ERDMAN ANTHONY

Memorandum

Date:		**To:**	Mark Rozich
From:	Rob Nuss	**Office:**	Mechanicsburg
Project Name:	Three Degree Road	**Project No.:**	57762.04
Subject:	Intersection Capacity improvements for SR 0228 & Three Degree Road and SR 0228 & Brickyard Road	**Copy:**	File

The purpose of this memorandum is to present the results of intersection capacity improvement analyses conducted by Erdman Anthony for two adjacent intersections along SR 0228 (Mars Road) located in Adams Township, Butler County.

Section 1 of this memorandum presents the results of Left Turn Lane, Right Turn Lane, and Auxiliary Through Lane (ATL) analyses for the intersection of SR 0228 and SR 3007 (Three Degree Road).

Section 2 of this memorandum presents the results of Traffic Signal Warrant Analysis and Left and Right Turn Lane Analyses conducted for SR 0228 and T-391 (Brickyard Road).

Section 1:

Existing Roadway Data- SR 0228 & SR 3007

According to PennDOT ITMS data, SR 0228 is classified as an urban principal arterial road to the west of Three Degree Road and a rural principal arterial to the east of Three Degree Road. SR228 runs in the east/west direction with a posted speed limit of 45 MPH in the area of the study intersection. SR 0228 has a separate left turn lane in each direction (approximately 140' length eastbound and 100' length westbound), a shared through/right turn lane in the westbound direction, and a through lane and island-separated right turn lane eastbound at the study intersection. According to PennDOT ITMS data, SR 3007 is classified as a central rural collector/local road to the north of SR 0228 and an urban minor arterial, collector, local road to the south of SR 0228. SR 3007 runs in the north/south direction with a posted speed limit of 40 MPH in the area of the study intersection. SR 3007 has a single shared left turn/through/right turn lane in each direction. Currently, this intersection is not interconnected with the nearest signalized intersections of Mars Valencia road to the west, and Pittsburgh Road to the east. It is recommended that this intersection be interconnected with the adjacent intersection of Brickyard Road to the west which is currently unsignalized, but warrants a traffic signal as discussed in Section 2.

Existing Traffic Data- SR 0228 & SR 3007

Vehicle turning movement counts taken on Wednesday, September 26, 2012 were provided by PennDOT and were used to compute AM, Mid-day, and PM peak hour volumes, peak hour factors, and truck percentages. A growth factor of 0.7% per year was applied to project volumes to the design year of 2035. Passenger car equivalent volumes used in the left and right turn lane analysis were calculated according to PennDOT Publication 46 Section 11.16. Count data and computations are shown in Appendix A.

Results of Synchro analysis for a 2035 no-build scenario consisting of 2035 volumes, existing lane configurations and a projected 160 second cycle length (assumed as the future scenario since other intersections along the SR 228 corridor have similar cycle lengths) are shown in Appendix B.

Left and Right Turn Lane Analysis Methodology

PennDOT Publication 46 "Traffic Engineering Manual" provides turn lane guidelines in Chapter 11, Section 16 to determine warrants for turn lanes and to identify desirable length. See Appendix C for this section in its entirety.

Left and Right Turn Lane Warrant Analysis Results- SR 0228 & SR 3007

The following tables summarize the results of the left and right turn lane warrant analysis by approach:

1) Eastbound approach:

Two lane highway, 45 MPH => use Figure 3 in Appendix B

Peak	PCE Left turns	PCE Through	PCE Advancing (L+T)	PCE Opposing	% Left turns	Left Turn Lane Warranted
AM	137	516	653	786	21.0%	Yes
MID	48	553	601	550	8.0%	Yes
PM	112	856	968	603	11.6%	Yes

Two lane highway, 45 MPH => use Figure 10 in Appendix B

Peak	Right Turning Volume	PCE Advancing (R+T)	Right Turn Lane Warranted
AM	33	549	Yes
MID	82	635	Yes
PM	120	976	Yes

2) Westbound approach:

Two lane highway, 45 MPH => use Figure 3 in Appendix B

Peak	PCE Left turns	PCE Through	PCE Advancing (L+T)	PCE Opposing	% Left turns	Left Turn Lane Warranted
AM	64	786	850	516	7.5%	Yes
MID	36	550	586	553	6.1%	Yes
PM	42	603	645	856	6.5%	Yes

Two lane highway, 45 MPH => use Figure 10 in Appendix B

Peak	Right Turning Volume	PCE Advancing (R+T)	Right Turn Lane Warranted
AM	8	794	No
MID	19	569	No
PM	26	629	Yes

3) Northbound approach:

Two lane highway, 40 MPH => use Figure 2 in Appendix B

Peak	PCE Left turns	PCE Through	PCE Advancing (L+T)	PCE Opposing	% Left turns	Left Turn Lane Warranted
AM	112	124	236	123	47.4%	No
MID	91	16	107	26	85.0%	No
PM	120	59	179	70	67.0%	No

Two lane highway, 40 MPH => use Figure 11 in Appendix B

Peak	Right Turning Volume	PCE Advancing (R+T)	Right Turn Lane Warranted
AM	41	165	No
MID	42	58	No
PM	109	168	No

Although a left turn lane is not warranted according to Figure 2, since left turns make up more than 50% of the advancing traffic during the MID and PM peaks, a left turn lane is recommended. Also, although a right turn lane is not warranted according to Figure 11, since right turns make up more than 50% of the advancing traffic during the MID and PM peaks, a right turn lane is recommended.

4) Southbound approach:

Two lane highway, 40 MPH => use Figure 2 in Appendix B

Peak	PCE Left turns	PCE Through	PCE Advancing (L+T)	PCE Opposing	% Left turns	Left Turn Lane Warranted
AM	53	123	176	124	30.1%	No
MID	18	26	44	16	40.9%	No
PM	31	70	101	59	30.7%	No

Two lane highway, 40 MPH => use Figure 11 in Appendix B

Peak	Right Turning Volume	PCE Advancing (R+T)	Right Turn Lane Warranted
AM	164	287	No
MID	72	98	No
PM	121	191	No

Although a left turn lane is not warranted according to Figure 2, since there are more than 30% left turns during the AM, MID, and PM peaks and a left turn lane is recommended in the northbound approach, a left turn lane is recommended on this approach as well. The same reasoning holds true for a right turn lane and is recommended as well.

Left and Right Turn Lane Storage Lengths

The following turn lane storage lengths calculated using PennDOT Pub 46 Chapter 11.16 are listed by approach in the tables below. Cycle length is assumed to be 160 seconds. Highest calculated storage lengths are highlighted in bold.

1) a) Eastbound Left Turn Lane Storage Length: 45 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	High	75	6	250	325	**325**
MID	Low	75	2	100	175	175
PM	High	75	5	200	275	275

b) Eastbound Right Turn Lane Storage Length: 45 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	Low	75	2	100	175	175
MID	High	75	4	175	250	250
PM	High	75	5	200	275	**275**

2) a) Westbound Left Turn Lane Storage Length: 45 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	Low	75	3	150	225	**225**
MID	Low	75	2	100	175	175
PM	Low	75	2	100	175	175

b) Westbound Right Turn Lane Storage Length: 45 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	Low	125	-	-	125	125
MID	Low	75	1	75	150	**150**
PM	Low	75	1	75	150	150

3) a)Northbound Left Turn Lane Storage Length: 40 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	High	61	5	200	261	**275**
MID	High	61	4	175	236	250
PM	High	61	5	200	261	275

b) Northbound Right Turn Lane Storage Length: 40 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	High	61	2	100	161	175
MID	High	61	2	100	161	175
PM	High	61	5	200	261	**275**

4) a)Southbound Left Turn Lane Storage Length: 40 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	High	61	2	100	161	**175**
MID	High	61	1	75	136	150
PM	High	61	1	75	136	150

b) Southbound Right Turn Lane Storage Length: 40 MPH using exhibits 11-6 to 11-8

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	High	61	7	275	336	**350**
MID	High	61	3	150	211	225
PM	High	61	5	200	261	275

Auxiliary Through Lane Analysis Methodology

The National Cooperative Highway Research Program (NCHRP) Report 707 provides guidelines to use for justification, design, and analysis of Auxiliary Through Lanes (ATL) at signalized intersections and was used as the primary basis of this analysis. Synchro analyses were performed using 2035 projected traffic volumes and including the additional turn lanes and lengths recommended from the turn lane analysis. Although the current signal phasing allows protected/permitted lefts eastbound, protected lefts westbound, and permitted lefts northbound and southbound; at some point in the future, protected lefts on

all approaches will most likely be implemented, so this projected phasing was used in the analysis. The coordinated signalization of the intersection of SR 0228 & T-391 and turn lane improvements as recommended in Section 2 were modeled in this analysis as well. Full HCM Synchro reports are included in Appendix D.

A spreadsheet-based computational engine (NCHRP 3-98) was used to estimate ATL utilization and length. Input requirements for the spreadsheet include volumes and adjusted saturation flow rates for the through and right turn movements, prevailing approach speed, and intersection width. Additional inputs such as average vehicle spacing at stop bar, critical gap for merging from ATL into CTL, driver reaction time, and a confidence level for calculating the downstream ATL length were defaulted to values provided in the spreadsheet. Each intersection approach was evaluated using the computational engine for two scenarios:

Scenario 1: Base case (build recommended right and left turn lanes)
Scenario 2: Add an ATL and an exclusive right-turn lane

Auxiliary Through Lane Analysis Results

Summarized results including average delay, Level of Service (LOS), ATL utilization, and estimated minimum upstream and downstream ATL lengths are shown in the table below. Longest estimated ATL lengths for each approach are highlighted in **bold**. Full computational engine results are shown in Appendix E.

Eastbound Approach					**Estimated Min ATL Length**	
Peak		**Average Delay (sec/veh)**	**LOS**	**ATL Utilization (%)**	**Upstream ATL (ft)**	**Downstream ATL (ft)**
AM	Scenario 1	39.93	D	-	-	-
	Scenario 2	34.86	C	19	500	320
MID	Scenario 1	37.34	C	-	-	-
	Scenario 2	32.63	C	19	500	320
PM	Scenario 1	81.95	F	-	-	-
	Scenario 2	40.38	D	27	**800**	**620**

Westbound Approach					**Estimated Min ATL Length**	
Peak		**Average Delay (sec/veh)**	**LOS**	**ATL Utilization (%)**	**Upstream ATL (ft)**	**Downstream ATL (ft)**
AM	Scenario 1	60.24	E	-	-	-
	Scenario 2	38.91	D	24	**700**	**490**
MID	Scenario 1	39.66	D	-	-	-
	Scenario 2	34.08	C	19	500	340
PM	Scenario 1	47.43	D	-	-	-
	Scenario 2	38.28	D	21	600	390

Northbound Approach					Estimated Min ATL Length	
Peak		Average Delay (sec/veh)	LOS	ATL Utilization (%)	Upstream ATL (ft)	Downstream ATL (ft)
AM	Scenario 1	48.45	D	-	-	-
	Scenario 2	47.15	D	30	100	**70**
MID	Scenario 1	44.05	D	-	-	-
	Scenario 2	44.13	D	-	-	-
PM	Scenario 1	47.90	D	-	-	-
	Scenario 2	47.57	D	37	**200**	50

Southbound Approach					Estimated Min ATL Length	
Peak		Average Delay (sec/veh)	LOS	ATL Utilization (%)	Upstream ATL (ft)	Downstream ATL (ft)
AM	Scenario 1	54.33	D	-	-	-
	Scenario 2	53.47	D	24	**200**	**80**
MID	Scenario 1	53.43	D	-	-	-
	Scenario 2	53.35	D	84	100	60
PM	Scenario 1	56.90	E	-	-	-
	Scenario 2	56.34	E	36	200	60

For the eastbound approach, construction of an ATL would improve the LOS by two levels and reduce delay by 40 seconds for the PM peak, so construction of an ATL on the eastbound approach is recommended. For the westbound approach, construction of an ATL would improve the LOS by a level and reduce delay by 21 seconds for the AM peak, so construction of an ATL on the westbound approach is recommended. Construction of an ATL on either the Northbound or Southbound approaches shows no LOS improvement and minimal delay improvements, so an ATL on either approach is not recommended.

Overall SR 0228 & SR 3007 Analysis Results

From the analysis results presented in the preceding paragraphs, improvements to the SR 0228 & SR 3007 intersection are recommended to be built as follows:

-SR 0228 Eastbound: 325’ left turn lane, 275’ right turn lane, ATL with 800’ upstream and 620’ downstream
-SR 0228 Westbound: 225’ left turn lane, 150’ right turn lane, ATL with 700’ upstream and 490’ downstream
-SR 3007 Northbound: 275’ left turn lane, 275’ right turn lane
-SR 3007 Southbound: 175’ left turn lane, 350’ right turn lane

Finally, Synchro analysis of the SR 0228 & SR 3007 final intersection configuration recommended as a result of the turn lane and ATL analysis was performed, and these reports are included in Appendix F. The following table compares No Build, Build Left and Right Turn Lanes, and Build All scenarios by

showing Level of Service and delay for each approach and for the entire intersection. The volume/capacity ratio for the entire intersection is also shown.

		2035 No Build			2035 Build Turn Lanes			2035 Build All		
Approach	**Peak**	**LOS**	**Delay (s)**		**LOS**	**Delay (s)**		**LOS**	**Delay (s)**	
Eastbound	**AM**	E	70.4		D	43.2		D	35.1	
	MID	B	13.6		B	15.3		B	13.9	
	PM	E	52.2		C	27.5		C	22.4	
Westbound	**AM**	F	114.5		E	57.5		D	36.0	
	MID	B	17.2		B	16.1		B	13.8	
	PM	C	32.0		C	29.0		C	22.6	
Northbound	**AM**	F	198.0		F	80.6		E	64.6	
	MID	F	112.7		E	72.3		E	71.4	
	PM	F	166.6		E	67.2		E	64.4	
Southbound	**AM**	E	70.0		E	69.9		E	63.3	
	MID	E	57.1		E	69.3		E	69.4	
	PM	E	58.8		E	66.3		E	64.8	
				v/c ratio			**v/c ratio**			**v/c ratio**
Total Intersection	**AM**	F	103.1	1.19	E	59.2	0.93	D	45.7	0.67
	MID	C	31.5	0.6	C	27.9	0.46	C	26.4	0.3
	PM	E	62.0	1.02	D	38.0	0.76	C	33.3	0.51

Section 2:

Existing Roadway Data- SR 0228 & T-391

The intersection of SR 0228 & T-391 is located approximately 2,800 feet west of SR 0228 & SR 3007. According to PennDOT ITMS data, SR 0228 is classified as an urban principal arterial road running in the east/west direction with a posted speed limit of 45 MPH in the area of the study intersection. SR 0228 has single through lanes in each direction. T-391 is a township road with a 35 MPH posted speed limit running parallel to the north of SR 0228 from Mars Valencia Road before ending at a T-intersection with SR 0228. T-391 has a single lane each direction and is currently unsignalized with stop-controlled southbound movements, but traffic signal warrant analysis was conducted as part of this capacity improvement study.

Existing Traffic Data- SR 0228 & T-391

Vehicle turning movement counts taken on Thursday, September 20, 2012 were provided by PennDOT and were used to compute AM, Mid-day, and PM peak hour volumes, peak hour factors, and truck percentages. A growth factor of 0.7% per year was applied to project volumes to the design year of 2035. Passenger car equivalent volumes used in the left and right turn lane analysis were calculated

according to PennDOT Publication 46 Section 11.16. Count data and computations are shown in Appendix G.

Results of Synchro analysis of a 2035 no-build scenario consisting of 2035 volumes, existing lane configurations and the intersection remaining un-signalized are shown in Appendix H.

Traffic Signal Warrant Analysis Methodology

PennDOT Publication 46 Section 4.3 lists eleven warrants for traffic signals as identified in 67 Pa. Code §212. A full explanation of the eleven warrants is given in Appendix I. HCS 2010 Warrants software was used to evaluate Warrants 1-8, while Warrants 9, 10 and 11 are not applicable to this intersection.

Traffic Signal Warrant Analysis Results- SR 0228 & T-391

Warrant 2: Four-Hour Vehicular Volume and Warrant 3: Peak Hour were met as shown in the HCS 2010 Warrants summary shown in Appendix J, so it is recommended that the intersection of SR 0228 & T-391 be signalized as part of this project.

Left and Right Turn Lane Analysis Results- SR 0228 & T-391

The following tables summarize the results of the left and right turn lane warrant analysis by approach:

1) Eastbound approach:

Two lane highway, 45 MPH => use Figure 3 in Appendix B

Peak	PCE Left turns	PCE Through	PCE Advancing (L+T)	PCE Opposing	% Left turns	Left Turn Lane Warranted
AM	6	831	837	971	1.0%	Yes
MID	12	759	771	703	1.5%	Yes
PM	6	1063	1069	915	1.0%	Yes

2) Westbound approach:

Two lane highway, 45 MPH => use Figure 10 in Appendix B

Peak	Right Turning Volume	PCE Advancing (R+T)	Right Turn Lane Warranted
AM	69	1040	Yes
MID	92	795	Yes
PM	106	1021	Yes

3) Southbound approach:

Since T-391 does not have a through lane, the turn lane warrants in PennDOT Publication 46 Section 11.16 do not apply. However, separate left and right turn lanes are recommended to separate right turning vehicles that will be allowed to turn right on red when the intersection is signalized.

Left and Right Turn Lane Storage Lengths

1) Eastbound Left Turn Lane Storage Length: 45 MPH using exhibits 11-6 to 11-8, assumed cycle length of 160s

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	Low	125	-	-	125	**125**
MID	Low	125	-	-	125	125
PM	Low	125	-	-	125	125

2) Westbound Right Turn Lane Storage Length: 45 MPH using exhibits 11-6 to 11-8, assumed cycle length of 160s

Peak	Turn Demand Volume	Storage Length-speed (ft)	Avg. No. of Veh/cycle (160s cycle length)	Storage Length for Avg. No. of Veh/cycle	Total Storage Length Calculated	Total Storage Length Design
AM	Low	75	3	150	225	225
MID	High	75	4	175	225	250
PM	High	75	5	200	275	**275**

3) Southbound Right Turn Lane Storage Length:

The minimum storage lane length of 75' as listed in Section 11.16 of PennDOT Publication 46 is recommended.

Overall SR 0228 & T-391 Analysis Results

From the analysis results presented in this section, recommended improvements to the SR 0228 & T-391 intersection are as follows:

-SR 0228 Eastbound: Add a 125' left turn lane
-SR 0228 Westbound: Add a 275' right turn lane
-T-391 Southbound: Add a 75' right turn lane
-Signalize and coordinate the intersection with the adjacent intersection of SR 0228 and SR 3007

Synchro analysis of the final recommended SR 0228 & T-391 intersection configuration and coordination timing, was performed and these reports are included in Appendix K. LOS for each approach and the volume capacity ratio for the entire intersection is shown in the table below.

		2035 No Build- Unsignalized LOS (delay in seconds)		2035 Build Turn Lanes- Signalized LOS (delay in seconds)	
Approach	**Peak**				
Eastbound	**AM**	A		A	
	MID	A		A	
	PM	A		A	
Westbound	**AM**	A		A	
	MID	A		A	
	PM	A		A	
Southbound	**AM**	F (150.7)		E	
	MID	F (86.2)		E	
	PM	F (770.2)		E	
			v/c ratio		**v/c ratio**
Total Intersection	**AM**	-	-	A	0.65
	MID	-	-	A	0.46
	PM	-	-	B	0.73

COUNTERS:

PennDOT

RAW VEHICLE VOLUME COUNTS

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 26, 2012
DAY: Wednesday
WEATHER:

INTERSECTION: SR 228 and SR 3007 (Three Degree Rd)

	SR 3007 SB				SR 228 WB				SR 3007 NB				SR 228 EB					
Starting Time	From North				From East				From South				From West				TOTAL TRAFFIC	PEAK HOUR
	R	T	L	TOTAL	R	T	L	TOTAL	R	T	L	TOTAL	R	T	L	TOTAL		
AM																		
600	7	3	0	10	0	72	6	78	3	1	10	14	4	56	0	60	162	892
615	0	1	0	1	0	2	2	4	0	0	0	0	0	1	0	1	6	1098
630	10	19	4	33	0	191	22	213	8	3	11	22	12	90	5	107	375	1542
645	16	5	6	27	1	167	24	192	4	9	13	26	7	84	13	104	349	1599
700	17	16	4	37	2	152	16	170	8	25	14	47	3	86	25	114	368	1623
715	62	53	14	129	1	103	12	116	8	27	20	55	7	98	45	150	450	1609
730	29	20	12	61	2	151	9	162	17	15	35	67	3	115	24	142	432	1514
745	18	16	6	40	2	181	16	199	2	7	20	29	8	85	12	105	373	1519
800	17	9	5	31	2	155	14	171	9	5	25	39	9	90	14	113	354	1532
815	19	11	2	32	8	140	11	159	8	16	20	44	7	88	25	120	355	1467
830	56	12	11	79	4	148	10	162	7	13	17	37	11	113	35	159	437	1349
845	28	10	9	47	5	132	10	147	8	8	34	50	16	103	23	142	386	
900	16	5	2	23	2	137	9	148	11	6	12	29	6	70	13	89	289	
915	11	4	3	18	2	98	5	105	2	6	13	21	9	73	11	93	237	
MID																		
1100	12	8	1	21	5	91	10	106	5	2	14	21	16	87	10	113	261	1075
1115	18	1	4	23	2	99	7	108	9	7	14	30	14	54	9	77	238	1069
1130	10	5	6	21	4	112	5	121	8	6	20	34	20	103	14	137	313	1156
1145	15	6	2	23	3	91	10	104	10	1	14	25	12	90	9	111	263	977
1200	12	4	4	20	2	95	8	105	2	2	16	20	15	90	5	110	255	964
1215	21	6	3	30	6	112	6	124	13	5	23	41	15	104	11	130	325	
1230	14	3	2	19	4	101	10	115	0	0	0	0	0	0	0	0	134	
1245	14	3	6	23	5	98	6	109	10	2	11	23	13	71	11	95	250	
PM																		
300	21	13	8	42	3	135	6	144	23	18	14	55	15	137	32	184	425	1746
315	25	10	6	41	5	128	8	141	19	15	20	54	25	132	52	209	445	1775
330	14	8	11	33	1	132	16	149	26	18	16	60	15	168	31	214	456	1778
345	14	16	5	35	6	87	10	103	20	11	21	52	32	180	18	230	420	1821
400	30	24	4	58	4	109	5	118	23	9	26	58	13	188	19	220	454	1810
415	17	7	4	28	7	131	6	144	19	14	21	54	28	172	22	222	448	1809
430	33	10	13	56	4	146	12	162	26	16	31	73	28	149	31	208	499	1813
445	25	9	6	40	5	112	11	128	31	20	17	68	18	138	17	173	409	1753
500	21	9	6	36	3	92	9	104	31	25	42	98	19	169	27	215	453	1712
515	19	6	5	30	5	145	10	160	25	15	25	65	23	155	19	197	452	
530	23	8	2	33	1	115	9	125	32	9	28	69	23	148	41	212	439	
545	20	9	6	35	1	125	8	134	15	12	14	41	21	102	35	158	368	
TOTAL	684	349	182	1215	107	4085	338	4530	442	348	631	1421	467	3589	658	4714	11880	

COUNTERS:

PennDOT

TRUCK PERCENTAGES

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 26, 2012
DAY: Wednesday
WEATHER:

INTERSECTION: SR 228 and SR 3007 (Three Degree Rd)

	SR 3007 SB				**SR 228 WB**				**SR 3007 NB**				**SR 228 EB**				**TOTAL TRAFFIC**
Starting Time	From North				From East				From South				From West				
	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	
700	17	16	4	37	2	152	16	170	8	25	14	47	3	86	25	114	368
715	62	53	14	129	1	103	12	116	8	27	20	55	7	98	45	150	450
730	29	20	12	61	2	151	9	162	17	15	35	67	3	115	24	142	432
745	18	16	6	40	2	181	16	199	2	7	20	29	8	85	12	105	373
AM Peak Vehicles	126	105	36	267	7	587	53	647	35	74	89	198	21	384	106	511	1623
AM Peak Trucks	9	0	6	15	0	55	1	56	0	21	4	25	5	37	7	49	145
AM Peak Truck %	**7.1%**	**0.0%**	**16.7%**	**5.6%**	**0.0%**	**9.4%**	**1.9%**	**8.7%**	**0.0%**	**28.4%**	**4.5%**	**12.6%**	**23.8%**	**9.6%**	**6.6%**	**9.6%**	**8.9%**
1130	10	5	6	21	4	112	5	121	8	6	20	34	20	103	14	137	313
1145	15	6	2	23	3	91	10	104	10	1	14	25	12	90	9	111	263
1200	12	4	4	20	2	95	8	105	2	2	16	20	15	90	5	110	255
1215	21	6	3	30	6	112	6	124	13	5	23	41	15	104	11	130	325
MID Peak Vehicles	58	21	15	94	15	410	29	454	33	14	73	120	62	387	39	488	1156
MID Peak Trucks	2	1	0	3	1	39	1	41	2	0	3	5	5	56	1	62	111
MID Peak Truck %	**3.4%**	**4.8%**	**0.0%**	**3.2%**	**6.7%**	**9.5%**	**3.4%**	**9.0%**	**6.1%**	**0.0%**	**4.1%**	**4.2%**	**8.1%**	**14.5%**	**2.6%**	**12.7%**	**9.6%**
345	14	16	5	35	6	87	10	103	20	11	21	52	32	180	18	230	420
400	30	24	4	58	4	109	5	118	23	9	26	58	13	188	19	220	454
415	17	7	4	28	7	131	6	144	19	14	21	54	28	172	22	222	448
430	33	10	13	56	4	146	12	162	26	16	31	73	28	149	31	208	499
PM Peak Vehicles	94	57	26	177	21	473	33	527	88	50	99	237	101	689	90	880	1821
PM Peak Trucks	6	2	0	8	1	27	2	30	3	0	2	5	1	27	0	28	71
PM Peak Truck %	**6.4%**	**3.5%**	**0.0%**	**4.5%**	**4.8%**	**5.7%**	**6.1%**	**5.7%**	**3.4%**	**0.0%**	**2.0%**	**2.1%**	**1.0%**	**3.9%**	**0.0%**	**3.2%**	**3.9%**

NOTES:

PEAK HOUR FACTORS (PHF)

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 26, 2012
DAY: Wednesday
WEATHER:

INTERSECTION: SR 228 and SR 3007 (Three Degree Rd)

	SR 3007 SB				SR 228 WB				SR 3007 NB				SR 228 EB				
Starting Time	From North				From East				From South				From West				TOTAL TRAFFIC
	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	
700	17	16	4	37	2	152	16	170	8	25	14	47	3	86	25	114	368
715	62	53	14	129	1	103	12	116	8	27	20	55	7	98	45	150	450
730	29	20	12	61	2	151	9	162	17	15	35	67	3	115	24	142	432
745	18	16	6	40	2	181	16	199	2	7	20	29	8	85	12	105	373
PHF	0.51	0.50	0.64	0.52	0.88	0.81	0.83	0.81	0.51	0.69	0.64	0.74	0.66	0.83	0.59	0.85	0.90
1130	10	5	6	21	4	112	5	121	8	6	20	34	20	103	14	137	313
1145	15	6	2	23	3	91	10	104	10	1	14	25	12	90	9	111	263
1200	12	4	4	20	2	95	8	105	2	2	16	20	15	90	5	110	255
1215	21	6	3	30	6	112	6	124	13	5	23	41	15	104	11	130	325
PHF	0.69	0.88	0.63	0.78	0.63	0.92	0.73	0.92	0.63	0.58	0.79	0.73	0.78	0.93	0.70	0.89	0.89
345	14	16	5	35	6	87	10	103	20	11	21	52	32	180	18	230	420
400	30	24	4	58	4	109	5	118	23	9	26	58	13	188	19	220	454
415	17	7	4	28	7	131	6	144	19	14	21	54	28	172	22	222	448
430	33	10	13	56	4	146	12	162	26	16	31	73	28	149	31	208	499
PHF	0.71	0.59	0.50	0.76	0.75	0.81	0.69	0.81	0.85	0.78	0.80	0.81	0.79	0.92	0.73	0.96	0.91

TABLE TOTALS

	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	TOTAL
AM	126	105	36	267	7	587	53	647	35	74	89	198	21	384	106	511	1623
MID	58	21	15	94	15	410	29	454	33	14	73	120	62	387	39	488	1156
PM	94	57	26	177	21	473	33	527	88	50	99	237	101	689	90	880	1821

NOTES:

2035 VOLUMES

Yearly Growth Rate: 0.7%
(Southwestern Planning Commission)
(Adams Township)

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 26, 2012
DAY: Wednesday
WEATHER:

INTERSECTION: SR 228 and SR 3007 (Three Degree Rd)

	SR 3007 SB				SR 228 WB				SR 3007 NB				SR 228 EB				TOTAL
Starting Time	From North				From East				From South				From West				TOTAL
	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	TRAFFIC
AM																	
700	20	19	5	43	2	178	19	200	9	29	16	55	4	101	29	134	432
715	73	62	16	151	1	121	14	136	9	32	23	65	8	115	53	176	528
730	34	23	14	72	2	177	11	190	20	18	41	79	4	135	28	167	507
745	21	19	7	47	2	212	19	234	2	8	23	34	9	100	14	123	438
MID																	
1130	12	6	7	25	5	131	6	142	9	7	23	40	23	121	16	161	367
1145	18	7	2	27	4	107	12	122	12	1	16	29	14	106	11	130	309
1200	14	5	5	23	2	112	9	123	2	2	19	23	18	106	6	129	299
1215	25	7	4	35	7	131	7	146	15	6	27	48	18	122	13	153	382
PM																	
345	16	19	6	41	7	102	12	121	23	13	25	61	38	211	21	270	493
400	35	28	5	68	5	128	6	139	27	11	31	68	15	221	22	258	533
415	20	8	5	33	8	154	7	169	22	16	25	63	33	202	26	261	526
430	39	12	15	66	5	171	14	190	31	19	36	86	33	175	36	244	586
TABLE TOTALS																	
	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	**TOTAL**
AM	148	123	42	313	8	689	62	760	41	87	104	232	25	451	124	600	1905
MID	68	25	18	110	18	481	34	533	39	16	86	141	73	454	46	573	1357
PM	110	67	31	208	25	555	39	619	103	59	116	278	119	809	106	1033	2138

2035 Volumes = Raw Data x (1+(0.007))^23 = 1.1740263

NOTES:

2035 Passenger Car Equivalent Volumes

Per PennDOT Pub 46 Chapter 11.16:

Truck adjustment factor : $T = 1+P_T(E_T-1)$ where

E_T = passenger car equivalent for trucks = 2.5 (Exhibit 11-5, Rolling terrain)

P_T = proportion of trucks in the traffic stream (expressed as a decimal fraction)

COUNTY: Butler

MUNICIPALITY: Adams Township

DATE: September 26, 2012

DAY: Wednesday

WEATHER:

INTERSECTION: SR 228 and SR 3007 (Three Degree Rd)

Calculated Truck Adjustment Factors

	SR 3007 SB				SR 228 WB				SR 3007 NB				SR 228 EB			
	From North				From East				From South				From West			
	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL
AM	1.11	1.00	1.25	1.08	1.00	1.14	1.03	1.13	1.00	1.43	1.07	1.19	1.36	1.14	1.10	1.14
MID	1.05	1.07	1.00	1.05	1.10	1.14	1.05	1.14	1.09	1.00	1.06	1.06	1.12	1.22	1.04	1.19
PM	1.10	1.05	1.00	1.07	1.07	1.09	1.09	1.09	1.05	1.00	1.03	1.03	1.02	1.06	1.00	1.05

Passenger Car Equivalent Volumes

	SR 3007 SB				SR 228 WB				SR 3007 NB				SR 228 EB				TOTAL
Starting Time	From North				From East				From South				From West				
	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	TRAFFIC
AM																	
700	22	19	6	47	2	204	19	226	9	42	18	66	5	116	32	153	491
715	81	62	21	164	1	138	14	154	9	45	25	77	11	132	58	201	596
730	38	23	18	78	2	202	11	215	20	25	44	94	5	154	31	191	577
745	23	19	9	51	2	242	19	264	2	12	25	40	13	114	15	141	497
MID																	
1130	12	6	7	26	5	150	6	161	10	7	25	42	26	147	17	191	421
1145	19	8	2	28	4	122	12	139	13	1	17	31	16	129	11	155	353
1200	15	5	5	25	3	127	10	140	3	2	20	25	20	129	6	154	343
1215	26	8	4	37	8	150	7	165	17	6	29	51	20	149	13	182	435
PM																	
345	18	20	6	44	8	111	13	131	25	13	25	63	38	224	22	283	521
400	39	30	5	73	5	139	6	150	28	11	31	70	15	234	24	271	564
415	22	9	5	35	9	167	8	184	23	16	25	65	33	214	27	273	557
430	42	12	15	70	5	186	15	206	32	19	37	88	33	185	39	256	621
TABLE TOTALS																	
	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	R	S	L	TOTAL	**TOTAL**
AM	164	123	53	340	8	786	64	859	41	124	112	276	33	516	137	686	2161
MID	72	26	18	116	19	550	36	605	42	16	91	150	82	553	48	682	1552
PM	121	70	31	222	26	603	42	672	109	59	120	287	120	856	112	1083	2263

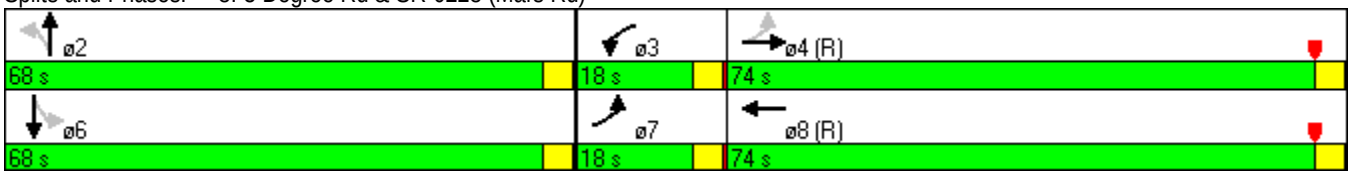
2035 Passenger Car Equivalent Volumes = 2035 Volumes x T (as calculated above)

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	140		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.990			0.998			0.971			0.935	
Flt Protected	0.950			0.950				0.978			0.995	
Satd. Flow (prot)	1687	1696	0	1770	1741	0	0	1615	0	0	1680	0
Flt Permitted	0.055			0.950				0.429			0.909	
Satd. Flow (perm)	98	1696	0	1770	1741	0	0	708	0	0	1535	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		3						10			35	
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		529			473			1093			1168	
Travel Time (s)		8.0			7.2			18.6			19.9	
Peak Hour Factor	0.59	0.83	0.66	0.83	0.81	0.88	0.64	0.69	0.51	0.64	0.50	0.51
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	7%	10%	24%	2%	9%	0%	5%	28%	0%	17%	0%	7%
Adj. Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
Shared Lane Traffic (%)												
Lane Group Flow (vph)	210	578	0	75	857	0	0	368	0	0	601	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4						2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	15.0	20.0		15.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	18.0	74.0		18.0	74.0		68.0	68.0		68.0	68.0	
Total Split (%)	11.3%	46.3%		11.3%	46.3%		42.5%	42.5%		42.5%	42.5%	
Maximum Green (s)	14.0	70.0		14.0	70.0		64.0	64.0		64.0	64.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	85.9	72.5		11.5	70.0			64.0			64.0	
Actuated g/C Ratio	0.54	0.45		0.07	0.44			0.40			0.40	
v/c Ratio	1.10	0.75		0.59	1.13			1.27			0.95	
Control Delay	136.3	44.2		90.2	114.3			185.7			68.3	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	136.3	44.2		90.2	114.3			185.7			68.3	
LOS	F	D		F	F			F			E	
Approach Delay		68.7			112.4			185.7			68.3	
Approach LOS		E			F			F			E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow, Master Intersection			
Natural Cycle: 150			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.27			
Intersection Signal Delay: 99.8		Intersection LOS: F	
Intersection Capacity Utilization 85.7%		ICU Level of Service E	
Analysis Period (min) 15			

Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	210	578	75	857	368	601
v/c Ratio	1.10	0.75	0.59	1.13	1.27	0.95
Control Delay	136.3	44.2	90.2	114.3	185.7	68.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	136.3	44.2	90.2	114.3	185.7	68.3
Queue Length 50th (ft)	~199	497	77	~1032	~480	579
Queue Length 95th (ft)	#156	591	124	#1080	#456	302
Internal Link Dist (ft)		449		393	1013	1088
Turn Bay Length (ft)	140		100			
Base Capacity (vph)	191	769	154	761	289	635
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.10	0.75	0.49	1.13	1.27	0.95

