926
v/s Ratio Prot		c0.11					0.13	c0.60			c0.52	
v/s Ratio Perm			0.02									0.16
v/c Ratio		0.74	0.15				0.80	0.75			0.87	0.27
Uniform Delay, d1		52.3	47.7				51.5	6.9			21.6	12.4
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		10.4	0.3				14.0	1.1			4.2	0.1
Delay (s)		62.7	48.0				65.5	8.0			25.8	12.5
Level of Service		E	D				E	A			C	B
Approach Delay (s)		54.6			0.0			13.7			23.9	
Approach LOS		D			A			B			C	

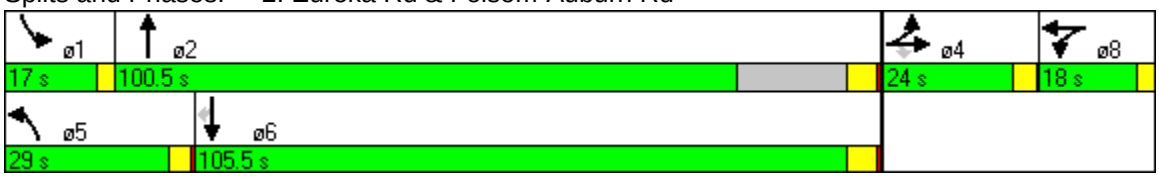
Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	127.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



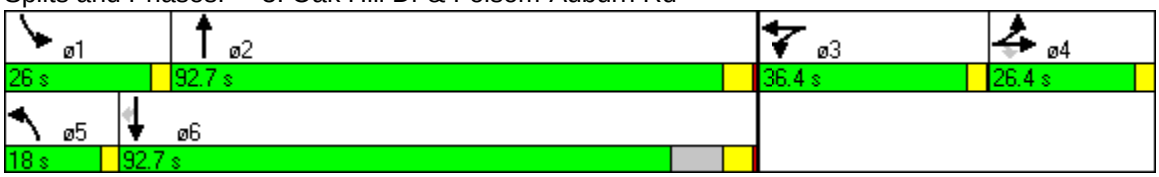
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.96		0.99		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	0.85		0.96		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1796	1523		1734		1770	3536		1770	3539	1583
Flt Permitted		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1796	1523		1734		1770	3536		1770	3539	1583
Volume (vph)	30	10	90	10	10	10	40	2210	10	10	1970	50
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	11	95	11	11	11	42	2326	11	11	2074	53
RTOR Reduction (vph)	0	0	90	0	11	0	0	0	0	0	0	5
Lane Group Flow (vph)	0	43	5	0	22	0	42	2337	0	11	2074	48
Confl. Peds. (#/hr)			4			3						
Confl. Bikes (#/hr)			4			1			4			
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		6.6	6.6		4.1		6.3	89.9		4.4	88.0	88.0
Effective Green, g (s)		6.0	6.0		3.5		5.3	91.6		3.4	89.7	89.7
Actuated g/C Ratio		0.05	0.05		0.03		0.04	0.76		0.03	0.74	0.74
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		89	76		50		78	2688		50	2634	1178
v/s Ratio Prot		c0.02			c0.01		c0.02	c0.66		0.01	0.59	
v/s Ratio Perm			0.00									0.03
v/c Ratio		0.48	0.06		0.45		0.54	0.87		0.22	0.79	0.04
Uniform Delay, d1		55.7	54.6		57.5		56.4	10.2		57.3	9.5	4.1
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.5	0.1		2.3		3.5	3.2		0.8	1.5	0.0
Delay (s)		57.2	54.7		59.8		59.9	13.4		58.1	11.0	4.1
Level of Service		E	D		E		E	B		E	B	A
Approach Delay (s)		55.5			59.8			14.2			11.1	
Approach LOS		E			E			B			B	

Intersection Summary			
HCM Average Control Delay	14.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	76.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	Min	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	140

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



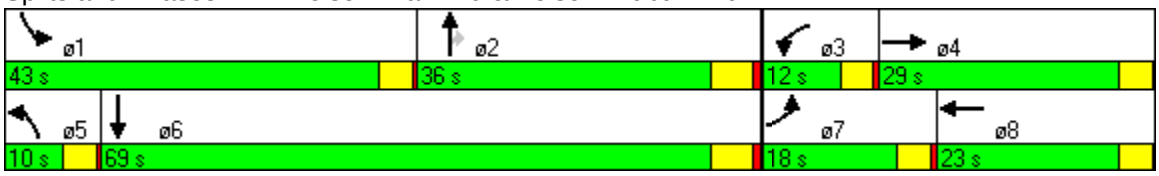
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1676		3433	1863	1583	1770	3539	1583	3433	3507	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1676		3433	1863	1583	1770	3539	1583	3433	3507	
Volume (vph)	100	20	40	220	20	1360	30	870	270	1110	940	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	21	42	232	21	1432	32	916	284	1168	989	63
RTOR Reduction (vph)	0	38	0	0	0	0	0	0	204	0	3	0
Lane Group Flow (vph)	105	25	0	232	21	1432	32	916	80	1168	1049	0
Turn Type	Prot			Prot		Free	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	13.3	10.7		8.0	5.4	120.0	3.9	32.4	32.4	51.4	79.9	
Effective Green, g (s)	13.3	10.7		8.0	5.4	120.0	3.9	33.9	33.9	51.4	81.4	
Actuated g/C Ratio	0.11	0.09		0.07	0.05	1.00	0.03	0.28	0.28	0.43	0.68	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	1.0	1.0		1.0	1.0		1.5	5.4	5.4	1.5	5.4	
Lane Grp Cap (vph)	196	149		229	84	1583	58	1000	447	1470	2379	
v/s Ratio Prot	0.06	0.01		0.07	0.01		0.02	0.26		0.34	0.30	
v/s Ratio Perm						c0.90			0.05			
v/c Ratio	0.54	0.17		1.01	0.25	0.90	0.55	0.92	0.18	0.79	0.44	
Uniform Delay, d1	50.4	50.5		56.0	55.3	0.0	57.2	41.7	32.5	29.7	8.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.05	1.01	
Incremental Delay, d2	1.4	0.2		62.9	0.6	8.9	6.3	14.3	0.9	2.1	0.4	
Delay (s)	51.8	50.7		118.9	55.9	8.9	63.5	55.9	33.4	33.4	9.4	
Level of Service	D	D		F	E	A	E	E	C	C	A	
Approach Delay (s)		51.4			24.7			50.9			22.0	
Approach LOS		D			C			D			C	

Intersection Summary			
HCM Average Control Delay	30.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	0.0
Intersection Capacity Utilization	78.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	43	36	12	29	10	69	18	23
Maximum Split (%)	35.8%	30.0%	10.0%	24.2%	8.3%	57.5%	15.0%	19.2%
Minimum Split (s)	6	27.5	12	29	6	21.5	6	12
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	2	7	8	2	2	7	2	8
Vehicle Extension (s)	1.5	5.4	1	1	1.5	5.4	1	1
Minimum Gap (s)	1.5	3.8	1	1	1.5	3.8	1	1
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		
Flash Dont Walk (s)		15		18		9		
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	101.5	24.5	60.5	72.5	101.5	111.5	60.5	78.5
End Time (s)	24.5	60.5	72.5	101.5	111.5	60.5	78.5	101.5
Yield/Force Off (s)	20.5	55	68.5	97.5	107.5	55	74.5	97.5
Yield/Force Off 170(s)	20.5	40	68.5	79.5	107.5	46	74.5	97.5
Local Start Time (s)	46.5	89.5	5.5	17.5	46.5	56.5	5.5	23.5
Local Yield (s)	85.5	0	13.5	42.5	52.5	0	19.5	42.5
Local Yield 170(s)	85.5	105	13.5	24.5	52.5	111	19.5	42.5

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	120
Offset: 55 (46%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



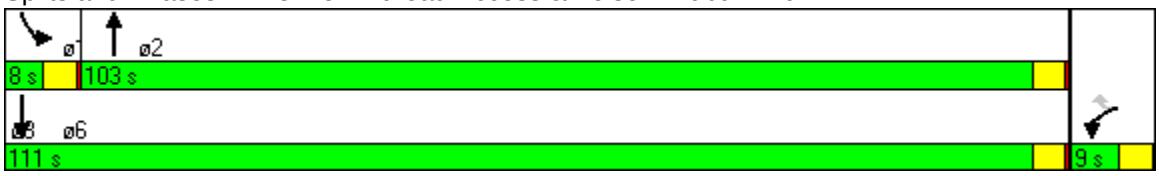
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3532		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3532		1770	3539
Volume (vph)	20	10	2300	30	10	2090
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	11	2421	32	11	2200
RTOR Reduction (vph)	0	11	1	0	0	0
Lane Group Flow (vph)	21	0	2452	0	11	2200
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	3.0	3.0	104.2		0.8	109.0
Effective Green, g (s)	3.0	3.0	104.2		0.8	109.0
Actuated g/C Ratio	0.02	0.02	0.87		0.01	0.91
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)	44	40	3067		12	3215
v/s Ratio Prot	c0.01		c0.69		0.01	c0.62
v/s Ratio Perm		0.00				
v/c Ratio	0.48	0.01	0.80		0.92	0.68
Uniform Delay, d1	57.7	57.0	3.4		59.6	1.3
Progression Factor	1.00	1.00	1.86		1.00	1.00
Incremental Delay, d2	7.9	0.1	1.1		212.2	1.2
Delay (s)	65.7	57.1	7.4		271.7	2.5
Level of Service	E	E	A		F	A
Approach Delay (s)	62.7		7.4			3.9
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	6.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	8	103	111	9
Maximum Split (%)	6.7%	85.8%	92.5%	7.5%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	13	21	13	4
End Time (s)	21	4	4	13
Yield/Force Off (s)	17	0	0	9
Yield/Force Off 170(s)	17	0	0	9
Local Start Time (s)	13	21	13	4
Local Yield (s)	17	0	0	9
Local Yield 170(s)	17	0	0	9

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	5085	5064	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	5085	5064	
Volume (vph)	70	30	20	2260	2050	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	32	21	2379	2158	63
RTOR Reduction (vph)	0	31	0	0	2	0
Lane Group Flow (vph)	74	1	21	2379	2219	0
Turn Type		Perm	Prot			
Protected Phases	4		1	6	2	
Permitted Phases		4				
Actuated Green, G (s)	6.0	6.0	46.0	104.0	61.0	
Effective Green, g (s)	6.0	6.0	46.0	104.0	61.0	
Actuated g/C Ratio	0.04	0.04	0.33	0.74	0.44	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	1.5	3.0	3.0	
Lane Grp Cap (vph)	76	68	582	3777	2206	
v/s Ratio Prot	c0.04		c0.01	c0.47	c0.44	
v/s Ratio Perm		0.00				
v/c Ratio	0.97	0.02	0.04	0.63	1.01	
Uniform Delay, d1	66.9	64.2	31.9	8.7	39.5	
Progression Factor	1.00	1.00	1.38	0.57	0.97	
Incremental Delay, d2	93.6	0.1	0.0	0.7	17.9	
Delay (s)	160.6	64.3	44.1	5.6	56.1	
Level of Service	F	E	D	A	E	
Approach Delay (s)	131.5			5.9	56.1	
Approach LOS	F			A	E	

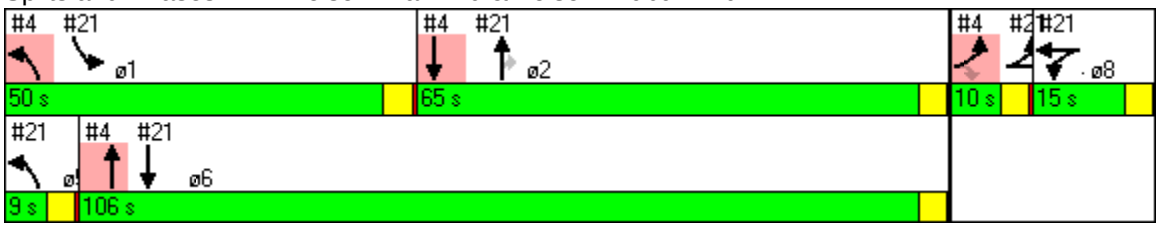
Intersection Summary			
HCM Average Control Delay	32.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	31.0
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Node Number	4	4	4	21	4	21
Movement	NBL	SBT	EBL	NBL	NBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	50	65	10	9	106	15
Maximum Split (%)	35.7%	46.4%	7.1%	6.4%	75.7%	10.7%
Minimum Split (s)	6	20	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	4	4	4	4	4
Vehicle Extension (s)	1.5	3	3	3	3	3
Minimum Gap (s)	1.5	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				
Flash Dont Walk (s)		9				
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	4	54	119	4	13	129
End Time (s)	54	119	129	13	119	4
Yield/Force Off (s)	50	115	125	9	115	0
Yield/Force Off 170(s)	50	106	125	9	115	0
Local Start Time (s)	29	79	4	29	38	14
Local Yield (s)	75	0	10	34	0	25
Local Yield 170(s)	75	131	10	34	0	25

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	140

Offset: 115 (82%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1694		1681	1698	2787	1770	3539	1583	3433	3528	
Flt Permitted	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1694		1681	1698	2787	1770	3539	1583	3433	3528	
Volume (vph)	30	20	30	220	20	1360	20	890	270	1110	950	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	21	32	232	21	1432	21	937	284	1168	1000	21
RTOR Reduction (vph)	0	31	0	0	0	0	0	0	152	0	1	0
Lane Group Flow (vph)	32	22	0	123	130	1432	21	937	132	1168	1020	0
Turn Type	Split			Split		Free	Prot		Perm	Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	6.0	6.0		11.0	11.0	140.0	3.0	61.0	61.0	46.0	104.0	
Effective Green, g (s)	6.0	6.0		11.0	11.0	140.0	3.0	61.0	61.0	46.0	104.0	
Actuated g/C Ratio	0.04	0.04		0.08	0.08	1.00	0.02	0.44	0.44	0.33	0.74	
Clearance Time (s)	4.0	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	1.5	3.0	
Lane Grp Cap (vph)	76	73		132	133	2787	38	1542	690	1128	2621	
v/s Ratio Prot	0.02	0.01		0.07	c0.08		0.01	c0.26		c0.34	0.29	
v/s Ratio Perm						c0.51			0.08			
v/c Ratio	0.42	0.31		0.93	0.98	0.51	0.55	0.61	0.19	1.04	0.39	
Uniform Delay, d1	65.3	65.0		64.1	64.4	0.0	67.8	30.3	24.3	47.0	6.5	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.67	0.38	
Incremental Delay, d2	3.7	2.4		57.5	70.4	0.7	16.2	1.8	0.6	23.4	0.1	
Delay (s)	69.0	67.4		121.7	134.8	0.7	84.1	32.1	24.9	101.8	2.6	
Level of Service	E	E		F	F	A	F	C	C	F	A	
Approach Delay (s)		68.0			19.9			31.3			55.5	
Approach LOS		E			B			C			E	

Intersection Summary			
HCM Average Control Delay	38.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Alternative 3 - AM

DELAY

4. Folsom Bridge (Auto Spa)/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	74	160.6	11,884
EBR	32	64.3	2,058
NBL	21	44.1	926
NBT	2,379	5.6	13,322
SBT	2,158	56.1	121,064
SBR	63	56.1	3,534
total	4,727	387	152,789

Reported Delay

EBL	EBR	NBL	NBT	SBT	SBR
160.6	64.3	44.1	5.6	56.1	

Reported Adj Flow

EBL	EBR	NBL	NBT	SBT	SBR
74	32	21	2,379	2,158	63

21. Existing Folsom Dam Road/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	32	69.0	2,208
EBT	21	67.4	1,415
EBR	32	67.4	2,157
WBL	232	121.7	28,234
WBT	21	134.8	2,831
WBR	1,432	0.7	1,002
NBL	21	84.1	1,766
NBT	937	32.1	30,078
NBR	284	24.9	7,072
SBL	1,168	101.8	118,902
SBT	1,000	2.6	2,600
SBR	21	2.6	55
total	5,201	709	198,320

total Adj. Volume	9,928
Int. Delay	**35.4**

Reported Delay

EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
69	67.4	121.7	134.8	0.7	84.1	32.1	24.9	101.8	2.6

Reported Adj Flow

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
32	21	32	232	21	1,432	21	937	284	1168	1000	21

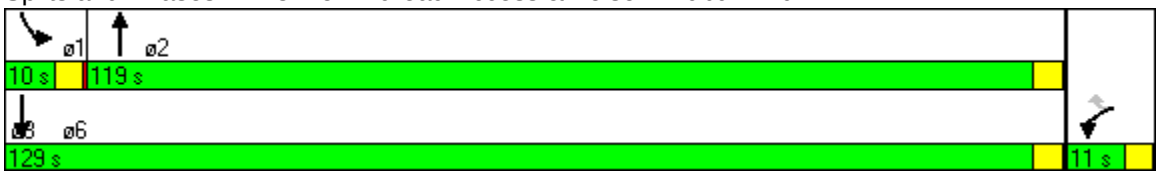
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3532		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3532		1770	3539
Volume (vph)	20	10	2300	30	10	2090
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	11	2421	32	11	2200
RTOR Reduction (vph)	0	11	1	0	0	0
Lane Group Flow (vph)	21	0	2452	0	11	2200
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	4.2	4.2	121.4		2.4	127.8
Effective Green, g (s)	4.2	4.2	121.4		2.4	127.8
Actuated g/C Ratio	0.03	0.03	0.87		0.02	0.91
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)	53	47	3063		30	3231
v/s Ratio Prot	c0.01		c0.69		0.01	c0.62
v/s Ratio Perm		0.00				
v/c Ratio	0.40	0.01	0.80		0.37	0.68
Uniform Delay, d1	66.7	65.9	4.0		68.0	1.4
Progression Factor	1.00	1.00	1.06		1.00	1.00
Incremental Delay, d2	4.8	0.1	1.8		7.4	1.2
Delay (s)	71.5	65.9	6.1		75.5	2.6
Level of Service	E	E	A		E	A
Approach Delay (s)	69.6		6.1			2.9
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	5.0	HCM Level of Service	A
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	10	119	129	11
Maximum Split (%)	7.1%	85.0%	92.1%	7.9%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	15	25	15	4
End Time (s)	25	4	4	15
Yield/Force Off (s)	21	0	0	11
Yield/Force Off 170(s)	21	0	0	11
Local Start Time (s)	15	25	15	4
Local Yield (s)	21	0	0	11
Local Yield 170(s)	21	0	0	11

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



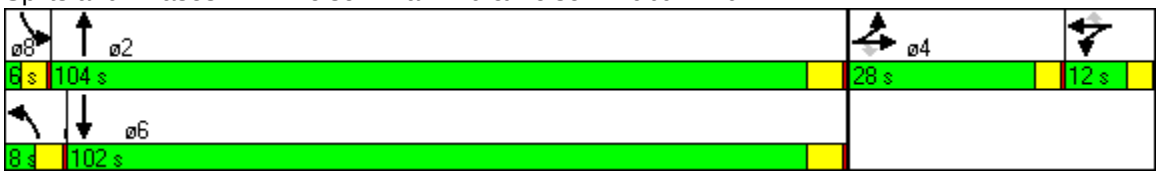
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3532		1770	3524	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3532		1770	3524	
Volume (vph)	100	0	60	20	0	10	40	2200	30	10	2030	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	0	63	21	0	11	42	2316	32	11	2137	63
RTOR Reduction (vph)	0	0	57	0	0	11	0	0	0	0	1	0
Lane Group Flow (vph)	0	105	6	0	21	0	42	2348	0	11	2199	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)		13.3	13.3		4.8	4.8	7.3	112.8		1.6	107.1	
Effective Green, g (s)		13.3	13.3		4.8	4.8	7.3	114.3		1.6	108.6	
Actuated g/C Ratio		0.09	0.09		0.03	0.03	0.05	0.76		0.01	0.72	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.5	5.4		1.5	5.4	
Lane Grp Cap (vph)		157	140		57	51	86	2691		19	2551	
v/s Ratio Prot		c0.06			c0.01		c0.02	c0.66		0.01	0.62	
v/s Ratio Perm			0.00			0.00						
v/c Ratio		0.67	0.04		0.37	0.01	0.49	0.87		0.58	0.86	
Uniform Delay, d1		66.2	62.5		71.1	70.3	69.5	12.7		73.9	15.2	
Progression Factor		1.00	1.00		1.00	1.00	1.10	0.78		1.00	1.00	
Incremental Delay, d2		8.1	0.0		1.5	0.0	1.0	2.7		23.8	4.1	
Delay (s)		74.3	62.6		72.6	70.3	77.8	12.5		97.7	19.3	
Level of Service		E	E		E	E	E	B		F	B	
Approach Delay (s)		69.9			71.8			13.6			19.7	
Approach LOS		E			E			B			B	

Intersection Summary			
HCM Average Control Delay	18.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	84.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	6	104	28	8	102	12
Maximum Split (%)	4.0%	69.3%	18.7%	5.3%	68.0%	8.0%
Minimum Split (s)	6	23.5	28	6	23.5	12
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	2	7	2	2	7	8
Vehicle Extension (s)	1.5	5.4	1	1.5	5.4	1
Minimum Gap (s)	1.5	3.8	1	1.5	3.8	1
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7	7		7	
Flash Dont Walk (s)		11	17		11	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	72.5	78.5	32.5	72.5	80.5	60.5
End Time (s)	78.5	32.5	60.5	80.5	32.5	72.5
Yield/Force Off (s)	74.5	27	56.5	76.5	27	68.5
Yield/Force Off 170(s)	74.5	16	39.5	76.5	16	68.5
Local Start Time (s)	45.5	51.5	5.5	45.5	53.5	33.5
Local Yield (s)	47.5	0	29.5	49.5	0	41.5
Local Yield 170(s)	47.5	139	12.5	49.5	139	41.5

Intersection Summary	
Cycle Length	150
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 27 (18%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



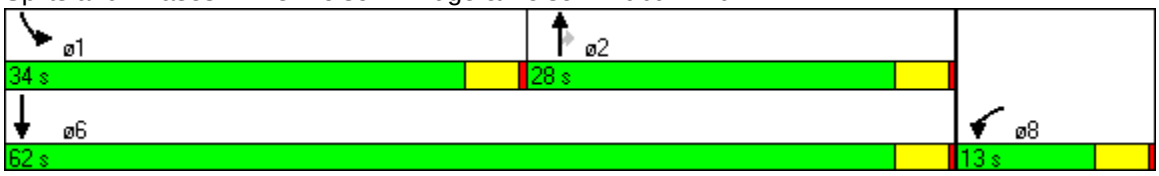
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.95	1.00	0.97	0.95
Frt	0.91	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.98	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3234	1441	3539	1583	3433	3539
Flt Permitted	0.98	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3234	1441	3539	1583	3433	3539
Volume (vph)	220	1380	910	270	1130	980
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	232	1453	958	284	1189	1032
RTOR Reduction (vph)	276	0	0	168	0	0
Lane Group Flow (vph)	267	1142	958	116	1189	1032
Turn Type		Free		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		Free		2		
Actuated Green, G (s)	8.5	75.0	27.6	27.6	26.9	58.5
Effective Green, g (s)	8.5	75.0	27.6	27.6	26.9	58.5
Actuated g/C Ratio	0.11	1.00	0.37	0.37	0.36	0.78
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)	367	1441	1302	583	1231	2760
v/s Ratio Prot	0.08		0.27		c0.35	0.29
v/s Ratio Perm		c0.79		0.07		
v/c Ratio	0.73	0.79	0.74	0.20	0.97	0.37
Uniform Delay, d1	32.1	0.0	20.5	16.2	23.6	2.6
Progression Factor	1.00	1.00	1.00	1.00	1.17	1.15
Incremental Delay, d2	7.1	4.5	3.7	0.8	11.8	0.2
Delay (s)	39.2	4.5	24.3	16.9	39.3	3.2
Level of Service	D	A	C	B	D	A
Approach Delay (s)	15.7		22.6			22.5
Approach LOS	B		C			C

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	88.2%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	34	28	62	13
Maximum Split (%)	45.3%	37.3%	82.7%	17.3%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	17	51	17	4
End Time (s)	51	4	4	17
Yield/Force Off (s)	47	0	0	13
Yield/Force Off 170(s)	47	0	0	13
Local Start Time (s)	17	51	17	4
Local Yield (s)	47	0	0	13
Local Yield 170(s)	47	0	0	13

Intersection Summary	
Cycle Length	75
Control Type	Actuated-Coordinated
Natural Cycle	70
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: Folsom Bridge & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	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	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99		1.00	0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1583	1770	3539	1563	3433	3513		1770	3444	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3539	1583	1770	3539	1563	3433	3513		1770	3444	
Volume (vph)	180	1190	590	200	950	100	290	960	50	60	970	190
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	189	1253	621	211	1000	105	305	1011	53	63	1021	200
RTOR Reduction (vph)	0	0	100	0	0	66	0	3	0	0	13	0
Lane Group Flow (vph)	189	1253	521	211	1000	39	305	1061	0	63	1208	0
Confl. Bikes (#/hr)						1						3
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	13.0	38.3	38.3	13.0	38.3	38.3	9.9	44.0		5.0	39.1	
Effective Green, g (s)	13.0	40.0	40.0	13.0	40.0	40.0	10.6	46.2		5.7	41.3	
Actuated g/C Ratio	0.11	0.33	0.33	0.11	0.33	0.33	0.09	0.38		0.05	0.34	
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	190	1171	524	190	1171	517	301	1342		83	1176	
v/s Ratio Prot	0.11	c0.35		c0.12	0.28		c0.09	0.30		0.04	c0.35	
v/s Ratio Perm			0.33			0.02						
v/c Ratio	0.99	1.07	0.99	1.11	0.85	0.07	1.01	0.79		0.76	1.03	
Uniform Delay, d1	53.9	40.4	40.3	54.0	37.7	27.8	55.2	33.1		56.9	39.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	63.4	47.2	37.5	98.0	6.2	0.1	55.3	3.4		29.1	33.4	
Delay (s)	117.3	87.6	77.8	152.0	44.0	27.8	110.4	36.5		86.0	73.2	
Level of Service	F	F	E	F	D	C	F	D		F	E	
Approach Delay (s)		87.4			60.0			53.0			73.8	
Approach LOS		F			E			D			E	

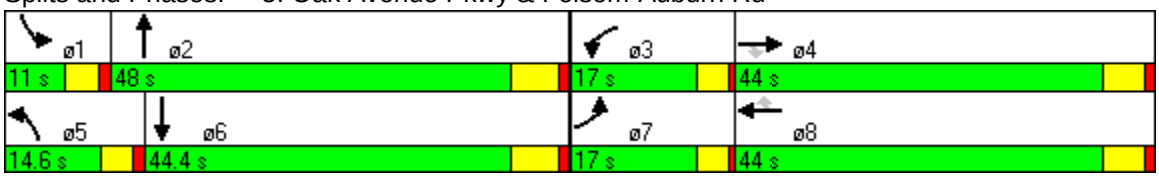
Intersection Summary			
HCM Average Control Delay	70.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.05		
Actuated Cycle Length (s)	120.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	98.5%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	11	48	17	44	14.6	44.4	17	44
Maximum Split (%)	9.2%	40.0%	14.2%	36.7%	12.2%	37.0%	14.2%	36.7%
Minimum Split (s)	6.7	13.2	8	30.7	6.7	13.2	8	27.7
Yellow Time (s)	3.5	5	3.5	4.5	3.5	5	3.5	4.5
All-Red Time (s)	1.2	1.2	0.5	1.2	1.2	1.2	0.5	1.2
Minimum Initial (s)	2	7	4	3	2	7	4	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	2	2.4	3	3	2	2.4	3	0.2
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	11	59	76	0	14.6	59	76
End Time (s)	11	59	76	0	14.6	59	76	0
Yield/Force Off (s)	6.3	52.8	72	114.3	9.9	52.8	72	114.3
Yield/Force Off 170(s)	6.3	52.8	72	96.3	9.9	52.8	72	99.3
Local Start Time (s)	105.4	116.4	44.4	61.4	105.4	0	44.4	61.4
Local Yield (s)	111.7	38.2	57.4	99.7	115.3	38.2	57.4	99.7
Local Yield 170(s)	111.7	38.2	57.4	81.7	115.3	38.2	57.4	84.7

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



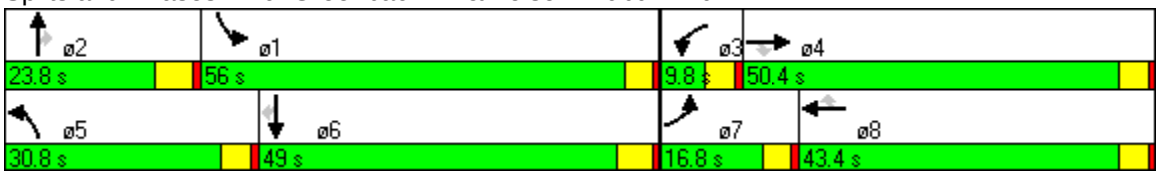
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	110	690	930	20	650	420	300	420	10	290	1460	140
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	116	726	979	21	684	442	316	442	11	305	1537	147
RTOR Reduction (vph)	0	0	237	0	0	309	0	0	10	0	0	42
Lane Group Flow (vph)	116	726	742	21	684	133	316	442	1	305	1537	105
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	11.4	49.8	49.8	3.2	41.6	41.6	16.8	16.5	16.5	51.5	51.2	51.2
Effective Green, g (s)	11.9	50.3	50.3	3.7	42.1	42.1	17.3	18.0	18.0	52.0	52.7	52.7
Actuated g/C Ratio	0.08	0.36	0.36	0.03	0.30	0.30	0.12	0.13	0.13	0.37	0.38	0.38
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	150	1272	569	47	1064	476	424	455	204	657	1332	596
v/s Ratio Prot	c0.07	0.21		0.01	0.19		0.09	c0.12		0.17	c0.43	
v/s Ratio Perm			c0.47			0.08			0.00			0.07
v/c Ratio	0.77	0.57	1.30	0.45	0.64	0.28	0.75	0.97	0.01	0.46	1.15	0.18
Uniform Delay, d1	62.7	36.1	44.9	67.1	42.4	37.4	59.2	60.7	53.2	33.4	43.6	29.2
Progression 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
Incremental Delay, d2	19.9	0.4	149.2	2.5	1.0	0.1	6.1	35.7	0.1	0.2	78.2	0.6
Delay (s)	82.6	36.5	194.1	69.6	43.4	37.5	65.4	96.4	53.3	33.6	121.9	29.8
Level of Service	F	D	F	E	D	D	E	F	D	C	F	C
Approach Delay (s)		124.2			41.6			83.0			101.5	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	94.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.16		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	56	23.8	9.8	50.4	30.8	49	16.8	43.4
Maximum Split (%)	40.0%	17.0%	7.0%	36.0%	22.0%	35.0%	12.0%	31.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
End Time (s)	61.5	5.5	71.3	121.7	12.5	61.5	78.3	121.7
Yield/Force Off (s)	57	0	66.8	117.2	8	56	73.8	117.2
Yield/Force Off 170(s)	57	117	66.8	92.2	8	37	73.8	92.2
Local Start Time (s)	5.5	121.7	61.5	71.3	121.7	12.5	61.5	78.3
Local Yield (s)	57	0	66.8	117.2	8	56	73.8	117.2
Local Yield 170(s)	57	117	66.8	92.2	8	37	73.8	92.2

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	145
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.97	1.00	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		1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1831	1541	1681	1691	1562	1770	4931		1770	3539	1549
Flt Permitted		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1831	1541	1681	1691	1562	1770	4931		1770	3539	1549
Volume (vph)	10	20	20	270	10	170	10	550	140	150	2250	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	21	21	284	11	179	11	579	147	158	2368	11
RTOR Reduction (vph)	0	0	20	0	0	71	0	14	0	0	0	2
Lane Group Flow (vph)	0	32	1	144	151	108	11	712	0	158	2368	9
Confl. Bikes (#/hr)			3			1						3
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		5.7	5.7	16.6	16.6	16.6	2.3	76.9		15.8	90.4	90.4
Effective Green, g (s)		6.2	6.2	17.1	17.1	17.1	2.8	79.4		16.3	92.9	92.9
Actuated g/C Ratio		0.05	0.05	0.13	0.13	0.13	0.02	0.59		0.12	0.69	0.69
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		84	71	213	214	198	37	2900		214	2435	1066
v/s Ratio Prot		c0.02		0.09	c0.09		0.01	0.14		c0.09	c0.67	
v/s Ratio Perm			0.00			0.07						0.01
v/c Ratio		0.38	0.01	0.68	0.71	0.55	0.30	0.25		0.74	0.97	0.01
Uniform Delay, d1		62.5	61.5	56.3	56.5	55.3	65.1	13.4		57.3	19.8	6.6
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		1.1	0.0	6.5	8.3	1.7	1.6	0.1		10.9	12.6	0.0
Delay (s)		63.6	61.5	62.8	64.9	57.0	66.8	13.5		68.2	32.4	6.6
Level of Service		E	E	E	E	E	E	B		E	C	A
Approach Delay (s)		62.8			61.3			14.3			34.5	
Approach LOS		E			E			B			C	

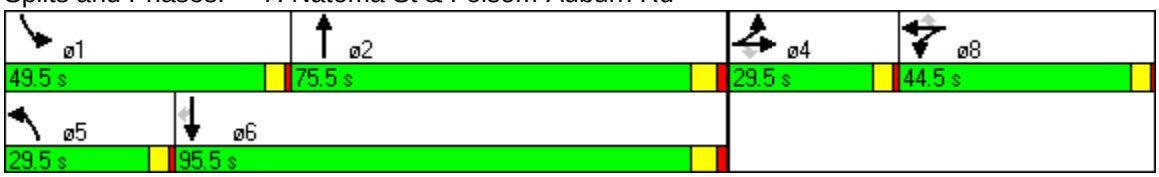
Intersection Summary			
HCM Average Control Delay	34.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	135.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	89.9%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



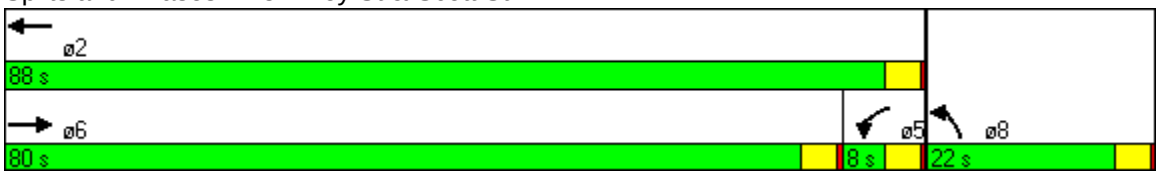
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3534		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3534		1770	1863	1695	
Volume (vph)	1080	10	10	980	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1137	11	11	1032	11	11
RTOR Reduction (vph)	0	0	0	0	11	0
Lane Group Flow (vph)	1148	0	11	1032	12	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	89.0		4.0	97.0	5.0	
Effective Green, g (s)	89.0		4.0	97.0	5.0	
Actuated g/C Ratio	0.81		0.04	0.88	0.05	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2859		64	1643	77	
v/s Ratio Prot	0.32		0.01	c0.55	c0.01	
v/s Ratio Perm						
v/c Ratio	0.40		0.17	0.63	0.15	
Uniform Delay, d1	3.0		51.4	1.7	50.5	
Progression Factor	0.62		1.00	1.00	1.00	
Incremental Delay, d2	0.4		0.8	1.8	0.9	
Delay (s)	2.2		52.2	3.6	51.4	
Level of Service	A		D	A	D	
Approach Delay (s)	2.2			4.1	51.4	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	3.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.6%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	8	80	22
Maximum Split (%)	80.0%	7.3%	72.7%	20.0%
Minimum Split (s)	11	22	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	18	18	0
Time To Reduce (s)	25	25	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	45	15	45	23
End Time (s)	23	23	15	45
Yield/Force Off (s)	19	19	11	41
Yield/Force Off 170(s)	19	19	1	28
Local Start Time (s)	34	4	34	12
Local Yield (s)	8	8	0	30
Local Yield 170(s)	8	8	100	17

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	75
Offset: 11 (10%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



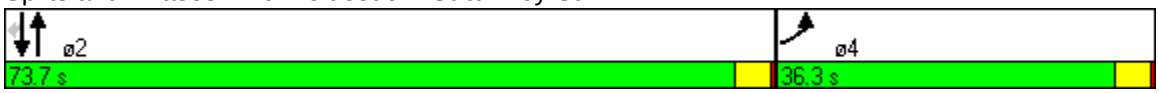
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.96			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3350			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3350			3539	1863	1583
Volume (vph)	30	10	0	1060	920	70
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	11	0	1116	968	74
RTOR Reduction (vph)	10	0	0	0	0	9
Lane Group Flow (vph)	33	0	0	1116	968	65
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	6.0			96.0	96.0	96.0
Effective Green, g (s)	6.0			96.0	96.0	96.0
Actuated g/C Ratio	0.05			0.87	0.87	0.87
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	183			3089	1626	1382
v/s Ratio Prot	c0.01			0.32	c0.52	
v/s Ratio Perm						0.04
v/c Ratio	0.18			0.36	0.60	0.05
Uniform Delay, d1	49.6			1.3	1.9	0.9
Progression Factor	1.00			0.11	0.49	0.57
Incremental Delay, d2	0.4			0.2	1.3	0.1
Delay (s)	50.1			0.3	2.2	0.6
Level of Service	D			A	A	A
Approach Delay (s)	50.1			0.3	2.1	
Approach LOS	D			A	A	

Intersection Summary			
HCM Average Control Delay	2.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	73.7	36.3
Maximum Split (%)	67.0%	33.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	54.3	18
End Time (s)	18	54.3
Yield/Force Off (s)	14	50.3
Yield/Force Off 170(s)	6	40.3
Local Start Time (s)	40.3	4
Local Yield (s)	0	36.3
Local Yield 170(s)	102	26.3

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 14 (13%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



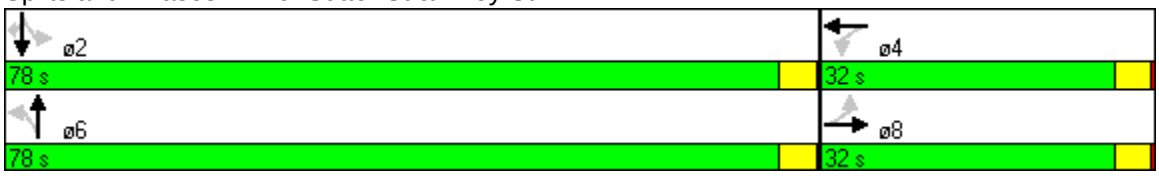
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1710	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.99			0.99			1.00			1.00	0.95
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.97			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1759			1741			1543			1815	1467
Flt Permitted		0.92			0.93			0.99			0.99	1.00
Satd. Flow (perm)		1631			1641			1529			1791	1467
Volume (vph)	10	20	10	10	10	10	10	1040	10	10	910	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	21	11	11	11	11	11	1095	11	11	958	11
RTOR Reduction (vph)	0	10	0	0	10	0	0	0	0	0	0	2
Lane Group Flow (vph)	0	33	0	0	23	0	0	1117	0	0	969	10
Confl. Peds. (#/hr)									3			10
Confl. Bikes (#/hr)			3			1			1			
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		7.0			7.0			95.0			95.0	95.0
Effective Green, g (s)		7.0			7.0			95.0			95.0	95.0
Actuated g/C Ratio		0.06			0.06			0.86			0.86	0.86
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		104			104			1321			1547	1267
v/s Ratio Prot												
v/s Ratio Perm		c0.02			0.01			c0.73			0.54	0.01
v/c Ratio		0.31			0.22			0.85			0.63	0.01
Uniform Delay, d1		49.2			48.9			3.8			2.2	1.0
Progression Factor		1.00			1.00			1.00			0.28	0.34
Incremental Delay, d2		0.6			0.4			6.8			1.6	0.0
Delay (s)		49.8			49.3			10.6			2.2	0.4
Level of Service		D			D			B			A	A
Approach Delay (s)		49.8			49.3			10.6			2.2	
Approach LOS		D			D			B			A	

Intersection Summary			
HCM Average Control Delay	8.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	90.4%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	100
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



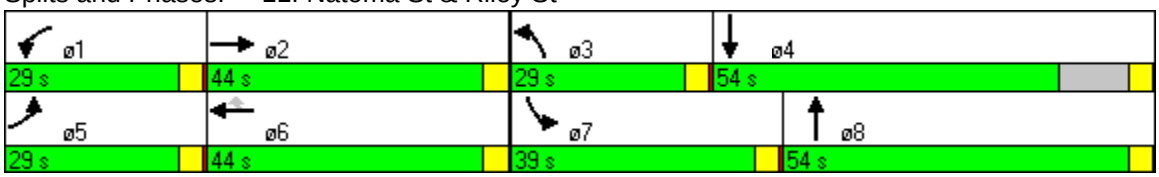
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1596	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00	0.85	1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1825		1770	1863	1583	1770	1556		1770	1839	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1825		1770	1863	1583	1770	1556		1770	1839	
Volume (vph)	30	450	70	60	410	540	20	490	20	340	540	50
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	474	74	63	432	568	21	516	21	358	568	53
RTOR Reduction (vph)	0	3	0	0	0	400	0	1	0	0	1	0
Lane Group Flow (vph)	32	545	0	63	432	168	21	536	0	358	620	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	5.0	41.0		8.4	44.4	44.4	4.3	52.0		33.1	80.8	
Effective Green, g (s)	5.0	41.0		8.4	44.4	44.4	4.3	52.0		33.1	80.8	
Actuated g/C Ratio	0.03	0.27		0.06	0.30	0.30	0.03	0.35		0.22	0.54	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	59	497		99	550	467	51	538		389	987	
v/s Ratio Prot	0.02	c0.30		c0.04	c0.23		0.01	c0.34		c0.20	0.34	
v/s Ratio Perm						0.11						
v/c Ratio	0.54	1.10		0.64	0.79	0.36	0.41	1.00		0.92	0.63	
Uniform Delay, d1	71.6	54.8		69.6	48.7	41.8	71.9	49.2		57.4	24.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.4	69.3		9.4	7.8	0.7	2.0	37.8		26.4	1.5	
Delay (s)	77.0	124.1		79.0	56.4	42.5	73.8	87.0		83.8	25.8	
Level of Service	E	F		E	E	D	E	F		F	C	
Approach Delay (s)		121.5			50.3			86.5			47.0	
Approach LOS		F			D			F			D	

Intersection Summary			
HCM Average Control Delay	68.6	HCM Level of Service	E
HCM Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	150.5	Sum of lost time (s)	20.0
Intersection Capacity Utilization	95.6%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	69	98	150	25	69	108	151
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	40	69	121	162	40	79	122

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 11: Natoma St & Riley St



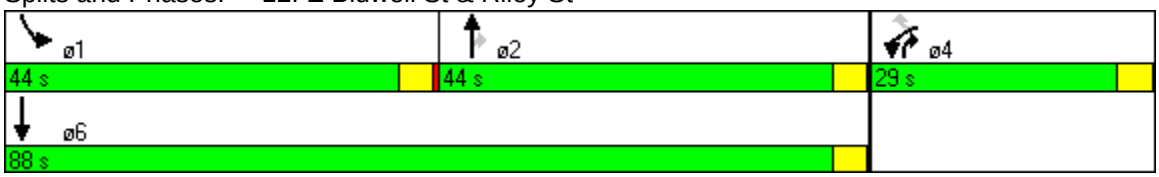
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.98	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1545	3539	1572	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1545	3539	1572	1770	1863
Volume (vph)	330	280	250	220	320	370
Peak-hour factor, PHF	0.90	0.90	0.90	0.90	0.90	0.90
Adj. Flow (vph)	367	311	278	244	356	411
RTOR Reduction (vph)	0	207	0	124	0	0
Lane Group Flow (vph)	367	104	278	120	356	411
Confl. Peds. (#/hr)		8		9		
Confl. Bikes (#/hr)		9		9		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	18.6	18.6	8.6	27.2	16.2	28.8
Effective Green, g (s)	18.6	18.6	8.6	27.2	16.2	28.8
Actuated g/C Ratio	0.34	0.34	0.16	0.49	0.29	0.52
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	594	519	549	885	518	968
v/s Ratio Prot	c0.21		0.08	0.05	c0.20	c0.22
v/s Ratio Perm		0.07		0.03		
v/c Ratio	0.62	0.20	0.51	0.14	0.69	0.42
Uniform Delay, d1	15.4	13.1	21.5	7.7	17.4	8.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.4	0.1	0.3	0.0	3.8	0.3
Delay (s)	16.8	13.2	21.7	7.7	21.2	8.5
Level of Service	B	B	C	A	C	A
Approach Delay (s)	15.1		15.2			14.4
Approach LOS	B		B			B

Intersection Summary			
HCM Average Control Delay	14.8	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	55.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	54.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	60

Splits and Phases: 12: E Bidwell St & Riley St



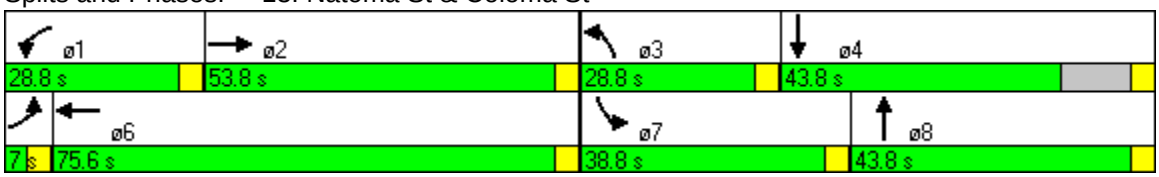
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.87		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1831		1770	1856		1770	1612		1770	1805	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1831		1770	1856		1770	1612		1770	1805	
Volume (vph)	10	710	90	250	780	20	160	30	270	20	40	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	747	95	263	821	21	168	32	284	21	42	11
RTOR Reduction (vph)	0	2	0	0	0	0	0	216	0	0	7	0
Lane Group Flow (vph)	11	840	0	263	842	0	168	100	0	21	46	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	3.2	50.7		22.8	70.3		14.9	17.2		4.9	7.2	
Effective Green, g (s)	3.0	50.5		22.6	70.1		14.7	17.0		4.7	7.0	
Actuated g/C Ratio	0.03	0.46		0.20	0.63		0.13	0.15		0.04	0.06	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	48	835		361	1174		235	247		75	114	
v/s Ratio Prot	0.01	c0.46		c0.15	0.45		c0.09	c0.06		0.01	0.03	
v/s Ratio Perm												
v/c Ratio	0.23	1.01		0.73	0.72		0.71	0.41		0.28	0.40	
Uniform Delay, d1	52.8	30.2		41.2	13.7		46.0	42.3		51.4	49.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.9	32.6		6.1	2.1		8.3	0.4		0.7	0.8	
Delay (s)	53.7	62.7		47.3	15.8		54.3	42.7		52.2	50.7	
Level of Service	D	E		D	B		D	D		D	D	
Approach Delay (s)		62.6			23.3			46.8			51.1	
Approach LOS		E			C			D			D	

Intersection Summary			
HCM Average Control Delay	42.0	HCM Level of Service	D
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	110.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	84.9%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	28.8	53.8	28.8	43.8	7	75.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	4.2%	45.8%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	1	1	7	1	1
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	3	2.4	3	3	3	2.4	3	3
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	7	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	7	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	3.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	3.2	78.8	117.6	151.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	143.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	139.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	139.6	50	88.8	122.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 13: Natoma St & Coloma St



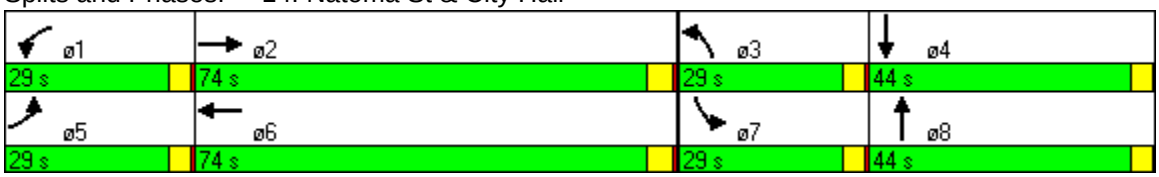
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		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	1.00		1.00	0.85		1.00	0.92	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3527		1770	3533		1770	1559		1770	1695	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3527		1770	3533		1770	1559		1770	1695	
Volume (vph)	10	970	20	410	960	10	80	10	310	10	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1021	21	432	1011	11	84	11	326	11	11	11
RTOR Reduction (vph)	0	1	0	0	0	0	0	291	0	0	10	0
Lane Group Flow (vph)	11	1041	0	432	1022	0	84	46	0	11	12	0
Confl. Peds. (#/hr)			1			1			1			1
Confl. Bikes (#/hr)			3			1			4			4
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	4.3	32.4		26.2	54.3		9.6	9.5		4.3	4.2	
Effective Green, g (s)	4.3	33.4		26.2	55.3		9.6	9.5		4.3	4.2	
Actuated g/C Ratio	0.05	0.37		0.29	0.62		0.11	0.11		0.05	0.05	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	85	1318		519	2185		190	166		85	80	
v/s Ratio Prot	0.01	c0.30		c0.24	0.29		c0.05	c0.03		0.01	0.01	
v/s Ratio Perm												
v/c Ratio	0.13	0.79		0.83	0.47		0.44	0.27		0.13	0.14	
Uniform Delay, d1	40.8	24.9		29.5	9.1		37.4	36.8		40.8	40.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	3.3		10.5	0.2		0.6	0.3		0.3	0.3	
Delay (s)	41.0	28.2		40.0	9.3		38.0	37.1		41.0	41.2	
Level of Service	D	C		D	A		D	D		D	D	
Approach Delay (s)		28.3			18.4			37.3			41.1	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	24.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	89.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 14: Natoma St & City Hall



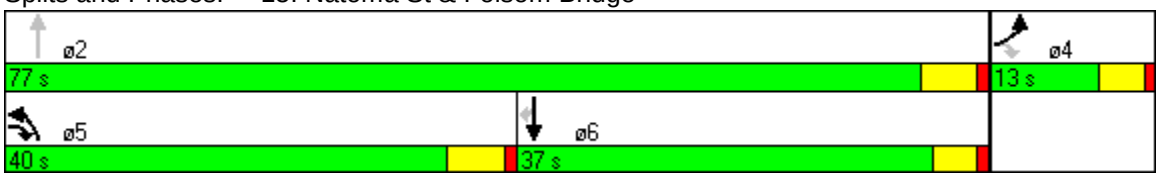
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	3539	1583
Volume (vph)	300	870	1100	1300	1180	220
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	316	916	1158	1368	1242	232
RTOR Reduction (vph)	0	5	0	0	0	147
Lane Group Flow (vph)	316	911	1158	1368	1242	85
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	8.5	43.0	34.5	71.3	32.3	32.3
Effective Green, g (s)	9.0	45.0	36.0	72.8	32.8	32.8
Actuated g/C Ratio	0.10	0.50	0.40	0.81	0.37	0.37
Clearance Time (s)	4.5	5.5	5.5	5.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	3.0	2.0	2.0
Lane Grp Cap (vph)	344	864	1376	2869	1293	578
v/s Ratio Prot	0.09	c0.42	0.34		c0.35	
v/s Ratio Perm		0.15		0.39		0.05
v/c Ratio	0.92	1.05	0.84	0.48	0.96	0.15
Uniform Delay, d1	40.0	22.4	24.3	2.6	27.9	19.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	28.0	46.0	4.8	0.1	16.4	0.0
Delay (s)	68.1	68.4	29.2	2.7	44.2	19.2
Level of Service	E	E	C	A	D	B
Approach Delay (s)	68.3			14.9	40.3	
Approach LOS	E			B	D	

Intersection Summary			
HCM Average Control Delay	34.6	HCM Level of Service	C
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	89.8	Sum of lost time (s)	8.0
Intersection Capacity Utilization	93.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	None	None	None	None
Maximum Split (s)	77	13	40	37
Maximum Split (%)	85.6%	14.4%	44.4%	41.1%
Minimum Split (s)	12.5	6.5	12.5	26.5
Yellow Time (s)	4.5	3.5	4.5	3.5
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	7	2	7	2
Vehicle Extension (s)	3	2	3	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	77	0	40
End Time (s)	77	0	40	77
Yield/Force Off (s)	71.5	85.5	34.5	72.5
Yield/Force Off 170(s)	71.5	85.5	34.5	57.5
Local Start Time (s)	50	37	50	0
Local Yield (s)	31.5	45.5	84.5	32.5
Local Yield 170(s)	31.5	45.5	84.5	17.5

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 15: Natoma St & Folsom Bridge



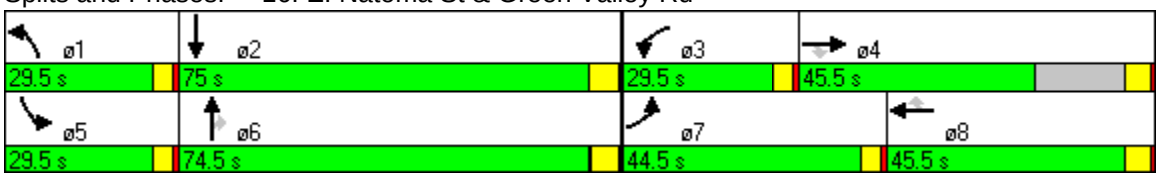
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Volume (vph)	820	950	50	390	900	50	70	190	160	150	910	1380
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	863	1000	53	411	947	53	74	200	168	158	958	1453
RTOR Reduction (vph)	0	0	24	0	0	20	0	0	133	0	0	0
Lane Group Flow (vph)	863	1000	29	411	947	33	74	200	35	158	958	1453
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	40.3	59.3	59.3	21.3	40.3	40.3	6.2	27.9	27.9	10.7	31.9	139.2
Effective Green, g (s)	40.8	60.8	60.8	21.8	41.8	41.8	6.7	29.4	29.4	11.2	33.9	139.2
Actuated g/C Ratio	0.29	0.44	0.44	0.16	0.30	0.30	0.05	0.21	0.21	0.08	0.24	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	1006	1546	691	538	1063	475	165	1074	334	276	1238	1583
v/s Ratio Prot	0.25	0.28		0.12	0.27		0.02	0.04		0.05	0.19	
v/s Ratio Perm			0.02			0.02			0.02			c0.92
v/c Ratio	0.86	0.65	0.04	0.76	0.89	0.07	0.45	0.19	0.11	0.57	0.77	0.92
Uniform Delay, d1	46.5	30.8	22.5	56.2	46.5	34.8	64.5	45.1	44.3	61.7	49.1	0.0
Progression 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
Incremental Delay, d2	7.1	1.1	0.0	5.8	10.0	0.1	0.7	0.1	0.2	1.8	3.2	10.0
Delay (s)	53.6	31.8	22.5	62.0	56.5	34.9	65.2	45.2	44.5	63.5	52.3	10.0
Level of Service	D	C	C	E	E	C	E	D	D	E	D	B
Approach Delay (s)		41.4			57.3			48.3			29.1	
Approach LOS		D			E			D			C	

Intersection Summary			
HCM Average Control Delay	40.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	139.2	Sum of lost time (s)	0.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	125

Splits and Phases: 16: E. Natoma St & Green Valley Rd



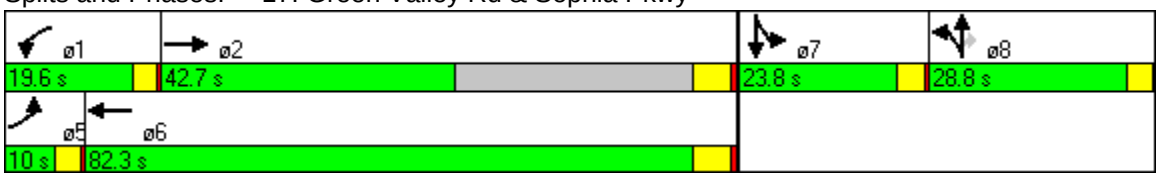
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)	1770	3499		1770	3537		1681	1694	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)	1770	3499		1770	3537		1681	1694	1583		1750	
Volume (vph)	10	970	80	210	2270	10	160	10	100	10	10	10
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	10	1000	82	216	2340	10	165	10	103	10	10	10
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	92	0	10	0
Lane Group Flow (vph)	10	1079	0	216	2350	0	85	90	11	0	20	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	5.4	66.6		16.2	77.4		12.6	12.6	12.6		4.6	
Effective Green, g (s)	5.0	68.3		15.8	79.1		12.4	12.4	12.4		4.4	
Actuated g/C Ratio	0.04	0.58		0.14	0.68		0.11	0.11	0.11		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	76	2044		239	2393		178	180	168		66	
v/s Ratio Prot	0.01	0.31		c0.12	c0.66		0.05	c0.05			c0.01	
v/s Ratio Perm									0.01			
v/c Ratio	0.13	0.53		0.90	0.98		0.48	0.50	0.07		0.31	
Uniform Delay, d1	53.9	14.6		49.8	18.2		49.2	49.3	47.0		54.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.4	0.3		33.2	14.4		2.1	2.3	0.2		2.8	
Delay (s)	54.3	14.9		83.0	32.6		51.3	51.6	47.2		57.5	
Level of Service	D	B		F	C		D	D	D		E	
Approach Delay (s)		15.2			36.8			49.9			57.5	
Approach LOS		B			D			D			E	

Intersection Summary			
HCM Average Control Delay	31.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	116.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	87.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	42.7	10	82.3	23.8	28.8
Maximum Split (%)	13.5%	29.5%	6.9%	56.8%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	4.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	1	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	10	92.3	116.1
End Time (s)	19.6	92.3	10	92.3	116.1	0
Yield/Force Off (s)	16	86.6	6.4	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	6.4	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	135.3	72.7	96.5
Local Yield (s)	141.3	67	131.7	67	92.7	121.5
Local Yield 170(s)	141.3	67	131.7	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	140

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: JDG
Agency/Co.: Fehr & Peers
Date Performed: 6/3/2005
Analysis Time Period: AM Peak
Intersection: E. Natoma/Briggs Ranch
Jurisdiction: Folsom, California
Units: U. S. Customary
Analysis Year: 2025
Project ID: Folsom Bridge (RS05 2106)
East/West Street: E. Natoma St.
North/South Street: Briggs Ranch
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		950	10		1320	
Peak-Hour Factor, PHF		0.95	0.95		0.95	
Hourly Flow Rate, HFR		1000	10		1389	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0		2	
Configuration		T	TR		T	
Upstream Signal?		No			Yes	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			220			
Peak Hour Factor, PHF			0.95			
Hourly Flow Rate, HFR			231			
Percent Heavy Vehicles			0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes			1			
Configuration			R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config					R			
v (vph)					231			
C(m) (vph)					518			
v/c					0.45			
95% queue length					2.27			
Control Delay					17.4			
LOS					C			
Approach Delay				17.4				
Approach LOS				C				

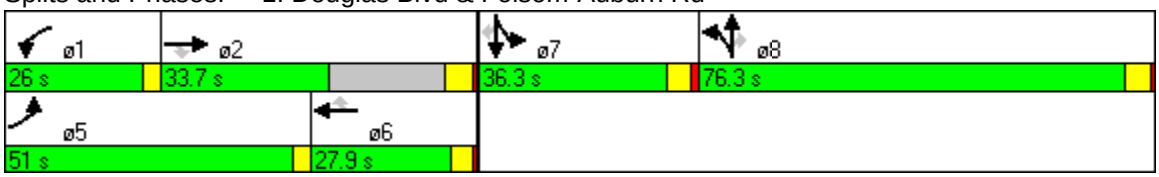
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.97	1.00	1.00	0.95	1.00	1.00	0.97	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1533	1770	3539	1497	3433	1863	1528	1770	3539	1550
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1533	1770	3539	1497	3433	1863	1528	1770	3539	1550
Volume (vph)	450	450	1190	130	350	90	1270	660	110	180	710	320
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	469	469	1240	135	365	94	1323	688	115	188	740	333
RTOR Reduction (vph)	0	0	478	0	0	83	0	0	71	0	0	144
Lane Group Flow (vph)	469	469	762	135	365	11	1323	688	44	188	740	189
Confl. Peds. (#/hr)			7			3			9			
Confl. Bikes (#/hr)			3			7						7
Turn Type	Prot		Perm	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			2			6			8			7
Actuated Green, G (s)	48.0	51.3	51.3	17.3	21.4	21.4	71.0	71.0	71.0	31.0	31.0	31.0
Effective Green, g (s)	47.0	53.0	53.0	16.3	22.3	22.3	72.3	72.3	72.3	32.3	32.3	32.3
Actuated g/C Ratio	0.25	0.28	0.28	0.09	0.12	0.12	0.38	0.38	0.38	0.17	0.17	0.17
Clearance Time (s)	3.0	5.7	5.7	3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (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
Lane Grp Cap (vph)	438	988	428	152	416	176	1307	709	582	301	602	264
v/s Ratio Prot	c0.27	0.13		0.08	0.10		c0.39	0.37		0.11	c0.21	
v/s Ratio Perm			c0.50			0.01			0.03			0.12
v/c Ratio	1.07	0.47	1.78	0.89	0.88	0.06	1.01	0.97	0.08	0.62	1.23	0.71
Uniform Delay, d1	71.4	56.9	68.4	85.9	82.5	74.5	58.8	57.7	37.5	73.2	78.8	74.4
Progression 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
Incremental Delay, d2	63.2	0.1	360.6	40.7	17.9	0.1	28.0	26.4	0.0	2.9	117.3	7.4
Delay (s)	134.6	57.0	429.0	126.6	100.4	74.6	86.8	84.1	37.5	76.1	196.1	81.9
Level of Service	F	E	F	F	F	E	F	F	D	E	F	F
Approach Delay (s)		285.5			102.3			83.2			148.0	
Approach LOS		F			F			F			F	

Intersection Summary			
HCM Average Control Delay	169.9	HCM Level of Service	F
HCM Volume to Capacity ratio	1.30		
Actuated Cycle Length (s)	189.9	Sum of lost time (s)	16.0
Intersection Capacity Utilization	111.3%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	26	33.7	51	27.9	36.3	76.3
Maximum Split (%)	13.6%	17.6%	26.6%	14.6%	19.0%	39.8%
Minimum Split (s)	6	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	0	51	78.9	115.2
End Time (s)	26	78.9	51	78.9	115.2	0
Yield/Force Off (s)	23	73.2	48	74	109.9	186.2
Yield/Force Off 170(s)	23	63.2	48	64	99.9	186.2
Local Start Time (s)	165.5	0	165.5	25	52.9	89.2
Local Yield (s)	188.5	47.2	22	48	83.9	160.2
Local Yield 170(s)	188.5	37.2	22	38	73.9	160.2

Intersection Summary	
Cycle Length	191.5
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0				4.0	4.0			4.0	4.0
Lane Util. Factor		1.00	1.00				1.00	0.95			0.95	1.00
Frpb, ped/bikes		1.00	0.98				1.00	1.00			1.00	1.00
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)		1770	1556				1770	3539			3539	1583
Flt Permitted		0.95	1.00				0.95	1.00			1.00	1.00
Satd. Flow (perm)		1770	1556				1770	3539			3539	1583
Volume (vph)	180	0	260	0	0	0	120	1960	0	0	1850	110
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	189	0	274	0	0	0	126	2063	0	0	1947	116
RTOR Reduction (vph)	0	0	229	0	0	0	0	0	0	0	0	17
Lane Group Flow (vph)	0	189	45	0	0	0	126	2063	0	0	1947	99
Confl. Bikes (#/hr)			4			14						
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		18.8	18.8				9.8	85.5			71.7	71.7
Effective Green, g (s)		18.8	18.8				9.8	87.0			73.2	73.2
Actuated g/C Ratio		0.17	0.17				0.09	0.76			0.64	0.64
Clearance Time (s)		4.0	4.0				4.0	5.5			5.5	5.5
Vehicle Extension (s)		3.0	3.0				1.0	2.5			2.5	2.5
Lane Grp Cap (vph)		292	257				152	2706			2276	1018
v/s Ratio Prot		c0.11					0.07	c0.58			c0.55	
v/s Ratio Perm			0.03									0.06
v/c Ratio		0.65	0.18				0.83	0.76			0.86	0.10
Uniform Delay, d1		44.4	40.8				51.2	7.6			16.1	7.7
Progression Factor		1.00	1.00				1.00	1.00			1.00	1.00
Incremental Delay, d2		4.9	0.3				28.4	1.3			3.3	0.0
Delay (s)		49.3	41.2				79.5	8.8			19.4	7.8
Level of Service		D	D				E	A			B	A
Approach Delay (s)		44.5			0.0			12.9			18.8	
Approach LOS		D			A			B			B	

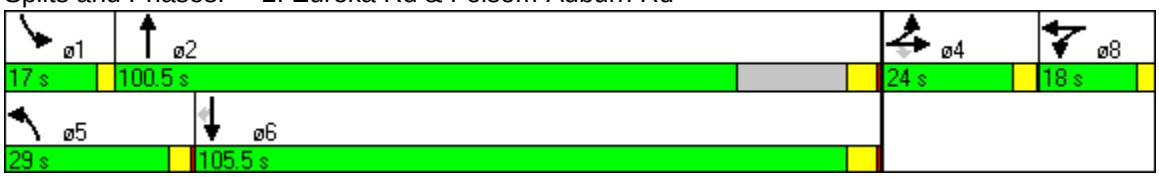
Intersection Summary			
HCM Average Control Delay	18.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	113.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	77.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	17	100.5	24	29	105.5	18
Maximum Split (%)	9.6%	56.9%	13.6%	16.4%	59.8%	10.2%
Minimum Split (s)	7	10.5	23	9	28.5	8
Yellow Time (s)	3	4.5	3.5	3.5	4.5	3
All-Red Time (s)	0	1	0.5	0.5	1	0
Minimum Initial (s)	4	5	5	5	10	5
Vehicle Extension (s)	1	2.5	3	1	2.5	3
Minimum Gap (s)	1	8	5	1	8	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)			5		5	
Flash Dont Walk (s)			14		18	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	17	134.5	0	29	158.5
End Time (s)	17	134.5	158.5	29	134.5	0
Yield/Force Off (s)	14	129	154.5	25	129	173.5
Yield/Force Off 170(s)	14	129	140.5	25	129	173.5
Local Start Time (s)	147.5	164.5	105.5	147.5	0	129.5
Local Yield (s)	161.5	100	125.5	172.5	100	144.5
Local Yield 170(s)	161.5	100	111.5	172.5	100	144.5

Intersection Summary	
Cycle Length	176.5
Control Type	Actuated-Uncoordinated
Natural Cycle	100

Splits and Phases: 2: Eureka Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00		1.00		1.00	0.95		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.94		0.97		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
Frt		1.00	0.85		0.95		1.00	1.00		1.00	1.00	0.85
Flt Protected		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1792	1481		1675		1770	3536		1770	3539	1548
Flt Permitted		0.96	1.00		0.98		0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1792	1481		1675		1770	3536		1770	3539	1548
Volume (vph)	40	10	160	20	10	20	60	2040	10	10	2030	30
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	42	11	168	21	11	21	63	2147	11	11	2137	32
RTOR Reduction (vph)	0	0	158	0	15	0	0	0	0	0	0	3
Lane Group Flow (vph)	0	53	10	0	38	0	63	2158	0	11	2137	29
Confl. Bikes (#/hr)			14			12			12			4
Turn Type	Split		Perm	Split			Prot			Prot		Perm
Protected Phases	4	4		3	3		5	2		1	6	
Permitted Phases			4									6
Actuated Green, G (s)		8.0	8.0		5.6		6.9	91.9		4.4	89.4	89.4
Effective Green, g (s)		7.4	7.4		5.0		5.9	93.6		3.4	91.1	91.1
Actuated g/C Ratio		0.06	0.06		0.04		0.05	0.75		0.03	0.73	0.73
Clearance Time (s)		3.4	3.4		3.4		3.0	5.7		3.0	5.7	5.7
Vehicle Extension (s)		1.0	1.0		0.5		1.0	1.0		1.0	1.0	1.0
Lane Grp Cap (vph)		106	87		67		83	2639		48	2571	1125
v/s Ratio Prot		c0.03			c0.02		c0.04	c0.61		0.01	0.60	
v/s Ratio Perm			0.01									0.02
v/c Ratio		0.50	0.11		0.56		0.76	0.82		0.23	0.83	0.03
Uniform Delay, d1		57.2	55.9		59.1		59.0	10.3		59.7	11.8	4.8
Progression Factor		1.00	1.00		1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2		1.4	0.2		6.3		29.1	2.0		0.9	2.3	0.0
Delay (s)		58.6	56.1		65.4		88.1	12.3		60.6	14.2	4.8
Level of Service		E	E		E		F	B		E	B	A
Approach Delay (s)		56.7			65.4			14.5			14.3	
Approach LOS		E			E			B			B	

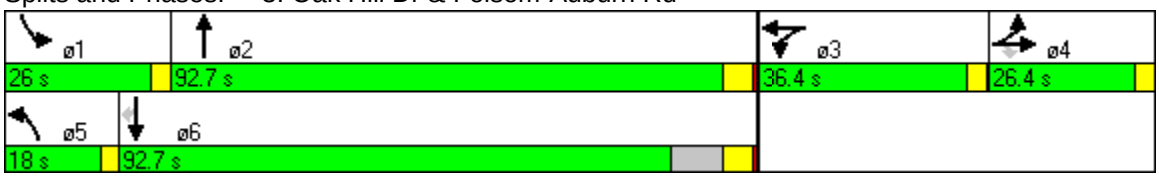
Intersection Summary			
HCM Average Control Delay	16.9	HCM Level of Service	B
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	125.4	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6
Movement	SBL	NBT	WBTL	EBTL	NBL	SBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	Min	Min	None	None	None	Min
Maximum Split (s)	26	92.7	36.4	26.4	18	92.7
Maximum Split (%)	14.3%	51.1%	20.1%	14.5%	9.9%	51.1%
Minimum Split (s)	6	17.7	16.4	20.4	6	18.7
Yellow Time (s)	3	4.7	3	3	3	4.7
All-Red Time (s)	0	1	0.4	0.4	0	1
Minimum Initial (s)	3	7	3	3	3	7
Vehicle Extension (s)	1	1	0.5	1	1	1
Minimum Gap (s)	1	1	0.5	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7	4	4		7
Flash Dont Walk (s)		5	9	13		6
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	26	118.7	155.1	0	18
End Time (s)	26	118.7	155.1	0	18	118.7
Yield/Force Off (s)	23	113	151.7	178.1	15	113
Yield/Force Off 170(s)	23	113	142.7	165.1	15	113
Local Start Time (s)	155.5	0	92.7	129.1	155.5	173.5
Local Yield (s)	178.5	87	125.7	152.1	170.5	87
Local Yield 170(s)	178.5	87	116.7	139.1	170.5	87

Intersection Summary	
Cycle Length	181.5
Control Type	Actuated-Uncoordinated
Natural Cycle	120

Splits and Phases: 3: Oak Hill Dr & Folsom-Auburn Rd



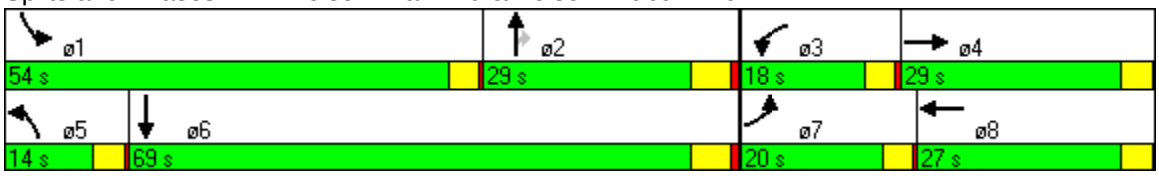
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.97	1.00	1.00	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.88		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1645		3433	1863	1583	1770	3539	1583	3433	3483	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1645		3433	1863	1583	1770	3539	1583	3433	3483	
Volume (vph)	100	20	70	330	20	1240	60	570	290	1370	510	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	21	74	347	21	1305	63	600	305	1442	537	63
RTOR Reduction (vph)	0	68	0	0	0	0	0	0	252	0	5	0
Lane Group Flow (vph)	105	27	0	347	21	1305	63	600	53	1442	595	0
Turn Type	Prot			Prot		Free	Prot		Perm	Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	18.9	11.1		14.0	6.2	130.0	7.1	21.2	21.2	66.2	80.3	
Effective Green, g (s)	18.9	11.1		14.0	6.2	130.0	7.1	22.7	22.7	66.2	81.8	
Actuated g/C Ratio	0.15	0.09		0.11	0.05	1.00	0.05	0.17	0.17	0.51	0.63	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	1.0	1.0		1.0	1.0		1.5	5.4	5.4	1.5	5.4	
Lane Grp Cap (vph)	257	140		370	89	1583	97	618	276	1748	2192	
v/s Ratio Prot	0.06	0.02		0.10	0.01		0.04	c0.17		0.42	0.17	
v/s Ratio Perm						c0.82			0.03			
v/c Ratio	0.41	0.20		0.94	0.24	0.82	0.65	0.97	0.19	0.82	0.27	
Uniform Delay, d1	50.5	55.3		57.6	59.6	0.0	60.2	53.3	45.8	27.0	10.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	0.96	1.00	
Incremental Delay, d2	0.4	0.2		30.6	0.5	5.0	10.7	29.7	1.6	2.5	0.2	
Delay (s)	50.9	55.5		88.2	60.1	5.0	70.9	83.0	47.4	28.6	11.0	
Level of Service	D	E		F	E	A	E	F	D	C	B	
Approach Delay (s)		53.1			23.0			71.0			23.4	
Approach LOS		D			C			E			C	

Intersection Summary			
HCM Average Control Delay	33.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Min	None	None	None	C-Min	None	None
Maximum Split (s)	54	29	18	29	14	69	20	27
Maximum Split (%)	41.5%	22.3%	13.8%	22.3%	10.8%	53.1%	15.4%	20.8%
Minimum Split (s)	6	27.5	12	29	6	21.5	6	12
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	2	7	8	2	2	7	2	8
Vehicle Extension (s)	1.5	5.4	1	1	1.5	5.4	1	1
Minimum Gap (s)	3	3.8	3	3	3	3.8	3	3
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		
Flash Dont Walk (s)		15		18		9		
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	30.5	84.5	113.5	1.5	30.5	44.5	113.5	3.5
End Time (s)	84.5	113.5	1.5	30.5	44.5	113.5	3.5	30.5
Yield/Force Off (s)	80.5	108	127.5	26.5	40.5	108	129.5	26.5
Yield/Force Off 170(s)	80.5	93	127.5	8.5	40.5	99	129.5	26.5
Local Start Time (s)	52.5	106.5	5.5	23.5	52.5	66.5	5.5	25.5
Local Yield (s)	102.5	0	19.5	48.5	62.5	0	21.5	48.5
Local Yield 170(s)	102.5	115	19.5	30.5	62.5	121	21.5	48.5

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Coordinated
Natural Cycle	130
Offset: 108 (83%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



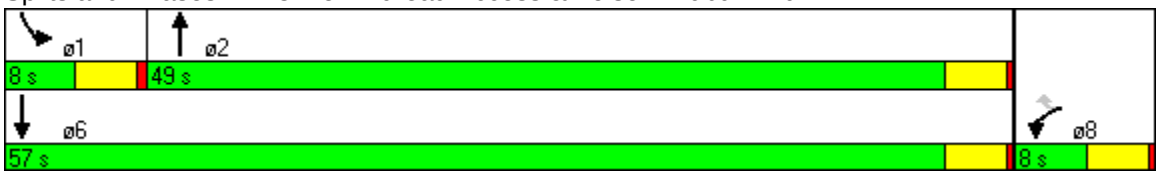
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3536		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3536		1770	3539
Volume (vph)	20	10	1900	10	10	1920
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	11	2000	11	11	2021
RTOR Reduction (vph)	0	11	0	0	0	0
Lane Group Flow (vph)	21	0	2011	0	11	2021
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	1.6	1.6	50.6		0.8	55.4
Effective Green, g (s)	1.6	1.6	50.6		0.8	55.4
Actuated g/C Ratio	0.02	0.02	0.78		0.01	0.85
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)	44	39	2753		22	3016
v/s Ratio Prot	c0.01		c0.57		0.01	c0.57
v/s Ratio Perm		0.00				
v/c Ratio	0.48	0.01	0.73		0.50	0.67
Uniform Delay, d1	31.3	30.9	3.7		31.9	1.7
Progression Factor	1.00	1.00	1.99		1.00	1.00
Incremental Delay, d2	7.9	0.1	0.9		16.8	1.2
Delay (s)	39.2	31.0	8.3		48.7	2.9
Level of Service	D	C	A		D	A
Approach Delay (s)	36.4		8.3			3.1
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	5.9	HCM Level of Service	A
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	65.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	8	49	57	8
Maximum Split (%)	12.3%	75.4%	87.7%	12.3%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	12	20	12	4
End Time (s)	20	4	4	12
Yield/Force Off (s)	16	0	0	8
Yield/Force Off 170(s)	16	0	0	8
Local Start Time (s)	12	20	12	4
Local Yield (s)	16	0	0	8
Local Yield 170(s)	16	0	0	8

Intersection Summary	
Cycle Length	65
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.91	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	5085	5062	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	5085	5062	
Volume (vph)	50	60	60	1860	1880	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	63	63	1958	1979	63
RTOR Reduction (vph)	0	62	0	0	2	0
Lane Group Flow (vph)	53	1	63	1958	2040	0
Turn Type		Perm	Prot			
Protected Phases	4		1	6	2	
Permitted Phases		4				
Actuated Green, G (s)	3.0	3.0	48.0	92.9	48.5	
Effective Green, g (s)	3.0	3.0	48.0	94.4	50.0	
Actuated g/C Ratio	0.02	0.02	0.37	0.73	0.38	
Clearance Time (s)	4.0	4.0	4.0	5.5	5.5	
Vehicle Extension (s)	1.0	1.0	1.0	4.7	5.4	
Lane Grp Cap (vph)	41	37	654	3692	1947	
v/s Ratio Prot	c0.03		c0.04	c0.39	c0.40	
v/s Ratio Perm		0.00				
v/c Ratio	1.29	0.04	0.10	0.53	1.05	
Uniform Delay, d1	63.5	62.1	26.8	7.9	40.0	
Progression Factor	1.00	1.00	1.39	0.72	0.97	
Incremental Delay, d2	238.7	0.2	0.0	0.5	32.1	
Delay (s)	302.2	62.3	37.4	6.2	70.8	
Level of Service	F	E	D	A	E	
Approach Delay (s)	171.9			7.2	70.8	
Approach LOS	F			A	E	

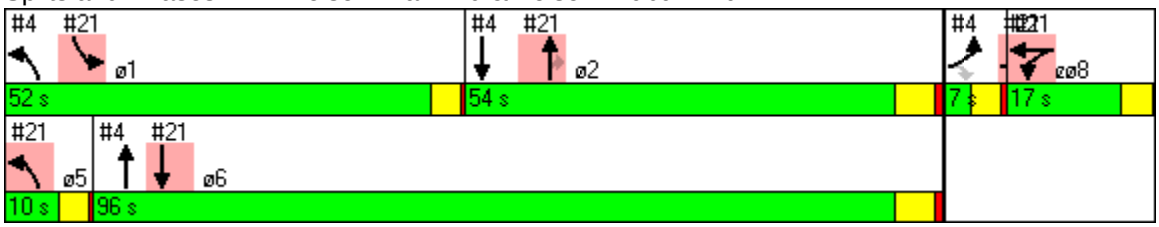
Intersection Summary			
HCM Average Control Delay	42.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	33.0
Intersection Capacity Utilization	54.3%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Node Number	4	4	4	21	4	21
Movement	NBL	SBT	EBL	NBL	NBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	52	54	7	10	96	17
Maximum Split (%)	40.0%	41.5%	5.4%	7.7%	73.8%	13.1%
Minimum Split (s)	5	21.5	6	6	12.5	8
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	1	7	2	2	7	4
Vehicle Extension (s)	1	5.4	1	1.5	4.7	3
Minimum Gap (s)	3	3.8	3	3	3.1	3
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7				
Flash Dont Walk (s)		9				
Dual Entry	No	No	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	4.5	56.5	110.5	4.5	14.5	117.5
End Time (s)	56.5	110.5	117.5	14.5	110.5	4.5
Yield/Force Off (s)	52.5	105	113.5	10.5	105	0.5
Yield/Force Off 170(s)	52.5	96	113.5	10.5	105	0.5
Local Start Time (s)	29.5	81.5	5.5	29.5	39.5	12.5
Local Yield (s)	77.5	0	8.5	35.5	0	25.5
Local Yield 170(s)	77.5	121	8.5	35.5	0	25.5

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Coordinated
Natural Cycle	130

Offset: 105 (81%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	0.88	1.00	0.95	1.00	0.97	0.95	
Frt	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1676		1681	1694	2787	1770	3539	1583	3433	3502	
Flt Permitted	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1676		1681	1694	2787	1770	3539	1583	3433	3502	
Volume (vph)	50	20	40	330	20	1240	30	630	290	1370	530	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	21	42	347	21	1305	32	663	305	1442	558	42
RTOR Reduction (vph)	0	41	0	0	0	0	0	0	158	0	4	0
Lane Group Flow (vph)	53	22	0	179	189	1305	32	663	147	1442	596	0
Turn Type	Split			Split		Free	Prot		Perm	Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	3.0	3.0		13.0	13.0	130.0	3.6	48.5	48.5	48.0	92.9	
Effective Green, g (s)	3.0	3.0		13.0	13.0	130.0	3.6	50.0	50.0	48.0	94.4	
Actuated g/C Ratio	0.02	0.02		0.10	0.10	1.00	0.03	0.38	0.38	0.37	0.73	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	1.0	1.0		3.0	3.0		1.5	5.4	5.4	1.0	4.7	
Lane Grp Cap (vph)	41	39		168	169	2787	49	1361	609	1268	2543	
v/s Ratio Prot	c0.03	0.01		0.11	c0.11		0.02	0.19		c0.42	0.17	
v/s Ratio Perm						c0.47			0.09			
v/c Ratio	1.29	0.56		1.07	1.12	0.47	0.65	0.49	0.24	1.14	0.23	
Uniform Delay, d1	63.5	62.9		58.5	58.5	0.0	62.6	30.3	27.1	41.0	5.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.75	0.55	
Incremental Delay, d2	238.7	10.6		87.9	104.5	0.6	21.3	1.2	0.9	62.8	0.0	
Delay (s)	302.2	73.5		146.4	163.0	0.6	83.9	31.5	28.1	134.5	3.2	
Level of Service	F	E		F	F	A	F	C	C	F	A	
Approach Delay (s)		178.0			34.5			32.2			96.0	
Approach LOS		F			C			C			F	

Intersection Summary			
HCM Average Control Delay	63.4	HCM Level of Service	E
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	82.8%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Alternative 3 - PM

DELAY

4. Folsom Bridge (Auto Spa)/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	53	302.2	16,017
EBR	63	62.3	3,925
NBL	63	37.4	2,356
NBT	1,958	6.2	12,140
SBT	1,979	70.8	140,113
SBR	63	70.8	4,460
total	4,179	550	179,011

Reported Delay

EBL	EBR	NBL	NBT	SBT	SBR
302.2	62.3	37.4	6.2	70.8	

Reported Adj Flow

EBL	EBR	NBL	NBT	SBT	SBR
53	63	63	1,958	1,979	63

21. Existing Folsom Dam Road/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	53	302.2	16,017
EBT	21	73.5	1,544
EBR	42	73.5	3,087
WBL	347	146.4	50,801
WBT	21	163.0	3,423
WBR	1,305	0.6	783
NBL	32	83.9	2,685
NBT	663	31.5	20,885
NBR	305	28.1	8,571
SBL	1,442	134.5	193,949
SBT	558	3.2	1,786
SBR	42	3.2	134
total	4,831	1,044	303,663

total Adj. Volume	9,010
Int. Delay	**53.6**

Reported Delay

EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
302.2	73.5	146.4	163	0.6	83.9	31.5	28.1	134.5	3.2

Reported Adj Flow

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
53	21	42	347	21	1,305	32	663	305	1442	558	42

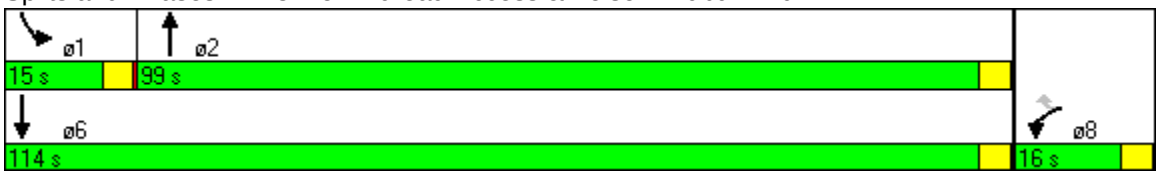
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3536		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3536		1770	3539
Volume (vph)	20	10	1900	10	10	1920
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	11	2000	11	11	2021
RTOR Reduction (vph)	0	11	0	0	0	0
Lane Group Flow (vph)	21	0	2011	0	11	2021
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	4.8	4.8	111.6		1.6	117.2
Effective Green, g (s)	4.8	4.8	111.6		1.6	117.2
Actuated g/C Ratio	0.04	0.04	0.86		0.01	0.90
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)	65	58	3036		22	3191
v/s Ratio Prot	c0.01		c0.57		0.01	c0.57
v/s Ratio Perm		0.00				
v/c Ratio	0.32	0.01	0.66		0.50	0.63
Uniform Delay, d1	61.0	60.3	3.0		63.8	1.5
Progression Factor	1.00	1.00	0.83		1.00	1.00
Incremental Delay, d2	2.9	0.0	1.0		16.8	1.0
Delay (s)	63.9	60.4	3.5		80.6	2.4
Level of Service	E	E	A		F	A
Approach Delay (s)	62.7		3.5			2.9
Approach LOS	E		A			A

Intersection Summary			
HCM Average Control Delay	3.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	130.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	15	99	114	16
Maximum Split (%)	11.5%	76.2%	87.7%	12.3%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	20	35	20	4
End Time (s)	35	4	4	20
Yield/Force Off (s)	31	0	0	16
Yield/Force Off 170(s)	31	0	0	16
Local Start Time (s)	20	35	20	4
Local Yield (s)	31	0	0	16
Local Yield 170(s)	31	0	0	16

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



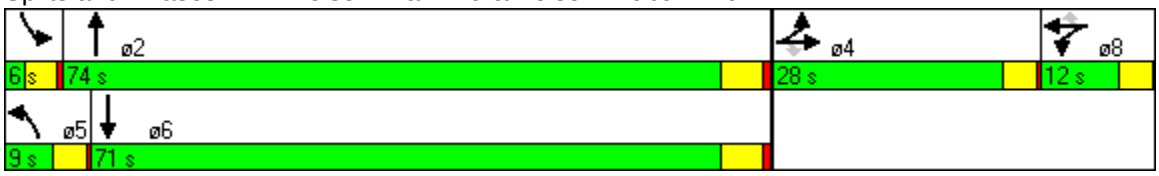
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0		4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00	1.00	1.00	0.95		1.00	0.95	
Frt		1.00	0.85		1.00	0.85	1.00	1.00		1.00	1.00	
Flt Protected		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)		1770	1583		1770	1583	1770	3536		1770	3523	
Flt Permitted		0.95	1.00		0.95	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)		1770	1583		1770	1583	1770	3536		1770	3523	
Volume (vph)	100	0	80	20	0	10	70	1800	10	10	1860	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	105	0	84	21	0	11	74	1895	11	11	1958	63
RTOR Reduction (vph)	0	0	76	0	0	11	0	0	0	0	1	0
Lane Group Flow (vph)	0	105	8	0	21	0	74	1906	0	11	2020	0
Turn Type	Split		Perm	Split		Perm	Prot			Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)		12.0	12.0		4.8	4.8	9.4	84.2		1.5	76.3	
Effective Green, g (s)		12.0	12.0		4.8	4.8	9.4	85.7		1.5	77.8	
Actuated g/C Ratio		0.10	0.10		0.04	0.04	0.08	0.71		0.01	0.65	
Clearance Time (s)		4.0	4.0		4.0	4.0	4.0	5.5		4.0	5.5	
Vehicle Extension (s)		1.0	1.0		1.0	1.0	1.5	5.4		1.5	5.4	
Lane Grp Cap (vph)		177	158		71	63	139	2525		22	2284	
v/s Ratio Prot		c0.06			c0.01		c0.04	c0.54		0.01	c0.57	
v/s Ratio Perm			0.01			0.00						
v/c Ratio		0.59	0.05		0.30	0.01	0.53	0.75		0.50	0.88	
Uniform Delay, d1		51.7	48.9		56.0	55.3	53.2	10.6		58.9	17.4	
Progression Factor		1.00	1.00		1.00	1.00	1.24	0.98		1.00	1.00	
Incremental Delay, d2		3.5	0.1		0.8	0.0	1.2	1.3		6.4	5.4	
Delay (s)		55.2	48.9		56.8	55.3	67.0	11.7		65.2	22.8	
Level of Service		E	D		E	E	E	B		E	C	
Approach Delay (s)		52.4			56.3			13.8			23.1	
Approach LOS		D			E			B			C	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	20.0
Intersection Capacity Utilization	77.0%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	6	74	28	9	71	12
Maximum Split (%)	5.0%	61.7%	23.3%	7.5%	59.2%	10.0%
Minimum Split (s)	6	23.5	28	6	23.5	12
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	2	7	2	2	7	8
Vehicle Extension (s)	1.5	5.4	1	1.5	5.4	1
Minimum Gap (s)	3	3.8	3	3	3.8	3
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7	7		7	
Flash Dont Walk (s)		11	17		11	
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	113.5	119.5	73.5	113.5	2.5	101.5
End Time (s)	119.5	73.5	101.5	2.5	73.5	113.5
Yield/Force Off (s)	115.5	68	97.5	118.5	68	109.5
Yield/Force Off 170(s)	115.5	57	80.5	118.5	57	109.5
Local Start Time (s)	45.5	51.5	5.5	45.5	54.5	33.5
Local Yield (s)	47.5	0	29.5	50.5	0	41.5
Local Yield 170(s)	47.5	109	12.5	50.5	109	41.5

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	120
Offset: 68 (57%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



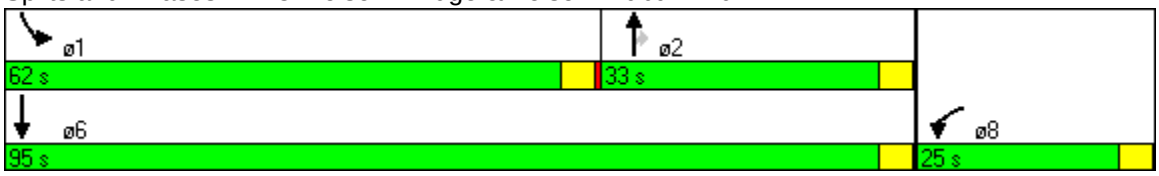
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.91	0.95	1.00	0.97	0.95
Frt	0.95	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.97	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	3321	1441	3539	1583	3433	3539
Flt Permitted	0.97	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	3321	1441	3539	1583	3433	3539
Volume (vph)	330	1260	660	290	1390	570
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	347	1326	695	305	1463	600
RTOR Reduction (vph)	58	0	0	221	0	0
Lane Group Flow (vph)	466	1149	695	84	1463	600
Turn Type		Free		Perm	Prot	
Protected Phases	8		2		1	6
Permitted Phases		Free		2		
Actuated Green, G (s)	19.8	120.0	32.6	32.6	55.6	92.2
Effective Green, g (s)	19.8	120.0	32.6	32.6	55.6	92.2
Actuated g/C Ratio	0.16	1.00	0.27	0.27	0.46	0.77
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)	548	1441	961	430	1591	2719
v/s Ratio Prot	0.14		0.20		c0.43	0.17
v/s Ratio Perm		c0.80		0.05		
v/c Ratio	0.85	0.80	0.72	0.20	0.92	0.22
Uniform Delay, d1	48.7	0.0	39.6	33.6	30.1	3.9
Progression Factor	1.00	1.00	1.00	1.00	0.46	0.90
Incremental Delay, d2	12.1	4.7	4.7	1.0	5.1	0.1
Delay (s)	60.8	4.7	44.3	34.6	19.0	3.6
Level of Service	E	A	D	C	B	A
Approach Delay (s)	22.2		41.4			14.5
Approach LOS	C		D			B

Intersection Summary			
HCM Average Control Delay	22.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.86		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	90.6%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	62	33	95	25
Maximum Split (%)	51.7%	27.5%	79.2%	20.8%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	29	91	29	4
End Time (s)	91	4	4	29
Yield/Force Off (s)	87	0	0	25
Yield/Force Off 170(s)	87	0	0	25
Local Start Time (s)	29	91	29	4
Local Yield (s)	87	0	0	25
Local Yield 170(s)	87	0	0	25

Intersection Summary	
Cycle Length	120
Control Type	Actuated-Coordinated
Natural Cycle	70
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: Folsom Bridge & Folsom-Auburn Rd



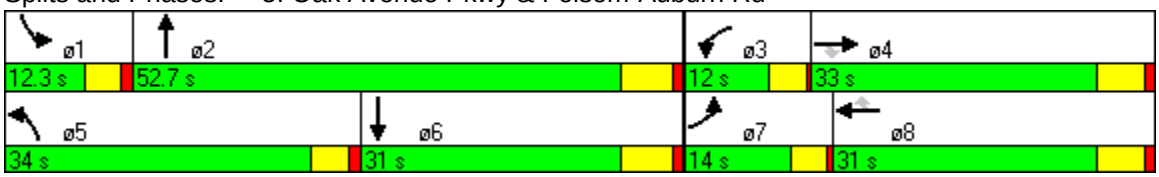
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frpb, ped/bikes	1.00	1.00	0.99	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	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3539	1560	1770	3539	1563	1770	3428		1770	3381	
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3539	1560	1770	3539	1563	1770	3428		1770	3381	
Volume (vph)	180	820	490	120	900	100	540	930	220	80	620	230
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	189	863	516	126	947	105	568	979	232	84	653	242
RTOR Reduction (vph)	0	0	366	0	0	76	0	18	0	0	34	0
Lane Group Flow (vph)	189	863	150	126	947	29	568	1193	0	84	861	0
Confl. Peds. (#/hr)									1			
Confl. Bikes (#/hr)			3			1			3			5
Turn Type	Prot		Perm	Prot		Perm	Prot			Prot		
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8						
Actuated Green, G (s)	10.0	27.3	27.3	8.0	25.3	25.3	29.3	49.0		6.1	25.8	
Effective Green, g (s)	10.0	29.0	29.0	8.0	27.0	27.0	30.0	51.2		6.8	28.0	
Actuated g/C Ratio	0.09	0.26	0.26	0.07	0.24	0.24	0.27	0.46		0.06	0.25	
Clearance Time (s)	4.0	5.7	5.7	4.0	5.7	5.7	4.7	6.2		4.7	6.2	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	2.0	3.8		2.0	3.8	
Lane Grp Cap (vph)	159	925	408	128	861	380	478	1581		108	853	
v/s Ratio Prot	c0.11	0.24		0.07	c0.27		c0.32	0.35		0.05	c0.25	
v/s Ratio Perm			0.10			0.02						
v/c Ratio	1.19	0.93	0.37	0.98	1.10	0.08	1.19	0.75		0.78	1.01	
Uniform Delay, d1	50.5	40.1	33.5	51.4	42.0	32.4	40.5	24.7		51.4	41.5	
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	131.1	15.8	0.6	74.2	61.7	0.1	104.1	2.2		26.7	33.0	
Delay (s)	181.6	55.8	34.1	125.7	103.7	32.5	144.6	26.9		78.1	74.5	
Level of Service	F	E	C	F	F	C	F	C		E	E	
Approach Delay (s)		63.8			99.7			64.5			74.8	
Approach LOS		E			F			E			E	

Intersection Summary			
HCM Average Control Delay	73.7	HCM Level of Service	E
HCM Volume to Capacity ratio	1.10		
Actuated Cycle Length (s)	111.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	102.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	12.3	52.7	12	33	34	31	14	31
Maximum Split (%)	11.2%	47.9%	10.9%	30.0%	30.9%	28.2%	12.7%	28.2%
Minimum Split (s)	6.7	13.2	8	30.7	6.7	13.2	8	27.7
Yellow Time (s)	3.5	5	3.5	4.5	3.5	5	3.5	4.5
All-Red Time (s)	1.2	1.2	0.5	1.2	1.2	1.2	0.5	1.2
Minimum Initial (s)	2	7	4	3	2	7	4	3
Vehicle Extension (s)	2	3.8	3	3	2	3.8	3	3
Minimum Gap (s)	0.2	2.4	3	0.2	0.2	2.4	3	0.2
Time Before Reduce (s)	0	10	0	0	0	10	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)				7				7
Flash Dont Walk (s)				18				15
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	12.3	65	77	0	34	65	79
End Time (s)	12.3	65	77	0	34	65	79	0
Yield/Force Off (s)	7.6	58.8	73	104.3	29.3	58.8	75	104.3
Yield/Force Off 170(s)	7.6	58.8	73	86.3	29.3	58.8	75	89.3
Local Start Time (s)	76	88.3	31	43	76	0	31	45
Local Yield (s)	83.6	24.8	39	70.3	105.3	24.8	41	70.3
Local Yield 170(s)	83.6	24.8	39	52.3	105.3	24.8	41	55.3

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 5: Oak Avenue Pkwy & Folsom-Auburn Rd



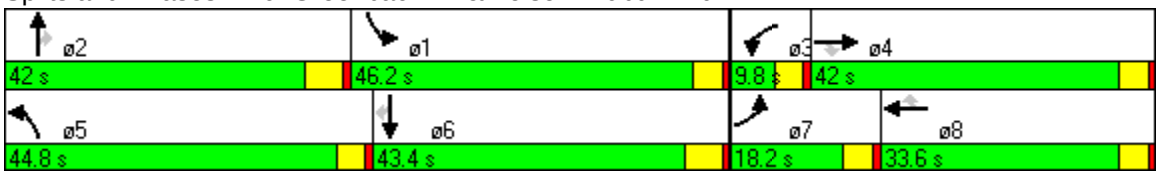
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	0.95	1.00	1.00	0.95	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1583	1770	3539	1583	3433	3539	1583	1770	3539	1583
Volume (vph)	220	640	520	10	790	560	1040	700	10	340	590	250
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	232	674	547	11	832	589	1095	737	11	358	621	263
RTOR Reduction (vph)	0	0	375	0	0	394	0	0	8	0	0	103
Lane Group Flow (vph)	232	674	172	11	832	195	1095	737	3	358	621	160
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases			4			8			2			6
Actuated Green, G (s)	13.7	43.4	43.4	2.1	31.8	31.8	40.3	33.8	33.8	41.7	35.2	35.2
Effective Green, g (s)	14.2	43.9	43.9	2.6	32.3	32.3	40.8	35.3	35.3	42.2	36.7	36.7
Actuated g/C Ratio	0.10	0.31	0.31	0.02	0.23	0.23	0.29	0.25	0.25	0.30	0.26	0.26
Clearance Time (s)	4.5	4.5	4.5	4.5	4.5	4.5	4.5	5.5	5.5	4.5	5.5	5.5
Vehicle Extension (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	5.1	5.1	2.0	5.1	5.1
Lane Grp Cap (vph)	180	1110	496	33	816	365	1000	892	399	534	928	415
v/s Ratio Prot	c0.13	0.19		0.01	c0.24		c0.32	0.21		c0.20	0.18	
v/s Ratio Perm			0.11			0.12			0.00			0.10
v/c Ratio	1.29	0.61	0.35	0.33	1.02	0.53	1.10	0.83	0.01	0.67	0.67	0.39
Uniform Delay, d1	62.9	40.7	37.0	67.8	53.8	47.3	49.6	49.5	39.2	42.8	46.2	42.4
Progression 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
Incremental Delay, d2	165.1	0.6	0.2	2.2	36.5	0.8	58.0	8.6	0.0	2.6	3.8	2.7
Delay (s)	228.0	41.4	37.1	70.0	90.4	48.0	107.6	58.1	39.3	45.4	50.0	45.1
Level of Service	F	D	D	E	F	D	F	E	D	D	D	D
Approach Delay (s)		69.6			72.8			87.4			47.7	
Approach LOS		E			E			F			D	

Intersection Summary			
HCM Average Control Delay	71.3	HCM Level of Service	E
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	140.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	SBL	NBT	WBL	EBT	NBL	SBT	EBL	WBT
Lead/Lag	Lag	Lead	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	C-Max	None	None	None	C-Max	None	None
Maximum Split (s)	46.2	42	9.8	42	44.8	43.4	18.2	33.6
Maximum Split (%)	33.0%	30.0%	7.0%	30.0%	32.0%	31.0%	13.0%	24.0%
Minimum Split (s)	6.5	35.5	6.5	36.5	6.5	31.5	6.5	36.5
Yellow Time (s)	3.5	4.5	3.5	3.5	3.5	4.5	3.5	3.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	2	2	7	2	2
Vehicle Extension (s)	2	5.1	2	2	2	5.1	2	2
Minimum Gap (s)	2	3.6	2	2	2	3.6	2	2
Time Before Reduce (s)	0	15	0	0	0	15	0	0
Time To Reduce (s)	0	20	0	0	0	20	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		23		25		19		25
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
End Time (s)	51.7	5.5	61.5	103.5	8.3	51.7	69.9	103.5
Yield/Force Off (s)	47.2	0	57	99	3.8	46.2	65.4	99
Yield/Force Off 170(s)	47.2	117	57	74	3.8	27.2	65.4	74
Local Start Time (s)	5.5	103.5	51.7	61.5	103.5	8.3	51.7	69.9
Local Yield (s)	47.2	0	57	99	3.8	46.2	65.4	99
Local Yield 170(s)	47.2	117	57	74	3.8	27.2	65.4	74

Intersection Summary	
Cycle Length	140
Control Type	Actuated-Coordinated
Natural Cycle	135
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 6: Greenback Ln & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0
Lane Util. Factor		1.00	1.00	0.95	0.95	1.00	1.00	0.91		1.00	0.95	1.00
Frpb, ped/bikes		1.00	0.98	1.00	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		1.00	1.00	1.00
Frt		1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	1.00	0.85
Flt Protected		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)		1831	1556	1681	1704	1562	1770	4933		1770	3539	1546
Flt Permitted		0.98	1.00	0.95	0.96	1.00	0.95	1.00		0.95	1.00	1.00
Satd. Flow (perm)		1831	1556	1681	1704	1562	1770	4933		1770	3539	1546
Volume (vph)	10	20	10	230	30	380	20	1360	290	360	740	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	21	11	242	32	400	21	1432	305	379	779	21
RTOR Reduction (vph)	0	0	11	0	0	159	0	15	0	0	0	7
Lane Group Flow (vph)	0	32	0	133	141	241	21	1722	0	379	779	14
Confl. Bikes (#/hr)			1			1			1			6
Turn Type	Split		Perm	Split		Perm	Prot			Prot		Perm
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases			4			8						6
Actuated Green, G (s)		5.8	5.8	26.3	26.3	26.3	3.9	63.6		37.1	96.8	96.8
Effective Green, g (s)		6.3	6.3	26.8	26.8	26.8	4.4	66.1		37.6	99.3	99.3
Actuated g/C Ratio		0.04	0.04	0.18	0.18	0.18	0.03	0.43		0.25	0.65	0.65
Clearance Time (s)		4.5	4.5	4.5	4.5	4.5	4.5	6.5		4.5	6.5	6.5
Vehicle Extension (s)		2.0	2.0	2.0	2.0	2.0	2.0	4.6		2.0	5.1	5.1
Lane Grp Cap (vph)		75	64	295	299	274	51	2134		436	2300	1005
v/s Ratio Prot		c0.02		0.08	0.08		0.01	c0.35		c0.21	0.22	
v/s Ratio Perm			0.00			c0.15						0.01
v/c Ratio		0.43	0.01	0.45	0.47	0.88	0.41	0.81		0.87	0.34	0.01
Uniform Delay, d1		71.5	70.3	56.4	56.6	61.4	72.9	37.8		55.2	12.0	9.4
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		1.4	0.0	0.4	0.4	25.0	2.0	2.6		16.1	0.2	0.0
Delay (s)		72.9	70.3	56.8	57.1	86.5	74.9	40.4		71.4	12.2	9.5
Level of Service		E	E	E	E	F	E	D		E	B	A
Approach Delay (s)		72.2			74.5			40.8			31.2	
Approach LOS		E			E			D			C	

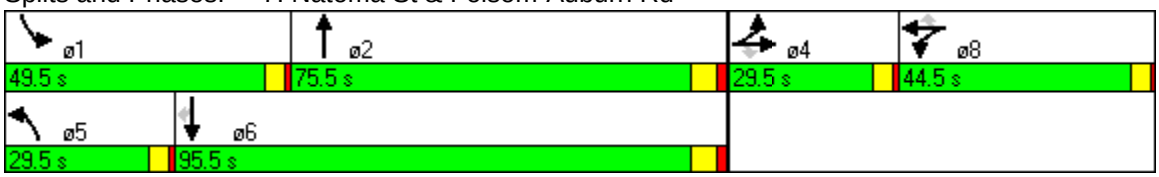
Intersection Summary			
HCM Average Control Delay	44.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	152.8	Sum of lost time (s)	16.0
Intersection Capacity Utilization	76.5%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	4	5	6	8
Movement	SBL	NBT	EBTL	NBL	SBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	Min	None	None	Min	None
Maximum Split (s)	49.5	75.5	29.5	29.5	95.5	44.5
Maximum Split (%)	24.9%	37.9%	14.8%	14.8%	48.0%	22.4%
Minimum Split (s)	6.5	31.5	6.5	6.5	21.5	34.5
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	1	2	1	1	2	1
Minimum Initial (s)	2	7	2	2	7	2
Vehicle Extension (s)	2	4.6	2	2	5.1	2
Minimum Gap (s)	2	3	2	2	3.6	2
Time Before Reduce (s)	0	15	0	0	15	0
Time To Reduce (s)	0	20	0	0	20	0
Walk Time (s)		7			7	7
Flash Dont Walk (s)		18			8	23
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	49.5	125	0	29.5	154.5
End Time (s)	49.5	125	154.5	29.5	125	0
Yield/Force Off (s)	45	118.5	150	25	118.5	194.5
Yield/Force Off 170(s)	45	118.5	150	25	118.5	171.5
Local Start Time (s)	80.5	130	6.5	80.5	110	36
Local Yield (s)	125.5	0	31.5	105.5	0	76
Local Yield 170(s)	125.5	0	31.5	105.5	0	53

Intersection Summary	
Cycle Length	199
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 7: Natoma St & Folsom-Auburn Rd



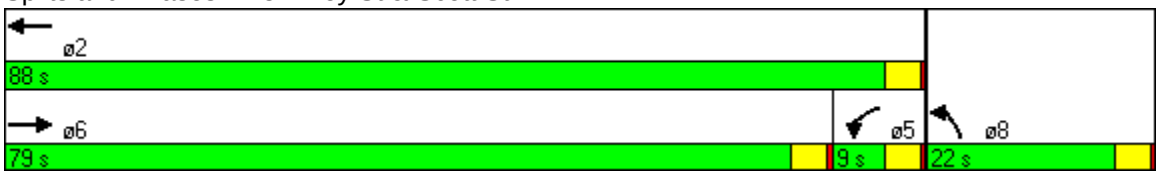
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0		4.0	4.0	4.0	
Lane Util. Factor	0.95		1.00	1.00	1.00	
Frt	1.00		1.00	1.00	0.93	
Flt Protected	1.00		0.95	1.00	0.98	
Satd. Flow (prot)	3531		1770	1863	1695	
Flt Permitted	1.00		0.95	1.00	0.98	
Satd. Flow (perm)	3531		1770	1863	1695	
Volume (vph)	1340	20	20	970	20	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1411	21	21	1021	21	21
RTOR Reduction (vph)	1	0	0	0	20	0
Lane Group Flow (vph)	1431	0	21	1021	22	0
Turn Type			Prot			
Protected Phases	6		5	2	8	
Permitted Phases						
Actuated Green, G (s)	86.5		5.0	95.5	6.5	
Effective Green, g (s)	86.5		5.0	95.5	6.5	
Actuated g/C Ratio	0.79		0.05	0.87	0.06	
Clearance Time (s)	4.0		4.0	4.0	4.0	
Vehicle Extension (s)	2.8		2.4	2.8	3.0	
Lane Grp Cap (vph)	2777		80	1617	100	
v/s Ratio Prot	0.41		0.01	c0.55	c0.01	
v/s Ratio Perm						
v/c Ratio	0.52		0.26	0.63	0.22	
Uniform Delay, d1	4.2		50.7	2.1	49.3	
Progression Factor	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.7		1.1	1.9	1.1	
Delay (s)	4.9		51.9	4.0	50.5	
Level of Service	A		D	A	D	
Approach Delay (s)	4.9			5.0	50.5	
Approach LOS	A			A	D	

Intersection Summary			
HCM Average Control Delay	5.7	HCM Level of Service	A
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	5	6	8
Movement	WBT	WBL	EBT	NBL
Lead/Lag		Lag	Lead	
Lead-Lag Optimize				
Recall Mode	C-Max	Min	C-Max	None
Maximum Split (s)	88	9	79	22
Maximum Split (%)	80.0%	8.2%	71.8%	20.0%
Minimum Split (s)	21	8	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2.4	2.8	3
Minimum Gap (s)	2.4	2.4	2.4	3
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)			7	5
Flash Dont Walk (s)			10	13
Dual Entry	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	35	4	35	13
End Time (s)	13	13	4	35
Yield/Force Off (s)	9	9	0	31
Yield/Force Off 170(s)	9	9	100	18
Local Start Time (s)	35	4	35	13
Local Yield (s)	9	9	0	31
Local Yield 170(s)	9	9	100	18

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	65
Offset: 0 (0%), Referenced to phase 2:WBT and 6:EBT, Start of Yellow	

Splits and Phases: 8: Riley St & Scott St



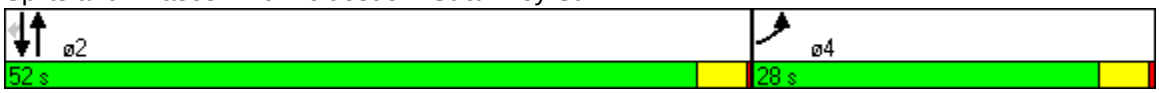
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0	4.0	4.0
Lane Util. Factor	0.97			0.95	1.00	1.00
Frt	0.98			1.00	1.00	0.85
Flt Protected	0.96			1.00	1.00	1.00
Satd. Flow (prot)	3402			3539	1863	1583
Flt Permitted	0.96			1.00	1.00	1.00
Satd. Flow (perm)	3402			3539	1863	1583
Volume (vph)	160	20	0	1200	950	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	168	21	0	1263	1000	42
RTOR Reduction (vph)	16	0	0	0	0	9
Lane Group Flow (vph)	173	0	0	1263	1000	33
Turn Type						Perm
Protected Phases	4			2	2	
Permitted Phases						2
Actuated Green, G (s)	9.9			62.1	62.1	62.1
Effective Green, g (s)	9.9			62.1	62.1	62.1
Actuated g/C Ratio	0.12			0.78	0.78	0.78
Clearance Time (s)	4.0			4.0	4.0	4.0
Vehicle Extension (s)	2.8			2.8	2.8	2.8
Lane Grp Cap (vph)	421			2747	1446	1229
v/s Ratio Prot	c0.05			0.36	c0.54	
v/s Ratio Perm						0.02
v/c Ratio	0.41			0.46	0.69	0.03
Uniform Delay, d1	32.4			3.1	4.3	2.0
Progression Factor	1.00			1.00	1.00	1.00
Incremental Delay, d2	0.6			0.6	2.7	0.0
Delay (s)	32.9			3.7	7.1	2.1
Level of Service	C			A	A	A
Approach Delay (s)	32.9			3.7	6.9	
Approach LOS	C			A	A	

Intersection Summary			
HCM Average Control Delay	7.2	HCM Level of Service	A
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4
Movement	NBSB	EBL
Lead/Lag		
Lead-Lag Optimize		
Recall Mode	C-Max	None
Maximum Split (s)	52	28
Maximum Split (%)	65.0%	35.0%
Minimum Split (s)	19	21
Yellow Time (s)	3.5	3.5
All-Red Time (s)	0.5	0.5
Minimum Initial (s)	7	5
Vehicle Extension (s)	2.8	2.8
Minimum Gap (s)	2.4	2.4
Time Before Reduce (s)	18	18
Time To Reduce (s)	25	25
Walk Time (s)	7	7
Flash Dont Walk (s)	8	10
Dual Entry	No	No
Inhibit Max	Yes	Yes
Start Time (s)	46	18
End Time (s)	18	46
Yield/Force Off (s)	14	42
Yield/Force Off 170(s)	6	32
Local Start Time (s)	32	4
Local Yield (s)	0	28
Local Yield 170(s)	72	18

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 14 (18%), Referenced to phase 2:NBSB, Start of Yellow	

