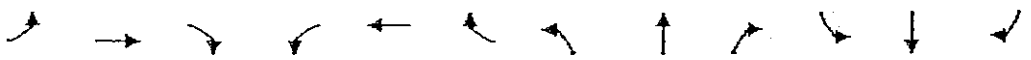
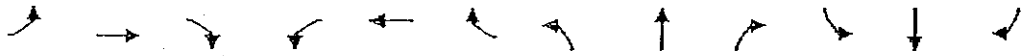


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	10	0	5	10	5	5	0	285	10	5	310	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	0	5	11	5	5	0	310	11	5	337	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	677	674	342	674	674	315	348			321		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	677	674	342	674	674	315	348			321		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	97	100	99	97	99	99	100			100		
cM capacity (veh/h)	359	373	700	364	373	726	1211			1239		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	16	22	321	353
Volume Left	11	11	0	5
Volume Right	5	6	11	11
cSH	429	419	1211	1239
Volume to Capacity	0.03	0.05	0.00	0.00
Queue Length 95th (ft)	3	4	0	0
Control Delay (s)	13.7	14.1	0.0	0.2
Lane LOS	B	B		A
Approach Delay (s)	13.7	14.1	0.0	0.2
Approach LOS	B	B		

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	30.9%	ICU Level of Service	A
Analysis Period (min)	15		

Existing AM Peak.

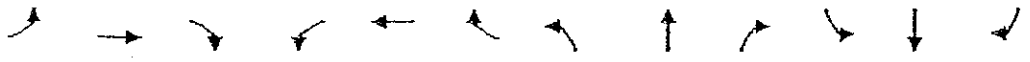


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	155	595	30	30	1015	35	35	15	25	35	15	185
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		0.89	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.97	1.00		0.99	
Satd. Flow (prot)	1770	3513		1770	3539	1583		1799	1583		1652	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.78	1.00		0.95	
Satd. Flow (perm)	1770	3513		1770	3539	1583		1446	1583		1586	
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)	168	647	33	33	1103	38	38	16	27	38	16	201
RTOR Reduction (vph)	0	5	0	0	0	23	0	0	19	0	135	0
Lane Group Flow (vph)	168	675	0	33	1103	15	0	54	8	0	120	0
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		
Actuated Green, G (s)	7.0	29.0		1.6	23.6	23.6		17.0	17.0		17.0	
Effective Green, g (s)	8.0	30.0		2.6	24.6	24.6		18.0	18.0		18.0	
Actuated g/C Ratio	0.13	0.48		0.04	0.39	0.39		0.29	0.29		0.29	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	226	1684		74	1391	622		416	455		456	
v/s Ratio Prot	c0.09	0.19		0.02	c0.31							
v/s Ratio Perm						0.01		0.04	0.00		c0.08	
v/c Ratio	0.74	0.40		0.45	0.79	0.02		0.13	0.02		0.26	
Uniform Delay, d1	26.3	10.5		29.3	16.8	11.6		16.5	16.0		17.2	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	12.4	0.2		4.2	3.2	0.0		0.6	0.1		1.4	
Delay (s)	38.7	10.7		33.5	19.9	11.7		17.1	16.0		18.6	
Level of Service	D	B		C	B	B		B	B		B	
Approach Delay (s)		16.2			20.1			16.8			18.6	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	18.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	62.6	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

Existing PM Peak

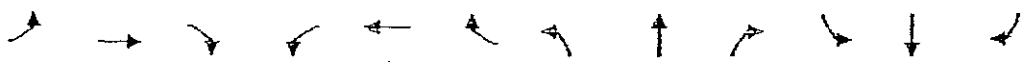


Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	70	725	25	35	1100	95	35	10	25	75	20	105
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	788	27	38	1196	103	38	11	27	82	22	114
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1299			815			1739	2315	394	1851	2239	598
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1299			815			1739	2315	394	1851	2239	598
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	86			95			0	64	96	0	36	74
cM capacity (veh/h)	529			808			78	30	600	27	34	446

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	76	394	394	27	38	598	598	103	38	27	136
Volume Left	76	0	0	0	38	0	0	0	38	82	
Volume Right	0	0	0	27	0	0	0	103	27	114	
cSH	529	1700	1700	1700	808	1700	1700	1700	30	56	
Volume to Capacity	0.14	0.23	0.23	0.02	0.05	0.35	0.35	0.06	2.55	3.86	
Queue Length 95th (ft)	12	0	0	0	4	0	0	0	224	Err	
Control Delay (s)	12.9	0.0	0.0	0.0	9.7	0.0	0.0	0.0	981.8	Err	
Lane LOS	B				A				F	F	
Approach Delay (s)	1.1			0.3			0.0		981.8	Err	
Approach LOS									F	F	

Intersection Summary			
Average Delay	892.1		
Intersection Capacity Utilization	57.6%	ICU Level of Service	B
Analysis Period (min)	15		

Existing PM Peak.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	10	770	5	0	970	150	2	1	0	55	5	10
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	837	5	0	1054	163	2	1	0	60	5	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1217			842			1402	2079	421	1495	1918	527
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1217			842			1402	2079	421	1495	1918	527
tC, single (s)	7.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	3.5			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			98	98	100	27	92	98
cM capacity (veh/h)	569			789			90	152	581	102	165	496

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	11	558	284	527	527	163	3	76	60	5	11
Volume Left	11	0	0	0	0	0	2	60			
Volume Right	0	0	5	0	0	163	0	11			
cSH	569	1700	1700	1700	1700	1700	72	92			
Volume to Capacity	0.02	0.33	0.17	0.31	0.31	0.10	0.05	0.83			
Queue Length 95th (ft)	1	0	0	0	0	0	3	111			
Control Delay (s)	11.5	0.0	0.0	0.0	0.0	0.0	57.2	133.3			
Lane LOS	B						F	F			
Approach Delay (s)	0.1		0.0				57.2	133.3			
Approach LOS							F	F			

Intersection Summary			
Average Delay	4.9		
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

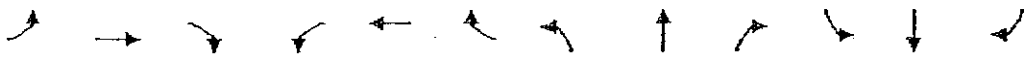
Existing PM Peak.

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	15	5	5	20	30	1
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	5	5	22	33	1
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	66	33	34			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	66	33	34			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	99	100			
cM capacity (veh/h)	936	1040	1578			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	22	27	34
Volume Left	16	5	0
Volume Right	5	0	1
cSH	960	1578	1700
Volume to Capacity	0.02	0.00	0.02
Queue Length 95th (ft)	2	0	0
Control Delay (s)	8.8	1.5	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	1.5	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	15.4%	ICU Level of Service	A
Analysis Period (min)	15		

Existing PM Peak.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	10	2	5	30	5	15	10	750	150	15	335	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	2	5	33	5	16	11	815	163	16	364	16
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1342	1405	372	1330	1332	897	380			978		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1342	1405	372	1330	1332	897	380			978		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	98	99	74	96	95	99			98		
cM capacity (veh/h)	117	135	674	128	149	339	1178			705		

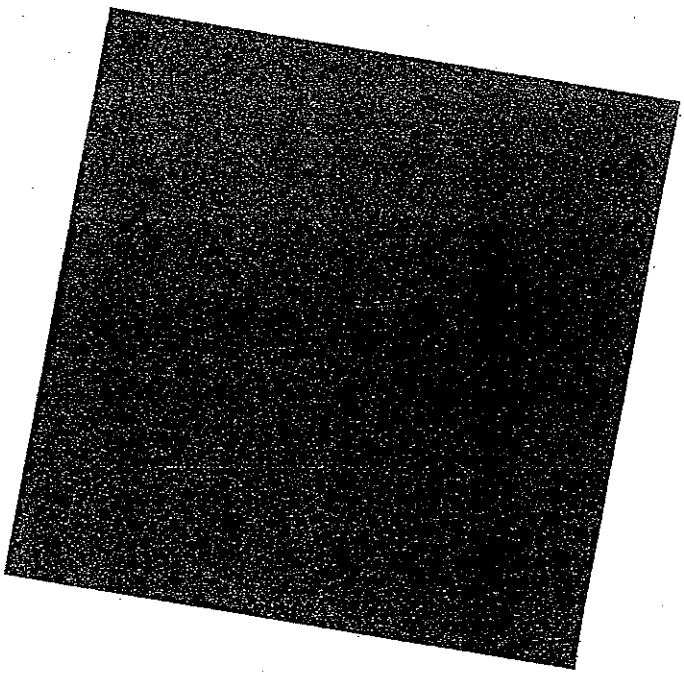
Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	18	54	989	394
Volume Left	11	33	11	16
Volume Right	2	16	163	16
cSH	157	158	1178	705
Volume to Capacity	0.12	0.34	0.01	0.02
Queue Length 95th (ft)	10	35	1	2
Control Delay (s)	30.9	39.2	0.3	0.7
Lane LOS	D	E	A	A
Approach Delay (s)	30.9	39.2	0.3	0.7
Approach LOS	D	E		

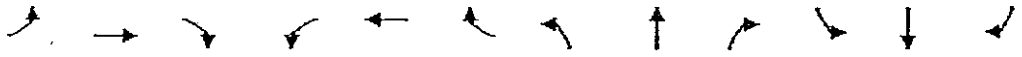
Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	62.4%	ICU Level of Service	B
Analysis Period (min)	15		

Existing PM Peak

APPENDIX C
BACKGROUND DEVELOPMENTS TRIP ASSIGNEMENTS

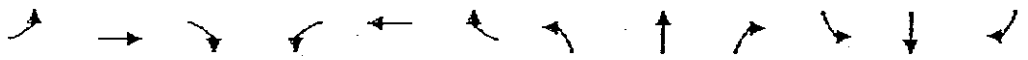
APPENDIX D
BACKGROUND LOS ANALYSIS WORKSHEETS





Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	1075	10	5	515	10	10	10	5	35	5	110
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	1.00		1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00		0.99	
Satd. Flow (prot)	1770	3534		1770	3539	1583		1817	1583		1658	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.87	1.00		0.94	
Satd. Flow (perm)	1770	3534		1770	3539	1583		1629	1583		1572	
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)	120	1168	11	5	560	11	11	11	5	38	5	120
RTOR Reduction (vph)	0	1	0	0	0	7	0	0	3	0	83	0
Lane Group Flow (vph)	120	1178	0	5	560	4	0	22	2	0	80	0
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		
Protected Phases	7	4		5	8			2			6	
Permitted Phases						8	2		2	6		
Actuated Green, G (s)	6.0	25.6		0.7	18.3	18.3		16.2	16.2		16.2	
Effective Green, g (s)	7.0	24.6		1.7	19.3	19.3		17.2	17.2		17.2	
Actuated g/C Ratio	0.13	0.44		0.03	0.35	0.35		0.31	0.31		0.31	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	223	1566		54	1231	550		505	491		487	
v/s Ratio Prot	c0.07	c0.33		0.00	0.16							
v/s Ratio Perm						0.00		0.01	0.00		c0.05	
v/c Ratio	0.54	0.75		0.09	0.45	0.01		0.04	0.00		0.16	
Uniform Delay, d1	22.7	12.9		26.2	14.0	11.8		13.4	13.2		13.9	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	2.5	2.1		0.7	0.3	0.0		0.2	0.0		0.7	
Delay (s)	25.2	15.0		26.9	14.3	11.8		13.6	13.2		14.7	
Level of Service	C	B		C	B	B		B	B		B	
Approach Delay (s)		15.9			14.4			13.5			14.7	
Approach LOS		B			B			B			B	

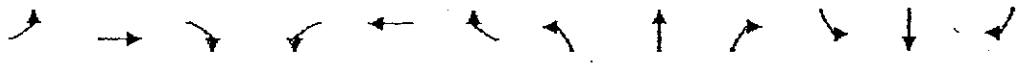
Intersection Summary			
HCM Average Control Delay	15.4	HCM Level of Service	B
HCM Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	55.5	Sum of lost time (s)	12.0
Intersection Capacity Utilization	59.0%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	LBL	LBT	LBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	70	1010	20	5	650	5	10	5	30	70	10	45
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	76	1098	22	5	707	5	11	5	33	76	11	49
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	712			1120			1668	1973	549	1454	1989	353
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	712			1120			1668	1973	549	1454	1989	353
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	91			99			76	90	93	0	80	92
cM capacity (veh/h)	884			620			46	306	480	78	54	545

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3
Volume Total	76	549	549	274	5	358	5	5	33	76	11	49
Volume Left	76	0	0	0	5	0	0	0	11	76		
Volume Right	0	0	0	274	0	0	0	5	33	0	0	49
cSH	884	1700	1700	1700	620	1700	1700	1700	121	103		
Volume to Capacity	0.09	0.32	0.32	0.00	0.01	0.21	0.21	0.00	0.40	1.32		
Queue Length 95th (ft)	7	0	0	0	1	0	0	0	43	237		
Control Delay (s)	9.5	0.0	0.0	0.0	10.9	0.0	0.0	0.0	53.1	271.5		
Lane LOS	A				B				F	F		
Approach Delay (s)	0.6				0.1				53.1	271.5		
Approach LOS									F	F		

Intersection Summary			
Average Delay	19.2		
Intersection Capacity Utilization	55.1%	ICU Level of Service	B
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	950	20	0	610	70	5	1	5	265	5	35
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	0.95			0.95	1.00		1.00			1.00	
Frt	1.00	1.00			1.00	0.85		0.94			0.98	
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.96	
Satd. Flow (prot)	1770	3528			3539	1583		1710			1757	
Flt Permitted	0.28	1.00			1.00	1.00		0.87			0.75	
Satd. Flow (perm)	514	3528			3539	1583		1522			1368	
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	1033	22	0	663	76	5	1	5	288	5	38
RTOR Reduction (vph)	0	2	0	0	0	46	0	3	0	0	9	0
Lane Group Flow (vph)	16	1053	0	0	663	30	0	8	0	0	322	0
Turn Type	pm+pt					Perm	Perm			Perm		
Protected Phases	7	4			8			2			6	
Permitted Phases	4					8	2			6		
Actuated Green, G (s)	24.4	24.4			18.8	18.8		16.1			16.1	
Effective Green, g (s)	25.4	25.4			19.8	19.8		17.1			17.1	
Actuated g/C Ratio	0.50	0.50			0.39	0.39		0.34			0.34	
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	298	1774			1388	621		515			463	
v/s Ratio Prot	0.00	c0.30			c0.19							
v/s Ratio Perm	0.03					0.02		0.01			c0.24	
v/c Ratio	0.05	0.59			0.48	0.05		0.01			0.70	
Uniform Delay, d1	6.8	8.9			11.5	9.5		11.1			14.5	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.1	0.5			0.3	0.0		0.0			4.5	
Delay (s)	6.9	9.4			11.7	9.5		11.1			19.0	
Level of Service	A	A			B	A		B			B	
Approach Delay (s)		9.4			11.5			11.1			19.0	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM Average Control Delay	11.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	50.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	15	950	20	0	610	70	5	1	5	265	5	35
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	16	1033	22	0	663	76	5	1	5	288	5	38
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	739		1054				1448	1815	527	1218	1750	332
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	739		1054				1448	1815	527	1218	1750	332
tC, single (s)	4.1		4.1				7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2		2.2				3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98		100				93	99	99	0	93	94
cM capacity (veh/h)	863		656				84	76	496	182	83	664

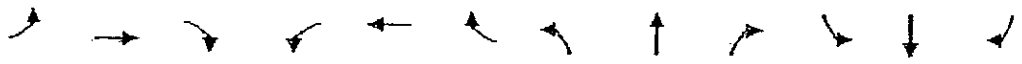
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	NB 2	SB 1	SB 2	SB 3
Volume Total	16	689	366	332	332	76	5	288	5	38	
Volume Left	16	0	0	0	0	0	5	288			
Volume Right	0	0	22	0	0	76	0	38			
cSH	863	1700	1700	1700	1700	1700	130	143			
Volume to Capacity	0.02	0.40	0.22	0.20	0.20	0.04	0.09	2.01			
Queue Length 95th (ft)	1	0	0	0	0	0	7	699			
Control Delay (s)	9.3	0.0	0.0	0.0	0.0	0.0	35.5	661.5			
Lane LOS	A						E	F			
Approach Delay (s)	0.1		0.0				35.5	661.5			
Approach LOS							E	F			

Intersection Summary			
Average Delay	102.1		
Intersection Capacity Utilization	57.3%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	5	5	60	20	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	5	65	22	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	109	33	43			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	109	33	43			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	100			
cM capacity (veh/h)	885	1041	1565			

Direction, Lane	EB 1	NB 1	SB 1
Volume Total	10	5	42
Volume Left	5	5	0
Volume Right	5	0	22
cSH	957	1565	1700
Volume to Capacity	0.01	0.00	0.03
Queue Length 95th (ft)	1	0	0
Control Delay (s)	8.8	0.6	0.0
Lane LOS	A	A	
Approach Delay (s)	8.8	0.6	0.0
Approach LOS	A		

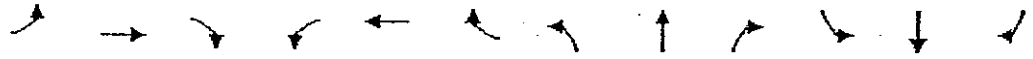
Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	17.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	10	5	5	10	5	5	5	340	10	5	370	10
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	5	5	11	5	5	5	370	11	5	402	11
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	812	810	408	812	810	375	413			380		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	812	810	408	812	810	375	413			380		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	96	98	99	96	98	99	100			100		
cM capacity (veh/h)	289	311	644	289	311	671	1046			1178		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	22	22	386	418
Volume Left	11	5	5	5
Volume Right	5	11	0	11
cSH	342	344	1146	1178
Volume to Capacity	0.06	0.06	0.00	0.00
Queue Length 95th (ft)	5	5	0	0
Control Delay (s)	16.2	16.2	0.2	0.2
Lane LOS	C	C	A	A
Approach Delay (s)	16.2	16.2	0.2	0.2
Approach LOS	C	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	32.9%	ICU Level of Service	A
Analysis Period (min)	15		



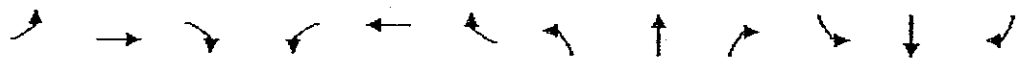
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	820	35	35	1340	40	40	15	30	40	20	230
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0	4.0		4.0	4.0		4.0	
Lane Util. Factor	1.00	0.95		1.00	0.95	1.00		1.00	1.00		1.00	
Frt	1.00	0.99		1.00	1.00	0.85		1.00	0.85		0.89	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00		0.99	
Satd. Flow (prot)	1770	3518		1770	3539	1583		1797	1583		1652	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.47	1.00		0.95	
Satd. Flow (perm)	1770	3518		1770	3539	1583		874	1583		1580	
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)	207	891	38	38	1457	43	43	16	33	43	22	250
RTOR Reduction (vph)	0	3	0	0	0	20	0	0	26	0	152	0
Lane Group Flow (vph)	207	925	0	38	1457	23	0	59	7	0	163	0
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		
Protected Phases	7	4		3	8			2			6	
Permitted Phases						8	2		2	6		
Actual Green, G (s)	14.0	50.2		5.4	40.6	40.6		16.2	16.2		16.2	
Effective Green, g (s)	15.0	51.2		5.4	41.6	41.6		17.2	17.2		17.2	
Actual g/C Ratio	0.17	0.60		0.06	0.48	0.48		0.20	0.20		0.20	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	309	2099		111	1716	768		175	317		317	
v/s Ratio Prot	0.12	0.26		0.02	c0.41							
v/s Ratio Perm						0.01		0.07	0.00		c0.10	
v/c Ratio	0.67	0.44		0.34	0.85	0.03		0.34	0.02		0.51	
Uniform Delay, d1	33.1	9.5		38.5	19.4	11.6		29.4	27.5		30.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	5.4	0.1		1.8	4.1	0.0		5.1	0.1		5.9	
Delay (s)	38.5	9.6		40.3	23.5	11.6		34.6	27.6		36.4	
Level of Service	D	A		D	C	B		C	C		D	
Approach Delay (s)		14.0			23.6			32.1			36.4	
Approach LOS		B			C			C			D	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	85.8	Sum of lost time (s)	12.0
Intersection Capacity Utilization	81.7%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↑↑	↱	↰	↑↑	↱		✣			✣	
Volume (veh/h)	90	980	30	40	1450	115	40	10	30	90	25	135
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	98	1065	33	43	1576	125	43	11	33	98	27	147
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1701			1098			2296	3049	533	2429	2957	788
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1701			1098			2296	3049	533	2429	2957	788
tC, single (s)	4.1			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	74			93			0	0	93	0	0	56
cM capacity (veh/h)	370			632			0	8	492	0	10	334

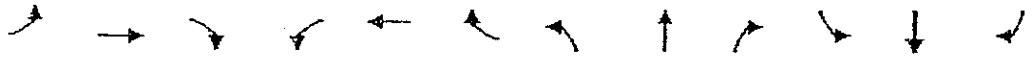
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	WB 4	NB 1	SB 1
Volume Total	98	533	533	33	43	788	788	125	87	272
Volume Left	98	0	0	0	43	0	0	0	43	98
Volume Right	0	0	0	33	0	0	0	125	33	147
cSH	370	1700	1700	1700	632	1700	1700	1700	0	0
Volume to Capacity	0.26	0.31	0.31	0.02	0.07	0.46	0.46	0.07	Err	Err
Queue Length 95th (ft)	26	0	0	0	6	0	0	0	Err	Err
Control Delay (s)	18.2	0.0	0.0	0.0	11.1	0.0	0.0	0.0	Err	Err
Lane LOS	C				B				F	F
Approach Delay (s)	1.5				0.3				Err	Err
Approach LOS									F	F