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

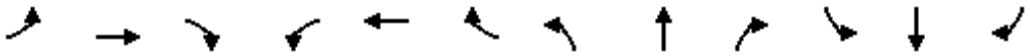
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.99		1.00	1.00			0.97			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1687	1697		1770	1742			1615			1679	
Flt Permitted	0.06	1.00		0.95	1.00			0.43			0.91	
Satd. Flow (perm)	98	1697		1770	1742			708			1534	
Peak-hour factor, PHF	0.59	0.83	0.66	0.83	0.81	0.88	0.64	0.69	0.51	0.64	0.50	0.51
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
RTOR Reduction (vph)	0	2	0	0	0	0	0	6	0	0	21	0
Lane Group Flow (vph)	210	576	0	75	857	0	0	362	0	0	580	0
Heavy Vehicles (%)	7%	10%	24%	2%	9%	0%	5%	28%	0%	17%	0%	7%
Turn Type	pm+pt	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	86.5	72.5		11.5	70.0			64.0			64.0	
Effective Green, g (s)	86.5	72.5		11.5	70.0			64.0			64.0	
Actuated g/C Ratio	0.54	0.45		0.07	0.44			0.40			0.40	
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)	192	768		127	762			283			613	
v/s Ratio Prot	c0.10	0.34		0.04	0.49							
v/s Ratio Perm	c0.50							c0.51			0.38	
v/c Ratio	1.09	0.75		0.59	1.12			1.28			0.95	
Uniform Delay, d1	53.9	36.3		72.0	45.0			48.0			46.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	92.2	6.7		7.2	72.6			150.0			23.6	
Delay (s)	146.1	42.9		79.1	117.6			198.0			70.0	
Level of Service	F	D		E	F			F			E	
Approach Delay (s)		70.4			114.5			198.0			70.0	
Approach LOS		E			F			F			E	

Intersection Summary			
HCM 2000 Control Delay	103.1	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.19		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	85.7%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1776	1713	1713	1863	1745	1745	1701	1701	1701	1806	1806	1806
Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Capacity, veh/h	198	834	0	93	776	7	309	223	119	84	271	261
Arriving On Green	0.09	0.49	0.00	0.05	0.45	0.45	0.38	0.38	0.38	0.38	0.38	0.38
Sat Flow, veh/h	1691.1	1713.3	0.0	1774.0	1725.6	16.2	733.3	278.8	309.3	181.3	604.9	680.6
Grp Volume(v), veh/h	210.2	541.3	0.0	74.7	0.0	855.8	356.8	0.0	0.0	558.6	0.0	0.0
Grp Sat Flow(s),veh/h/ln	1691.1	1713.3	0.0	1774.0	0.0	1741.8	1608.1	0.0	0.0	1538.8	0.0	0.0
Q Serve(g_s), s	14.0	36.9	0.0	6.5	0.0	70.0	0.0	0.0	0.0	28.2	0.0	0.0
Cycle Q Clear(g_c), s	14.0	36.9	0.0	6.5	0.0	70.0	25.5	0.0	0.0	53.7	0.0	0.0
Proportion In Lane	1.000		0.000	1.000		0.009	0.456		0.192	0.118		0.442
Lane Grp Cap(c), veh/h	198.3	834.0	0.0	93.5	0.0	783.0	650.3	0.0	0.0	615.9	0.0	0.0
V/C Ratio(X)	1.060	0.649	0.000	0.799	0.000	1.093	0.549	0.000	0.000	0.907	0.000	0.000
Avail Cap(c_a), veh/h	198.3	834.0	0.0	159.5	0.0	783.0	672.2	0.0	0.0	653.8	0.0	0.0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	0.000	1.000	1.000	0.000	0.000	1.000	0.000	0.000
Uniform Delay (d), s/veh	54.3	30.0	0.0	72.9	0.0	42.9	37.5	0.0	0.0	44.3	0.0	0.0
Incr Delay (d2), s/veh	80.7	1.8	0.0	14.3	0.0	60.5	0.9	0.0	0.0	15.9	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	135.0	31.8	0.0	87.3	0.0	103.4	38.4	0.0	0.0	60.2	0.0	0.0
Lane Group LOS	F	C		F		F	D			E		
Approach Volume, veh/h		752			931			357			559	
Approach Delay, s/veh		60.6			102.1			38.4			60.2	
Approach LOS		E			F			D			E	

Timer												
Assigned Phase	7	4		3	8			2			6	
Phase Duration (G+Y+Rc), s	18.00	79.80		12.20	74.00			63.71			63.71	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00			4.00			4.00	
Max Green Setting (Gmax), s	14.00	70.00		14.00	70.00			64.00			64.00	
Max Q Clear Time (g_c+I1), s	16.00	38.91		8.49	72.00			27.54			55.70	
Green Extension Time (p_c)	0.00	11.27		0.06	0.00			8.17			4.01	

Intersection Summary	
HCM 2010 Control Delay	72.3
HCM 2010 Level of Service	E



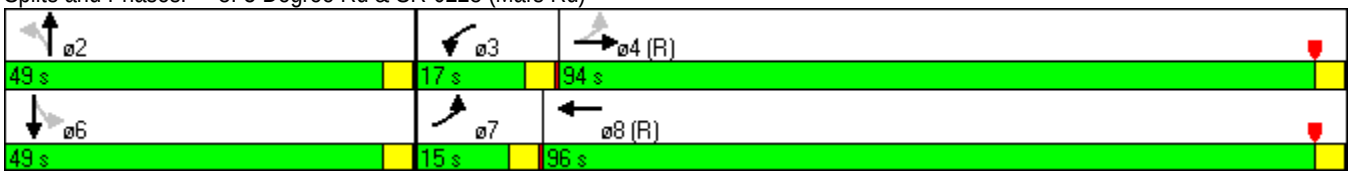
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	140		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.976			0.992			0.958			0.914	
Flt Protected	0.950			0.950				0.973			0.991	
Satd. Flow (prot)	1752	1628	0	1752	1716	0	0	1702	0	0	1674	0
Flt Permitted	0.396			0.950				0.588			0.912	
Satd. Flow (perm)	730	1628	0	1752	1716	0	0	1029	0	0	1540	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		10			3			14			55	
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		529			473			1093			1168	
Travel Time (s)		8.0			7.2			18.6			19.9	
Peak Hour Factor	0.70	0.93	0.78	0.73	0.92	0.63	0.79	0.58	0.63	0.63	0.88	0.69
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	3%	15%	8%	3%	10%	7%	4%	0%	6%	0%	5%	3%
Adj. Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	580	0	46	549	0	0	197	0	0	154	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4						2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	15.0	20.0		15.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	15.0	94.0		17.0	96.0		49.0	49.0		49.0	49.0	
Total Split (%)	9.4%	58.8%		10.6%	60.0%		30.6%	30.6%		30.6%	30.6%	
Maximum Green (s)	11.0	90.0		13.0	92.0		45.0	45.0		45.0	45.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	115.8	109.8		9.6	112.2			30.6			30.6	
Actuated g/C Ratio	0.72	0.69		0.06	0.70			0.19			0.19	
v/c Ratio	0.11	0.52		0.44	0.46			0.95			0.46	
Control Delay	6.7	16.5		84.8	13.9			108.7			38.8	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	6.7	16.5		84.8	13.9			108.7			38.8	
LOS	A	B		F	B			F			D	
Approach Delay		15.5			19.3			108.7			38.8	
Approach LOS		B			B			F			D	

Intersection Summary

Area Type: Other
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow, Master Intersection
Natural Cycle: 65
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.95
Intersection Signal Delay: 30.7 Intersection LOS: C
Intersection Capacity Utilization 56.2% ICU Level of Service B
Analysis Period (min) 15

Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)



Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	65	580	46	549	197	154
v/c Ratio	0.11	0.52	0.44	0.46	0.95	0.46
Control Delay	6.7	16.5	84.8	13.9	108.7	38.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	6.7	16.5	84.8	13.9	108.7	38.8
Queue Length 50th (ft)	15	284	47	243	193	92
Queue Length 95th (ft)	29	502	73	421	154	148
Internal Link Dist (ft)		449		393	1013	1088
Turn Bay Length (ft)	140		100			
Base Capacity (vph)	611	1120	142	1204	299	472
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.11	0.52	0.32	0.46	0.66	0.33

Intersection Summary

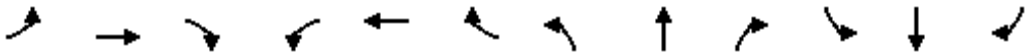
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lane Util. Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Frt	1.00	0.98		1.00	0.99			0.96			0.91	
Flt Protected	0.95	1.00		0.95	1.00			0.97			0.99	
Satd. Flow (prot)	1752	1628		1752	1716			1703			1674	
Flt Permitted	0.40	1.00		0.95	1.00			0.59			0.91	
Satd. Flow (perm)	731	1628		1752	1716			1029			1540	
Peak-hour factor, PHF	0.70	0.93	0.78	0.73	0.92	0.63	0.79	0.58	0.63	0.63	0.88	0.69
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
RTOR Reduction (vph)	0	3	0	0	1	0	0	11	0	0	44	0
Lane Group Flow (vph)	65	577	0	46	548	0	0	186	0	0	110	0
Heavy Vehicles (%)	3%	15%	8%	3%	10%	7%	4%	0%	6%	0%	5%	3%
Turn Type	pm+pt	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	115.0	109.0		8.4	111.4			30.6			30.6	
Effective Green, g (s)	115.0	109.0		8.4	111.4			30.6			30.6	
Actuated g/C Ratio	0.72	0.68		0.05	0.70			0.19			0.19	
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)	563	1109		91	1194			196			294	
v/s Ratio Prot	0.00	c0.35		c0.03	0.32							
v/s Ratio Perm	0.08							c0.18			0.07	
v/c Ratio	0.12	0.52		0.51	0.46			0.95			0.37	
Uniform Delay, d1	7.3	12.6		73.8	10.8			63.9			56.3	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.1	1.7		4.4	1.3			48.8			0.8	
Delay (s)	7.4	14.3		78.1	12.1			112.7			57.1	
Level of Service	A	B		E	B			F			E	
Approach Delay (s)		13.6			17.2			112.7			57.1	
Approach LOS		B			B			F			E	

Intersection Summary			
HCM 2000 Control Delay	31.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	56.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1845	1668	1668	1845	1730	1730	1826	1826	1826	1848	1848	1848
Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Capacity, veh/h	608	1193	0	60	1183	54	160	37	59	69	70	158
Arriving On Green	0.03	0.72	0.00	0.03	0.72	0.72	0.16	0.16	0.16	0.16	0.16	0.16
Sat Flow, veh/h	1756.8	1668.5	0.0	1756.8	1641.5	75.0	774.4	139.2	375.2	334.1	256.1	1008.1
Grp Volume(v), veh/h	65.2	486.9	0.0	46.5	0.0	545.2	188.7	0.0	0.0	139.8	0.0	0.0
Grp Sat Flow(s),veh/h/ln	1756.8	1668.5	0.0	1756.8	0.0	1716.5	1351.9	0.0	0.0	1677.0	0.0	0.0
Q Serve(g_s), s	1.3	15.0	0.0	3.3	0.0	16.6	6.5	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	1.3	15.0	0.0	3.3	0.0	16.6	16.0	0.0	0.0	9.5	0.0	0.0
Proportion In Lane	1.000		0.000	1.000		0.044	0.573		0.278	0.199		0.601
Lane Grp Cap(c), veh/h	608.1	1193.1	0.0	59.9	0.0	1237.4	256.4	0.0	0.0	296.8	0.0	0.0
V/C Ratio(X)	0.107	0.408	0.000	0.777	0.000	0.441	0.736	0.000	0.000	0.471	0.000	0.000
Avail Cap(c_a), veh/h	709.9	1193.1	0.0	179.0	0.0	1237.4	438.5	0.0	0.0	548.0	0.0	0.0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	0.000	1.000	1.000	0.000	0.000	1.000	0.000	0.000
Uniform Delay (d), s/veh	5.4	7.3	0.0	61.2	0.0	7.3	50.6	0.0	0.0	49.5	0.0	0.0
Incr Delay (d2), s/veh	0.1	0.2	0.0	19.0	0.0	0.2	4.1	0.0	0.0	1.2	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	5.5	7.5	0.0	80.1	0.0	7.5	54.7	0.0	0.0	50.6	0.0	0.0
Lane Group LOS	A	A		F		A	D			D		
Approach Volume, veh/h		552			592			189			140	
Approach Delay, s/veh		7.3			13.2			54.7			50.6	
Approach LOS		A			B			D			D	

Timer												
Assigned Phase	7	4		3	8			2			6	
Phase Duration (G+Y+Rc), s	7.60	95.26		8.35	96.00			24.01			24.01	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00			4.00			4.00	
Max Green Setting (Gmax), s	11.00	90.00		13.00	92.00			45.00			45.00	
Max Q Clear Time (g_c+I1), s	3.26	16.98		5.35	18.58			18.01			11.49	
Green Extension Time (p_c)	0.06	7.55		0.03	7.55			2.01			2.09	

Intersection Summary		
HCM 2010 Control Delay	19.9	
HCM 2010 Level of Service	B	

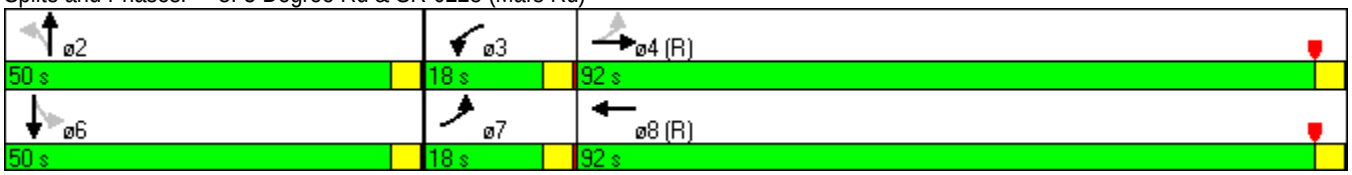


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	140		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	0		0	0		0
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.978			0.993			0.952			0.936	
Flt Protected	0.950			0.950				0.979			0.991	
Satd. Flow (prot)	1805	1794	0	1703	1781	0	0	1738	0	0	1691	0
Flt Permitted	0.215			0.950				0.549			0.847	
Satd. Flow (perm)	408	1794	0	1703	1781	0	0	974	0	0	1446	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		9			2			17			28	
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		529			473			1093			1168	
Travel Time (s)		8.0			7.2			18.6			19.9	
Peak Hour Factor	0.73	0.92	0.79	0.69	0.81	0.75	0.80	0.78	0.85	0.50	0.59	0.71
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	0%	4%	1%	6%	6%	5%	2%	0%	3%	0%	4%	6%
Adj. Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	144	1026	0	56	716	0	0	341	0	0	329	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			0			0	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2		1	2		1	2		1	2	
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	
Leading Detector (ft)	20	100		20	100		20	100		20	100	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	pm+pt	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases	4						2			6		
Detector Phase	7	4		3	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	15.0	20.0		15.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	18.0	92.0		18.0	92.0		50.0	50.0		50.0	50.0	
Total Split (%)	11.3%	57.5%		11.3%	57.5%		31.3%	31.3%		31.3%	31.3%	
Maximum Green (s)	14.0	88.0		14.0	88.0		46.0	46.0		46.0	46.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)	0.0	0.0		0.0	0.0			0.0			0.0	
Total Lost Time (s)	4.0	4.0		4.0	4.0			4.0			4.0	
Lead/Lag	Lead	Lag		Lead	Lag							
Lead-Lag Optimize?	Yes	Yes		Yes	Yes							
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	C-Max		None	C-Max		None	None		None	None	
Walk Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)		11.0			11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)		0			0		0	0		0	0	
Act Effct Green (s)	102.3	93.6		10.5	91.8			46.0			46.0	
Actuated g/C Ratio	0.64	0.58		0.07	0.57			0.29			0.29	
v/c Ratio	0.41	0.97		0.50	0.70			1.17			0.76	
Control Delay	13.7	54.7		87.1	29.2			152.4			59.7	
Queue Delay	0.0	0.0		0.0	0.0			0.0			0.0	
Total Delay	13.7	54.7		87.1	29.2			152.4			59.7	
LOS	B	D		F	C			F			E	
Approach Delay		49.6			33.4			152.4			59.7	
Approach LOS		D			C			F			E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 0 (0%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow, Master Intersection			
Natural Cycle: 150			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 1.17			
Intersection Signal Delay: 59.5		Intersection LOS: E	
Intersection Capacity Utilization 94.0%		ICU Level of Service F	
Analysis Period (min) 15			

Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)

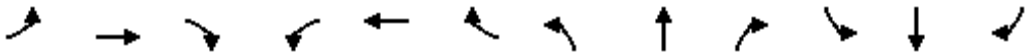


Lane Group	EBL	EBT	WBL	WBT	NBT	SBT
Lane Group Flow (vph)	144	1026	56	716	341	329
v/c Ratio	0.41	0.97	0.50	0.70	1.17	0.76
Control Delay	13.7	54.7	87.1	29.2	152.4	59.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	13.7	54.7	87.1	29.2	152.4	59.7
Queue Length 50th (ft)	52	1033	58	515	~410	291
Queue Length 95th (ft)	64	#1414	81	580	#492	231
Internal Link Dist (ft)		449		393	1013	1088
Turn Bay Length (ft)	140		100			
Base Capacity (vph)	389	1053	149	1022	292	435
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.37	0.97	0.38	0.70	1.17	0.76

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
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	0.98		1.00	0.99			0.95			0.94	
Flt Protected	0.95	1.00		0.95	1.00			0.98			0.99	
Satd. Flow (prot)	1805	1794		1703	1781			1738			1692	
Flt Permitted	0.21	1.00		0.95	1.00			0.55			0.85	
Satd. Flow (perm)	408	1794		1703	1781			975			1446	
Peak-hour factor, PHF	0.73	0.92	0.79	0.69	0.81	0.75	0.80	0.78	0.85	0.50	0.59	0.71
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
RTOR Reduction (vph)	0	4	0	0	1	0	0	12	0	0	20	0
Lane Group Flow (vph)	144	1022	0	56	715	0	0	329	0	0	309	0
Heavy Vehicles (%)	0%	4%	1%	6%	6%	5%	2%	0%	3%	0%	4%	6%
Turn Type	pm+pt	NA		Prot	NA		Perm	NA		Perm	NA	
Protected Phases	7	4		3	8			2			6	
Permitted Phases	4						2			6		
Actuated Green, G (s)	103.0	92.8		9.2	91.8			46.0			46.0	
Effective Green, g (s)	103.0	92.8		9.2	91.8			46.0			46.0	
Actuated g/C Ratio	0.64	0.58		0.06	0.57			0.29			0.29	
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)	351	1040		97	1021			280			415	
v/s Ratio Prot	0.03	c0.57		c0.03	0.40							
v/s Ratio Perm	0.24							c0.34			0.21	
v/c Ratio	0.41	0.98		0.58	0.70			1.17			0.74	
Uniform Delay, d1	17.9	32.8		73.5	24.3			57.0			51.7	
Progression Factor	1.00	1.00		1.00	1.00			1.00			1.00	
Incremental Delay, d2	0.8	24.1		8.1	4.0			109.6			7.1	
Delay (s)	18.7	56.9		81.6	28.3			166.6			58.8	
Level of Service	B	E		F	C			F			E	
Approach Delay (s)		52.2			32.2			166.6			58.8	
Approach LOS		D			C			F			E	

Intersection Summary			
HCM 2000 Control Delay	62.0	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.02		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	94.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1900	1835	1835	1792	1793	1793	1864	1864	1864	1823	1823	1823
Lanes	1	1	0	1	1	0	0	1	0	0	1	0
Capacity, veh/h	447	1200	0	71	1117	46	195	84	113	92	146	156
Arriving On Green	0.04	0.65	0.00	0.04	0.65	0.65	0.22	0.22	0.22	0.22	0.22	0.22
Sat Flow, veh/h	1809.5	1834.7	0.0	1707.1	1710.7	70.1	735.2	227.1	525.7	333.6	461.2	726.0
Grp Volume(v), veh/h	144.2	876.2	0.0	56.0	0.0	711.2	323.3	0.0	0.0	306.3	0.0	0.0
Grp Sat Flow(s),veh/h/ln	1809.5	1834.7	0.0	1707.1	0.0	1780.9	1641.7	0.0	0.0	1679.5	0.0	0.0
Q Serve(g_s), s	3.5	42.6	0.0	4.4	0.0	31.1	1.1	0.0	0.0	0.0	0.0	0.0
Cycle Q Clear(g_c), s	3.5	42.6	0.0	4.4	0.0	31.1	22.8	0.0	0.0	21.8	0.0	0.0
Proportion In Lane	1.000		0.000	1.000		0.039	0.448		0.320	0.199		0.432
Lane Grp Cap(c), veh/h	447.3	1199.6	0.0	71.3	0.0	1163.2	392.1	0.0	0.0	393.6	0.0	0.0
V/C Ratio(X)	0.322	0.730	0.000	0.784	0.000	0.611	0.825	0.000	0.000	0.778	0.000	0.000
Avail Cap(c_a), veh/h	558.5	1199.6	0.0	177.4	0.0	1163.2	515.6	0.0	0.0	551.3	0.0	0.0
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	0.000	1.000	1.000	0.000	0.000	1.000	0.000	0.000
Uniform Delay (d), s/veh	11.2	15.4	0.0	63.9	0.0	13.5	50.0	0.0	0.0	50.1	0.0	0.0
Incr Delay (d2), s/veh	0.4	2.3	0.0	16.9	0.0	0.9	8.1	0.0	0.0	4.6	0.0	0.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	11.6	17.8	0.0	80.8	0.0	14.4	58.2	0.0	0.0	54.8	0.0	0.0
Lane Group LOS	B	B		F		B	E			D		
Approach Volume, veh/h		1020			767			323			306	
Approach Delay, s/veh		16.9			19.3			58.2			54.8	
Approach LOS		B			B			E			D	

Timer												
Assigned Phase	7	4		3	8			2			6	
Phase Duration (G+Y+Rc), s	9.72	92.09		9.63	92.00			33.00			33.00	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00			4.00			4.00	
Max Green Setting (Gmax), s	14.00	88.00		14.00	88.00			46.00			46.00	
Max Q Clear Time (g_c+I1), s	5.54	44.63		6.37	33.07			24.82			23.76	
Green Extension Time (p_c)	0.21	15.21		0.05	16.10			4.18			4.25	

Intersection Summary		
HCM 2010 Control Delay		28.0
HCM 2010 Level of Service		C

11.16 Turn Lane Guidelines

General

The following turn lane guidelines have been developed to determine the warrants for turn lanes and to identify desirable length. The guidelines apply to highway occupancy permit projects, traffic signal permit projects, and Department construction projects. The guidelines apply for any one-hour period during the typical analysis periods. Typical analysis periods for projects are those for the future design year, as specified.

Traffic Engineering Software

In addition to the procedures outlined in this document, at the discretion of the Engineering District, an operational analysis may be conducted to determine whether turn lanes may be warranted and to identify associated storage lengths. The operational analysis shall be conducted utilizing traffic engineering software packages that are approved by the Department as prescribed in **Chapter 12 -Traffic Engineering Software**. The results of both procedures can then be compared, and the more conservative results may be used. For example, although the application of these turn lane guidelines may indicate a turn lane is not warranted, if the operational analysis identifies the need for a turn lane to achieve acceptable levels of service, then the incorporation of the turn lane into the design may be considered.

Additionally, in those cases involving closely spaced intersections and complex transportation systems when intersection function may be affected by adjacent locations, the operational analysis may yield more appropriate results based on site conditions and may be given more consideration than the results obtained from these guidelines.

Use the 95th percentile turn lane queue when estimating required storage length from traffic engineering software packages, unless directed otherwise.

Truck Adjustment Factors

To adjust for truck traffic, the following formula shall be used to develop a truck adjustment factor to be applied to the hourly volume to obtain a passenger-car equivalent volume for the advancing, opposing, and left turning volumes for both warrants and design:

$$T = 1 + P_T (E_T - 1)$$

where

E_T = passenger-car equivalent for trucks

P_T = proportion of trucks in the traffic stream (expressed as a decimal fraction)

T = truck adjustment factor

The value used for E_T shall be taken from the following table based on the terrain of the surrounding area:

Exhibit 11-5 Truck Adjustment Factors

Type of Terrain		
Level	**Rolling**	**Mountainous**
1.5	2.5	4.5

The hourly volume shall be multiplied by the truck adjustment factor (T), and the resulting passenger-car equivalent volume shall then be used in all subsequent calculations identified in these guidelines. The truck adjustment factors were taken from Reference 3 (see page 11-50).

Turn Lane Warrants

Use Figures 1 through 8 in the Chapter 11 Appendix page 11-60 to determine whether a left turn lane is warranted on two-lane and four-lane roadways at unsignalized and signalized intersections. Use Figures 9 through 12 in the Chapter 11 Appendix to determine whether a right turn lane is warranted on two-lane and four-lane roadways at unsignalized and signalized intersections. For unsignalized intersections, the warrants only apply to the free flow approach. For left turns, if the plotted point falls above the appropriate left turn percentage line (L), a left turn lane is considered warranted. Engineering District discretion should be used as to whether the actual left turn percentage should be rounded up or down to match one of the lines in the graph. A turn lane may be considered if the criteria is met for any one-hour period.

Figures 1 through 8 in the Chapter 11 Appendix were adapted from References 1, 2, 4, and 9. Figures 9 through 12 in the Chapter 11 Appendix were taken from Reference 5 (see page 11-50 for a list of references).

Turn Lane Storage Length

Use Exhibit 11-6 through Exhibit 11-8 to compute storage length for left and right turn lanes at unsignalized and signalized intersections. Exhibit 11-6 to Exhibit 11-8 were adapted from Reference 5. Minimum recommended storage length is 75 feet, and all results should be rounded the next highest 25-foot increment. Turn lane storage length does not include taper length.

Consider using dual left turn lanes at signalized intersections when the hourly left turn volume exceeds 300 vehicles per hour.

Exhibit 11-6 Turn Lane Storage - Type of Traffic Control Condition (A, B or C)

TYPE OF TRAFFIC CONTROL	SPEED (MPH)					
	25 – 35		40 – 45		50 - 60	
	TURN DEMAND VOLUME					
	HIGH	LOW*	HIGH	LOW*	HIGH	LOW*
SIGNALIZED	A	A	B or C**	B or C**	B or C**	B or C**
UNSIGNALIZED	A	A	C	B	B or C**	B

* LOW is considered 10% or less of approach traffic volume

** Whichever is greater

Exhibit 11-7 Turn Lane Storage – For Speed and Condition

CONDITION A	
SPEED (MPH)	STORAGE LENGTH
Any speed	Length from Exhibit 11-8
CONDITION B	
SPEED (MPH)	STORAGE LENGTH
40	75’
45	125’
50	175’
55	235’
60	295’
CONDITION C	
SPEED (MPH)	STORAGE LENGTH
40	61’ + Additional length from Exhibit 11-8
45	75’ + Additional length from Exhibit 11-8
50	93’ + Additional length from Exhibit 11-8
55	114’ + Additional length from Exhibit 11-8
60	131’ + Additional length from Exhibit 11-8

Exhibit 11-8 Turn Lane Storage Based on Average No. of Vehicles/Cycle

Average no. of vehicles/cycle*	Length (feet)	Average no. of vehicles/cycle*	Length (feet)
1	75	17	600
2	100	18	625
3	150	19	650
4	175	20	675
5	200	21	725
6	250	22	750
7	275	23	775
8	325	24	800
9	350	25	825
10	375	30	975
11	400	35	1125
12	450	40	1250
13	475	45	1400
14	500	50	1550
15	525	55	1700
16	550	60	1850

* Average no. of vehicles/cycle = design hour volume of turning lane/cycles per hour
If cycles per hour are unknown, assume:
Unsignalized or 2 phase – 60 cycles per hour
3 phase – 40 cycles per hour
4 phase or more – 30 cycles per hour

At signalized intersections, consider dual left turn lanes and operational analysis.

Other Warranting Factors and Considerations

While the preceding sections present analytical procedures to determine whether turn lanes may be warranted, it must be recognized that there are other factors that may need to be considered. These factors may justify turn lanes at some locations where the numerical warrants are not satisfied.

Some of the factors, or combinations of factors, that may need to be considered and may justify turn lanes to preserve safe and efficient traffic flow include crash history; sight distance; deceleration requirements; the type and volume of turning traffic considering nearby land use; grades; locations on high-speed, multilane highways; 85th percentile and safe running speeds; and engineering judgment.

Example Problem

Problem Statement

Determine whether an exclusive left turn lane is warranted and its desired storage length on a signalized approach of a rural arterial highway (speed = 50 mph, 20% trucks, rolling terrain). Intersection approach volumes consist of 100 left turning vehicles per hour and 680 through vehicles per hour. Opposing traffic volume is 500 vehicles per hour. The traffic signal has a 90-second cycle length.

Determine Whether a Left Turn Lane Is Warranted

First, convert the hourly volume to a passenger-car equivalent volume:

T = 1 + .2 (2.5 – 1) = 1.3

Passenger-car equivalent volume (left) = 1.3 (100) = 130 vehicles

Passenger-car equivalent volume (through) = 1.3 (680) = 884 vehicles

Passenger-car equivalent volume (opposing) = 1.3 (500) = 650 vehicles

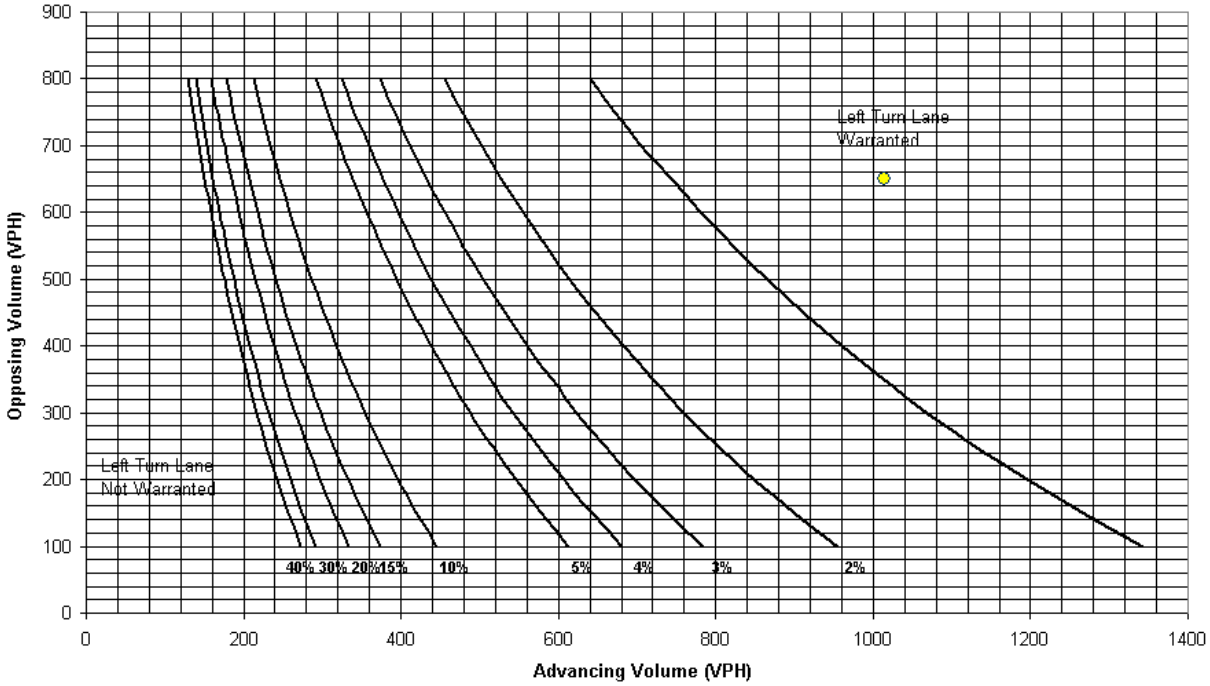
Passenger-car equivalent volume (advancing) = 130 + 884 = 1,014 vehicles.

Next, identify the percentage of left turns contained in the advancing volume:

L = 130/1014 = 12.8%.

Then, use the appropriate graph from Figures 1 through 8 in the Chapter 11 Appendix to determine if a left turn lane is warranted. Therefore, based on site conditions, ***Figure 4*** will be utilized to plot the traffic information as follows:

Figure 4. Warrant for left turn lanes on two-lane highways (50 mph speed, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)



Since the plotted point falls above all of the left turn percentage lines, a left turn lane is warranted.

Determine Storage Length

Refer to **Exhibit 11-6**. Using the given speed of 50 mph, enter the column with the speed "50-60". Next, determine if the left turn demand volume is "high" or "low". "Low" is considered 10% or less of the approach traffic flow. The demand is 130/(884 + 130) = 12.8%. Therefore, the left turn demand is considered "high". Based on a "signalized" intersection, the table indicates that Condition B or C (whichever is greater) should be used to calculate the storage length of the left turn lane.

Condition B, for the 50 mph speed from **Exhibit 11-7** gives a storage length of 175 feet.

Condition C is calculated by adding the 93 feet (for the 50 mph speed from **Exhibit 11-7**) to the additional length determined from **Exhibit 11-8**. To determine the additional length, first calculate the number of cycles/hour (3600 seconds/hour ÷ 90 seconds/cycle = 40 cycles/hour). Next, divide the hourly left turn approach volume by the number of cycles per hour (130 left turning vehicles divided by 40 cycles/hour = 3.25 = round to 3). Using **Exhibit 11-8**, the additional length is 150 feet. Adding the 150 feet to the 93 feet noted above equals 243 feet. A comparison of the values from Condition B and Condition C yields a storage length of 175 feet and 243 feet, respectively. Therefore, use the greater value of 243 feet. Rounding to the next highest 25-foot increment results in a recommended left turn storage length of 250 feet.

References

1. *Aspects of Traffic Control Devices, Volume Warrants for Left-Turn Storage Lanes at Unsignalized Grade Intersections*, M.D. Harmelink, Highway Research Record Number 211, Highway Research Board, National Research Council, National Academy of Sciences, Publication 1554, 1967.
2. *Guidelines for Left-Turn Lanes*, J.C. Oppenlander and J.C. Bianchi, 1990 ITE Compendium of Technical Papers, Pages 191 through 196.
3. *Highway Capacity Manual*, Transportation Research Board, National Research Council, 2000.
4. *Left-Turn Treatments at Intersections*, *NCHRP Synthesis 225*, Transportation Research Board, National Research Council, 1996.
5. *Location and Design Manual, Volume 1, Section 400, Intersection Design*, Ohio Department of Transportation, October 2004.
6. *Manual on Uniform Traffic Control Devices*, Federal Highway Administration, 2009 Edition.
7. *A Policy on Geometric Design of Highways and Streets, Fourth Edition,* American Association of State Highway and Transportation Officials, 2001.
8. *Design Manual Part 2 Highway Design, Publication 13M,* Pennsylvania Department of Transportation, July 2002.
9. *Engineering Study Guide for Evaluating Intersection Improvements, NCHRP Report No. 457*, Transportation Research Board, 2001.

