

**TECHNICAL APPENDIX I:
SIGNAL WARRANT ANALYSIS**

to the

Final Environmental Impact Report



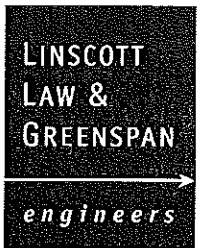
*University Towne Center
Revitalization Project*

SCH No. 2002071071 LDR No. 41-0159/PTS No. 2214

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Prepared For:
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March 2008



February 20, 2008

Mr. Greg Fitchitt
 Westfield Corporation, Inc.
 402 W. Broadway, Suite 2050
 San Diego, CA 92101

LLG Reference: 3-04-1415

Subject: **Towne Centre Drive / Excalibur Way
 Signal Warrant and Site Access Review, San Diego**

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Dear Greg,

The purpose of this letter is to assess a signal warrant and review the site access at the Towne Centre Drive / Excalibur Way intersection serving the Vista La Jolla residential development. This work was conducted on behalf of the University Towne Centre Revitalization Project (UTC) in response to a comment on the DEIR. As outlined in the *Caltrans Traffic Manual, Manual on Uniform Traffic Control Devices (MUTCD), and the Associated California Supplement*, four Warrants were analyzed for the subject intersection.

EXISTING CONDITIONS

Towne Centre Drive is a north-south four-lane roadway. The roadway is under local jurisdiction and is classified as a four-lane Major north of Golden Haven Drive and as a four-lane Collector south of Golden Haven Drive. The posted speed limit is 40 mph. Land uses along Towne Centre Drive through the study area are primarily office, retail commercial and residential.

Table 1 below provides an overview of the existing geometric conditions at the intersection. The existing traffic volumes were counted on January 15, 2008 (Tuesday) and can be found in *Attachment A*.

**TABLE 1
 EXISTING CONDITIONS**

Intersection	Major Street	Number of Lanes per Approach	
		Major Street	Minor Street
Towne Centre Drive/ Excalibur Way	Towne Centre Drive	2	1

Pasadena
 Costa Mesa
 San Diego
 Las Vegas

Philip M. Linscott, PE (1924-2000)
 Jack M. Greenspan, PE
 William A. Law, PE (Ret.)
 Paul W. Wilkinson, PE
 John P. Keating, PE
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METHODOLOGY

The signal warrants analyzed in this study include:

- Warrant 1. Eight-Hour Vehicular Volume, Condition A and Condition B
- Warrant 2. Four-Hour Volume Warrant
- Warrant 3. Peak Hour Volume Warrant
- Warrant 12. Average Daily Traffic (ADT) Warrant

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 for installing a traffic signal. The Interruption of Continuous Traffic, Condition B, is intended for application at locations where 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.

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 signal.

Warrant 3: Peak-Hour Vehicular Volume—The Peak-Hour Vehicular Volume signal Warrant is intended for use at a location where traffic conditions are such that for a minimum one hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

Warrant 12: Average Daily Traffic Volume—The Average Daily Traffic Volume Warrant is intended for use at a location where traffic conditions are such that the traffic volumes on the intersecting roadways on a daily basis exceed a particular threshold.

Attachment B contains a description of all these warrants from the MUTCD.

ANALYSIS & RESULTS

Warrant 1: Eight-Hour Vehicular Volume

The relevant information to the Warrant analyses include the peak hour, four-hour and eight-hour traffic volumes, the number of approach lanes for the major and minor streets, as well as the speed on the major street. **Table 2** shows the minimum vehicular volumes and **Table 3** shows the eight-hour volumes at the major street and minor street approaches. The eight hours selected were the highest for the minor street.

TABLE 2
CONDITION A FOR WARRANT 1—MINIMUM VEHICULAR VOLUMES

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 (One Direction Only)	
Major Street	Minor Street	Urban	Rural	Urban	Rural
1	1	500	350	150	105
2 or more	1	600	420	150	105
2 or more	2 or more	600	420	200	140
1	2 or more	500	350	200	140

TABLE 3
VOLUMES FOR THE EIGHT HIGHEST HOURS ENTERING THE INTERSECTION
WARRANT 1, CONDITION A

Approach	Warrant Volume	7:00 am to 8:00 am	8:00 am to 9:00 am	9:00 am to 10:00 am	10:00 am to 11:00 am	11:00am to 12:00pm	12:00pm to 1:00pm	1:00pm to 2:00pm	2:00pm to 3:00pm
High volume minor street approach	150	64	42	50	26	45	21	31	55
Both major approaches	600	558	711	562	467	724	929	758	806
Hourly Warrant Met?		No	No	No	No	No	No	No	No

Based on the eight-hour volumes in *Table 3*, *Condition A Warrant 1 is not met*.

As explained in the MUTCD (*Attachment B*), since Condition A was not warranted, Condition B was analyzed. *Table 4* highlights the criteria necessary to complete the analysis for Condition B.

TABLE 4
CONDITION B FOR WARRANT 1 – 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 (One Direction Only)
Major Street	Minor Street	Urban	Urban
2 or more	1	900	75

Existing eight-hour volumes do not exceed the 100% parameters for Condition B for the major and minor streets. The highest minor street volume is 64 vehicles and the threshold is 75 vehicles. Therefore, **Condition B Warrant 1 is not met.**

Based on the eight-hour volumes, *Table 3* and *4* show that both Conditions A and B of Warrant 1 are not met.

Warrant 2: Four-Hour Volume Warrant

Table 5 shows the highest four-hour volume for the minor and major street approaches. Warrant 2 requires that the four-hour volumes shown in *Table 5* falls above the 80 vehicles per hour minimum threshold curve shown on graph on *Figure 4C-1 (Attachment C)*. The four-hour traffic volumes do not exceed the 80 vehicles per hour minimum curve for a minor street approach with one lane. **Warrant 2 is therefore not met.**

TABLE 5
 WARRANT 2—FOUR-HOUR VOLUMES

Approach	Lanes	Warrant Volume	7:00 am to 8:00 am	8:00 am to 9:00 am	9:00 am to 10:00 am	10:00 am to 11:00 am
High volume minor street approach	1	See Graph	64	42	50	26
Both major approaches	2	See Graph	558	711	562	467
Hourly Warrant Met?			No	No	No	No

Warrant 3: Peak Hour Volume Warrant

Existing peak hour volumes were conducted at Towne Centre Drive / Excalibur Way intersection on January 15, 2008 (Tuesday). As shown in *Attachment B*, Category A and B of the Peak Hour Warrant must be met in order warrant a signal.