Splits and Phases: 9: Leidesdorff St & Riley St



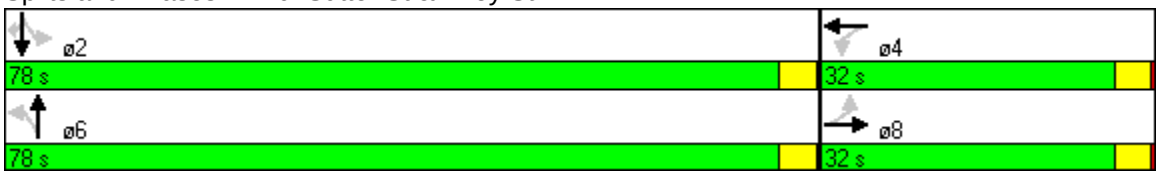
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1610	1900	1900	1900	1900
Grade (%)		0%			0%			-5%			5%	
Total Lost time (s)		4.0			4.0			4.0			4.0	4.0
Lane Util. Factor		1.00			1.00			1.00			1.00	1.00
Frpb, ped/bikes		0.98			0.98			1.00			1.00	0.98
Flpb, ped/bikes		1.00			1.00			1.00			1.00	1.00
Frt		0.97			0.96			1.00			1.00	0.85
Flt Protected		0.99			0.98			1.00			1.00	1.00
Satd. Flow (prot)		1744			1720			1451			1815	1512
Flt Permitted		0.91			0.72			0.99			0.98	1.00
Satd. Flow (perm)		1603			1264			1438			1788	1512
Volume (vph)	30	90	40	40	40	40	10	1130	20	10	930	30
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	95	42	42	42	42	11	1189	21	11	979	32
RTOR Reduction (vph)	0	13	0	0	19	0	0	0	0	0	0	7
Lane Group Flow (vph)	0	156	0	0	107	0	0	1221	0	0	990	25
Confl. Peds. (#/hr)			23			25						
Confl. Bikes (#/hr)									18			1
Parking (#/hr)							0	0	0			
Turn Type	Perm			Perm			Perm			Perm		Perm
Protected Phases		8			4			6			2	
Permitted Phases	8			4			6			2		2
Actuated Green, G (s)		16.5			16.5			85.5			85.5	85.5
Effective Green, g (s)		16.5			16.5			85.5			85.5	85.5
Actuated g/C Ratio		0.15			0.15			0.78			0.78	0.78
Clearance Time (s)		4.0			4.0			4.0			4.0	4.0
Vehicle Extension (s)		2.0			2.0			2.8			2.8	2.8
Lane Grp Cap (vph)		240			190			1118			1390	1175
v/s Ratio Prot												
v/s Ratio Perm		c0.10			0.08			c0.85			0.55	0.02
v/c Ratio		0.65			0.56			1.09			0.71	0.02
Uniform Delay, d1		44.0			43.4			12.3			6.1	2.8
Progression Factor		1.00			1.00			1.00			1.00	1.00
Incremental Delay, d2		4.8			2.3			55.5			3.1	0.0
Delay (s)		48.8			45.7			67.8			9.2	2.8
Level of Service		D			D			E			A	A
Approach Delay (s)		48.8			45.7			67.8			9.0	
Approach LOS		D			D			E			A	

Intersection Summary			
HCM Average Control Delay	41.8	HCM Level of Service	D
HCM Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	103.0%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	6	8
Movement	SBTL	WBTL	NBTL	EBTL
Lead/Lag				
Lead-Lag Optimize				
Recall Mode	C-Max	None	C-Max	None
Maximum Split (s)	78	32	78	32
Maximum Split (%)	70.9%	29.1%	70.9%	29.1%
Minimum Split (s)	22	25	21	22
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	7	4	7	4
Vehicle Extension (s)	2.8	2	2.8	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)	7	7	7	7
Flash Dont Walk (s)	11	14	10	11
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	46	14	46	14
End Time (s)	14	46	14	46
Yield/Force Off (s)	10	42	10	42
Yield/Force Off 170(s)	109	28	0	31
Local Start Time (s)	36	4	36	4
Local Yield (s)	0	32	0	32
Local Yield 170(s)	99	18	100	21

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Coordinated
Natural Cycle	150
Offset: 10 (9%), Referenced to phase 2:SBTL and 6:NBTL, Start of Yellow	

Splits and Phases: 10: Sutter St & Riley St



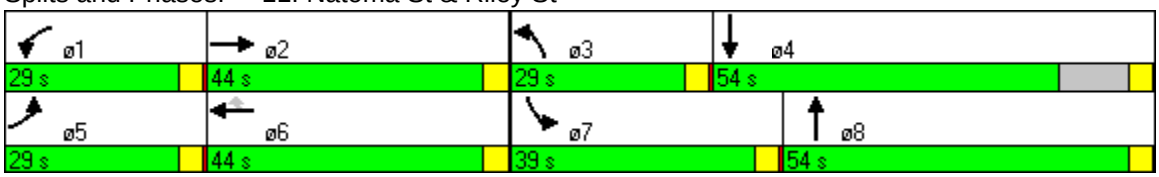
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1560	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	1.00	0.85	1.00	1.00		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1815		1770	1863	1583	1770	1526		1770	1844	
Flt Permitted	0.95	1.00		0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1815		1770	1863	1583	1770	1526		1770	1844	
Volume (vph)	20	540	110	100	410	480	40	660	10	560	420	30
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	568	116	105	432	505	42	695	11	589	442	32
RTOR Reduction (vph)	0	4	0	0	0	342	0	0	0	0	1	0
Lane Group Flow (vph)	21	680	0	105	432	163	42	706	0	589	473	0
Turn Type	Prot			Prot		Perm	Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases						6						
Actuated Green, G (s)	4.4	41.6		13.5	50.7	50.7	7.1	50.9		35.0	78.8	
Effective Green, g (s)	4.4	41.6		13.5	50.7	50.7	7.1	50.9		35.0	78.8	
Actuated g/C Ratio	0.03	0.26		0.09	0.32	0.32	0.05	0.32		0.22	0.50	
Clearance Time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Vehicle Extension (s)	2.0	4.1		2.0	4.1	4.1	2.0	4.1		2.0	4.1	
Lane Grp Cap (vph)	50	481		152	602	511	80	495		395	926	
v/s Ratio Prot	0.01	c0.37		c0.06	0.23		0.02	c0.46		c0.33	0.26	
v/s Ratio Perm						0.10						
v/c Ratio	0.42	1.41		0.69	0.72	0.32	0.52	1.43		1.49	0.51	
Uniform Delay, d1	75.0	57.7		69.7	46.8	40.1	73.3	53.0		61.0	26.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.1	197.8		10.4	4.4	0.5	2.8	203.3		234.1	0.7	
Delay (s)	77.1	255.5		80.1	51.3	40.6	76.1	256.3		295.1	26.9	
Level of Service	E	F		F	D	D	E	F		F	C	
Approach Delay (s)		250.2			49.0			246.2			175.5	
Approach LOS		F			D			F			F	

Intersection Summary			
HCM Average Control Delay	168.1	HCM Level of Service	F
HCM Volume to Capacity ratio	1.37		
Actuated Cycle Length (s)	157.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	128.0%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	None	None	Min	None	None	None	Min
Maximum Split (s)	29	44	29	54	29	44	39	54
Maximum Split (%)	17.5%	26.5%	17.5%	32.5%	17.5%	26.5%	23.5%	32.5%
Minimum Split (s)	6	23	6	23	6	22	6	22
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	4.1	2	4.1	2	4.1	2	4.1
Minimum Gap (s)	2	2.4	2	3	2	2.4	2	3
Time Before Reduce (s)	0	18	0	18	0	18	0	18
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		12		11		11
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	73	102	0	29	73	112
End Time (s)	29	73	102	0	29	73	112	0
Yield/Force Off (s)	25	69	98	162	25	69	108	162
Yield/Force Off 170(s)	25	57	98	162	25	58	108	162
Local Start Time (s)	137	0	44	73	137	0	44	83
Local Yield (s)	162	40	69	133	162	40	79	133
Local Yield 170(s)	162	28	69	133	162	29	79	133

Intersection Summary	
Cycle Length	166
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 11: Natoma St & Riley St



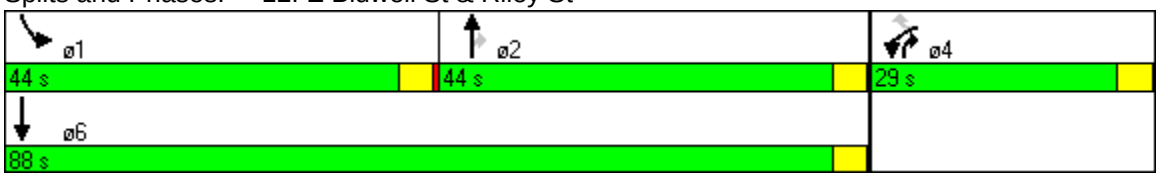
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	0.95	1.00	1.00	1.00
Frpb, ped/bikes	1.00	0.97	1.00	0.99	1.00	1.00
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	0.85	1.00	0.85	1.00	1.00
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1770	1537	3539	1570	1770	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	1770	1537	3539	1570	1770	1863
Volume (vph)	210	340	360	260	200	410
Peak-hour factor, PHF	0.98	0.98	0.98	0.98	0.98	0.98
Adj. Flow (vph)	214	347	367	265	204	418
RTOR Reduction (vph)	0	269	0	149	0	0
Lane Group Flow (vph)	214	78	367	116	204	418
Confl. Peds. (#/hr)		3		3		
Confl. Bikes (#/hr)		16		8		
Turn Type		Perm		pm+ov	Prot	
Protected Phases	4		2	4	1	6
Permitted Phases		4		2		
Actuated Green, G (s)	8.9	8.9	8.5	17.4	10.3	22.8
Effective Green, g (s)	8.9	8.9	8.5	17.4	10.3	22.8
Actuated g/C Ratio	0.22	0.22	0.21	0.44	0.26	0.57
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	1.0	1.0	1.0	1.0	3.1	3.1
Lane Grp Cap (vph)	397	345	758	846	459	1070
v/s Ratio Prot	c0.12		0.10	0.03	0.12	c0.22
v/s Ratio Perm		0.05		0.04		
v/c Ratio	0.54	0.23	0.48	0.14	0.44	0.39
Uniform Delay, d1	13.6	12.6	13.7	6.7	12.3	4.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1	0.2	0.0	0.7	0.2
Delay (s)	14.3	12.7	13.9	6.7	13.0	4.9
Level of Service	B	B	B	A	B	A
Approach Delay (s)	13.3		10.9			7.6
Approach LOS	B		B			A

Intersection Summary			
HCM Average Control Delay	10.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.43		
Actuated Cycle Length (s)	39.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	43.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	6
Movement	SBL	NBT	WBL	SBT
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	Min	Min	None	Min
Maximum Split (s)	44	44	29	88
Maximum Split (%)	37.6%	37.6%	24.8%	75.2%
Minimum Split (s)	6	20	24	11
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	2	2	7
Vehicle Extension (s)	3.1	1	1	3.1
Minimum Gap (s)	2.4	1	1	2.4
Time Before Reduce (s)	18	0	0	18
Time To Reduce (s)	25	0	0	25
Walk Time (s)		7	7	
Flash Dont Walk (s)		9	13	
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	44	88	0
End Time (s)	44	88	0	88
Yield/Force Off (s)	40	84	113	84
Yield/Force Off 170(s)	40	84	100	84
Local Start Time (s)	73	0	44	73
Local Yield (s)	113	40	69	40
Local Yield 170(s)	113	40	56	40

Intersection Summary	
Cycle Length	117
Control Type	Actuated-Uncoordinated
Natural Cycle	60

Splits and Phases: 12: E Bidwell St & Riley St



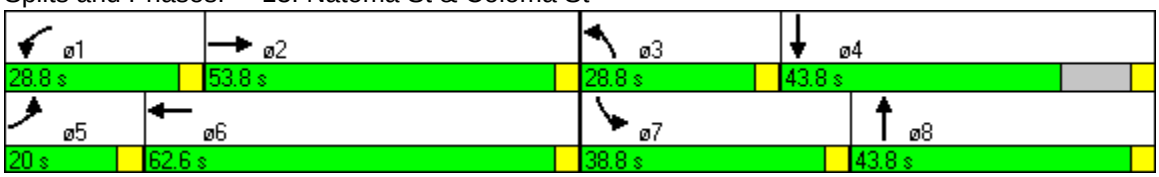
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.89		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1832		1770	1842		1770	1655		1770	1805	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1832		1770	1842		1770	1655		1770	1805	
Volume (vph)	10	970	120	250	740	60	150	90	260	30	40	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1021	126	263	779	63	158	95	274	32	42	11
RTOR Reduction (vph)	0	2	0	0	1	0	0	65	0	0	7	0
Lane Group Flow (vph)	11	1145	0	263	841	0	158	304	0	32	46	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	1.9	53.6		23.2	74.9		15.2	25.9		3.8	14.5	
Effective Green, g (s)	1.7	53.4		23.0	74.7		15.0	25.7		3.6	14.3	
Actuated g/C Ratio	0.01	0.44		0.19	0.61		0.12	0.21		0.03	0.12	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	25	804		335	1131		218	349		52	212	
v/s Ratio Prot	0.01	c0.62		c0.15	0.46		c0.09	c0.18		0.02	0.03	
v/s Ratio Perm												
v/c Ratio	0.44	1.42		0.79	0.74		0.72	0.87		0.62	0.22	
Uniform Delay, d1	59.5	34.2		47.0	16.7		51.4	46.4		58.4	48.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.4	198.0		10.6	2.7		9.7	19.4		14.2	0.2	
Delay (s)	64.0	232.1		57.6	19.4		61.0	65.7		72.6	48.8	
Level of Service	E	F		E	B		E	E		E	D	
Approach Delay (s)		230.5			28.5			64.3			57.8	
Approach LOS		F			C			E			E	

Intersection Summary			
HCM Average Control Delay	117.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	121.7	Sum of lost time (s)	16.0
Intersection Capacity Utilization	107.1%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	Min
Maximum Split (s)	28.8	53.8	28.8	43.8	20	62.6	38.8	43.8
Maximum Split (%)	17.4%	32.6%	17.4%	26.5%	12.1%	37.9%	23.5%	26.5%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	7	1	7	1	7
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	28.8	82.6	111.4	0	20	82.6	121.4
End Time (s)	28.8	82.6	111.4	0	20	82.6	121.4	0
Yield/Force Off (s)	25	78.8	107.6	161.4	16.2	78.8	117.6	161.4
Yield/Force Off 170(s)	25	78.8	107.6	151.4	16.2	78.8	117.6	161.4
Local Start Time (s)	136.4	0	53.8	82.6	136.4	156.4	53.8	92.6
Local Yield (s)	161.4	50	78.8	132.6	152.6	50	88.8	132.6
Local Yield 170(s)	161.4	50	78.8	122.6	152.6	50	88.8	132.6

Intersection Summary	
Cycle Length	165.2
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 13: Natoma St & Coloma St



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	0.98		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	0.99		1.00	1.00		1.00	0.86		1.00	0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3514		1770	3532		1770	1570		1770	1779	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3514		1770	3532		1770	1570		1770	1779	
Volume (vph)	10	1190	50	310	840	10	190	20	390	20	30	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1253	53	326	884	11	200	21	411	21	32	11
RTOR Reduction (vph)	0	2	0	0	0	0	0	348	0	0	9	0
Lane Group Flow (vph)	11	1304	0	326	895	0	200	84	0	21	34	0
Confl. Bikes (#/hr)			3			1			4			3
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	1.8	52.1		26.7	77.0		17.6	18.3		5.1	5.8	
Effective Green, g (s)	1.8	53.1		26.7	78.0		17.6	18.3		5.1	5.8	
Actuated g/C Ratio	0.02	0.45		0.22	0.65		0.15	0.15		0.04	0.05	
Clearance Time (s)	4.0	5.0		4.0	5.0		4.0	4.0		4.0	4.0	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	27	1565		396	2311		261	241		76	87	
v/s Ratio Prot	0.01	c0.37		c0.18	0.25		c0.11	c0.05		0.01	0.02	
v/s Ratio Perm												
v/c Ratio	0.41	0.83		0.82	0.39		0.77	0.35		0.28	0.40	
Uniform Delay, d1	58.2	29.1		44.0	9.5		48.8	45.1		55.3	55.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.6	4.0		12.4	0.1		11.4	0.3		0.7	1.1	
Delay (s)	61.8	33.1		56.4	9.6		60.2	45.4		56.0	56.1	
Level of Service	E	C		E	A		E	D		E	E	
Approach Delay (s)		33.4			22.1			50.1			56.0	
Approach LOS		C			C			D			E	

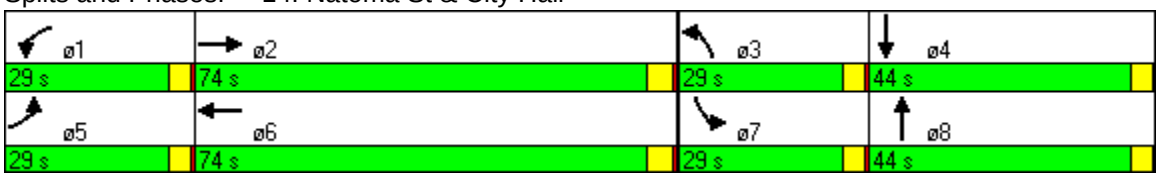
Intersection Summary			
HCM Average Control Delay	32.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.77		
Actuated Cycle Length (s)	119.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	86.8%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	Min	None
Maximum Split (s)	29	74	29	44	29	74	29	44
Maximum Split (%)	16.5%	42.0%	16.5%	25.0%	16.5%	42.0%	16.5%	25.0%
Minimum Split (s)	5	22	5	25	5	20	5	25
Yellow Time (s)	3.5	4	3.5	3.5	3.5	4	3.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	0.5	1	0.5	0.5
Minimum Initial (s)	1	7	1	2	1	7	1	2
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	1	2.4	1	2	1	2.4	1	2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		10		14		8		14
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29	103	132	0	29	103	132
End Time (s)	29	103	132	0	29	103	132	0
Yield/Force Off (s)	25	98	128	172	25	98	128	172
Yield/Force Off 170(s)	25	98	128	158	25	98	128	158
Local Start Time (s)	147	0	74	103	147	0	74	103
Local Yield (s)	172	69	99	143	172	69	99	143
Local Yield 170(s)	172	69	99	129	172	69	99	129

Intersection Summary	
Cycle Length	176
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 14: Natoma St & City Hall



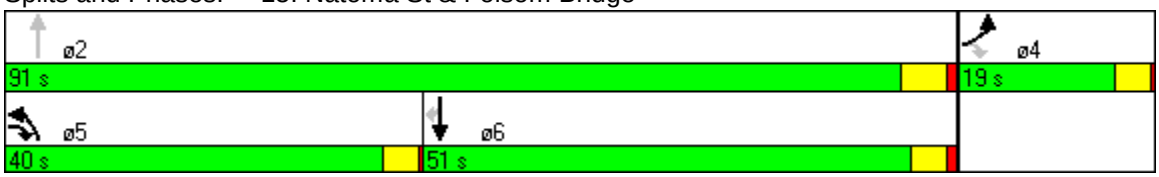
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.95	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	3539	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	3539	1583
Volume (vph)	450	840	920	1140	1470	210
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	474	884	968	1200	1547	221
RTOR Reduction (vph)	0	4	0	0	0	98
Lane Group Flow (vph)	474	880	968	1200	1547	123
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	15.0	51.0	36.0	85.5	46.5	46.5
Effective Green, g (s)	15.0	51.0	36.0	87.0	47.0	47.0
Actuated g/C Ratio	0.14	0.46	0.33	0.79	0.43	0.43
Clearance Time (s)	4.0	4.0	4.0	5.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0	2.0	3.0	2.0	2.0
Lane Grp Cap (vph)	468	792	1124	2799	1512	676
v/s Ratio Prot	0.14	c0.36	0.28		c0.44	
v/s Ratio Perm		0.19		0.34		0.08
v/c Ratio	1.01	1.11	0.86	0.43	1.02	0.18
Uniform Delay, d1	47.5	29.5	34.7	3.6	31.5	19.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	44.9	67.1	6.7	0.1	29.2	0.0
Delay (s)	92.4	96.6	41.4	3.7	60.7	19.6
Level of Service	F	F	D	A	E	B
Approach Delay (s)	95.1			20.5	55.6	
Approach LOS	F			C	E	

Intersection Summary			
HCM Average Control Delay	51.4	HCM Level of Service	D
HCM Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	110.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	99.3%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	None	None	None	None
Maximum Split (s)	91	19	40	51
Maximum Split (%)	82.7%	17.3%	36.4%	46.4%
Minimum Split (s)	12.5	6	6	26.5
Yellow Time (s)	4.5	3.5	3.5	3.5
All-Red Time (s)	1	0.5	0.5	1
Minimum Initial (s)	7	2	2	2
Vehicle Extension (s)	3	2	2	2
Minimum Gap (s)	2.4	0.2	0.2	0.2
Time Before Reduce (s)	18	0	0	0
Time To Reduce (s)	25	0	0	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	91	0	40
End Time (s)	91	0	40	91
Yield/Force Off (s)	85.5	106	36	86.5
Yield/Force Off 170(s)	85.5	106	36	71.5
Local Start Time (s)	70	51	70	0
Local Yield (s)	45.5	66	106	46.5
Local Yield 170(s)	45.5	66	106	31.5

Intersection Summary	
Cycle Length	110
Control Type	Actuated-Uncoordinated
Natural Cycle	110

Splits and Phases: 15: Natoma St & Folsom Bridge



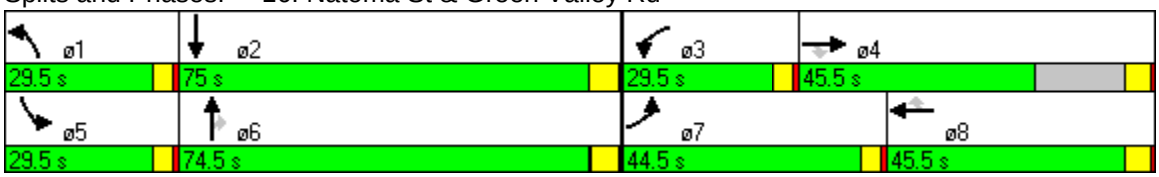
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Volume (vph)	1160	820	50	320	900	130	60	990	320	100	390	760
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1221	863	53	337	947	137	63	1042	337	105	411	800
RTOR Reduction (vph)	0	0	28	0	0	52	0	0	242	0	0	0
Lane Group Flow (vph)	1221	863	25	337	947	85	63	1042	95	105	411	800
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	40.1	61.5	61.5	18.8	40.2	40.2	6.0	40.5	40.5	8.9	42.9	149.7
Effective Green, g (s)	40.6	63.0	63.0	19.3	41.7	41.7	6.5	42.0	42.0	9.4	44.9	149.7
Actuated g/C Ratio	0.27	0.42	0.42	0.13	0.28	0.28	0.04	0.28	0.28	0.06	0.30	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	931	1489	666	443	986	441	149	1427	444	216	1525	1583
v/s Ratio Prot	c0.36	0.24		0.10	c0.27		0.02	c0.20		0.03	0.08	
v/s Ratio Perm			0.02			0.05			0.06			c0.51
v/c Ratio	1.31	0.58	0.04	0.76	0.96	0.19	0.42	0.73	0.21	0.49	0.27	0.51
Uniform Delay, d1	54.5	33.2	25.5	63.0	53.2	41.2	69.8	48.7	41.2	67.8	39.9	0.0
Progression 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
Incremental Delay, d2	147.9	0.7	0.0	6.8	19.9	0.4	0.7	2.2	0.4	0.6	0.1	1.2
Delay (s)	202.4	33.9	25.5	69.8	73.1	41.5	70.5	50.9	41.6	68.4	40.0	1.2
Level of Service	F	C	C	E	E	D	E	D	D	E	D	A
Approach Delay (s)		130.0			69.3			49.6			18.7	
Approach LOS		F			E			D			B	

Intersection Summary			
HCM Average Control Delay	74.8	HCM Level of Service	E
HCM Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	149.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	29.5	75	29.5	45.5	29.5	74.5	44.5	45.5
Maximum Split (%)	15.2%	38.6%	15.2%	23.4%	15.2%	38.3%	22.9%	23.4%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	29.5	104.5	134	0	29.5	104.5	149
End Time (s)	29.5	104.5	134	0	29.5	104.5	149	0
Yield/Force Off (s)	25	98.5	129.5	189	25	99	144.5	189
Yield/Force Off 170(s)	25	98.5	129.5	161	25	99	144.5	160
Local Start Time (s)	165	0	75	104.5	165	0	75	119.5
Local Yield (s)	190	69	100	159.5	190	69.5	115	159.5
Local Yield 170(s)	190	69	100	131.5	190	69.5	115	130.5

Intersection Summary	
Cycle Length	194.5
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 16: Natoma St & Green Valley Rd



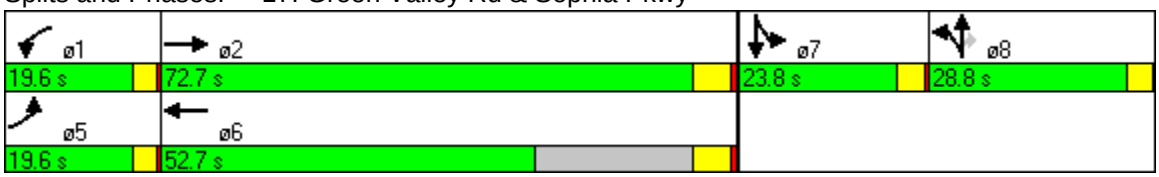
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		0.95	0.95	1.00		1.00	
Frt	1.00	0.99		1.00	1.00		1.00	1.00	0.85		0.96	
Flt Protected	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (prot)	1770	3502		1770	3534		1681	1704	1583		1750	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	0.96	1.00		0.98	
Satd. Flow (perm)	1770	3502		1770	3534		1681	1704	1583		1750	
Volume (vph)	10	2110	160	110	1160	10	80	10	230	10	10	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	2221	168	116	1221	11	84	11	242	11	11	11
RTOR Reduction (vph)	0	3	0	0	0	0	0	0	220	0	11	0
Lane Group Flow (vph)	11	2386	0	116	1232	0	46	49	22	0	22	0
Turn Type	Prot			Prot			Split		Perm	Split		
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases									8			
Actuated Green, G (s)	5.5	68.2		11.2	73.9		10.5	10.5	10.5		4.6	
Effective Green, g (s)	5.1	69.9		10.8	75.6		10.3	10.3	10.3		4.4	
Actuated g/C Ratio	0.05	0.63		0.10	0.68		0.09	0.09	0.09		0.04	
Clearance Time (s)	3.6	5.7		3.6	5.7		3.8	3.8	3.8		3.8	
Vehicle Extension (s)	2.2	3.2		2.2	3.2		3.1	3.1	3.1		3.1	
Lane Grp Cap (vph)	81	2197		172	2398		155	158	146		69	
v/s Ratio Prot	0.01	c0.68		c0.07	0.35		0.03	c0.03			c0.01	
v/s Ratio Perm									0.01			
v/c Ratio	0.14	1.09		0.67	0.51		0.30	0.31	0.15		0.33	
Uniform Delay, d1	51.0	20.8		48.6	8.8		47.2	47.2	46.5		52.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00	1.00		1.00	
Incremental Delay, d2	0.4	47.3		8.4	0.2		1.1	1.2	0.5		2.8	
Delay (s)	51.4	68.0		57.0	9.0		48.3	48.4	47.0		54.9	
Level of Service	D	E		E	A		D	D	D		D	
Approach Delay (s)		67.9			13.2			47.4			54.9	
Approach LOS		E			B			D			D	

Intersection Summary			
HCM Average Control Delay	48.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	111.4	Sum of lost time (s)	16.0
Intersection Capacity Utilization	91.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	Min	Min	Min	None	None
Maximum Split (s)	19.6	72.7	19.6	52.7	23.8	28.8
Maximum Split (%)	13.5%	50.2%	13.5%	36.4%	16.4%	19.9%
Minimum Split (s)	7.6	34.7	4.6	12.7	8.8	27.8
Yellow Time (s)	3.1	4.7	3.1	4.7	3.3	3.3
All-Red Time (s)	0.5	1	0.5	1	0.5	0.5
Minimum Initial (s)	4	7	1	7	5	5
Vehicle Extension (s)	2.2	3.2	2.2	3.2	3.1	3.1
Minimum Gap (s)	0.2	2.8	0.2	2.8	0.2	0.2
Time Before Reduce (s)	0	0.1	0	0.1	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				7
Flash Dont Walk (s)		22				17
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19.6	0	19.6	92.3	116.1
End Time (s)	19.6	92.3	19.6	92.3	116.1	0
Yield/Force Off (s)	16	86.6	16	86.6	112.3	141.1
Yield/Force Off 170(s)	16	86.6	16	86.6	112.3	124.1
Local Start Time (s)	125.3	0	125.3	0	72.7	96.5
Local Yield (s)	141.3	67	141.3	67	92.7	121.5
Local Yield 170(s)	141.3	67	141.3	67	92.7	104.5

Intersection Summary	
Cycle Length	144.9
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 17: Green Valley Rd & Sophia Pkwy



HCS2000: Unsignalized Intersections Release 4.1d

TWO-WAY STOP CONTROL SUMMARY

Analyst: JDG
Agency/Co.: Fehr & Peers
Date Performed: 6/3/2005
Analysis Time Period: PM Peak
Intersection: E. Natoma/Briggs Ranch
Jurisdiction: Folsom, California
Units: U. S. Customary
Analysis Year: 2025
Project ID: Folsom Bridge (RS05 2106)
East/West Street: E. Natoma St.
North/South Street: Briggs Ranch
Intersection Orientation: EW Study period (hrs): 0.25

Vehicle Volumes and Adjustments

Major Street: Approach	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume		980	110		1130	
Peak-Hour Factor, PHF		0.95	0.95		0.95	
Hourly Flow Rate, HFR		1031	115		1189	
Percent Heavy Vehicles		--	--		--	--
Median Type/Storage	Undivided		/			
RT Channelized?						
Lanes		2	0		2	
Configuration		T	TR		T	
Upstream Signal?		No			Yes	

Minor Street: Approach	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume			310			
Peak Hour Factor, PHF			0.95			
Hourly Flow Rate, HFR			326			
Percent Heavy Vehicles			0			
Percent Grade (%)		0			0	
Flared Approach: Exists?/Storage			/			/
Lanes			1			
Configuration			R			

Delay, Queue Length, and Level of Service

Approach	EB	WB	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Config					R			
v (vph)					326			
C(m) (vph)					468			
v/c					0.70			
95% queue length					5.30			
Control Delay					28.5			
LOS					D			
Approach Delay				28.5				
Approach LOS				D				

2025 Conditions – Mitigation

Level of Service Technical Calculations

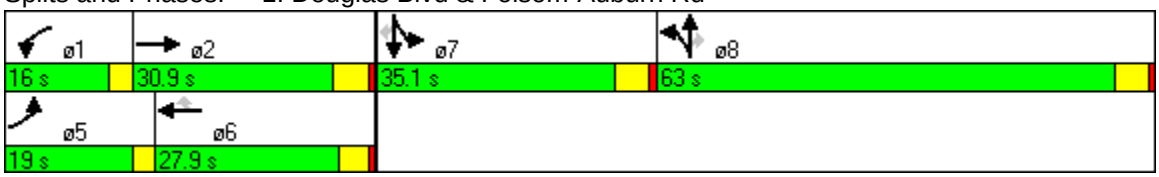
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.96	1.00	1.00	0.98	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	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1562	1770	3539	1525	3433	1863	1549	1770	3539	1563
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1562	1770	3539	1525	3433	1863	1549	1770	3539	1563
Volume (vph)	190	220	890	130	400	180	1450	640	50	90	730	480
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	200	232	937	137	421	189	1526	674	53	95	768	505
RTOR Reduction (vph)	0	0	0	0	0	162	0	0	31	0	0	128
Lane Group Flow (vph)	200	232	937	137	421	27	1526	674	22	95	768	377
Confl. Peds. (#/hr)						3			5			
Confl. Bikes (#/hr)			7			3			1			1
Turn Type	Prot		Free	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			Free			6			8			7
Actuated Green, G (s)	16.0	22.1	141.6	12.7	19.6	19.6	57.7	57.7	57.7	29.8	29.8	29.8
Effective Green, g (s)	15.0	23.8	141.6	11.7	20.5	20.5	59.0	59.0	59.0	31.1	31.1	31.1
Actuated g/C Ratio	0.11	0.17	1.00	0.08	0.14	0.14	0.42	0.42	0.42	0.22	0.22	0.22
Clearance Time (s)	3.0	5.7		3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	188	595	1562	146	512	221	1430	776	645	389	777	343
v/s Ratio Prot	c0.11	0.07		0.08	c0.12		c0.44	0.36		0.05	0.22	
v/s Ratio Perm			c0.60			0.02			0.01			c0.24
v/c Ratio	1.06	0.39	0.60	0.94	0.82	0.12	1.07	0.87	0.03	0.24	0.99	1.10
Uniform Delay, d1	63.3	52.4	0.0	64.6	58.8	52.7	41.3	37.8	24.4	45.6	55.1	55.2
Progression 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
Incremental Delay, d2	83.6	0.2	1.7	55.0	9.8	0.1	44.0	9.8	0.0	0.1	29.0	77.9
Delay (s)	146.9	52.6	1.7	119.6	68.6	52.8	85.3	47.6	24.4	45.7	84.1	133.2
Level of Service	F	D	A	F	E	D	F	D	C	D	F	F
Approach Delay (s)		31.5			73.9			72.6			99.5	
Approach LOS		C			E			E			F	

Intersection Summary			
HCM Average Control Delay	69.4	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	141.6	Sum of lost time (s)	16.0
Intersection Capacity Utilization	97.2%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	16	30.9	19	27.9	35.1	63
Maximum Split (%)	11.0%	21.3%	13.1%	19.2%	24.2%	43.4%
Minimum Split (s)	8	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	16	0	19	46.9	82
End Time (s)	16	46.9	19	46.9	82	0
Yield/Force Off (s)	13	41.2	16	42	76.7	139.7
Yield/Force Off 170(s)	13	31.2	16	32	66.7	139.7
Local Start Time (s)	129	0	129	3	30.9	66
Local Yield (s)	142	25.2	0	26	60.7	123.7
Local Yield 170(s)	142	15.2	0	16	50.7	123.7

Intersection Summary	
Cycle Length	145
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.86	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	5085	6381	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	5085	6381	
Volume (vph)	70	30	20	2260	2050	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	74	32	21	2379	2158	63
RTOR Reduction (vph)	0	31	0	0	5	0
Lane Group Flow (vph)	74	1	21	2379	2216	0
Turn Type		Perm	Prot			
Protected Phases	4		1	6	2	
Permitted Phases		4				
Actuated Green, G (s)	3.2	3.2	18.8	47.0	29.8	
Effective Green, g (s)	3.2	3.2	18.8	47.0	29.8	
Actuated g/C Ratio	0.04	0.04	0.25	0.63	0.40	
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	
Vehicle Extension (s)	3.0	3.0	1.5	3.0	3.0	
Lane Grp Cap (vph)	76	68	444	3187	2535	
v/s Ratio Prot	c0.04		c0.01	c0.47	c0.35	
v/s Ratio Perm		0.00				
v/c Ratio	0.97	0.02	0.05	0.75	0.87	
Uniform Delay, d1	35.9	34.4	21.3	9.8	20.9	
Progression Factor	1.00	1.00	1.26	0.56	0.97	
Incremental Delay, d2	93.6	0.1	0.0	1.4	3.5	
Delay (s)	129.5	34.5	26.9	6.9	23.8	
Level of Service	F	C	C	A	C	
Approach Delay (s)	100.8			7.0	23.8	
Approach LOS	F			A	C	

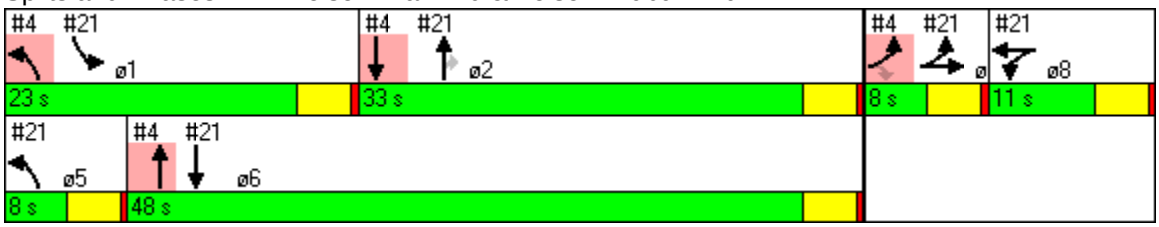
Intersection Summary			
HCM Average Control Delay	17.0	HCM Level of Service	B
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	27.2
Intersection Capacity Utilization	54.2%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Node Number	4	4	4	21	4	21
Movement	NBL	SBT	EBL	NBL	NBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	23	33	8	8	48	11
Maximum Split (%)	30.7%	44.0%	10.7%	10.7%	64.0%	14.7%
Minimum Split (s)	6	20	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Minimum Initial (s)	2	4	4	4	4	4
Vehicle Extension (s)	1.5	3	3	3	3	3
Minimum Gap (s)	1.5	3	3	3	3	3
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		7				
Flash Dont Walk (s)		9				
Dual Entry	No	Yes	Yes	No	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	73	21	54	73	6	62
End Time (s)	21	54	62	6	54	73
Yield/Force Off (s)	17	50	58	2	50	69
Yield/Force Off 170(s)	17	41	58	2	50	69
Local Start Time (s)	23	46	4	23	31	12
Local Yield (s)	42	0	8	27	0	19
Local Yield 170(s)	42	66	8	27	0	19

Intersection Summary	
Cycle Length	75
Control Type	Actuated-Coordinated
Natural Cycle	75

Offset: 50 (67%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	0.88	1.00	0.95	1.00	0.94	0.95	
Frt	1.00	0.91		1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1694		1681	1698	2787	1770	3539	1583	4990	3528	
Flt Permitted	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1694		1681	1698	2787	1770	3539	1583	4990	3528	
Volume (vph)	30	20	30	220	20	1360	20	890	270	1110	950	20
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	21	32	232	21	1432	21	937	284	1168	1000	21
RTOR Reduction (vph)	0	31	0	0	0	0	0	0	171	0	2	0
Lane Group Flow (vph)	32	22	0	123	130	1432	21	937	113	1168	1019	0
Turn Type	Split			Split		Free	Prot		Perm	Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	3.2	3.2		7.2	7.2	75.0	1.6	29.8	29.8	18.8	47.0	
Effective Green, g (s)	3.2	3.2		7.2	7.2	75.0	1.6	29.8	29.8	18.8	47.0	
Actuated g/C Ratio	0.04	0.04		0.10	0.10	1.00	0.02	0.40	0.40	0.25	0.63	
Clearance Time (s)	4.0	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	1.5	3.0	
Lane Grp Cap (vph)	76	72		161	163	2787	38	1406	629	1251	2211	
v/s Ratio Prot	0.02	0.01		0.07	0.08		0.01	c0.26		c0.23	0.29	
v/s Ratio Perm						c0.51			0.07			
v/c Ratio	0.42	0.31		0.76	0.80	0.51	0.55	0.67	0.18	0.93	0.46	
Uniform Delay, d1	35.0	34.8		33.1	33.2	0.0	36.3	18.5	14.7	27.5	7.3	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.54	0.46	
Incremental Delay, d2	3.7	2.5		19.1	23.1	0.7	16.2	2.5	0.6	7.2	0.4	
Delay (s)	38.7	37.3		52.2	56.3	0.7	52.6	21.0	15.3	49.6	3.7	
Level of Service	D	D		D	E	A	D	C	B	D	A	
Approach Delay (s)		37.8			8.7			20.3			28.2	
Approach LOS		D			A			C			C	

Intersection Summary			
HCM Average Control Delay	20.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.0%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Alternative 3 - AM

DELAY

4. Folsom Bridge (Auto Spa)/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	74	129.5	9,583
EBR	32	34.5	1,104
NBL	21	26.9	565
NBT	2,379	6.9	16,415
SBT	2,158	23.8	51,360
SBR	63	23.8	1,499
total	4,727	245	80,527

Reported Delay

EBL	EBR	NBL	NBT	SBT	SBR
129.5	34.5	26.9	6.9	23.8	

Reported Adj Flow

EBL	EBR	NBL	NBT	SBT	SBR
74	32	21	2,379	2,158	63

21. Existing Folsom Dam Road/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	32	38.7	1,238
EBT	21	37.3	783
EBR	32	37.3	1,194
WBL	232	52.2	12,110
WBT	21	56.3	1,182
WBR	1,432	0.7	1,002
NBL	21	52.6	1,105
NBT	937	21.0	19,677
NBR	284	15.3	4,345
SBL	1,168	49.6	57,933
SBT	1,000	3.7	3,700
SBR	21	3.7	78
total	5,201	368	104,348

total Adj. Volume	9,928
Int. Delay	**18.6**

Reported Delay

EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
38.7	37.3	52.2	56.3	0.7	52.6	21	15.3	49.6	3.7

Reported Adj Flow

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
32	21	32	232	21	1,432	21	937	284	1168	1000	21

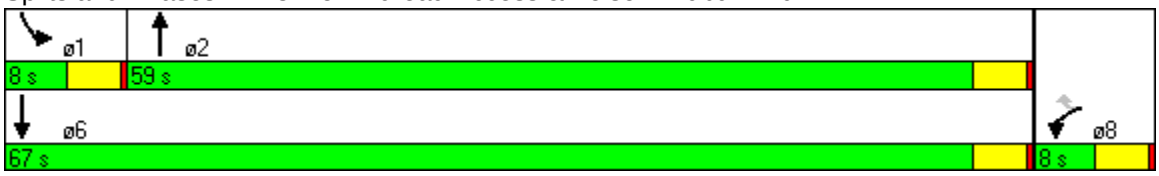
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3532		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3532		1770	3539
Volume (vph)	20	10	2300	30	10	2090
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	11	2421	32	11	2200
RTOR Reduction (vph)	0	11	1	0	0	0
Lane Group Flow (vph)	21	0	2452	0	11	2200
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	1.6	1.6	60.6		0.8	65.4
Effective Green, g (s)	1.6	1.6	60.6		0.8	65.4
Actuated g/C Ratio	0.02	0.02	0.81		0.01	0.87
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)	38	34	2854		19	3086
v/s Ratio Prot	c0.01		c0.69		0.01	c0.62
v/s Ratio Perm		0.00				
v/c Ratio	0.55	0.01	0.86		0.58	0.71
Uniform Delay, d1	36.3	35.9	4.5		36.9	1.6
Progression Factor	1.00	1.00	1.27		1.00	1.00
Incremental Delay, d2	16.2	0.1	2.6		36.3	1.4
Delay (s)	52.6	36.0	8.3		73.2	3.1
Level of Service	D	D	A		E	A
Approach Delay (s)	46.9		8.3			3.4
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.87		
Actuated Cycle Length (s)	75.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	8	59	67	8
Maximum Split (%)	10.7%	78.7%	89.3%	10.7%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	12	20	12	4
End Time (s)	20	4	4	12
Yield/Force Off (s)	16	0	0	8
Yield/Force Off 170(s)	16	0	0	8
Local Start Time (s)	12	20	12	4
Local Yield (s)	16	0	0	8
Local Yield 170(s)	16	0	0	8

Intersection Summary	
Cycle Length	75
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



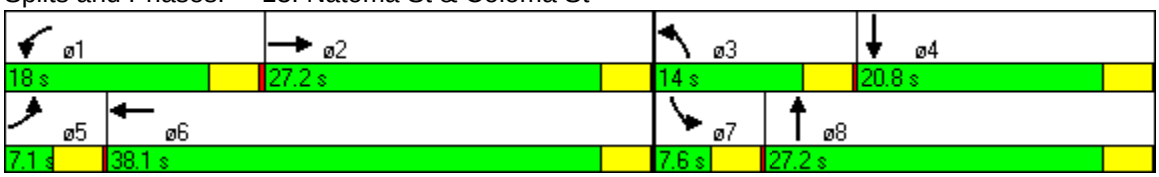
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	1.00		1.00	0.87		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3479		1770	3526		1770	1612		1770	1805	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3479		1770	3526		1770	1612		1770	1805	
Volume (vph)	10	710	90	250	780	20	160	30	270	20	40	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	747	95	263	821	21	168	32	284	21	42	11
RTOR Reduction (vph)	0	12	0	0	2	0	0	235	0	0	10	0
Lane Group Flow (vph)	11	830	0	263	840	0	168	81	0	21	43	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	3.5	19.3		11.8	27.6		8.2	10.7		3.9	6.4	
Effective Green, g (s)	3.3	19.1		11.6	27.4		8.0	10.5		3.7	6.2	
Actuated g/C Ratio	0.05	0.31		0.19	0.45		0.13	0.17		0.06	0.10	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	96	1091		337	1586		233	278		108	184	
v/s Ratio Prot	0.01	c0.24		c0.15	0.24		c0.09	c0.05		0.01	0.02	
v/s Ratio Perm												
v/c Ratio	0.11	0.76		0.78	0.53		0.72	0.29		0.19	0.23	
Uniform Delay, d1	27.4	18.8		23.4	12.1		25.4	22.0		27.2	25.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	3.2		10.3	0.3		8.9	0.2		0.3	0.2	
Delay (s)	27.6	22.0		33.8	12.4		34.3	22.2		27.5	25.4	
Level of Service	C	C		C	B		C	C		C	C	
Approach Delay (s)		22.1			17.5			26.4			26.0	
Approach LOS		C			B			C			C	

Intersection Summary			
HCM Average Control Delay	21.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	60.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	Min	None
Maximum Split (s)	18	27.2	14	20.8	7.1	38.1	7.6	27.2
Maximum Split (%)	22.5%	34.0%	17.5%	26.0%	8.9%	47.6%	9.5%	34.0%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	1	1	7	1	1
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	3	2.4	3	3	3	2.4	3	3
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	18	45.2	59.2	0	7.1	45.2	52.8
End Time (s)	18	45.2	59.2	0	7.1	45.2	52.8	0
Yield/Force Off (s)	14.2	41.4	55.4	76.2	3.3	41.4	49	76.2
Yield/Force Off 170(s)	14.2	41.4	55.4	66.2	3.3	41.4	49	66.2
Local Start Time (s)	62	0	27.2	41.2	62	69.1	27.2	34.8
Local Yield (s)	76.2	23.4	37.4	58.2	65.3	23.4	31	58.2
Local Yield 170(s)	76.2	23.4	37.4	48.2	65.3	23.4	31	48.2

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 13: Natoma St & Coloma St



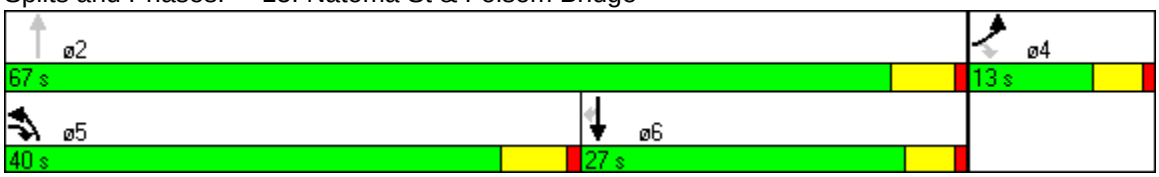
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.91	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	5085	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	5085	1583
Volume (vph)	300	870	1100	1300	1180	220
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	316	916	1158	1368	1242	232
RTOR Reduction (vph)	0	1	0	0	0	166
Lane Group Flow (vph)	316	915	1158	1368	1242	66
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	8.5	42.9	34.4	60.8	21.9	21.9
Effective Green, g (s)	9.0	44.9	35.9	62.3	22.4	22.4
Actuated g/C Ratio	0.11	0.57	0.45	0.79	0.28	0.28
Clearance Time (s)	4.5	5.5	5.5	5.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	3.0	2.0	2.0
Lane Grp Cap (vph)	390	976	1554	2780	1436	447
v/s Ratio Prot	0.09	c0.42	0.34		c0.24	
v/s Ratio Perm		0.15		0.39		0.04
v/c Ratio	0.81	0.94	0.75	0.49	0.86	0.15
Uniform Delay, d1	34.3	15.9	17.9	3.0	27.0	21.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	11.4	15.7	2.0	0.1	5.5	0.1
Delay (s)	45.8	31.6	19.9	3.1	32.5	21.4
Level of Service	D	C	B	A	C	C
Approach Delay (s)	35.2			10.8	30.8	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay	22.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	79.3	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	None	None	None	None
Maximum Split (s)	67	13	40	27
Maximum Split (%)	83.8%	16.3%	50.0%	33.8%
Minimum Split (s)	12.5	6.5	12.5	26.5
Yellow Time (s)	4.5	3.5	4.5	3.5
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	7	2	7	2
Vehicle Extension (s)	3	2	3	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	67	0	40
End Time (s)	67	0	40	67
Yield/Force Off (s)	61.5	75.5	34.5	62.5
Yield/Force Off 170(s)	61.5	75.5	34.5	47.5
Local Start Time (s)	40	27	40	0
Local Yield (s)	21.5	35.5	74.5	22.5
Local Yield 170(s)	21.5	35.5	74.5	7.5

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Uncoordinated
Natural Cycle	80

Splits and Phases: 15: Natoma St & Folsom Bridge



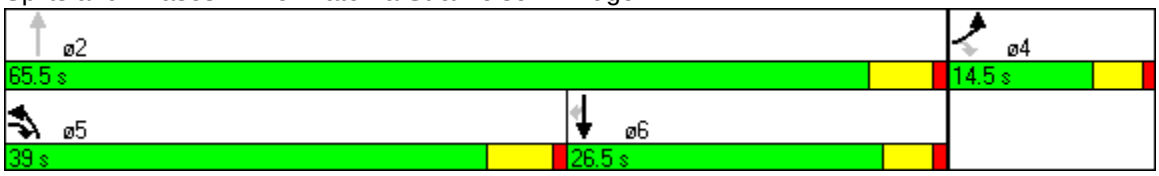
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.91	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	5085	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	5085	1583
Volume (vph)	300	870	1100	1300	1180	220
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	316	916	1158	1368	1242	232
RTOR Reduction (vph)	0	1	0	0	0	168
Lane Group Flow (vph)	316	915	1158	1368	1242	64
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	10.1	44.0	33.9	59.9	21.5	21.5
Effective Green, g (s)	10.6	46.0	35.4	61.4	22.0	22.0
Actuated g/C Ratio	0.13	0.57	0.44	0.77	0.28	0.28
Clearance Time (s)	4.5	5.5	5.5	5.5	4.5	4.5
Vehicle Extension (s)	2.0	3.0	3.0	3.0	2.0	2.0
Lane Grp Cap (vph)	455	989	1519	2716	1398	435
v/s Ratio Prot	0.09	c0.41	0.34		c0.24	
v/s Ratio Perm		0.17		0.39		0.04
v/c Ratio	0.69	0.93	0.76	0.50	0.89	0.15
Uniform Delay, d1	33.2	15.4	18.8	3.5	27.8	21.9
Progression Factor	0.90	1.09	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	13.0	2.3	0.1	7.0	0.1
Delay (s)	37.7	29.8	21.1	3.7	34.9	22.0
Level of Service	D	C	C	A	C	C
Approach Delay (s)	31.8			11.7	32.8	
Approach LOS	C			B	C	

Intersection Summary			
HCM Average Control Delay	22.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	83.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	Min	C-Min	None	Min
Maximum Split (s)	65.5	14.5	39	26.5
Maximum Split (%)	81.9%	18.1%	48.8%	33.1%
Minimum Split (s)	12.5	6.5	12.5	26.5
Yellow Time (s)	4.5	3.5	4.5	3.5
All-Red Time (s)	1	1	1	1
Minimum Initial (s)	7	2	7	2
Vehicle Extension (s)	3	2	3	2
Minimum Gap (s)	2.4	0.2	2.4	0.2
Time Before Reduce (s)	18	0	18	0
Time To Reduce (s)	25	0	25	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	42.5	28	42.5	1.5
End Time (s)	28	42.5	1.5	28
Yield/Force Off (s)	22.5	38	76	23.5
Yield/Force Off 170(s)	22.5	38	76	23.5
Local Start Time (s)	4.5	70	4.5	43.5
Local Yield (s)	64.5	0	38	65.5
Local Yield 170(s)	64.5	0	38	65.5

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	80
Offset: 38 (48%), Referenced to phase 4:EBL, Start of Yellow	

Splits and Phases: 15: Natoma St & Folsom Bridge



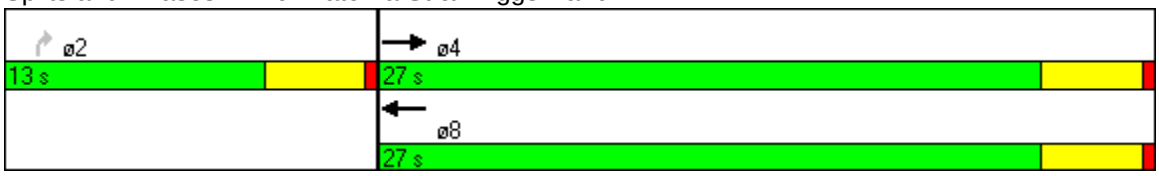
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		1.00
Frt	1.00			1.00		0.86
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3533			3539		1611
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3533			3539		1611
Volume (vph)	950	10	0	1320	0	220
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1000	11	0	1389	0	232
RTOR Reduction (vph)	1	0	0	0	0	91
Lane Group Flow (vph)	1010	0	0	1389	0	141
Turn Type						custom
Protected Phases	4			8		
Permitted Phases						2
Actuated Green, G (s)	25.4			25.4		6.6
Effective Green, g (s)	25.4			25.4		6.6
Actuated g/C Ratio	0.64			0.64		0.16
Clearance Time (s)	4.0			4.0		4.0
Vehicle Extension (s)	3.0			3.0		3.0
Lane Grp Cap (vph)	2243			2247		266
v/s Ratio Prot	0.29			c0.39		
v/s Ratio Perm						c0.09
v/c Ratio	0.45			0.62		0.53
Uniform Delay, d1	3.7			4.4		15.3
Progression Factor	1.00			1.14		1.00
Incremental Delay, d2	0.7			0.9		2.0
Delay (s)	4.4			5.9		17.3
Level of Service	A			A		B
Approach Delay (s)	4.4			5.9	17.3	
Approach LOS	A			A	B	

Intersection Summary			
HCM Average Control Delay	6.3	HCM Level of Service	A
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	40.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	46.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	8
Movement	NBR	EBT	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	None	C-Min	C-Min
Maximum Split (s)	13	27	27
Maximum Split (%)	32.5%	67.5%	67.5%
Minimum Split (s)	8	8	8
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	0	13	13
End Time (s)	13	0	0
Yield/Force Off (s)	9	36	36
Yield/Force Off 170(s)	9	36	36
Local Start Time (s)	4	17	17
Local Yield (s)	13	0	0
Local Yield 170(s)	13	0	0

Intersection Summary	
Cycle Length	40
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 36 (90%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	

Splits and Phases: 19: Natoma St & Briggs Ranch



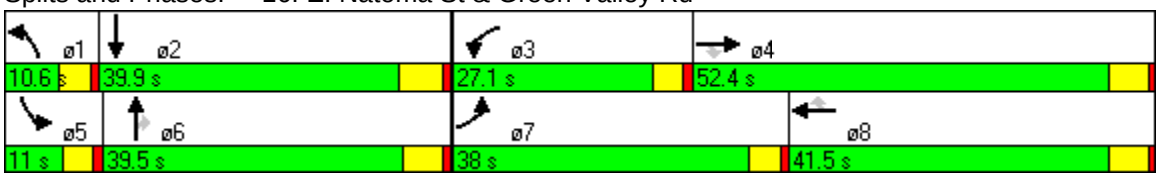
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Volume (vph)	820	950	50	390	900	50	70	190	160	150	910	1380
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	863	1000	53	411	947	53	74	200	168	158	958	1453
RTOR Reduction (vph)	0	0	31	0	0	32	0	0	128	0	0	0
Lane Group Flow (vph)	863	1000	22	411	947	21	74	200	40	158	958	1453
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	31.3	47.3	47.3	17.8	33.8	33.8	4.5	26.5	26.5	6.7	28.2	118.3
Effective Green, g (s)	31.8	48.8	48.8	18.3	35.3	35.3	5.0	28.0	28.0	7.2	30.2	118.3
Actuated g/C Ratio	0.27	0.41	0.41	0.15	0.30	0.30	0.04	0.24	0.24	0.06	0.26	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	923	1460	653	531	1056	472	145	1204	375	209	1298	1583
v/s Ratio Prot	0.25	0.28		0.12	0.27		0.02	0.04		0.05	0.19	
v/s Ratio Perm			0.01			0.01			0.03			c0.92
v/c Ratio	0.93	0.68	0.03	0.77	0.90	0.04	0.51	0.17	0.11	0.76	0.74	0.92
Uniform Delay, d1	42.2	28.5	20.7	48.0	39.8	29.5	55.5	35.9	35.4	54.7	40.4	0.0
Progression 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
Incremental Delay, d2	15.9	1.5	0.0	6.3	10.5	0.1	1.3	0.1	0.2	12.9	2.3	10.0
Delay (s)	58.1	29.9	20.7	54.4	50.2	29.6	56.7	36.0	35.6	67.6	42.8	10.0
Level of Service	E	C	C	D	D	C	E	D	D	E	D	B
Approach Delay (s)		42.4			50.7			39.3			25.8	
Approach LOS		D			D			D			C	

Intersection Summary			
HCM Average Control Delay	37.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.92		
Actuated Cycle Length (s)	118.3	Sum of lost time (s)	0.0
Intersection Capacity Utilization	82.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	10.6	39.9	27.1	52.4	11	39.5	38	41.5
Maximum Split (%)	8.2%	30.7%	20.8%	40.3%	8.5%	30.4%	29.2%	31.9%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	10.6	50.5	77.6	0	11	50.5	88.5
End Time (s)	10.6	50.5	77.6	0	11	50.5	88.5	0
Yield/Force Off (s)	6.1	44.5	73.1	124.5	6.5	45	84	124.5
Yield/Force Off 170(s)	6.1	44.5	73.1	96.5	6.5	45	84	95.5
Local Start Time (s)	119	129.6	39.5	66.6	119	0	39.5	77.5
Local Yield (s)	125.1	33.5	62.1	113.5	125.5	34	73	113.5
Local Yield 170(s)	125.1	33.5	62.1	85.5	125.5	34	73	84.5

Intersection Summary	
Cycle Length	130
Control Type	Actuated-Uncoordinated
Natural Cycle	125

Splits and Phases: 16: E. Natoma St & Green Valley Rd



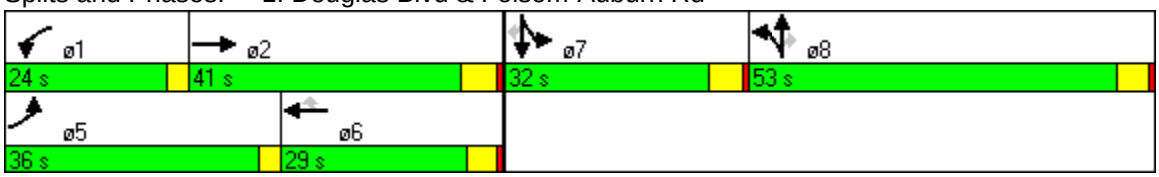
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	0.97	1.00	1.00	1.00	0.95	1.00
Frpb, ped/bikes	1.00	1.00	0.99	1.00	1.00	0.95	1.00	1.00	0.97	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	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	3539	1560	1770	3539	1506	3433	1863	1537	1770	3539	1552
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	3539	1560	1770	3539	1506	3433	1863	1537	1770	3539	1552
Volume (vph)	450	450	1190	130	350	90	1270	660	110	180	710	320
Peak-hour factor, PHF	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96	0.96
Adj. Flow (vph)	469	469	1240	135	365	94	1323	688	115	188	740	333
RTOR Reduction (vph)	0	0	0	0	0	82	0	0	76	0	0	183
Lane Group Flow (vph)	469	469	1240	135	365	12	1323	688	39	188	740	150
Confl. Peds. (#/hr)			7			3			9			
Confl. Bikes (#/hr)			3			7						7
Turn Type	Prot		Free	Prot		Perm	Split		Perm	Split		Perm
Protected Phases	5	2		1	6		8	8		7	7	
Permitted Phases			Free			6			8			7
Actuated Green, G (s)	33.0	36.1	144.1	14.3	18.2	18.2	47.7	47.7	47.7	26.7	26.7	26.7
Effective Green, g (s)	32.0	37.8	144.1	13.3	19.1	19.1	49.0	49.0	49.0	28.0	28.0	28.0
Actuated g/C Ratio	0.22	0.26	1.00	0.09	0.13	0.13	0.34	0.34	0.34	0.19	0.19	0.19
Clearance Time (s)	3.0	5.7		3.0	4.9	4.9	5.3	5.3	5.3	5.3	5.3	5.3
Vehicle Extension (s)	1.0	1.0		1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lane Grp Cap (vph)	393	928	1560	163	469	200	1167	633	523	344	688	302
v/s Ratio Prot	c0.27	0.13		0.08	0.10		c0.39	0.37		0.11	c0.21	
v/s Ratio Perm			c0.79			0.01			0.03			0.10
v/c Ratio	1.19	0.51	0.79	0.83	0.78	0.06	1.13	1.09	0.07	0.55	1.08	0.50
Uniform Delay, d1	56.0	45.2	0.0	64.3	60.5	54.7	47.6	47.6	32.2	52.3	58.0	51.8
Progression 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
Incremental Delay, d2	109.5	0.2	4.3	26.7	7.3	0.0	71.2	61.7	0.0	1.0	56.4	0.5
Delay (s)	165.5	45.4	4.3	91.0	67.7	54.7	118.8	109.2	32.2	53.3	114.5	52.2
Level of Service	F	D	A	F	E	D	F	F	C	D	F	D
Approach Delay (s)		47.8			71.0			111.0			88.9	
Approach LOS		D			E			F			F	

Intersection Summary			
HCM Average Control Delay	80.3	HCM Level of Service	F
HCM Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	144.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	104.6%	ICU Level of Service	G
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	5	6	7	8
Movement	WBL	EBT	EBL	WBT	SBTL	NBTL
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize						
Recall Mode	None	None	None	None	None	Min
Maximum Split (s)	24	41	36	29	32	53
Maximum Split (%)	16.0%	27.3%	24.0%	19.3%	21.3%	35.3%
Minimum Split (s)	6	27.7	6	26.9	27.3	27.3
Yellow Time (s)	3	4.7	3	3.9	4.3	4.3
All-Red Time (s)	0	1	0	1	1	1
Minimum Initial (s)	3	3	3	3	6	6
Vehicle Extension (s)	1	1	1	1	1	1
Minimum Gap (s)	1	1	1	1	1	1
Time Before Reduce (s)	0	0	0	0	0	0
Time To Reduce (s)	0	0	0	0	0	0
Walk Time (s)		12		12	12	12
Flash Dont Walk (s)		10		10	10	10
Dual Entry	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	24	0	36	65	97
End Time (s)	24	65	36	65	97	0
Yield/Force Off (s)	21	59.3	33	60.1	91.7	144.7
Yield/Force Off 170(s)	21	49.3	33	50.1	81.7	144.7
Local Start Time (s)	126	0	126	12	41	73
Local Yield (s)	147	35.3	9	36.1	67.7	120.7
Local Yield 170(s)	147	25.3	9	26.1	57.7	120.7

Intersection Summary	
Cycle Length	150
Control Type	Actuated-Uncoordinated
Natural Cycle	150

Splits and Phases: 1: Douglas Blvd & Folsom-Auburn Rd



Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	0.91	0.86	
Frt	1.00	0.85	1.00	1.00	1.00	
Flt Protected	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (prot)	1770	1583	1770	5085	6378	
Flt Permitted	0.95	1.00	0.95	1.00	1.00	
Satd. Flow (perm)	1770	1583	1770	5085	6378	
Volume (vph)	50	60	60	1860	1880	60
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	63	63	1958	1979	63
RTOR Reduction (vph)	0	61	0	0	5	0
Lane Group Flow (vph)	53	2	63	1958	2037	0
Turn Type		Perm	Prot			
Protected Phases	4		1	6	2	
Permitted Phases		4				
Actuated Green, G (s)	3.0	3.0	23.9	48.5	26.6	
Effective Green, g (s)	3.0	3.0	23.9	50.0	28.1	
Actuated g/C Ratio	0.04	0.04	0.30	0.62	0.35	
Clearance Time (s)	4.0	4.0	4.0	5.5	5.5	
Vehicle Extension (s)	1.0	1.0	1.0	4.7	5.4	
Lane Grp Cap (vph)	66	59	529	3178	2240	
v/s Ratio Prot	c0.03		c0.04	c0.39	c0.32	
v/s Ratio Perm		0.00				
v/c Ratio	0.80	0.04	0.12	0.62	0.91	
Uniform Delay, d1	38.2	37.1	20.4	9.1	24.7	
Progression Factor	1.00	1.00	1.30	0.69	0.94	
Incremental Delay, d2	46.6	0.1	0.0	0.8	5.6	
Delay (s)	84.8	37.2	26.5	7.1	28.8	
Level of Service	F	D	C	A	C	
Approach Delay (s)	59.0			7.7	28.8	
Approach LOS	E			A	C	

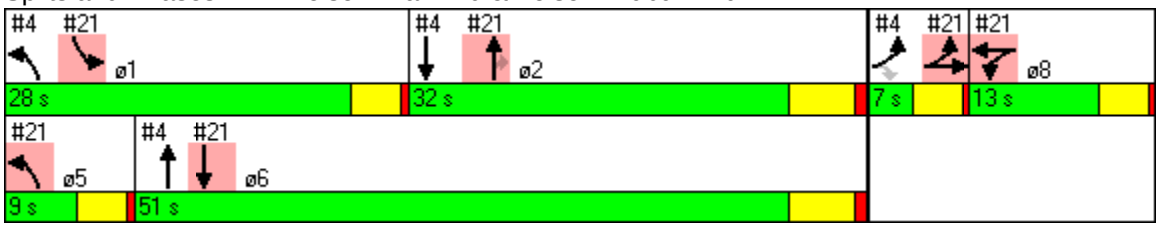
Intersection Summary			
HCM Average Control Delay	19.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	29.0
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	4	5	6	8
Node Number	4	4	4	21	4	21
Movement	NBL	SBT	EBL	NBL	NBT	WBTL
Lead/Lag	Lead	Lag		Lead	Lag	
Lead-Lag Optimize						
Recall Mode	None	C-Min	None	None	C-Min	None
Maximum Split (s)	28	32	7	9	51	13
Maximum Split (%)	35.0%	40.0%	8.8%	11.3%	63.8%	16.3%
Minimum Split (s)	5	21.5	6	6	12.5	8
Yellow Time (s)	3.5	4.5	3.5	3.5	4.5	3.5
All-Red Time (s)	0.5	1	0.5	0.5	1	0.5
Minimum Initial (s)	1	7	2	2	7	4
Vehicle Extension (s)	1	5.4	1	1.5	4.7	3
Minimum Gap (s)	3	3.8	3	3	3.1	3
Time Before Reduce (s)	0	10	0	0	10	0
Time To Reduce (s)	0	25	0	0	25	0
Walk Time (s)		7				
Flash Dont Walk (s)		9				
Dual Entry	No	No	No	No	No	Yes
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	79.5	27.5	59.5	79.5	8.5	66.5
End Time (s)	27.5	59.5	66.5	8.5	59.5	79.5
Yield/Force Off (s)	23.5	54	62.5	4.5	54	75.5
Yield/Force Off 170(s)	23.5	45	62.5	4.5	54	75.5
Local Start Time (s)	25.5	53.5	5.5	25.5	34.5	12.5
Local Yield (s)	49.5	0	8.5	30.5	0	21.5
Local Yield 170(s)	49.5	71	8.5	30.5	0	21.5

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	80

Offset: 54 (68%), Referenced to phase 2:SBT and 6:NBT, Start of Yellow

Splits and Phases: 4: Folsom Dam Rd & Folsom-Auburn Rd



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00		0.95	0.95	0.88	1.00	0.95	1.00	0.94	0.95	
Frt	1.00	0.90		1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.99	
Flt Protected	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1770	1676		1681	1694	2787	1770	3539	1583	4990	3502	
Flt Permitted	0.95	1.00		0.95	0.96	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (perm)	1770	1676		1681	1694	2787	1770	3539	1583	4990	3502	
Volume (vph)	50	20	40	330	20	1240	30	630	290	1370	530	40
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	53	21	42	347	21	1305	32	663	305	1442	558	42
RTOR Reduction (vph)	0	40	0	0	0	0	0	0	198	0	6	0
Lane Group Flow (vph)	53	23	0	179	189	1305	32	663	107	1442	594	0
Turn Type	Split			Split		Free	Prot		Perm	Prot		
Protected Phases	4	4		8	8		5	2		1	6	
Permitted Phases						Free			2			
Actuated Green, G (s)	3.0	3.0		9.0	9.0	80.0	2.0	26.6	26.6	23.9	48.5	
Effective Green, g (s)	3.0	3.0		9.0	9.0	80.0	2.0	28.1	28.1	23.9	50.0	
Actuated g/C Ratio	0.04	0.04		0.11	0.11	1.00	0.02	0.35	0.35	0.30	0.62	
Clearance Time (s)	4.0	4.0		4.0	4.0		4.0	5.5	5.5	4.0	5.5	
Vehicle Extension (s)	1.0	1.0		3.0	3.0		1.5	5.4	5.4	1.0	4.7	
Lane Grp Cap (vph)	66	63		189	191	2787	44	1243	556	1491	2189	
v/s Ratio Prot	0.03	0.01		0.11	c0.11		0.02	0.19		c0.29	0.17	
v/s Ratio Perm						c0.47			0.07			
v/c Ratio	0.80	0.36		0.95	0.99	0.47	0.73	0.53	0.19	0.97	0.27	
Uniform Delay, d1	38.2	37.6		35.3	35.5	0.0	38.7	20.7	18.1	27.7	6.8	
Progression Factor	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00	1.64	0.58	
Incremental Delay, d2	46.6	1.3		49.8	61.4	0.6	39.6	1.6	0.8	8.7	0.1	
Delay (s)	84.8	38.8		85.1	96.9	0.6	78.3	22.4	18.8	54.1	4.1	
Level of Service	F	D		F	F	A	E	C	B	D	A	
Approach Delay (s)		59.9			20.5			23.1			39.4	
Approach LOS		E			C			C			D	

Intersection Summary			
HCM Average Control Delay	30.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.70		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	69.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Alternative 3 - PM

DELAY

4. Folsom Bridge (Auto Spa)/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	53	84.8	4,494
EBR	63	37.2	2,344
NBL	63	26.5	1,670
NBT	1,958	7.1	13,902
SBT	1,979	28.8	56,995
SBR	63	28.8	1,814
total	4,179	213	81,219

Reported Delay

EBL	EBR	NBL	NBT	SBT	SBR
84.8	37.2	26.5	7.1	28.8	

Reported Adj Flow

EBL	EBR	NBL	NBT	SBT	SBR
53	63	63	1,958	1,979	63

21. Existing Folsom Dam Road/Folsom-Auburn Road

Movement	Adj. Vol.	Delay	Delay*Vol
EBL	53	84.8	4,494
EBT	21	38.8	815
EBR	42	38.8	1,630
WBL	347	85.1	29,530
WBT	21	96.9	2,035
WBR	1,305	0.6	783
NBL	32	78.3	2,506
NBT	663	22.4	14,851
NBR	305	18.8	5,734
SBL	1,442	54.1	78,012
SBT	558	4.1	2,288
SBR	42	4.1	172
total	4,831	527	142,849

total Adj. Volume	9,010
Int. Delay	**24.9**

Reported Delay

EBL	EBT	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
84.8	38.8	85.1	96.9	0.6	78.3	22.4	18.8	54.1	4.1

Reported Adj Flow

EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
53	21	42	347	21	1,305	32	663	305	1442	558	42

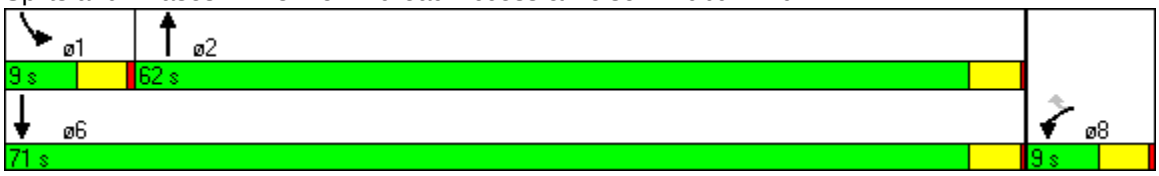
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0		4.0	4.0
Lane Util. Factor	1.00	1.00	0.95		1.00	0.95
Frt	1.00	0.85	1.00		1.00	1.00
Flt Protected	0.95	1.00	1.00		0.95	1.00
Satd. Flow (prot)	1770	1583	3536		1770	3539
Flt Permitted	0.95	1.00	1.00		0.95	1.00
Satd. Flow (perm)	1770	1583	3536		1770	3539
Volume (vph)	20	10	1900	10	10	1920
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	21	11	2000	11	11	2021
RTOR Reduction (vph)	0	11	0	0	0	0
Lane Group Flow (vph)	21	0	2011	0	11	2021
Turn Type		Perm			Prot	
Protected Phases	8		2		1	6
Permitted Phases		8				
Actuated Green, G (s)	2.4	2.4	64.6		1.0	69.6
Effective Green, g (s)	2.4	2.4	64.6		1.0	69.6
Actuated g/C Ratio	0.03	0.03	0.81		0.01	0.87
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)	53	47	2855		22	3079
v/s Ratio Prot	c0.01		c0.57		0.01	c0.57
v/s Ratio Perm		0.00				
v/c Ratio	0.40	0.01	0.70		0.50	0.66
Uniform Delay, d1	38.1	37.6	3.4		39.3	1.6
Progression Factor	1.00	1.00	0.81		1.00	1.00
Incremental Delay, d2	4.8	0.1	1.2		16.8	1.1
Delay (s)	42.9	37.7	4.0		56.0	2.7
Level of Service	D	D	A		E	A
Approach Delay (s)	41.1		4.0			3.0
Approach LOS	D		A			A

Intersection Summary			
HCM Average Control Delay	3.8	HCM Level of Service	A
HCM Volume to Capacity ratio	0.71		
Actuated Cycle Length (s)	80.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.1%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	6	8
Movement	SBL	NBT	SBT	WBL
Lead/Lag	Lead	Lag		
Lead-Lag Optimize				
Recall Mode	None	C-Min	C-Min	None
Maximum Split (s)	9	62	71	9
Maximum Split (%)	11.3%	77.5%	88.8%	11.3%
Minimum Split (s)	8	8	8	8
Yellow Time (s)	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5
Minimum Initial (s)	4	4	4	4
Vehicle Extension (s)	3	3	3	3
Minimum Gap (s)	3	3	3	3
Time Before Reduce (s)	0	0	0	0
Time To Reduce (s)	0	0	0	0
Walk Time (s)				
Flash Dont Walk (s)				
Dual Entry	No	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	13	22	13	4
End Time (s)	22	4	4	13
Yield/Force Off (s)	18	0	0	9
Yield/Force Off 170(s)	18	0	0	9
Local Start Time (s)	13	22	13	4
Local Yield (s)	18	0	0	9
Local Yield 170(s)	18	0	0	9

Intersection Summary	
Cycle Length	80
Control Type	Actuated-Coordinated
Natural Cycle	60
Offset: 0 (0%), Referenced to phase 2:NBT and 6:SBT, Start of Yellow	

Splits and Phases: 18: new Bureau Access & Folsom-Auburn Rd



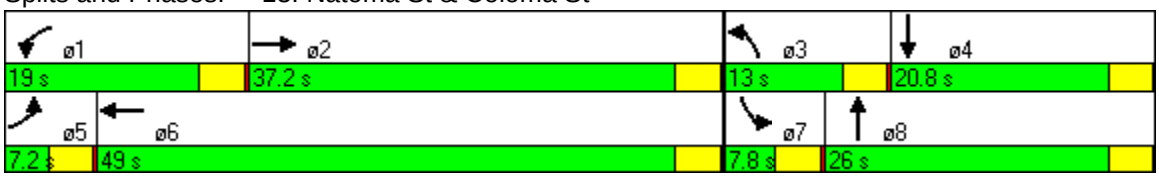
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.99		1.00	0.89		1.00	0.97	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	3481		1770	3499		1770	1655		1770	1805	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	3481		1770	3499		1770	1655		1770	1805	
Volume (vph)	10	970	120	250	740	60	150	90	260	30	40	10
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	11	1021	126	263	779	63	158	95	274	32	42	11
RTOR Reduction (vph)	0	11	0	0	6	0	0	123	0	0	10	0
Lane Group Flow (vph)	11	1136	0	263	836	0	158	246	0	32	43	0
Turn Type	Prot			Prot			Prot			Prot		
Protected Phases	5	2		1	6		3	8		7	4	
Permitted Phases												
Actuated Green, G (s)	3.8	27.7		13.1	37.0		9.4	14.6		2.0	7.2	
Effective Green, g (s)	3.6	27.5		12.9	36.8		9.2	14.4		1.8	7.0	
Actuated g/C Ratio	0.05	0.38		0.18	0.51		0.13	0.20		0.02	0.10	
Clearance Time (s)	3.8	3.8		3.8	3.8		3.8	3.8		3.8	3.8	
Vehicle Extension (s)	1.0	3.1		1.0	3.1		1.0	2.0		1.0	2.0	
Lane Grp Cap (vph)	88	1319		315	1774		224	328		44	174	
v/s Ratio Prot	0.01	c0.33		c0.15	0.24		c0.09	c0.15		0.02	0.02	
v/s Ratio Perm												
v/c Ratio	0.12	0.86		0.83	0.47		0.71	0.75		0.73	0.25	
Uniform Delay, d1	33.0	20.8		28.8	11.6		30.4	27.4		35.2	30.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.2	6.0		16.4	0.2		8.0	8.3		39.6	0.3	
Delay (s)	33.2	26.8		45.2	11.8		38.4	35.7		74.7	30.6	
Level of Service	C	C		D	B		D	D		E	C	
Approach Delay (s)		26.9			19.8			36.5			47.2	
Approach LOS		C			B			D			D	

Intersection Summary			
HCM Average Control Delay	26.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	72.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	79.4%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	WBL	EBT	NBL	SBT	EBL	WBT	SBL	NBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	Min	Min	None	None
Maximum Split (s)	19	37.2	13	20.8	7.2	49	7.8	26
Maximum Split (%)	21.1%	41.3%	14.4%	23.1%	8.0%	54.4%	8.7%	28.9%
Minimum Split (s)	4.8	22.8	4.8	20.8	4.8	22.8	4.8	20.8
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Minimum Initial (s)	1	7	1	7	1	7	1	7
Vehicle Extension (s)	1	3.1	1	2	1	3.1	1	2
Minimum Gap (s)	0.2	2.4	0.2	0.2	0.2	2.4	0.2	0.2
Time Before Reduce (s)	0	18	0	0	0	18	0	0
Time To Reduce (s)	0	25	0	0	0	25	0	0
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		12		10		12		10
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	19	56.2	69.2	0	7.2	56.2	64
End Time (s)	19	56.2	69.2	0	7.2	56.2	64	0
Yield/Force Off (s)	15.2	52.4	65.4	86.2	3.4	52.4	60.2	86.2
Yield/Force Off 170(s)	15.2	52.4	65.4	76.2	3.4	52.4	60.2	76.2
Local Start Time (s)	71	0	37.2	50.2	71	78.2	37.2	45
Local Yield (s)	86.2	33.4	46.4	67.2	74.4	33.4	41.2	67.2
Local Yield 170(s)	86.2	33.4	46.4	57.2	74.4	33.4	41.2	57.2

Intersection Summary	
Cycle Length	90
Control Type	Actuated-Uncoordinated
Natural Cycle	90

Splits and Phases: 13: Natoma St & Coloma St



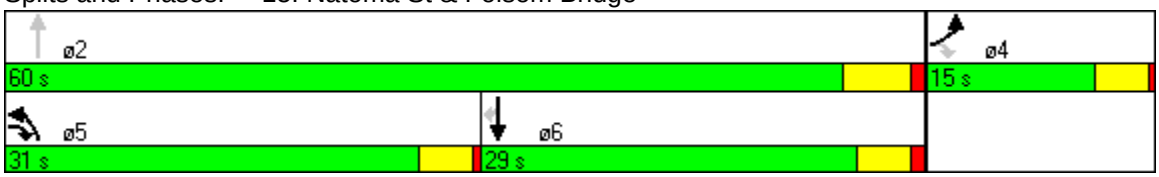
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.91	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	5085	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	5085	1583
Volume (vph)	450	840	920	1140	1470	210
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	474	884	968	1200	1547	221
RTOR Reduction (vph)	0	1	0	0	0	148
Lane Group Flow (vph)	474	883	968	1200	1547	73
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	11.0	38.0	27.0	54.4	24.4	24.4
Effective Green, g (s)	11.0	38.0	27.0	55.9	24.9	24.9
Actuated g/C Ratio	0.15	0.51	0.36	0.75	0.33	0.33
Clearance Time (s)	4.0	4.0	4.0	5.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0	2.0	3.0	2.0	2.0
Lane Grp Cap (vph)	504	888	1238	2641	1690	526
v/s Ratio Prot	0.14	c0.36	0.28		c0.30	
v/s Ratio Perm		0.20		0.34		0.05
v/c Ratio	0.94	0.99	0.78	0.45	0.92	0.14
Uniform Delay, d1	31.6	18.3	21.3	3.6	24.0	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	25.7	28.6	3.0	0.1	8.0	0.0
Delay (s)	57.3	47.0	24.4	3.8	32.0	17.5
Level of Service	E	D	C	A	C	B
Approach Delay (s)	50.6			13.0	30.2	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay	28.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	74.9	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	None	None	None	None
Maximum Split (s)	60	15	31	29
Maximum Split (%)	80.0%	20.0%	41.3%	38.7%
Minimum Split (s)	12.5	6	6	26.5
Yellow Time (s)	4.5	3.5	3.5	3.5
All-Red Time (s)	1	0.5	0.5	1
Minimum Initial (s)	7	2	2	2
Vehicle Extension (s)	3	2	2	2
Minimum Gap (s)	2.4	0.2	0.2	0.2
Time Before Reduce (s)	18	0	0	0
Time To Reduce (s)	25	0	0	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	0	60	0	31
End Time (s)	60	0	31	60
Yield/Force Off (s)	54.5	71	27	55.5
Yield/Force Off 170(s)	54.5	71	27	40.5
Local Start Time (s)	44	29	44	0
Local Yield (s)	23.5	40	71	24.5
Local Yield 170(s)	23.5	40	71	9.5

Intersection Summary	
Cycle Length	75
Control Type	Actuated-Uncoordinated
Natural Cycle	75

Splits and Phases: 15: Natoma St & Folsom Bridge



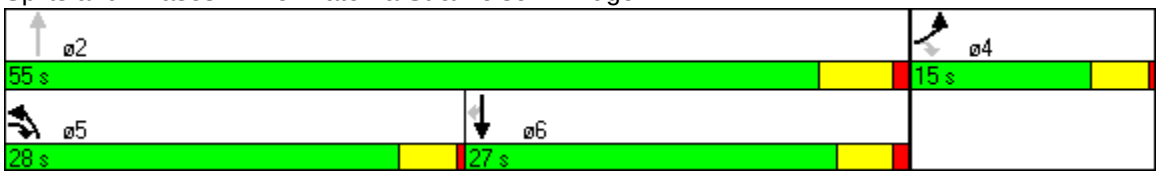
Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	1.00	0.97	0.95	0.91	1.00
Frt	1.00	0.85	1.00	1.00	1.00	0.85
Flt Protected	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (prot)	3433	1583	3433	3539	5085	1583
Flt Permitted	0.95	1.00	0.95	1.00	1.00	1.00
Satd. Flow (perm)	3433	1583	3433	3539	5085	1583
Volume (vph)	450	840	920	1140	1470	210
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	474	884	968	1200	1547	221
RTOR Reduction (vph)	0	1	0	0	0	148
Lane Group Flow (vph)	474	884	968	1200	1547	73
Turn Type		pm+ov	Prot			Perm
Protected Phases	4	5	5		6	
Permitted Phases		4		2		6
Actuated Green, G (s)	10.9	35.0	24.1	49.6	22.5	22.5
Effective Green, g (s)	10.9	35.0	24.1	51.1	23.0	23.0
Actuated g/C Ratio	0.16	0.50	0.34	0.73	0.33	0.33
Clearance Time (s)	4.0	4.0	4.0	5.5	4.5	4.5
Vehicle Extension (s)	2.0	2.0	2.0	3.0	2.0	2.0
Lane Grp Cap (vph)	535	882	1182	2583	1671	520
v/s Ratio Prot	0.14	c0.34	0.28		c0.30	
v/s Ratio Perm		0.21		0.34		0.05
v/c Ratio	0.89	1.00	0.82	0.46	0.93	0.14
Uniform Delay, d1	28.9	17.5	21.0	3.9	22.7	16.5
Progression Factor	1.06	0.98	1.00	1.00	1.00	1.00
Incremental Delay, d2	17.2	28.8	4.3	0.1	9.1	0.0
Delay (s)	47.8	45.9	25.3	4.0	31.7	16.6
Level of Service	D	D	C	A	C	B
Approach Delay (s)	46.6			13.5	29.8	
Approach LOS	D			B	C	

Intersection Summary			
HCM Average Control Delay	27.4	HCM Level of Service	C
HCM Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.1%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	5	6
Movement	NBT	EBL	NBL	SBT
Lead/Lag			Lead	Lag
Lead-Lag Optimize				
Recall Mode	Min	C-Min	None	Min
Maximum Split (s)	55	15	28	27
Maximum Split (%)	78.6%	21.4%	40.0%	38.6%
Minimum Split (s)	12.5	6	6	26.5
Yellow Time (s)	4.5	3.5	3.5	3.5
All-Red Time (s)	1	0.5	0.5	1
Minimum Initial (s)	7	2	2	2
Vehicle Extension (s)	3	2	2	2
Minimum Gap (s)	2.4	0.2	0.2	0.2
Time Before Reduce (s)	18	0	0	0
Time To Reduce (s)	25	0	0	0
Walk Time (s)				7
Flash Dont Walk (s)				15
Dual Entry	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes
Start Time (s)	64	49	64	22
End Time (s)	49	64	22	49
Yield/Force Off (s)	43.5	60	18	44.5
Yield/Force Off 170(s)	43.5	60	18	44.5
Local Start Time (s)	15	0	15	43
Local Yield (s)	64.5	11	39	65.5
Local Yield 170(s)	64.5	11	39	65.5

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	70
Offset: 49 (70%), Referenced to phase 4:EBL, Start of Green	

Splits and Phases: 15: Natoma St & Folsom Bridge



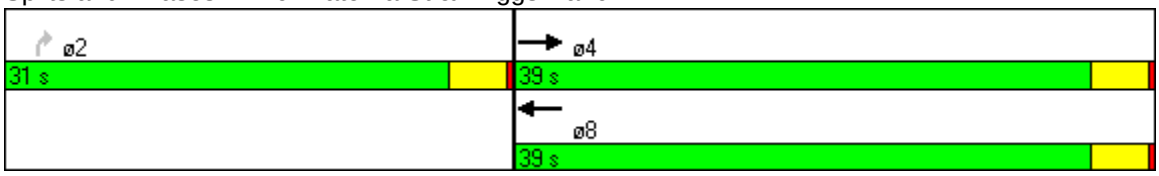
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0			4.0		4.0
Lane Util. Factor	0.95			0.95		1.00
Frt	0.98			1.00		0.86
Flt Protected	1.00			1.00		1.00
Satd. Flow (prot)	3486			3539		1611
Flt Permitted	1.00			1.00		1.00
Satd. Flow (perm)	3486			3539		1611
Volume (vph)	980	110	0	1130	0	310
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1032	116	0	1189	0	326
RTOR Reduction (vph)	8	0	0	0	0	53
Lane Group Flow (vph)	1140	0	0	1189	0	273
Turn Type						custom
Protected Phases	4			8		
Permitted Phases						2
Actuated Green, G (s)	46.0			46.0		16.0
Effective Green, g (s)	46.0			46.0		16.0
Actuated g/C Ratio	0.66			0.66		0.23
Clearance Time (s)	4.0			4.0		4.0
Vehicle Extension (s)	3.0			3.0		3.0
Lane Grp Cap (vph)	2291			2326		368
v/s Ratio Prot	0.33			c0.34		
v/s Ratio Perm						c0.17
v/c Ratio	0.50			0.51		0.74
Uniform Delay, d1	6.1			6.2		25.1
Progression Factor	1.00			0.32		1.00
Incremental Delay, d2	0.8			0.5		7.8
Delay (s)	6.9			2.5		32.9
Level of Service	A			A		C
Approach Delay (s)	6.9			2.5	32.9	
Approach LOS	A			A	C	

Intersection Summary			
HCM Average Control Delay	8.1	HCM Level of Service	A
HCM Volume to Capacity ratio	0.57		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	56.5%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	2	4	8
Movement	NBR	EBT	WBT
Lead/Lag			
Lead-Lag Optimize			
Recall Mode	None	C-Min	C-Min
Maximum Split (s)	31	39	39
Maximum Split (%)	44.3%	55.7%	55.7%
Minimum Split (s)	8	8	8
Yellow Time (s)	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5
Minimum Initial (s)	4	4	4
Vehicle Extension (s)	3	3	3
Minimum Gap (s)	3	3	3
Time Before Reduce (s)	0	0	0
Time To Reduce (s)	0	0	0
Walk Time (s)			
Flash Dont Walk (s)			
Dual Entry	Yes	Yes	Yes
Inhibit Max	Yes	Yes	Yes
Start Time (s)	40	1	1
End Time (s)	1	40	40
Yield/Force Off (s)	67	36	36
Yield/Force Off 170(s)	67	36	36
Local Start Time (s)	4	35	35
Local Yield (s)	31	0	0
Local Yield 170(s)	31	0	0

Intersection Summary	
Cycle Length	70
Control Type	Actuated-Coordinated
Natural Cycle	40
Offset: 36 (51%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	

Splits and Phases: 19: Natoma St & Briggs Ranch



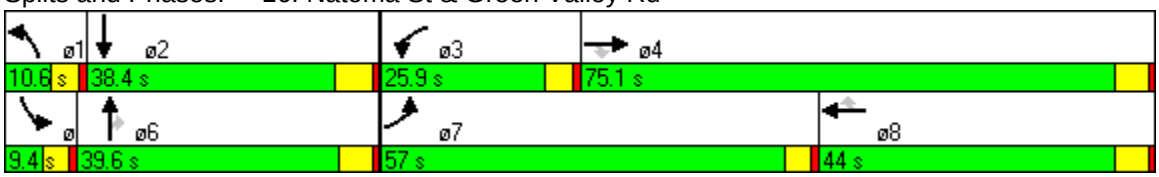
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	0.97	0.95	1.00	0.97	0.95	1.00	0.97	0.91	1.00	0.97	0.91	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	5085	1583	3433	5085	1583
Volume (vph)	1160	820	50	320	900	130	60	990	320	100	390	760
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	1221	863	53	337	947	137	63	1042	337	105	411	800
RTOR Reduction (vph)	0	0	27	0	0	51	0	0	248	0	0	0
Lane Group Flow (vph)	1221	863	26	337	947	86	63	1042	89	105	411	800
Turn Type	Prot		Perm	Prot		Perm	Prot		Perm	Prot		Free
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases			4			8			6			Free
Actuated Green, G (s)	52.5	72.7	72.7	18.3	38.5	38.5	4.9	34.7	34.7	4.9	34.2	150.6
Effective Green, g (s)	53.0	74.2	74.2	18.8	40.0	40.0	5.4	36.2	36.2	5.4	36.2	150.6
Actuated g/C Ratio	0.35	0.49	0.49	0.12	0.27	0.27	0.04	0.24	0.24	0.04	0.24	1.00
Clearance Time (s)	4.5	5.5	5.5	4.5	5.5	5.5	4.5	5.5	5.5	4.5	6.0	
Vehicle Extension (s)	2.0	4.1	4.1	2.0	4.5	4.5	2.0	4.5	4.5	2.0	3.7	
Lane Grp Cap (vph)	1208	1744	780	429	940	420	123	1222	381	123	1222	1583
v/s Ratio Prot	c0.36	0.24		0.10	c0.27		0.02	c0.20		0.03	0.08	
v/s Ratio Perm			0.02			0.05			0.06			c0.51
v/c Ratio	1.01	0.49	0.03	0.79	1.01	0.21	0.51	0.85	0.23	0.85	0.34	0.51
Uniform Delay, d1	48.8	25.6	19.7	63.9	55.3	43.0	71.3	54.7	46.0	72.2	47.3	0.0
Progression 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
Incremental Delay, d2	28.6	0.3	0.0	8.5	31.2	0.4	1.5	6.4	0.5	39.1	0.2	1.2
Delay (s)	77.4	25.9	19.7	72.4	86.5	43.4	72.8	61.0	46.6	111.3	47.5	1.2
Level of Service	E	C	B	E	F	D	E	E	D	F	D	A
Approach Delay (s)		55.2			79.0			58.2			24.4	
Approach LOS		E			E			E			C	

Intersection Summary			
HCM Average Control Delay	54.8	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	150.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	93.8%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Phase Number	1	2	3	4	5	6	7	8
Movement	NBL	SBT	WBL	EBT	SBL	NBT	EBL	WBT
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize								
Recall Mode	None	Min	None	None	None	Min	None	None
Maximum Split (s)	10.6	38.4	25.9	75.1	9.4	39.6	57	44
Maximum Split (%)	7.1%	25.6%	17.3%	50.1%	6.3%	26.4%	38.0%	29.3%
Minimum Split (s)	6.5	35	6.5	40.5	6.5	38.5	6.5	41.5
Yellow Time (s)	3.5	5	3.5	4.5	3.5	4.5	3.5	4.5
All-Red Time (s)	1	1	1	1	1	1	1	1
Minimum Initial (s)	2	7	2	7	2	7	2	7
Vehicle Extension (s)	2	3.7	2	4.1	2	4.5	2	4.5
Minimum Gap (s)	2	2	2	2.4	2	3	2	3
Time Before Reduce (s)	0	10	0	10	0	10	0	10
Time To Reduce (s)	0	25	0	25	0	25	0	25
Walk Time (s)		7		7		7		7
Flash Dont Walk (s)		22		28		26		29
Dual Entry	No	No	No	No	No	No	No	No
Inhibit Max	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Start Time (s)	0	10.6	49	74.9	0	9.4	49	106
End Time (s)	10.6	49	74.9	0	9.4	49	106	0
Yield/Force Off (s)	6.1	43	70.4	144.5	4.9	43.5	101.5	144.5
Yield/Force Off 170(s)	6.1	43	70.4	116.5	4.9	43.5	101.5	115.5
Local Start Time (s)	139.4	0	38.4	64.3	139.4	148.8	38.4	95.4
Local Yield (s)	145.5	32.4	59.8	133.9	144.3	32.9	90.9	133.9
Local Yield 170(s)	145.5	32.4	59.8	105.9	144.3	32.9	90.9	104.9

Intersection Summary	
Cycle Length	150
Control Type	Actuated-Uncoordinated
Natural Cycle	145

Splits and Phases: 16: Natoma St & Green Valley Rd



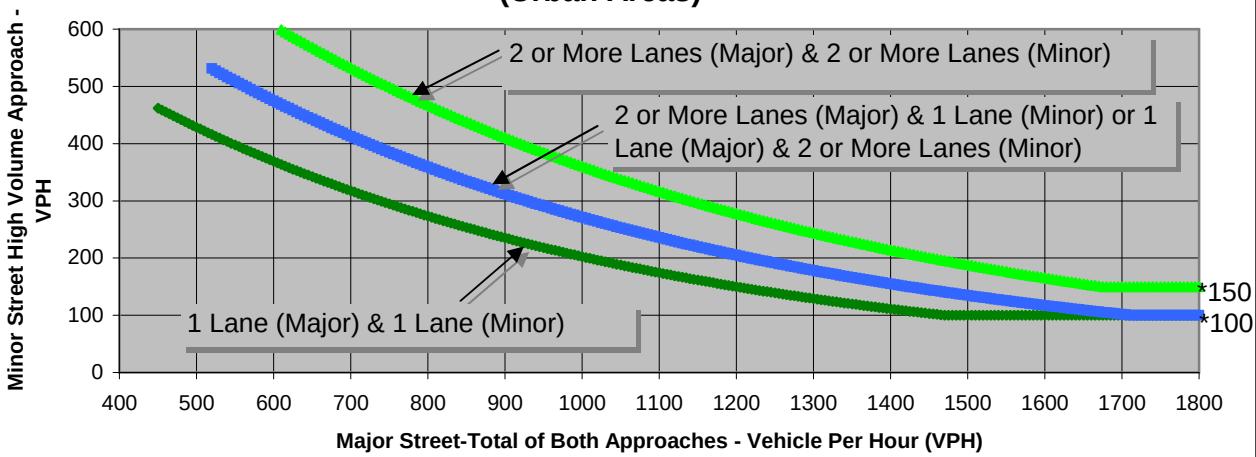
2025 Conditions – Alternatives 2-4

Signal Warrant Analysis

FEHR & PEERS
TRANSPORTATION CONSULTANTS

				Project No	RS05 2106	Page No	1/1
				Subject	E. Natoma St/Briggs Ranch		
Computed by	JDG	Date	6.10.05		AM Peak		
Checked by		Date			2025 Alternatives 2-4		
Approved by		Date		Sheet No	1	of	1

Figure 9-8
PEAK HOUR VOLUME WARRANT
(Urban Areas)



*Note: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.
Source: Traffic Manual, Caltrans 1996.

Name of Street		Major Street	Minor Street	Warrant Met
Number of Lanes	Two or More Lane (Y/N)	y		YES
	One Lane (Y/N)		y	
Traffic Volume (VPH) *		2280	220	

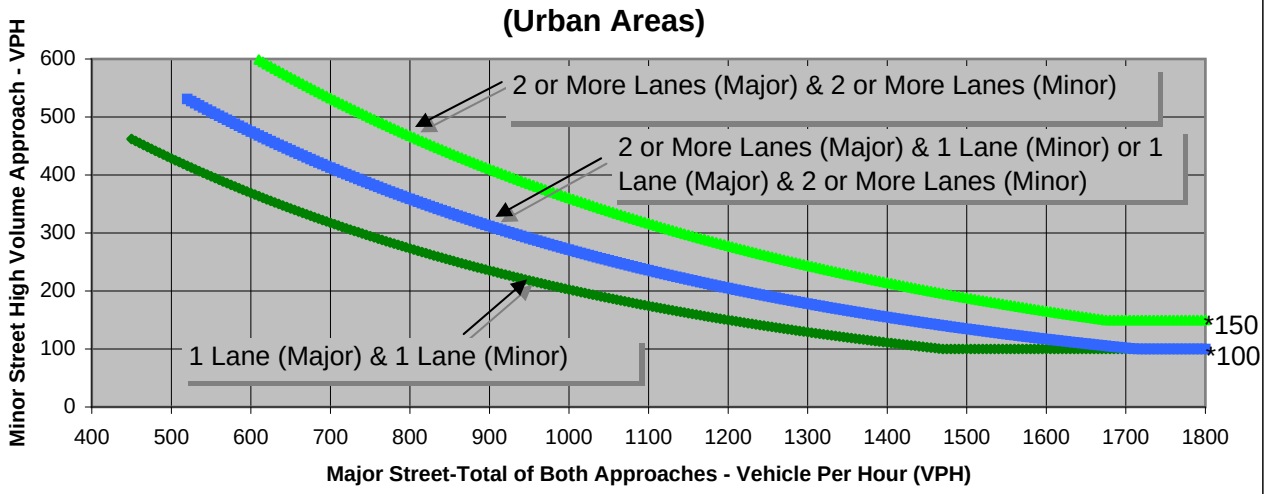
*Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

- ☐ Existing Conditions
- ☐ Existing Plus Project Conditions
- ☐ Cumulative No Project Conditions
- ☑ Cumulative Plus Project Conditions

FEHR & PEERS
TRANSPORTATION CONSULTANTS

			Project No	RS05 2106	Page No 1/1
			Subject	E. Natoma St/Briggs Ranch	
Computed by	JDG	Date 6.10.05		PM Peak	
Checked by		Date		2025 Alternatives 2-4	
Approved by		Date	Sheet No	1 of 1	

Figure 9-8
PEAK HOUR VOLUME WARRANT
(Urban Areas)

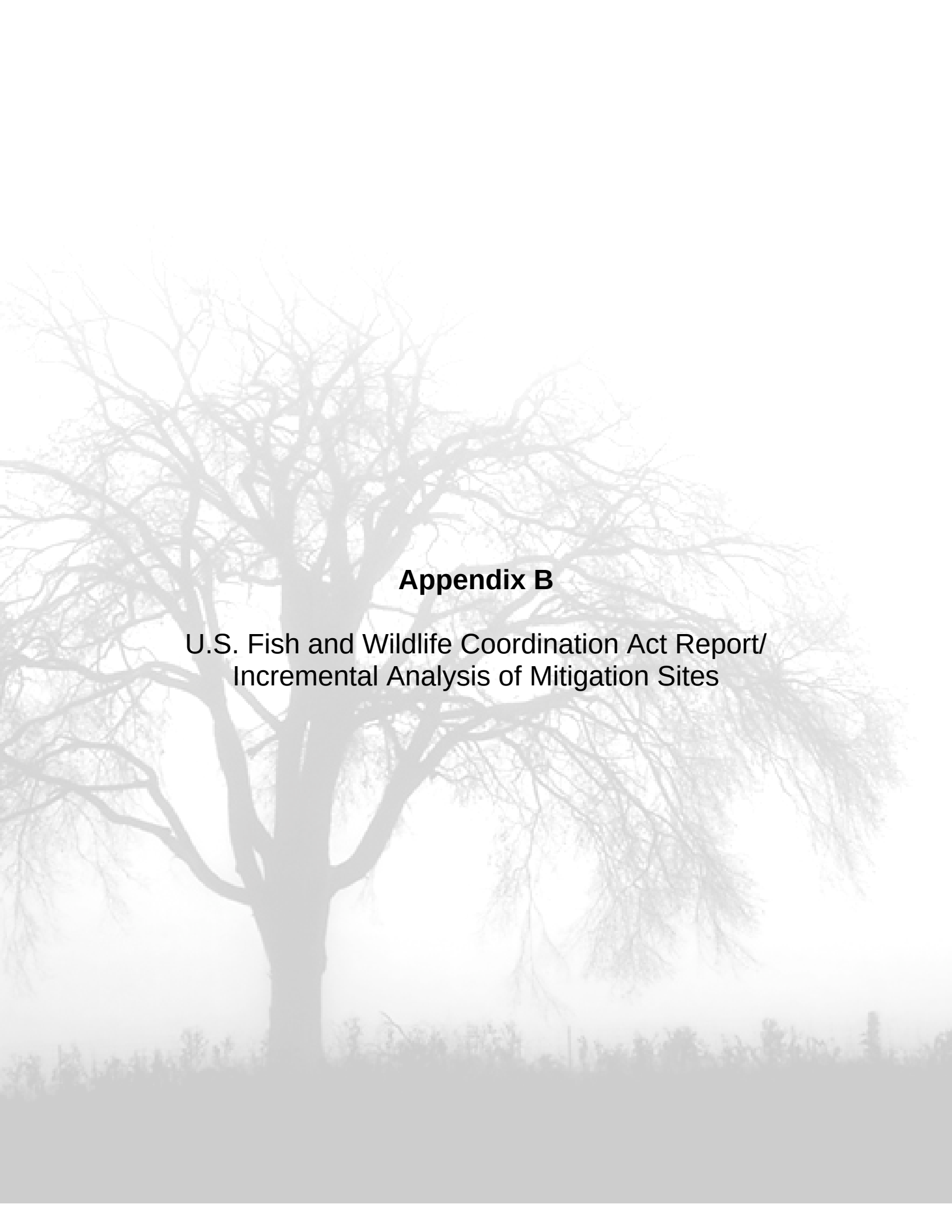


*Note: 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.
Source: Traffic Manual, Caltrans 1996.

Name of Street		Major Street	Minor Street	Warrant Met
Number of Lanes	Two or More Lane (Y/N)	y		YES
	One Lane (Y/N)		y	
Traffic Volume (VPH) *		2220	310	

*Note: Traffic Volume for Major Street is Total Volume of Both Approches.
Traffic Volume for Minor Street is the Volume of High Volume Approach.

- ☐ Existing Conditions
- ☐ Existing Plus Project Conditions
- ☐ Cumulative No Project Conditions
- ☑ Cumulative Plus Project Conditions



Appendix B

U.S. Fish and Wildlife Coordination Act Report/
Incremental Analysis of Mitigation Sites

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:

Mr. Scott Clark
Chief, Planning Division
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95825-2922

Dear Mr. Clark:

The Corps of Engineers has requested supplemental coordination under the Fish and Wildlife Coordination Act (FWCA) for the Folsom Bridge Project, California, as part of the American River Watershed Investigation Long-Term Evaluation. The enclosed report constitutes the Fish and Wildlife Service's Revised Draft Supplemental FWCA report for the proposed project.

If you have any questions regarding this report on the proposed project, please contact Doug Weinrich at (916) 414-6563.

Sincerely,

David L. Harlow
Acting Field Supervisor

Enclosure

TAKE PRIDE IN AMERICA

cc:
CNO, Sacramento, CA
NOAA Fisheries, Sacramento, CA
Regional Manager, Region II, CDFG, Rancho Cordova, CA
Jane Rinck, COE, Sacramento, CA

UNITED STATES DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

REVISED SUPPLEMENTAL
FISH AND WILDIFE COORDINATION ACT REPORT

FOR THE

AMERICAN RIVER WATERSHED INVESTIGATION
FOLSOM DAM MODIFICATION PROJECT

Prepared by

U.S. FISH AND WILDLIFE SERVICE
HABITAT CONSERVATION DIVISION
SACRAMENTO FISH AND WILDLIFE OFFICE
SACRAMENTO, CALIFORNIA

Prepared for

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT
SACRAMENTO, CALIFORNIA

March 2006

SUPPLEMENTAL
FISH AND WILDLIFE COORDINATION ACT REPORT
AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA
FOLSOM BRIDGE PROJECT
MARCH 2006

BACKGROUND

The Folsom Bridge Project is part of the Folsom Dam Raise Project, which is a component of the Corps of Engineers' (Corps) American River Watershed Long-Term Project. The final Supplemental Plan Formulation Report/Environmental Impact Statement/ Environmental Impact Report (SEIS/EIR) for the Long-Term Project was completed in February 2002. The subsequent Chief of Engineers' Report was forwarded to Congress for possible authorization for construction.

The Folsom Dam Raise Project includes various features to address the Sacramento area's potential flood risk. The main feature of the project is to raise Folsom Dam up to 10 feet to increase the flood storage capacity behind the dam. Construction of the Dam Raise Project (concurrent with construction of the Folsom Dam Modifications Project) is expected to take place over 20 years. Since numerous closures of the existing Folsom Dam Road would be expected during construction, a temporary bridge was proposed to mitigate the effects of these closures.

In February 2003, the U.S. Bureau of Reclamation (Reclamation) closed Folsom Dam Road indefinitely for security and public safety reasons. This closure had significant effects on the residents and businesses in the surrounding area. In September 2004, Congress authorized the Folsom Dam Raise Project, including authorization of construction of a permanent bridge just downstream of Folsom Dam.

The Folsom Dam Bridge Project was authorized by Congress in the Energy and Water Development Appropriations Act of 2004 (Public Law 108-137):

> The Secretary is authorized to accept funds from State and local governments and other Federal agencies for the purpose of constructing a permanent bridge instead of the temporary bridge described in the recommended plan....
>
> The Secretary, in cooperation with appropriate non-Federal interests, shall immediately commence appropriate studies for, and the design of, a permanent bridge (including an evaluation of potential impacts of bridge construction on traffic patterns and identification of alternatives for mitigating such impacts) and.... shall proceed to construction of the bridge as soon as practicable....

The study authority for the American River Watershed Investigation was provided under the Flood Control Act of 1962 (Public Law 87-874), and specific direction was provided in section 566 of the Water Resources Development Act of 1999 (Public Law 106-53).

In the Energy and Water Appropriations Act of 2006 (Public Law 109-103) Congress directed the Corps and Reclamation to work together to reduce flood damages and address dam safety at Folsom Dam. This effort, termed the Combined Federal Project, is a joint effort to address objectives associated with both the Corps' flood damage reduction mission and Reclamation's dam safety program at Folsom Dam and its associated structures. Therefore, concurrent with the Corps' bridge construction project, the Combined Federal Project will evaluate and consider issues associated with the current hydrologic conditions and major flood events, seismic conditions, and static conditions including seepage and piping through the embankments. An initial screening of measures which could be undertaken as part of this effort included construction of an auxiliary spillway on the left abutment of Folsom Dam. As a result, the bridge project assumed a spillway would be built and included it in design of the bridge project.

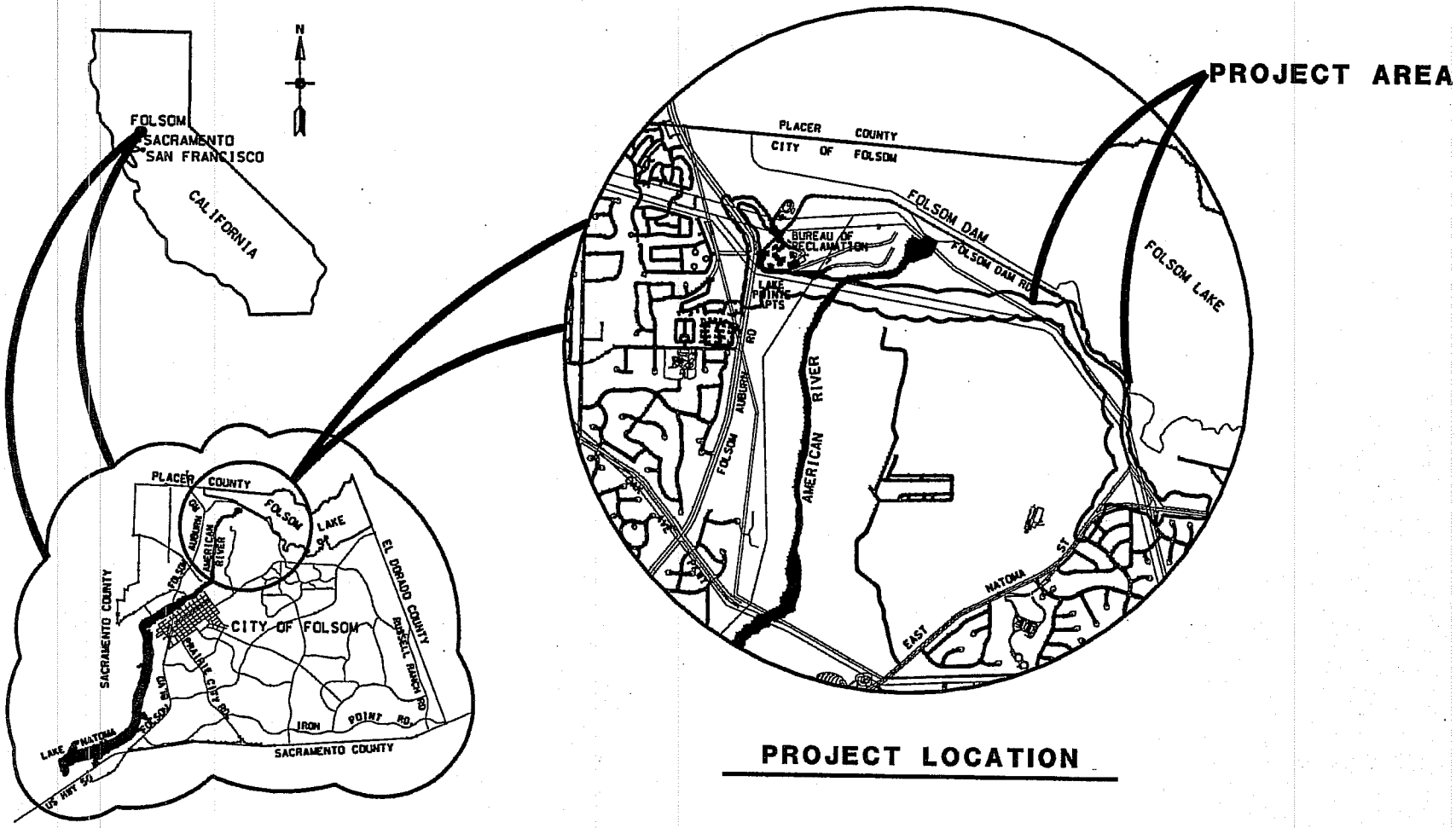
PROJECT DESCRIPTION

The project is located in northeastern Sacramento County, near the City of Folsom, California (Figure 1). The project area is shown outlined in black on Figure 2. A general road alignment of the alternatives being evaluated by the Corps for the Folsom Bridge Project is shown in Figures 3 and 4.

The alternatives are:

Alternative 1 - No Action
Alternative 2 - Four-Lane Bridge, Four-Lane Road, Full Intersections
Alternative 3 - Four-Lane Bridge, Two-Lane Road, Full Intersections
Alternative 4 - Four-Lane Bridge, Two-Lane Road, Partial Intersection (East)
Alternative 5 - Four-Lane Bridge, Two-Lane Road, Two Partial Intersections

Each action alternative would provide a full traffic arterial between the existing Folsom Dam Road intersection at East Natoma Street to the Folsom-Auburn Road with a bridge crossing at the American River in the vicinity of Folsom Dam. Each alternative would be designed to meet current transportation design and safety standards for a main traffic arterial as defined by the City of Folsom and California Department of Transportation (Caltrans). Features would include a four-lane thoroughfare with approach roads, bridge structure, terminus and feeder intersections, turn lanes, associated facilities, and bicycle and pedestrian access. The main features of each alternative are described below. A more complete description can be found in the Corps' environmental documentation.