11.17 Chapter 11 Appendix

Turn Lane Warrant Figures

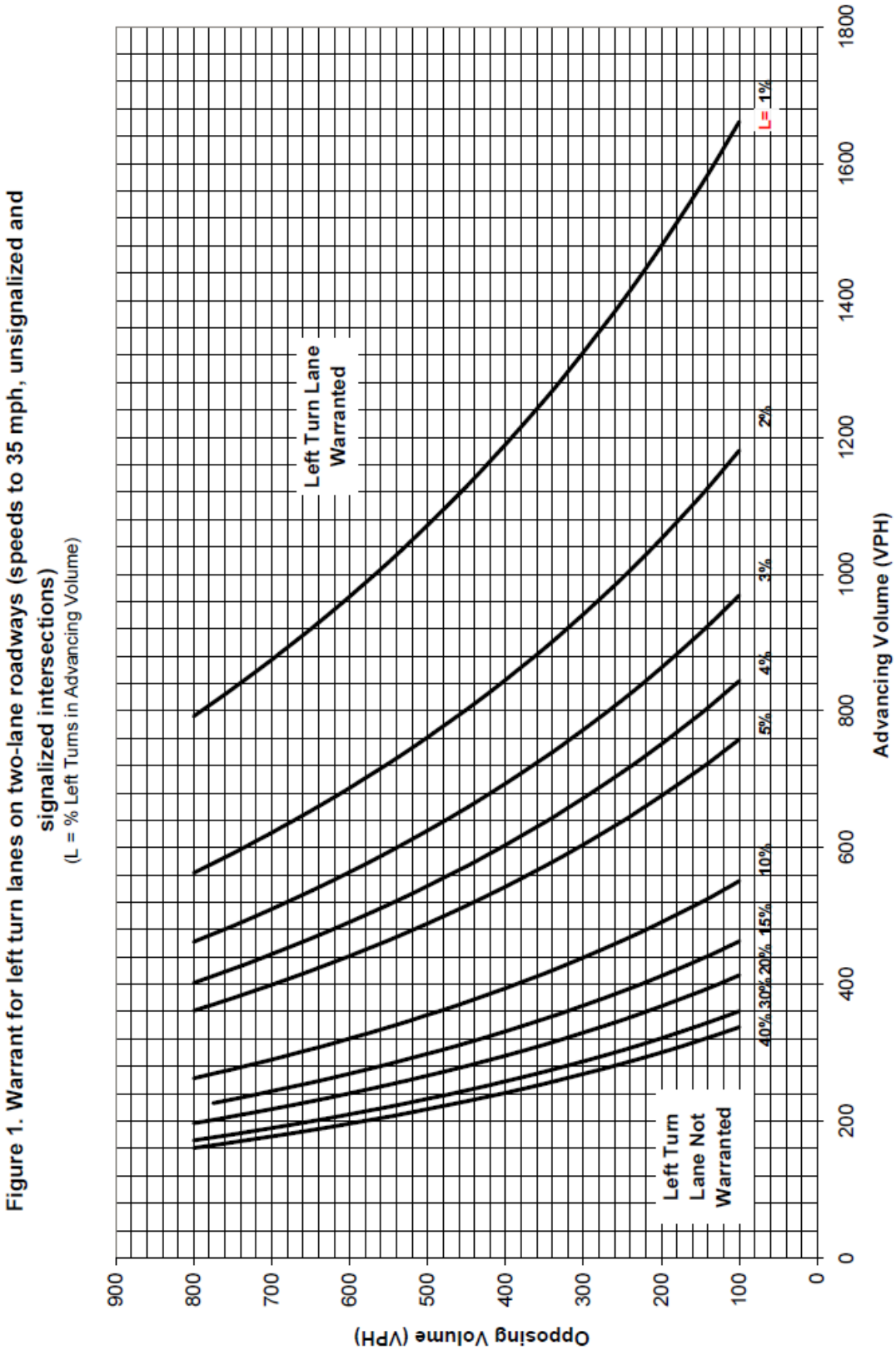


Figure 1. Warrant for left turn lanes on two-lane roadways (speeds to 35 mph, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

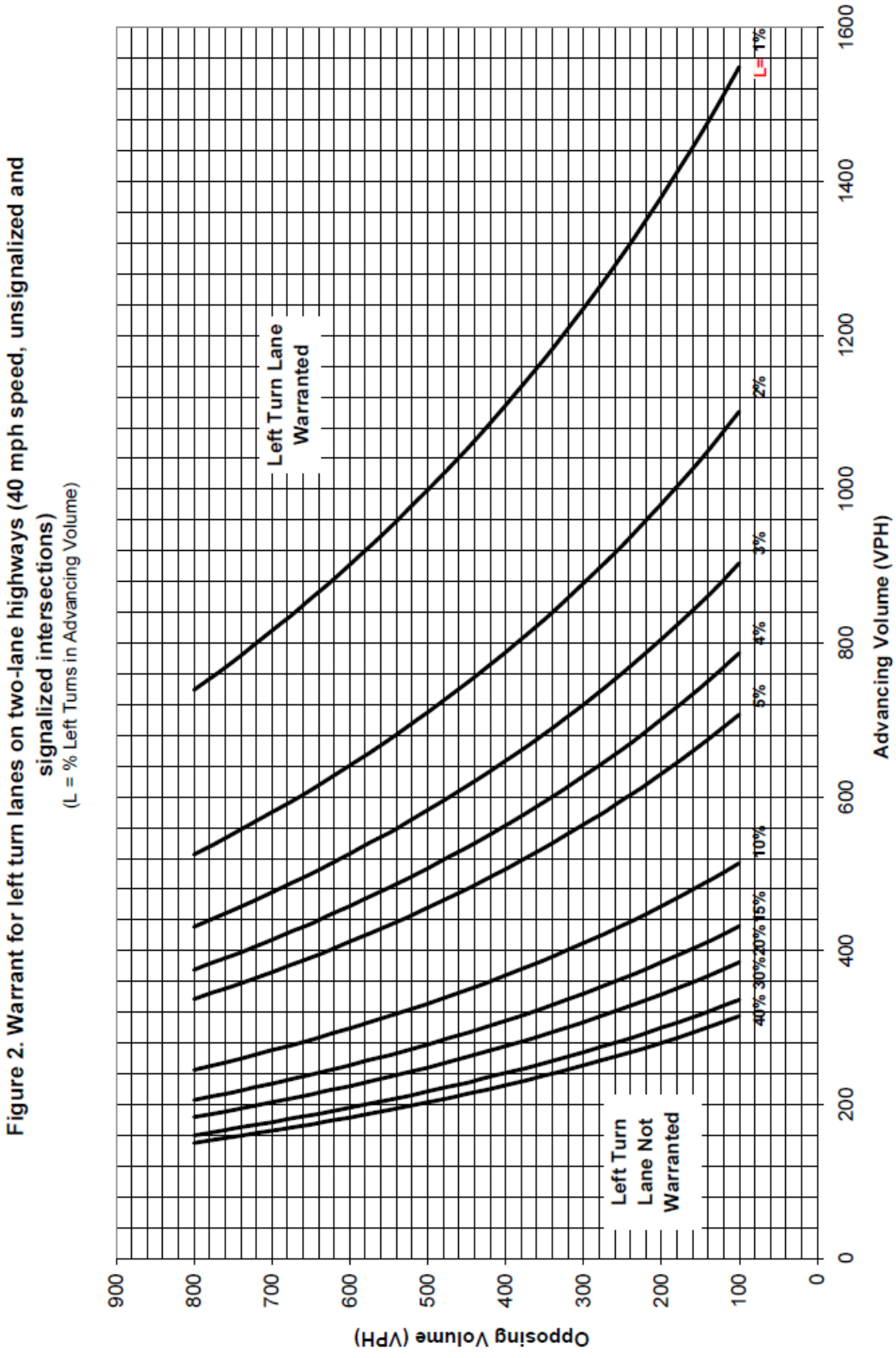


Figure 2. Warrant for left turn lanes on two-lane highways (40 mph speed, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

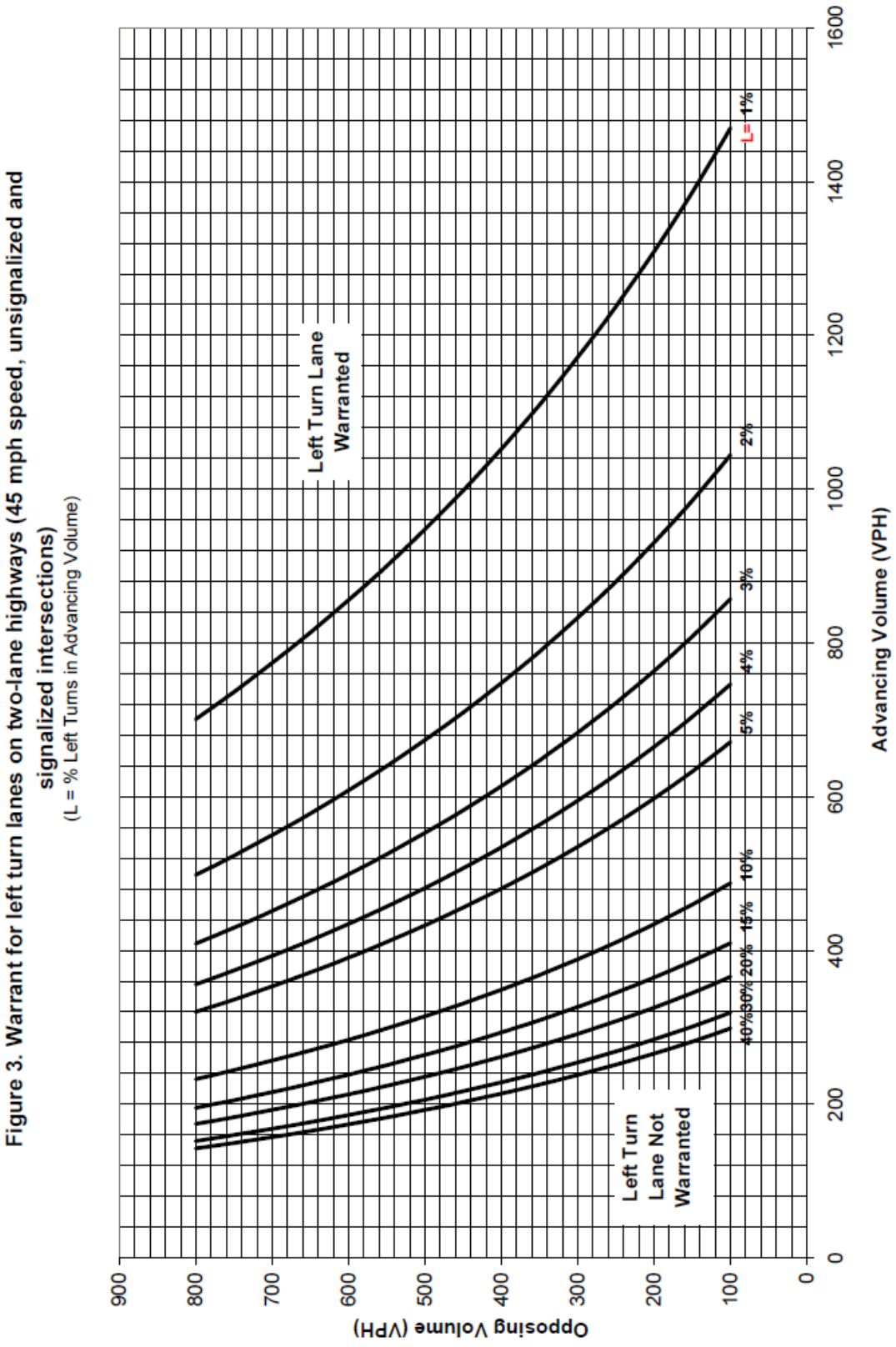


Figure 3. Warrant for left turn lanes on two-lane highways (45 mph speed, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

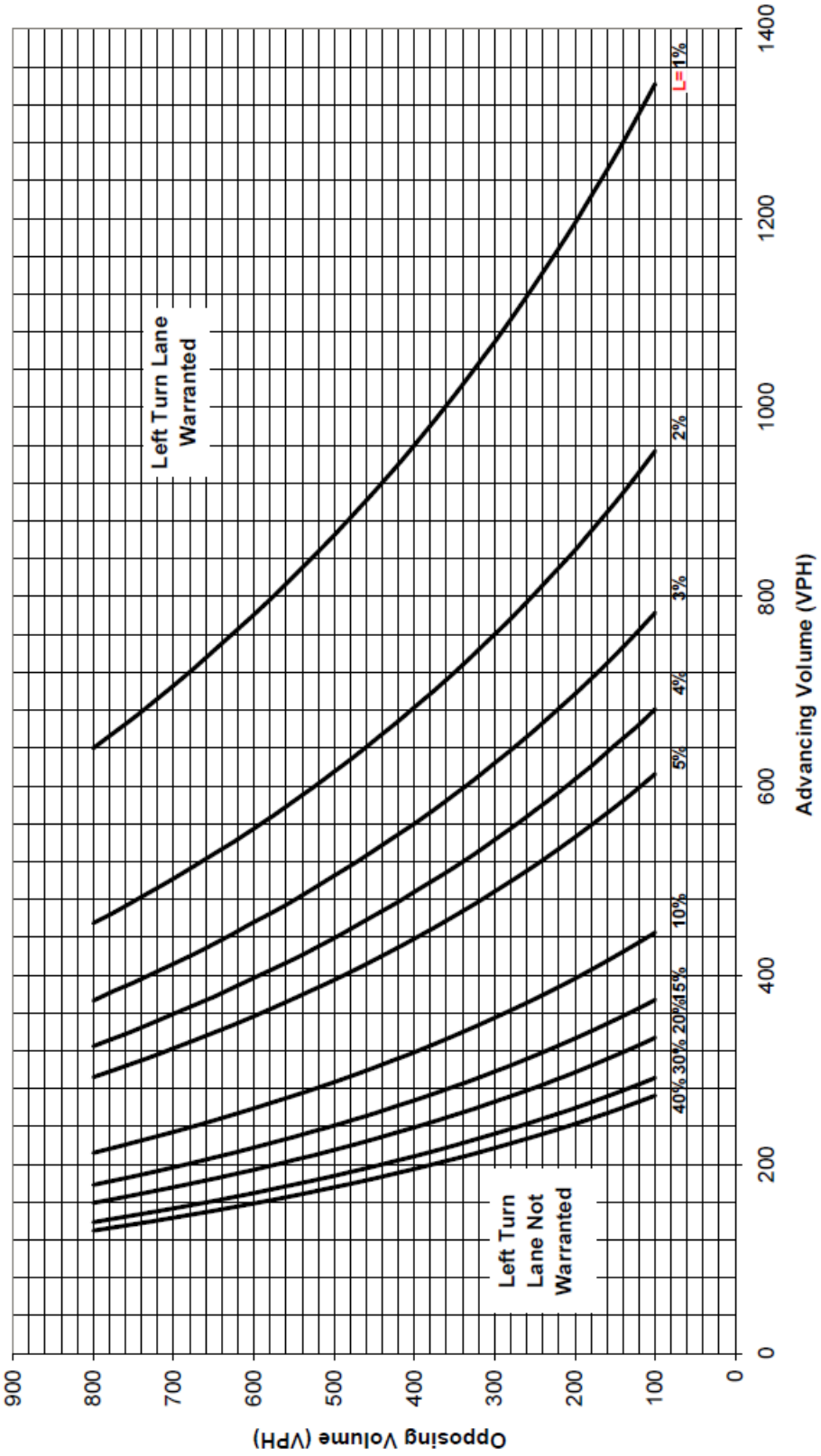


Figure 4. Warrant for left turn lanes on two-lane highways (50 mph speed, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

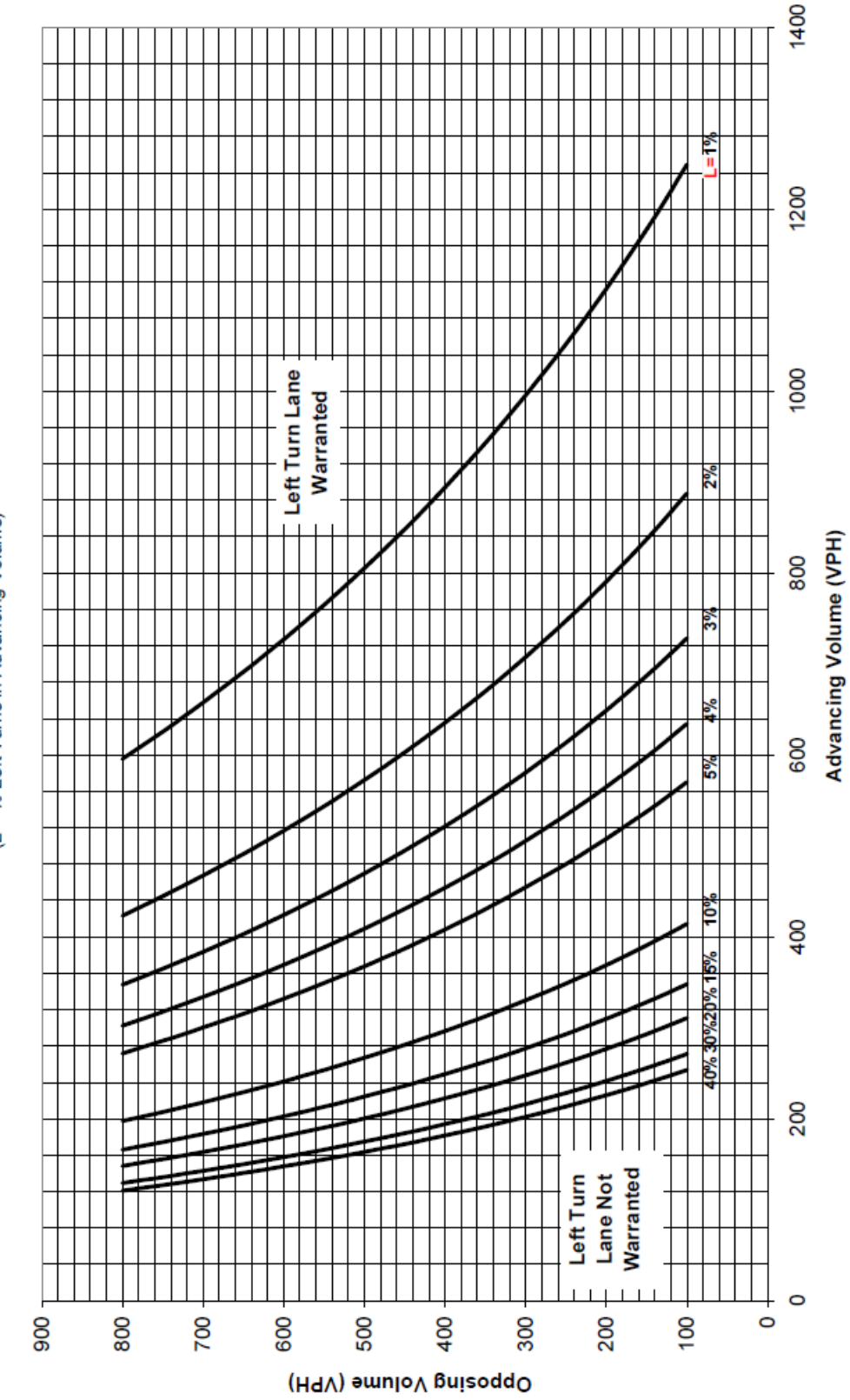


Figure 5. Warrant for left turn lanes on two-lane highways (55 mph speed, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

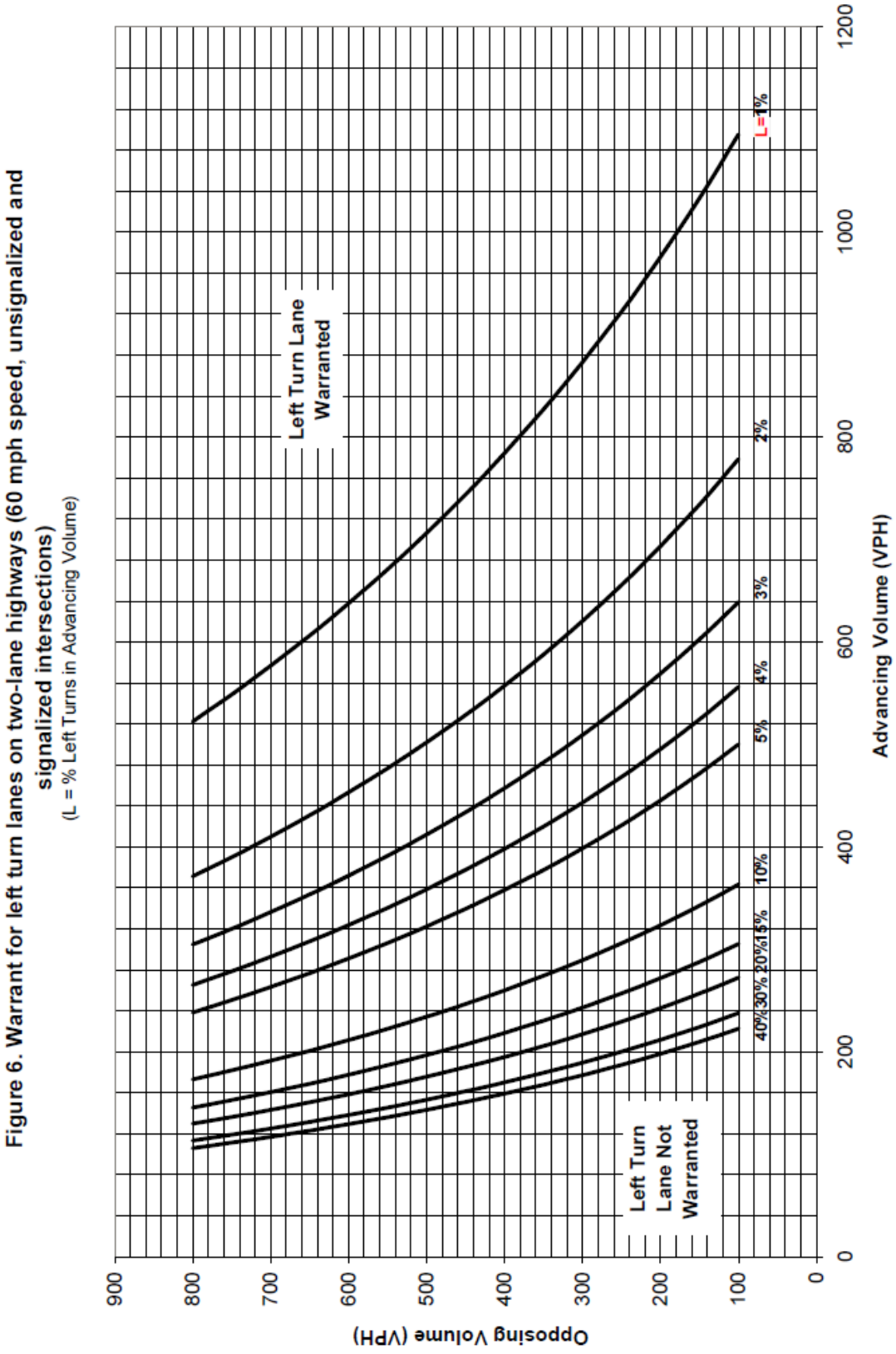


Figure 6. Warrant for left turn lanes on two-lane highways (60 mph speed, unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

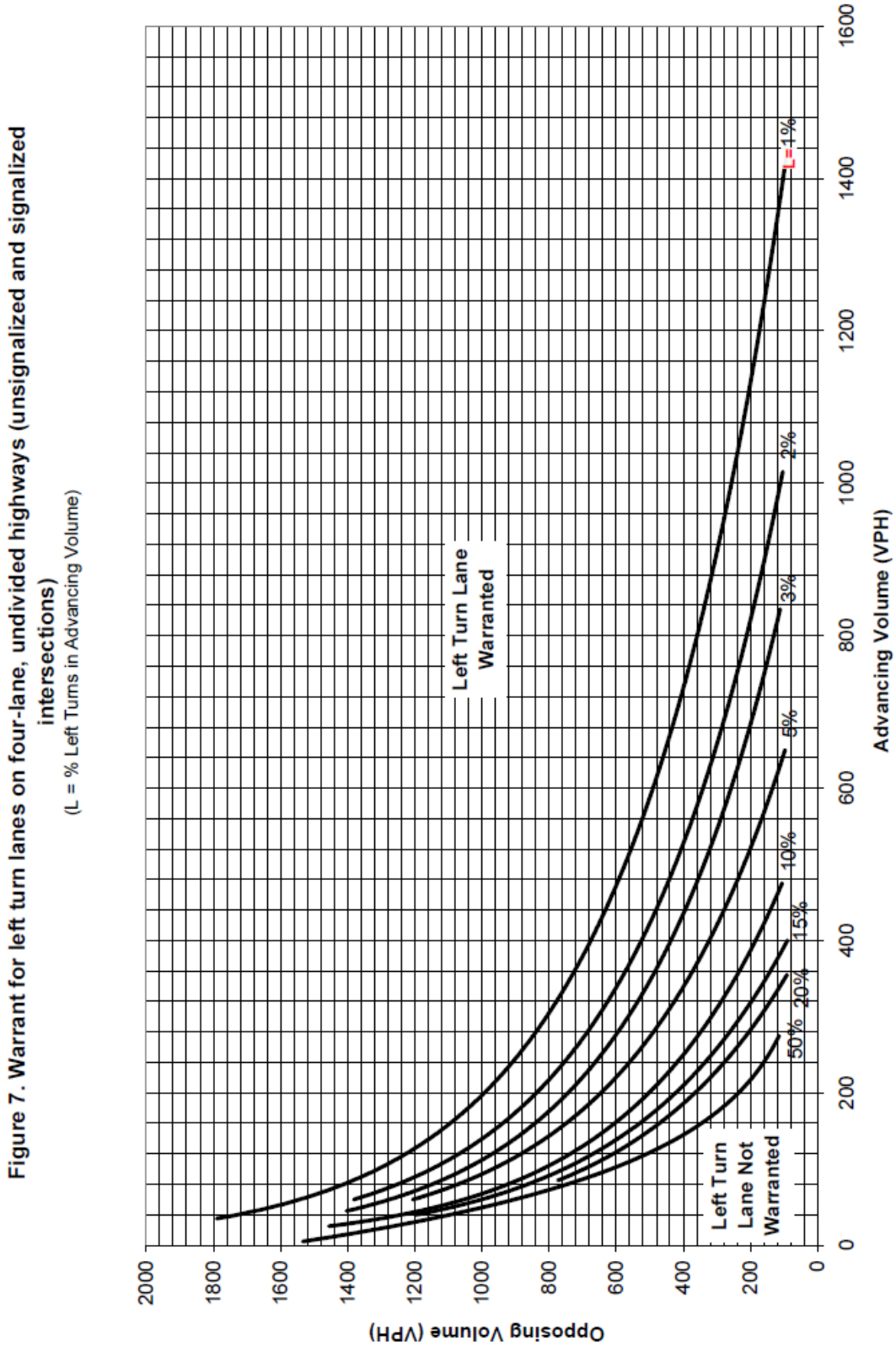


Figure 7. Warrant for left turn lanes on four-lane, undivided highways (unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

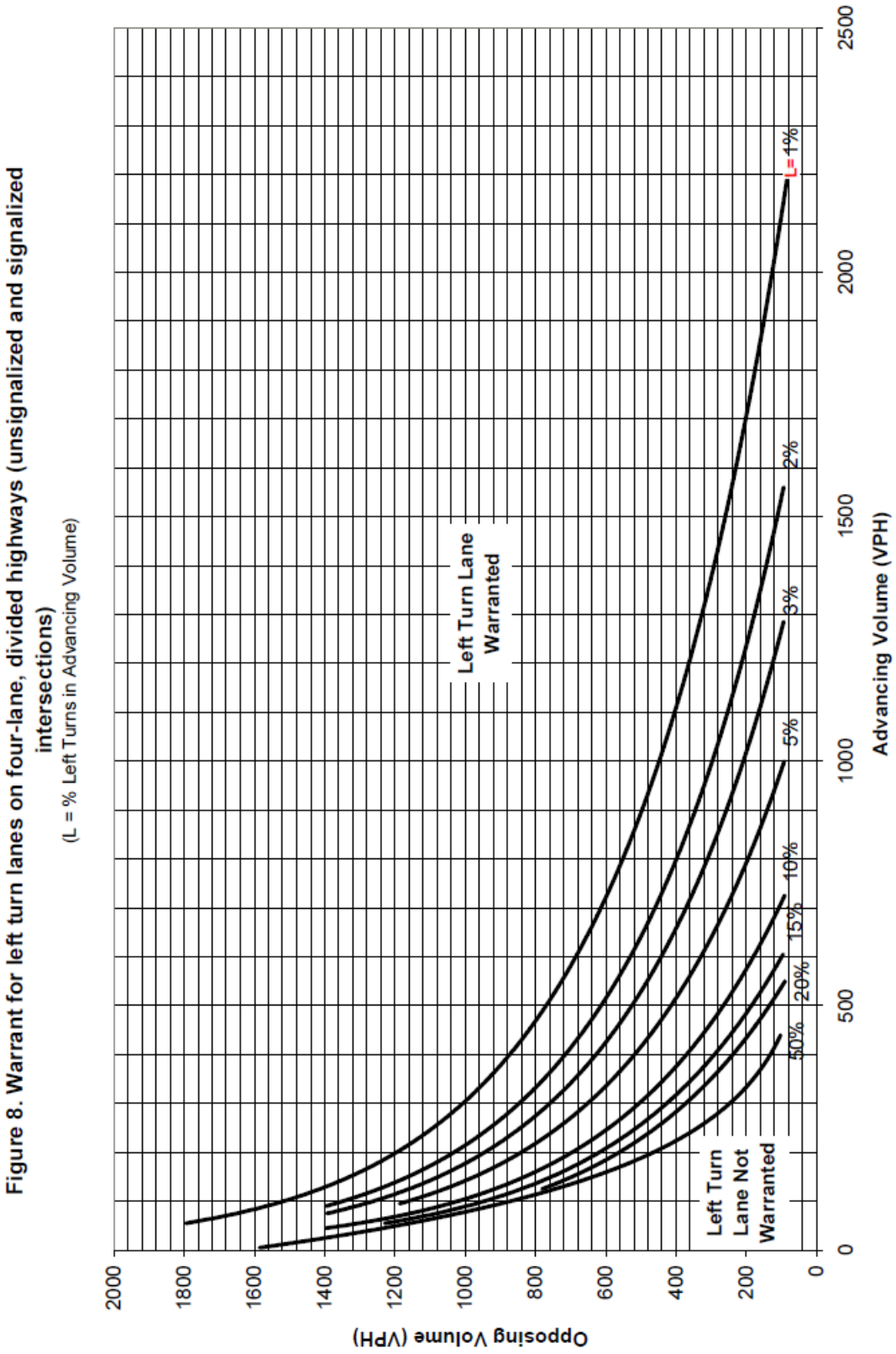


Figure 8. Warrant for left turn lanes on four-lane, divided highways (unsignalized and signalized intersections)
(L = % Left Turns in Advancing Volume)

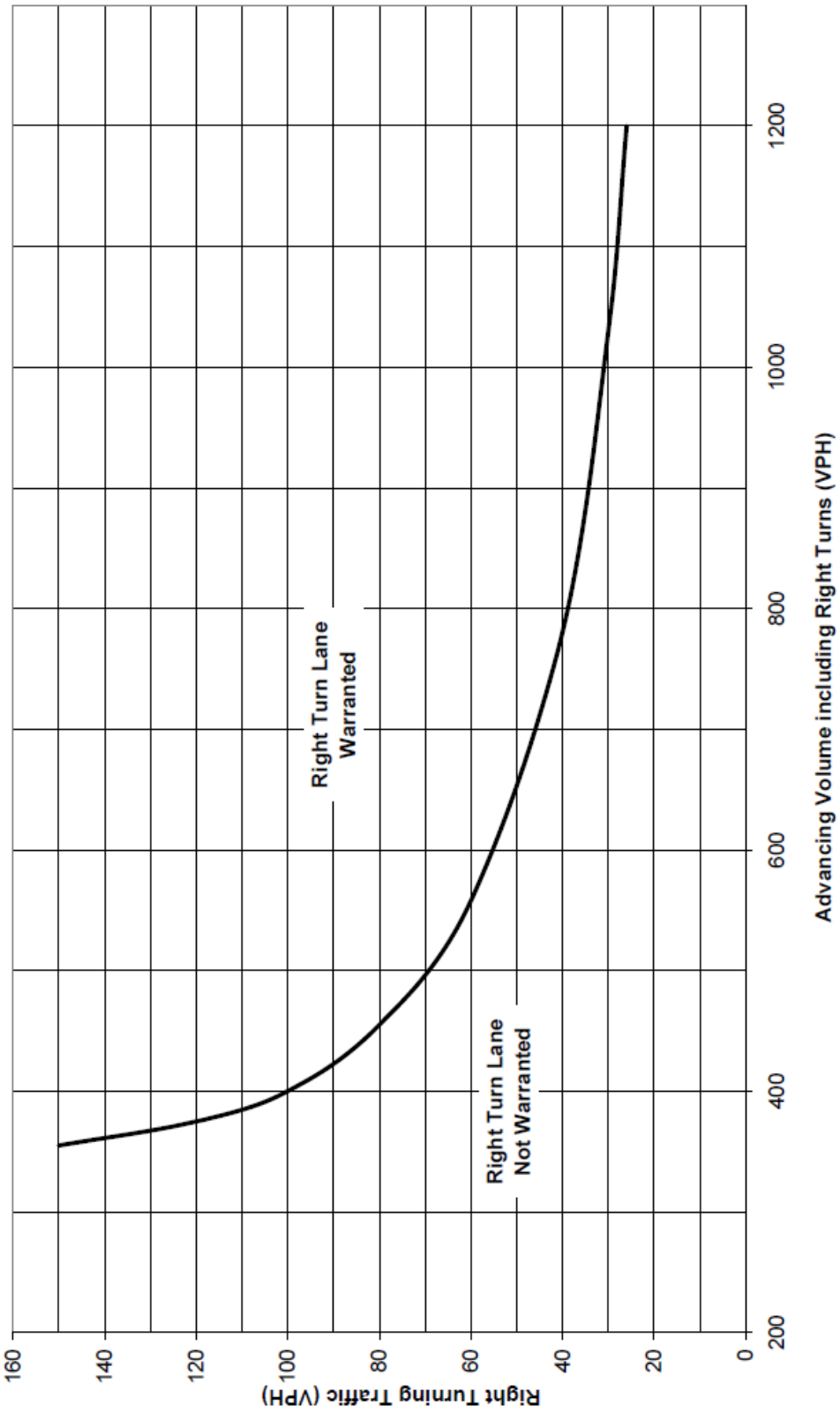


Figure 9. Warrant for right turn lanes on two-lane roadways (40 mph or lower speeds, unsignalized and signalized intersections)

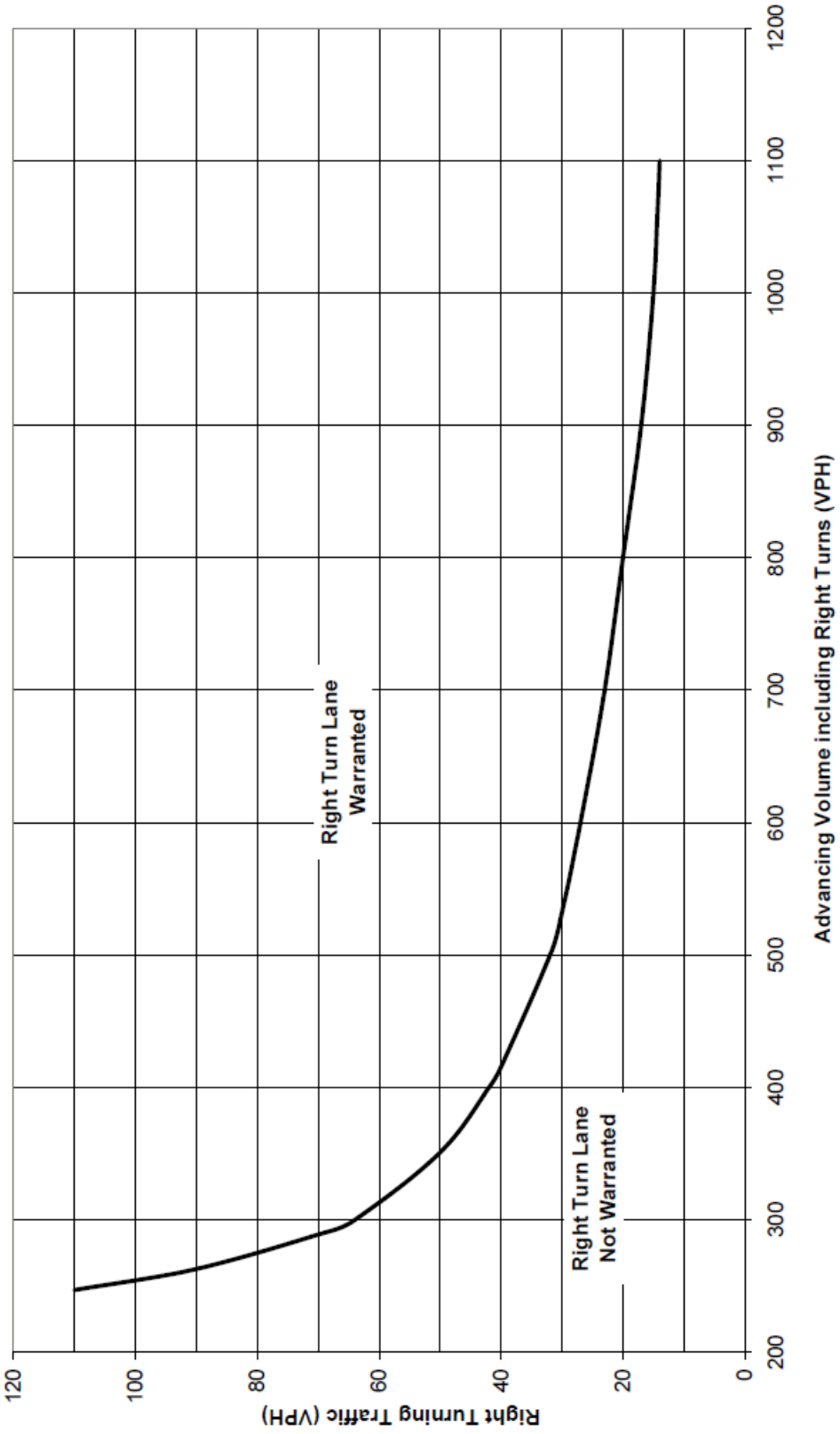


Figure 10. Warrant for right turn lanes on two-lane roadways (45 mph or greater speeds, unsignalized and signalized intersections)