Category A requires the following in order for a signal to be warranted:

1. The total delay experienced by traffic, on the minor street approach controlled by a STOP sign, exceeds four vehicle-hours. ***This requirement is not met for the AM and PM peak hours.***
2. The volume on the minor street approach exceeds 100 vehicles per hour (vph) for one moving lane of traffic. ***This requirement is not met for the AM and PM peak hours.***
3. The total entering volume serviced during the hour is greater than 650 vph (for intersections with three approaches). ***This requirement is met for the AM and PM peak hours.***

The delay analysis was completed using the Synchro 6 software package. *Attachment D* shows the peak hour intersection delay worksheets. *Category A of the Warrant is not met for the AM and PM peak hours.*

Category B of the Warrant necessitates the use of a graph, also found in *Attachment E*. The co-ordinates plotted are shown in the *Table 6* below. The resulting point for the AM and PM peak hours clearly shows that the peak hour volumes at this intersection are below the 80 vehicles per hour minimum volume for a minor-street approach with one lane. *Category B is therefore not met for the AM and PM peak hours.*

TABLE 6
 WARRANT 3—PEAK HOUR VOLUMES

Approach	Lanes	Warrant Volume	Peak Hour Volume AM/PM
High volume minor street approach	1	See Graph	31/19
Both major approaches	4	See Graph	740/1130
Peak Hour Warrant Met?			No/No

Warrant 12: Average Daily Volumes Warrant (Caltrans Traffic Manual)

Table 7 highlights the criteria necessary to complete the analysis for average daily traffic Warrant as outlined in the *Caltrans Traffic Manual*. If the average daily traffic volumes are greater than 9600 for the major street (total of both approaches) and 2400 vehicles per hour for the minor street for an urban roadway respectively, then a signal is Warranted. *Attachment F* shows the ADT Warrant calculation sheet.

TABLE 7
 WARRANT 12—AVERAGE DAILY TRAFFIC VOLUME WARRANT

Towne Centre Drive / Excalibur Way Intersection	Lanes	Threshold (ADT)	Existing Volumes (ADT)
Minor street approach	1	2,400	520
Both major approaches	2	9,600	11,500

Table 7 shows that the volumes on the major and minor street do not exceed the thresholds and *Warrant 12 is not met*.

WARRANT SUMMARY

Table 8 provides a summary of the four Warrants assessed in this study. The eight-hour, four-hour, peak hour and average daily traffic signal Warrants have not been satisfied for the Towne Centre Drive/ Excalibur Way intersection.

TABLE 8
SIGNAL WARRANT ANALYSIS SUMMARY

Warrant		Results
Warrant 1.	Eight-Hour Vehicular Volume	Warrant Not Met
Warrant 2.	Four-Hour Vehicular Volume	Warrant Not Met
Warrant 3.	Peak hour Volume	Warrant Not Met
Warrant 12.	Average Daily Volume	Warrant Not Met

FUTURE CONDITIONS

It is true that the UTC Revitalization Project will result in an increase of traffic on Town Centre Drive. However, the volumes of Excalibur Way will remain constant, as this is a built out neighborhood. Because of this relatively low side street volume, the signal Warrants will not be met after the UTC project is built or if future background traffic increases along Towne Centre Drive. *Attachment G* contains Near-Term and Horizon Year planning warrant worksheets.

SIGHT DISTANCE

Excalibur Way is located on the inside of a large radius curve on Towne Centre Drive. This curve and the embankment in the public right-of-way restrict sight distance to the north for vehicles turning left out of Excalibur Way. The physical sight was checked and found to be adequate, but limited.

The limit line is located west of the concrete apron. From this point visibility to the north is limited. Although not known to all drivers, it is legal and practical to creep into the intersection to enhance visibility after stopping at the limit line. Improper driver positioning and the periodic lack of gaps on Towne Centre Drive can make turning left out of Excalibur Way difficult.

Table 9 shows an assessment of the sight distance at several different speeds. The posted speed limit is 40 mph. For a vehicle stopped at the limit line (driver's eye is about 10 feet behind the limit line), there is about 250 feet of sight distance available. This

does not meet the required stopping or corner sight distance at 40 mph. A driver moving up to the flow line is afforded a sight distance of about 400 feet. This meets the stopping sight distance requirement but not the corner sight distance. The furthest drivers can position themselves is with their eye at the gutter line without encroaching into the number two lane. From this point, about 500 feet of sight distance is available. This exceeds the stopping and corner sight distance requirements at 40 mph.

**TABLE 9
 SIGHT DISTANCE REQUIREMENTS**

Drivers Eye	Sight Distance Available	Required Stopping Sight Distance			Required Corner Sight Distance		
		35mph	40mph	45mph	35mph	40mph	45mph
10 feet behind limit line	250 feet	250 feet	300 feet	360 feet	385 feet	440 feet	495 feet
At flow line	400 feet	250 feet	300 feet	360 feet	385 feet	440 feet	495 feet
At gutter line	500 feet	250 feet	300 feet	360 feet	385 feet	440 feet	495 feet

There are several alternatives to facilitate or enhance the safety of the left-turn out of Excalibur Way, as outlined below:

1. Signalize the intersection. Although as calculated above, it does not meet the traffic volume Warrants under existing or future conditions.
2. Construct a raised median on Towne Centre Drive across Excalibur Way to restrict the intersection to right-turns as the maximum or to restrict left-turns and straight movements from Excalibur as a minimum. The no left out would be replaced by a southbound to northbound U-turn at Renaissance Avenue (currently not allowed) due to a right-turn overlap. This would require a signal modification to remove the overlap phasing. The Sears traffic signal at UTC is the first location for northbound traffic to make a U-turn, to replace a no left-turn in, which is a little far out of direction. Therefore, we would recommend prohibiting the left-turn out and allowing the left-turn in.
3. Permanently remove the vegetation in the public right-of-way in northwest corner of the intersection and regrade the slope with a retaining wall.
4. Install a shoulder stripe or stripe southbound right-turn lane on Towne Centre Drive to "push traffic to the east," maintaining the current positioning of the lane lines. Basically the shoulder is striped out. This will discourage drivers from hugging the inside of the curve and reducing sight distance. With the defined travel lane to the east the limit line for Excalibur Way can

be moved easterly, giving drivers more sight distance without feeling they are waiting at the intersection.