US Army Corps of Engineers
Sacramento District

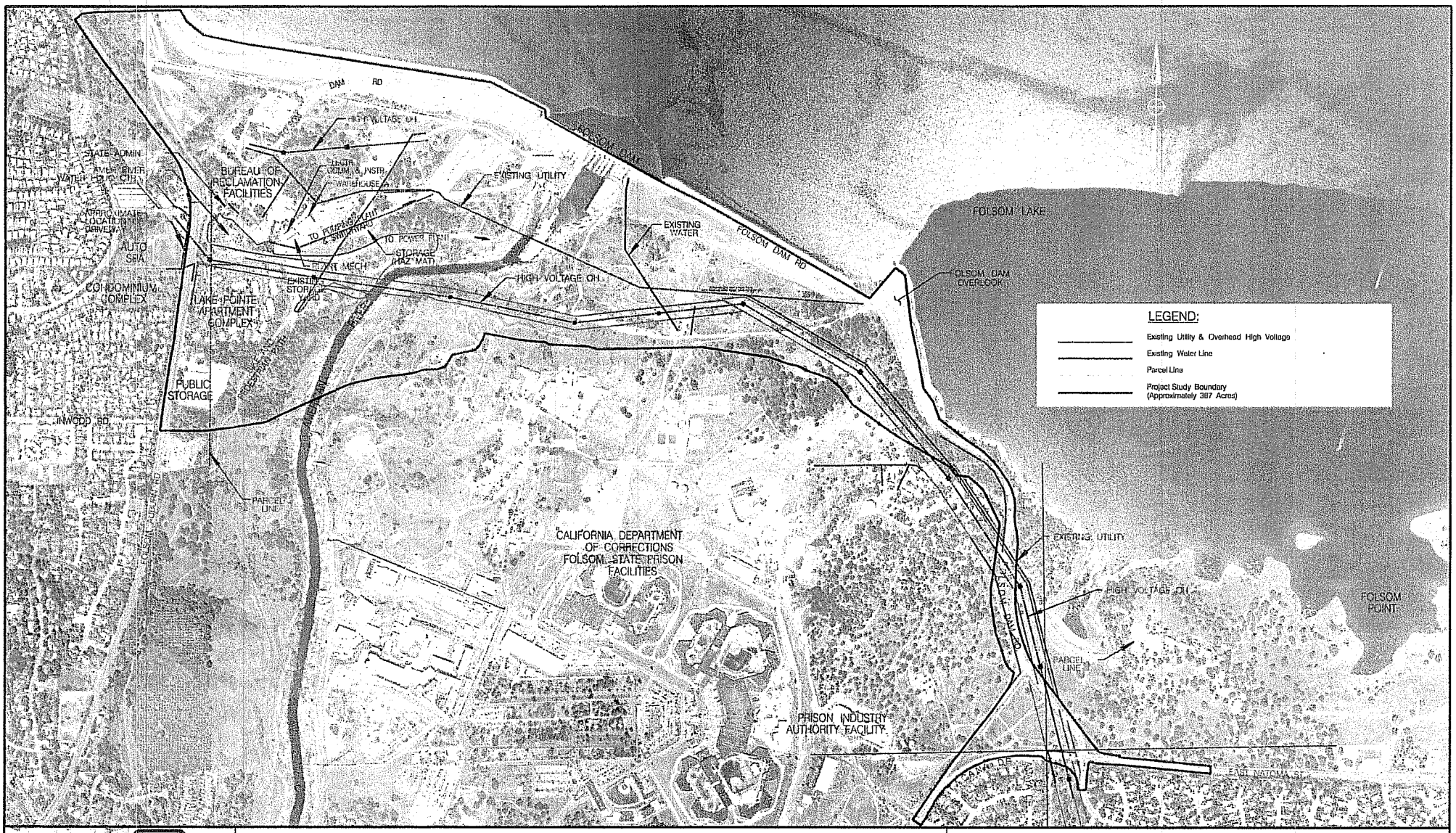
American River Watershed Project

Folsom Dam Raise and Folsom Bridge SEIS/EIR

Figure 1. - Project Location Map

May 20, 2005

No Scale



US Army Corps of Engineers
Sacramento District

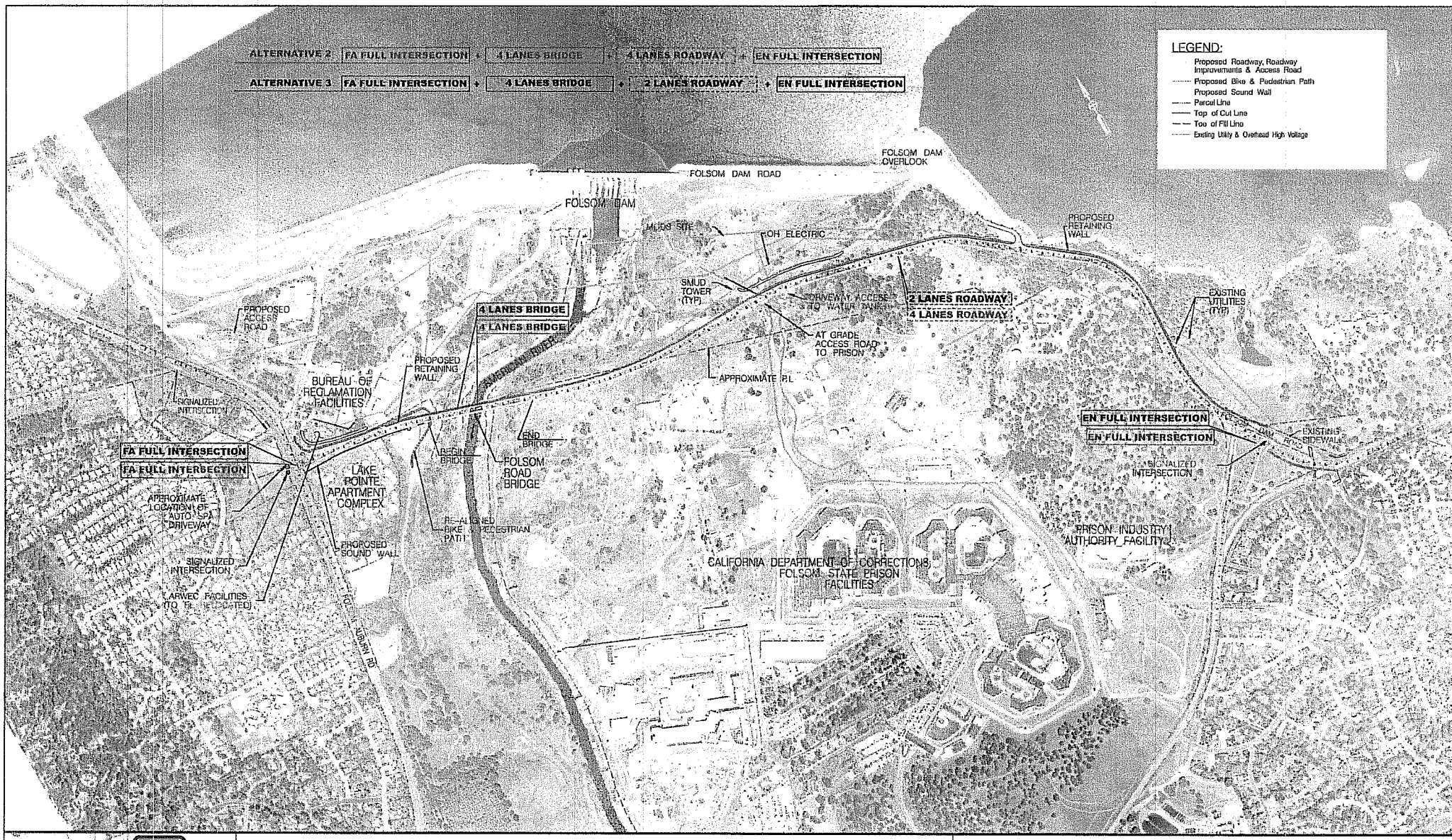
American River Watershed Project

Folsom Bridge SEIS/SEIR

Figure 2. - Project Study Area

February 10, 2006

Scale 1" = 800'



US Army Corps of Engineers
Sacramento District

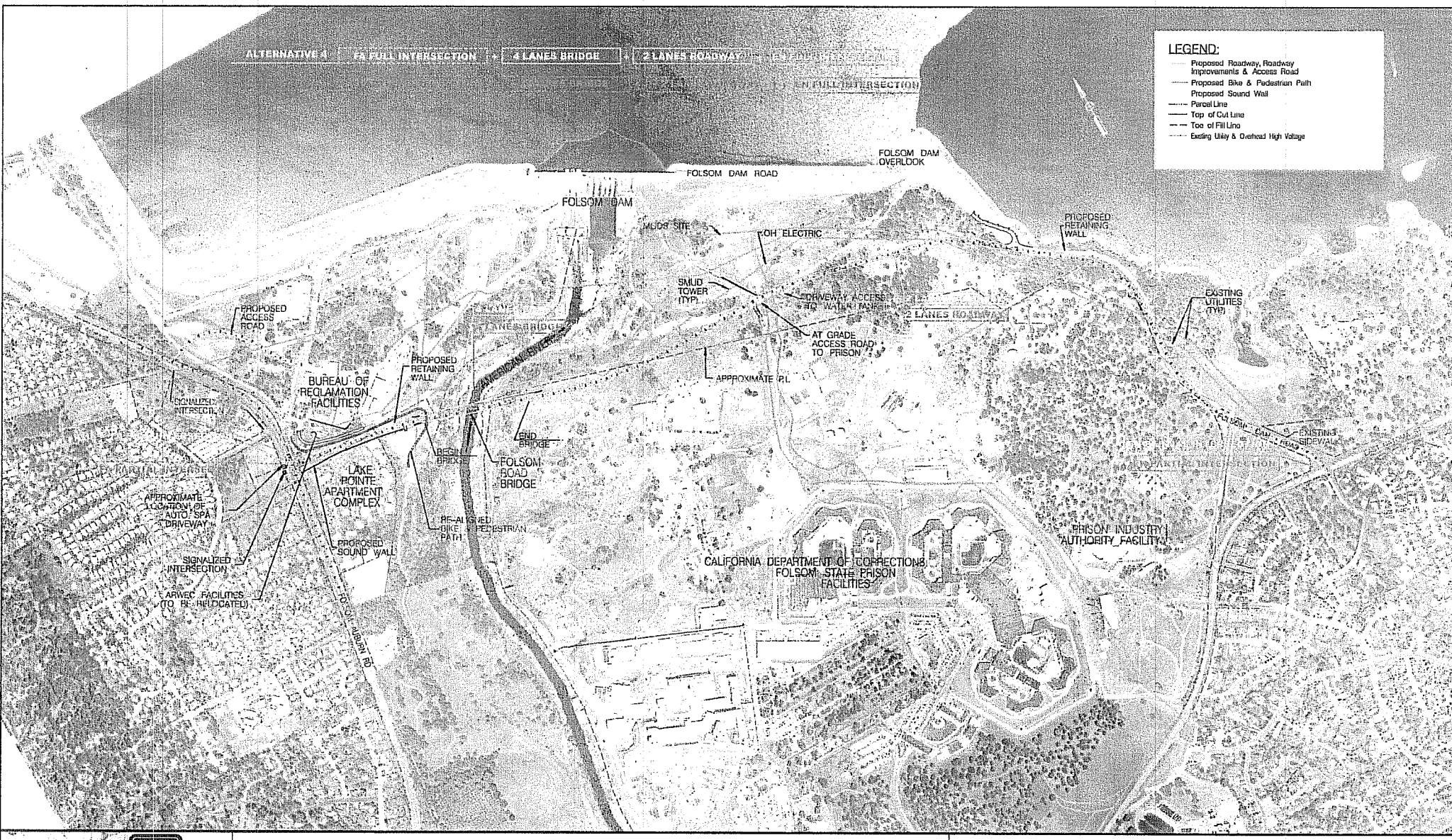
American River Watershed Project

Folsom Bridge SEIS/SEIR

Figure 3. - Alternative 2 and Alternative 3

February 10, 2006

Scale 1" = 800'



US Army Corps of Engineers
Sacramento District

American River Watershed Project

Folsom Bridge SEIS/SEIR

Figure 4. - Alternative 4 and Alternative 5

February 10, 2006

Scale 1" = 800'

Alternative 2 – Four-Lane Bridge, Four-Lane Road, Full Intersections

Folsom Dam Road and Bridge

Intersection of Folsom Dam Road and East Natoma Street. The existing intersection at Folsom Dam Road and East Natoma Street would be reconfigured to accommodate four lanes of traffic flow and improve traffic circulation. A new signaled T-intersection would be constructed to the northwest, replacing the existing four-way intersection. At the T-intersection, two left turn lanes and one right turn lane northbound, and two left turn lanes and one right turn land eastbound would be provided to accommodate traffic flow. New four-lane segments of roadway would be constructed east and southwest from the new intersection, eventually transitioning into the existing two lanes of East Natoma Street.

The existing intersection with Briggs Ranch Drive would be eliminated and a new segment of Briggs Ranch Drive would be constructed southwest of the new Folsom Dam Road/East Natoma Street. Portions of the old intersection of Folsom Dam Road and East Natoma Street would be removed. The exisintg segment of East Natoma Street south of the old intersection would likely be abandoned

Roadway from Intersection to Bridge. The new roadway segment from the intersection at East Natoma Street would generally follow the existing Folsom Dam Road alignment to a veer-off about 1,000 feet south of the Folsom Dam overlook driveway. Construction of this portion of the roadway would include some cut into the existing hillside to provide clearance for the new four-lane roadway. Additionally, there would be a 300-foot-long retaining wall along the east side of the road to support the fill material for the roadway. At the veer-off point, the road would rotate to the southwest Folsom Modifications Project area (proposed gated spillway structure) and then continue through California Department of Corrections (CDC) facilities to the river. This alignment would cross about 4 acres of CDC property.

Construction of each new roadway segment would include site preparation (cut, fill, and grading), laying a base of gravel, laying the riding surface of asphalt, and finishing the road with striping. The excess cut or ripped material would be removed, temporarily stockpiled, and reused for future work by Reclamation or the City of Folsom. Construction right-of-way on the roadway would be 10 to 15 feet beyond the cut and fill line. The new four-lane roadway would have 12-foot-wide lanes and 8-foot-wide shoulders.

Work along the existing Folsom Dam Road alignment would be done in stages (half the roadway at one time) to accommodate movement of traffic during construction. The old roadway surface (asphalt) would be removed, incorporated into roadway fill, or recycled.

Reclamation and Prison Access Roads.
Construction of the gated auxiliary spillway would convert the part of the staging area for the Folsom Dam Modification Project to a concrete structure for outflow management and/or dam safety. The remaining portion of this area would likely be used as a staging area for this project and an access road would be constructed to the staging area and spillway for maintenance.

A new intersection and short roadway would be constructed to connect the new Folsom Dam Road to the existing dam road for Reclamation's operations and maintenance activities. Farther west, an access driveway from the new Folsom Dam Road would be provided to Reclamation and the City of Folsom's water control structure. In addition, access would be provided via a left turn lane to allow for continued access CDC's Sacramento-Folsom firing range.

Bridge Across American River. The new Folsom Dam Road would continue west and connect to the east bridge abutment, which would be located 500 feet east of the river. The bridge's orientation would align slightly north to allow the road to connect to the existing Folsom Dam Road intersection at Folsom-Auburn Road just south of most of Reclamation's facilities.

Two roads would provide access for workers, vehicles, and equipment to the bridge construction area. Access from the east would be provided via an existing dirt road that would connect with a new section of Folsom Dam Road, access from the west would be provided via Reclamation's existing road to the powerhouse.

The area just west of the proposed bridge is covered with about 80 feet of fill material previously excavated during construction of Folsom Dam. This material is not suitable for construction and would need to be excavated and removed prior to construction of the new bridge

The new bridge would be a pre-stressed concrete, cast-in-place, segmental box girder structure. The bridge span and concrete abutments would be about 915 feet long. The span would be supported by two piers placed above the mean river water level in the river bank areas below. The bridge span would have an estimated clearance of 180 feet above the river (top of deck to mean river surface).

The bridge would be designed to allow stormwater to drain by gravity off the roadway surface to the edge of the bridge. The stormwater would also contain oils, fuels, and other potentially hazardous materials from the vehicle traffic crossing the bridge. To avoid contamination of the land or river below, the bridge would have a water collection system. The stormwater would flow into drains at the end of the bridge, collect in pipelines, if needed, gravity flow off the bridge, and discharge into a siltation basin containing riparian or similar vegetation to bio-remediate the runoff.

Roadway from Bridge to Intersection. The west bridge abutment would be located 400 feet west of the river. From the abutment, the alignment of the new roadway segment would cross the north side of existing the Reclamation storage yard; a dam service road, the northeast edge of the Lake Point Apartment complex, and south side of the American River Water Education Center (ARWEC) facilities, and connect to the existing Folsom-Auburn Road across from the existing driveway to the Auto Spa. This alignment would affect the ARWEC, some existing Reclamation storage and parking, and Lake Point Apartment complex facilities. Sound walls and landscaping would be incorporated into the roadway design

Intersection of Folsom Dam Road and Folsom-Auburn Road. A new intersection would be constructed at the terminus of the new roadway at Folsom-Auburn Road. The new intersection would include signals and medians, incorporate access to the Auto Spa, and accommodate four lanes of traffic flow. Folsom-Auburn Road would need to be widened to provide right turn/acceleration lanes.

Traffic flow at the reconfigured intersection would be diverted to the new Folsom Dam Road, and the existing roadway to Folsom Dam would be closed permanently or be a restricted non-signaled driveway access for emergency and maintenance vehicles.

A new signaled T-intersection and two-lane access road about 1,200 feet northwest of the existing Folsom Dam Road intersection would be constructed for Reclamation to provide secured access to their facilities, and possible access to new ARWEC facilities.

Relocations. Several existing facilities would need to be relocated prior to construction of the Folsom Dam Road segment west of the new bridge. These include Reclamation's storage yard, the ARWEC, and California State Park's Folsom Lake SRA offices, and possibly some Lake Point Apartment complex features.

Materials and parking at the Reclamation storage yard would be relocated to an area east of the Reclamation shop buildings near the existing HTRW storage area. The Federal Government would continue to own the existing storage yard property and likely leave it as open space.

The existing ARWEC and State Parks offices would be to new buildings on about 5 acres near the new intersection. Relocation of ARWEC and State Parks personnel and functions would be coordinated to minimize disruption as much as possible. Some of the existing buildings would be demolished and some would be retained for other purposes.

Utilities. The types of utilities in the project area include electricity, gas, telephone, cable, waste water and sewer, and water supply. Any utilities affected by relocation of facilities or construction of the intersections, roadway, and bridge would be relocated or replaced. These include wooden poles carrying telephone and cable utilities; utilities associated with the nine Reclamation buildings, ARWEC, State Parks offices, and Reclamation's storage yard; and one high-powered electric utility tower owned by SMUD. The wooden poles would be relocated, and the tower would be relocated to a nearby location approved by SMUD and replaced with a steel pole structure.

Bicycle/Pedestrian Trails. Two types of bicycle trails would be constructed to provide continuous access between East Natoma Street and Folsom-Auburn Road, as well as additional recreational opportunities for biking and walking. A new Class 1 bike trail would extend along the north side of the new Folsom Dam Road. This 10-foot-wide trail would be surfaced with asphalt and be physically separate from the roadway. Both bicyclists and pedestrians could use

this bike trail.

Two new Class 2 bike trails would extend along the north and south shoulders of the new roadway. These 8-foot-wide trails would be surfaced in asphalt and physically part of the new roadway surface. While bicyclists could use these trails, pedestrian use would be restricted to the Class 1 bicycle/ pedestrian trail due to safety issues.

Currently, there are several segments of existing bike trail in the project area. These include: (1) Class 1 bike trails on each side of the roadway at the intersection of Briggs Ranch Drive and East Natoma Street and (2) Jedediah Smith bike trail on the west side of the river. These trails were constructed, and are currently maintained by the City of Folsom and State Parks, respectively. The new Class 1 bike trail would connect to these existing bike trails, as well as incorporate the section of trail along the alignment of Folsom Dam Road north of East Natoma Street into the design.

In addition, a new bike trail underpass would be designed and constructed about 800 feet east of the existing Folsom Dam Road intersection with Folsom-Auburn Road.

Security Measures. Security measures would be implemented to prohibit public access to secured CDC, Reclamation, and State Parks facilities both during and after construction of the project. These would include setbacks, fencing walls, locked gates, lights and signs.

Staging Areas. Although the contractor would be responsible for identifying the final staging areas, the most likely locations would be the Reclamation storage yard and the triangle intersection area near the intersection of Folsom Dam Road and East Natoma Street. Other possible areas include the overlook area and the storage area near the CDC firing range intersection.

Excavation, Temporary Stockpile, and Disposal Area. Some of the excavated soil material would be used as fill elsewhere on the Folsom Bridge Project. Since the quantity of this excavated material would be sufficient to meet the fill needs of the project, no soil would need to be obtained and imported for the project. Material such as gravel, concrete, and asphalt to construct the roadway, bridge, and bike trails would be obtained and transported by truck from local commercial sources.

Excess excavated material would be temporarily stockpiled near the excavated area for future use in other proposed Folsom Dam work. Specific sites have not yet been coordinated with Reclamation.

Disposal of excavated material not suitable for fill, such as vegetation and debris, would be disposed of at a local landfill. Asphalt, concrete, and other material from the old roadway segments would be removed, incorporated into roadway fill, or recycled. Materials from the SMUD tower structure would remain the property of SMUD, who would recycle or dispose of

the materials. Building debris from relocation of ARWEC, State Parks offices, and apartment complex facilities would be recycled or disposed of at a local landfill.

Operation and Maintenance. The City of Folsom would be responsible for the operation and maintenance of the new intersections, Folsom Dam Road, and the bridge over the American River following transfer of ownership from the Federal Government. The intersections, roadway, and bridge would be included in the City's plan and schedule for regular street operation and maintenance.

Construction Details and Schedule. All intersections and roadway sections would be constructed in accordance with applicable Corps, Caltrans, Sacramento County, and City of Folsom standards. Prior to initiation of construction, the contractor would prepare a traffic management plan identifying measures to minimize traffic congestion and delays and ensure public safety. These measures could include scheduling construction activities to avoid commute hours, posting warning signs and speed limits, and using flaggers.

Roadway segments and the new bridge would be constructed at the same time. The work would require between 80 and 100 workers per day. Parking for the worker vehicles would be provided near East Natoma Street and Folsom-Auburn Road, and the workers would be transported to the work areas.

Construction of the new roadway and bridge could begin in the summer/fall of 2007 and be completed in 1.5 to 2 years. Work would be normally limited to daylight hours, with possible suspensions of work during local commute hours when traffic is allowed on the Folsom Dam Road segment. If necessary, work could be conducted during evening or night hours in areas away from residential neighborhood or commercial areas.

Alternative 3 – Four-Lane Bridge, Two-Lane Road, Full Intersections

The features of Alternative 3 are very similar to Alternative 2 except: (1) a portion of the new road where it veers to the southwest and extends below the proposed spillway structure would be a two lane roadway (rather than four lanes) to the river, and (2) the bike trails would be Class 2 (refer to Figure 3).

Alternative 4 – Four-Lane Bridge, Two-Lane Road, Partial Intersection

The features of Alternative 4 are very similar to Alternative 3, except the intersection of the new roadway with East Natoma Street. This intersection would be reconfigured and signaled across from Briggs Ranch Drive (refer to Figure 4)

Alternative 5 – Four-Lane Bridge, Two-Lane Road, Partial Intersections

The features of Alternative 5 are very similar to Alternative 4, except the intersections at each end of the new road would be reconfigured for less traffic lanes and the new roadway would be two lanes. The retaining wall where the road veers toward the river would not be needed for this

alternative.

More specific information on the various alternatives being considered as well as those not studied in greater detail can be found in the Corps' environmental documents.

Prior to working on assessing impacts of the project, a multi-agency team working toward a comprehensive plan for mitigation for the entire American River Watershed Investigation was formed. Agencies represented on this team include the Corps, Service, Sacramento County Parks and Recreation, Sacramento Area Flood Control Association, and the California Department of Water Resources. In order to complete an evaluation of adverse project impacts on fish and wildlife species and their habitat and determine any compensation measures, a typical site suitable for compensation needed to be identified. The multi-agency team selected a site located at Rossmoor Bar within the American River Parkway as a typical candidate site for a mitigation area. This site exhibited the characteristics, mainly annual grassland with some scatted areas of oak woodland, which the team considered essential for a mitigation site. Selection of this site was also coordinated with the State Reclamation Board. It is one of several sites which are being considered for use as a mitigation site for the bridge project within the American River Parkway. Selection of an actual site will be coordinated with the agencies above and other local governments.

FISH AND WILDLIFE RESOURCES

A detailed discussion of the existing fish and wildlife resources in the project area is included in the Service's earlier FWCA reports for this project (USFWS 2001, 2005a), and other associated Corps projects in this area (USFWS 1994, 2001). These reports should be consulted for more specific information on these resources.

The proposed construction site is best described as a complex of oak woodland, riparian areas associated with seasonal drainages and swales, seasonal wetlands, and annual grassland. The oak woodland generally consists of an overstory dominated by oak and California buckeye trees, a midstory of younger oaks, buckeyes, and elderberry shrubs, and an understory comprised of poison oak, herbaceous plants, and non-native grass species. The riparian areas are dominated by cottonwood trees and some willows with an understory of poison oak, buckeye, and elderberry shrubs, and annual grasses. The seasonal wetland areas contain species such as cattail, sedges, and brome. A list of the plant species identified in the seasonal wetland areas of the project is included in a wetland delineation report completed for this project by the Service (2005b).

The area supports typical mammal species including small mammals and deer. Bird species in the area include typical passerine species, turkeys and California quail, and raptors such as red-tailed hawk. A bald eagle was observed soaring in the area in February 2005. Waterfowl (mallards and Canada geese) and other waterbirds, such as killdeer, egrets, and herons utilize the seasonal wetland areas in the project area and the American River.

The American River, downstream of Folsom Dam to Nimbus Dam, supports several species of

fish including bass, rainbow trout, channel catfish, sculpin, wakasagi, mosquitofish, and other species. Downstream of Nimbus Dam the river supports anadromous species including Chinook salmon, steelhead, striped bass and American shad.

SERVICE MITIGATION POLICY

The recommendations provided herein for the protection of fish and wildlife resources are in accordance with the Service's Mitigation Policy as published in the Federal Register (46:15; January 23, 1981).

The Mitigation Policy provides Service personnel with guidance in making recommendations to protect or conserve fish and wildlife resources. The policy helps ensure consistent and effective Service recommendations, while allowing agencies and developers to anticipate Service recommendations and plan early for mitigation needs. The intent of the policy is to ensure protection and conservation of the most important and valuable fish and wildlife resources, while allowing reasonable and balanced use of the Nation's natural resources.

Under the Mitigation Policy, resources are assigned to one of four distinct Resource Categories, each having a mitigation planning goal which is consistent with the fish and wildlife values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife. However, the Mitigation Policy does not apply to threatened and endangered species, Service recommendations for completed Federal projects or projects permitted or licensed prior to enactment of Service authorities, or Service recommendations related to the enhancement of fish and wildlife resources.

In applying the Mitigation Policy during an impact assessment, the Service first identifies each specific habitat or cover-type that may be impacted by the project. Evaluation species which utilize each habitat or cover-type are then selected for Resource Category analysis. Selection of evaluation species can be based on several rationale, as follows: (1) species known to be sensitive to specific land- and water-use actions; (2) species that play a key role in nutrient cycling or energy flow; (3) species that utilize a common environmental resource; or (4) species that are associated with Important Resource Problems, such as anadromous fish and migratory birds, as designated by the Director or Regional Directors of the Fish and Wildlife Service. (Note: Evaluation species used for Resource Category determinations may or may not be the same evaluation species used in a HEP application, if one is conducted). Based on the relative importance of each specific habitat to its selected evaluation species, and the habitat's relative abundance, the appropriate Resource Category and associated mitigation planning goal are determined.

Mitigation planning goals range from "no loss of existing habitat value" (i.e., Resource Category 1) to "minimize loss of habitat value" (i.e., Resource Category 4). The planning goal of Resource Category 2 is "no net loss of in-kind habitat value"; to achieve this goal, any unavoidable losses would need to be replaced in-kind. "In-kind replacement" means providing or managing

substitute resources to replace the habitat value of the resources lost, where such substitute resources are physically and biologically the same or closely approximate those lost.

In addition to mitigation planning goals based on habitat values, Region 1 of the Service, which includes California, has a mitigation planning goal of no net loss of acreage and value for wetland habitat. This goal is applied in all impact analyses.

In recommending mitigation for adverse impacts to fish and wildlife habitat, the Service uses the same sequential mitigation steps recommended in the Council on Environmental Quality's regulations. These mitigation steps (in order of preference) are: avoidance, minimization, rectification of measures, measures to reduce or eliminate impacts over time, and compensation.

Five fish and/or wildlife habitats were identified in the Folsom Bridge Project area which had potential for impacts from the project. These are oak woodland, riparian woodland, seasonal wetland, annual grassland, and other. The resource categories, evaluation species, and mitigation planning goal for the habitats impacted by the project are summarized in Table 1.

Table 1. Resource categories, evaluation species, and mitigation planning goal for the habitats possibly impacted by the Folsom Bridge Project, California.

COVER-TYPE	EVALUATION SPECIES	RESOURCE CATEGORY	MITIGATION GOAL
Oak woodland	Acorn woodpecker Turkey Mule deer	2	No net loss of in-kind habitat value.
Riparian woodland	Swainson's hawk Wood duck Northern oriole	2	No net loss of in-kind habitat value or acreage.
Seasonal wetland	Mallard Egret	2	No net loss of in-kind habitat value or acreage.
Annual grassland	Red-tailed hawk	3	No net loss of habitat value while minimizing loss of in-kind habitat value.
Other	None	4	Minimize loss of habitat value

The evaluation species selected for the oak woodland that would be impacted are acorn woodpecker, turkey, and mule deer. Acorn woodpeckers utilize oak woodlands for nearly all their life requisites; 50-60 percent of the acorn woodpecker's annual diet consists of acorns. Acorn woodpeckers can also represent impacts to other canopy-dwelling species. Turkeys forage and breed in oak woodlands and are abundant in the project area. Mule deer also heavily depend on acorns as a dietary item in the fall and spring; the abundance of acorns and other browse

influence the seasonal pattern of habitat use by deer. These latter species represent species which utilize the ground component of the habitat and both have important consumptive and non-consumptive human uses (i.e., hunting and bird watching). Based on the high value of oak woodlands to the evaluation species, and their declining abundance, the Service has determined oak woodlands which would be affected by the project should be placed in Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value."

The evaluation species selected for the riparian woodland that would be impacted are Swainson's hawks, wood ducks, and northern orioles. Woody riparian vegetation provides important cover, and roosting, foraging, and nesting habitat for these species. Large diameter trees also provide nesting sites for species such as wood ducks and Swainson's hawks. Riparian woodland cover-types are of generally high value to the evaluation species, and are overall, extremely scarce (less than 2 percent remaining from pre-development conditions). Therefore, the Service finds that any riparian woodland cover-type that would be impacted by the project should be placed in Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value." In addition, the Service's regional goal of no net loss of wetland acreage or habitat values, whichever is greater, would apply to these habitat types.

The mallard duck and egrets were selected as the evaluation species for the seasonal wetland cover-type. These species were selected because of: (a) their dependence on wetlands for feeding and nesting, (b) their ability to represent other waterfowl and water-related birds using these habitats, (c) their importance for consumptive and non-consumptive human uses (i.e., hunting and bird watching), and (d) the Service's responsibility for their management, under the Migratory Bird Treaty Act. These wetland habitats occur in the project area typically occur in association with water ponding or in the swales and drainages occurring during the rainy season in the project area. These wetlands provide valuable habitat for many water-birds including waterfowl, shorebirds, and wading birds. These habitats are severely reduced in the project area and ecoregion. Therefore, the Service designates these habitats in the project area potentially impacted by the project as Resource Category 2. Our associated mitigation planning goal is for "no net loss of in-kind habitat value or acreage."

The evaluation species selected for the annual grassland cover-type is the red-tailed hawk, which utilizes these areas for foraging. This species was selected because of the Service's responsibility for their protection and management under the Migratory Bird Treaty Act, and their overall high non-consumptive values to humans. Annual grassland areas potentially impacted by the project vary in their relative values to the evaluation species, depending on the degree of human disturbance, plant species composition, and juxtaposition to other foraging and nesting areas. Therefore the Service designates the annual grassland cover-type in the project area as Resource Category 3. Our associated mitigation planning goal for these areas is "no net loss of habitat value while minimizing loss of in-kind habitat value."

No evaluation species were identified for the "Other" cover-type. This cover-type encompasses those areas which do not fall within the other cover-types such as gravel and paved roads,

parking areas, buildings, bare ground, riprap, etc. Generally this cover-type would not provide any significant habitat value for wildlife species. Therefore the Service designates the "Other" cover-type in the project area as Resource Category 4. Our associated mitigation planning goal for these areas is "minimize loss of in-kind habitat value."

CONCLUSIONS

All four construction alternatives have similar impacts and compensation needs based on the Habitat Evaluation Procedures conducted for this project (Appendix A). The difference in compensation need between the least impact alternative (Alternative 5) to the most impacting alternative (Alternative 2) is 5.96 acres. In all alternatives, annual grasslands would be replanted when disturbance ends to minimize the effect of work, so no additional compensation measures were identified. No mitigation measures are recommended for the "other" cover-type. Table 3 summarizes the acres impacted and compensation need by cover-type for all alternatives. The impacts of the alternatives may change as the design is further refined, however the impacts of each alternative relative to each other should not change.

As part of alternative selection and bridge design, the Corps needed to conduct an initial phase of the project which included material borings to determine material conditions and engineering properties for use in construction of the bridge. There were 16 core borings and 20 auger borings. These borings were conducted on both sides of the river. The core borings were about 75 feet deep and the auger borings were about 20 feet deep. All equipment was truck or track mounted and accessed the core/auger sites via existing dirt or paved roads, new dirt roads, or brought in by helicopter. The impact of constructing any new roads was included in the HEP

Fifteen elderberry shrubs have been located within 100 feet of proposed boring for the Folsom Dam Bridge Project. The Corps consulted with the Service on the effects of the project to these shrubs, which is the host plant for the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*), a federally listed threatened species under the Endangered Species Act (ESA), as amended (Service files 1-1-05-F-0108; 1-1-05-F-0222; 1-1-06-I-0335) (Appendix B). The Corps developed conservation measures to avoid and minimize effects on the beetle based on the Service's July 9, 1999, *Conservation Guidelines for the Valley Elderberry Longhorn Beetle*. The Corps' proposed conservation measures include transplanting directly impacted shrubs to the American River Parkway and planting elderberry seedlings and associated native plants at the proposed compensation site for this project once the site is selected. See Appendix B for more complete information on the consultation and its history.

Once the preferred alternative is selected, the Corps will reinitiate consultation with the Service for project effects on the valley elderberry longhorn beetle and any other listed species affected by the proposed project.

Table 3. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Bridge Project, California

Alternative 2—Four Lane Bridge, Four Lane Road, Full Intersections.

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	33.87	37.31	2.39	-35.24	51.67
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.51	2.99	0.63	-1.20	2.51
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**41.84**				**59.98**

Alternative 3 – Four-Lane Bridge, Two-Lane Road, Full Intersections.

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	32.87	36.18	2.31	-33.87	50.10
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.51	2.99	0.63	-1.20	2.51
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**40.84**				**58.41**

Alternative 4. –Four-Lane Bridge, Two-Lane Road, Partial Intersection (East)

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	31.19	34.31	2.19	-32.12	47.51
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.28	2.72	0.27	-2.45	2.28
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**38.93**				**55.59**

Alternative 5. –Four Lane Bridge, Two-Lane Road, Two Partial Intersections

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	30.19	33.18	2.13	-31.05	45.94
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.28	2.72	0.27	-2.45	2.28
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**37.93**				**54.02**

Note: The compensation need for the riparian woodland and seasonal wetland cover-types was slightly less the figure shown in Table 3. The figure was adjusted up to the acreage impacted to conform with the Service's Mitigation Policy of no net loss of in-kind habitat value or acreage for Resource Category 2 designations

RECOMMENDATIONS
The Service recommends the Corps:

GENERAL
1. Avoid impacts to oak woodlands and riparian areas outside construction easements by fencing their boundaries with orange construction fencing or cyclone fencing just outside the dripline of associated woody vegetation near these areas. All woody vegetation adjacent to staging areas and access and haul routes should be similarly fenced.

2. Avoid impacts to nesting migratory birds by only clearing riparian or seasonal wetland vegetation as necessary during the summer months after young-of-the year birds have fledged the nest.

3. Minimize impacts to fish and wildlife resources and their habitat by restricting off-road vehicle use to established roads in the project area and confining parking to established areas (parking lot and staging area).

4. Minimize impacts in all disturbed portions of construction easements, borrow sites, staging areas, and haul routes by seeding these areas with native annual grasses at the completion of construction, or when these disturbed areas are to be undisturbed for the growing season.

ALTERNATIVE 2
5. Compensate for the loss of 33.87 acres of oak woodland habitat by developing 51.67 acres of oak woodland habitat at a site approved by the Service.

6. Compensate for the loss of 5.46 acres of riparian woodland habitat by developing 5.80 acres of riparian habitat at a site approved by the Service.

7. Compensate for the loss of 2.51 acres of seasonal wetland habitat by developing 2.51 acres of seasonal wetland habitat at a site approved by the Service, or alternatively, purchase credits at a Service-approved mitigation bank which service's the project area.

ALTERNATIVE 3
8. Compensate for the loss of 32.87 acres of oak woodland habitat by developing 50.10 acres of oak woodland habitat at a site approved by the Service.

9. Compensate for the loss of 5.46 acres of riparian woodland habitat by developing 5.80 acres of riparian habitat at a site approved by the Service.

10. Compensate for the loss of 2.51 acres of seasonal wetland habitat by developing 2.51 acres of seasonal wetland habitat at a site approved by the Service, or alternatively, purchase credits at a Service-approved mitigation bank which service's the project area.

ALTERNATIVE 4

11. Compensate for the loss of 31.19 acres of oak woodland habitat by developing 47.51 acres of oak woodland habitat at a site approved by the Service.

12. Compensate for the loss of 5.46 acres of riparian woodland habitat by developing 5.80 acres of riparian habitat at a site approved by the Service.

13. Compensate for the loss of 2.28 acres of seasonal wetland habitat by developing 2.28 acres of seasonal wetland habitat at a site approved by the Service, or alternatively, purchase credits at a Service-approved mitigation bank which service's the project area.

ALTERNATIVE 5

14. Compensate for the loss of 30.19 acres of oak woodland habitat by developing 45.94 acres of oak woodland habitat at a site approved by the Service.

15. Compensate for the loss of 5.46 acres of riparian woodland habitat by developing 5.80 acres of riparian habitat at a site approved by the Service.

16. Compensate for the loss of 2.28 acres of seasonal wetland habitat by developing 2.28 acres of seasonal wetland habitat at a site approved by the Service, or alternatively, purchase credits at a Service-approved mitigation bank which service's the project area.

ENDANGERED SPECIES

17. Re-survey the construction and staging areas, borrow sites, access routes and haul roads for the presence of elderberry shrubs prior to construction activity. The presence of any new shrubs with stems measuring 1-inch or greater at ground level should be reported to the Service and consultation under section 7 of the ESA should be reinitiated.

18. Implement the conservation measures outlined in the Service's May 4, 2005, biological opinion (Service file 1-1-05-F-0108; 1-1-05-F-0222; 1-1-06-I-0335) for the boring work and reinitiate consultation if there are any changes in the proposed work.

19. Provide worker awareness training to all construction personnel alerting them to the purpose of the fencing provided to protect the habitat adjacent to the construction zones. This can be combined with the worker awareness training to be conducted for listed species such as the valley elderberry longhorn beetle.

20. Complete consultation with the California Department of Fish and Game for species protected under the California Endangered Species Act.

REFERENCES

USFWS (U.S. Fish and Wildlife Service). 1994. Planning Aid Report for the American River Watershed Investigation, Raising Folsom Dam Alternative, California. Sacramento Fish and Wildlife Office, Sacramento, California.

_____. 2001. Fish and Wildlife Coordination Act Report for the American River Watershed Investigation, Folsom Dam Outlet Modification Project, California. Sacramento Fish and Wildlife Office, Sacramento, California. 31 pp. + appendices.

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_____. 2005a. Supplemental Fish and Wildlife Coordination Act Report for the American River Watershed Investigation, Folsom Dam Modification Project, California. Sacramento Fish and Wildlife Office, Sacramento, California.

_____. 2005b. Wetland Delineation Report for the U.S. Army of Engineers. American River Watershed Investigation, Folsom Dam Bridge Project and Folsom Dam Outlet Modification Project, California. Sacramento Fish and Wildlife Office, Sacramento, California. 6 pp. + appendices.

APPENDIX A

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

FOLSOM BRIDGE PROJECT

REVISED
HABITAT EVALUATION PROCEDURES

MARCH 2006

INTRODUCTION

The Folsom Bridge Project is part of the Folsom Dam Raise Project, which is a component of the Corps of Engineers' (Corps) American River Watershed Long-Term Project. A final Supplemental Plan Formulation Report/Environmental Impact Statement/ Environmental Impact Report (SEIS/EIR) for the Long-Term Project was completed in February 2002. The subsequent Chief of Engineers' Report was forwarded to Congress for possible authorization for construction.

The Folsom Dam Raise Project includes various features to address the Sacramento area's potential flood risk. The main feature of the project is to raise Folsom Dam up to 10 feet to increase the flood storage capacity behind the dam. Construction of the Dam Raise Project (concurrent with construction of the Folsom Dam Modifications Project) is expected to take place over 20 years. Since numerous closures of the existing Folsom Dam Road would be expected during construction, a temporary bridge was initially proposed in the 2002 report to mitigate the effects of these closures.

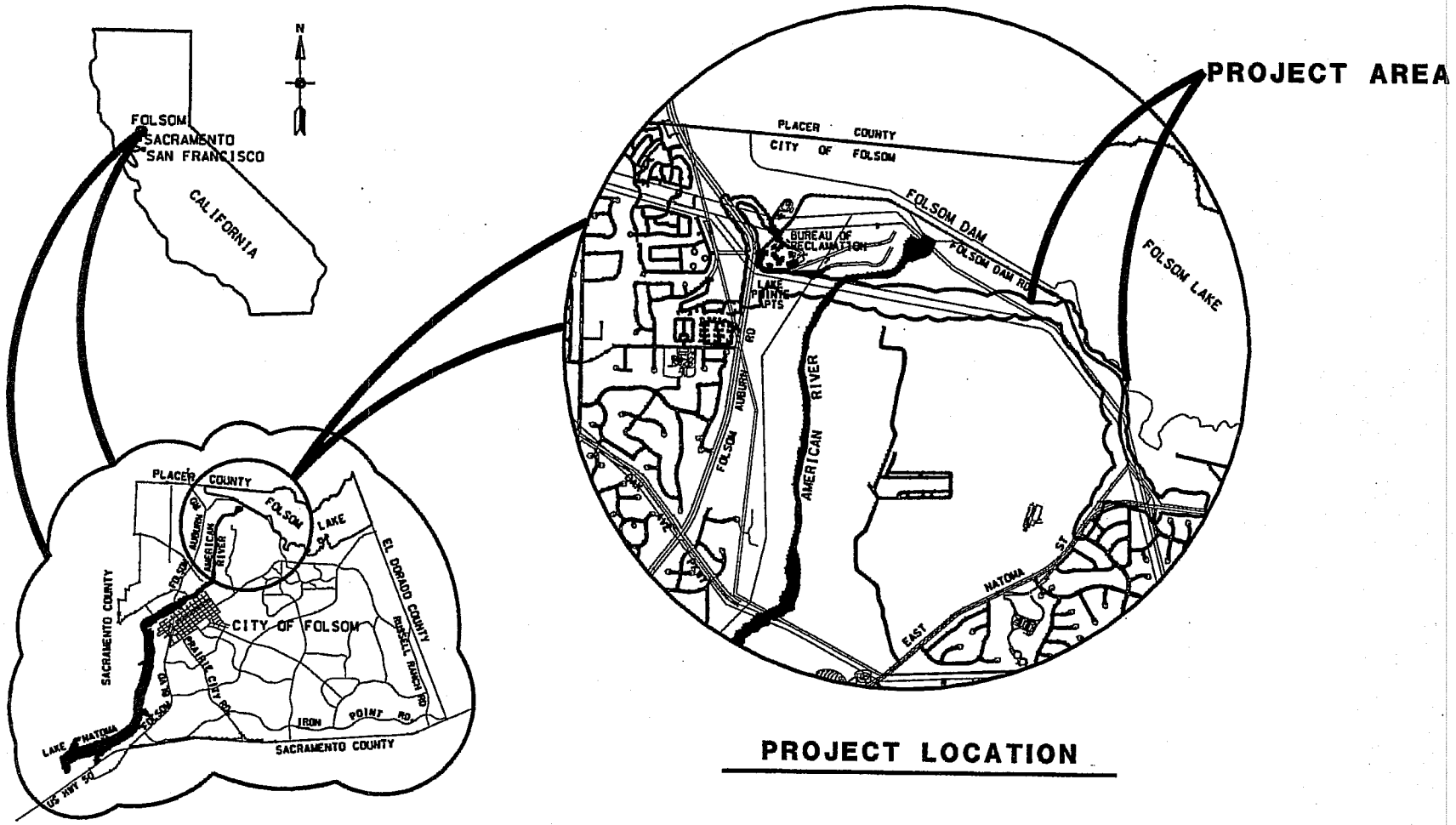
In February 2003, the U.S. Bureau of Reclamation (Reclamation) closed Folsom Dam Road indefinitely for security and public safety reasons. This closure had significant effects on the residents and businesses in the surrounding area. In September 2004, Congress authorized the Folsom Dam Raise Project, including authorization of construction of a permanent bridge just downstream of Folsom Dam.

The Folsom Bridge Project was authorized by Congress in the Energy and Water Development Appropriations Act of 2004 (Public Law 108-137). Since the initial project impact evaluation was conducted by the Service in 2001 (USFWS 2003) for the American River Watershed Long-Term Project, several project refinements have been made. This application of Habitat Evaluation Procedures (HEP) is intended to quantify the impacts on fish and wildlife resources associated with the design for the current bridge proposal

PROJECT DESCRIPTION

The project is located in northeastern Sacramento County, near the City of Folsom, California (Figure 1). Several preliminary road alignment alternatives were evaluated by the Corps for the new Folsom Dam Road connecting East Natoma Street with Folsom-Auburn Road. The alignment that was selected the Folsom Bridge Project begins with a new intersection at East Natoma Street and then generally follows the existing Folsom Dam Road crosses the American River downstream of Folsom Dam and terminates at a new intersection at Folsom-Auburn Road (Figures 2 and 3).

The Corps is evaluating several alternatives for completing this road alignment. Each alternative would provide unrestricted access to both sides of the river near Folsom Reservoir and meet current transportation design and safety standards. A more detailed description of these features is contained in the accompanying Fish and Wildlife Coordination Act report and the Corps'



PROJECT AREA

PROJECT LOCATION

VICINITY MAP

US Army Corps of Engineers
Sacramento District

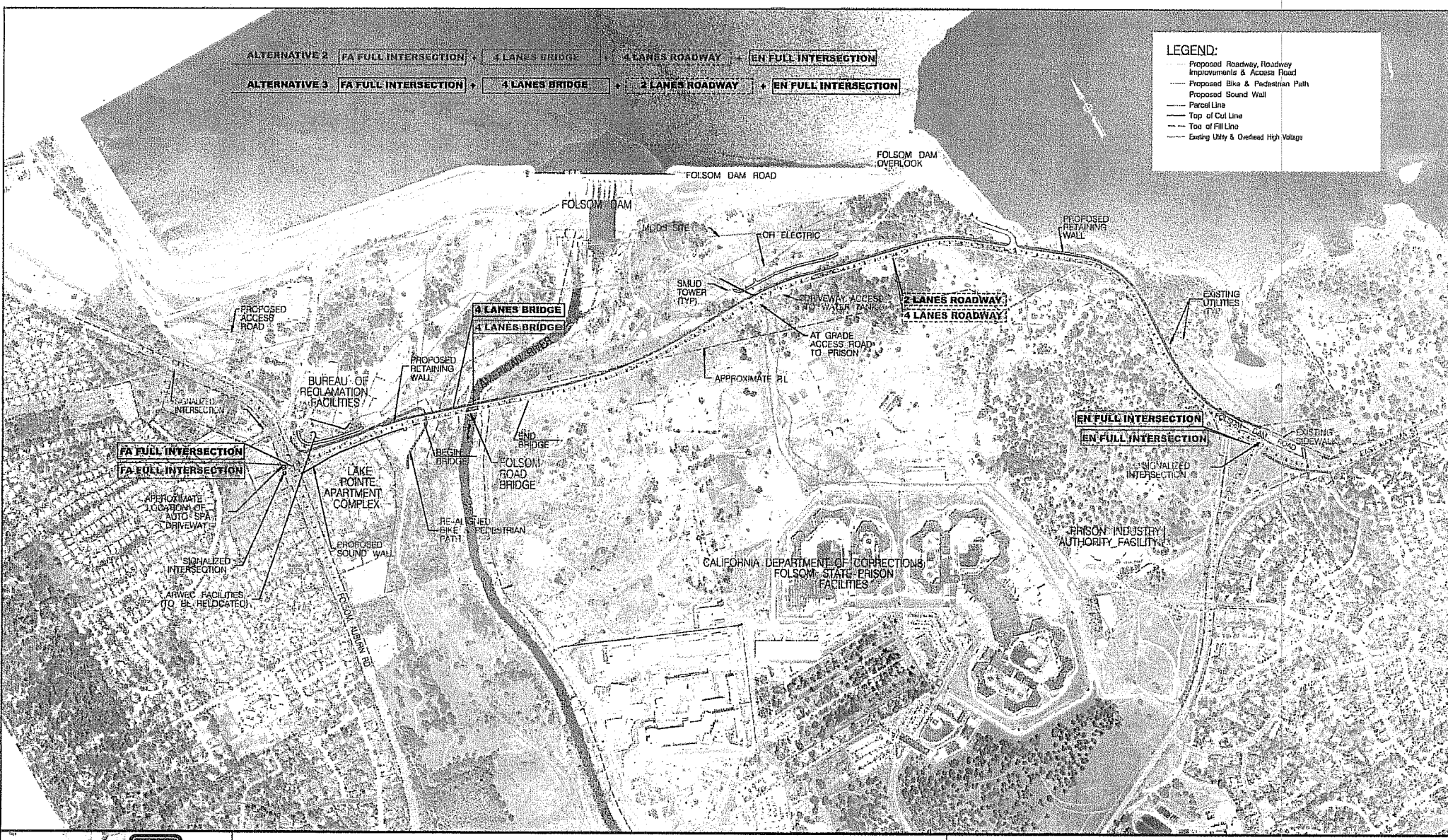
American River Watershed Project

Folsom Dam Raise and Folsom Bridge SEIS/EIR

Figure 1. - Project Location Map

May 20, 2005

No Scale



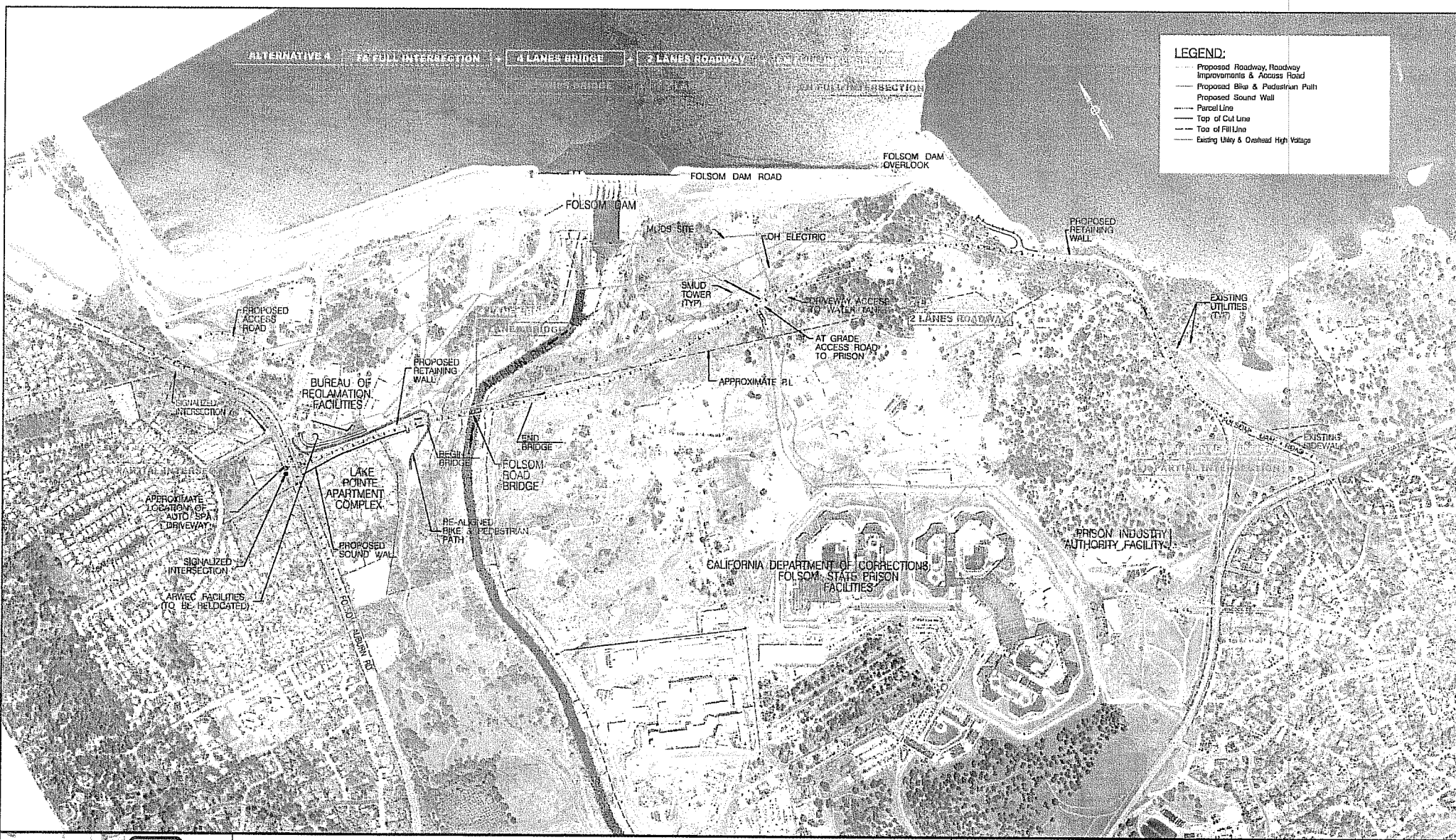
US Army Corps of Engineers
Sacramento District

American River Watershed Project
Folsom Bridge SEIS/SEIR

Figure 2. - Alternative 2 and Alternative 3

February 10, 2006

Scale 1" = 800'



US Army Corps of Engineers
Sacramento District

American River Watershed Project

Folsom Bridge SEIS/SEIR

Figure 3. - Alternative 4 and Alternative 5

February 10, 2006

Scale 1" = 800'

environmental documents for this project.

The alternatives are:
Alternative 1 - No Action
Alternative 2 - Four-Lane Bridge, Four-Lane Road, Full Intersections
Alternative 3 - Four-Lane Bridge, Two-Lane Road, Full Intersections
Alternative 4 - Four-Lane Bridge, Two-Lane Road, Partial Intersection (East)
Alternative 5 - Four-Lane Bridge, Two-Lane Road, Two Partial Intersections

METHODOLOGY

HEP is a methodology developed by the Fish and Wildlife Service (Service) and other State and Federal resource and water development agencies which can be used to document the quality and quantity of available habitat for selected fish and wildlife species. HEP provides information for two general types of habitat comparisons: (1) the relative value of different areas at the same point in time; and (2) the relative value of the same areas at future points in time. By combining the two types of comparisons, the impacts of proposed or anticipated land-use and water-use changes on habitat can be quantified. In a similar manner, any compensation needs (in terms of acreage) for the project can also be quantified, provided a mitigation plan has been developed for specific alternative mitigation sites.

A HEP application is based on the assumption that the value of a habitat for selected species or the value of a community can be described in a model which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs). The HUs and Average Annual Habitat Units (AAHUs) over the life of the project are then used in the comparisons described above.

The reliability of a HEP application and the significance of HUs are directly dependent on the ability of the user to assign a well-defined and accurate HSI to the selected evaluation elements or communities. Also, a user must be able to identify and measure the area of each distinct habitat being utilized by fish and wildlife species within the project area. Both the HSIs and the habitat acreage must also be reasonably estimable at various future points in time. The HEP team, comprised of Corps and Service staff, determined that these HEP criteria could be met, or at least reasonably approximated, for the Folsom Bridge Project, thus HEP was considered an appropriate analytical tool to analyze impacts of the proposed project alternatives[1].

GENERAL HEP ASSUMPTIONS

Some general assumptions are necessary to use HEP and Habitat Suitability Index (HSI) Models in the impact assessment:

[1] For further information on HEP see ESM 100-104 which is available from the Service's Sacramento Fish and Wildlife Office.

Use of HEP:

1. HEP is the preferred method to evaluate the impacts of the proposed project on fish and/or wildlife resources.
2. HEP is a suitable methodology for quantifying project-induced impacts to fish and wildlife habitats.
3. Quality and quantity of fish and wildlife habitat can generally be numerically described using the indices derived from the HSI models and associated habitat units.
4. The HEP assessment is applicable to the habitat types being evaluated.

Use of HSI Models

5. HSI models are hypotheses based on available data.
6. HSI models are conceptual models and may not measure all ecological factors that affect the quality of a given cover-type for the evaluation species (e.g. vulnerability to predation). In some cases, assumptions may need to be made by the HEP Team and incorporated into the analysis to account for loss of those factors not reflected by the model.

The HEP field work for the project was completed by staff from the Service's Sacramento Fish and Wildlife Office and the Corps (Sacramento District) and occurred during March and April 2005. Five cover-types would be permanently impacted by the project including oak woodland, riparian woodland, seasonal wetland, annual grassland and other[2]. These cover-types were mapped by the HEP Team on aerial photographs and the acreage was quantified by a Corps consultant using GIS. The cover-types and acreage affected by the proposed work is summarized in Table 1.

Eight HSI models were used in this HEP application to quantify project impacts. A summary of the models applied for each cover-type is also included in Table 1. The western gray squirrel and plain titmouse models were selected to evaluate the oak woodland cover-type. These species were chosen because they utilize this cover-type for nesting and foraging. The western fence lizard, yellow warbler, and northern oriole models were chosen to evaluate the project impacts to the riparian woodland cover-type. These species were selected because the bird species utilize the riparian tree canopy provided by the cover-type for nesting and foraging. The western fence lizard utilizes the ground component of the cover-type including rocks boulders, and downed wood for shelter and foraging. The red-winged blackbird, great egret (feeding) and California vole models were selected for evaluating impacts to the seasonal wetland cover-type because these species forage, nest, or inhabit this cover-type. The annual grassland and "other" cover-types were not included in the HEP analysis because they do not currently provide significant habitat for wildlife species or the conditions (habitat values) after the completion of work are expected to be similar to pre-project conditions.

2. "Other" encompasses those areas which do not fall within the other cover-types such as gravel and paved roads, parking areas, buildings, bare ground, riprap, etc.

Table 1. Cover-types, acreage, and HSI model used to evaluate impacts of the proposed refinements to the Folsom Bridge Project, California.

COVER-TYPE	ACREAGE (acres)				HSI MODEL
	Alt. 2	Alt. 3	Alt.4	Alt. 5	
Oak Woodland	33.87	32.87	31.19	39.19	Western gray squirrel Plain titmouse
Riparian Woodland	5.46	5.46	5.46	5.46	Northern oriole Yellow warbler Western fence lizard
Seasonal Wetland	2.51	2.51	2.28	2.28	Great egret (feeding) California vole Red-winged blackbird
Annual Grassland	No HEP proposed, disturbed areas will be reseeded after construction.				
Other	No HEP proposed.				
TOTAL	**41.84**	**40.84**	**38.93**	**37.93**	

The cover-type designations and HSI models were also selected in part to be consistent with previous impact analyses completed for the American River Watershed Investigation Long-Term Project (now referred to as Folsom Dam Raise Project) (USFWS 2003) and the American River Watershed Investigation Folsom Dam Modification Project which is occurring concurrently with the Folsom Bridge Project.

FIELD SAMPLING AND DATA COLLECTION

The HEP Team defined direct construction impacts as those that would cause immediate and complete loss of habitat values on the site at the time of project construction. These impacts would occur within the project area along the road alignment between East Natoma Street and Folsom-Auburn Road and where facilities and utilities would be relocated (refer to Figures 2 and 3). All vegetation, rocks, logs, and other debris would be removed from these sites and woody vegetation would not be allowed to re-establish

Data for each cover-type was collected using transects at the sample sites. Generally, transects were laid out perpendicular to the proposed roads or other construction features in the project area. Using line-intercept techniques, the data corresponding to the variables in the HSI models were recorded. Some variables were estimated due to the density of the vegetation (impenetrable) and presence of large stands of poison oak. The number of transects needed to adequately represent the habitat values of each cover-type was determined in the field based on the size of the cover-type and its relative homogeneity as determined by members of the HEP Team. The cover-types, proposed HSI models, and HSI model variables for the Folsom Bridge Project are summarized in Table 2 and the specific data collection methods utilized are summarized below.

Table 2. HEP Cover-types, proposed HSI models, and HSI model variables for the Folsom Bridge Project, California.

COVER-TYPE	PROPOSED HSI MODELS	HSI MODEL VARIABLES
(1) Oak woodland	Western gray squirrel	V1 - Canopy closure of mast-producing species V2 - Density of leaf litter layer V3 - Tree canopy cover V4 - Den site availability per acre
	Plain titmouse	V1 - Tree diameter V2 - Trees per acre V3 - % composition of tree species that are oaks
(2) Riparian woodland	Yellow warbler	V1 - % deciduous shrub crown cover V2 – Average height of deciduous shrub canopy V3 - % deciduous shrub canopy comprised of hydrophytic shrubs
	Northern Oriole	V1 - Average height of deciduous tree shrub V2 – % deciduous tree crown cover V3 – Stand width
	Western fence lizard	V1 - % ground cover V2 – Average size of ground cover objects V3 – Structural diversity/interspersion V4 - % canopy cover
(3) Seasonal wetlands	Great egret (feeding)	V1 - Percentage of area with water 10-23 cm V2 - Percentage of submerged or emergent vegetation cover in zone 10-23 cm deep
	California vole	V1 - Height of herbaceous vegetation V2 - Percent cover of herbaceous vegetation V3 - Soil type V4 - Presence of logs and other types of cover
	Red-winged blackbird	V1 - Predominance of narrow or broadleaf monocots V2 - Water presence throughout the year V3 - Presence or absence of carp V4 - Presence or absence of damselflies or dragonflies V5 - Mix of herbaceous vegetation V6 - Suitability of foraging substrate
(5) Annual grassland	No HEP proposed; disturbed areas will be reseeded after construction is complete.	
(6) Other	No HEP proposed.	

DATA COLLECTION PROCEDURES

Oak Woodland Cover-Type

1. A 50-foot-long transect was laid out at the sample site. Using line-intercept techniques the canopy cover of hard mast producing trees and shrubs, the canopy cover of all trees, and leaf litter were recorded.

2. A 15-foot-wide belt transect was set up along the 50-foot-long transect. Dbh of all trees in the belt transect was measured using a dbh tape. All oak trees were noted on the data sheet.

Riparian Cover-Type

1. A 25-meter-long transect was laid out at the sample site. Using line-intercept techniques the herbaceous canopy cover, herbaceous vegetation height, and shrub crown cover was recorded.

2. A 15-foot-wide belt transect was set up along the 25-meter-long transect. Dbh of all trees in the belt transect was measured using a dbh tape.

Seasonal Wetland Cover-Type

1. A 25-meter-long transect was laid out at the sample site. Using line-intercept techniques the herbaceous vegetation height, water depth and submergent/emergent vegetation cover in water 4-9 inches deep was recorded.

2. A check-list for the remaining variables was constructed and a check mark was placed to indicate the conditions for the particular variable (see data sheet).

The project area was divided into five reaches prior to data collection. Each of the four action alternatives is composed of these reaches to simplify any future project changes and the associated impact which may occur prior to actual construction. Figure 4 depicts the five reaches.

As previously mentioned, when using HEP, it is necessary to determine HSIs for each evaluation species at selected target years, including future years, for both with-project and without-project scenarios, and for proposed mitigation areas. Since it is not possible to empirically determine habitat quality and quantity for future years, future HSI values were projected. This was accomplished by increasing or decreasing the measured baseline SI (Suitability Index) values for each evaluation species, according to probable future conditions; consideration of the HSI model variables; literature review; professional observations; and review of completed restoration and revegetation projects. A summary of these predicted conditions appears in Appendix A-1. HSI values for all evaluation species were calculated at the completion of field data collection. All SIs and HSIs were calculated by hand, or using a calculator, as appropriate. The equations used to calculate HSIs are contained within each model. The assumptions used in predicting habitat changes in future Target Years and the predicted future scenarios are contained in Appendix A-1.

US Army Corps of Engineers
Sacramento District

American River Watershed Project

Folsom Bridge SEIS/SEIR

Figure 4. - HEP Study Reaches for the Folsom Bridge Project.

February 10, 2006

Scale 1" = 800'

A typical compensation site located in the American River Parkway at Rossmoor Bar on the American River was used in the HEP to quantify the baseline habitat values[3] for what the HEP Team considered a typical candidate mitigation site. The HEP Team developed a compensation scenario based on a suite of assumptions for development of site for each of the cover-types impacted.

The HEP version 2.2 Accounting Software package was used on an IBM-compatible personal computer to calculate HUs, AAHUs, and sizes of the compensation areas needed to offset project impacts to fish and wildlife, for all cover-types evaluated. Copies of the HSI models used for the HEP are attached in Appendix A-2.

RESULTS AND DISCUSSION

This HEP analyzed the impacts of four alternatives for: 1) constructing a new road between the existing Folsom Dam Road intersection at East Natoma Street to Folsom-Auburn Road, with a bridge over the American River (just downstream of Folsom Dam), 2) building new roads and widening existing roads for construction purposes, 3) construction and operation of the staging area, and 4) possible relocation of Reclamation facilities and the American River Water Education Center.

Tables 3-6 summarize the cover-types, acres impacted, net change in AAHUs with- and without the project and compensation need for the four construction alternatives. Based on this analysis, Alternative 5 would have the least impacts in terms of total compensation needs (54.02 acres). Alternative 2 would have the greatest impacts (total compensation need of 59.98 acres). The difference the least and most impact alternatives is 5.46 acres. It should be noted that the impacts of any of the alternatives could significantly change when the details of relocating Reclamation, ARWEC and State Parks facilities are finalized. In all alternatives, annual grasslands would be replanted when disturbance ends to minimize the effects of the project, so no additional compensation measures were identified.

Table 7 summarizes the acres impacted and compensation need by cover-type for all alternatives.

3 The Rossmoor Bar site was chosen as a typical site to gather baseline habitat values for a compensation site. The actual compensation site could be one of many sites being considered within the Lower American River Parkway

Table 3 Alternative 2. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units With- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Bridge Project, California

REACH 1

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	8.23	9.14	0.58	-9.08	12.66
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.31	0.37	0.04	-0.33	0.31
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**8.54**				**12.97**

REACH 2

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	15.95	18.03	1.13	-16.70	25.00
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.01	0.01	0.00	-0.01	0.01
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**15.96**				**25.01**

REACH 3

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	1.38	1.56	0.10	-1.46	2.16
Riparian woodland	0.60	0.97	0.00	-0.97	0.60
Seasonal wetland	1.39	1.66	0.17	-1.49	1.39
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**3.37**				**4.15**

REACH 4

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	4.65	5.25	0.33	-4.92	7.29
Riparian woodland	1.15	1.86	0.02	-1.84	1.15
Seasonal wetland	N/A	N/A	N/A	N/A	N/A
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**5.80**				**8.44**

REACH 5 (ARWEC AND USBR ACCESS RD)

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	3.66	3.33	0.25	-3.08	4.56
Riparian woodland	3.71	5.54	0.03	-5.51	4.05
Seasonal wetland	0.80	0.95	0.09	-0.86	0.80
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**7.37**				**9.41**

Table 4 Alternative 3. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Bridge Project, California

REACH 1

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	8.23	9.14	0.58	-9.08	12.66
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.31	0.37	0.04	-0.33	0.31
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**8.54**				**12.97**

REACH 2

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	14.95	16.90	1.05	-15.85	23.43
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.01	0.01	0.00	-0.01	0.01
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**14.96**				**23.44**

REACH 3

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	1.38	1.56	0.10	-1.46	2.16
Riparian woodland	0.60	0.97	0.00	-0.97	0.60
Seasonal wetland	1.39	1.66	0.17	-1.49	1.39
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**3.37**				**4.15**

REACH 4

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	4.65	5.25	0.33	-4.92	7.29
Riparian woodland	1.15	1.86	0.02	-1.84	1.15
Seasonal wetland	N/A	N/A	N/A	N/A	N/A
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**5.80**				**8.44**

REACH 5 (ARWEC AND USBR ACCESS RD)

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	3.66	3.33	0.25	-3.08	4.56
Riparian woodland	3.71	5.54	0.03	-5.51	4.05
Seasonal wetland	0.80	0.95	0.09	-0.86	0.80
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**7.37**				**9.41**

Table 5 Alternative 4. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Dam Bridge Project, California

REACH 1

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	6.55	7.27	0.46	-6.81	10.07
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.08	0.10	0.01	-0.09	0.08
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**6.63**				**10.15**

REACH 2

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	14.95	16.90	1.05	-15.85	23.43
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.01	0.01	0.00	-0.01	0.01
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**14.96**				**23.44**

REACH 3

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	1.38	1.56	0.10	-1.46	2.16
Riparian woodland	0.60	0.97	0.00	-0.97	0.60
Seasonal wetland	1.39	1.66	0.17	-1.49	1.39
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**3.37**				**4.15**

REACH 4

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	4.65	5.25	0.33	-4.92	7.29
Riparian woodland	1.15	1.86	0.02	-1.84	1.15
Seasonal wetland	N/A	N/A	N/A	N/A	N/A
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**5.80**				**8.44**

REACH 5 (ARWEC AND USBR ACCESS RD)

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	3.66	3.33	0.25	-3.08	4.56
Riparian woodland	3.71	5.54	0.03	-5.51	4.05
Seasonal wetland	0.80	0.95	0.09	-0.86	0.80
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**7.37**				**9.41**

Table 6 Alternative 5. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Dam Bridge Project, California

REACH 1

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	6.55	7.27	0.46	-6.81	10.07
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.08	0.10	0.01	-0.09	0.08
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**6.63**				**10.15**

REACH 2

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	13.95	15.77	0.99	-14.78	21.86
Riparian woodland	N/A	N/A	N/A	N/A	N/A
Seasonal wetland	0.01	0.01	0.00	-0.01	0.01
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**13.96**				**21.87**

REACH 3

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	1.38	1.56	0.10	-1.46	2.16
Riparian woodland	0.60	0.97	0.00	-0.97	0.60
Seasonal wetland	1.39	1.66	0.17	-1.49	1.39
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**3.37**				**4.15**

REACH 4

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	4.65	5.25	0.33	-4.92	7.29
Riparian woodland	1.15	1.86	0.02	-1.84	1.15
Seasonal wetland	N/A	N/A	N/A	N/A	N/A
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**5.80**				**8.44**

REACH 5 (ARWEC AND USBR ACCESS RD)

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	3.66	3.33	0.25	-3.08	4.56
Riparian woodland	3.71	5.54	0.03	-5.51	4.05
Seasonal wetland	0.80	0.95	0.09	-0.86	0.80
Annual grassland	N/A	N/A	N/A	N/A	Re-plant
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	**7.37**				**9.41**

Table 7. Alternative 2. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Bridge Project, California

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	33.87	37.31	2.39	-35.24	51.67
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.51	2.99	0.63	-1.20	2.51
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	41.84				59.98

Alternative 3. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual HabitatUnits with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Bridge Project, California

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	32.87	36.18	2.31	-33.87	50.10
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.51	2.99	0.63	-1.20	2.51
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	40.84				58.41

Alternative 4. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Bridge Project, California

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	31.19	34.31	2.19	-32.12	47.51
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.28	2.72	0.27	-2.45	2.28
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	38.93				55.59

Alternative 5. Summary of Cover-Types, Acres Impacted, Net Change in Average Annual Habitat Units with- and Without-Project and Compensation Need for the direct impacts of construction of the Folsom Bridge Project, California

Cover-Type	Acres Impacted	AAHUs Without Project	AAHUs With Project	Net Change in AAHUs	Compensation Need (acres)
Oak woodland	30.19	33.18	2.13	-31.05	45.94
Riparian woodland	5.46	8.37	0.05	-8.32	5.80
Seasonal wetland	2.28	2.72	0.27	-2.45	2.28
Annual grassland	N/A	N/A	N/A	N/A	N/A
Other	N/A	N/A	N/A	N/A	N/A
TOTAL	37.93				54.02

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APPENDIX A-1

DATA ANALYSIS ASSUMPTIONS

REACH 1 EAST NATOMA STREET TO PARKING LOT NEAR SOUTH END OF DAM

PA 1 - Future Without Project (Impact Area)

OAK WOODLAND

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured)

V1 - % canopy closure of trees and shrubs that produce hard mast (65%)
V2 - Density of leaf litter layer (M)
V3 - % tree cover (61%)
V4 - Den site availability (53)

HSI Food $= (V1 \times V2)^{1/2}$ HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$

HSI = 0.46 (lowest of values)

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0.46

TY 51

V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0.46

PLAIN TITMOUSE

TY 0 - Baseline (measured)

V1 - dbh
V2 - Number trees/acre
V3 - % trees that are oaks

$$HSI = \frac{V1 + V2 + V3}{3}$$

HSI = 0 .65

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.65

TY 51 V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.65

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured) HSI = 0.46

TY 1 - V1 - no trees SI = 0
V2 - low leaf litter SI = 0.2
V3 - no trees SI = 0
V4 - no den sites SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 51- V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (measured) HSI = 0.65

TY 1 - V1 - no trees SI = 0.2
V2 - no trees SI = 0
V3 - no trees SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2}{3} = 0.06$$

TY 51 - V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1

HSI = .06

MP 1 - Management Area - Future Without Project (Compensation Site)

Assume: 1. Annual grassland area selected for conversion to oak woodland.

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated)

V1 - % canopy closure of trees and shrubs that produce hard mast (no trees)		SI = 0
V2 - Density of leaf litter (low)		SI = 0.2
V3 - Den site availability (no trees)		SI = 0

HSI Food $= (V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0

TY 15 - no change from TY 1 HSI = 0

TY 51 - no change from TY 15 HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

V1 - dbh (0)	SI = 0.2
V2 - Number trees/acre (0)	SI = 0
V3 - % trees that are oaks (0)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = .06

TY 15 - no change from TY 1 HSI = .06

TY 51 - no change from TY 15 HSI = .06

MP 2 - Management Area - Future With Project (Compensation Site)

Assume:
1. Acquire lands (currently annual grasslands)
2. Annual grassland area prepared for planting in TY 1 , provide access and maintenance roads
3. Plant 100% blue and live oak trees (4"x4"x14" tree pots) at a density of 400 trees/acre and cover crop
4. Moderate management intensity (assume 1.5 inches dbh after 10 yrs; 90 percent survival).
5. Watering, weed, pest control for minimum of 3 years and remedial actions as necessary to ensure plant establishment.
6. Assume maximum growth rate of 12"/year
7. Develop O&M manual
8. TY 51 values equal values measured for impact zone

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated) HSI = 0

TY 1 -	V1 - tree species planted /no mast	SI = 0
	V2 - low	SI = 0.2
	V3 - 0 (no trees)	SI = 0
	V4 - 0 (no trees)	SI = 0

HSI = 0

TY 15 -	V1 - oak trees reach 16ft. high 8%	SI = 0.15
	V2 - low	SI = 0.2
	V3 - 8%	SI = 0.15
	V4 - 0	SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.15 \times 0.2)^{1/2}$
= .17

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(0.15 \times 0)^{1/2}$
= 0

HSI = 0

TY 51	V1 - 40%	SI = 0.8
	V2 - medium	SI = 0.8
	V3 - 53%	SI = 1.0
	V4 - 24/ac	SI = 1.0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.8 \times 0.2)^{1/2}$
= 0.40

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(1.0 \times 1.0)^{1/2}$
= 1.0

HSI = 0.40

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

HSI = .06

TY 1 -

V1 - tree species planted (oak) (0 dbh)	SI = 0.2
V2 - 400 (100% $\leq$ 16 ft tall; no trees)	SI = 0
V3 - 100% (no trees)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = 0\ .06$$

TY 15 -

V1 - oak trees reach 16 ft. high (dbh = 1.75)	SI = 0.2
V2 - $\geq$ 100 tree/ac	SI = 1.0
V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = 0.73$$

TY 51 -

V1 - 2.5 dbh	SI = 0.2
V2 - $\geq$ 100 tree/ac	SI = 1.0
V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = 0\ .73$$

PA 1 - Future Without Project (Impact Area)

SEASONAL WETLAND

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – no change from baseline

HSI = 0.23

TY 51 – no change from baseline

HSI = 0.23

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitable nest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline

HSI = 0.2

TY 51 – no change from baseline

HSI = 0.2

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 – no change from baseline

HSI = 0.76

TY 51 – no change from baseline

HSI = 0.76

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation
3. existing drainages culverted under roads

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – V1 – 0 SI = 0
V2 - 0 SI = 0.1

$$HSI = \frac{0 + 0.1}{2} = 0.05$$

TY 51 – no change from TY 1

HSI = 0.05

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitable nest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline

HSI = 0

TY 51 – no change from baseline TY 1

HSI = 0

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 –	V1 – 0	SI = 0
	V2 – 0	SI = 0
	V3 – not silty or loamy ; not friable	SI = 0.2

$$HSI = \frac{0 + 0 + 0.2}{3} = 0.06$$

TY 51 – no change from TY 1

HSI = 0.06

MP 1 - Future Without Project (Compensation Area)

Assumption: 1. Annual grassland area will be converted to wetlands

GREAT EGRET

TY 0 - Baseline (measured)

V1 - % of area with water 4-9 inches deep (0) SI = 0

V2 - % of area 4-9 deep with emergent/submergent vegetation (0) SI = .1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 no change from TY 0

TY 4 no change from TY 1

TY 51 no change from TY 4

CALIFORNIA VOLE

TY 0 - Baseline (estimated)

V1 - Height of herbaceous vegetation ($\geq$ 6in.) SI = 1.0

V2 - % cover of herbaceous vegetation (80%) SI = 6.7

V3 - soil type (mod. friable) SI = 0.5

TY 1 - V1 - no change from TY 0

V2 - no change from TY 0

V3 - no change from TY 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 4 - V1 - no change from TY 1

TY 51 - V1 - no change from TY 4

RED-WINGED BLACKBIRD

TY 0 - Baseline (estimated) - upland area unsuitable for species HSI = 0

TY 1 - no change from TY 0

TY 4 - no change from TY 1

TY 51 - no change from TY 4

MP 2 - Future With Project (Compensation Site)

Assumption:

1. Acquire annual grassland area
2. Portion of wetland area will have permanent water
3. Wetland will be designed to provide equal mix of open water and emergent vegetation
4. Carp will not be stocked
5. Site baseline is a Condition C wetland.
6. Site is minimum of 1-acre in size and access and maintenance roads are provided.
7. 40% of area designed for summer conditions of water 4-9 in deep
8. Plant appropriate wetland plant species, provide pest control and maintenance as needed for minimum of 3 years or until wetland is established.
9. Cover crop planted on all disturbed non-wetland areas.

GREAT EGRET

TY 0 - Baseline (estimated)

V1 - % of area with water 4-9 inches deep (0) SI = 0

V2 - % of area with water 4-9 deep with emergent/submergent vegetation SI = 0.1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 - V1 - 40% SI = 0.4

V2 - 5% SI = 0.2

$$HSI = \frac{0.4 + 0.2}{2} = \frac{0.6}{2} = .30$$

TY 4 - V1 - 40% SI = 0.4

V2 - 40% - 60% SI = 1.0

$$HSI = \frac{0.4 + 1.0}{2} = .70$$

TY 51 - no change from TY 4

HSI = .70

CALIFORNIA VOLE

TY 0 - Baseline (estimated)

V1 - Height of herbaceous vegetation ($\geq$ 6 in.) SI = 1.0

V2 - % cover of herbaceous vegetation (80%) SI = 0.7

V3 - soil type (mod friable) SI = 0.5

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 1 -	V1 - $\geq$ 6 in	SI = 1.0
	V2 - 90%	SI = 0.85
	V3 - no change fro baseline	SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 4 -	V1 - no change from TY 1	SI = 1.0
	V2 - 100%	SI = 0
	V3 - no change from TY 1	SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 51- V1 - no change from TY 4
V2 - no change from TY 4
V3 - no change from TY 4

HSI = .78

RED-WINGED BLACKBIRD

TY 0 - Baseline (estimated) - upland area unsuitable for species

HSI = 0

TY 1 -	V1 - Emergent vegetation is old/new growth monocot (other)	SI = 0.1
	V2 - Water present throughout year (yes)	SI = 1.0
	V3 - Carp presence (absent)	SI = 1.0
	V4 - larvae of dragonflies/damselflies presence (yes)	SI = 1.0
	V5 - vegetation density (sparse first year)	SI = 0.1

$$HSI = (V1 + V2 + V3 + V4 + V5)^{1/2} = (0.1 \times 1.0 \times 1.0 \times 1.0 \times 0.1)^{1/2} = 0.1$$

TY 4 -	V1 - old/new growth monocots	SI = 1.0
	V2 - no change	SI = 1.0
	V3 - no change	SI = 1.0
	V4 - no change	SI = 1.0
	V5 - 50%	SI = 1.0

$$HSI = (1.0 \times 1.0 \times 1.0 \times 1.0 \times 1.0)^{1/2} = 1.0$$

TY 51 - no change from TY 4

HSI = 1.0

REACH 2 - PARKING LOT NEAR SOUTH END OF DAM TO FOLSOM PRISON ACCESS ROAD

PA 1 - Future Without Project (Impact Area)

OAK WOODLAND

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured)

V1 - % canopy closure of trees and shrubs that produce hard mast
V2 - Density of leaf litter layer
V3 - % tree cover
V4 - Den site availability

HSI Food $= (V1 \times V2)^{1/2}$ HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$

HSI = 0.48 (lowest of values)

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0.48

TY 51

V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0.48

PLAIN TITMOUSE

TY 0 - Baseline (measured)

V1 - dbh
V2 - Number trees/acre
V3 - % trees that are oaks

$$HSI = \frac{V1 + V2 + V3}{3}$$

HSI = 0 .65

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.65

TY 51 V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.65

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured) HSI = 0.48

TY 1 - V1 - no trees SI = 0
V2 - low leaf litter SI = 0.2
V3 - no trees SI = 0
V4 - no den sites SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 51- V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (measured) HSI = 0.65

TY 1 - V1 - no trees SI = 0.2
V2 - no trees SI = 0
V3 - no trees SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2}{3} = 0.06$$

TY 51 - V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1

HSI = .06

MP 1 - Management Area - Future Without Project (Compensation Site)

Assume: 1. Annual grassland area selected for conversion to oak woodland.

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated)

V1 - % canopy closure of trees and shrubs that produce hard mast (no trees)		SI = 0
V2 - Density of leaf litter (low)		SI = 0.2
V3 - Den site availability (no trees)		SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0

TY 15 - no change from TY 1 HSI = 0

TY 51 - no change from TY 15 HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

V1 - dbh (0)	SI = 0.2
V2 - Number trees/acre (0)	SI = 0
V3 - % trees that are oaks (0)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = .06

TY 15 - no change from TY 1 HSI = .06

TY 100 - no change from TY 15 HSI = .06

MP 2 - Management Area - Future With Project (Compensation Site)

Assume:
1. Acquire lands (currently annual grasslands)
2. Annual grassland area prepared for planting in TY 1 , provide access and maintenance roads
3. Plant 100% blue and live oak trees (4"x4"x14" tree pots) at a density of 400 trees/acre and cover crop
4. Moderate management intensity (assume 1.5 inches dbh after 10 yrs; 90 percent survival).
5. Watering, weed, pest control for minimum of 3 years and remedial actions as necessary to ensure plant establishment.
6. Assume maximum growth rate of 12"/year
7. Develop O&M manual
8. TY 51 values equal values measured for impact zone

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated) HSI = 0

TY 1 -	V1 - tree species planted /no mast	SI = 0
	V2 - low	SI = 0.2
	V3 - 0 (no trees)	SI = 0
	V4 - 0 (no trees)	SI = 0

HSI = 0

TY 15 -	V1 - oak trees reach 16ft. high 8%	SI = 0.15
	V2 - low	SI = 0.2
	V3 - 8%	SI = 0.15
	V4 - 0	SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.15 \times 0.2)^{1/2}$
= .17

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(0.15 \times 0)^{1/2}$
= 0

HSI = 0

TY 51	V1 - 40%	SI = 0.8
	V2 - medium	SI = 0.8
	V3 - 53%	SI = 1.0
	V4 - 24/ac	SI = 1.0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.8 \times 0.2)^{1/2}$
= 0.40

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(1.0 \times 1.0)^{1/2}$
= 1.0

HSI = 0.40

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

HSI = .06

TY 1 -	V1 - tree species planted (oak) (0 dbh)	SI = 0.2
	V2 - 400 (100% $\leq$ 16 ft tall; no trees)	SI = 0
	V3 - 100% (no trees)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = 0.06$$

TY 15 -	V1 - oak trees reach 16 ft. high (dbh = 1.75)	SI = 0.2
	V2 - $\geq$ 100 tree/ac	SI = 1.0
	V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = 0.73$$

TY 51 -	V1 - 2.5 dbh	SI = 0.2
	V2 - $\geq$ 100 tree/ac	SI = 1.0
	V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = 0.73$$

PA 1 - Future Without Project (Impact Area)

SEASONAL WETLAND

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – no change from baseline

HSI = 0.23

TY 51 – no change from baseline

HSI = 0.23

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitable nest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline

HSI = 0.2

TY 51 – no change from baseline

HSI = 0.2

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 – no change from baseline

HSI = 0.76

TY 51 – no change from baseline

HSI = 0.76

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation
3. existing drainages culverted under roads

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – V1 – 0 SI = 0
V2 - 0 SI = 0.1

$$HSI = \frac{0 + 0.1}{2} = 0.05$$

TY 51 – no change from TY 1

HSI = 0.05

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitablenest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline

HSI = 0

TY 51 – no change from baseline TY 1

HSI = 0

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 – V1 – 0 SI = 0
V2 – 0 SI = 0
V3 – not silty or loamy ; not friable SI = 0.2

$$HSI = \frac{0 + 0 + 0.2}{3} = 0.06$$

TY 51 – no change from TY 1

HSI = 0.06

MP 1 - Future Without Project (Compensation Area)

Assumption: 1. Annual grassland area will be converted to wetlands

GREAT EGRET

TY 0 - Baseline (measured)
V1 - % of area with water 4-9 inches deep (0) SI = 0
V2 - % of area 4-9 deep with emergent/submergent vegetation (0) SI = .1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 no change from TY 0

TY 4 no change from TY 1

TY 51 no change from TY 4

CALIFORNIA VOLE

TY 0 - Baseline (estimated)
V1 - Height of herbaceous vegetation (≥ 6in.) SI = 1.0
V2 - % cover of herbaceous vegetation (80%) SI = 6.7
V3 - soil type (mod. friable) SI = 0.5

TY 1 - V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 4 - V1 - no change from TY 1

TY 51 - V1 - no change from TY 4

RED-WINGED BLACKBIRD

TY 0 - Baseline (estimated) - upland area unsuitable for species HSI = 0

TY 1 - no change from TY 0

TY 4 - no change from TY 1

TY 51 - no change from TY 4

MP 2 - Future With Project (Compensation Site)

Assumption:

1. Acquire annual grassland area
2. Portion of wetland area will have permanent water
3. Wetland will be designed to provide equal mix of open water and emergent vegetation
4. Carp will not be stocked
5. Site baseline is a Condition C wetland.
6. Site is minimum of 1-acre in size and access and maintenance roads are provided.
7. 40% of area designed for summer conditions of water 4-9 in deep
8. Plant appropriate wetland plant species, provide pest control and maintenance as needed for minimum of 3 years or until wetland is established.
9. Cover crop planted on all disturbed non-wetland areas.

GREAT EGRET

TY 0 - Baseline (estimated)
V1 - % of area with water 4-9 inches deep (0) SI = 0
V2 - % of area with water 4-9 deep with emergent/submergent vegetation SI = 0.1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 - V1 - 40% SI = 0.4
V2 - 5% SI = 0.2

$$HSI = \frac{0.4 + 0.2}{2} = \frac{0.6}{2} = .30$$

TY 4 - V1 - 40% SI = 0.4
V2 - 40% - 60% SI = 1.0

$$HSI = \frac{0.4 + 1.0}{2} = .70$$

TY 51 - no change from TY 4

HSI = .70

CALIFORNIA VOLE

TY 0 - Baseline (estimated)
V1 - Height of herbaceous vegetation ($\geq$ 6 in.) SI = 1.0
V2 - % cover of herbaceous vegetation (80%) SI = 0.7
V3 - soil type (mod friable) SI = 0.5

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 1 - V1 - $\geq$ 6 in SI = 1.0
V2 - 90% SI = 0.85
V3 - no change fro baseline SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 4 - V1 - no change from TY 1 SI = 1.0
V2 - 100% SI = 0
V3 - no change from TY 1 SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 51- V1 - no change from TY 4
V2 - no change from TY 4
V3 - no change from TY 4

HSI = .78

TY 0 - Baseline (estimated) - upland area unsuitable for species

HSI = 0

TY 1 -	V1 - Emergent vegetation is old/new growth monocot (other)	SI = 0.1
	V2 - Water present throughout year (yes)	SI = 1.0
	V3 - Carp presence (absent)	SI = 1.0
	V4 - larvae of dragonflies/damselflies presence (yes)	SI = 1.0
	V5 - vegetation density (sparse first year)	SI = 0.1

$HSI = (V1 + V2 + V3 + V4 + V5)^{½} = (0.1 \times 1.0 \times 1.0 \times 1.0 \times 0.1)^{½} = 0.1$

TY 4 -	V1 - old/new growth monocots	SI = 1.0
	V2 - no change	SI = 1.0
	V3 - no change	SI = 1.0
	V4 - no change	SI = 1.0
	V5 - 50%	SI = 1.0

$HSI = (1.0 \times 1.0 \times 1.0 \times 1.0 \times 1.0)^{½} = 1.0$

TY 51 - no change from TY 4

HSI = 1.0

PA 1 - Future Without Project (Impact Area)

RIPARIAN

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0%) SI = 0
V2 - average height of deciduous shrub canopy (7 ft) SI = 1.0
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0%) SI = 0.1

HSI = $(V1 \times V2 \times V3)^{1/3} = (0 \times 1.0 \times 0.1)^{1/3} = 0$

TY 1 – no change from baseline

HSI = 0

TY 51 – V1 – 10% SI = 0.17
V2 – 7 ft SI = 1.0
V3 – 75% SI = 0.68

HSI = $(0.17 \times 1.0 \times 0.68)^{1/3} = 0.49$

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (47 ft) SI = 1.0
V2 - % deciduous tree crown cover (90-100%) SI = 0.8
V3 – stand width (< 300 ft) SI = 0.5

HSI = $(V1 \times V2 \times V3)^{1/3} = 0.74$

TY 1 – no change from baseline

HSI = 0.74

TY 51 – no change from baseline

HSI = 0.77

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (80-100%) SI = 0.66
V2 - average size of ground cover objects (2 ft) SI = 0.8
V3 - structural diversity/interspersion (C) SI = 1.0
V4 - % canopy cover (90 – 100%) SI = 0

$CI = (2V1 \times V2 \times V3)^{1/3} = (2\ 0.66 \times 0.8 \times 1.0)^{1/3} = 1.0$
$TI = (V1 \times V4)^{1/2} = (0.66 \times 0)^{1/2} = 0$
$HSI = (CI \times TI)^{1/2} = 0$ (average of transects)

TY 1 – no change from baseline

HSI = 0

TY 51 – no change from baseline

V1 - % ground cover (80%)	SI = 0.66
V2 - average size of ground cover objects (2 ft)	SI = 0.8
V3 - structural diversity/interspersion (C)	SI = 1.0
V4 - % canopy cover (75%)	SI = 0.3

$CI = (2V1 \times V2 \times V3)^{1/3} = (2\ 0.66 \times 0.8 \times 1.0)^{1/3} = 1.0$

$TI = (V1 \times V4)^{1/2} = (0.66 \times 0.3)^{1/2} = 0.44$

$HSI = (CI \times TI)^{1/2} = 0.66$

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1.
2. Temporary easement areas will not be replanted with woody vegetation.

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover
V2 - average height of deciduous shrub canopy
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1	– V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 51	– V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy
V2 - % deciduous tree crown cover
V3 – stand width

$HSI = (V1 \times V2 \times V3)^{1/3} = 0.74$

TY 1 -	V1 – no trees	SI = 0
	V2 – no trees	SI = 0
	V3 – no trees	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 51 –	V1 – no trees	SI = 0
	V2 – no trees	SI = 0
	V3 – no trees	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover
V2 - average size of ground cover objects
V3 - structural diversity/interspersion
V4 - % canopy cover

$CI = (2V1 \times V2 \times V3)^{1/3}$

$TI = (V1 \times V4)^{1/2}$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 –	V1 – no ground cover	SI = 0
	V2 – no cover objects	SI = 0
	V3 – A	SI = 0.1
	V4 – no canopy cover	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 51 – No change from TY 1

MP 1 – Management Area – Future Without the Project (Compensation Site)

Assume: 1. Existing riparian river bank upstream of Rossmoor Bar can be enhanced by planting riparian species (south side of river).

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (5 ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline
HSI = 0

TY 15 – no change from baseline
HSI = 0

TY 30 – no change from baseline
HSI = 0

TY 51 – no change from baseline
HSI = 0

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft)	SI = 0.77
V2 - % deciduous tree crown cover (0)	SI = 0
V3 – stand width (1)	SI = 0.2

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline
HSI = 0

TY 15 – no change from baseline
HSI = 0

TY 30 – no change from baseline
HSI = 0

TY 51 – no change from baseline
HSI = 0

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 – no change from baseline
HSI = 0

TY 15 – no change from baseline
HSI = 0

TY 30 – no change from baseline
HSI = 0

TY 51 – no change from baseline
HSI = 0

MP 2 – Management Area – Future With Project (Compensation Site)

Assume:
1. Acquire lands.
2. Watering, weed and pest management for a minimum of 3 years and remedial actions as necessary to ensure plant establishment.
3. Willow species and cottonwoods (80% of woody plantings wil be planted near the mean summer water surface elevation and less water tolerant plants (oaks, etc) will be planted higher on the bank.
4. The site will extend no more than 25 feet up the bank from mean summer water surface elevation.
5. Assume average growth rate of 24 inches/year for willows and cottonwood trees.

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (5 ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – V1 - % deciduous shrub crown cover (5%) SI = 0.15
V2 - average height of deciduous shrub canopy (1 ft) SI = 0.17
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%) SI = 0.80

$HSI = (0.15 \times 0.17 \times 0.80)^{1/2} = 0.14$

TY 15 – V1 - % deciduous shrub crown cover (75%) SI = 1.0
V2 - average height of deciduous shrub canopy (5ft) SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%) SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/2} = 0.81$

TY 30 – V1 - % deciduous shrub crown cover (75%) SI = 1.0
V2 - average height of deciduous shrub canopy (5ft) SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%) SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/2} = 0.81$

TY 51 – no change from TY 30

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft) SI = 0.77
V2 - % deciduous tree crown cover (0) SI = 0
V3 – stand width (1) SI = 0.2

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – V1 - average height of deciduous tree canopy (27 ft) SI = 0.77
V2 - % deciduous tree crown cover (0) SI = 0
V3 – stand width (< 300 ft) SI = 0.5

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 15 – V1 - average height of deciduous tree canopy (16 ft) SI = 0.77
V2 - % deciduous tree crown cover (25%) SI = 1.0
V3 – stand width (< 300 ft) SI = 0.5

$HSI = (0.77 \times 1.0 \times 0.5)^{1/3} = 0.54$

TY 30 – V1 - average height of deciduous tree canopy (40 ft) SI = 1.0
V2 - % deciduous tree crown cover (50%) SI = 1.0
V3 – stand width (< 300 ft) SI = 0.5

$HSI = (1.0 \times 1.0 \times 0.5)^{1/3} = 0.79$

TY 51 - V1 - average height of deciduous tree canopy (80 ft) SI = 1.0
V2 - % deciduous tree crown cover (75%) SI = 0.9
V3 – stand width (< 300 ft) SI = 0.5

$HSI = (1.0 \times 0.9 \times 0.5)^{1/3} = 0.77$

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (0) SI = 0
V2 - average size of ground cover objects (< 1 ft) SI = 0.2
V3 - structural diversity/interspersion (A) SI = 0.1
V4 - % canopy cover (0) SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 – V1 - % ground cover (0) SI = 0
V2 - average size of ground cover objects (< 1 ft) SI = 0.2
V3 - structural diversity/interspersion (A) SI = 0.1
V4 - % canopy cover (0) SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 15 – V1 - % ground cover (5%) SI = 0
V2 - average size of ground cover objects (≤ 1 ft) SI = 0.2
V3 - structural diversity/interspersion (A) SI = 0.1
V4 - % canopy cover (40%) SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 30 –	V1 - % ground cover (25%)	SI = 1.0
	V2 - average size of ground cover objects (2 ft)	SI = 0.8
	V3 - structural diversity/interspersion (C)	SI = 1.0
	V4 - % canopy cover (75%)	SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

TY 51 –	V1 - % ground cover (50%)	SI = 1.0
	V2 - average size of ground cover objects (2 ft)	SI = 0.8
	V3 - structural diversity/interspersion (C)	SI = 1.0
	V4 - % canopy cover (75%)	SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

REACH 3 - FOLSOM PRISON ACCESS ROAD TO SOUTH END OF BRIDGE

PA 1 - Future Without Project (Impact Area)

OAK WOODLAND

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured)

V1 - % canopy closure of trees and shrubs that produce hard mast
V2 - Density of leaf litter layer
V3 - % tree cover
V4 - Den site availability

HSI Food $= (V1 \times V2)^{1/2}$ HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$

HSI = 0.48 (lowest of values)

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0.48

TY 51

V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0.48

PLAIN TITMOUSE

TY 0 - Baseline (measured)

V1 - dbh
V2 - Number trees/acre
V3 - % trees that are oaks

$$HSI = \frac{V1 + V2 + V3}{3}$$

HSI = 0 .65

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.65

TY 51 V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.65

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured) HSI = 0.48

TY 1 - V1 - no trees SI = 0
V2 - low leaf litter SI = 0.2
V3 - no trees SI = 0
V4 - no den sites SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 51- V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (measured) HSI = 0.65

TY 1 - V1 - no trees SI = 0.2
V2 - no trees SI = 0
V3 - no trees SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2}{3} = 0.06$$

TY 51 - V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1

HSI = .06

MP 1 - Management Area - Future Without Project (Compensation Site)

Assume: 1. Annual grassland area selected for conversion to oak woodland.

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated)

V1 - % canopy closure of trees and shrubs that produce hard mast (no trees)		SI = 0
V2 - Density of leaf litter (low)		SI = 0.2
V3 - Den site availability (no trees)		SI = 0

HSI Food $= (V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0

TY 15 - no change from TY 1 HSI = 0

TY 51 - no change from TY 30 HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

V1 - dbh (0)	SI = 0.2
V2 - Number trees/acre (0)	SI = 0
V3 - % trees that are oaks (0)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = .06

TY 15 - no change from TY 1 HSI = .06

TY 51 - no change from TY 30 HSI = .06

MP 2 - Management Area - Future With Project (Compensation Site)

Assume:
1. Acquire lands (currently annual grasslands)
2. Annual grassland area prepared for planting in TY 1 , provide access and maintenance roads
3. Plant 100% blue and live oak trees (4"x4"x14" tree pots) at a density of 400 trees/acre and cover crop
4. Moderate management intensity (assume 1.5 inches dbh after 10 yrs; 90 percent survival).
5. Watering, weed, pest control for minimum of 3 years and remedial actions as necessary to ensure plant establishment.
6. Assume maximum growth rate of 12"/year
7. Develop O&M manual
8. TY 51 values equal values measured for impact zone

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated) HSI = 0

TY 1 -	V1 - tree species planted /no mast	SI = 0
	V2 - low	SI = 0.2
	V3 - 0 (no trees)	SI = 0
	V4 - 0 (no trees)	SI = 0

HSI = 0

TY 15 -	V1 - oak trees reach 16ft. high 8%	SI = 0.15
	V2 - low	SI = 0.2
	V3 - 8%	SI = 0.15
	V4 - 0	SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.15 \times 0.2)^{1/2}$
= .17

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(0.15 \times 0)^{1/2}$
= 0

HSI = 0

TY 51	V1 - 40%	SI = 0.8
	V2 - medium	SI = 0.8
	V3 - 53%	SI = 1.0
	V4 - 24/ac	SI = 1.0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.8 \times 0.2)^{1/2}$
= 0.40

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(1.0 \times 1.0)^{1/2}$
= 1.0

HSI = 0.40

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

HSI = .06

TY 1 -

V1 - tree species planted (oak) (0 dbh)	SI = 0.2
V2 - 400 (100% ≤ 16 ft tall; no trees)	SI = 0
V3 - 100% (no trees)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = 0.06$$

TY 15 -

V1 - oak trees reach 16 ft. high (dbh = 1.75)	SI = 0.2
V2 - ≥ 100 tree/ac	SI = 1.0
V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = 0.73$$

TY 51 -

V1 - 2.5 dbh	SI = 0.2
V2 - ≥ 100 tree/ac	SI = 1.0
V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = 0.73$$

RIPARIAN

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover
V2 - average height of deciduous shrub canopy
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs

$$HSI = (V1 \times V2 \times V3)^{1/3}$$

TY 1 – no change from baseline

HSI = 0.22

TY 51 – no change from baseline

HSI = 0.22

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy
V2 - % deciduous tree crown cover
V3 – stand width

$HSI = (V1 \times V2 \times V3)^{1/3}$

TY 1 – no change from baseline

HSI = 0.77

TY 51 – no change from baseline

HSI = 0.77

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover
V2 - average size of ground cover objects
V3 - structural diversity/interspersion
V4 - % canopy cover

$CI = (2V1 \times V2 \times V3)^{1/3}$
$TI = (V1 \times V4)^{1/2}$

$HSI = (CI \times TI)^{1/2} = 0.63$ (average of transects)

TY 1 – no change from baseline

HSI = 0.63

TY 51 – no change from baseline

HSI = 0.63

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1.
2. Temporary easement areas will not be replanted with woody vegetation.

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover
V2 - average height of deciduous shrub canopy
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs

$HSI = (V1 \times V2 \times V3)^{1/3}$

TY 1 –	V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 51 –	V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy
V2 - % deciduous tree crown cover
V3 – stand width

$HSI = (V1 \times V2 \times V3)^{1/3}$

TY 1 -	V1 – no trees	SI = 0
	V2 – no trees	SI = 0
	V3 – no trees	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 51 –	V1 – no trees	SI = 0
	V2 – no trees	SI = 0
	V3 – no trees	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover
V2 - average size of ground cover objects
V3 - structural diversity/interspersion
V4 - % canopy cover

$CI = (2V1 \times V2 \times V3)^{1/3}$

$TI = (V1 \times V4)^{1/2}$

$HSI = (CI \times TI)^{1/2} = 0.63$ (average of transects)

TY 1 –	V1 – no ground cover	SI = 0
	V2 – no cover objects	SI = 0
	V3 – A	SI = 0.1
	V4 – no canopy cover	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 51 – No change from TY 1

MP 1 – Management Area – Future Without the Project (Compensation Site)

Assume: 1. Existing riparian river bank upstream of Rossmoor Bar can be enhanced by planting riparian species (south side of river).

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (5 ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline

HSI = 0

TY 15 – no change from baseline

HSI = 0

TY 30 – no change from baseline

HSI = 0

TY 51 – no change from baseline

HSI = 0

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft)	SI = 0.77
V2 - % deciduous tree crown cover (0)	SI = 0
V3 – stand width (1)	SI = 0.2

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline

HSI = 0

TY 15 – no change from baseline

HSI = 0

TY 30 – no change from baseline

HSI = 0

TY 51 – no change from baseline

HSI = 0

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 – no change from baseline

HSI = 0

TY 15 – no change from baseline

HSI = 0

TY 30 – no change from baseline

HSI = 0

TY 51 – no change from baseline

HSI = 0

MP 2 – Management Area – Future With Project (Compensation Site)

Assume:
1. Acquire lands.
2. Watering, weed and pest management for a minimum of 3 years and remedial actions as necessary to ensure plant establishment.
3. Willow species and cottonwoods (80% of woody plantings will be planted near the mean summer water surface elevation and less water tolerant plants (oaks, etc) will be planted higher on the bank.
4. The site will extend no more than 25 feet up the bank from mean summer water surface elevaton
5. Assume average growth rate of 24 inches/year for willows and cottonwood trees..

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (5 ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – V1 - % deciduous shrub crown cover (5%)	SI = 0.15
V2 - average height of deciduous shrub canopy (1 ft)	SI = 0.17
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%)	SI = 0.80

$HSI = (0.15 \times 0.17 \times 0.80)^{1/2} = 0.14$

TY 15 – V1 - % deciduous shrub crown cover (75%)	SI = 1.0
V2 - average height of deciduous shrub canopy (5ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%)	SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/2} = 0.81$

TY 30 – V1 - % deciduous shrub crown cover (75%)	SI = 1.0
V2 - average height of deciduous shrub canopy (5ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%)	SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/2} = 0.81$

TY 51 – no change from TY 30

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft)	SI = 0.77
V2 - % deciduous tree crown cover (0)	SI = 0
V3 – stand width (1)	SI = 0.2

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 –	V1 - average height of deciduous tree canopy (27 ft)	SI = 0.77
	V2 - % deciduous tree crown cover (0)	SI = 0
	V3 – stand width (< 300 ft)	SI = 0.5

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 15 –	V1 - average height of deciduous tree canopy (16 ft)	SI = 0.77
	V2 - % deciduous tree crown cover (25%)	SI = 1.0
	V3 – stand width (< 300 ft)	SI = 0.5

$HSI = (0.77 \times 1.0 \times 0.5)^{1/3} = 0.54$

TY 30 –	V1 - average height of deciduous tree canopy (40 ft)	SI = 1.0
	V2 - % deciduous tree crown cover (50%)	SI = 1.0
	V3 – stand width (< 300 ft)	SI = 0.5

$HSI = (1.0 \times 1.0 \times 0.5)^{1/3} = 0.79$

TY 51 -	V1 - average height of deciduous tree canopy (>40 ft)	SI = 1.0
	V2 - % deciduous tree crown cover (75%)	SI = 0.9
	V3 – stand width (< 300 ft)	SI = 0.5

$HSI = (1.0 \times 0.9 \times 0.5)^{1/3} = 0.77$

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/3} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 –	V1 - % ground cover (0)	SI = 0
	V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
	V3 - structural diversity/interspersion (A)	SI = 0.1
	V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/3} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 15 – V1 - % ground cover (5%) SI = 0
V2 - average size of ground cover objects (≤ 1 ft) SI = 0.2
V3 - structural diversity/interspersion (A) SI = 0.1
V4 - % canopy cover (40%) SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 30 – V1 - % ground cover (25%) SI = 1.0
V2 - average size of ground cover objects (2 ft) SI = 0.8
V3 - structural diversity/interspersion (C) SI = 1.0
V4 - % canopy cover (75%) SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

TY 51 – V1 - % ground cover (50%) SI = 1.0
V2 - average size of ground cover objects (2 ft) SI = 0.8
V3 - structural diversity/interspersion (C) SI = 1.0
V4 - % canopy cover (75%) SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

REACH 4 - NORTH END OF BRIDGE TO FOLSOM-AUBURN ROAD (SOUTH ROUTE)

PA 1 - Future Without Project (Impact Area)

OAK WOODLAND

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured)

V1 - % canopy closure of trees and shrubs that produce hard mast (100%)	SI = 1.0
V2 - Density of leaf litter layer (M)	SI = 0.8
V3 - % tree cover (100%)	SI = 1.0
V4 - Den site availability (>4)	SI = 1.0

HSI Food $= (V1 \times V2)^{1/2} = 0.89$ HSI Cover/Reproduction $= (V3 \times V4)^{1/2} = 1.0$

HSI = 0.89 (lowest of values)

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0.89

TY 51

V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0.89

PLAIN TITMOUSE

TY 0 - Baseline (measured)

V1 - dbh (6.1-24 in.)	SI = 1.0
V2 - Number trees/acre (>60)	SI = 0.6
V3 - % trees that are oaks (>70%)	SI = 1.0

$$HSI = \frac{V1 + V2 + V3}{3}$$

HSI = 0 .87

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.87

TY 51 V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.87

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured) HSI = 0.89

TY 1 - V1 - no trees SI = 0
V2 - low leaf litter SI = 0.2
V3 - no trees SI = 0
V4 - no den sites SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction $= (V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 51- V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (measured) HSI = 0.87

TY 1 - V1 - no trees SI = 0.2
V2 - no trees SI = 0
V3 - no trees SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2}{3} = 0.06$$

TY 51 - V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1

HSI = .06

MP 1 - Management Area - Future Without Project (Compensation Site)

Assume: 1. Annual grassland area selected for conversion to oak woodland.

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated)

V1 - % canopy closure of trees and shrubs that produce hard mast (no trees) SI = 0
V2 - Density of leaf litter (low) SI = 0.2
V3 - Den site availability (no trees) SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 1 -

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0

TY 15 - no change from TY 1 HSI = 0

TY 51 - no change from TY 15 HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

V1 - dbh (0) SI = 0.2
V2 - Number trees/acre (0) SI = 0
V3 - % trees that are oaks (0) SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 1 -

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = .06

TY 15 - no change from TY 1 HSI = .06

TY 51 - no change from TY 15 HSI = .06

MP 2 - Management Area - Future With Project (Compensation Site)

Assume:
1. Acquire lands (currently annual grasslands)
2. Annual grassland area prepared for planting in TY 1 , provide access and maintenance roads
3. Plant 100% blue and live oak trees (4"x4"x14" tree pots) at a density of 400 trees/acre and cover crop
4. Moderate management intensity (assume 1.5 inches dbh after 10 yrs; 90 percent survival).
5. Watering, weed, pest control for minimum of 3 years and remedial actions as necessary to ensure plant establishment.
6. Assume maximum growth rate of 12"/year
7. Develop O&M manual
8. TY 51 values equal values measured for impact zone

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated) HSI = 0

TY 1 -	V1 - tree species planted /no mast	SI = 0
	V2 - low	SI = 0.2
	V3 - 0 (no trees)	SI = 0
	V4 - 0 (no trees)	SI = 0

HSI = 0

TY 15 -	V1 - oak trees reach 16ft. high 8%	SI = 0.15
	V2 - low	SI = 0.2
	V3 - 8%	SI = 0.15
	V4 - 0	SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.15 \times 0.2)^{1/2}$
= .17

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(0.15 \times 0)^{1/2}$
= 0

HSI = 0

TY 51	V1 - 40%	SI = 0.8
	V2 - medium	SI = 0.8
	V3 - 53%	SI = 1.0
	V4 - 24/ac	SI = 1.0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.8 \times 0.2)^{1/2}$
= 0.40

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(1.0 \times 1.0)^{1/2}$
= 1.0

HSI = 0.40

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

HSI = .06

TY 1 -	V1 - tree species planted (oak) (0 dbh)	SI = 0.2
	V2 - 400 (100% $\leq$ 16 ft tall; no trees)	SI = 0
	V3 - 100% (no trees)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 15 -	V1 - oak trees reach 16 ft. high (dbh = 1.75)	SI = 0.2
	V2 - $\geq$ 100 tree/ac	SI = 1.0
	V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = .73$$

TY 30 -	V1 - 2.5 dbh	SI = 0.2
	V2 - $\geq$ 100 tree/ac	SI = 1.0
	V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = .73$$

REACH 5 - NEW ACCESS TO BUREAU OF RECLAMATION FACILITIES AND ARWEC RELOCATION

PA 1 - Future Without Project (Impact Area)

OAK WOODLAND

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated)

V1 - % canopy closure of trees and shrubs that produce hard mast (65%)	SI = 1.0
V2 - Density of leaf litter layer (L)	SI = 0.2
V3 - % tree cover (>50%)	SI = 1.0
V4 - Den site availability (>4)	SI = 1.0

HSI Food $= (V1 \times V2)^{1/2} = 0.45$ HSI Cover/Reproduction $= (V3 \times V4)^{1/2} = 1.0$

HSI = 0.45 (lowest of values)

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0.45

TY 51

V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0.45

PLAIN TITMOUSE

TY 0 - Baseline (measured)

V1 - dbh (0-6 in.)	SI = 0.2
V2 - Number trees/acre (10)	SI = 0.17
V3 - % trees that are oaks (>70%)	SI = 1.0

$$HSI = \frac{V1 + V2 + V3}{3}$$

HSI = 0 .46

TY 1

V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.46

TY 51 V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = 0.46

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation

WESTERN GRAY SQUIRREL

TY 0 - Baseline (measured) HSI = 0.45

TY 1 - V1 - no trees SI = 0
V2 - low leaf litter SI = 0.2
V3 - no trees SI = 0
V4 - no den sites SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 51- V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1
V4 - no change from TY 1

HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (measured) HSI = 0.46

TY 1 - V1 - no trees SI = 0.2
V2 - no trees SI = 0
V3 - no trees SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2}{3} = 0.06$$

TY 51 - V1 - no change from TY 1
V2 - no change from TY 1
V3 - no change from TY 1

HSI = .06

MP 1 - Management Area - Future Without Project (Compensation Site)

Assume: 1. Annual grassland area selected for conversion to oak woodland.