Intersection Summary			
Average Delay	Err		
Intersection Capacity Utilization	71.6%	ICU Level of Service	C
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1040	5	0	1305	230	5	0	5	95	5	30
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	0.95			0.95	1.00		1.00			1.00	
Frt	1.00	1.00			1.00	0.85		0.93			0.97	
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.96	
Satd. Flow (prot)	1770	3537			3539	1583		1695			1740	
Flt Permitted	0.14	1.00			1.00	1.00		0.86			0.78	
Satd. Flow (perm)	255	3537			3539	1583		1491			1404	
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)	38	1130	5	0	1418	250	5	0	5	103	5	33
RTOR Reduction (vph)	0	0	0	0	0	124	0	4	0	0	21	0
Lane Group Flow (vph)	38	1135	0	0	1418	126	0	6	0	0	120	0
Turn Type	pm+pt					Perm	Perm			Perm		
Protected Phases	7	4			8			2			6	
Permitted Phases	4					8	2			6		
Actuated Green, G (s)	30.5	30.5			24.2	24.2		9.4			9.4	
Effective Green, g (s)	31.5	31.5			25.2	25.2		10.4			10.4	
Actuated g/C Ratio	0.63	0.63			0.51	0.51		0.21			0.21	
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	231	2233			1787	799		311			293	
v/s Ratio Prot	0.01	c0.32			c0.40							
v/s Ratio Perm	0.10					0.08		0.00			c0.09	
v/c Ratio	0.16	0.51			0.79	0.16		0.02			0.41	
Uniform Delay, d1	6.7	5.0			10.2	6.6		15.7			17.1	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	0.3	0.2			2.5	0.1		0.0			0.9	
Delay (s)	7.1	5.2			12.7	6.7		15.7			18.0	
Level of Service	A	A			B	A		B			B	
Approach Delay (s)		5.2			11.8			15.7			18.0	
Approach LOS		A			B			B			B	

Intersection Summary			
HCM Average Control Delay	9.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.69		
Actuated Cycle Length (s)	49.9	Sum of lost time (s)	12.0
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



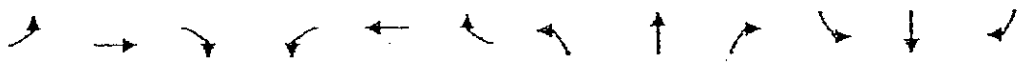
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	35	1040	5	0	1305	230	5	0	5	95	5	30
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	38	1130	5	0	1418	250	5	0	5	103	5	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1668			1136			1954	2878	568	2065	2630	709
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1668			1136			1954	2878	568	2065	2630	709
tC, single (s)	7.5			4.1			7.5	6.5	6.9	7.5	6.5	6.9
tC, 2 stage (s)												
tF (s)	3.5			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	90			100			79	100	99	0	74	91
cM capacity (veh/h)	57			611			26	14	466	29	24	876
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	38	1754	709	709	250	141						
Volume Left	38	0	0	0	0	5	103					
Volume Right	0	0	0	0	250	5	33					
cSH	381	1700	1700	1700	1700	1700	49	36				
Volume to Capacity	0.10	0.74	0.42	0.42	0.42	0.15	0.52	3.94				
Queue Length 95th (ft)	8	0	0	0	0	0	18	Err				
Control Delay (s)	15.5	0.0	0.0	0.0	0.0	0.0	97.9	Err				
Lane LOS	C						F	F				
Approach Delay (s)	0.5		0.0				97.9	Err				
Approach LOS							F	F				

Intersection Summary			
Average Delay	472.4		
Intersection Capacity Utilization	53.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	20	5	5	25	35	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	5	5	27	38	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	79	71	43			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	79	41	43			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	99	100			
cM capacity (veh/h)	921	1000	1565			

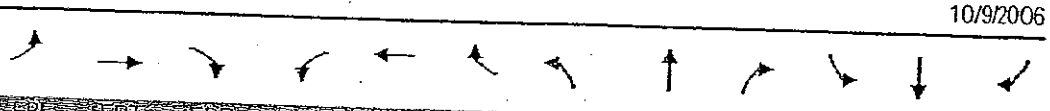
Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	27	5	43
Volume Left	22	5	0
Volume Right	5	0	5
cSH	941	1565	1700
Volume to Capacity	0.03	0.00	0.03
Queue Length 95th (ft)	2	0	0
Control Delay (s)	8.9	1.2	0.0
Lane LOS	A	A	
Approach Delay (s)	8.9	1.2	0.0
Approach LOS	A		

Intersection Summary			
Average Delay	2.7		
Intersection Capacity Utilization	15.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Volume (veh/h)	10	5	5	35	5	20	10	890	180	20	400	20
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	5	5	38	5	22	11	967	196	22	435	22
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1601	1674	446	1584	1587	1065	457			1163		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1601	1674	446	1584	1587	1065	457			1163		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			7.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			3.5		
p0 queue free %	85	94	99	52	95	92	99			96		
cM capacity (veh/h)	79	94	613	79	109	270	1104			601		
Direction, Lane #	EB 1	EB 2	WB 1	WB 2	NB 1	SB 1						
Volume Total	22	65	1174	478								
Volume Left	11	38	11	22								
Volume Right	5	22	196	22								
cSH	100	107	1104	601								
Volume to Capacity	0.22	0.61	0.01	0.04								
Queue Length 95th (ft)	19	74	1	3								
Control Delay (s)	50.9	80.7	0.3	1.0								
Lane LOS	F	F	A	A								
Approach Delay (s)	50.9	80.7	0.3	1.0								
Approach LOS	F	F										
Intersection Summary												
Average Delay			4.2									
Intersection Capacity Utilization			72.5%		ICU Level of Service				C			
Analysis Period (min)			15									

APPENDIX E
TOTAL LOS ANALYSIS WORKSHEETS



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	110	1215	10	5	1245	10	10	10	5	35	5	110
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	1.00		1.00	1.00	0.85		1.00	0.85		0.90	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.98	1.00		0.99	
Satd. Flow (prot)	1770	3535		1770	3539	1583		1817	1583		1658	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.88	1.00		0.94	
Satd. Flow (perm)	1770	3535		1770	3539	1583		1633	1583		1569	
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)	120	1321	11	5	1353	11	11	11	5	38	5	120
RTOR Reduction (vph)	0	0	0	0	0	6	0	0	4	0	85	0
Lane Group Flow (vph)	120	1332	0	5	1359	5	0	22	1	0	78	0
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		
Protected Phases	7	4		5	2							
Permitted Phases						8	2		2	6		
Actuated Green, G (s)	5.8	46.5		0.7	40.2	40.2		21.6	21.6		21.6	
Effective Green, g (s)	7.8	47.3		1.7	41.2	41.2		22.6	22.6		22.6	
Actuated g/C Ratio	0.09	0.57		0.02	0.49	0.49		0.27	0.27		0.27	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	165	2000		36	1744	780		441	428		424	
v/s Ratio Prot	c0.07	0.38		0.00	c0.38							
v/s Ratio Perm						0.00		0.01	0.00		c0.05	
v/c Ratio	0.73	0.67		0.14	0.78	0.01		0.05	0.00		0.18	
Uniform Delay, d1	36.9	12.6		40.2	17.4	10.8		22.6	22.3		23.4	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	14.8	0.8		1.8	2.2	0.0		0.2	0.0		0.9	
Delay (s)	51.6	13.5		42.0	19.6	10.8		22.8	22.3		24.4	
Level of Service	D	B		D	B	B		C	C		C	
Approach Delay (s)		16.6			19.6			22.7			24.4	
Approach LOS		B			B			C			C	

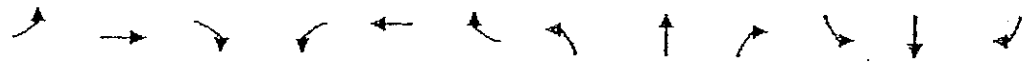
Intersection Summary			
HCM Average Control Delay	18.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	83.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

HCM Signalized Intersection Capacity Analysis
3: RT 340 & RT 27

1/16/2007

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	70	1010	710	735	650	5	135	15	170	70	50	45
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	3.0		4.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	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	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	3433	3539	1583	1681	1701	1583		1810	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	1770	3539	1583	3433	3539	1583	1681	1701	1583		1810	1583
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)	76	1098	772	799	707	5	147	16	185	76	54	49
RTOR Reduction (vph)	0	0	151	0	0	2	0	0	0	0	0	44
Lane Group Flow (vph)	76	1098	621	799	707	3	147	32	185	0	130	5
Turn Type	Prot		pm+ov	Prot		pm+ov	Split		Free	Split		Perm
Protected Phases	7	4	5	3	8	6	2	2		6	6	
Permitted Phases			4			8			Free			6
Actuated Green, G (s)	7.9	39.8	55.2	31.5	63.4	76.7	15.4	15.4	120.0		13.3	13.3
Effective Green, g (s)	8.9	40.8	57.2	32.5	64.4	78.7	16.4	16.4	120.0		14.3	13.3
Actuated g/C Ratio	0.07	0.34	0.48	0.27	0.54	0.66	0.14	0.14	1.00		0.12	0.11
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	131	1203	807	930	1899	1038	230	232	1583		216	175
v/s Ratio Prot	c0.04	c0.31	c0.11	c0.23	0.20	0.00	0.09	0.01			c0.07	
v/s Ratio Perm			0.29			0.00			0.12			0.00
v/c Ratio	0.58	0.91	0.77	0.86	0.37	0.00	0.64	0.14	0.12		0.60	0.03
Uniform Delay, d1	53.7	37.9	26.0	41.6	16.1	7.1	47.0	47.0	0.0		50.1	47.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	6.4	10.6	4.5	8.0	0.1	0.0	4.2	4.2	0.2		4.7	0.1
Delay (s)	60.1	48.5	30.4	49.5	16.2	7.1	51.2	51.2	0.2		54.8	47.7
Level of Service	E	D	C	D	B	A	D	D	A		D	D
Approach Delay (s)		41.8			33.8			24.0			52.9	
Approach LOS		D			C			C			D	

Intersection Summary				
HCM Average Control Delay	37.7	HCM Level of Service	D	
HCM Volume to Capacity ratio	0.82			
Actuated Cycle Length (s)	120.0	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				



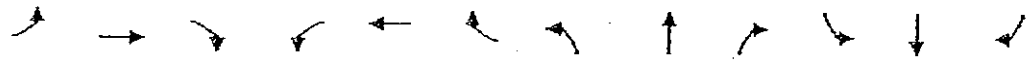
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	15	1455	20	0	700	105	5	1	5	450	5	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0			4.0	4.0		4.0			4.0	
Lane Util. Factor	1.00	0.95			0.95	1.00		1.00			1.00	
Frt	1.00	1.00			1.00	0.85		0.94			0.99	
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.96	
Satd. Flow (prot)	1770	3532			3539	1583		1740			1764	
Flt Permitted	0.95	1.00			1.00	1.00		0.87			0.74	
Satd. Flow (perm)	1770	3532			3539	1583		1526			1357	
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	1582	22	0	761	114	5	1	5	489	5	38
RTOR Reduction (vph)	0	2	0	0	0	67	0	3	0	0	2	0
Lane Group Flow (vph)	16	1602	0	0	761	47	0	8	0	0	530	0
Turn Type	Prot					Perm	Perm			Perm		
Protected Phases	7	4			8			2			6	
Permitted Phases						8	2			6		
Actuated Green, G (s)	3.2	58.0			49.8	49.8		55.0			55.0	
Effective Green, g (s)	4.2	59.0			50.8	50.8		56.0			56.0	
Actuated g/C Ratio	0.03	0.48			0.41	0.41		0.46			0.46	
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	60	1694			1462	654		695			618	
v/s Ratio Prot	0.01	c0.45			0.22							
v/s Ratio Perm						0.03		0.01			c0.39	
v/c Ratio	0.27	0.95			0.52	0.07		0.01			0.86	
Uniform Delay, d1	57.9	30.5			27.0	21.8		18.3			29.9	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	2.4	11.4			0.3	0.0		0.0			11.3	
Delay (s)	60.2	41.9			27.3	21.9		18.4			41.2	
Level of Service	E	D			C	C		B			D	
Approach Delay (s)		42.1			26.6			18.4			41.2	
Approach LOS		D			C			B			D	

Intersection Summary			
HCM Average Control Delay	37.4	HCM Level of Service	D
HCM Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	123.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	81.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	5	5	5	430	85	20
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	5	5	467	92	22
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	582	103	114			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	582	103	114			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	99	99	100			
cM capacity (veh/h)	472	952	1475			

Direction, Lane #	EB 1	NB 1	NB 2	SB 1
Volume Total	11	478	114	114
Volume Left	5	5	0	
Volume Right	5	0	22	
cSH	633	1475	1700	
Volume to Capacity	0.02	0.00	0.07	
Queue Length 95th (ft)	1	0	0	
Control Delay (s)	10.8	0.1	0.0	
Lane LOS	B	A		
Approach Delay (s)	10.8	0.1	0.0	
Approach LOS	B			

Intersection Summary			
Average Delay	0.3		
Intersection Capacity Utilization	36.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↑	↱		↔		↰	↦	
Volume (vph)	100	370	10	5	340	285	10	5	5	60	5	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0		4.0	4.0	
Lane Util. Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Frt		1.00			1.00	0.85		0.97		1.00	0.92	
Flt Protected		0.99			1.00	1.00		0.97		0.95	1.00	
Satd. Flow (prot)		1838			1862	1583		1757		1770	1723	
Flt Permitted		0.86			0.99	1.00		1.00		1.00	1.00	
Satd. Flow (perm)		1605			1852	1583		1803		1863	1723	
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)	109	402	11	5	370	310	11	5	5	65	5	5
RTOR Reduction (vph)	0	1	0	0	0	116	0	5	0	0	5	0
Lane Group Flow (vph)	0	521	0	0	375	194	0	16	0	65	5	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		6			2			4			8	
Permitted Phases	6			2		2	4			8		
Actuated Green, G (s)		17.1			17.1	17.1		2.2		2.2	2.2	
Effective Green, g (s)		17.1			17.1	17.1		2.2		2.2	2.2	
Actuated g/C Ratio		0.63			0.63	0.63		0.08		0.08	0.08	
Clearance Time (s)		4.0			4.0	4.0		4.0		4.0	4.0	
Vehicle Extension (s)		3.0			3.0	3.0		3.0		3.0	3.0	
Lane Grp Cap (vph)		1005			1160	992		145		150	139	
v/s Ratio Prot								0.01			0.00	
v/s Ratio Perm		c0.32			0.20	0.12				c0.03		
v/c Ratio		0.52			0.32	0.20		0.11		0.43	0.04	
Uniform Delay, d1		2.8			2.4	2.2		11.6		12.0	11.6	
Progression Factor		1.00			1.00	1.00		1.00		1.00	1.00	
Incremental Delay, d2		0.5			0.2	0.1		0.3		2.0	0.1	
Delay (s)		3.3			2.6	2.3		12.0		14.0	11.7	
Level of Service		A			A	A		B		B	B	
Approach Delay (s)		3.3			2.4			12.0			13.7	
Approach LOS		A			A			B			B	

Intersection Summary			
HCM Average Control Delay	3.6	HCM Level of Service	A
HCM Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	27.3	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			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	25	120	200	205	815	680
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	3.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	0.97	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	1583	1863	1583	3433	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.59	1.00
Satd. Flow (perm)	1770	1583	1863	1583	2116	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	130	217	223	886	739
RTOR Reduction (vph)	0	118	0	33	0	0
Lane Group Flow (vph)	27	12	217	190	886	739
Turn Type		Perm		pm+ov	pm+pt	
Protected Phases			2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	7.6	7.6	55.8	63.4	72.4	72.4
Effective Green, g (s)	8.6	8.6	56.8	65.4	73.4	73.4
Actuated g/C Ratio	0.10	0.10	0.63	0.73	0.82	0.82
Clearance Time (s)	5.0	5.0	5.0	5.0	4.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	169	151	1176	1221	1925	1519
v/s Ratio Prot	0.02		c0.12	c0.01	0.07	0.40
v/s Ratio Perm		0.01		0.11	0.31	
v/c Ratio	0.16	0.08	0.18	0.16	0.46	0.49
Uniform Delay, d1	37.4	37.1	6.9	3.8	2.2	2.5
Progression Factor	1.00	1.00	1.00	1.00	0.94	0.83
Incremental Delay, d2	0.4	0.2	0.3	0.1	0.1	0.5
Delay (s)	37.8	37.3	7.3	3.9	2.1	2.6
Level of Service	D	D	A	A	A	A
Approach Delay (s)	37.4		5.5		2.9	
Approach LOS	D		A		A	

Intersection Summary			
HCM Average Control Delay	5.5	HCM Level of Service	A
HCM Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	4.0
Intersection Capacity Utilization	47.1%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	20	75	330	25	100	605
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	82	359	27	109	658
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						603
pX, platoon unblocked	0.88					
vC, conflicting volume	1247	372			386	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1214	372			386	
tC, single (s)	6.9	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	88			91	
cM capacity (veh/h)	164	674			1174	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	103	109	658		
Volume Left	22	109	0		
Volume Right	82	0	0		
cSH	403	1173	1700		
Volume to Capacity	0.26	0.09	0.39		
Queue Length 95th (ft)	25	8	0		
Control Delay (s)	17.0	8.2	0.0		
Lane LOS	C	A			
Approach Delay (s)	17.0	1.2			
Approach LOS	C				

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	44.2%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
9: Access 3 & RT 27

1/16/2007

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	20	50	305	25	325	300
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	54	332	27	353	326
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1378	345			359	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1378	345			359	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	81	92			71	
cM capacity (veh/h)	113	698			1200	

Direction, Lane #	WB 1	WB 2	NB 1	SB 1	SB 2
Volume Total	22	54	359	353	326
Volume Left	22	0	0	353	0
Volume Right	0	54	27	0	0
cSH	113	698	1700	1200	1700
Volume to Capacity	0.19	0.08	0.21	0.29	0.19
Queue Length 95th (ft)	17	6	0	31	0
Control Delay (s)	44.5	10.6	0.0	9.2	0.0
Lane LOS	E	B		A	
Approach Delay (s)	20.3		0.0	4.8	
Approach LOS	C				

Intersection Summary			
Average Delay	4.3		
Intersection Capacity Utilization	48.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	5	25	305	50	215	105
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	27	332	54	234	114
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	940	359			386	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	940	359			386	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	96			80	
cM capacity (veh/h)	234	686			1168	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	5	27	386	288	349
Volume Left	5	0	0	234	
Volume Right	0	27	54	0	
cSH	234	686	1700	1173	
Volume to Capacity	0.02	0.04	0.23	0.20	
Queue Length 95th (ft)	2	3	0	19	
Control Delay (s)	20.7	10.5	0.0	6.6	
Lane LOS	C	B		A	
Approach Delay (s)	12.2		0.0	6.6	
Approach LOS	B				

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	49.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations							
Volume (veh/h)	10	5	350	85	5	105	
Sign Control	Stop		Free			Free	
Grade	0%		0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	11	5	380	92	5	114	
Pedestrians							
Lane Width (ft)							
Walking Speed (ft/s)							
Percent Blockage							
Right turn flare (veh)							
Median type			None			None	
Median storage veh)							
Upstream signal (ft)							
pX, platoon unblocked							
vC, conflicting volume	552	427				473	
vC1, stage 1 conf vol							
vC2, stage 2 conf vol							
vCu, unblocked vol	552	427				473	
tC, single (s)	6.4	6.2				4.1	
tC, 2 stage (s)							
tF (s)	3.5	3.3				2.2	
p0 queue free %	98	99				100	
cM capacity (veh/h)	493	628				1089	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1
Volume Total	16	5	475	97	119
Volume Left	11	0	0	5	
Volume Right	0	5	95	0	
cSH	493	628	1700	1089	
Volume to Capacity	0.02	0.01	0.28	0.00	
Queue Length 95th (ft)	2	1	0	0	
Control Delay (s)	12.5	10.8	0.0	0.4	
Lane LOS	B	B		A	
Approach Delay (s)	11.9		0.0	0.4	
Approach LOS	B				

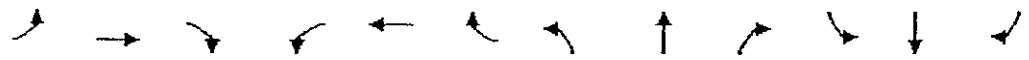
Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	33.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	190	1475	35	35	1525	40	40	5	30	40	20	230
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	1.00		1.00	1.00	0.85		1.00	0.85		0.89	
Flt Protected	0.95	1.00		0.95	1.00	1.00		0.96	1.00		0.99	
Satd. Flow (prot)	1770	3527		1770	3539	1583		1783	1583		1652	
Flt Permitted	0.95	1.00		0.95	1.00	1.00		0.36	1.00		0.95	
Satd. Flow (perm)	1770	3527		1770	3539	1583		672	1583		1581	
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)	207	1603	38	38	1658	43	43	5	33	43	22	250
RTOR Reduction (vph)	0	1	0	0	0	14	0	0	27	0	109	0
Lane Grp Flow (vph)	207	1640	0	38	1658	29	0	48	6	0	206	0
Turn Type	Prot			Prot		Perm	Perm		Perm	Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases						6	8		8	4		
Actuated Green, G (s)	19.0	81.2		4.2	67.4	67.4		22.6	22.6		22.6	
Effective Green, g (s)	19.0	82.2		5.2	68.4	68.4		22.6	22.6		22.6	
Actuated g/C Ratio	0.16	0.67		0.04	0.56	0.56		0.19	0.19		0.19	
Clearance Time (s)	5.0	5.0		5.0	5.0	5.0		5.0	5.0		5.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0	3.0		3.0	3.0		3.0	
Lane Grp Cap (vph)	276	2376		75	1984	888		124	293		293	
v/s Ratio Prot	c0.12	0.46		0.02	c0.47							
v/s Ratio Perm						0.02		0.07	0.00		c0.13	
v/c Ratio	0.75	0.69		0.51	0.84	0.03		0.39	0.02		0.70	
Uniform Delay, d1	49.2	12.1		57.1	22.2	12.0		43.6	40.7		46.6	
Progression Factor	1.00	1.00		1.00	1.00	1.00		1.00	1.00		1.00	
Incremental Delay, d2	10.9	0.9		5.3	3.2	0.0		8.9	0.1		13.2	
Delay (s)	60.1	13.0		62.4	25.4	12.0		52.5	40.8		59.8	
Level of Service	E	B		E	C	B		D	D		E	
Approach Delay (s)		18.3			25.9			47.7			59.8	
Approach LOS		B			C			D			E	