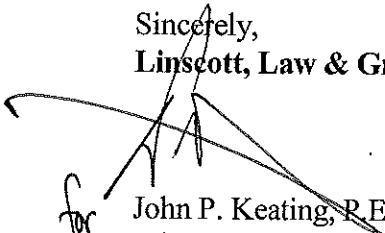
5. Encourage better utilization of the two-way left-turn lane on Towne Centre Drive north of Excalibur Way. This allows drivers to turn left out in two stages, using two different gaps in Towne Centre Drive traffic.

We would recommend Alternative 4, described above, to be implemented by the City to improve the left-turn out situation. It should be noted that this is a pre-existing condition, independent of the UTC project, however we recommend the Applicant work with the City in implementing this solution to the compromised sight distance at this location.

CONCLUSION

Based on this study, it can be concluded that the Towne Centre Drive / Excalibur Way intersection does *not* meet the Eight-Hour, Four-Hour, Peak Hour, and ADT volume traffic signal Warrants. To address the existing condition of limited sight distance, we recommend the left-turn from Excalibur Way to Towne Centre Drive could be improved by the City, in consultation with the Applicant, by installing a shoulder stripe/southbound right-turn lane and relocating the limit line.

Sincerely,
Linscott, Law & Greenspan, Engineers


John P. Keating, P.E.
Principal

cc: Walter B. Musial, P.E., LLG
Attachments

ATTACHMENT A
EXISTING TRAFFIC VOLUMES

Traffic Data Service Southwest Event Counts

EventCount-136 -- English (ENU)

Datasets:

Site: [00501N] Town Center Drive - N/O Excalibur Way
Input A: 1 - North bound. - Added to totals. (1)
Input B: 0 - Unused or unknown. - Excluded from totals. (0)
Survey Duration: 17:16 Monday, January 14, 2008 => 13:46 Wednesday, January 16, 2008
File: Z:\mcd\LLG\2008\005\00501N16Jan2008.EC0 (Plus)
Identifier: M299DS4P MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm: Event Count
Data type: Axle sensors - Separate (Count)

Profile:

Filter time: 18:00 Monday, January 14, 2008 => 12:00 Wednesday, January 16, 2008
Name: Factory default profile
Scheme: Count events divided by two.
Units: Non metric (ft, mi, ft/s, mph, lb, ton)
In profile: Events = 8603 / 9269 (92.81%)

*** Monday, January 14, 2008=857 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250	192	178	134	69	34	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	73	56	60	31	22	7	16
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	59	51	43	42	23	10	5
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61	42	37	30	10	10	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57	43	38	31	14	7	5

*** Tuesday, January 15, 2008=5431, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
29	9	8	1	7	50	150	420	584	406	266	308	516	502	379	266	261	292	302	227	210	121	80	37	
16	2	4	0	1	6	23	63	150	126	73	70	106	136	107	71	81	61	78	53	69	31	21	11	6
5	4	1	1	1	11	32	86	167	105	62	68	110	148	100	71	65	73	74	59	51	28	17	11	11
3	2	2	0	2	13	31	128	144	96	60	78	132	113	89	58	47	72	72	49	51	29	15	7	6
5	1	1	0	3	20	64	143	123	79	71	92	168	105	83	66	68	86	78	66	39	33	27	8	4

AM Peak 0745 - 0845 (604), AM PHF=0.90 PM Peak 1230 - 1330 (584), PM PHF=0.87

*** Wednesday, January 16, 2008=2314 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
27	13	6	3	10	36	149	422	619	443	281	305	-	-	-	-	-	-	-	-	-	-	-	-	-
6	7	1	0	1	4	24	72	163	166	81	66	-	-	-	-	-	-	-	-	-	-	-	-	-
11	4	2	1	4	10	23	77	157	105	52	69	-	-	-	-	-	-	-	-	-	-	-	-	-
6	2	2	2	3	5	44	121	146	90	79	67	-	-	-	-	-	-	-	-	-	-	-	-	-
4	0	1	0	2	17	58	152	153	82	69	103	-	-	-	-	-	-	-	-	-	-	-	-	-

ADT: 5431 + 6057 = 11488

Traffic Data Service Southwest Event Counts

EventCount-138 -- English (ENU)

Datasets:

Site: [00503N] Town Center Drive - S/O Excallbur Way
Input A: 1 - North bound. - Added to totals. (1)
Input B: 0 - Unused or unknown. - Excluded from totals. (0)
Survey Duration: 17:58 Monday, January 14, 2008 => 13:45 Wednesday, January 16, 2008
File: Z:\mcddata\LLG\2008\005\00503N16Jan2008.EC0 (Plus)
Identifier: A7987E8Y MC56-1 [MC55] (c)Microcom 07/06/99
Algorithm: Event Count
Data type: Axle sensors - Separate (Count)

Profile:

Filter time: 18:00 Monday, January 14, 2008 => 13:00 Wednesday, January 16, 2008
Name: Factory default profile
Scheme: Count events divided by two.
Units: Non metric (ft, mi, ft/s, mph, lb, ton)
In profile: Events = 9114 / 9116 (99.98%)

*** Monday, January 14, 2008=1092 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	331	263	209	145	98	46	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	67	76	56	35	35	11	23
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	98	70	60	39	28	14	7
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	86	63	49	32	14	12	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80	54	44	39	21	9	7

*** Tuesday, January 15, 2008=5682, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
39	14	9	5	6	49	138	422	569	380	276	287	412	391	368	333	347	405	374	290	272	140	110	46	
23	4	2	1	1	6	20	64	159	111	77	69	90	108	84	83	98	108	92	79	83	36	38	13	16
7	4	2	1	1	9	27	79	154	111	62	74	95	96	102	85	81	104	98	66	67	41	26	17	13
2	4	4	0	2	14	32	123	133	88	68	66	98	99	89	76	67	80	84	65	69	32	19	6	11
7	2	1	3	2	20	59	156	123	70	69	78	129	88	93	89	101	113	100	80	53	31	27	10	8

AM Peak 0745 - 0845 (602), AM PHF=0.95 PM Peak 1245 - 1345 (432), PM PHF=0.84

*** Wednesday, January 16, 2008=2337 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
48	16	9	3	5	34	126	410	580	435	281	309	81	-	-	-	-	-	-	-	-	-	-	-	-
16	8	3	0	1	3	21	61	166	166	79	68	80	-	-	-	-	-	-	-	-	-	-	-	-
13	5	2	2	1	9	20	78	138	98	50	75	0	-	-	-	-	-	-	-	-	-	-	-	-
11	2	2	1	3	5	38	118	130	92	82	75	1	-	-	-	-	-	-	-	-	-	-	-	-
8	1	2	0	0	17	47	153	146	79	70	91	0	-	-	-	-	-	-	-	-	-	-	-	-