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated)

V1 - % canopy closure of trees and shrubs that produce hard mast (no trees) SI = 0
V2 - Density of leaf litter (low) SI = 0.2
V3 - Den site availability (no trees) SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
$= (0 \times 0.2)^{1/2}$
$= 0$

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
$= (0 \times 0)^{1/2}$
$= 0$

HSI = 0

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0
V4 - no change from TY 0

HSI = 0

TY 15 - no change from TY 1 HSI = 0

TY 51 - no change from TY 15 HSI = 0

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

V1 - dbh (0) SI = 0.2
V2 - Number trees/acre (0) SI = 0
V3 - % trees that are oaks (0) SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 1 -
V1 - no change from TY 0
V2 - no change from TY 0
V3 - no change from TY 0

HSI = .06

TY 15 - no change from TY 1 HSI = .06

TY 51 - no change from TY 15 HSI = .06

MP 2 - Management Area - Future With Project (Compensation Site)

Assume:
1. Acquire lands (currently annual grasslands)
2. Annual grassland area prepared for planting in TY 1 , provide access and maintenance roads
3. Plant 100% blue and live oak trees (4"x4"x14" tree pots) at a density of 400 trees/acre and cover crop
4. Moderate management intensity (assume 1.5 inches dbh after 10 yrs; 90 percent survival).
5. Watering, weed, pest control for minimum of 3 years and remedial actions as necessary to ensure plant establishment.
6. Assume maximum growth rate of 12"/year
7. Develop O&M manual
8. TY 51 values equal values measured for impact zone

WESTERN GRAY SQUIRREL

TY 0 - Baseline (estimated) HSI = 0

TY 1 -	V1 - tree species planted /no mast	SI = 0
	V2 - low	SI = 0.2
	V3 - 0 (no trees)	SI = 0
	V4 - 0 (no trees)	SI = 0

HSI = 0

TY 15 -	V1 - oak trees reach 16ft. high 8%	SI = 0.15
	V2 - low	SI = 0.2
	V3 - 8%	SI = 0.15
	V4 - 0	SI = 0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.15 \times 0.2)^{1/2}$
= .17

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(0.15 \times 0)^{1/2}$
= 0

HSI = 0

TY 51	V1 - 40%	SI = 0.8
	V2 - medium	SI = 0.8
	V3 - 53%	SI = 1.0
	V4 - 24/ac	SI = 1.0

HSI Food = $(V1 \times V2)^{1/2}$
= $(0.8 \times 0.2)^{1/2}$
= 0.40

HSI Cover/Reproduction = $(V3 \times V4)^{1/2}$
= $(1.0 \times 1.0)^{1/2}$
= 1.0

HSI = 0.40

PLAIN TITMOUSE

TY 0 - Baseline (estimated)

HSI = .06

TY 1 -

V1 - tree species planted (oak) (0 dbh)	SI = 0.2
V2 - 400 (100% ≤ 16 ft tall; no trees)	SI = 0
V3 - 100% (no trees)	SI = 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{0.2 + 0 + 0}{3} = .06$$

TY 15 -

V1 - oak trees reach 16 ft. high (dbh = 1.75)	SI = 0.2
V2 - ≥ 100 tree/ac	SI = 1.0
V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = .73$$

TY 51 -

V1 - 2.5 dbh	SI = 0.2
V2 - ≥ 100 tree/ac	SI = 1.0
V3 - 100%	SI = 1.0

$$HSI = \frac{0.2 + 1.0 + 1.0}{3} = .73$$

PA 1 - Future Without Project (Impact Area)

RIPARIAN

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (7 ft)	SI = 1.0
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0.1

$$HSI = (V1 \times V2 \times V3)^{1/3} = 0$$

TY 1 – no change from baseline

HSI = 0

TY 51 –

V1-10%	SI = 0.17
V2- 7 ft	SI = 1.0
V3- 75%	SI = 0.68

$$HSI = (0.17 \times 1.0 \times 0.68)^{1/3} = 0.49$$

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (59 ft)	SI = 1.0
V2 - % deciduous tree crown cover (100%)	SI = 0.8
V3 – stand width (<300 ft)	SI = 0.5

$HSI = (V1 \times V2 \times V3)^{1/3} = 0.93$

TY 1 – no change from baseline

HSI = 0.93

TY 51 – no change from baseline

HSI = 0.93

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (100%) SI =	SI = 0
V2 - average size of ground cover objects (2 ft)	SI = 0.8
V3 - structural diversity/interspersion (C)	SI = 1.0
V4 - % canopy cover (100 %)	SI = 0.3

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$
$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 – no change from baseline

HSI = 0

TY 51 – no change from baseline

HSI = 0

PA 2 - Future With Project (Impact Area)

Assume: 1. All vegetation removed from temporary and permanent impactzones in year 1.
2. Temporary easement areas will not be replanted with woody vegetation.

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover
V2 - average height of deciduous shrub canopy
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 –	V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 51 –	V1 – no shrubs	SI = 0
	V2 – no shrubs	SI = 0
	V3 - no shrubs	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy
V2 - % deciduous tree crown cover
V3 – stand width

$HSI = (V1 \times V2 \times V3)^{1/3}$

TY 1 -	V1 – no trees	SI = 0
	V2 – no trees	SI = 0
	V3 – no trees	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 51 –	V1 – no trees	SI = 0
	V2 – no trees	SI = 0
	V3 – no trees	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover
V2 - average size of ground cover objects
V3 - structural diversity/interspersion
V4 - % canopy cover

$CI = (2V1 \times V2 \times V3)^{1/3}$

$TI = (V1 \times V4)^{1/2}$

$HSI = (CI \times TI)^{1/2} = 0.63$ (average of transects)

TY 1 –	V1 – no ground cover	SI = 0
	V2 – no cover objects	SI = 0
	V3 – A	SI = 0.1
	V4 – no canopy cover	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 51 – No change from TY 1

MP 1 – Management Area – Future Without the Project (Compensation Site)

Assume: 1. Existing riparian river bank upstream of Rossmoor Bar can be enhanced by planting riparian species (south side of river).

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (5 ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline
HSI = 0

TY 15 – no change from baseline
HSI = 0

TY 30 – no change from baseline
HSI = 0

TY 51 – no change from baseline
HSI = 0

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft)	SI = 0.77
V2 - % deciduous tree crown cover (0)	SI = 0
V3 – stand width (1)	SI = 0.2

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – no change from baseline
HSI = 0

TY 15 – no change from baseline
HSI = 0

TY 30 – no change from baseline
HSI = 0

TY 51 – no change from baseline
HSI = 0

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 – no change from baseline
HSI = 0

TY 15 – no change from baseline
HSI = 0

TY 30 – no change from baseline
HSI = 0

TY 51 – no change from baseline
HSI = 0

MP 2 – Management Area – Future With Project (Compensation Site)

Assume:
1. Acquire lands.
2. Watering, weed and pest management for a minimum of 3 years and remedial actions as necessary to ensure plant establishment.
3. Willow species and cottonwoods (80% of woody plantings willbe planted near the mean summer water surface elevation and less water tolerant plants (oaks, etc) will be planted higher on the bank.
4. The site will extend no more than 25 feet up the bank from mean summer water surface elevation.
5. Assume average growth rate of 24 inches/year for willows and cottonwood trees.

YELLOW WARBLER

TY 0 – Baseline (measured)

V1 - % deciduous shrub crown cover (0)	SI = 0
V2 - average height of deciduous shrub canopy (5 ft)	SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (0)	SI = 0

$HSI = (V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – V1 - % deciduous shrub crown cover (5%) SI = 0.15
V2 - average height of deciduous shrub canopy (1 ft) SI = 0.17
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%) SI = 0.80

$HSI = (0.15 \times 0.17 \times 0.80)^{1/2} = 0.14$

TY 15 – V1 - % deciduous shrub crown cover (75%) SI = 1.0
V2 - average height of deciduous shrub canopy (5ft) SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%) SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/2} = 0.81$

TY 30 – V1 - % deciduous shrub crown cover (75%) SI = 1.0
V2 - average height of deciduous shrub canopy (5ft) SI = 0.82
V3 - % deciduous shrub canopy comprised of hydrophytic shrubs (80%) SI = 0.80

$HSI = (1.0 \times 0.82 \times 0.80)^{1/2} = 0.81$

TY 51 – no change from TY 30

NORTHERN ORIOLE

TY 0 – Baseline (measured)

V1 - average height of deciduous tree canopy (27 ft) SI = 0.77
V2 - % deciduous tree crown cover (0) SI = 0
V3 – stand width (1) SI = 0.2

HSI = $(V1 \times V2 \times V3)^{1/3} = 0$

TY 1 – V1 - average height of deciduous tree canopy (27 ft) SI = 0.77
V2 - % deciduous tree crown cover (0) SI = 0
V3 – stand width (< 300 ft) SI = 0.5

HSI = $(V1 \times V2 \times V3)^{1/3} = 0$

TY 15 – V1 - average height of deciduous tree canopy (16 ft) SI = 0.77
V2 - % deciduous tree crown cover (25%) SI = 1.0
V3 – stand width (< 300 ft) SI = 0.5

HSI = $(0.77 \times 1.0 \times 0.5)^{1/3} = 0.54$

TY 30 – V1 - average height of deciduous tree canopy (40 ft) SI = 1.0
V2 - % deciduous tree crown cover (50%) SI = 1.0
V3 – stand width (< 300 ft) SI = 0.5

HSI = $(1.0 \times 1.0 \times 0.5)^{1/3} = 0.79$

TY 51 - V1 - average height of deciduous tree canopy (80 ft) SI = 1.0
V2 - % deciduous tree crown cover (75%) SI = 0.9
V3 – stand width (< 300 ft) SI = 0.5

HSI = $(1.0 \times 0.9 \times 0.5)^{1/3} = 0.77$

WESTERN FENCE LIZARD

TY 0 – Baseline (measured)

V1 - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 1 –

V1 - % ground cover (0)	SI = 0
V2 - average size of ground cover objects (< 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (0)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 15 –

V1 - % ground cover (5%)	SI = 0
V2 - average size of ground cover objects (≤ 1 ft)	SI = 0.2
V3 - structural diversity/interspersion (A)	SI = 0.1
V4 - % canopy cover (40%)	SI = 1.0

$CI = (2V1 \times V2 \times V3)^{1/3} = 0$

$TI = (V1 \times V4)^{1/2} = 0$

$HSI = (CI \times TI)^{1/2} = 0$

TY 30 –

V1 - % ground cover (25%)	SI = 1.0
V2 - average size of ground cover objects (2 ft)	SI = 0.8
V3 - structural diversity/interspersion (C)	SI = 1.0
V4 - % canopy cover (75%)	SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

TY 51 –

V1 - % ground cover (50%)	SI = 1.0
V2 - average size of ground cover objects (2 ft)	SI = 0.8
V3 - structural diversity/interspersion (C)	SI = 1.0
V4 - % canopy cover (75%)	SI = 0.33

$CI = (2V1 \times V2 \times V3)^{1/3} = 1.16\ (1.0)$

$TI = (V1 \times V4)^{1/2} = 0.57$

$HSI = (CI \times TI)^{1/2} = 0.75$

PA 1 - Future Without Project (Impact Area)

SEASONAL WETLAND

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – no change from baseline

HSI = 0.23

TY 51 – no change from baseline

HSI = 0.23

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitable nest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline

HSI = 0.2

TY 51 – no change from baseline

HSI = 0.2

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 – no change from baseline

HSI = 0.76

TY 51 – no change from baseline

HSI = 0.76

PA 2 - Future With Project (Impact Area)

Assume:
1. All vegetation removed from temporary and permanent impact zones in year 1
2. temporary easement areas will not be replanted with woody vegetation
3. existing drainages culverted under roads

GREAT EGRET

TY 0 – Baseline (measured)

V1 - % area with water 4-9 inches deep
V2 - % of substrate in zone 4-9 inches deep with sub- and emergent vegetation

$$HSI = \frac{V1 + V2}{2} = 0.23$$

TY 1 – V1 – 0 SI = 0
V2 - 0 SI = 0.1

$$HSI = \frac{0 + 0.1}{2} = 0.05$$

TY 51 – no change from TY 1

HSI = 0.05

RED-WINGED BLACKBIRD

TY 0 – Baseline (measured)

V6 quality of foraging areas within 620 feet of suitable nest areas

Condition C wetland $HSI = (0.1 \times V6)^{1/2} = 0.2$

TY 1 – no change from baseline

HSI = 0

TY 51 – no change from baseline TY 1

HSI = 0

CALIFORNIA VOLE

TY 0 – Baseline (measured)

V1 – Height herbaceous vegetation
V2 - % herbaceous cover
V3 – Soil type

$$HSI = \frac{V1 + V2 + V3}{3} = 0.76$$

TY 1 –	V1 – 0	SI = 0
	V2 – 0	SI = 0
	V3 – not silty or loamy ; not friable	SI = 0.2

$$HSI = \frac{0 + 0 + 0.2}{3} = 0.06$$

TY 51 – no change from TY 1

HSI = 0.06

MP 1 - Future Without Project (Compensation Area)

Assumption: 1. Annual grassland area will be converted to wetlands

GREAT EGRET

TY 0 - Baseline (measured)

V1 - % of area with water 4-9 inches deep (0) SI = 0

V2 - % of area 4-9 deep with emergent/submergent vegetation (0) SI = .1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 no change from TY 0

TY 4 no change from TY 1

TY 51 no change from TY 4

CALIFORNIA VOLE

TY 0 - Baseline (estimated)

V1 - Height of herbaceous vegetation (≥ 6in.) SI = 1.0

V2 - % cover of herbaceous vegetation (80%) SI = 6.7

V3 - soil type (mod. friable) SI = 0.5

TY 1 - V1 - no change from TY 0

V2 - no change from TY 0

V3 - no change from TY 0

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 4 - V1 - no change from TY 1

TY 51 - V1 - no change from TY 4

RED-WINGED BLACKBIRD

TY 0 - Baseline (estimated) - upland area unsuitable for species HSI = 0

TY 1 - no change from TY 0

TY 4 - no change from TY 1

TY 51 - no change from TY 4

MP 2 - Future With Project (Compensation Site)

Assumption:

1. Acquire annual grassland area
2. Portion of wetland area will have permanent water
3. Wetland will be designed to provide equal mix of open water and emergent vegetation
4. Carp will not be stocked
5. Site baseline is a Condition C wetland.
6. Site is minimum of 1-acre in size and access and maintenance roads are provided.
7. 40% of area designed for summer conditions of water 4-9 in deep
8. Plant appropriate wetland plant species, provide pest control and maintenance as needed for minimum of 3 years or until wetland is established.
9. Cover crop planted on all disturbed non-wetland areas.

GREAT EGRET

TY 0 - Baseline (estimated)

V1 - % of area with water 4-9 inches deep (0) SI = 0

V2 - % of area with water 4-9 deep with emergent/submergent vegetation SI = 0.1

$$HSI = \frac{V1 + V2}{2} = \frac{0 + 0.1}{2} = .05$$

TY 1 - V1 - 40% SI = 0.4

V2 - 5% SI = 0.2

$$HSI = \frac{0.4 + 0.2}{2} = \frac{0.6}{2} = .30$$

TY 4 - V1 - 40% SI = 0.4

V2 - 40% - 60% SI = 1.0

$$HSI = \frac{0.4 + 1.0}{2} = .70$$

TY 51 - no change from TY 4

HSI = .70

CALIFORNIA VOLE

TY 0 - Baseline (estimated)

V1 - Height of herbaceous vegetation ($\geq$ 6 in.) SI = 1.0

V2 - % cover of herbaceous vegetation (80%) SI = 0.7

V3 - soil type (mod friable) SI = 0.5

$$HSI = \frac{V1 + V2 + V3}{3} = \frac{1.0 + 0.7 + 0.5}{3} = .73$$

TY 1 - V1 - ≥ 6 in — SI = 1.0
V2 - 90% — SI = 0.85
V3 - no change fro baseline — SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 4 - V1 - no change from TY 1 — SI = 1.0
V2 - 100% — SI = 0
V3 - no change from TY 1 — SI = 0.5

$$HSI = \frac{1.0 + 0.85 + 0.5}{3} = .78$$

TY 51- V1 - no change from TY 4
V2 - no change from TY 4
V3 - no change from TY 4

HSI = .78

RED-WINGED BLACKBIRD

TY 0 - Baseline (estimated) - upland area unsuitable for specie

HSI = 0

TY 1 - V1 - Emergent vegetation is old/new growth monocot (other) — SI = 0.1
V2 - Water present throughout year (yes) — SI = 1.0
V3 - Carp presence (absent) — SI = 1.0
V4 - larvae of dragonflies/damselflies presence (yes) — SI = 1.0
V5 - vegetation density (sparse first year) — SI = 0.1

$$HSI = (V1 + V2 + V3 + V4 + V5)^{1/2} = (0.1 \times 1.0 \times 1.0 \times 1.0 \times 0.1)^{1/2} = 0.1$$

TY 4 - V1 - old/new growth monocots — SI = 1.0
V2 - no change — SI = 1.0
V3 - no change — SI = 1.0
V4 - no change — SI = 1.0
V5 - 50% — SI = 1.0

$$HSI = (1.0 \times 1.0 \times 1.0 \times 1.0 \times 1.0)^{1/2} = 1.0$$

TY 51 - no change from TY 4

HSI = 1.0

APPENDIX A-2

HSI MODELS

NORTHERN ORIOLE
HABITAT SUITABILITY INDEX MODEL

HABITAT SUITABILITY INDEX MODEL

NORTHERN ORIOLE (*Icterus spurius*)

BREEDING HABITAT, CENTRAL VALLEY

CALIFORNIA

U.S. Fish and Wildlife Service
Ecological Services
Sacramento, California

January 1988

COVER TYPE	LIFE REQUISITE	HABITAT VARIABLES
Valley Woodland (W) Riparian (R)	Reproduction/Cover	Average height of deciduous tree canopy (V_1) Percent deciduous tree Crown cover (V_2) Stand width (V_3)

FOOD

The diet of the northern oriole is comprised mainly of insects. Fruits, berries, and nectar are also utilized (Bent 1958; Martin et al. 1961). For purposes of this model, it is assumed that if suitable habitat is available for nesting and cover, food resources are not limiting.

Minimum habitat area

Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before an area will be occupied by a species. Based on reported pair densities (Walcheck 1970; Gaines 1974; Pleasant 1979), it is assumed that at least 0.25 acres of suitable habitat must be available for the northern oriole to occupy an area. If less than this amount is present, the HSI is assumed to be zero.

VARIABLE	HABITAT TYPE	SUGGESTED TECHNIQUE
V_1 Average height of deciduous tree canopy	R, W	Range finder and clinometer on belt transect
V_2 Percent deciduous tree crown cover	R, W	Line intercept
V_3 Stand width	R, W	Visual observation, aerial interpretation

HSI Determination

LIFE REQUISITE	COVER TYPE	EQUATION
Reproduction	R, W	$(V_1 \times V_2 \times V_3)^{1/3}$

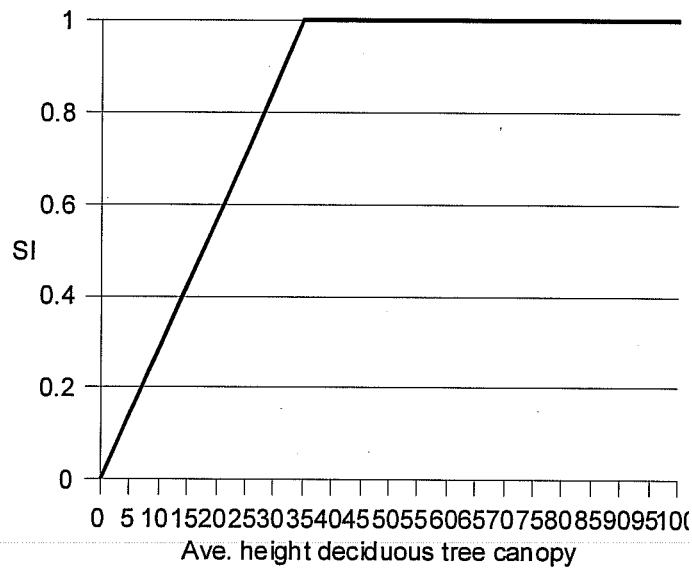
The HSI value for the northern oriole is equal to the reproduction/cover value.

Model Applicability

The model applies to breeding habitat of the northern oriole in the Central Valley of California up to 500 feet in elevation.

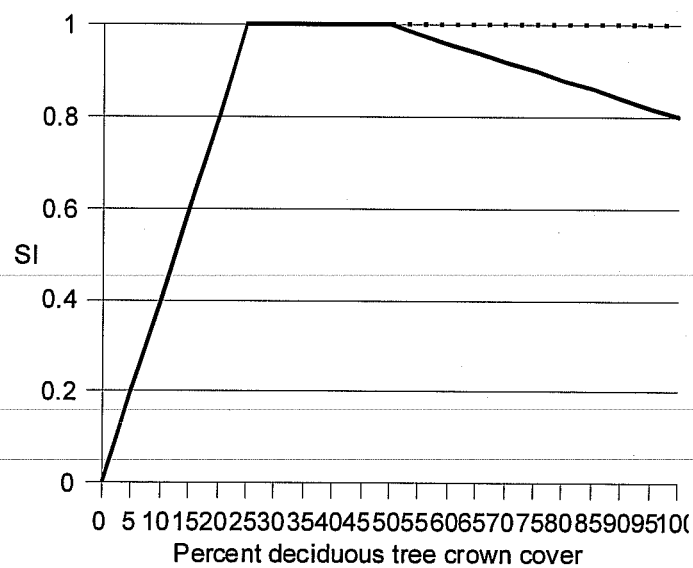
1. Average height of deciduous tree canopy.

Assumption: Orioles nest almost exclusively in large, preferably deciduous, trees (derived from nesting data of Schaefer (1976A)). Tree height of 35 feet or greater is optimum the dominant canopy strata equals those trees comprising 50% of total canopy closure.



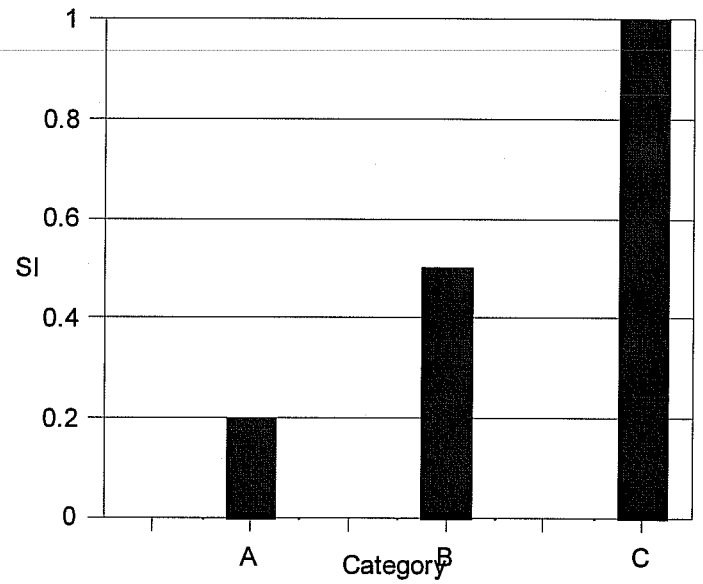
2. Percent deciduous tree crown cover.

Assumption: Orioles prefer open stands of deciduous trees for nesting (Grinnel and Miller 1944). Crown cover of 25-50% is assumed to be optimum.



3. Stand width

Assumption: Orioles prefer large blocks of riparian or oak woodland for nesting (USFWS 1981).



A - Woodland a narrow band comprising the width of one tree.
B - Woodland a strip less than 300 feet wide at its widest point.
C - Woodland greater than 300 feet wide at widest point.

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WESTERN FENCE LIZARD
HABITAT SUITABILITY INDEX MODEL

HABITAT SUITABILITY INDEX MODEL

WESTERN FENCE LIZARD (*Sceloporus occidentalis*)

by
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Sacramento, California

March 1989

INTRODUCTION

The western fence lizard (*Sceloporus occidentalis*) ranges from British Columbia southward through Washington, Oregon and throughout California and the Great Basin to northwestern Baja California (Smith, 1948; Stebbins, 1985). It occupies a wide variety of habitats, excluding extreme desert conditions, from sea level to over 9500 feet in the Sierra Nevada. In California, four subspecies are present (Jennings, 1987). Preferring wooded, rocky areas, it frequents talus and rocky outcrops of hillsides, canyons and along streams. Western fence lizards are attracted to old buildings, woodpiles, fences, telephone poles, woodrat nests and banks with rodent burrows. It requires cover and, except for dispersing females (Jennings, personal communication) is seldom encountered in open fields or extremely barren areas (Stebbins, 1954). It is frequently a colonizer of disturbed habitats (Lillywhite, et.al., 1977).

The western fence lizard can be semi-arboreal (Cunningham, 1955; Davis and Verbeek, 1972). Trees apparently do not constitute a life requisite as was shown by *Sceloporus occidentalis* populations in chaparral (Lillywhite, Friedman and Ford 1972) and at high elevations (Grinnell and Storer, 1924). Trees may simply act as another type of available cover. This indicates the microhabitat plasticity of this species (Rose, 1978).

MODEL APPLICABILITY

This model was designed for use in plant communities found in the Central Valley of California and surrounding foothills up to an elevation of approximately 1500 feet and applies to the subspecies *S. o. occidentalis* and *S.o. biseriatus*. The model is based on both empirical data provided by expert review and information obtained from current literature.

Cover Type	Life Requisite	Habitat Variable
		Percent ground cover (V_1)
	Cover/Reproduction	Average size of ground cover objects (V_2)
Riparian (R) Oak savannah (O) Oak woodland (W) Scrub (S) Annual Grassland (G)		Structural diversity/ Interspersion (V_3)
	Thermoregulation	Percent ground cover (V_1)
		Percent canopy cover (V_4)

Habitat Variable	Cover Type	Suggested Techniques
V_1 - Percent ground cover	R.O.W.S,G	Line intercept, measurement of random points using a 3 feet diameter loop.
V_2 - Average size of ground cover objects	R.O.W.S,G	Line intercept
V_3 - Structural diversity/ interspersion	R.O.W.S,G	Ocular estimate
V_4 - Percent canopy cover	R.O.W.S,G	Spherical densiometer, line intercept, point intercept on aerial photos.

Variable 1. Percent ground cover

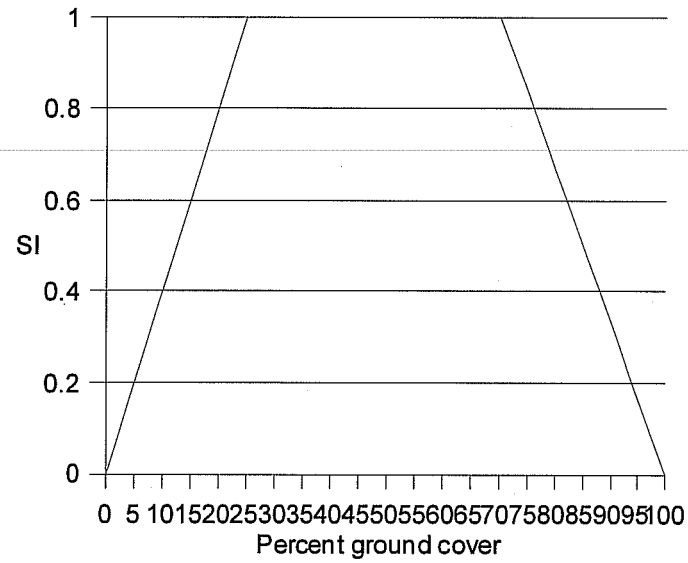
Assumes:

Only those objects less than 8 feet above the ground surface are considered. This includes rocks, logs, branches, tree trunks, fences, wood piles and live vegetation. Western fence lizards exhibit no well-defined habitat preference, but favor areas with logs, trees or other objects upon which they can climb, sun and display (Fitch, 1940). Brush piles and cavities under rocks and logs provide refuge (Marcellini and Mackey, 1979). An amount of ground cover beyond a particular density results in less than optimal conditions as it conceals predators and interferes with movement and the ability to defend a territory (Davis and Ford, 1983). Davis and Verbeek (1972) found that western fence lizards avoided dense grasslands. However, dispersing juveniles will cross dense grasslands and colonize any suitable isolated habitat found (Jennings, personal communication).

In California, western fence lizards centered their territorial activities about logs, fence posts, stumps and exposed boulders from which males display (Carpenter, 1980) and to observe mates or rival males (Fitch, 1940).

Eggs are placed in damp, friable, well-aerated soil from mid-May to mid-July in pits dug by the female and covered with loose soil (Stebbins, 1954) or under rocks and logs (Jennings, personal communication). In non-riparian conditions, nest sites are probably limited to areas within the shade of large cover objects.

Ground cover ranging from 25 to 70 percent is considered optimum for western fence lizards as it provides sufficient cover for maximum use of an area while not being so abundant as to interfere with movement. Western fence lizards undergo hibernation from November to February (Smith, 1946) and require cover for winter survival (Jennings, personal communication).



Variable 2. Average size of ground cover objects.

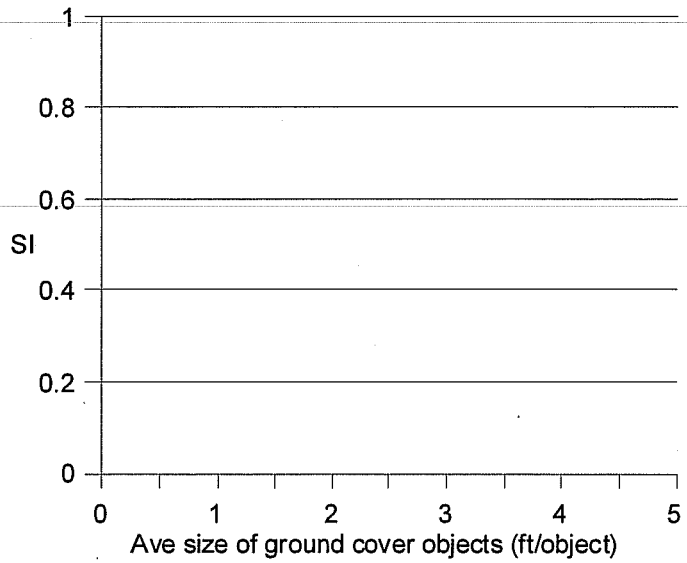
Assumes:

Ground cover objects include tree trunks but no other living material. The objects must be sufficiently large to provide escape cover. Western fence lizards have the habit of running to the opposite side of their perch (rock, log, etc.) when approached (Nussbaum et al., 1983). The objects must also be large enough to provide cover for hibernation, nest building, shade for summer thermoregulation, and to offer vantage points for territorial defense and mating display.

An average ground cover object size of 3.0 feet and larger is considered optimum as it is sufficiently large to provide for escape cover, thermoregulation and reproductive needs.

The average size of ground cover objects greater than 4 inches is diameter are measured in the field using the line intercept method and is determined by the formula:

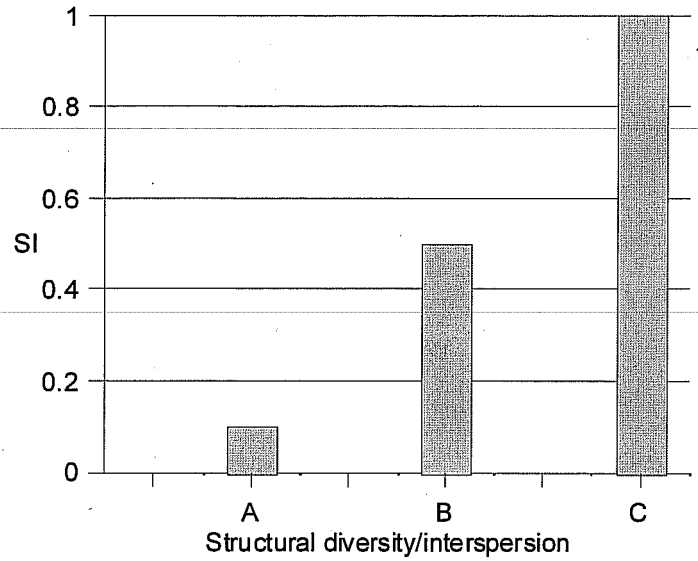
$$\text{Average size of ground cover objects} = \frac{\text{Total feet of line intercepted}}{\text{Total number of ground cover objects intercepted}}$$



Variable 3. Structural diversity/interspersion

Assumes:

This variable is related to the habitat heterogeneity. The western fence lizard areas have a mixture and sufficient quantity of cover types (rocks, logs, living vegetation, rodent burrows, cracks and crevices) in a semi-open environment with lots of habitat edge allowing for sufficient exposure to the sun (Ruth, personal communication), escape cover and a production base for food organisms (Jennings, personal communication). These areas usually have a significant vertical component in the form of large boulders, trees, fence rows, old buildings or log piles (Nussbaum et al, 1983). Davis and Ford (1983) found optimal habitat was provided by large fallen oaks in various stages of decay or by large, standing oaks from which limbs and branches had fallen to the ground creating massive tangles. Western fence lizards commonly show low distributions in climax communities due to the homogeneity of the habitat(Ruth, personal communication).



A - Low habitat diversity. Ground cover limited to 1 or 2 types (i.e., grassland and bare soil). Site mostly homogeneous with little edge. Cover component mostly one dimensional without a significant vertical element (average less than 1 foot above ground). An exception may be rock talus which can be good (Ruth, communication).

B - Moderate habitat diversity. Two or more major ground cover types occur (i.e., large rocks, logs and woodpiles). A moderate amount of edge and interspersion is present between vegetation types and/or ground cover types. A significant vertical element to the cover component (average 1 -4 feet above ground) is present.

C - High habitat diversity. Three or more major ground cover types are present (i.e., large rocks, logs and woodpiles). Heterogeneity is high with logs of edge between evenly dispersed vegetation and cover types. Overall, habitat has a significant vertical component (average greater than 4 feet above ground). May include rock talus.

Variable 4. Percent canopy cover

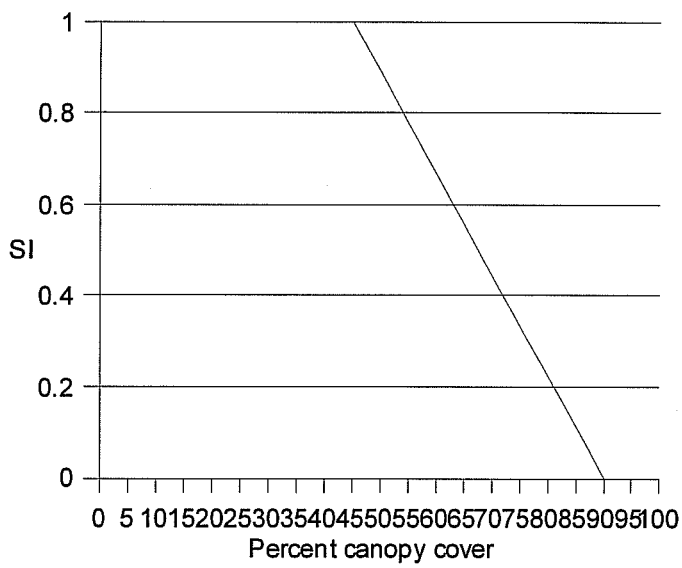
Assumes:

The canopy is defined as standing live vegetation greater than 6 feet above ground. This variable relates directly to the ability of the habitat to provide sufficient exposure so that western fence lizards can thermoregulate.

The ability of a western fence lizard to thermoregulate in an area is a major determinant of its habitat occupancy. The ability of this species to absorb sunlight and warm quickly enables it to inhabit areas from sea level to over 9000 feet in elevation (Tanner and Hopkin, 1972). Western fence lizards typically move from areas of sunlight to shade to maintain their desired body temperature. Davis and Verbeek (1972) found this species shifted from rocks to trees and vice versa according to ambient temperature. Western fence

lizards avoid dense, shaded woods (Stebbins, 1959).

A canopy cover ranging from 0 - 45 percent is considered optimum as it provides sufficient sunlight on the ground or ground cover surface for thermoregulation by western fence lizards. An area with a canopy cover greater than 90 percent is considered uninhabitable for western fence lizards due to a lack of sunlight on the ground surface for thermoregulation.



CALCULATIONS

Life Requisite	Cover Type	Index and Equation
Cover//Reproduction	R.O.W.S,G	$CI = (2V_1 \times V_2 \times V_3)^{1/3}$
Thermoregulation	R.O.W.S,G	$TI = (V_1 \times V_4)^{1/2}$

HSI Determination $HSI = (CI \times TI)^{1/2}$

Assumes percent ground cover is the major determining factor due to its importance in reproduction, predator avoidance and thermoregulation.

An HSI value of 1.0 is considered optimum. An HSI value greater than 1.0 achieved through the use of this formula is to be considered 1.0.

Feeding

It is assumed that where all necessary habitat components are present, food availability is not a factor limiting the use of an area by western fence lizards. Low availability of insects may be a limiting factor on winter recruitment of juveniles into the adult population (Jennings, personal communication). In arid areas, food can be limiting to adults in late summer (Ruth, personal communication).

The western fence lizard is an opportunistic insectivore which feeds on a variety of insects and other arthropods including leaf hoppers, aphids, beetles, wasps, termites, ants and spiders (Fitch, 1940; Johnson, 1965; Rose, 1976; Stebbins, 1954).

Rose (1976) found the three primary groups in the fence lizard diet to be ants (*Formicidae*), beetles (*Coleoptera*) and termites (*Isoptera*). Johnson (1965) found flies (*Diptera*), beetles and ants to be important prey while Clark (1973) found grasshoppers (*Acrididae*) the most common prey item. Otvos (1977) found moths or butterflies (*Lepidoptera*) the most common prey item in stomachs analyzed. Western fence lizards commonly bask or loaf in the shade and eat whatever arthropod comes close enough to attract their attention (Tanner and Hopkin, 1972). It can therefore be assumed that food availability is not a limiting factor under normal lizard population levels and habitat conditions.

Reproduction

It is assumed that, if ground cover of rocks, logs, trees, woodpiles, etc. of sufficient size and quantity are available for non-reproductive activities, then areas with moist, friable soil necessary for lizard nesting purposes would be present beneath the cover and should not be a limiting factor. Females may travel several hundred feed to find appropriate nesting conditions (Ruth, personal communication).

Water requirements

Considering the wide distribution of this species in all but the most extreme desert regions, it is unlikely that water availability would be a limiting factor to the western fence lizard though densities are often highest where water (seeps, ponds, etc.)are nearby (Ruth, personal communication). This assumes that sufficient ground cover exists for thermoregulation and nesting. This species receives the bulk of its moisture through metabolic water from its prey (Ruth, personal communication). These lizards may lower metabolic rates to compensate for higher body temperatures and water stress during warm seasons (Tsuji, 1985).

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FWS/OBS-82/10.27
July 1982

HABITAT SUITABILITY INDEX MODELS: YELLOW WARBLER

by

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[3] Schroeder, R.L. 1982. Habitat suitability index models: yellow warbler. U.S. Dept. Int., Fish Wildl. Serv. FWS/OBS-82/10.27. 7 pp.

PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series (FWS/OBS-82/10), which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information Section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. The habitat use information provides the foundation for HSI models that follow. In addition, this same information may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents a habitat model and information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The application information indudes descriptions of the geographic ranges and seasonal application of the model, its current verification status, and a listing of model variables with recommended measurement techniques for each variable.

In essence, the model presented herein is a hypothesis of species-habitat relationships and not a statement of proven cause and effect relationships. Results of model performance tests, when available, are referenced. However, models that have demonstrated reliability in specific situations may prove unreliable in others. For this reason, feedback is encouraged from users of this model concerning improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning. Please send suggestions to:

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YELLOW WARBLER (*Dendroica petechia*)

HABITAT USE INFORMATION

General

The yellow warbler (*Dendroica petechia*) is a breeding bird throughout the entire United States, with the exception of parts of the Southeast (Robbins et al. 1966). Preferred habitats are wet areas with abundant shrubs or small trees (Bent 1953). Yellow warblers inhabit hedgerows, thickets, marshes, swamp edges (Starling 1978), aspen (*Populus* spp.) groves, and willow (*Salix* spp.) swamps (Salt 1957), as well as residential areas (Morse 1966).

Food

More than 90% of the food of yellow warblers is insects (Bent 1953), taken in proportion to their availability (Busby and Sealy 1979). Foraging in Maine occurred primarily on small limbs in deciduous foliage (Morse 1973).

Water

Dietary water requirements were not mentioned in the literature. Yellow warblers prefer wet habitats (Bent 1953; Morse 1966; Stauffer and Best 1980).

Cover

Cover needs of the yellow warbler are assumed to be the same as reproduction habitat needs are discussed in the following section.

Reproduction

Preferred foraging and nesting habitats in the Northeast are wet areas, partially covered by willows and alders (*Alnus* spp.), ranging in height from 1.5 to 4 m (5 to 13.3 ft) (Morse 1966). It is unusual to find yellow warblers in extensive forests (Hebard 1961) with closed canopies (Morse 1966). Yellow warblers in small islands of mixed coniferous-deciduous growth in Maine utilized deciduous foliage far more frequently than would be expected by chance alone (Morse 1973). Coniferous areas were mostly avoided and areas of low deciduous growth preferred.

Nests are generally placed 09 to 2.4 m (3 to 8 ft) above the ground, and nest heights rarely exceed 9.1 to 12.2 m (30 to 40 ft) (Bent 1953). Plants used for nesting include willows, alders, and other hydrophytic shrubs and trees (Bent 1953), including box-elders (*Acer negundo*) and cottonwoods (*Populus* spp.) (Schrantz 1943). In Iowa, dense thickets were frequently occupied by yellow warblers while open thickets with widely spaced shrubs rarely contained nests (Kendeigh 1941).

Males frequently sing from exposed song perches (Kendeigh 1941; Ficken and Ficken 1965), although yellow warblers will nest in areas without elevated perches (Morse 1966).

A number of Breeding Bird Census reports (Van Velzen 1981) were summarized to determine nesting habitat needs of the yellow warbler, and a clear pattern of habitat preferences emerged. Yellow warblers nested in less than 5% of census areas comprised of extensive upland forested cover types (deciduous or coniferous) across the entire country. Approximately two-thirds of all census areas with deciduous shrub-dominated cover types were utilized, while shrub wetlands types received 100% use. Wetlands dominated by shrubs had the highest average breeding densities of all cover types [2.04 males per ha (2.5 acre)]. Approximately two-thirds of the census areas comprised of forested draws and riparian forests of the western United States were used, but average densities were low [0.5 males per ha (2.5 acre)].

Interspersion

Yellow warblers in Iowa have been reported to prefer edge habitats (Kendeigh 1941); Stauffer and Best 1980). Territory size has been reported as 0.16 ha (0.4 acre) (Kendeigh 1941) and 0.15 ha (0.37 acre) (Kammeraad 1964).

Special Considerations

The yellow warbler has been on the Audubon Society's Blue List of declining birds for 9 of the last 10 years (Tate 1981).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model has been developed for application within the breeding range of the yellow warbler.

Season. This model was developed to evaluate the breeding season habitat needs of the yellow warbler.

Cover types. This model was developed to evaluate habitat in the dominant cover types used by the yellow warbler. Deciduous Shrubland (DS) and Deciduous Scrub/Shrub Wetland (DSW) (terminology follows that of U.S. Fish and Wildlife Service 1981). Yellow warblers only occasionally utilize forested habitats and reported populated densities in forests are low. The habitat requirements in forested habitats are not well documented in the literature. For these reasons, this model does not consider forested cover types.

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous that is required before an area will be occupied by a species. Information on the minimum habitat area for the yellow warbler was not located in the literature. Based on reported territory sizes, it is assumed that at least 0.15 ha (0.37 acre) of suitable habitat must be available for the yellow warbler to occupy an area. If less than this amount is present, the HSI is assumed to be 0.0.

Verification level. Previous drafts of the yellow warbler habitat model were reviewed by Douglass H. Morse and specific comments were incorporated into the current model (Morse, pers. comm.).

Model Description

Overview. This model considers the quality of the reproduction (nesting) habitat needs of the yellow warbler to determine overall habitat suitability. Food, cover, and water requirements are assumed to be met by nesting needs.

The relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler is illustrated in Figure 1.

The following sections provide a written documentation of the logic and assumptions used to interpret the habitat information for the yelow warbler and to explain and justify and variable and equations that are used in the HSI model. Specifically, these sections cover the following: (1) identification of variables that will be used in the model; (2) definition and justification of the suitability levels of each variable; and (3) description of the assumed relationship between variables.

Reproduction component. Optimal nesting habitat for the yellow warbler is provided in wet areas with dense, moderately tall stands of hydrophytic deciduous shrubs. Upland shrub habitats on dry sites will provide only marginal suitability.

It is assumed that optimal habitats contain 100% hydrophytic deciduous shrubs and that habitats with no hydrophytic shrubs will provide marginal suitability. Shrub densities between 60 and 80% crown cover are assumed to be optimal. As shrub densities approach zero cover, suitability also approaches zero.

Figure 1. Relationship between habitat variables, life requisites, cover types, and the HSI for the yellow warbler.

Habitat variable	Life requisite	Cover types	
Percent deciduous shrub crown cover			
Average height of deciduous shrub canopy	Reproduction	Deciduous Shrubland Deciduous Scrub/ Shrub Wetland	HSI
Percent of shrub canopy comprised of hydrophytic shrubs			

Totally closed shrub canopies are assumed to be of only moderate suitability, due to the probable restrictions on movement of the warblers in those conditions. Shrub heights of 2 m (6.6 ft) or greater are assumed to be optimal, and suitability will decrease as heights decrease to zero.

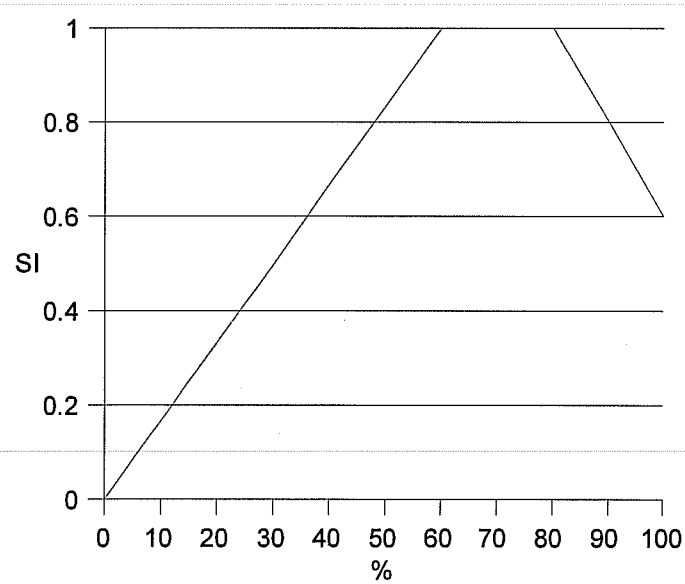
Each of these habitat variables exert a major influence in determining overall habitat quality for the yellow warbler. A habitat must contain optimal levels of all variables to have maximum suitabilityLow values of any one variable may be partially offset by higher values of the remaining variables. Habitats with low values for two or more variables will provide low overall suitability levels.

Model Relationships

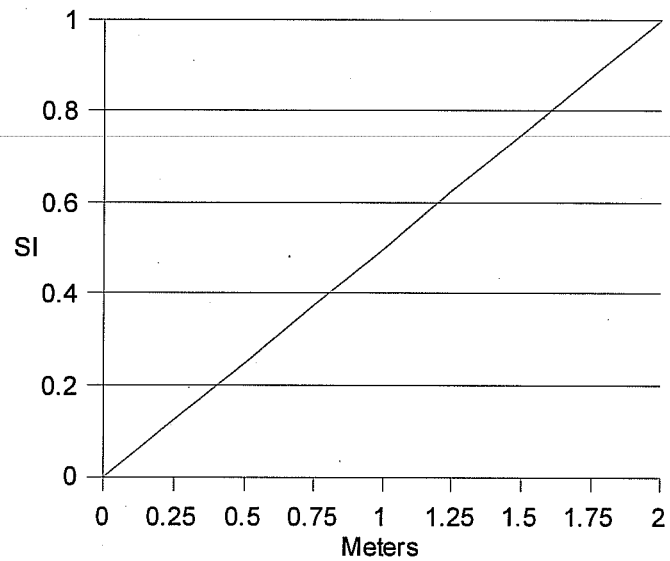
Suitability Index (SI) graphs for habitat variables. This section contains suitability index graphs that illustrate the habitat relationships described in the previous section.

Cover-type Variable

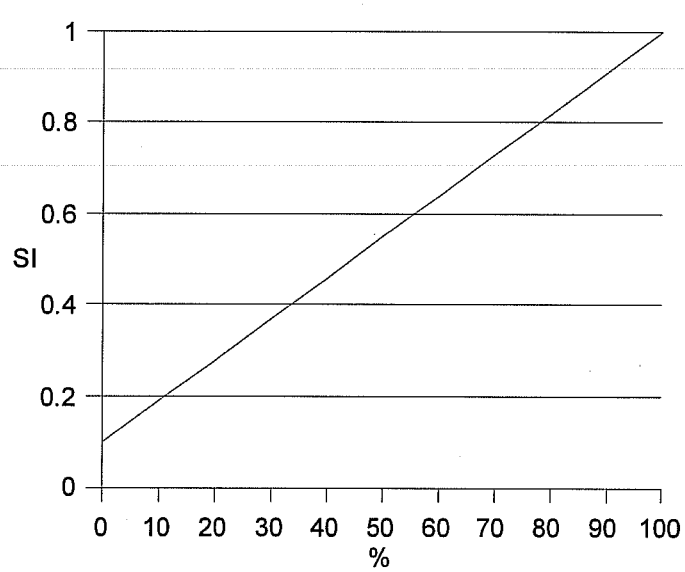
DS,DSW V_1 **Percent deciduous shrub crown cover.**



DS,DSW **V_2** **Average height of deciduous shrub canopy.**



DS, DSW **V_3** **Percent of deciduous shrub canopy comprised of hydrophytic shrubs**



Equations. In order to obtain life requisite values for the yellow warbler, the SI values for appropriate variables must be combined with the use of equations. A discussion and explanation of the assumed relationship between variables was included under Model Description, and the specific equation in this model was chosen to mimic these perceived biological relationships as closely as possible. The suggested equation for obtaining a reproduction value is presented below.

Life requisite	Cover type	Equation
Reproduction	DS,DSW	$(V_1 \times V_2 \times V_3)^{1/2}$

HSI determination. The HSI value for the yellow warbler is equal to the reproduction value.

Application of the Model

Definitions of variables and suggested field measurement techniques (Hays et al 1981) are provided in Figure 2.

Figure 2. Definitions of variables and suggested measurement techniques.

Variable (definition)	Cover types	Suggested techniques
V_1 Percent deciduous shrub crown cover (the percent of the ground that is shaded by a vertical projection of the canopies of woody deciduous vegetation which are less than 5 m (16.5 ft) in height).	DS,DSW	Line intercept
V_2 Average height of deciduous shrub canopy (the average height from the ground surface to the top of those shrubs which comprise the uppermost shrub canopy).	DW,DSW	Graduated rod
V_3 Percent of deciduous shrub canopy comprised of hydrophytic shrubs (the relative percent of the amount of hydrophytic shrubs compared to all shrubs, based on canopy cover).	DW.DSW	Line Intercept

SOURCES OF OTHER MODELS

No other habitat models for the yellow warbler were located.

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HABITAT SUITABILITY INDEX MODELS: RED-WINGED BLACKBIRD

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PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series [Biological Report 82(10)] which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are data that can be used to derive quantification relationships between key environmental variables and habitat suitability. This information provides the foundation for the HSI model and may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model Section documents the habitat and includes information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The HSI Model Section includes information about the geographic range and seasonal application of the model, its current verification status, and a list of the model variables with recommended measurement techniques for each variable.

The model is a formalized synthesis of biological and habitat information published in the scientific literature and may include unpublished information reflecting the opinions of identified experts. Habitat information about wildlife species frequently is represented by scattered data sets collected during different seasons and years and from different sites throughout the range of a species. The model presents this broad data base in a formal, logical, and simplified manner. The assumptions necessary for organizing and synthesizing the species-habitat information into the model are discussed. The model should be regarded as a hypothesis of species-habitat relationships and not as a statement of proven cause and effect relationships. The model may have merit in planning wildlife habitat research studies about species, as well as in providing an estimate of the relative quality of habitat for that species.

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I gratefully acknowledge Dr. Gordon H. Orians, Department of Zoology, University of Washington, Seattle, for his review of this red-winged blackbird model . The cover of this document was illustrated by Jennifer Shoemaker. Word processing was provided by Carolyn Gulzow, Dora Ibarra, and Elizabeth Graf.

RED-WINGED BLACKBIRD (*Agelaius phoeniceus L.*)

HABITAT USE INFORMATION

General

The red-winged blackbird (*Agelaius phoeniceus L*) nests in fresh-water and brackish herbaceous wetlands, bushes and small trees along watercourses, and certain upland cover types from (American Ornithologists' Union 1983:723):

> ... east-central, south-coastal and southern Alaska..., southern Yukon westcentral and southern Mackenzie, northwestern and central Saskatchewan, central Manitoba, central Ontario, southern Quebec..., New Brunswick, Prince Edward Island, Nova Scotia and southwestern Newfoundland south to northern Baja California, through Mexico... and along both coasts of Central America to Nicaragua and northern Costa Rica .... and to southern Texas, the Gulf coast and southern Florida. [This blackbird winters] from southern British Columbia, Idaho, Colorado, Kansas, Iowa, the southern Great Lakes region, southern Ontario and New England... south throughout the remainder of the breeding range, with the southwestern and most of Middle American populations being sedentary.

The red-winged blackbird traditionally was considered to be a wetland nesting bird. It has adapted, within the last century, to habitat changes brought about by man; it now commonly nests in hayfields, along roadsides and ditches, and in other upland sites (Dolbeer 1980).

Food

Red-winged blackbirds vary their diet throughout the year, presumably in response to the nutritive demands of reproduction. The percent of waste grain and seeds in the diet of male blackbirds in one study in Ontario, Canada, was at least 80 to 87% in March and April, 46% in May, only 10% in July, and 85% in late July to October (McNicolet al. 1982). Insects amounted to 51 to 84% of the diet during May and July. The diet of female red-winged blackbirds varied between 67 and 79% insect parts in May and July but was only 15% insectivorous in late July-October, after fledging had occurred.

Water

References describing the dependency of the red-winged blackbird on surface water for drinking and bathing were not found in the literature. Nesting occurs in herbaceous wetlands and upland habitat near surface water and in suitable vegetation distant from free water. Red-winged blackbirds seem to prefer habitats near wetlands for foraging. Communal roosting, which occurs after fledging is completed, is either in herbaceous wetlands or dense communities of young trees with thick canopies growing on moist sites (Micacchion and Townsend 1983).

Cover

The red-winged blackbird nests in a variety of habitats. Blackbirds in southern Michigan prefer old and new hay fields, pastures, old fields, and wetlands with robust vegetation capable of supporting nests and dense cover that provides protection for nests (Albers 1978). They avoid cut or fallow fields, woodlots, agricultural croplands, open water, and tilled soil.

Areas with tall, dense, herbaceous vegetation seem to provide preferred nest sites. Blackbirds that nest early in the breeding season select tall, dense, old-growth herbaceous vegetation while blackbirds that nest late in the breeding season select tall, dense, new-growth herbaceous vegetation (Albers 1978). Upland nest sites of red-winged blackbirds in Ontario were in plant communities commonly dominated by goldenrod (*Solidago* spp.), alfalfa (*Medicago sativa*), fleabane (*Erigeron* spp.), clover (*Trifolium* spp.), various thistles (*Cirsium* spp.), and similar herbaceous weeds (Joyner 1978). Blackbirds in fresh water sites selected old- and new-growth of broad-leaved monocots, like cattails (*Typha* spp.) and broad-leaved

sedges (*Carex* spp.), and commonly rejected old and new-growth of narrow-leaved monocots and forbs (Albers 1978). Woody species, such as hightide bush (*Iva* frutescens) and groundselbush (*Baccharis halimifolia*), and robust herbaceous plants, like cattails, supported the most nests in tidal herbaceous wetlands (Meanley and Webb 1963).

The density of preferred plant cover is not adequately described either in the literature or in this model. The height of preferred plant cover is inferred, below, from descriptions of nest sites.

Red-winged blackbirds frequently use scattered trees and fence posts near their breeding territories as observation posts. Blackbirds use both herbaceous wetlands and trees for communal roosts after fledging is completed. Roost trees characteristically are young, occur at high densities, provide thick canopies, and are adapted to moist sites (Micacchion and Townsend 1983).

Reproduction

Red-winged blackbirds are migratory in the northern portion of their range. Males migrate to or congregate at future nesting habitats in late winter, and females arrive at the territories in early spring (Case and Hewitt 1963). In areas with resident populations, individuals of both sexes may remain near breeding territories throughout the year, even though the areas are not actively defended or used in winter except, perhaps, as roosting sites (Orians pers. comm.). Males are polygynous, and up to six females commonly nest within a male's territory (Holm 1973). Harem size was larger in herbaceous wetlands with open stands of cattails than in herbaceous wetlands dominated by bulrushes (*Scirpus* spp.) or by closed stands of cattails (Holm 1973). Harem size has sometimes been observed to exceed 10 to 12 females and, in one instance, numbered 32 females (Orians pers. comm.).

Males do not participate in nest building, incubation, or feeding of the incubating female (Orians pers comm.). Males may help feed nestlings and are likely to help feed fledglings. The timing of breeding varies throughout the range of the red-winged blackbird. Nesting frequently begins in March or April and is completed by mid-July in the more temperate habitats. Most young in North America are fledged by late July.

Herbaceous wetlands dominated by cattails generally seem to be the most productive habitats for red-winged blackbirds in terms of nests/ha or number of young fledged/ha (Robertson 1972). Favorable herbaceous wetland sites produce more suitable food per unit area and have higher nest densities, highly synchronous nesting, higher nest survival rates. and lower nest predation rates than do upland nest sites.

Nests of red-winged blackbirds are placed on the edges of cattail clumps that border areas of open water (Wiens 1965). Herbaceous wetlands that are dominated by cattails and have open, permanent water have the optimum number of available nest sites. Early nests are placed in the old growth vegetation remaining from past growing seasons, while late nests may be built on new growth. Nest success in one herbaceous wetland habitat seemed related to: (1) increased depth of permanent water (up to 50 cm or more), which apparently reduced mammalian predation on nests; (2) nest placement close to water (greater nest success was observed for nests 20 cm above water than nests 100 cm above water), (3) nest placement in herbaceous wetland vegetation interspersed with open water, rather than in herbaceous wetland vegetation where no open water was present; and (4) nest placement in marsh grass and loosestrife (*Decadon verticillatus*), rather than in sweet gale (*Myrica gale*) and sedges (Weatherhead and Robertson 1977). Other studies have indicated that nests placed at 1.2 m heights were more successful than nests placed at 0.6 m heights in tidal herbaceous wetlands on Chesapeake Bay (Meanley and Webb 1963) and that nest success was higher when permanent water levels were greater than 25 cm (Robertson 1972).

Nests of red-winged blackbirds in upland sites typically are wound between and attached to stalks of herbaceous vegetation (Bent 1958). Early nests are entwined with old growth stems and late nests with the

sturdiest stems of the new growth. Activities, such as intensive livestock grazing, mowing, and burning of old growth stubble, make herbaceous uplands unavailable for early nest placement. Mowing hayfields during the nesting season disrupts nesting success on upland sites (Albers 1978). Redwinged blackbirds seem to prefer areas with the densest, tallest herbaceous vegetation for nest placement. Vegetation that restricted visibility was more important than the number of plant stems and leaves per unit area. Trees greater than 5.0 m in height were in most territories (Albers 1978). The mean height of nest placement was 15 cm in monotypic stands of reed canarygrass (*Phalaris arundinacea*) 58 cm high (Joyner 1978). Nest sites often are close to open water (Joyner 1978), although no specific descriptions of acceptable distances of upland nest sites from open water were found in the literature.

Interspersion

The red-winged blackbird seems to be closely associated with the presence of standing water (Bent 1958) and certain types of dense herbaceous vegetation for nest placement. Herbaceous wetlands or sloughs I with extensive cattails, bulrushes, sedges, reeds (*Phragmites* spp.), or tules (*Scirpus* spp.), historically have provided important nesting habitat for the blackbird (Bent 1958). However, blackbirds also nest in dense herbaceous cover in hayfields, along roadsides and ditches, and in other upland sites (Dolbeer 1980). Red-winged blackbirds forage for insects in understory, midstory, and overstory canopies (Snelling 1968) during the nesting season.

The blackbird is primarily a seed eater, except during fledging. The species sometimes forms large communal flocks in wetland herbaceous habitats or in trees and brushlands and these birds may forage on agricultural crops or understory seed sources (Mott et al. 1972; Johnson and Caslick 1982). After the autumn migration from the northern portion of their range, redwinged blackbirds frequently roost in herbaceous wetland habitats, trees, or shrubs and feed on seeds within understory vegetation.

Special Consideration

Red-winged blackbirds shift from a dispersed insectivorous feeding behavior during the nesting season to a communal granivorous feeding habit after fledging has occurred. They frequently move into agricultural areas at this time. Costs related to their consumption of grain can become high and may exceed the benefits of insect control related to their foraging habits during fledging (Bendell et al. 1981). Damage to ripening corn (*Zea mays*) occurs during August and September (Somers et al. 1981; Stehn and de Becker 1982), when blackbirds often congregate at night in herbaceous wetlands or in roosts in young deciduous trees in great concentrations (perhaps up to 1 million birds) (Stehn and de Becker 1982). The distance from these autumn roosts to corn fields and the proximity of corn fields to traditional flightlines strongly influences the amount of damage inflicted on individual corn fields. Bird damage to crops in Ohio diminished consistently as distances from communal roosts increased from 3.2 to 8 km, and the level of damage remained constant and low at distances of 8 to 19.2 km (Dolbeer 1980).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographic area. This model will produce an HSI for nesting habitats of the redwinged blackbird. The breeding range and the year-round range of the blackbird occur throughout the contiguous 48 States.

Season. The model will produce an HSI for nesting habitat throughout the nesting seasons, which generally occurs from March to late July.

Cover types. This model was developed to evaluate habitat in herbaceous wetlands (HW) and upland herbaceous cover types, such as pasture and hayland (P/H), forbland (F), and grassland (G) (terminology follows that of U.S. Fish and Wildlife Service 1981).

Minimum habitat area Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before a species will live and reproduce in an area. Specific information on minimum areas required for red-winged blackbirds was not found in the literature. It is assumed, however, that a wetland area must contain at least 0.10 ha in emergent herbaceous vegetation, like cattails, to be considered nesting habitat for the blackbird. Several studies have described the minimum territory for male red-winged blackbirds as 0.02 ha (Weatherhead and Robertson 1977; Orians 1980). A 0.10 ha area of emergent herbaceous vegetation might, therefore, potentially provide territories for up to five male blackbirds. Territories in upland habitats are much larger than those in wetland habitats. It is assumed that a block of upland and habitat must be at least 1.0 ha in area to provide adequate breeding habitat for redwinged blackbirds.

Verification level This model was developed from descriptiveinformation about nesting cover and species-habitat relationships identified in the literature. The HSI derived from the use of this model describes the potential of an area for providing nesting habitat for the redwinged blackbird. The model is designed to rank the suitability of nesting habitat as would a biologist with expert knowledge about the reproductive requirements of the blackbird. The model should not be expected to rank habitats in the same way as population data because many nonhabitatrelated criteria can significantly impact populations of wildlife species.

Model Description

Overview. The red-winged blackbird uses a variety of habitat layers throughout the year. Tall, dense, herbaceous vegetation seems to satisfy nesting, foraging, and cover requirements. The red-winged blackbird readily uses midstory and overstory layers of habitat at times but does not seem to be dependent on the presence of these layers.

The red-winged blackbird typically nests in tall (over 0.5 m), dense (undefined) herbaceous vegetation, although it occasionally nests in shrubs and trees. This nest site requirement is best met in herbaceous wetland habitats where nest sites are available in sturdy cattails over open, permanent water. Nesting requirements also can be met by suitable herbaceous vegetation in upland sites. Tall, sturdy, herbaceous stems or midstory or overstory components are used as display perches or observation posts. Redwinged blackbirds nesting in herbaceous wetland habitats may feed on insects associated with shrub, tree canopy, or herbaceous vegetation within the wetland or on insects associated with midstory and overstory canopies or in the grass understory outside the wetland boundary (Snelling 1968). Birds nesting in upland sites typically forage for insects in understory vegetation near the nest site.

This model attempts to evaluate the ability of a habitat to meet the food and reproductive needs of the red winged blackbird during the nesting season. The logic used in this speciehabitat model is described in Figure 1. The following sections document this logic and the assumptions used to translate habitat information for the red-winged blackbird into the variables selected for the HSI model. These sections also describe the assumptions inherent in the model, identify the variables used in the model, define and justify the suitability level of each variable, and describe the assumed relationships between variables.

FIGURE 1

Food and reproductive components (herbaceous wetland cover types) There are three conditions (A, B, and C) included in Figure 1. Condition A wetlands, with a minimum of 0.10 ha in emergent herbaceous vegetation, can be very productive nesting habitats for redwinged blackbirds if water ispresent throughout the year, water chemistry is favorable for photosynthesis, and abundant, persistent, emergent vegetation suitable for nest placement is present. The quality of such a wetland as nesting habitat for redwinged blackbirds can be estimated with the following five habitat variables.

Variable 1 (V1) refers to the type of emergent herbaceous vegetation available in the wetland.

V1 = 1.0 if emergent herbaceous vegetation is predominantly old or new growth of broadleaved monocots, like cattails.

V1 = 0.1 if emergent herbaceous vegetation is predominantly narrowleaved monocots or other herbaceous materials.

Variable 2 (V2) considers the water regime of the wetlands. The suitability index of V2 is 1.0 if the wetland is permanently flooded or intermittently exposed with water usually present throughout the year. This is a desirable condition because permanent water is necessary to support persistent populations of invertebrates that overwinter in various larval instars, maximizing the production of aquatic insects that emerge throughout the next spring and early summer. These insects seem to be the favored food source for blackbirds nesting in herbaceous wetlands (Orians 1980). The presence of permanent water within the wetland may reduce mammalian predation on nests of redwinged blackbirds (Robertson 1972).

V2 = 1.0 if water usually is present in the wetland throughout the year.

V2 = 0.1 if the wetland usually is dry during some portion of the year.

Variable 3 (V3) pertains to the abundance of carp (*Cyprinus carpio*) within the wetlands. Carp disturb submergent vegetation within the wetlands, which may destroy habitat for emergent aquatic insects (like Odonates) and reduce wetland food sources for blackbirds.

V3 = 1.0 if carp are absent from the wetland.

V3 = 0.1 if carp are present within the wetland.

Variable 4 (V4) in the model measures the abundance of larvae of emergent aquatic insects. The adult form of these species provides a potentially important food source for red-winged blackbirds nesting in wetland habitats. The biomass of these benthic invertebrates is variable within a herbaceous wetland at any one time, as well as between sampling periods (Hynes 1972). This biomass should not be regarded as a direct measure of productivity because production, in terms of both numbers and weight, is many times larger than that present at any one sample periods, and the assessment of numbers or biomass per unit of area presents formidable, perhaps insurmountable, difficulties (Hynes 1972). The presence or absence of suitable benthic invertebrates can be determined by sampling with a sieve net (Needham and Needham 1970) along the edge of clumps of emergent vegetation. Sampling is more likely to be accurate than inferences about the presence of benthic invertebrates based on measures of water chemistry that may inadequately consider pollutants that impact aquatic food chains. Inferences about the presence of benthic invertebrates based on the appearance of aquatic vegetation also are less accurate than sampling (Orians pers. comm.). Therefore, sampling to determine the presence or absence of important benthic invertebrates is the preferred assessment technique.

V4 = 1.0 if larvae of damselflies and dragonflies (Order Odonata) are present in the wetland.

V4 = 0.1 if larvae of damselflies and dragonflies are not present in the wetland.

Dense stands of emergent vegetation in wetlands prevent sunlight from penetrating to the water surface, which reduces aquatic productivity. A mat of vegetation can form a wetland "floor", which reduces the availability of arthropods to red-winged blackbirds and may result in increased nest predation. Open water, interspersed throughout the emergent herbaceous vegetation, supports submergent vegetation within the wetland boundary that can be used by aquatic insects as food and cover. The openings also provide an interface between emergent vegetation and open water, which increases the vegetation surface area available to emerging insects and foraging red-winged blackbirds and may increase the presence of potential nest sites. Blackbirds frequently nest on the edge of cattail clumps that border open water (Wiens 1965). They are highly territorial, and the number of territories in a wetland is assumed to be dependent on the quantity of edge between emergent vegetation and open water that is available for nest sites. An exact measure of the amount of edge within a wetland can be difficult and unreliable because of the highly dynamic nature of the herbaceous vegetation, resulting from water level fluctuations, life cycles of the vegetation, and activities of animals like muskrats (*Ondatra zibethica*). Measures of the patchiness of emergent herbaceous vegetation and open water within a wetland is represented by variable 5 (V5) in the model.

Blackbirds prefer patchy stands of cattails interspersed with areas of open water over dense homogeneous stands of cattails (Robertson 1972). Variable 5 is assumed to have a suitability index of 1.0 when the quantity of open water and emergent vegetation is about even (about 40% to 60%). Robertson (1972) found a nesting density of about 96 nests/ha in herbaceous wetland habitat when patchy vegetation was about 41% of the total wetland area. Wetlands with large areas of emergent vegetation and small areas of open water receive relatively low SIs because of the small quantity of suitable nest sites. Case and Hewitt (1963) described the Inlet Valley Marsh in New York as a small, closed herbaceous wetland with upland

trees and shrubs immediately adjacent for nesting and foraging sites. The redwinged blackbird nesting density in this herbaceous wetland was about 33/ha. Variable 5 is assigned an SI of 0.3 when a wetland is completely covered with emergent herbaceous vegetation, as described above.

Conditions where there are small areas of emergent vegetation and large areas of open water also receive a low SI because of the reduced availability of niche spaces. Moulton (1980) found redwinged blackbirds nesting in emergent vegetation along ditch banks that surrounded large areas of open water in rice (*Oryza sativa*) paddies in northern Minnesota. Nest densities averaged about 2.5 nests/ha of total wetland habitat, presumably because both nests and emergent vegetation were restricted to long, narrow strips of edge. The territorial behavior of redwinged blackbirds may have restricted the nest density along the ditch banks. An SI of 0.1 is assigned to V5 for wetland habitats with a limited amount of emergent herbaceous cover. The SI's for wetlands with different amounts of emergent herbaceous vegetation are listed below. User's can interpolate between listed values as needed.

V5 = 1.0 if the wetland area contains about an equal mix of emergent herbaceous vegetation and open water.

V5 = 0.3 if the wetland area is covered by a dense stand of emergent herbaceous vegetation.

V5 = 0.1 if the wetland area contains a few patches of emergent herbaceous vegetation and extensive areas of open water.

Condition B wetlands are wetlands that are likely to be dry sometime during the year or that do not have an aquatic insect resource. These wetlands may still provide some habitat for nesting redwinged blackbirds. Blackbirds will tend to use the available emergent vegetation as nest sites and rely on vegetation surrounding the wetland as a foraging substrate. The distance that redwinged blackbirds will fly from wetlands to forage on insects in upland habitats is not known. In this model, only foraging sites within 200 m of wetlands that contain nest sites are assumed to be useful to blackbirds. The quality of a wetland without permanent water or an aquatic insect resource is assumed to be no better than the quality of available foraging sites outside the wetland (V6). Wetlands that only have upland habitats with understory vegetation (such as old fields, pastures, or hay fields) available as foraging substrates are given an SI of 0.1. Wetlands near uplands that have a deciduous midstory or tree canopy as a foraging substrate are assumed to have an SI of 0. 4. Redwinged blackbirds nesting in one herbaceous wetland will forage on insects in other, close-by, herbaceous wetlands (Holm 1973). Condition B wetlands situated within 200 m of a condition A herbaceous wetland that has an emergent aquatic insect fauna (Odonates) and undefended foraging areas are given an SI of 0.9.

V6 = 0.1 if the only suitable foraging substrate is an understory layer.

V6 = 0.4 if the suitable foraging substrates include a midstory and/or an overstory layer.

V6 = 0.9 if the suitable foraging area is a condition A wetland.

Food and reproductive components (upland cover types) Upland habitats (Fig. 1; condition C) frequently are less productive than are wetland habitats. The number of young redwinged blackbirds fledged per territory may be as large in upland sites as in some wetland habitats (Dolbeer 1976). The number of young fledged/ha in upland sites, however, frequently is less than 10% of the number fledged/ha in good quality wetland habitat. For example, Robertson (1972) reported 133 young fledged/ha in one wetland study area, while only 5 young fledged/ha in nearby upland sites. The nesting density in the wetland habitat, with patches of emergent, herbaceous vegetation interspersed with patches of open water, was about 10 times

higher than in upland habitats. Robertson found about 100 redwinged blackbird nests/ha in suitable wetland habitat, 2 to 13 nests/ha in hay fields, and 0.1 nests/ha in a Christmas tree plantation.

Robertson's (1972) data on the numbers of nests/ha and young fledged/ha suggest that, if the best wetland habitats have an HSI of 1.0, the best upland sites may have an HSI of about 0.1. Graber and Graber (1963) determined that summer populations of redwinged blackbirds (number/40 ha) in Illinois from 1958 to 1959 were 301 birds in herbaceous wetlands (whether condition A or B is unknown), 342 birds in edge shrubs, 204 birds in sweet clover, 158 birds along drainage ditches, 134 birds in mixed hay, 89 birds in red clover (*Trifolium pratense*), 65 birds in oat (*Avena sativa*) fields, 64 birds in ungrazed grasslands, 58 birds in alfalfa, 30 birds in wheat (*Triticum aestivum*), 27 birds in fallow fields, 24 birds in pastureland, 23 birds in shrub-grown areas, 5 birds in corn fields, and 3 birds in soybeans (Glycine max). The observed nest densities would not exceed the values measured by Robertson (1972) for upland habitats even if all of the birds in each of these different habitat types were nesting females.

The type of upland cover available as nest sites for the redwinged blackbird is represented by V7 in the model. Red-winged blackbirds nest in a wide variety of upland sites. For example, blackbirds nested in hay fields and old fields, but not in tilled and fallow fields in southern Michigan (Albers 1978). Important characteristics of upland nest sites include the presence of dense, tall, herbaceous vegetation, the availability of fence posts and other structures that serve as display perches for males and as observation posts for both males and females, and a proximity to open water (Joyner 1978). Specific information on the preferred proximity of nest sites in upland habitats to open water were not found in the literature.

Variable 7 (V7) describes the availability of dense, sturdy herbaceous vegetation in forbland, grassland, and pasture/hayland upland sites. Variable 7 has a habitat suitability index of 0.1 if the herbaceous vegetation is dense and tall, like sweet clover (Melilotus spp.), mixed hay, alfalfa, and coarse weeds, which provide suitable nest sites and protective cover. Variable 7 has a suitability index of 0.0 if the habitat site has some other surface cover, such as cut or fallow fields, agricultural fields, woodlots, or tilled soils.

V7 = 0.1 if upland habitat provides dense, tall, herbaceous vegetation.
V7 = 0.0 if upland habitat has some other surface cover.

Early nests of red-winged blackbirds in upland sites are more productive than are late nests (Dolbeer 1976). Early nests are placed in robust, dense, old herbaceous growth. Activities that are destructive to this vegetation, such as mowing, heavy grazing pressure, or burning, reduce habitat suitability for red winged blackbirds. The occurrence of disturbances that might impact nesting success in upland cover types is included as V8 in the model.

V8 = 0.1 if disturbances, such as mowing, heavy grazing, or burning, do not occur to the potential habitat site in most years.

V8 = 0.0 disturbances occur to the potential habitat site in most years

<u>HSI determination</u>. Three types of habitat conditions (A, B, and C) are described in Figure 1. Condition A represents a wetland that contains the preferred vegetative structure for nest placement, permanent water that supports a population of emergent aquatic insects that are available as food, the absence of carp, and the interspersion of open water within emergent herbaceous vegetation. The equation combining the SIs for VI to VS to estimate an HSI for condition A wetlands is:

$$HSI = (V1 \times V2 \times V3 \times V4 \times V5)$$

Condition B habitats (Fig. 1) are wetlands where the emergent herbaceous vegetation does not have the preferred structure, there is no permanent water, carp are present, or benthic invertebrates are absent. Condition B habitats have a basic SI of0.1, determined by the 0.1 SI for the unsuitable conditions of V1, V2, V3, or V4. The basic SI of 0.1 can be increased if suitable foraging substrate is available outside the boundary of the wetland. Food sources are considered more limiting if only an understory layer is available than if deciduous midstory and/or overstory layers also are available as foraging surfaces. A condition B habitat may be of highest value to redwinged blackbirds if the birds can readily feed on emergent aquatic insects in a nearby condition A herbaceous wetland habitat. The equation for estimating the HSI for condition B habitats is:

$$HSI = (0.1 \times V6)^{1/2}$$

Condition C habitats are upland sites, like grass, forb, and pasture/hayland cover types. Their HSI'S, which will be either 0.1 or 0, are described by the following equation:

$$HSI = (V7 \times V8)^{1/2}$$

The measure of habitat quality represented by the HSI actually reflects an estimate of the quantity of niche space available to the blackbird. Habitats with higher HSIs are assumed to contain more niche space than habitats with lower HSI'S. More niche space in a habitat frequently means that more individuals will occur in that habitat.

Application of the Model

Summary of model variables This model can be applied by interpreting a recent, good quality, aerial photograph of the assessment area and making selected field measurements. The habitat to be evaluated is outlined on the aerial photograph. Each wetland within the assessment area is identified and a 200 m zone drawn around its perimeter. The wetlands within the assessment area are evaluated, on a per ha basis, with field observations and measurements that determine: (1) the type of emergent vegetation present; (2) the probable permanency of the water; (3) the presence or absence of carp; (4) the presence or absence of larval stages of emergent aquatic insects; (5) the mix of open water and emergent herbaceous vegetation; and (6) the nature of vegetative cover within 200 m surrounding the wetland (Fig. 2). The proportion of open water and emergent herbaceous vegetation within the wetland is estimated from a map made after boating or wading through the wetland. The presence of benthic invertebrates is determined from field sampling. Upland habitats within the assessment area are evaluated by ground truthing to determine cover types and land-use practices. Habitat conditions, like the presence of dense, tall herbaceous cover and the probability that disturbances such as grazing, burning, mowing, and tilling will occur during the March to July nesting season, are noted.

Definitions of variables and suggested field measurement techniques are provided in Figure 3.

Model assumptions. I have assumed that it is possible to synthesize results from many studies conducted in different seasons of the year different locations in North America into a model years, and a wide variety of nest sites throughout North America into a model describing the relative quality of breeding habitat for the red-winged blackbird. My basic assumptions about habitat criteria important to redwinged blackbirds are based on descriptive and correlative relationships expressed in the literature. My descriptors of habitat quality will obviously be in error if authors made incorrect judgements or measurements or if I have emphasized the wrong data sets or misinterpreted the meaning of published data.

I have assumed that the quality of some wetland habitats exceeds the quality of best upland habitats. This assumption was based largely on quality of the blackbirds fledged per hectare of wetland and upland habitats. I compiled and analyzed characteristics of wetland habitats that seemed to distinguish habitats where varying numbers of red-winged blackbirds were fledged. I assumed that I could meaningfully bound the size of study areas to be evaluated as nesting habitat as $\geq$ 0.1 ha for wetland sites and $\exists$ 1.0 ha for suitable upland sites. I arbitrarily selected distances (200 m) that blackbirds might fly from their nests in wetlands to forage on insects and seeds in surrounding vegetative cover. I assumed that the presence of dense, tall, herbaceous cover reasonably close to water, coupled with a strong probability that the dense cover would remain relatively undisturbed during the breeding season, would adequately indicate the value of upland habitats as nest sites for the red-winged blackbird.

The values for Variables 1 through 8 are estimates. The ecological information available does not seem sufficient to suggest: (1) other pertinent variables; (2) more appropriate values for the present variables; or (3) more definitive interrelationships between the variables. Finally, I have assumed that the multiplicative relationship described in the model is appropriate summary statement to provide a Habitat Suitability Index that reflects the relative importance of different habitats as nest sites for the red-winged blackbird.

Figure 3. Definitions of variables and suggested measurement techniques.

Variable (definition)		Cover type	Suggested technique
VI	Type of emergent	HW	Identify the dominant species of emergent herbaceous vegetation in the wetland. Determine if the dominant species is a broad-leaved monocot.
V2	Water regime	HW	Determine whether or not water will be retained in the wetland throughout the year in most years; use, if possible, indicators like muskrat houses and fish. Evaluate records describing permanence and level of water in wetland. Determine the classification type of wetland if the wetland has been classified.
V3	Abundance of carp within the wetland.	HW	Determine presence of carp by seining, using local data about presence of carp within wetland or observations to see if water is clear or generally murky, as it is when carp are feeding.
V4	Abundance of larval	HW	Collect insect larvae by dragging astages of emergent aquatic sieve net along water bottom near edge insects(Order Odonata) of clumps of emergent herbaceous within the wetland. vegetation. Sampling is done for some fixed time period. A second sampling procedure involves kicking up the

			substratum at the edge of clumps of emergent herbaceous vegetation in front of the mouth of a net in some standardized manner (Hynes 1972:240). The collected invertebrates are sorted and identified by comparison with illustrations in an appropriate manual (like Needham and Needham 1970) to determine the presence of damselfly and dragonfly larvae (Order Odonata).
V5	Percent emergent	HW	Determine the mix of open water and herbaceous canopy emergent herbaceous vegetation within the wetland study area. Estimate the mix from a map prepared after wading, walking or boating through the wetland or from a map made from a recent, high quality, aerial photograph
V6	Types of foraging sites	HW	Use map measurer (Hays et al. 1981) available outside the wetland. to determine if another wetland with an emergent aquaticinsect population occurs within 200 m of nest sites within the wetland being evaluated. Map vegetation within 200 m of the wetland and determine, using a dot grid (Hays et al. 1981) or a planimeter, if deciduous midstory and overstory layers comprise atleast 10% cover when projected to the ground surface. If midstory and/or overstory do not provide at least 10% cover, and a condition. A wetland does not occur within 200 m of the wetland being evaluated assume only the understory layer is available as a foraging substrate.
V7	Presence of dense, sturdy	F,G,P/H	Interpret the aerial photograph or a herbaceous vegetation Vegetation on-site map prepared from the aerial photograph to determine areas of upland herbaceous vegetation. Ground truth to determine types of herbaceous vegetation occurring in the upland within the assessment area and determine if tall, dense, herbaceous cover covers at least 10% of the surface area.
V8	Occurrence of disturbances	F,G,P/H	Ground truth to predict past and future like grazing, mowing, burning, land-use practices (types of and tilling on potential uplanddisturbances that may impact nesting nest sites. success).

SOURCES OF OTHER MODELS

Weatherhead and Robertson (1977) identified and quantified some parameters that affected the nesting success of red-winged blackbirds in wetland habitats in Ontario, Canada. They determined that nesting success, as judged by numbers of young fledged per female, was positively correlated with territory quality scores based on nest placement. Nesting success seemed to be related to four parameters: (1) water depth within the wetland; (2) height of nest above the herbaceous wetland floor; (3) relative openness of nesting cover within the wetland; and (4) the identity of the support vegetation holding the nest. Two of these variables are represented in the present model of habitat suitability for the redwinged blackbird: (1) presence or absence of permanent water; and (2) the relative openness of vegetation within flooded herbaceous wetlands. No other models for use in predicting the quality of nesting habitat for redwinged blackbirds were found in the literature.

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HABITAT SUITABILITY INDEX MODELS: GREAT EGRET

by

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PREFACE

The habitat suitability index (HSI) model for the great egret presented in this report is intended for use in the habitat evaluation procedures (HEP) developed by the U.S. Fish and Wildlife Service (1980) for impact assessment and habitat management. The model was developed from a review and synthesis of existing information and is scaled to produce an index of habitat suitability between 0 (unsuitable habitat) and 1.0 (optimally suitable habitat). Assumptions used to develop the HSI model and guidelines for model applications, including methods for measuring model variables, are described.

This model is a hypothesis of species-habitat relations, not a statement of proven cause and effect. The model has not been field tested, but it has been applied to three hypothetical data sets that are presented and discussed. The U.S. Fish and Wildlife Service encourages model users to convey comments and suggestions that may help increase the utility and effectiveness of this habitat-based approach to fish and wildlife management. Please send any comments or suggestions you may have on the great egret HSI model to the following address.

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Earlier versions of the habitat suitability index model and narrative for the great egret were reviewed by Dr. R. Douglas Slack and Jochen H. Wiese. The model's structure and functional relationships were thoroughly evaluated by personnel of the U.S. Fish and Wildlife Service's (FWS) National Coastal Ecosystems Team. Model and narrative reviews were also provided by FWS Regional personnel.

GREAT EGRET (*Casmerodius albus*)

INTRODUCTION

The great egret, also called common egret or American egret, is a large white heron in the order Ciconiiformes, family Ardeidae. Great egrets stand 37-41 inches tall and have a wing spread to 55 inches (Terres 1980). The species is associated with streams, ponds, lakes, mud flats, swamps, and freshwater and salt marshes. The birds feed in shallow water on fishes, amphibians, reptiles, crustaceans and insects (Terres 1980).

Distribution

The great egret is a common breeding species in all coastal areas south from southern Oregon on the Pacific coast and from Maine on the Atlantic coast; in riverine, palustrine and estuarine habitats along the coast of the Gulf of Mexico; and in the Eastern-Central United States (Palmer 1962; Erwin and Korschgen 1979; American Ornithologists' Union 1983). The great egret undergoes an extensive postbreeding dispersal that extends the range of the species to most of the United States exclusive of the arid Southwest (Byrd1978). Young birds hatched in Gulf coast colonies tend to move northward for a short period (Byrd 1978; Ogden 1978). However, with the onset of colder weather most great egrets and other herons migrate south and many winter along the gulf coast in Texas, Louisiana, and Florida (Lowery 1974; Oberholser and Kincaid 1974; Byrd 1978). Analysis of banding data indicates that many birds winter in Cuba, the Bahamas, the Greater and Lesser Antilles, Mexico, and Central America (Coffey 1948). Lowery (1974) suggested that during severe winters, a higher proportion of the population winters farther south.

Life History Overview

Great egrets nest in mixed-species colonies that number from a few pairs to thousands of individuals. A colony may include other species of herons, spoonbills, ibises, cormorants, anhingas, and pelicans. Colony and nestsite selections begin as early as December along the gulf coast, but most great egrets do not initiate nesting activities until mid-February or early March (Bent 1926; Oberholser and Kincaid 1974; Chaney et al. 1978; Morrison and Shanley 1978). Eggs have been recorded from March through early August, and young have been observed in nests from mid-May through late August (Oberholser and Kincaid 1974; Chaney et al. 1978). Clutch size varies from one to six eggs per nest, but three to four eggs is most common (Bent 1926). Incubation period in a Texas colony ranged from 23 to 27 days (Morrison and Shanley 1978). The first flights of young have been noted about 42 days after hatching (Terres 1980).

SPECIFIC HABITAT REQUIREMENTS

Food and Foraging Habitat

Fish constitute up to 83% of the great egret's diet (Hoffman 1978). Most fish taken by great egrets are minnow-sized 3.9 inches, but fish up to 14 inches can be captured and swallowed (Willard 1977; Schlorff 1978). Other major food items include insects, crustaceans, frogs, and snakes, while small mammals, small birds, salamanders, turtles, snails, and plant seeds are occasionally taken (Baynard 1912; Bent 1926; Hunsaker 1959; Palmer 1962; Genelly 1964; Kushlan 1978b).

Little specific information exists on the food habits of various age classes of great egrets. An adult great egret weighing 32.3 ounces (oz) (Palmer 1962) may require approximately 3.9 oz of food per day (estimated by using the wading bird weight-daily food requirement model proposed by Kushlan 1978b). Daily food requirements are undoubtedly higher during the nesting season when adults are feeding young (Kushlan 1978b).

Great egrets usually forage in open, calm, shallow water areas near the margins of wetlands. They show no preference for fresh-, brackish, or saltwater habitat. Custer and Osborn (1978a,b) found that feeding habitat selection in coastal areas of North Carolina varied daily with the tidal cycle. During low tide, great egrets fed in estuarine seagrass beds. During high tide, freshwater ponds and the margins of *Spartina* marshes were used. Inland, great egrets feed near the banks of rivers or lakes, in drainage ditches, marshlands, rain pools (Bent 1926; Dusi et al.

1971; Kushlan 1976b), and occasionally in grassy areas (Weise and Crawford 1974). Feeding sites are generally not turbid and are fairly open with no vegetative canopy and few emergent shoots (Thompson 1979b).

Great egrets forage singly, in single-species groups, and in mixed-species associations (Kushlan 1978b). Great egrets generally fly alone to feeding sites (Custer and Osborn 1978a,b) and may use the same feeding site repeatedly. The density and abundance of fish at a given location in estuarine habitats may vary with season, time of day, tidal stage, turbidity, and other factors. If feeding success is low, great egrets may move to other areas (Cypert 1958; Schlorff 1978) and join other conspecifics in good feeding habitats (Custer and Osborn 1978a,b). Most instances of group feeding have been observed during specific environmental conditions, such as lowered water levels, that tend to concentrate prey (Kushlan 1976a,b; Schlorff 1978).

Meyerriecks (1960, 1962) and Kushian (1976a, 1978a, b) provided detailed information on hunting techniques employed by great egrets. The "stand-and-wait" and "slow-wade" methods are used most frequently. Because of their long legs, great egrets can forage in somewhat deeper water than most other herons. In New Jersey, foraging depths ranged from 0 (standing on the bank while fishing) to 11 inches, but depths ranging from 4 to 9 inches were most commonly used (Willard 1977). In North Carolina, great egrets fed in water with a mean depth of 25.1 cm (9.8 inches) in *Spartina* habitat and of 6.8 inches in non-*Spartina* habitat (Custer and Osborn 1978b). Mean water depth was 7.9 inches for foraging great egrets in California (Hom 1983). In addition to wading, great egrets can feed by alighting on the surface of deep waters to catch prey, a method rarely employed (Reese 1973; Rodgers 1974, 1975).

Although recent declines of great egret populations in the central coastal region of Texas occurred simultaneously with declines in coastal marine and estuarine fish populations (Chapman 1980), no causal relationship has been proven. At present there are no known management practices that provide suitable food alternatives for piscivorous species, such as the great egret, during periods of fish population decline. Known fish nursery and feeding areas need protection from destruction or habitat alteration to ensure adequate prey populations for fish-eating birds.

Water

The physiologic water requirement of great egrets is probably met during feeding activities in aquatic habitats (Dusi et al . 1971). Water depth affects the quantity, variety, and distribution of food and cover; great egret food and cover needs are generally met between the shoreline and water 1.6 feet deep (Willard 1977).

Interspersion

Suitable habitat for the great egret must include (1) extensive shallow, open water habitat from 4 to9 inches deep (Willard 1977); (2) food species present in sufficient quantity (Custer and Osborn 1977); and (3) adequate nesting or roosting habitat close to feeding habitat. Most great egrets at a colony in North Carolina flew less than 2.5 miles from nesting colonies (and presumably, from roosting sites) to feeding areas (Custer and Osborn 1978a), but flight distances of up to 22.4 miles have been recorded in the floodplain of the Upper Mississippi River (Thompson 1979b).

Several heronries may be close together. Great egrets from one colony may fly over or near an adjacent colony, but rarely feed in the same areas as conspecifics from the adjacent colony (Thompson 1979b).

HABITAT SUITABILITY INDEX (HSI) MODELS

Model Applicability

Geographic area. The habitat suitability index (HSI) models in this report were developed for application in coastal wetland habitats in Texas and Louisiana. Because there are few differences in habitat requirements along the Atlantic coast, the remainder of the gulf coast, and inland sites in the Southeastern United States, the HSI models may also be used to evaluate potential habitat in those areas.

Season. This model will produce an HSI values based upon habitat requirements of great egrets during the breeding season (February to August). Because there is no apparent seasonal difference in feeding habitat preference and because winter nocturnal roosts are similar to nesting sites, the HSI models may also be used to evaluate winter habitat for the great egret.

Cover types. Great egrets nest on upland islands and in the following cover types of Cowardin et al. (1979): Estuarine Intertidal Scrub-Shrub wetland (E2SS), Estuarine Intertidal Forested wetland (E2FO), Palustrine Scrub-Shrub wetland (PSS) (including deciduous and evergreen subclasses), and Palustrine Forested wetland (PFO) (including deciduous and evergreen subclasses). Great egrets may also feed in these wooded wetlands, but preferred feeding areas may be any one of a wide variety of wetland cover types.

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous suitable habitat required before an area can be occupied by a particular species. Specific information on minimum areas required by great egrets was not found in the literature. If local information is available to define the minimum habitat area, and less than this amount of area is available, the HSI for the species will be zero.

Verification level. The output of these HSI models is an index between 0 and 1.0 that is believed to reflect habitat potential for great egrets. Two biologists reviewed and evaluated the great egret HSI model throughout its development: Dr. R. Douglas -Slack, Texas A&M University, College Station, and Jochen H. Wiese, Environmental Science and Engineering Company, Gainesville, Florida. Their recommendations were incorporated into the model building effort. The authors, however, are responsible for the final version of the models. The models have not been field-tested.

Model Descriptions

Feeding HSI model. Great egret feeding habitat suitability is related to prey availability. Habitat suitability is optimal when two conditions are met: (1) the populations of minnow-sized fish are high; and (2) shallow open water (necessary for successful prey capture), aquatic vegetation (necessary for prey survival and reproduction), and deeper water are present in a ratio that maximizes prey density and minimizes hunting interference. Use of this model assumes that deep or permanent water environments are not limiting in coastal habitats and that fish populations are distributed uniformly. Because great egrets hunt a variety of species in many different habitat types, a general approach to modeling feeding habitat suitability is presented. Suitability of all wetland cover types for feeding is determined by integrating two factors: (1) the abundance of prey and (2) the accessibility of prey.

The abundance of prey is determined by the ability of the habitat to support the major prey species, especially minnow-sized fish. It is assumed that the abundance of major prey species is related to the primary and secondary productivity of the aquatic habitat; however, few field studies have documented this relationship. The model assumes that prey abundance is not limiting in coastal habitats. Therefore, the accessibility of prey is used as the indicator of feeding habitat suitability.

The accessibility of prey is determined by water depth and percentage cover of aquatic vegetation. A wetland with 100% of its area covered by water 4-9 inches deep is assumed to be optimal for feeding by great egrets (V_1). Although an absence of submerged or emergent vegetation would render fish species most vulnerable to capture, it is unlikely that many prey species would use such an area because it totally lacks cover. The model assumes, therefore, that optimal conditions for both the occurrence and susceptibility to capture of prey species exist when 40%60% of the wetland substrate is covered by submerged or emergent vegetation (V_2). When such vegetation is lacking, the habitat has a low value for feeding great egrets because small fish may use unvegetated water that is too shallow for their larger aquatic predators.

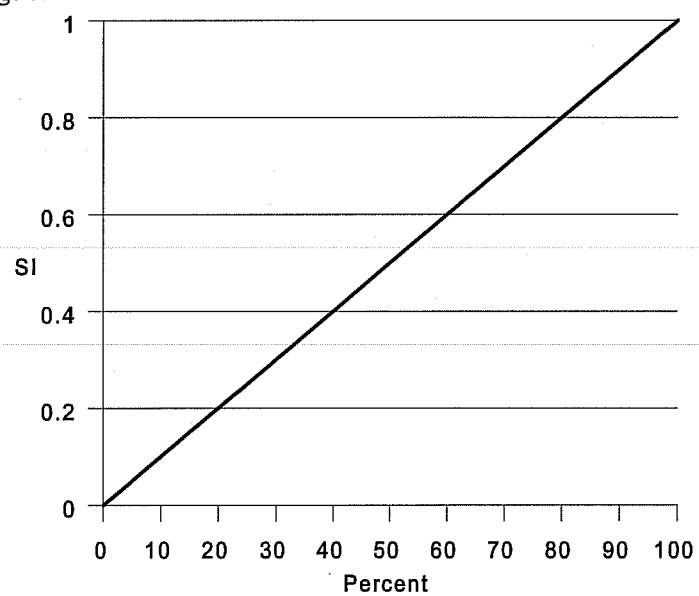
	Habitat variable	Component	
V_1	Percentage of area with water 10-23 cm deep.	Food	HSI (Feeding)
V_2	Percentage of submerged or emergent vegetation cover in zone 10-23 cm deep.		

Suitability Index (SI) Graphs for Model Variables

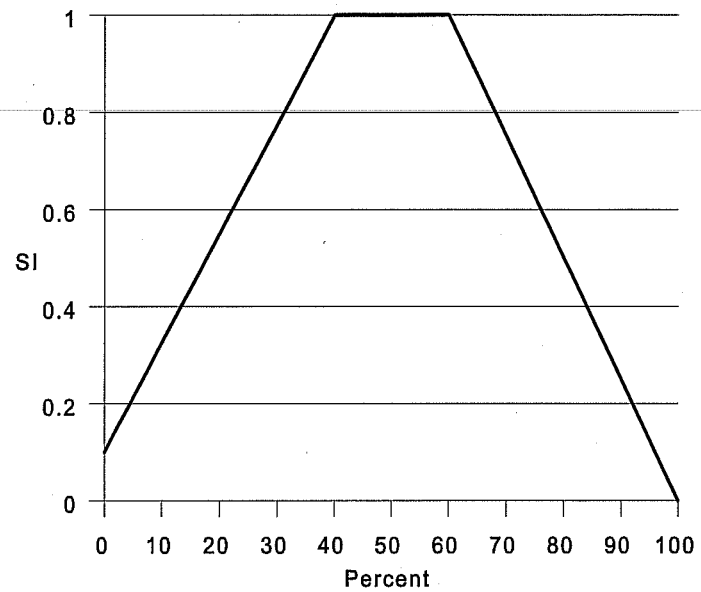
This section provides graphic representation of the relationship between habitat variables and habitat suitability for the great egret in wetland (see Table 2 for abbreviations) and upland (U) cover types. The SI values are read directly from the graph (1.0 = optimal suitability, 0.0 = no suitability) foreach variable.

The SI graphs are based on the assumption that the suitability of a particular variable can be represented by a two dimensional linear response surface. Although there may be interdependencies and correlations between many habitat variables, the model assumes that each variable operates independently over the range of other variables under consideration.

V_1 Percentage of study area with water 4-9 inches deep. In tidal areas, use depth at mean low tide. In nontidal areas, use average summer conditions.



V_2 Percentage of substrate in zone 4-9 inches deep covered by submerged or emergent vegetation.



Feeding HSI.

$$HSI = \frac{V_1 + V_2}{2}$$

Data representing three hypothetical study areas for great egret were used to calculate sample HSI values The HSI values obtained are believed to reflect the potential of the areas to support feeding or nesting great egrets.

Field Use of Models

The level of detail needed for application of these models will depend on time, money, and accuracy constraints. Detailed field sampling of all variables will provide the most reliable and replicable HSI values. Any orall variables can be estimated to reduce the amount of time or money required to apply the models. Increased use of the subjective estimates decreases reliability and replicability, and these estimates should be accompanied by appropriate documentation to insure that decision makers understand both the method of HSI determination and quality of data used in the model. Techniques for measuring habitat variables included in the great egret HSI models are suggested in Table 5.

A project area may contain both potential feeding and nesting habitat. To decrease the cost and time necessary to evaluate the area, assume that food is not limiting and apply only the nesting HSI model. This recommendation is based upon the following assumptions: (1) in most coastal areas of Texas and Louisiana, aquatic habitats suitable for feeding are abundant and are, therefore, less of a limiting factor to great egrets than are suitable nesting sites; and (2) nesting value is easier and more accurately estimated by using subjective methods than is food value. The variables used to measure food use of past colony sites, and (2) the enhancement of a site by the presence of other herons. These two factors are usually, but not always, interrelated. Great egrets tend to use the same colony site in successive years until the site is degraded, and the site may include great blue herons. When applying the HSI model , the user should be aware that an area known to be used by great egrets (or great blue herons) is more likely to be used in future years than an area with an equal HSI value not known to have a history as a colony site.

Table 5. Suggested measurement techniques for habitat variables used in the great egret HSI models.

Variable	Suggested technique
V_1	The percentage of the area with water 4-9 inches deep can be determined by line transect sampling of water depth.
V_2	The percentage of substrate in the 4-9 inches water depth zone covered by submerged or emergent vegetation can be determined from available cover maps, aerial photographs, or by line transect sampling.

HABITAT SUITABILITY INDEX MODEL

CALIFORNIA VOLE (*Microtus californicus*)

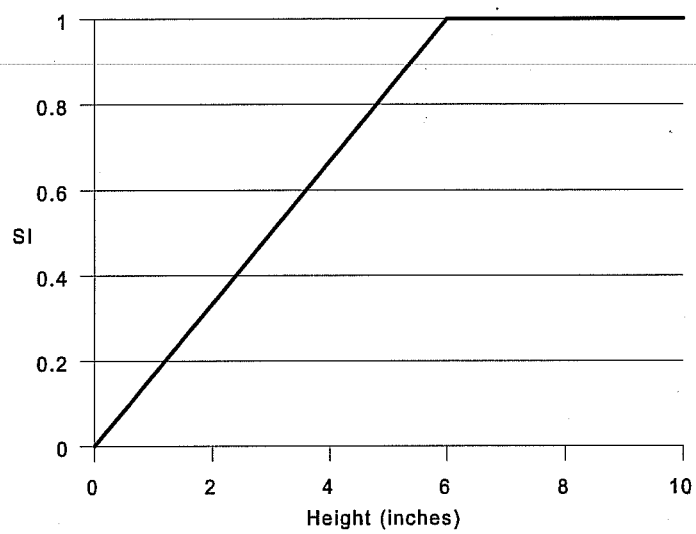
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

Cover-Type	Life Requisite	Habitat Variable
Annual Grassland Seasonal Wetland	Food/Cover Reproduction	Height of herbaceous vegetation (V1) Percent cover of herbaceous vegetation (V2) Soil Type (V3)
Riparian Woodland Oak Woodland	Reproduction Food/Cover	Height of herbaceous vegetation (V1) Percent cover herbaceous vegetation (V2) Soil Type (V3) Presence of logs and other types of cover (V4)

Variable	Cover-Type	Sampling Technique
V1 - Height of herbaceous	Annual Grassland Oak Woodland Riparian Woodland Seasonal Wetland	Average vegetation height in 1 m^2 quadrat
V2 - Percent cover of herbaceous vegetation	Annual Grassland Seasonal Wetland Oak Woodland Riparian Woodland	1 m^2 quadrat
V3 - Soil Type	Annual Grassland Seasonal Wetland Oak Woodland Riparian Woodland	Site inspection County Soil Survey
V4 - Presence of logs and other types of cover	Annual Grassland Seasonal Wetland Oak Woodland Riparian Woodland	Visual inspections Sample point

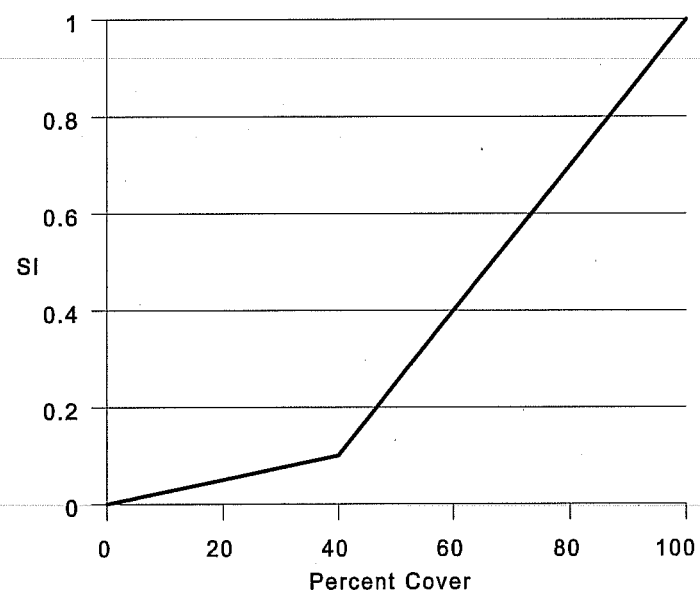
Variable 1: Height of herbaceous vegetation.

Assumes: California voles require relatively tall herbaceous vegetation for both food (Gill 1977. Batzil 1986) and cover (Ingles 1965). Herbaceous vegetation ≥ 6 in tall is considered optimum.



Variable 2: Percent cover of herbaceous vegetation.

Assumes: Relatively dense herbaceous vegetation is needed for cover percent cover ≥ 100 percent is considered optimum (CDFG undated).



Variable 3: Soil type

Assumes: Friable soils such as silts and loams are optimum because voles can dig their burrows (Ingles 1965). Soils such as sands and clays are not optimum.

Suitability Index (SI)

SI = 1.0 if soil type is silty or loamy and friable.

SI = 0.5 if soil type is not silty or loamy and is moderately friable

SI = 0.2 if soil type is not silty or loamy and is not friable.

Variable 4: Presence of logs and other cover types within the sample area.

Assumes: California voles will use logs, brush piles, and rocks for cover in addition to their burrows (California Department of Fish and Game). These sources of cover are more important in woodland habitats than grassland and wetland habitats.

SI = 1.0 logs, brush piles, and rocks are abundant and well distributed throughout the sample site (e.g.,$\geq$ 4 per sample site).

SI = 0.7 if logs, brush piles, and rocks are moderate abundant and distributed throughout the sample site (e.g., 24 per sample site).

SI = 0.4 logs, brush piles, and rocks are absent or sparsely distributed throughout the sample site ($\leq$ 1 per sample site).

SI = 0.1 if logs, brush piles, matted vegetation, and/or rocks are absent From sample area.

HSI Determination

For annual grasslands and seasonal wetlands.

$$HSI = \frac{V_1 + V_2 + V_3}{3}$$

For oak woodlands and riparian woodlands:

$$HSI = \frac{V_1 + V_2 + V_3 + V_4}{4}$$

All variables are assumed to contribute equally to the availability of a given habitat type for the California vole. Water is assumed not be a limiting factor and is represented by the herbaceous vegetation variables.

Model Applicability

This model is a hypothesis of the relationships between various attributes of grassland, wetland, and oak riparian woodland habitats and the suitability of these habitats to California voles. The model is designed for use in the Central Valley of California up to 2,500 feet in elevation. California voles are permanent year-round residents, and this model can be applied to these habitats at all times of the year.

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HABITAT SUITABILITY INDEX MODEL
Plain Titmouse (*Parus inornatus*)

by
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U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

June 1989

Habitat Use Information

General

The plain titmouse inhabits oak and piñon-juniper woodlands from Oregon south and west to Texas. It is a year-round resident, and maintains a territory throughout the year. The species is generally a secondary cavity nester, although it may occasionally excavate its own hole.

Food

As a group, titmice take a wide variety of foods, but they are considered insectivorous during the summer, and consumers of fruit, seeds, and some insects in the winter (Ferrins 1979). Root (1967 - cited by Verner 1979), found that a large proportion of their food consisted of plant material and arthropods living on the bark of trees. Wagner (1981) found the plain titmouse took a great variety of arthropod taxa.

The titmouse is primarily a bark forager, although it also forages on tree foliage and occasionally on the ground (Hertz et. al. 1976). Most foraging by this species is done between 0-30 feet (0-9 m) of the ground (Wagner 1981; Hertz et. al. 1976). Hertz et al. found that plain titmice showed a preference for foraging in blue oaks (*Quercus douglasii*) over coast live oaks (*Q. agrifolia*). Hertz et. al. (1976) attributed the avoidance of live oaks to their smooth bark which is poor habitat for arthropods. Block and Morrison (1986) also found the titmouse to use blue oaks more than valley oaks (*Q. lobata*), black oak (*Q. kelloggii*), and canyon live oak (*Q. chrysolepis*) for foraging at Tejon Ranch, California. The plain titmouse will forage extensively in live oaks however, especially when other oak species are not present (Dixon 1964).

Reproduction

The plain titmouse is a secondary cavity nester, nesting in natural cavities, old woodpecker holes, or nest boxes. It prefers natural cavities over excavated cavities (Wilson, pers. comm.). Bent (1946) reported nests from 3-32 feet (1-10 m) above the ground. Bent, citing Dawson (1923), reported the titmouse to occasionally excavate its own nest cavity in blue oaks. The plain titmouse prefers wooded areas with intermediate to high percentage canopy coverage dominated by blue, live and valley oaks (Verner and Boss 1980).

Cover

Cover is provided by the oak woodlands and riparian areas in which the plain titmouse lives. Roost sites are provided by natural cavities, old woodpecker holes, or by dense foliage which simulates a cavity (Dixon 1949).

Interspersion

Plain titmice maintain year-round territories. Three territories observed by Hertz et. al. (1976) averaged 2.0 acres (0.8 ha) in California oak woodland. Dixon (1949) found 12 territories ranged located primarily in live oak woodland. These territories ranged in size from 3.3-12.5 acres (1.3-5.1 ha) with an average size of 6.3 acres (2.6 ha). According to Dixon (1956) 2.5 acres (1.0 ha) would probably be close to an absolute minimum size for a territory.

Water Requirements

In a study by Williams and Koenig (1980), the plain titmouse was classified as an occasional drinker.

Model Applicability

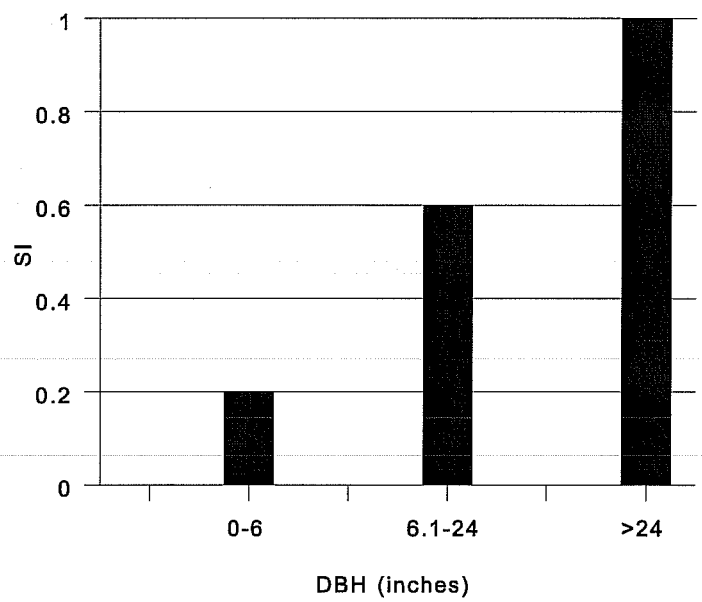
This model was developed for use in evaluating habitat suitability of oak savannah, oak woodland, and riparian woodland in Merced, Fresno, Stanislaus, and San Benito Counties in California from 500- 2,500 ft in elevation. The basic assumptions for using the model are that meeting the reproductive needs of the plain titmouse will take care of its cover and food needs throughout the year. This assumption seems warranted. Verner (1979) believes that proper management for oaks for breeding birds should also provide the habitat needs for speciesthat use oaks at other times of the year. In addition, it is assumed that water is not a limiting factor. It is assumed that the model is valid for use in riparian areas as well as the oak woodlands despite the fact that the model was initially developed for oak woodlands.

Model Description

Little quantitative data were found on the habitat needs of the plain titmouse. The most useful information was the information on habitat factors related to breeding for the species presented by Ohmann and Mayer (1986). Using data from the California Wildlife Habitat Relationships data base and the Forest Inventory and Analysis Research Unit inventory, Ohmann and Mayer developed a habitat suitability index model for the plain titmouse from which Variable 1 was derived.

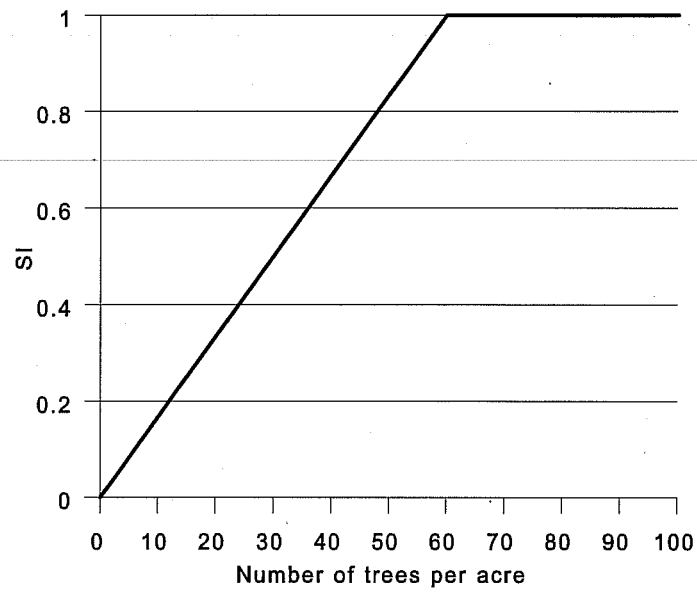
Variable 1. Tree diameter. (A tree is defined as a woody plant species 16 feet high or greater)

Ohmann and Mayer found tree size and percent canopy closure to be the major variables determining suitability of a habitat for the plain titmouse. Our model will assume that the diameter of a tree and the size of the canopy are correlated to the extent that they can be considered a single variable to be represented in this model by diameter at breast height (DBH). Presumably this variable best represents older trees with more cavities for nesting and greater bark surface which supports a greater prey base.



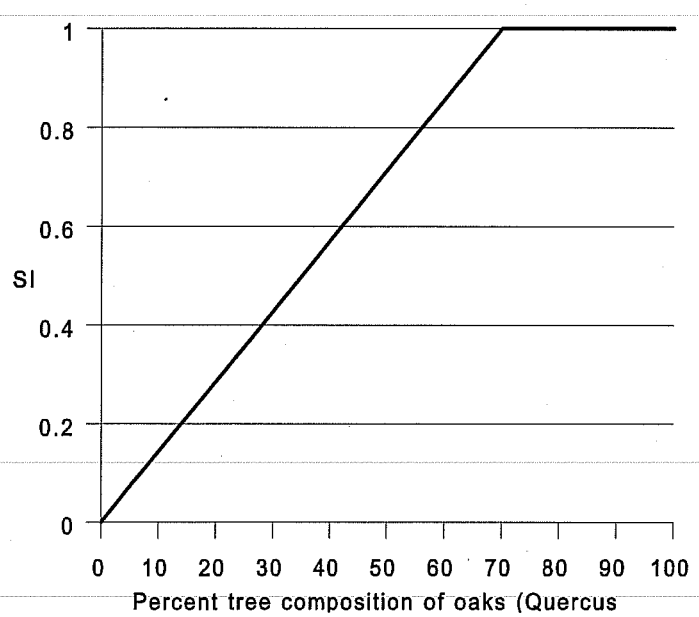
Variable 2. Trees per acre.