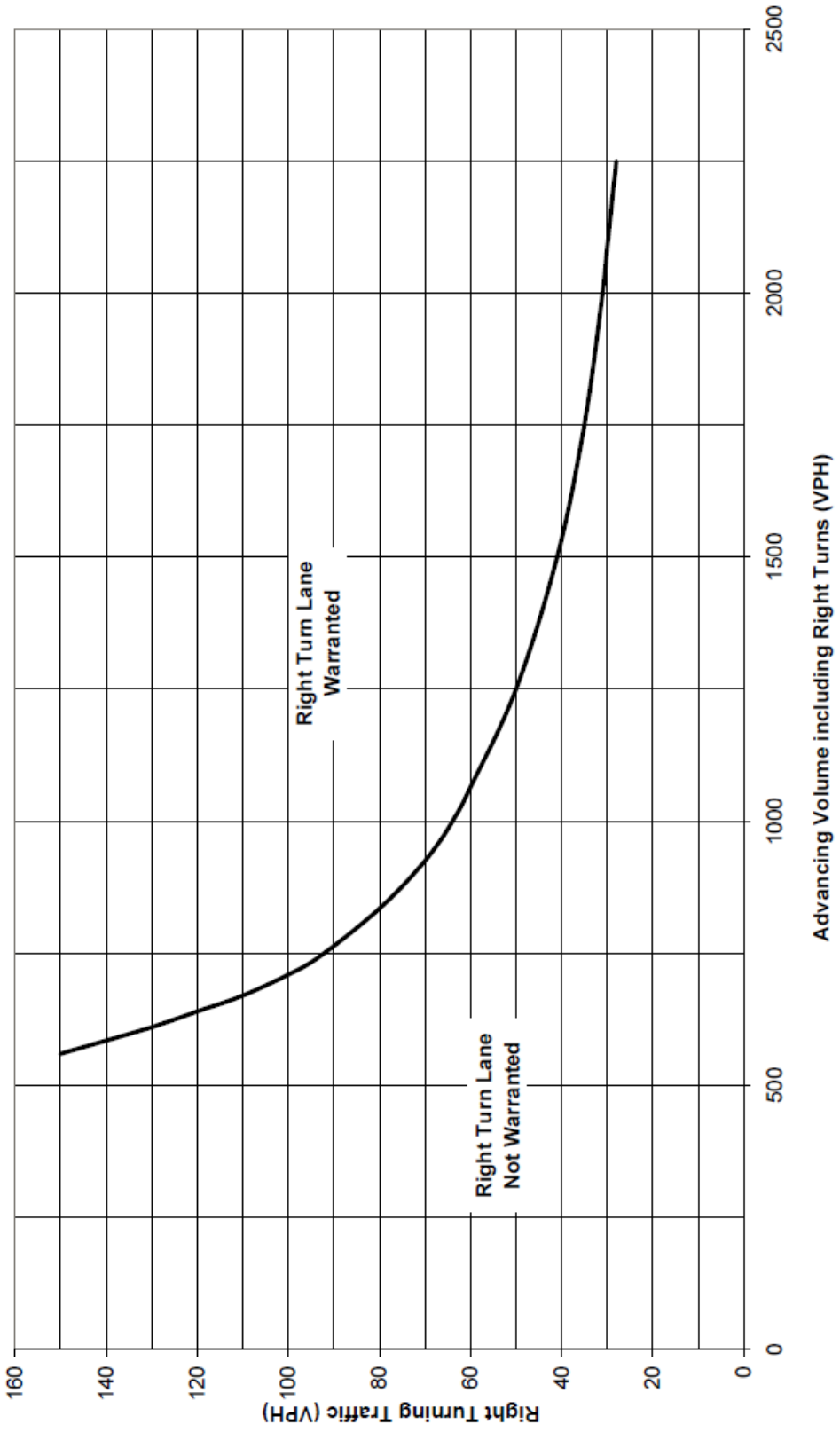


Figure 11. Warrant for right turn lanes on four-lane roadways (40 mph or lower speeds, unsignalized and signalized intersections)

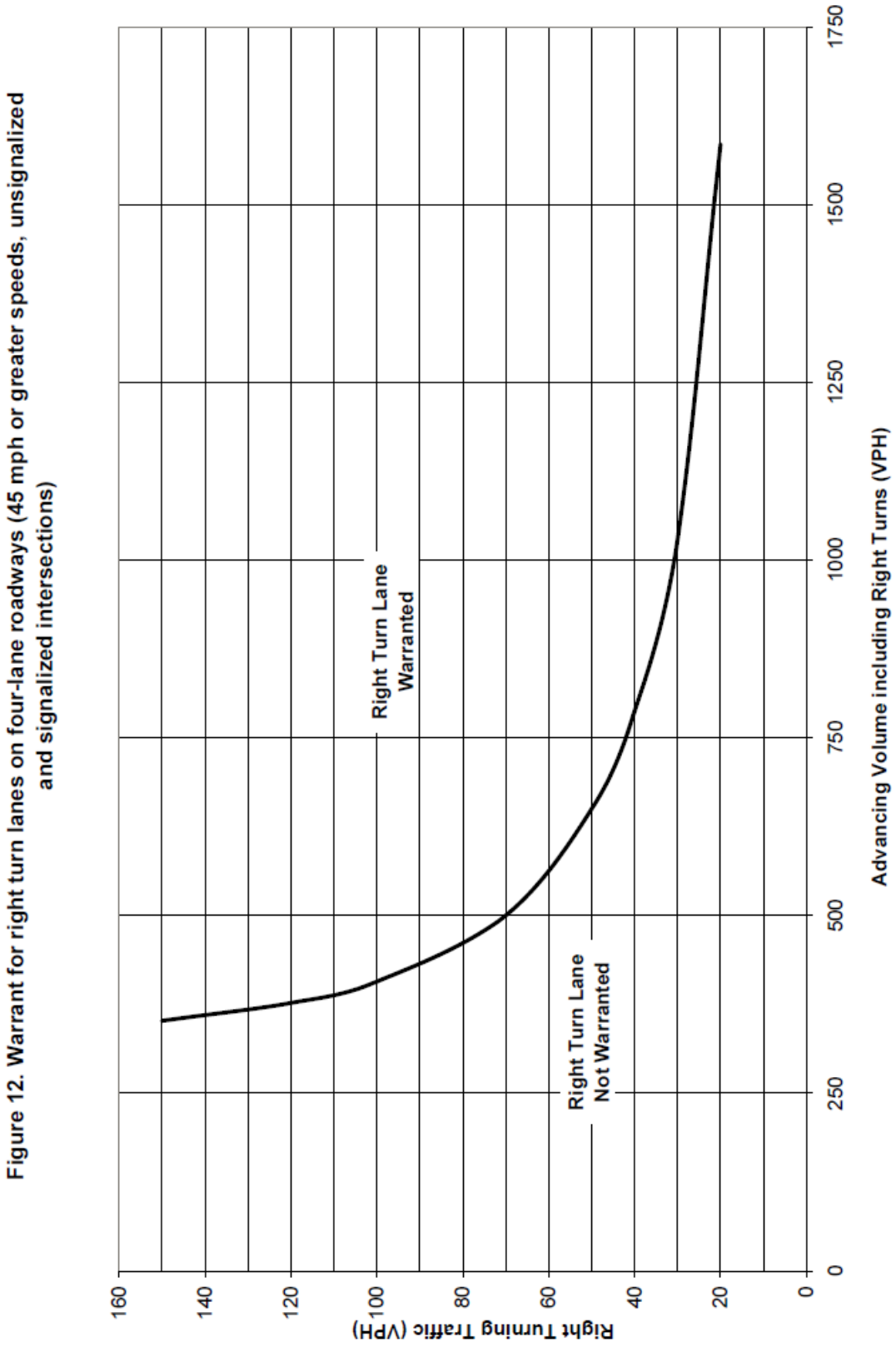
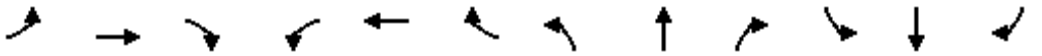


Figure 12. Warrant for right turn lanes on four-lane roadways (45 mph or greater speeds, unsignalized and signalized intersections)

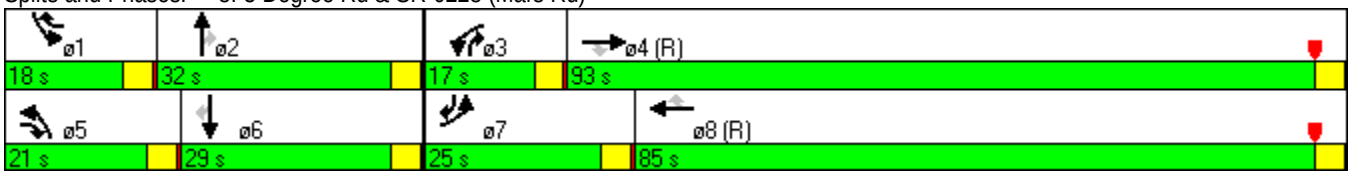


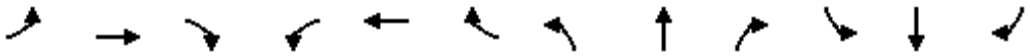
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	325		275	225		150	275		275	175		350
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1687	1727	1302	1770	1743	1615	1719	1484	1615	1543	1900	1509
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1687	1727	1302	1770	1743	1615	1719	1484	1615	1543	1900	1509
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			37			61			80			123
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		529			473			1093			1168	
Travel Time (s)		8.0			7.2			18.6			19.9	
Peak Hour Factor	0.59	0.83	0.66	0.83	0.81	0.88	0.64	0.69	0.51	0.64	0.50	0.51
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	7%	10%	24%	2%	9%	0%	5%	28%	0%	17%	0%	7%
Adj. Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
Shared Lane Traffic (%)												
Lane Group Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4			8			2			6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0
Total Split (s)	25.0	93.0	21.0	17.0	85.0	18.0	21.0	32.0	17.0	18.0	29.0	25.0
Total Split (%)	15.6%	58.1%	13.1%	10.6%	53.1%	11.3%	13.1%	20.0%	10.6%	11.3%	18.1%	15.6%
Maximum Green (s)	21.0	89.0	17.0	13.0	81.0	14.0	17.0	28.0	13.0	14.0	25.0	21.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Walk Time (s)		5.0			5.0			5.0			5.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	21.3	92.6	113.4	11.1	82.5	98.0	16.7	28.7	43.9	11.5	23.5	48.8
Actuated g/C Ratio	0.13	0.58	0.71	0.07	0.52	0.61	0.10	0.18	0.27	0.07	0.15	0.30
v/c Ratio	0.94	0.54	0.04	0.61	0.94	0.01	0.91	0.47	0.16	0.59	0.88	0.53
Control Delay	108.6	22.0	1.3	92.9	56.4	0.0	116.5	65.5	8.8	93.1	97.3	29.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	108.6	22.0	1.3	92.9	56.4	0.0	116.5	65.5	8.8	93.1	97.3	29.2
LOS	F	C	A	F	E	A	F	E	A	F	F	C
Approach Delay		44.1			58.8			75.8			64.1	
Approach LOS		D			E			E			E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow, Master Intersection			
Natural Cycle: 100			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.94			
Intersection Signal Delay: 58.0		Intersection LOS: E	
Intersection Capacity Utilization 68.6%		ICU Level of Service C	
Analysis Period (min) 15			

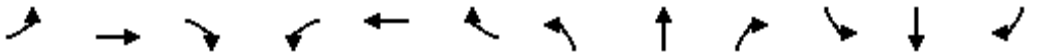
Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)





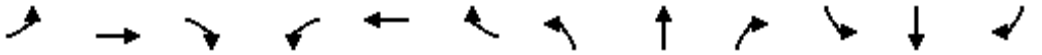
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
v/c Ratio	0.94	0.54	0.04	0.61	0.94	0.01	0.91	0.47	0.16	0.59	0.88	0.53
Control Delay	108.6	22.0	1.3	92.9	56.4	0.0	116.5	65.5	8.8	93.1	97.3	29.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	108.6	22.0	1.3	92.9	56.4	0.0	116.5	65.5	8.8	93.1	97.3	29.2
Queue Length 50th (ft)	211	367	1	77	838	0	171	118	0	68	253	142
Queue Length 95th (ft)	192	415	2	125	883	0	177	142	0	85	183	72
Internal Link Dist (ft)		449			393			1013			1088	
Turn Bay Length (ft)	325		275	225		150	275		275	175		350
Base Capacity (vph)	224	999	935	143	898	1036	182	267	518	135	296	546
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.94	0.54	0.04	0.52	0.94	0.01	0.90	0.47	0.15	0.49	0.83	0.53

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1687	1727	1302	1770	1743	1615	1719	1484	1615	1543	1900	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1687	1727	1302	1770	1743	1615	1719	1484	1615	1543	1900	1509
Peak-hour factor, PHF	0.59	0.83	0.66	0.83	0.81	0.88	0.64	0.69	0.51	0.64	0.50	0.51
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
RTOR Reduction (vph)	0	0	12	0	0	4	0	0	60	0	0	89
Lane Group Flow (vph)	210	541	25	75	848	5	163	125	20	66	246	200
Heavy Vehicles (%)	7%	10%	24%	2%	9%	0%	5%	28%	0%	17%	0%	7%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	21.3	92.7	109.4	11.1	82.5	94.0	16.7	28.7	39.8	11.5	23.5	44.8
Effective Green, g (s)	21.3	92.7	109.4	11.1	82.5	94.0	16.7	28.7	39.8	11.5	23.5	44.8
Actuated g/C Ratio	0.13	0.58	0.68	0.07	0.52	0.59	0.10	0.18	0.25	0.07	0.15	0.28
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	224	1000	922	122	898	989	179	266	442	110	279	460
v/s Ratio Prot	c0.12	0.31	0.00	0.04	c0.49	0.00	c0.09	0.08	0.00	0.04	c0.13	0.06
v/s Ratio Perm			0.02			0.00			0.01			0.07
v/c Ratio	0.94	0.54	0.03	0.61	0.94	0.01	0.91	0.47	0.05	0.60	0.88	0.44
Uniform Delay, d1	68.7	20.6	8.2	72.4	36.6	13.7	70.9	58.8	45.7	72.0	66.9	47.2
Progression Factor	1.03	0.93	0.54	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	36.9	1.7	0.0	8.9	19.2	0.0	42.6	1.3	0.0	8.5	26.1	0.7
Delay (s)	107.6	20.8	4.4	81.2	55.8	13.7	113.5	60.1	45.7	80.5	93.0	47.9
Level of Service	F	C	A	F	E	B	F	E	D	F	F	D
Approach Delay (s)		43.2			57.5			80.6			69.9	
Approach LOS		D			E			F			E	

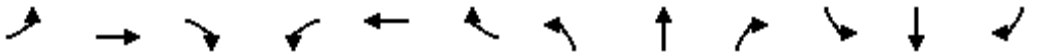
Intersection Summary			
HCM 2000 Control Delay	59.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.93		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.6%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1776	1727	1532	1863	1743	1900	1810	1484	1900	1624	1900	1776
Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Capacity, veh/h	223	1015	903	93	886	905	182	308	420	80	293	431
Arriving On Green	0.13	0.59	0.00	0.05	0.51	0.00	0.11	0.21	0.21	0.05	0.15	0.15
Sat Flow, veh/h	1691.1	1302.4	1302.4	1774.0	1615.0	1615.0	1723.4	1615.0	1615.0	1546.6	1509.3	1509.3
Grp Volume(v), veh/h	210.2	541.3	0.0	74.7	847.9	0.0	162.7	125.5	68.6	65.8	245.7	247.1
Grp Sat Flow(s),veh/h/ln	1691.1	1727.3	1302.4	1774.0	1743.1	1615.0	1723.4	1484.4	1615.0	1546.6	1900.0	1509.3
Q Serve(g_s), s	19.6	30.0	0.0	6.6	74.3	0.0	14.9	11.7	5.2	6.7	20.0	22.3
Cycle Q Clear(g_c), s	19.6	30.0	0.0	6.6	74.3	0.0	14.9	11.7	5.2	6.7	20.0	22.3
Proportion In Lane	1.000		1.000	1.000		1.000	1.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	222.8	1014.6	902.7	93.1	885.7	904.6	182.2	308.4	420.3	80.4	292.6	431.3
V/C Ratio(X)	0.944	0.534	0.000	0.802	0.957	0.000	0.893	0.407	0.163	0.819	0.840	0.573
Avail Cap(c_a), veh/h	222.8	1014.6	902.7	144.7	885.7	904.6	183.8	308.4	420.3	135.8	298.0	435.6
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Uniform Delay (d), s/veh	68.6	19.8	0.0	74.7	37.5	0.0	70.4	54.6	45.5	74.8	65.5	48.6
Incr Delay (d2), s/veh	44.6	2.0	0.0	16.1	21.5	0.0	37.8	0.9	0.2	17.9	18.6	1.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	113.2	21.8	0.0	90.8	59.0	0.0	108.2	55.5	45.7	92.7	84.1	50.4
Lane Group LOS	F	C		F	E		F	E	D	F	F	D
Approach Volume, veh/h		752			923			357			559	
Approach Delay, s/veh		47.4			61.6			77.7			70.2	
Approach LOS		D			E			E			E	

Timer												
Assigned Phase	7	4		3	8		5	2		1	6	
Phase Duration (G+Y+Rc), s	25.00	97.63		12.37	85.00		20.85	37.12		12.29	28.55	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00		4.00	4.00		4.00	4.00	
Max Green Setting (Gmax), s	21.00	89.00		13.00	81.00		17.00	28.00		14.00	25.00	
Max Q Clear Time (g_c+I1), s	21.65	32.02		8.64	76.26		16.86	13.66		8.72	24.28	
Green Extension Time (p_c)	0.00	12.75		0.05	3.26		0.01	2.71		0.05	0.27	

Intersection Summary	
HCM 2010 Control Delay	61.5
HCM 2010 Level of Service	E

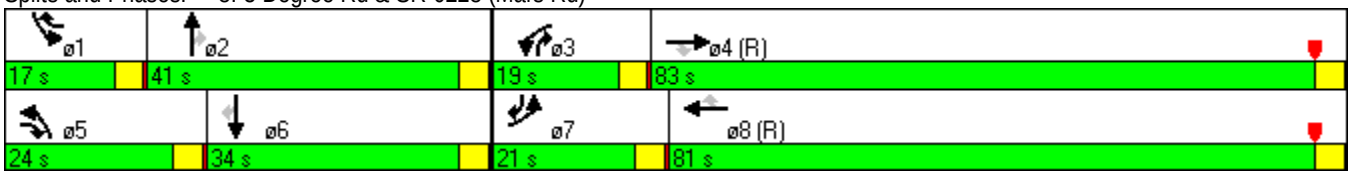


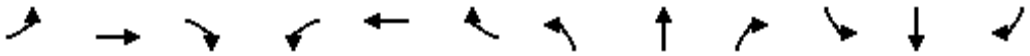
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	325		275	225		150	275		275	175		350
Storage Lanes	1		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	1652	1495	1752	1727	1509	1736	1900	1524	1805	1810	1568
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1752	1652	1495	1752	1727	1509	1736	1900	1524	1805	1810	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			93			61			61			98
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		529			473			1093			1168	
Travel Time (s)		8.0			7.2			18.6			19.9	
Peak Hour Factor	0.70	0.93	0.78	0.73	0.92	0.63	0.79	0.58	0.63	0.63	0.88	0.69
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	3%	15%	8%	3%	10%	7%	4%	0%	6%	0%	5%	3%
Adj. Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4			8			2			6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0
Total Split (s)	21.0	83.0	24.0	19.0	81.0	17.0	24.0	41.0	19.0	17.0	34.0	21.0
Total Split (%)	13.1%	51.9%	15.0%	11.9%	50.6%	10.6%	15.0%	25.6%	11.9%	10.6%	21.3%	13.1%
Maximum Green (s)	17.0	79.0	20.0	15.0	77.0	13.0	20.0	37.0	15.0	13.0	30.0	17.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Walk Time (s)		5.0			5.0			5.0			5.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	11.3	115.4	134.5	9.6	113.7	126.9	15.0	13.8	25.3	9.2	8.0	19.2
Actuated g/C Ratio	0.07	0.72	0.84	0.06	0.71	0.79	0.09	0.09	0.16	0.06	0.05	0.12
v/c Ratio	0.53	0.41	0.07	0.44	0.42	0.02	0.66	0.17	0.21	0.27	0.31	0.36
Control Delay	91.1	10.2	0.5	84.6	12.9	0.1	88.7	67.7	12.3	78.5	81.6	13.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	91.1	10.2	0.5	84.6	12.9	0.1	88.7	67.7	12.3	78.5	81.6	13.2
LOS	F	B	A	F	B	A	F	E	B	E	F	B
Approach Delay		16.9			17.9			62.1			37.5	
Approach LOS		B			B			E			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow, Master Intersection			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.66			
Intersection Signal Delay: 24.9		Intersection LOS: C	
Intersection Capacity Utilization 50.0%		ICU Level of Service A	
Analysis Period (min) 15			

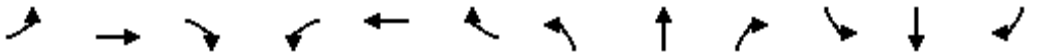
Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
v/c Ratio	0.53	0.41	0.07	0.44	0.42	0.02	0.66	0.17	0.21	0.27	0.31	0.36
Control Delay	91.1	10.2	0.5	84.6	12.9	0.1	88.7	67.7	12.3	78.5	81.6	13.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	91.1	10.2	0.5	84.6	12.9	0.1	88.7	67.7	12.3	78.5	81.6	13.2
Queue Length 50th (ft)	67	200	0	47	230	0	111	27	0	29	29	0
Queue Length 95th (ft)	93	251	3	73	388	0	152	38	13	44	63	20
Internal Link Dist (ft)		449			393			1013			1088	
Turn Bay Length (ft)	325		275	225		150	275		275	175		350
Base Capacity (vph)	186	1192	1314	164	1227	1244	217	439	341	146	339	327
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.35	0.41	0.07	0.28	0.42	0.02	0.50	0.06	0.18	0.19	0.08	0.30

Intersection Summary



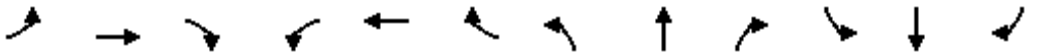
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1752	1652	1495	1752	1727	1509	1736	1900	1524	1805	1810	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1752	1652	1495	1752	1727	1509	1736	1900	1524	1805	1810	1568
Peak-hour factor, PHF	0.70	0.93	0.78	0.73	0.92	0.63	0.79	0.58	0.63	0.63	0.88	0.69
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
RTOR Reduction (vph)	0	0	18	0	0	7	0	0	53	0	0	88
Lane Group Flow (vph)	65	487	75	46	521	21	108	28	8	28	28	10
Heavy Vehicles (%)	3%	15%	8%	3%	10%	7%	4%	0%	6%	0%	5%	3%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	11.3	113.8	128.8	9.6	112.1	120.2	15.0	12.5	22.1	8.1	5.6	16.9
Effective Green, g (s)	11.3	113.8	128.8	9.6	112.1	120.2	15.0	12.5	22.1	8.1	5.6	16.9
Actuated g/C Ratio	0.07	0.71	0.81	0.06	0.70	0.75	0.09	0.08	0.14	0.05	0.03	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	123	1174	1240	105	1209	1171	162	148	248	91	63	204
v/s Ratio Prot	c0.04	0.29	0.01	0.03	c0.30	0.00	c0.06	0.01	0.00	0.02	c0.02	0.00
v/s Ratio Perm			0.04			0.01			0.00			0.00
v/c Ratio	0.53	0.41	0.06	0.44	0.43	0.02	0.67	0.19	0.03	0.31	0.44	0.05
Uniform Delay, d1	71.8	9.5	3.2	72.6	10.3	5.0	70.1	69.0	59.7	73.2	75.7	64.3
Progression Factor	1.09	0.84	0.58	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6	1.0	0.0	2.9	1.1	0.0	9.9	0.6	0.1	1.9	4.9	0.1
Delay (s)	81.9	9.0	1.9	75.5	11.4	5.0	80.0	69.6	59.8	75.2	80.6	64.4
Level of Service	F	A	A	E	B	A	F	E	E	E	F	E
Approach Delay (s)		15.3			16.1			72.3			69.3	
Approach LOS		B			B			E			E	

Intersection Summary			
HCM 2000 Control Delay	27.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	50.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1845	1652	1759	1845	1727	1776	1827	1900	1792	1900	1810	1845
Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Capacity, veh/h	84	1121	1131	60	1148	1034	135	246	249	37	131	189
Arriving On Green	0.05	0.68	0.00	0.03	0.66	0.00	0.08	0.13	0.13	0.02	0.07	0.07
Sat Flow, veh/h	1756.8	1495.4	1495.4	1756.8	1509.3	1509.3	1739.9	1523.6	1523.6	1809.5	1568.0	1568.0
Grp Volume(v), veh/h	65.2	486.9	0.0	46.5	521.4	0.0	108.1	28.2	52.4	27.9	27.9	84.1
Grp Sat Flow(s),veh/h/ln	1756.8	1652.2	1495.4	1756.8	1727.3	1509.3	1739.9	1900.0	1523.6	1809.5	1809.5	1568.0
Q Serve(g_s), s	4.3	15.6	0.0	3.1	16.9	0.0	7.1	1.5	3.5	1.8	1.7	5.8
Cycle Q Clear(g_c), s	4.3	15.6	0.0	3.1	16.9	0.0	7.1	1.5	3.5	1.8	1.7	5.8
Proportion In Lane	1.000		1.000	1.000		1.000	1.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	84.2	1121.3	1130.5	59.8	1148.4	1034.3	134.5	245.8	249.0	36.9	131.1	188.7
V/C Ratio(X)	0.775	0.434	0.000	0.777	0.454	0.000	0.804	0.115	0.210	0.755	0.213	0.445
Avail Cap(c_a), veh/h	256.6	1121.3	1130.5	226.4	1148.4	1034.3	299.0	604.0	536.2	202.1	466.4	479.2
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Uniform Delay (d), s/veh	54.8	8.5	0.0	55.8	9.4	0.0	52.8	44.8	42.2	56.7	50.9	47.6
Incr Delay (d2), s/veh	14.0	1.2	0.0	19.0	1.3	0.0	10.6	0.2	0.4	26.2	0.8	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	68.8	9.7	0.0	74.8	10.7	0.0	63.4	45.0	42.6	82.9	51.7	49.2
Lane Group LOS	E	A		E	B		E	D	D	F	D	D
Approach Volume, veh/h		552			568			189			140	
Approach Delay, s/veh		16.7			15.9			54.9			56.4	
Approach LOS		B			B			D			E	

Timer												
Assigned Phase	7	4		3	8		5	2		1	6	
Phase Duration (G+Y+Rc), s	9.58	83.00		7.96	81.39		13.00	19.06		6.37	12.43	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00		4.00	4.00		4.00	4.00	
Max Green Setting (Gmax), s	17.00	79.00		15.00	77.00		20.00	37.00		13.00	30.00	
Max Q Clear Time (g_c+I1), s	6.27	17.62		5.06	18.87		9.12	5.47		3.78	7.80	
Green Extension Time (p_c)	0.08	7.22		0.04	7.21		0.17	0.70		0.02	0.64	

Intersection Summary	
HCM 2010 Control Delay	25.2
HCM 2010 Level of Service	C



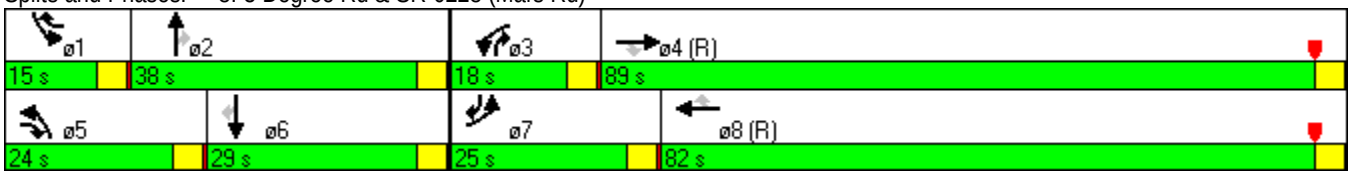
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	325		275	225		150	275		275	175		350
Storage Lanes	0		1	1		1	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	1827	1599	1703	1792	1538	1770	1900	1568	1805	1827	1524
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1805	1827	1599	1703	1792	1538	1770	1900	1568	1805	1827	1524
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			145			89			121			155
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		529			473			1093			1168	
Travel Time (s)		8.0			7.2			18.6			19.9	
Peak Hour Factor	0.73	0.92	0.79	0.69	0.81	0.75	0.80	0.78	0.85	0.50	0.59	0.71
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	0%	4%	1%	6%	6%	5%	2%	0%	3%	0%	4%	6%
Adj. Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7

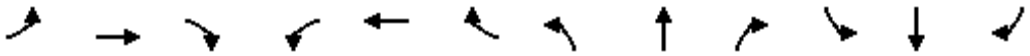
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4			8			2			6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0
Total Split (s)	25.0	89.0	24.0	18.0	82.0	15.0	24.0	38.0	18.0	15.0	29.0	25.0
Total Split (%)	15.6%	55.6%	15.0%	11.3%	51.3%	9.4%	15.0%	23.8%	11.3%	9.4%	18.1%	15.6%
Maximum Green (s)	21.0	85.0	20.0	14.0	78.0	11.0	20.0	34.0	14.0	11.0	25.0	21.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Walk Time (s)		5.0			5.0			5.0			5.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	18.0	101.0	122.2	10.6	93.6	107.4	17.2	24.8	39.4	9.7	15.2	37.2
Actuated g/C Ratio	0.11	0.63	0.76	0.07	0.58	0.67	0.11	0.16	0.25	0.06	0.10	0.23
v/c Ratio	0.71	0.76	0.12	0.50	0.65	0.03	0.76	0.26	0.25	0.56	0.65	0.33
Control Delay	90.3	24.2	0.7	86.1	28.5	0.0	94.2	61.2	7.7	92.0	86.7	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.3	24.2	0.7	86.1	28.5	0.0	94.2	61.2	7.7	92.0	86.7	7.6
LOS	F	C	A	F	C	A	F	E	A	F	F	A
Approach Delay		29.3			31.4			56.3			50.4	
Approach LOS		C			C			E			D	

Intersection Summary

Area Type: Other
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow, Master Intersection
Natural Cycle: 100
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.76
Intersection Signal Delay: 36.1 Intersection LOS: D
Intersection Capacity Utilization 68.8% ICU Level of Service C
Analysis Period (min) 15

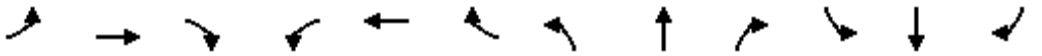
Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
v/c Ratio	0.71	0.76	0.12	0.50	0.65	0.03	0.76	0.26	0.25	0.56	0.65	0.33
Control Delay	90.3	24.2	0.7	86.1	28.5	0.0	94.2	61.2	7.7	92.0	86.7	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	90.3	24.2	0.7	86.1	28.5	0.0	94.2	61.2	7.7	92.0	86.7	7.6
Queue Length 50th (ft)	150	706	4	58	471	0	149	71	0	63	116	0
Queue Length 95th (ft)	183	1004	4	80	625	0	199	103	42	63	115	18
Internal Link Dist (ft)		449			393			1013			1088	
Turn Bay Length (ft)	325		275	225		150	275		275	175		350
Base Capacity (vph)	244	1152	1280	151	1048	1072	221	403	509	124	285	504
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.59	0.76	0.12	0.37	0.65	0.03	0.66	0.19	0.24	0.49	0.40	0.31

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	1827	1599	1703	1792	1538	1770	1900	1568	1805	1827	1524
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	1827	1599	1703	1792	1538	1770	1900	1568	1805	1827	1524
Peak-hour factor, PHF	0.73	0.92	0.79	0.69	0.81	0.75	0.80	0.78	0.85	0.50	0.59	0.71
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
RTOR Reduction (vph)	0	0	39	0	0	12	0	0	94	0	0	122
Lane Group Flow (vph)	144	876	111	56	683	21	145	75	27	61	113	33
Heavy Vehicles (%)	0%	4%	1%	6%	6%	5%	2%	0%	3%	0%	4%	6%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	18.0	100.2	117.4	10.6	92.8	101.2	17.2	24.8	35.4	8.4	16.0	34.0
Effective Green, g (s)	18.0	100.2	117.4	10.6	92.8	101.2	17.2	24.8	35.4	8.4	16.0	34.0
Actuated g/C Ratio	0.11	0.63	0.73	0.07	0.58	0.63	0.11	0.16	0.22	0.05	0.10	0.21
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	203	1144	1213	112	1039	1011	190	294	386	94	182	361
v/s Ratio Prot	c0.08	c0.48	0.01	0.03	0.38	0.00	c0.08	0.04	0.00	0.03	c0.06	0.01
v/s Ratio Perm			0.06			0.01			0.01			0.01
v/c Ratio	0.71	0.77	0.09	0.50	0.66	0.02	0.76	0.26	0.07	0.65	0.62	0.09
Uniform Delay, d1	68.5	21.5	6.1	72.1	22.8	10.9	69.4	59.5	49.3	74.4	69.1	50.6
Progression Factor	1.13	0.87	0.51	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.8	3.5	0.0	3.5	3.3	0.0	16.5	0.5	0.1	14.4	6.4	0.1
Delay (s)	84.9	22.2	3.1	75.6	26.1	11.0	85.9	59.9	49.3	88.8	75.5	50.7
Level of Service	F	C	A	E	C	B	F	E	D	F	E	D
Approach Delay (s)		27.5			29.0			67.2			66.3	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	38.0	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	68.8%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1900	1827	1881	1792	1792	1810	1863	1900	1845	1900	1827	1792
Lanes	1	1	1	1	1	1	1	1	1	1	1	1
Capacity, veh/h	171	1168	1176	71	1052	969	171	295	309	79	187	300
Arriving On Green	0.09	0.64	0.00	0.04	0.59	0.00	0.10	0.16	0.16	0.04	0.10	0.10
Sat Flow, veh/h	1809.5	1599.0	1599.0	1707.1	1538.1	1538.1	1774.0	1568.0	1568.0	1809.5	1523.6	1523.6
Grp Volume(v), veh/h	144.2	876.2	0.0	56.0	683.2	0.0	144.8	75.0	103.5	60.8	113.0	132.4
Grp Sat Flow(s),veh/h/ln	1809.5	1826.9	1599.0	1707.1	1792.5	1538.1	1774.0	1900.0	1568.0	1809.5	1826.9	1523.6
Q Serve(g_s), s	10.4	44.2	0.0	4.3	33.9	0.0	10.7	4.6	7.5	4.4	7.9	10.2
Cycle Q Clear(g_c), s	10.4	44.2	0.0	4.3	33.9	0.0	10.7	4.6	7.5	4.4	7.9	10.2
Proportion In Lane	1.000		1.000	1.000		1.000	1.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	171.1	1168.1	1176.4	71.4	1051.5	969.1	170.9	294.5	308.6	78.6	186.6	299.7
V/C Ratio(X)	0.843	0.750	0.000	0.784	0.650	0.000	0.847	0.255	0.335	0.774	0.606	0.442
Avail Cap(c_a), veh/h	285.8	1168.1	1176.4	179.7	1051.5	969.1	266.9	485.9	466.5	149.7	343.5	430.6
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Uniform Delay (d), s/veh	59.2	16.6	0.0	63.1	18.4	0.0	59.1	49.4	45.9	62.9	57.1	47.0
Incr Delay (d2), s/veh	10.9	4.4	0.0	16.9	3.1	0.0	13.8	0.5	0.6	14.8	3.1	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	70.1	21.1	0.0	80.0	21.5	0.0	72.9	49.9	46.6	77.7	60.3	48.0
Lane Group LOS	E	C		E	C		E	D	D	E	E	D
Approach Volume, veh/h		1020			739			323			306	
Approach Delay, s/veh		28.0			25.9			59.1			58.4	
Approach LOS		C			C			E			E	

Timer												
Assigned Phase	7	4		3	8		5	2		1	6	
Phase Duration (G+Y+Rc), s	16.57	89.02		9.56	82.00		16.81	24.61		9.78	17.58	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00		4.00	4.00		4.00	4.00	
Max Green Setting (Gmax), s	21.00	85.00		14.00	78.00		20.00	34.00		11.00	25.00	
Max Q Clear Time (g_c+I1), s	12.43	46.19		6.32	35.85		12.68	9.55		6.42	12.16	
Green Extension Time (p_c)	0.21	14.23		0.05	14.59		0.19	1.71		0.03	1.42	