AM Peak 0745 - 0845 (587), AM PHF=0.88

5682 + 6213 = 11895

Traffic Data Service Southwest Event Counts

EventCount-138 -- English (ENU)

Datasets:

Site: [00503S] Town Center Drive - S/O Excalibur Way
Input A: 3 - South bound. - Added to totals. (1)
Input B: 0 - Unused or unknown. - Excluded from totals. (0)
Survey Duration: 18:00 Monday, January 14, 2008 => 13:42 Wednesday, January 16, 2008
File: Z:\mcd\data\LLG\2008\005\00503S16Jan2008.EC0 (Base)
Identifier: A56374S4 MC56-1 [MC55] (c)Microcom 07/06/99
Algorithm: Event Count
Data type: Axle sensors - Separate (Count)

Profile:

Filter time: 18:00 Monday, January 14, 2008 => 13:00 Wednesday, January 16, 2008
Name: Factory default profile
Scheme: Count events divided by two.
Units: Non metric (ft, mi, ft/s, mph, lb, ton)
In profile: Events = 9173 / 9173 (100.00%)

*** Monday, January 14, 2008=1369 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	506	318	241	156	107	41	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	138	89	66	54	46	13	9
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	149	79	63	41	24	9	9
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	125	80	61	34	25	7	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	94	70	51	27	12	12	5

*** Tuesday, January 15, 2008=6213, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
25	12	7	2	12	24	54	254	233	215	216	338	376	344	453	548	704	877	651	337	220	158	113	40	
9	6	3	0	2	5	12	42	61	55	55	61	87	102	93	136	164	241	225	111	75	42	36	13	5
9	5	0	0	1	1	12	65	53	63	46	78	123	78	122	138	146	209	145	97	62	53	27	12	13
2	1	3	0	2	5	15	91	54	41	50	88	80	80	130	144	215	209	169	79	43	41	32	7	2
5	0	1	2	7	13	15	56	65	56	65	111	86	84	108	130	179	218	112	50	40	22	18	8	3

AM Peak 1130 - 1230 (409), AM PHF=0.83 PM Peak 1700 - 1800 (877), PM PHF=0.91

*** Wednesday, January 16, 2008=1589 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
23	9	3	5	6	17	56	244	263	225	200	402	136	-	-	-	-	-	-	-	-	-	-	-	-
5	2	0	0	1	1	8	33	71	38	47	80	133	-	-	-	-	-	-	-	-	-	-	-	-
13	4	1	2	2	4	10	78	59	70	45	86	3	-	-	-	-	-	-	-	-	-	-	-	-
2	1	1	1	1	7	18	76	75	59	41	110	0	-	-	-	-	-	-	-	-	-	-	-	-
3	2	1	2	2	5	20	57	58	58	67	126	0	-	-	-	-	-	-	-	-	-	-	-	-

AM Peak 1115 - 1215 (455), AM PHF=0.86

Traffic Data Service Southwest Event Counts

EventCount-136 -- English (ENU)

Datasets:

Site: [00504] Excalibur Way - W/O Town Center Drive
Input A: 2 - East bound. - Excluded from totals. (0)
Input B: 4 - West bound. - Added to totals. (1)
Survey Duration: 17:27 Monday, January 14, 2008 => 13:47 Wednesday, January 16, 2008
File: Z:\mcd\LLG\2008\005\0050416Jan2008.EC0 (Plus)
Identifier: M279P9K6 MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm: Event Count
Data type: Axle sensors - Separate (Count)

Profile:

Filter time: 19:00 Monday, January 14, 2008 => 11:00 Wednesday, January 16, 2008
Name: Factory default profile
Scheme: Count events divided by two.
Units: Non metric (ft, mi, ft/s, mph, lb, ton)
In profile: Events = 1438 / 1627 (88.38%)

*** Monday, January 14, 2008=68 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	29	18	11	7	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	4	1	4	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	1	4	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	8	1	1	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	5	5	2	0

*** Tuesday, January 15, 2008=461, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
3	0	0	0	0	3	3	24	23	27	13	37	39	27	39	34	38	38	54	25	14	12	8	0
3	0	0	0	0	0	0	4	5	7	3	14	8	6	3	11	11	5	13	7	3	6	3	0
0	0	0	0	0	0	2	6	8	12	3	5	19	10	21	4	6	11	13	12	3	4	4	0
0	0	0	0	0	3	1	4	3	7	2	2	9	4	7	14	6	11	18	3	6	2	0	0
0	0	0	0	0	0	0	10	7	1	5	16	3	7	8	5	15	11	10	3	2	0	1	0

AM Peak 1145 - 1245 (52), AM PHF=0.68 PM Peak 1745 - 1845 (65), PM PHF=0.76

*** Wednesday, January 16, 2008=121 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300
0	0	1	0	0	2	4	30	24	29	31	-	-	-	-	-	-	-	-	-	-	-	-	-
0	0	0	0	0	0	0	4	3	10	9	-	-	-	-	-	-	-	-	-	-	-	-	-
0	0	1	0	0	0	3	4	5	9	8	-	-	-	-	-	-	-	-	-	-	-	-	-
0	0	0	0	0	0	1	8	12	6	3	-	-	-	-	-	-	-	-	-	-	-	-	-
0	0	0	0	0	2	0	14	4	4	11	-	-	-	-	-	-	-	-	-	-	-	-	-

461 + 518 = 979.

Traffic Data Service Southwest
P.O. Box 1544
Lakeside, CA 92040
(619) 390-8495 Fax (619) 390-8427

Weather: Clear & Dry
Counted By: B. Vockeroth
Board No.: D1-2172
Loc: Town Cntr Dr & Excalibur/Renaissance