Intersection Summary			
HCM Average Control Delay	25.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.79		
Actuated Cycle Length (s)	122.0	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			

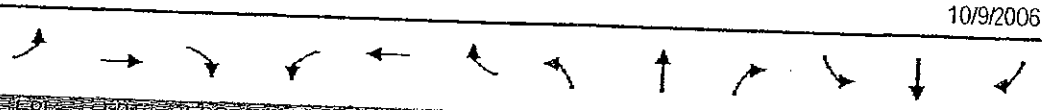
HCM Signalized Intersection Capacity Analysis
3: RT 340 & RT 27

1/16/2007



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	980	205	225	1445	115	665	45	685	90	35	135
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	3.0		4.0	5.0
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	0.95	0.95	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	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (prot)	1770	3539	1583	3433	3539	1583	1681	1696	1583		1798	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	0.96	1.00		0.97	1.00
Satd. Flow (perm)	1770	3539	1583	3433	3539	1583	1681	1696	1583		1798	1583
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)	98	1065	223	245	1571	125	723	49	745	98	38	147
RTOR Reduction (vph)	0	0	80	0	0	46	0	0	0	0	0	82
Lane Group Flow (vph)	98	1065	143	245	1571	79	723	49	745	0	136	65
Turn Type	Prot		pm+ov	Prot		pm+ov	Split		Free	Split		Perm
Protected Phases	5	2	3	1	6	4	8	8		7	4	
Permitted Phases			2			6			Free			4
Actuated Green, G (s)	8.0	46.4	74.9	11.6	52.0	65.5	28.5	28.5	120.0		13.5	13.5
Effective Green, g (s)	7.0	47.4	76.9	12.6	53.0	67.5	29.5	29.5	120.0		14.5	13.5
Actuated g/C Ratio	0.06	0.39	0.64	0.10	0.44	0.56	0.25	0.25	1.00		0.12	0.11
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0			5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0			3.0	3.0
Lane Grp Cap (vph)	103	1398	1014	360	1563	943	413	417	1583		217	178
v/s Ratio Prot	c0.06	0.30	0.03	0.07	c0.44	0.01	0.23	c0.03			c0.08	0.04
v/s Ratio Perm			0.06			0.04			0.47			0.04
v/c Ratio	0.95	0.76	0.14	0.68	1.01	0.08	0.98	0.93	0.47		0.63	0.37
Uniform Delay, d1	56.3	31.4	8.5	51.8	33.5	12.0	44.2	44.3	0.0		50.2	49.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	72.8	4.0	0.1	5.2	24.0	0.0	14.1	14.8	0.4		5.6	1.3
Delay (s)	129.1	35.4	8.6	57.0	57.5	12.1	58.2	59.1	0.4		55.7	50.6
Level of Service	F	D	A	E	E	B	E	E	A		E	D
Approach Delay (s)		37.7			54.5			30.1			53.1	
Approach LOS		D			D			C			D	

Intersection Summary			
HCM Average Control Delay	42.7	HCM Level of Service	D
HCM Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	81.2%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	35	1165	5	0	1765	395	5	1	5	145	5	30
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	0.95			0.95	1.00		1.00			1.00	
Frt	1.00	1.00			1.00	0.85		0.94			0.98	
Flt Protected	0.95	1.00			1.00	1.00		0.98			0.96	
Satd. Flow (prot)	1770	3537			3539	1583		1710			1750	
Flt Permitted	0.95	1.00			1.00	1.00		0.90			0.76	
Satd. Flow (perm)	1770	3537			3539	1583		1578			1384	
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)	38	1266	5	0	1918	429	5	1	5	158	5	33
RTOR Reduction (vph)	0	0	0	0	0	151	0	4	0	0	8	0
Lane Group Flow (vph)	38	1271	0	0	1918	278	0	2	0	158	30	0
Turn Type	Prot					Perm	Perm				Perm	
Protected Phases	5	2			6			8			4	
Permitted Phases						6	8			4		
Actuated Green, G (s)	7.1	62.0			54.0	54.0		19.3			19.3	
Effective Green, g (s)	3.1	58.0			50.9	50.9		15.3			15.3	
Actuated g/C Ratio	0.04	0.71			0.63	0.63		0.19			0.19	
Clearance Time (s)	5.0	5.0			5.0	5.0		5.0			5.0	
Vehicle Extension (s)	3.0	3.0			3.0	3.0		3.0			3.0	
Lane Grp Cap (vph)	67	2523			2216	991		297			260	
v/s Ratio Prot	0.02	c0.36			c0.54							
v/s Ratio Perm						0.18		0.00			c0.14	
v/c Ratio	0.57	0.50			0.87	0.28		0.01			0.12	
Uniform Delay, d1	38.4	5.2			12.4	6.9		26.9			31.0	
Progression Factor	1.00	1.00			1.00	1.00		1.00			1.00	
Incremental Delay, d2	10.6	0.2			3.8	0.2		0.0			0.5	
Delay (s)	49.0	5.4			16.2	7.0		26.9			31.5	
Level of Service	D	A			B	A		C			C	
Approach Delay (s)		6.6			14.5			26.9			31.5	
Approach LOS		A			B			C			C	

Intersection Summary			
HCM Average Control Delay	13.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	81.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	72.2%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	185	740	655	40	160	305
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	1.00	1.00	0.97	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	1583	1863	1583	3433	1863
Flt Permitted	0.95	1.00	1.00	1.00	0.09	1.00
Satd. Flow (perm)	1770	1583	1863	1583	336	1863
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	201	804	712	43	174	332
RTOR Reduction (vph)	0	65	0	12	0	0
Lane Group Flow (vph)	201	739	712	31	174	332
Turn Type		pm+ov		Perm	pm+pt	
Protected Phases	7	8	2		1	6
Permitted Phases		8		2	6	
Actuated Green, G (s)	16.6	54.8	53.2	53.2	95.4	95.4
Effective Green, g (s)	16.6	54.8	53.2	53.2	95.4	95.4
Actuated g/C Ratio	0.14	0.46	0.44	0.44	0.80	0.80
Clearance Time (s)	5.0	5.0	5.0	5.0	5.0	5.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	245	776	826	702	1253	1481
v/s Ratio Prot	c0.11	c0.39	c0.38		0.00	0.18
v/s Ratio Perm		0.16		0.02	0.07	
v/c Ratio	0.82	0.95	0.86	0.04	0.14	0.22
Uniform Delay, d1	50.3	31.4	30.1	19.0	11.7	3.1
Progression Factor	1.00	1.00	1.00	1.00	4.76	0.56
Incremental Delay, d2	19.3	21.4	11.5	0.1	0.0	0.3
Delay (s)	69.5	52.8	41.6	19.1	55.8	2.1
Level of Service	E	D	D	B	E	A
Approach Delay (s)	56.1		40.5		20.6	
Approach LOS	E		D		C	

Intersection Summary			
HCM Average Control Delay	42.9	HCM Level of Service	D
HCM Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	120.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.0%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	20	85	610	25	100	390
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	92	663	27	109	424
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						603
pX, platoon unblocked	0.99					
vC, conflicting volume	1318	677			690	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1315	677			690	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	86	80			88	
cM capacity (veh/h)	161	453			907	

Direction, Lane #	WB 1	NB 1	NB 2	SB 1
Volume Total	114	690	109	424
Volume Left	22	0	109	0
Volume Right	92	27	0	0
cSH	328	1700	904	1700
Volume to Capacity	0.35	0.41	0.12	0.25
Queue Length 95th (ft)	38	0	10	0
Control Delay (s)	21.7	0.0	9.5	0.0
Lane LOS	C		A	
Approach Delay (s)	21.7	0.0	1.9	
Approach LOS	C			

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	55.5%	ICU Level of Service	B
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	20	295	340	25	65	345
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	321	370	27	71	375
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	899	383			397	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	899	383			397	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	93	52			94	
cM capacity (veh/h)	290	664			1162	

Direction, Lane #	WB 1	NB 1	SB 1	SB 2
Volume Total	22	321	397	71	375
Volume Left	22	0	0	71	0
Volume Right	0	321	27	0	0
cSH	290	664	1700	1162	1700
Volume to Capacity	0.07	0.48	0.23	0.06	0.22
Queue Length 95th (ft)	6	66	0	5	0
Control Delay (s)	18.4	15.4	0.0	8.3	0.0
Lane LOS	C	C		A	
Approach Delay (s)	15.6		0.0	1.3	
Approach LOS	C				

Intersection Summary				
Average Delay	5.0			
Intersection Capacity Utilization	44.3%	ICU Level of Service		A
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	45	170	195	5	40	325
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	49	185	212	5	43	353
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	835	215			217	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	655	215			217	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	78			97	
cM capacity (veh/h)	417	825			1352	

Direction, Lane #	WB 1	WB 2	NB 1	NB 2	SB 1	SB 2
Volume Total	49	185	217	397		
Volume Left	49	0	0	43		
Volume Right	0	185	5	0		
cSH	417	825	1700	1352		
Volume to Capacity	0.12	0.22	0.13	0.03		
Queue Length 95th (ft)	10	21	0	2		
Control Delay (s)	14.8	10.6	0.0	1.1		
Lane LOS	B	B		A		
Approach Delay (s)	11.5		0.0	1.1		
Approach LOS	B					

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	43.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (veh/h)	75	25	175	15	5	365
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	82	27	190	16	5	397
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	606	198			207	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	606	198			207	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	82	97			100	
cM capacity (veh/h)	458	843			1365	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	107	207	402
Volume Left	82	0	5
Volume Right	25	16	0
cSH	458	1700	1365
Volume to Capacity	0.23	0.12	0.00
Queue Length 95th (ft)	16	0	0
Control Delay (s)	14.5	0.0	0.1
Lane LOS	B		A
Approach Delay (s)	13.3	0.0	0.1
Approach LOS	B		

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	34.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Volume (veh/h)	20	5	5	115	365	5
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	22	5	5	125	397	5
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	935	399	402			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	535	399	402			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	96	99	100			
cM capacity (veh/h)	504	630	1156			

Volume Total	27	130	402			
Volume Left	22	5	0			
Volume Right	5	0	5			
cSH	527	1156	1700			
Volume to Capacity	0.05	0.00	0.24			
Queue Length 95th (ft)	4	0	0			
Control Delay (s)	12.2	0.4	0.0			
Lane LOS	B	A				
Approach Delay (s)	12.2	0.4	0.0			
Approach LOS	B					

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	29.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↰	↱		↔			↰	↦
Volume (vph)	40	400	20	10	890	250	10	5	5	280	5	105
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		4.0			4.0	4.0		4.0			4.0	4.0
Lane Util. Factor		1.00			1.00	1.00		1.00			1.00	1.00
Frt		0.99			1.00	0.85		0.97			1.00	0.86
Flt Protected		1.00			1.00	1.00		0.97			0.95	1.00
Satd. Flow (prot)		1844			1862	1583		1757			1770	1595
Flt Permitted		0.63			0.99	1.00		0.89			0.74	1.00
Satd. Flow (perm)		1162			1853	1583		1607			1385	1595
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)	43	435	22	11	967	272	11	5	5	304	5	114
RTOR Reduction (vph)	0	2	0	0	0	107	0	4	0	0	82	0
Lane Group Flow (vph)	0	498	0	0	978	165	0	17	0	309	37	0
Turn Type	Perm			Perm		Perm	Perm			Perm		
Protected Phases		6			2			4			8	
Permitted Phases	6			2		2	4			8		
Actuated Green, G (s)		44.4			44.4	44.4		20.6			20.6	20.6
Effective Green, g (s)		44.4			44.4	44.4		20.6			20.6	20.6
Actuated g/C Ratio		0.61			0.61	0.61		0.28			0.28	0.28
Clearance Time (s)		4.0			4.0	4.0		4.0			4.0	4.0
Vehicle Extension (s)		3.0			3.0	3.0		3.0			3.0	3.0
Lane Grp Cap (vph)		707			1127	963		453			391	450
v/s Ratio Prot												0.02
v/s Ratio Perm		0.43			c0.53	0.10		0.01			c0.22	
v/c Ratio		0.70			0.87	0.17		0.04			0.79	0.08
Uniform Delay, d1		9.8			11.9	6.3		19.0			24.1	19.3
Progression Factor		1.00			1.00	1.00		1.00			1.00	1.00
Incremental Delay, d2		3.2			7.3	0.1		0.0			9.4	0.1
Delay (s)		13.0			19.1	6.3		19.0			33.5	19.3
Level of Service		B			B	A		B			C	B
Approach Delay (s)		13.0			16.3			19.0			29.5	
Approach LOS		B			B			B			C	

Intersection Summary			
HCM Average Control Delay	18.1	HCM Level of Service	B
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	73.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	84.5%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX F
SIGNAL WARRANT ANALYSIS
(Peak Hour Warrant)

Greenhorne & O'Mara

Route 27/Route 9

Signal Warrant Analysis

Study Name : Route 27 @ Route 9
Study Date : 10/06/06
Page No. : 1

Signal Warrants - Summary

Major Street Approaches

Northbound: Route 9
Number of Lanes: 1
Approach Speed: 35
Total Approach Volume: 1,710

Southbound: Route9
Number of Lanes: 1
Approach Speed: 35
Total Approach Volume: 940

Minor Street Approaches

Eastbound: Route 27
Number of Lanes: 1

Total Approach Volume: 40

Westbound: Route 27
Number of Lanes: 1

Total Approach Volume: 475

Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Not Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Not Satisfied**
Required volumes reached for 2 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Not Satisfied**
Number of hours (1) volumes exceed minimum < minimum required (4).

Warrant 3 - Peak Hour ..... **Satisfied**

Warrant 3A - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 3B - Peak Hour Volumes ..... **Satisfied**
Volumes exceed minimums for at least one hour.

Warrant 4 - Pedestrian Volumes ..... **Not Satisfied**
Required 4 Hr pedestrian volume reached for 0 hour(s) and the single hour volume for 0 hour(s)

Warrant 5 - School Crossing ..... **Not Satisfied**
Number of gaps > .0 seconds (0) exceeds the number of minutes in the crossing period (0).

Warrant 6 - Coordinated Signal System ..... **Not Satisfied**
No adjacent coordinated signals are present

Warrant 7 - Crash Experience ..... **Not Satisfied**
Number of accidents (-1) is less than minimum (5). Volume minimums are not met.

Warrant 8 - Roadway Network ..... **Not Satisfied**
Major Route conditions not met. One or more volume requirement met.

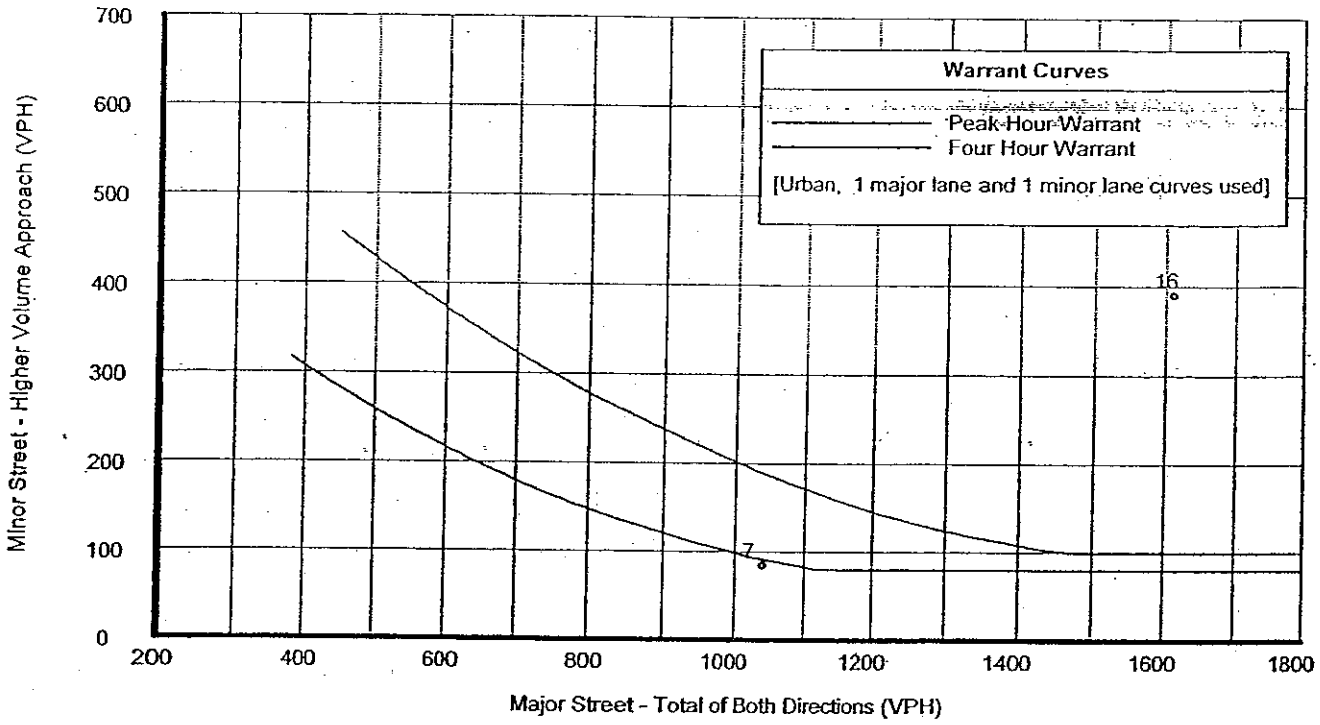
Greenhorne & O'Mara

Route 27/Route 9

Signal Warrant Analysis

Study Name : Route 27 @ Route 9
Study Date : 10/06/06
Page No. : 2

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

Hour Begin	Major Total	Higher Minor Vol	Dir	War-1A Major Crit	War-1A Minor Crit	War-1A Meets?	War-1B Major Crit	War-1B Minor Crit	War-1B Meets?	War-1A&B Major Crit	War-1A&B Minor Crit	War-1A&B Meets?
00:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
01:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
02:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
03:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
04:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
05:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
06:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
07:00	1,040	85	WB	500-Yes	150-No	Major	750-Yes	75-Yes	Both	600-Yes	120-No	Major
08:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
09:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
10:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
11:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
12:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
13:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
14:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
15:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
16:00	1,610	390	WB	500-Yes	150-Yes	Both	750-Yes	75-Yes	Both	600-Yes	120-Yes	Both
17:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
18:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
19:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
20:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
21:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
22:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—
23:00	0	0	EB	500-No	150-No	—	750-No	75-No	—	600-No	120-No	—

Greenhorne & O'Mara

US 340/Route 27

Signal Warrant Analysis

Study Name : US 340 @ Route 27
Study Date : 10/06/06
Page No. : 1

Signal Warrants - Summary

Major Street Approaches

Eastbound: US 340
Number of Lanes: 2
Approach Speed: 41
Total Approach Volume: 3,065

Westbound: US 340
Number of Lanes: 2
Approach Speed: 65
Total Approach Volume: 3,685

Minor Street Approaches

Northbound: Route 27
Number of Lanes: 2
Total Approach Volume: 1,715

Southbound: Route 27
Number of Lanes: 1
Total Approach Volume: 425

Warrant Summary (Rural values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Not Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Not Satisfied**
Required volumes reached for 2 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Not Satisfied**
Required volumes reached for 2 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Not Satisfied**
Required volumes reached for 2 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Not Satisfied**
Number of hours (2) volumes exceed minimum < minimum required (4).

Warrant 3 - Peak Hour ..... **Satisfied**

Warrant 3A - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 3B - Peak Hour Volumes ..... **Satisfied**
Volumes exceed minimums for at least one hour.

Warrant 4 - Pedestrian Volumes ..... **Not Satisfied**
Required 4 Hr pedestrian volume reached for 0 hour(s) and the single hour volume for 0 hour(s)

Warrant 5 - School Crossing ..... **Not Satisfied**
Number of gaps > .0 seconds (0) exceeds the number of minutes in the crossing period (0).

Warrant 6 - Coordinated Signal System ..... **Not Satisfied**
No adjacent coordinated signals are present

Warrant 7 - Crash Experience ..... **Not Satisfied**
Number of accidents (-1) is less than minimum (5). Volume minimums are not met.

Warrant 8 - Roadway Network ..... **Not Satisfied**
Major Route conditions not met. One or more volume requirement met.