Intersection Summary	
HCM 2010 Control Delay	35.5
HCM 2010 Level of Service	D

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Eastbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: AM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	67	67
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	451	
7	Total saturation flow rate for CTL(s) (vph) =	1727	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	25	
9	Right-turn lane saturation flow rate (vph) =	1302	
10	Prevailing approach speed (mph) =	45	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	451	0	451	0.62	**40.6**	**D**	600
2	RT	0	25	25	0.05	**27.7**	**C**	0
3								
4								
TOTAL		451	25	476				
Scenario 2								
1	CTL	365	0	365	0.50	**36.8**	**D**	500
2	ATL	86	0	86	0.12	**28.8**	**C**	100
3	RT		25		0.05	**27.7**	**C**	0
4								
TOTAL		451	25	451				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**39.93**	**D**	N/A	**NA**	**NA**
Scenario 2	**34.86**	**C**	19%	**500**	**320**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Eastbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: MID Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	70	70
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	454	
7	Total saturation flow rate for CTL(s) (vph) =	1652	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	73	
9	Right-turn lane saturation flow rate (vph) =	1495	
10	Prevailing approach speed (mph) =	45	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	454	0	454	0.63	**39.0**	**D**	600
2	RT	0	73	73	0.11	**27.0**	**C**	100
3								
4								
TOTAL		454	73	527				
Scenario 2								
1	CTL	367	0	367	0.51	**35.1**	**D**	500
2	ATL	87	0	87	0.12	**27.1**	**C**	100
3	RT		73		0.11	**27.0**	**C**	100
4								
TOTAL		454	73	454				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**37.34**	**D**	N/A	**NA**	**NA**
Scenario 2	**32.63**	**C**	19%	**500**	**320**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Eastbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: PM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	68	68
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	809	
7	Total saturation flow rate for CTL(s) (vph) =	1827	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	119	
9	Right-turn lane saturation flow rate (vph) =	1599	
10	Prevailing approach speed (mph) =	45	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	809	0	809	1.04	**89.7**	**F**	1400
2	RT	0	119	119	0.18	**29.1**	**C**	200
3								
4								
TOTAL		809	119	928				
Scenario 2								
1	CTL	592	0	592	0.76	**46.1**	**D**	800
2	ATL	217	0	217	0.28	**30.9**	**C**	300
3	RT		119		0.18	**29.1**	**C**	100
4								
TOTAL		809	119	809				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**81.95**	**F**	N/A	**NA**	**NA**
Scenario 2	**40.38**	**D**	27%	**800**	**620**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Westbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: AM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	69	69
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	689	
7	Total saturation flow rate for CTL(s) (vph) =	1743	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	8	
9	Right-turn lane saturation flow rate (vph) =	1615	
10	Prevailing approach speed (mph) =	45	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	689	0	689	0.92	**60.6**	**E**	1000
2	RT	0	8	8	0.01	**26.0**	**C**	0
3								
4								
TOTAL		689	8	697				
Scenario 2								
1	CTL	522	0	522	0.69	**42.2**	**D**	700
2	ATL	167	0	167	0.22	**29.3**	**C**	200
3	RT		8		0.01	**26.0**	**C**	0
4								
TOTAL		689	8	689				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**60.24**	**E**	N/A	**NA**	**NA**
Scenario 2	**38.91**	**D**	24%	**700**	**490**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Westbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: MID Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	69	69
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	481	
7	Total saturation flow rate for CTL(s) (vph) =	1727	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	18	
9	Right-turn lane saturation flow rate (vph) =	1509	
10	Prevailing approach speed (mph) =	45	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	481	0	481	0.65	**40.2**	**D**	600
2	RT	0	18	18	0.03	**26.3**	**C**	0
3								
4								
TOTAL		481	18	499				
Scenario 2								
1	CTL	388	0	388	0.52	**36.0**	**D**	500
2	ATL	93	0	93	0.12	**27.7**	**C**	100
3	RT		18		0.03	**26.3**	**C**	0
4								
TOTAL		481	18	481				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**39.66**	**D**	N/A	**NA**	**NA**
Scenario 2	**34.08**	**C**	19%	**500**	**340**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Westbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: PM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	65	65
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	555	
7	Total saturation flow rate for CTL(s) (vph) =	1792	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	25	
9	Right-turn lane saturation flow rate (vph) =	1538	
10	Prevailing approach speed (mph) =	45	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	555	0	555	0.76	**48.3**	**D**	800
2	RT	0	25	25	0.04	**28.8**	**C**	0
3								
4								
TOTAL		555	25	580				
Scenario 2								
1	CTL	436	0	436	0.60	**40.9**	**D**	600
2	ATL	119	0	119	0.16	**30.7**	**C**	200
3	RT		25		0.04	**28.8**	**C**	0
4								
TOTAL		555	25	555				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**47.43**	**D**	N/A	**NA**	**NA**
Scenario 2	**38.28**	**D**	21%	**600**	**390**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Northbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: AM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	40	40
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	87	
7	Total saturation flow rate for CTL(s) (vph) =	1484	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	41	
9	Right-turn lane saturation flow rate (vph) =	1615	
10	Prevailing approach speed (mph) =	40	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	87	0	87	0.23	**49.3**	**D**	100
2	RT	0	41	41	0.10	**46.7**	**D**	100
3								
4								
TOTAL		87	41	128				
Scenario 2								
1	CTL	61	0	61	0.16	**47.9**	**D**	100
2	ATL	26	0	26	0.07	**46.2**	**D**	0
3	RT		41		0.10	**46.7**	**D**	100
4								
TOTAL		87	41	87				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**48.45**	**D**	N/A	**NA**	**NA**
Scenario 2	**47.15**	**D**	30%	**100**	**70**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
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Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Northbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: MID Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	43	43
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	16	
7	Total saturation flow rate for CTL(s) (vph) =	1900	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	39	
9	Right-turn lane saturation flow rate (vph) =	1524	
10	Prevailing approach speed (mph) =	40	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	16	0	16	0.03	**43.3**	**D**	0
2	RT	0	39	39	0.10	**44.4**	**D**	100
3								
4								
TOTAL		16	39	55				
Scenario 2								
1	CTL	-4	0	-4	-0.01	**42.7**	**D**	#NUM!
2	ATL	20	0	20	0.04	**43.4**	**D**	0
3	RT		39		0.10	**44.4**	**D**	100
4								
TOTAL		16	39	16				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**44.05**	**D**	N/A	**NA**	**NA**
Scenario 2	**44.13**	**D**	125%	**#NUM!**	**#NUM!**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Northbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: PM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	41	41
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	59	
7	Total saturation flow rate for CTL(s) (vph) =	1900	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	103	
9	Right-turn lane saturation flow rate (vph) =	1568	
10	Prevailing approach speed (mph) =	40	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	59	0	59	0.12	**46.2**	**D**	100
2	RT	0	103	103	0.26	**48.9**	**D**	200
3								
4								
TOTAL		59	103	162				
Scenario 2								
1	CTL	37	0	37	0.08	**45.4**	**D**	100
2	ATL	22	0	22	0.05	**44.9**	**D**	0
3	RT		103		0.26	**48.9**	**D**	200
4								
TOTAL		59	103	59				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**47.90**	**D**	N/A	**NA**	**NA**
Scenario 2	**47.57**	**D**	37%	**200**	**50**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Southbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: AM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	37	37
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	123	
7	Total saturation flow rate for CTL(s) (vph) =	1900	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	148	
9	Right-turn lane saturation flow rate (vph) =	1509	
10	Prevailing approach speed (mph) =	40	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	123	0	123	0.28	**52.1**	**D**	200
2	RT	0	148	148	0.42	**56.2**	**E**	200
3								
4								
TOTAL		123	148	271				
Scenario 2								
1	CTL	94	0	94	0.21	**50.9**	**D**	200
2	ATL	29	0	29	0.07	**48.3**	**D**	0
3	RT		148		0.42	**56.2**	**E**	200
4								
TOTAL		123	148	123				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**54.33**	**D**	N/A	**NA**	**NA**
Scenario 2	**53.47**	**D**	24%	**200**	**80**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Southbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: MID Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	33	33
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	25	
7	Total saturation flow rate for CTL(s) (vph) =	1810	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	68	
9	Right-turn lane saturation flow rate (vph) =	1568	
10	Prevailing approach speed (mph) =	40	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	25	0	25	0.07	**51.5**	**D**	0
2	RT	0	68	68	0.21	**54.2**	**D**	100
3								
4								
TOTAL		25	68	93				
Scenario 2								
1	CTL	4	0	4	0.01	**50.6**	**D**	0
2	ATL	21	0	21	0.06	**51.3**	**D**	0
3	RT		68		0.21	**54.2**	**D**	100
4								
TOTAL		25	68	25				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**53.43**	**D**	N/A	**NA**	**NA**
Scenario 2	**53.35**	**D**	84%	**100**	**50**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2

NCHRP 3-98 GUIDELINES FOR AUXILIARY THROUGH LANES AT SIGNALIZED INTERSECTIONS
COMP ENGINE FOR ESTIMATING ATL UTILIZATION AND LENGTH FOR 1- AND 2-CTL APPROACHES

TITLE : Southbound ATL Analysis
INTERSECTION: SR 228 & SR 3007 (Three Degree Road)
ANALYSIS YEAR: 2035
TIME PERIOD: PM Peak
OTHER

I. GEOMETRIC CONFIGURATION AND SIGNAL TIMING

		Scenario 1	Scenario 2
1	Number of CTLs (1 OR 2)	1	1
2	ATL (Y/N)?	N	Y
3	Exclusive right-turn lane (Y/N)?	Y	Y
4	Effective green time for through movement(s) (sec)=	32	32
5	Cycle length (sec) =	160	160

II. APPROACH CHARACTERISTICS

		User Input (Applies to Both Scenarios)	Comment
6	Total approach through volume (vph) =	67	
7	Total saturation flow rate for CTL(s) (vph) =	1827	Add sat flow across both lanes for 2 CTL approaches
8	Right-turn volume (vph) =	110	
9	Right-turn lane saturation flow rate (vph) =	1524	
10	Prevailing approach speed (mph) =	40	Speed at which vehicles approach intersection during green phase
11	Average vehicle spacing at stop bar (ft) =	25	Default value = 25 ft
12	Average acceleration rate from stop bar (ft/sec/sec) =	10	Default value = 10.0 ft/sec/sec
13	Intersection width measured from stop bar to far curb (ft) =	100	
14	Critical gap in adjacent CTL (sec) =	6	Default value = 6.0 seconds
15	Driver reaction time (sec) =	1	Default value = 1.0 seconds
16	Confidence level for calculation of downstream length =	0.85	Express as decimal between .85 and .95

III. LANE-BY-LANE RESULTS

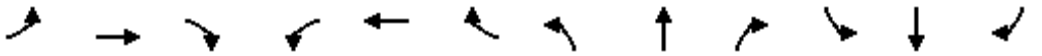
Lane	Configuration	TH Vol (vph)	RT Vol (vph)	TH + RT Vol (vph)	XALL	Avg. Delay (sec/veh)	LOS	95th % Queue (ft)
Scenario 1								
1	CTL	67	0	67	0.18	**54.3**	**D**	100
2	RT	0	110	110	0.36	**58.5**	**E**	200
3								
4								
TOTAL		67	110	177				
Scenario 2								
1	CTL	43	0	43	0.12	**53.1**	**D**	100
2	ATL	24	0	24	0.07	**52.2**	**D**	0
3	RT		110		0.36	**58.5**	**E**	200
4								
TOTAL		67	110	67				

IV. APPROACH RESULTS

	Avg. Delay (sec/veh)	LOS	ATL Utilization (ATL TH/Total TH)	Estimated Min. ATL Length	
				Upstream ATL (ft)	Downstream ATL (ft)
Scenario 1	**56.90**	**E**	N/A	**NA**	**NA**
Scenario 2	**56.34**	**E**	36%	**200**	**60**

Notes:
CTL = Continuous Through Lane
ATL = Auxiliary Through Lane
RTL = Right-turn Lane
Shared = Right-turn movements allowed with through movements
Minimum ATL Length estimates do not include taper lengths

RELEASE DATE SEPTEMBER 2011
VERSION 2.2



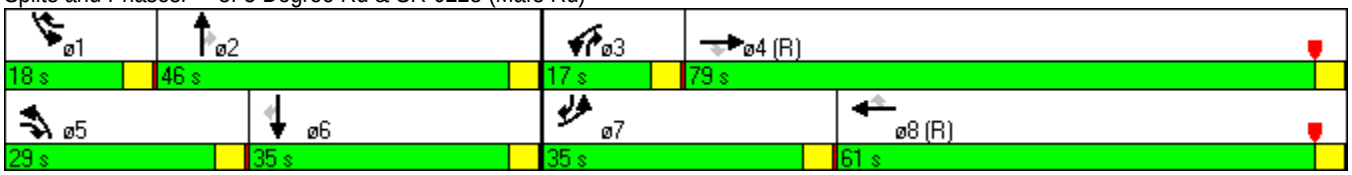
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	325		538	225		425	275		275	175		350
Storage Lanes	1		2	1		2	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1687	3282	1302	1770	3312	1615	1719	1484	1615	1543	1900	1509
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1687	3282	1302	1770	3312	1615	1719	1484	1615	1543	1900	1509
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			37			89			80			108
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		550			473			1093			1168	
Travel Time (s)		8.3			7.2			18.6			19.9	
Peak Hour Factor	0.59	0.83	0.66	0.83	0.81	0.88	0.64	0.69	0.51	0.64	0.50	0.51
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	7%	10%	24%	2%	9%	0%	5%	28%	0%	17%	0%	7%
Adj. Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
Shared Lane Traffic (%)												
Lane Group Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7

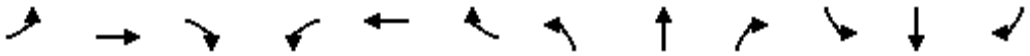
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4			8			2			6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0
Total Split (s)	35.0	79.0	29.0	17.0	61.0	18.0	29.0	46.0	17.0	18.0	35.0	35.0
Total Split (%)	21.9%	49.4%	18.1%	10.6%	38.1%	11.3%	18.1%	28.8%	10.6%	11.3%	21.9%	21.9%
Maximum Green (s)	31.0	75.0	25.0	13.0	57.0	14.0	25.0	42.0	13.0	14.0	31.0	31.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Walk Time (s)		5.0			5.0			5.0			5.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	24.6	87.4	111.3	11.4	74.1	89.6	19.9	33.7	49.1	11.5	25.3	54.0
Actuated g/C Ratio	0.15	0.55	0.70	0.07	0.46	0.56	0.12	0.21	0.31	0.07	0.16	0.34
v/c Ratio	0.81	0.30	0.04	0.60	0.55	0.01	0.77	0.40	0.15	0.59	0.82	0.50
Control Delay	83.2	23.5	2.6	91.4	35.3	0.0	89.8	56.9	6.9	93.1	86.0	27.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	83.2	23.5	2.6	91.4	35.3	0.0	89.8	56.9	6.9	93.1	86.0	27.1
LOS	F	C	A	F	D	A	F	E	A	F	F	C
Approach Delay		38.5			39.5			60.6			58.5	
Approach LOS		D			D			E			E	

Intersection Summary

Area Type: Other
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow, Master Intersection
Natural Cycle: 75
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.82
Intersection Signal Delay: 46.3 Intersection LOS: D
Intersection Capacity Utilization 51.4% ICU Level of Service A
Analysis Period (min) 15

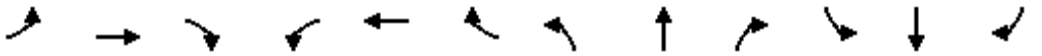
Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)





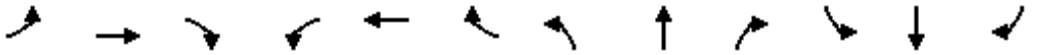
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
v/c Ratio	0.81	0.30	0.04	0.60	0.55	0.01	0.77	0.40	0.15	0.59	0.82	0.50
Control Delay	83.2	23.5	2.6	91.4	35.3	0.0	89.8	56.9	6.9	93.1	86.0	27.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	83.2	23.5	2.6	91.4	35.3	0.0	89.8	56.9	6.9	93.1	86.0	27.1
Queue Length 50th (ft)	216	156	0	77	339	0	167	114	0	68	251	148
Queue Length 95th (ft)	185	233	6	125	418	0	167	126	0	85	174	71
Internal Link Dist (ft)		470			393			1013			1088	
Turn Bay Length (ft)	325		538	225		425	275		275	175		350
Base Capacity (vph)	326	1793	957	145	1534	967	268	389	568	135	368	636
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.64	0.30	0.04	0.52	0.55	0.01	0.61	0.32	0.14	0.49	0.67	0.45

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1687	3282	1302	1770	3312	1615	1719	1484	1615	1543	1900	1509
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1687	3282	1302	1770	3312	1615	1719	1484	1615	1543	1900	1509
Peak-hour factor, PHF	0.59	0.83	0.66	0.83	0.81	0.88	0.64	0.69	0.51	0.64	0.50	0.51
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	210	541	37	75	848	9	163	125	80	66	246	289
RTOR Reduction (vph)	0	0	12	0	0	4	0	0	57	0	0	74
Lane Group Flow (vph)	210	541	25	75	848	5	163	125	23	66	246	215
Heavy Vehicles (%)	7%	10%	24%	2%	9%	0%	5%	28%	0%	17%	0%	7%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	24.6	87.4	107.3	11.4	74.2	85.7	19.9	33.7	45.1	11.5	25.3	49.9
Effective Green, g (s)	24.6	87.4	107.3	11.4	74.2	85.7	19.9	33.7	45.1	11.5	25.3	49.9
Actuated g/C Ratio	0.15	0.55	0.67	0.07	0.46	0.54	0.12	0.21	0.28	0.07	0.16	0.31
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	259	1792	905	126	1535	905	213	312	495	110	300	508
v/s Ratio Prot	c0.12	0.16	0.00	0.04	c0.26	0.00	c0.09	0.08	0.00	0.04	c0.13	0.06
v/s Ratio Perm			0.02			0.00			0.01			0.08
v/c Ratio	0.81	0.30	0.03	0.60	0.55	0.01	0.77	0.40	0.05	0.60	0.82	0.42
Uniform Delay, d1	65.5	19.7	8.8	72.1	30.9	17.3	67.8	54.4	41.8	72.0	65.1	43.6
Progression Factor	0.99	1.08	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	14.2	0.3	0.0	7.4	1.4	0.0	15.0	0.8	0.0	8.5	15.9	0.6
Delay (s)	78.7	21.6	8.0	79.4	32.4	17.3	82.8	55.3	41.8	80.5	81.0	44.2
Level of Service	E	C	A	E	C	B	F	E	D	F	F	D
Approach Delay (s)		36.2			36.0			64.6			63.3	
Approach LOS		D			D			E			E	

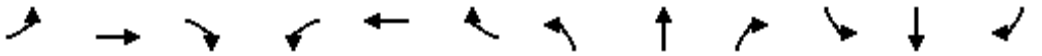
Intersection Summary			
HCM 2000 Control Delay	46.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.67		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	51.4%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	106	384	21	53	587	7	89	74	35	36	105	126
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1776	1727	1532	1863	1743	1900	1810	1484	1900	1624	1900	1776
Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Capacity, veh/h	237	1811	861	95	1541	836	189	333	449	81	319	464
Arriving On Green	0.14	0.55	0.00	0.05	0.47	0.00	0.11	0.22	0.22	0.05	0.17	0.17
Sat Flow, veh/h	1691.1	1302.4	1302.4	1774.0	1615.0	1615.0	1723.4	1615.0	1615.0	1546.6	1509.3	1509.3
Grp Volume(v), veh/h	210.2	541.3	0.0	74.7	847.9	0.0	162.7	125.5	68.6	65.8	245.7	247.1
Grp Sat Flow(s),veh/h/ln	1691.1	1640.9	1302.4	1774.0	1656.0	1615.0	1723.4	1484.4	1615.0	1546.6	1900.0	1509.3
Q Serve(g_s), s	16.6	12.0	0.0	5.7	25.0	0.0	12.6	9.7	4.4	5.7	16.8	18.4
Cycle Q Clear(g_c), s	16.6	12.0	0.0	5.7	25.0	0.0	12.6	9.7	4.4	5.7	16.8	18.4
Proportion In Lane	1.000		1.000	1.000		1.000	1.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	236.7	1811.1	861.3	94.6	1541.0	836.1	188.6	333.4	448.9	81.1	318.5	464.2
V/C Ratio(X)	0.888	0.299	0.000	0.789	0.550	0.000	0.863	0.376	0.153	0.811	0.771	0.532
Avail Cap(c_a), veh/h	385.8	1811.1	861.3	169.7	1541.0	836.1	317.0	458.7	585.3	159.3	433.4	555.5
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Uniform Delay (d), s/veh	57.4	16.3	0.0	63.6	26.1	0.0	59.5	44.6	37.0	63.7	54.1	39.0
Incr Delay (d2), s/veh	13.6	0.4	0.0	13.5	1.4	0.0	11.9	0.7	0.2	17.2	5.8	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	71.0	16.8	0.0	77.1	27.5	0.0	71.4	45.3	37.2	80.9	59.9	39.9
Lane Group LOS	E	B		E	C		E	D	D	F	E	D
Approach Volume, veh/h		752			923			357			559	
Approach Delay, s/veh		31.9			31.5			55.7			53.5	
Approach LOS		C			C			E			D	

Timer												
Assigned Phase	7	4		3	8		5	2		1	6	
Phase Duration (G+Y+Rc), s	23.02	79.00		11.25	67.23		18.87	34.52		11.13	26.78	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00		4.00	4.00		4.00	4.00	
Max Green Setting (Gmax), s	31.00	75.00		13.00	57.00		25.00	42.00		14.00	31.00	
Max Q Clear Time (g_c+I1), s	18.59	14.03		7.66	27.01		14.62	11.73		7.72	20.42	
Green Extension Time (p_c)	0.43	12.31		0.05	10.65		0.28	3.23		0.05	2.36	

Intersection Summary	
HCM 2010 Control Delay	39.7
HCM 2010 Level of Service	D



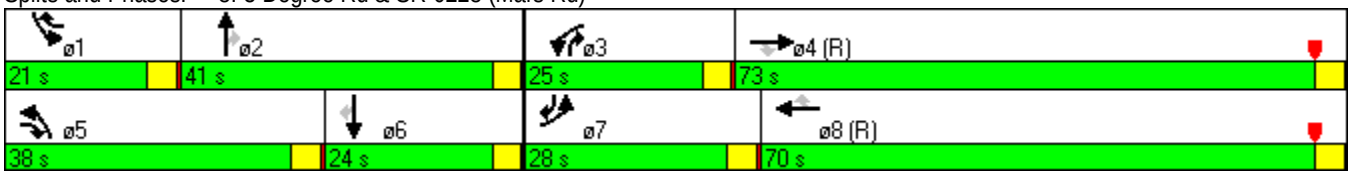
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	325		538	225		425	275		275	175		350
Storage Lanes	1		2	1		2	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1752	3139	1495	1752	3282	1509	1736	1900	1524	1805	1810	1568
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1752	3139	1495	1752	3282	1509	1736	1900	1524	1805	1810	1568
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			93			61			61			98
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		529			473			1093			1168	
Travel Time (s)		8.0			7.2			18.6			19.9	
Peak Hour Factor	0.70	0.93	0.78	0.73	0.92	0.63	0.79	0.58	0.63	0.63	0.88	0.69
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	3%	15%	8%	3%	10%	7%	4%	0%	6%	0%	5%	3%
Adj. Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
Shared Lane Traffic (%)												
Lane Group Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7

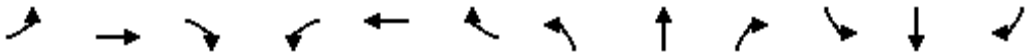
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4			8			2			6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0
Total Split (s)	28.0	73.0	38.0	25.0	70.0	21.0	38.0	41.0	25.0	21.0	24.0	28.0
Total Split (%)	17.5%	45.6%	23.8%	15.6%	43.8%	13.1%	23.8%	25.6%	15.6%	13.1%	15.0%	17.5%
Maximum Green (s)	24.0	69.0	34.0	21.0	66.0	17.0	34.0	37.0	21.0	17.0	20.0	24.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Walk Time (s)		5.0			5.0			5.0			5.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	11.3	115.2	134.5	9.6	113.5	126.7	15.3	14.1	25.5	9.2	8.0	19.2
Actuated g/C Ratio	0.07	0.72	0.84	0.06	0.71	0.79	0.10	0.09	0.16	0.06	0.05	0.12
v/c Ratio	0.53	0.22	0.07	0.44	0.22	0.02	0.65	0.17	0.21	0.27	0.31	0.36
Control Delay	91.0	8.0	0.5	84.6	9.9	0.1	87.2	67.1	12.1	78.5	81.6	13.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	91.0	8.0	0.5	84.6	9.9	0.1	87.2	67.1	12.1	78.5	81.6	13.2
LOS	F	A	A	F	A	A	F	E	B	E	F	B
Approach Delay		15.3			15.2			61.1			37.5	
Approach LOS		B			B			E			D	

Intersection Summary

Area Type: Other
Cycle Length: 160
Actuated Cycle Length: 160
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow, Master Intersection
Natural Cycle: 70
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.65
Intersection Signal Delay: 23.1 Intersection LOS: C
Intersection Capacity Utilization 38.0% ICU Level of Service A
Analysis Period (min) 15

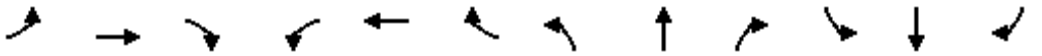
Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)





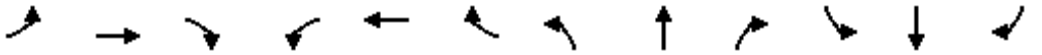
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
v/c Ratio	0.53	0.22	0.07	0.44	0.22	0.02	0.65	0.17	0.21	0.27	0.31	0.36
Control Delay	91.0	8.0	0.5	84.6	9.9	0.1	87.2	67.1	12.1	78.5	81.6	13.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	91.0	8.0	0.5	84.6	9.9	0.1	87.2	67.1	12.1	78.5	81.6	13.2
Queue Length 50th (ft)	67	77	0	47	101	0	111	27	0	29	29	0
Queue Length 95th (ft)	93	130	3	73	163	0	150	38	13	44	63	20
Internal Link Dist (ft)		449			393			1013			1088	
Turn Bay Length (ft)	325		538	225		425	275		275	175		350
Base Capacity (vph)	262	2259	1408	229	2327	1278	368	439	398	191	226	391
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.25	0.22	0.07	0.20	0.22	0.02	0.29	0.06	0.15	0.15	0.12	0.25

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1752	3139	1495	1752	3282	1509	1736	1900	1524	1805	1810	1568
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1752	3139	1495	1752	3282	1509	1736	1900	1524	1805	1810	1568
Peak-hour factor, PHF	0.70	0.93	0.78	0.73	0.92	0.63	0.79	0.58	0.63	0.63	0.88	0.69
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	65	487	93	46	521	28	108	28	61	28	28	98
RTOR Reduction (vph)	0	0	18	0	0	7	0	0	52	0	0	88
Lane Group Flow (vph)	65	487	75	46	521	21	108	28	9	28	28	10
Heavy Vehicles (%)	3%	15%	8%	3%	10%	7%	4%	0%	6%	0%	5%	3%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	11.3	113.6	128.9	9.6	111.9	120.0	15.3	12.7	22.3	8.1	5.5	16.8
Effective Green, g (s)	11.3	113.6	128.9	9.6	111.9	120.0	15.3	12.7	22.3	8.1	5.5	16.8
Actuated g/C Ratio	0.07	0.71	0.81	0.06	0.70	0.75	0.10	0.08	0.14	0.05	0.03	0.11
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	123	2228	1241	105	2295	1169	166	150	250	91	62	203
v/s Ratio Prot	c0.04	0.16	0.01	0.03	c0.16	0.00	c0.06	0.01	0.00	0.02	c0.02	0.00
v/s Ratio Perm			0.04			0.01			0.00			0.00
v/c Ratio	0.53	0.22	0.06	0.44	0.23	0.02	0.65	0.19	0.03	0.31	0.45	0.05
Uniform Delay, d1	71.8	8.0	3.2	72.6	8.6	5.1	69.8	68.8	59.5	73.2	75.8	64.4
Progression Factor	1.09	0.87	0.57	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.6	0.2	0.0	2.9	0.2	0.0	8.8	0.6	0.1	1.9	5.2	0.1
Delay (s)	81.8	7.1	1.8	75.5	8.8	5.1	78.6	69.4	59.6	75.2	80.9	64.5
Level of Service	F	A	A	E	A	A	E	E	E	E	F	E
Approach Delay (s)		13.9			13.8			71.4			69.4	
Approach LOS		B			B			E			E	

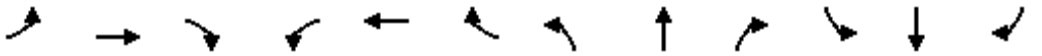
Intersection Summary			
HCM 2000 Control Delay	26.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.30		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	38.0%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	39	387	62	29	410	15	73	14	33	15	21	58
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1845	1652	1759	1845	1727	1776	1827	1900	1792	1900	1810	1845
Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Capacity, veh/h	85	2072	1105	60	2120	1007	137	250	252	38	133	191
Arriving On Green	0.05	0.66	0.00	0.03	0.65	0.00	0.08	0.13	0.13	0.02	0.07	0.07
Sat Flow, veh/h	1756.8	1495.4	1495.4	1756.8	1509.3	1509.3	1739.9	1523.6	1523.6	1809.5	1568.0	1568.0
Grp Volume(v), veh/h	65.2	486.9	0.0	46.5	521.4	0.0	108.1	28.2	52.4	27.9	27.9	84.1
Grp Sat Flow(s),veh/h/ln	1756.8	1569.6	1495.4	1756.8	1640.9	1509.3	1739.9	1900.0	1523.6	1809.5	1809.5	1568.0
Q Serve(g_s), s	3.8	6.5	0.0	2.7	7.0	0.0	6.4	1.4	3.1	1.6	1.5	5.2
Cycle Q Clear(g_c), s	3.8	6.5	0.0	2.7	7.0	0.0	6.4	1.4	3.1	1.6	1.5	5.2
Proportion In Lane	1.000		1.000	1.000		1.000	1.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	84.8	2072.5	1105.4	59.8	2120.0	1007.0	137.5	249.7	252.1	38.4	133.2	191.2
V/C Ratio(X)	0.768	0.235	0.000	0.777	0.246	0.000	0.786	0.113	0.208	0.725	0.210	0.440
Avail Cap(c_a), veh/h	403.4	2072.5	1105.4	353.0	2120.0	1007.0	566.0	672.6	591.3	294.3	346.3	375.8
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Uniform Delay (d), s/veh	49.2	7.1	0.0	50.1	7.8	0.0	47.3	40.0	37.7	50.8	45.5	42.6
Incr Delay (d2), s/veh	13.5	0.3	0.0	19.0	0.3	0.0	9.5	0.2	0.4	22.6	0.8	1.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	62.6	7.4	0.0	69.1	8.1	0.0	56.7	40.2	38.1	73.4	46.3	44.2
Lane Group LOS	E	A		E	A		E	D	D	E	D	D
Approach Volume, veh/h		552			568			189			140	
Approach Delay, s/veh		13.9			13.1			49.1			50.4	
Approach LOS		B			B			D			D	

Timer												
Assigned Phase	7	4		3	8		5	2		1	6	
Phase Duration (G+Y+Rc), s	9.05	73.00		7.56	71.51		12.26	17.74		6.22	11.70	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00		4.00	4.00		4.00	4.00	
Max Green Setting (Gmax), s	24.00	69.00		21.00	66.00		34.00	37.00		17.00	20.00	
Max Q Clear Time (g_c+I1), s	5.83	8.52		4.74	8.99		8.38	5.11		3.60	7.20	
Green Extension Time (p_c)	0.11	7.64		0.06	7.62		0.26	0.70		0.02	0.51	

Intersection Summary	
HCM 2010 Control Delay	21.7
HCM 2010 Level of Service	C

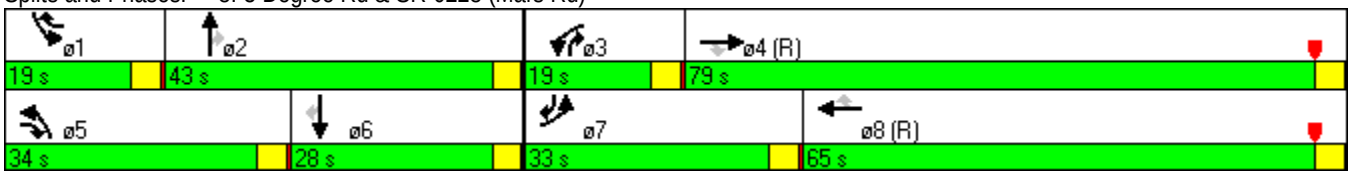


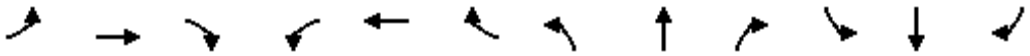
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	325		538	225		425	275		275	175		350
Storage Lanes	1		2	1		2	1		1	1		1
Taper Length (ft)	25			25			25			25		
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.850			0.850			0.850			0.850
Flt Protected	0.950			0.950			0.950			0.950		
Satd. Flow (prot)	1805	3471	1599	1703	3406	1538	1770	1900	1568	1805	1827	1524
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1805	3471	1599	1703	3406	1538	1770	1900	1568	1805	1827	1524
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)			150			89			121			155
Link Speed (mph)		45			45			40			40	
Link Distance (ft)		575			473			1093			1168	
Travel Time (s)		8.7			7.2			18.6			19.9	
Peak Hour Factor	0.73	0.92	0.79	0.69	0.81	0.75	0.80	0.78	0.85	0.50	0.59	0.71
Growth Factor	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	0%	4%	1%	6%	6%	5%	2%	0%	3%	0%	4%	6%
Adj. Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
Shared Lane Traffic (%)												
Lane Group Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	2	1	1	2	1	1	2	1	1	2	1
Detector Template	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Leading Detector (ft)	20	100	20	20	100	20	20	100	20	20	100	20
Trailing Detector (ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	20	20	6	20	20	6	20	20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94			94			94			94	
Detector 2 Size(ft)		6			6			6			6	
Detector 2 Type		Cl+Ex			Cl+Ex			Cl+Ex			Cl+Ex	
Detector 2 Channel												
Detector 2 Extend (s)		0.0			0.0			0.0			0.0	
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Permitted Phases			4			8			2			6
Detector Phase	7	4	5	3	8	1	5	2	3	1	6	7
Switch Phase												
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0	15.0	20.0	15.0
Total Split (s)	33.0	79.0	34.0	19.0	65.0	19.0	34.0	43.0	19.0	19.0	28.0	33.0
Total Split (%)	20.6%	49.4%	21.3%	11.9%	40.6%	11.9%	21.3%	26.9%	11.9%	11.9%	17.5%	20.6%
Maximum Green (s)	29.0	75.0	30.0	15.0	61.0	15.0	30.0	39.0	15.0	15.0	24.0	29.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead	Lead	Lag	Lead
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	None	None	C-Max	None	None	None	None	None	None	None
Walk Time (s)		5.0			5.0			5.0			5.0	
Flash Dont Walk (s)		11.0			11.0			11.0			11.0	
Pedestrian Calls (#/hr)		0			0			0			0	
Act Effct Green (s)	18.1	99.8	122.2	10.6	92.3	107.1	18.4	25.0	39.6	10.8	15.2	37.3
Actuated g/C Ratio	0.11	0.62	0.76	0.07	0.58	0.67	0.12	0.16	0.25	0.07	0.10	0.23
v/c Ratio	0.71	0.40	0.12	0.50	0.35	0.03	0.71	0.25	0.25	0.50	0.65	0.33
Control Delay	80.3	17.9	1.2	86.1	20.5	0.0	86.8	60.9	7.6	85.7	86.7	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.3	17.9	1.2	86.1	20.5	0.0	86.8	60.9	7.6	85.7	86.7	7.6
LOS	F	B	A	F	C	A	F	E	A	F	F	A
Approach Delay		23.4			24.4			53.0			49.2	
Approach LOS		C			C			D			D	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow, Master Intersection			
Natural Cycle: 70			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 30.8		Intersection LOS: C	
Intersection Capacity Utilization 48.7%		ICU Level of Service A	
Analysis Period (min) 15			

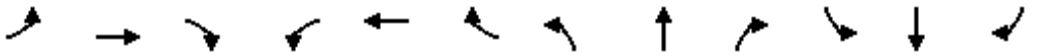
Splits and Phases: 8: 3 Degree Rd & SR 0228 (Mars Rd)





Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Group Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
v/c Ratio	0.71	0.40	0.12	0.50	0.35	0.03	0.71	0.25	0.25	0.50	0.65	0.33
Control Delay	80.3	17.9	1.2	86.1	20.5	0.0	86.8	60.9	7.6	85.7	86.7	7.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	80.3	17.9	1.2	86.1	20.5	0.0	86.8	60.9	7.6	85.7	86.7	7.6
Queue Length 50th (ft)	150	204	0	58	192	0	149	71	0	63	116	0
Queue Length 95th (ft)	176	375	15	80	266	0	192	102	41	61	115	18
Internal Link Dist (ft)		495			393			1013			1088	
Turn Bay Length (ft)	325		538	225		425	275		275	175		350
Base Capacity (vph)	327	2164	1361	159	1965	1097	331	463	518	169	274	567
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.44	0.40	0.11	0.35	0.35	0.03	0.44	0.16	0.23	0.36	0.41	0.27