File Name : 08005010
Site Code : 00005010
Start Date : 1/15/2008
Page No : 1

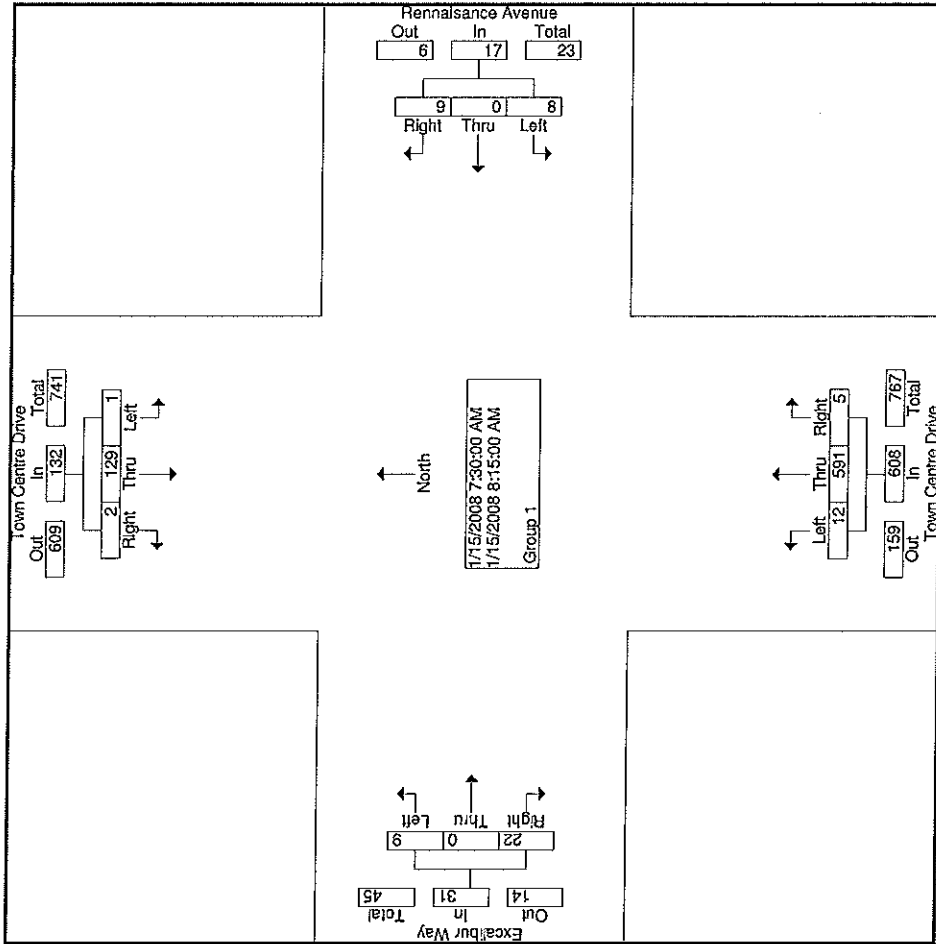
Start Time	Town Centre Drive Southbound				Renaissance Avenue Westbound				Town Centre Drive Northbound				Excalibur Way Eastbound							
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total		
07:00	0	23	1	0	24	0	0	2	0	2	1	62	1	1	64	2	0	2	4	
07:15	0	35	0	4	35	1	0	1	1	1	87	0	0	0	88	0	0	1	1	
07:30	1	42	0	0	43	3	0	2	1	5	125	2	0	129	5	0	7	12		
07:45	0	35	1	0	36	1	0	3	3	4	152	0	1	156	2	0	8	10		
Total	1	135	2	4	138	5	0	7	5	12	8	426	3	2	437	9	0	18	27	
08:00	0	25	0	4	25	2	0	2	1	4	3	148	2	0	153	1	0	4	1	
08:15	0	27	1	1	28	2	0	2	0	4	3	166	1	0	170	1	0	3	5	
08:30	0	35	0	0	35	2	0	4	0	6	3	126	0	0	129	1	0	4	0	
08:45	0	50	1	0	51	1	0	1	6	2	123	0	0	125	3	0	1	4		
Total	0	137	2	5	139	7	0	9	7	16	11	563	3	0	577	6	0	12	6	
Grand Total	1	272	4	9	277	12	0	16	12	28	19	989	6	2	1014	15	0	30	6	
Approach %	0.4	98.2	1.4		42.9	0.0	57.1			1.9	97.5	0.6			33.3	0.0	66.7		29	
Total %	0.1	19.9	0.3		20.3	0.9	0.0	1.2		2.1	1.4	72.5	0.4		74.3	1.1	0.0	2.2		2.1

Start Time	Town Centre Drive Southbound				Renaissance Avenue Westbound				Town Centre Drive Northbound				Excalibur Way Eastbound								
	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total			
Peak Hour From 07:00 to 08:45 - Peak 1 of 1	1	129	2		132	8	0	9		17	12	591	5		608	9	0	22		31	
Intersection Volume	0.8	97.7	1.5		28	47.1	0.0	52.9		4	2.0	97.2	0.8		170	29.0	0.0	71.0		4	
08:15 Volume	0	27	1		28	2	0	2		4	3	166	1		170	1	0	3		4	
Peak Factor																					0.956
High Int. Volume	1	42	0		43	07:30	3	0	2	5	08:15	3	166	1	170	07:30	5	0	7		12
Peak Factor					0.767					0.850					0.894						0.646

Traffic Data Service Southwest
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File Name : 08005010
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 Start Date : 1/15/2008
 Page No : 2

Weather: Clear & Dry
 Counted By: B. Vockeroth
 Board No.: D1-2172
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File Name : 08005011
Site Code : 00005011
Start Date : 1/15/2008
Page No : 1

Weather: Clear & Dry
Counted By: B. Vockerath
Board No.: D1-2172
Loc: Town Cntr Dr & Excalibur/Renaissance