Plain titmouse abundance was found to increase as the number of trees increased (Wilson, pers. comm.). This may be particularly important in areas of low to moderate canopy cover. Studies at the Hopland, California field station found titmouse abundances to peak in areas with 60 trees/acre.



Both Variables 1 and 2 relate directly to the extent of a stand's canopy closure such that the importance placed on canopy closure by Ohmann and Mayer is incorporated into this model through the use ofVariables 1 and 2.

Variable 3. Percent composition of tree species that are oaks (*Quercus*).
Verner and Boss (1980) stated that the plain titmouse prefers stands dominated by blue, live and valley oaks. We have been unable to find and studies documenting the presence of the plain titmouse in an area without a major proportion of oaks. For the sake of this model then, we will consider the presence of oaks to be a life requisite such that the optimum titmouse habitat is one dominated by oaks.



HSI Determination

In each sample area, tree diameter is measured along with the number of trees per acre and the percentage of those trees that are oaks. The Habitat Suitability Index for the sample site is then determined using the following formula:

$$HSI = \frac{V1 + V2 + V3}{3}$$

Suggestions for Applying the Model

1. The tree diameter classes for calculating Variable 1 (DBH) were not specified by Ohmann and Mayer. Therefore, all trees within the sample plot should be included in the DBH determination.

2. If no trees, 4-inch DBH or greater, are found in the sample plot, the HSI for the sample plot is 0.0. A 4-inch DBH tree is probably about the smallest tree that could have a cavity of sufficient size for the titmouse.

3. Ideally, all tree species in the study area should be fully leafed out when applying the model. Therefore, the best time for sampling is spring and summer.

Literature Cited

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BOBCAT

HABITAT SUITABILITY INDEX MODEL

HABITAT SUITABILITY INDEX MODEL

BOBCAT (*Felis rufus*)

Pacific Gas and Electric Company

1986

Geographic Area: This HSI Model was developed for use on the west slope of the Sierra Nevada in Fresno County, California.

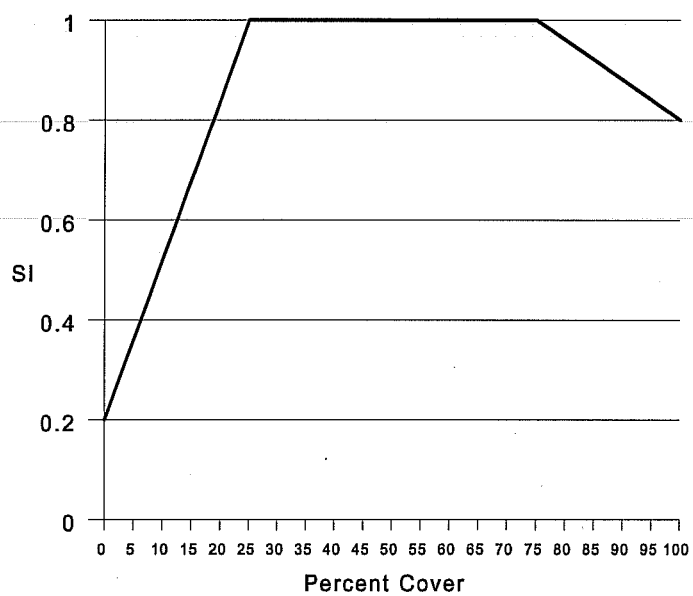
Season: This model was developed to evaluate year-round habitat suitability for the bobcat *(Felis rufus)*.

Cover Types: This model was designed to evaluate habitat suitability for the bobcat in the Chaparral cover type (terminology follows that of Verner and Boss 1980).

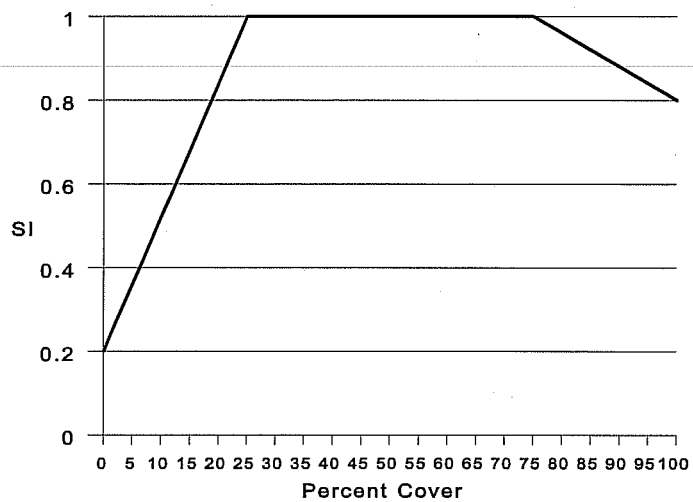
Guild:	Feeding	Breeding
	Surface	Subsurface

Equation: $$HSI = \frac{(V_1 + V_2 + V_3 + V_4)}{5}$$

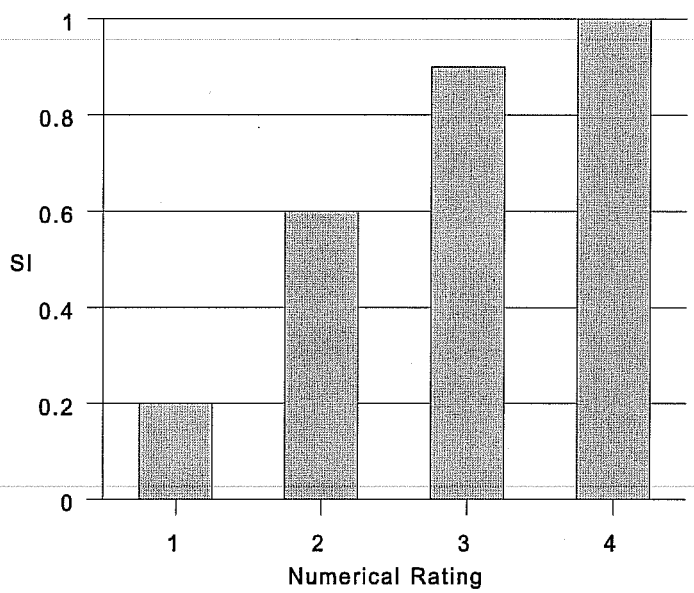
V1 - Percent Shrub Cover



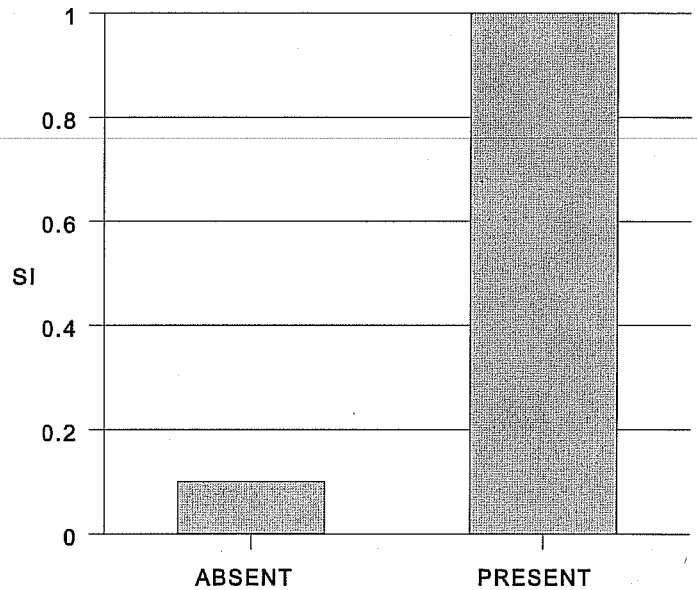
V2 - Herbaceous Cover



V3 - Degree of Patchiness



V4 - Rock Outcroppings



California Thrasher

FISH AND WILDLIFE HABITAT CAPABILITY MODELS

AND

SPECIAL HABITAT CRITERIA

FOR THE NORTHEAST ZONE NATIONAL FORESTS

LASSEN NATIONAL FOREST
MENDOCINO NATIONAL FOREST
MODOC NATIONAL FOREST
PLUMAS NATIONAL FOREST

Karen Shimamoto and Daniel Airola (editors)

JANUARY 15, 1981

INTRODUCTION

by Hal Salwasser and Karen Shimamoto

Under National Forest Management Act (NFMA) planning regulations (36 CFR 219), fish and wildlife management indicator species are selected by each Forest for planning and management attention. These species will help guide land allocations and shape multiple-resource prescriptions in meeting legal requirements and local resource demand. To support this role each species must have a documented description of the habitat conditions needed to sustain it at different population levels. The minimum habitat conditions necessary for sustaining population viability are also required. The development of prescriptions to favor certain management indicator species also requires a description of habitat conditions associated with high population levels of each species. The descriptions of habitat conditions associated with different population levels are called Habitat Capability Models (HCM).

NFMA regulations mandate that each Forest maintain habitat conditions to support wildlife and fish populations at or above the abundance and distribution needed for long-term population viability. However, neither managers nor scientists fully know what kinds, amounts, and distribution of habitats are necessary to maintain population viability. Therefore, existing knowledge of species ecology and habitat needs must serve to describe the habitat conditions needed. Models (standards and criteria) must be formulated to describe in quantitative and qualitative terms the habitat conditions by which to judge existing and projected habitat resources.

Most of the HCMs address the habitat conditions required by individual reproductive units within wildlife and fish populations. This is because land management projects usually affect small part of populations such as a breeding pair, a family unit, a small group of breeding pairs, or a small group of family units before whole population changes are noticed. Total population abundance and distribution on the Forest can be projected by aggregating and mapping those land areas that provide capable, available, and suitable habitat for reproductive units of populations.

The HCMs do not address some aspects of population viability. Minimum to optimum distances between reproductive units and population size are two important attributes of viability that must be addressed for relevant species outside the HCMs.

Special Habitat Criteria were first developed by biologists on the Stanislaus National Forest as an extension of the HCM concept (Hurley et al 1981). While HCMs describe habitat conditions for individual management indicator species, the information in the Special Habitat Criteria models describes conditions necessary to maintain or optimize populations of fish and wildlife species closely associated with special habitats (riparian, aspen, snags, etc.).

HABITAT CAPABILITY MODELS

The following format was used in the construction of each habitat capability model.

Model Applicability

Life Stage(s) - Identify the appropriate life stages covered by the model e.g. egg, larval, fry, juvenile, adult, all

Season(s) - Identify the appropriate season(s) e.g. fall, winter, spring, summer

Geographic Area - The model may apply to the species' entire range. However, if regional differences in habitat use and preference occur, separate models may be appropriate.

Intended Application - Most models will be formulated with Forest planning in mind. Some models, however, may be detailed enough to apply to project work. Provide a clear statement of the intended use.

Expected Reliability - The following hierarchy was used:

Level 1 - Model predicts existing carrying capacity density with acceptable variance, i.e. 10-20%

Level 2 - Model habitat capability ratings directly correlate with density estimates

Level 3 - Model habitat capability ratings directly correlate with ratings of the same sites by species authorities

Level 4 - Model structure and outputs appear reasonable to species authorities

Level 5 - Model structure and outputs meet technical standards and appear reasonable to author(s), editor(s), and users.

Verification Status - The purpose of verification is to ensure that the model meets the expected reliability criteria and that it faithfully provides the intended outputs. Each step in verification depends on the expected reliability of the model. The following hierarchy was used:

1) Model is in draft.

2) Model reviewed by editor (the editor should check for conformance with model quality standards, sufficiency of documentation, and understandability).

3) Model reviewed by editor and users.

4) Model reviewed by species authority.

5) Model evaluated with sample data - apply the model with sample data sets which mimic various habitat conditions, e.g. high, medium, and low habitat capability. Evaluate model outputs as to how well they give a reasonable prediction of habitat conditions.

6) Model tested with field data - field data must be available to provide measurements of both habitat variables and indicators of habitat capability. The latter can range from ratings of habitat capability by species authorities to density estimates to actual densities. Statistical and sampling expertise is required to design and perform these tests.

Model variables were restricted to physical, chemical, or biological characteristics of habitats. Species population variables, such as birth rates and sex ratios, are not suitable due to high cost of measurement, difficulty of prediction, and dependency on other factors beyond habitat. The critical question answered was, "what environmental variable, when changed, will affect the capability of an area to support a management indicator species?"

Each of the identified habitat variables were combined with the others to produce a habitat capability model. Each variable has values with different implications for habitat capability. For example, the variable average tree canopy cover has a high habitat value for goshawks when it is between 40-60%. Each of the variables and its respective values were ranked according to habitat capability:

High: the values are related to the highest densities of the species; the values are preferred over other values;

Medium: the values are related to moderate densities of the species; the

values are required for the long-term viability of the population or reproductive unit of the population:

Low: the values are related to the lowest densities of the species; the values are denote marginal habitat capability for the species and would not be capable of supporting a viable population.

The variables were organized according to their importance in determining habitat capability and arrayed in rows under the headings high, medium, and low. An attempt was made to reduce redundant variables, retaining only those variables that are most practical to measure.

Documentation

As in model reliability and verification status, documentation for each model is in varying stages of completion. The levels of documentation are:

Level 1 - Literature references, written or personal communication, and the author's judgement are cited.

Level 2 - A narrative accompanies the model, summarizing why each variable was selected, how each variable is related to the species' habitat needs, and how habitat capability values were determined. This level also includes Level 1.

Level 3 - A narrative accompanies the model with documentation on the species ecology and habitat use. This information is related to

the habitat variables in the model. It involves preparing a species note with the following information:

I. Distribution, Abundance, and Seasonality

II. Specific Habitat Requirements

A. Feeding

B. Cover

C. Water

D. Reproduction

E. Pattern

III. Species Life History

A. Activity Patterns

B. Seasonal Movements/Migration

C. Home Range/Territory

D. Reproduction

E. Niche

This level also includes Levels 1 and 2.

Level 4 - The habitat variables are aggregated to develop a mathematical formulation of the model (U.S. Fish and Wildlife Service 1980). Assumptions and limitations to be used when applying the model are provided and the necessary steps to correctly use the math-

ematical model is documented. The latter includes how to collect data on model variables, how to treat that data as model inputs, and how to interpret habitat capability based on the data. This level includes levels 1, 2, and 3.

Because many initial species models will be developed from scant data, modelers will rely on experiential evidence and intuition to establish the model variables and relationships. Such models will have level 1 or 2 documentation. As model application and verification improve, habitat relationships can be more accurately represented and the models made more quantitative. Models with level 3 or 4 documentation are examples of species where more information is known and the models have been "calibrated" with real data.

Vegetation Types and Successional Stages

The vegetation types and successional stages used in the habitat capability models are consistent with the California Wildlife Habitat Relationships Program for the Northeast Interior Zone (Laudenslayer in prep), the Western Sierra Zone (Verner and Boss 1980) and the North Coast-Cascades Zone (Marcot 1979). For convenience, the codes used for successional stages are defined in Table 1.

Rating Overall Habitat Capability

For any given area of land, habitat capability ratings (high, medium, low) will be different for each habitat variable. This makes rating the overall

habitat capability difficult. Models for spotted owl and mule deer have been developed to include a mathematical calculation of habitat capability where different ratings are quantitatively assessed and an overall capability index is mathematically calculated. The method for rating overall habitat capability for the other models, however, must be done using subjective biological judgement.

For such cases, the simplest approach is to assess the overall habitat capability rating in terms of a simple majority of variable ratings. For example, if three variables were rated as medium and one variable as high for bald eagle habitat, the overall rating could be considered medium.

In other situations, experience may justify identifying one or more variables as more important or possibly overriding other variables. Biologists should then weight these variables accordingly when determining overall habitat capability.

Table 1. Successional stage codes

Code	Definition
1	Barren/grass/forbs
2	Shrub/seedling/sapling; tree saplings <11" DBH
2a	<40% tree canopy closure
2b	40-70% tree canopy closure
2c	>70% tree canopy closure
3	Small sawtimber; 11-24" DBH
3a	<40% overstory canopy closure
3b	40-70% overstory canopy closure
3c	>70% overstory canopy closure
4	Medium to large sawtimber; >24" DBH
4a	<40% overstory canopy closure
4b	40-70% overstory canopy closure
4c	>70% overstory canopy closure
5	Two-storied stand; scattered overstory over a well-stocked understory (4a over 2c or 3c)

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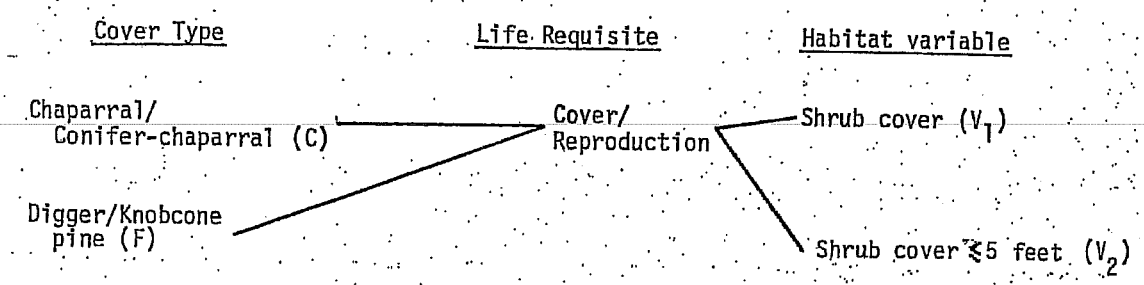
DRAFT
HABITAT SUITABILITY INDEX MODEL
WRENTIT (*Chamaea fasciata*)

U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

September 1984

VARIABLE		COVER TYPES	SUGGESTED TECHNIQUE
(V_1)	Shrub cover - % of ground shaded by a vertical projection of the shrub canopy	C,F	Line intercept
(V_2)	Shrub cover $\leq$5 feet	C,F	Belt transect, graduated rod

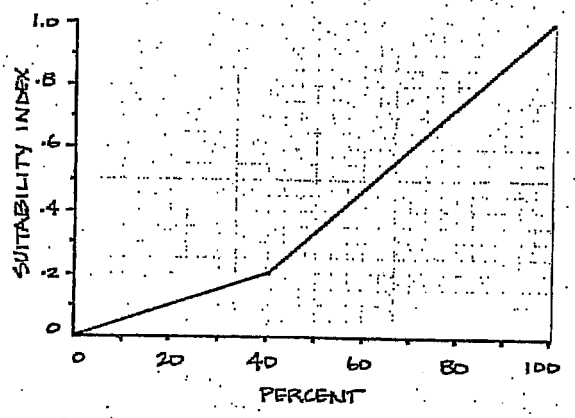

Cover Type
Life Requisite
Habitat variable
Chaparral/
Conifer-chaparral (C)
Digger/Knobcone
pine (F)
Cover/
Reproduction
Shrub cover (V_1)
Shrub cover ≲5 feet (V_2)

Variable 1. Shrub cover - % of ground shaded by a vertical projection of the shrub canopy

Assumes: 1) Dense stands of chaparral needed for optimum conditions.

2) Sample size should include an area of at least 2.0 acres

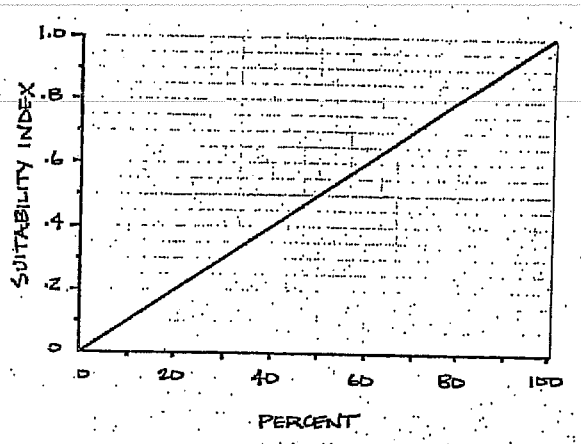
3) 40 percent canopy provides marginal quality and that 100 percent is optimum



Variable 2. Shrub cover ≤5 feet

Assumes: 1) Most nests are located within 1-4 feet from the ground.

2) Some additional height is needed for overhead protection.



Equation Used to Calculate Suitability Indices

Cover/Reproduction: $V_1 \times V_2$

HSI determination

Cover/reproduction was the only life requisite considered in this model, and the HSI for the wrentit is equal to the life requisite value for cover/reproduction.

General Assumptions

Overview

This model uses the reproductive habitat needs of the wrentit to determine overall habitat quality. It is assumed that cover needs are met by reproductive habitat needs and that neither food nor water will be more limiting than the wrentit's cover/reproductive needs. All of the life requirements of the wrentit can be provided in chaparral and other dense brush.

Cover/ reproduction component

Optimal nesting habitat for the wrentit is provided in moderately tall, dense stand of chaparral (Bent 1968, Small 1974). Dense stands of chaparral provides maximum protection for feeding and nesting. As such, it is assumed that optimal habitat contains 100 percent or greater of shrub crown canopy. Studies indicate that most of the nesting occurs between 1 and 4 feet off the ground and only occasionally have nests been found up to 7 feet from the ground (Bent 1968). Most of the wrentit's existence is spent beneath the crown foliage of brush not more than 5 feet from the ground (Bent 1968). Studies indicate that most of the life requisites of the wrentit are provided within an area ranging in size from 0.2 to 1.2 ha (0.5 to 3.0 acres) (Cogswell 1962, Bent 1968, Erickson 1938).

Literature Cited

Bent, A.C. 1948. Life histories of North American nuthatches, wrens, thrashers, and their allies. U.S. Natl. Mus. Bull. 196. 475 pp.

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Erickson, M.M. 1938. Territory, annual cycle, and numbers in a population of wrentits (Chamaea fasciata). Univ. California Publ. Zool. 42: 247-334

Harrison, H.H. 1979. A field guide to western birds nests, Houghton Mifflin Co. Boston.

Small, A. 1974. The Birds of California. Collier Macmillan Pub. Co., New York

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Shasta C

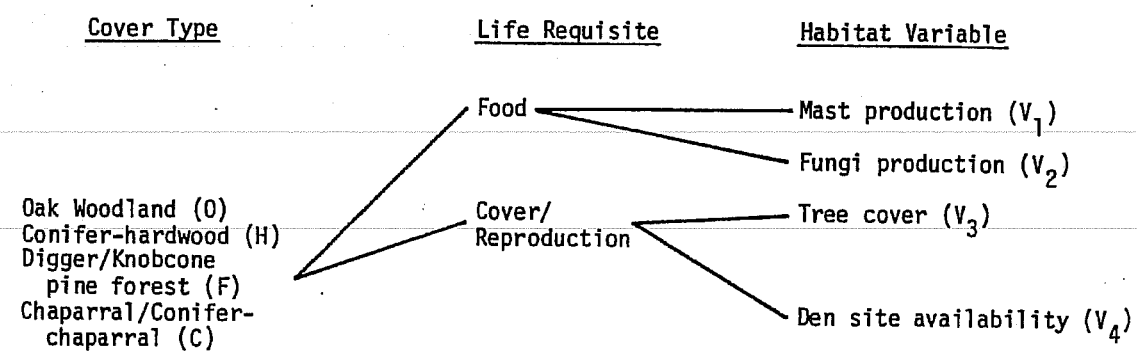
DRAFT HABITAT SUITABILITY INDEX MODEL
WESTERN GRAY SQUIRREL (*Sciurus griseus*)

U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, CA

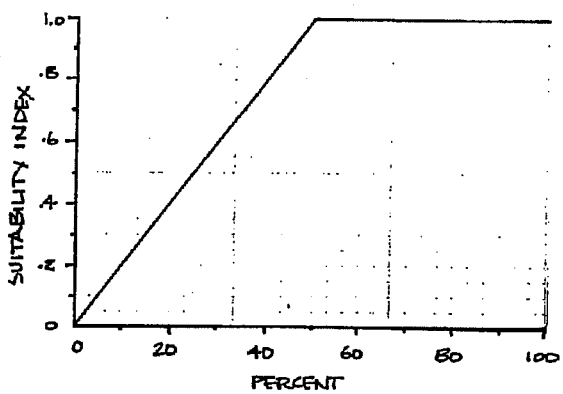
September 1984

Squirrel

VARIABLE	COVER TYPES	SUGGESTED TECHNIQUE
(V_1) Mast production - % canopy closure of trees > 5 m (16.5 ft) tall and shrubs that produce hard mast	O,H,F,C	Line intercept
(V_2) Fungi production - estimate of density of leaf litter layer	O,H,F,C	Ocular estimate along line intercept
(V_3) Tree cover - % of ground surface shaded canopies of all woody vegetation > 5 m (16.5 ft) in height	O,H,F,C	Line intercept
(V_4) Den site availability - number of trees per acre with dbh ≥38.1 cm (15 in).	O,H,F,C	Belt transect, diameter tape



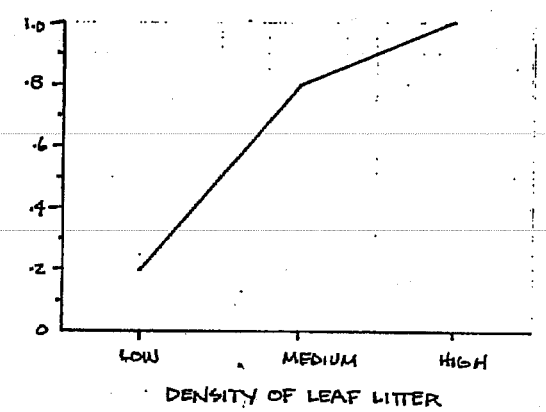
Variable 1. Hard mast production - % canopy closure of trees ≥ 5 m (16.5 ft) tall and shrubs that produce hard mast (e.g. oaks and conifers).



Assumes: 1) Optimum density of hard mast trees is between 40 - 100% canopy closure (derived from Shimamoto and Airola, 1981).

2) Trees ≤ 5 m (16.5 ft) tall will not produce significant mast (Allen, 1982).

Variable 2. Fungi production - an estimate of the density of the leaf litter layer.



Assumes: 1) Hypogeous fungi is a major component of the western gray squirrel diet (Stienecker, 1977).

2) Fungi is related to the amount of organic material (represented by leaf litter) in the uppermost soil layers (SCS, 1980).

Density of Leaf Litter (from SCS, 1980):

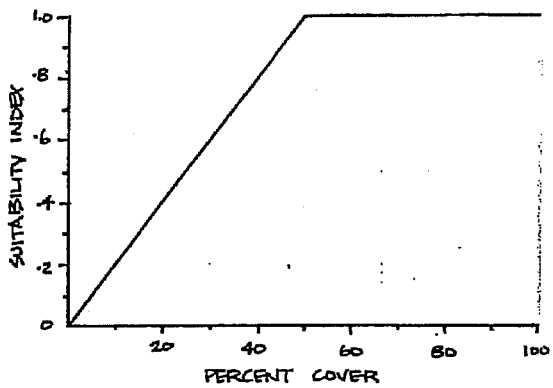
High - leaf litter is abundant with thick identifiable layers of leaves over mulch.

Medium - leaf litter is moderately abundant with low to moderate separation of leaf-mulch layers.

Low - leaf litter scarce with very thin leaf - mulch layer; little or no separation.

Variable 3. Tree cover - % of ground surface shaded by vertical projection of canopies of all woody vegetation ≥ 5 m (16 ft.) tall

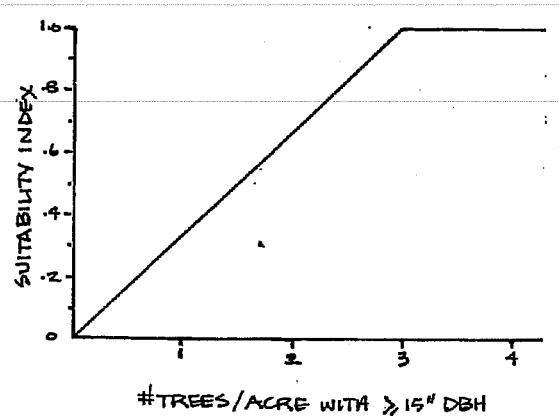
Assumes: 1) Optimum conditions occur when tree cover ranges from 40 to 100% (derived from Shimamoto and Airola, 1981).



Variable 4. Den site availability - number of trees per acre with dbh ≥ 38.1 cm (15 in)

Assumes: 1) Western gray squirrels most often utilize oak, cottonwoods, maples, conifers, and sycamores for den sites (Ingles, 1947).

2) Optimum den sites are provided by trees having an average dbh of 15 inches (Shimamoto and Airola, 1981).



Squirrel

Equations Used to Calculate Suitability Indices

a) Food:

Cover Type	Equation
O,H,F,C	$(V_1 \times V_2)^{\frac{1}{2}}$

b) Cover/Reproduction:

Cover Type	Equation
O,H,F,C	$(V_3 \times V_4)^{\frac{1}{2}}$

HSI Determination:

1) The minimum habitat area equals the mean minimum home range. If habitat area is less than one acre, the HSI value equals zero. (Ingles, 1947).

2) The HSI for the western gray squirrel will equal the lowest of the values for the food and cover/reproduction component.

Literature Cited

Allen, A.W. 1982. Habitat Suitability index models. Gray squirrel. FWS/OBS (WELUT) - 82/10.19. 11 pp.

Ingles, L.G. 1947. Ecology and life history of the California gray squirrel. Calif. Fish and Game 33(3):139-158.

Shimamoto, K. and D. Airola. 1981. Fish and wildlife habitat capability models and special habitat criteria for the northeast zone national forests. U.S. Forest Service publ. 260 pp.

Soil Conservation Service. 1980. Draft habitat suitability index model - western gray squirrel - Ecoregion 2610 - Central Valley. 15 pp.

Steinecker, W.F. 1977. Supplemental data on the food habits of the western gray squirrel. Calif. Fish and Game 56(1):36-48.

APPENDIX B

AMERICAN RIVER WATERSHED INVESTIGATION
FOLSOM DAM BRIDGE PROJECT, CALIFORNIA

ENDANGERED SPECIES CONSULTATION

MAY 2005

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
1-1-05-F-0108

MAY 4 2005

Mark C. Charlton
Chief, Planning Division
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Subject: Endangered Species Section 7 Consultation for the U.S. Army Corps of Engineers' *Proposed Material Borings for the Folsom Bridge Project*, Sacramento County, California

Dear Mr. Charlton:

This letter is in response to your April 11, 2005, letter requesting formal consultation with the U.S. Fish and Wildlife Service (Service) on the U.S. Army Corps of Engineers' (COE) proposed material borings (proposed project) to determine the material conditions and engineering properties associated with the bridge construction. This is considered the initial phase of the larger Folsom Bridge project within Sacramento County, California. Your letter was received in this office on April 14, 2005. Elderberry shrubs are the sole host plant for the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle). In accordance with section 7 of the Endangered Species Act of 1973, as amended (Act), this document represents the Service's biological opinion of the effects of the proposed action on the threatened beetle.

Our analysis of potential effects to the valley elderberry longhorn beetle is based on the following information: (1) the COEs' April 11, 2005 letter describing the proposed project; (2) several site visits and meeting that occurred between March 7 and April 14, 2005 with COE and Service biologists; (3) the Services informal consultation (Service Ref. No.1-1-05-I-0565) on the proposed soil borings for the same project; (4) the Service's 1999 *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* (Guidelines); and (5) other information available to the Service.

TAKE PRIDE IN AMERICA

Consultation History

January 31, 2005. Consultation for the Proposed Soil Borings and Auger Borings Associated with the Folsom Dam Bridge Bypass, Sacramento County, California. (Service Ref. No. 1-1-05-I-0565)

February 22, 2005. Service and COE staff conducted a site visit to proposed boring locations and access roads.

March 7, 2005. Biologists from the COE, Jane Rinck and Becky Victorine and the Service Doug Weinrich and Stephanie Rickabaugh, conducted Habitat Evaluation Procedures (HEP) and surveyed elderberry shrubs at the proposed project site.

March 24, 2005. The Service received a letter from the COE requesting formal Section 7 consultation on the proposed material borings for the *Folsom Bridge project, Sacramento, California.* The letter was received by the Service on March 24, 2005.

March 25, 2005. Jane Rinck, telephoned Doug Weinrich and stated that changes were being made to the project description outlined in the March 24, 2005 consultation letter. During that telephone call, it was agreed the COE would send a new letter initiating Section 7 consultation with the new project description.

April 14, 2005. Service and COE staff confirmed a minor change in a boring location would not have direct impacts on elderberry shrubs.

April 14, 2005. The Service received a letter from the COE requesting formal Section 7 consultation on the proposed material borings for the *Folsom Bridge Project, Sacramento, California.* The letter was dated April 11, 2005.

April 27, 2005. The Service received an electronic letter from the COE clarifying the compensation for the proposed *Material Boring project* and their request to defer some of the compensation to be included in the proposed *Folsom Bridge project.* A follow up telephone conversation between Jane Rinck, COE and Stephanie Rickabaugh, FWS further clarified the compensation numbers stated in the electronic letter.

BIOLOGICAL OPINION

Description of the Proposed Action

In 1992 a temporary bridge across the American River was authorized, as part of the American River Watershed Project. The temporary bridge was analyzed in the *Long Term Study Final Supplemental Plan Formulation Report/ Environmental Impact Statement (EIS)/Environmental Impact Report (EIR).* However, the COE, Sacramento District, has recently been authorized by Congress to construct a permanent bridge that spans the American River below Folsom Dam.

A draft EIS/EIR, containing a full description and analysis of the permanent bridge project alternatives is expected to be completed by August 2005.

As part of the initial phase of the permanent bridge project, the COE is requesting consultation on the material borings to determine the material conditions and engineering properties for use in the subsequent bridge construction. The boring work is scheduled to begin April 18, 2005, and would be completed by the end of June 2005.

The material borings would include 16 core boring and 20 auger borings. Borings would be done on the west and east sides of the American River just below the Folsom Dam spilling basin. The core borings would be about 75 feet deep and take about three days per hole to complete. Core borings No. 1 through No. 8 would be done with equipment mounted on a truck; borings No. 9 and No. 10 would likely be done with equipment brought in with a helicopter or a skid rig. The auger borings would be about 20 feet deep, and about three holes would be completed in one day. The auger borings would be done with either truck- or track-mounted equipment. One to two additional vehicles would accompany the boring equipment.

Access to the boring sites on the north side of the river would be via existing dirt and paved roads and trails. The equipment for two of the core borings, No. 7 and No. 8, would be brought in by helicopter. On the south side of the river, some new access roads would be needed. For core borings No. 11 and No. 12, a temporary trail would be cut through an areas of annual grassland, thus no woody vegetation would be affected.

Access to core borings No. 9 and No. 10 would require construction of a new road. The new road would be about 500 feet in length; start and connect with an existing dirt road on Folsom Prison property. The road would be constructed using a Cat D-6 dozer or similar sized equipment. Some cut and fill would be required for the road construction but it will follow an existing terrace. The road would be a level width of 8 feet. Efforts would be made to keep the disturbance of the surrounding area to a minimum.

On the south side of the river, there are 14 elderberry shrubs within 100 feet of the new access road that would be constructed to access borings No. 9 and No. 10. These shrubs would be indirectly affected by the boring road construction; however, two of these shrubs (P22 and P23) would be directly affected by the construction of the proposed bridge project.

On the north side of the river, there is one elderberry shrub (#302) within 100 feet of the proposed boring work. This shrub would be within 75 feet of core boring activities. This shrub has a total of 13 stems over 1 inch in diameter with no exit holes. All of the equipment and activities would remain 75 feet from the shrub. However, this shrub would be directly affected by the proposed bridge project, and field surveys have determined that this shrub could not be transplanted because of the severe slope and/or large shrub size.

All 15 shrubs are in non-riparian habitat based on their location. They are high up on steep, north facing, rocky slopes where water drainage from above and is kept to the surface by the rocks; at no point would these shrubs be inundated by floodwaters along the American River.

The river does not appear to be influencing the shrubs found along this section of hillside. No exit holes were found on any of these shrubs.

The COE proposes to compensate for adverse affects from the proposed material borings project at a rate 3.5x the normal compensation because the work is being done during the beetle's flight period when the beetles are vulnerable to dust and disturbance. However, the COE requests that the compensation for the three shrubs directly affected by the proposed bridge project be included in the subsequent bridge consultation. This subsequent compensation for the three shrubs has been agreed to by the Service.

Proposed Minimization Measures

For Direct and Indirect Effects:

1. Complete avoidance (*i.e.*, no adverse effects) will be achieved whenever possible, using a 100-foot (or wider) buffer established and maintained around elderberry plants containing stems measuring 1.0 inch or greater in diameter at ground level. Firebreaks may not be included in the buffer zone. In buffer areas, construction-related disturbance will be minimized, and any damaged area will be promptly restored following construction. The Service will be consulted before any additional disturbances within the buffer area are undertaken. In addition, the Service will be provided with a map identifying the avoidance area and written details describing avoidance measures.

2. All elderberry areas to be avoided during construction activities will be fenced and flagged. In areas where encroachment into the 100-foot buffer has been approved by the Service, a minimum buffer setback of at least 20 feet will be provided from the dripline of each elderberry plant.

3. Work crews and contractors will be given environmental awareness training that will emphasize the identification of elderberry shrubs and the need to avoid damaging the elderberry shrubs and the possible penalties of non-compliance.

4. Water trucks and/ or hoses with portable pumps will be used to control fugitive dust during road construction.

5. Signs will be erected every 50 feet along the edge of the avoidance area with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines, and imprisonment." The signs should be clearly readable from a distance of 20 feet and will be maintained throughout the construction period.

Restoration and Maintenance Measures

1. Any adverse effects to the buffer area (within 100 feet of elderberry shrubs) during construction will be restored. Erosion control and revegetation with appropriate native plants will be provided for the affected areas.

2. After construction, if appropriate, buffer areas will continue to be protected from the adverse effects of the project. Appropriate measures will include fencing, weeding, posting signs, and removing trash.

3. Associated native plants will be planted in the same area as elderberry seedlings.

4. No insecticide, herbicides, fertilizers, or other chemicals that might harm the elderberry shrub or the beetle will be used within 20 feet of any elderberry shrub with one or more stems measuring 1.0 inch or greater in diameter at ground level.

5. A written description of the restoration, protection, and maintenance of the adversely affected areas will be provided to the Service within 30 days of construction completion.

Elderberry plants for which impacts cannot be avoided shall be compensated for, at a rate 3.5x the normal rate and following the criteria set forth in Table 1 of the Guidelines, as modified by the Service. These guidelines provide for transplanting and planting of elderberries, as well as planting of associated riparian vegetation.

Status of the Species/Environmental Baselines

Valley Elderberry Longhorn Beetle

The beetle was federally listed as a threatened species on August 8, 1980 (45 FR 52803). Critical habitat for the species was designated for this animal. Two areas along the lower American River in the Sacramento metropolitan area have been designated as critical habitat for the beetle– one along the American River at Goethe and Ancil Hoffman parks (American River Parkway Zone) about 10 miles upstream from the river's mouth and another at the Sacramento Zone, an area about 2 miles upstream from the river's mouth and about 0.5-mile northeast of the river's right-bank (downstream aspect) levee. In addition, an area along Putah Creek in Solano County and an area west of Nimbus Dam along the American River Parkway, Sacramento County, are designated as essential habitat in the *Valley Elderberry Longhorn Beetle Recovery Plan* (Service 1984). Each of these areas is known to support large numbers of mature elderberry shrubs with evidence of beetle use.

The beetle depends on its host plant, the elderberry shrub. Elderberries are locally common components of the remaining riparian forest and savannah landscapes, and to a lesser extent the mixed chaparral-foothill woodlands, of the Central Valley. Use of elderberry shrubs plants by the beetle, a wood borer, is rarely apparent. Frequently, the only exterior evidence of the shrub's use by the beetle is an exit hole created by the larva emerging just prior to the pupal stage.

Observations of elderberry shrubs along the Cosumnes River and in the Folsom Lake area indicate that larval beetles can be found in elderberry stems with no apparent exit holes; the larvae either succumb prior to constructing an exit hole or not developed sufficiently to construct one. Larvae appear to be distributed in stems which are 1.0 inch or greater in diameter at ground level and can occur within both living and dead stems. The *Valley Elderberry Longhorn Beetle Recovery Plan* (Service 1984) and Barr (1991) further describe the beetle's life history.

Beetle densities are probably naturally low (Service 1984); and it has been suggested, based on the spatial distribution of occupied shrubs (Barr 1991), that the beetle is a poor disperser. Low density and limited dispersal capability result in high vulnerability to the negative effects of habitat fragmentation and the resulting isolation of small sub-populations.

When the beetle was initially listed as threatened, the species was known from less than 10 localities along the American and Merced Rivers, and Putah Creek. By completion of the *Valley Elderberry Longhorn Beetle Recovery Plan* in 1984, additional species localities had been found along the American River and Putah Creek. And by 1998, the California Natural Diversity Database (CNDDB) had catalogued 181 occurrences for this species in 44 drainages throughout the Central Valley; these occurrences ranged from the Sacramento River in Shasta County southward to an area along Caliente Creek in Kern County (CNDDB 1998). Additional CNDDB occurrences have been recorded between 1998 and 2003. Although the beetle continues to be threatened by long-term habitat loss and fragmentation due to extensive urbanization and land-use conversions throughout its range, relatively new threats included destruction by non-native Argentine ants (*Linepithema humile*), mortality due to pesticide drift, competition due to exotic plant invasions and the various adverse effects arising from livestock grazing.

Habitat loss has been ranked as the single greatest threat to biodiversity in the United States (Wilcove *et al.* 1998). In the 1980 final rule to list the beetle as threatened, habitat destruction was cited as the primary factor contributing to the need to federally list the species. As described in the final rule, by the time the species was listed, its habitat had largely disappeared throughout much of its former range, due to such factors as agricultural conversions, levee construction and stream channelization. The 1984 recovery plan reiterated the primary threats to the beetle as: loss and alteration of habitat by agricultural conversions; grazing; levee construction; stream and river channelization; removal of riparian vegetation; riprapping of shorelines; and recreational, industrial and urban development (Service 1984).

Riparian forests, the primary habitat for the beetle, have been severely depleted throughout the Central Valley over the last 2 centuries as a result of expansive agricultural and urban development (Katibah 1984; Thompson 1961; Roberts *et al.* 1977). Since human colonization, these forests have been "...modified with a rapidity and completeness matched in few parts of the United States" (Thompson 1961). As of 1849, the rivers and larger streams of the Central Valley were still largely undisturbed, supporting continuous bands of riparian woodland 4-5 miles in width along some major drainages such as the lower Sacramento River and generally about 2 miles wide along the lesser streams (Thompson 1961). Most of the riverine floodplains supported riparian vegetation to about the 100-year flood elevation level (Katibah 1984). A large human population influx after 1849, however, resulted in Central Valley riparian habitat being

rapidly converted to agriculture and used as a source of wood for fuel and construction over a wide area (Thompson 1961). By 1868, riparian woodland had already been severely impacted in the Central Valley, as evidenced by the following excerpt:

> "This fine growth of timber which once graced our river (Sacramento), tempered the atmosphere, and gave protection to the adjoining plains from the sweeping winds, has entirely disappeared - the woodchopper's axe has stripped the river farms of nearly all the hard wood timber, and the owners are now obliged to rely upon the growth of willows for firewood." (Cronise 1868, *in* Thompson 1961).

The clearing of riparian forests for fuel and construction also made this land available for agriculture (Thompson 1977). Natural levees bordering the rivers, once supporting vast tracts of riparian habitat, became prime agricultural land (Thompson 1961, 1977). As agriculture expanded in the Central Valley, needs for increased water supply and flood protection spurred water development and reclamation projects. Artificial levees, river channelization, dam building, water diversion, and heavy groundwater pumping further reduced riparian habitat to small, isolated fragments (Katibah 1984). In recent decades, these riparian areas have continued in decline, as a result of ongoing agricultural conversion as well and urban development and stream channelization. As of 1989, there were over 100 dams within the Central Valley drainage basin and thousands of miles of water delivery canals and streambank flood control projects for irrigation, municipal and industrial water supplies; hydroelectic power; flood control; navigation; and recreation (Frayer *et al.* 1989). As a result, much of the riparian forests in the Central Valley have dwindled to discontinuous, unconnected narrow strips with widths measurable in feet compared to the former miles.

By some estimates, the Sacramento Valley once supported about 775,000-800,000 acres of riparian forest as recently as 1848 (Smith 1977; Katibah 1984). No comparable estimates are available for the San Joaquin Valley. Based on early soil maps, however, more than 921,000 acres of riparian habitat are estimated to have been present throughout the Central Valley under pre-settlement conditions (Katibah 1984). Another source estimates that of about 5.0 million acres of wetlands in the Central Valley in the 1850s, about 1.6 million acres were riparian wetlands (Warner 1985; Frayer *et al.* 1989).

Based on a California Department of Fish Game (CDFG) riparian vegetation distribution map, by 1979 there were about 102,000 acres of riparian vegetation remaining in the Central Valley. This represents a decline in acreage of about 89 percent as of 1979 (Katibah 1984). Significant losses were also estimated by Frayer *et al.* (1989), who reported that woody riparian forests in the Central Valley had declined to 34,600 acres by the mid-1980s (from 65,400 acres in 1939). These studies document the dramatic historic loss trend of riparian habitat in the Central Valley in general. And because the beetle's habitat is a key component of riparian habitat, it is a reasonable conclusion that loss of beetle habitat has been equally as dramatic.

A number of studies have focused on riparian loss along the Sacramento River, which supports some of the densest known populations of the beetle. About 98 percent of the middle Sacramento River's historic riparian vegetation is estimated to have been extirpated by 1977

(California Department of Water Resources 1979). It has been estimated that native riparian habitat along the Sacramento River from Redding to Colusa decreased from 27,720 acres to 18,360 acres (-34 percent) in just 2 decades from 1952 and 1972 (McGill 1975; Conrad *et al.* 1977). The average rate of riparian loss on the middle Sacramento River was 430 acres per year during this 2-decade period and 410 acres per year from 1972 to 1977. In 1987, riparian areas as large as 180 acres were observed to have been converted to orchards along this river reach (McCarten and Patterson 1987).

No comparable information exists on the historic loss of beetle habitat in non-riparian situations, such as elderberry savanna and other vegetation communities where elderberry occurs (*e.g.*, oak or mixed chaparral-woodland, or grasslands, adjacent to riparian habitat). However, all natural habitats throughout the Central Valley have been heavily impacted within the last 200 years (Thompson 1961) and we can therefore assume that non-riparian beetle habitat also has suffered a widespread decline. This analysis focuses on loss of riparian habitat, because the beetle is primarily dependent upon riparian habitat. Nevertheless, adjacent upland areas are also likely to be important for the species (Huxel pers com 2000), but this upland habitat typically consist of oak woodland or elderberry savanna bordering willow riparian habitat (Barr 1991). The riparian acreage figures given by Frayer *et al.* (1989) and Katibah (1984) included the oak woodlands concentrated along major drainages in the Central Valley and, therefore, probably included lands we would classify as upland habitat for the beetle adjacent to riparian drainages.

Between 1980 and 1995, human population growth in the Central Valley was about 50 percent, while the remainder of California grew by 37 percent. The Central Valley's population totaled 4.7 million by 1999, and it is expected to more than double again by 2040. The American Farmland Trust estimates that by 2040 more than 1 million cultivated acres will be lost and 2.5 million more put at risk (Ritter 2000) through urbanization related to population growth. The rapidly expanding human populations of the Central Valley will likely result in continued pressure on riparian habitat, related elderberry shrubs, and the beetle. As evidence, the Sacramento Office of the Service presently receives a number of requests each month for consultation on the beetle under section 7 of the Endangered Species Act.

While habitat loss is clearly a large factor leading to the species' decline, other factors may also pose significant long-term threats to the beetle's survival. Only about 20 percent of riparian sites with elderberries observed by Barr (1991) and Collinge *et al.* (in prep.) support beetle populations (Barr 1991; Collinge *et al.* in prep.). Jones and Stokes (1988) found that only 65 percent of 4,800 riparian acres on the Sacramento River had evidence of beetle presence. The fact that a large percentage of apparently suitable habitat is unoccupied suggests that the beetle is limited by other factors such as its limited dispersal ability, habitat quality, or habitat fragmentation.

Massive destruction of riparian habitat in central California has clearly resulted in not only a loss of acreage, but severe habitat fragmentation. Fahrig (1997) indicated that habitat fragmentation becomes most important for those habitats that have suffered greater than 80 percent loss. Riparian habitat in the Central Valley, which has experienced greater than 90 percent loss by most estimates, exceeds this criterion. Existing data suggests that beetle populations are affected

by such habitat fragmentation. Barr (1991) found that small, isolated habitat remnants were less likely to be occupied by beetles than larger patches, indicating that beetle sub-populations are often extirpated from small remaining habitat fragments. Moreover, Barr (1991) and Collinge *et al.* (in prep.) consistently found beetle exit holes occurring in clumps of elderberry bushes rather than isolated bushes, suggesting that isolated shrubs are less viable host habitat for this species.

Habitat fragmentation such as now occurs can be an important factor contributing to a species' decline because: (1) it divides a large population into two or more small populations that become more vulnerable to direct loss, inbreeding depression, genetic drift, and other problems associated with small populations; (2) it limits a species' potential for dispersal and colonization; and (3) it makes habitat more vulnerable to outside influences by increasing the edge:interior ratio (Primack 1998).

Small, isolated sub-populations are susceptible to extirpation from random demographic, environmental or genetic events (Shaffer 1981, Lande 1988, Primack 1998). While a large area may support a single large population, the smaller sub-populations that result from habitat fragmentation may not be large enough to persist over the long-term. As a population becomes smaller, it tends to lose genetic variability through genetic drift, leading to inbreeding depression and a lack of adaptive flexibility. Smaller populations also become more vulnerable to random fluctuations in reproductive and mortality rates, and are more likely to be extirpated by random environmental factors.

Species that characteristically have small population sizes, such as large predators or habitat specialists, are more likely to become extinct than species that typically have large populations (Primack 1998). Also, a species with low population density (few individuals per unit area) tends to have only small populations remaining if its habitat is fragmented. Populations of species that naturally occur at lower density become extinct more rapidly than do those of more abundant species (Bolger *et al.* 1991). The species may be unable to persist within each fragment and thus gradually dies out across the landscape.

The beetle, a specialist on elderberry plants, tends to have small population sizes, and to occur in low densities (Barr 1991; Collinge *et al.* in prep.). Collinge *et al.* (in prep.) compared resource use and density of exit holes between the beetle and a related subspecies, the California elderberry longhorn beetle (*Desmocerus californicus californicus*). The beetle tended to occur in areas with higher elderberry densities, but had lower exit hole densities than the California elderberry longhorn beetle. With extensive riparian habitat loss and fragmentation, these naturally small populations are broken into even smaller, isolated populations. Once a small population has been extirpated from an isolated habitat patch, the species may be unable to re-colonize this patch.

Insects with limited dispersal and colonization abilities may persist better in large habitat patches than small patches because small fragments may be insufficient to maintain viable populations and the insects may be unable to disperse to more suitable habitat (Collinge 1996).

Some studies suggest that the beetle is unable to recolonize drainages where the species has been extirpated, because of its limited dispersal ability (Huxel in prep.; Barr 1991; Collinge *et al.* in prep.). Huxel (in prep) used computer simulations of colonization and extinction patterns for the beetle based on differing dispersal distances and found that the short dispersal simulations best matched the 1997 census data in terms of site occupancy. This suggests that in natural-system

dispersal recolonization is limited to nearby sites. At spatial scales greater than 10 km., such as across drainages, beetle occupancy appears to be strongly influenced by regional extinction and colonization processes, and colonization is constrained by limited dispersal (Collinge *et al.* in prep.).

Except for one occasion, drainages examined by Barr (1991) that were occupied in 1991 remained occupied in 1997 (Collinge *et al.* in prep.). The one exception was Stoney Creek, which was occupied in 1991, but not in 1997. All drainages found by Barr (1991) to be unoccupied in 1991 were also unoccupied in 1997. This data suggests that drainages unoccupied by the beetle remain unoccupied.

In addition, recent evidence indicates that the invasive Argentine ant poses a risk to the long-term survival of the beetle. Surveys along Putah Creek found beetle presence where Argentine ants were not present or had recently colonized, but the beetle was absence from otherwise suitable sites where Argentine ants had become well-established (Huxel, in prep.). The Argentine ant has already negatively impacted populations of other native arthropod species (Holway 1998; Ward 1987). Predation on eggs, larvae, and pupae are the most likely impacts these ants have on the beetle. In Portugal, Argentine ants have been found to be significant egg predators on the eucalyptus borer, a cerambycid similar to the beetle. Egg predation on the beetle could lead to local extirpations, as indicated by a population viability study suggesting that egg and juvenile mortality are significant factors affecting probability of extinction for the beetle (Huxel and Collinge, in prep.). The Argentine ant has been expanding its range throughout California since its introduction around 1907, especially in riparian woodlands associated with perennial streams (Holway 1998; Ward 1987). Huxel (in prep.) concluded that, given the potential for Argentine ants to spread with the aid of human activities such as movement of plant nursery stock and agricultural products, this species may come to infest most drainages in the Central Valley along the valley floor, where the beetle is found.

Another potential harmful factor for the beetle is direct spraying with pesticides and related pesticide drift. A wide range of such spraying is done to control mosquitoes, crop diseases, and undesirable plants and insects. Although there have been no studies specifically focusing on the direct and indirect effects of pesticides, on the beetle, evidence suggests that the species may be adversely affected by some pesticide applications. As of 1980, the prevalent land-use adjacent to riparian habitat in the Sacramento Valley was agriculture, even in regions where agriculture was historically not generally the most common land use (Katibah *et al.* 1984), therefore the species is likely vulnerable to pesticide contamination from an array of agricultural pesticide application practices. Recent studies of major rivers and streams documented that 96 percent of all fish, 100 percent of all surface water samples and 33 percent of major aquifers contained one or more pesticides at detectable levels (Gilliom 1999). Pesticides were identified as one of the 15 leading

causes of impairment for streams included on the Clean Water Act section 303(d) lists of impaired waters. Because the beetle occurs primarily in riparian habitat, the contamination of rivers and streams likely has affects on this species and its habitat. Pesticides have been identified as one of a number of potential causes of pollinator species' declines and declines of other insects beneficial to agriculture (Ingraham *et al.* 1996); therefore, it is likely that the beetle, typically occurring adjacent to agricultural lands, has harmful effects due to pesticides.

Also, competition from invasive exotic plants, such as giant reed (*Arundo donax*), negatively affects riparian habitat supporting the beetle. Giant reed, a native of Asia, has become a serious problem in California riparian habitats, forming dense, homogenous stands essentially devoid of wildlife. Giant reed can grow up to 2.5 inches per day and yield 8.3 tons of oven-dry cane per acre; it also tolerates drought, floods, and extreme temperatures, and is not significantly affected by insects, disease, herbivory, fire, or mechanical disturbance. It has an extensive root system allowing it to resprout rapidly after any disturbance and it easily out-competes native riparian vegetation. Giant reed also introduces a frequent fire cycle into the riparian ecosystem, disrupting natural riparian dynamics and eventually forming homogenous climax communities. Although giant reed has become extensively distributed throughout the Central Valley and along its waterways, the extent to which it has negatively affected elderberries and the beetle is not specifically known

Another potential factor in the beetle's decline is the effects of adverse livestock grazing practices, which can result in destruction of entire elderberry plants and inhibition of elderberry regeneration. Cattle, sheep and goats readily forage on new elderberry growth, and goats will consume even decadent growth. Well-manicured stands of elderberries, such as occurs due to livestock grazing, have generally been shown to have a relative absence of beetles (Service 1984). The effects on the beetle of both grazing and exotic plant invasions are likely significantly exacerbated by the problem of habitat fragmentation of elderberries. Such fragmentation increases the edge:interior ratio of habitat patches, thereby facilitating the adverse effects of these outside influences.

The American River Zone is considered essential habitat for the recovery of the valley elderberry longhorn beetle. The project site contains several elderberry shrubs with stems one inch in diameter at ground level. Therefore, given its biology and ecology, the presence of suitable habitat, the Service has concluded the beetle likely inhabits the action area.

EFFECTS OF THE PROPOSED ACTION

Biologists from the COE and the Service conducted surveys for the presence of the beetles, exit holes, and elderberry shrubs in the project area on December 22, 2004, March 10, 2005, and April 4, 2005. Results of the surveys indicated that construction activities in the areas could affect a total of 15 elderberry shrubs with at least one stem greater than or equal to 1 inch in diameter at ground level. This includes all shrubs within the 100-foot buffer area required by the Service. These shrubs would be indirectly affected by dust or vibration from construction

activities within the buffer zone. Additionally, beetle nurseries and mating behaviors would also be indirectly affected. Therefore, the Service has determined that the proposed material borings will have adverse effects to elderberry shrubs and therefore, the beetle.

All 15 shrubs would be indirectly affected by the temporary access road construction activities and the borings, however, 3 of those shrubs are also expected to be directly affected by the proposed bridge construction, scheduled to begin in 2006. The COE proposes to compensation at a rate 3.5x the normal compensation rate and be applied in the form of elderberry seedlings and associated native plants as directed in the Guidelines. The compensation for the three shrubs expected to be directly affected by the bridge construction will be deferred until the bridge consultation is conducted. This deferment does not change or lessen the compensation required. Table 1 and Table 2 summarize all the compensation required for the proposed material borings project.

Table 1. Compensation for indirect affects of the proposed Material Borings project.

Location	Stems (maximum diameter at ground level)	Exit Hole on Shrub (Yes or No)	Elderberry Seedling Ratio	Associated Native Plant Ratio	Number of Stems Observed	Required Elderberry Plantings	Required Associated Native Plant Plantings
Non-riparian	stems ≥1" & ≤3"	No	3.5:1	1:1	2	7	2
Non-riparian	stems >3" & <5"	No	7:1	1:1	7	49	14
Non-riparian	stems ≥5"	No	10.5:1	1:1	21	220.5	63
Total					30	276.5	276.5
Total Elderberry shrubs affected					15		
Compensation area required for the plantings based on the 3.5x normal compensation rate						2.285	

Table 2. Compensation for indirect affects of the proposed Material Borings that will be deferred and included in the proposed upcoming bridge project.

Location	Stems (maximum diameter at ground level)	Exit Hole on Shrub (Yes or No)	Elderberry Seedling Ratio	Associated Native Plant Ratio	Number of Stems Observed	Required Elderberry Plantings	Required Associated Native Plant Plantings
Non-riparian	stems ≥1" & ≤3"	No	3.5:1	1:1	8	28	28
Non-riparian	stems >3" & <5"	No	7:1	1:1	2	14	14
Non-riparian	stems ≥5"	No	10.5:1	1:1	7	73.5	73.5
Total					17	115.5	115.5
Total Elderberry shrubs affected					3		
Compensation area required for the plantings based on the 3.5x normal compensation rate.						0.955	

Mitigation for the proposed project would occur at the American River Watershed Project mitigation site (Rossmoor Site) along the lower American River in accordance with the Guidelines.

Cumulative Effects

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

Continued human population growth in the Central Valley, in general, and the Sacramento area, in particular, is expected to drive further development of agriculture, cities, industry, transportation, and water resources in the foreseeable future. Some of these future activities will not be subject to Federal jurisdiction (and thus are considered to enter into cumulative effects), and are likely to result in loss of riparian and other habitats where elderberry shrubs and the beetle occur.

Many of activities affecting the beetle involve impacts to elderberry shrubs located within riparian ecosystems adjoining or within jurisdictional wetlands. These projects will be evaluated via formal consultation between the Service and the COE via the Federal nexus provided by section 404 of the Clean Water Act.

A number of projects have no need to discharge dredged or fill material into waters of the U.S. These projects, for which no section 404 permit is required, may lack a Federal nexus and thus, move forward absent formal consultation. These projects pose a significant threat to the recovery of the beetle, particularly when they result in the removal of elderberry savannah ecosystems. These foothill/upland landscapes often consist of mixed stands of elderberry shrubs and oak (*Quercus* spp.) trees which are interspersed with open grasslands in a savannah-like arrangement. Elderberry shrubs in these savannah systems often achieve great size, due perhaps to the lack of light competition from broadleaf trees and/or entanglement with California grape (*Vitus californica*) and/or Himalayan blackberry (*Rubus discolor*) vines, as often occurs in riparian communities. Elderberry savannah communities are important in that they represent a large portion of the diverse habitat in which elderberry shrubs occur and because urban sprawl threatens a significant acreage of these systems. This loss of habitat negatively affects the environmental baseline and is difficult to quantify.

Conclusion

After reviewing the current status of the beetle, the environmental baseline for the action area, the effects of the material borings and road construction activities of the proposed project and the cumulative effects, it is the Service's biological opinion that the action, as proposed, is not likely to jeopardize the continued existence of the beetle. Critical habitat has been designated for the beetle but none exists in the action area; therefore, no beetle critical habitat will be adversely modified or destroyed.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act, provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are nondiscretionary for listed species in this opinion and must be implemented by the COE in order for the exemption in section 7(o)(2) to apply. The COE has a continuing duty to regulate the activity that is covered by this incidental take statement. If the Federal agency (1) fails to adhere to the terms and conditions of the incidental take statement, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

Amount or Extent of Take

Valley Elderberry Longhorn Beetle

The Service expects that incidental take of the beetle will be difficult to detect or quantify. The cryptic nature of these species and their relatively small body size make the finding of an injured or dead specimen unlikely. The species occurs in habitats that make them difficult to detect. Due to the difficulty in quantifying the number of beetles that will be taken as a result of the proposed action, the Service is quantifying take incidental to the project as death, injury, harassment, and harm of all beetles inhabiting or otherwise utilizing the 15 elderberry shrubs with stems one inch or greater in diameter at ground level, as described in this biological opinion and the Environmental Assessment.

Effect of the Take

The Service has determined that this level of anticipated take in this opinion is not likely to result in jeopardy to the beetle or result in destruction or adverse modification of its critical habitat.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the effect of the proposed Material Boring Project, as described, on the beetle.

1. The COE shall implement the project as proposed in their April 11, 2005, letter and this biological opinion.

2. Effects of harassment of individual beetles, and of the loss and degradation of the species' habitat shall be minimized.

Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, the COE must ensure that the proposed project complies with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are nondiscretionary.

1. The following terms and conditions implement reasonable and prudent measure one (1):

   a. The COE shall minimize the potential for incidental take of the beetle resulting from the project related activities by implementation of the conservation measures as described in the environmental assessment and the project description of this biological opinion.

   b. The COE shall include a copy of this biological opinion within its solicitations for construction of the project, making the prime contractor responsible for implementing all requirements and obligations included in this biological opinion and to educate and inform all other contractors involved in the project as to the requirements of this biological opinion. A copy of the solicitations containing the biological opinion will be provided to the Chief of Endangered Species (Central Valley) at the Service's Sacramento Fish and Wildlife Office.

2. The following terms and conditions implement Reasonable and Prudent Measure number two (2):

   a. The procedures outlined in the Service's *Conservation Guidelines for the Valley Elderberry Longhorn Beetle* dated July 9, 1999, shall be followed for all actions related to the proposed project unless otherwise stated below.

   b. The establishment of the elderberry and associated native plant seedlings must occur between September 1, 2004 and February 15, 2005.

   c. The COE shall ensure that the elderberry and associated native plant seedlings are established on no less than 2.28 acres at a Service approved site.

   d. As described above the COE maintains responsibility for the deferred compensation of the 33 elderberry planting and 33 associated native plant planting and ensure that they are included in the proposed bridge project.

e. If requested, the COE or their representative shall allow access to the project site by the Service or the California Department of Fish and Game to assess the effects of the project on the beetle.

Reporting Requirements

A post-construction compliance report prepared by the monitoring biologists shall be prepared and forwarded to the Service within 60 calendar days of the completion of construction activity. This report shall detail (i) dates that construction occurred; (ii) pertinent information concerning the success of the Project in meeting compensation and other conservation measures; (iii) an explanation of failure to meet such measures, if any; (iv) known project effects on federally listed species, if any; (v) occurrences of incidental take of federally listed species, if any; and (vi) other pertinent information.

The Service shall be notified immediately by facsimile or telephone and in writing within one (1) working day of any unanticipated take of beetle, and of the take or suspected take of listed wildlife species not authorized in this opinion. Notification must include the date, time, and location of the incident of the incident or of the finding of a dead or injured animal, and any other pertinent information. The Service contact persons are the Chief of the Endangered Species Division, at (916) 414-6600 and the Resident Agent-in-Charge of the Service's Law Enforcement Division at (916) 414-6660.

Any dead or injured beetles must be relinquished to the Service. Any killed species that have been taken shall be properly preserved in accordance with the techniques recommended by the Entomology Department of the California Academy of Sciences. Information concerning how the animal was taken, length of the interval between death and preservation, and any other relevant information should be written on 100% rag content paper with permanent ink and included in the container with the specimen. Preserved specimens shall be delivered to the Service's Division of Law Enforcement at 2800 Cottage Way, Room W-2928, Sacramento, California 95825-1846, phone (916) 414-6660.

Proof of environmental training and fulfillment of compensation requirements shall be delivered to the Chief of the Endangered Species Division, Sacramento Fish and Wildlife Office, 2800 Cottage Way, Room W-2605, Sacramento, California, 95825-1846.

Reporting requirements for the beetle are found in the "Monitoring" section of the 1999 Conservation Guidelines for this species. The reports shall be combined, where applicable, with the reporting requirements for other species and the experimental conservation measures, where appropriate.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities that can

be implemented to further the purposes of the Act, such as preservation of endangered species habitat, implementation of recovery actions, or development of information and data bases.

1. The COE should work with the Service to address significant, unavoidable environmental impacts to federally-listed species approved by local agencies.

2. The COE should assist the Service in the implementation of recovery efforts for the beetle.

In order for the Service to be kept informed of actions minimizing or avoiding adverse effects or benefiting listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION NOTICE

This concludes formal consultation on the Material Borings for the Folsom Bridge Project. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals that the agency action may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

If you have any questions regarding this biological opinion please contact Stephanie Rickabaugh or the Acting Sacramento Branch Chief at (916) 414-6600.

Sincerely,

for Ken Sanchez
Acting Field Supervisor

cc:
Jane Rinck, U.S. Army Corps of Engineers, Sacramento, California
Dee Warenycia, California Department of Fish and Game, Sacramento, California

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:
1-1-05-F-0222

AUG 15 2005

Thomas E. Trainer
Chief, Planning Division
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Subject: Amendment to the Service's Biological Opinion for the Proposed Material Borings for the American River Watershed Folsom Bridge Project, Sacramento County, California

Dear Mr. Trainer:

This is in response to a July 29, 2005, letter from the U.S. Army Corps of Engineers (COE) to the U.S. Fish and Wildlife Service (Service), identifying delays in the project and changes to the indirect effects on the federally listed valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle) in the May 4, 2005, biological opinion for the Proposed Material borings for the Folsom Bridge Project, Sacramento County, California (project) (Service File Number 1-1-05-F-0108). Your letter was received in our office on August 1, 2005. This letter revises the proposed compensation for direct and indirect affects of the proposed project and amends the project's biological opinion, as appropriate.

The findings and recommendations in this consultation are based on: (1) the July 29, 2005, electronic correspondence letter from Jane Rinck (COE) to Stephanie Rickabaugh (Service), requesting an amendment to the project's biological opinion; (2) the July 12, 2005, site visit; (3) the August 4, 2005, telephone conversation between Jane and Stephanie clarifying the proposed compensation ratios and (4) other information available to the Service.

Due to project delays some of the boring activities scheduled to be completed in June 2005, were not completed until August 5, 2005. On the south (and east) side of the American River the boring activities began on July 18, 2005, and will be completed by August 5, 2005. The remaining project activities and description are the same; however, the COE has proposed reducing the compensation rate from 3.5x the normal ratio to 2.5 times the normal ratio for

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adverse affects to the beetle and thus the elderberry shrubs (*Sambucus* spp.) (shrub) on the south side of the river. This decrease in the compensation ratio for these 14 shrubs that are indirectly affected by the proposed project is because the construction activities would take place outside the transplant window but no longer during the beetles' emergence period.

The May 4, 2005, biological opinion is now amended to read:

Page 4: Description of the Proposed Action, paragraph 2 from: The COE proposes to compensate for adverse affects from the proposed material borings project at a rate 3.5x the normal compensation because the work is being done during the beetle's flight period when the beetles are vulnerable to dust and disturbance. However, the COE requests that the compensation for the three shrubs directly affected by the proposed bridge project be included in the subsequent bridge consultation. This subsequent compensation for the three shrubs has been agreed to by the Service.

To: For boring activities occurring before June 30, 2005, the COE proposes to compensate for adverse affects from the proposed material borings project at a rate 3.5x the normal compensation because the work is being done during the beetle's flight period when the beetles are vulnerable to dust and disturbance. For boring and construction activities occurring between July 18, 2005 and August 5, 2005, the COE proposed to compensate for adverse affects from the proposed material borings project at a rate 2.5x the normal compensation because the work is being done outside of the normal transplant window. However, the COE requests that the compensation for the three shrubs directly affected by the proposed bridge project be included in the subsequent bridge consultation. This subsequent compensation for the three shrubs has been agreed to by the Service.

Page 5: Proposed Minimization Measures, last paragraph from: Elderberry plants for which impacts cannot be avoided shall be compensated for, at a rate 3.5x the normal rate and following the criteria set forth in Table 1 of the Guidelines, as modified by the Service. These guidelines provide for transplanting and planting of elderberries, as well as planting of associated riparian vegetation.

To: Elderberry plants shall be compensated for, at a rate 3.5x the normal rate for which adverse effects cannot be avoided April through June 2005, and 2.5x the normal rate for which adverse effects cannot be avoided July 18 through August 2005, and following the criteria set forth in Table 1 of the Guidelines, as modified by the Service. These guidelines provide for transplanting and planting of elderberries, as well as planting of associated riparian vegetation.

Page 12: Effects of the Proposed Action, paragraph 2 from: All 15 shrubs would be indirectly affected by the temporary access road construction activities and the borings, however, 3 of those shrubs are also expected to be directly affected by the proposed bridge construction, scheduled to begin in 2006. The COE proposes to compensation at a rate 3.5x the normal compensation rate and be applied in the form

of elderberry seedlings and associated native plants as directed in the Guidelines. The compensation for the three shrubs expected to be directly affected by the bridge construction will be deferred until the bridge consultation is conducted. This deferment does not change or lessen the compensation required. Table 1 and Table 2 summarize all the compensation required for the proposed material borings project.

To: All 15 shrubs would be indirectly affected by the temporary access road construction activities and the borings, however, 3 of those shrubs are also expected to be directly affected by the proposed bridge construction, scheduled to begin in 2006. The COE proposes to compensate at a rate 3.5x and 2.5x the normal compensation rate and be applied in the form of elderberry seedlings and associated native plants as directed in the Guidelines. The compensation for the three shrubs expected to be directly affected by the bridge construction will be deferred until the bridge consultation is conducted. This deferment does not change or lessen the compensation required. Table 1 and Table 2 summarize all the compensation required for the proposed material borings project.

Page 12: Effects of the Proposed Action, Replace Table 1, with the following;

Table 1. Compensation for indirect affects occurring on the south side of American River, for the proposed Material Borings project.

Location	Stems (maximum diameter at ground level)	Exit Hole on Shrub (Yes or No)	Elderberry Seedling Ratio	Associated Native Plant Ratio	Number of Stems Observed	Proposed Elderberry Plantings	Proposed Associated Native Plant Plantings
Non-riparian	stems ≥1" & ≤3"	No	2.5:1	1:1	2	5	5
Non-riparian	stems >3" & <5"	No	5:1	1:1	7	35	35
Non-riparian	stems ≥5"	No	7.5:1	1:1	21	157.5	157.5
Total					30	197.5	197.5
Total Elderberry shrubs affected					14		
Compensation area required for the plantings based on the 2.5x normal compensation rate						1.63	

Page 15: Terms and Conditions, Number 2B, Omit: The establishment of the elderberry and associated native plant seedlings must occur between September 1, 2004, and February 15, 2005.

Page 15: Terms and Conditions, Number 2C from: The COE shall ensure that the elderberry and associated native plant seedlings are established on no less than 2.28 acres at a Service approved site.

To: The COE shall ensure that the elderberry and associated native plant seedlings are established on no less than 1.63 acres at a Service approved site.

The other portions of the project description, species, baseline, effects analysis, conclusion, incidental take, reasonable and prudent measures, and conservation recommendations in the May 4, 2005, biological opinion remains the same.

This concludes formal consultation with COE on the Material Borings for the Folsom Bridge Project. As provided in 50 CFR §402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

Please contact Stephanie Rickabaugh or the Acting Sacramento Valley Branch Chief at (916) 414-6724 if you have questions regarding this amendment to the biological opinion.

Sincerely,

Kenneth Sanchez
Acting Field Supervisor

cc:
Jane Rinck, U.S. Army Corps of Engineers, Sacramento, California
Dee Warenycia, California Department of Fish and Game, Sacramento, California

United States Department of the Interior

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In reply refer to:
1-1-06-I-0335

JAN 3 2006

Mr. Brandon C. Muncy
Chief, Planning Division
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Subject: Review of Proposed Additional Geotechnical Work Associated with the Folsom Dam Bridge, Sacramento County, California

Dear Mr. Muncy:

This letter is in response to the U.S. Army Corps of Engineers' December 20, 2005, request for concurrence that conducting additional core borings to determine the material conditions and engineering properties associated with the bridge construction, as part of the Folsom Dam Bridge Bypass Project (proposed action), is not likely to adversely affect listed species. Your request was received by the U.S. Fish and Wildlife Service (Service) on December 21, 2005. At issue are the potential effects of the proposed project on the federally-listed valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle). Our primary concern and mandate is the protection of federally-listed species pursuant to the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*) (Act).

We have reviewed the proposed action, including: (1) your December 20, 2005, letter initiating section 7 consultation with the Service; (2) the May 4, 2005, biological opinion (1-1-05-F-0108) and August 15, 2005, amendment (1-1-05-F-0222) issued for the proposed project; and (3) other information available to the Service.

The additional three or four core borings would be about 30 to 50 feet deep and take between three to four weeks to complete. The proposed action would include two core borings for Pier 2 on the north side of the American River and one core boring for Pier 3 on the south side of the American River. A forth core boring maybe needed for Pier 3, depending on the results of a test pit excavation during drill pad preparation. The locations of the new proposed boring are within the same vicinity as the borings completed in August 2005. Access to the proposed boring locations would be via existing roads and by helicopter. The existing access road to Pier 3 would need to be improved for access during wet weather. This includes the transport and placement of crushed rock along 400 feet of the road.

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The proposed project site contains 15 elderberry shrubs (*Sambucus* sp.) which is the sole host plant for the valley elderberry longhorn beetle. Only two are within 75 feet of the proposed project site and both remain fenced from the earlier boring activity. Activities associated with the proposed action would be completed by February 15, 2006, during the elderberry shrubs' dormant season and the non-flight season for the beetle. Significant dust is not expected because the proposed action would occur during the winter season and because the shrubs are located in a very rocky area with little exposed soil. Additionally, because of the small range and relative brevity of the boring activity, the Service concurs with your determination that the proposed project will not adversely affect the beetle. Therefore, unless new information reveals effects of the proposed action that may affect listed species in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed action, no further action pursuant to the Act is necessary.

If you have questions regarding the proposed Additional Geotechnical Work Associated with the Folsom Dam Bridge Project, please contact Stephanie Rickabaugh or Mary Hammer, the Acting Sacramento Valley Branch Chief, at (916) 414-6724.

Sincerely,

Peter A. Cross

Peter A. Cross
Deputy Assistant Field Supervisor

cc:
AES, Portland, OR
Jane Rinck, COE, Sacramento, CA

COST EFFECTIVENESS/INCREMENTAL COST ANALYSIS

FOLSOM BRIDGE PROJECT

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INCREMENTAL COST ANALYSIS FOR MITIGATION

1.0 PURPOSE

The purpose of the incremental cost analysis is to evaluate mitigation alternatives to compensate for project-related adverse effects to biological resources resulting from the Folsom Dam Bridge Project. By applying the findings of this analysis, the project proposes to compensate for adverse effects in the most cost-effective manner.

Guidance for developing this incremental cost analysis comes from Engineer Regulations (ER) 1105-2-100 and 1105-2-50, Engineer Circular 1105-2-185, and the Institute for Water Resources Report 94-PS-2. The goal of this analysis is to develop, through the economic justification of mitigation alternatives, the "least-cost plan" that still fully compensates for project-related effects. The analysis is a two-step process. First, a cost-effectiveness analysis is done to ensure that the least-cost solution is identified for each possible level of environmental mitigation output. This step eliminates economically inefficient and ineffective mitigation solutions. Second, an incremental cost analysis of the least-cost solutions is done to show changes in costs for increasing levels of environmental mitigation output. This second step is termed "justifying the last-added increment of mitigation effort." IWR Plan Software version 3.3 was used for this analysis.

The environmental output analysis is based on habitat evaluation procedures (HEP) that define the relationship between increasing habitat value with each increase in compensation increment features and increases in environmental output. The analysis then compares successive environmental outputs and associated incremental increases in costs. Compensation measures (increments) for each significant habitat are then combined to show their cumulative increase in environmental output and cost. Combinations of increments are developed for each habitat that approximate the habitat value replacement goal developed during the HEP. Each grouping of compensation measures for each habitat type is then combined with other habitat-specific increments to become mitigation proposals for one or more proposed mitigation sites, each of which is habitat specific. Decisions could then be made on selecting the proposal(s) that compensate for adverse effects while being cost effective and incrementally justified.

Under the provisions of the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service (FWS) has prepared a draft coordination act report (Draft CAR) that includes the HEP analysis for this project. The purpose of the Draft CAR is to assess project-related effects to biological resources in the project area. This incremental analysis reflects the findings of the HEP report and incorporates the mitigation strategy developed by the HEP team that identifies the important biological resources that should be included in the analysis. A major purpose of this incremental analysis is documenting the "steps" taken in identifying mitigation alternatives and developing a recommended compensation plan. The incremental analysis helps ensure compliance with the statutory requirements of the Fish and Wildlife Coordination Act and agency

regulations, both of which state that the project proponents give full consideration to Federal and State agency comments and recommendations resulting from resource agency consultation.

2.0 ENVIRONMENTAL VALUES

The project area is located within the 6-mile area between Folsom Dam and Nimbus Dam. Most of the land in this area is owned by either the Federal Government of the State of California and is generally undeveloped. Because this area is largely owned by the government and is close to Folsom Prison, the area will likely remain in its undeveloped state. Most of the project area was disturbed during the construction of Folsom Dam. The existing habitat is the area has reestablished after the dam was completed.

The project area currently supports the following habitat types: oak woodland, riparian woodland, seasonal wetland, chaparral, and annual grassland. In addition, disturbed areas with various species of nonnative vegetation are found around roadways and facilities in the project area.

Oak woodland is the predominant habitat type in the project area, consisting of mostly blue oak, interior live oak, some valley oak, buckeye, and an understory of annual grassland species. Smaller areas of riparian woodland and seasonal wetlands are also found. Riparian areas have sparse vegetation including various willow species and Fremont cottonwood. Seasonal wetland species include cattail, blackberry, soft chess brome, perennial rye grass, curly dock, and various willow species. Common chaparral species include manzanita and chemise, while understory species include poison oak, California wild rose, and lupine. Nonnative grassland species include wild oats, soft brome, ryegrass, mustard, and foxtail. In additional, there are numerous elderberry shrubs associated with the oak woodland and nonnative grassland habitats in the project area.

The habitats in the project area support various wildlife species. Mammal species include mule deer, coyote, bobcat, gray fox, black-tailed jackrabbit, Virginia opossum, striped skunk, and a variety of rodents. Common bird species in the project area include acorn woodpecker, Nuttall's woodpecker, loggerhead shrike, western wood pewee, scrub jay, Bullock's oriole, California quail, introduced wild turkeys, and plain titmouse. Common raptors include red-tailed hawk, American kestrel, prairie falcon, great horned owl, and bald eagle. Reptile and amphibian species likely found in the project area include western fence lizard, gopher snake, western rattlesnake, common kingsnake, Pacific treefrog, and western toad.

The presence of year-round water provides habitat for many water-associated species such as raccoon, Canada geese, wood duck, common merganser, mallard, black phoebe, great blue heron, greater yellowlegs, belted kingfisher, and common yellowthroat. Areas dominated by annual grassland provide foraging habitat and cover for California ground squirrel, pocket gopher, turkey vulture, coyote, western fence lizard, western rattlesnake, western kingbird, and western meadowlark.

3.0 Project-Related Effects Requiring Mitigation

A HEP analysis was performed to determine potential adverse effects within the project area. A HEP analysis is a habitat-based evaluation methodology developed for use in adverse effect assessment and mitigation planning. A HEP analysis is based on the assumption that the value of a habitat for selected species or the value of a community can be described in a model, which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs). HUs are converted to Average Annual Habitat Units (AAHUs) or an annualized computation of HUs expressed as a derivation of habitat value across all years in the economic life of the project. The HUs and AAHUs, over the life of the project, are then used in the following comparisons: (1) the relative value of different areas at the same point in time; and (2) the relative value of the same areas at future points in time. By combining the two types of comparisons, various project-related effects can be quantified. This information can also be used for mitigation planning to identify compensation needs. Additional information on the HEP and associated HSI models used for this project can be found in Appendix A of the FWS Draft CAR, Appendix B. Table 1 provides acres impacted by habitat type, AAHUs lost, and the compensation objectives. Additional information on project effects can be found in Chapter 4.0 of the SEIS/EIR.

Table 1. Project Related Adverse Effects

Habitat Type	Acres Effected	AAHU's Lost	Compensation Objective (acres)[1]
Oak woodland	32.87	33.87	50.10
Riparian woodland	5.46	8.32	5.80
Seasonal Wetland	2.51	1.20	2.51
Annual Grassland	N/A	N/A	N/A
Other	N/A	N/A	N/A

N/A =Not Applicable

1 Extent of compensation habitat required to achieve mitigation based on the HEP analysis.

2 See Section 6.0 "Compensation Strategy Increments" for definitions of compensation increments

4.0 Compensation Objectives

According to ER 1105-2-100, the first step in mitigation planning is to avoid effects if possible and then to minimize adverse effects through design modification. For those project effects that are unavoidable, the compensation objective is to fully restore lost habitat values through reasonable and justifiable in-kind, onsite replacement.

Direct construction impacts are those that would cause immediate and complete loss of habitat values at a particular site at the time of project construction. These immediate impacts would occur in the footprint area of the bridge and roadway and within all temporary and permanent construction easement areas.

Trees and other woody vegetation within temporary construction easement areas would not be reestablished once construction is completed. Impacts to herbaceous vegetation that would occur within staging and borrow areas would be temporary because these areas will be reseeded after construction. All woody vegetation at the staging and borrow areas would be adversely affected. Compensation objectives are provided in Table 1. The compensation objective includes wetlands that are to be "fully mitigated" through actions to avoid, minimize, and compensate for unavoidable losses to meet the goal of no net loss of wetlands, (Water Resources Development Act of 1990, Section 307 (a); ER 1105-2-100, paragraph 7-35g).

In accordance with ER 1105-2-110, project lands (lands required for authorized project purposes) are considered for mitigation purposes first, followed by public lands (lands owned or otherwise legally entrusted to a local, State, or Federal agency), and then private lands. For this project, Federally owned lands were initially considered for the mitigation of all habitat types. However, the site previously identified for mitigation for the American River Long-Term Project, Mormon Island Preserve, is no longer available for mitigation use. Other suitable sites along the Lower American River were considered for compensation. The compensation areas are discussed in the following section.

5.0 Mitigation Sites to Compensate for Habitat Loss

HEP procedures were used to evaluate potential mitigation sites to compensate for habitat losses identified as a result of construction of the project. Habitat values that could be developed on a site were quantified for each of the cover-types impacted. The HEP analysis assumed the compensation sites would not currently support any woody vegetation and would be capable of supporting the cover-type proposed for the site (i.e., a site would have the appropriate hydrology to support seasonal wetlands or riparian cover-types). The preferred sites included lands within the American River Parkway above the levees, downstream of Sunrise Bridge. These lands are owned by Sacramento County Parks. The assumptions used to develop the compensation site scenarios are listed in Appendix A-1 of the FWS Draft CAR.

A specific compensation site was not analyzed in the HEP analysis. Instead a typical site was developed, and assumptions were made that the site would be an annual grassland area without significant existing woody vegetation for a baseline condition. For the riparian and seasonal wetland cover-types, a critical assumption was made that any site selected for compensation would require the appropriate hydrology to support these cover-types. The HEP noted that suitable lands for oak woodland, and riparian woodland were observed at sites for consideration along the American River Parkway.

6.0 Compensation Strategy Increments

According to ER 1105-2-100, a management/compensation plan increment consists of one or more management features. Plan increments may interrelate and complement one another, but they cannot be functionally dependent upon another increment. Low intensity, medium intensity, and high intensity plan increments were

developed for the oak woodland, riparian woodland, and seasonal wetland habitat types. These plan increments are made up of one or more management features (or measures). When deciding on compensation strategy increments, the following items were considered.

Two or three increments provide a full range of planning possibilities for mitigation. The possibilities range from little compensation to a logical maximum level of effort while keeping the number of possible measure combinations manageable. Each of the increments can stand alone as a possible mitigation measure. Combining more features into each successive increment is logical since each increment incorporated the previous increment's mitigation features to add its cumulative increase in habitat value. Combining compensation features into the two or three increments and then tailoring the increments to each habitat type being compensated allows the analysis to show the HU gain specific to that habitat.

This analysis compares implementation strategies for one mitigation site, a representative site along the Lower American River Parkway. Three compensation increments were identified for each compensation habitat type:

- Increment 1—minimum (application of low-cost mitigation measures that generally provide fewer AAHUs than more expensive measures);
- Increment 2—moderate (application of moderate-cost mitigation measures that generally provide fewer AAHUs than more expensive measures, but provide more AAHUs than lower cost measures); and
  Increment 3—maximum (application of high-cost mitigation measures that generally provide greater AAHUs than low and moderate increments).

The compensation increments vary in the level of effort (i.e., labor, materials, equipment, and other cost-related items) required to implement each compensation increment and, as a result of different levels of effort, would be expected to provide varying levels of output in the form of AAHUs generated. The compensation increments for each habitat type are summarized in Tables 2, 3, and 4.

The results of the analysis are expressed as the absolute per-acre AAHUs provided by each compensation increment for each mitigated habitat and per-acre mitigation cost per AAHU generated under each of the increments for each habitat.

The cost of each compensation increment for each compensation habitat type is calculated based on the combined costs of its mitigation features multiplied by the mitigation site acreage needed to compensate project impacts. Compensation costs were then compared by increment. This comparison allows an analysis of each compensation increment's cost compared to its increase in HSI values. Compensation increments with varying compensation measures were developed for each of the main habitat types affected by project work.

Specific criteria were developed for each habitat type to ensure the success of

the low to the high intensity compensation increments. These criteria remained constant throughout the analysis and are essential to the long-term biological success of the compensation.

Costs for the criteria listed below are included in the compensation costs of each increment with the exception of monitoring, access/maintenance roads, and developing the Operations and Maintenance manual (O&M manual. No long-term maintenance, monitoring, or contingency costs were included in these cost estimates. The cost estimates do not include any costs associated with vegetation, hydrology, or wildlife monitoring surveys and are based on estimates prepared for similar projects

- Oak Woodland—Dedicate lands (currently annual grasslands); prepare annual grasslands for planting; provide access and maintenance roads; assume 10% mortality for each of first 3 years; assume maximum growth rate of 12 inches/year; and develop O&M manual.
- Riparian Woodland—Dedicate lands; prepare annual grasslands for planting; provide access and maintenance roads; grade site to facilitate natural seasonal flooding; assume maximum growth rate of 12 inches/year; and develop O&M manual.
- Seasonal Wetland—Dedicate lands (proposed site baseline is Condition C wetland); design portion of wetland to have permanent water; do not stock carp; provide access and maintenance roads; plant cover crop on all disturbed non-wetland areas; and develop O&M manual.

Table 2. Oak Woodland Compensation Plan—Increments 1-3

Compensation Increments	Description
Increment 1 – Low Intensity	Plant 500 acorns per acre; do not irrigate or provide plant protection; monitor plant survival and replant acorns as necessary to maintain 250 trees per acre
Increment 2 – Moderate Intensity	Plant 400 trees (4"x4"x10" size) per acre (live and blue oaks); seed cover crop; provide site specific irrigation system; provide watering, weeding, and pest control as needed for 3 years; provide general maintenance and cleanup into perpetuity; monitor for 3 years and replant to ensure <10% mortality
Increment 3 – High Intensity	Plant 600 trees (4"x4"x10" size) per acre (90% blue and live oaks and 10% gray pine); seed cover crop; provide site specific irrigation system; provide watering, weeding, and pest control as needed for 3 years; provide general maintenance and cleanup into perpetuity; monitor for 3 years and replant to ensure <10% mortality

Table 3. Riparian Woodland Compensation Plan—Increments 1-3

Compensation Increments	Description
Increment 1 – Low Intensity	Allow site to revegetate naturally; grade site to facilitate natural seasonal flooding
Increment 2 – Moderate Intensity	Plant 200 trees (4"x4"x10" size) per acre as overstory (oak, cottonwood, and willow trees) and 200 understory shrubs (4"x4"x10" size) per acre (wild rose and wild grape); seed cover crop; grade site to facilitate natural seasonal flooding; provide site specific irrigation system; provide watering, weeding, and pest control as needed for 3 years; provide general maintenance and cleanup into perpetuity; monitor for 3 years and replant to ensure <10% mortality
Increment 3 – High Intensity	Plant 400 trees (4"x4"x10" size) per acre as overstory (oak, cottonwood, and willow trees) and 400 understory shrubs (4"x4"x10" size) per acre (wild rose and wild grape); seed cover crop; grade site to facilitate natural seasonal flooding; provide site specific irrigation system; provide watering, weeding, and pest control as needed for 3 years; provide general maintenance and cleanup into perpetuity; monitor for 3 years and replant to ensure <10% mortality

Table 4. Seasonal Wetland Compensation Plan—Increments 1-3

Compensation Increments	Description
Increment 1 – Low Intensity	Grade site to facilitate natural flooding to maintain 20% of wetland area with 4-9 inch deep water throughout the summer; allow site to naturally revegetate; plant cover crop on disturbed upland areas
Increment 2 – Moderate Intensity	Grade site to maintain 20% of wetland area with 4-9 inch deep water throughout the summer; plant wetland plugs 12 inches on center over 80% of the wetland area; plant cover crop on disturbed upland areas; provide site specific irrigation system; provide watering, weeding, and pest control as needed for 3 years or until site is self-sustaining; provide general maintenance and cleanup into perpetuity
Increment 3 – High Intensity	Grade site to maintain 40% of wetland area with 4-9 inch deep water throughout the summer; plant wetland plugs 12 inches on center over 60% of the wetland area; plant cover crop on disturbed upland areas; provide site specific irrigation system; provide watering, weeding, and pest control as needed for 3 years or until site is self-sustaining; provide general maintenance and cleanup into perpetuity

7.0 General Assumptions Used

To conduct this analysis, HEP-generated AAHUs provided by the FWS in the Draft CAR were used. The FWS generated AAHUs for one compensation increment for each habitat type. Compensation increments analyzed in the Draft CAR include the following:

Oak woodland—Increment 2
Riparian woodland—Increment 2
Seasonal wetland—Increment 3

Therefore, to make comparisons among the compensation increments for each habitat type, AAHUs were generated for the remaining increments using the HSI models in the HEP analysis, in consultation with FWS based on the following criteria:

- **Oak woodland–Increment 1.** Increment 1 includes planting acorns without supplemental irrigation for establishment and, therefore, a longer period would be required for trees to establish than under Increment 2. Consequently, it is assumed that Increment 1 will accrue habitat values at 25% of the rate of Increment 2.
- **Oak woodland-Increment 3.** Increment 3 increases the planting density 150 % above Increment 2, therefore it is assumed the tree canopy will increase more rapidly than under Increments 1 and 2.
- **Riparian woodland–Increment 1.** Increment 1 allows for natural regeneration of the riparian plant community and, therefore, it will take considerably longer for Increment 1 to develop shrub crown cover and forest overstory. Consequently, it is assumed that Increment 1 will accrue habitat values at 10% of the rate of Increment 2.
- **Riparian woodland–Increment 3.** Increment 3 increases the planting density of both shrub and overstory species. It was estimated that 10 years after planting, Increment 2 would have 25% shrub cover while Increment 3 would have 50% shrub cover. In the HSI model used for this habitat type, values for this variable drop once 50% shrub crown cover is reached, therefore Increment 3 was given a lower value than Increment 2.
- **Seasonal wetland–Increment 1.** Increment 1 would develop volunteer vegetation 50% as fast as planted vegetation in Increment 3.
- **Seasonal wetland–Increment 2.** Increment 2 would be constructed to provide approximately 50% the open water area as Increment 3 (i.e., more area would be planted with wetland species in Increment 2 and less area would be open water).

8.0 Mitigation Comparisons and Cost Effectiveness

The extent of compensation habitat required to fully compensate impacts on habitat for each compensation increment is presented in Table 5. The AAHUs and compensation acres shown in Table 1 are for Increment 3 of the seasonal wetland compensation plan and Increment 2 for the remaining habitat types and are based on the HEP analysis conducted for the Draft CAR. Per acre AAHUs that would be generated with implementation of Increments 1 and 2 for seasonal wetland and with implementation of Increments 1 and 3 for the remaining habitat types were estimated n consultation with FWS based on:

- professional experience with conducting HEP analyses,
- an assessment of how each of the compensation increments would effect outputs of the HSI models used by the FWS to conduct the Draft CAR HEP analysis,
- assumptions about the rate at which key habitat variables would develop under each of the compensation increments relative to assumptions used for the increments analyzed in the Draft CAR HEP analysis.

Total compensation costs and per acre compensation costs for each increment and habitat type are presented in Table 6. While cost of average annual habitat units per acre are shown in Table 7.

Table 5. Mitigation Acreage Comparisons for Each Habitat Type

Habitat Type	AAHUs Needed for Compensation	Average Annual Habitat Unit Gain					
		Increment 1		Increment 2		Increment 3	
		AAHU Gain (per acre)	Compensation Objective (acres)	AAHU Gain (per acre)	Compensation Objective (acres)	AAHU Gain (per acre)	Compensation Objective (acres)
Oak Woodland	33.87	0.17	199.2	0.67	50.10	0.89	38.1
Riparian Woodland	8.32	0.14	59.4	1.43	5.80	1.22	6.82
Seasonal Wetland	1.20	0.24	5.0	0.59	2.03	0.48	2.51

Notes: AAHU = Average Annual Habitat Units AAHU Gain = Difference in AAHUs between existing AAHUs and AAHUs generated with implementation of the compensation increment

Table 6. Cost per Acre by Compensation Increment

	Increment 1			Increment 2			Increment 3		
Habitat Type	Total Compen-sation Cost	Compen-sation Objective (acres)	Cost per acre	Total Compen-sation Cost	Compen-sation Objective (acres)	Cost per acre	Total Compen-sation Cost	Compen-sation Objective (acres)	Cost per acre
Oak Woodland	$3,744,960	199.20	$18,800	$2,655,300	50.10	$53,000	$2,482,215	38.1	$65,150
Riparian Woodland	$1,116,720	59.40	$18,800	$307,400	5.80	$53,000	$444,323	6.82	$65,150
Seasonal Wetland	$231,520	5.0	$46,304	$46,304	2.03	$99,200	$321,280	2.51	$128,000

Table 7. Cost of Average Annual Habitat Unit per Acre

	Increment 1			Increment 2			Increment 3		
Habitat Type	AAHU Gain (per acre)	Per Acre Cost	Cost per AAHU	AAHU Gain (per acre)	Per Acre Cost	Cost per AAHU	AAHU Gain (per acre)	Per Acre Cost	Cost per AAHU
Oak Woodland	0.17	$18,800	$110,588	0.67	$53,000	$79,104	0.89	$65,150	$73,202
Riparian Woodland	0.14	$18,800	$134,285	1.43	$53,000	$37,062	1.22	$65,150	$53,401
Seasonal Wetland	0.24	$46,304	$192,933	0.59	$99,200	$168,135	0.48	$128,000	$266,666

9.0 Incremental Cost Analysis

The mitigation increment outputs and cost information described above was used with the IWR-Plan software (version 3.3) to complete the cost effectiveness and incremental cost analysis. There were 3 cost effective combinations and 3 best buy combinations. The best buy plans are shown on Figure 1. The incremental cost of the best buy combinations are shown in Table 8.

Figure 1. Best Buy Plans

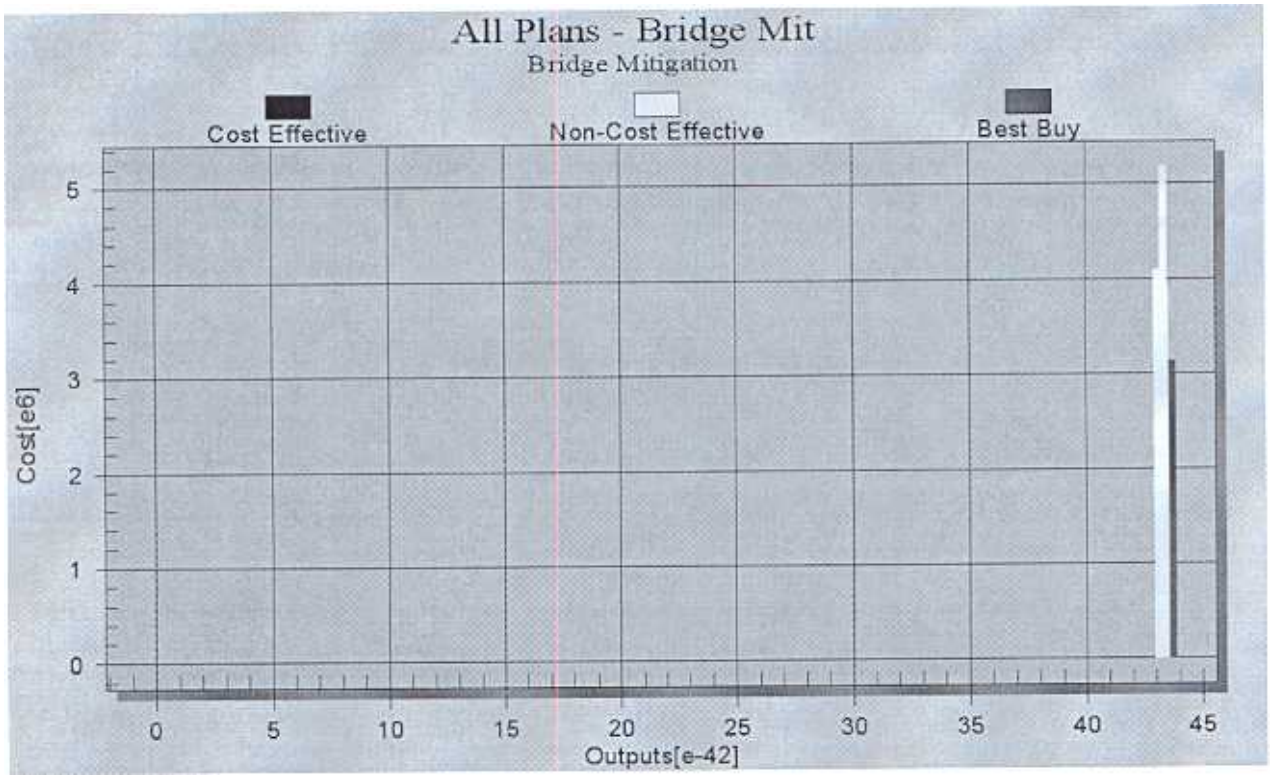

Table 8. Incremental Cost of Best Buy Plan Combinations

Plan	Total Outputs	Total Cost (dollars)	Incremental Cost (dollars)	Incremental Output (AAHU)	Incremental Cost per Output
A0 B0 C0*	00.0	0.00	0.00	0.00	0.00
A3 B2 C2*	43.40	$2,990,991	$2,990,991	43.4	$68,916.84
A3 B3 C2*	43.42	$3,127,914	$136,923	0.02	$6,846,150

* A=Oak Woodland, B=Riparian Woodland, C=Seasonal Wetland

10. Summary and Recommendations

The cost effectiveness and incremental analysis identified the combination of oak woodland increment 3, riparian woodland increment 2, and seasonal wetland increment 2 as the most cost effective increment for mitigation. This plan varies from the recommendations provided by FWS in the Draft CAR. We will work with FWS to

implement mitigation plan that cost effective and fully mitigates for the project-related adverse effects

Appendix C

Correspondence Regarding Special Status Species

Federal Endangered and Threatened Species that Occur in or may be Affected by Projects in the FOLSOM (511B) U.S.G.S. 7 1/2 Minute Quad Database Last Updated: March 16, 2005 Document Number: 050404125931

Listed Species

Invertebrates

- Critical habitat, vernal pool invertebrates (X)

Branchinecta lynchi - vernal pool fairy shrimp (T)

Desmocerus californicus dimorphus - valley elderberry longhorn beetle (T)

Lepidurus packardi - vernal pool tadpole shrimp (E)

Fish

Hypomesus transpacificus - delta smelt (T)

Oncorhynchus mykiss - Central Valley steelhead (T)

Oncorhynchus tshawytscha - Central Valley spring-run chinook salmon (T)

Oncorhynchus tshawytscha - winter-run chinook salmon (E)

Amphibians

Ambystoma californiense - California tiger salamander (T)

Rana aurora draytonii - California red-legged frog (T)

Reptiles

Thamnophis gigas - giant garter snake (T)

Birds

Haliaeetus leucocephalus - bald eagle (T)

Plants

- Critical habitat, vernal pool plants (X)

Orcuttia viscida - Sacramento Orcutt grass (E)

Candidate Species

Fish

Acipenser medirostris - green sturgeon (C)

Oncorhynchus tshawytscha - Central Valley fall/late fall-run chinook salmon (C)

Oncorhynchus tshawytscha - Critical habitat, Central Valley fall/late fall-run chinook (C)

Species of Concern

Invertebrates

Branchinecta mesovallensis - Midvalley fairy shrimp (SC)

Linderiella occidentalis - California linderiella fairy shrimp (SC)

Fish

Pogonichthys macrolepidotus - Sacramento splittail (SC)

Spirinchus thaleichthys - longfin smelt (SC)

Amphibians

Spea hammondii (was Scaphiopus h.) - western spadefoot toad (SC)

Reptiles

Clemmys marmorata marmorata - northwestern pond turtle (SC)

Phrynosoma coronatum frontale - California horned lizard (SC)

Birds

Agelaius tricolor - tricolored blackbird (SC)

Athene cunicularia hypugaea - western burrowing owl (SC)

Baeolophus inornatus - oak titmouse (SLC)

Branta canadensis leucopareia - Aleutian Canada goose (D)

Buteo regalis - ferruginous hawk (SC)

Buteo Swainsoni - Swainson's hawk (CA)

Carduelis lawrencei - Lawrence's goldfinch (SC)

Chaetura vauxi - Vaux's swift (SC)

Charadrius montanus - mountain plover (SC)

Cypseloides niger - black swift (SC)

Elanus leucurus - white-tailed (=black shouldered) kite (SC)

Empidonax traillii brewsteri - little willow flycatcher (CA)

Falco peregrinus anatum - American peregrine falcon (D)

Lanius ludovicianus - loggerhead shrike (SC)

Melanerpes lewis - Lewis' woodpecker (SC)

Numenius americanus - long-billed curlew (SC)

Picoides nuttallii - Nuttall's woodpecker (SLC)

Plegadis chihi - white-faced ibis (SC)

Riparia riparia - bank swallow (CA)

Selasphorus rufus - rufous hummingbird (SC)

Toxostoma redivivum - California thrasher (SC)

Mammals

Corynorhinus (=Plecotus) townsendii townsendii - Pacific western big-eared bat (SC)

Euderma maculatum - spotted bat (SC)

Eumops perotis californicus - greater western mastiff-bat (SC)

Myotis ciliolabrum - small-footed myotis bat (SC)

Myotis evotis - long-eared myotis bat (SC)

Myotis thysanodes - fringed myotis bat (SC)

Myotis volans - long-legged myotis bat (SC)

Myotis yumanensis - Yuma myotis bat (SC)

Perognathus inornatus - San Joaquin pocket mouse (SC)

Plants

Naverretia myersii spp. myersii - pincushion navarretia (SC)

Key

(E) ***Endangered*** - Listed (in the Federal Register) as being in danger of extinction.

(T) ***Threatened*** - Listed as likely to become endangered within the foreseeable future.

(P) ***Proposed*** - Officially proposed (in the Federal Register) for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Marine Fisheries Service. Consult with them directly about these species

Critical Habitat - Area essential to the conservation of a species.

(PX) ***Proposed Critical Habitat*** - The species is already listed. Critical habitat is being proposed for it.

(C) ***Candidate*** - Candidate to become a proposed species.

(CA) Listed by the State of California but not by the Fish & Wildlife Service.

(D) ***Delisted*** - Species will be monitored for 5 years.

(SC) ***Species of Concern***/(SLC) Species of Local Concern - Other species of concern to the Sacramento Fish & Wildlife Office.

(X) ***Critical Habitat*** designated for this species

Important Information About Your Species List

How We Make Species Lists

We store information about endangered and threatened species lists by U.S. Geological Survey 7½ minute quads. The United States is divided into these quads, which are about the size of San Francisco.

The animals on your species list are ones that occur within, or may be affected by projects within, the quads covered by the list.

- Fish and other aquatic species appear on your list if they are in the same watershed as your quad or if water use in your quad might affect them.

  Amphibians will be on the list for a quad or county if pesticides applied in that area may be carried to their habitat by air currents.

  Birds are shown regardless of whether they are resident or migratory. Relevant birds on the county list should be considered regard-less of whether they appear on a quad list.

Plants

Any plants on your list are ones that have actually been observed in the quad or quads covered by the list. Plants may exist in an area without ever having been detected there. You can find out what's in the nine surrounding quads through the California Native Plant Society's online Inventory of Rare and Endangered Plants.

Surveying

Some of the species on your list may not be affected by your project. A trained biologist or botanist, familiar with the habitat requirements of the species on your list, should determine whether they or habitats suitable for them may be affected by your project. We recommend that your surveys include any proposed and candidate species on your list.

For plant surveys, we recommend using the Guidelines for Conducting and Reporting Botanical Inventories. The results of your surveys should be published in any environmental documents prepared for your project.

State-Listed Species

If a species has been listed as threatened or endangered by the State of California, but not by us nor by the National Marine Fisheries Service, it will appear on your list as a Species of Concern. However you should contact the California Department of Fish and Game Wildlife and Habitat Data Analysis Branch for official information about these species.

Your Responsibilities Under the Endangered Species Act

All plants and animals identified as listed above are fully protected under the Endangered Species Act of 1973, as amended. Section 9 of the Act and its implementing regulations prohibit the take of a federally listed wildlife species. Take is defined by the Act as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" any such animal.

> Take may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR §17.3).

Take incidental to an otherwise lawful activity may be authorized by one of two procedures:

- If a Federal agency is involved with the permitting, funding, or carrying out of a project that may result in take, then that agency must engage in a formal consultation with the Service.

  During formal consultation, the Federal agency, the applicant and the Service work together to avoid or minimize the impact on listed species and their habitat. Such consultation would result in a biological opinion by the Service addressing the anticipated effect of the project on listed and proposed species. The opinion may authorize a limited level of incidental take.

- If no Federal agency is involved with the project, and federally listed species may be taken as part of the project, then you, the applicant, should apply for an incidental take permit. The Service may issue such a permit if you submit a satisfactory conservation plan for the species that would be affected by your project.

  Should your survey determine that federally listed or proposed species occur in the area and are likely to be affected by the project, we recommend that you work with this office and the California Department of Fish and Game to develop a plan that minimizes the project's direct and indirect impacts to listed species and compen-sates for project-related loss of habitat. You should include the plan in any environmental documents you file.

Critical Habitat

When a species is listed as endangered or threatened, areas of habitat considered essential to its conservation may be designated as critical habitat. These areas may require special management considerations or protection. They provide needed space for growth and normal behavior; food, water, air, light, other nutritional or physiological requirements; cover or shelter; and sites for breeding, reproduction, rearing of offspring, germination or seed dispersal.

Although critical habitat may be designated on private or State lands, activities on these lands are not restricted unless there is Federal involvement in the activities or direct harm to listed wildlife.

If any species has proposed or designated critical habitat within a quad, there will be a separate line for this on the species list. Boundary descriptions of the critical habitat may be found in the Federal Register. The information is also reprinted in the Code of Federal Regulations (50 CFR 17.95). See our critical habitat page for maps.

Candidate Species

We recommend that you address impacts to candidate species. We put plants and animals on our candidate list when we have enough scientific information to eventually propose them for listing as threatened or endangered. By considering these species early in your planning process you may be able to avoid the problems that could develop if one of these candidates was listed before the end of your project.

Species of Concern

Your list may contain a section called Species of Concern. This is an informal term that refers to those species that the Sacramento Fish and Wildlife Office believes might be in need of concentrated conservation actions. Such conservation actions vary depending on the health of the populations and degree and types of threats. At one extreme, there may only need to be periodic monitoring of populations and threats to the species and its habitat. At the other extreme, a species may need to be listed as a Federal threatened or endangered species. Species of concern receive no legal protection and the use of the term does not necessarily mean that the species will eventually be proposed for listing as a threatened or endangered species.

Wetlands

If your project will impact wetlands, riparian habitat, or other jurisdictional waters as defined by section 404 of the Clean Water Act and/or section 10 of the Rivers and Harbors Act, you will need to obtain a permit from the U.S. Army Corps of Engineers. Impacts to wetland habitats require site specific mitigation and monitoring. For questions regarding wetlands, please contact Mark Littlefield of this office at (916) 414-6580.

Updates

Our database is constantly updated as species are proposed, listed and delisted. If you address proposed, candidate and special concern species in your planning, this should not be a problem. However, we recommend that you get an updated list every 90 days. That would be July 03, 2005.

Appendix D

Water Quality/Wetlands Delineation

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to:

MAY 1 0 2005

Mr. Mark C. Charlton
Chief, Planning Division
Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Mr. Charlton:

Enclosed is the Fish and Wildlife Service's Wetland Delineation Report for the American River Watershed Investigation (Folsom Dam Bridge and Folsom Dam Outlet Modification Project). The Service is also providing a copy of this report on a CD for your use.

If you have any questions regarding the report please contact either Mark Littlefield or Doug Weinrich at (916) 414-6600.

Sincerely,

David L. Harlow
Acting Field Supervisor

cc:
Jane Rinck, Corps of Engineers, Sacramento, CA
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TAKE PRIDE IN AMERICA

Wetland Delineation Report
for the
U.S. Army Corps of Engineers

AMERICAN RIVER WATERSHED INVESTIGATION

Folsom Dam Bridge Project
Folsom Dam Outlet Modification Project

Prepared for:
U.S. Army Corps of Engineers
Sacramento District

Prepared by:
U.S. Department of the Interior
Fish and Wildlife Service
Sacramento Fish and Wildlife Office

May 2005

Introduction

The U.S. Army Corps of Engineers (Corps) regulates impacts to waters of the United States under the jurisdictional authority of section 404 of the Clean Water Act (33 U.S.C. 404 et seq.). Jurisdictional waters of the United States include all navigable waters, interstate waters, their tributaries, and adjacent wetlands (Environmental Laboratory 1987; Federal Register 1986).

The purpose of this report is to describe the extent and type of jurisdictional wetlands and other waters of the United States present within the proposed project site that fall under the jurisdiction of section 404 of the Clean Water Act. Accordingly, this report addresses all identified potential jurisdictional waters of the United States, including wetlands, for the Corps' Folsom Dam Bridge Project and Folsom Dam Outlet Modification Project (Project) located east of the city of Folsom in eastern Sacramento County, California. Data and conclusions contained in this report are based on information gathered in the field, the *1987 U.S. Army Corps of Engineers Wetland Delineation Manual*, and Federal regulations governing wetland areas.

Definitions and Criteria

Wetlands. For regulatory purposes, wetlands are a subgroup of waters of the United States defined as areas that are inundated, or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR 328.3; 40 CFR 230.3).

Waters of the United States. As used in this report, this term refers to unvegetated waterways and water bodies with a defined bed and bank and an ordinary high water mark, such as drainages, creeks, rivers and lakes. Waters of the United States typically lack hydrophytic vegetation and may also lack hydric soils.

Other Waters of the United States. As used in this report, this term refers to vegetated waterways and water bodies with a defined bed and bank and an ordinary high water mark, such as vegetated swales, drainages, creeks. Other waters of the United States typically contain hydrophytic vegetation and hydric soils, and as such are wetlands in addition to being waters of the United States.

Study Area

The Folsom Dam study area is located about 25 miles east of the city of Sacramento in the American River basin. Folsom Dam and Reservoir, a multipurpose water project, was constructed by the Corps in 1955 and is operated by the U.S. Bureau of Reclamation as part of the Central Valley Project. Folsom Dam regulates runoff from about 1,875 square miles. The reservoir provides flood protection for the Sacramento area; water supply for irrigation, domestic, municipal, and industrial uses; and hydropower. The reservoir also provides extensive water-related recreational opportunities; water quality

control in the Sacramento-San Joaquin Delta; and maintenance of flows stipulated to balance anadromous and resident fisheries, wildlife, and recreational considerations in and along the lower American River. Appendix 1 provides a project vicinity and general location map.

Summary of Findings

The project area supports a total of about 11.22 acres of jurisdictional wetlands, waters of the United States, and other waters of the United States. Jurisdictional wetlands include limited areas of freshwater marsh and seasonal wetlands typically located within or adjacent to streams, swales or other drainages. Waters of the United States within the project boundary, include the American River and two un-named tributaries to the American River. Upland areas include areas lacking indicators of wetland vegetation, wetland soils, and/or wetland hydrology, such as riparian and oak woodlands, annual grasslands, historic borrow/spoil sites, roads, parking areas, and disturbed areas.

Project Area and Description

The Project is located on Bureau of Reclamation and Folsom State Prison lands adjacent to the downstream face of Folsom Dam in eastern Sacramento County, California, generally north of East Folsom Street, along Folsom Dam Road, north to Auburn Folsom Road. The Project area is bisected by the American River.