Intersection Summary



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1805	3471	1599	1703	3406	1538	1770	1900	1568	1805	1827	1524
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1805	3471	1599	1703	3406	1538	1770	1900	1568	1805	1827	1524
Peak-hour factor, PHF	0.73	0.92	0.79	0.69	0.81	0.75	0.80	0.78	0.85	0.50	0.59	0.71
Growth Factor (vph)	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	144	876	150	56	683	33	145	75	121	61	113	155
RTOR Reduction (vph)	0	0	40	0	0	12	0	0	94	0	0	122
Lane Group Flow (vph)	144	876	110	56	683	21	145	75	27	61	113	33
Heavy Vehicles (%)	0%	4%	1%	6%	6%	5%	2%	0%	3%	0%	4%	6%
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	7	4	5	3	8	1	5	2	3	1	6	7
Permitted Phases			4			8			2			6
Actuated Green, G (s)	18.1	99.0	117.4	10.6	91.5	100.9	18.4	25.0	35.6	9.4	16.0	34.1
Effective Green, g (s)	18.1	99.0	117.4	10.6	91.5	100.9	18.4	25.0	35.6	9.4	16.0	34.1
Actuated g/C Ratio	0.11	0.62	0.73	0.07	0.57	0.63	0.11	0.16	0.22	0.06	0.10	0.21
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	204	2147	1213	112	1947	1008	203	296	388	106	182	362
v/s Ratio Prot	c0.08	c0.25	0.01	0.03	0.20	0.00	c0.08	0.04	0.00	0.03	c0.06	0.01
v/s Ratio Perm			0.06			0.01			0.01			0.01
v/c Ratio	0.71	0.41	0.09	0.50	0.35	0.02	0.71	0.25	0.07	0.58	0.62	0.09
Uniform Delay, d1	68.4	15.6	6.1	72.1	18.3	11.1	68.3	59.3	49.1	73.4	69.1	50.5
Progression Factor	0.98	1.04	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	7.7	0.4	0.0	3.5	0.5	0.0	11.3	0.5	0.1	7.4	6.4	0.1
Delay (s)	74.8	16.5	6.4	75.6	18.8	11.1	79.6	59.8	49.2	80.7	75.5	50.6
Level of Service	E	B	A	E	B	B	E	E	D	F	E	D
Approach Delay (s)		22.4			22.6			64.4			64.8	
Approach LOS		C			C			E			E	

Intersection Summary			
HCM 2000 Control Delay	33.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	16.0
Intersection Capacity Utilization	48.7%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	90	689	101	33	473	21	99	50	88	26	57	94
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Queue, veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking, Bus Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow Rate	1900	1827	1881	1792	1792	1810	1863	1900	1845	1900	1827	1792
Lanes	1	2	1	1	2	1	1	1	1	1	1	1
Capacity, veh/h	175	2160	1153	72	1933	940	175	302	315	79	191	306
Arriving On Green	0.10	0.62	0.00	0.04	0.57	0.00	0.10	0.16	0.16	0.04	0.10	0.10
Sat Flow, veh/h	1809.5	1599.0	1599.0	1707.1	1538.1	1538.1	1774.0	1568.0	1568.0	1809.5	1523.6	1523.6
Grp Volume(v), veh/h	144.2	876.2	0.0	56.0	683.2	0.0	144.8	75.0	103.5	60.8	113.0	132.4
Grp Sat Flow(s),veh/h/ln	1809.5	1735.6	1599.0	1707.1	1702.8	1538.1	1774.0	1900.0	1568.0	1809.5	1826.9	1523.6
Q Serve(g_s), s	9.4	15.4	0.0	3.9	13.1	0.0	9.7	4.2	6.8	4.0	7.1	9.2
Cycle Q Clear(g_c), s	9.4	15.4	0.0	3.9	13.1	0.0	9.7	4.2	6.8	4.0	7.1	9.2
Proportion In Lane	1.000		1.000	1.000		1.000	1.000		1.000	1.000		1.000
Lane Grp Cap(c), veh/h	174.9	2160.3	1152.8	71.5	1933.1	940.4	174.9	302.5	315.3	79.3	190.7	306.3
V/C Ratio(X)	0.825	0.406	0.000	0.782	0.353	0.000	0.828	0.248	0.328	0.768	0.593	0.432
Avail Cap(c_a), veh/h	435.4	2160.3	1152.8	212.5	1933.1	940.4	441.6	614.9	573.1	225.2	363.8	450.7
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.000	1.000	0.000	1.000	1.000	0.000	1.000	1.000	1.000	1.000	1.000	1.000
Uniform Delay (d), s/veh	53.4	11.5	0.0	57.2	14.1	0.0	53.3	44.3	41.2	57.0	51.5	42.1
Incr Delay (d2), s/veh	9.4	0.6	0.0	16.7	0.5	0.0	9.5	0.4	0.6	14.3	2.9	1.0
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane Group Delay (d), s/veh	62.8	12.1	0.0	73.9	14.6	0.0	62.8	44.8	41.8	71.3	54.4	43.1
Lane Group LOS	E	B		E	B		E	D	D	E	D	D
Approach Volume, veh/h		1020			739			323			306	
Approach Delay, s/veh		19.2			19.1			51.9			52.9	
Approach LOS		B			B			D			D	

Timer												
Assigned Phase	7	4		3	8		5	2		1	6	
Phase Duration (G+Y+Rc), s	15.65	79.00		9.05	72.40		15.88	23.18		9.28	16.58	
Change Period (Y+Rc), s	4.00	4.00		4.00	4.00		4.00	4.00		4.00	4.00	
Max Green Setting (Gmax), s	29.00	75.00		15.00	61.00		30.00	39.00		15.00	24.00	
Max Q Clear Time (g_c+I1), s	11.43	17.37		5.91	15.08		11.65	8.81		6.01	11.16	
Green Extension Time (p_c)	0.31	14.62		0.05	14.02		0.32	1.76		0.06	1.42	

Intersection Summary	
HCM 2010 Control Delay	27.9
HCM 2010 Level of Service	C

COUNTERS:

PennDOT

RAW VEHICLE VOLUME COUNTS

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 20, 2012
DAY: Thursday
WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD SB				SR 228 WB				SR 228 EB					
Starting Time	From North				From East				From West				TOTAL TRAFFIC	PEAK HOUR
	R		L	TOTAL	R	T		TOTAL		T	L	TOTAL		
AM														
630	0		8	8	9	173		182		105	3	108	298	1345
645	2		2	4	18	212		230		105	1	106	340	1449
700	0		9	9	14	159		173		136	1	137	319	1395
715	0		8	8	13	158		171		207	2	209	388	1330
730	0		8	8	12	199		211		183	0	183	402	1233
745	0		7	7	19	149		168		109	2	111	286	1199
800	1		6	7	12	101		113		133	1	134	254	1310
815	0		5	5	11	135		146		138	2	140	291	1383
830	3		15	18	36	167		203		144	3	147	368	1394
845	2		15	17	49	204		253		123	4	127	397	
900	5		14	19	26	179		205		97	6	103	327	
915	1		12	13	14	146		160		118	11	129	302	
MID														
1100	1		6	7	19	154		173		90	1	91	271	1097
1115	0		3	3	17	148		165		99	1	100	268	1104
1130	2		11	13	9	123		132		117	1	118	263	1105
1145	2		8	10	26	149		175		107	3	110	295	1176
1200	6		8	14	17	115		132		128	4	132	278	1193
1215	3		11	14	13	112		125		129	1	130	269	
1230	1		18	19	25	153		178		136	1	137	334	
1245	5		12	17	17	122		139		153	3	156	312	
PM														
300	4		5	9	30	148		178		173	2	175	362	1504
315	2		15	17	19	137		156		178	4	182	355	1486
330	4		16	20	29	158		187		184	4	188	395	1533
345	0		12	12	20	158		178		202	0	202	392	1620
400	3		10	13	24	127		151		178	2	180	344	1643
415	8		6	14	24	169		193		192	3	195	402	1714
430	7		32	39	27	181		208		233	2	235	482	1737
445	4		19	23	23	182		205		186	1	187	415	1655
500	4		5	9	19	167		186		220	0	220	415	1665
515	0		13	13	20	174		194		216	2	218	425	
530	4		18	22	24	162		186		190	2	192	400	
545	2		10	12	46	173		219		187	7	194	425	
TOTAL	76		347	423	681	4994		5675		4896	80	4976	11074	

COUNTERS:

PennDOT

TRUCK PERCENTAGES

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 20, 2012
DAY: Thursday
WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD SB				SR 228 WB				SR 228 EB				
Starting Time	From North				From East				From West				TOTAL TRAFFIC
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	
645	2		2	4	18	212		230		105	1	106	340
700	0		9	9	14	159		173		136	1	137	319
715	0		8	8	13	158		171		207	2	209	388
730	0		8	8	12	199		211		183	0	183	402
AM Peak Vehicles	2		27	29	57	728		785		631	4	635	1449
AM Peak Trucks	0		4	4	1	66		67		51	1	52	123
AM Peak Truck %	**0.0%**		**14.8%**	**13.8%**	**1.8%**	**9.1%**		**8.5%**		**8.1%**	**25.0%**	**8.2%**	**8.5%**
1200	6		8	14	17	115		132		128	4	132	278
1215	3		11	14	13	112		125		129	1	130	269
1230	1		18	19	25	153		178		136	1	137	334
1245	5		12	17	17	122		139		153	3	156	312
MID Peak Vehicles	15		49	64	72	502		574		546	9	555	1193
MID Peak Trucks	2		5	7	4	65		69		67	1	68	144
MID Peak Truck %	**13.3%**		**10.2%**	**10.9%**	**5.6%**	**12.9%**		**12.0%**		**12.3%**	**11.1%**	**12.3%**	**12.1%**
430	7		32	39	27	181		208		233	2	235	482
445	4		19	23	23	182		205		186	1	187	415
500	4		5	9	19	167		186		220	0	220	415
515	0		13	13	20	174		194		216	2	218	425
PM Peak Vehicles	15		69	84	89	704		793		855	5	860	1737
PM Peak Trucks	0		0	0	1	50		51		33	0	33	84
PM Peak Truck %	**0.0%**		**0.0%**	**0.0%**	**1.1%**	**7.1%**		**6.4%**		**3.9%**	**0.0%**	**3.8%**	**4.8%**

NOTES:

PEAK HOUR FACTORS (PHF)

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 20, 2012
DAY: Thursday
WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD SB				SR 228 WB				SR 228 EB				TOTAL
Starting Time	From North				From East				From West				TRAFFIC
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	
645	2		2	4	18	212		230		105	1	106	340
700	0		9	9	14	159		173		136	1	137	319
715	0		8	8	13	158		171		207	2	209	388
730	0		8	8	12	199		211		183	0	183	402
PHF	0.25		0.75	0.81	0.79	0.86		0.85		0.76	0.50	0.76	0.90
1200	6		8	14	17	115		132		128	4	132	278
1215	3		11	14	13	112		125		129	1	130	269
1230	1		18	19	25	153		178		136	1	137	334
1245	5		12	17	17	122		139		153	3	156	312
PHF	0.63		0.68	0.84	0.72	0.82		0.81		0.89	0.56	0.89	0.89
430	7		32	39	27	181		208		233	2	235	482
445	4		19	23	23	182		205		186	1	187	415
500	4		5	9	19	167		186		220	0	220	415
515	0		13	13	20	174		194		216	2	218	425
PHF	0.54		0.54	0.54	0.82	0.97		0.95		0.92	0.63	0.91	0.90

TABLE TOTALS

	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	TOTAL
AM	2		27	29	57	728		785		631	4	635	1449
MID	15		49	64	72	502		574		546	9	555	1193
PM	15		69	84	89	704		793		855	5	860	1737

NOTES:

2035 VOLUMES

Yearly Growth Rate: 0.7%
(Southwestern Planning Commission)
(Adams Township)

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 20, 2012
DAY: Thursday
WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD				SR 228 WB				SR 228 EB				
Starting Time	From North				From East				From West				TOTAL TRAFFIC
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	
AM													
645	2		2	5	21	249		270		123	1	124	399
700	0		11	11	16	187		203		160	1	161	375
715	0		9	9	15	185		201		243	2	245	456
730	0		9	9	14	234		248		215	0	215	472
MID													
1200	7		9	16	20	135		155		150	5	155	326
1215	4		13	16	15	131		147		151	1	153	316
1230	1		21	22	29	180		209		160	1	161	392
1245	6		14	20	20	143		163		180	4	183	366
PM													
430	8		38	46	32	212		244		274	2	276	566
445	5		22	27	27	214		241		218	1	220	487
500	5		6	11	22	196		218		258	0	258	487
515	0		15	15	23	204		228		254	2	256	499

TABLE TOTALS

	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	**TOTAL**
AM	2		32	34	67	855		922		741	5	746	1701
MID	18		58	75	85	589		674		641	11	652	1401
PM	18		81	99	104	827		931		1004	6	1010	2039

2035 Volumes = Raw Data x (1+(0.007))^23 = 1.1740263

NOTES:

2035 VOLUMES

Yearly Growth Rate: 0.7%
(Southwestern Planning Commission)
(Adams Township)

COUNTY: Butler
MUNICIPALITY: Adams Township
DATE: September 20, 2012
DAY: Thursday
WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

	BRICKYARD RD				SR 228 WB				SR 228 EB				
Starting Time	From North				From East				From West				TOTAL TRAFFIC
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	
AM													
630	0		9	9	11	203		214		123	4	127	350
645	2		2	5	21	249		270		123	1	124	399
700	0		11	11	16	187		203		160	1	161	375
715	0		9	9	15	185		201		243	2	245	456
Hr 1 Total	*2*		*32*	*34*	*63*	*824*		*888*		*649*	*8*	*657*	*1579*
730	0		9	9	14	234		248		215	0	215	472
745	0		8	8	22	175		197		128	2	130	336
800	1		7	8	14	119		133		156	1	157	298
815	0		6	6	13	158		171		162	2	164	342
Hr 2 Total	*1*		*31*	*32*	*63*	*686*		*749*		*661*	*6*	*667*	*1448*
830	4		18	21	42	196		238		169	4	173	432
845	2		18	20	58	240		297		144	5	149	466
900	6		16	22	31	210		241		114	7	121	384
915	1		14	15	16	171		188		139	13	151	355
Hr 3 Total	*13*		*66*	*79*	*147*	*817*		*964*		*566*	*28*	*594*	*1637*
MID													
1100	1		7	8	22	181		203		106	1	107	318
1115	0		4	4	20	174		194		116	1	117	315
1130	2		13	15	11	144		155		137	1	139	309
1145	2		9	12	31	175		205		126	4	129	346
Hr 4 Total	*6*		*33*	*39*	*83*	*674*		*757*		*485*	*7*	*492*	*1288*
1200	7		9	16	20	135		155		150	5	155	326
1215	4		13	16	15	131		147		151	1	153	316
1230	1		21	22	29	180		209		160	1	161	392
1245	6		14	20	20	143		163		180	4	183	366
Hr 5 Total	*18*		*58*	*75*	*85*	*589*		*674*		*641*	*11*	*652*	*1401*
PM													
300	5		6	11	35	174		209		203	2	205	425
315	2		18	20	22	161		183		209	5	214	417
330	5		19	23	34	185		220		216	5	221	464
345	0		14	14	23	185		209		237	0	237	460
Hr 6 Total	*12*		*56*	*68*	*115*	*706*		*821*		*865*	*12*	*877*	*1766*
400	4		12	15	28	149		177		209	2	211	404
415	9		7	16	28	198		227		225	4	229	472
430	8		38	46	32	212		244		274	2	276	566
445	5		22	27	27	214		241		218	1	220	487
Hr 7 Total	*26*		*79*	*104*	*115*	*774*		*889*		*926*	*9*	*936*	*1929*
500	5		6	11	22	196		218		258	0	258	487
515	0		15	15	23	204		228		254	2	256	499
530	5		21	26	28	190		218		223	2	225	470
545	2		12	14	54	203		257		220	8	228	499
Hr 8 Total	*12*		*54*	*66*	*128*	*794*		*922*		*954*	*13*	*967*	*1955*
TABLE TOTALS													
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	**TOTAL**
	89		407	497	800	5863		6663		5748	94	5842	13001

2035 Volumes = Raw Data x (1+(0.007))^23 = 1.1740263

NOTES:

2035 Passenger Car Equivalent Volumes

Per PennDOT Pub 46 Chapter 11.16:

Truck adjustment factor : $T = 1+P_T(E_T-1)$ where

E_T = passenger car equivalent for trucks = 2.5 (Exhibit 11-5, Rolling terrain)

P_T = proportion of trucks in the traffic stream (expressed as a decimal fraction)

COUNTY: Butler

MUNICIPALITY: Adams Township

DATE: September 20, 2012

DAY: Thursday

WEATHER:

INTERSECTION: SR 228 and Brickyard Rd

Calculated Truck Adjustment Factors

	BRICKYARD RD SB				SR 228 WB				SR 228 EB			
	From North				From East				From West			
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL
AM	1.00		1.22	1.21	1.03	1.14		1.13		1.12	1.38	1.12
MID	1.20		1.15	1.16	1.08	1.19		1.18		1.18	1.17	1.18
PM	1.00		1.00	1.00	1.02	1.11		1.10		1.06	1.00	1.06

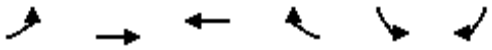
Passenger Car Equivalent Volumes

	BRICKYARD RD SB				SR 228 WB				SR 228 EB				
Starting Time	From North				From East				From West				TOTAL TRAFFIC
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	
AM													
645	2		3	6	22	283		304		138	2	140	450
700	0		13	13	17	212		229		179	2	181	422
715	0		11	11	16	211		226		273	3	276	513
730	0		11	11	14	266		279		241	0	241	532
MID													
1200	8		11	19	22	161		183		178	5	184	386
1215	4		15	19	17	157		173		179	1	181	373
1230	1		24	26	32	214		247		189	1	191	463
1245	7		16	23	22	171		193		213	4	217	433
PM													
430	8		38	46	32	235		268		290	2	292	605
445	5		22	27	27	236		264		231	1	232	523
500	5		6	11	23	217		239		273	0	273	523
515	0		15	15	24	226		250		268	2	271	535

TABLE TOTALS

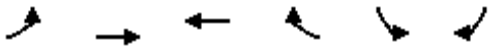
	R		L	TOTAL	R	S		TOTAL		S	L	TOTAL	TOTAL
AM	2		39	41	69	971		1039		831	6	837	1917
MID	21		66	87	92	703		795		759	12	772	1654
PM	18		81	99	106	915		1020		1063	6	1067	2186

2035 Passenger Car Equivalent Volumes = 2035 Volumes x T (as calculated above)



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	4	631	728	57	27	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.989		0.976	
Flt Protected					0.960	
Satd. Flow (prot)	0	1757	1733	0	1584	0
Flt Permitted					0.960	
Satd. Flow (perm)	0	1757	1733	0	1584	0
Link Speed (mph)		45	45		35	
Link Distance (ft)		395	571		956	
Travel Time (s)		6.0	8.7		18.6	
Peak Hour Factor	0.50	0.76	0.86	0.79	0.75	0.25
Growth Factor	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	25%	8%	9%	2%	15%	0%
Adj. Flow (vph)	9	971	990	84	42	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	980	1074	0	51	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 58.9%		ICU Level of Service B	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	4	631	728	57	27	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.50	0.76	0.86	0.79	0.75	0.25
Hourly flow rate (vph)	9	971	990	84	42	9
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	1075				2023	1033
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1075				2023	1033
tC, single (s)	4.3				6.5	6.2
tC, 2 stage (s)						
tF (s)	2.4				3.6	3.3
p0 queue free %	98				27	97
cM capacity (veh/h)	569				58	285

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	981	1075	51
Volume Left	9	0	42
Volume Right	0	84	9
cSH	569	1700	67
Volume to Capacity	0.02	0.63	0.76
Queue Length 95th (ft)	1	0	88
Control Delay (s)	0.5	0.0	150.7
Lane LOS	A		F
Approach Delay (s)	0.5	0.0	150.7
Approach LOS			F

Intersection Summary			
Average Delay	3.9		
Intersection Capacity Utilization	58.9%	ICU Level of Service	B
Analysis Period (min)	15		

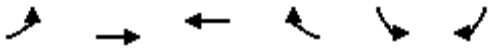
Intersection	
Intersection Delay (sec/veh):	3.8

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	4	631	728	57	27	2
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.50	0.76	0.86	0.79	0.75	0.25
Heavy Vehicles(%)	25	8	9	2	15	0
Movement Flow Rate	9	971	990	84	42	9
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	1074	0	0	0	2021	1032
Stage 1	-	-	-	-	1032	-
Stage 2	-	-	-	-	989	-
Follow-up Headway	2.425	-	-	-	3.635	3.3
Pot Capacity-1 Maneuver	570	-	-	-	59	285
Stage 1	-	-	-	-	325	-
Stage 2	-	-	-	-	341	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	570	-	-	-	57	285
Mov Capacity-2 Maneuver	-	-	-	-	57	-
Stage 1	-	-	-	-	325	-
Stage 2	-	-	-	-	329	-

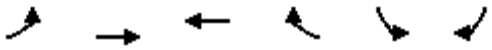
Approach	EB	WB	SB
HCM Control Delay (s)	0.1	0	152.5
HCM LOS	A	A	F

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					67
HCM Control Delay (s)	11.421	-	-	-	152.5
HCM Lane VC Ratio	0.016	-	-	-	0.768
HCM Lane LOS	B	-	-	-	F
HCM 95th Percentile Queue (veh)	0.05	-	-	-	3.53



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	9	546	502	72	49	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor						
Frt			0.981		0.966	
Flt Protected		0.999			0.964	
Satd. Flow (prot)	0	1695	1664	0	1598	0
Flt Permitted		0.999			0.964	
Satd. Flow (perm)	0	1695	1664	0	1598	0
Link Speed (mph)		45	45		35	
Link Distance (ft)		395	571		956	
Travel Time (s)		6.0	8.7		18.6	
Confl. Peds. (#/hr)				2	1	1
Peak Hour Factor	0.56	0.89	0.82	0.72	0.68	0.63
Growth Factor	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	11%	12%	13%	6%	10%	13%
Adj. Flow (vph)	19	718	716	117	84	28
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	737	833	0	112	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 53.3%		ICU Level of Service A	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	9	546	502	72	49	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.56	0.89	0.82	0.72	0.68	0.63
Hourly flow rate (vph)	19	718	716	117	84	28
Pedestrians		1	1		2	
Lane Width (ft)		12.0	12.0		12.0	
Walking Speed (ft/s)		4.0	4.0		4.0	
Percent Blockage		0	0		0	
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	835				1533	778
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	835				1533	778
tC, single (s)	4.2				6.5	6.3
tC, 2 stage (s)						
tF (s)	2.3				3.6	3.4
p0 queue free %	98				29	93
cM capacity (veh/h)	759				120	379

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	737	833	112
Volume Left	19	0	84
Volume Right	0	117	28
cSH	759	1700	144
Volume to Capacity	0.02	0.49	0.78
Queue Length 95th (ft)	2	0	120
Control Delay (s)	0.7	0.0	86.2
Lane LOS	A		F
Approach Delay (s)	0.7	0.0	86.2
Approach LOS			F

Intersection Summary			
Average Delay		6.0	
Intersection Capacity Utilization		53.3%	ICU Level of Service A
Analysis Period (min)		15	

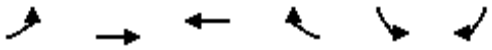
Intersection	
Intersection Delay (sec/veh):	6.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	9	546	502	72	49	15
Conflicting Peds.(#/hr)	0	0	0	2	1	1
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.56	0.89	0.82	0.72	0.68	0.63
Heavy Vehicles(%)	11	12	13	6	10	13
Movement Flow Rate	19	718	716	117	84	28
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	834	0	0	0	1532	776
Stage 1	-	-	-	-	776	-
Stage 2	-	-	-	-	756	-
Follow-up Headway	2.299	-	-	-	3.59	3.417
Pot Capacity-1 Maneuver	762	-	-	-	123	380
Stage 1	-	-	-	-	440	-
Stage 2	-	-	-	-	450	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	762	-	-	-	118	380
Mov Capacity-2 Maneuver	-	-	-	-	118	-
Stage 1	-	-	-	-	440	-
Stage 2	-	-	-	-	431	-

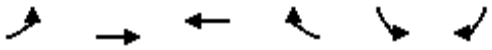
Approach	EB	WB	SB
HCM Control Delay (s)	0.3	0	89.1
HCM LOS	A	A	F

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					142
HCM Control Delay (s)	9.844	-	-	-	89.1
HCM Lane VC Ratio	0.025	-	-	-	0.79
HCM Lane LOS	A	-	-	-	F
HCM 95th Percentile Queue (veh)	0.076	-	-	-	4.884



Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	855	704	89	69	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt			0.982		0.976	
Flt Protected					0.960	
Satd. Flow (prot)	0	1828	1757	0	1780	0
Flt Permitted					0.960	
Satd. Flow (perm)	0	1828	1757	0	1780	0
Link Speed (mph)		45	45		35	
Link Distance (ft)		395	571		956	
Travel Time (s)		6.0	8.7		18.6	
Peak Hour Factor	0.63	0.92	0.97	0.82	0.54	0.54
Growth Factor	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	0%	4%	7%	1%	0%	0%
Adj. Flow (vph)	9	1087	849	127	150	33
Shared Lane Traffic (%)						
Lane Group Flow (vph)	0	1096	976	0	182	0
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		0	0		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Sign Control		Free	Free		Stop	

Intersection Summary			
Area Type:	Other		
Control Type: Unsignalized			
Intersection Capacity Utilization 69.5%		ICU Level of Service C	
Analysis Period (min) 15			



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	5	855	704	89	69	15
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.63	0.92	0.97	0.82	0.54	0.54
Hourly flow rate (vph)	9	1087	849	127	150	32
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	976				2019	913
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	976				2019	913
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				0	90
cM capacity (veh/h)	715				64	334

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	1097	976	182
Volume Left	9	0	150
Volume Right	0	127	32
cSH	715	1700	75
Volume to Capacity	0.01	0.57	2.43
Queue Length 95th (ft)	1	0	433
Control Delay (s)	0.4	0.0	770.2
Lane LOS	A		F
Approach Delay (s)	0.4	0.0	770.2
Approach LOS			F

Intersection Summary			
Average Delay		62.4	
Intersection Capacity Utilization		69.5%	ICU Level of Service C
Analysis Period (min)		15	

Intersection	
Intersection Delay (sec/veh):	63.3

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Volume (vph)	5	855	704	89	69	15
Conflicting Peds.(#/hr)	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
Right Turn Channelized	None	None	None	None	None	None
Storage Length	0			0	0	0
Median Width		0	0		12	
Grade (%)		0%	0%		0%	
Peak Hour Factor	0.63	0.92	0.97	0.82	0.54	0.54
Heavy Vehicles(%)	0	4	7	1	0	0
Movement Flow Rate	9	1087	849	127	149	32
Number of Lanes	0	1	1	0	1	0

Major/Minor	Major 1		Major 2			
Conflicting Flow Rate - All	976	0	0	0	2018	913
Stage 1	-	-	-	-	913	-
Stage 2	-	-	-	-	1105	-
Follow-up Headway	2.2	-	-	-	3.5	3.3
Pot Capacity-1 Maneuver	715	-	-	-	# 65	334
Stage 1	-	-	-	-	395	-
Stage 2	-	-	-	-	320	-
Time blocked-Platoon(%)	0	-	-	-	0	0
Mov Capacity-1 Maneuver	715	-	-	-	# 63	334
Mov Capacity-2 Maneuver	-	-	-	-	# 63	-
Stage 1	-	-	-	-	395	-
Stage 2	-	-	-	-	310	-

Approach	EB	WB	SB
HCM Control Delay (s)	0.1	0	$ 784.1
HCM LOS	A	A	F

Lane	EBL	EBT	WBT	WBR	SBLn1
Capacity (vph)					74
HCM Control Delay (s)	10.101	-	-	-	$ -1
HCM Lane VC Ratio	0.013	-	-	-	2.459
HCM Lane LOS	B	-	-	-	F
HCM 95th Percentile Queue (veh)	0.039	-	-	-	17.418

4.3 Traffic Signal Warrants and Engineering Studies

General

Determination of the need to install, revise, or remove a traffic signal shall be based on a thorough engineering and traffic study of roadway and traffic conditions in accordance with 67 Pa. Code Chapter 212. Responsibilities shall be as follows:

a) State Highways. The Engineering District will conduct studies at locations that involve State highways except for first and second class cities, municipalities having municipal traffic engineering certification, municipalities having an agreement with the Department, or for locations involving a business development. In these latter cases, the study will be conducted by that particular entity. When the Department completes a traffic signal study at the request of a municipality and determines that a traffic signal warrant is satisfied, the municipality shall be responsible to design the proposed traffic signal, prepare the bid documents, and prepare the traffic signal permit drawing. The proposed signal design, bid documents, and traffic signal permits shall be reviewed and approved by the Department prior to the project being advertised for bid by the municipality.

b) Local Highways. Local authorities shall be responsible for conducting all studies for traffic signals at locations that do not involve State highways.

c) Business Development. In accordance with Chapter 441, Section 441.6(4)(i) and Publication 282, developers shall be responsible for all studies necessary to justify traffic signals requested on any type of highway as a result of the traffic demands at a new or existing development.

d) Department Coordination. Regardless of the party that conducts the study for traffic signals, the Department is required to approve the traffic signal by the issuance of a Traffic Signal Permit except for those municipalities having municipal traffic engineering certification and in accordance with an agreement with the Department.

e) Plan. A scale drawing that depicts the geometric and topographic features of the location must be submitted with every completed traffic signal application form. The drawing shall be prepared in compliance with Publication 149 and other guidelines provided by the Department. The applicant shall be responsible for developing the drawing unless the signal installation is part of a Department construction project; in which case, the Department will develop the drawings as part of the project.

f) Costs. All costs related to these studies shall be the responsibility of the entity conducting the study as indicated above.

Traffic Control Signal Warrants

There are eleven (11) warrants for traffic signals, which are as identified in 67 Pa. Code §212 (relating to warrants for traffic control signals). Warrants 1 through 9 are as defined in Sections 4C.02 through 4C.10 in *Part 4 of the MUTCD*, and the tenth and eleventh warrants as defined in 67 Pa. Code §212 .

All eleven (11) warrants should be performed or considered when justifying a traffic signal. If a warrant is not applicable, this should be clearly stated within the traffic engineering study.

The elevent warrants, and in some cases clarifying information, are as follows:

Warrant 1, Eight-Hour Vehicular Volume

The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

It is intended that Warrant 1 be treated as a single warrant. If Condition A is satisfied, then Warrant 1 is satisfied and analyses of Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then Warrant 1 is satisfied and an analysis of the combination of Conditions A and B is not needed.

For full details on Warrant 1, see Section 4C.02 of the MUTCD.

Warrant 2, Four-Hour Vehicular Volume

The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

For full details on Warrant 1, see Section 4C.03 of the MUTCD.

Warrant 3, Peak Hour

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street. **Central Office approval is required if Warrant 3 is the only traffic signal warrant that can be met.**

For full details on Warrant 1, see Section 4C.04 of the MUTCD.

Warrant 4, Pedestrian Volume

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

For full details on Warrant 1, see Section 4C.05 of the MUTCD.

Warrant 5, School Crossing

The School Crossing signal warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word “school children” includes elementary through high school students.

In addition to the criteria in Section 4C.06 of the MUTCD, to satisfy Warrant 5 at an established school crossing, it is necessary to perform a traffic engineering study to determine the adequacy and frequency of vehicular traffic gaps. Guidelines for these "gap acceptance studies" are as follows:

a) Conduct gap studies in accordance with the procedures developed in the Institute of Transportation Engineer’s publication, “School Trip Safety Zone Guidelines,” 1984 Edition.

b) The study shall cover all times during the day when children use the crossing. This will involve, as a minimum, a morning and an afternoon study period.

c) Each study period must be a minimum of 30 minutes in length; however, the study period should cover the entire time period the children use the crossing.

d) Analyze locations where a median is involved in accordance with the following:

1. Median width of 6 feet or less: This median width is not sufficient to provide adequate protection for the pedestrian; therefore, the width of the school crossing is from curb to curb.

2. Median width greater than 6 feet to a maximum of 16 feet: This width may be sufficient for adequate pedestrian protection. Determine adequacy during the study based on the number of pedestrians, the speed of traffic, the type of median, etc.

3. Median width greater than 16 feet: This size median is sufficient for adequate pedestrian protection. In this case, the width of the school crossing is from the curb to the median.

Justification for the installation of a signal under Warrant 5 requires the local officials or school officials to submit the following:

a) Documentation clearly showing that the proposed signal installation is located at an established school crossing. A map of the local school area or municipality showing all established school crossings is desirable.

b) A response to the following questions:

1. Is it possible to relocate the school crossing to eliminate the need for a traffic signal?

2. Can adult crossing guards or police officers more efficiently and safely control the school crossing?

c) A completed "gap acceptance study" detailing the method of study with supporting data and analysis in the format described in the ITE publication referenced above. This study must show that the number of adequate gaps in the traffic stream during the period when the children are using the crossing is less than the number of minutes in the same period.

The design of signals installed under Warrant 5 shall include the following:

a) Pedestrian-control signals.

b) If at an intersection, the signal must be both traffic and pedestrian actuated.

c) If installed within the limits of a progressive signal system, the signal must be interconnected with the system so that the timing does not disrupt the progressive movement.

d) If installed at a non-intersection crossing, the signal shall be pedestrian-actuated. Parking and other obstructions to sight distance should be prohibited for at least 100 feet in advance of and 20 feet beyond the crosswalk.

The installation of traffic signals at school crossings may not be the absolute solution to the problem of conflicts between vehicles and school children. School and local traffic authorities must be aware of their responsibility to properly instruct children in the use of traffic signals. Moreover, the installation of a signal under the school crossing warrant does not preclude the use of school crossing guards.

Warrant 6, Coordinated Signal System

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

For full details on Warrant 6, see Section 4C.07 of the MUTCD.

Warrant 7, Crash Experience

The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

In addition to the criteria pertaining to Warrant 7 in Section 4C.08 of the MUTCD, the five or more reported crashes of types susceptible to correction that occur within a 12-month period may include both reportable crashes and non-reportable crashes that are documented in the police files, and that occurred within a 12-month period during the most recent 3 years of available crash data.

Warrant 8, Roadway Network

Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

To qualify under Warrant 8 in Section 4C.09 of the MUTCD, a major route must be classified as an Urban Extension, Principal Arterial, or Minor Arterial that is a reasonable connection between two Principal Arterials and/or Urban Extensions as shown on the official Functional Classification Map.

To be justified under this warrant, a copy of the location as it appears on the Functional Classification Map, with approval date along with the federal-aid route numbers, must be submitted with the request for traffic signal approval.

Warrant 9, Intersection Near a Grade Crossing

The Intersection Near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

For full details on Warrant 9, see Section 4C.10 of the MUTCD. Also, if a traffic signal is warranted, the Department must involve the Public Utility Commission (PUC) as indicated in the section **Traffic Signals near Grade Crossings** on page **4-50**.

Warrant PA-1, ADT Volume Warrant

An ‘‘ADT volume warrant’’ is added in Section 212 and may be used in addition to the nine warrants contained in Sections 4C.02 through 4C.10 of the MUTCD (relating to Warrants 1 through 9). This warrant must apply at a proposed intersection, an intersection revised by a highway construction project, or at the driveway of a proposed commercial or residential development where vehicle counts cannot be taken. If a traffic-control signal is installed under this warrant, a traffic count must be taken within 6 months of the opening of a development or within 2 years of the opening of a highway. If the traffic volumes do not satisfy this warrant, or one or more of the other nine warrants, consideration should be given to removing the traffic-control signal and replacing it with appropriate alternative traffic-control devices, if any are needed.

This warrant is satisfied when the estimated ADT volumes on the major street and on the higher volume minor street or driveway approach to the intersection, when projected using an accepted procedure such as put forth in the latest Trip Generation Manual published by the Institute of Transportation Engineers, equals or exceeds the values in either Condition A or Condition B of the tables found within the warrant.

See Section 212 at http://www.pacode.com/secure/data/067/chapter212/s212.302.html for full details on this warrant.