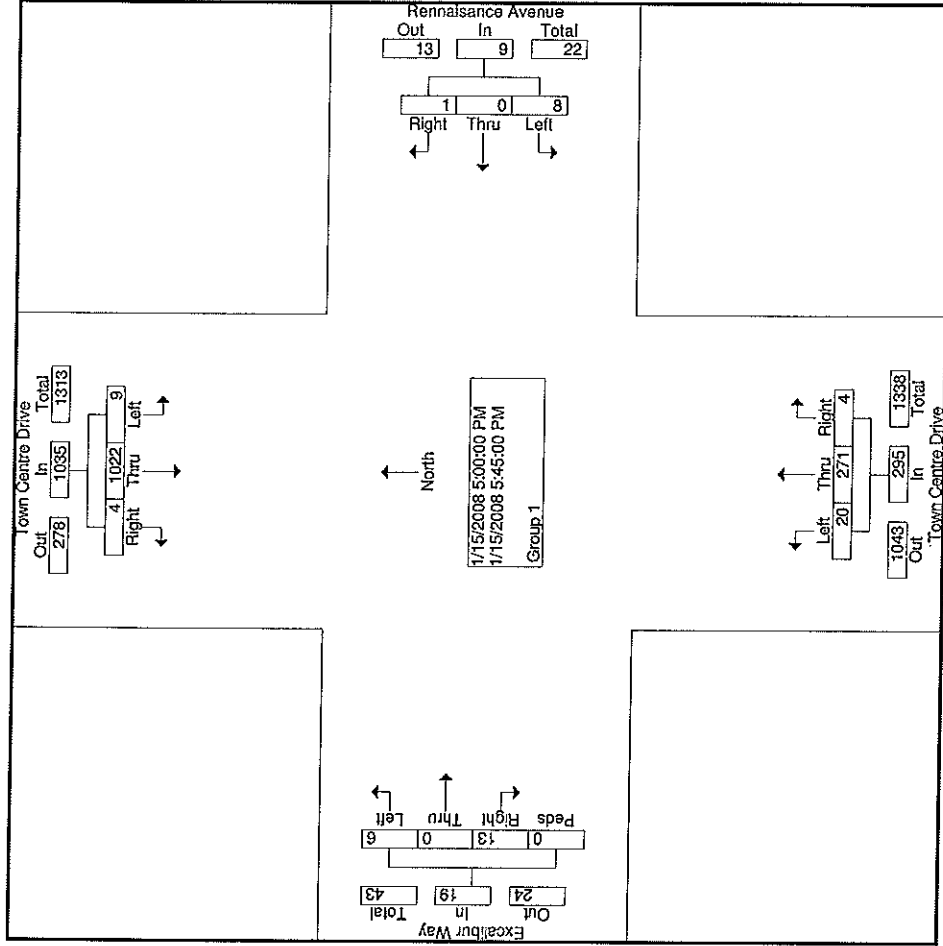
Start Time	Town Centre Drive Southbound						Renaissance Avenue Westbound						Town Centre Drive Northbound						Excalibur Way Eastbound					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	
16:00	1	174	3	0	178	1	0	0	0	1	4	85	0	0	89	2	0	2	0	4	0	272	272	
16:15	2	155	2	2	159	1	0	1	1	2	3	56	0	7	59	2	0	2	0	4	10	224	234	
16:30	0	192	1	0	193	1	0	0	0	1	4	51	0	0	55	0	0	6	0	6	0	255	255	
16:45	1	173	6	1	180	1	0	1	6	2	3	67	1	0	71	2	0	1	2	5	7	258	265	
Total	4	694	12	3	710	4	0	2	7	6	14	259	1	7	274	6	0	11	2	19	17	1009	1026	
17:00	2	284	0	0	286	0	0	0	0	0	3	51	0	4	54	0	0	3	0	3	4	343	347	
17:15	0	239	0	0	239	2	0	0	0	2	6	68	3	0	77	2	0	2	0	4	0	322	322	
17:30	4	232	1	0	237	0	0	0	0	0	5	73	0	0	78	2	0	3	0	5	0	320	320	
17:45	3	267	3	0	273	6	0	1	0	7	6	79	1	0	86	2	0	5	0	7	0	373	373	
Total	9	1022	4	0	1035	8	0	1	0	9	20	271	4	4	295	6	0	13	0	19	4	1358	1362	
Grand Total	13	1716	16	3	1745	12	0	3	7	15	34	530	5	11	569	12	0	24	2	38	21	2367	2388	
Approch %	0.7	98.3	0.9			80.0	0.0	20.0		0.6	6.0	93.1	0.9			31.6	0.0	63.2	5.3					
Total %	0.5	72.5	0.7			0.5	0.0	0.1			1.4	22.4	0.2			24.0	0.0	1.0	0.1	1.6	0.9	99.1		

Start Time	Town Centre Drive Southbound						Renaissance Avenue Westbound						Town Centre Drive Northbound						Excalibur Way Eastbound					
	Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total		Left	Thru	Right	Peds	App. Total	
Intersection 17:00	9	1022	4	0	1035	8	0	1	0	9	20	271	4	4	295	6	0	13	0	19	4	1358	1362	
Volume	9	1022	4	0	1035	8	0	1	0	9	20	271	4	4	295	6	0	13	0	19	4	1358	1362	
Percent	0.9	98.7	0.4			88.9	0.0	11.1		0.6	6.8	91.9	1.4			31.6	0.0	68.4	0.0	7	0.9	99.1		
17:45 Volume	3	267	3	0	273	6	0	1	0	7	6	79	1	0	86	2	0	5	0	7	0	373	373	
Peak Factor																								
High Int. 17:00	2	284	0	0	286	17:45	6	0	1	7	17:45	6	79	1	86	17:45	2	0	5	0	7	0.910		
Volume	2	284	0	0	286	6	0	1	0	7	6	79	1	0	86	2	0	5	0	7	0	373	373	
Peak Factor						0.905				0.321	17:45	6	79	1	0.858	17:45	2	0	5	0	0.679			

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Weather: Clear & Dry
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 Board No.: D1-2172
 Loc: Town Cntr Dr & Excalibur/Renaissance

File Name : 08005011
 Site Code : 00005011
 Start Date : 1/15/2008
 Page No : 2



ATTACHMENT B
SIGNAL WARRANT EXCERPTS

CHAPTER 4C. TRAFFIC CONTROL SIGNAL NEEDS STUDIES

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

Standard:

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.

The investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the following traffic signal warrants and other factors related to existing operation and safety at the study location:

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.

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

Support:

Sections 8D.07 and 10D.05 contain information regarding the use of traffic control signals instead of gates and/or flashing light signals at highway-railroad grade crossings and highway-light rail transit grade crossings, respectively.

Guidance:

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

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.

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

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 above signal warrants.

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 dictate whether an approach should be 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, engineering judgment could indicate that it should be considered a one-lane approach if the traffic using the left-turn lane is minor. In such a case, 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.

Similar engineering judgment and rationale should be applied to a street approach with one 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.

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.

For signal warrant analysis, a location with a wide median, even if the median width is greater than 9 m (30 ft), should be considered as one intersection.

Option:

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.

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

Support:

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:

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 above 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.

The following data, which are desirable for a more precise understanding of the operation of the intersection, may be obtained during the periods specified in Item B of the preceding paragraph:

- 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:**

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 the criteria for Warrant 1 is satisfied and Condition B and the combination of Conditions A and B are not needed. Similarly, if Condition B is satisfied, then the criteria for Warrant 1 is satisfied and the combination of Conditions A and B is not needed.

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 70 km/h or 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 70 km/h or exceeds 40 mph or in an isolated community with a population of less than 10,000.

Standard:

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:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or 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:

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:

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.

Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or 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:**

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:

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:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or 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:**

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.