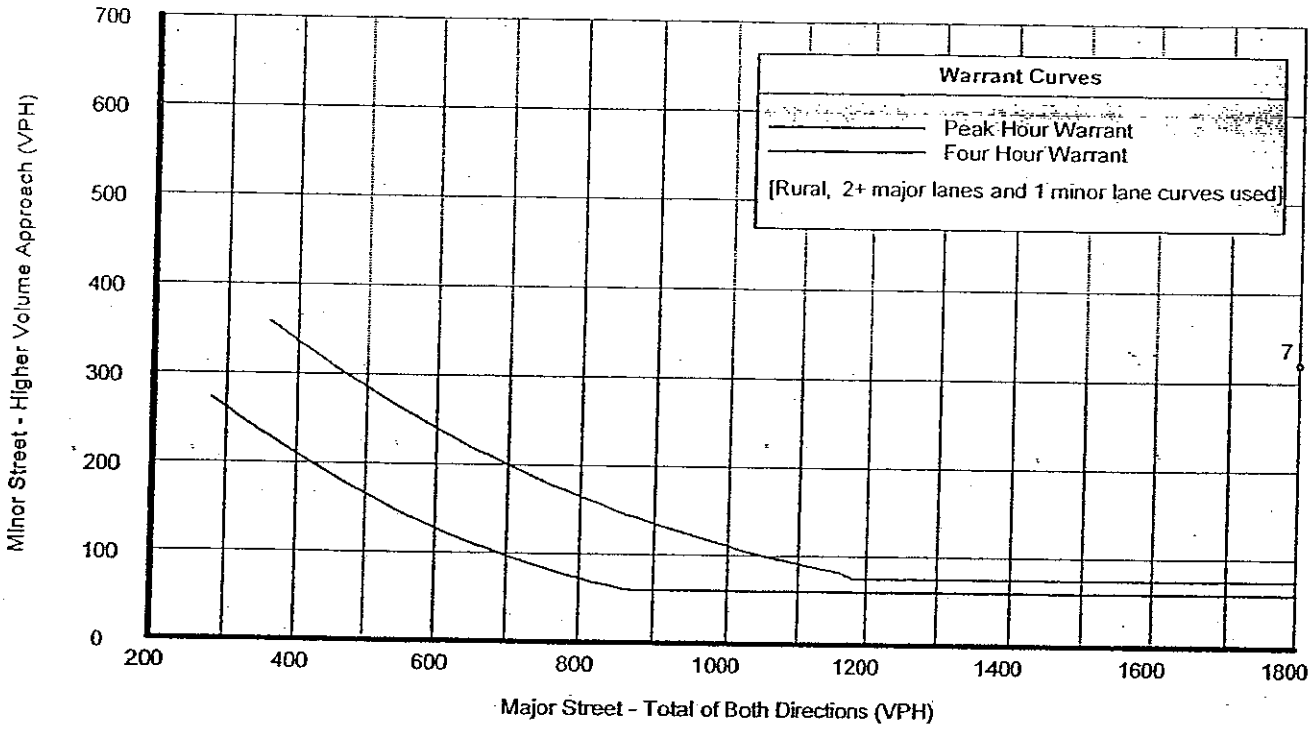
Greenhorne & O'Mara

US 340/Route 27

Signal Warrant Analysis

Study Name : US 340 @ Route 27
Study Date : 10/06/06
Page No. : 2

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

Hour Begin	Major Total	Higher Minor Vol	Higher Minor Dir	War-1A Major Crit	War-1A Minor Crit	War-1A Meets?	War-1B Major Crit	War-1B Minor Crit	War-1B Meets?	War-1A&B Major Crit	War-1A&B Minor Crit	War-1A&B Meets?
00:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
01:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
02:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
03:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
04:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
05:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
06:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
07:00	3,180	320	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
08:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
09:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
10:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
11:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
12:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
13:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
14:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
15:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
16:00	3,570	1,395	NB	420-Yes	105-Yes	Both	630-Yes	52-Yes	Both	504-Yes	84-Yes	Both
17:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
18:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
19:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
20:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
21:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
22:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—
23:00	0	0	NB	420-No	140-No	—	630-No	70-No	—	504-No	112-No	—

Greenhorne & O'Mara

Route 27/Northern Access (1)

Signal Warrant Analysis

Signal Warrants - Summary

Study Name : Route 27 @ Northern Access (1)
Study Date : 10/06/06
Page No. : 1

Major Street Approaches

Northbound: Route 27
Number of Lanes: 1
Approach Speed: 0
Total Approach Volume: 1,100

Southbound: Route 27
Number of Lanes: 2
Approach Speed: 0
Total Approach Volume: 1,960

Minor Street Approaches

Eastbound:
Number of Lanes: 1
Total Approach Volume: 0

Westbound: Nothern Site Access
Number of Lanes: 2
Total Approach Volume: 1,070

Warrant Summary (Urban values apply.)

Warrant 1 - Eight Hour Vehicular Volumes ..... **Not Satisfied**

Warrant 1A - Minimum Vehicular Volume ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic ..... **Not Satisfied**
Required volumes reached for 2 hours, 8 are needed

Warrant 1 A&B - Combination of Warrants ..... **Not Satisfied**
Required volumes reached for 1 hours, 8 are needed

Warrant 2 - Four Hour Volumes ..... **Not Satisfied**
Number of hours (2) volumes exceed minimum < minimum required (4).

Warrant 3 - Peak Hour ..... **Satisfied**

Warrant 3A - Peak Hour Delay ..... **Not Satisfied**
Total approach volumes and delays on minor street do not exceed minimums for any hour.

Warrant 3B - Peak Hour Volumes ..... **Satisfied**
Volumes exceed minimums for at least one hour.

Warrant 4 - Pedestrian Volumes ..... **Not Satisfied**
Required 4 Hr pedestrian volume reached for 0 hour(s) and the single hour volume for 0 hour(s)

Warrant 5 - School Crossing ..... **Not Satisfied**
Number of gaps > .0 seconds (0) exceeds the number of minutes in the crossing period (0).

Warrant 6 - Coordinated Signal System ..... **Not Satisfied**
No adjacent coordinated signals are present

Warrant 7 - Crash Experience ..... **Not Satisfied**
Number of accidents (-1) is less than minimum (5). Volume minimums are not met.

Warrant 8 - Roadway Network ..... **Not Satisfied**
Major Route conditions not met. One or more volume requirement met.

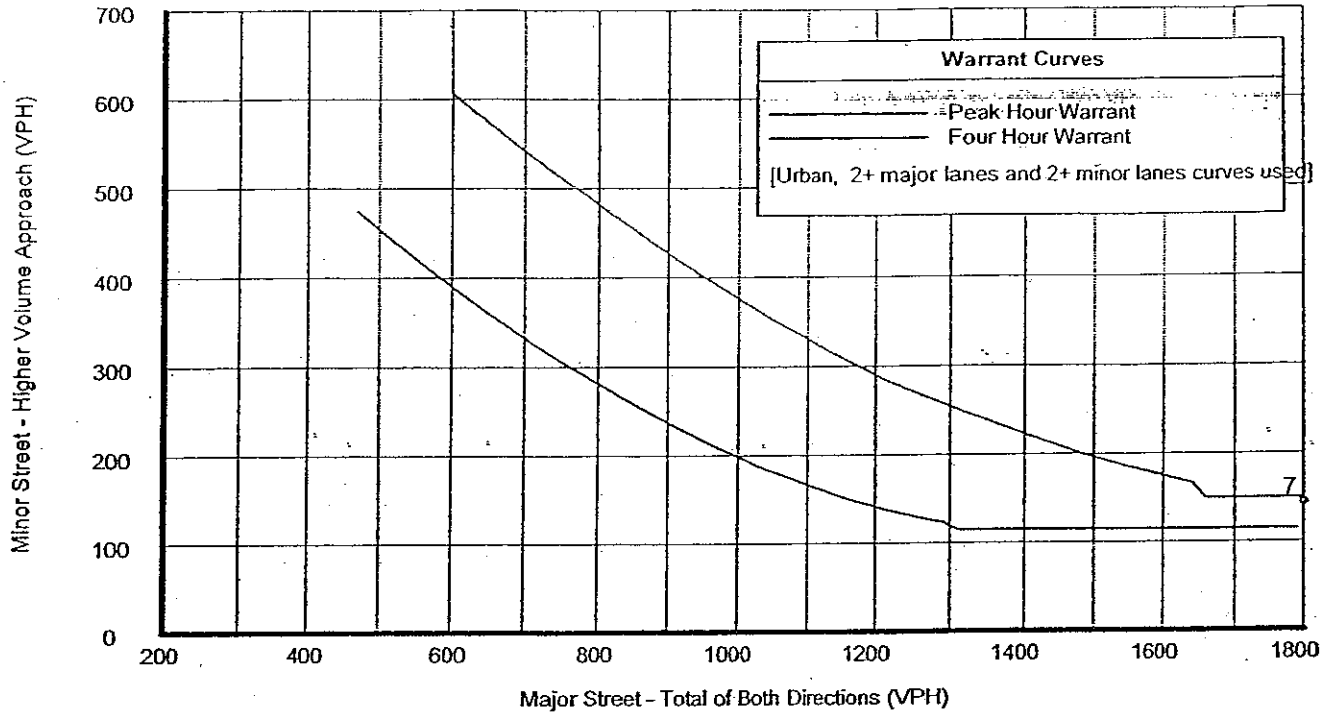
Greenhorne & O'Mara

Route 27/Northern Access (1)

Signal Warrant Analysis

Study Name : Route 27 @ Northern Access (1)
Study Date : 10/06/06
Page No. : 2

Signal Warrants - Summary



Analysis of 8-Hour Volume Warrants:

Hour Begin	Major Total	Higher Minor Vol	Dir	War-1A Major Crit	War-1A Minor Crit	War-1A Meets?	War-1B Major Crit	War-1B Minor Crit	War-1B Meets?	War-1A&B Major Crit	War-1A&B Minor Crit	War-1A&B Meets?
00:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
01:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
02:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
03:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
04:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
05:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
06:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
07:00	1,900	145	WB	600-Yes	200-No	Major	900-Yes	100-Yes	Both	720-Yes	160-No	Major
08:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
09:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
10:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
11:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
12:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
13:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
14:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
15:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
16:00	1,160	925	WB	600-Yes	200-Yes	Both	900-Yes	100-Yes	Both	720-Yes	160-Yes	Both
17:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
18:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
19:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
20:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
21:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
22:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—
23:00	0	0	EB	600-No	200-No	—	900-No	100-No	—	720-No	160-No	—

Discussions with the West Virginia Department of Highways and Jefferson County Planning Office indicate that a three and half percent (3.5%) annual growth rate is anticipated in this area. Thus, because the Old Standard LLC Quarry development is expected to be completed in 5 years, traffic volumes were projected for the year 2011. Figure 4 presents the Background Growth Volumes.

The following background developments were included as part of the background conditions analysis:

Table 2. Background Developments Trip Generation

Development Name	Land Use	Size	Unit	Daily	AM Peak			PM Peak		
					In	Out	Total	In	Out	Total
Sheridan Subdivision	Single Family Home (210)	131	Units	1,333	25	76	101	86	51	137
Jefferson Crossing	Motel (320)	80	Rooms	465	13	23	36	28	24	51
	Retail (820)	152000	SF	8,915	123	78	201	396	429	825
	Resturant (932)	10000	SF	1272	60	55	115	67	43	109
	Bank w/i Drive-Thru (912)	2400	SF	694	17	13	30	55	55	110
	Resturant (934)	3000	SF	1488	81	78	159	54	50	104
Total				**12,834**	**294**	**248**	**542**	**599**	**600**	**1,199**
Beallair Phase II	Active Adult Home	49	Units		5	14	19	11	10	21
Windmill Crossings	Townhomes (230)	140	Units	854	11	56	68	53	26	79
	Codos (230)	60	Units	416	6	28	34	26	13	40
	Medical Office (720)	13,200	SF	540	26	7	33	13	35	48
Total				**1,810**	**43**	**91**	**135**	**93**	**74**	**167**
Background Total				**15,977**	**362**	**415**	**777**	**778**	**725**	**1,503**

The number of vehicle-trips generated by these background developments was estimated based on the rates documented in Trip Generation, by the Institute of Transportation Engineers (ITE), Seventh Edition, 2003. Table 2, above, presents the estimated peak hour vehicle-trips generated by each development

As can be see from Table 2, the four background developments are expected to generate approximately 775 vehicle trips during the AM peak hour and approximately 1,505 trips during the PM peak hour. It has been assumed that all of these developments will be built and fully occupied by the year 2011 which coincides with the buildout of the Old Standard LLC Quarry development.

The traffic studies completed for all the background developments were obtained from the Jefferson County Planning office. The trip distribution and assignments presented in their individual traffic studies was used to assign the trips impacting the study intersections. The trip distribution/assignments for all the background developments are included in Appendix C. Figure 5 presents the total background development volumes. These volumes were added to the Background Growth Volume presented in Figure 4 to determine the Total Background Volumes presented in Figure 6.

Figure 6 presents the Background Volumes, lane geometries, and LOS results. Background conditions were evaluated using the volumes presented in Figure 6 and Synchro to determine the LOS. Table 3 presents the LOS results.

Table 3. Background LOS Results

Intersection	Existing		Background	
	AM Peak	PM Peak	AM Peak	PM Peak
US 340/US 340 Alt	B (14.7)	B (18.4)	B (15.4)	C (21.9)
US 340/Route 27				
NB LT	c (22.1)	f (981.8)	f (53.3)	f (-)
SB LT	e (45.8)	f (-)	f (271.5)	f (-)
EB LT	a (8.7)	b (12.9)	a (9.5)	c (18.2)
WB LT	a (9.6)	a (9.7)	b (10.9)	b (11.1)
US 340/Route 230				
NB LT	d (26.8)	c (15.1)	e (35.5)	f (97.9)
SB LT	f (80.3)	f (133.3)	f (661.5)	f (-)
EB LT	a (8.6)	b (11.5)	a (9.3)	c (15.5)
With signalization			***B (11.6)***	***A (9.5)***
Route 27/Route 23				
NB LT	a (-)	a (-)	a (-)	a (-)
EB LT	a (8.4)	a (8.8)	a (8.8)	a (8.9)
Route 9/Route 27				
NB LT	a (-)	a (-)	a (-)	a (0.3)
SB LT	a (-)	a (0.3)	a (-)	a (0.6)
EB LT	b (13.7)	d (30.9)	c (16.2)	f (50.9)
WB LT	b (14.1)	e (39.2)	c (16.2)	f (80.7)

X (00.0) = signalized intersection LOS (delay)
x (00.0) = unsignalized intersection critical movement LOS (delay)

As can be seen in Table 3, the signalized intersection of US 340/US 340 alternate is expected to operate at LOS C or better during the peak hours. Furthermore, it is our understanding that the US 340/Route 230 intersection is to be signalized as part of the Sheridan Subdivision Development. As a signalized intersection, it is expected to operate at LOS B or better during the peak hours.

The left turns from the minor street at the US 340/Route 27 intersection are expected to experience lengthy delays and operate at LOS F during the peak hours. Similarly, all movements at the Route 9/Route 27 intersection are expected to operate at LOS C or better with the exception of the left turn movement from Route 27 which is expected to operate at LOS F during the PM peak hour. All movements at the strop sign controlled Route 27/Route 23 intersection are expected to continue operating at LOS A during both the AM and PM peak hours.

It is our understanding that there are no other improvements being made in the study area. Appendix D contains the analysis worksheets.

IV. PROPOSED PROJECT TRAFFIC

As currently proposed, the site will consist of office space, warehousing, restaurant, and a hotel with conference facility. This development is expected to be built out and fully occupied by 2011.

This development proposes five access points along Route 27. Since the site is divided into two pads due to the Old Standard Quarry Lake, the northernmost access will serve the eastern pad. The access point just south of the northernmost access is expected to serve the hotel/conference center and the restaurant. The three southern accesses will serve the remaining western pad site.

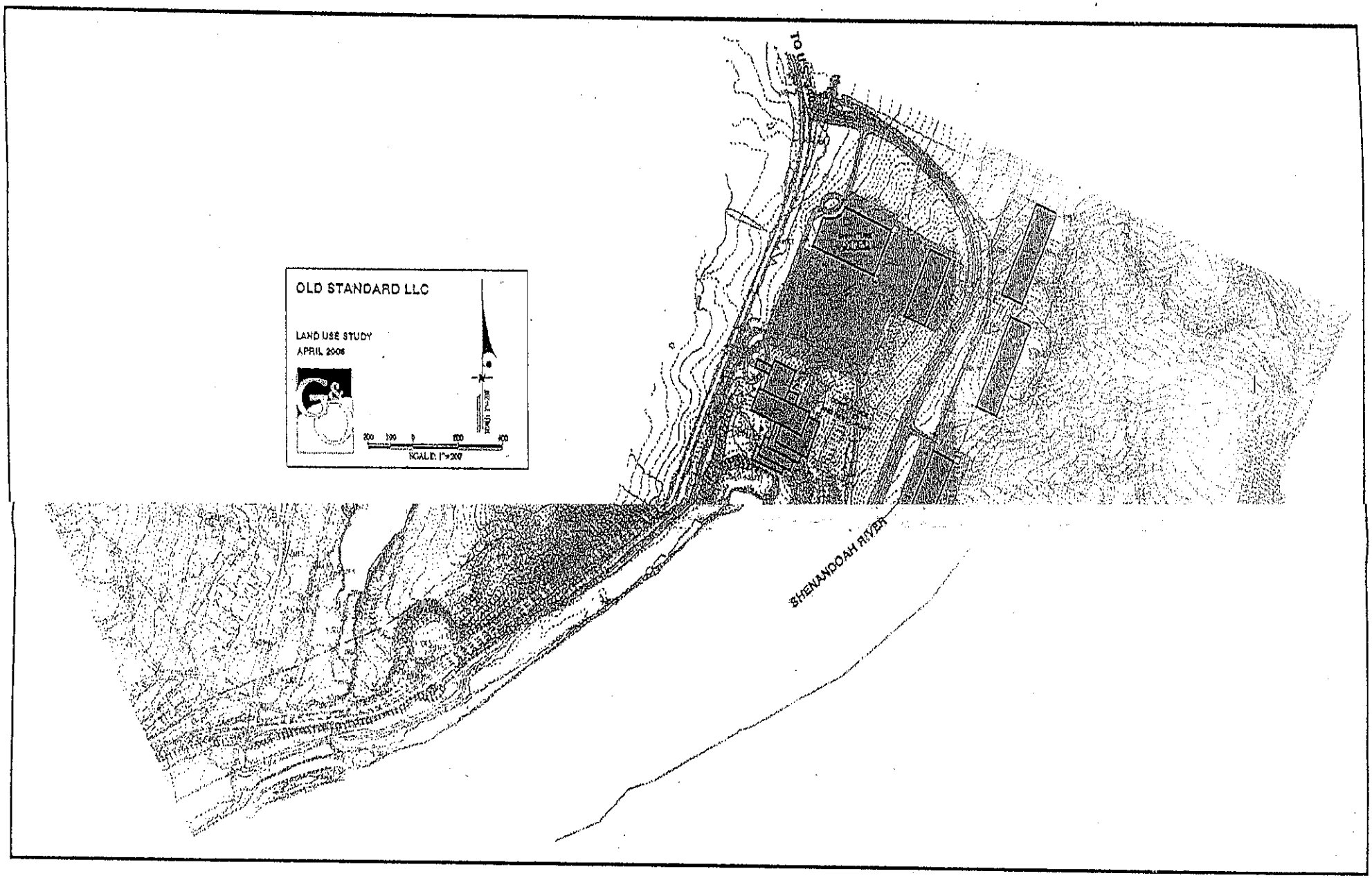


Figure 2. Conceptual Site Plan
Old Standard LLC Quarry Development

Route 27 is a two lane north-south roadway with abuts the west side of the site. This roadway extends from south of Route 9 past US 340 to the north. The speed limit along this roadway is 30 miles per hour. This roadway has sharp horizontal curves near the site. All intersections along this roadway, in the vicinity of the site, are stop sign controlled. Near its intersection with Route 9, this roadway can only allow one lane of traffic at a time for approximately 50 feet over a structure which is too narrow provide two travel lanes. There are signs posted along both sides of the structure warning of the one lane section.

Route 230 is a two lane roadway which extends from US 340 to north towards Shepherdstown. It provides access to various residential as well as institutional developments located along it. In particular it provides access to the Sheridan Subdivision, which is a proposed residential development that has been approved by the Jefferson County planning board. As part of the Sheridan Subdivision improvements, a traffic signal is expected to be installed at the US 340/Route 230 intersection.

Route 9 is a two lane roadway extending through Charlestown to the north and crossing the Shenandoah River and traveling south towards the DC area. The posted speed limit along this roadway is 35 mph. Its intersection with Route 27 is stop sign controlled on Route 27 such that Route 9 has the right of way.

B. Existing Volumes and Traffic Operations

In August of 2006, Friday AM and PM peak hour turning movement volumes were recorded at the following intersections:

- US 340/US 340 Alternate
- US 340/Route 27
- US 340/Route 230
- Route 27/Route 23
- Route 9/Route 27

These turning movement counts along with the existing lane geometry and levels of service are shown in Figure 3. The raw traffic count data is included in Appendix A.

Existing traffic operations were evaluated at each intersection according to techniques documented in the Highway Capacity Manual, by the Transportation Research Board (TRB), 2000. The result of such an analysis is a level of service (LOS) rating, which is a qualitative assessment of the traffic flow based on the average stopped delay per vehicle at a controlled intersection. Levels of service are described by a letter designation ranging from "A" to "F", with LOS A representing essentially uninterrupted flow, and LOS F representing a breakdown of traffic flow with excessive congestion and delay. The signalized intersection capacity analysis results in an overall level of service, representative of all movements through the intersection. The unsignalized intersection capacity analysis produces LOS results for each movement which must yield to conflicting traffic at the intersection. Per the WVDOH guidelines, the LOS of the study intersections should be not worse than the LOS before the new facility opens.