Warrant PA-2, Optional Traffic Signal Warrant for Midblock Crossings and Trail Crossings

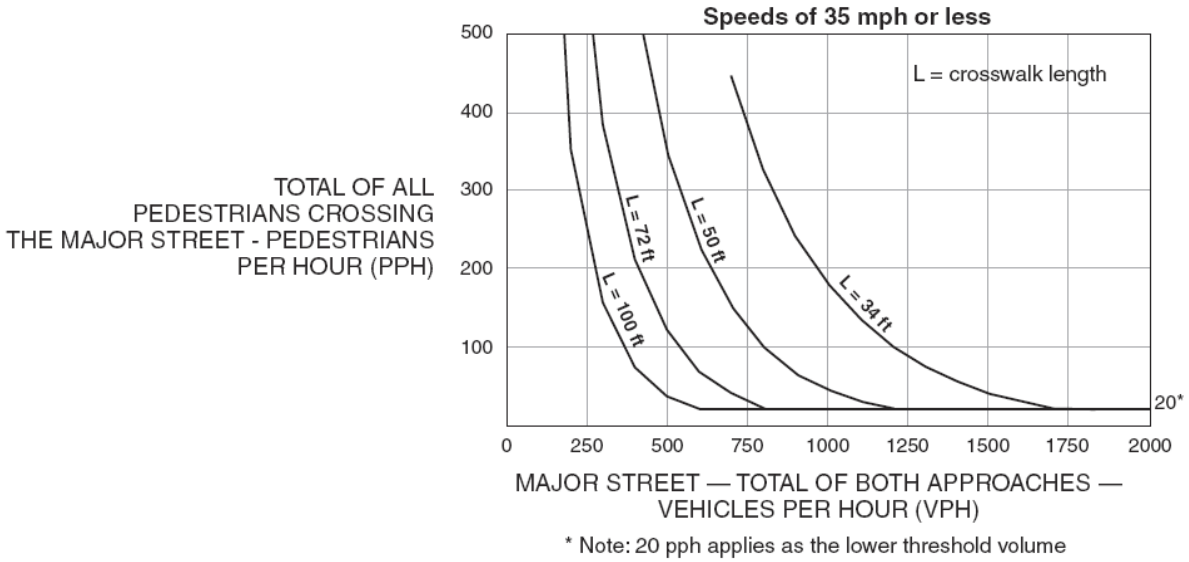
The guidelines below for the ''Optional Traffic Signal Warrant for Midblock Crossings and Trail Crossings'' (see Exhibit 4-6 and Exhibit 4-7) requires the approval of the appropriate District Traffic Engineer prior to performing the analysis. The intent of this warrant is to evaluate a traffic control device in locations where safety concerns may exist at a midblock or trail crossing. Since the Department will not permit the use of the Pedestrian Hybrid Beacon, the following will provide an alternative to handling these challenging unique situations. The traffic signal must be at least 100' away from other intersections.

Additionally, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the marked crosswalk, or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance. Suitable standard signs and pavement markings should be installed in accordance with PennDOT Publication 149 "Traffic Signal Design Handbook".

If this is the only traffic signal warrant that is met than a reevaluation of this warrant shall occur every 5 years. If it is determined that the signal is no longer needed then the traffic signal removal process should begin.

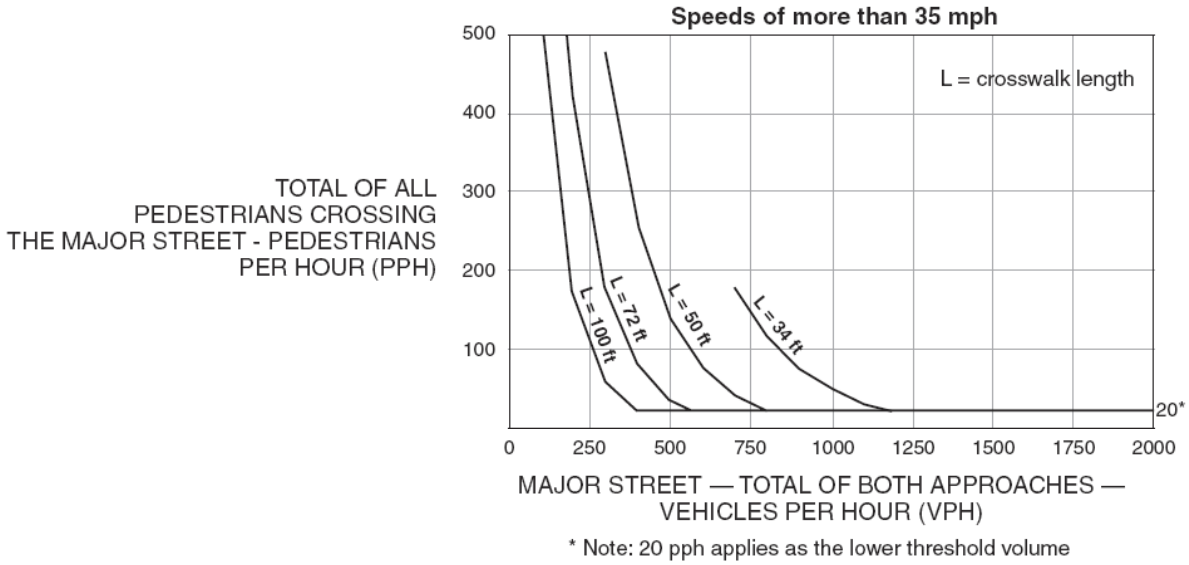
In addition to the information found in this warrant, signal spacing should be considered (i.e., how will this new installation fit in with adjacent intersections). In addition, other treatments such as pedestrian activated flashers should be installed first and if non-effective consider this warrant.

Exhibit 4-6 Guidelines for Optional Traffic Signal Warrant for Midblock Crossing and Trail Crossings (Low-Speed Roadways)



* Note: 20 pph applies as the lower threshold volume

Exhibit 4-7 Guidelines for Optional Traffic Signal Warrant for Midblock Crossing and Trail Crossings (High-Speed Roadways)



Intersection Control Beacon Warrants

Flashing beacons at intersections include intersection control beacons mounted on span wire directly over an intersection, stop beacons mounted on a pedestal above stop signs (red), and warning beacons mounted on a pedestal above intersection ahead symbols signs (yellow). Both overhead and pedestal mounted beacons have advantages and disadvantages. Overhead beacons may distract the motorist from roadway signing, but they aid the motorist in locating the intersection. Pedestal mounted beacons help draw attention to stop and intersection ahead signing, but do not help locate the intersection for the mainline driver who sees only flashing yellow mounted on an intersection ahead sign, somewhere in advance of the intersection itself. In any case, any flashing beacon must be justified under one or more of the following warrants. **The District Traffic Engineer will determine if an intersection Control Beacon is appropriate based on the warrants supplied below**.

WARRANT 1: Limited Visibility

Where sight distance is limited, a flashing beacon may be installed if the sight distance is less than that shown in Exhibit 4-8 for any approach to the intersection. Locations qualifying under limited visibility must have previously had adequate warning signs and pavement markings installed.

CHAPTER 4C. TRAFFIC CONTROL SIGNAL NEEDS STUDIES

Section 4C.01 Studies and Factors for Justifying Traffic Control Signals

Standard:

01 **An engineering study of traffic conditions, pedestrian characteristics, and physical characteristics of the location shall be performed to determine whether installation of a traffic control signal is justified at a particular location.**

02 **The investigation of the need for a traffic control signal shall include an analysis of factors related to the existing operation and safety at the study location and the potential to improve these conditions, and the applicable factors contained in the following traffic signal warrants:**

Warrant 1, Eight-Hour Vehicular Volume
Warrant 2, Four-Hour Vehicular Volume
Warrant 3, Peak Hour
Warrant 4, Pedestrian Volume
Warrant 5, School Crossing
Warrant 6, Coordinated Signal System
Warrant 7, Crash Experience
Warrant 8, Roadway Network
Warrant 9, Intersection Near a Grade Crossing

03 **The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.**

Support:

04 Sections 8C.09 and 8C.10 contain information regarding the use of traffic control signals instead of gates and/or flashing-light signals at highway-rail grade crossings and highway-light rail transit grade crossings, respectively.

Guidance:

05 *A traffic control signal should not be installed unless one or more of the factors described in this Chapter are met.*

06 *A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.*

07 *A traffic control signal should not be installed if it will seriously disrupt progressive traffic flow.*

08 *The study should consider the effects of the right-turn vehicles from the minor-street approaches. Engineering judgment should be used to determine what, if any, portion of the right-turn traffic is subtracted from the minor-street traffic count when evaluating the count against the signal warrants listed in Paragraph 2.*

09 *Engineering judgment should also be used in applying various traffic signal warrants to cases where approaches consist of one lane plus one left-turn or right-turn lane. The site-specific traffic characteristics should dictate whether an approach is considered as one lane or two lanes. For example, for an approach with one lane for through and right-turning traffic plus a left-turn lane, if engineering judgment indicates that it should be considered a one-lane approach because the traffic using the left-turn lane is minor, the total traffic volume approaching the intersection should be applied against the signal warrants as a one-lane approach. The approach should be considered two lanes if approximately half of the traffic on the approach turns left and the left-turn lane is of sufficient length to accommodate all left-turn vehicles.*

10 *Similar engineering judgment and rationale should be applied to a street approach with one through/left-turn lane plus a right-turn lane. In this case, the degree of conflict of minor-street right-turn traffic with traffic on the major street should be considered. Thus, right-turn traffic should not be included in the minor-street volume if the movement enters the major street with minimal conflict. The approach should be evaluated as a one-lane approach with only the traffic volume in the through/left-turn lane considered.*

11 *At a location that is under development or construction and where it is not possible to obtain a traffic count that would represent future traffic conditions, hourly volumes should be estimated as part of an engineering study for comparison with traffic signal warrants. Except for locations where the engineering study uses the satisfaction of Warrant 8 to justify a signal, a traffic control signal installed under projected conditions should have an engineering study done within 1 year of putting the signal into stop-and-go operation to determine if the signal is justified. If not justified, the signal should be taken out of stop-and-go operation or removed.*

12 *For signal warrant analysis, a location with a wide median, even if the median width is greater than 30 feet, should be considered as one intersection.*

Option:

13 At an intersection with a high volume of left-turn traffic from the major street, the signal warrant analysis may be performed in a manner that considers the higher of the major-street left-turn volumes as the "minor-street" volume and the corresponding single direction of opposing traffic on the major street as the "major-street" volume.

14 For signal warrants requiring conditions to be present for a certain number of hours in order to be satisfied, any four sequential 15-minute periods may be considered as 1 hour if the separate 1-hour periods used in the warrant analysis do not overlap each other and both the major-street volume and the minor-street volume are for the same specific one-hour periods.

15 For signal warrant analysis, bicyclists may be counted as either vehicles or pedestrians.

Support:

16 When performing a signal warrant analysis, bicyclists riding in the street with other vehicular traffic are usually counted as vehicles and bicyclists who are clearly using pedestrian facilities are usually counted as pedestrians.

Option:

17 Engineering study data may include the following:

A. The number of vehicles entering the intersection in each hour from each approach during 12 hours of an average day. It is desirable that the hours selected contain the greatest percentage of the 24-hour traffic volume.
B. Vehicular volumes for each traffic movement from each approach, classified by vehicle type (heavy trucks, passenger cars and light trucks, public-transit vehicles, and, in some locations, bicycles), during each 15-minute period of the 2 hours in the morning and 2 hours in the afternoon during which total traffic entering the intersection is greatest.
C. Pedestrian volume counts on each crosswalk during the same periods as the vehicular counts in Item B and during hours of highest pedestrian volume. Where young, elderly, and/or persons with physical or visual disabilities need special consideration, the pedestrians and their crossing times may be classified by general observation.
D. Information about nearby facilities and activity centers that serve the young, elderly, and/or persons with disabilities, including requests from persons with disabilities for accessible crossing improvements at the location under study. These persons might not be adequately reflected in the pedestrian volume count if the absence of a signal restrains their mobility.
E. The posted or statutory speed limit or the 85th-percentile speed on the uncontrolled approaches to the location.
F. A condition diagram showing details of the physical layout, including such features as intersection geometrics, channelization, grades, sight-distance restrictions, transit stops and routes, parking conditions, pavement markings, roadway lighting, driveways, nearby railroad crossings, distance to nearest traffic control signals, utility poles and fixtures, and adjacent land use.
G. A collision diagram showing crash experience by type, location, direction of movement, severity, weather, time of day, date, and day of week for at least 1 year.

18 The following data, which are desirable for a more precise understanding of the operation of the intersection, may be obtained during the periods described in Item B of Paragraph 17:

A. Vehicle-hours of stopped time delay determined separately for each approach.
B. The number and distribution of acceptable gaps in vehicular traffic on the major street for entrance from the minor street.
C. The posted or statutory speed limit or the 85th-percentile speed on controlled approaches at a point near to the intersection but unaffected by the control.
D. Pedestrian delay time for at least two 30-minute peak pedestrian delay periods of an average weekday or like periods of a Saturday or Sunday.
E. Queue length on stop-controlled approaches.

Section 4C.02 Warrant 1, Eight-Hour Vehicular Volume

Support:

01 The Minimum Vehicular Volume, Condition A, is intended for application at locations where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

02 The Interruption of Continuous Traffic, Condition B, is intended for application at locations where Condition A is not satisfied and where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

03 It is intended that Warrant 1 be treated as a single warrant. If Condition A is satisfied, then Warrant 1 is satisfied and analyses of Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then Warrant 1 is satisfied and an analysis of the combination of Conditions A and B is not needed.

Standard:

04 **The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:**

A. The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

B. The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

In applying each condition the major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.

Option:

05 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 70 percent columns in Table 4C-1 may be used in place of the 100 percent columns.

Guidance:

06 *The combination of Conditions A and B is intended for application at locations where Condition A is not satisfied and Condition B is not satisfied and should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.*

Standard:

07 **The need for a traffic control signal shall be considered if an engineering study finds that both of the following conditions exist for each of any 8 hours of an average day:**

A. The vehicles per hour given in both of the 80 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; and

B. The vehicles per hour given in both of the 80 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.

These major-street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Condition A—Minimum Vehicular Volume

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Condition B—Interruption of Continuous Traffic

Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100%[a]	80%[b]	70%[c]	56%[d]	100%[a]	80%[b]	70%[c]	56%[d]
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

[a] Basic minimum hourly volume

[b] Used for combination of Conditions A and B after adequate trial of other remedial measures

[c] May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

[d] May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000

Option:

08 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.03 Warrant 2, Four-Hour Vehicular Volume

Support:

01 The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-2 may be used in place of Figure 4C-1.

Section 4C.04 Warrant 3, Peak Hour

Support:

01 The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Standard:

02 **This signal warrant shall be applied only in unusual cases, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.**

03 **The need for a traffic control signal shall be considered if an engineering study finds that the criteria in either of the following two categories are met:**

A. If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:

1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and

3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

B. The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.

Option:

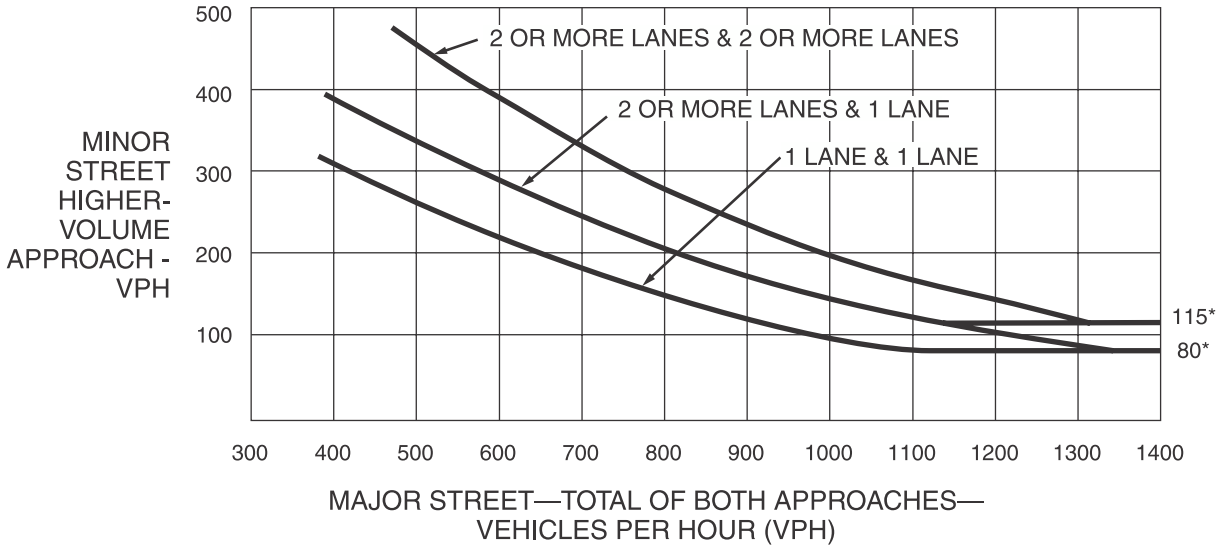
04 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-4 may be used in place of Figure 4C-3 to evaluate the criteria in the second category of the Standard.

05 If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal may be operated in the flashing mode during the hours that the volume criteria of this warrant are not met.

Guidance:

06 *If this warrant is the only warrant met and a traffic control signal is justified by an engineering study, the traffic control signal should be traffic-actuated.*

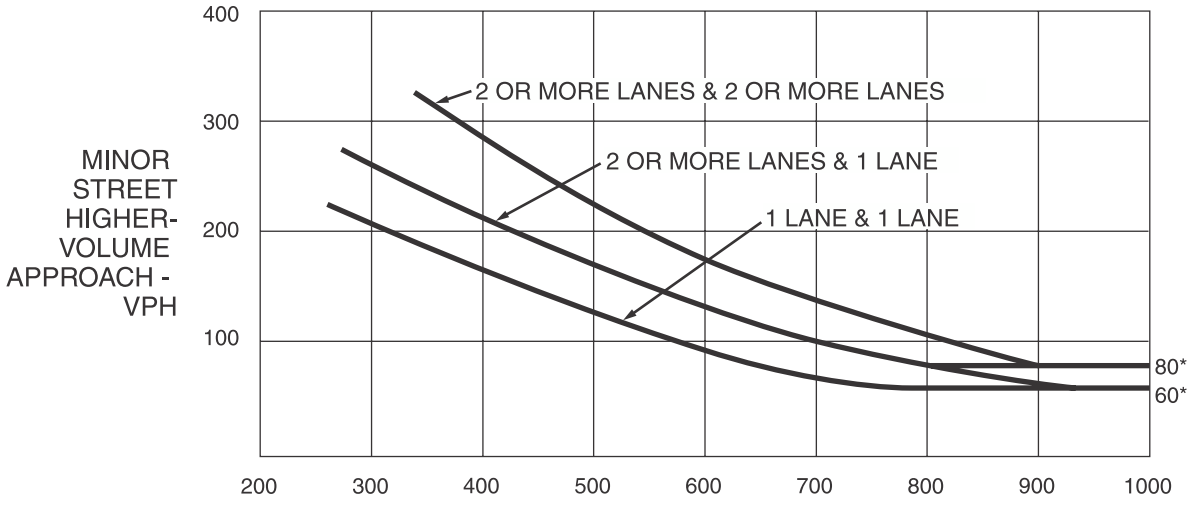
Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

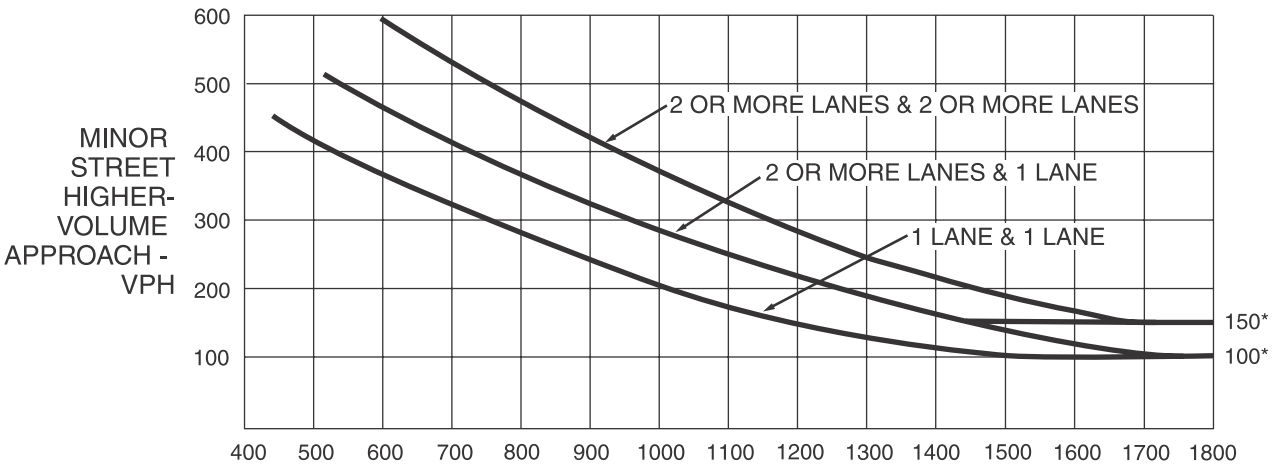
Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

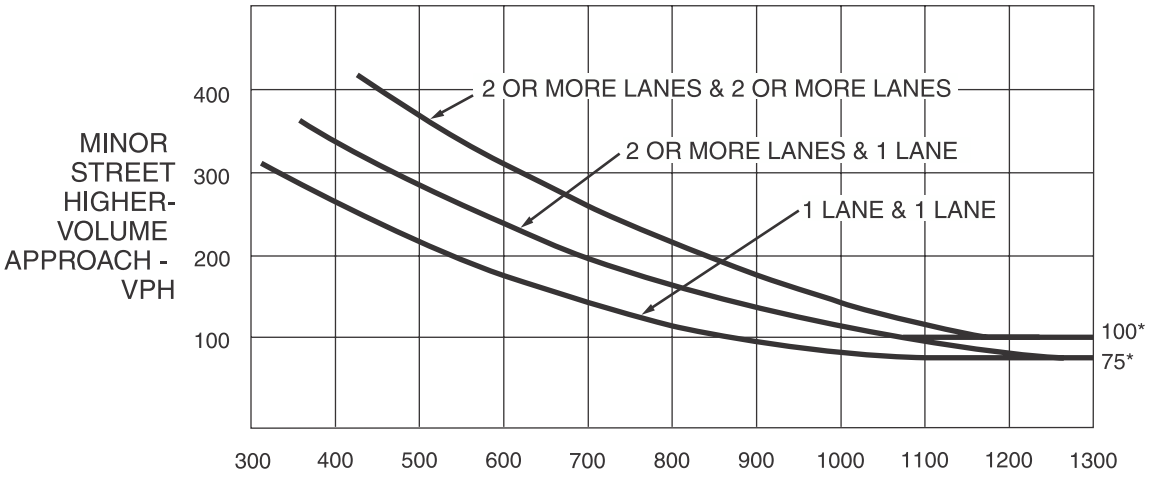
Figure 4C-3. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-4. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Section 4C.05 Warrant 4, Pedestrian Volume

Support:

01 The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

Standard:

02 **The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:**

- **A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or**
- **B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.**

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 35 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, Figure 4C-6 may be used in place of Figure 4C-5 to evaluate Criterion A in Paragraph 2, and Figure 4C-8 may be used in place of Figure 4C-7 to evaluate Criterion B in Paragraph 2.

Standard:

04 **The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal or STOP sign controlling the street that pedestrians desire to cross is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

05 **If this warrant is met and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E.**

Guidance:

06 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

- *A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.*
- *B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.*
- *C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.*

Option:

07 The criterion for the pedestrian volume crossing the major street may be reduced as much as 50 percent if the 15th-percentile crossing speed of pedestrians is less than 3.5 feet per second.

08 A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street.

Section 4C.06 Warrant 5, School Crossing

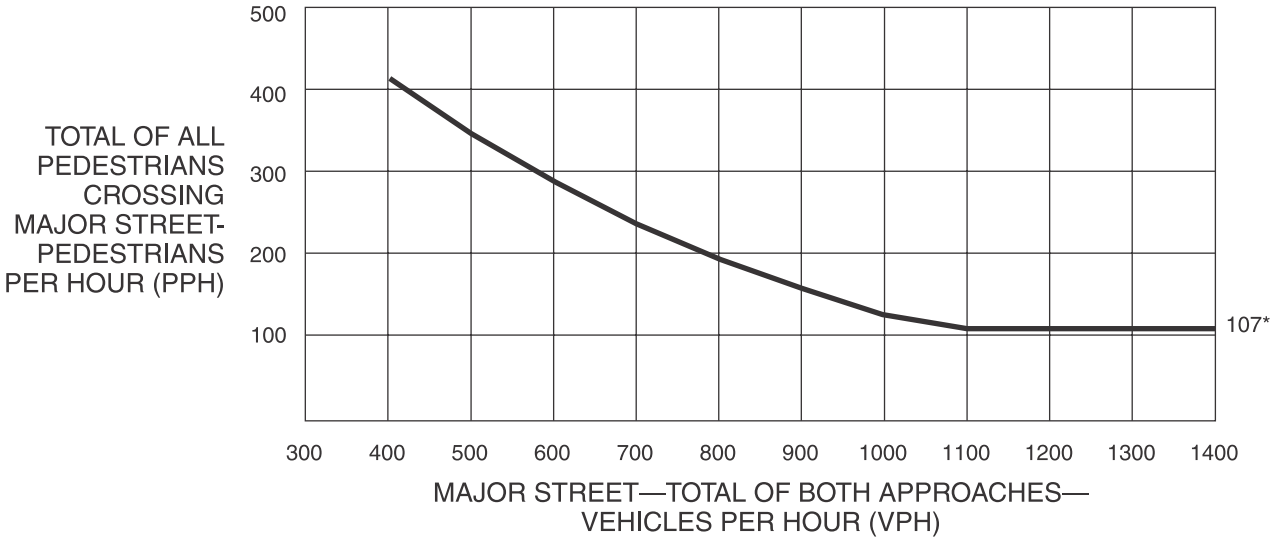
Support:

01 The School Crossing signal warrant is intended for application where the fact that schoolchildren cross the major street is the principal reason to consider installing a traffic control signal. For the purposes of this warrant, the word “schoolchildren” includes elementary through high school students.

Standard:

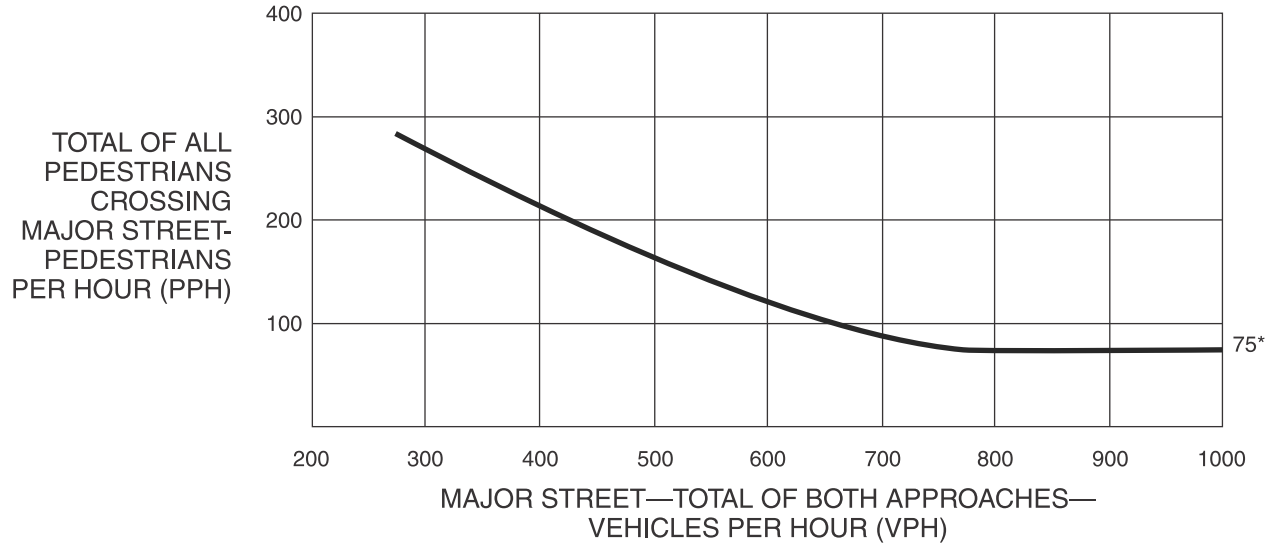
02 **The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.**

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume



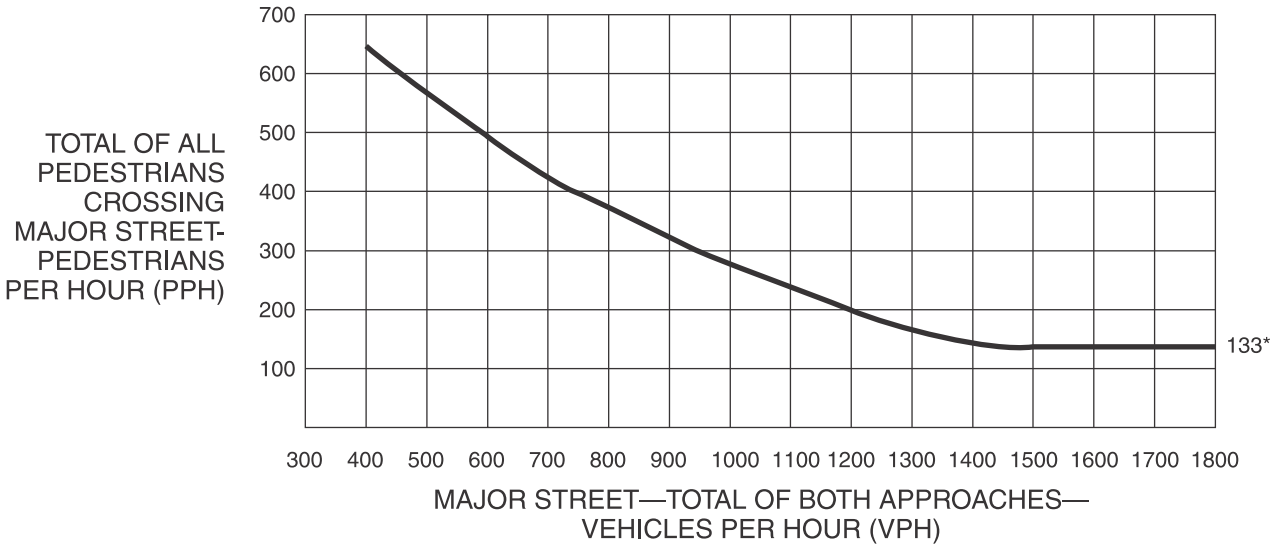
*Note: 107 pph applies as the lower threshold volume.

Figure 4C-6. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



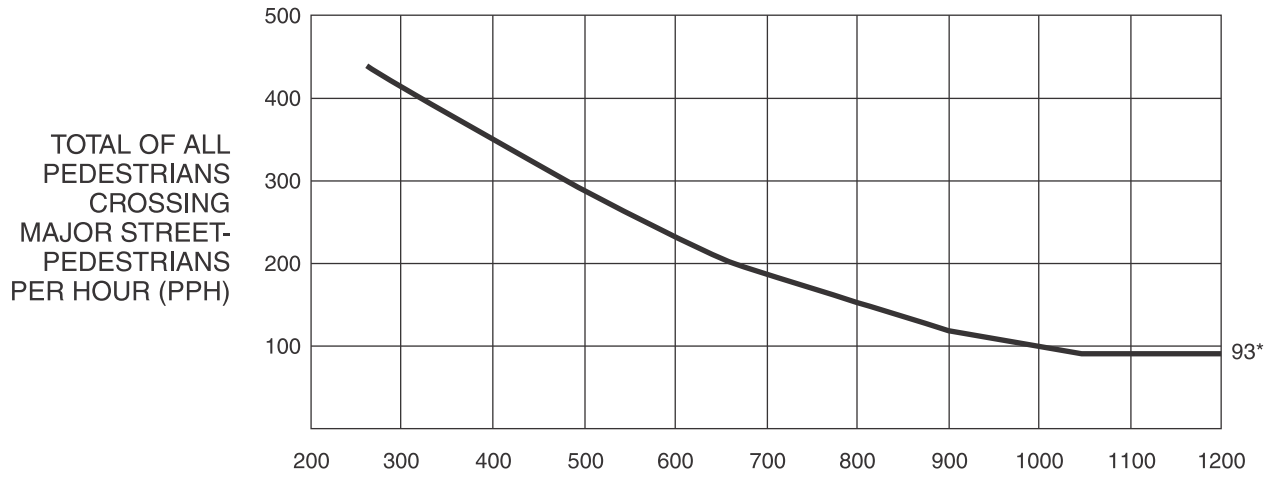
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

03 **Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.**

04 **The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

Guidance:

05 *If this warrant is met and a traffic control signal is justified by an engineering study, then:*

A. If it is installed at an intersection or major driveway location, the traffic control signal should also control the minor-street or driveway traffic, should be traffic-actuated, and should include pedestrian detection.

B. If it is installed at a non-intersection crossing, the traffic control signal should be installed at least 100 feet from side streets or driveways that are controlled by STOP or YIELD signs, and should be pedestrian-actuated. If the traffic control signal is installed at a non-intersection crossing, at least one of the signal faces should be over the traveled way for each approach, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk or site accommodations should be made through curb extensions or other techniques to provide adequate sight distance, and the installation should include suitable standard signs and pavement markings.

C. Furthermore, if it is installed within a signal system, the traffic control signal should be coordinated.

Section 4C.07 Warrant 6, Coordinated Signal System

Support:

01 Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:**

A. On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.

B. On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

Guidance:

03 *The Coordinated Signal System signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 1,000 feet.*

Section 4C.08 Warrant 7, Crash Experience

Support:

01 The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:**

A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and

C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.

Option:

03 If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40 mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in the 56 percent columns in Table 4C-1 may be used in place of the 80 percent columns.

Section 4C.09 Warrant 8, Roadway Network

Support:

01 Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

Standard:

02 **The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:**

- **A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or**
- **B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday).**

03 **A major route as used in this signal warrant shall have at least one of the following characteristics:**

- **A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow.**
- **B. It includes rural or suburban highways outside, entering, or traversing a city.**
- **C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.**

Section 4C.10 Warrant 9, Intersection Near a Grade Crossing

Support:

01 The Intersection Near a Grade Crossing signal warrant is intended for use at a location where none of the conditions described in the other eight traffic signal warrants are met, but the proximity to the intersection of a grade crossing on an intersection approach controlled by a STOP or YIELD sign is the principal reason to consider installing a traffic control signal.

Guidance:

02 *This signal warrant should be applied only after adequate consideration has been given to other alternatives or after a trial of an alternative has failed to alleviate the safety concerns associated with the grade crossing. Among the alternatives that should be considered or tried are:*

- *A. Providing additional pavement that would enable vehicles to clear the track or that would provide space for an evasive maneuver, or*
- *B. Reassigning the stop controls at the intersection to make the approach across the track a non-stopping approach.*

Standard:

03 **The need for a traffic control signal shall be considered if an engineering study finds that both of the following criteria are met:**

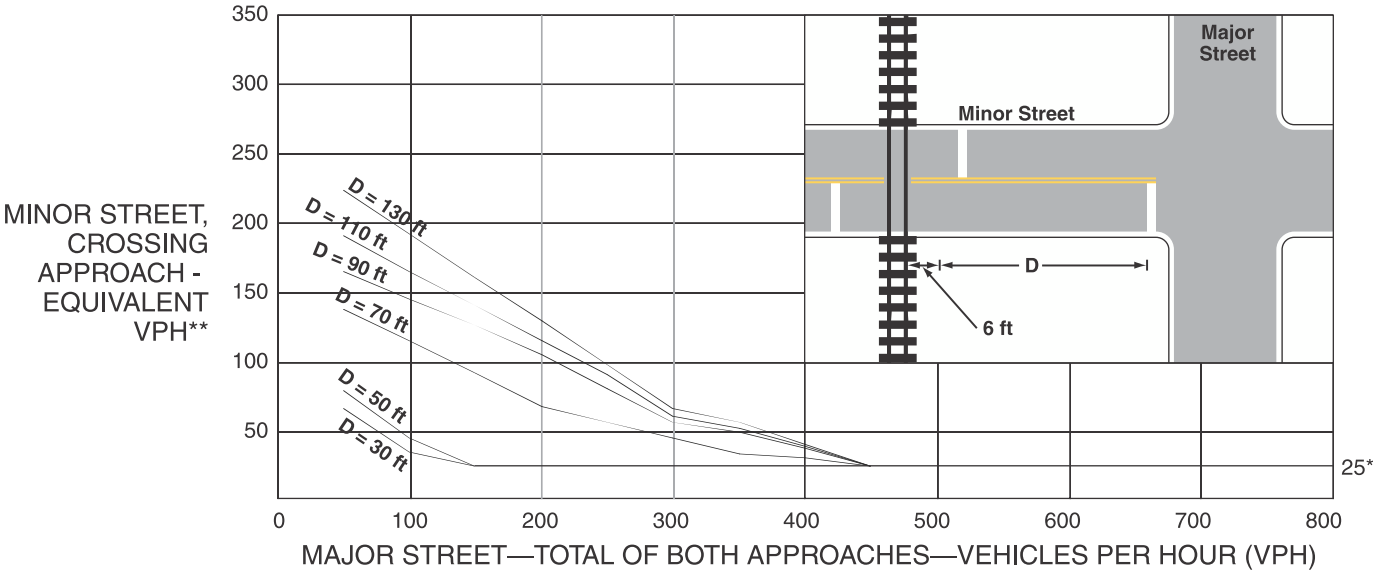
- **A. A grade crossing exists on an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach; and**
- **B. During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the minor-street approach that crosses the track (one direction only, approaching the intersection) falls above the applicable curve in Figure 4C-9 or 4C-10 for the existing combination of approach lanes over the track and the distance D, which is the clear storage distance as defined in Section 1A.13.**

Guidance:

04 *The following considerations apply when plotting the traffic volume data on Figure 4C-9 or 4C-10:*

- *A. Figure 4C-9 should be used if there is only one lane approaching the intersection at the track crossing location and Figure 4C-10 should be used if there are two or more lanes approaching the intersection at the track crossing location.*

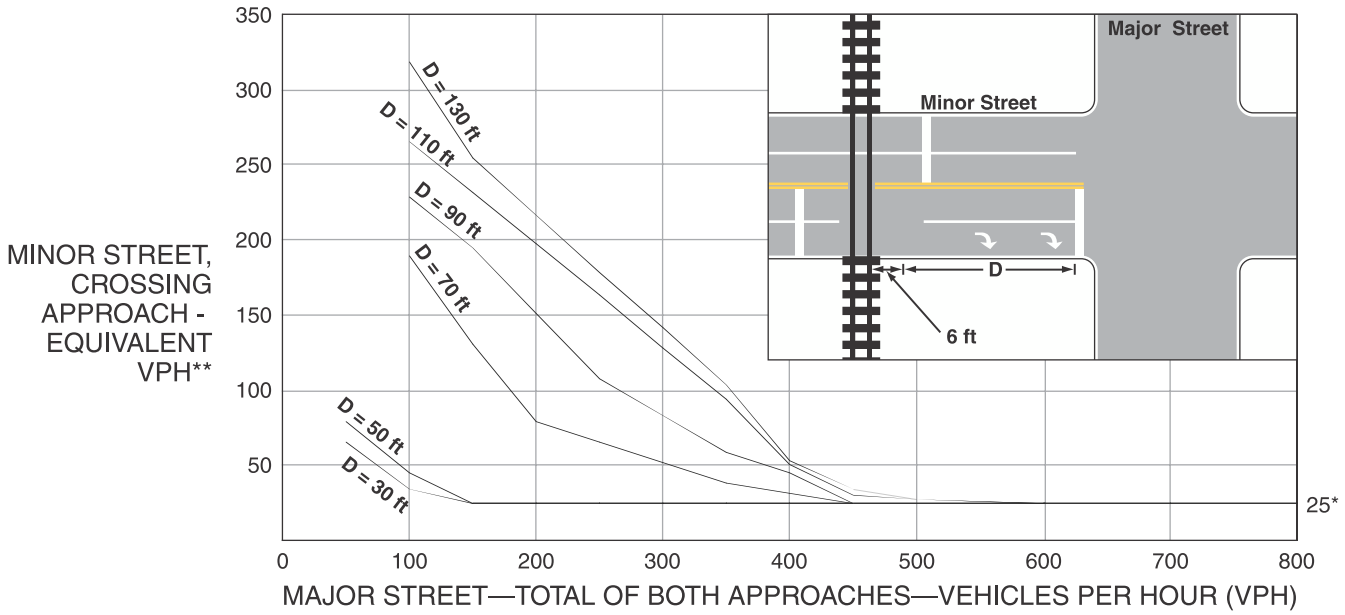
Figure 4C-9. Warrant 9, Intersection Near a Grade Crossing (One Approach Lane at the Track Crossing)



* 25 vph applies as the lower threshold volume

** VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate

Figure 4C-10. Warrant 9, Intersection Near a Grade Crossing (Two or More Approach Lanes at the Track Crossing)



* 25 vph applies as the lower threshold volume

** VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate

B. After determining the actual distance D, the curve for the distance D that is nearest to the actual distance D should be used. For example, if the actual distance D is 95 feet, the plotted point should be compared to the curve for D = 90 feet.