Developed land uses such as residential and public/industrial use (Reclamation's Office, Folsom State Prison, and improved and unimproved roads) are found throughout the Project site. Large portions of the Project site have been historically altered (graded, leveled, channelized) during the construction of Folsom Dam and its support facilities. However, areas of open space and native habitat remain.

Soils. Soils on the project site are mapped as Andregg, and Xerolls. The following soil descriptions are adapted from the most recent Natural Resource Conservation Service (NRCS) Soil Survey for Sacramento County (NRCS 1993). See Appendix 2 for the soils map.

Andregg soils occur on the project site on 2 to 15 percent slopes. This moderately deep, well drained soil is located on foothill locations. Parent material for these soils is granitic. Slopes are complex. Inclusions of Auburn, Argonaut, and Fiddyment soils may be present. Typically surface layers are brown course sandy loam about 11 inches thick. Subsoils are light yellowish brown course sandy loam about 21 inches thick.

Xerolls are shallow to deep somewhat excessively drained soils on terrace escarpments and steep hillsides (30 to 70 percent slope) near the American River. Parent material for these soils is granitic or metabasic rocks. Small inclusions of Andregg, Auburn, Argonaut, Fiddyment, Kaseberg, and Red Bluff soils may be present. The texture, color, and thickness of soil layers vary from site to site. At the reference location for this soil

the surface layer is about 10 inches of dark loam and very gravelly loam. Upper subsoils are dark yellowish brown gravelly clay loam about 9 inches thick. Deeper subsoils are brown very gravelly clay loam and very gravelly sandy clay loam about 25 inches thick.

Vegetation. Vegetation on both soil types within the Project area is mainly oaks, annual grasses and a variety of native and non-native forbs.

Methodology

Delineation of wetlands and waters of the United States within the proposed project site was based on the delineation process for routine determinations as described in the *1987 U.S. Army Corps of Engineers Wetland Delineation Manual*. For non-wetland waters of the United States, all areas located within the Ordinary Mean High Water line were considered waters of the United States whether or not wetland criteria were met.

The objective of the wetland assessment was to gather information on the vegetation, soils, and hydrologic conditions of the project site and then determine the total acreage of areas potentially subject to the Corps jurisdiction. Plant species were identified based on Reed (1988) and Hickman (1993) and then recorded as hydrophytic or upland based on classifications by Reed (1988). Soil colors were determined based on the Munsell soil color chart 1992. Soil taxonomy and drainage characteristics were determined based on the U.S. Department of Agriculture, NRCS April 1993 soil survey for Sacramento County.

Field investigation procedures for wetlands were conducted on March 14-15 and April 7 and April 18, 2005, by U.S. Fish and Wildlife Service and Corps staff (see Appendix 3 for list of delineators and preparers). The entire corridor within the project site was assessed visually on foot. Data forms for each site are included in this report as Appendix 4.

Vegetation

The vegetation along the entire site was examined for the presence of wetland indicator species as listed in the *National List of Plant Species that Occur in Wetlands: California (Region 0)*. When more than 50 percent of the dominant species in a plant community have an indicator status of obligate wetland, faculative wetland, and/or facultative, hydrophytic vegetation is determined to be present. A total of 22 locations within the project site were closely examined during the assessment to identify and determine the plant species present and their composition. See Appendix 5 for a list of species common to the site.

Hydrology

The project site was assessed for the presence of wetland hydrology. The term "wetland hydrology" encompasses all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Indicators of wetland hydrology may include but are not limited to:

- Drift lines
- Sediment deposition
- Watermarks
- Historic records and
- Visual observations of saturated soils and/or inundation

Soils

Hydric soils require long periods (hundreds of years) for development of wetland soil characterists, and most man-induced wetlands have not been in existence for a sufficiently long enough period to allow for their development. Soil pits were dug and soil color was noted at locations where there was the presence of wetland hydrology and/or hydrophytic vegetation. Soils maps for the Project area were published by the U.S. Department of Agriculture, NRCS in April 1993. This soil survey and its attendant maps were reviewed prior to field visits.

Conclusions

The project site contains waters of the United States, jurisdictional wetlands, and other waters of the United States. Wetland areas are characterized as riverine semipermanently flooded freshwater marsh, seasonal wetland, and seasonal drainage/swale. Natural flooding in the area occurs due to storm events during the winter months and runoff from urban/developed areas during the summer months. In addition, some areas may receive water year round as a result of seepage from Folsom Lake through subsurface strata, surfacing downstream of the dam structure. Appendix 6 contains map locations of water of the United States, jurisdictional wetlands, and other waters of the United States within the project site. Appendix 7 contains site photos.

<u>Waters of the United States</u>

A total of about 9.426 acres of waters of the United States occur within the project site. This includes about 8.7 acres of waters of the United States associated with the American River (map unit SW-14). Also included in this category is map unit SW-16 which is an area of stream channel which has been highly disturbed and is largely unvegetated. In addition, portions of this channel segment flow through culverts.

Soil samples were not taken at SW-3, SW-8, SW-14, SW-15. Soils on these sites were not sampled due to the observed lack of wetland indicators (i.e. no hydrophytic vegetation and/or no wetland soils would be expected to be present).

Seasonal Wetland

A total of 0.297 acre of seasonal wetlands was located within the project site. With the exception of one area (SW-10) seasonal wetlands within the project site are depressional wetland features occurring on areas with little or no topographic slope. These features hold water for limited periods of time during the winter months and may be subject to repeated filling and drying cycles during the wet season. SW-10 is a seasonal wetland located on a 2-5 percent slope which appears to receive water as a result of sub-surface irrigation from an unknown source. No indicators of surface flow into this area were noted.

In general, plant species found in seasonal wetlands on the project site range from facultative to wetland obligates as defined in the *National List of Plant Species that Occur in Wetlands: California (Region 0)*. Vegetation within these seasonal wetlands is highly variable, but these features commonly support annual wildrye (*Lolium perenne*), curly dock (*Rumex crispus*), *Carex* spp., *Eleocharis* spp., and buttercup (*Ranunculus bonariensis*)

With the exception of SW-4, all seasonal wetland soils exhibited a low matrix croma of 1. No soil pit was dug at SW-4 due to the hardness of the soil at this location. This site was graded historically and used as a staging area during the construction of Folsom Dam and as such, does not exhibit natural soil conditions. Soil textures at each location varied slightly, but generally soils were sandy loams or sandy clay loams. Several locations had very high amounts of organic matter within the soil matrix.

Other Waters of the United States---Vegetated Swales and Drainages

A total of 1.5 acres of swales and drainages are located within the project site. For the purposes of this report, swales and drainages are defined as slope wetlands which convey water on a permanent or seasonal basis. Vegetation within swales and drainages on the project site are highly variable and may have few wetland species present or may be dominated by wetland species as is found within SW-13, SW-17 and SW-18. Several areas within these swales, exhibit features typically found in freshwater marsh habitat types. These freshwater marsh habitat areas are dominated by *Eleocharis* spp., and cattail (*Typha* spp.), both obligate wetland plant species as defined by the *National List of Plant Species that Occur in Wetlands: California (Region 0).* Also present in these freshwater marshes are iris-leafed rush (*Juncus xiphiodes*), watercress (*Rorippa nasturtium-aquaticum*), water hemlock (*Cicuta maculate*), curly dock, and cocklebur (*Xanthium strumarium*).

As with vegetation, soil within swales and drainages is variable. Wetter sites typically exhibit a low matrix croma of 1. However, areas such as SW-3 while structurally functioning as a seasonal swale, exhibited no wetland soil characteristics or wetland vegetation and as such was identified as a water of the United States.

The following table summarizes jurisdictional waters of the United States and wetland types and acreages found within the project site.

Wetland Type	Mapping ID #	Acreage	Total Acreage
Waters of the U.S.	SW-3	.003	9.426
	SW-8	.015	
	SW-9	.451	
	SW-16	.013	
	SW-14	8.727	
	SW-15	.216	
	SW-22	.001	
Seasonal wetlands	SW-1	.050	.297
	SW-4	.047	
	SW-5	.079	
	SW-10	.109	
	SW-19	.008	
	SW-20	.004	
Other waters of the United States--- Vegetated Swales/Drainages[1]	SW-2	.026	1.5
	SW-6	.590	
	SW-7	.176	
	SW-12	.132	
	SW-13	.075	
	SW-17	.066	
	SW-18	.222	
	SW-21	.213	

[1] Areas identified as swales/drainages are also waters of the U.S., but are separated in this table as they also have wetland features such as hydrophytic vegetation and/or indicators of hydric soils in addition to a hydrologic connection to a navigable waterway.

References

Environmental Laboratory, Department of the Army. 1987 "Corps of Engineers Wetland Delineation Manual" (Technical Report Y-87-1). U.S. Army Corps of Engineers. Waterways Experimental Station. Vicksburg, Mississippi. 100 pp. + Appendices.

Hickman, James C., ed. 1993. The Jepson Manual, Higher Plants of California. University of California Press. Berkeley, California 1400 pp.

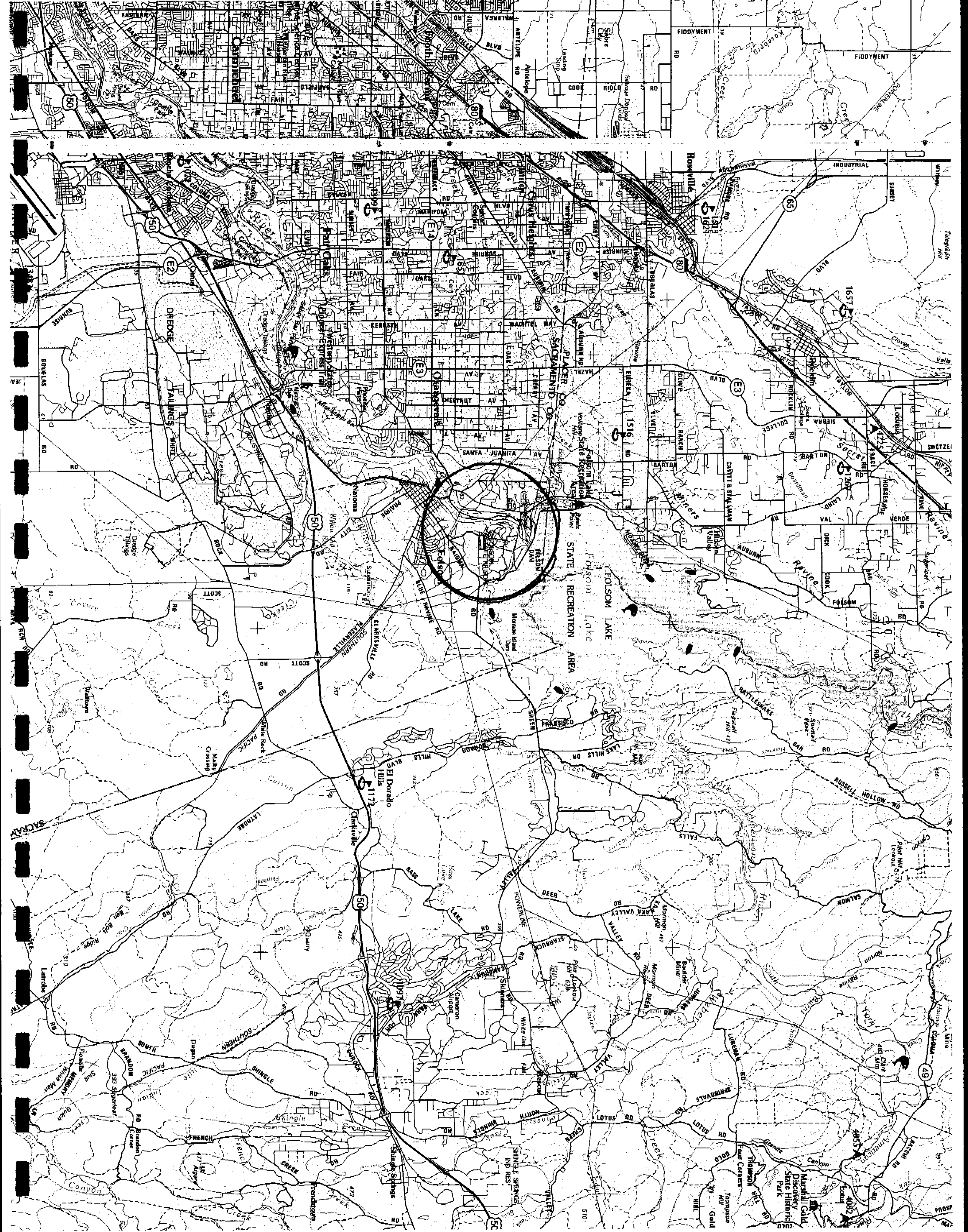
Munsell. 1992. Soil Color Charts. Kollmorgen Instruments Corporation. Newburg, New York.

Reed, P.B., Jr. 1988. National list of plant species that occur in wetlands: California (Region 0). U.S. Fish and Wildlife Service Biol. Rep. 88(26.10) 135 pp.

United States Department of Agriculture, Natural Resources Conservation Service 1993. Soil Survey of Sacramento County, California.

Appendix 1

Project Area Maps



Carmichael
Fair Oaks
Citrus Heights
Orangevale
Roseville
Rocklin
Loomis
Folsom
FOLSOM DAM
Folsom Lake State Recreation Area
FOLSOM LAKE STATE RECREATION AREA
Folsom Lake
PLACER CO
SACRAMENTO CO
DREDGE TAILINGS
Natoma
El Dorado Hills
Clarksville
Latrobe
Shingle Springs
SHINGLE SPRINGS IND RES
Cameron Airpark
Marshall Gold Discovery State Historic Park
Four Corners
Mormon Island Dam
Dredge Tailings
SANTA JUANITA AV
CHESTNUT AV
WACHTEL WAY
SUNRISE
FAIR OAKS BLVD
MADISON AV
OAK AV
GREENBACK
SCOTT RD
WHITE ROCK RD
GREEN VALLEY RD
LATROBE RD
SOUTH SHINGLE RD
FRENCH CREEK RD
LOTUS RD
SALMON FALLS
RUSSELL HOLLOW RD
RATTLESNAKE BAR RD
AUBURN FOLSOM RD
SIERRA COLLEGE BLVD
TAYLOR RD
FIDDYMENT
INDUSTRIAL
BARTON RD
BASS LAKE RD
DEER VALLEY RD
MORMON ISLAND
Pilot Hill
Mormon Hill
Bass Lake
1657
1516
1172
4855

Appendix 2

USDA Soil Mapping

SHEET NO. 4

SOIL SURVEY OF SACRAMENTO COUNTY, CALIFORNIA

(FOLSOM QUADRANGLE)

Appendix 3

Names of Delineators and Preparers

Delineators

Mark Littlefield, U.S. Fish and Wildlife Service
Stephanie Rickabaugh, U.S. Fish and Wildlife Service
Becky Victorine, U.S. Army Corps of Engineers

Preparers

Mark Littlefield, U.S. Fish and Wildlife Service
Stephanie Rickabaugh, U.S. Fish and Wildlife Service

Appendix 4

Field Data Forms

WETLAND RESOURCES SURVEY REPORT

ate & Time (start/stop): 3/14/05 11:12 AM
eam Leader: Gillfield
eld Staff: Rickabaugh, Vertrees
eneral Survey Location: East Matoma's outside guard shack
ask Designation:

Community ID:
Transect ID:
Data Point ID: SW2 #1
Feet/bearing:
Photo: 1-3 on 3/14/05

o normal environmental conditions exist at the plant community? Yes ☑ No ☐
as the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
o "new normal" circumstances exist at the site? Yes ☑ No ☐
the site an agricultural land? Yes ☐ No ☑

38 41 39.688
121 08 36.374
PDOP 4.2

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Eleocharis sp.		Obl	5	
Rumulus - buttercup (mudwort?)			<1	
Rumex crispus		FACW	<1	
Eryngium sp. (coyotethistle)		Obl	<1	
Elymus sp.		FAC		
Vasey.				

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 100%

Morphological adaptations ☐ Taxonomic references ☑
Technical literature ☑ Other ☐
the hydrophytic vegetation criterion met? Yes ☑ No ☐
Rationale:

SOILS

lap Unit Name (series and phase): 104
axonomy (subgroup):
Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
0-2 inches	A	10YR 3-1			moist
2-6 inches			7YR 4-6		moist

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☑ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☑ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

bservations: Irrigated Land leveled Ditch drained Pumped Graded

the hydrophytic soil criterion met? Yes ☒ No ☐
Rationale:

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 8"

Depth to free-standing water in pit/soil probe hole: 8"

Depth to saturated soil: Surface

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☑ Water marks
- ☑ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: Water Ponded on Site

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☑ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☑ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

tadpoles, turkey tracks in mud.

Historic occurrence on site and information sources:

e & Time (start/stop): 3/11/05 12:01
m Leader:
ld Staff:
neral Survey Location: E. Natomas Rd - across fence on Prison
k Designation:

Community ID:
Transect ID:
Data Point ID: SW # 2
Feet/bearing:
Photo: 1 photo - marked Back.

Taken

normal environmental conditions exist at the plant community? Yes ☑ No ☐
s the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
he area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
"new normal" circumstances exist at the site? Yes ☑ No ☐
he site an agricultural land? Yes ☐ No ☑

Seen through fence

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Carex Spp.		obl	10	
Eleocharis Sp.		Obl	50	
Lolium Perenne		FAC	20	
Silybum marianum (milk thistle)				
Yellow Star thistle				

rcent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 80

Morphological adaptations ☑ Taxonomic references ☑
Technical literature ☑ Other ☐
the hydrophytic vegetation criterion met? Yes ☐ No ☐
Rationale:

SOILS — NOT taken.

ap Unit Name (series and phase): 104
xonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
	See site SW1 - this location is on other side of road				

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

bservations: Irrigated Land leveled Ditch drained Pumped Graded

the hydrophytic soil criterion met? Yes ☑ No ☐
Rationale:

Delineated under Rd - into wet swale - track Rd within wet swale

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: Surface + 3"

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: 0

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): 3/14/05
Team Leader:
Field Staff:
General Survey Location: East of C Natomas Rd Before Gate
Task Designation:

Community ID:
Transect ID:
Data Point ID: SW #3
Feet/bearing:
Photo: Dn, close One W/Rd.

Do normal environmental conditions exist at the plant community? Yes ☑ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
Is the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
Do "new normal" circumstances exist at the site? Yes ☑ No ☐
Is the site an agricultural land? Yes ☐ No ☑

Water of U.S. / Swale

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Star thistle		—		
Silybum marianum		—		
Rubus Rubens		NI		

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 0%

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐

Is the hydrophytic vegetation criterion met? Yes ☐ No ☑

Rationale: Non-Wetland seasonal swale w/ no wetland indicators

SOILS

Map Unit Name (series and phase): 104
Taxonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
				Non	Wetland soil

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded

Is the hydrophytic soil criterion met? Yes ☐ No ☑

Rationale:

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: _____

Depth to free-standing water in pit/soil probe hole: _____

Depth to saturated soil: _____

Primary Hydrology Indicators:

- ☐ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☐ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☐ No ☑

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Historic occurrence on site and information sources:

Site has defined bank
Bank water has flowed this year
Muddy from Road Runoff

Site is other waters of the US

WETLAND RESOURCES SURVEY REPORT

)ate & Time (start/stop): 3/14/05 12:49
'eam Leader:
ield Staff:
ieneral Survey Location: MODS Staging Area
'ask Designation:

Community ID:
Transect ID:
Data Point ID: SW #4
Feet/bearing:
Photo: 1- Becky & Dan in photo

)o normal environmental conditions exist at the plan community? Yes ☑ No ☐
las the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
; the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
)o "new normal" circumstances exist at the site? Yes ☑ No ☐
; the site an agricultural land? Yes ☐ No ☑

VEGETATION

Dominant Plant Species	*Stratum*	*Indicator Status*	*Percent Cover*	*Associated Species*
Sedge		OBL		
Lolium Perenne		FAC		
Selaginella bigelowii		- FAC		
				Cotr
Algal Balls				

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 100%

Morphological adaptations ☑ Taxonomic references ☑
Technical literature ☑ Other ☐
; the hydrophytic vegetation criterion met? Yes ☑ No ☐
Rationale:

SOILS

No soil bore taken

lap Unit Name (series and phase): 103
axonomy (subgroup):
Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	*Horizon*	*Matrix Color*	*Mottle Color*	*Abundance/ Contrast*	*Texture, Concretions, Structure, etc.*

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

bservations: Irrigated (Land leveled) Ditch drained Pumped (Graded)

the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale: Site is graded / soils have been altered due to historic grading

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 4"

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: 0

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☑ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: Standing water

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☒ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Waterstriders, tadpoles, fairy shrimp

Historic occurrence on site and information sources:

Ground highly compacted from building of dam - Area was used as staging Area

WETLAND RESOURCES SURVEY REPORT

ate & Time (start/stop): 3/14/05 1:08
eam Leader:
ield Staff:
eneral Survey Location:
ask Designation:

Community ID:
Transect ID:
Data Point ID: SW5
Feet/bearing:
Photo: Sample w/ & w/o flags

flagged

o normal environmental conditions exist at the plan community? Yes ☑ No ☐
as the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
o "new normal" circumstances exist at the site? Yes ☑ No ☐
the site an agricultural land? Yes ☐ No ☑

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Rumex Crispus		FACW	8	
Lolium Perenne		FAC	5	
Sedges		OBL	3	
Populus sp.		FACW	1	
Poison Ivy		–	1	
Taraxacum officinale			<1	
T. [illegible]				

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 80%

Morphological adaptations ☐ Taxonomic references ☑
Technical literature ☑ Other ☐
the hydrophytic vegetation criterion met? Yes ☑ No ☐
Rationale:

SOILS

lap Unit Name (series and phase): 103
axonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
		10YR 2/1			

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☑ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

To hard to get 16" soil bore

bservations: Irrigated Land leveled Ditch drained Pumped Graded Histic

the hydrophytic soil criterion met? Yes ☑ No ☐
Rationale: Low Chroma Soils

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☑ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 9"

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: 0

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☑ Water marks
- ☑ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Turtle

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): 3/14/05 1:27pm
Team Leader: M. Littlefield
Field Staff: S. Rickabaugh, B. Victorine (COE)
General Survey Location:
Task Designation:

Community ID:
Transect ID:
Data Point ID: SW 10
Feet/bearing:
Photo: Stormwater pond w/ park

Do normal environmental conditions exist at the plan community? Yes ☑ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
Is the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
Do "new normal" circumstances exist at the site? Yes ☑ No ☐
Is the site an agricultural land? Yes ☐ No ☑

- defined bank
- flagged.

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Lolium Perenne		FAC	90	
Geranium richardsonii		FACW	5	
Rumex crispus		FACW	1	
Populus sp.		FACW	1	
Salix sp.				
Mimulus lewisii				
Conium maculatum		FACW		

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 100 %

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☑ Other ☐

Is the hydrophytic vegetation criterion met? Yes ☑ No ☐

Rationale:

SOILS

Map Unit Name (series and phase): 103
Taxonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
0-2" loamy		10YR 4-3			
2+" coarse sand					High amounts of organics

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☑ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded → Histic

Is the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale: indicators

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 2" Avg.

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: 0

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

tadpoles in ponded area

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

ate & Time (start/stop): 3/15/05 11:40AM
eam Leader: Little field
ield Staff: R. Vanderwalker, Nichoine
eneral Survey Location: Folsom Dam –
ask Designation:

Community ID:
Transect ID: SW 7
Data Point ID:
Feet/bearing:
Photo: VPS – Ck at drainage w/ Poison Hemlock

o normal environmental conditions exist at the plan community? Yes ☑ No ☐
as the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
o "new normal" circumstances exist at the site? Yes ☑ No ☐
the site an agricultural land? Yes ☐ No ☑

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Lolium perenne		FAC	~~35~~ 35	
Conium maculatum		FACW	~~35~~ 35	
Rubus discolor		FACW	~~<1~~ <1	
Salix sp.			~~2~~ 2	
Sambucus		FAC	~~2~~ 2	
Rumex crispus		FACW	~~2~~ 2	
Geranium richardsonii		FACW	10	
Galium sp (bedstraw)			10	
Minus lettus – sound lure				
Cattail (Narrow leaf)				

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 100

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐

the hydrophytic vegetation criterion met? Yes ☐ No ☐

Rationale: water depth @ 12" above surface

SOILS

14" pit filled w/ H2O

lap Unit Name (series and phase): 103
axonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
0-4"	A				Organics / Sandy L
4-12"	Basic Color	5YR 3-2	7.5YR 4-6		

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☒ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

bservations: Irrigated Land leveled Ditch drained Pumped Graded

the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale: Sandy soils possibly disturbed during dam Construction

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: _____

Depth to free-standing water in pit/soil probe hole: _____

Depth to saturated soil: 12"

Primary Hydrology Indicators:

- ☒ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☒ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☒ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☒ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

_____

Animals Observed:

_____

Historic occurrence on site and information sources:

_____

WETLAND RESOURCES SURVEY REPORT

)ate & Time (start/stop): _____
'eam Leader: _____
)ield Staff: _____
)eneral Survey Location: BLM Stmacc - Northside
'ask Designation: _____

Community ID: _____
Transect ID: _____
Data Point ID: Sw 9a
Feet/bearing: _____
Photo: 2- swale B/T CKS

)o normal environmental conditions exist at the plan community? Yes ☑ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
; the area a potential Problem Area or Atypical Situation? Yes ☐ No ☑
)o "new normal" circumstances exist at the site? Yes ☐ No ☑
; the site an agricultural land? Yes ☐ No ☑

Sw9- Herb 3 waterbrook st. Show location of [illegible]

VEGETATION

100 % ground cover = 5 plots

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Lolium Perenna		FAC	60	
Vicia Americana		NI	1	
Rumex Crispus		FACW	1	
Clover			1	
Eleocharis sp.		Obl	~~10~~ 12	
Barley			1	
Agrostis nebulosa		FACW	1	
Bromus Rubens		NI	3-4	
Cattails			5 -	

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 80

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☑ Other ☐
; the hydrophytic vegetation criterion met? Yes ☑ No ☐
Rationale: _____

SOILS

Map Unit Name (series and phase): 103
'axonomy (subgroup): _____
Drainage Class: _____
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
0-5"					Sandy loam, high organic
					Roots throughout ~12"
		10YR 3.3	@ 9"		0

lydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☑ High organic content in sandy soils
- ☑ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

)bservations: Irrigated Land leveled Ditch drained Pumped Graded

; the hydrophytic soil criterion met? Yes ☐ No ☑
Rationale: _____

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 8" below surface

Depth to free-standing water in pit/soil probe hole: _____

Depth to saturated soil: _____

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

_____

Animals Observed:

Birds, Butterflys, Canada Geese

Historic occurrence on site and information sources:

_____

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): 3/15/05 – 12:19
Team Leader:
Field Staff:
General Survey Location:
Task Designation:

Community ID:
Transect ID:
Data Point ID: SW 9b Waters.
Feet/bearing:
Photo:

– free-flowing
– Avg. tree dbh = 12"

Do normal environmental conditions exist at the plant community? Yes ☑ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
Is the area a potential Problem Area or Atypical Situation? Yes ☐ No ☑
Do "new normal" circumstances exist at the site? Yes ☐ No ☑
Is the site an agricultural land? Yes ☐ No ☑

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Urtica dioica		FACW		
Typha latifolia		OBL		
Cicuta maculata		FACW		
Populus sp.		FACW		
wild cucumber				
Rumex crispus		FACW		
Silybommarianum		—		
sedge				
poison oak, Blk Berry				

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 90 %

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☑ Other ☐
Is the hydrophytic vegetation criterion met? Yes ☑ No ☐
Rationale:

SOILS

Map Unit Name (series and phase): 103
Taxonomy (subgroup):
Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
	See				
	SW 9a				

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☑ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded

Is the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale:

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: Wet at Surface

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil:

Primary Hydrology Indicators:

- ☐ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

birds,

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

)ate & Time (start/stop): 3-15-05 1:20
'eam Leader:
ield Staff:
ieneral Survey Location: B/T Blm Storage + Prison Fence
'ask Designation:

Community ID:
Transect ID:
Data Point ID: SW 10
Feet/bearing:
Photo: 1 - Hlg Pitchemlock

)o normal environmental conditions exist at the plant community? Yes ☒ No ☐
las the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☐ No ☐
; the area a potential Problem Area or Atypical Situation? Yes ☒ No ☒
)o "new normal" circumstances exist at the site? Yes ☐ No ☐
; the site an agricultural land? Yes ☐ No ☐

No evidence of hydrology!

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Montia parvifolia		FACW	~~90~~ 5	
Conium maculatum		FACW	90	
Silybum marianum			<1	
Urtica dioica		FACW	2	
Sisymbrium altissimum		FACU	<1	
Marrubium vulgare		FAC	<1	
[illegible]		FAC	<1	

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)?
Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐
; the hydrophytic vegetation criterion met? Yes ☐ No ☐
Rationale:

SOILS

Map Unit Name (series and phase): 103
axonomy (subgroup):
Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
0-12"		Very dark brown 1			fine sandy loam wooded land [illegible] good garden soil

ydric Soil Indicators
- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☑ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

)bservations: Irrigated Land leveled Ditch drained Pumped Graded

; the hydrophytic soil criterion met? Yes ☑ No ☐
Rationale: high chroma and organic content in sandy soil

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: _____

Depth to free-standing water in pit/soil probe hole: _____

Depth to saturated soil: moist

Primary Hydrology Indicators:

- ☐ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

_____

Animals Observed:

BIRDS, deer from parlier

Historic occurrence on site and information sources:

_____

WETLAND RESOURCES SURVEY REPORT

ate & Time (start/stop): 8/15/05 1:40
eam Leader:
ield Staff:
eneral Survey Location: B/T fences.
ask Designation:

Community ID:
Transect ID:
Data Point ID: SW12(a)
Feet/bearing:
Photo: yes - also in earlier photo - Swift On Page Site 24.

Some standing H_2O at surface.

o normal environmental conditions exist at the plan community?	Yes ☑	No ☐
as the vegetation, soils, and/or hydrology been significantly disturbed?	Yes ☐	No ☑
the area a potential Problem Area or Atypical Situation?	Yes ☐	No ☑
o "new normal" circumstances exist at the site?	Yes ☐	No ☑
the site an agricultural land?	Yes ☐	No ☑

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Lolium perenne		FAC		
Eleocharis		OBL		
BCK Bering				
Galium sp.				
Rumex crispus		FAC W		
Geum macrophyllum Richardsonii		FAC W		

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 100 %

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☑ Other ☐

the hydrophytic vegetation criterion met? Yes ☑ No ☐

Rationale:

SOILS

lap Unit Name (series and phase):
axonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
0-12"			NONE		highly organic
12"		7YR 5-2			(1 sandy soil
8"		10YR 3-1			

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☑ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

bservations: Irrigated Land leveled Ditch drained Pumped Graded

the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale:

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: Ø

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: to Surface

Primary Hydrology Indicators:

- ☐ Direct observation of inundation
- ☒ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☒ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☒ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

ate & Time (start/stop): 3/15/05 1:31
eam Leader:
ield Staff:
eneral Survey Location:
ask Designation:

Community ID:
Transect ID:
Data Point ID: SW 12(b)
Feet/bearing:
Photo: 1

o normal environmental conditions exist at the plant community? Yes ☑ No ☐
as the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
o "new normal" circumstances exist at the site? Yes ☑ No ☐
the site an agricultural land? Yes ☐ No ☑

(Swales coming into pondered area. See SW 12)

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Xanthium strumarium		FAC+	80	
Bidens cernuus		FACW	10	
Rumex crispus		FAC	10	
Lolium perenne		obl		
rush-leafed rush				

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 100%

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☑ Other ☐

s the hydrophytic vegetation criterion met? Yes ☐ No ☐

Rationale:

SOILS

Map Unit Name (series and phase): 103
axonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
		See SW 12a			

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded

detention basin w/ culvert

s the hydrophytic soil criterion met? Yes ☐ No ☐

Rationale:

SOILS

full 3ft / Current 17

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water:

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil:

Primary Hydrology Indicators:

- ☒ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☒ Water marks
- ☒ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

tadpoles,

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

ate & Time (start/stop): 3/15/05 2:00
eam Leader:
eld Staff:
eneral Survey Location: BIT BLUFF [illegible]
ask Designation: SW, [illegible]

Community ID:
Transect ID:
Data Point ID: SW13
Feet/bearing:
Photo: 1 – Shows grape vine

o normal environmental conditions exist at the plant community? Yes ☑ No ☐
as the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
the area a potential Problem Area or Atypical Situation? Yes ☑ No ☐
o "new normal" circumstances exist at the site? Yes ☑ No ☐
the site an agricultural land? Yes ☐ No ☑

Swale that Runs into sump under the.

VEGETATION

Dominant Plant Species	*Stratum*	*Indicator Status*	*Percent Cover*	*Associated Species*
Eleocharis sp.		OBL		
Rumex crispus		FACW		
Conium maculatum		FACW		
Vitis californica		FACW		
Populus sp.		FACW		
Pipe line				

ercent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 100%

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☑ Other ☐
the hydrophytic vegetation criterion met? Yes ☑ No ☐
Rationale:

SOILS

ap Unit Name (series and phase): 103
axonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	*Horizon*	*Matrix Color*	*Mottle Color*	*Abundance/ Contrast*	*Texture, Concretions, Structure, etc.*
at 8"		10YR 3-1			

ydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☑ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☑ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

bservations: Irrigated Land leveled Ditch drained Pumped Graded

the hydrophytic soil criterion met? Yes ☐ No ☐

Rationale:

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: at surface

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: 0

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Historic occurrence on site and information sources:

Date & Time (start/stop): 4/7/05 9:00
Team Leader:
Field Staff: Littfield, Rickenbach, B. Victorine
General Survey Location:
Task Designation: Bike trail across from Tees + Ed

Community ID:
Transect ID: SW-17
Data Point ID:
Feet/bearing:
Photo: Yes

Do normal environmental conditions exist at the plan community? Yes ☒ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☐ No ☒
Is the area a potential Problem Area or Atypical Situation? Yes ☒ No ☐
Do "new normal" circumstances exist at the site? Yes ☐ No ☒ - Not currently
Is the site an agricultural land? Yes ☐ No ☒

Channel width = 9 ft.

VEGETATION

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
lolium perenna		FAC	50	
dandalion CA-Native			20	
Geranium			10	
Bedstraw				
Slawthistle				

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)?
Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐
Is the hydrophytic vegetation criterion met? Yes ☐ No ☐
Rationale:

SOILS

Map Unit Name (series and phase):
Taxonomy (subgroup):
Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
0 - 1"					organics
1 - 4		10YR 4/3			Sandy / gravelly

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☒ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☒ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other Clay

Observations: Irrigated Land leveled Ditch drained Pumped Graded → Constructed Trapezoidal Channel

Is the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale:

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 3"

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: Surface

Primary Hydrology Indicators:

- ☒ Direct observation of inundation
- ☒ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☒ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☒ No ☐

Remarks: meets based on Veg and Hydrology - Soils weak but are disturbed - atypical

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

tadpoles,

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): 4/7/05 9:30
Team Leader:
Field Staff: ML, SR, BK
General Survey Location:
Task Designation:

Community ID:
Transect ID: SW-18
Data Point ID:
Feet/bearing:
Photo:

Do normal environmental conditions exist at the plan community? Yes ☒ No ☐ — 6ft wide Channel
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☐ No ☒
Is the area a potential Problem Area or Atypical Situation? Yes ☒ No ☐ — BP 1 flows into this Chan
Do "new normal" circumstances exist at the site? Yes ☐ No ☒
Is the site an agricultural land? Yes ☐ No ☐

VEGETATION

water hemlock

Dominant Plant Species	Stratum	Indicator Status	Percent Cover	Associated Species
Ellerosis		OBL	2	
Mint		OBL	2	
Willow sp. Salsiandra		OBL	13	
poison oak				
Carex spp.		OBL	20	
Rumex		FAC W -	20	
Blk Berry			5	
lollium Perenn		FAC	2	
Speedwell, water		OBL	3	

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 64%

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐

Is the hydrophytic vegetation criterion met? Yes ☑ No ☐
Rationale:

SOILS

Map Unit Name (series and phase):
Taxonomy (subgroup):
Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	Horizon	Matrix Color	Mottle Color	Abundance/ Contrast	Texture, Concretions, Structure, etc.
Same as SW-17		10YR/4/3			

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☒ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☒ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other — Constructed ditch -

Observations: Irrigated Land leveled Ditch drained Pumped Graded

Is the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale: Soils meet based on fact that site has been graded and disturbed during constration of Dam - Channels are man made

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 1-2"

Depth to free-standing water in pit/soil probe hole:

Depth to saturated soil: surface

Primary Hydrology Indicators:

- ☒ Direct observation of inundation
- ☒ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: Veg. and Hydrology — Soils disturbed

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Gray squirrel

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): 4-18-2005
Team Leader:
Field Staff: L. Hafield
General Survey Location:
Task Designation:

Community ID:
Transect ID: BW-19
Data Point ID:
Feet/bearing:
Photo:

Do normal environmental conditions exist at the plan community? Yes ☑ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☐ No ☑
Is the area a potential Problem Area or Atypical Situation? Yes ☐ No ☑
Do "new normal" circumstances exist at the site? Yes ☐ No ☑
Is the site an agricultural land? Yes ☐ No ☑

VEGETATION

Dominant Plant Species	*Stratum*	*Indicator Status*	*Percent Cover*	*Associated Species*
Lolium Perenne		FAC	35	
Soft Chess		FAC-u	20	
eleocharis		OBL	15	
Horibum jubatum		FAC +	<2	
hydrocotyle		FAC W-	<2	

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 54%

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐

Is the hydrophytic vegetation criterion met? Yes ☑ No ☐

Rationale:

SOILS

Map Unit Name (series and phase):
Taxonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	*Horizon*	*Matrix Color*	*Mottle Color*	*Abundance/ Contrast*	*Texture, Concretions, Structure, etc.*
	A	10YR 2/2			Sandy Loam

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded

Is the hydrophytic soil criterion met? Yes ☐ No ☐

Rationale:

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 0

Depth to free-standing water in pit/soil probe hole: 8"

Depth to saturated soil: Surface

Primary Hydrology Indicators:

- ☐ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Seasonal wetland - small plug on drainage
Depressional feature

Animals Observed:

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): 4/18/2005
Team Leader:
Field Staff: Littlefield, Becky
General Survey Location:
Task Designation:

Community ID:
Transect ID: SW-2D
Data Point ID:
Feet/bearing:
Photo:

Do normal environmental conditions exist at the plan community? Yes ☐ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☐ No ☐
Is the area a potential Problem Area or Atypical Situation? Yes ☐ No ☐
Do "new normal" circumstances exist at the site? Yes ☐ No ☐
Is the site an agricultural land? Yes ☐ No ☐

VEGETATION

Dominant Plant Species	*Stratum*	*Indicator Status*	*Percent Cover*	*Associated Species*
Lolium Perenne		FAC	35	
Soft Chess		FAC-u	10	
Elicorris		OBL	15	
Lonicera Japonica		FAC+	4	
Curly Dock		FACW-	4	

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 58%

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐

Is the hydrophytic vegetation criterion met? Yes ☑ No ☐

Rationale:

SOILS

Map Unit Name (series and phase):
Taxonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	*Horizon*	*Matrix Color*	*Mottle Color*	*Abundance/ Contrast*	*Texture, Concretions, Structure, etc.*
	A	10 YR 2/2			Sandy Loam

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded

Is the hydrophytic soil criterion met? Yes ☐ No ☐

Rationale:

SOILS

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 1"

Depth to free-standing water in pit/soil probe hole: 0"

Depth to saturated soil: Surface

Primary Hydrology Indicators:

- ☐ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☐ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: Last rain ~2 weeks from site visit

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Seasonal wetland Depressional feature

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Animals Observed:

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): 4-18-2005
Team Leader:
Field Staff: Littlefield, Beck
General Survey Location:
Task Designation:

Community ID:
Transect ID:
Data Point ID: SW-31
Feet/bearing:
Photo:

Do normal environmental conditions exist at the plan community? Yes ☑ No ☐
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☐ No ☑
Is the area a potential Problem Area or Atypical Situation? Yes ☐ No ☑
Do "new normal" circumstances exist at the site? Yes ☐ No ☑
Is the site an agricultural land? Yes ☐ No ☑

VEGETATION

Dominant Plant Species	*Stratum*	*Indicator Status*	*Percent Cover*	*Associated Species*
Trisetum Grass		OBL	25	
Floating		OBL	25-30	
Lolium		FAC	15	
Cattail		OBL	7	
Rumex Crispus		FACW	<1	
Willow Salicaceae		OBL	<1	
Soft Chess (Bromus mollis)		FAC-U	<2	
Blue oat		UPL	<1	

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? 70%

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐

Is the hydrophytic vegetation criterion met? Yes ☑ No ☐

Rationale:

SOILS

Map Unit Name (series and phase):
Taxonomy (subgroup):

Drainage Class:
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	*Horizon*	*Matrix Color*	*Mottle Color*	*Abundance/ Contrast*	*Texture, Concretions, Structure, etc.*
	A	10YR 3/1			Sandy Loam

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☑ Sulfidic odor
- ☑ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded

Is the hydrophytic soil criterion met? Yes ☑ No ☐

Rationale:

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: 6"

Depth to free-standing water in pit/soil probe hole: Surface

Depth to saturated soil: Surface

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☑ Saturation in upper 12"
- ☐ Water marks
- ☐ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☑ No ☐

Remarks:

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

Dead turtle

Animals Observed:

Historic occurrence on site and information sources:

WETLAND RESOURCES SURVEY REPORT

Date & Time (start/stop): _____
Team Leader: _____
Field Staff: Littlefield, Victorine
General Survey Location: _____
Task Designation: _____

Community ID: _____
Transect ID: SW-22
Data Point ID: _____
Feet/bearing: _____
Photo: _____

Do normal environmental conditions exist at the plan community? Yes ☐ No ☑
Has the vegetation, soils, and/or hydrology been significantly disturbed? Yes ☑ No ☐
Is the area a potential Problem Area or Atypical Situation? Yes ☐ No ☐
Do "new normal" circumstances exist at the site? Yes ☐ No ☐
Is the site an agricultural land? Yes ☐ No ☑

non-wetland
Colvert

VEGETATION

Dominant Plant Species	*Stratum*	*Indicator Status*	*Percent Cover*	*Associated Species*

Percent of dominant species that are OBL, FACW, and/or FAC (excluding FAC-)? _____

Morphological adaptations ☐ Taxonomic references ☐
Technical literature ☐ Other ☐

Is the hydrophytic vegetation criterion met? Yes ☐ No ☑

Rationale: _____

SOILS

Map Unit Name (series and phase): _____
Taxonomy (subgroup): _____

Drainage Class: _____
Confirmed Map Type? Yes ☐ No ☐

Profile Description Depth	*Horizon*	*Matrix Color*	*Mottle Color*	*Abundance/ Contrast*	*Texture, Concretions, Structure, etc.*

Hydric Soil Indicators

- ☐ Histosil (except folists)
- ☐ Histic epipedons
- ☐ Sulfidic odor
- ☐ Aquic moisture regime
- ☐ Peraquic moisture
- ☐ Reducing condition
- ☐ Gleyed or low chroma colors
- ☐ Concretions
- ☐ Listed on local soils list
- ☐ Listed on national soils list
- ☐ High organic content in sandy soils
- ☐ Organic streaking in sandy soils
- ☐ Spodic horizon
- ☐ Other

Observations: Irrigated Land leveled Ditch drained Pumped Graded

Is the hydrophytic soil criterion met? Yes ☐ No ☑

Rationale: _____

Recorded Data

- ☐ Stream, lake or tide gauge
- ☐ Aerial photographs
- ☐ Other
- ☐ No recorded data available

Field Observations

Depth of water: _____

Depth to free-standing water in pit/soil probe hole: _____

Depth to saturated soil: _____

Primary Hydrology Indicators:

- ☑ Direct observation of inundation
- ☐ Saturation in upper 12"
- ☑ Water marks
- ☐ Sediment deposits
- ☑ Wetland drainage patterns
- ☐ Drift lines

Secondary Hydrology Indicators (2 or more required)

- ☐ Water-stained leaves
- ☐ Oxidized rhizosphyeres (living roots in upper 1")
- ☐ Local Soil Survey Data
- ☐ FAC - neutral test
- ☐ Other

Is the wetland hydrology criterion met? Yes ☑ No ☐

Rationale: _____

JURISDICTIONAL DETERMINATION AND RATIONALE

Is the site evaluated a wetland? Yes ☐ No ☑

Remarks: SW-22 is a constructed Culvert connecting SW-21 w/wetland on adjacent property (Folsom Prison). Culvert is Water of U.S.

- ☐ Possible Section 10 Jurisdiction?
- ☐ Possible exempt from Corps/EPA regulation?
  - ☐ Construction in dry land (until abandoned) of: farm/stock ponds, ditches, farm or forest roads using BMPs, irrigated areas, temporary sed. basins at construction sites, or ornamental ponds.
  - ☐ Maintenance of currently serviceable structures
  - ☐ On-going agriculture, silviculture, and ranching
  - ☐ Ag fields considered prior converted cropland
  - ☐ Waste treatment ponds (in operation)
  - ☐ Irrigated areas that would revert to upland
  - ☐ Superfund sites
  - ☐ Federal projects authorized by Congress with EIS
  - ☐ Removal/planting of vegetation
  - ☐ De minimis, incidental to normal dredging
  - ☐ Activities occurring before cut off dates

SPECIAL STATUS REPTILES, AMPHIBIANS, AND INVERTEBRATES

Assessment of habitat suitability:

_____

Animals Observed:

_____

Historic occurrence on site and information sources:

_____

Appendix 5

Plant Species List

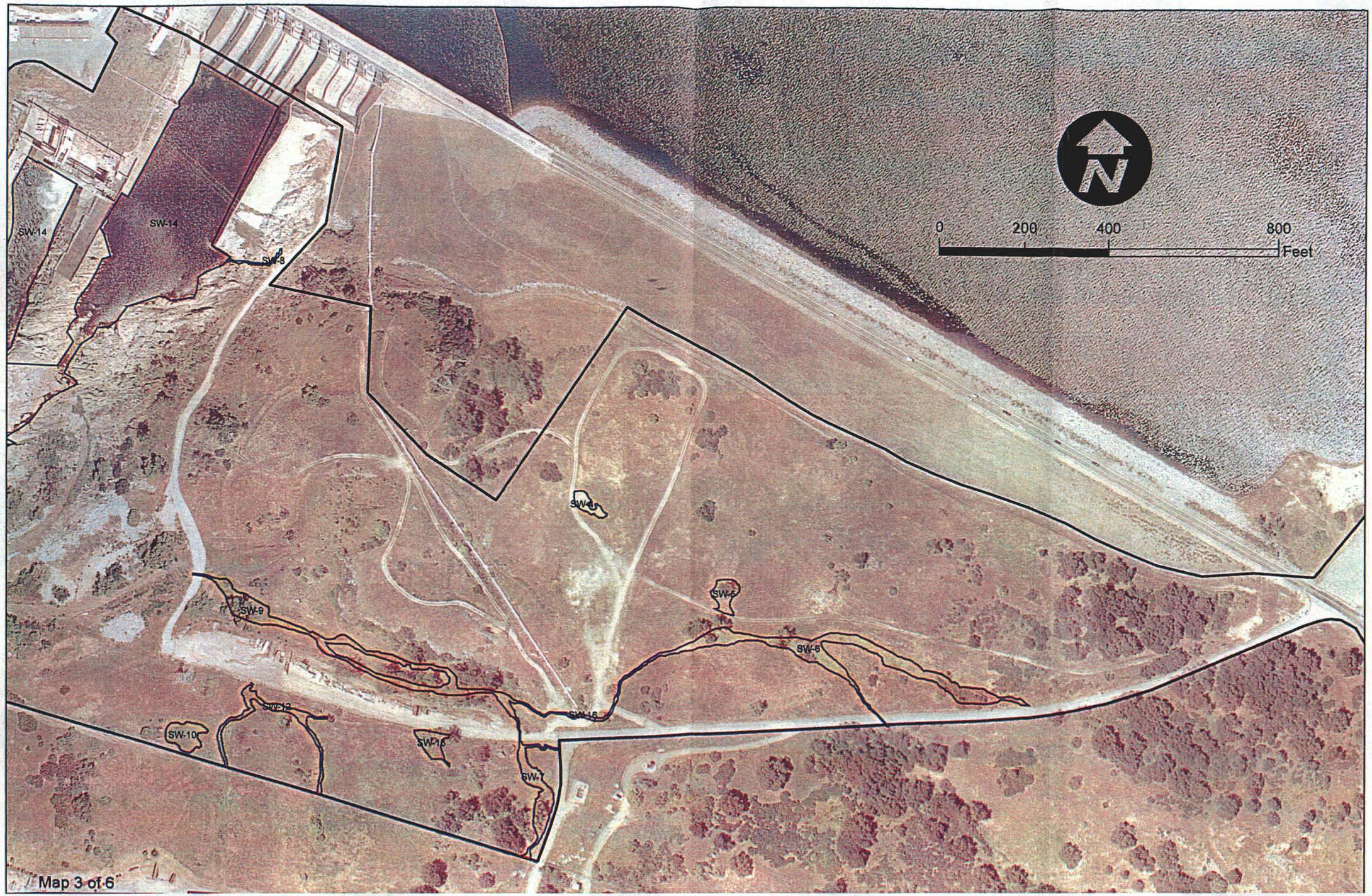
Aristolochia californica
Avena spp.
Bromis mollis
Bromis rubens
Carex spp.
Centaurea solstitialis
Claytonia parviflora
Cicuta maculata
Eleocharis macrostachya
Eryngium vaseyi
Galium spp.
Geranium dissectum
Geranium richardsonii
Hordiun hystrix
Juncus xiphiodes
Lasthenia spp.
Lolium perenne
Marah spp.
Marrubium vulgare
Populus fremontii
Ranunculus bonariensis
Rubus discolor
Rumex crispus
Rorippa nasturtium-aquaticum
Salix spp.
Sambucus mexicana
Selasinella bigelovii
Silybum marianum
Taraxacum californicum
Typha latifolia
Urtica dioica
Vicia americana
Vitis californica
Xanthium strumarium

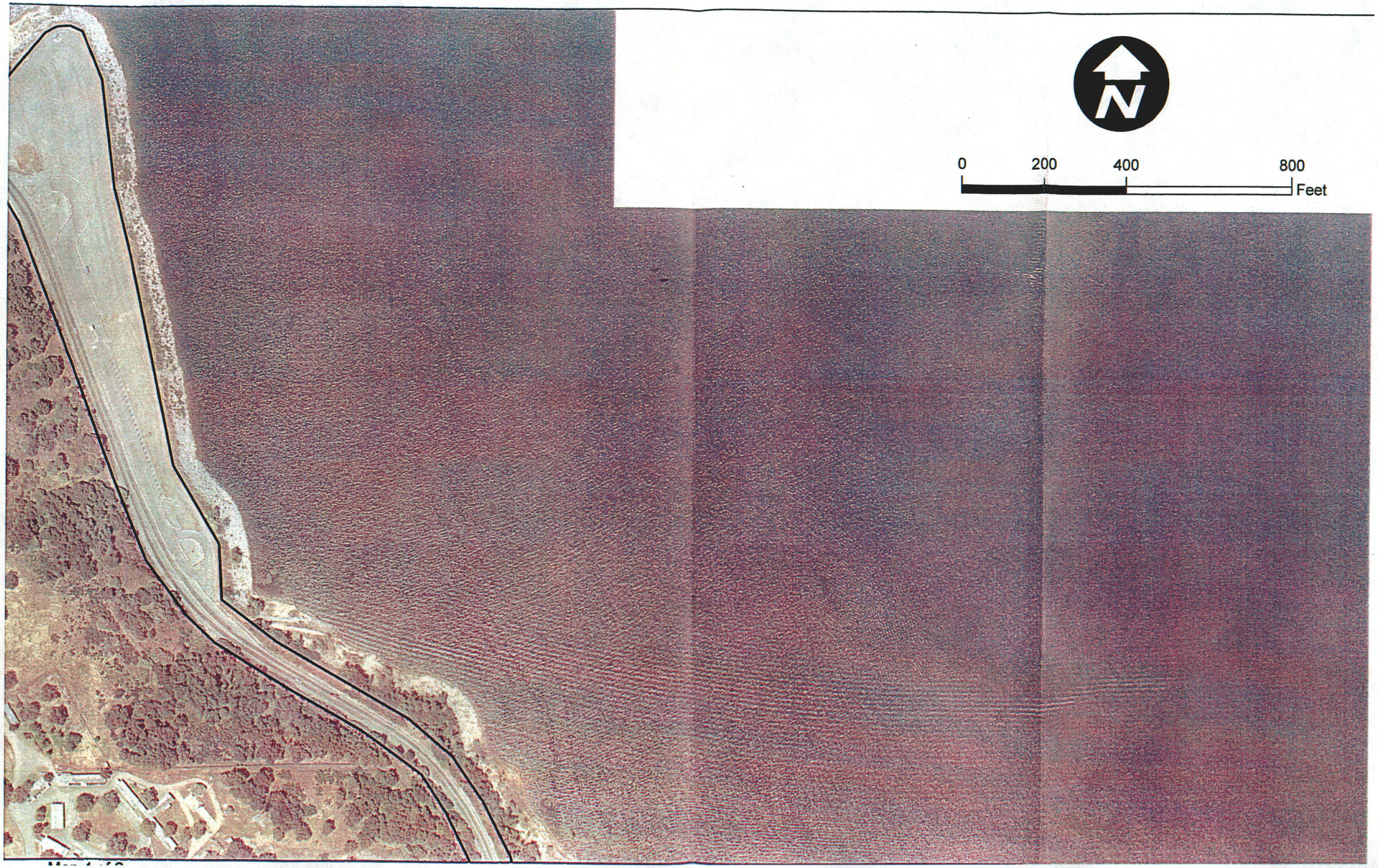
Appendix 6

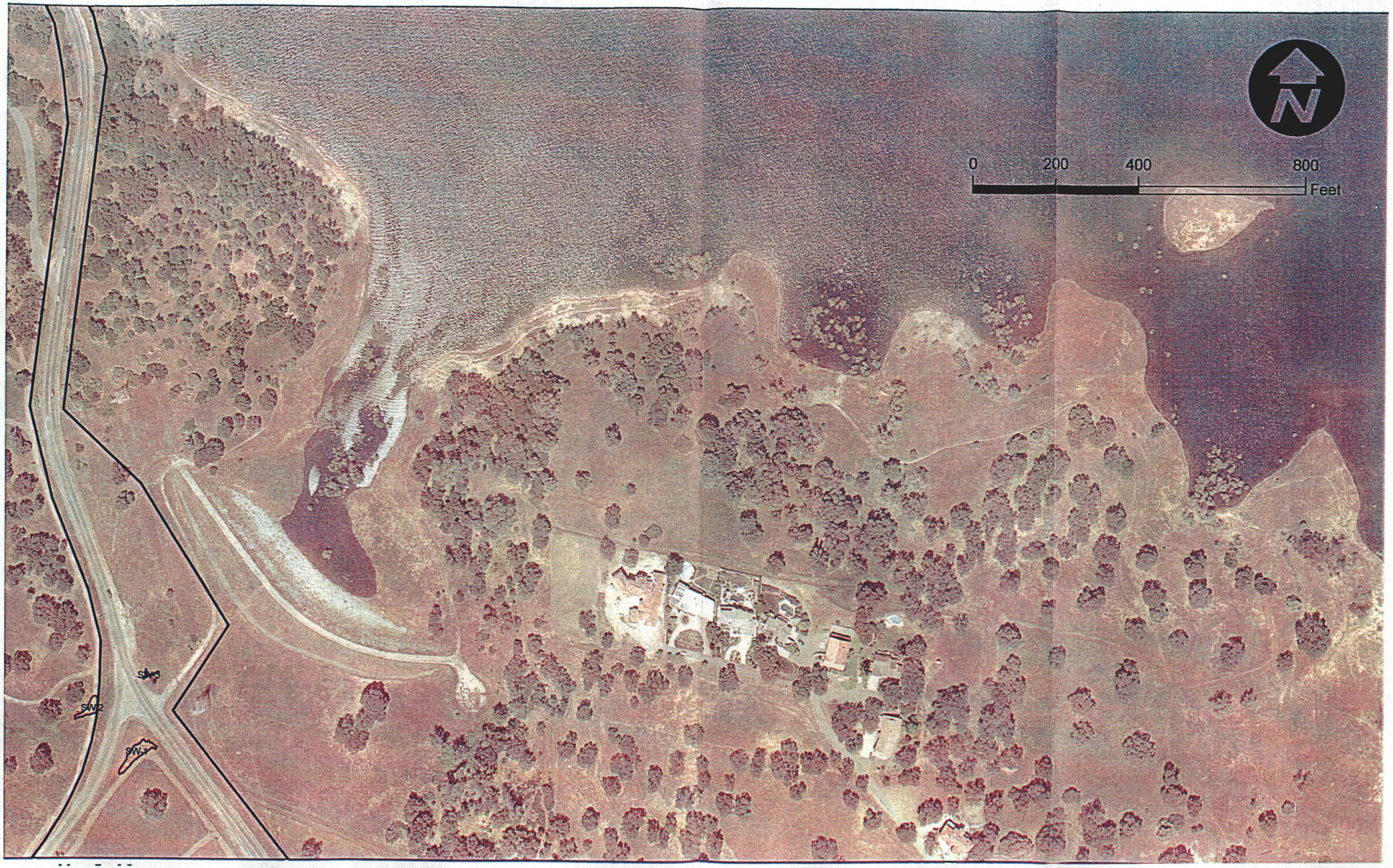
Wetland Delineation Maps

Map 1 of 6

Map 2 of 6


SW-14
SW-14
SW-8
SW-4
SW-9
SW-6
SW-5
SW-12
SW-16
SW-10
SW-13
SW-7
0
200
400
800
Feet
N
Map 3 of 6


N
0
200
400
800
Feet


N
0
200
400
800
Feet
SW-3
SW-2
SW-1

Map 6 of 6

Appendix 7

Site Photos

SW1

SW3B

SW13

SW2

SW4

SW5B

SW3

SW5

SW6B

SW6D

SW6

SW6C

SW9

SW10

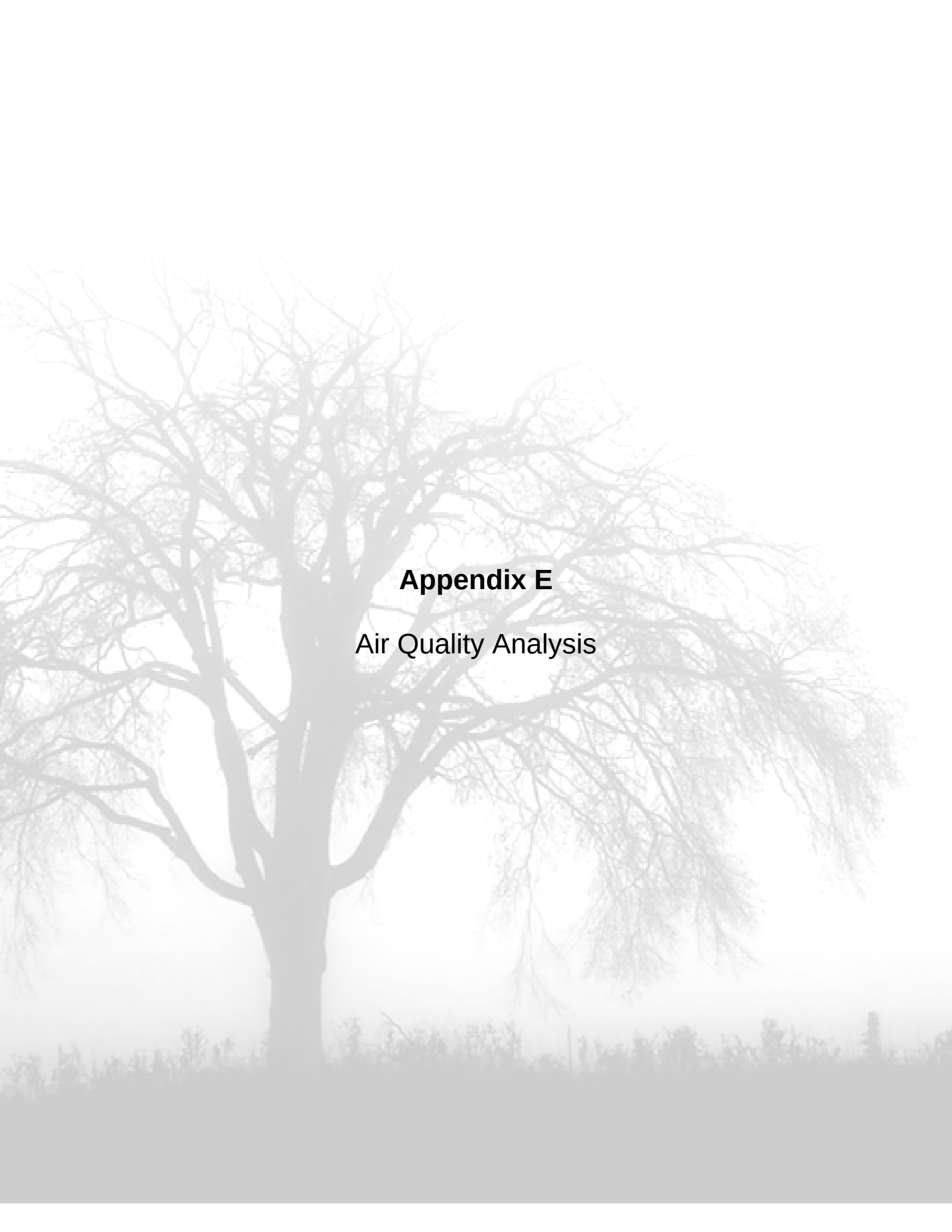
SW7

SW9B

SW12
SW12a

SW12C
SW12

SW12B



Appendix E

Air Quality Analysis

Appendix E. Air Quality Analysis

Construction Emission Calculations – Alternatives 2, 3, 4, and 5
Operational Emission Calculations – Ozone Precursors and PM10
Operational CO Concentrations

Construction Emission Calculations – Alternatives 2, 3, and 4

The 1996-2000 emission standards for diesel powered equipment (Tier I) equal 1 gram ROG, 8.5 grams CO, 6.9 grams NOx, and 0.4 grams PM10 per brake horsepower-hour. For off-road equipment, pounds per day calculations were estimated as follows: pounds/day = grams/hp-hr x hp x number vehicles x 8 hours/day x load factor / 454 grams/pound. For on-road equipment, pounds per day calculations were estimated as follows: pounds/day x grams/mile (per EMFAC2002 results at 30 mph) x 100 miles per day / 454 grams/pound.

Mitigated lbs/day only applied to off-road equipment and assumes that emissions would be reduced by 20% for NOx and 45% for PM10.

Phase 1				Load		lbs/day				Mitigated lbs/day	
Access Road Development	Number	Equipment	hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
	1	Pickups	150	1	360	0.05		0.1	0.0	0.1	0.0
	1	Fuel Truck	210	1	177	0.15		1.7	0.1	1.7	0.1
	2	Water Truck	210	1	720	0.15		3.4	0.1	3.4	0.1
	4	Dozers - D8	285	0.59	2880	11.9	100.7	81.8	4.7	65.4	2.6
	1	Motor Patrol	200	0.575	360	2.0	17.2	14.0	0.8	11.2	0.4
	1	Vibratory Rollers	155	0.43	360	1.2	10.0	8.1	0.5	6.5	0.3
	1	Dump Trucks	250	1	720	0.15		1.7	0.1	1.7	0.1
	1	Trucks	150	1	176	0.15		1.7	0.1	1.7	0.1
					Total->	15.71	127.95	112.54	6.29	91.8	3.6
SMUD Tower Relocation	1	Pickups	150	1	176	2.6	22.5	18.2	1.1	14.6	0.6
	1	Line Trucks	210	1	528	0.15		1.7	0.1	1.7	0.1
	1	Hydraulic Crane	250	0.43	176	1.9	16.1	13.1	0.8	10.5	0.4
	1	Reel Trailers	100	0.75	176	1.3	11.2	9.1	0.5	7.3	0.3
	1	Rollers	285	0.43	80	2.2	18.4	14.9	0.9	11.9	0.5
					Total->	8.17	68.16	57.04	3.26	46.0	1.8

Phase 2a

Phase 1				Load		lbs/day				Mitigated lbs/day	
Access Road Development	Number	Equipment	hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
Roadway Excavation	1	Pickups	150	1	4800	0.05		0.1	0.0	0.1	0.0
	1	Fuel Truck	210	1	2000	0.15		1.7	0.1	1.7	0.1
	1	Water Trucks	210	1	4800	0.15		1.7	0.1	1.7	0.1
	1	Compressors	325	1	6000	5.7	48.7	39.5	2.3	31.6	1.3
	1	Dozer D10	570	0.59	2400	5.9	50.4	40.9	2.4	32.7	1.3
	1	Loader 988	430	0.465	2400	3.5	29.9	24.3	1.4	19.4	0.8
	1	Off-Highway Truck	450	1	12000	0.15		1.7	0.1	1.7	0.1
	1	Motor Graders	200	0.575	2400	2.0	17.2	14.0	0.8	11.2	0.4
	1	??? 825	315	1	2400	5.6	47.2	38.3	2.2	30.6	1.2
	1	Dozer	215	0.59	2400	2.2	19.0	15.4	0.9	12.3	0.5
	1	Truck	150	1	2400	0.15		1.7	0.1	1.7	0.1
					Total->	25.64	212.40	179.38	10.21	144.9	5.7
Drainage	1	Pickup	150	1	800	0.05		0.1	0.0	0.1	0.0
	1	Boom Truck	210	1	800	0.15		1.7	0.1	1.7	0.1
	1	Backhoe	290	0.465	600	2.4	20.2	16.4	1.0	13.1	0.5
	1	Loader	215	0.465	600	1.8	15.0	12.2	0.7	9.7	0.4
	1	Compressor	50	1	200	0.9	7.5	6.1	0.4	4.9	0.2
	1	Hydraulic Hoe	100	0.465	600	0.8	7.0	5.7	0.3	4.5	0.2
	1	Truck - Disposal	210	1	300	0.15		1.7	0.1	1.7	0.1
	1	Truck - Backfill	210	1	600	0.15		1.7	0.1	1.7	0.1
	1	Water Truck	210	1	800	0.15		1.7	0.1	1.7	0.1
					Total->	6.49	49.63	47.25	2.55	39.2	1.5
Roadway Structural	1	Pickup	150	1	220	0.05		0.1	0.0	0.1	0.0
	1	Water Truck	210	1	220	0.15		1.7	0.1	1.7	0.1
	1	Motor Graders	200	0.575	220	2.0	17.2	14.0	0.8	11.2	0.4
	1	Roller	155	0.43	220	1.2	10.0	8.1	0.5	6.5	0.3

Phase 1				Load		lbs/day				Mitigated lbs/day	
Access Road Development	Number	Equipment	hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
	1	Dump Trucks	225	1	3400	0.15		1.7	0.1	1.7	0.1
	1	Roller	100	0.43	220	0.8	6.4	5.2	0.3	4.2	0.2
	1	Truck	175	1	220	0.15		1.7	0.1	1.7	0.1
					Total->	4.46	33.65	32.56	1.74	27.1	1.0
Road Structural	1	Pickup	150	1	80	0.05		0.1	0.0	0.1	0.0
Difference Section	1	Paving Machine	160	0.53	80	1.5	12.7	10.3	0.6	8.2	0.3
	1	Rollers	90	0.43	300	0.7	5.8	4.7	0.3	3.8	0.2
	1	Trucks	250	1	40	0.15		1.7	0.1	1.7	0.1
	1	Water Truck	210	1	40	0.15		1.7	0.1	1.7	0.1
	1	Dump Trucks	250	1	1500	0.15		1.7	0.1	1.7	0.1
	1	Trucks	210	1	40	0.15		1.7	0.1	1.7	0.1
					Total->	2.83	18.50	21.98	1.08	19.0	0.7
Bike Path Subgrade	1	Pickup	150	1	56	0.05		0.1	0.0	0.1	0.0
	1	Water Truck	210	1	56	0.15		1.7	0.1	1.7	0.1
	1	Motor Grader	200	0.575	56	2.0	17.2	14.0	0.8	11.2	0.4
	1	Rollers	90	0.43	56	0.7	5.8	4.7	0.3	3.8	0.2
					Total->	2.9	23.0	20.5	1.1	16.8	0.7
Bike Path Pavement	1	Pickup	150	1	56	0.05		0.1	0.0	0.1	0.0
	1	Paving Machine	100	0.53	56	0.9	7.9	6.4	0.4	5.2	0.2
	1	Roller	90	0.43	112	0.7	5.8	4.7	0.3	3.8	0.2
	1	Boot Truck	250	1	30	0.15		1.7	0.1	1.7	0.1
	1	Water Truck	210	1	30	0.15		1.7	0.1	1.7	0.1
	1	Dump Truck	250	1	700	0.15		1.7	0.1	1.7	0.1
					Total->	2.12	13.73	16.40	0.81	14.2	0.5

Phase 1				Load		lbs/day				Mitigated lbs/day	
Access Road Development	Number	Equipment	hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
Fence	1	Pickup	150	1	220	0.05		0.1	0.0	0.1	0.0
	1	Boom Truck	210	1	100	0.15		1.7	0.1	1.7	0.1
	1	Drill Rig	210	0.75	100	2.8	23.6	19.1	1.1	15.3	0.6
	1	Compressor	50	1	100	0.9	7.5	6.1	0.4	4.9	0.2
					Total->	3.9	31.1	27.0	1.5	22.0	0.9
Curb & Gutter	1	Pickup	150	1	350	0.05		0.1	0.0	0.1	0.0
	1	Boot Truck	210	1	100	0.15		1.7	0.1	1.7	0.1
	1	Roller	90	0.43	100	0.7	5.8	4.7	0.3	3.8	0.2
	1	Concrete Trucks	300	1	176	0.15		1.7	0.1	1.7	0.1
	1	Water Trucks	210	1	50	0.15		1.7	0.1	1.7	0.1
	1	Compressor	50	1	50	0.9	7.5	6.1	0.4	4.9	0.2
	1	Scrap Forms	150	1	176	2.6	22.5	18.2	1.1	14.6	0.6
					Total->	4.7	35.8	34.3	1.8	28.5	1.1
Signage	1	Pickups	150	1	600	0.05		0.1	0.0	0.1	0.0
	1	Line Truck	210	1	200	0.15		1.7	0.1	1.7	0.1
	1	Boom Truck	210	1	200	0.15		1.7	0.1	1.7	0.1
	1	Reel Trailers	100	1	200	1.8	15.0	12.2	0.7	9.7	0.4
	1	Compressors	50	1	200	0.9	7.5	6.1	0.4	4.9	0.2
					Total->	3.0	22.5	21.8	1.2		
Misc.	1	Flat Reet	200	1	900	3.5	30.0	24.3	1.4	19.5	0.8
	1	Loader/Foot Lift	215	1	450	3.8	32.2	26.1	1.5	20.9	0.8
	1	Welding	50	1	450	0.9	7.5	6.1	0.4	4.9	0.2
	1	Compressors	50	1	450	0.9	7.5	6.1	0.4	4.9	0.2
					Total->	9.1	77.1	62.6	3.6	50.1	2.0

Phase 1				Load		lbs/day				Mitigated lbs/day	
Access Road Development	Number	Equipment	hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
Phase IIB Bridge Construction											
Abutment Foundations	1	Pickup	150	1	160	0.05		0.1	0.0	0.1	0.0
	1	Drill Rig	400	1	80	7.0	59.9	48.6	2.8	38.9	1.6
	1	Crane	250	0.43	120	1.9	16.1	13.1	0.8	10.5	0.4
	1	Concrete Trucks	300	1	400	0.15		1.7	0.1	1.7	0.1
	1	Compressor	50	1	80	0.9	7.5	6.1	0.4	4.9	0.2
	1	Welding Equipment	50	1	40	0.9	7.5	6.1	0.4	4.9	0.2
					Total->	10.9	91.0	75.7	4.3	60.9	2.4
Pier Foundations	1	Pickup	150	1	600	0.05		0.1	0.0	0.1	0.0
	1	Compressor	325	1	800	5.7	48.7	39.5	2.3	31.6	1.3
	1	Backhoe	290	0.465	200	2.4	20.2	16.4	1.0	13.1	0.5
	1	Crane	250	0.43	200	1.9	16.1	13.1	0.8	10.5	0.4
	1	Trucks	250	1	600	0.15		1.7	0.1	1.7	0.1
	1	Water Trucks	210	1	200	3.7	31.5	25.5	1.5	20.4	0.8
	1	Concrete Trucks	300	1	200	5.3	44.9	36.5	2.1	29.2	1.2
					Total->	19.2	161.4	132.8	7.6	106.6	4.2
Sub Structure	1	Crane	250	0.43	400	1.9	16.1	13.1	0.8	10.5	0.4
	1	Boom Truck	175	1	400	0.15		1.7	0.1	1.7	0.1
	1	Compressor	50	1	200	0.9	7.5	6.1	0.4	4.9	0.2
	1	Welding	50	1	200	0.9	7.5	6.1	0.4	4.9	0.2
	1	Concrete Truck	300	1	1000	0.15		1.7	0.1	1.7	0.1
	1	Pickups	150	1	1200	0.05		0.1	0.0	0.1	0.0
	1	Compressors	200	1	1200	3.5	30.0	24.3	1.4	19.5	0.8
	1	Compressors	15	1	400	0.3	2.2	1.8	0.1	1.5	0.1
	1	Concrete Pumps	300	1	200	5.3	44.9	36.5	2.1	29.2	1.2

Phase 1				Load		lbs/day				Mitigated lbs/day	
Access Road Development	Number	Equipment	hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
					Total->	13.1	108.2	91.4	5.2	73.8	2.9
Super Structure	1	Pickups	150	1	7200	0.05		0.1	0.0	0.1	0.0
	1	Boom Truck	210	1	2000	0.15		1.7	0.1	1.7	0.1
	1	Crane	250	0.43	3500	1.9	16.1	13.1	0.8	10.5	0.4
	1	Generators	200	1	4800	3.5	30.0	24.3	1.4	19.5	0.8
	1	Conveyors	50	1	600	0.9	7.5	6.1	0.4	4.9	0.2
	1	Compressors	50	1	600	0.9	7.5	6.1	0.4	4.9	0.2
	1	Welding	50	1	600	0.9	7.5	6.1	0.4	4.9	0.2
	1	Finishing	50	1	150	0.9	7.5	6.1	0.4	4.9	0.2
	1	Concrete Pump	300	1	600	5.3	44.9	36.5	2.1	29.2	1.2
	1	Concrete Trucks	300	1	3600	0.15		1.7	0.1	1.7	0.1
					Total->	14.58	120.95	101.71	5.80	82.1	3.2
General Hauling	1	Flat Truck	150	1	1000	0.15		1.7	0.1	1.7	0.1
	1	Loader/Forklift	215	0.475	1000	1.8	15.3	12.4	0.7	9.9	0.4
	1	Trucks	150	1	1000	0.15		1.7	0.1	1.7	0.1
					Total->	2.10	15.30	15.85	0.82	13.4	0.5
Worker Commute		@100 Workers		1		1.84141		4.193833	0.15859	2.1	1.1

Daily Emissions Summary With and Without Mitigation: Alternatives 2, 3, and 4

	Unmitigated			Mitigated	
Construction Phase and Activity	ROG	NOx	PM10	NOx	PM10
Phase 1 Access Road Develop					
Access Road Development	15.7	112.5	6.3	91.8	3.6
SMUD Relocation	8.2	57.0	3.3	46.0	1.8
Phase 2a Road Construction					
Roadway Excavation	25.6	179.4	10.2	144.9	5.7
Roadway Structural	4.5	32.6	1.7	27.1	1.0
Roadway Paving	2.8	22.0	1.1	19.0	0.7
Bike Path Subgrade	2.9	20.5	1.1	16.8	0.7
Bike Path Pavement	2.1	16.4	0.8	14.2	0.5
Fence	3.9	27.0	1.5	22.0	0.9
Curb & Gutter	4.7	34.3	1.8	28.5	1.1
Signage	3.0	21.8	1.2	0.0	0.0
Miscellaneous	9.1	62.6	3.6	50.1	2.0
Phase 2b Bridge Construction					
Abutment Foundations	10.9	75.7	4.3	60.9	2.4
Pier Foundations	19.2	132.8	7.6	106.6	4.2
Substructure	13.1	91.4	5.2	73.8	2.9
Superstructure	14.6	101.7	5.8	82.1	3.2
General Hauling	2.1	15.8	0.8	13.4	0.5

Annual Emissions: Mitigated and Unmitigated (tons per year): Alternatives 2, 3, and 4

	Unmitigated ROG	Unmitigated NOx	Exhaust PM10	Fugitive PM10	Total PM10	Mitigated ROG	Mitigated NOx	Exhaust PM10	Dust PM10	Total PM10
2006	8.156	55.671	3.179	6.250	9.429	8.156	45.005	1.793	3.125	4.918
2007	7.848	53.783	3.048	6.250	9.298	7.848	43.457	1.706	3.125	4.831

Construction Emission Calculations – Alternative 5

Alternative 5 (4-lanes)											
Phase 1				Load		lbs/day				Mitigated lbs/day	
Clearing	Number		hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
	2	Crawler Tractor	200	0.575	80	4.05	34.45	27.96	1.62	22.4	0.9
	1	Loader	351	0.465	40	2.88	24.45	19.84	1.15	15.9	0.6
	4	Trucks	175	1	160	0.61		6.9	0.2	6.9	0.2
					Total->	7.54	58.90	54.67	2.98	45.1	1.7
Phase 2											
Excavation	1	Water Truck	210	1	1060	3.70	31.45	25.53	1.48	20.4	0.8
	4	Haul Truck	250	1	4240	0.61		6.9	0.2	6.9	0.2
	1	Loader	351	0.575	1060	3.56	30.23	24.54	1.42	19.6	0.8
	1	D8	285	0.59	1060	2.96	25.19	20.44	1.19	16.4	0.7
	2	D9	474	0.59	2120	9.86	83.77	68.01	3.94	54.4	2.2
					Total->	20.68	170.64	145.38	8.24	117.7	4.6
Pipelaying	1	Backhoe	290	0.465	525	2.38	20.20	16.40	0.95	13.1	0.5
	1	Loader	351	0.465	525	2.88	24.45	19.84	1.15	15.9	0.6
	1	Hop Crawler	114	0.65	525	1.31	11.10	9.01	0.52	7.2	0.3
	1	BF Pullers	125	1	525	0.15		1.7	0.1	1.4	0.0
					Total->	6.71	55.74	46.96	2.68	37.6	1.5
SMUD Relocate	3	Pickup	125	1	360	0.46		5.1	0.2	5.1	0.2
	3	Crew Trucks	125	1	360	0.46		5.1	0.2	5.1	0.2
	1	Crane	250	0.65	120	2.86	24.34	19.76	1.15	15.8	0.6
					Total->	3.78	24.34	30.04	1.46	26.1	0.9
Miscellaneous	4	Pickup	150	1	8000	0.61		6.9	0.2	6.9	0.2

	1	Water Truck	210	1	2000	3.70	31.45	25.53	1.48	25.5	1.5
	1	Boom Truck	175	1	2000	0.15		1.7	0.1	1.4	0.0
	1	Loffa for Lift	75	1	1500	0.15		1.7	0.1	1.4	0.0
	1	Crane	250	0.43	1000	1.89	16.10	13.07	0.76	13.1	0.8
	3	Compressors	200	1	3000	10.57	89.87	72.95	4.23	58.4	2.3
					Total->	17.08	137.42	121.84	6.78	106.6	4.8
Road Embankment	1	Water Truck	210	1	1060	3.70	31.45	25.53	1.48	25.5	1.5
	1	Loader	351	0.465	1060	2.88	24.45	19.84	1.15	15.9	0.6
	1	Crawler Tractor	200	0.575	1060	2.03	17.22	13.98	0.81	11.2	0.4
	1	Compactor	100	0.675	1060	1.19	10.11	8.21	0.48	6.6	0.3
					Total->	9.79	83.23	67.57	3.92	59.2	2.8
Phase 3											
Aggregate Base	15	Haul Units	150	1	3300	2.28		25.7	0.8	25.7	0.8
	1	Water Truck	210	1	220	3.70	31.45	25.53	1.48	25.5	1.5
	1	Motor Grader	200	0.575	220	2.03	17.22	13.98	0.81	11.2	0.4
	1	Crawler Tractor D-6	185	0.575	220	1.87	15.93	12.93	0.75	10.3	0.4
	1	Vibratory Roller	155	0.43	220	1.17	9.98	8.10	0.47	6.5	0.3
					Total->	11.1	74.6	86.3	4.3	79.3	3.4
Phase 4											
Asphalt	1	Pickup	150	1						0.0	0.0
	1	Paving Machine	160	0.54	200	1.52	12.94	10.51	0.61	8.4	0.3
	1	Roller	285	0.43	200	2.16	18.36	14.90	0.86	11.9	0.5
	1	Boot Truck	150	1	200	0.15		1.7	0.1	1.7	0.1
	3	Pullers	125	1	600	0.46		5.1	0.2	5.1	0.2
	10	Haul Units	150	1	2000	1.52		17.1	0.5	17.1	0.5
					Total->	5.81	31.30	49.40	2.20	44.3	1.5
Worker Commute		@100 Workers		1		1.84141		4.193833	0.15859	2.1	1.1

Daily Emissions Summary With and Without Mitigation: Alternative 5

4-Lane Construction Phase and Activity	ROG	CO	NOx	PM10	Mitigated NOx	Mitigated PM10
Phase 1. Access Road Development/SMUD Tower Relocation						
Access Road Development	7.5	58.9	54.7	3.0	45.1	1.7
SMUD Relocation	3.8	24.3	30.0	1.5	26.1	0.9
Phase 2a. Roadway Construction						
Roadway Excavation	20.7	170.6	145.4	8.2	117.7	4.6
Roadway Structural	9.8	83.2	67.6	3.9	59.2	2.8
Roadway Paving	8.1	31.3	75.1	3.0	70.0	2.3
Bike Path Subgrade	2.9	0.0	20.5	1.1	16.8	0.7
Bike Path Pavement	2.1	0.0	16.4	0.8	14.2	0.5
Fence	3.9	0.0	27.0	1.5	22.0	0.9
Curb & Gutter	4.7	0.0	34.3	1.8	28.5	1.1
Signage	3.0	0.0	21.8	1.2	18.1	0.7
Miscellaneous	17.1	137.4	121.8	6.8	106.6	4.8
Phase 2b. Bridge Construction						
Abutment Foundations	10.9	0.0	75.7	4.3	60.9	2.4
Pier Foundations	19.2	0.0	132.8	7.6	106.6	4.2
Substructure	13.1	0.0	91.4	5.2	73.8	2.9
Superstructure	14.6	0.0	101.7	5.8	82.1	3.2
General Hauling	2.1	0.0	15.8	0.8	13.4	0.5

Annual Emissions: Mitigated and Unmitigated (tons per year): Alternative 5

	tons/year ROG		NOx	Exhaust PM10	Fugitive PM10	Total PM10	Mitigated NOx	Exhaust PM10	Dust PM10	Total PM10
2006	2.3	13.8	15.0	0.8	6.3	7.1	12.5	0.5	3.1	3.6
2007	5.2	28.3	36.7	2.0	6.3	8.2	31.8	1.3	3.1	4.4

Construction Emission Calculations – Alternative 6

Alternatives 6
(6-lanes)

Phase 1				Load		lbs/day				Mitigated lbs/day	
Clearing	Number		hp	Factors	Total Hours	ROG	CO	NOx	PM10	NOx	PM10
	2	Crawler Tracker	200	0.575	100	4.05	34.45	27.96	1.62	22.4	0.9
	1	Loader	351	0.465	50	2.88	24.45	19.84	1.15	15.9	0.6
	4	Trucks	175	1	180	0.61		6.9	0.2	6.9	0.2
					Total->	7.54	58.90	54.67	2.98	45.1	1.7
Phase 2											
Excavation	1	Water Truck	210	1	1400	3.70	31.45	25.53	1.48	20.4	0.8
	8	Haul Truck	250	1	11200	1.22		13.7	0.4	13.7	0.4
	2	Loader	200	0.575	2800	4.05	34.45	27.96	1.62	22.4	0.9
	2	D8	285	0.59	2800	5.93	50.37	40.89	2.37	32.7	1.3
	2	D9	474	0.59	2800	9.86	83.77	68.01	3.94	54.4	2.2
					Total->	24.75	200.05	176.11	9.83	143.6	5.6
Pipelaying	1	Backhoe	290	0.465	700	2.38	20.20	16.40	0.95	13.1	0.5
	1	Loader	351	0.465	700	2.88	24.45	19.84	1.15	15.9	0.6
	1	Hop Crawler	114	0.65	700	1.31	11.10	9.01	0.52	7.2	0.3
	1	BF Pullers	125	1	700	0.15		1.7	0.1	1.4	0.0
					Total->	6.71	55.74	46.96	2.68	37.6	1.5
SMUD											
Relocate	3	Pickup			360	0.46		5.1	0.2	5.1	0.2
	3	Crew Trucks			360	0.46		5.1	0.2	5.1	0.2
	1	Crane	250		120	0.15		1.7	0.1	1.4	0.0
					Total->	1.06	0.00	12.00	0.36	11.7	0.3
Miscellaneous	4	Pickup	150	1	8000	0.61		6.9	0.2	6.9	0.2
	1	Water Truck	210	1	2000	3.70	31.45	25.53	1.48	25.5	1.5

	1	Boom Truck	175	1	2000	0.15		1.7	0.1	1.4	0.0
	1	Loffa for Lift	75	1	1500	0.15		1.7	0.1	1.4	0.0
	1	Crane	250	0.43	1000	1.89	16.10	13.07	0.76	13.1	0.8
	3	Compressors	325	1	5000	17.18	146.04	118.55	6.87	94.8	3.8
					Total->	23.69	193.59	167.43	9.42	143.0	6.3
Road Embankment	1	Water Truck	210	1	1000	3.70	31.45	25.53	1.48	25.5	1.5
	1	Loader	351	0.465	1000	2.88	24.45	19.84	1.15	15.9	0.6
	1	Crawler Tractor	200	0.575	1000	2.03	17.22	13.98	0.81	11.2	0.4
	1	Compactor	50	0.575	1000	0.15		1.7	0.1	1.4	0.0
					Total->	8.75	73.12	61.07	3.49	54.0	2.6
Phase 3 Aggregate Base	15	Haul Units	150	1	3450	2.28		25.7	0.8	25.7	0.8
	1	Water Truck	210	1	230	3.70	31.45	25.53	1.48	25.5	1.5
	1	Motor Grader	200	0.575	230	2.03	17.22	13.98	0.81	11.2	0.4
	1	Crawler Tractor D-6	185	0.575	230	1.87	15.93	12.93	0.75	10.3	0.4
	1	Vibratory Roller	155	0.43	230	1.17	9.98	8.10	0.47	6.5	0.3
					Total->	11.1	74.6	86.3	4.3	79.3	3.4
Phase 4 Asphalt	1	Pickup	150	1		0.15		1.7	0.1	1.7	0.1
	1	Paving Machine	160	0.54	200	1.52	12.94	10.51	0.61	8.4	0.3
	1	Roller	285	0.43	200	2.16	18.36	14.90	0.86	11.9	0.5
	1	Boot Truck	150	1	200	0.15		1.7	0.1	1.7	0.1
	3	Pullers	125	1	600	0.46		5.1	0.2	5.1	0.2
	10	Haul Units	150	1	2000	1.52		17.1	0.5	17.1	0.5
					Total->	5.96	31.30	51.12	2.25	46.0	1.6

Daily Emissions Summary With and Without Mitigation: Alternative 6 (6-Lane)

6-Lane Construction Phase and Activity	ROG	CO	NOx	PM10	Mitigated NOx	Mitigated PM10
Phase 1. Access Road Development/SMUD Tower Relocation						
Access Road Development	7.5	58.9	54.7	3.0	45.1	1.7
SMUD Relocation	1.1	0.0	12.0	0.4	11.7	0.3
Phase 2a. Roadway Construction						
Roadway Excavation	24.8	200.0	176.1	9.8	143.6	5.6
Roadway Structural	8.8	73.1	61.1	3.5	54.0	2.6
Roadway Paving	17.0	105.9	137.4	6.5	125.3	5.0
Bike Path Subgrade	2.9	0.0	20.5	1.1	16.8	0.7
Bike Path Pavement	2.1	0.0	16.4	0.8	14.2	0.5
Fence	3.9	0.0	27.0	1.5	22.0	0.9
Curb & Gutter	4.7	0.0	34.3	1.8	28.5	1.1
Signage	3.0	0.0	21.8	1.2	18.1	0.7
Miscellaneous	23.7	193.6	167.4	9.4	143.0	6.3
Phase 2b. Bridge Construction						
Abutment Foundations	10.9	0.0	75.7	4.3	60.9	2.4
Pier Foundations	19.2	0.0	132.8	7.6	106.6	4.2
Substructure	13.1	0.0	91.4	5.2	73.8	2.9
Superstructure	14.6	0.0	101.7	5.8	82.1	3.2
General Hauling	2.1	0.0	15.8	0.8	13.4	0.5

Annual Emissions: Mitigated and Unmitigated (tons per year): Alternative 6

	tons/year		Exhaust	Fugitive	Total	Mitigated	Exhaust	Dust	Total
	ROG	NOx	PM10	PM10	PM10	NOx	PM10	PM10	PM10
2006	3.4	24.7	1.3	6.3	7.5	21.2	0.9	3.1	4.0
2007	7.0	50.8	2.7	6.3	8.9	43.8	2.1	3.1	5.2

Operational Emission Calculations – Ozone Precursors and PM10

EMFAC2002 Model Results

EMFAC2002 Model Results for 2007

: Sacramento County Avg 2007Annual Default Title
: Emfac2002 V2.2 Sept 23 2002
Date : 7/22/2005 16:55:40
Year: 2007-- Model Years: 1965to 2007
: Annual
: Sacramento County

Year:2007 -- Model Years 1965to 2007Inclusive -- Annual
Emfac2002 Emission Factors: V2.2 Sept 23 2002

County Average Sacramento Count County Average

Table 1:00Running Exhaust Emissions (grams/mile)

Pollutant Name: Reactive Org Gases Temperature: 85F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
25	0.155	0.256	0.271	0.843	1.269	2.545	0.253
28	0.135	0.226	0.237	0.745	1.098	2.445	0.223
29	0.13	0.217	0.228	0.717	1.05	2.422	0.214
30	0.125	0.209	0.219	0.69	1.006	2.403	0.207
35	0.106	0.18	0.186	0.584	0.829	2.378	0.177
38	0.098	0.168	0.173	0.536	0.753	2.418	0.164

Pollutant Name: Oxides of Nitrogen Temperature: 85F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
25	0.279	0.504	0.903	8.083	7.871	0.918	0.952
28	0.268	0.486	0.875	7.869	7.576	0.94	0.923
29	0.265	0.481	0.868	7.82	7.507	0.948	0.916
30	0.263	0.476	0.861	7.782	7.452	0.955	0.91
35	0.252	0.46	0.841	7.741	7.374	0.993	0.894
38	0.248	0.455	0.839	7.839	7.482	1.016	0.897

Pollutant Name: PM10 Temperature: 85F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
25	0.013	0.022	0.027	0.276	0.155	0.034	0.035
28	0.011	0.019	0.024	0.251	0.138	0.033	0.031
29	0.011	0.018	0.023	0.243	0.133	0.032	0.03
30	0.011	0.018	0.022	0.236	0.129	0.032	0.029
35	0.009	0.015	0.019	0.207	0.111	0.032	0.025
38	0.008	0.014	0.017	0.193	0.103	0.032	0.024

EMFAC2002 Model Results for 2025

: Sacramento County Avg 2025Annual Default Title
: Emfac2002 V2.2 Sept 23 2002
Date : 7/22/2005 16:56:25
Year: 2025-- Model Years: 1980to 2025
: Annual
: Sacramento County

Year:2025 -- Model Years 1980to 2025Inclusive -- Annual
Emfac2002 Emission Factors: V2.2 Sept 23 2002

County Average Sacramento Count County Average

Table 1:00Running Exhaust Emissions (grams/mile)

Pollutant Name: Reactive Org Gases Temperature: 85F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
25	0.019	0.039	0.062	0.21	0.473	2.039	0.045
28	0.016	0.034	0.054	0.189	0.412	1.93	0.04
29	0.015	0.032	0.052	0.182	0.395	1.903	0.038
30	0.015	0.031	0.05	0.176	0.379	1.881	0.037
35	0.012	0.026	0.042	0.152	0.316	1.827	0.032
38	0.011	0.024	0.039	0.141	0.289	1.841	0.03

Pollutant Name: Oxides of Nitrogen Temperature: 85F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL

25	0.048	0.112	0.209	1.254	3.97	0.827	0.175
28	0.046	0.107	0.202	1.221	3.83	0.827	0.169
29	0.045	0.106	0.2	1.214	3.797	0.828	0.168
30	0.045	0.104	0.198	1.208	3.771	0.829	0.166
35	0.042	0.099	0.191	1.202	3.739	0.838	0.163
38	0.041	0.097	0.19	1.217	3.795	0.848	0.163

Pollutant Name: PM10 Temperature: 85F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
25	0.013	0.023	0.029	0.086	0.092	0.016	0.022
28	0.011	0.02	0.026	0.079	0.082	0.015	0.019
29	0.011	0.019	0.025	0.076	0.079	0.015	0.019
30	0.01	0.018	0.024	0.074	0.076	0.015	0.018
35	0.009	0.015	0.02	0.065	0.065	0.014	0.015
38	0.008	0.014	0.018	0.06	0.06	0.015	0.014

Operational CO Concentrations

Carbon Monoxide Dispersion Modeling

Predicting the ambient air quality impacts of pollutant emissions requires an assessment of the transport, dispersion, chemical transformation, and removal processes that affect pollutant emissions after their release from a source. Gaussian dispersion models are frequently used for such analyses. The term "Gaussian dispersion" refers to a general type of mathematical equation used to describe the horizontal and vertical distribution of pollutants downwind from an emission source.

Gaussian dispersion models treat pollutant emissions as being carried downwind in a defined plume, subject to horizontal and vertical mixing with the surrounding atmosphere. The plume spreads horizontally and vertically with a reduction in pollutant concentrations as it travels downwind. Mixing with the surrounding atmosphere is greatest at the edge of the plume, resulting in lower pollutant concentrations outward (horizontally and vertically) from the center of the plume. This decrease in concentration outward from the center of the plume is treated as following a Gaussian ("normal") statistical distribution. Horizontal and vertical mixing generally occur at different rates. Because turbulent motions in the atmosphere occur on a variety of spatial and time scales, vertical and horizontal mixing also vary with distance downwind from the emission source.

The CALINE4 Model

The ambient air quality effects of traffic emissions were evaluated using the CALINE4 dispersion model (Benson 1989). CALINE4 is a Gaussian dispersion model specifically designed to evaluate air quality impacts of roadway projects. Each roadway link analyzed in the model is treated as a sequence of short segments. Each segment of a roadway link is treated as a separate emission source producing a plume of pollutants that disperses downwind. Pollutant concentrations at any specific location are calculated using the total contribution from overlapping pollution plumes originating from the sequence of roadway segments.

When winds are essentially parallel to a roadway link, pollution plumes from all roadway segments overlap. This produces high concentrations near the roadway (near the center of the overlapping pollution plumes), and low concentrations well away from the roadway (at the edges of the overlapping pollution plumes). When winds are at an angle to the roadway link, pollution plumes from distant roadway segments make essentially no contribution to the pollution concentration observed at a receptor location. Under such cross-wind situations, pollutant concentrations near the highway are lower than under parallel wind conditions (fewer overlapping plume contributions), while pollutant concentrations away from the highway may be greater than would occur with parallel winds (near the center of at least some pollution plumes).

The CALINE4 model employs a "mixing cell" approach to estimating pollutant concentrations over the roadway itself. The size of the mixing cell over each roadway segment is based on the width of the traffic lanes of the highway (generally 12 feet per lane) plus an additional turbulence zone on either side (generally 10 feet on each side). Parking lanes and roadway shoulders are not counted as traffic lanes. The model calculates the height of the mixing cell.

Pollutants emitted along a highway link are treated as being well mixed within the mixing cell volume due to mechanical turbulence from moving vehicles and convective mixing due to the temperature of vehicle exhaust gases. Pollutant concentrations downwind from the mixing cell are calculated using horizontal and vertical dispersion rates which are a function of various meteorological and ground surface conditions.

Modeling Procedures

Roadway and Traffic Conditions. Traffic volumes and operating conditions used in the modeling were obtained from the traffic analysis prepared for this project by Fehr and Peers (2005). Free flow traffic speeds were adjusted to reflect congested speeds using methodology from the Highway Capacity Manual (Highway Research Board 1965). CO modeling was conducted on at the intersections of Auburn-Folsom Road at Douglas Boulevard, Folsom-Auburn Road at Oak Avenue Parkway, Folsom-Auburn Road at Greenback Lane, Riley Street at Sutter Street, Riley Street at Natoma Street, Coloma Street at Natoma Street, and Green Valley Road/Blue Ravine Road at E. Natoma Street, as these intersections have the worst LOS/delay and traffic volumes of any roadways analyzed in the project area.

Vehicle Emission Rates. Vehicle emission rates were determined using the California Air Resources Board's EMFAC2002 (version 2.2) emission rate program. The program assumed Sacramento County regional traffic data operating during the winter months. A mean January temperature of 37 degrees Fahrenheit and humidity of 30% were assumed.

Receptor Locations. CO concentrations were estimated at 4 receptor locations located at each of the intersections analyzed, for a total of 28 receptors. The receptors are placed at 100 feet away from the center of each roadway, 100 feet from the road edge, and located 200 feet from each other. Receptor heights were set at 5.0 feet.

Meteorological Conditions. Meteorological inputs to the CALINE4 model were determined using methodology recommended in Air Quality Technical Analysis Notes (California Department of Transportation 1988). The meteorological conditions used in the modeling represent a calm winter period. Worst case wind angles were modeled to determine a worst-case concentration for each receptor. The meteorological inputs include: 0.5 meters per second wind speed, ground-level temperature inversion (atmospheric stability class G), wind direction standard deviation equal to five degrees, and a mixing height of 1000 meters.

Background Concentrations and Eight-Hour Values. A background concentration of 3.2 ppm was added to the modeled cumulative 1-hour values, while a background concentration of 2.11 ppm was added to the modeled cumulative 8-hour values. Background concentration data for 1- and 8-hour values were obtained from the EPA's Air Data webpage (U.S. Environmental Protection Agency 2005). Maximum 1- and 8-hour values for the years 2002-2004 were averaged to obtain a background concentration. Eight-hour modeled values were calculated from the 1-hour values using a persistence factor of 0.7. Background concentrations for future 2007 and 2025 years were assumed to be the same as those for the current year. Actual 1- and 8-hour background concentrations in future years would likely be lower than those used in the CO modeling analysis because the trend in CO emissions and concentrations is decreasing because of continuing improvements in engine technology and the retirement of older, higher-emitting vehicles.

References:

Benson, P. E. 1989. CALINE4---a dispersion model for predicting air pollution concentrations near roadways. California Department of Transportation. Sacramento, CA.

California Department of Transportation. 1988. Air Quality Technical Analysis Notes. Sacramento, CA.

Fehr and Peers. 2005. Traffic analysis section prepared for the Folsom Bridge EIS. Roseville, CA.

Highway Research Board. 1965. Highway Capacity Manual. Washington, D.C.

U.S. Environmental Protection Agency. 2005. Air Data. Last Revised: July 5, 2005. Available: <http://www.epa.gov/air/data/reports.html>. Accessed: July 26, 2005.