Synchro, a traffic analysis software which analyzes signalized and unsignalized roadway networks, was used for the operational analysis. All the signal timings have been optimizedusing Synchro; however, the results presented in the report are HCS outputs. The analysis worksheets are included in Appendix B. Figure 3 graphically presents the Existing Friday peak hour traffic volumes, lane geometries, and LOS results. Table 1 presents the existing LOS results.

Table 1. Existing Level Of Service Results

Intersection	Peak Hour Level of Service	
	AM Peak	PM Peak
US 340/US 340 Alt	B (14.7)	B (18.4)
US 340/Route 27		
NB LT	a (22.1)	f (-)
SB LT	e (45.8)	f (-)
EB LT	a (8.7)	b (12.9)
WB LT	a (9.6)	a (9.7)
US 340/Route 230		
NB LT	d (26.8)	c (15.1)
SB LT	f (80.3)	f (133.3)
EB LT	a (8.6)	b (11.5)
Route 27/Route 23		
NB LT	a(0.7)	a (1.5)
EB LT	a (8.4)	a (8.8)
Route 7/Route 27		
NB LT	a (-)	a (-)
SB LT	a (-)	a (0.3)
EB LT	b (13.7)	d (30.9)
WB LT	b (14.1)	e (39.2)

X (00.0) = signalized intersection LOS (delay in seconds)
x (00.0) = unsignalized intersection critical movement LOS (delay in seconds)
- = HCS does not report delay (delay is very long)

As presented in Figure 3, the signalized intersection of US 340/US 340 Alt operates at LOS B during both the AM and PM peak hour. All movements at the unsignalized intersection of US 340/Route 27 operate at LOS D or better with the exception of the left turn movements from Route 27 which are expected to experience LOS E or F conditions during the peak hours.

Similarly, all the movements at the unsignalized intersection of US 340/Route 230 are expected to operate at acceptable LOS with the exception of the left turn movement from the Route 230 which is expected to operate at LOS F during both the AM and PM peak hours.

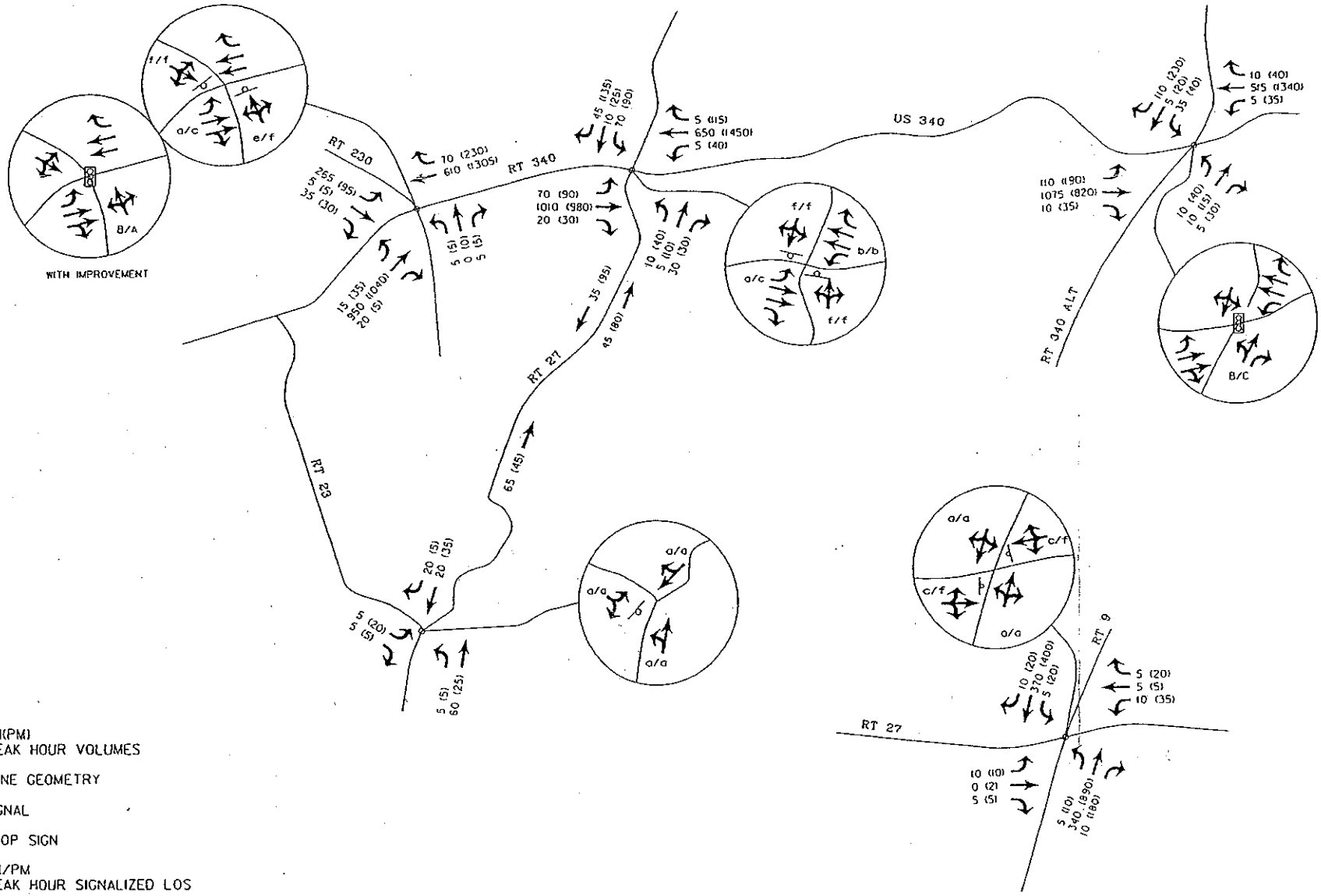
All movements at the stop-sign controlled intersection of Route 27/Route 23 operate at LOS A during the peak hours. Similarly all movements at the unsignalized intersection of Route 9/Route 27 operate at LOS D or better with the exception of the left turn movement from westbound Route 27 which operates at LOS E during the PM peak hour.

Overall, the study area intersections generally do not have capacity problems during the weekday peak hours with the exception of the minor street left turn movements along US 340. It is fairly common for left turn movements along high volume roadway to have long delays during peak hours.

III. FUTURE CONDITIONS WITHOUT PROPOSED DEVELOPMENT

Background traffic is the projected traffic volumes on the roadway network at the time of completion of the proposed development without the traffic generated by the site.

Background volumes include historic growth trends, as well as developments which have been approved for construction but not yet built. Discussions with the Jefferson County Planning Staff have indicated that there are four developments which have been approved in the vicinity of the Old Standard LLC Quarry development.



nd:

= AM(PM)
PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

= STOP SIGN

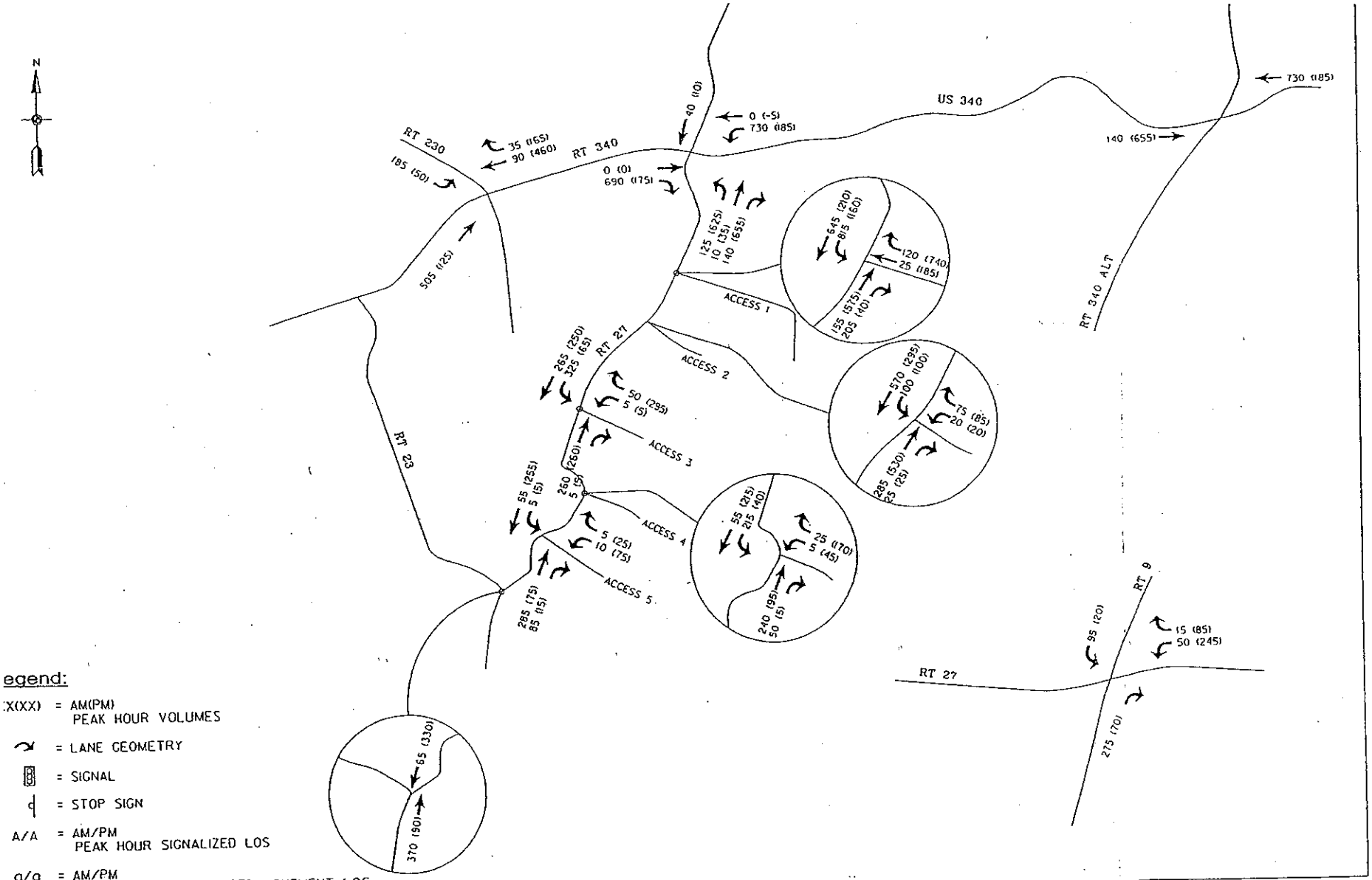
= AM/PM
PEAK HOUR SIGNALIZED LOS

= AM/PM
PEAK HOUR UNSIGNALIZED MOVEMENT LOS

OLD STANDARD LLC QUARRY DEVELOPMENT
BACKGROUND TOTAL TRAFFIC VOLUME, LANE GEOMETRY, AND LOS RESULTS

FIGURE 6

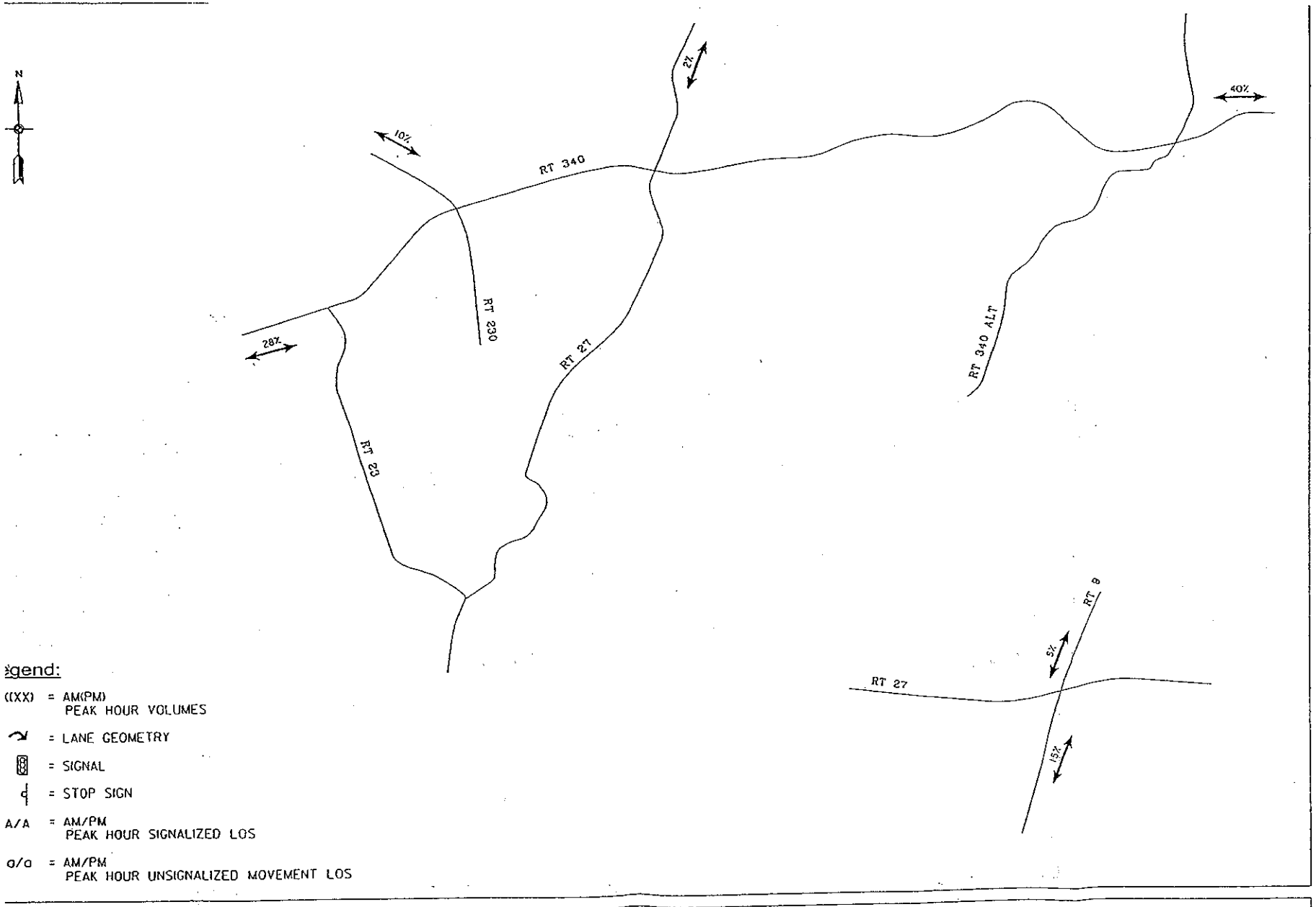
GROUND TOTAL.dgn 11/6/2006 3:55:01 PM



G&O OLD STANDARD LLC QUARRY DEVELOPMENT
SITE TRIP ASSIGNMENT

FIGURE 8

)52-TOTAL SITE TRAFFIC.dgn 11/6/2006 3:56:25 PM



Legend:

((XX) = AM(PM) PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

= STOP SIGN

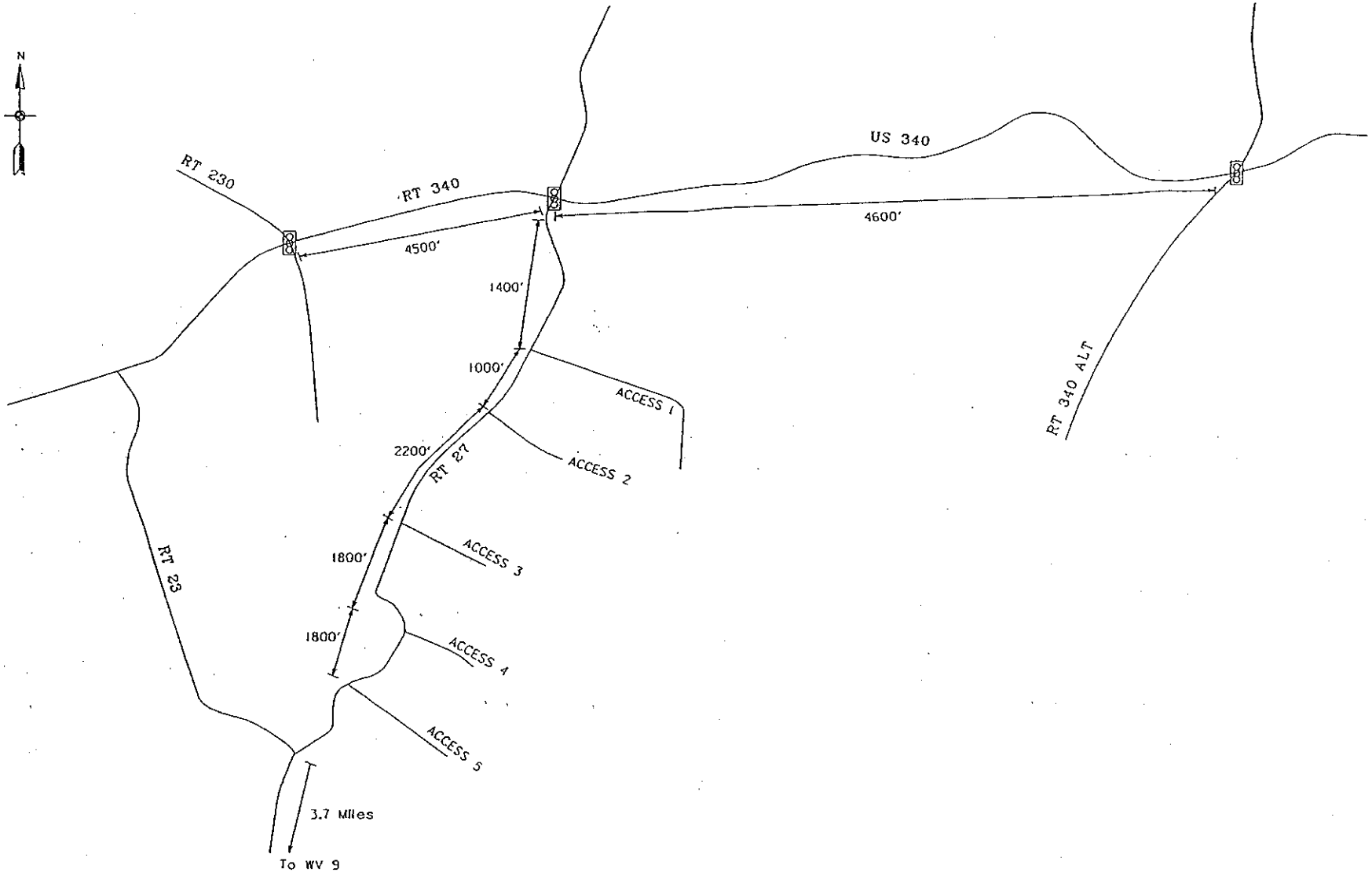
A/A = AM/PM PEAK HOUR SIGNALIZED LOS

a/a = AM/PM PEAK HOUR UNSIGNALIZED MOVEMENT LOS

OLD STANDARD LLC QUARRY DEVELOPMENT
SITE TRIP DISTRIBUTION

FIGURE 7

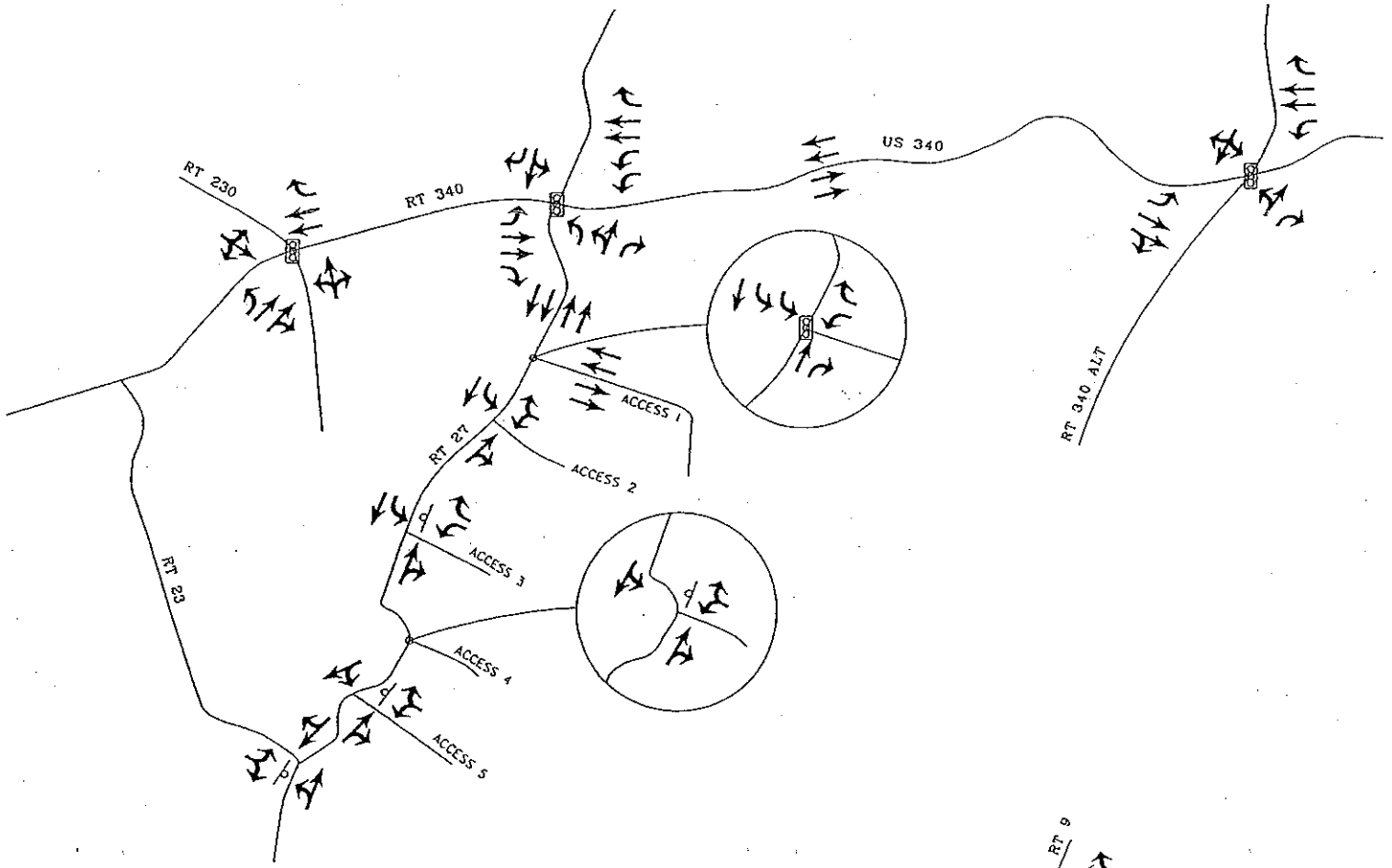
ITE TRIP DISTR.dgn 11/6/2006 3:55:44 PM



OLD STANDARD LLC QUARRY DEVELOPMENT
APPROXIMATE DISTANCES BETWEEN INTERSECTIONS

FIGURE 12

ics\0952-Distances.dgn 1/16/2007 1:15:43 PM



Legend:

(X(XX) = AM(PM) PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

= STOP SIGN

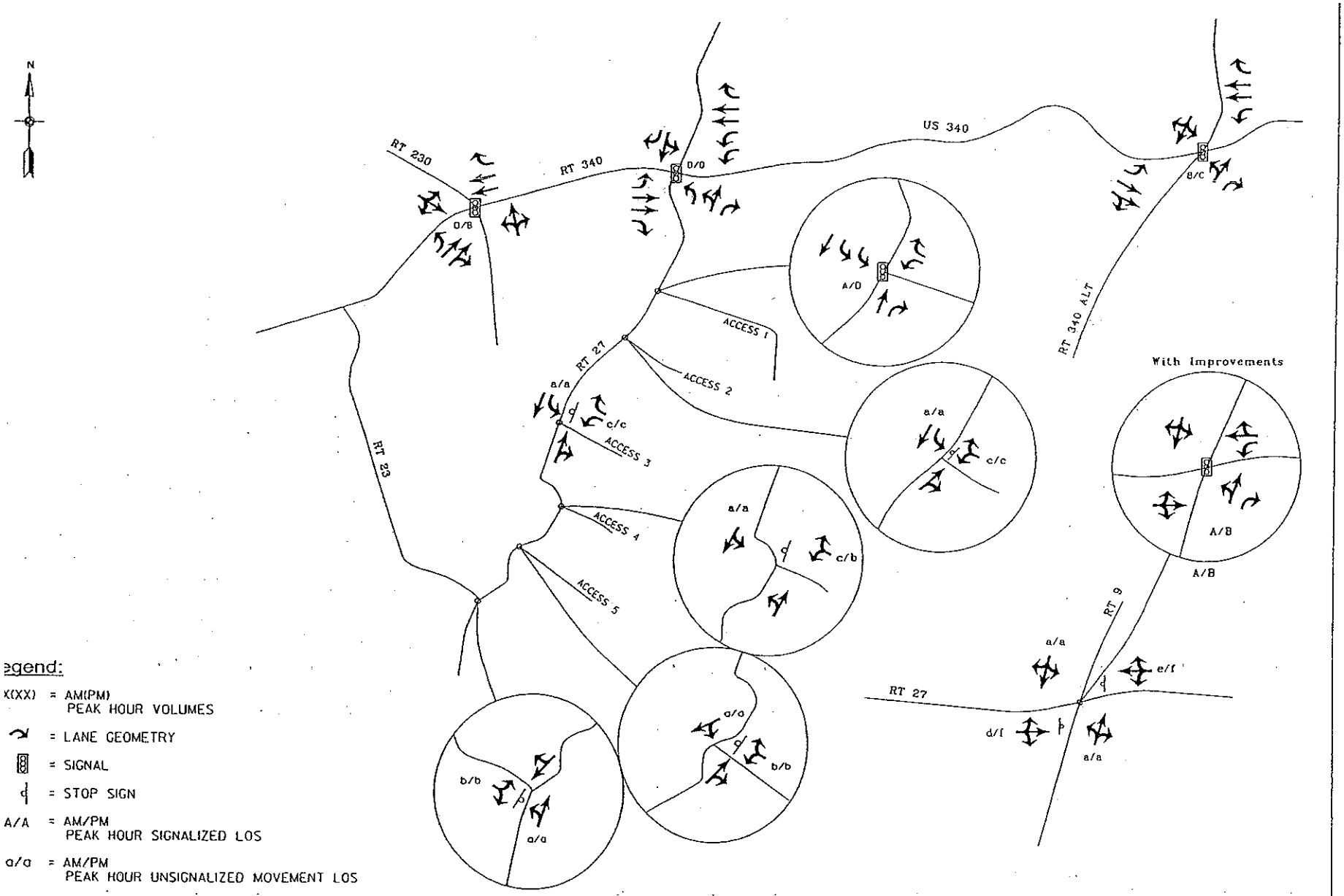
A/A = AM/PM PEAK HOUR SIGNALIZED LOS

a/a = AM/PM PEAK HOUR UNSIGNALIZED MOVEMENT LOS

J&J OLD STANDARD LLC QUARRY DEVELOPMENT
SUGGESTED LANE GEOMETRY

FIGURE 11

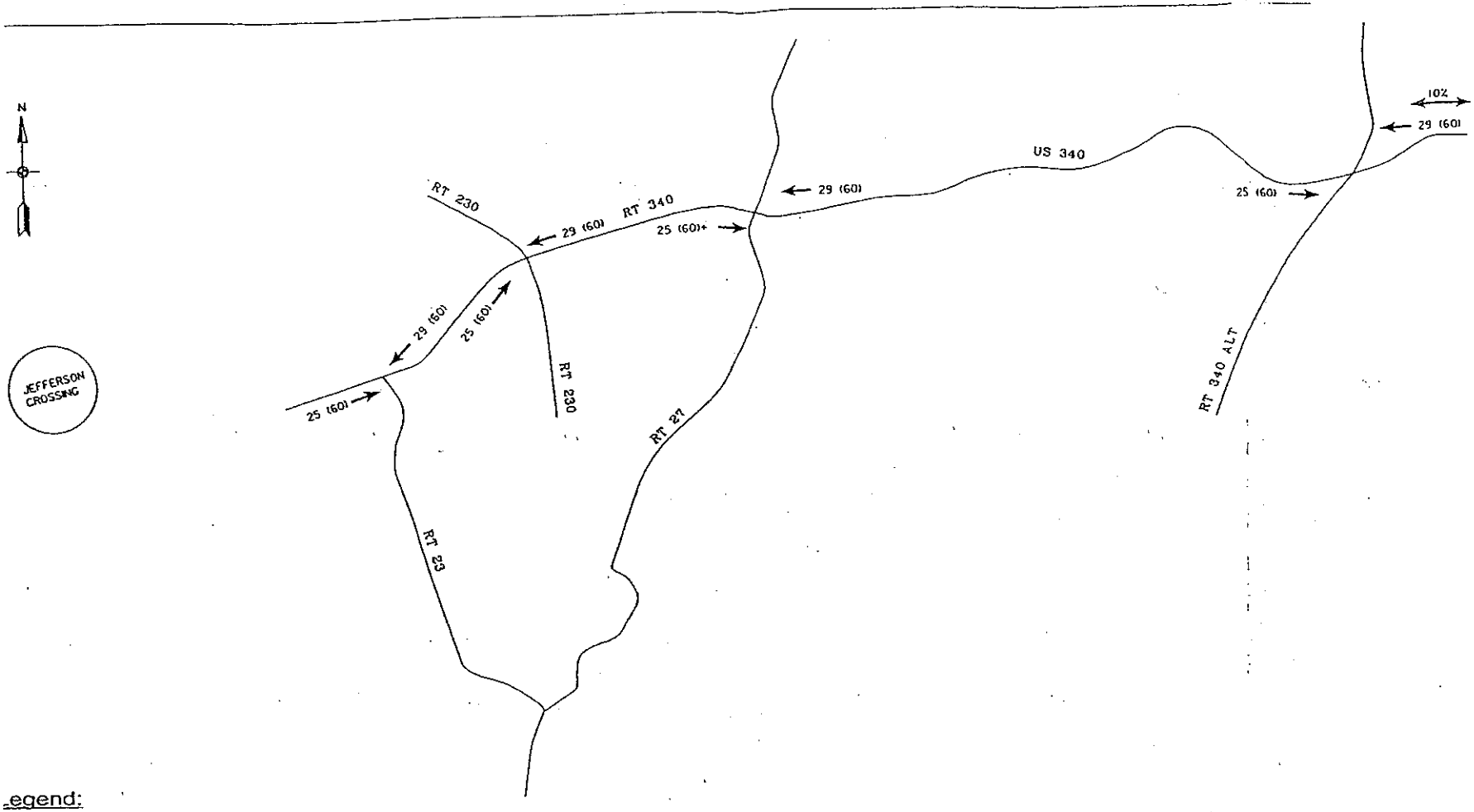
Lane Geo.dgn _ Revised 1/16/2007 1:15:07 PM



OLD STANDARD LLC QUARRY DEVELOPMENT
TOTAL TRAFFIC LANE GEOMETRY AND LOS RESULTS

FIGURE 10

otal traffic lane geo.dgn 1/16/2007 1:14:40 PM



Legend:

XX(XX) = AM(PM) PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

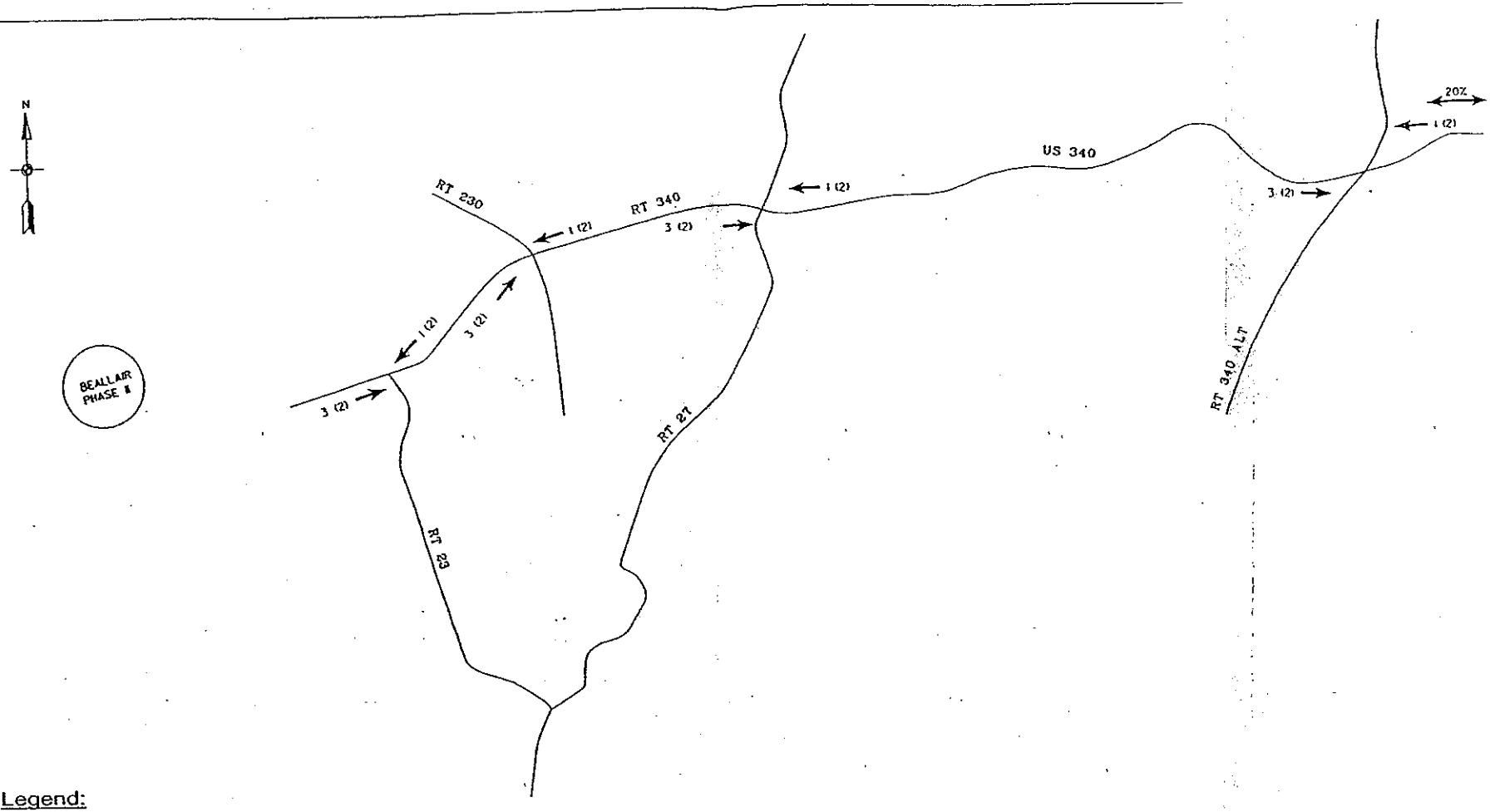
= STOP SIGN

A/A = AM/PM PEAK HOUR SIGNALIZED LOS

a/a = AM/PM PEAK HOUR UNSIGNALIZED MOVEMENT LOS

F&O OLD STANDARD LLC QUARRY DEVELOPMENT
JEFFERSON CROSSINGS

2-jefferson crossing.dgn 11/6/2006 4:00:06 PM



Legend:

XX(XX) = AM(PM) PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

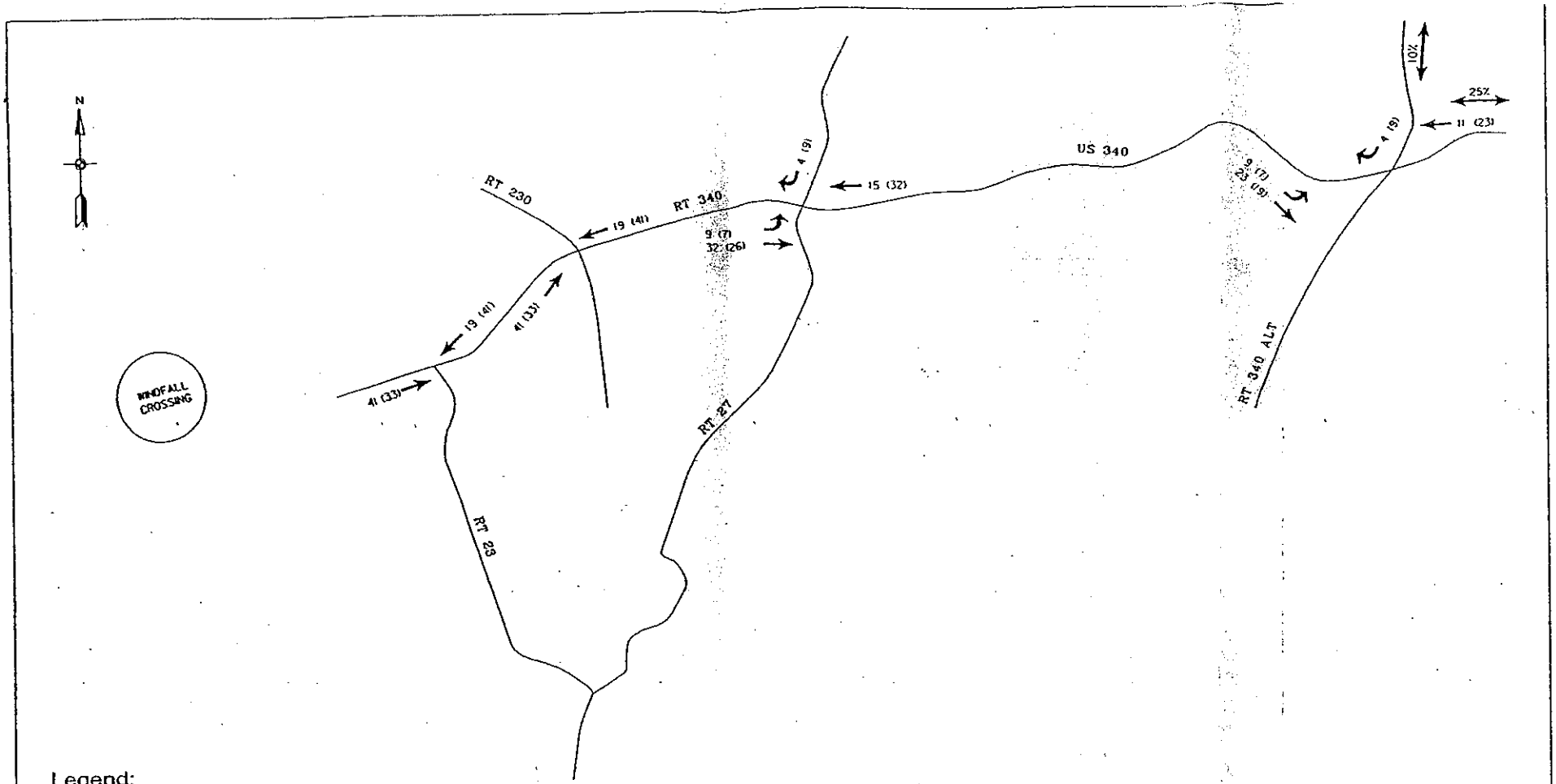
= STOP SIGN

A/A = AM/PM PEAK HOUR SIGNALIZED LOS

a/a = AM/PM PEAK HOUR UNSIGNALIZED MOVEMENT LOS

G&O OLD STANDARD LLC QUARRY DEVELOPMENT
BEALLAIR PHASE II

0952-BEALLAIR PHASE II.dgn 11/6/2006 3:59:31 PM



G&O OLD STANDARD LLC QUARRY DEVELOPMENT
WINDMILL CROSSINGS

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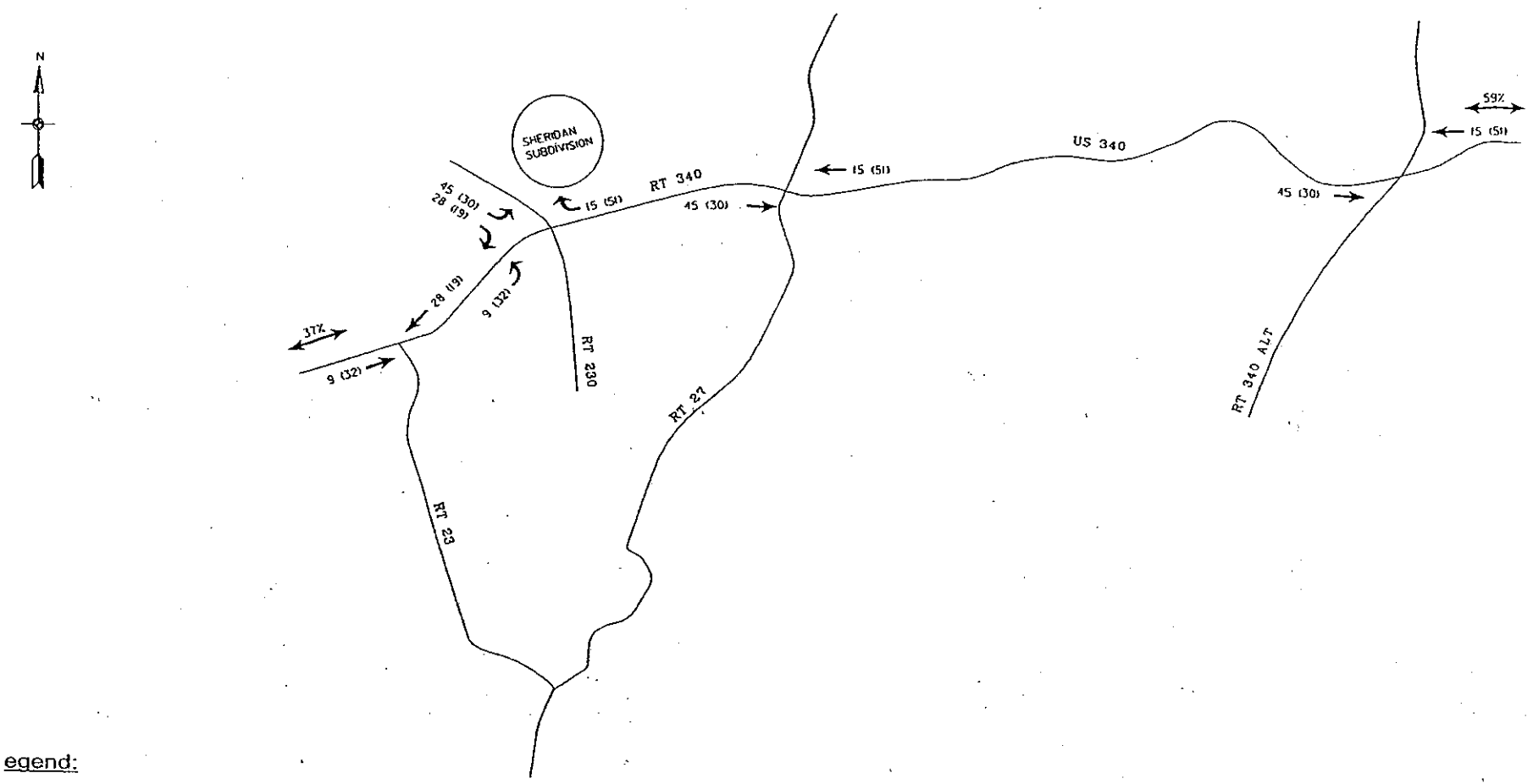


egend:

X(XX) = AM(PM)
PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

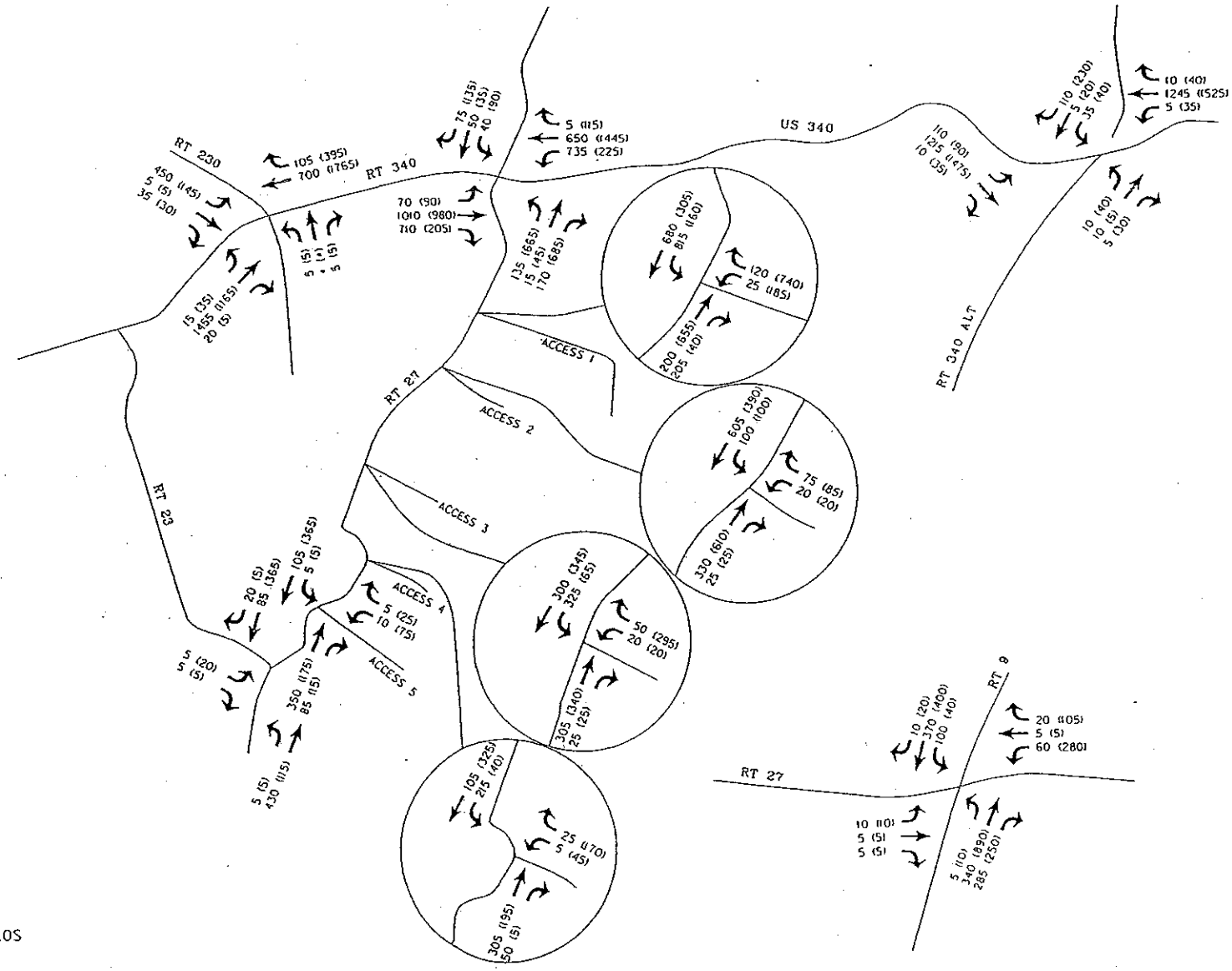
= STOP SIGN

A/A = AM/PM
PEAK HOUR SIGNALIZED LOS

o/o = AM/PM
PEAK HOUR UNSIGNALIZED MOVEMENT LOS

OLD STANDARD LLC QUARRY DEVELOPMENT
SHERIDAN SUBDIVISION

HENDAN SUBDIVISION.dgn 11/6/2006 4:00:40 PM



Legend:

(X(XX) = AM(PM) PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

= STOP SIGN

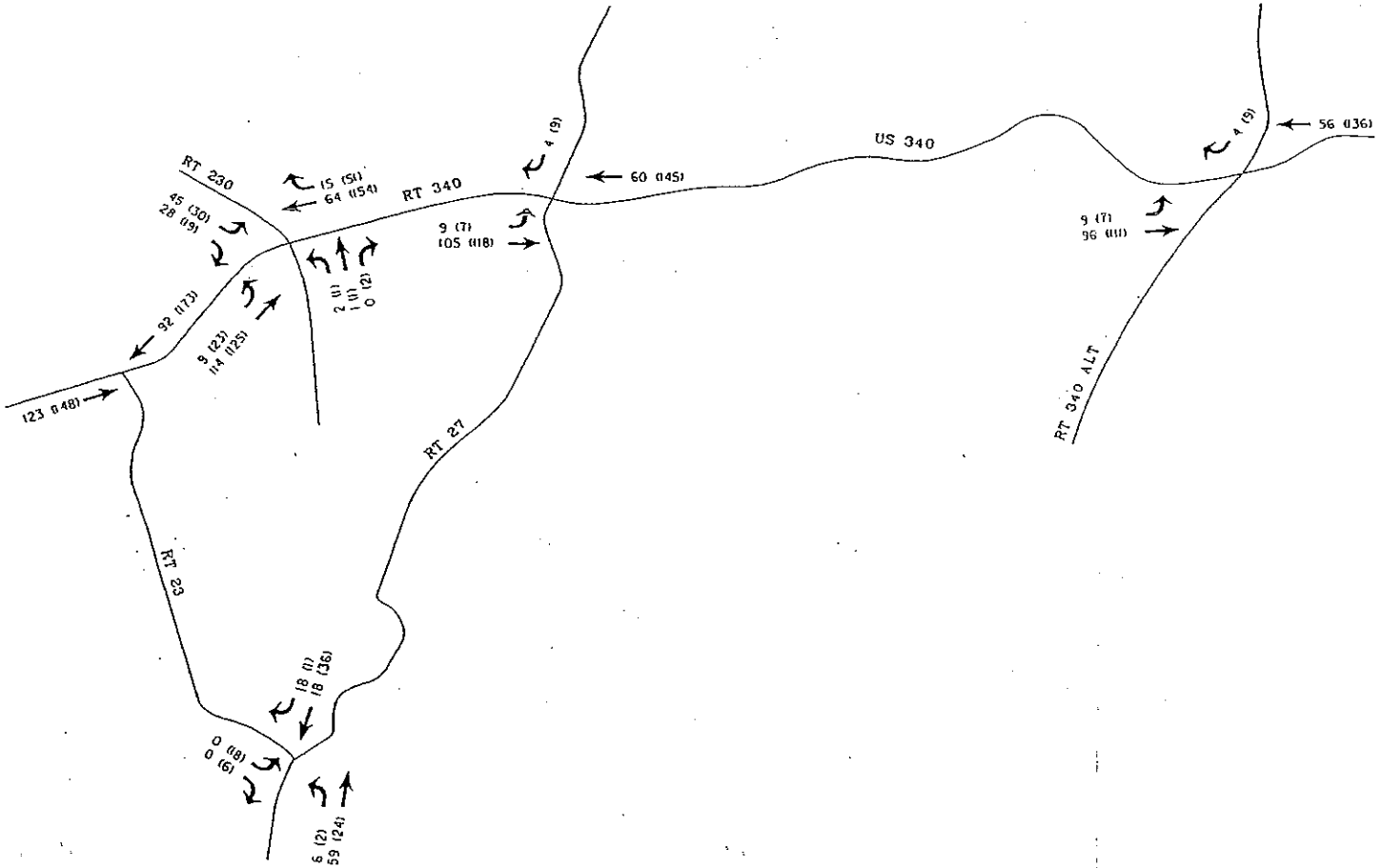
A/A = AM/PM PEAK HOUR SIGNALIZED LOS

a/a = AM/PM PEAK HOUR UNSIGNALIZED MOVEMENT LOS

OLD STANDARD LLC QUARRY DEVELOPMENT
TOTAL TRAFFIC VOLUME

FIGURE 9

TOTAL TRAFFIC.dgn 1/16/2007 1:23:02 PM



Legend:

XX(XX) = AM(PM) PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

= STOP SIGN

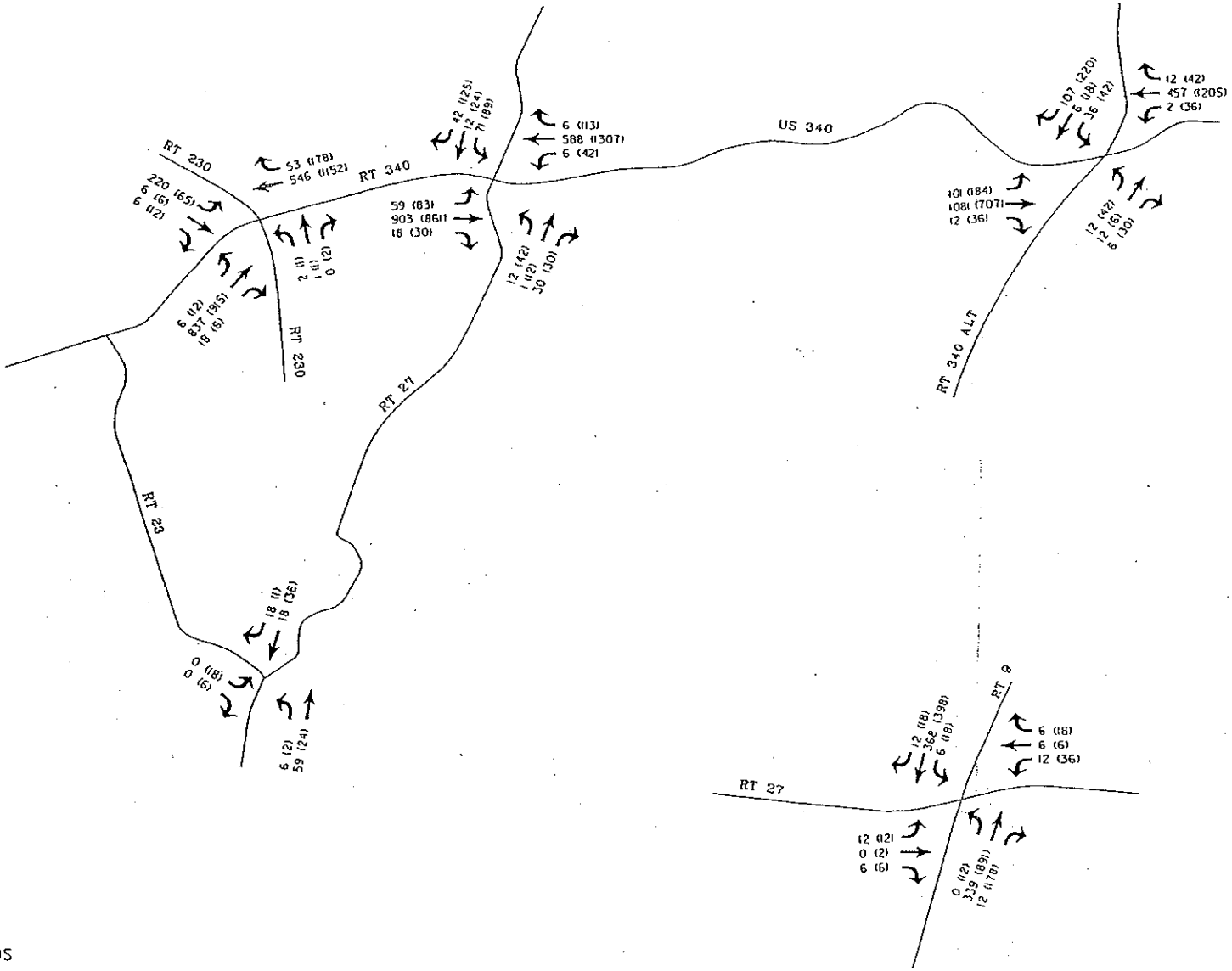
A/A = AM/PM PEAK HOUR SIGNALIZED LOS

a/a = AM/PM PEAK HOUR UNSIGNALIZED MOVEMENT LOS

J&O OLD STANDARD LLC QUARRY DEVELOPMENT
TOTAL BACKGROUND DEVELOPMENT VOLUMES

FIGURE 5

TOTAL BACK-DEVELOP.dgn 11/6/2006 3:54:28 PM



nd:

= AM(PM)
PEAK HOUR VOLUMES

= LANE GEOMETRY

= SIGNAL

= STOP SIGN

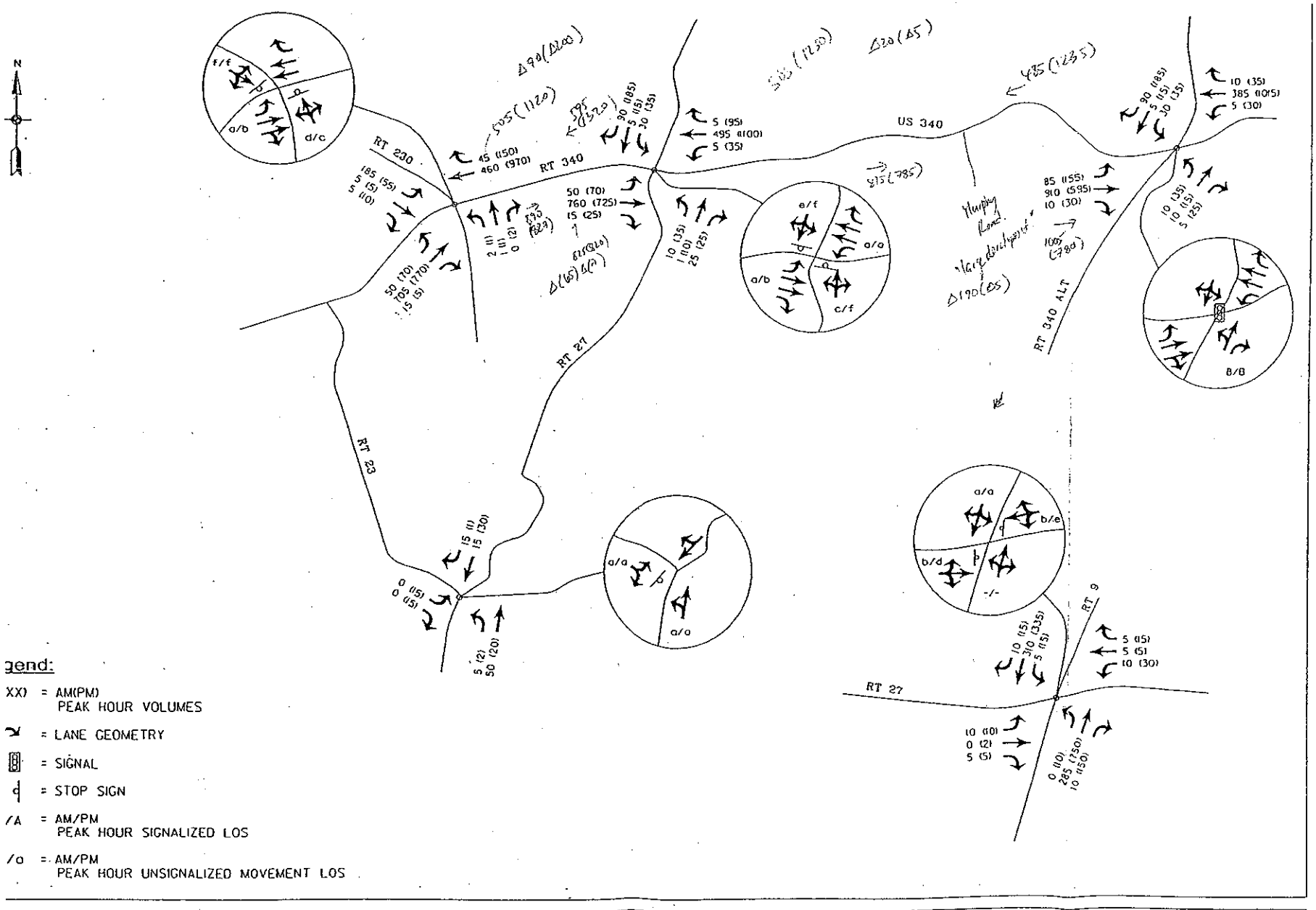
= AM/PM
PEAK HOUR SIGNALIZED LOS

= AM/PM
PEAK HOUR UNSIGNALIZED MOVEMENT LOS

OLD STANDARD LLC QUARRY DEVELOPMENT
BACKGROUND TRAFFIC GROWTH VOLUMES (3.5%) - YEAR 2011

FIGURE 4

2-BACKGROUND.dgn 11/6/2006 3:53:32 PM



& OLD STANDARD LLC QUARRY DEVELOPMENT
) EXISTING TRAFFIC VOLUMES, LANE GEOMETRY, AND LOS RESULTS

FIGURE 3

\0952-Existing.dgn 11/6/2006 3:52:06 PM

OLD STANDARD EXTENDED STAY HOTEL

10-Sep-08

ROOM SUMMARY		Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Rooms Available		250	250	250	250	250	250	250	250	250	250
Occupancy Rate		95%	95%	95%	95%	95%	95%	95%	95%	95%	95%
Annual Room Nights Occupied		86,688	86,688	86,688	86,688	86,688	86,688	86,688	86,688	86,688	86,688
Room Rate		100	103	106	109	113	116	119	123	127	130
REVENUE											
Annual Room Revenue		8,668,750	8,928,813	9,196,677	9,472,577	9,756,754	10,049,457	10,350,941	10,661,469	10,981,313	11,310,753
Services Revenue (% of Room Revenue)	5%	433,438	446,441	459,834	473,629	487,838	502,473	517,547	533,073	549,066	565,538
Sub Total - Operating Revenue		9,102,188	9,375,253	9,656,511	9,946,206	10,244,592	10,551,930	10,868,488	11,194,543	11,530,379	11,876,290
EXPENSES											
Flag Fees		-	-	-	-	-	-	-	-	-	-
Operating Expenses (% of Room Revenue)	55%	4,767,813	4,910,847	5,058,172	5,209,917	5,366,215	5,527,201	5,693,017	5,863,808	6,039,722	6,220,914
Sub Total - Expenses		4,767,813	4,910,847	5,058,172	5,209,917	5,366,215	5,527,201	5,693,017	5,863,808	6,039,722	6,220,914
NOI		4,334,375	4,464,406	4,598,338	4,736,289	4,878,377	5,024,729	5,175,470	5,330,735	5,490,657	5,655,376
COSTS & LOAN											
Hard Costs	31,250,000										
FF&E	3,750,000										
Soft Costs	1,312,500										
Land (5 Acres)	2,500,000										
Less Equity	(2,500,000)										
Mortgage	36,312,500										
Interest Rate	6%										
Term (Years)	25										
Debt Service		2,840,608	2,840,608	2,840,608	2,840,608	2,840,608	2,840,608	2,840,608	2,840,608	2,840,608	2,840,608
Principle		661,858	701,569	743,663	788,283	835,580	885,715	938,858	995,189	1,054,901	1,118,195
Interest		2,178,750	2,139,039	2,096,944	2,052,325	2,005,028	1,954,893	1,901,750	1,845,418	1,785,707	1,722,413
Loan Balance		35,650,642	34,949,073	34,205,410	33,417,127	32,581,547	31,695,832	30,756,974	29,761,785	28,706,884	27,588,689
CASH FLOW											
Operating Revenue		9,102,188	9,375,253	9,656,511	9,946,206	10,244,592	10,551,930	10,868,488	11,194,543	11,530,379	11,876,290
Expenses		4,767,813	4,910,847	5,058,172	5,209,917	5,366,215	5,527,201	5,693,017	5,863,808	6,039,722	6,220,914
Debt Service		$2,840,608	$2,840,608	$2,840,608	$2,840,608	$2,840,608	$2,840,608	$2,840,608	$2,840,608	$2,840,608	$2,840,608
Cash Flow		1,493,767	1,623,799	1,757,731	1,895,681	2,037,770	2,184,121	2,334,863	2,490,127	2,650,049	2,814,769
Annual CPI	3%										

MNPS Data Center Site
Proforma Budget Projections

Warm, Lit Shell Construction

4-Feb-08
Prepared By: T. Gatzet

MNPS Harpers Ferry, W Va.
~~Baseline Proforma~~
Development Program: 200,000 GSF Data Center Lease Building #1

Total Size of All Buildings (GSF)	200,000	Total Building Size (SF)	200,000
Core Factor (5%)	10,000	Site Acreage	9.00
Total Size of All Buildings (RSF)	190,000	F.A.R. (Density)	0.50
		Footprint	
		Total Parking Spaces	146