C. If the rail traffic arrival times are unknown, the highest traffic volume hour of the day should be used.

Option:

05 The minor-street approach volume may be multiplied by up to three adjustment factors as provided in Paragraphs 6 through 8.

06 Because the curves are based on an average of four occurrences of rail traffic per day, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-2 for the appropriate number of occurrences of rail traffic per day.

07 Because the curves are based on typical vehicle occupancy, if at least 2% of the vehicles crossing the track are buses carrying at least 20 people, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-3 for the appropriate percentage of high-occupancy buses.

08 Because the curves are based on tractor-trailer trucks comprising 10% of the vehicles crossing the track, the vehicles per hour on the minor-street approach may be multiplied by the adjustment factor shown in Table 4C-4 for the appropriate distance and percentage of tractor-trailer trucks.

Standard:

09 **If this warrant is met and a traffic control signal at the intersection is justified by an engineering study, then:**

A. The traffic control signal shall have actuation on the minor street;

B. Preemption control shall be provided in accordance with Sections 4D.27, 8C.09, and 8C.10; and

C. The grade crossing shall have flashing-light signals (see Chapter 8C).

Guidance:

10 *If this warrant is met and a traffic control signal at the intersection is justified by an engineering study, the grade crossing should have automatic gates (see Chapter 8C).*

Table 4C-2. Warrant 9, Adjustment Factor for Daily Frequency of Rail Traffic

Rail Traffic per Day	Adjustment Factor
1	0.67
2	0.91
3 to 5	1.00
6 to 8	1.18
9 to 11	1.25
12 or more	1.33

Table 4C-3. Warrant 9, Adjustment Factor for Percentage of High-Occupancy Buses

% of High-Occupancy Buses* on Minor-Street Approach	Adjustment Factor
0%	1.00
2%	1.09
4%	1.19
6% or more	1.32

* A high-occupancy bus is defined as a bus occupied by at least 20 people.

Table 4C-4. Warrant 9, Adjustment Factor for Percentage of Tractor-Trailer Trucks

% of Tractor-Trailer Trucks on Minor-Street Approach	Adjustment Factor	
	D less than 70 feet	D of 70 feet or more
0% to 2.5%	0.50	0.50
2.6% to 7.5%	0.75	0.75
7.6% to 12.5%	1.00	1.00
12.6% to 17.5%	2.30	1.15
17.6% to 22.5%	2.70	1.35
22.6% to 27.5%	3.28	1.64
More than 27.5%	4.18	2.09

Warrants Summary

Information			
Analyst	Chad Martin	Intersection	SR 0228 & Brickyard Rd
Agency/Co	Erdman Anthony	Jurisdiction	Adams Township
Date Performed	12/6/2012	Units	U.S. Customary
Project ID	57762.04- ThreeDegRd	Time Period Analyzed	
East/West Street	SR 0228 (Mars Rd)	North/South Street	Brickyard Rd
File Name	TSWarrants-BrickyardRd	Major Street	East-West

Project Description *57762.04- ThreeDegRd*

General				Roadway Network	
Major Street Speed (mph)	45	☑	Population < 10,000	Two Major Routes	☐
Nearest Signal (ft)	2800	☐	Coordinated Signal System	Weekend Count	☐
Crashes (per year)	0	☐	Adequate Trials of Alternatives	5-yr Growth Factor	0

Geometry and Traffic	EB			WB			NB			SB		
	LT	TH	RT	LT	TH	RT	LT	TH	RT	LT	TH	RT
Number of lanes, N	0	1	0	0	1	0	0	0	0	0	0	0
Lane usage		LT			TR						LR	
Vehicle Volume Averages (vph)	7	478	0	0	488	66	0	0	0	34	0	7
Peds (ped/h) / Gaps (gaps/h)	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--	--	0 / 0	--
Delay (s/veh) / (veh-hr)	--	2.6 / 0.4	--	--	0 / 0	--	--	0 / 0	--	--	84.9 / 0.3	--

Warrant 1: Eight-Hour Vehicular Volume	☐
1 A. Minimum Vehicular Volumes (Both major approaches --and-- higher minor approach) --or--	☐
1 B. Interruption of Continuous Traffic (Both major approaches --and-- higher minor approach) --or--	☐
1 80% Vehicular --and-- Interruption Volumes (Both major approaches --and-- higher minor approach)	☐
Warrant 2: Four-Hour Vehicular Volume	☑
2 A. Four-Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 3: Peak Hour	☑
3 A. Peak-Hour Conditions (Minor delay --and-- minor volume --and-- total volume) --or--	☐
3 B. Peak- Hour Vehicular Volumes (Both major approaches --and-- higher minor approach)	☑
Warrant 4: Pedestrian Volume	☐
4 A. Pedestrian Volumes (Four hours --or-- one hour) --and--	☐
4 B. Gaps Same Period (Four hours --or-- one hour)	☐
Warrant 5: School Crossing	☐
5. Student Volumes --and--	☐
5. Gaps Same Period	☐
Warrant 6: Coordinated Signal System	☐
6. Degree of Platooning (Predominant direction or both directions)	☐
Warrant 7: Crash Experience	☐
7 A. Adequate trials of alternatives, observance and enforcement failed --and--	☐
7 B. Reported crashes susceptible to correction by signal (12-month period) --and--	☐
7 C. 80% Volumes for Warrants 1A, 1B --or-- 4 are satisfied	☐

Warrant 8: Roadway Network	☐
8 A. Weekday Volume (Peak hour total --and-- projected warrants 1, 2 or 3) --or--	☐
8 B. Weekend Volume (Five hours total)	☐

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HCS+: MUTCD Signal Warrants Release 5.5

Analyst: Chad Martin
Agency: Erdman Anthony
Date: 12/6/2012
Project ID: 57762.04- ThreeDegRd
EW Street: SR 0228 (Mars Rd)

Intersection: SR 0228 & Brickyard Rd
Jurisdiction: Adams Township
Units: U.S. Customary
Analysis Year: 2035
NS Street: Brickyard Rd

General Information

Major St. Speed (mph): 45
Nearest Signal (ft): 2800
Crashes per Yr: 0

Population: Less than 10000
Coordinated Signal System: N

School Crossing

Students in Highest Hour: 0
Adequate Gaps in Period: 0
Minutes in Period: 0

Roadway Network

Two Major Routes: 0
Weekend Count: 0
5-yr Growth Factor: 0

Geometry and Traffic

	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
No. Lanes	0	1	0	0	1	0	0	0	0	0	0	0
LaneUsage		LT			TR						LR	

Results

Warrant 1: Eight-Hour Vehicular Volume	[ ]
1 A. Minimum Vehicular Volumes	[ ]
1 B. Interruption of Continuous Traffic	[ ]
1 80% Vehicular --and-- Interruption Volumes	[ ]
Warrant 2: Four-Hour Vehicular Volume	
2 A. Four-Hour Vehicular Volumes	[X]
Warrant 3: Peak Hour	[X]
3 A. Peak-Hour Conditions	[ ]
3 B. Peak-Hour Vehicular Volume Hours Met	[X]
Warrant 4: Pedestrian Volume	[ ]
4 A. Pedestrian Volumes	[ ]
4 B. Gaps Same Period	[ ]
Warrant 5: School Crossing	[ ]
5 A. Student Volumes	[ ]
5 B. Gaps Same Period	[ ]
Warrant 6: Coordinated Signal System	
6 Degree of Platooning	[ ]
Warrant 7: Crash Experience	[ ]
7 A. Adequate trials of alternatives	[ ]

7 B. Reported crashes [ ]
7 80% Volumes for Warrants 1A, 1B --or-- 4 [ ]

Warrant 8: Roadway Network [ ]
8 A. Weekday Volume [ ]
8 B. Weekend Volume [ ]

Summary

Hours	Major Volume	Minor Volume	Total Volume	Delay (Veh-hr)	1A 70%	1A 56%	1B 70%	1B 56%	2 70%	3A 70%	3B 70%
06-07	1544	34	1578	1.5	No	No	No	No	No	No	No
07-08	1416	32	1448	0.0	No	No	No	No	No	No	No
08-09	1558	79	1637	0.0	No	No	Yes	Yes	Yes	No	Yes
09-10	1249	39	1288	0.0	No	No	No	No	No	No	No
10-11	1326	76	1402	0.0	No	No	Yes	Yes	Yes	No	Yes
11-12	1698	68	1766	0.0	No	No	Yes	Yes	Yes	No	No
12-13	1824	105	1929	2.3	Yes	Yes	Yes	Yes	Yes	No	Yes
13-14	1889	66	1955	0.0	No	No	Yes	Yes	Yes	No	No
14-15	0	0	0	0.0	No	No	No	No	No	No	No
15-16	0	0	0	0.0	No	No	No	No	No	No	No
16-17	0	0	0	0.0	No	No	No	No	No	No	No
17-18	0	0	0	0.0	No	No	No	No	No	No	No
Total	12504	499	13003		1	1	5	5	5	0	3

Traffic Volumes (vph)

Eastbound			Westbound			Northbound			Southbound		
L	T	R	L	T	R	L	T	R	L	T	R
8	649	0	0	824	63	0	0	0	32	0	2
6	661	0	0	686	63	0	0	0	31	0	1
28	566	0	0	817	147	0	0	0	66	0	13
7	485	0	0	674	83	0	0	0	33	0	6
11	641	0	0	589	85	0	0	0	58	0	18
12	865	0	0	706	115	0	0	0	56	0	12
9	926	0	0	774	115	0	0	0	79	0	26
13	954	0	0	794	128	0	0	0	54	0	12
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0

Pedestrian Volumes and Gaps (Per Hour)

Volume	Gap	Volume	Gap	Volume	Gap	Volume	Gap
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

Delay	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs	sec/veh	veh-hrs
	11.5	2.1	0.0	0.0	0.0	0.0	156.3	1.5
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

9.9	2.6	0.0	0.0	0.0	0.0	78.2	2.3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10.1	0.0	0.0	0.0	0.0	0.0	784.1	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Chad Martin*
Agency/Co.	*Erdman Anthony*
Date Performed	*12/10/2012*
Analysis Time Period	*AM Peak*

Site Information

Intersection	*SR 0228 & Brickyard Rd*
Jurisdiction	*Adams Township*
Analysis Year	*2035*

Project Description *57762.04 Three Degree Rd*

East/West Street: *SR 0228* | North/South Street: *Brickyard Rd*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*5*	*741*			*855*	*67*
Peak-Hour Factor, PHF	*0.50*	*0.76*	*1.00*	*1.00*	*0.86*	*0.79*
Hourly Flow Rate, HFR (veh/h)	*10*	*975*	*0*	*0*	*994*	*84*
Percent Heavy Vehicles	*25*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*32*		*2*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.75*	*1.00*	*0.25*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*42*	*0*	*8*
Percent Heavy Vehicles	*0*	*0*	*0*	*15*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*10*						*50*	
C (m) (veh/h)	*568*						*65*	
v/c	*0.02*						*0.77*	
95% queue length	*0.05*						*3.49*	
Control Delay (s/veh)	*11.5*						*156.3*	
LOS	*B*						*F*	
Approach Delay (s/veh)	--	--					*156.3*	
Approach LOS	--	--					*F*	

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Chad Martin*
Agency/Co.	*Erdman Anthony*
Date Performed	*12/10/2012*
Analysis Time Period	*MID Peak*

Site Information

Intersection	*SR 0228 & Brickyard Rd*
Jurisdiction	*Adams Township*
Analysis Year	*2035*

Project Description *57762.04 Three Degree Rd*

East/West Street: *SR 0228* | North/South Street: *Brickyard Rd*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*11*	*641*			*589*	*85*
Peak-Hour Factor, PHF	*0.56*	*0.89*	*1.00*	*1.00*	*0.82*	*0.72*
Hourly Flow Rate, HFR (veh/h)	*19*	*720*	*0*	*0*	*718*	*118*
Percent Heavy Vehicles	*11*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*58*		*18*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.68*	*1.00*	*0.63*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*85*	*0*	*28*
Percent Heavy Vehicles	*0*	*0*	*0*		*0*	*13*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*19*						*113*	
C (m) (veh/h)	*760*						*151*	
v/c	*0.03*						*0.75*	
95% queue length	*0.08*						*4.55*	
Control Delay (s/veh)	*9.9*						*78.2*	
LOS	*A*						*F*	
Approach Delay (s/veh)	--	--				*78.2*		
Approach LOS	--	--				*F*		

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TWO-WAY STOP CONTROL SUMMARY

General Information

Analyst	*Chad Martin*
Agency/Co.	*Erdman Anthony*
Date Performed	*12/10/2012*
Analysis Time Period	*PM Peak*

Site Information

Intersection	*SR 0228 & Brickyard Rd*
Jurisdiction	*Adams Township*
Analysis Year	*2035*

Project Description *57762.04 Three Degree Rd*

East/West Street: *SR 0228* | North/South Street: *Brickyard Rd*

Intersection Orientation: *East-West* | Study Period (hrs): *0.25*

Vehicle Volumes and Adjustments

Major Street	Eastbound			Westbound		
Movement	1	2	3	4	5	6
	L	T	R	L	T	R
Volume (veh/h)	*6*	*1004*			*827*	*104*
Peak-Hour Factor, PHF	*0.63*	*0.92*	*1.00*	*1.00*	*0.97*	*0.82*
Hourly Flow Rate, HFR (veh/h)	*9*	*1091*	*0*	*0*	*852*	*126*
Percent Heavy Vehicles	*0*	--	--	*0*	--	--
Median Type	*Undivided*					
RT Channelized			*0*			*0*
Lanes	*0*	*1*	*0*	*0*	*1*	*0*
Configuration	*LT*					*TR*
Upstream Signal		*0*			*0*	

Minor Street	Northbound			Southbound		
Movement	7	8	9	10	11	12
	L	T	R	L	T	R
Volume (veh/h)				*81*		*18*
Peak-Hour Factor, PHF	*1.00*	*1.00*	*1.00*	*0.54*	*1.00*	*0.54*
Hourly Flow Rate, HFR (veh/h)	*0*	*0*	*0*	*149*	*0*	*33*
Percent Heavy Vehicles	*0*	*0*	*0*	*0*	*0*	*0*
Percent Grade (%)		*0*			*0*	
Flared Approach		*N*			*N*	
Storage		*0*			*0*	
RT Channelized			*0*			*0*
Lanes	*0*	*0*	*0*	*0*	*0*	*0*
Configuration					*LR*	

Delay, Queue Length, and Level of Service

Approach	Eastbound	Westbound	Northbound			Southbound		
Movement	1	4	7	8	9	10	11	12
Lane Configuration	*LT*						*LR*	
v (veh/h)	*9*						*182*	
C (m) (veh/h)	*714*						*74*	
v/c	*0.01*						*2.46*	
95% queue length	*0.04*						*17.42*	
Control Delay (s/veh)	*10.1*						*784.1*	
LOS	*B*						*F*	
Approach Delay (s/veh)	--	--					*784.1*	
Approach LOS	--	--					*F*	

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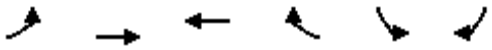
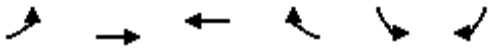


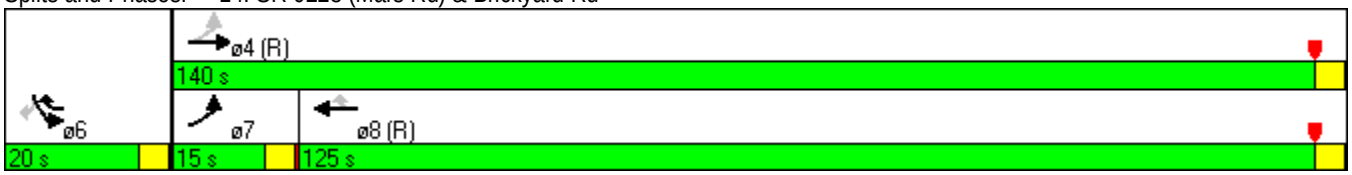
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	4	631	728	57	27	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	125			275	0	75
Storage Lanes	1			1	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1444	1759	1743	1583	1570	1615
Flt Permitted	0.244				0.950	
Satd. Flow (perm)	371	1759	1743	1583	1570	1615
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				84		34
Link Speed (mph)		45	45		35	
Link Distance (ft)		395	571		956	
Travel Time (s)		6.0	8.7		18.6	
Peak Hour Factor	0.50	0.76	0.86	0.79	0.75	0.25
Growth Factor	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	25%	8%	9%	2%	15%	0%
Adj. Flow (vph)	9	971	990	84	42	9
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	971	990	84	42	9
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (ft)	20	100	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94	94			
Detector 2 Size(ft)		6	6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA	pm+ov	NA	Perm
Protected Phases	7	4	8	6	6	

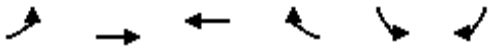


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	4			8		6
Detector Phase	7	4	8	6	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	140.0	125.0	20.0	20.0	20.0
Total Split (%)	9.4%	87.5%	78.1%	12.5%	12.5%	12.5%
Maximum Green (s)	11.0	136.0	121.0	16.0	16.0	16.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	C-Max	None	None	None
Walk Time (s)		5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0	0
Act Effct Green (s)	142.3	142.3	140.3	157.2	9.7	9.7
Actuated g/C Ratio	0.89	0.89	0.88	0.98	0.06	0.06
v/c Ratio	0.02	0.62	0.65	0.05	0.44	0.07
Control Delay	1.5	4.4	8.4	0.1	86.1	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	4.4	8.4	0.1	86.1	1.0
LOS	A	A	A	A	F	A
Approach Delay		4.4	7.8		71.1	
Approach LOS		A	A		E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 80 (50%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow			
Natural Cycle: 90			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.65			
Intersection Signal Delay: 7.7		Intersection LOS: A	
Intersection Capacity Utilization 54.8%		ICU Level of Service A	
Analysis Period (min) 15			

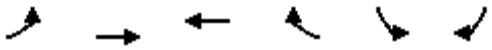
Splits and Phases: 14: SR 0228 (Mars Rd) & Brickyard Rd





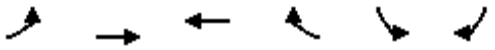
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	9	971	990	84	42	9
v/c Ratio	0.02	0.62	0.65	0.05	0.44	0.07
Control Delay	1.5	4.4	8.4	0.1	86.1	1.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	1.5	4.4	8.4	0.1	86.1	1.0
Queue Length 50th (ft)	1	177	259	0	43	0
Queue Length 95th (ft)	2	211	239	0	71	0
Internal Link Dist (ft)		315	491		876	
Turn Bay Length (ft)	125			275		75
Base Capacity (vph)	403	1564	1528	1561	157	192
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.62	0.65	0.05	0.27	0.05

Intersection Summary

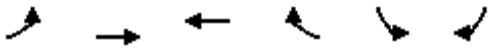


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	4	631	728	57	27	2
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1444	1759	1743	1583	1570	1615
Flt Permitted	0.24	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	370	1759	1743	1583	1570	1615
Peak-hour factor, PHF	0.50	0.76	0.86	0.79	0.75	0.25
Growth Factor (vph)	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	9	971	990	84	42	9
RTOR Reduction (vph)	0	0	0	7	0	8
Lane Group Flow (vph)	9	971	990	77	42	1
Heavy Vehicles (%)	25%	8%	9%	2%	15%	0%
Turn Type	pm+pt	NA	NA	pm+ov	NA	Perm
Protected Phases	7	4	8	6	6	
Permitted Phases	4			8		6
Actuated Green, G (s)	142.3	142.3	137.1	146.8	9.7	9.7
Effective Green, g (s)	142.3	142.3	137.1	146.8	9.7	9.7
Actuated g/C Ratio	0.89	0.89	0.86	0.92	0.06	0.06
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)	337	1564	1493	1491	95	97
v/s Ratio Prot	0.00	c0.55	c0.57	0.00	c0.03	
v/s Ratio Perm	0.02			0.05		0.00
v/c Ratio	0.03	0.62	0.66	0.05	0.44	0.01
Uniform Delay, d1	3.5	2.2	3.8	0.6	72.5	70.6
Progression Factor	1.00	1.00	1.70	0.00	1.00	1.00
Incremental Delay, d2	0.0	1.9	2.0	0.0	3.3	0.0
Delay (s)	3.5	4.1	8.4	0.0	75.8	70.6
Level of Service	A	A	A	A	E	E
Approach Delay (s)		4.0	7.8		74.9	
Approach LOS		A	A		E	

Intersection Summary			
HCM 2000 Control Delay	7.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	54.8%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



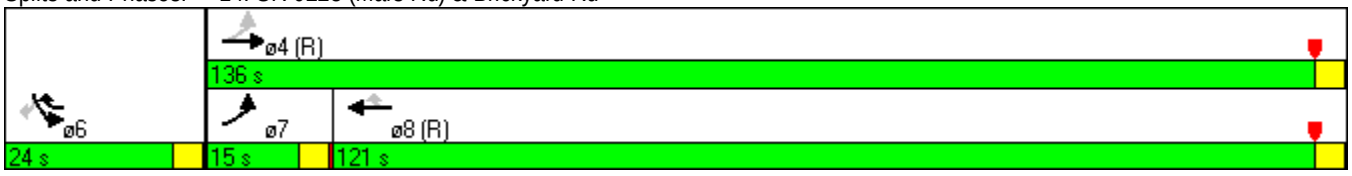
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	9	546	502	72	49	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	125			275	0	75
Storage Lanes	1			1	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor				0.97	0.99	0.98
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1626	1696	1681	1524	1641	1429
Flt Permitted	0.337				0.950	
Satd. Flow (perm)	577	1696	1681	1478	1633	1394
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				117		34
Link Speed (mph)		45	45		35	
Link Distance (ft)		395	571		956	
Travel Time (s)		6.0	8.7		18.6	
Confl. Peds. (#/hr)				2	1	1
Peak Hour Factor	0.56	0.89	0.82	0.72	0.68	0.63
Growth Factor	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	11%	12%	13%	6%	10%	13%
Adj. Flow (vph)	19	718	716	117	84	28
Shared Lane Traffic (%)						
Lane Group Flow (vph)	19	718	716	117	84	28
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (ft)	20	100	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94	94			
Detector 2 Size(ft)		6	6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			

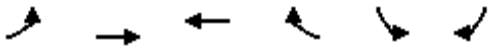


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Turn Type	pm+pt	NA	NA	pm+ov	NA	Perm
Protected Phases	7	4	8	6	6	
Permitted Phases	4			8		6
Detector Phase	7	4	8	6	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	136.0	121.0	24.0	24.0	24.0
Total Split (%)	9.4%	85.0%	75.6%	15.0%	15.0%	15.0%
Maximum Green (s)	11.0	132.0	117.0	20.0	20.0	20.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	C-Max	None	None	None
Walk Time (s)		5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0	0
Act Effct Green (s)	138.5	138.5	132.5	146.0	13.5	13.5
Actuated g/C Ratio	0.87	0.87	0.83	0.91	0.08	0.08
v/c Ratio	0.04	0.49	0.51	0.09	0.61	0.19
Control Delay	2.0	4.1	4.6	0.1	88.2	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.0	4.1	4.6	0.1	88.2	17.4
LOS	A	A	A	A	F	B
Approach Delay		4.0	4.0		70.5	
Approach LOS		A	A		E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 56 (35%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow			
Natural Cycle: 75			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.61			
Intersection Signal Delay: 8.4		Intersection LOS: A	
Intersection Capacity Utilization 43.9%		ICU Level of Service A	
Analysis Period (min) 15			

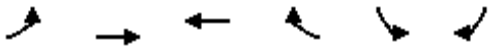
Splits and Phases: 14: SR 0228 (Mars Rd) & Brickyard Rd





Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	19	718	716	117	84	28
v/c Ratio	0.04	0.49	0.51	0.09	0.61	0.19
Control Delay	2.0	4.1	4.6	0.1	88.2	17.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	2.0	4.1	4.6	0.1	88.2	17.4
Queue Length 50th (ft)	2	134	97	0	86	0
Queue Length 95th (ft)	4	233	114	0	106	9
Internal Link Dist (ft)		315	491		876	
Turn Bay Length (ft)	125			275		75
Base Capacity (vph)	571	1468	1392	1398	205	204
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.03	0.49	0.51	0.08	0.41	0.14

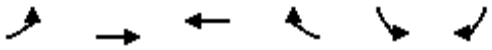
Intersection Summary



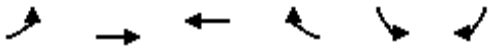
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	9	546	502	72	49	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00	1.00	0.97	1.00	0.98
Flpb, ped/bikes	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1626	1696	1681	1482	1641	1394
Flt Permitted	0.34	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	577	1696	1681	1482	1641	1394
Peak-hour factor, PHF	0.56	0.89	0.82	0.72	0.68	0.63
Growth Factor (vph)	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	19	718	716	117	84	28
RTOR Reduction (vph)	0	0	0	11	0	26
Lane Group Flow (vph)	19	718	716	106	84	2
Confl. Peds. (#/hr)				2	1	1
Heavy Vehicles (%)	11%	12%	13%	6%	10%	13%
Turn Type	pm+pt	NA	NA	pm+ov	NA	Perm
Protected Phases	7	4	8	6	6	
Permitted Phases	4			8		6
Actuated Green, G (s)	138.5	138.5	130.9	144.4	13.5	13.5
Effective Green, g (s)	138.5	138.5	130.9	144.4	13.5	13.5
Actuated g/C Ratio	0.87	0.87	0.82	0.90	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)	523	1468	1375	1374	138	117
v/s Ratio Prot	0.00	c0.42	c0.43	0.01	c0.05	
v/s Ratio Perm	0.03			0.06		0.00
v/c Ratio	0.04	0.49	0.52	0.08	0.61	0.02
Uniform Delay, d1	2.6	2.5	4.6	0.8	70.7	67.2
Progression Factor	1.00	1.00	0.63	0.23	1.00	1.00
Incremental Delay, d2	0.0	1.2	1.4	0.0	7.4	0.1
Delay (s)	2.7	3.7	4.3	0.2	78.1	67.3
Level of Service	A	A	A	A	E	E
Approach Delay (s)		3.6	3.7		75.4	
Approach LOS		A	A		E	

Intersection Summary			
HCM 2000 Control Delay	8.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	43.9%	ICU Level of Service	A
Analysis Period (min)	15		

c Critical Lane Group



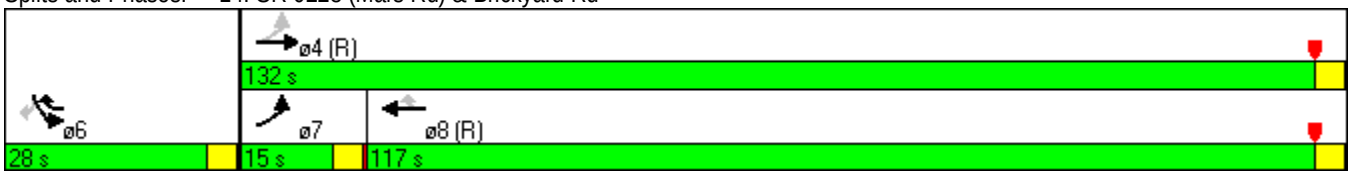
Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	855	704	89	69	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)	125			275	0	75
Storage Lanes	1			1	1	1
Taper Length (ft)	25				25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt				0.850		0.850
Flt Protected	0.950				0.950	
Satd. Flow (prot)	1805	1827	1776	1599	1805	1615
Flt Permitted	0.273				0.950	
Satd. Flow (perm)	519	1827	1776	1599	1805	1615
Right Turn on Red				Yes		Yes
Satd. Flow (RTOR)				127		34
Link Speed (mph)		45	45		35	
Link Distance (ft)		395	571		956	
Travel Time (s)		6.0	8.7		18.6	
Peak Hour Factor	0.63	0.92	0.97	0.82	0.54	0.54
Growth Factor	117%	117%	117%	117%	117%	117%
Heavy Vehicles (%)	0%	4%	7%	1%	0%	0%
Adj. Flow (vph)	9	1087	849	127	150	32
Shared Lane Traffic (%)						
Lane Group Flow (vph)	9	1087	849	127	150	32
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Left	Left	Right	Left	Right
Median Width(ft)		12	12		12	
Link Offset(ft)		0	0		0	
Crosswalk Width(ft)		16	16		16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15			9	15	9
Number of Detectors	1	2	2	1	1	1
Detector Template	Left	Thru	Thru	Right	Left	Right
Leading Detector (ft)	20	100	100	20	20	20
Trailing Detector (ft)	0	0	0	0	0	0
Detector 1 Position(ft)	0	0	0	0	0	0
Detector 1 Size(ft)	20	6	6	20	20	20
Detector 1 Type	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel						
Detector 1 Extend (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0
Detector 2 Position(ft)		94	94			
Detector 2 Size(ft)		6	6			
Detector 2 Type		Cl+Ex	Cl+Ex			
Detector 2 Channel						
Detector 2 Extend (s)		0.0	0.0			
Turn Type	pm+pt	NA	NA	pm+ov	NA	Perm
Protected Phases	7	4	8	6	6	

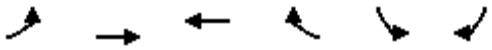


Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Permitted Phases	4			8		6
Detector Phase	7	4	8	6	6	6
Switch Phase						
Minimum Initial (s)	4.0	4.0	4.0	4.0	4.0	4.0
Minimum Split (s)	15.0	20.0	20.0	20.0	20.0	20.0
Total Split (s)	15.0	132.0	117.0	28.0	28.0	28.0
Total Split (%)	9.4%	82.5%	73.1%	17.5%	17.5%	17.5%
Maximum Green (s)	11.0	128.0	113.0	24.0	24.0	24.0
Yellow Time (s)	3.5	3.5	3.5	3.5	3.5	3.5
All-Red Time (s)	0.5	0.5	0.5	0.5	0.5	0.5
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	4.0	4.0	4.0	4.0	4.0
Lead/Lag	Lead		Lag			
Lead-Lag Optimize?	Yes		Yes			
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0
Recall Mode	None	C-Max	C-Max	None	None	None
Walk Time (s)		5.0	5.0	5.0	5.0	5.0
Flash Dont Walk (s)		11.0	11.0	11.0	11.0	11.0
Pedestrian Calls (#/hr)		0	0	0	0	0
Act Effct Green (s)	133.7	133.7	131.7	157.2	18.3	18.3
Actuated g/C Ratio	0.84	0.84	0.82	0.98	0.11	0.11
v/c Ratio	0.02	0.71	0.58	0.08	0.73	0.15
Control Delay	3.0	9.2	7.4	0.1	87.8	17.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.0	9.2	7.4	0.1	87.8	17.6
LOS	A	A	A	A	F	B
Approach Delay		9.2	6.4		75.5	
Approach LOS		A	A		E	

Intersection Summary			
Area Type:	Other		
Cycle Length: 160			
Actuated Cycle Length: 160			
Offset: 56 (35%), Referenced to phase 4:EBTL and 8:WBT, Start of Yellow			
Natural Cycle: 80			
Control Type: Actuated-Coordinated			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 13.3		Intersection LOS: B	
Intersection Capacity Utilization 63.8%		ICU Level of Service B	
Analysis Period (min) 15			

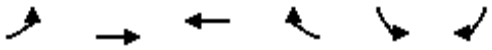
Splits and Phases: 14: SR 0228 (Mars Rd) & Brickyard Rd





Lane Group	EBL	EBT	WBT	WBR	SBL	SBR
Lane Group Flow (vph)	9	1087	849	127	150	32
v/c Ratio	0.02	0.71	0.58	0.08	0.73	0.15
Control Delay	3.0	9.2	7.4	0.1	87.8	17.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	3.0	9.2	7.4	0.1	87.8	17.6
Queue Length 50th (ft)	1	382	209	0	154	0
Queue Length 95th (ft)	4	648	311	0	130	6
Internal Link Dist (ft)		315	491		876	
Turn Bay Length (ft)	125			275		75
Base Capacity (vph)	522	1526	1461	1571	270	271
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.02	0.71	0.58	0.08	0.56	0.12

Intersection Summary



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (vph)	5	855	704	89	69	15
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	1.00	1.00
Frt	1.00	1.00	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	1.00	0.95	1.00
Satd. Flow (prot)	1805	1827	1776	1599	1805	1615
Flt Permitted	0.27	1.00	1.00	1.00	0.95	1.00
Satd. Flow (perm)	520	1827	1776	1599	1805	1615
Peak-hour factor, PHF	0.63	0.92	0.97	0.82	0.54	0.54
Growth Factor (vph)	117%	117%	117%	117%	117%	117%
Adj. Flow (vph)	9	1087	849	127	150	32
RTOR Reduction (vph)	0	0	0	10	0	28
Lane Group Flow (vph)	9	1087	849	117	150	4
Heavy Vehicles (%)	0%	4%	7%	1%	0%	0%
Turn Type	pm+pt	NA	NA	pm+ov	NA	Perm
Protected Phases	7	4	8	6	6	
Permitted Phases	4			8		6
Actuated Green, G (s)	133.7	133.7	128.5	146.8	18.3	18.3
Effective Green, g (s)	133.7	133.7	128.5	146.8	18.3	18.3
Actuated g/C Ratio	0.84	0.84	0.80	0.92	0.11	0.11
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)	444	1526	1426	1507	206	184
v/s Ratio Prot	0.00	c0.59	0.48	0.01	c0.08	
v/s Ratio Perm	0.02			0.06		0.00
v/c Ratio	0.02	0.71	0.60	0.08	0.73	0.02
Uniform Delay, d1	4.7	5.3	5.9	0.6	68.4	62.9
Progression Factor	1.00	1.00	0.95	0.00	1.00	1.00
Incremental Delay, d2	0.0	2.9	1.8	0.0	12.1	0.0
Delay (s)	4.7	8.2	7.4	0.0	80.5	62.9
Level of Service	A	A	A	A	F	E
Approach Delay (s)		8.2	6.4		77.4	
Approach LOS		A	A		E	

Intersection Summary			
HCM 2000 Control Delay	13.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.73		
Actuated Cycle Length (s)	160.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	63.8%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			