Operational CO Concentration Modeling Results

Existing Conditions Modeling Results

```
          CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
                   JUNE 1989 VERSION
                   PAGE   1

              JOB: Folsom Bridge Existing 1
              RUN: Hour 1           (WORST CASE ANGLE)
        POLLUTANT: Carbon Monoxide


  I.  SITE VARIABLES

        U=    .5 M/S             Z0= 100. CM            ALT=     0. (M)
      BRG= WORST CASE            VD=   .0 CM/S
     CLAS=     7 (G)             VS=   .0 CM/S
     MIXH= 1000. M              AMB=   .0 PPM
    SIGTH=    5. DEGREES       TEMP=  2.8 DEGREE (C)


 II.  LINK VARIABLES
```

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1W	5850	6000	6000	6000	AG	2771	5.8	.0	16.2
B. 1E	6150	6000	6000	6000	AG	1010	6.2	.0	16.2
C. 1N	6000	6150	6000	6000	AG	1565	6.0	.0	16.2
D. 1S	6000	5850	6000	6000	AG	2526	6.2	.0	16.2
E. 5W	2850	3000	3000	3000	AG	906	6.1	.0	16.2
F. 5E	3150	3000	3000	3000	AG	107	7.1	.0	16.2
G. 5N	3000	2850	3000	3000	AG	2525	5.8	.0	16.2
H. 5S	3000	3150	3000	3000	AG	3246	5.8	.0	16.2
I. 6W	-150	0	0	0	AG	3382	7.6	.0	16.2
J. 6E	150	0	0	0	AG	2644	8.1	.0	16.2
K. 6N	0	150	0	0	AG	3476	7.4	.0	16.2
L. 6S	0	-150	0	0	AG	3534	7.3	.0	16.2
M. 10W	-3150	3000	-3000	3000	AG	221	8.8	.0	16.2
N. 10E	-2850	3000	-3000	3000	AG	229	8.1	.0	16.2
O. 10N	-3000	3150	-3000	3000	AG	2466	7.9	.0	16.2
P. 10S	-3000	2850	-3000	3000	AG	2472	7.4	.0	16.2
Q. 11W	-3150	-3000	-3000	-3000	AG	799	9.9	.0	16.2
R. 11E	-2850	-3000	-3000	-3000	AG	1655	8.8	.0	16.2
S. 11N	-3000	-3150	-3000	-3000	AG	2332	8.3	.0	16.2
T. 11S	-3000	-2850	-3000	-3000	AG	1632	9.4	.0	16.2

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge Existing 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 1W	5979	6021	1.5
2. 1E	6021	6021	1.5
3. 1N	6021	5979	1.5
4. 1S	5979	5979	1.5
5. 5W	2979	3021	1.5
6. 5E	3021	3021	1.5
7. 5N	3021	2979	1.5
8. 5S	2979	2979	1.5
9. 6W	-21	21	1.5
10. 6E	21	21	1.5
11. 6N	21	-21	1.5
12. 6S	-21	-21	1.5
13. 10W	-3021	3021	1.5
14. 10E	-2979	3021	1.5
15. 10N	-2979	2979	1.5
16. 10S	-3021	2979	1.5
17. 11W	-3021	-2979	1.5
18. 11E	-2979	-2979	1.5
19. 11N	-2979	-3021	1.5
20. 11S	-3021	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Folsom Bridge Existing 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	1.0 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	7 (G)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	5. DEGREES	TEMP=	2.8 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 13W	-6150	-6000	-6000	-6000	AG	1681	5.9	.0	16.2
B. 13E	-5850	-6000	-6000	-6000	AG	1685	5.9	.0	16.2
C. 13N	-6000	-6150	-6000	-6000	AG	236	6.4	.0	16.2
D. 13S	-6000	-5850	-6000	-6000	AG	520	6.5	.0	16.2
E. 16W	2850	-3000	3000	-3000	AG	1275	5.4	.0	16.2
F. 16E	3150	-3000	3000	-3000	AG	657	5.5	.0	16.2
G. 16N	3000	-3150	3000	-3000	AG	2192	5.8	.0	16.2
H. 16S	3000	-2850	3000	-3000	AG	1374	5.4	.0	16.2

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 13W	-6021	-5979	1.5
2. 13E	-5979	-5979	1.5
3. 13N	-5979	-6021	1.5
4. 13S	-6021	-6021	1.5
5. 16W	2979	-2979	1.5
6. 16E	3021	-2979	1.5
7. 16N	3021	-3021	1.5
8. 16S	2979	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge Existing 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 13W	104.	.4	.0	.4	.0	.0	.0	.0	.0	.0
2. 13E	256.	.4	.4	.0	.0	.0	.0	.0	.0	.0
3. 13N	284.	.4	.4	.0	.0	.0	.0	.0	.0	.0
4. 13S	75.	.4	.0	.4	.0	.0	.0	.0	.0	.0
5. 16W	166.	.6	.0	.0	.0	.0	.2	.0	.4	.0
6. 16E	194.	.5	.0	.0	.0	.0	.0	.0	.4	.0
7. 16N	284.	.6	.0	.0	.0	.0	.3	.0	.3	.0
8. 16S	54.	.4	.0	.0	.0	.0	.0	.0	.3	.0

2007 Modeling Results

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CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: Folsom Bridge 2007 NP 1
     RUN: Hour 1           (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
```

I. SITE VARIABLES