		$/GSF	$/RSF	TOTAL $	COMMENTS
	LAND				
1	Basis	$30.00	$31.58	$6,000,000	Lump sum
2	Property Taxes	$0.40	$0.42	$80,539	$2.2372 per $100 investment taking 60% of Market Value
3	Builders Risk Insurance	$0.24	$0.25	$47,500	$/SF estimate
4	Settlement Costs	$0.25	$0.26	$50,000	Lump sum estimate
	Land Subtotal	**$30.89**	**$32.52**	**$6,178,039**	
	DESIGN				
5	Architect/MEP/Structural Engineer	$7.50	$7.89	$1,500,000	Lump Sum Estimate
6	Arch Design Contingency	$0.50	$0.53	$100,000	Lump Sum Estimate
7	Civil Eng'r	$0.38	$0.39	$75,000	Lump Sum Estimate
8	Civil Design Contingency	$0.10	$0.10	$19,000	Lump Sum Estimate
9	Traffic Study	$0.13	$0.13	$25,000	Lump Sum Estimate
10	Geotech Eng'r	$0.10	$0.10	$19,000	Lump Sum Estimate
11	Landscape Architect	$0.13	$0.13	$25,000	Lump Sum Estimate
12	Testing, Inspections, 3rd Party Reports	$0.29	$0.30	$57,000	Lump Sum Estimate
13	Reimburseables	$0.25	$0.26	$50,000	Lump Sum Estimate
	Design Subtotal	**$9.35**	**$9.84**	**$1,870,000**	
	PERMITS AND FEES				
14	Impact Fees	$0.00	$0.00	$0	
15	Site Plan Fees	$0.08	$0.10	$15,000	Lump Sum Estimate
16	Public Improvement Bond	$0.00	$0.00	$100,000	Lump Sum Estimate
17	Conservation/Escrow Bond	$0.00	$0.00	$100,000	Lump Sum Estimate
18	Utilities Permit	$0.10	$0.10	$65,000	Lump Sum Estimate
19	Utilities Connection	$0.71	$0.75	$142,500	Lump Sum Estimate (tap fee)
20	Building Permit Fees	$0.48	$0.50	$150,000	Lump Sum Estimate
21	Permit Consultant	$0.11	$0.12	$22,800	$/SF estimate
	Permits Subtotal	**$1.47**	**$1.57**	**$595,300**	
	HARD COSTS				
22	Demolition	$0.00	$0.00	$0	
23	Base Building Construction	$171.00	$180.00	$34,200,000	$/SF estimate
24	Sitework & Utilities	$23.75	$25.00	$4,750,000	$/SF estimate
25	HVAC	$33.25	$35.00	$6,650,000	$/SF estimate
26	Electrical Installation	$23.75	$25.00	$4,750,000	$/SF estimate
27	Landscaping & Irrigation	$0.38	$0.40	$76,000	$/SF estimate
28	Back-up Generators	$7.50	$7.89	$1,500,000	Lump Sum estimate
29	Signage/FFE/Security	$0.33	$0.35	$225,000	Lump Sum estimate
30	Construction Contingency	$13.04	$13.72	$2,607,550	of Construction Hard Costs.
	Construction Subtotal	**$273.79**	**$288.20**	**$54,758,550**	
	TENANT IMPROVEMENTS				
31	Test Fits	$0.00	$0.00	$0	Warm Lit Shell- rest by tenant
32	Multi-Tenant Expense	$0.00	$0.00	$0	
33	Tenant Allowance	$0.00	$0.00	$0	
	TI Subtotal	**$0.00**	**$0.00**	**$0**	
	ADMINISTRATION				
34	Developer Fees	$14.31	$15.06	$2,861,193	of Project Direct Costs -- Less Land Costs
35	Legal Fees	$0.95	$1.00	$190,000	$/SF estimate
36	Marketing Expenses	$0.13	$0.13	$25,000	Lump sum estmate
37	Sale Commissions	$0.00	$0.00	$0	N/A
38	Lease Commissions	$9.50	$10.00	$1,900,000	to Stonewall Heights LLC/ outside broker
	Administration Subtotal	**$24.88**	**$26.19**	**$4,976,193**	
39	PROJECT DIRECT COSTS	$340.38	$358.32	$68,378,082	
	FINANCE				
40	Construction Loan Fee	$2.56	$2.70	$512,836	of 75% of Project Direct Costs
41	Permanent Loan Fee	$0.75	$0.78	$149,000	of $63.4M Permanent Loan
42	Legal Fees/Closing Costs	$0.48	$0.50	$95,000	$/SF estimate
43	Net Lease Up Income	$0.00	$0.00	$0	N/A
44	Construction Interest	$11.97	$12.60	$2,393,233	rate, $68.4M loan, 50% avg bal, carried over 12 months
45	Lease Up Interest Carry	$0.00	$0.00	$0	Carried in 10-yr cash flow
	Finance Subtotal	**$15.75**	**$16.58**	**$3,150,068**	
46	CONTINGENCY	$15.55	$16.37	$3,110,002	of Project Direct Costs -- Less Land Costs.
47	TOTAL PROJECT COSTS	$373.19	$392.63	$74,638,152	

MNPS Data Center Site
Proforma Budget Projections

CONFIDENTIAL

Warm, Lit Shell Construction

4-Feb-08
Prepared By: T. Glatzel

MNPS Harpers Ferry, W Va.
Baseline Proforma
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47	TOTAL PROJECT COSTS	$373.19	$392.83	$74,638,152	

State of West Virginia

04-002

OFFICE OF ENVIRONMENTAL HEALTH SERVICES

CAPITOL and WASHINGTON STREETS 1 DAVIS SQUARE, SUIE 200 CHARLESTON, WEST VIRGINIA 25301
TELEPHONE 304-558-2981

PERMIT

PROJECT: (Sewage) Old Standard Development Wastewater Collection & WWTP

PERMIT NO.: 17,411

LOCATION: Millville COUNTY: Jefferson DATE: 2-26-2007

THIS IS TO CERTIFY that after reviewing plans, specifications, application forms, and other essential information that

Old Standard, L.L.C.
c/o Herb Jonkers
Route 2, Box 99E
Charles Town, West Virginia 25414

is hereby granted approval to: amend and modify Permit Nos. 16,170 and 16,229 the Old Standard Development wastewater collection and treatment facilities. Major modifications are the relocation of the wastewater treatment plant; modifying the intake structures so that flow will first be through the screens then to equalization basins; changing the membrane treatment plant from a single train to a dual train plant; increasing the membrane treatment plant basin to treat a higher organic loading; changing the ultraviolet disinfection system from an enclosed to an open system; adding space for an office and laboratory; adding pumps to the post-anoxic basins in order to move sludge to the sludge basin; adding aerators and sludge pumps in the sludge basins; and other necessary piping, valves, controls and appurtenances.

NOTE: **This permit is contingent upon all unchanged conditions and requirements of Permit Nos. 16,170 and 16,229 remaining in effect.**

The Environmental Engineering Division of the **OEHS-Kearneysville District Office**, telephone (304) 725-9453 is to be notified when construction begins.

Validity of this permit is contingent upon conformity with plans, specifications, application forms, and other information submitted to the West Virginia Bureau for Public Health.

FOR THE DIRECTOR

William S. Herold, Jr., P.E., Assistant Manager
Infrastructure and Capacity Development
Environmental Engineering Division

WSH:emt
pc: Potesta & Associates, Inc.
Katheryn Emery, P.E., DEP
James W. Ellars, P.E., PSC-Engineering Division
Amy Swann, PSC
Jefferson County Health Department
OEHS-EED Kearneysville District Office

POTESTA
Engineers and Environmental Consultants

TRANSMITTAL LETTER

7012 MacCorkle Avenue, SE, Charleston, WV 25304 ▫ Phone: (304) 342-1400 ▫ Fax: (304) 343-9031

To: Mr. Herb Jonkers
Old Standard, LLC
Route 2, Box 99E
Charles Town, West Virginia 25414

Date: March 2, 2007
Project No.: 0101-04-0012

Sent Via: [ ] Mail [X] Federal Express [ ] United Parcel Service
[ ] Hand Carried [ ] Other: _____

Quantity	Description
1	West Virginia Bureau for Public Health Permit No. 17,411 for Old Standard Development Waste Water Collection and Treatment Facilities

Remarks: This permit amends and modifies Permit Nos. 16,170 and 16,229.

By: Vincent J. Ammirato/ljk

c: Lee Snyder, Snyder Environmental Services

west virginia department of environmental protection

Environmental Enforcement
601 57th Street
Charleston, WV 25304
Telephone: (304) 926-0470 Fax: (304) 926-0488

Joe Manchin III, Governor
Randy C. Huffman, Cabinet Secretary
www.wvdep.org

August 8, 2008

Old Standard, LLC
Mr. Herbert Jonkers
PO Box 341
Millwood, VA 22646

Certified Return Receipt Requested
Cert #7007 0220 0000 0373 9390

Dear Mr. Jonkers:

Enclosed is a copy of the inspection report submitted to the U.S. Environmental Protection Agency, the Department of Environmental Protection's Division of Water and Waste Management and to Environmental Enforcement's Romney Office.

No deficiencies were noted during the inspection of your facility. You and your staff are to be commended for your commitment to proper operation and maintenance of your treatment facility.

If you have any questions, please contact Jack Fleshman at (304) 822-7266.

Sincerely,

Joseph M. Hickman
Assistant Chief Inspector

JH/mks
Enclosure
cc: DWWM Water Permits
NE Regional Office
Compliance Monitoring
Ashley K. Toy, US EPA, Region III

Summary

Old Standard LLC's Membrane Bioreactor Wastewater Treatment Plant was placed into service in March, 2008, with an average design flow of 0.05 MGD to serve Sheridan Subdivision. The operation of the facility is contracted out to Snyder Environmental. Records of operation, sampling results, etc. are up to date. The laboratory work is contracted to Hydrochem. The facility appears to be operating properly with no deficiencies noted during this evaluation.

Facility

The Old Standard LLC Wastewater Treatment Plant (WWTP) is a 0.05 MGD Membrane Bioreactor (MBR) wastewater treatment plant. The collection system is comprised of approximately 5,700 linear feet of 12-inch diameter gravity sewer line, 23 manholes, one 35gpm duplex submersible sewage pump station/equalization basin, 7,300 linear feet of 6-inch diameter force main line.

This 0.05 MGD MBR wastewater treatment plant is being constructed in three phases. Currently, phase one is complete, with an average design flow of 0.05 MGD. Phase one is comprised of a 1/8" fine screen and screen washing, 2 MBR basins with a combined capacity of 0.25 MGD (currently one is in operation), and ultraviolet disinfection units. This system discharges wastewater through outlet 001 into the Shenandoah River of the Potomac River.

The operation of this wastewater plant is contracted to Snyder Environmental. Mr. Mike Mercer of Snyder Environmental was on-site for the inspection. Old Standard LLC was not notified in advance of this inspection. However, Mike Mercer was given one day's notice, because Snyder Environmental personnel are on-site two times per week.

Permit

Old Standard LLC WWTP currently operates under WV/NPDES permit number WV0105724, dated February 15, 2005, which expires on February 15, 2010. A current copy of the permit was available on-site for inspection. The name and address of the permittee was correct and the facility operates as described on the permit. The number of discharge outlets, as well as the receiving river, is listed correctly.

Records/Reports

A review of records kept on-site showed that the facility has retained their NPDES records since the start of the plant. The sludge is land applied at the Styles Farm. The sludge reports are not due to DEP until February 2009. Upon review of Discharge Monitoring Reports (DMR), it was noted that loading calculations used the correct flow measurement period, average monthly fecal coliform concentrations were calculated using the geometric mean, and analytical values under Method Detection Limits were properly reported. All

reports for this facility are completed and submitted to the Romney Office in the required time frame. The facility maintains very good sampling records, which include all necessary information. Facility personnel also complete chain-of-custody forms. Flow charts are kept since the start of the facility. A flow meter calibration was performed by Instrulogic Corp from Round Hill, VA on June 25, 2008. As a result of this review, it appears that all records and reports required by the permit are well-organized and available for inspection.

Facility Site Review

The system and equipment appeared to be functioning properly during the walk-through of the facility. All permitted outlets are properly marked and adequate fencing surrounds the entire facility. In case of a spill, Snyder Environmental will perform the sewage spill remediation work.

Flow Measurement

This facility utilizes a Magmeter measurement device as its primary means of flow measurement. The primary flow measurement device is designed to meet permit requirements and is located where a representative measurement of actual flow can be obtained. Spare pen, charts and other parts are available on-site.

Laboratory

The facility uses HydroChem of Shenandoah Junction for their testing; however, it was not evaluated during this inspection.

Self-Monitoring Program

The facility appears to follow the appropriate sampling procedures and all necessary information is included in sampling documents. The required records appear satisfactory. Laboratory and accuracy of flow measurement were not evaluated during this inspection.

Effluent/Receiving Waters

The discharge monitoring reports received for the past 4 months were reviewed during this inspection. The facility did not exceed effluent limitations for any parameter during this period. The effluent was observed during the walk-through of the facility and it appeared satisfactory. No visible sludge, foam, plume, or odor was noted at the discharge outlet.

Compliance Schedule

No items in this section are applicable to this facility at this time.

Pretreatment

Currently there are no industrial users on this system.

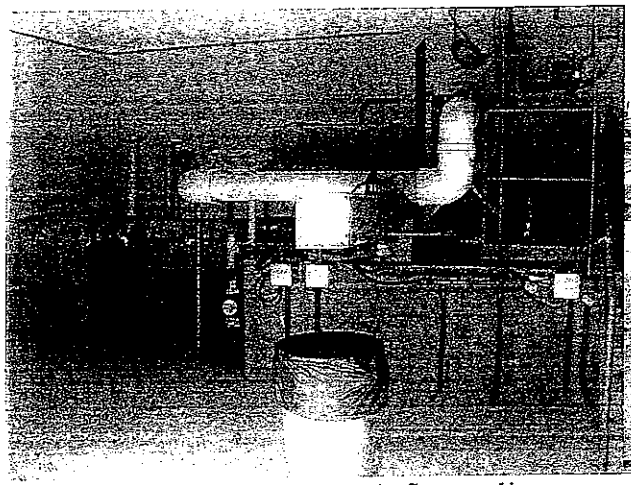


Figure 1: 7/8" Fine Screen & flow splitter

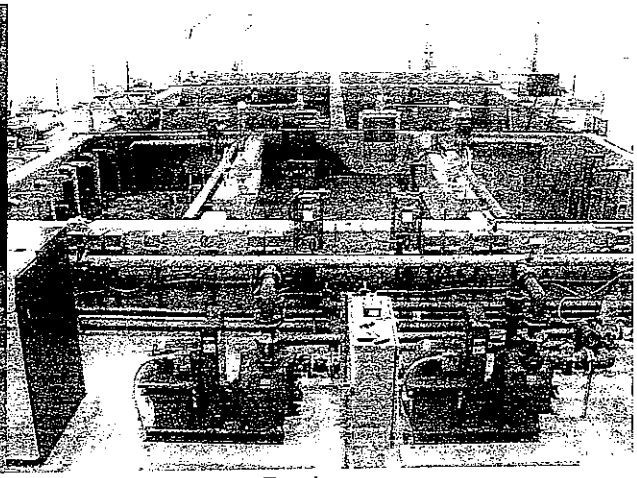


Figure 2: MBR Basins

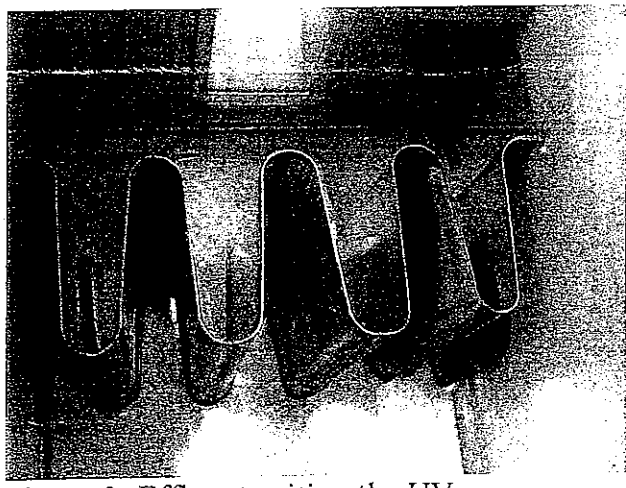


Figure 3: Effluent exiting the UV

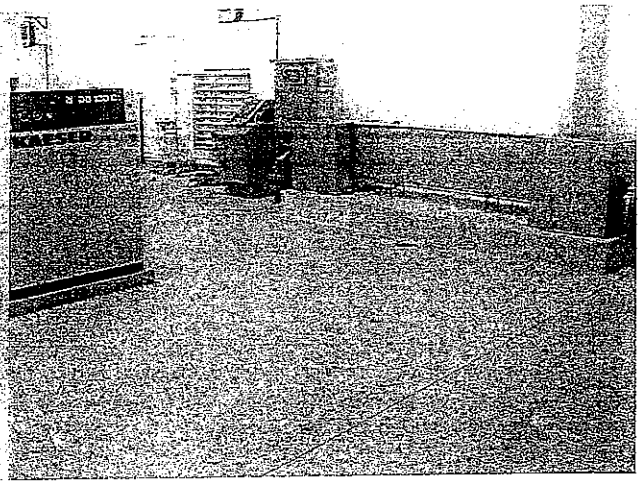
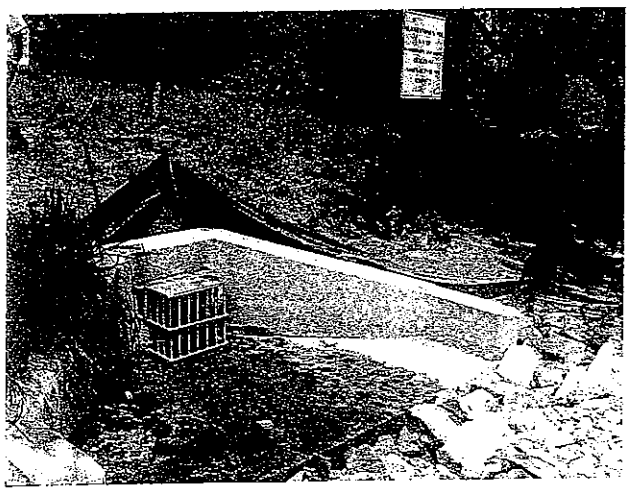


Figure 4: UV system



EPA Water Compliance Inspection Report

Section A: National Data System Coding (ie PCS)

Transaction	Code	NDPES	Mo/Day/Yr	Inspection Type	Inspector	Facility Type
N	5	WV0105724	07/17/2008	C	S	2

Remarks:

Inspection Work Days	Facility Self-Monitoring Evaluation Rating	BI	QA	Reserved
1	5	N	N	

Section B: Facility Data

Name and Location of Facility Inspected:	Old Standard LLC Millville Rd Millville, WV 25432	**Entry Time:** 12:30pm	**Permit Effective Date:** 3-17-2005
Name(s) of On-SiteRepresentatives(s) Titles/Phone and Fax Numbers:	Mike Mercer Contractor for the plant operations (304)279-3334: cell (304)724-4250: fax	**Exit Time/Date:** 2:15pm 7/17/2008	**Permit Expiration Date:** 2-15-2010
Name, Address of Responsible Official/Title/Phone/Fax:	Herbert Jonkers PO Box 341 Millwood, VA 22646	Contacted: Yes ☐ No ☒	**Other Facility Data:**

Section C: Areas Evaluated During Inspection

M - Marginal; N - No; N/A - Not Applicable; N/E - Not Evaluated; S - Satisfactory; U - Unsatisfactory; Y - Yes

S	Permit	S	Flow Measurement	N/E	Sampling	S	Operations & Maintenance
S	Records/Reports	N/E	Laboratory	N/A	Compliance Schedule	N/E	Sludge Disposal
S	Fac Site Review	S	Eff / Rec. Waters Visual	S	Self-Monitoring	N/E	Pollution Prevention
S	Pretreatment	N/A	Stormwater	N/A	CSO/SSO	N/A	Multimedia
N/A	Groundwater Data	N/A	Unpermitted Bypass				

Section D: Summary of Findings / Comments (attach additional sheets if necessary):
This facility appears to be operating properly. The plant has been in service since March 2008.
Compliance Assistance (check all that apply): Troubleshooting ☐ Records/Reports ☐ Sampling ☐

Name/Signature(s) of Inspectors(s)	Agency/Office/Telephone/Fax	Date
Michael Kanehl Sarah Woody Sarah Woody	WVDEP - HC 63 Box 2545 Romney, WV 26757 304-822-7266 304-822-3687	7-25-2008 7/25/08
Signature of Management QA Reviewer Jack Fleshman Jack L Fleshman	**Agency/Office/Phone/Fax** WVDEP - HC 63 Box 2545 Romney, WV 26757 304-822-7266 304-822-3687	**Date** 7-25-08

Revised: October 2003

Sampling

Sampling locations, methods, and frequencies conform to NPDES requirements. Sampling location and methods provide representative samples. Samples are taken in required containers and preserved as stated in 40 CFR, Part 136. Samples for fecal coliform and BOD appear to be taken using approved protocols. Chain-of-custody forms are maintained on-site and available for inspection.

Operations & Maintenance

All treatment units were operating properly at the time of inspection. Routine and preventative maintenance items are scheduled. Plant O&M manuals are onsite. As previously mentioned, auxiliary power is available. Spare parts for the equipment are available.

Sludge Disposal

The sludge is land applied on the Style's Farm in Rippon, WV. This site (WVSG10026) is permitted through Snyder Environmental, therefore this site was not evaluated.