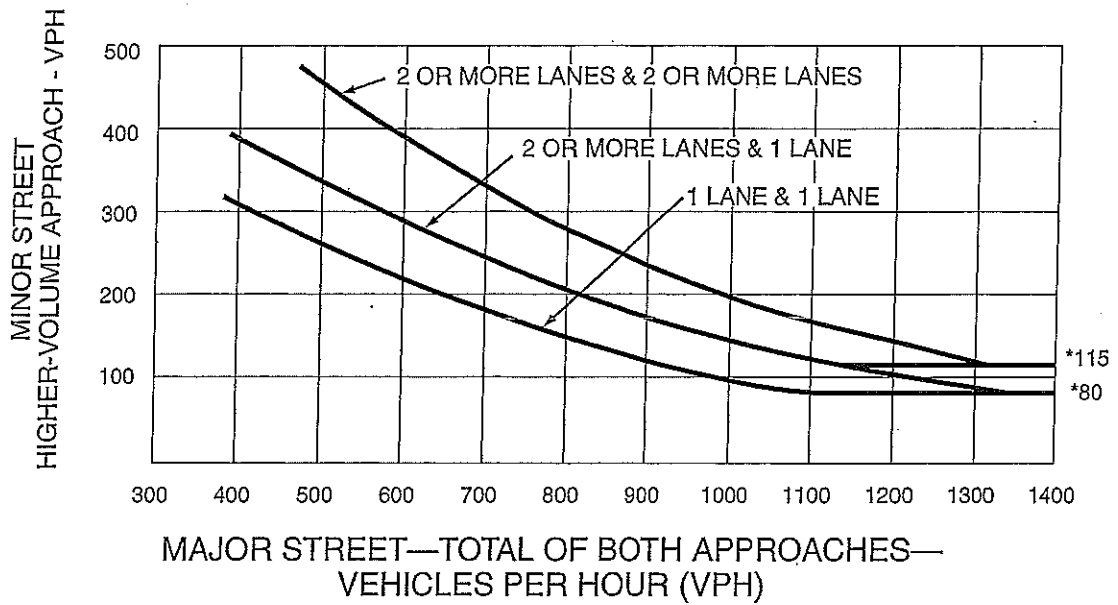
Standard:

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.

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

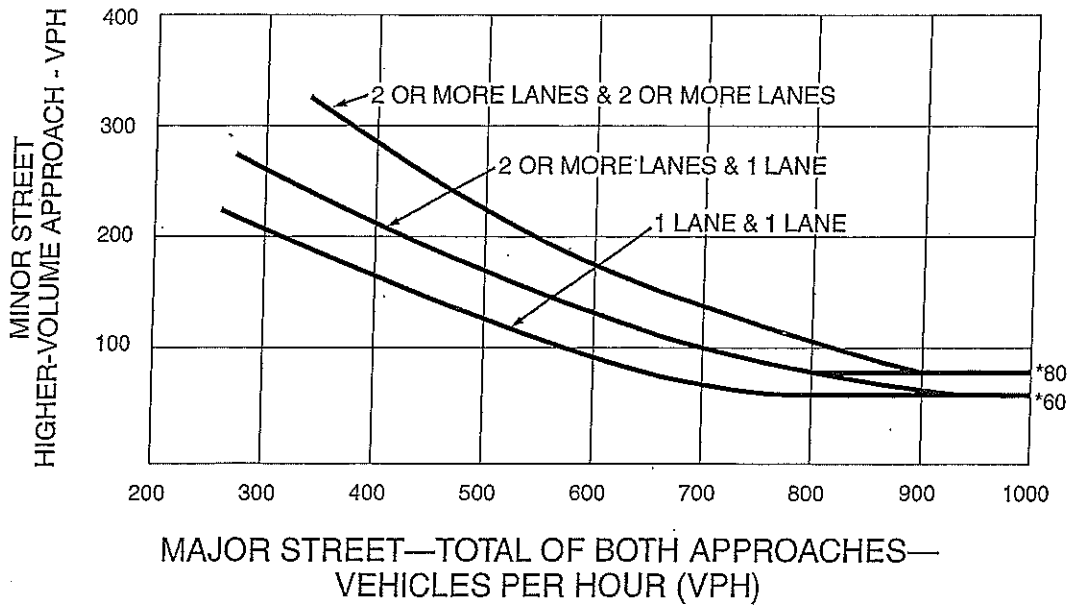
Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



*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 70 km/h 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.

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:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 70 km/h or 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 satisfy the criteria in the second category of the Standard.

Section 4C.05 Warrant 4, Pedestrian Volume

Support:

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:

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

- A. The pedestrian volume crossing the major street at an intersection or midblock location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour; and
- B. There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.

The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

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 conforming to requirements set forth in Chapter 4E.

Guidance:

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

- A. If at an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors.
- B. If at a nonintersection crossing, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.
- C. Furthermore, if installed within a signal system, the traffic control signal should be coordinated.

Option:

The criterion for the pedestrian volume crossing the major roadway may be reduced as much as 50 percent if the average crossing speed of pedestrians is less than 1.2 m/sec (4 ft/sec).

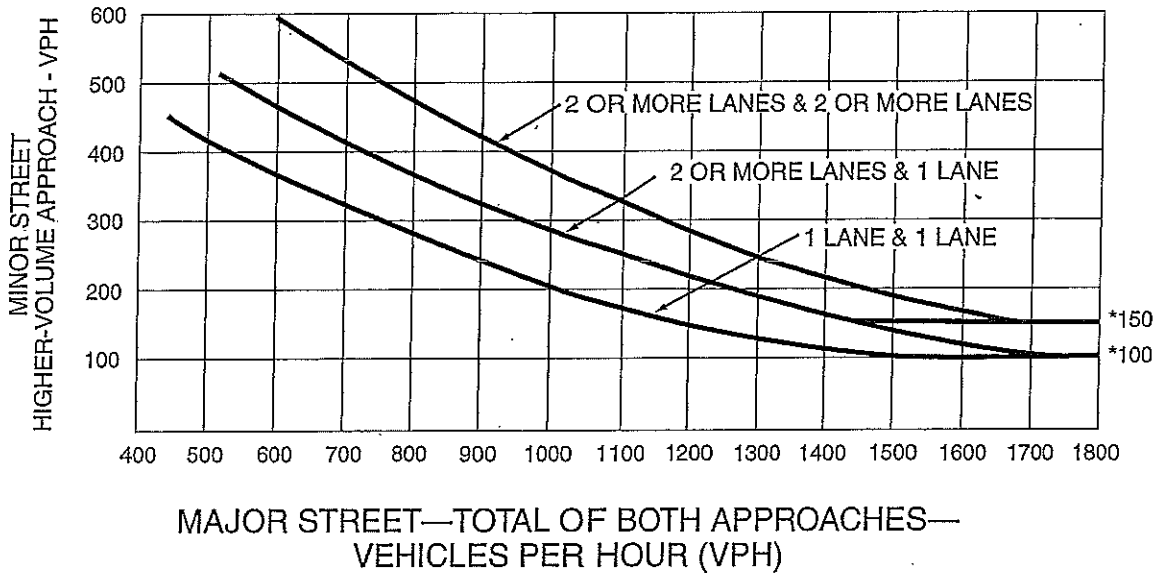
A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street, even if the rate of gap occurrence is less than one per minute.