```
      U=    .5 M/S            Z0= 100. CM          ALT=     0. (M)
    BRG= WORST CASE           VD=   .0 CM/S
   CLAS=     7 (G)            VS=   .0 CM/S
   MIXH= 1000. M             AMB=   .0 PPM
  SIGTH=    5. DEGREES       TEMP=  2.8 DEGREE (C)
```

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1W	5850	6000	6000	6000	AG	3170	5.6	.0	16.2
B. 1E	6150	6000	6000	6000	AG	1170	5.9	.0	16.2
C. 1N	6000	6150	6000	6000	AG	1830	5.8	.0	16.2
D. 1S	6000	5850	6000	6000	AG	2930	6.0	.0	16.2
E. 5W	2850	3000	3000	3000	AG	1070	4.9	.0	16.2
F. 5E	3150	3000	3000	3000	AG	120	5.5	.0	16.2
G. 5N	3000	2850	3000	3000	AG	2940	4.8	.0	16.2
H. 5S	3000	3150	3000	3000	AG	3730	4.7	.0	16.2
I. 6W	-150	0	0	0	AG	3940	7.2	.0	16.2
J. 6E	150	0	0	0	AG	3050	7.9	.0	16.2
K. 6N	0	150	0	0	AG	4070	7.1	.0	16.2
L. 6S	0	-150	0	0	AG	4200	7.3	.0	16.2
M. 10W	-3150	3000	-3000	3000	AG	230	10.3	.0	16.2
N. 10E	-2850	3000	-3000	3000	AG	250	8.4	.0	16.2
O. 10N	-3000	3150	-3000	3000	AG	2830	8.2	.0	16.2
P. 10S	-3000	2850	-3000	3000	AG	2840	8.5	.0	16.2
Q. 11W	-3150	-3000	-3000	-3000	AG	1080	8.8	.0	16.2
R. 11E	-2850	-3000	-3000	-3000	AG	2260	8.4	.0	16.2
S. 11N	-3000	-3150	-3000	-3000	AG	2840	8.0	.0	16.2
T. 11S	-3000	-2850	-3000	-3000	AG	1840	8.4	.0	16.2

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2007 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 1W	5979	6021	1.5
2. 1E	6021	6021	1.5
3. 1N	6021	5979	1.5
4. 1S	5979	5979	1.5
5. 5W	2979	3021	1.5
6. 5E	3021	3021	1.5
7. 5N	3021	2979	1.5
8. 5S	2979	2979	1.5
9. 6W	-21	21	1.5
10. 6E	21	21	1.5
11. 6N	21	-21	1.5
12. 6S	-21	-21	1.5
13. 10W	-3021	3021	1.5
14. 10E	-2979	3021	1.5
15. 10N	-2979	2979	1.5
16. 10S	-3021	2979	1.5
17. 11W	-3021	-2979	1.5
18. 11E	-2979	-2979	1.5
19. 11N	-2979	-3021	1.5
20. 11S	-3021	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: Folsom Bridge 2007 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 1W	167.	1.5	.6	.0	.0	.9	.0	.0	.0	.0
2. 1E	256.	1.3	.9	.0	.4	.0	.0	.0	.0	.0
3. 1N	283.	1.5	.9	.0	.0	.6	.0	.0	.0	.0
4. 1S	13.	1.2	.6	.0	.6	.0	.0	.0	.0	.0
5. 5W	167.	.9	.0	.0	.0	.0	.2	.0	.7	.0
6. 5E	257.	.9	.0	.0	.0	.0	.3	.0	.0	.6
7. 5N	347.	.9	.0	.0	.0	.0	.0	.0	.0	.8
8. 5S	13.	1.0	.0	.0	.0	.0	.2	.0	.0	.8
9. 6W	166.	2.4	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	257.	2.3	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	283.	2.3	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	77.	2.2	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	167.	1.3	.0	.0	.0	.0	.0	.0	.0	.0
14. 10E	193.	1.3	.0	.0	.0	.0	.0	.0	.0	.0
15. 10N	347.	1.3	.0	.0	.0	.0	.0	.0	.0	.0
16. 10S	13.	1.3	.0	.0	.0	.0	.0	.0	.0	.0
17. 11W	103.	1.6	.0	.0	.0	.0	.0	.0	.0	.0
18. 11E	193.	1.8	.0	.0	.0	.0	.0	.0	.0	.0
19. 11N	347.	1.6	.0	.0	.0	.0	.0	.0	.0	.0
20. 11S	77.	1.8	.0	.0	.0	.0	.0	.0	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge 2007 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S	T
1. 1W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. 1E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. 1N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. 1S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5. 5W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6. 5E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7. 5N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8. 5S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9. 6W	.9	.0	.0	1.4	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	1.3	.0	1.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	1.3	.0	.0	1.0	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	.0	1.2	.0	1.0	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	.0	.0	.0	.0	.0	.0	.0	1.2	.0	.0	.0	.0
14. 10E	.0	.0	.0	.0	.0	.0	.0	1.2	.0	.0	.0	.0
15. 10N	.0	.0	.0	.0	.0	.0	1.2	.0	.0	.0	.0	.0
16. 10S	.0	.0	.0	.0	.0	.0	1.2	.0	.0	.0	.0	.0
17. 11W	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.6
18. 11E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.7	1.2	.0
19. 11N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.7	.0	.9
20. 11S	.0	.0	.0	.0	.0	.0	.0	.0	.0	1.0	.8	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Folsom Bridge 2007 NP 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	.5 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	7 (G)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	5. DEGREES	TEMP=	2.8 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 13W	-6150	-6000	-6000	-6000	AG	2260	6.2	.0	16.2
B. 13E	-5850	-6000	-6000	-6000	AG	2250	6.2	.0	16.2
C. 13N	-6000	-6150	-6000	-6000	AG	270	6.5	.0	16.2
D. 13S	-6000	-5850	-6000	-6000	AG	600	7.7	.0	16.2
E. 16W	2850	-3000	3000	-3000	AG	1560	4.6	.0	16.2
F. 16E	3150	-3000	3000	-3000	AG	790	4.8	.0	16.2
G. 16N	3000	-3150	3000	-3000	AG	2620	4.9	.0	16.2
H. 16S	3000	-2850	3000	-3000	AG	1590	4.6	.0	16.2

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 13W	-6021	-5979	1.5
2. 13E	-5979	-5979	1.5
3. 13N	-5979	-6021	1.5
4. 13S	-6021	-6021	1.5
5. 16W	2979	-2979	1.5
6. 16E	3021	-2979	1.5
7. 16N	3021	-3021	1.5
8. 16S	2979	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2007 NP 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 13W	103.	.9	.0	.8	.0	.2	.0	.0	.0	.0
2. 13E	257.	.9	.8	.0	.0	.2	.0	.0	.0	.0
3. 13N	283.	.8	.8	.0	.0	.0	.0	.0	.0	.0
4. 13S	77.	.8	.0	.8	.0	.0	.0	.0	.0	.0
5. 16W	167.	.9	.0	.0	.0	.0	.3	.0	.7	.0
6. 16E	193.	.8	.0	.0	.0	.0	.0	.1	.7	.0
7. 16N	283.	.9	.0	.0	.0	.0	.4	.0	.4	.0
8. 16S	77.	.7	.0	.0	.0	.0	.0	.2	.4	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Folsom Bridge 2007 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	.5 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	7 (G)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	5. DEGREES	TEMP=	2.8 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1W	5850	6000	6000	6000	AG	3170	5.6	.0	16.2
B. 1E	6150	6000	6000	6000	AG	1170	5.9	.0	16.2
C. 1N	6000	6150	6000	6000	AG	1850	5.8	.0	16.2
D. 1S	6000	5850	6000	6000	AG	2950	6.0	.0	16.2
E. 5W	2850	3000	3000	3000	AG	3660	6.7	.0	16.2
F. 5E	3150	3000	3000	3000	AG	2760	7.2	.0	16.2
G. 5N	3000	2850	3000	3000	AG	3460	6.4	.0	16.2
H. 5S	3000	3150	3000	3000	AG	3140	6.5	.0	16.2
I. 6W	-150	0	0	0	AG	1740	4.9	.0	16.2
J. 6E	150	0	0	0	AG	120	5.5	.0	16.2
K. 6N	0	150	0	0	AG	2120	4.8	.0	16.2
L. 6S	0	-150	0	0	AG	3100	4.6	.0	16.2
M. 10W	-3150	3000	-3000	3000	AG	260	8.8	.0	16.2
N. 10E	-2850	3000	-3000	3000	AG	250	7.8	.0	16.2
O. 10N	-3000	3150	-3000	3000	AG	2530	7.5	.0	16.2
P. 10S	-3000	2850	-3000	3000	AG	2540	7.5	.0	16.2
Q. 11W	-3150	-3000	-3000	-3000	AG	870	8.4	.0	16.2
R. 11E	-2850	-3000	-3000	-3000	AG	2060	7.8	.0	16.2
S. 11N	-3000	-3150	-3000	-3000	AG	2540	7.4	.0	16.2
T. 11S	-3000	-2850	-3000	-3000	AG	1490	8.3	.0	16.2

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2007 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 1W	5979	6021	1.5
2. 1E	6021	6021	1.5
3. 1N	6021	5979	1.5
4. 1S	5979	5979	1.5
5. 5W	2979	3021	1.5
6. 5E	3021	3021	1.5
7. 5N	3021	2979	1.5
8. 5S	2979	2979	1.5
9. 6W	-21	21	1.5
10. 6E	21	21	1.5
11. 6N	21	-21	1.5
12. 6S	-21	-21	1.5
13. 10W	-3021	3021	1.5
14. 10E	-2979	3021	1.5
15. 10N	-2979	2979	1.5
16. 10S	-3021	2979	1.5
17. 11W	-3021	-2979	1.5
18. 11E	-2979	-2979	1.5
19. 11N	-2979	-3021	1.5
20. 11S	-3021	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: Folsom Bridge 2007 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 1W	167.	1.5	.6	.0	.0	.9	.0	.0	.0	.0
2. 1E	256.	1.3	.9	.0	.4	.0	.0	.0	.0	.0
3. 1N	283.	1.5	.9	.0	.0	.6	.0	.0	.0	.0
4. 1S	13.	1.2	.6	.0	.6	.0	.0	.0	.0	.0
5. 5W	167.	1.9	.0	.0	.0	.0	.8	.0	1.1	.0
6. 5E	257.	1.9	.0	.0	.0	.0	1.2	.0	.0	.7
7. 5N	283.	1.9	.0	.0	.0	.0	1.2	.0	.7	.0
8. 5S	77.	1.8	.0	.0	.0	.0	.0	1.0	.7	.0
9. 6W	167.	1.0	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	257.	.9	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	283.	1.0	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	13.	.9	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	167.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
14. 10E	193.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
15. 10N	347.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
16. 10S	13.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
17. 11W	103.	1.3	.0	.0	.0	.0	.0	.0	.0	.0
18. 11E	193.	1.6	.0	.0	.0	.0	.0	.0	.0	.0
19. 11N	347.	1.3	.0	.0	.0	.0	.0	.0	.0	.0
20. 11S	77.	1.6	.0	.0	.0	.0	.0	.0	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge 2007 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S	T
1. 1W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. 1E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. 1N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. 1S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5. 5W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6. 5E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7. 5N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8. 5S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9. 6W	.3	.0	.0	.7	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	.5	.0	.4	.0	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	.5	.0	.0	.5	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	.3	.0	.6	.0	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0
14. 10E	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0
15. 10N	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0	.0
16. 10S	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0	.0
17. 11W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.9	.0	.5
18. 11E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.6	1.0	.0
19. 11N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.6	.0	.7
20. 11S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.9	.7	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Folsom Bridge 2007 WP 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= .5 M/S Z0= 100. CM ALT= 0. (M)
BRG= WORST CASE VD= .0 CM/S
CLAS= 7 (G) VS= .0 CM/S
MIXH= 1000. M AMB= .0 PPM
SIGTH= 5. DEGREES TEMP= 2.8 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 13W	-6150	-6000	-6000	-6000	AG	1960	5.0	.0	16.2
B. 13E	-5850	-6000	-6000	-6000	AG	2050	5.0	.0	16.2
C. 13N	-6000	-6150	-6000	-6000	AG	260	5.5	.0	16.2
D. 13S	-6000	-5850	-6000	-6000	AG	510	5.6	.0	16.2
E. 16W	2850	-3000	3000	-3000	AG	2250	5.0	.0	16.2
F. 16E	3150	-3000	3000	-3000	AG	830	5.1	.0	16.2
G. 16N	3000	-3150	3000	-3000	AG	3220	5.0	.0	16.2
H. 16S	3000	-2850	3000	-3000	AG	1640	5.1	.0	16.2

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 13W	-6021	-5979	1.5
2. 13E	-5979	-5979	1.5
3. 13N	-5979	-6021	1.5
4. 13S	-6021	-6021	1.5
5. 16W	2979	-2979	1.5
6. 16E	3021	-2979	1.5
7. 16N	3021	-3021	1.5
8. 16S	2979	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2007 WP 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 13W	103.	.7	.0	.6	.0	.1	.0	.0	.0	.0
2. 13E	257.	.7	.6	.0	.0	.1	.0	.0	.0	.0
3. 13N	283.	.6	.6	.0	.0	.0	.0	.0	.0	.0
4. 13S	77.	.6	.0	.6	.0	.0	.0	.0	.0	.0
5. 16W	167.	1.2	.0	.0	.0	.0	.4	.0	.8	.0
6. 16E	193.	1.0	.0	.0	.0	.0	.0	.2	.8	.0
7. 16N	283.	1.2	.0	.0	.0	.0	.6	.0	.5	.0
8. 16S	13.	.9	.0	.0	.0	.0	.4	.0	.0	.5

2025 Modeling Results

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CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
         JUNE 1989 VERSION
         PAGE   1

     JOB: Folsom Bridge 2025 NP 1
     RUN: Hour 1           (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide
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I. SITE VARIABLES

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      U=    .5 M/S            Z0= 100. CM            ALT=     0. (M)
    BRG= WORST CASE           VD=   .0 CM/S
   CLAS=     7 (G)            VS=   .0 CM/S
   MIXH= 1000. M             AMB=   .0 PPM
  SIGTH=    5. DEGREES       TEMP=  2.8 DEGREE (C)
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II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1W	5850	6000	6000	6000	AG	3960	1.4	.0	16.2
B. 1E	6150	6000	6000	6000	AG	1310	1.4	.0	16.2
C. 1N	6000	6150	6000	6000	AG	2320	1.4	.0	16.2
D. 1S	6000	5850	6000	6000	AG	3910	1.4	.0	16.2
E. 5W	2850	3000	3000	3000	AG	3540	1.5	.0	16.2
F. 5E	3150	3000	3000	3000	AG	4130	1.6	.0	16.2
G. 5N	3000	2850	3000	3000	AG	3810	1.5	.0	16.2
H. 5S	3000	3150	3000	3000	AG	3980	1.5	.0	16.2
I. 6W	-150	0	0	0	AG	3960	1.4	.0	16.2
J. 6E	150	0	0	0	AG	2950	1.5	.0	16.2
K. 6N	0	150	0	0	AG	3670	1.4	.0	16.2
L. 6S	0	-150	0	0	AG	3460	1.4	.0	16.2
M. 10W	-3150	3000	-3000	3000	AG	240	1.7	.0	16.2
N. 10E	-2850	3000	-3000	3000	AG	240	1.6	.0	16.2
O. 10N	-3000	3150	-3000	3000	AG	2770	1.5	.0	16.2
P. 10S	-3000	2850	-3000	3000	AG	2770	1.5	.0	16.2
Q. 11W	-3150	-3000	-3000	-3000	AG	910	1.6	.0	16.2
R. 11E	-2850	-3000	-3000	-3000	AG	2010	1.6	.0	16.2
S. 11N	-3000	-3150	-3000	-3000	AG	2770	1.5	.0	16.2
T. 11S	-3000	-2850	-3000	-3000	AG	1810	1.5	.0	16.2

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2025 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 1W	5979	6021	1.5
2. 1E	6021	6021	1.5
3. 1N	6021	5979	1.5
4. 1S	5979	5979	1.5
5. 5W	2979	3021	1.5
6. 5E	3021	3021	1.5
7. 5N	3021	2979	1.5
8. 5S	2979	2979	1.5
9. 6W	-21	21	1.5
10. 6E	21	21	1.5
11. 6N	21	-21	1.5
12. 6S	-21	-21	1.5
13. 10W	-3021	3021	1.5
14. 10E	-2979	3021	1.5
15. 10N	-2979	2979	1.5
16. 10S	-3021	2979	1.5
17. 11W	-3021	-2979	1.5
18. 11E	-2979	-2979	1.5
19. 11N	-2979	-3021	1.5
20. 11S	-3021	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge 2025 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 1W	167.	.4	.2	.0	.0	.3	.0	.0	.0	.0
2. 1E	256.	.4	.3	.0	.1	.0	.0	.0	.0	.0
3. 1N	283.	.4	.3	.0	.0	.2	.0	.0	.0	.0
4. 1S	13.	.4	.2	.0	.2	.0	.0	.0	.0	.0
5. 5W	104.	.5	.0	.0	.0	.0	.0	.3	.0	.2
6. 5E	193.	.5	.0	.0	.0	.0	.0	.2	.3	.0
7. 5N	346.	.5	.0	.0	.0	.0	.0	.2	.0	.3
8. 5S	76.	.5	.0	.0	.0	.0	.0	.3	.2	.0
9. 6W	167.	.4	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	257.	.4	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	283.	.4	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	13.	.4	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	167.	.2	.0	.0	.0	.0	.0	.0	.0	.0
14. 10E	193.	.2	.0	.0	.0	.0	.0	.0	.0	.0
15. 10N	347.	.2	.0	.0	.0	.0	.0	.0	.0	.0
16. 10S	13.	.2	.0	.0	.0	.0	.0	.0	.0	.0
17. 11W	103.	.3	.0	.0	.0	.0	.0	.0	.0	.0
18. 11E	193.	.3	.0	.0	.0	.0	.0	.0	.0	.0
19. 11N	347.	.3	.0	.0	.0	.0	.0	.0	.0	.0
20. 11S	77.	.3	.0	.0	.0	.0	.0	.0	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge 2025 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S	T
1. 1W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. 1E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. 1N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. 1S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5. 5W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6. 5E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7. 5N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8. 5S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9. 6W	.2	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	.3	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	.3	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	.2	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0
14. 10E	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0
15. 10N	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0
16. 10S	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0
17. 11W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0
18. 11E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.2	.0
19. 11N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.0	.2
20. 11S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.1	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Folsom Bridge 2025 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U= .5 M/S Z0= 100. CM ALT= 0. (M)
BRG= WORST CASE VD= .0 CM/S
CLAS= 7 (G) VS= .0 CM/S
MIXH= 1000. M AMB= .0 PPM
SIGTH= 5. DEGREES TEMP= 2.8 DEGREE (C)

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1W	5850	6000	6000	6000	AG	3960	1.4	.0	16.2
B. 1E	6150	6000	6000	6000	AG	1310	1.4	.0	16.2
C. 1N	6000	6150	6000	6000	AG	2320	1.4	.0	16.2
D. 1S	6000	5850	6000	6000	AG	3910	1.4	.0	16.2
E. 5W	2850	3000	3000	3000	AG	3540	1.5	.0	16.2
F. 5E	3150	3000	3000	3000	AG	4130	1.6	.0	16.2
G. 5N	3000	2850	3000	3000	AG	3810	1.5	.0	16.2
H. 5S	3000	3150	3000	3000	AG	3980	1.5	.0	16.2
I. 6W	-150	0	0	0	AG	3960	1.4	.0	16.2
J. 6E	150	0	0	0	AG	2950	1.5	.0	16.2
K. 6N	0	150	0	0	AG	3670	1.4	.0	16.2
L. 6S	0	-150	0	0	AG	3460	1.4	.0	16.2
M. 10W	-3150	3000	-3000	3000	AG	240	1.7	.0	16.2
N. 10E	-2850	3000	-3000	3000	AG	240	1.6	.0	16.2
O. 10N	-3000	3150	-3000	3000	AG	2770	1.5	.0	16.2
P. 10S	-3000	2850	-3000	3000	AG	2770	1.5	.0	16.2
Q. 11W	-3150	-3000	-3000	-3000	AG	910	1.6	.0	16.2
R. 11E	-2850	-3000	-3000	-3000	AG	2010	1.6	.0	16.2
S. 11N	-3000	-3150	-3000	-3000	AG	2770	1.5	.0	16.2
T. 11S	-3000	-2850	-3000	-3000	AG	1810	1.5	.0	16.2

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2025 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 1W	5979	6021	1.5
2. 1E	6021	6021	1.5
3. 1N	6021	5979	1.5
4. 1S	5979	5979	1.5
5. 5W	2979	3021	1.5
6. 5E	3021	3021	1.5
7. 5N	3021	2979	1.5
8. 5S	2979	2979	1.5
9. 6W	-21	21	1.5
10. 6E	21	21	1.5
11. 6N	21	-21	1.5
12. 6S	-21	-21	1.5
13. 10W	-3021	3021	1.5
14. 10E	-2979	3021	1.5
15. 10N	-2979	2979	1.5
16. 10S	-3021	2979	1.5
17. 11W	-3021	-2979	1.5
18. 11E	-2979	-2979	1.5
19. 11N	-2979	-3021	1.5
20. 11S	-3021	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge 2025 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 1W	167.	.4	.2	.0	.0	.3	.0	.0	.0	.0
2. 1E	256.	.4	.3	.0	.1	.0	.0	.0	.0	.0
3. 1N	283.	.4	.3	.0	.0	.2	.0	.0	.0	.0
4. 1S	13.	.4	.2	.0	.2	.0	.0	.0	.0	.0
5. 5W	104.	.5	.0	.0	.0	.0	.0	.3	.0	.2
6. 5E	193.	.5	.0	.0	.0	.0	.0	.2	.3	.0
7. 5N	346.	.5	.0	.0	.0	.0	.0	.2	.0	.3
8. 5S	76.	.5	.0	.0	.0	.0	.0	.3	.2	.0
9. 6W	167.	.4	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	257.	.4	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	283.	.4	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	13.	.4	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	167.	.2	.0	.0	.0	.0	.0	.0	.0	.0
14. 10E	193.	.2	.0	.0	.0	.0	.0	.0	.0	.0
15. 10N	347.	.2	.0	.0	.0	.0	.0	.0	.0	.0
16. 10S	13.	.2	.0	.0	.0	.0	.0	.0	.0	.0
17. 11W	103.	.3	.0	.0	.0	.0	.0	.0	.0	.0
18. 11E	193.	.3	.0	.0	.0	.0	.0	.0	.0	.0
19. 11N	347.	.3	.0	.0	.0	.0	.0	.0	.0	.0
20. 11S	77.	.3	.0	.0	.0	.0	.0	.0	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge 2025 NP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S	T
1. 1W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. 1E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. 1N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. 1S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5. 5W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6. 5E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7. 5N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8. 5S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9. 6W	.2	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	.3	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	.3	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	.2	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0
14. 10E	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0
15. 10N	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0
16. 10S	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0
17. 11W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0
18. 11E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.2	.0
19. 11N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.0	.2
20. 11S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.1	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Folsom Bridge 2025 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	.5 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	7 (G)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	5. DEGREES	TEMP=	2.8 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 1W	5850	6000	6000	6000	AG	4030	1.4	.0	16.2
B. 1E	6150	6000	6000	6000	AG	1310	1.4	.0	16.2
C. 1N	6000	6150	6000	6000	AG	2410	1.4	.0	16.2
D. 1S	6000	5850	6000	6000	AG	4070	1.5	.0	16.2
E. 5W	2850	3000	3000	3000	AG	3160	1.2	.0	16.2
F. 5E	3150	3000	3000	3000	AG	2240	1.4	.0	16.2
G. 5N	3000	2850	3000	3000	AG	2140	1.2	.0	16.2
H. 5S	3000	3150	3000	3000	AG	2920	1.2	.0	16.2
I. 6W	-150	0	0	0	AG	3460	1.3	.0	16.2
J. 6E	150	0	0	0	AG	2240	1.3	.0	16.2
K. 6N	0	150	0	0	AG	2660	1.3	.0	16.2
L. 6S	0	-150	0	0	AG	2870	1.2	.0	16.2
M. 10W	-3150	3000	-3000	3000	AG	240	1.3	.0	16.2
N. 10E	-2850	3000	-3000	3000	AG	240	1.3	.0	16.2
O. 10N	-3000	3150	-3000	3000	AG	2170	1.3	.0	16.2
P. 10S	-3000	2850	-3000	3000	AG	2170	1.2	.0	16.2
Q. 11W	-3150	-3000	-3000	-3000	AG	1150	1.6	.0	16.2
R. 11E	-2850	-3000	-3000	-3000	AG	2100	1.5	.0	16.2
S. 11N	-3000	-3150	-3000	-3000	AG	2170	1.5	.0	16.2
T. 11S	-3000	-2850	-3000	-3000	AG	1340	1.6	.0	16.2

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2025 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 1W	5979	6021	1.5
2. 1E	6021	6021	1.5
3. 1N	6021	5979	1.5
4. 1S	5979	5979	1.5
5. 5W	2979	3021	1.5
6. 5E	3021	3021	1.5
7. 5N	3021	2979	1.5
8. 5S	2979	2979	1.5
9. 6W	-21	21	1.5
10. 6E	21	21	1.5
11. 6N	21	-21	1.5
12. 6S	-21	-21	1.5
13. 10W	-3021	3021	1.5
14. 10E	-2979	3021	1.5
15. 10N	-2979	2979	1.5
16. 10S	-3021	2979	1.5
17. 11W	-3021	-2979	1.5
18. 11E	-2979	-2979	1.5
19. 11N	-2979	-3021	1.5
20. 11S	-3021	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge 2025 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 1W	166.	.5	.2	.0	.0	.3	.0	.0	.0	.0
2. 1E	256.	.4	.3	.0	.1	.0	.0	.0	.0	.0
3. 1N	284.	.5	.3	.0	.0	.2	.0	.0	.0	.0
4. 1S	13.	.4	.2	.0	.2	.0	.0	.0	.0	.0
5. 5W	103.	.3	.0	.0	.0	.0	.0	.2	.0	.1
6. 5E	257.	.3	.0	.0	.0	.0	.2	.0	.0	.1
7. 5N	347.	.3	.0	.0	.0	.0	.0	.1	.0	.2
8. 5S	13.	.3	.0	.0	.0	.0	.1	.0	.0	.2
9. 6W	167.	.3	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	257.	.3	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	283.	.3	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	13.	.3	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	167.	.2	.0	.0	.0	.0	.0	.0	.0	.0
14. 10E	193.	.2	.0	.0	.0	.0	.0	.0	.0	.0
15. 10N	347.	.2	.0	.0	.0	.0	.0	.0	.0	.0
16. 10S	13.	.2	.0	.0	.0	.0	.0	.0	.0	.0
17. 11W	103.	.3	.0	.0	.0	.0	.0	.0	.0	.0
18. 11E	193.	.3	.0	.0	.0	.0	.0	.0	.0	.0
19. 11N	347.	.2	.0	.0	.0	.0	.0	.0	.0	.0
20. 11S	77.	.3	.0	.0	.0	.0	.0	.0	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 4

JOB: Folsom Bridge 2025 WP 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S	T
1. 1W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. 1E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. 1N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. 1S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5. 5W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6. 5E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7. 5N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8. 5S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9. 6W	.2	.0	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	.2	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	.2	.0	.0	.1	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	.2	.0	.2	.0	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	.0	.0	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0
14. 10E	.0	.0	.0	.0	.0	.0	.0	.1	.0	.0	.0	.0
15. 10N	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0
16. 10S	.0	.0	.0	.0	.0	.0	.2	.0	.0	.0	.0	.0
17. 11W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.0	.0
18. 11E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.2	.0
19. 11N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.1	.0	.1
20. 11S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.2	.1	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 1

JOB: Folsom Bridge 2025 WP 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

I. SITE VARIABLES

U=	.5 M/S	Z0=	100. CM	ALT=	0. (M)
BRG=	WORST CASE	VD=	.0 CM/S		
CLAS=	7 (G)	VS=	.0 CM/S		
MIXH=	1000. M	AMB=	.0 PPM		
SIGTH=	5. DEGREES	TEMP=	2.8 DEGREE (C)		

II. LINK VARIABLES

LINK DESCRIPTION	LINK COORDINATES (M) X1	Y1	X2	Y2	TYPE	VPH	EF (G/MI)	H (M)	W (M)
A. 13W	-6150	-6000	-6000	-6000	AG	2000	1.4	.0	16.2
B. 13E	-5850	-6000	-6000	-6000	AG	2310	1.4	.0	16.2
C. 13N	-6000	-6150	-6000	-6000	AG	240	1.4	.0	16.2
D. 13S	-6000	-5850	-6000	-6000	AG	910	1.5	.0	16.2
E. 16W	2850	-3000	3000	-3000	AG	3750	1.2	.0	16.2
F. 16E	3150	-3000	3000	-3000	AG	2590	1.2	.0	16.2
G. 16N	3000	-3150	3000	-3000	AG	3530	1.2	.0	16.2
H. 16S	3000	-2850	3000	-3000	AG	2130	1.3	.0	16.2

III. RECEPTOR LOCATIONS

RECEPTOR	COORDINATES (M) X	Y	Z
1. 13W	-6021	-5979	1.5
2. 13E	-5979	-5979	1.5
3. 13N	-5979	-6021	1.5
4. 13S	-6021	-6021	1.5
5. 16W	2979	-2979	1.5
6. 16E	3021	-2979	1.5
7. 16N	3021	-3021	1.5
8. 16S	2979	-3021	1.5

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 2

JOB: Folsom Bridge 2025 WP 2
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 13W	103.	.2	.0	.2	.0	.0	.0	.0	.0	.0
2. 13E	257.	.2	.2	.0	.0	.0	.0	.0	.0	.0
3. 13N	347.	.2	.0	.1	.0	.0	.0	.0	.0	.0
4. 13S	77.	.2	.0	.2	.0	.0	.0	.0	.0	.0
5. 16W	167.	.4	.0	.0	.0	.0	.2	.0	.2	.0
6. 16E	193.	.3	.0	.0	.0	.0	.0	.1	.2	.0
7. 16N	283.	.4	.0	.0	.0	.0	.2	.0	.1	.0
8. 16S	77.	.3	.0	.0	.0	.0	.0	.2	.1	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION
PAGE 3

JOB: Folsom Bridge Existing 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE)

RECEPTOR	BRG (DEG)	PRED CONC (PPM)	CONC/LINK (PPM) A	B	C	D	E	F	G	H
1. 1W	167.	1.4	.6	.0	.0	.8	.0	.0	.0	.0
2. 1E	257.	1.2	.8	.0	.3	.0	.0	.0	.0	.0
3. 1N	283.	1.4	.8	.0	.0	.5	.0	.0	.0	.0
4. 1S	13.	1.1	.6	.0	.5	.0	.0	.0	.0	.0
5. 5W	167.	1.0	.0	.0	.0	.0	.2	.0	.8	.0
6. 5E	257.	1.0	.0	.0	.0	.0	.3	.0	.0	.6
7. 5N	347.	1.0	.0	.0	.0	.0	.0	.0	.0	.9
8. 5S	13.	1.1	.0	.0	.0	.0	.2	.0	.0	.9
9. 6W	167.	2.1	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	257.	2.1	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	283.	2.1	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	13.	2.1	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	167.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
14. 10E	193.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
15. 10N	347.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
16. 10S	13.	1.1	.0	.0	.0	.0	.0	.0	.0	.0
17. 11W	103.	1.4	.0	.0	.0	.0	.0	.0	.0	.0
18. 11E	193.	1.6	.0	.0	.0	.0	.0	.0	.0	.0
19. 11N	347.	1.4	.0	.0	.0	.0	.0	.0	.0	.0
20. 11S	77.	1.5	.0	.0	.0	.0	.0	.0	.0	.0

CALINE4: CALIFORNIA LINE SOURCE DISPERSION MODEL
JUNE 1989 VERSION

JOB: Folsom Bridge Existing 1
RUN: Hour 1 (WORST CASE ANGLE)
POLLUTANT: Carbon Monoxide

IV. MODEL RESULTS (WORST CASE WIND ANGLE) (CONT.)

RECEPTOR	CONC/LINK (PPM) I	J	K	L	M	N	O	P	Q	R	S	T
1. 1W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
2. 1E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
3. 1N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
4. 1S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
5. 5W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
6. 5E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
7. 5N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
8. 5S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
9. 6W	.9	.0	.0	1.2	.0	.0	.0	.0	.0	.0	.0	.0
10. 6E	1.3	.0	.9	.0	.0	.0	.0	.0	.0	.0	.0	.0
11. 6N	1.3	.0	.0	.9	.0	.0	.0	.0	.0	.0	.0	.0
12. 6S	.9	.0	1.3	.0	.0	.0	.0	.0	.0	.0	.0	.0
13. 10W	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0
14. 10E	.0	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0
15. 10N	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0	.0
16. 10S	.0	.0	.0	.0	.0	.0	1.0	.0	.0	.0	.0	.0
17. 11W	.0	.0	.0	.0	.0	.0	.0	.0	.0	.8	.0	.6
18. 11E	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5	1.1	.0
19. 11N	.0	.0	.0	.0	.0	.0	.0	.0	.0	.5	.0	.9
20. 11S	.0	.0	.0	.0	.0	.0	.0	.0	.0	.8	.7	.0

Operational CO EMFAC2002 Runs

Title : Sacramento County Avg Existing 1
Version : Emfac2002 V2.2 Apr 23 2003
Run Date : 07/25/05 12:51:15
Scen Year: 2005 -- Model Years: 1965 to 2005
Season : Winter
Area : Sacramento County
****

Year:2005 -- Model Years 1965 to 2005 Inclusive -- Winter
Emfac2002 Emission Factors: V2.2 Apr 23 2003

County Average Sacramento Count County Average

Pollutant Name: Carbon Monoxide Temperature: 37F Relative Humidity: 30%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
6	7.882	13.905	12.084	36.396	60.519	56.514	12.282
8	7.362	12.770	10.960	30.942	51.178	52.116	11.156
9	7.126	12.265	10.466	28.621	47.220	50.202	10.661
10	6.905	11.796	10.011	26.531	43.666	48.458	10.205
11	6.697	11.360	9.592	24.646	40.470	46.870	9.784
12	6.502	10.955	9.205	22.943	37.591	45.428	9.396
13	6.318	10.577	8.847	21.404	34.996	44.121	9.037
14	6.144	10.225	8.516	20.011	32.652	42.939	8.705
15	5.979	9.896	8.209	18.748	30.533	41.875	8.396
16	5.824	9.589	7.924	17.602	28.615	40.922	8.110
17	5.677	9.302	7.660	16.561	26.878	40.072	7.843
23	4.942	7.924	6.416	12.013	19.341	36.888	6.586
24	4.840	7.741	6.255	11.472	18.452	36.645	6.423
25	4.743	7.570	6.105	10.979	17.643	36.478	6.270
26	4.651	7.410	5.965	10.529	16.908	36.387	6.127
27	4.564	7.260	5.835	10.119	16.238	36.371	5.994
29	4.401	6.988	5.600	9.406	15.079	36.563	5.753
30	4.326	6.865	5.495	9.098	14.579	36.773	5.644
32	4.187	6.644	5.308	8.565	13.719	37.426	5.450
33	4.122	6.545	5.224	8.337	13.353	37.874	5.363
41	3.722	6.005	4.782	7.252	11.650	44.869	4.887
42	3.686	5.968	4.753	7.196	11.568	46.258	4.854
46	3.569	5.884	4.694	7.123	11.497	53.351	4.775
47	3.547	5.880	4.694	7.143	11.544	55.575	4.770

Title : Sacramento County Avg 2007 NP
Version : Emfac2002 V2.2 Apr 23 2003
Run Date : 07/25/05 12:52:39
Scen Year: 2007 -- Model Years: 1965 to 2007
Season : Winter
Area : Sacramento County
****

Year:2007 -- Model Years 1965 to 2007 Inclusive -- Winter
Emfac2002 Emission Factors: V2.2 Apr 23 2003

County Average Sacramento Count County Average

Pollutant Name: Carbon Monoxide Temperature: 37F Relative Humidity: 30%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
3	7.324	13.521	11.620	32.938	48.944	57.856	11.623
4	7.062	12.906	11.156	32.938	48.944	57.856	11.254
5	6.817	12.339	10.728	32.938	48.944	57.856	10.912
7	6.374	11.323	9.739	27.891	41.178	53.135	9.896
8	6.172	10.871	9.304	25.748	37.897	51.078	9.451
9	5.983	10.452	8.904	23.820	34.956	49.203	9.041
10	5.805	10.062	8.534	22.083	32.316	47.493	8.663
11	5.638	9.700	8.192	20.517	29.942	45.938	8.314
15	5.056	8.479	7.060	15.613	22.566	41.043	7.160
16	4.929	8.222	6.825	14.660	21.143	40.108	6.922
17	4.809	7.981	6.607	13.795	19.855	39.276	6.699
18	4.695	7.756	6.403	13.008	18.686	38.539	6.492
19	4.586	7.544	6.213	12.291	17.626	37.894	6.299
20	4.483	7.346	6.036	11.639	16.663	37.337	6.119
21	4.385	7.160	5.870	11.045	15.788	36.863	5.951
22	4.292	6.985	5.716	10.503	14.993	36.470	5.793
23	4.203	6.820	5.571	10.009	14.269	36.155	5.646
24	4.118	6.666	5.436	9.559	13.610	35.917	5.508
41	3.165	5.167	4.163	6.038	8.572	43.971	4.196
42	3.133	5.132	4.135	5.990	8.510	45.331	4.166
46	3.025	5.047	4.071	5.926	8.456	52.280	4.092
47	3.004	5.040	4.067	5.942	8.489	54.459	4.085
50	2.955	5.056	4.087	6.067	8.706	62.328	4.097
51	2.944	5.075	4.105	6.135	8.818	65.467	4.112

Title : Sacramento County Avg 2025 NP
Version : Emfac2002 V2.2 Apr 23 2003
Run Date : 07/25/05 12:53:04
Scen Year: 2025 -- Model Years: 1980 to 2025
Season : Winter
Area : Sacramento County
****

Year:2025 -- Model Years 1980 to 2025 Inclusive -- Winter
Emfac2002 Emission Factors: V2.2 Apr 23 2003

County Average Sacramento Count County Average

Pollutant Name: Carbon Monoxide Temperature: 37F Relative Humidity: 30%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
3	1.216	2.338	2.888	5.420	11.053	29.859	2.042
4	1.191	2.282	2.820	5.420	11.053	29.859	2.005
5	1.166	2.227	2.755	5.420	11.053	29.859	1.970
6	1.142	2.175	2.675	4.997	10.100	28.753	1.902
7	1.119	2.124	2.600	4.617	9.250	27.736	1.839
8	1.097	2.076	2.529	4.274	8.491	26.801	1.781
9	1.075	2.029	2.461	3.965	7.813	25.940	1.725
10	1.054	1.984	2.397	3.685	7.205	25.149	1.674
11	1.034	1.941	2.337	3.432	6.660	24.422	1.625
12	1.014	1.899	2.279	3.202	6.170	23.755	1.579
13	0.995	1.859	2.224	2.994	5.729	23.143	1.536
19	0.890	1.645	1.942	2.084	3.854	20.457	1.322
20	0.874	1.613	1.902	1.975	3.637	20.150	1.292
21	0.858	1.582	1.863	1.876	3.440	19.879	1.264
22	0.843	1.553	1.826	1.785	3.260	19.642	1.237
23	0.829	1.524	1.790	1.702	3.098	19.439	1.211
24	0.814	1.496	1.756	1.627	2.950	19.267	1.186
25	0.801	1.470	1.723	1.557	2.815	19.128	1.163
32	0.713	1.304	1.523	1.212	2.165	19.029	1.024
33	0.702	1.283	1.499	1.178	2.104	19.144	1.007

Appendix F

Noise Analysis

Draft Noise Analysis Report

Folsom Bridge Project
Folsom, California

March 2006

Prepared for

US Army Corps of Engineers

US Army Corps
of Engineers

Sacramento District
South Pacific Region

Prepared by

CH2MHILL / URS Team
a joint venture

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1.0 INTRODUCTION

The American River and Lake Natoma bisect the City of Folsom (City). The two-lane Folsom Dam Road, which used to accommodate a significant part of cross-town commuter traffic, was closed permanently in February 2003 for security reasons. Following the Folsom Dam Road closure, the United States Army Corp of Engineers (USACE) proposed the construction of a new bridge crossing downstream of the Folsom Dam. The bridge project is a component of the congressionally appropriated American River Watershed project. The project intends to help relieve severe congestion on City streets, particularly at the City's Historic District and adjacent neighborhoods, caused by traffic diversions due to the closure of Folsom Dam Road.

1.1 Study Purpose

The purpose of this noise analysis is to evaluate the existing (2004) and projected future (2025) traffic noise conditions under no-action and project plan conditions at noise-sensitive locations within the project study area, assess potential traffic and construction noise impacts and, if required, identify the level of noise mitigation required. The findings of the noise analysis shall be incorporated into the Environmental Impact Report (EIR) being prepared for the proposed project.

1.2 Project Description

Major features of the bridge project include:

1. A new bridge across the American River Canyon immediately below Folsom Dam.
2. New roadway approaches between Folsom-Auburn Road and East Natoma Street, with a total intersection to intersection distance of approximately 2 miles, including the new bridge structure.
3. New or improved intersections at both Folsom-Auburn Road and East Natoma Street.

URS understands the currently selected alignment of the proposed new roadway used as the basis for conducting this noise analysis was selected from a pool of four alternatives as providing the same benefits for least cost. It connects the proposed west abutment of the bridge alignment and crosses the area between the Bureau of Reclamation (BOR) facilities and the Lake Point Apartments (LPA). To help mitigate noise due to traffic, an approximately thousand-foot-long sound wall and landscaping would be constructed between and run nearly parallel with the new roadway and LPA. In addition, an approximately 600-foot-long L-shaped sound wall would be constructed between the new roadway and BOR facilities. This selected roadway alignment then terminates at a new intersection at Folsom-Auburn Road about 400 feet south of the existing (closed) intersection of Folsom Dam Road.

This new four-way intersection would include the Auto Spa driveway opposite the new roadway segment and consist of two left-turn lanes from southbound Folsom-Auburn Road onto the new roadway, one dedicated southbound lane, and one combination lane for southbound or right turns. Northbound Folsom-Auburn Road would have two dedicated northbound lanes, a right-turn lane onto the new roadway, and a left-turn lane. The existing Folsom-Auburn Road along the LPA complex would need to be widened for the addition of a right turn lane.

In the event of a major change in the project horizontal or vertical alignment, the noise analysis findings would need to be revisited.

1.3 Fundamentals of Traffic Noise

Sound pressure can be measured in units of micronewtons per square meter, called micropascals (μPa). One μPa is approximately one-hundred-billionth of the normal atmospheric pressure. The pressure of a very loud sound may be 200 million μPa, or 10 million times the pressure of the weakest audible sound (20 μPa). Expressing sound levels in terms of μPa would be very cumbersome because of this wide range, which is analogous to describing mass ranging from a battleship to a paperclip. Therefore, sound pressure levels are described in logarithmic units of ratios of actual sound pressures to a reference pressure squared. These units are called bels, named after Alexander G. Bell. To provide a finer resolution, a bel is subdivided into decibels (dB). A dB is a tenth of a bel.

Appendix A provides a description of the acoustical terminology used in this report. Unless otherwise stated, all sound levels reported are in A-weighted decibels (dBA). A-weighted decibels are measured with a sound-level meter having the metering characteristics and a frequency weighting specified in the American National Standards Institute (ANSI) Specification for Sound Level Meters, ANSI S 1.4–1983. The A-weighting de-emphasizes lower frequency sounds below 1,000 Hertz (Hz) (equivalent to 1 kilohertz [kHz]) and higher frequency sounds above 4 kHz. It emphasizes sounds between 1 kHz and 4 kHz. A-weighting is the most generally used measure for traffic and environmental noise throughout the world. Most community noise standards utilize A-weighting because it provides a high degree of correlation with human annoyance and health effects. Table 1 shows the relative A-weighted sound levels or noise levels of common sounds measured in the environment and in industry.

The actual impact of noise is not a function of loudness alone. The time of day during which noise occurs and the duration of the noise are also important. In addition, most noise that lasts for more than a few seconds is variable in its intensity. Consequently, a variety of noise descriptors have been used, such as L_{10}, L_{50}, and day-night noise level (L_{dn}). The noise descriptor used for this study is L_{eq}, the equivalent steady-state noise level, which in a stated period of time would contain the same acoustical energy as the time-varying noise level during the same period. The L_{eq}(h) is the energy-average of the A-weighted noise levels occurring during a 1-hour period, in decibels (a 1-hour L_{eq}).

Table 1. Noise Levels from Common Sources

Noise Source At a Given Distance	A-Weighted Sound Level (dBA)	Noise Environments	Subjective Impression
Shotgun	140	Carrier flight deck	
Civil defense siren (100 ft)	130		
Jet Takeoff (200 ft)	120		Threshold of pain
Loud rock music	110	Rock music concert	
Pile driver (50 ft) Ambulance siren (100 ft)	100		Very loud
Freight cars (50 ft)	90	Boiler room Printing press plant	
Pneumatic drill (50 ft) Freeway (100 ft)	80	Noisy restaurant	
Busy traffic; hair dryer	70		Moderately loud
Normal conversation (5 ft) Air conditioning unit (100 ft)	60	Data processing center Department store	
Light traffic (100 ft); rainfall Large transformer (200 ft)	50	Private business office	
Bird calls (distant)	40	Average living room library	Quiet
Soft whisper (5 ft); rustling leaves	30	Quiet bedroom	
	20	Recording studio	
Normal breathing	10		
	0		Threshold of hearing

From the source to the receiver, noise changes both in level and frequency spectrum. The most obvious change is the decrease in noise as the distance from the source increases. The manner in which noise reduces with distance depends on the following important factors:

- Geometric spreading from point and line sources
- Ground absorption
- Atmospheric effects and refraction
- Shielding by natural and manmade features, noise barriers, diffraction, and reflection

Sound from a small localized source (approximating a “point” source) radiates uniformly outwards as it travels away from the source in a spherical pattern. The noise level decreases or drops off at a rate of 6 dBA for each doubling of the distance (DD).

However, highway traffic noise is not a single, stationary point source of sound. The movement of the vehicles makes the source of the sound appear to emanate from a line (line source) rather than a point when viewed over some time interval. Generally, noise levels from a highway decrease at rates of 3 dBA to 4.5 dBA for each doubling of distance from the highway, depending on the type of terrain between the highway and receivers. Two site types currently used in traffic noise models are as follows:

- **Hard**. These are sites with a reflective surface between the source and the receiver such as parking lots or smooth bodies of water. No excess ground attenuation is assumed for these sites and the changes in noise levels with distance (drop-off rate) is simply 6dB or 3dB per doubling of distance (DD) for point and line sources, respectively.
- **Soft**. These sites have an absorptive ground surface such as soft dirt, grass or scattered brushes and trees. An excess ground attenuation value of 1.5 dBA is normally assumed and hence add to the aforementioned “hard” drop-off rates.

Research by the California Department of Transportation (Caltrans) and others has shown that atmospheric conditions can have an effect on noise levels within 200 feet from a highway. Wind has been shown to be the single most important meteorological factor within approximately 500 feet, and vertical air temperature gradients are more important over longer distances. Other factors, such as humidity, and turbulence, also have significant effects.

Changes in noise levels are generally perceived as follows:

- 3–dBA change is barely perceptible.
- 5–dBA change is readily perceptible.
- 10–dBA change is perceived as a doubling or halving of noise.

1.4 Methodology

Traffic noise levels were evaluated using the Federal Highway Administration (FHWA) Traffic Noise Model (TNM) version 2.5 computer program. TNM is the latest analytical method developed for roadway traffic noise prediction. The model is based upon reference energy emission levels for automobiles, medium trucks (2 axles), heavy trucks (3 or more axles), buses and motorcycles, with consideration given to vehicle volume, speed, roadway configuration, distance to the receiver, atmospheric conditions, and the acoustical characteristics of the site. TNM was developed to predict hourly L_{eq} values for free-flowing and interrupted-flow traffic conditions, and is generally considered to be accurate within $\pm$3 dB. The model enables the user to account for the effects of different pavement types, graded

roadways, and attenuation over/through rows of buildings and dense vegetation. For a conservative assessment of future traffic noise levels, noise attenuating effects of trees and foliage have not been considered in this analysis. The model uses traffic noise emission curves, which are recommended by the FHWA to accurately calculate noise levels generated by traffic.

Traffic data used in the noise model were developed from data provided by the project traffic consultant (Fehr & Peers, 2005). Appendix B lists the traffic assumptions used as inputs to the noise model.

TNM allows for input of an overall site temperature and relative humidity to account for the atmospheric effects of these factors on noise propagation. Based on the FHWA recommendation, the default temperature of 68 degrees Fahrenheit (°F) and a relative humidity of 50 percent are used in this analysis. Current tools do not offer analysis capabilities for the effects of other factors such as wind and atmospheric inversions. Therefore, similar to other noise studies of its kind, a no-wind condition is assumed for this noise analyses.

Construction noise levels were estimated based upon available reference noise level data from construction equipment (USDOT, 1977) and distance between construction activities and nearest identified receiver locations.

2.0 SETTING

2.1 Existing Land Use

Existing noise-sensitive land uses within the project study area comprise of multifamily and mobile homes near the intersection of the proposed project with Folsom-Auburn Road, and single-family homes in the vicinity of the east approach of the project at East Natoma Street. Near the west approach, LPA, Lakeside Townhomes, and the adjoining mobile homes east of Folsom-Auburn Road would potentially be impacted by traffic noise resulting from the project. Other noise-sensitive land uses in this area include the BOR facilities and the American River Water Education Center (ARWEC) facilities.

Other land uses along the project corridor are primarily open, undeveloped land, including areas within Folsom Prison. Some of the new roadway alignment may pass with several hundred feet of some existing prison facilities; however none of these facilities appeared to have noise sensitive uses, so noise analyses were not conducted in those areas.

2.2 Applicable Noise Criteria

Based on the California Environmental Quality Act (CEQA) guideline, a project would normally have a significant effect on the environment if it: conflicts with the adopted environmental plans and goals of the community in which it is located, substantially increases the ambient noise levels for adjoining areas, or exposes people to severe noise levels.

The proposed project would be subject to the City noise criteria and is also evaluated in terms of state and federal criteria for transportation noise sources.

2.2.1 Local Criteria

The Noise Element of the Folsom General Plan (Folsom Community Development Department, 1988) is the planning document that has established criteria and policies designed to achieve land use compatibility for proposed development. The Noise Element defines a noise exposure criterion of 60 dB CNEL or Ldn for exterior activity areas of noise sensitive land uses, including residential land uses, schools, hospitals, and nursing homes. In the event that a noise level of 60 dB CNEL cannot be achieved through the application of practical noise mitigation measures, the General Plan allows an exterior noise level of up to 65 dBA CNEL for such land uses.

The City of Folsom Noise Ordinance exempts noise from construction activities during daytime hours from its standards. For this purpose, daytime hours are defined as between 7 a.m. and 6 p.m. on weekdays, and between 8 a.m. and 5 p.m. on weekends. For the purposes of this analysis, a significant construction noise impact would occur if construction activities exceed the noise ordinance standards for construction activity and occur outside of the hours allowed by the noise ordinance. Maximum noise levels not to be exceeded are 70 dBA before 10 p.m. and 65 dBA after 10 p.m.

2.2.2 Federal and State Criteria

The criteria for evaluating traffic noise impacts that are used in this report are contained in Title 23 Code of Federal Regulations (CFR) Part 772 – *Procedures for Abatement of Highway Traffic Noise and Construction Noise,* and the California Department of Transportation (Caltrans) *Traffic Noise Analysis Protocol* dated October 1998. The Category B criterion in these documents applies to residences, churches, schools, recreation areas and similar uses, and is an hourly sound level that approaches or exceeds 67 dBA L_{eq}.

Other developed land, such as commercial or industrial uses, are included in Category C, for which an hourly sound level criterion that approaches or exceeds 72 dBA L_{eq} has been established. There are no criteria for undeveloped land or construction noise. The above-described criterion sound levels are determined at the exterior of structures during peak hour noise conditions.

Table 2 shows the FHWA noise abatement criteria used for determining impacts to specific land uses (e.g. residential and commercial).

Table 2. FHWA Noise Abatement Criteria

Activity Category	Design Noise Levels L_{eq} hourly (dB A)	Description of Land Use Activity Category
A[1]	57 (Exterior)	Tracts of land which serenity and quiet are of extraordinary significance and serve an important public need and where the preservation of those qualities is essential if they are to continue to serve their intended purpose. Such areas could include amphitheaters, particular parks or portions of parks, open spaces, or historic districts which are dedicated or recognized by appropriate local officials for activities requiring special qualities of serenity and quiet.
B	67 (Exterior)	Picnic areas, recreation areas, playgrounds, active sports areas, and parks which are not included in category A and residences, motels, hotels, public meeting rooms, schools, churches, libraries, and hospitals.
C	72 (Exterior)	Developed lands, properties or activities not included in Categories A and B above.
D	--	Undeveloped lands
E	52 (Interior)	Residences, motels, hotels, public meeting rooms, schools, churches, libraries, hospitals, and auditoriums.
Source: Code of Federal Regulations. Title 23 CFR Part 772–Procedures for Abatement of Highway Traffic Noise and Construction Noise. Federal Highway Administration, April 1992.		

FHWA and Caltrans consider a traffic noise impact to occur if predicted peak-hour traffic noise levels approach or exceed the noise abatement criteria. Caltrans defines “approach or exceed” as noise levels within 1 dBA of noise abatement criterion, meaning 66 dBA for Activity Category B. In addition to the criterion sound levels described above, the FHWA and Caltrans consider a traffic noise impact to

occur if predicted sound levels "substantially" exceed existing noise levels. Caltrans defines "substantial" as an increase of 12 dBA over existing peak-hour noise levels. Caltrans and FHWA policies dictate that noise abatement measures must be considered when noise impacts are identified.

2.3 Measured Noise Levels

Currently, vehicular traffic on area roadways, particularly Folsom-Auburn Road and East Natoma Street, is the dominant source of noise affecting noise-sensitive land uses in the study area. Occasional distant aircraft overflights and natural background sound sources are also parts of the existing noise environment, but are not real contributors to the overall noise levels.

On July 11 and 12, 2005, CH2MHill conducted short-term and long-term noise level measurements and, in some cases, concurrent traffic counts at the exterior areas of representative noise-sensitive residential locations within the study area. The six noise monitoring locations of this study appear on Figures 1-A and 1-B as sites numbered 1 through 6, with descriptions in Table 4.

Appendix C includes photographs of the noise monitors as they were set up at each monitoring location. Measurement equipment consisted of a Larson Davis (LD) Model 824 sound level meter, equipped with a LD Model 2560 ½" polarized condenser microphone, and two LD Model 820 sound level meters, one equipped with a PCB 377A ½" microphone and the other with a LD Model 2551 ½" microphone. A LD CAL-200 acoustical calibrator was used for field calibration check of the microphones to ensure the accuracy of the measurements. All the equipment complies with the requirements of the American National Standards Institute (ANSI) and the International Electrotechnical Commission (IEC) for precision sound level measurement instrumentation.

Weather conditions during the measurements consisted of clear skies, calm to slightly breezy wind conditions, and temperatures were between 75 degrees Fahrenheit (º F) in the morning to 100º F in the afternoon. All roadway pavements were dry during the noise level measurement period.

The purpose of the noise level measurements was to document existing background noise levels and to validate the use of the Traffic Noise Model (TNM) in predicting traffic noise exposure within the study area. The detailed noise measurement data are attached to this report in Appendix D.

2.4 Noise Model Validation

One step during noise modeling includes an evaluation of agreement between the noise levels measured in the field and those calculated by the noise model. This evaluation serves to validate the model, to ensure that it is an accurate representation of the actual field conditions.

Model accuracy of the project area, particularly with regards to the roadway and receiver locations, can depend on site inspection diligence. Hence, field survey notes should include site-specific features which may affect the acoustical condition

at each location, such as existing terrain features, building structures, existing barriers, intervening ground types, and roadway and receiver elevations.

The noise model utilizes existing roadway geometry, receiver locations, intervening terrain data and number of vehicles counted during the noise measurement periods. Available topographic data enables the model to contain exact three-dimensional coordinates of the monitoring sites. With these parameters, TNM predicts noise levels at these exterior locations of residential areas.

Table 3 is a summary of noise levels obtained during the traffic noise level measurements and their comparison to levels predicted by the noise model. A positive (+) number in the "Difference" column of Table 3 indicates that noise levels measured in the field are lower than those predicted by the computer model. A negative (-) difference shows that measured noise levels are greater than predicted noise levels.

Table 3. Comparison of Measured and Predicted Traffic Noise Levels

Receiver Location	Measured L_{eq} (dBA)	Predicted L_{eq} (dBA)	Difference (dBA)
1	66.0	66.3	+0.3
2	59.0	60.4	+1.4
4	61.9	62.4	+0.5
5	53.3	52.8	-0.5
6	62.1	63.3	+1.2

From data in Table 3, it is apparent that field measurement and noise model results show good agreement (within ±3 dBA of each other) and indicate that the TNM may be used to accurately calculate traffic noise exposure at the selected receiver locations.

2.5 Calculated Existing Traffic Noise Levels

As displayed in Table 4, a total of 22 receiver locations, including the 6 noise monitoring locations, were used for predicting existing peak-hour and 24-hour traffic noise levels within the project study area. Figure 1-A and 1-B show the selected noise receiver locations. To calculate existing peak-hour noise levels, existing (2004) traffic data provided by the traffic consultant (Fehr & Peers, 2005) were used. Vehicle composition in terms of percentages of automobiles, medium trucks and heavy trucks were developed from the results of traffic counts obtained in the field during the noise monitoring. Existing peak-hour traffic noise levels for the selected receiver locations are summarized in Table 5.

Table 4. Identified Noise Receiver Locations

ID	Area	Description
1	West Approach	Front Unit of Lakeside Townhomes, located approximately 100 feet west of Folsom-Auburn Road centerline
2	West Approach	At Building 700, Unit 707 of Lake Pointe Apartments, approximately 165 feet east of the centerline of Folsom-Auburn Road
3	West Approach	At east side of Building 1200 of Lake Pointe Apartments, located just south of the existing tennis courts
4	East Approach	In front of 104 Tacana Drive, located approximately 100 feet south of East Natoma Street centerline
5	East Approach	Within Lot 34 of the La Collina Del Lago residential subdivision (undeveloped), located approximately 65 feet north of the existing soundwall
6	East Approach	Backyard of 104 Showers Court, just east of the intersection of East Natoma Street and Briggs Ranch Road
7	West Approach	Mobile home near Lark Lane and Robin Lane, approximately 90 feet west of Folsom-Auburn Road centerline
8	West Approach	Mobile home on Lark Lane near northeast corner of mobile home part, approximately 100 feet west of Folsom-Auburn Road centerline
9	West Approach	North side of Building 800 at Lake Pointe Apartments, approximately 525 feet east of the Folsom-Auburn Road centerline
10	West Approach	West side of Building 100 at Lake Pointe Apartments, approximately 120 feet east of the Folsom-Auburn Road centerline
11	West Approach	South side of Building 800 at Lake Pointe Apartments, approximately 300 feet east of the Folsom-Auburn Road centerline
12	West Approach	South side of Building 1700 at Lake Pointe Apartments, approximately 700 feet east of the Folsom-Auburn Road centerline
13	West Approach	East side of Building 1300 at Lake Pointe Apartments, approximately 850 feet east of the Folsom-Auburn Road centerline
14	West Approach	ARWEC South, approximately 350 feet east of Folsom-Auburn Road centerline
15	West Approach	ARWEC North, approximately 350 feet east of Folsom-Auburn Road centerline
16	West Approach	Existing Bureau of Reclamation facility approximately 550 feet east of Folsom-Auburn Road centerline
17	West Approach	Alternate future Bureau of Reclamation facility approximately 1700 feet east of Folsom-Auburn Road centerline
18	East Approach	Home on Tracana Drive, located approximately 60 feet south of E. Natoma Street centerline
19	East Approach	Backyard of home on Tracana Drive, located approximately 100 feet south of East E. Natoma Street centerline
20	East Approach	Backyard of home on Amaya Drive, located approximately 100 feet south of south E. Natoma Street centerline
21	East Approach	Backyard of home at end of Strouse Ct. cul-de-sac, approximately 100 south of E. Natoma St. centerline
22	East Approach	Backyard of home at end of Sanborn Ct. cul-de-sac, approximately 100 south of E. Natoma St. centerline

In addition, based on the 24-hour noise level measurements conducted at receiver 6, the existing CNEL at this location was determined to be 62 dBA. Assuming that peak-hour traffic volume passing by each location next to the major roadways is a fixed percentage of the average daily traffic volume and that daytime and nighttime traffic distribution is fixed on average, the difference between the peak-hour noise level and CNEL obtained at receiver 6 may be applied to the calculated peak-hour noise levels to arrive at CNEL values for other receivers in close proximity to traffic.

From the data shown in Table 5, it is evident that existing peak-hour noise levels at some of the receiver locations already exceed the applicable peak-hour noise criterion. Likewise, estimated CNEL values at locations next to the roadways mostly exceed the City's exterior noise criterion of 60 dB CNEL.

Table 5. Existing (2004) Peak-Hour Noise Levels (dBA)

Receiver Location	Peak-hour Noise Level	24-hour Noise Level (CNEL)*
West Approach		
1	**68**	**64**
2	62	58
3	50**	54
7	70	**66**
8	69	**66**
9	50	56
10	65	61
11	57	54
12	49	---
13	50	---
14 - ARWEC South	53	---
15 - ARWEC – North	54	---
16 - Existing BOR	48	---
17 – New BOR	---	---
East Approach		
4	65	**61**
5	55	55
6	66	**62****
18	**68**	**65**
19	64	60
20	64	**61**
21	66	**63**
22	64	**61**

BOR: Bureau of Reclamation
ARWEC: American River Water Education Center
* Estimated from calculated peak-hour noise levels.
** Based on actual field noise measurements.
Bold underlined numbers indicate noise levels that exceed the applicable noise criterion for residential land use.

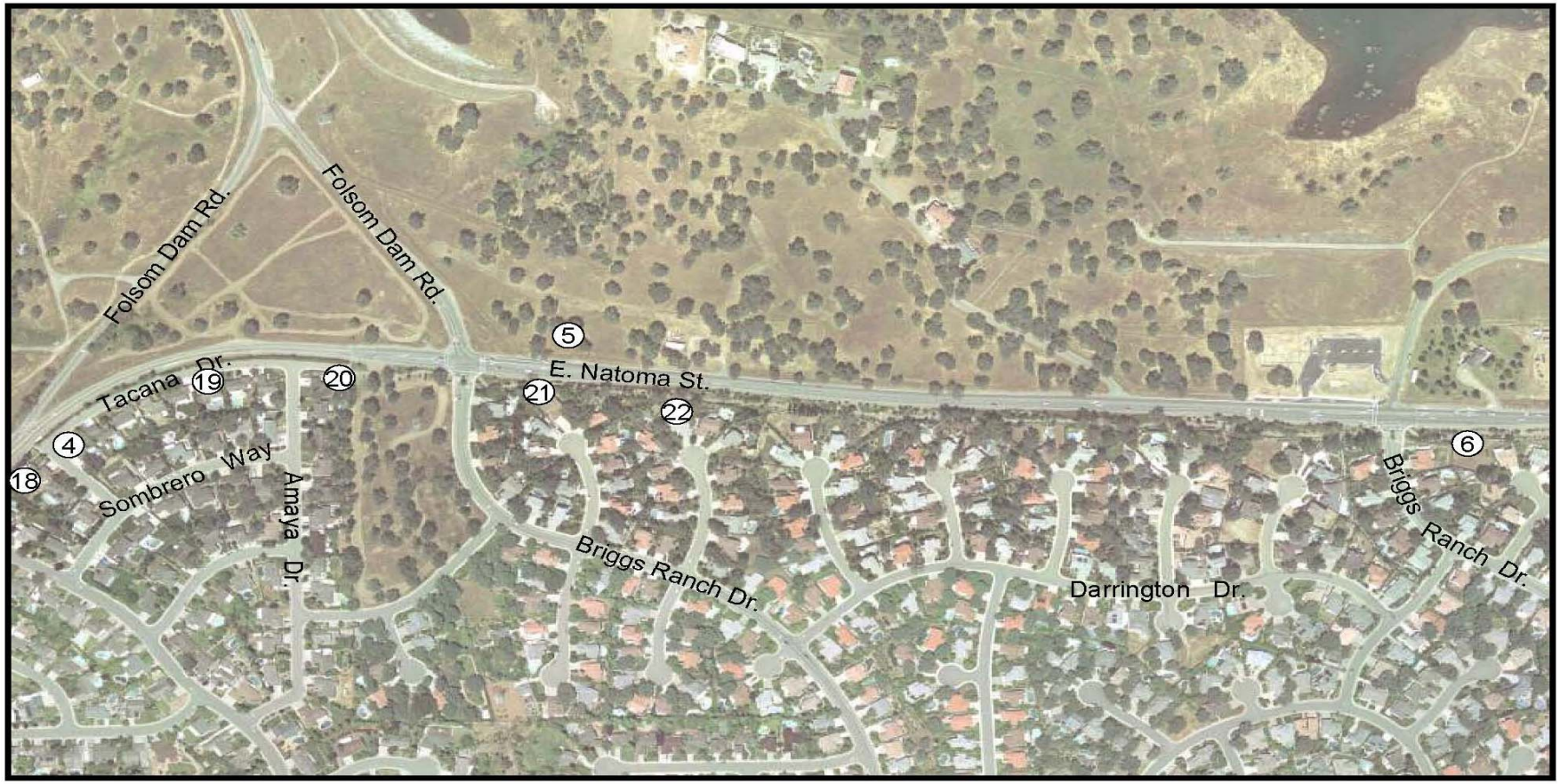
From the data shown in Table 5, it is evident that existing peak-hour noise levels at a number of the receivers exceed the applicable peak-hour noise criterion. Likewise, estimated CNEL values at locations next to the roadways mostly exceed the City's exterior noise criterion of 60 dB CNEL.

Figure 1-A Noise Receiver Locations – Western Receivers

(#) Noise Receivers

N

Figure 1-B Noise Receiver Locations – Eastern Receivers



(#) Noise Receivers

N

3.0 ENVIRONMENTAL CONSEQUENCES

3.1 Basis of Significance

Project noise effects on sensitive land uses are considered significant if any of the following would result from implementation of the proposed plan:

- Project construction would occur during nighttime hours and cause noise levels at noise-sensitive land uses to exceed noise limits established by the City of Folsom Noise Ordinance. For this purpose, non-exempt hours are defined as between 6 p.m. and 7 a.m. on weekdays, and between 5 p.m. and 8 a.m. on weekends. Maximum noise levels not to be exceeded are 70 dBA before 10 p.m. and 65 dBA after 10 p.m.

- At locations where future peak-hour traffic noise levels without the project (i.e., no-action) would be below the effective Federal and State noise abatement criterion of 66 dBA, implementation of the proposed plan would cause noise levels to exceed this criterion.

- Implementation of the proposed plan would cause traffic noise levels at any location to increase by 5 dBA or more above no-action conditions.

3.2 Potential Future Noise Impacts

Future noise effects of the proposed plan during construction and operation phases were evaluated to determine the potential noise impacts and need for mitigation. The same 22 noise receivers were used as representative locations to evaluate the potential noise impacts of the proposed plan on nearby sensitive land uses.

3.2.1 No Build

The no-build alternative assumes that no permanent bridge would be constructed by the Corps. Traffic noise exposure at noise-sensitive locations would be primarily due to projected traffic growth on the existing roadway system.

Future (2025) no-action and proposed plan peak-hour traffic noise levels were calculated based upon projected traffic volumes on area roadways. Table 6 summarizes the future peak-hour traffic noise levels for two cases: 1) no-action, and 2) the proposed plan, and compares them to existing noise levels.

Table 6. Future Traffic Noise Levels – No Mitigation

Rec. ID	Calculated Peak Hour Traffic Noise Levels, Leq (dBA)				
	Existing (2004)	No Build		Build	
		Level	Increase	Level	Increase
West Approach					
1	68	70	2	67	0
2	62	64	2	67	5
3	46	48	2	66	20
7	70	72	2	68	-2
8	69	72	3	68	-1
9	50	52	2	65	15
10	65	67	2	60	-5
11	57	59	2	55	-2
12	49	51	2	50	1
13	50	52	2	54	4
14	53	55	2	69	16
15	54	56	2	63	9
16	48	50	2	61	13
17	---	47	---	--	---
East Approach					
4	65	68	3	64	-1
5	55	58	3	59	4
6	66	69	3	69	3
18	68	72	4	69	1
19	64	67	3	57	-7
20	64	68	4	58	-6
21	66	69	3	69	3
22	64	68	4	69	5

Traffic noise levels at exterior activity areas of single-family homes along East Natoma Street in the vicinity of Folsom Dam Road (represented by receivers 4 through 6 and 18 through 22) would range between 58 dBA and 72 dBA for the future no-build alternativer, which would be 3 to 4 dBA above existing peak-hour noise levels. Such increases would be caused by projected future traffic growth on East Natoma Street. All first-row backyards are expected to be exposed to peak-hour noise levels in excess of the FHWA criteria.

On the west end, future (2025) no-build peak-hour traffic noise levels at exterior activity areas of LPA closest to Folsom-Auburn Road (represented by receivers 2 and 10) would range between 64 and 67 dBA, which is up to 2 dBA above existing peak-hour noise levels. At units located in the interior of the apartment complex (receivers 3, 9, 11, and 12), future noise levels are expected to increase only slightly (up to 2 dBA) from existing noise levels. At the BOR and ARWEC facilities, future no-action traffic noise levels are expected to remain well below the applicable noise criterion and only slightly (up to 2 dBA) higher than existing noise levels.

Along the west side of Folsom-Auburn Road, future (2025) no-build peak-hour noise levels at exterior activity areas of the first row of buildings in Lakeside Townhomes (represented by receiver 1) would be 70 dBA, which is higher than the traffic noise criterion but only 2 dBA above existing peak-hour noise levels. At

exterior activity areas of the first row of the mobile homes (represented by receivers 7 and 8) would be 72 dBA, which is 2 to 3 dBA above existing peak-hour noise levels.

3.2.2 Proposed Plan – New Folsom Dam Road between Reclamation Facilities and Lake Pointe Apartment Complex

3.2.2.1 Construction Noise

Construction activities associated with the roadway alignment between East Natoma Street and the Folsom Dam overlook would affect noise exposure at single-family homes along East Natoma Street. Maximum construction noise levels from roadway construction are expected to reach 85 to 90 dBA at exterior areas of the nearest homes to the roadway. Such levels, albeit temporary, would create a significant impact if construction occurs after 6 p.m. on weekdays. Pile driving would occur far to the north and well shielded by intervening terrain and is not expected to create excessive noise levels at homes in this area.

During the construction phase of the project, noise from construction activities would add to the noise environment in the immediate project area. Activities involved in construction would generate noise levels, as indicated in Table 7, ranging from 82 to 102 dBA at a distance of 100 feet. By far, the loudest construction noise levels would be those due to pile driving. Construction noise impacts could result in annoyance or sleep disruption if nighttime operations occur or if unusually noisy equipment is used.

Noise would also be generated during the construction phase by increased truck traffic on area roadways associated with transport of heavy materials and equipment. This noise increase would be of short duration, and would probably occur primarily during daytime hours.

Table 7. Construction Equipment Noise Levels

Construction Activity	Loudest Equipment	Maximum Noise Level at 100 Feet (dBA)
Clearing and Grubbing	Bulldozer, backhoe	83
Earthwork	Scraper, bulldozer	85
Foundation	Backhoe, loader	82
Superstructure	Crane, loader	83
Base Preparation	Truck, bulldozer	85
Paving	Paver, truck	86
Pile Driving	Pile Driver	102

Source: U.S. Department of Transportation, 1977.

3.2.2.2 East Approach

Implementation of the plan would have no significant noise effects on single-family homes along East Natoma Street relative to the no-build alternative.

Future (2025) peak-hour traffic noise levels at exterior locations of single-family homes along East Natoma Street would be similar to or at some locations substantially below traffic noise levels under the no-build alternative. At some homes, traffic noise levels would even decrease below existing noise levels (see Table 6).

3.2.2.3 West Approach

Maximum construction noise levels at the west approach due to the proposed plan was estimated based on reference noise level data and attenuating effect of distance to receivers. Table 8 summarizes the estimated maximum construction noise levels at noise-sensitive receivers closest to such activities.

Table 8. Estimated Maximum Construction Noise Levels at West Approach of Project (dBA)

Construction Activity	North Pointe Apartments	BOR
Clearing and Grubbing	82	78
Earthwork	84	80
Foundation	81	77
Superstructure	82	78
Base Preparation	84	80
Paving	85	81
Pile Driving	88	85

Note: Calculated noise levels do not account for intervening vegetation or terrain shielding effects and are therefore conservative estimates of construction noise levels.

Maximum noise levels from roadway construction activities are expected to be between 81 and 85 dBA at exterior areas of North Pointe Apartments (NPA) and 77 and 81 dBA at BOR facilities. Such levels would exceed the City's noise limits and would therefore result in a significant impact if construction occurs after 6 p.m. on weekdays or 5 p.m. on weekends. Pile driving would be the loudest construction noise source. The nearest pile driving would result in maximum noise level 88 dBA at NPA. At the BOR, maximum pile driving noise levels would be 85 dBA. Pile driving would also result in significant noise impacts if it occurs during the above hours.

From Table 6, future (2025) peak-hour traffic noise levels at exterior activity areas of LPA closest to Folsom-Auburn Road (represented by receivers 2 and 10) would range between 67 and 60 dBA. At LPA units located on the southern end of the complex (receivers 11 and 12), future noise levels would be kept to less than significant impacts. For units located in the interior of the LPA complex (receivers 3 and 9) and at site 16 (representing BOR facilities), future noise levels would increase by well over 10 dBA from existing 2004 levels without some form of mitigation. The subsequent section (3.3) concerning mitigation presents the predicted effects of barriers currently planned for the project.

Although project planning considered a “partial intersection” alternative to the currently proposed and TNM-modeled “full intersection” at Folsom-Auburn Road and the selected roadway alignment, URS believes the key difference between the two—an additional northbound lane—would not significantly impact noise levels due to an assumption of identical future traffic volumes for both partial and full intersection cases. Therefore, the results of the modeled intersection alternative reported here are expected to be representative for all intersection alternatives.

Along the west side of Folsom-Auburn Road, future (2025) peak-hour noise levels at exterior activity areas of the first row of buildings in Lakeside Townhomes (represented by receiver 1) would be 67 dBA, which is similar to existing peak-hour noise levels. Exterior activity areas of the first row of the mobile homes (represented by receivers 7 and 8) would be 68 dBA, which are 1-2 dB lower than existing traffic sound levels and 4 dB below the no-action peak-hour noise levels.

3.2.2.4 ARWEC Setback Distance

URS understands ARWEC will be relocated as a result of plan implementation. Hence, should the new ARWEC location remain in the general vicinity of the project site, the Corps requested URS to calculate a setback distance that would permit new external frequent usage areas to comply with applicable noise limits. Applying the same assumption from Section 2.5, whereby the difference between the peak-hour noise level and CNEL obtained at receiver 6 may be applied to the calculated peak-hour noise levels to arrive at CNEL values for other receivers in close proximity to traffic, complying with 65 dBA CNEL would require a perpendicular setback distance from Folsom-Auburn Road of 100’. Meeting 60 dBA CNEL would require 200’ of distance.

3.3 Mitigation

3.3.1 Barrier Evaluation

The only areas where future peak-hour traffic levels, under the 2025 build conditions, would experience a significant noise impact of 5 dB or more would be the apartment buildings located on the north side of the LPA complex and the southern end of the BOR facilities that face the proposed new roadway.

For a more dense set of receptor locations at the western end of the new roadway than those previously discussed and as shown in Figure 2, the TNM model determines a traffic noise level reduction provided by intended project sound barriers, calculating insertion loss by accounting for variables such as distance from source to barrier, distance from barrier to receiver, source and receiver locations, and barrier height. Per standard assumptions, effective acoustical sub-source heights of automobiles, medium trucks and heavy trucks are between 0 feet and 12 feet above the roadway surface. Receiver height is, with respect to ground, either 5 feet or 17 feet depending on whether or not the receptor is adjacent to a single-story or second-story apartment unit.

3.3.1.1 Lake Pointe Apartments Barrier Study

For a range of barrier heights including 14' and 20', Table 9 exhibits anticipated noise reduction at the aforesaid set of LPA unit receivers (please refer to attached Figure 2 for locations). While the model predicts a 14' tall barrier wall should provide perceptible noise reduction, it also indicates that—on average—increasing the wall height above this dimension does not furnish what we believe is meaningful improvement in barrier performance.

With the 14'-high barrier, lower and upper storey receptors from Table 9 are below 64 dBA L_{eq}, suggesting 60 dBA CNEL or less per the aforestated assumption of section 2.5.

Table 9. Lake Pointe Apartments Noise Barrier Performance Analysis

Rec ID	Rec. Description	Future Noise Levels, Leq (dBA)/Barrier Height								
		None	14 feet		16 feet		18 feet		20 feet	
		Level	Level	NR	Level	NR	Level	NR	Level	NR
2A/L	Unit 707	63.5	61.0	2.5	60.9	2.6	60.9	2.6	60.9	2.6
2A/U	Unit 708	65.4	63.4	2.0	62.8	2.6	62.5	2.9	62.4	3.0
2B/L	Unit 705	62.2	61.5	0.7	61.5	0.7	61.4	0.8	61.4	0.8
2B/U	Unit 706	63.9	63.0	0.9	62.8	1.1	62.7	1.2	62.6	1.3
2C/L	Unit 703	67.1	55.3	11.8	54.3	12.8	53.5	13.6	52.8	14.3
2C/U	Unit 704	68.4	62.4	6.0	59.0	9.4	56.8	11.6	55.2	13.2
2D/L	Unit 701	64.0	54.1	9.9	53.2	10.8	52.4	11.6	51.7	12.3
2D/U	Unit 702	66.4	57.7	8.7	55.7	10.7	54.2	12.2	53.3	13.1
2E/L	Unit 607	62.2	60.3	1.9	60.2	2.0	60.1	2.1	60.0	2.2
2E/U	Unit 608	64.1	61.2	2.9	61.0	3.1	60.8	3.3	60.7	3.4
2F/L	Unit 605	61.9	57.9	4.0	57.7	4.2	57.5	4.4	57.4	4.5
2F/U	Unit 606	64.5	59.5	5.0	59.1	5.4	58.9	5.6	58.8	5.7
2G/L	Unit 603	62.5	56.3	6.2	56.0	6.5	55.7	6.8	55.5	7.0
2G/U	Unit 604	65.3	58.9	6.4	58.2	7.1	57.8	7.5	57.6	7.7
2H/L	Unit 601	63.6	55.3	8.3	54.7	8.9	54.2	9.4	53.8	9.8
2H/U	Unit 602	66.3	58.6	7.7	57.6	8.7	56.9	9.4	56.6	9.7
9A/L	Unit 807	62.7	53.0	9.7	52.4	10.3	51.8	10.9	51.4	11.3
9A/U	Unit 808	65.1	55.1	10.0	54.4	10.7	53.8	11.3	53.4	11.7
9B/L	Unit 805	63.0	52.4	10.6	51.6	11.4	50.9	12.1	50.3	12.7
9B/U	Unit 806	65.4	54.6	10.8	53.6	11.8	52.9	12.5	52.2	13.2
9C/L	Unit 803	63.4	52.6	10.8	51.8	11.6	51.0	12.4	50.4	13.0
9C/U	Unit 804	65.7	54.8	10.9	53.7	12.0	53.0	12.7	52.1	13.6
9D/L	Unit 801	63.9	53.3	10.6	52.5	11.4	51.8	12.1	51.1	12.8
9D/U	Unit 802	66.3	55.6	10.7	54.7	11.6	53.9	12.4	53.1	13.2
9E/L	Unit 1115	60.3	49.8	10.5	49.0	11.3	48.3	12.0	47.7	12.6
9E/U	Unit 1116	63.0	52.6	10.4	51.8	11.2	51.1	11.9	50.5	12.5
9F/L	Unit 1107	63.2	52.4	10.8	51.8	11.4	51.2	12.0	50.9	12.3
9F/U	Unit 1108	65.8	55.3	10.5	54.7	11.1	54.1	11.7	53.7	12.1
Average NR			7.5		8.3		8.9		9.3	

Notes: in receiver ID column U = Upper/2nd floor level apartment, L = Lower/ground level apartment, barrier heights are above finished grade level. NR refers to Noise Reduction, the difference in the noise level with and without the barrier.

3.3.1.2 Bureau of Reclamation Barrier Study

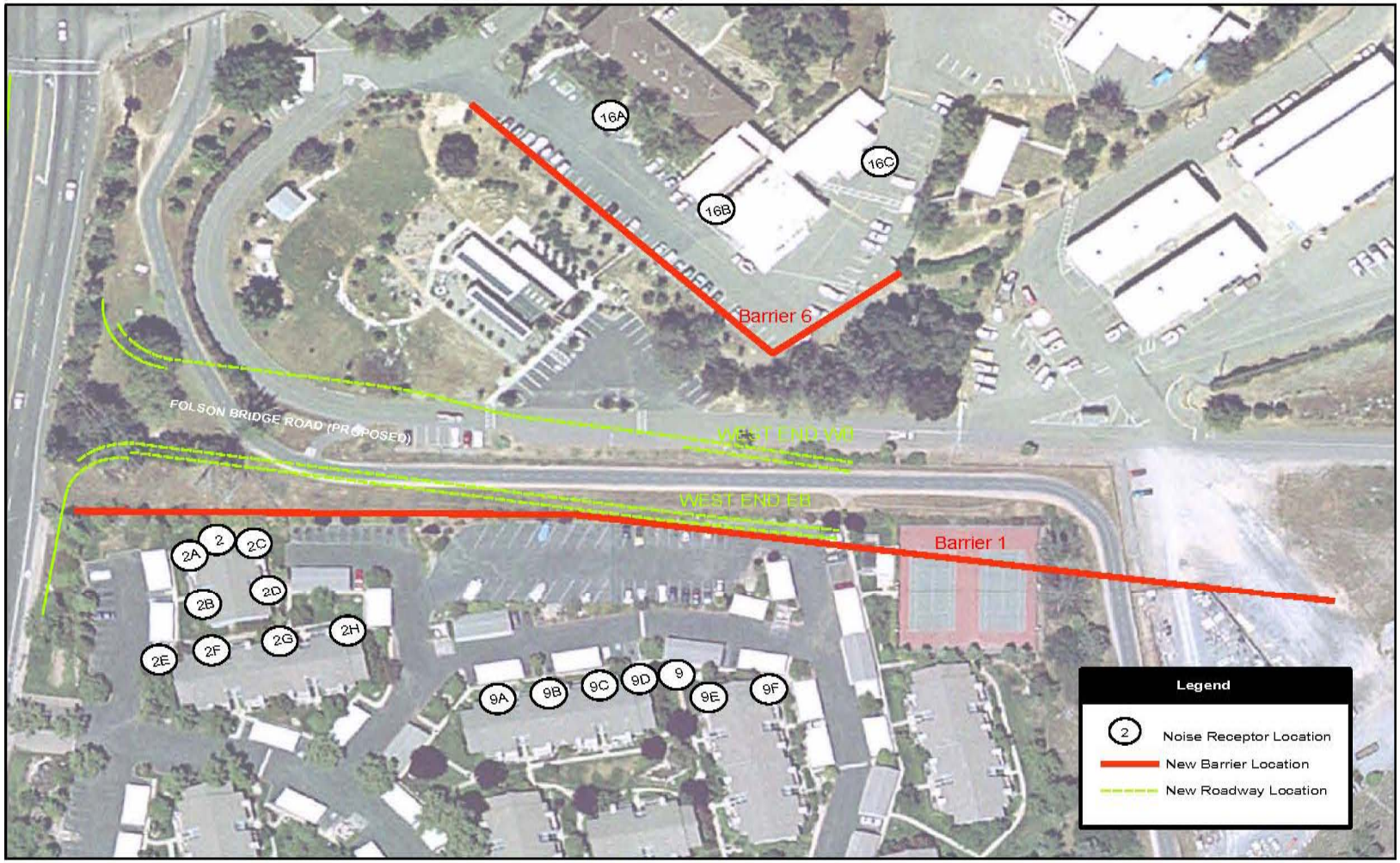
The TNM-based analysis of noise mitigation also makes a prediction of two different barrier heights of the wall contemplated for the BOR facilities. The TNM model considers three new receptors, shown in Figure 2, within close proximity to receiver location #16 of the original set of 22 receptors. Table 10 presents the predicted results. According to the results in Table 10, neither the 6 foot or 8 foot tall barrier would provide substantial noise reduction in this area. However, we note here that this land use is generally not considered noise sensitive.

Table 10. Bureau of Reclamation Noise Barrier Performance Analysis

Rec ID	***Rec. Description***	***Future Noise Levels, Leq (dBA)/Barrier Height***				
		None	***6 feet***		***8 feet***	
		Level	***Level***	***NR***	***Level***	***NR***
16A	BOR West	61.7	60.8	0.9	59.9	1.8
16B	BOR South	63.8	63.5	0.3	62.6	1.2
16C	BOR East	60.6	59.2	1.4	58.6	2.0
Average NR			0.9		1.7	

NR refers to Noise Reduction, the difference in the noise level with and without the barrier.

Figure 2. Proposed Noise Mitigation



3.3.2 Construction Noise

By implementing the proposed plan, there would be significant short-term construction noise effects to residential receivers at both ends of the project and Reclamation and ARWEC facilities if construction activities occur after 6 p.m. and before 7 a.m. on weekdays or after 5 p.m. and before 8 a.m. on weekends.

To mitigate construction noise impacts, it is recommended that heavy construction activities at the two ends of the project be limited to daytime hours of 7 a.m. to 6 p.m. on weekdays and 8 a.m. to 5 p.m. on weekends.

Although construction noise impacts would be temporary, the following standard measures are also recommended to minimize such impacts during daytime hours:

- For construction activities closest to noise-sensitive areas, place temporary noise barriers or curtains between sources of noise and nearest receivers.
- Whenever possible, limit operation of heavy equipment and other noisy procedures to non-sleeping hours.
- Install and maintain effective mufflers on equipment.
- Locate equipment and vehicle staging areas as far from residential areas as possible.
- Limit unnecessary idling of equipment.

Operation of the proposed plans would not result in significant noise impacts with inclusion of needed noise walls as evaluated in the previous paragraphs. Exact locations and heights of such walls would be determined during the final design of the project. Additional mitigation measures would not be required.

4.0 References

Bolt, Beranek, and Newman, Inc. 1973. Fundamentals and Abatement of Highway Traffic Noise. U.S. Department of Transportation Contract Number DOT-FH-11-7976, Office of Environmental Policy, Federal Highway Administration.

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Harris, Cyril M. 1998. Handbook of Acoustical Measurements and Noise Control, Third Edition. Acoustical Society of America. Woodbury, NY.

Traffic Noise Analysis Protocol for New Highway Construction and Reconstruction Projects, California Department of Transportation, Environmental Program; Noise, Air Quality, and Hazardous Waste Management Office. October, 1998.

Technical Noise Supplement, California Department of Transportation, Environmental Program; Noise, Air Quality, and Hazardous Waste Management Office. October, 1998.

Highway Traffic Noise Analysis and Abatement Policy and Guidance, U.S. Department of Transportation, Federal Highway Administration, Office of Environment and Planning, Noise and Air Quality Branch, Washington, D.C. June 1995.

Noise Measurement Handbook Measurement of Highway-Related Noise, USDOT, FHWA, (FHWA-PO-96-046), NTIS publication number PB 9712 0489, January 1997.

Appendix A
Acoustical Terminology

Acoustical Terminology

Ambient Noise (Level) - All-encompassing noise (level) at a given place and time, usually a composite of sounds from all sources near and far, including any specific source(s) of interest.

A-Weighted Sound Level (Abbreviated dBA or dB(A)) - Frequency weighted Sound Pressure Level approximating the frequency response of the human ear. It is defined as the sound level, in decibels, measured with a sound-level meter having the metering characteristics and a frequency weighting specified in the American National Standards Institute (ANSI) Specification for Sound Level Meters, ANSI S 1.4 - 1983. The A-weighting de-emphasizes lower frequency sounds below 1,000 Hz (1 kHz) and higher frequency sounds above 4 kHz. It emphasizes sounds between 1 kHz and 4 kHz. A-weighting is the most used measure for traffic and environmental noise throughout the world.

Community Equivalent Noise Level (CNEL) - A noise level that takes into account all of the A-weighted noise energy from a source during 24 hours and weights the evening (7 p.m. to 10 p.m.) noise by adding approximately 5 dBA to noise levels during that period, and nighttime (10 p.m. to 7 a.m.) noise by adding 10 dBA during that period.

Decibel (Abbreviated dB) - A decibel is one-tenth of a Bel. It is a measure on a logarithmic scale that indicates the squared ratio of sound pressure to a reference sound pressure (unit for *sound pressure level*) or the ratio of sound power to a reference sound power (unit for *sound power level*).

Day-Night Noise Level (L_{dn}) - A noise level that takes into account all of the A-weighted noise energy from a source during 24 hours and weights the nighttime (10 p.m. to 7 a.m.) noise by adding 10 dBA during that period.

Existing Noise Levels - The noise, resulting from the natural and mechanical sources and human activity, considered to be usually present in a particular area.

L_{eq} - The equivalent steady-state sound level which, in a stated period of time, would contain the same acoustical energy as the time-varying sound level during the same period.

L_{max} - The highest sound pressure level in a specific time period.

L_n (Where n= 1-99; e.g. L_{10}, L_{50}) - The sound pressure level exceeded n percent of a specific time period. L_{10} is the level exceeded 10 percent of the time; L_{50} is the level exceeded 50 percent of the time.

Appendix B
Traffic Data

Traffic Data

Traffic Data used for Traffic Noise Calculations

Alternative	Roadway	Modeled Traffic Data (Vehicles per hour/mph)		
		Autos	Medium Trucks	Heavy Trucks
Existing (2004)	Folsom Auburn Rd (NB)	1152/50	36/50	12/50
	Folsom Auburn Rd (SB)	1089/50	34/50	11/50
	E. Natoma Street, *West of Folsom Dam Rd.* (EB)	819/45	26/45	8/45
	E. Natoma Street, *East of Folsom Dam Rd* (EB)	805/45	25/45	8/45
	E. Natoma Street, *East of Folsom Dam Rd* (WB)	710/45	22/45	7/45
	E. Natoma Street, *West of Folsom Dam Rd* (WB)	741/45	23/45	8/45
Future No Build (2025)	Folsom Auburn Rd (NB)	1709/50	53/50	18/50
	Folsom Auburn Rd (SB)	1958/50	61/50	21/50
	E. Natoma Street, *West of Folsom Dam Rd.* (EB)	1699/45	53/45	18/45
	E. Natoma Street, *East of Folsom Dam Rd* (EB)	1613/45	50/45	17/45
	E. Natoma Street, *East of Folsom Dam Rd* (WB)	1575/45	49/45	16/45
	E. Natoma Street, *West of Folsom Dam Rd* (WB)	1613/45	50/45	17/45
Future Build (2025)	Folsom Auburn Rd. (NB)	1142/50	36/50	12/50
	Folsom Auburn Rd (SB)	1171/50	37/50	12/50
	(New) West Folsom Bridge Road (EB)	1363/50	43/50	14/50
	(New) West Folsom Bridge Road (WB)	1575/50	49/50	16/50
	(New) East Folsom Bridge Road (EB)	1949/50	61/45	20/45
	(New) East Folsom Bridge Road (WB)	1651/45	52/45	17/45
	E. Natoma Street, *East of Folsom Bridge Rd* (EB)	1949/45	61/45	20/45
	E. Natoma Street, *East of Folsom Bridge Rd* (WB)	1651/45	52/45	17/45
	E. Natoma Street, *West of Folsom Bridge Rd* (EB)	1536/45	48/45	16/45
	E. Natoma Street, *West of Folsom Bridge Rd* (WB)	1210/45	38/45	12/45

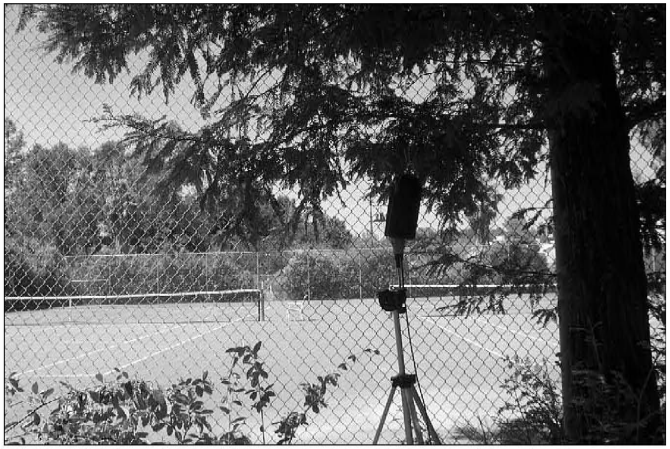
Appendix C
Noise Monitoring Site Photographs

Site 1: view to east towards Folsom Auburn Rd.

Site 1: side view from north of monitor

Site 2: view to southwest, towards Folsom Auburn Rd.

Site 2: view from west towards receiver



Site 3: view to north towards future Folsom Dam Rd.

Site 3: side view to west

Site 4: view to north, towards E. Natoma St.

Site 4: view from west towards receiver

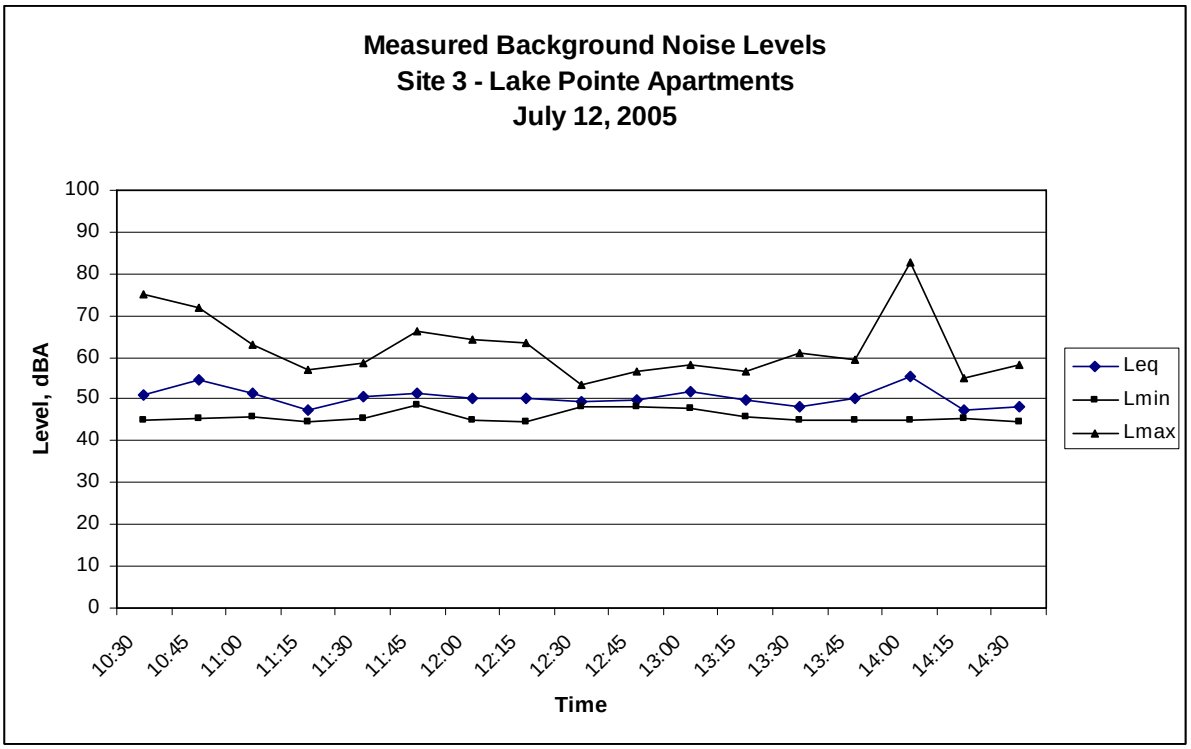
Site 5: view to south, towards E. Natoma St.

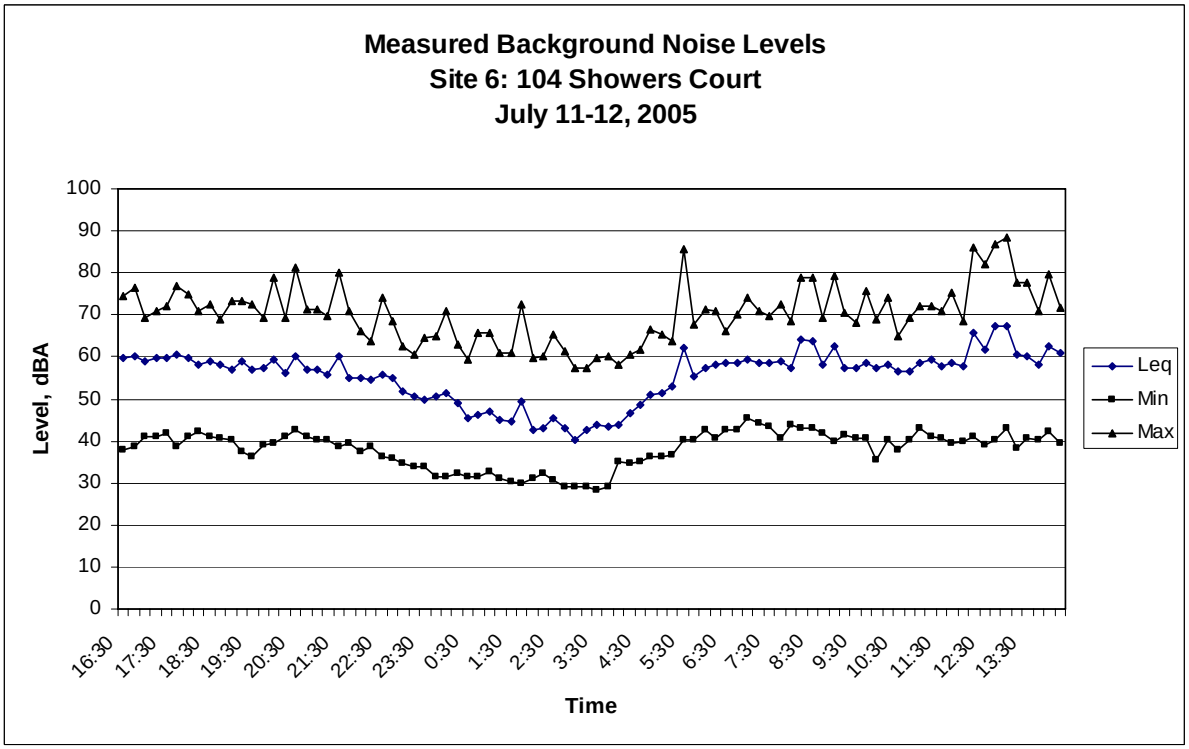
Site 5: view from west towards monitor

Site 6: view to north towards E. Natoma St.

Site 6: side view to northeast

Appendix D
Measured Existing Noise Levels


Measured Background Noise Levels
Site 3 - Lake Pointe Apartments
July 12, 2005
Level, dBA
100
90
80
70
60
50
40
30
20
10
0
10:30
10:45
11:00
11:15
11:30
11:45
12:00
12:15
12:30
12:45
13:00
13:15
13:30
13:45
14:00
14:15
14:30
Time
Leq
Lmin
Lmax


Measured Background Noise Levels
Site 6: 104 Showers Court
July 11-12, 2005
Level, dBA
100
90
80
70
60
50
40
30
20
10
0
16:30
17:30
18:30
19:30
20:30
21:30
22:30
23:30
0:30
1:30
2:30
3:30
4:30
5:30
6:30
7:30
8:30
9:30
10:30
11:30
12:30
13:30
Time
Leq
Min
Max

Traffic Noise Level Measurement Data

Date: 7/12/05	Project: Folsom Bridge Project

Monitoring Location: #1 – In front of Unit 105 of Lakeside Townhomes, located approximately 100 feet west of the centerline of Folsom-Auburn Road

Equipment: Sound level meter LD 820; Microphone LD Model 2551; Calibrator LD CA-200

Weather: Temp. 90°F clear Wind Conditions: calm Humidity: 50%

Measurement Start Time	Duration (mins)	L_{eq}	L_{min}	L_{max}	Traffic Counts					
					Autos		Medium Trucks		Heavy Trucks	
					NB	SB	NB	SB	NB	SB
11:45 a.m.	15	66.0	44.2	77.2	191	211	7	3	0	1

Notes (site characteristics, pertinent distances, elevations, traffic speed, other):

Motorcycle counts: 5 NB, 0 SB

Homes at the same elevation as roadway

Data by: FF

CH2MHILL

Traffic Noise Level Measurement Data

Date: 7/12/05	Project: Folsom Bridge Project

Monitoring Location: #2 – At Building 700, Unit 707 of Lake Pointe Apartments, located approximately 165 feet east of of the centerline of Folsom-Auburn Road

Equipment: Sound level meter LD 820; Microphone LD Model 2551; Calibrator LD CA-200

Weather: Temp. 90°F clear Wind Conditions: calm Humidity: 50%

Measurement Start Time	Duration (mins)	L_{eq}	L_{min}	L_{max}	Traffic Counts					
					Autos		Medium Trucks		Heavy Trucks	
					NB	SB	NB	SB	NB	SB
11:00 a.m.	15	59.0	45.2	69.4	185	182	4	6	4	0

Notes (site characteristics, pertinent distances, elevations, traffic speed, other):

Measurement site is elevated approximately 5 feet above the roadway pavement surface. Single row of shrubbery blocks line-of-sight to roadway.

Motorcycle counts: 1 NB, 0 SB

Data by: FF

CH2MHILL

Traffic Noise Level Measurement Data

Date: 7/12/05	Project: Folsom Bridge Project

Monitoring Location: #4 – In front of 104 Tacana Drive, located approximately 100 feet south of East Natoma Street centerline

Equipment: Sound level meter LD 820; Microphone LD Model 2551; Calibrator LD CA-200

Weather: Temp. 95°F clear Wind Conditions: calm Humidity: 50%

Measurement Start Time	Duration (mins)	L_{eq}	L_{min}	L_{max}	Traffic Counts					
					Autos		Medium Trucks		Heavy Trucks	
					EB	WB	EB	WB	EB	WB
1:00 pm	15:00	61.9	42.4	75.3	120	141	3	4	0	1

Notes (site characteristics, pertinent distances, elevations, traffic speed, other):

Measurement site is at approximately the same elevation as the roadway pavement surface. Single row of shrubbery blocks line-of-sight to roadway.

Data by: FF

Traffic Noise Level Measurement Data

Date: 7/12/05	Project: Folsom Bridge Project

Monitoring Location: #5 – Within Lot 34 of the La Collina Del Lago residential subdivision (undeveloped), located approximately 65 feet north of the existing soundwall

Equipment: Sound level meter LD 820; Microphone LD Model 2551; Calibrator LD CA-200

Weather: Temp. 95°F clear Wind Conditions: calm Humidity: 50%

Measurement Start Time	Duration (mins)	L_{eq}	L_{min}	L_{max}	Traffic Counts					
					Autos		Medium Trucks		Heavy Trucks	
					NB	SB	NB	SB	NB	SB
1:50 p.m.	15:00	53.3	42.2	68.7						

Notes (site characteristics, pertinent distances, elevations, traffic speed, other):

Measurement site is elevated approximately 10 feet above the roadway pavement surface.

There is an existing tall property line block wall between the roadway and measurement site.

Data by: FF

Appendix G

Correspondence Regarding Cultural Resources

This appendix will be provided in a future submittal.

Appendix H

HTRW Site Assessment

APPENDIX H

ENVIRONMENTAL SITE ASSESSMENT

FOLSOM BRIDGE PROJECT
FOLSOM, CALIFORNIA

Prepared by: June 2005

U.S. Army Corps of Engineers, Sacrament District
Environmental Chemistry Section

APPENDIX H

ENVIRONMENTAL SITE ASSESSMENT

FOLSOM BRIDGE PROJECT
FOLSOM, CALIFORNIA

Prepared by:

U.S. Army Corps of Engineers, Sacrament District
Environmental Chemistry Section

Approved by: Date:

_____ _____

John Esparza, R.E.A.
Section Chief, Environmental Chemistry Section

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APPENDICES
APPENDIX A: Regulatory Lists of HTRW Sites
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APPENDIX G: Naturally Occurring Asbestos

ATTACHMENTS
ATTACHMENT A: The EDR Radius Atlas with GeoCheck
Folsom Dan Area, Folsom, Ca 95630
Inquiry Number: 01395089.1r
ATTACHMENT B: EDR NEPA Check
Folsom Dan Area, Folsom, Ca 95630
Inquiry Number: 01395089.1r

ACRONYMS

AST	Aboveground Storage Tank
ASTM	American Society of Testing and Materials
CA FID	California Facility Inventory Database
CA ML	Sacramento County Master List
CA MS	Placer County Master List
Corps	U.S. Army Corps of Engineers
CEQA	California Environmental Quality Act C
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESPK	U.S. Army Corps, Sacramento District
CHMIRS	California Hazardous Material Incident Report System
CS	Contaminated Sites
CRWQCB	California Regional Water Quality Control Board
EDR	Environmental Data Resources, Inc.
ERNS	Emergency Response Notification System
ESA	Environmental Site Assessment
ED-GC	Environmental Chemistry Section
ER	Engineering Regulation
FIFRA	Federal Insecticide, Fungicide and Rodenticide
FIFRA/TSCA	Federal Insecticide, Fungicide and Rodenticide/Toxic Substance Control Act
HIST	Historical UST
HSWA	Hazardous Solid Waste Amendments
HTRW	Hazardous, Toxic, or Radioactive Waste
LUST	Leaking Underground Storage Tank
NOA	Naturally Occurring asbestos
NEPA	National Environmental Policy Act
NFA	No Further Action
NPL	National Priority List
PCB	Polychlorinated Biphenyls
RCRA	Resource Conservation and Recovery Act
SLIC	Spill, Leaks, Investigation & Cleanup
SSTS	Section 7 Tacking System
SWF/LF	Solid Waste Facility/Landfill
SWIS	Solid Waste Information System
SWRCB	State Water Resource Control Board
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
WDS	Waste Discharge System
WMUDS	Waste Management Unit Database System
VCP	Voluntary Cleanup Program

EXECUTIVE SUMMARY

Prior to February 2003, automobiles used to cross over the American River by driving over Folsom Dam via the Folsom Dam Road in Folsom, California. In 2003, the Bureau of Reclamation closed the Folsom Dam Road for security reasons. In the near future, the United States Army Corps of Engineers (USACE), Sacramento District plans to construct a 2-mile bridge-roadway as an alternate route to the Folsom Dam Road. Estimated completion date is 2007.

The National Environmental Policy Act, the California Environmental Quality Act, and the USACE regulations require that an Environmental Site Assessment (ESA) will be performed on a construction project site and its surrounding area. The purpose of the ESA is to identify Hazardous, Toxic, or Radioactive Wastes (HTRW) sites that may have adverse environmental impacts on the site.

In March 2005, USACE performed an ESA for the proposed project. The ESA identified 174 HTRW sites and categorized them as being 131 AST, UST, treatment, generator, storage or disposal facilities and 43 mitigating sites or sites with reported spills.

25 of these sites are located at the west end of the proposed project site and belong to government agencies or small private offices. The remaining 149 sites are not located on the proposed project site.

Due to the location, the ownership, the usage, the research performed on historical records, and the site reconnaissance, the 174 sites are not expected to have an adverse environmental impact on the project site.

1.0 INTRODUCTION

The Environmental Chemistry Section (ED-GC) of the Geotechnical & Environmental Engineering Branch of the USACE in Sacramento, California has prepared this Appendix for the proposed Folsom Bridge Project site at Folsom Dam, California (Figure 1). This Appendix is known as HTRW by the USACE, and commonly known as ESA by the environmental industry.

Prior to 2003, automobiles used to cross over the American River by driving over Folsom Dam via the Folsom Dam Road in Folsom, California. In 2003, the Bureau of Reclamation closed the Folsom Dam Road for security reasons. In the near future, the USACE plans to construct an approximately 2-mile bridge-roadway as an alternate route to the Folsom Dam Road. Estimated completion date is 2007.

The National Environmental Policy Act (NEPA), the California Environmental Quality Act (CEQA), and the USACE regulations require that an ESA will be performed on a construction project site and its surrounding area. The purpose of an ESA is to identify HTRW sites that may have adverse environmental impacts on the proposed project.

In March 2005, USACE performed an ESA on the project site and its surrounding area. The ESA consisted of reviewing regulatory lists of HTRW sites, historical literatures and aerial photographs, and websites and conducting interviews with people who are knowledgeable about the project, the project site, and the surrounding area. A site reconnaissance was also conducted as part of the ESA process

The scope of this ESA is limited to identifying HTRW sites at the project site and its surrounding area. The **project site** is defined as being the proposed 2+ miles bridge-roadway with four lanes and a bicycle path. The **surrounding area** (or also known as the **study area**) is defined as being the area encompassed by a 2-mile radius from the "Star" center in Figure 2, "Overview Map – 01395089.1r – Army Corps of Engineers." This area consists of mostly of federal and state park land, Folsom State Prison, and private property.

The ESA does not include any sampling or testing of materials such as the soil, water, air, or building materials.

2.0 SITE DESCRIPTION

The existing Folsom Dam Road consists of a two-lane asphalt road that runs across the top of the dam between Folsom-Auburn Road and East Natoma Street. The dam is located at the confluence of the north and south forks of the American River near the city of Folsom, approximately 29 miles upstream from Sacramento, California.

The new bridge will be located approximately 1,500 feet downstream from Folsom Dam. The new road will run parallel to the existing Folsom Dam Road, cross the American River, and be bounded by the Folsom-Auburn Road on the west and the East Natoma Street on the east (Figure 3). The road will have four traffic lanes and a bike lane.

Geologically speaking, the project site is located in the low, undulating foothills of the central Sierra Nevada Mountains. The predominant underlying rock consists of granite (quartz diorite) - a light-colored, medium- grained, holocrystalline granitoid, Jurassic-aged rock. It is considered to be an outlier of the Sierra Nevada batholith and underlies the main concrete dam and appurtenant works and the wing dams (USACE, 2004).

The elevation height varies from 175 feet along the NW shoreline to 30 feet along the southeast shoreline of Folsom Lake. The elevation height of the terraces along the American River is about 150 feet (Figure 4).

3.0 LAWS AND REGULATIONS

President George W. Bush signed the 2004 Energy and Water Appropriation Bill and authorized the construction of an alternate route to the Folsom Dam Road.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and Resource Conservation and Recovery Act (RCRA), both promulgated by the U.S. Environmental Protection Agency (USEPA), indirectly necessitate the ESA action.

The NEPA and the CEQA require that an ESA be conducted on any construction project to identify existing or potential HTRW sites at the project site. Because the purpose of the ESA is to identify and confirm the site's recognized environmental conditions resulting from past actions, they do not meet the requirement of NEPA, however, ESA does provide background information for NEPA documents and can be included in the appendix of NEPA documentation or included by reference.

This ESA will follow the environmental industry practice of following guidelines set forth in the American Society of Testing and Materials (ASTM) E 1527-00 and ASTM E 1528-00, and also USACE Engineering Regulation (ER) 1162-2-132.

4.0 METHODS

The ASTM E 1527-00 and ASTM E 1528-00 require that an ESA consist of "diligently" conducting a reasonable search of all available information and interviewing people who are knowledgeable about the current and past uses of the project site and surrounding area, its waste disposal practices, and its environmental compliance history.

Specifically, this search consisted of consulting six sources of information:

(1) Twenty-five regulatory agency database records (Appendix A - Regulatory Lists of HTRW Sites)
(2) Nine pieces of historical literatures (Appendix B – Historical Literature Reviews)
(3) Twenty-four Site Reconnaissance Photographs (Appendix C – Site Reconnaissance)
(4) Eleven aerial photographs (Appendix D – Aerial Photographs 1952-1998)
(5) Eleven website queries (Appendix E – Website Queries)
(6) Fourteen interviews (Appendix F – Interviews)

USACE hired a contractor, Environmental Data Resources, Inc. (EDR) of Milford, Connecticut, to perform database searches. It provided two reports: (1) The EDR Radius Atlas with GeoCheck dated April 7, 2005; and (2) EDR NEPACheck® dated March 16, 2005 (See Attachments A and B).

The search also consisted of conducting fourteen interviews with the site personnel and appropriate government (Federal, State and local) officials (Appendix F - Interviews).

The ESA did not include any sampling or testing of materials such as soil, water, air, or building materials.

The ESA was performed on the **project site,** which is defined as being the proposed 2+ mile bridge-roadway with four lanes and a bicycle path, and the **study area,** which is defined as being the area encompassed by a 2-mile radius from the "Star" center in Figure 2, "Overview Map – 01395089.1r – Army Corps of Engineers."

Note 1: ASTM E 1528-00 specifies that the indicated minimum search distances [for the study area] will be the area encompassed by a 1.0 mile radius of the construction site.

Note 2: EDR conducted a HTRW search of an area encompassed by a 2.5-mile radius from the "Star" center in Figure 2.

5.0 RESULTS AND DISCUSSION

The ESA yielded the following six results:

1. The informational search and the interviews identified 174 HTRW sites in the study area. These sites area are organized into 25 categories of HTRW sites and some sites (i.e., Folsom State Prison, Folsom Dan Yard) are listed in more than one category.

2. 25 sites are located at the west end of the proposed project site and belong to government agencies or small private offices. The remaining 149 sites are not located on the proposed project site.

3. Due to the location, the ownership, the usage, the research performed on historical records, and the site reconnaissance, the 174 sites are not expected to have an adverse environmental impact on the project site.

4. The literature reviews (see Appendix B – Historical Literature Reviews) did not identify any NOA (see Appendix G - Naturally Occurring Asbestos), which are commonly associated with serpentinite or ultramafic rock. Serpentinite may contain chrysotile asbestos, especially near fault zones. However, NOA may exist and be irregularly distributed. The only way to confirm its existence is to conduct testing.

5. The interviews (see Appendix F - Interviews) indicated that the metal concentration of the sediment and water samples were similar to the background concentration. It also revealed that concentration of less than 20 part per million of polychlorinated biphenyls (PCB) was found.

6. Observations were made during the site reconnaissance of five locations within the study area that should be investigated for potential HTRW release or HTRW removal. The locations are:

    1. Stockpile (Appendix C, Photograph # 2)
    2. Heavy Stained soils (Appendix C, Photograph # 14)
    3. Stockpile (Appendix C, Photograph #17)
    4. Wash basin and 4-5 railroad ties (Appendix C, Photograph #19)
    5. Leaking garbage container (Appendix C, Photograph #21)

6.0 CONCLUSION AND RECOMMENDATIONS

The ESA for the proposed project identified and categorized 174 HTRW sites. The sites consisted of 131 AST, UST, treatment, generator, storage or disposal facilities and 43 mitigating sites or sites with reported spills. 25 sites are located at the west end of the proposed project site and belong to government agencies or small private offices. The remaining 149 sites are not located on the proposed project site.

Due to the location, the ownership, the usage, the research performed on historical records, and the site reconnaissance, this ESA concludes that the 174 sites are not expected to have an adverse environmental impact on the project site.

The ESA makes three recommendations:

(1) Five locations within the study area should be investigated or removed for potential HTRW release. The locations are:

1. Stockpile (Appendix C, Photograph # 2)
2. Heavy Stained soils (Appendix C, Photograph # 14)
3. Stockpile (Appendix C, Photograph #17)
4. Wash basin and 4-5 railroad ties (Appendix C, Photograph #19)
5. Leaking garbage container (Appendix C, Photograph #21)

(2) A sampling and analysis plan should be developed for naturally occurring asbestos.

(3) A health and safety plan should be developed for naturally occurring asbestos.

7.0 REFERENCES

(1) ASTM, E 1527-00 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process (Phases I ESA)

(2) ASTM, E 1528-00 Standard Practice for Environmental Site Assessments: Transaction Screen Process (Transaction Screen)

(3) USACE, ER 1165-2-132 Hazardous, Toxic, and Radioactive Waste (HTWR) Guidance for Civil Works Projects, 26 June, 1992

(4) USACE Sacramento District, Final Geotechnical Report, Folsom Dam Resident Office, Staging Areas, and Access Roads, American River Watershed, California, July 2004

APPENDIX A

REGULATORY LISTS OF HTRW SITES

The following regulatory lists identify the HTRW sites in the study area and organize them into 25 categories.

Although each category gives a total number of HTRW sites, some HTRW sites are listed in more than one category (i.e., Folsom State Prison, Folsom Dan Yard), and are denoted in **bold** font. Also, some of the HTRW sites were updated by information obtained from interviews (Appendix F - Interviews).

A total of 174 HTRW sites were identified. 25 sites are located within the west end of the proposed project site (see Attachment A – Detail Map 12 of 25-01395089.1r**: 30, B10, B11, D, D25, C24 locations**), which intersects with Folsom-Auburn Road and are denoted in *italic* font. Attachment A provides detailed information for each site. The remaining 149 sites are not located on the proposed project site.

SUMMARY OF HTRW SITES				
Category	**Number of Sites**		**Category**	**Number of Sites**
NPL	0		SSTS	1
RCRAinfo	8		FIFRA/TSCA	2
ERNS	5		CS	11
Cal-Sites	0		AST	5
CHMIRS	12		WDS	1
Cortese	6		SLIC	1
SWF/LF	1		HAZNET	34
WMUDS	1		CA MS	2
LUST	6		CA ML	63
UST	3		Brownfield	1
VCP	1		NFA	0
CA FID	5		Drycleaners	0
HIST	5			
Total: 174				

1. NPL (National Priority List). This list is maintained by the USEPA (U.S. Environmental Protection Agency) and identifies Superfund sites. It listed no HTRW sites.

2. RCRAinfo. This list is maintained by the USEPA and identifies sites that generate, transport, store, treat and dispose hazardous waste in compliance with the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. It listed eight HTRW sites.

1. **Folsom State Prison, 330 Prison Road**
2. **California Department of Food and Agriculture, 600 East Natoma Street**
3. **Folsom Cordova USD Blanche Sprentz, 249 Flower Circle**
4. **City of Folsom, 48 Natoma Street**
5. **US Department of Interior BLM, 63 Natoma Street**
6. **Folsom Cordova USD Theodore JU, 101 Dean Way.**
7. **Chevron Station 92130, 9881 Greenback Lane**
8. **Tosco Northwest CO No. 01496, 9871 Greenback Lane**

3. ERNS (Emergency Response Notification System). This list is maintained by the USEPA and identifies sites that record and store information on reported releases of oil and hazardous substances. It listed five HTRW sites.

    1. **Folsom State Prison, 330 Prison Road**
    2. Folsom Lake near town of Folsom
    3. Folsom South Canal between HWY 50
    4. Folsom State Prison, between Bldg and garage
    5. **173 Prison Road**

4. Cal-Sites. This list is maintained by the California Environmental Protection Agency and is a compilation of known hazardous waste sites in California from the Abandoned Sites Program Information System and the State "Superfund" list. It listed no HTRW site.

5. CHMIRS (California Hazardous Material Incident Report System). The California Office of Emergency Services maintains this system and records reported hazardous material incidents, i.e., accidental releases or spills. It listed ten HTRW sites with a total of 12 reported incidents.

    1. 560 East Natoma Street
    2. **300 Prison Road**
    3. 300 Prison Road Minimum Camp
    4. 300 Prison Road, Near 4-Tower, Folsom Prison
    5. **173 Prison Road**
    6. 173 Prison Road, Correctional Facility
    7. 173 Prison Road, Behind B Facility at Prison Industry
    8. 173 Prison Road, Ca State Prison, Minimum Kitchen
    9. 9700 Oak Avenue
    10. 103 Hollyann Drive

6. Cortese. This source is maintained by the California Environmental Protection Agency/Office of Emergency Information and identifies public drinking water wells with detectable levels of contamination, sites selected for remedial action, sites with known toxic material identified, sites with underground storage tanks (USTs) having a reportable release, and all solid waste disposal facilities which

there is known migration. Cortese identified six HTRW sites.

1. ***Folsom Dam Yard, 7794 Folsom Dam Rd***
2. **County Boy General Store, 7530 Folsom-Auburn Blvd**
3. Sierra Life Church, 64 Mary
4. **Unocal #4899, 51 Natoma Street**
5. **BP #01496, 9871-A Greenback Lane**
6. **Love Chevrolet, 9871-B Greenback Lane**

7. SWF/LF (Solid Waste Facilities/Landfill Sites). This source is derived from the Integrated Waste Management Board's Solid Waste Information System (SWIS) database and contains an inventory of solid waste disposal facilities or landfills by state. It did not identify any potential HTRW sites.

8. WMUDS (Waste Management Unit Database System). This system is maintained by the State Water Resources Control Board (SWRCB) and is used for program tracking and inventorying waste management units. It identified one HTRW site.

    1. **CDC- Folsom State Prison, 300 Prison Road**

9. LUST (Leaking Underground Storage Tank). This source is maintained by the SWRCB and contains an inventory of reported leaking underground tank incidents. It identified six HTRW sites.

    1. San Juan Suburban Water District, 9925 Auburn-Folsom Rd
    2. ***Folsom Dam Yard, 7794 Folsom Dam Rd***
    3. **Country Boy General Store, 7530 Folsom-Auburn Blvd.**
    4. **Unocal #4899, 7530 Folsom-Auburn Blvd**
    5. **BP #01496, 9871- A Greenback Lane**
    6. **Love Chevrolet, 9871- Greenback Lane**

10. UST (Underground Storage Tank). This source is derived from the SWRCB's Hazardous Substance Storage Container Database and contains registered USTs. It identified three HTRW sites.

    1. **Tosco 76 #30756-4899, 51 Natoma Street.**
    2. **Chevron #92130, 9881 Greenback Lane**
    3. BP Oil #1496-30212

11. VCP (Voluntary Cleanup Program). This program is managed by the Department of Toxic Substance Control (DTSC) and tracks the voluntary cleanup of sites with confirmed or unconfirmed releases. It identified one site

    1. Folsom Prison, North of Folsom City; adjacent to the American River.

12. CA FID (California Facility Inventory Database). This database is maintained by the SWRCB and lists active and inactive UST sites. It identified five HTRW sites.

    1. San UAN Suburban Water District, 9965 Folsom- Auburn Road
    2. **San UAN Suburban Water District, 9935 Folsom- Auburn Road**
    3. ***American River District, 7806 Folsom-Auburn Road***
    4. ***Folsom Dam Yard, 7794 Folsom Dam Road***
    5. ***Folsom Substation, Folsom Dam***

13. HIST (Historical UST Registered Database). This database is maintained by the SWRCB. It identified five HTRW sites.

    1. ***Pinebrook Village, 7900 Folsom-Auburn Road***.
    2. *American River District, 7806 Folsom-Auburn Road.*
    3. *U.S. Bureau of Reclamation Folsom, 7794 Folsom Dam Road*
    4. **Union Oil SS#4899, 51 Natoma Street**
    5. **Love Chevrolet, 9871 Greenback Lane**

14. SSTS (Section 7 of Tracking System of the Federal insecticide Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). This system requires all registered pesticide-producing establishments to submit an annual report to the EPA. It identified one HTRW site.

    1. Prison Industrial Authority Chemical Division, 560 East Natoma Street

15. FIFRA/TSCA (Federal Insecticide, Fungicide and Rodenticide Act/ (FIFRA)/TSCA (Toxic Substance Control Act) Tracking System (FTTS). This source is obtained from EPA and tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA. It identified two HTRW sites.

    1. ***Bureau of Reclamation-Folsom-Dam, 7794 Folsom Dam Road***
    2 **Folsom State Prison, 300 Prison Road**

16. CS (Contaminated Sites). The Sacramento County maintains this source. It identified eleven HTRW sites.

    1. **WAPA-Folsom Substation, Folsom Dam Road**
    2. California State Prison Garage, 560 East. Natoma Street
    3. City of Folsom/Sold Waste Division, 560 E. Natoma Street
    4. Folsom Prison-Green Valley, 560 E. Natoma Street
    5. Folsom Prison Inside Bureau, 560 E. Natoma Street
    6. ***Folsom Dam Yard, 7794 Folsom Dam Road***
    7. Country Boy General Store, 7530 Folsom-Auburn Road

8. **Perris Plaza, 49 Natoma Street**
9. **Unocal #4899, 51 Natoma Street**
10. **BP Service Station #1496, 9871 Greenback Lane**
11. **Love Chevrolet, 9871 Greenback Lane**

17. AST (Above-Ground Storage Tank). This database is derived from SWRCBs Hazardous Substance Storage Container Database and lists registered ASTs. It identified four sites. An interview with Folsom State Prison personnel identified an additional one site

    1. Folsom Water Treatment Plant, 194 Randall Drive
    2. **San UAN Water District, 9935 Folsom-Auburn Road**
    3. *Folsom Lake, 7806 Folsom-Auburn Road*
    4. ***Folsom Substation, Folsom Dam***
    5. **Folsom State Prison, 300 Prison Road**

18. WDS (Waste Discharge System). This record is maintained by the SWRCB and identified one HTRW site.

    1. Sacramento Area MS4, Folsom, 50 Natoma Street

19. SLIC (Spill, Leaks, Investigation & Cleanup Cost Recovery). This listing is maintained by the Regional SWRCB and identified one HTRW site.

    1. CDFA Folsom Facility, 600 East Natoma Street

20. HAZNET. This data is maintained by Department of Toxic, Substance Control and is extracted from the copies of hazardous waste manifests received by it each year. It identified 34 potential HTRW sites.

    1. **CW Rowen Construction, 194 Randall Drive**
    2. **City of Folsom/Solid Waste Division, 560 East Natoma Street**
    3. Folsom Community Correctional, 570 East Natoma Street
    4. **California Department Food & Agriculture, 600 East Natoma**
    5. **San UAN Water District, 9935 Folsom-Auburn Road**
    6. REX Hall, 7792 Lakeshore Drive
    7. *DPR Folsom Lakes, 7806 Folsom-Auburn Road*
    8. ***US Bureau of Reclamation, 7794 Folsom Dam Road***
    9. *Andy Bohart, 7794 Folsom Dam Road*
    10. Brothers Boats, 7450 Folsom-Auburn Road
    11. Zach Enterprises, 410 Danielle
    12. Ennifer Brinitzeer, 9824 Oak Place West (?)
    13. Cole Cutler, 7007 Folsom-Auburn Road
    14. Nevins ENT/DAB/MIDAS Muffler, 7007 Folsom-Auburn Road
    15. Blanche Sprentz Elementary School, 249 Flower Drive
    16. 1X Norris Wilden, 72 Dean Way

17. Theodore Udah Elementary, 101 Dean way
18. Keely Crider, 47-A Natoma Street
19. Kurt W Thompson DDS, 47-A Natoma Street
20. City of Folsom Fire Department, 48 Natoma Street
21. Folsom 76, 51 Natoma Street
22. Tosco Corporation SS#30756, 51 Natoma Street
23. Unocal Service Station #4899, 51 Natoma Street
24. US Department of Interior BLM, 63 Natoma Street
25. Cornerstone Folsom Gardens Cor, 613 Stafford Street
26. Cornerstone Folsom Gardens Cor, 713 Stafford Street
27. Carpenter Chiropractic Center, 6693 Folsom-Auburn Road
28. Scott A Reiman DDS, 205 Natoma Street
29. Chevron 92130, 9881 Greenback Lane
30. Tosco Northwest Co #01496, 9871 Greenback Lane
31. L Ted Brush, R. DDS Inc., 309 Natoma Street
32. Folsom Family Dental Group, 6611 Folsom-Auburn Road
33. Sutter Terrace Dental Group, 6610 Folsom Auburn Road
34. Speedee Oil & Tune-up, 6604 Folsom-Auburn Road

21. CA MS (Placer County Master List). This source maintained by the Placer Country and lists ASTs, USTs and site Clean-up sites. It identified two HTRW sites.

    1. **San UAN Suburban Water District, 9935 Auburn Folsom Road**
    2. Nextel COM (Site 1781), 9651 Folsom-Auburn Road

22. CA ML (Sacramento County Master List). This source is maintained by the Sacramento County and lists businesses that have hazardous materials or onsite-hazardous materials storage sites, USTs and waste generators. It identified 63 potential HTRW sites.

    1. **WAPA-Folsom Substation, Folsom Dam Road**
    2. **CW Rowen Construction, 194 Randall Drive**
    3. Folsom Correctional Resource, 194 Randall Drive
    4. **City of Folsom/Solid Waste Division, 560 East Natoma**
    5. California State Prison-Sacramento, 560 East Natoma Street
    6. AT & T Wireless Services, 771 Oak Avenue Parkway
    7. State of California Food/ Agriculture, 600 East Natoma Street
    8. Summit Dental, 2500 Blue Revine Road
    9. Ralph's # 988, 2500 Blue Ravine Road
    10. MA Nangle DC, 7940 Folsom-Auburn Road
    11. Pinebrook Village, 7900 Folsom-Auburn Road
    12. American River District, 7806 Folsom-Auburn Road
    13. Central California Area Office, 7794 Folsom-Auburn Road
    14. Bureau of Reclamation-Drill Yard, 7794 Folsom-Auburn Road
    15. Folsom Substation, Folsom Dam

16. Hastie's Capital & Gravel Co., 7700 Folsom-Auburn Road
17. Doug Rekers DDS, 8008 Folsom-Auburn Road
18. Folsom Dam Auto Repair, 7530, Folsom-Auburn Road
19. Earnest J Hook DPM, 8018 Folsom-Auburn Road
20. Brothers Boats, 8018 Folsom-Auburn Road
21. Folsom State Prison, 300 Prison Road
22. Prison Industry Authority, 300 Prison Road
23. Tom Howard Moving Service, 236 Spencer Street
24. 173 Prison road
25. SBC (UC345), 98 Montrose Count
26. Midas Muffler & Brake Shop, 50 Montrose Drive
27. Kindred Hospital-Sacramento, 223 Fargo Way
28. St. Jude's Hospital, 223 Fargo Way
29. Blanche Sprentz Elementary School
30. Burger Physical Therapy, 101 East Natoma Street
31. Theodore Udah Elementary, 101 Dean Way
32. Keely M Crider DDS, 47 Natoma Street
33. Perris Plaza, 49 Natoma Street
34. Kurt W Thomson DDS, 47-F Natoma Street
35. Folsom Lasertype & Graphic, 47 Natoma Street
36. City of Folsom Fire Department, 49 Natoma Street
37. Comcast Corporation, 50 Natoma Street
38. Unocal # 4899, 51 Natoma Street
39. Union Oil SS#4899, 51 Natoma Street
40. Q K Towing, 139 Mckiernan Drive
41. Sacramento Valley LTD Partnership, 7173 Baldwin Dam Road
42. City of Folsom, 401 Stafford Street #A
43. North Interstate, 75 Natoma Street #G
44. L & S Distributing, 147 Sierra Wood Circle
45. Circle K #955, 95 Natoma Street
46. John Croft DDS, 118 Natoma Street
47. John W Thompson, DDS, 118 Natoma Street
48. Bright's Furniture Refinishing, 500 Mill Street
49. Folsom Convalescent Hospital, 510 Mill Street
50. Dickson Machines, 221 Dean Way
51. Folsom Executive Car Wash, 6605 Folsom-Auburn Road
52. LA Simmons, DC, 6693 Folsom-Auburn Road
53. North Interstate Construction Inc., 201 Natoma street
54. James M Padgett, DC, 205 Natoma Street
55. Scott a Reiman DDS, 205 Natoma Street
56. Chevron #92130, 9881 Greenback Lane
57. Love Chevrolet, 9871 Greenback Lane
58. Estabrook Construction Co, 408 Leidesdorff Street
59. L Ted Brush Jr, DDS, 309 Natoma Street
60. Folsom Family Dental Center, 6611 Folsom-Auburn
61. Riebe's Auto Parts, 316 Natoma Street

62. Sutter Terrace Dental Group, 6610 Folsom Auburn
63. Speedee Oil Change and Tune UP, 6604 Folsom-Auburn Road

23. Brownfield Database. The database tracks the site with either confirmed or unconfirmed releases and agreed to cleanup. The Department of Toxic Substance Control (DTSC) oversees the VCP. The VCP has revealed 1 HTRW site.

1. Folsom State Prison, north of Folsom City and adjacent to American

24 NFA (No Further Action): The source is DTSC. It has not revealed any site.

25 Drycleaners. This list is maintained by EPA and did not reveal any sites.

APPENDIX B

HISTORICAL LITERATURE REVIEWS

The purpose of historical literature review is to obtain and review records that will help identify recognized environmental conditions, and identify the likehood of past uses associated with the study area. The primary sources of the historical literature reviews were:

(1) U.S. Army Corps of Engineer, Sacramento District. Final Environment Assessment/Initial Study, American River Watershed, California, Folsom Dam Modification Project. August 2001.

(2) U.S. Army Corps of Engineer, Sacramento District. Feasibility Report (Part I and Part II), American River Investigation. December 1991.

(3) U.S. Army Corps of Engineer, Sacramento District. Feasibility Report Supplements (Part I and Part II), American River Investigation. March 1996.

(4) U.S. Army Corps of Engineer, Sacramento District. Folsom Dam Resident Office, Staging Areas, and Access Roads, American River Watershed, California. July 2004.

(5) Geotechnical Consultant, Inc. Environmental Conditions, Soils, Folsom Lake State Recreation Area. April 2003.

(6) Jones & Stokes. Program Environmental Impact Report on Flood Control Improvements Along the Mainstem of the American River, Volume I. April 2000.

(7) City of Folsom. Community Workshop on Naturally Occurring Asbestos in Folsom. October 2004.

(8) Memorandum from Tommy Waldrup to JJ Baum. November 15, 2004

(9) US Army Corps of Engineers Sacramento District, Environmental Chemistry Section. SW-846 Method 4020 Analytical Report. March 2005.

APPENDIX C

SITE RECONNAISSANCE

For this ESA, the primary purpose of site reconnaissance (a.k.a field observations) was to identify past, present or potentially future releases of hazardous substances (particularly petroleum) in the study area.

On May 4, 2005, USACE personnel conducted a site reconnaissance of the study area. The temperature was 65-75 degrees; the weather was sunny with a few clouds; and the visibility was over 15 miles. The site reconnaissance took approximately 5 hours to complete.

The site reconnaissance consisted of USACE personnel walking 2+ miles along the centerline of the proposed roadway (that were marked with wooden stakes at approximately every 50 feet by the contractor). They walked mostly along the centerline and not off the sides of the projected roadway. This is because the sides of the road were mostly inaccessible due to dense bushes and prison oak plants. Also, the roadway is considered to be the most important area to observe because it had the most relevance to the project. The areas that could not be assessed closely were observed using a pair of binoculars.

When USACE personnel came to the American River, they did not walk down the valley to the river because of the valley's steep slope and dense vegetation. Instead, they observed the area with a pair of binoculars.

During the site reconnaissance, USACE personnel were looking for areas of known or potential UST, AST, and transformer sites. They also were looking for areas that had spilled materials, stressed vegetation, discolored soils, containers, pipes, drains, storm or sanitary sewers, fuel tanks, oil pans, lagoons, pits, wash basins, waste stockpiles, storages, garage containers, waste, standing pools, and corrosions or process treatment systems.

Their observations are shown in the following photographs along with corresponding coordinates using a Garmin (Model GPSmap 765) global position system which has $\pm$ 10 feet of accuracy.

Photo 1: East Natoma Street and Folsom Dam Road intersection ($38^0$42'41.8" N $121^0$08'32.5" W)

Photo 2: Pile of soil with concrete slabs of red sign ($38^0$42'13.9" N $121^0$08'32.5" W)

Photo 3: Typical center marker on centerline of proposed roadway ($38^0$42'06.2" N $121^0$08'45.7" W)

Photo 4: Drain outlet about 20 feet from center marker in Photo 3

Photo 5: Trees located on prison property ($38^0$41’53.9” N $121^0$08’34.6” W)

Photo 6: Broken glass and porcelain fragments and discarded tires ($38^0$41’56.3” N $121^0$08’35.6” W)

Photo 7: Prison oak trees near the center marker ($38^0$42’00.5” N $121^0$08’38.1” W)

Photo 8: Unused drain pipe encased inside concrete block ($38^0$42’11.8” N $121^0$08’52.2” W)

Photo 9: Unused drain pipe encased inside concrete block ($38^0$42’12.8” N $121^0$08’52.3” W)

Photo 10: Area showing 55-gallon plastic drums, rusted machinery, and storage containers ($38^0$42’11.5” N $121^0$09’16.9” W)

Photo 11: Stained soil and petroleum container ($38^0$42’12.8” N $121^0$09’20.1” W)

Photo 12: Close-up of stained soils and petroleum container in Photo 11 ($38^0$42’12.8” N $121^0$09’20.1” W)

Photo 13: Close-up of A box containing WD-40, motor oil, antifreeze ($38^0$42’13.6” N $121^0$09’21.8” W)

Photo 14: Heavy stained soils ($38^0$42’11.6” N $121^0$09’17.3” W)

Photo 15: Storage container and 55-gallon drum equipped with hand-pump ($38^0$42’11.7” N $121^0$09’16.8” W)

Photo 16: Folsom Dam Road and Folsom-Auburn Road intersection ($38^0$42’22.5” N 121^0 10’04.8” W)

Photo 17: Pile of soil and asphalt - 15 feet diameter ($38^0$42’17.4” N $121^0$09’54.7” W)

Photo 18: Apparent wash basin ($38^0$42’16.1” N $121^0$09’54.5” W)

Photo 19: Railroad tires left of wash basin

Photo 20: American River (foreground) and prison property (background). Photo taken from $38^0$42’18.5” N $121^0$09’50.2” W

Photo 21: Garbage container leaking petroleum (black spot) and stained concrete pad ($38^0$42’22.7” N $121^0$09’29.9” W)

Photo 22: Drain pipe ($38^0$42’21.3” N $121^0$09’51.0” W

Photo 23: Hazardous material storage area ($38^0$42’21.8” N $121^0$09’47.5” W)

Photo 24: WAPA Folsom Substation containing electrical transformers. Photo taken from $38^0$42’24.3” N $121^0$09’39.8” W

APPENDIX D

AERIAL PHOTOGRAPHS 1952 – 1998

EDR (Environmental Data Resources), Inc. provided USACE with eleven aerial photographs from of the project site taken from 1952 to 1998. .

Photo 1: Aerial photograph (dated 1952) of future dam site. Note the three white, man-made structures.

Photo 2: Aerial photograph (dated 1952) of future dam site, American River and the Folsom-Auburn Road. Note again the three white, man-made structures.

Photo 3: Aerial photograph (dated 1952) of the future dam site. Note again the three white, man-made structures.

Photo 4: Aerial photograph (dated 1961) of Folsom Dam, the American River, the Folsom-Auburn Road, and Folsom Dam Road. Note the multiple man-made structures located on the east bank of the River and that the three white, man-made structures (in first three photographs) are no longer seen.

Photo 5: Aerial photograph (dated 1961) of east side of the dam. Note again that the three white, man-made structures (in first three photographs) are no longer seen.

Photo 6: Aerial photograph (dated 1961) of the area southeast of the dam.

Photo 7: Aerial photograph (dated 1981) of the area southeast of the dam. Note the two installed water tanks.

Photo 8: Aerial photograph (dated 1993) of Folsom State Prison and Folsom Dam Road.

Photo 9: Aerial photograph (dated 1993) of Folsom Dam, American River, Folsom State Prison and the Folsom-Auburn Road. A considerable number of man-made structures could be seen west of Folsom-Auburn Road.

Photo 10: Aerial photograph (dated1998) of Folsom Dam Road and East Natoma Street. A considerable number of man-made structures could be seen west of East Natoma Street.

Photo 11: Aerial photograph (dated 1998) of Folsom Dam Road and Folsom State Prison with three apparent water tanks.

APPENDIX E

WEBSITE QUERIES

The following websites were queried to confirm the findings of the EDR report and supplement Appendix B - Historical Literature Review.

1. www.conservation.ca.gov/CGS/index,htm
2. CESPK online “pilecivcad on 'gold' (E:) drive; “Folsom” folder
3. http://www.parks.ca.gov
4. http://www.swrcb.ca.gov/ust/cleanup/electronic_reporting/about.html
5. http://www.epa.gov/superfund/sites/npl/npl.htm
6. http://www.ciwmb.ca.gov/SWIS/Search.asp
7. http://www.dtsc.ca.gov/sitecleanup/index.html#Cleanup%20Sites
8. http://www.epa.gov/superfund/sites/cursites/
9. http://bard.wr.usgs.gov/historical/jpg/folsom1944a.jpg
10. http:/64.143.64.21/compliance/asbestosnaturallyocurring.shtml#meeting041005
11. http://bard.wr.usgs.gov/historical/jpg/folsom1941a.jpg

APPENDIX F

INTERVIEWS

The purpose of conducting interviews was to obtain up-to-date new information and confirm known information about the project site and the study area. The following table lists the individuals who were interviewed. Details about each interview may be found in the succeeding pages.

Individual Contacted	Date	Position/Organization	Phone Number	Page Number
Mr. Pete Vonich	March 23, 2005	Naturally Resource Specialist/US Bureau of Reclamation	PVONICH@mp.usbr.gov	2
Mr. Ron Phillips	March 23, 2005	Deputy Chief/Operations Folsom City Fire Dept	916-984-2286	2
Mr. Michael Gross	March 30, 2005	Park Superintendent/ Folsom Section/Gold Field District/California Dept of Parks and Recreation	916-988-0205 MGTOS@parks.ca.gov	3
Mr. Ben McIntosh	April 7, 2005	California Dept of Toxic Substances Control, Site Mitigation Program	916-323-3399	3
Ms. Deanna Flanagin	April 7, 2005	Secretary/State Water Resources Control Board	916-341-5851	4
Mr. Joe Fran	April 8 and 28, 2005	Senior Hazardous Material Specialist	916-351-3020	4
Mr. Darin Ajax	April 8, 2005	Supervisor/ Folsom City Public Works Dept (Division of Hazardous Material)	916-355-3571	5
Mr. West Mindermann	April 12, 2005	Senior Waste Management Engineer/California Integrated Waste Management Board	916-341-6314	5
Ms. Carol Oz	April 21, 2005	Environmental scientist/California Dept of Fish and Game, Region 2	916-358-2918	6
Mr. Barry Marcus	April 21, May 6, 2005	Environmental Specialist / Sacramento County Environmental Management Dept (Water Protection Division)	916-386-6171	7
Mr. Tommy Waldrup	April 28, 2005	Senior QA Chemist/CESPK-ED-GC	916-557-7673	8
Mr. Steve Kalcelage	May 2, 2005	Supervisor/ Sacramento County Environmental Management Dept (Environmental Heath Section)	916-875-8416	9

Mr. Peck Ha	May 2, 2005	Chemist/ USACE, Sacramento District	916-557-6617	9
Ms. Becky Victorine	May 4, 2005	Environmental Manager/ U.S. Army Corps of Engineers	916- 557-5162	10

INTERVIEW #1

Name: Mr. Pete Vonich
Naturally Resource Specialist
US Bureau of Reclamation

Email: PVONICH@mp.usbr.gov

Contacted by: Kim Emerick, CESPK-ED-GD

Date: March 23, 2005

Mr. Vonich emailed Ms. Emerick on March 23, 2005 and stated that the USTs were removed and received site closure clearance from Sacramento County. He also emailed her on March 25, 2005 and described the dump site, which was cleaned up 7-8 years ago.

Action Taken: The EDR report and the email were compared and found the following discrepancies:

The EDR report incorrectly indicated that total tank capacity is 2,500 gallons whereas the email indicated 3,750 gallons.

INTERVIEW #2

Name: Mr. Ron Phillips
Deputy Chief - Operations
Folsom City Fire Department

Phone: 916-984-2286

Contacted by: Kim Emerick, CESPK-ED-GD
Date: March 23, 2005

Mr. Ron Phillips said that he did not find any documentation of previous hazardous material incidents that occurred within the Study Area. He also checked with both fire department staff and the City of Folsom Utility Department (Hazardous Waste Program) and found no incidents.

Action Taken: This information was compared with the EDR report and no discrepancies were found.

INTERVIEW #3

Name: Mr. Michael Gross
Park Superintendent/ Folsom Section/Gold Field District/California Department of Parks and Recreation

Phone: 916-988-0205
Email: MGTOS@parks.ca.gov

Contacted by: Kim Emerick, CESPK-ED-GD
Date: March 30, 2005

Mr. Michael Gross emailed Ms. Emerick with a list of hazardous materials storage sites at the State Parks on April 5, 2005. The list confirmed with the findings of the EDR report.

Action Taken: None.

INTERVIEW #4

Name: Ben McIntosh
California Department of Toxic Substances Control, Site Mitigation Program

Phone: 916-323-3399

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 7, 2005

Mr. McIntosh said that the Department of Toxic Substances Control's database is updated daily and it can be downloaded at http://www.dtsc.ca.gov. The database provides the latest information regarding Cortese List, Cal-Sites, School Property Evaluation Program, Voluntary Cleanup Program Properties, Properties Needing Further Evaluation, and No Further Action Determination..

Action Taken: Information was downloaded from the website on April 27, 2005 and was compared with the EDR report. No discrepancies were found.

INTERIVEW #5

Name: Deanna Flanagin
Secretary
State Water Resources Control Board

Phone: 916-341-5851

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 7, 2005

Ms. Flanagin said the official and current list of LUFT (Leaking Underground Field Tank), Land Disposal Sites, Wells, and UST Sites can be downloaded at: http://geotracker.swrcb.ca.gov.

Action Taken: The information were downloaded from the website and compared it to the EDR report and found no discrepancies.

INTERVIEW #6

Name: Mr. Joe Fran
Senior Hazardous Material Specialist
Folsom Prison Fire Department

Phone: 916-351-3020

Contacted by: Kim Emerick, CESPK-ED-GD
Date: April 8, 2005

Contacted by: Yuen Kee Chan, CESPK-ED-GC
Date: April 28, 2005

Ms. Emerick received some faxed information from Mr. Fran.

Action Taken: I obtained the information from Ms. Emerick and found that EDR didn't report the 12 aboveground storage tanks. The information also indicates that the prison is under voluntary cleanup program as reported by EDR, and there are 7 landfills closed under clean closures, and one firing ranges.

INTERVIEW #7

Name: Darin Ajax
Supervisor
Folsom City Public Works Department (Division of Hazardous Material)

Phone: 916-355-3571

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 8, 2005

Mr. Ajax said that he was unaware of any spill in the study area and suggested that the Sacramento County would have a list of reported incidents.

Action Taken: I went to the Sacramento County Environmental Management Department - Water Protection Division (Interview #3).

INTERVIEW #8

Name: West Mindermann
Senior Waste Management Engineer
California Integrated Waste Management Board

Phone: 916-341-6314

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 12, 2005

Mr. Mindermann said that there was a closed landfill (SWIS Number: 34-CR-5019) located at the East Bidwell Street and Riley Road near the study area. He suggested that the Solid Waste Information System (SWIS) be queried for a list of disposal sites, and that Folsom State Prison officials should be contracted to verify that it is a closed landfill and inquire if there are any other landfills.

Action Taken: I downloaded a list of SWIS sites from http://www.ciwmb.ca.gov on April 27, 2005. The list does not have 34-CR-5019. I contacted Mr. Mindermann on April 28, 2005 and he reiterated that the Folsom E. Bidwell landfill obtained clean closure. He did not know 34-CR-2019 was not on the list.

My co-worker, Ms. Kim Emerick contacted Mr. Joe Fran of the state prison. She provided the information presented in Interview #6.

INTERVIEW #9

Name: Carol Oz, Environmental Scientist
California Department of Fish and Game, Region 2

Phone: 916-323-2918

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 21, 2005

Ms. Oz said that the American River is known to have chemical compounds associated with mercury due to mining in the past. She was unaware of the presence of hazardous substances as a result of dumping. She recommended that Sacramento County Environmental Management Department be contacted for hazardous substance related information.

Action Taken: Water Protection Division and Hazardous Materials Division of Sacramento County Environmental Management Department were contacted on April 21, May 2 and 6 (refer to Interviews # 10 and 12).

INTERVIEW #10

Name: Mr. Barry Marcus
Environmental Specialist
Sacramento County Environmental Management Department (Water Protection Division)

Phone: 916-386-6171

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 21 and May 6, 2005

I met Mr. Marcus at his office (8475 Jackson Road, Suite 230, Sacramento, Ca 95826) and was provided access to the following files:

1 County of Sacramento, Environmental Management Department, Toxic Ste Clean-up Site Specific Report, March 15, 2005

2 Underground Storage Tank Removals, November 15, 1999

3 Underground Storage Tanks Installation, November 15, 1999

4 County of Sacramento Environmental Management Department, Master List of Facilities Within Sacramento County with Potentially Hazardous Material, April 19, 2005

5 Report of Incident Response (Complaints) for the Period 01/19/1960 to 04/19/2005, April 19, 2005

6 Monitoring Well List

Action Taken: I compared the EDR report with the above files and found the following discrepancies:

The EDR report incorrectly stated the following HTRW sites were closed but the Master List of Facilities within Sacramento County with Potentially Hazardous Material (4th file) stated (and confirmed by Mr. Marcus) that the cases are still open:

1. California State Prison garage
2. Folsom Prison Green Valley
3. Folsom Prison Inside Bus Repair
4. Perris Plaza
5. UNOCAL #4899

INTERVIEW #11

Name: Mr. Tommy Waldrup
Senior QA Chemist
CESPK-ED-GC

Phone: 916-557-7673

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 28, 2005

Mr. Waldrup said that the background sediment and water samples were collected on October 14, 2004 during the dewatering of stilling basin.

The sediment samples show concentration ranges of arsenic (18.7 – 25.3 mg/kg), barium (627 – 739 mg/kg), chromium (45.7 – 77.1 mg/kg), lead (23.8 – 36.2 mg/kg), and mercury (0.19 – 1.1 mg/kg). Cadmium, selenium and silver were not detected with the reporting limits of 3.5 mg/kg, 8.8 mg/kg and 8.7 mg/kg, respectively.

The water samples show concentration ranges of barium (0.022 – 0.024 mg/L), chromium (0.016 – 0.020 mg/L), and lead (< 0.003 – 0.0018 mg/L). Arsenic, cadmium, mercury, and selenium were not detected with the reporting limits of 0.01 mg/L, 0.02 mg/L and 0.005 mg/L, respectively. Silver also was not detected with reporting limit of 0.005 mg/L.

Action Taken: The sediment and water samples collected from the dam area are considered to be within the ambient range of naturally occurring metal concentrations. Therefore, the site does not appear to be contaminated.

INTERVIEW #12

Name: Mr. Steve Kalcelage
Supervisor of Environmental Health Division
Sacramento County Environmental Management Department (Hazardous Materials Division)

Phone: 916-875-8416

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: March 28, 2005

I spoke with Mr. Kalcelage and asked him about the area within a 2-mile radius with the dam. Specifically, I asked him about hazardous substances, ongoing groundwater monitoring, sites that need corrective action, and landfill that are known to the Hazardous Materials Division.

Mr. Kalcelage said that information that I had received from Mr. Barry Marcus (Interview #3) is valid and that there are no separate files between the Water Protection and the Environmental Heath.

Action Taken: No action was taken.

INTERVIEW #13

Name: Mr. Peck Ha
Chemist
CESPK-ED-GC

Phone: 916-557-76XX

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: April 21, 2005

Mr. Ha said that 19 field and 2 duplicate samples were collected at WAPA Folsom Substation on March 10, 2005. The samples were analyzed for PCB using Ensys™ immunoassay test kits. The results were: 18 samples have less than 10 part per million (ppm) of PCB and the other 3 samples have between 10 ppm and 20 ppm. All the concentrations were less than the site specified PCB concentration according to him.

Action Taken: The findings were incorporated in the ESA, Section 6.0 Results and Discussion.

INTERVIEW #14

Name: Ms. Becky Victorine
Environmental Manager
CESPK-ED-GC

Phone: 916-557-5162

Contacted by: Yuen Kee Chan, CESPK-ED-GC

Date: May 3, 2005

Ms. Victorine escorted Mr. John Esparaza (Supervisor, CESPK-ED-GC) and me during the site reconnaissance on May 3, 2005. She said that the Bureau of Land and Management told her that the areas and items shown in Photos # 12, 13, 14 and 15 will be cleaned or removed.

Action Taken: None.

APPENDIX G

NATURALLY OCCURRING ASBESTOS

The naturally occurring asbestos (NOA) is commonly associated with serpentinite or ultramafic rock often in veins near earthquake faults. Serpentinite may contain chrysotile asbestos, especially near fault zones. Ultramafic rock, a rock closely related to serpentinite, may also contain asbestos minerals. The chemistry of serpentinite is unlike that of most rocks in the earth's crust. Serpentinite rock is mostly composed of a mineral called serpentine and also contains high levels of potentially toxic elements such as magnesium, chromium, and nickel.

Serpentine minerals are light to dark green, commonly varied in hue, and greasy looking; the mineral feels slippery. Serpentine is usually fine-grained and compact but may be granular, platy, or fibrous in appearance. They occur on every continent where ocean plate seduction occurred in the past or present. The richest place in the United States that contains serpentine group rocks is California. Serpentinite, incidentally, is California's state rock. Serpentinite and/or ultramafic rock often are found in the Coast Ranges and the foothills of the Sierra Nevada mountains and other areas of California. Asbestos can also be associated with other rock types in California.

The surveys done by LSA Associates, Inc. and the California Department of Conservation do not seem to suggest the study area have rocks associated with the NOA as show in Figures 5, 6 and 7. However, the geologic map (Figure 8) for the City of Folsom prepared by Sacramento Metropolitan Air Quality Management District shows Copper Hill Volcanic rocks at the east end of the roadway. The state geologist concluded that these rocks formation generally have low to moderate potential for NOA. This is because NOA occurrences can be small and irregularly distributed, thus only way to know for sure whether there's asbestos on a particular property is to test for it.

FIGURES

Figure 1: American River Watershed Map

Figure 2: Overview Map – 01395089.1r – Army Corps of Engineers

Figure 3: American River Watershed Project
Folsom Dam Raise – Folsom Bridge Project

Figure 4: Topographic Map, Folsom, California

Figure 5: Soil Types, Folsom Lake

Figure 6: Ultramfic Rock Areas

Figure 7: A General Location Guide for Ultramafic Rocks in California

Figure 8: Geologic Map

APPENDICES

APPENDIX A: Regulatory Lists of HTRW Sites

APPENDIX B: Historical Literature Reviews

APPENDIX C: Site Reconnaissance

APPENDIX D: Aerial Photographs 1952-1998

APPENDIX E: Website Queries

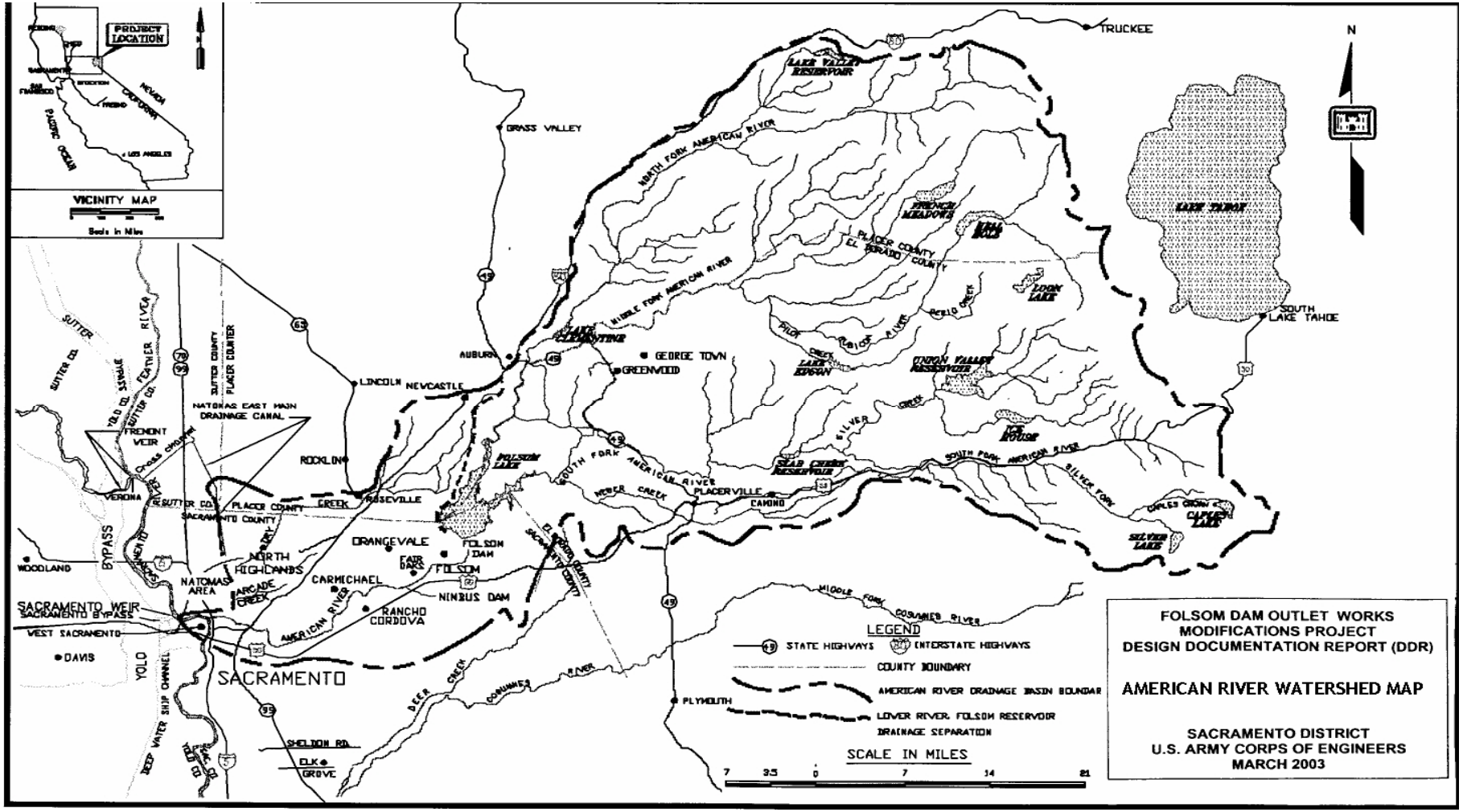
APPENDIX F: Interviews

APPENDIX G: Naturally Occurring Asbestos

ATTACHMENTS

ATTACHMENT A: The EDR Radius Atlas with GeoCheck
Folsom Dan Area, Folsom, Ca 95630
Inquiry Number: 01395089.1r

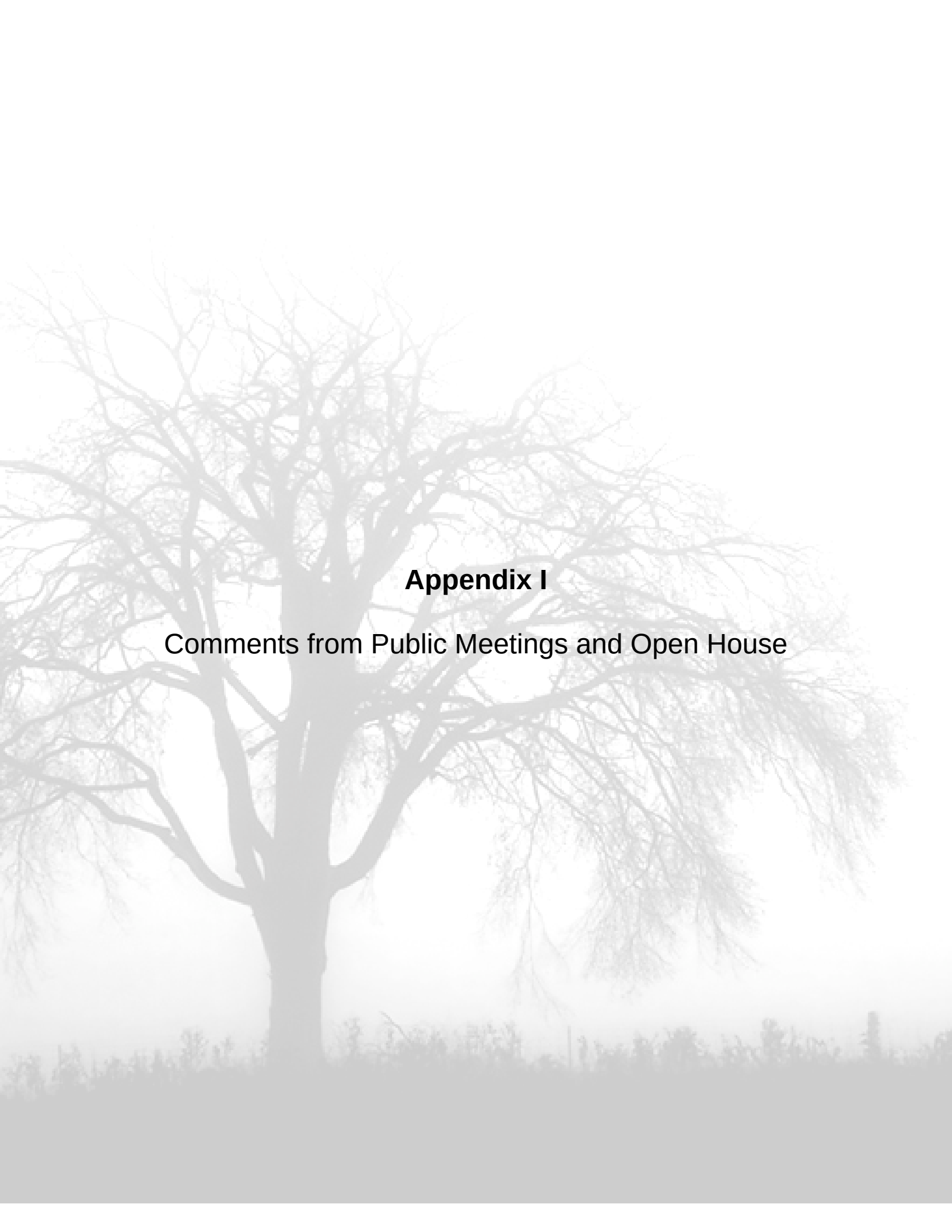
ATTACHMENT B: EDR NEPA Check
Folsom Dan Area, Folsom, Ca 95630
Inquiry Number: 01395089.1r


PROJECT LOCATION
VICINITY MAP
Scale in Miles
NEVADA
CALIFORNIA
PACIFIC OCEAN
LOS ANGELES
FRESNO
TRUCKEE
N
LAKE VALLEY RESERVOIR
GRASS VALLEY
NORTH FORK AMERICAN RIVER
MIDDLE FORK AMERICAN RIVER
FRENCH MEADOWS
LAKE TAHOE
EL DORADO COUNTY
PLACER COUNTY
LAKE ALDER
LAKE ELDON
SOUTH LAKE TAHOE
LAKE CLEVELAND
AUBURN
GEORGE TOWN
GREENWOOD
UNION VALLEY RESERVOIR
LINCOLN
NEWCASTLE
NATOMAS EAST MAIN DRAINAGE CANAL
FREMONT WEIR
ROCKLIN
FOLSOM LAKE
SOUTH FORK AMERICAN RIVER
SILVER CREEK
ICE HOUSE
SILVER FORK
SLAB CREEK RESERVOIR
PLACERVILLE
CAMINO
CAPLES CROSSING
CAPLES LAKE
SILVER LAKE
VERONA
SUTTER CO.
PLACER COUNTY
SACRAMENTO COUNTY
ROSEVILLE
ORANGEVALE
FAIR OAKS
FOLSOM
FOLSOM DAM
NORTH HIGHLANDS
CARMICHAEL
NIMBUS DAM
RANCHO CORDOVA
WOODLAND
NATOMAS AREA
SACRAMENTO WEIR
SACRAMENTO BYPASS
WEST SACRAMENTO
DAVIS
YOLO
SACRAMENTO
AMERICAN RIVER
DEEP WATER SHIP CHANNEL
SHELDON RD.
ELK GROVE
DEER CREEK
COSUMNES RIVER
MIDDLE FORK COSUMNES RIVER
PLYMOUTH
LEGEND
STATE HIGHWAYS
INTERSTATE HIGHWAYS
COUNTY BOUNDARY
AMERICAN RIVER DRAINAGE BASIN BOUNDAR
LOWER RIVER, FOLSOM RESERVOIR DRAINAGE SEPARATION
SCALE IN MILES
7 3.5 0 7 14 21
FOLSOM DAM OUTLET WORKS
MODIFICATIONS PROJECT
DESIGN DOCUMENTATION REPORT (DDR)
AMERICAN RIVER WATERSHED MAP
SACRAMENTO DISTRICT
U.S. ARMY CORPS OF ENGINEERS
MARCH 2003

ENVIRONMENTAL SITE ASSESSMENT
FOLSOM BRIDGE PROJECT
FOLSOM, CALIFORNIA June 2005

ENVIRONMENTAL SITE ASSESSMENT
FOLSOM BRIDGE PROJECT
FOLSOM, CALIFORNIA June 2005

ENVIRONMENTAL SITE ASSESSMENT
FOLSOM BRIDGE PROJECT
FOLSOM, CALIFORNIA June 2005



Appendix I

Comments from Public Meetings and Open House

This appendix will be provided in a future submittal.

Appendix J

TAC Summary

US Army Corps of Engineers
Sacramento District

Meeting Summary

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

July 19, 2004

City of Folsom, Public Works Conference Room

50 Natoma Street, Folsom, CA 95630

I. Welcome & Introductions

Ron began the meeting by welcoming the participants and asking everyone to introduce themselves.

II. TAC Mission

Jane noted that the Traffic Advisory Committee (TAC) was formed as a result of comments received during the March 3, 2004 agency meeting for the project. The mission of the TAC is to: 1) act as an advisory group, 2) provide technical input regarding study methodologies, 3) assist the Corps in identifying potential traffic effects and mitigation measures, and 4) ensure communication among the transportation-related agencies interested in the project.

III. Review of June 30th TAC Meeting Summary

Ron asked if anyone had comments from the June 30th TAC meeting. Mark stated that he had one new traffic count and provided it. Ron mentioned that he spoke with Matt Darrow (County of Sacramento) who could not attend today's meeting and explained that the County had comments on the existing roadway segment analysis. Matt asked that roadway segments in Sacramento County be analyzed using the County's LOS thresholds. Ron stated that this change had already been made. Ron also gave Matt a brief overview of the preliminary forecasts that are the subject of this meeting.

IV. SACMET Modifications

Ron explained that the traffic forecasts for this project have been developed using a modified version of the regional SACMET Travel Demand Forecasting Model. Ron handed out a package of graphics and model plots displaying the SACMET modifications, the model validation results, and the preliminary daily traffic forecasts for 2007 and 2025.

The model was modified within the project study area to refine the level of detail of the traffic analysis zone (TAZ) structure and roadway network (Appendix plates 1 through 4). These refinements make the model more sensitive to roadway improvements such as adding a new bridge crossing. To verify that the sensitivity of the model improved, static and dynamic validation tests were performed with the model. The static validation tests measure the model's ability to estimate existing 2004 traffic counts with acceptable

tolerances. The acceptable tolerances used for this study are those contained in *Travel Forecasting Guidelines*, Caltrans, 1992. Appendix plate 5, 6, 7, and 8 show the validation results.

In general, the model validated acceptably within the study area for daily, a.m. peak hour, and p.m. peak hour conditions. Some individual roadway segments were highlighted on Appendix plate 5 to show key items for discussion. The green circle highlights the volumes over the two existing Folsom bridges. The purple circles highlight cut-through routes. The orange circles highlight locations were the validation did not meet Caltrans' thresholds. Rick asked that Ron clarify lines shown on the figures, and it was explained that dark blue lines are roadways while the light purple/pink lines are centroid connectors between the network and TAZs. These connectors represent all of the local driveways and streets that provide access to the major roadway from the TAZ.

Rick and Ron discussed that the planned widening of Auburn-Folsom Road by Placer County would likely minimize the potential cut-through on Oak Hill Drive. Mark agreed with the identification of Briggs Ranch Drive and the extension of Oak Avenue Parkway to East Natoma Street as potential cut through routes in the City with future new bridges in place.

The TAC discussed the roadway segments that did not meet validation thresholds (the orange circles on plate 5) and Mark and Rick made some suggested TAZ and network changes that may improve the validation for these locations. Fehr & Peers will test a few more changes but will begin developing intersection forecasts with the model starting July 26 unless other comments are provided by July 23.

V. Preliminary 2007 and 2025 Forecasts of Daily Roadway Segment Traffic Volumes

Ron stated that Appendix plates 9 through 16 contained the preliminary daily traffic forecasts for 2007 and 2025 conditions as listed below.

- *Appendix plate 9 – 2007 No Project*
- *Appendix plate 10 – 2007 with a 2-lane Army Corps Bridge*
- *Appendix plate 11 – 2007 with a 4-lane Army Corps Bridge*
- Appendix plate 12 – 2025 No project without Oak Avenue Parkway Bridge
- *Appendix plate 13 – 2025 No project with 4-lane Oak Avenue Parkway Bridge*
- Appendix plate 14 – 2025 with a 4-lane Army Corps Bridge and without Oak Avenue Bridge
- *Appendix plate 15 – 2025 with a 2-lane Army Corps Bridge and 4-lane Oak Avenue Parkway Bridge*
- *Appendix plate 16 – 2025 with a 4-lane Army Corps Bridge and 4-lane Oak Avenue Parkway Bridge*

Ron explained that not all of the model runs listed above will be included in the full traffic analysis. The extra 2025 runs were conducted to test the effect of different assumptions regarding the Oak Avenue Parkway Bridge. The City of Folsom confirmed the assumption that the Oak Avenue Parkway bridge will be in place by 2025 and directed that the modeling assume it to be four lanes. The TAC discussed how the other model run information should be used in the document and Jane wanted to know what the LOS results showed. Ron explained that the LOS had not been conducted but was able to provide some quick assessments of LOS concluding the following.

- A single 2-lane bridge in 2007 would operate at LOS F

- A single 4-lane bridge in 2025 would operate at LOS F
- A 4-lane bridge in 2007 would provide approximately LOS D conditions
- Two 4-lane bridges in 2025 would provide approximately LOS D conditions

The TAC agreed that the extra model run information should be used to explain the need for two new bridges, but the traffic analysis only needed to include the scenarios shown in italics in bulleted list above.

Ron also pointed out the following key issues with some of the model run scenarios.

2007

He confirmed that the Folsom light rail transit (LRT) extension is included in the 2007 model and noted that the City has not yet planned how local bus service will connect to LRT. Mark confirmed that the City is just starting the bus planning. Ron said that the City's planning would not be done in time for use in the model and that the SACOG coding of bus service that was already in the model would be used. Under 2007 conditions, Rick mentioned that the Placer County Board of Supervisors decided to complete the Auburn-Folsom Road widening improvements in phases. Phase 1 will provided four lanes from Douglas Boulevard to Eureka Road and then from Oak Hill Drive to the county line by 2007 leaving a gap between Eurkea Road and Oak Hill Drive that will remain 2 lanes. Rick said the County could accelerate the widening of the gap if funding were available.

2007 and 2025

Cut through traffic on Briggs Ranch Drive will be difficult to mitigate without physical modification to Briggs Ranch Drive or its intersection with East Natoma Street. Jane wanted to know how the City dealt with this problem in the past when the Dam Road was open. Mark mentioned that a detailed traffic study was done in 1999 on the subject and that he would send a copy to Fehr & Peers.

Under the 2-lane Army Corps bridge scenarios, substantial congestion would likely occur at the approach intersections. Rick mentioned that the intersections could potentially be designed to accommodate larger storage areas to avoid operational problems. Ron agreed that the intersection and bridge approach design would be important in minimizing potential operational problems. Jane stated that this would be a good subject for the next meeting. Keith agreed because he wants to know what the priority for funding should be between the bridge structure versus the approaches especially if funding is limited.

VI. Other Business

No other business was discussed.

VII. Next Meeting

The next meeting was scheduled for Thursday, August 5th at 9:00 AM at the Folsom Public Works Department conference room. It was requested that the new design consultants be asked to attend as well.

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

May 17, 2004, 9:00 a.m.

City of Folsom, Public Works Conference Room

50 Natoma Street, Folsom, CA 95630

I. Welcome

- Provided Agenda and list of Tier 1 projects to each attendee. Committee was tasked with bringing copies of May 10 meeting minutes; HDR brought extra copies of complete packet for those without.

II. Introductions of New Attendees

- No new attendees joined group, Jessica Delich, with HDR, took meeting minutes. See Attachment 1, Sign-in Sheet for meeting attendees. Note: Placer and El Dorado County representatives were unable to attend the meeting.

III. Review of May 10th, TAC Meeting Summary

- Changes included:
- Pg 3 – Add Auburn-Folsom Road/Dam Road intersection to Intersections for Study list.
- Pg 3 – Move Hazel Ave/Greenback and Hazel Ave/Madison Ave from "Intersections for Study" list to "Intersections for Consideration Following Initial Roadway Traffic Volume Forecast" list on page 4. Also add Hazel Ave/Oak Avenue to page 4 list.

IV. Follow-up on Discussion and Action Items from May 10th TAC Meeting

- Ron Milam has all counts, policies, assumed background needed to begin running model.
- Ron Milam identified 5-10 intersection and roadway segments that will require new traffic counts. Need approval today to get numbers before Memorial Day. Mark Rackovan to provide Ron with additional intersection and roadway segment counts.
- Traffic count scope for intersections and roadway segments to be funded by the City of Folsom, Mark Rackovan to check with Rich Lorenz for authorization. Needs email confirmation for Ron to do counts (get approval from Rich Lorenz today).
- Katie Eastham, Caltrans, brought loop data to distribute to team
- Mark Rackovan to send new transit route 2007 scenario to Ron Milam.

V. General Agreement Items

A. Related projects list for cumulative impact analysis

1. Tier 1 Projects: Tier 1 list developed 2 years ago. Group discussion involved hypothesis that at the time the Tier 1 list was developed, wording purposely deemphasized Oak Avenue connection by calling it a more generic American River Bridge. Mark confirmed that American River Bridge – first project on Tier 1 list – is the Oak Ave Crossing.

2. Jane Rinck agreed that Fehr & Peers (FPA) should do a sensitivity analysis for Oak Avenue Crossing. Mark Rackovan will confirm that scope change to contract can be accommodated by City of Folsom through FPA's on-call contract to expedite timeframe FPA can produce model run. Ron Milam to develop cost difference to submit to City. Cost to take out link and run in post process – not large scope change.
3. Upon contract extension confirmation by City, FPA will include sensitivity analysis for Oak Avenue Crossing.
4. Analysis for 2007:
   a) Questions on what is on Teir 1 list and what is in model
   b) El Dorado County – are they extending Saratoga?
      - Sophia Parkway/Empire Ranch interchange – need to confirm that Folsom side will be 2- or 4- way and open by 2007. Per Mark Rackovan, assume:
        - 4 lanes from Iron Point to Broadstone Parkway.
        - 2 lanes at E. Natoma Street.
      - Green Valley Road – after 2007, City intent to have Sophia/Empire done before Sophia expansion.
5. Per Mark Rackovan - Not currently on list: Widen Sibley from Blue Ravine to Glenn to four lanes and widen Glenn to four lanes from Sibley to Folsom Blvd (on fiscal budget this year, not yet approved).
6. Per Matt Rackovan– Sac. Co. project dates look okay, but will verify projects with dates close to 2007.
7. Action: Ron Milam to double check with Placer County and El Dorado County to confirm year of project on Tier 1 project list.

B. Assumed growth in background traffic to year 2025

- Level of analysis needed for regulatory compliance. Depends on definition used.
- USACE definition of "reasonably foreseeable" is more formal in that project has been approved in General plan.
- What should we include in MTP list?
- Not assumed in SACMET 2025: Development proposed south of 50 in Folsom SOI, Rio del Oro, & Gencorp.
- If included, need to rationalize: under planning process.
- SACOG assumed 0 growth South of 50.
  1. Used 1996 GP for El Dorado County.
  2. S of 50 area is big question.
  3. May use Hazel Corridor Study cumulative land use assumptions for Rio del Oro and Gen Corp.
  4. Decision: start with 2025 MTP, add Gencorp, Rio del Oro, and Folsom regional center (these projects are far enough along in planning process to justify including in our analysis).
  5. ACTION: Ron Milam received most of info, will follow up with Placer and El Dorado Counties.

VI. Other Business

- CEQA lead? Mark Rackovan to talk to Rich Lorenz and Will Kempton to verify lead agency. Rich Lorenz at last council meeting said yes, City will be lead agency. Need written verification. Needs discretionary action to act as trigger for CEQA. The discretionary action would be that the authorizing bill states that the City of Folsom will have responsibility for O&M for the new bridge.

- Land Use Assumptions: Rancho Cordova in process of adopting General Plan – 3-5 year process. Still under Sacramento's General Plan. No way to know how Rancho Cordova's General Plan numbers will affect traffic.
- Mather Field current cargo facility: May be categorized as a Cargo HUB – Number of trucks traveling in and out of area may increase 3-4 times. Ron to contact Toni Berry at Sacramento County Environmental. For more clarification.
- El Dorado Hills – Should not change traffic counts because County General Plan can't affect them, already set.

VII. Next Meeting

- Target: June 28 at 9 AM as place holder at City of Folsom
- Ron Milam to have summary of existing conditions analysis and preliminary traffic volume forecasts – see Meeting 3 scope deliverable

VIII. Action items Summary (update per comments above)

- Move Hazel Ave/Greenback & Hazel Ave/Madison to "Intersections for Consideration Following Initial Roadway Traffic Volume Forecast" list.
- Add Auburn Folsom Road/Dam road intersection to initial run, brings total to 17.
- FPA to do sensitivity analysis with Oak Ave Crossing as part of on call task with City of Folsom.
- Include traffic counts under on-call
- Tier 1 MTP list: Ron Milam follow up with El Dorado County on Saratoga Avenue and Sophia Parkway. Add Sibley Road widening at request of Mark, Glenn Ave widening, and Placer County.
- Matt Darrow to verify timing on Tier 1 projects.
- Include Gencorp and Rio Del Oro and Kaiser Project in background, not City's SOI
- Ron check with Toni Berry on Mather Cargo Hub
- Mark Rackovan to talk to Will and Rick for City to take CEQA lead

US Army Corps of Engineers
Sacramento District

Meeting Summary

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

June 30, 2004
City of Folsom, Public Works Conference Room
50 Natoma Street, Folsom, CA 95630

I. Welcome
Ron Milam, of Fehr & Peers, welcomed attendees to the meeting and thanked them for their attendance.

II. Introduction of New Attendees
Keith Montag, of the U.S. Army Corps of Engineers (Corps), introduced Garry Horton and Tom Post of the CH2M/URS team, which was awarded the Corps contract for the design of the Folsom Dam Bridge.

III. Review of May 17, TAC Meeting Summary
Hard copies of the May 17 TAC Meeting Summary were provided to those in attendance. Electronic copies were also provided to TAC members prior to the meeting. TAC members were encouraged to review the meeting summary and provide any revisions or corrections. No revisions were received during the meeting.

IV. Follow-up on Discussion and Action Items from May 17 TAC Meeting
None.

V. Existing Traffic Operations
Ron provided draft handouts reflecting existing traffic data to meeting attendees and requested comments on the content and format. Ron also noted the use of both color and black and white copies to experiment with the clarity and readability of the figures.

Figure 1 - Project Study Area and Study Roadway Segments - Ron explained that the project study area reflects the main influence area of the project and includes roadway segments and detailed intersection operations. Fehr & Peers' effort is focused on areas where the bridge affects traffic, which includes local intersections in Folsom as well as regional roadways that extend from Placer, El Dorado, and Sacramento Counties.

Figure 2 & Table: Functional Class and LOS Thresholds - Ron explained that following development of the LOS thresholds for daily roadway traffic, traffic count data was obtained and then compared to those presented in the table. Ron further explained that any LOS below "E" is referred to as "F". Ron also explained that LOS is just one performance measure and is based on the perspective of drivers. The project may also impact transit, bicycles, and pedestrians which will be addressed in the transportation impact study.

Ron posed a number of questions to the TAC members regarding how the Dam Road should be characterized. For example: Would the Dam Road act as an undivided arterial or collector? Mark Rackovan, of the City of Folsom, noted the high operating speeds on the Dam Road previous to its closure and its general operation as an arterial. Ron requested that the TAC participants review the handouts and provide any comments at the July 19th meeting, or if at all possible, prior to the meeting. Comments should be provided to Ron directly at Fehr & Peers.

Table: Roadway Level of Service - Existing Conditions - Ron presented information contained in this table, noting that some counts are not readily available, some of the data is old (e.g., from the mid-1990s), and some daily volumes are estimated from peak hour traffic counts. Some of the older data was also collected when the Dam Road was open. As a result, there is some concern that the traffic patterns have changed. Mark Rackovan will be able to provide some information to fill data gaps and will provide that information to Ron directly.

Keith Montag asked if it was possible to extrapolate between new and old data to obtain the missing data. Ron replied that this had been considered and there was an effort to correlate the old data into growth rates; however the variation in growth rates ranged from 2 to 9 percent. Ron also discussed using peak hour counts to estimate daily volumes. While this method is generally accepted, it would not provide complete coverage of all study locations and would need to be caveated in the report. Ron also noted that the model can forecast future year daily volumes without having an existing count, but the preferred approach is to use the existing count in adjusting future year forecasts due to potential differences between the base year model and existing counts. Ron's professional opinion is that data no later than 2003 (i.e., with the Dam Road closed) should be used in the existing conditions analysis.

In response to a question from Jim Calkins of Caltrans regarding the possibility of taking new counts for the purposes of this study, Ron and Jane Rinck of the Corps collectively responded that the combination of timing and budget precluded taking new counts as a singular approach to incomplete data and that measuring counts now would not reflect traffic patterns when schools are in session. However, following the initiation of the modeling effort, if areas were identified where the trend was close to the threshold, then additional analysis or counts could be considered at that time. Jane suggested that the group come back to this issue at the July 19th meeting.

Ron will revise the table to indicate that the 2004 condition reflects the Dam Road closed.

Figures 3A & 3B - Intersection Peak Hour Traffic Volumes, Lane Configurations, and Traffic Control - Existing Conditions - Ron reminded the meeting attendees that as discussed in a previous a TAC meeting, 17 intersections were identified for evaluation and are shown on Figure 3A. The 17 intersections were analyzed on a peak hour basis (am and pm) and the existing peak hour volumes are shown on Figure 3B. The results demonstrate that substantial congestion occurs during peak hours and extends throughout the study area.

Table: Intersection Level of Service - Existing Conditions - Ron reviewed the existing conditions data available for the 17 study intersections (shown on the table), noting the importance of evaluating both the LOS as well as the delay at intersections. Results presented in the table indicate there are areas of significant congestion and Ron suggests that demand is much higher than what is presented in the counts. Shaded areas on the table indicate those intersections that are influenced by adjacent intersections. These intersections have longer delays and operate worse than the reported LOS due to the effects of queuing from downstream intersections.

Figures 4A & 4B - Travel Time Analysis Route 1 - Rainbow Bridge & Travel Time Analysis Route 2 - Lake Natoma Bridge - Though out of scope, Fehr & Peers prepared GPS travel time

runs for two routes--one extending from the Dam Road over the Rainbow Bridge, and the second extending from the Dam Road over the Lake Natoma Bridge in Folsom. The purposes of preparing these travel time analyses was to assist in analyzing how corridor service could change, and to help explain what is happening in intersections in a way that is meaningful to the public. The results of the travel time analysis did not support the perception that the Rainbow Bridge is a quicker route than the Natoma Bridge yet this bridge carries a higher daily volume.

VI. Existing Transit Conditions

Figure 5 - Existing Transit Facilities within Focused Study Area - Ron reminded TAC members that the analysis for the new bridge would include transit, pedestrian, and bicycle traffic as well as automobile traffic. Figure 5 presents existing transit facilities within the focused study area. Ron anticipates that the focused study area is likely to have the greatest effect. He will need additional information regarding how the Light Rail connection in Folsom will affect bus routes and other existing transit operations. According to Mark Rackovan, no information is presently available from the City of Folsom. Ron noted that while Light Rail is coded in the model, bus routes that feed into it are unclear. Until information is available, he will rely on the information contained in the SACMET model.

VII. Existing Bicycle and Pedestrian Conditions

Figure 6 - Existing Bicycle and Pedestrian Facilities within Focused Study Area - Figure 6 presents the existing bicycle and pedestrian facilities within the focused study area.

VIII. Preliminary Modifications to SACMET Travel Demand Model

A. Synchro Model Development

Fehr & Peers is using the Synchro Model for the intersection operations analysis. Ron commented that it is a complex model that includes traffic control signal timing, etc., but does not provide a full simulation. Ron offered to provide TAC members an opportunity to review the networks used in the model if they were interested.

Jim Calkins of Caltrans asked if Fehr & Peers had considered using the Paramics model for the study. Ron stated that simulation modeling was considered during the project scoping and that the project team concluded that the impacts of the project alternatives could be adequately measured without relying on detailed simulation models. However, the SYNCHRO model was set up to potentially transfer to a simulation model. Potential simulation software that could be used includes Simtraffic, Paramics, CORSIM, or VISSIM.

Mark Rackovan noted that some recent changes to signaling at certain intersections in the City of Folsom will need to be included in the model. He will provide Ron with the updated signaling information.

Results from the Synchro Model will be used to develop mitigation measures for the project and will be included in the technical appendix of the EIR/EIS.

B. Forecasting

Figure 8 - Original SACMET Base Year Network - 2001 Conditions - Ron began the forecasting discussion by describing the regional SACMET model as developed by SACOG. Figure 8 presents the network in the study area as represented for 2001 conditions in the SACMET model.

Figure 9 - Modified SACMET Base Year Network - 2004 Conditions - Ron briefly described Fehr & Peers' modifications to the model which was also used for the US 50 Empire Ranch project. Some of the modifications included:

- Revising the base year to 2004,

- Modifying the roadway network for 2004,
- Updating land use information for 2004,
- Removing the Dam Road from the transportation network, and
- Adding HOV lanes on US 50.

The new model will incorporate route changes, distributional effects, and potential mode shifts, but will not be sensitive to potential shifts in trips from off-peak to the peak hour due to increased bridge capacity.

Table: List of Tier 1 Projects within Regional Study Area - Ron referred the TAC members to the List of Tier 1 Projects within the Regional Study Area. Fehr & Peers has been working with TAC members to determine the most realistic model year for Tier 1 Projects. The model years presented in the table represents that effort and are considered "reasonably foreseeable projects" for purposes of the EIR/EIS analysis. Jane Rinck noted that the Corps has a more stringent guideline for identifying "reasonably foreseeable projects" and developments to include in EIR/EIS analysis. Ron replied that he will provide a narrative for the EIR/EIS that presents the rationale used in developing the Tier 1 project list.

In addition to modifying the model and updating the model year used for Tier 1 Projects, Fehr & Peers is conducting a model calibration and validation process to ensure that the model produces reliable forecasts. For this effort, Fehr & Peers is adhering to Caltrans' validation guidelines. The results of the initial validation and calibration process will be presented at the next TAC meeting in the form of daily traffic volumes.

IX. Other Business

Following the discussion of Tier 1 Projects, meeting attendees briefly discussed potential project issues related to growth inducement. Ron commented that "induced traffic" and "induced growth" were not defined in the same way. The attendees agreed that limited river crossings have not impeded land use development and that development in Folsom has followed the General Plan, which assumed that up to 12 new travel lanes across the river would be constructed.

X. Next Meeting

- July 19, 2004 - See attached agenda
- Action Items

  A. TAC members to provide comments on format and content of June 30th handout materials to Ron prior to the July 19th TAC meeting if possible.

  B. Mark Rackovan will provide updates to Ron regarding signal changes in Folsom and possibly additional traffic counts.

US Army Corps of Engineers
Sacramento District

Meeting Summary

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

July 19, 2004

City of Folsom, Public Works Conference Room
50 Natoma Street, Folsom, CA 95630

I. Attendees:

Ron Milam, Jeff Gulden (Fehr & Peers), Jane Rinck, Tom Rudd, Keith Montag (US Army Corps of Engineers), Gary Petersen (HDR Engineering), Rick Dondro (Placer County), Mark Rackovan (City of Folsom), Andy Schildt (SAFCA)

II. Welcome & Introductions

Ron began the meeting by welcoming the participants and asking everyone to introduce themselves.

III. Review of June 30th TAC Meeting Summary

Ron asked if anyone had comments from the June 30th TAC meeting. Mark stated that he had one new traffic count and provided it. Ron mentioned that he spoke with Matt Darrow (County of Sacramento) who could not attend today's meeting and explained that the County had comments on the existing roadway segment analysis. Matt asked that roadway segments in Sacramento County be analyzed using the County's LOS thresholds. Ron stated that this change had already been made. Ron also gave Matt a brief overview of the preliminary forecasts that are the subject of this meeting.

IV. SACMET Modifications & Validations

Ron explained that the traffic forecasts for this project have been developed using a modified version of the regional SACMET Travel Demand Forecasting Model. Ron handed out a package of graphics and model plots displaying the SACMET modifications, the model validation results, and the preliminary daily traffic forecasts for 2007 and 2025.

The model was modified within the project study area to refine the level of detail of the traffic analysis zone (TAZ) structure and roadway network (Appendix plates 1 through 4). These refinements make the model more sensitive to roadway improvements such as adding a new bridge crossing. To verify that the sensitivity of the model improved, static and dynamic validation tests were performed with the model. The static validation tests measure the model's ability to estimate existing 2004 traffic counts with acceptable tolerances. The acceptable tolerances used for this study are those contained in *Travel Forecasting Guidelines*, Caltrans, 1992. Appendix plates 5, 6, 7, and 8 show the validation results.

In general, the model validated acceptably within the study area for daily, a.m. peak hour, and p.m. peak hour conditions. Some individual roadway segments were highlighted on Appendix plate 5 to show key items for discussion. The green circle highlights the volumes over the two existing Folsom bridges. The purple circles highlight cut-through routes. The orange circles highlight locations were the validation did not meet Caltrans' thresholds. Rick asked that Ron clarify lines shown on the figures, and it was explained that dark blue lines are roadways while the light purple/pink lines are centroid connectors between the network and TAZs. These connectors represent all of the local driveways and streets that provide access to the major roadway from the TAZ.

Rick and Ron discussed that the planned widening of Auburn-Folsom Road by Placer County would likely minimize the potential cut-through on Oak Hill Drive. Mark agreed with the identification of Briggs Ranch Drive and the extension of Oak Avenue Parkway to East Natoma Street as potential cut through routes in the City with future new bridges in place.

The TAC discussed the roadway segments that did not meet validation thresholds (the orange circles on plate 5) and Mark and Rick made some suggested TAZ and network changes that may improve the validation for these locations. Fehr & Peers will test a few more changes but will begin developing intersection forecasts with the model starting July 26 unless other comments are provided by July 23.

V. Preliminary 2007 and 2025 Forecasts of Daily Roadway Segment Traffic Volumes

Ron stated that Appendix plates 9 through 16 contained the preliminary daily traffic forecasts for 2007 and 2025 conditions as listed below.

- *Appendix plate 9 – 2007 No Project*
- *Appendix plate 10 – 2007 with a 2-lane Army Corps Bridge*
- *Appendix plate 11 – 2007 with a 4-lane Army Corps Bridge*
- Appendix plate 12 – 2025 No project without Oak Avenue Parkway Bridge
- *Appendix plate 13 – 2025 No project with 4-lane Oak Avenue Parkway Bridge*
- Appendix plate 14 – 2025 with a 4-lane Army Corps Bridge and without Oak Avenue Bridge
- *Appendix plate 15 – 2025 with a 2-lane Army Corps Bridge and 4-lane Oak Avenue Parkway Bridge*
- *Appendix plate 16 – 2025 with a 4-lane Army Corps Bridge and 4-lane Oak Avenue Parkway Bridge*

Ron explained that not all of the model runs listed above will be included in the full traffic analysis. The extra 2025 runs were conducted to test the effect of different assumptions regarding the Oak Avenue Parkway Bridge. The City of Folsom confirmed the assumption that the Oak Avenue Parkway Bridge will be in place by 2025 and directed that the modeling assume it to be four lanes. The TAC discussed how the other model run information should be used in the document and Jane wanted to know what the LOS results showed. Ron explained that the LOS had not been conducted but was able to provide some quick assessments of LOS concluding the following.

- A single 2-lane bridge in 2007 would operate at LOS F
- A single 4-lane bridge in 2025 would operate at LOS F
- A 4-lane bridge in 2007 would provide approximately LOS D conditions
- Two 4-lane bridges in 2025 would provide approximately LOS D conditions

The TAC agreed that the extra model run information should be used to explain the need for two new bridges, but the traffic analysis only needed to include the scenarios shown in italics in bulleted list above.

Ron also pointed out the following key issues with some of the model run scenarios.

2007

He confirmed that the Folsom light rail transit (LRT) extension is included in the 2007 model and noted that the City has not yet planned how local bus service will connect to LRT. Mark confirmed that the City is just starting the bus planning. Ron said that the City's planning would not be done in time for use in the model and that the SACOG coding of bus service that was already in the model would be used. Under 2007 conditions, Rick mentioned that the Placer County Board of Supervisors decided to complete the Auburn-Folsom Road widening improvements in phases. Phase 1 will provided four lanes from Douglas Boulevard to Eureka Road and then from Oak Hill Drive to the county line by 2007 leaving a gap between Eureka Road and Oak Hill Drive that will remain 2 lanes. Rick said the County could accelerate the widening of the gap if funding were available.

2007 and 2025

Cut through traffic on Briggs Ranch Drive will be difficult to mitigate without physical modification to Briggs Ranch Drive or its intersection with East Natoma Street. Jane wanted to know how the City dealt with this problem in the past when the Dam Road was open. Mark mentioned that a detailed traffic study was done in 1999 on the subject and that he would send a copy to Fehr & Peers.

Under the 2-lane Army Corps bridge scenarios, substantial congestion would likely occur at the approach intersections. Rick mentioned that the intersections could potentially be designed to accommodate larger storage areas to avoid operational problems. Ron agreed that the intersection and bridge approach design would be important in minimizing potential operational problems. Jane stated that this would be a good subject for the next meeting. Keith agreed because he wants to know what the priority for funding should be between the bridge structure versus the approaches especially if funding is limited.

VI. Other Business

No other business was discussed.

VII. Next Meeting

The next meeting was scheduled for Thursday, August 5th at 9:00 AM at the Folsom Public Works Department conference room. It was requested that the new design consultants be asked to attend as well.

US Army Corps of Engineers
Sacramento District

Meeting Summary

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

August 5, 2004, 9:00 a.m.

City of Folsom, Public Works Conference Room

50 Natoma Street, Folsom, CA 95630

I. Welcome

Jane Rinck of the U.S. Army Corps of Engineers (Corps) welcomed attendees to the meeting. A sign-in sheet was circulated and copied for participants.

II. Review of July 19th, TAC Meeting Summary

Ron Milam of Fehr & Peers briefly highlighted key information from the July 19 meeting noting that travel demand forecast results indicated traffic on the dam bridge would exceed capacity by 2007 if only two lanes are constructed. Four lanes would provide LOS D operations.

Jane requested that the spelling of her last name on the July 19 meeting summary be corrected. No other comments were received.

III. Conceptual Bridge Approach and Terminal Intersection Configurations

Background Information

Ron began the discussion by providing a brief background on the issues to be considered regarding design options for the bridge approach and intersections. He reiterated that the project limits extend from E. Natoma to Folsom-Auburn Road and that a focused evaluation is necessary to ensure that the two key intersections are of sufficient size for the project. Background information for consideration included:

- While the Dam Road approaches of the past worked relatively well, there were long queues and Briggs Ranch experienced some cut-through problems as a result. The City of Folsom evaluated the cut-through issues prior to the Dam Road closure, but did not reach consensus on specific implementation actions. In general, the, the intersections/approaches must be larger than what presently exists to avoid queues that would interrupt through street operations and attempt to achieve the City's minimum acceptable LOS of C.

- When the Dam Road was operational there was heavy am and pm peak volume. Within the study area, peak hour volumes are projected to increase approximately 15 percent (to occur between 2004 and 2007) due to local and regional increases in population and employment. An increase in peak hour volumes of approximately 30 percent is

anticipated by 2025. Peak hour volumes will dictate the number of turn lanes needed for the bridge approaches.

- The total bridge crossing volume for all Folsom bridges is expected to increase from between 20 and 25 percent by 2007 and between 45 and 55 percent by 2025.

Intersection Configuration Options

Fehr & Peers has identified a set of intersection configurations that can be used with either 2 or 4 lanes. These configurations were presented in Figures 2-4 and are summarized in table format below. Fehr & Peers welcomes input on these configurations.

Folsom-Auburn Road at Dam Road Southbound				
Lane Type & Number				
Condition	**Left**	**Thru**	**Thru Right**	**Bike**
Existing	1	1	1	1
Option 1	2	1	1	1
Option 2	2	1	1	1
Option 3	2	1	1	1

Notes:
- These configurations attempt to reduce impacts to existing ROW.
- Consideration should be given to extending the length of left turn lanes for added queuing space.
- A minimum of a four-lane section is needed through the area in front of the USBR offices for "storage". This area needs to be long enough so that minimal queuing occurs on Folsom-Auburn Road. The merge lane needs to be carefully placed-possibly with a length of 500 feet or more. This is dependent on design speed as well as cost etc.
- There is a high level of bike usage in this area and an existing bike lane.
- Peak hour flows are generally equal going both north- and southbound on Folsom-Auburn Road.
- The existing configuration of a tight westbound right-turn was not ideal when the Dam Road was open because drivers would get caught in the intersection during signal changes.

Folsom-Auburn Road at Dam Road Northbound					
Lane Type & Number					
Condition	**Left**	**Thru**	**Right**	**Thru Right**	**Bike**
Existing	1	1	0	1	1
Option 1	1	2	1	0	1
Option 2	1	2	1	0	1
Option 3	1	2	1	0	1

Notes:
- There was a relatively low volume of traffic turning right onto the Dam Road from Folsom-Auburn Road when the Dam Road was open.
- There is a high level of bike usage in this area and an existing bike lane.
- Peak hour flows are generally equal going both north- and southbound.

Dam Road at Folsom-Auburn Road Eastbound	
Lane Type & Number	
Condition	**Thru/Left/Right**
Existing	1
Option 1	1
Option 2	1
Option 3	1

Notes:
- For Option 2, the dual controlled right turn lanes are ideal for pedestrians and bicyclists.

Dam Road at Folsom-Auburn Road Westbound		
Lane Type & Number		
Condition	**Thru/Left**	**Right**
Existing	1	1
Option 1	1	2
Option 2	1	2
Option 3	1	2

Notes:

- Consideration should be given to providing a signalized option for traffic from the USBR buildings such as: 1) a green light every other cycle, 2) a left turn pocket which would preserve the traffic flow, or 3) a grade separation (more costly). The design option chosen should be included in the project description rather than included as a mitigation measure.
- USBR has expressed its interest in continuing to have its facilities located on the dam side of the road.
- There is a need for a westbound double-right turn lane or a free flow right turn lane. Bicyclists and pedestrians typically find uncontrolled movements undesirable while dual right-turn lanes create potential safety problems because of sight distance.
- There is a high level of bike usage in this area. The American River Parkway Class I Bike Path crosses under the Dam Road just east of the intersection with Folsom-Auburn Road. Crossing the bike path and integrating bicyclists using the new bridge will be important design considerations.

E. Natoma Street at Dam Road/Briggs Ranch Drive Southwesterly bound (toward Folsom)			
Lane Type & Number			
Condition	**Left**	**Thru**	**Right**
Existing	1	1	1
Option 1	1	2	1-free
Option 2	1	2	2
Option 3	1	2	1-free

Notes:

- The parcel north east of this intersection is being developed.
- The City has already given consideration to what to do at this intersection.
- The previous westbound right-turn volume at this intersection (when the Dam Road was open) was approximately 700 vehicles in the a.m. peak hour This volume is expected to nearly double by 2025.
- If either a free right-turn or a dual controlled right-turn is not constructed, traffic will queue on E. Natoma Street toward Green Valley Road.
- Ideally, E. Natoma Street should be planned for 6 lanes between the Dam Road and Green Valley Road.
- Split phasing may be an option here to minimize green time for cut through traffic on Briggs Ranch Drive.
- These options do not address pedestrian and bike access. Connection to the bike path is another issue to be addressed as the bridge will have pedestrian and bicycle access that did not exist previously. Also, there is a State plan for extending the bike lane and the regional plan has identified E. Natoma St. as an important bike route. There is still uncertainty regarding whether or not a Class I bike path in this area could be used for equestrian purposes.

E. Natoma Street at Dam Road/Briggs Ranch Drive Northeasterly Bound toward Green Valley Road)				
Lane Type & Number				
Condition	**Left**	**Thru**	**Right**	**Thru/Right**
Existing	1	1	0	1
Option 1	1	2	1	0
Option 2	1	2	1	0
Option 3	1	2	1	0

Notes:
- Currently, there is a single left turn lane from E. Natoma Street (north-bound) to the Dam Road.
- The limited visibility for drivers making the southbound right-turn from the Dam Road separated movement is a concern. The intersection design should consider keeping the southbound right-turn movement as part of the intersection with E. Natoma Street.
- These options do not address pedestrian and bike access. Connection to the bike path is another issue to be addressed as the bridge will have pedestrian and bicycle access that did not exist previously. Also, there is a State plan for extending the bike lane and the regional plan has identified E. Natoma St. as an important bike route. There is still uncertainty regarding whether or not a Class I bike path in this area could be used for equestrian purposes.

Dam Road/Briggs Ranch Drive at E. Natoma Street Southbound (through Briggs Ranch)				
Lane Type & Number				
Condition	**Left**	**Thru/Left/Right**	**Right**	**Thru**
Existing	1	1	0	0
Option 1	2	0	1	1
Option 2	2	0	1	1
Option 3	2	0	1-free	0

Notes:
- This approach requires a minimum ofapproximately 1,000 feet for lane transitions and storage.

Dam Road/Briggs Ranch Drive at E. Natoma Street Northbound (toward the Bridge)				
Lane Type & Number				
Condition	**Left**	**Thru/Left**	**Right**	**Thru/Right**
Existing	0	1	1	0
Option 1	1	0	0	1
Option 2	1	0	0	1
Option 3	1	0	0	1

Notes:
- Physical turning movement restrictions would be required on this approach to minimize cut through traffic.

IV. Conceptual Mitigation for Neighborhood Impacts

City Traffic Studies

Ron provided background information on the Briggs Ranch traffic issues stating that the City conducted two traffic studies when the Dam Road was open. Issues considered included the volume of traffic, traffic speed, and driving behavior. Traffic calming measures that the City has previously considered include multi-way stops, traffic circles, physical design features such as speed bumps, and road narrowing. Traffic impacts to neighborhoods are difficult to solve because measures which divert drivers from one route, often result in the use of other local roads. Simply put, there is not one design feature that would not result in a shift of traffic to another residential street.

City Traffic Calming Program
Mark Rackovan of the City of Folsom commented that he frequently receives requests from city residents for traffic calming measures. The City believes it would be beneficial to establish a traffic calming program and has hired Fehr & Peers to develop such a program. One aspect of the program is to formalize the extent of traffic calming measures desired by residents. Mark anticipates that the City's traffic calming program will be approved by the end of this calendar year, or early next year.

Ron acknowledged that even if mitigation measures are implemented which prevent cut through traffic in Briggs Ranch, there will be secondary impacts to other area routes which would likely be identified as significant and unavoidable impacts. To assist in identifying effective mitigation measures, Fehr & Peers will conduct model runs that implement turn penalties at the Briggs Ranch/Dam Road intersection. These model runs will help to determine: if the number of vehicles diverted to other intersections can be extrapolated; if a likely cut through can be identified, or what volumes of diverted traffic may need to be addressed. Mark will provide Ron with the turn penalties the City would like to test. Fehr & Peers will present the results of this model run at the next meeting.

Measures Incorporated into Project Design
Ron suggested that developing the City-wide traffic calming program and incorporating the measures into the bridge project design is one way to address the neighborhood impact issues. Jane suggested that, alternatively, the project documentation could identify the *types* of measures that the City is considering for implementation in Briggs Ranch. Ron reiterated the need for the project EIR to be legally defensible, disclose impacts, and include good planning as much as feasibly possible. There is insufficient scope and schedule to solve all of the traffic problems because they are so widespread throughout various neighborhoods. The Corps anticipates designing the Dam Road/Briggs Ranch intersection to meet the City's specifications.

V. Other Business

City Priorities
Will Kempton of the City of Folsom joined the meeting briefly to reiterate that while he understood the need for long term planning, and the potential for constructing additional lanes in a phased approach, the City's immediate goal was that of a replacement facility. Will expressed his concern that discussions of 2025 traffic volumes are moving away from the goal of constructing a 2-lane replacement facility.

Keith Montag of the Corps commented that the alignment studies to be conducted by the CH2/URS team will provide some indication of the cost of constructing a 4-lane bridge compared to a 2-lane bridge. Keith also noted that the project schedule would support that the number of lanes is not the primary driver of the project schedule.

Rick Dondro of Placer County expressed concern that the project not be built for excess capacity, noting that a LOS of D or E may be acceptable and may not encourage cross-regional commute.

Jane reiterated the need to keep the number of lanes flexible, so that, if necessary, a change in the number of lanes constructed could be made based on public input.

Oak Hill Cut-Through, Placer County

Rick Dondro discussed some of the issues with cut-through traffic in the Oak Hill neighborhood. Numerous measures have been considered (such as additional stop signs, establishing Oak Hill as a private, or closed community), though consensus has not been reached on any of those options.

The widening of Auburn-Folsom Road to four lanes will reduce some of the cut-through problem that occurs today, though some of the widening will not take place until after the new dam road is opened. .

Rick also commented that the County is collecting traffic mitigation fees; however the cost of the widening project has increased from $17 million to approximately $20 million as a result of the decision to phase the effort. Nearly $17 million in revenue could be generated from build-out, but spending this entire revenue on one project is controversial. Requests for additional project funding have been made to the regional traffic impact fee program authority (SPRTA) as well as through Representative Doolittle's office.

Rick questioned to what extent the Dam Road project will have obligation to mitigate the impact to the Oak Hill community. He further questioned if the Folsom-Auburn Road widening effort completed *after* the new Dam Road opening would be identified as mitigation for the project. Ron stated that they would do a model run to test what happens if all of the four-lane widening of Auburn-Folsom Road is completed by 2007. This improvement could be a mitigation measure for the project given that the modeling shows the cut through problem on Oak Hill to be exacerbated by the addition of new bridge lanes. However, if funding for mitigation measures is pending political action, then no guarantee of implementation of the mitigation exists, and thus, would result in a significant unavoidable impact.

Conceptual Alignment Designs

Jane requested that the CH2/URS team present conceptual alignment designs and layouts for comments by the TAC at the next TAC meeting. After some discussion, it was determined that Fehr & Peers would wait until after the next TAC meeting before proceeding with the remainder of its studies. Ron noted that in the interim, Fehr & Peers would like to more closely examine the E. Natoma Street traffic patterns.

VI. Next Meeting

The next TAC meeting will be held on **September 2, 2004 at 9 a.m**. at the City of Folsom offices. Fehr and Peers will present results from model runs conducted for Briggs Ranch. The URS/CH2 team will present conceptual alignment designs and layouts for consideration by the TAC.

US Army Corps of Engineers
Sacramento District

Meeting Summary (Revised: 10-04-04)

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

September 14, 2004, 9:00 a.m.

HDR Engineering, Inc., San Joaquin Conference Room
2365 Iron Point Road, Suite 300, Folsom, CA 95630

I. Welcome

Jane Rinck of the U.S. Army Corps of Engineers (Corps) welcomed attendees to the meeting and introduced Miki Fujitsubo also with the Corps. A sign-in sheet was circulated and copied for participants.

II. Review of August 5th, TAC Meeting Summary

The following topics were covered in the August 5th meeting, as summarized by Ron Milam:

- Conceptual bridge approaches.
- Neighborhood mitigation.
- Traffic options analysis. The detailed analysis was put on hold until alignment optins are developed by CH2MHill/URS.

III. Traffic Mitigation Tests

a. Ron Milam provided handouts (and explained the results) showing three different "Year 2007 Daily Volume" scenarios. These included: (a) With 4-Lane Bridge, (b) With Turn Penalties at E. Natoma/Briggs Ranch Dr., and (c) With Auburn/Folsom Rd. built to 4 Lanes.

b. Oak Hill Drive – This is a "cut-through" route now. There may be a lack of funding sufficient to complete 4 lanes throughout on Folsom/Auburn Road, therefore a gap may be in place when the bridge is finished. With 4 lanes on Folsom/Auburn Road, Oak Hill traffic would be dramatically reduced, but volumes still would exceed the desired 4 Lane LOS "C". The conclusion is that 4 lanes will be needed on Folsom/Auburn Road in order to achieve the desired LOS. The question (rhetorical, for the time being) was posed – "Would there be some level of federal support for the Folsom/Auburn improvement?" An answer to this question is not available at the present time, but will need to be addressed at some point. The City of Folsom desires to achieve LOS "C" wherever possible. LOS "D" may be the best possible on

Oak Hill. If it remains a 4-lane undivided road, then the expectation would be LOS "E".

c. Briggs Ranch Drive – Fehr &Peers did a test using a turn prevention method on Briggs Ranch Drive. With this in place, traffic would shift to the Rainbow Bridge, East Bidwell Street and other local streets. The conclusion is that the appropriate method of mitigation would be left to the City of Folsom's "traffic calming program." One method of turn movement prevention that was discussed could be a so-called "gull wing" concrete barrier at the intersection to permit only "right-in" and right-out" turning movements (this was modeled as no N/B & S/B turns).

d. Fehr and Peers has done a review of the daily segment analysis. The conclusion is that the study area has been sufficiently circumscribed and therefore no new intersections need to be included in the analysis.

IV. Bridge Approach Design Concepts

CH2/URS is under contract to the Corps for bridge design. Garry Horton (URS) stated that they had initially developed 4 alignment alternatives, consisting of 2 bridge alignments and 2 west-end intersection locations. Team members had walked the route and determined that one major constraint which will need to be dealt with is crossing beneath a number of existing power lines. Mr. Horton then went on to describe two of the 4 alternatives developed thus far:

Alternative No. 1: This would be an 1800' structure (with a 500' main span). The bridge would cross the river at an oblique angle. URS is trying to locate the alignment between the prison fence and power line. They have found that the power line is too low, and therefore a cast-in-place construction method cannot be used. This has led to consideration of either moving the power lines or coming up with some other solution. Another problem is that if the alignment is moved to avoid the power lines, then the bridge profile changes and this result in an inability to have secure access into the Bureau of Reclamation (BOR) facilities. Another idea that is being considered is to build another road for this purpose, with an intersection along the bridge road.

Ron Milam stated that he would prefer this rather than an alignment that results in an intersection with Folsom/Auburn Road only 300' south of the existing intersection (see Alternative No. 4, below).

Alternative No. 4: This alignment would result in a structure that is 800' to 1200' shorter than Alternative No. 1, but would require an intersection with Auburn/Folsom Road just 300' south of the existing intersection (see Ron's comment above). This alternative was proposed to avoid the significant impact on BOR buildings. It is expected that the PG&E power line crossing will not present a problem for operational clearance, but again, the required vertical clearance would preclude the use of cast-in-place construction methods. Further investigation is needed to determine the best alignment. This alternative would require the taking of some property from the prison. Also, it would take a portion of the existing BOR Water Education facility.

Ron stated that the new intersection, together with the existing one, would have to operate as one, making movements difficult or troublesome. More detailed traffic analysis is needed for this configuration.

Alternatives No. 2 & No. 3: These are variations of the above and were not specifically described.

Discussion:

Jane stated that the project will need to provide a thorough analysis of all alternatives, including the least expensive.

Mark Rackovan stated that a new gas station is being planned on the west side of Folsom/Auburn Road at the location of the proposed new intersection (under Bridge Alternative No. 4); therefore, if this alignment is chosen, it would require site plan revisions for the gas station. Mark agreed to obtain a copy of the site plan and forward it to Garry Horton.

James Labanowski stated that there are both mobile homes and expensive homes nearby, with an attendant expected dislike for the new intersection location.

Andy Schildt asked if the power line problems could be avoided with changing roadway geometrics. Garry Horton replied that it is too soon to know. URS will do more refinements.

Jane stated that Ron will need to analyze more alternatives in order for the analysis to be complete and defensible.

Keith Montag stated that we should account for an occasional rerouting of public traffic, because the BOR has unscheduled deliveries of high profile equipment that would require roadway closure. This only happens infrequently, however, perhaps once per year or even less frequently than that.

Mark stated that there could be another development project, located northwest of Folsom/Auburn Road. Therefore, it is possible that there may need to be yet another intersection, making 3 within a very short spacing.

Garry Horton raised several other issues:

(1) Connectivity of Class I bike path. East Natoma currently has a Class II bike path. Mark stated that he would be meeting with a bicycle advocacy group on Friday and he should have better information then on the desires of the bicycle community. Mark also has information on the local bike path network.

(2) There is a need for (a 15 to 20-year requirement) secure construction access to the dam road staging area at the south end of the new road. This would require another mid-point intersection. Ron stated that this would result in less than desirable traffic conditions.

(3) Prison rifle range access. Garry Horton stated that access to the prison rifle range was yet another consideration to be accommodated.

Andy recommended that someone should talk with Bill Hawkins regarding construction staging. Jane stated that this has been done.

V. Construction Traffic Impact Study

James Labanowski provided handouts for the conceptual construction schedule and associated truck volumes. This information assumes that the BOR facility relocation (if required) would be completed before the bridge is opened. Several members of the TAC noted that this will not be

the case and simultaneous construction activity should be assumed. The analysis was done assuming that peak trucks/day refers to the maximum expectation on a given day. An analysis is still needed for worker vehicles.

Gary Petersen stated that it may be desirable for the Corps to consider convening a “cumulative impacts workshop” which would be attended by representatives of the major projects, the purpose of which would to more fully understand the scope and timing of multiple sets of construction activities over the bridge implementation period.

Schedule

URS is working on the preliminary alignments and is due to have this activity completed in one month.

Fehr and Peers will be preparing a revision of its scope to account for the additional intersection analysis that will be needed. Fehr and peers will conduct a cost tradeoff with existing tasks to keep things moving along. The questions to be answered by the new Fehr and Peers work will be: (a) Will two intersections work? (b) How to manage all access requirements with one intersection? (c) If a mid-alignment intersection is needed, how would that work?

VI. Next Meeting

The next TAC meeting will be held on **October 5th, 2004 at 1 p.m.** at the offices of the City of Folsom.

US Army Corps of Engineers
Sacramento District

Meeting Summary

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

October 5, 2004, 1:00 p.m.

City of Folsom, Public Works Conference Room

50 Natoma Street, Folsom, CA 95630

I. Welcome
Jane Rinck of the U.S. Army Corps of Engineers (Corps) welcomed attendees to the meeting. A sign-in sheet was circulated and copied for participants.

II. Review of September 14th, TAC Meeting Summary
The following topics were covered in the September 14th meeting, as summarized by Ron Milam:

- Traffic Mitigation Tests
- Bridge Approach Design Concepts
- Construction Traffic Impact

Mark Rackovan noted that a bicycle subcommittee of the Highway 50 Transportation Management Authority would be consulted regarding bicycle issues as they may affect the bridge project.

III. Roadway Segment Analysis
Ron distributed detailed results of the segment analysis in a series of tables. Daily level of Service (LOS) capacity thresholds (based on City of Folsom, Sacramento County, Placer County, and El Dorado County standards) were used to determine impacts. Of the 38 roadway segments analyzed, 18 are currently in excess of LOS "C" which is the City's standard for impact. In the year 2007, of the roadway segments already experiencing unacceptable levels of service, without the proposed bridge in place, the number of roadway segments exceeding LOS "C" would be 18. By the year 2025, 21 segments would be in this condition. With the proposed bridge in place, shifts in traffic would occur among the roadway segments, and levels of service would be improved in 2007 on 5 roadway segments, whereas deteriorations in level of service would occur on 3 segments. By the year 2025, the bridge would result in improvements on 2 roadway segments and deteriorations would occur on 2 segments, reflecting the growth in traffic expected to occur over time.

When the existing and proposed bridges are considered by themselves, in the year 2007, the Folsom Boulevard Bridge would experience LOS "F", improving to "D" with either the 2-lane or

4-lane new bridge. The Rainbow Bridge would experience LOS “F” in 2007, and would have lower volumes with a new bridge, but not improve to a better LOS with either new bridge configuration. The proposed new bridge would have an LOS of “F” with 2 lanes and “D” with 4 lanes. By the year 2025, with the Oak Avenue Bridge also in place, the Folsom Boulevard Bridge would have an LOS of “D” without the new dam bridge, “E” with new bridge at 2 lanes and “D” with the new bridge at 4 lanes. The Rainbow Bridge would have an LOS of “F” irrespective of the new bridge configuration. The new bridge itself would have an LOS of “F” irrespective of the lane configuration. The Oak Avenue Bridge would have an LOS of “F” without the new dam bridge, improving to “E” with a 2-lane new bridge and “D” with a 4-lane new bridge.

The model-based traffic impact analysis will be used to identify mitigation. Both CEQA and NEPA documents apply. CEQA impact analysis is incremental, comparing with local impact thresholds and existing, as well as future, conditions, whereas the NEPA analysis is done relative to absolute standards. The analysis is conducted using a model that shows shifts or disturbances in traffic patterns on the bridge. Ron noted that the TAC members are encouraged to provide thoughts and comments on the analysis results.

Based on the results described above, Ron suggested that providing a median barrier on the bridge (not currently assumed) would improve the bridge’s performance and would result in an improved level of service. This is so because a median barrier provides enough psychological comfort the driver to allow somewhat higher speeds and capacity. A discussion took place regarding the details of median barriers and the tradeoffs between a 6-lane undivided bridge versus a 4-lane divided bridge.

Mark suggested considering 11-foot wide lanes and straightening out the bridge as much as possible, which would help to improve LOS. Garry Horton commented that the roadway section should be uniform throughout, for safety reasons. It was also suggested that the local impact standard of LOS “C could be used as justification for providing a median barrier as mitigation. An analysis of the cost implications of including a median barrier will be done by URS. Jane commented that a decision will need to be made on this topic for purposes of constructing the project description. Garry indicated that alternative cross sections would be examined for cost effectiveness, with varying lane, median and shoulder widths. Also, the issue of a raised concrete median barrier, versus a painted median, would be examined.

IV. Review of Focused Bridge Approach Intersection Analysis

Ron handed out a memorandum explaining the focused impact analysis at the New Bridge/Folsom-Auburn Road intersection. Three different intersection options were initially identified. The first would provide a single signalized intersection at the existing Folsom Dam Road approach with a new driveway to serve the BOR property at least 500 feet north of the existing Folsom Dam Road intersection. This new Bureau driveway would likely align with the access for a new development project on the west side of Folsom-Auburn Road and could be signalized to provide full access. In the second option, two separate intersections would be proposed, one of which would bring the new bridge into a new intersection with Folsom-Auburn Road approximately 300 feet to the south of the existing intersection and aligned across from a new driveway to the Folsom Dam Auto Spa. Bureau access under this option would be provided by a new driveway north of the existing Folsom Dam Road intersection. In the third option, the bridge approach would be similar to Option 2 but a Bureau of Reclamation access road would be brought into the existing Folsom Dam Road intersection.

All of the options would have very large volumes of south-to-eastbound left turns onto the bridge and west-to-northbound right turns off the bridge. The 2025 p.m. peak hour volumes are high enough to require a triple southbound left-turn lane and dual controlled westbound right-turn lanes or a free-flow westbound right-turn lane.

Option 1 would accommodate the volumes through one intersection at the existing Folsom Dam Road/Folsom-Auburn Road intersection. This option had the lowest delays of all three options

Option 2 would result in the same turning movements, but at the new southerly intersection with Folsom-Auburn Road, and, in addition, would load heavy north- and southbound through movements on the existing intersection. Potential right-of-way constraints could limit the ability to provide adequate turn lanes especially for the northbound right-turn movement, due to inefficiencies in operating two closely spaced signals.

Option 3 would have the same movements as above, with the addition of some volumes to and from the Bureau facilities passing through the existing Folsom Dam Road intersection. This option would have similar delays and ROW constraints as Option 2.

There is a SMUD power pole located close to the Auto Spa (currently under construction) driveway, which presents a physical constraint to moving the intersection. However, a discussion has occurred with SMUD staff, who indicated that this could be moved

Based on the group discussion, it would appear that Option 1, with triple left turn lanes, would be the preferred choice, at the present time. This option would require further design refinements to verify ROW impacts/availability.

V. Bridge Design Concepts

Garry Horton described the current state of the design effort. URS is continuing to analyze different alternatives. Two additional alternatives were described.

Alternative 1C – This alternative has an access provided to the prison shooting range and Bureau construction area. A signalized intersection would be provided. At the east end, the intersection of the new bridge approach with East Natoma Boulevard would be designed to include the turn-lanes recommended by Fehr & Peers with potential turn prohibitions included to prevent cut through traffic onto Briggs Ranch Drive. Garry Horton will discuss the specific turn prohibitions with Mark Rackovan. Ron Milam recommended that the bridge approach to the intersection include two exclusive eastbound left-turn lanes and a shared left/right-turn lane providing a total of three left-turn lanes. The northbound departure leg of East Natoma Street should have three lanes to Blue Ravine Road. East Natoma Street should also have three southbound lanes from Blue Ravine to the bridge approach with the shoulder lane trapping to a free-flow right-turn lane. URS has met with SMUD and they do not have a problem with relocating a number of towers required for the alignment of this, and other, alternatives. This alternative would have a 2,000-foot bridge. A meeting is scheduled for October 6th with representatives of the prison.

Alternative 2B would have a 900-foot bridge that would require a small amount of prison property and possible relocation of SMUD towers. This alternative would provide a “mini interchange” and under crossing to provide access to the prison shooting range and Bureau construction area.

A discussion took place regarding the bikeway accommodations at East Natoma Blvd. Class I versus Class II facilities were discussed and a crosswalk may also be considered. It may be possible to accommodate bicycle turning movements in the outside 3rd left turn lane. Bike trail access may be an issue. Need to look at trail access to lake from Briggs Ranch end.

Ron mentioned that he doesn't yet have the approved traffic calming strategy from the City of Folsom, for the East Natoma and Briggs Ranch areas, to which Mark replied that final decisions would be made by the following meeting.

VI. Other

Jane suggested that one more TAC meeting, beyond the originally scheduled 7, will be needed and everyone was in agreement. Ron suggested that the next meeting be devoted to understanding the proposed project description and the last meeting would cover final decisions regarding proposed mitigation.

VII. Schedule

A planning meeting between the design team and Corps staff is scheduled for October 14th, the results of which would be presented at a plan formulation meeting on October 26th, and this should lead to final project description elements.

VIII. Next Meeting

The next TAC meeting will be held on **November 2nd, 2004 at 10:00 a.m.** at the offices of the City of Folsom.

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE MEETING

November 2, 2004, 1:00 p.m.

City of Folsom, Public Works Conference Room

50 Natoma Street, Folsom, CA 95630

I. Welcome
Jane Rinck of the U.S. Army Corps of Engineers (Corps) welcomed attendees to the meeting. A sign-in sheet was circulated and copied for participants.

II. Introduction of New Attendees
Gordon Tornberg advised the TAC attendees that he was sitting in for Mark Rackovan for the City of Folsom.

III. Review of October 5th, TAC Meeting Summary
Ron Milam of Fehr & Peers noted that the City of Folsom's traffic calming efforts at Briggs Ranch Road and Folsom Dam Road would result in a shift of traffic to other arterial routes and residential streets. Ron is awaiting an update from Mark Rackovan regarding the City's traffic calming strategies. Ron will build the strategies into the project description traffic assumptions. Gordon stated he would check with Mark on the status of final decisions on traffic calming strategies.

IV. Update on Bridge Design
Jane Rinck of the U.S. Army Corps of Engineers (Corps) noted that a meeting had been held the week of October 25, 2004 to discuss plan formulation for the project. As a result of this meeting, the project options have been somewhat simplified. However, there is not presently a preferred alternative or final project description. Sufficient information is available to allow URS to begin design activities. Jane acknowledged that there is some risk in beginning design activities prior to having a complete project description, but the Corps has determined that the level of perceived risk is acceptable in order to meet the project schedule. The final project description is anticipated to be available in late November or early December. The bridge components to date are as follows.

a. Bridge type: Pre-stressed concrete box girder (cast-in-place, segmental)
b. Facility type: Urban arterial
c. Design speed: The design speed for the bridge will be 45 mph. A cost benefit comparison will be performed (i.e., a slower design speed may require less earth work, but could create a less safe roadway). There was some discussion as to the distinction between design speed and the posted speed for the roadway.
d. Number of lanes: The number of lanes is still being evaluated. Options being discussed include:
    1. 2 lanes:
    2. 2 lanes expandable to 4 lanes;

3. 4 lanes; and
4. 5 lanes including a 3-lane/2-lane option (i.e., a reversible lane for peak hours).

5-Lanes

Questions arose concerning operational issues of a reversible/bi-directional lane such as cost, the ability of the City to operate such a configuration, operational issues associated with the left turn pocket, etc. Ron noted that a 5- or 6-lane design would be beneficial to traffic flow on the approaches more so than on the bridge itself. There are some concerns regarding right-of-way (ROW) limitations, as well.

Jane requested input from the TAC on the depth of consideration to be given to the number of lanes for each alternative. Jane recommended that the environmental documentation discuss the limiting factors of each alternative considered.

e. Project bounds/limits: The USACE is attempting to define the limits of the federal project so that project funding and associated costs and impacts, among other things, can be appropriately identified. One possibility (favored by Corps staff at the present time) is to define the project limits as extending from intersection (East Natoma Street) to intersection (Auburn/Folsom Road). Jane and Miki Fujitsubo will request a recommendation from the Corps Sacramento District Office of Counsel. It is anticipated that the environmental documentation for the project would address the entire portion of the bridge and the approaches irrespective of the project bounds/limits as defined by the USACE's Office of Counsel.

   With regard to the factors that would contribute to the project limits, Keith Montag, USACE noted that there were several including Congressional intent, termination of the original bridge, and the PCA, to name a few. Keith also stated that the Congresional authorization has a ceiling of $66 million, which would also influence where the limits are drawn. Ron Milam inquired as to whether or not the project bounds would affect how the project was constructed--specifically, would it be possible for the federal portion of the project to be constructed before the City's portion if local funding was not simultaneously available? (If so, this would mean that an understanding of the impacts associated with constructing the project in segments would be needed.) Jane responded that this was possible. Garry Horton inquired as to what entity would bear the cost of adding a lane to Blue Ravine Road if the project bounds extended from intersection to intersection. Gary Petersen stated that the FHWA concept of "logical termini" may also be appropriate to consider.

   It is understood that the City's preference is to define the project bounds as extending from intersection to intersection.

f. Bikes/pedestrian: Location and design options for the bike/pedestrian trails are still being evaluated. The USACE is meeting with the Folsom State Prison and California Department of Corrections (CDC) to discuss placement of bike/pedestrian lanes with regard to CDC safety/security issues. Garry Horton of URS noted that the bridge design will restore all bike paths. Jane encouraged Garry to talk with biking organizations to help identify some of their design concerns. It is also uncertain how the bike path would be connected at Folsom/Auburn Road.

g. Folsom-Auburn Tie-In: The USACE is undecided as to the placement/routing of the alignment with the intersection of Folsom-Auburn Road. The USACE may carry forward

two options into the environmental analysis: (a) generally along the existing alignment, and (b) the alternative alignment near the existing apartment complex. Drew noted that the BOR does not want a significant impact to result and one way to mitigate this is to move the BOR's existing offices. An Oak or Inwood crossing would be more preferable for the BOR though either alignment being considered would require that the BOR be moved as mitigation. Drew also noted that he did not think that land acquisition costs were included in the project cost breakdown.

Ron commented that it would be important to incorporate the cost of access loss or diminishment for the gas station/spa on Folsom-Auburn Road into the project analysis.

Andy inquired about the utility relocation requirements in the vicinity of Folsom-Auburn Road. Garry Horton commented that this issue had not yet been researched, but as the utilities are in sidewalk areas, costs could be the responsibility of either the project, or the utility. For example, relocation of SMUD's high-voltage power lines would likely be part of the project costs.

Jane will talk to Miki about what information of this type is needed for his documentation purposes.

h. Mid-point access. Garry Horton stated that at-grade intersections will be incorporated into the design to provide access to the BOR facilities and also the prison shooting range.

V. Final Project Description

Gary Peterson of HDR asked if a two-lane alternative was still being considered. Jane responded that she anticipates the project being an elevated four-lane structure, though one alternative may include roadway segments that are two-lane, while another alternative would assume four lanes from intersection to intersection. The two-lane alternative should be included in the environmental documentation as an alternative considered, but rejected due to resulting level-of-service (LOS).

Ron cautioned that we would need to ensure that sufficient information is available to analyze the alternative lane configurations/hybrids. Jane noted that the quantitative analysis of the LOS could be used for the four-lane alternative while a qualitative analysis could be used for the two-lane alternatives.

Jane also noted that more than one alternative will likely be carried forward into the final analysis (referred to as Alternatives AS2 and BS2) and that alternative language to the "preferred project" would be used; e.g., "tentatively preferred alternative". The Corps will provide adequate justification for the "screening out" of other alternatives to yield the two moving forward into the environmental document.

VI. Other Business

Andy Schildt of the Sacramento Area Flood Control Agency (SAFCA) suggested that a summary meeting/briefing may be appropriate for political-interested authorities/entities.

Drew Lessard of the BOR announced that the draft EIS for the Dam Road Opening/Closure is expected to be released in mid-November.

A brief discussion was held on the appropriate traffic index to be used for the project. The traffic associated with the BOR's dam safety work and the Corps' dam raise and modifications would need to be considered as part of the traffic indices.

While an initial identification of number of construction related truck trips for the project is available (HDR has prepared some preliminary estimates), truck traffic/trips for the other area projects (e.g., dam modifications, dam raise, etc.) have not been incorporated. This information and the traffic index will be necessary for the cumulative impacts analysis. Similar information will be necessary for air and noise-related impacts. The possibility of holding a cumulative impacts workshop to discuss construction sequences, establish a preliminary level of truck traffic, and identify any City traffic restrictions anticipated for the Dam Road was suggested.

A design charette will be scheduled with the Bureau of Reclamation and California Department of Corrections to discuss the present state of the alternatives. Jane expects this effort to be concluded by early December.

Jane stated that the draft EIS for the project is still expected to be released in May 2005.

VII. Next Meeting

Jane suggested that future TAC meetings be combined with Plan Formulation meetings at the Corps since many of the attendees are the same. The next Plan Formulation meeting is tentatively scheduled for early-to-mid December.

VIII. Action Items

Mark to provide Fehr & Peers information on the City's traffic calming strategies.

Mark to provide Fehr & Peers information on available ROW in the E. Natomas/Blue Ravine area.

Jane to inform TAC of Plan Formulation meeting date/time.

US Army Corps of Engineers
Sacramento District

FOLSOM DAM BRIDGE PROJECT
TRAFFIC ADVISORY COMMITTEE SUMMARY

I. Introduction

At the March 3, 2004 agency information meeting for the American River Watershed, CA: Folsom Dam Mini-Raise Project-Folsom Bridge, several comments were heard concerning the potential traffic effects that would occur as a result of the project and also how the traffic analysis would be conducted to estimate those effects. Comments were heard on this subject from Placer County Department of Public Works, City of Folsom, Caltrans (District 3), El Dorado County Department of Transportation, and Sacramento County Department of Transportation. As a result of the discussion that took place, a recommendation was made to form a Traffic Advisory Committee (TAC), whose purpose would be to assist in developing the traffic analysis that will support the project's environmental document, and to maintain communication on this subject with the participating agencies having an interest in the analysis. Committees such as this have been used successfully on other projects in developing a consensus on the analysis methodology, analysis results, characterization of the effects and proposed mitigation. This document summarizes the approach to organizing and managing the efforts of the Folsom Dam Bridge TAC. The appendix to this summary document includes attendee sign-in sheets, agendas, hand outs and meeting summaries from each of the TAC meetings.

II. Study Area Definition & TAC Composition

The composition of the TAC included those agencies having either a direct interest in the traffic effects associated with the proposed project or which could provide a needed methodological input. Those parties were identified within a study area circumscribing the project that reflects, to the best extent possible using current information, the area in which measurable changes in traffic volumes would occur. Based upon traffic analysis work that has been done for other projects in the vicinity, a study area was preliminarily identified that extends from Hazel Avenue on the west to Silva Valley Parkway on the east and from Douglas Boulevard/Folsom Dam Road/Green Valley Road on the north to US 50 on the south. Within this area, the following agencies and organizations were identified as potential participants of the TAC:

- US Army Corps of Engineers (Sacramento District) - Chair
- Caltrans (District 3)
- Sacramento Area Council of Governments
- Sacramento County Transportation Authority
- Placer County Transportation Commission
- Placer County Department of Public Works
- El Dorado County Transportation Commission
- El Dorado County Department of Transportation
- Sacramento County Department of Transportation
- City of Folsom
- Sacramento Area Flood Control Authority

- U.S. Bureau of Reclamation
- State of California Reclamation Board

III. TAC Mission & Organization

The TAC functioned as an advisory group and had no direct decision making authority concerning the proposed project. Decisions of the TAC were arrived at through discussion and a consensus approach (i.e., general agreement or accord); voting did not occur. The mission of the TAC was to carry out the following objectives:

(a) assist the Corps in achieving consensus on the evaluation of traffic impacts associated with the project alternatives and proposed mitigation measures (including assigning responsibility for carrying out such mitigation),

(b) provide input to the Corps and its consultants regarding appropriate technical and methodological assumptions to guide the traffic analysis process, and

(c) maintain communication between the TAC membership and each represented constituency.

Seven TAC Meetings were held between May and November of 2004 and were generally scheduled monthly or as otherwise required to respond to project development milestones. At the first meeting, the dates of several subsequent meetings were established and a list of proposed milestones discussed.

IV. TAC Meeting Organization & Management

Jane Rinck, Corps representative, chaired the TAC, following an agenda prepared by the Corps consultants. The TAC was supported by both a general (HDR, Inc.) and traffic (Fehr & Peers) consultant. The TAC general consultant assumed responsibility for preparing and distributing meeting agendas, hand out materials, displays, meeting summary notes and maintaining the membership roster. The TAC general consultant made arrangements for the location and time of each TAC meeting and assisted the chair in conducting the meeting, as required by the material being presented or discussed. In the course of carrying out its duties, the TAC general consultant relied on the traffic consultant for technical information to be presented to the TAC members.

V. Project Milestones

A series of key milestones were established at the first TAC meeting to guide the traffic analysis to achieve interim consensus on milestone items. Key milestones, as presented at the first TAC meeting, were generally consistent with the eventual direction and progress of the TAC as summarized below.

Meeting #1 (May 10, 2004)

- Overview of Traffic Impact Analysis Approach
  - Study Area Boundaries (consensus item)
  - Transportation & Roadway Network (consensus item)
  - Key Intersections (consensus item)
- Impact significance Criteria
- Background Study & Data

Meeting #2 (May 17, 2004)

- TAC members submit traffic counts, background studies, etc.
- Related projects list for cumulative impact analysis (consensus item)
- Assumed growth in background traffic to year 2025 (consensus item)

Meeting #3 (June 30, 2004)

- Existing Traffic Operations
  - Traffic Counts
  - Daily Roadway Segment Capacity Analysis
  - Roadway Segment Daily Analysis
  - SYNCHRO Model Development
  - Intersection Peak Hour LOS
- Existing Transit Conditions
- Existing Bicycle & Pedestrian Conditions
- Preliminary Modifications to SACMET Travel Demand Model

Meeting #4 (July 19, 2004)

- SACMET Modifications
- Modified SACMET Validation
- Preliminary 2007 & 2025 Forecasts of Daily Road Segment Volumes
  - No Project
  - 2-lane Bridge
  - 4-Lane Bridge

Meeting #5 (August 5, 2004)

- Conceptual Bridge Approach & Terminal Intersection Configurations
- Conceptual Mitigation for Neighborhood Impacts

Meeting #6 (September 14, 2004)

- Traffic Mitigation Tests
- Construction Traffic Impact Summary
- Bridge Approach Design Concepts

Meeting #7 (October 5, 2004)

- Roadway Segment Analysis
- Update on Bridge Design Concepts and Project Description
- Added Intersection Analysis

Meeting #8 (November 2, 2004)

- Update on Bridge Design and Final Project Description

TAC Completion

The final meeting of the TAC was held on November 2, 2004. At that meeting, the TAC chair, Jane Rinck suggested that future meetings of the TAC be combined with the Plan Formulation meetings held at the USACE as many of the attendees are the same.