Section 4C.06 Warrant 5, School Crossing

Support:

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.

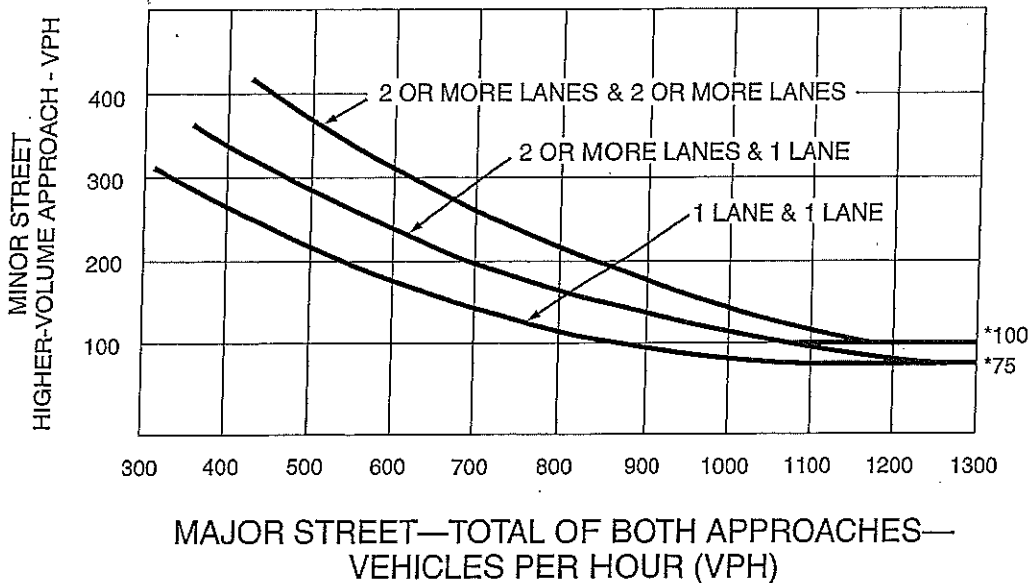
Figure 4C-3. Warrant 3, Peak Hour



*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 70 km/h 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.

Standard:

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 school children 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 children 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 students during the highest crossing hour.

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.

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 90 m (300 ft), unless the proposed traffic control signal will not restrict the progressive movement of traffic.

Guidance:

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

- A. If at an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors.
- B. If at a nonintersection crossing, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 30 m (100 ft) in advance of and at least 6.1 m (20 ft) beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.
- C. Furthermore, if installed within a signal system, the traffic control signal should be coordinated.

Section 4C.07 Warrant 6, Coordinated Signal System**Support:**

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:

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:

The Coordinated Signal System signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 300 m (1,000 ft).

Section 4C.08 Warrant 7, Crash Experience**Support:**

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:

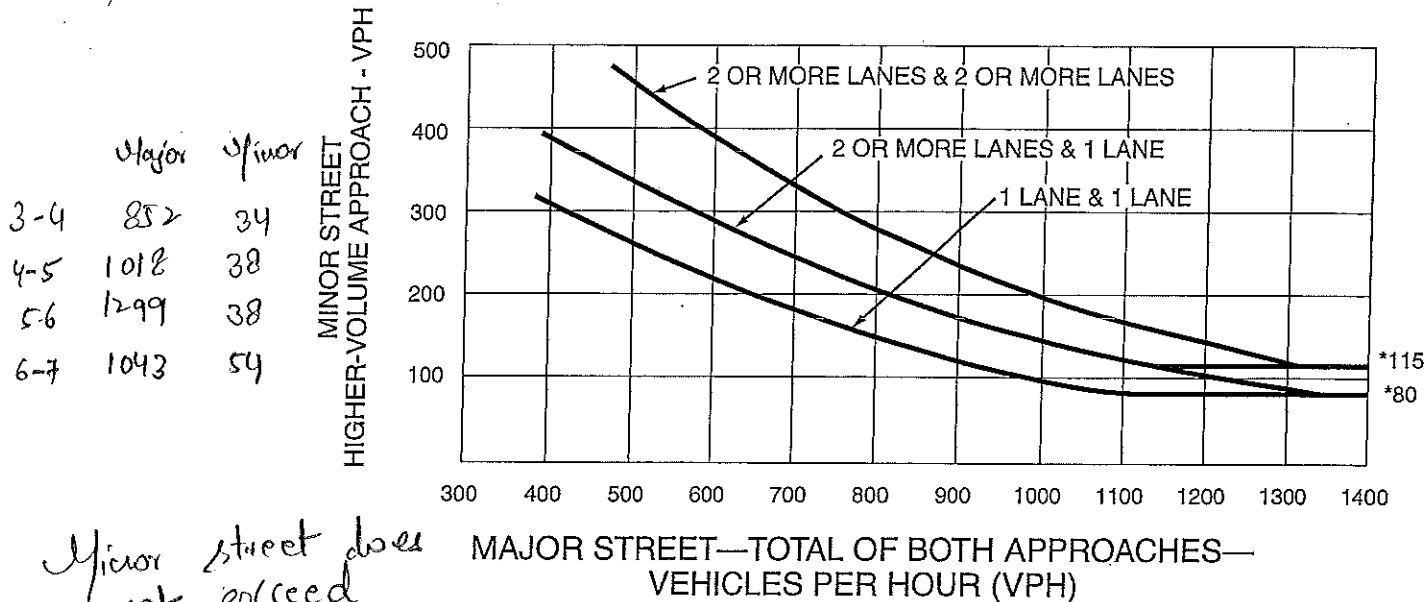
The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:

- 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

ATTACHMENT C

WARRANT 2: FOUR-HOUR VOLUME WARRANTS

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



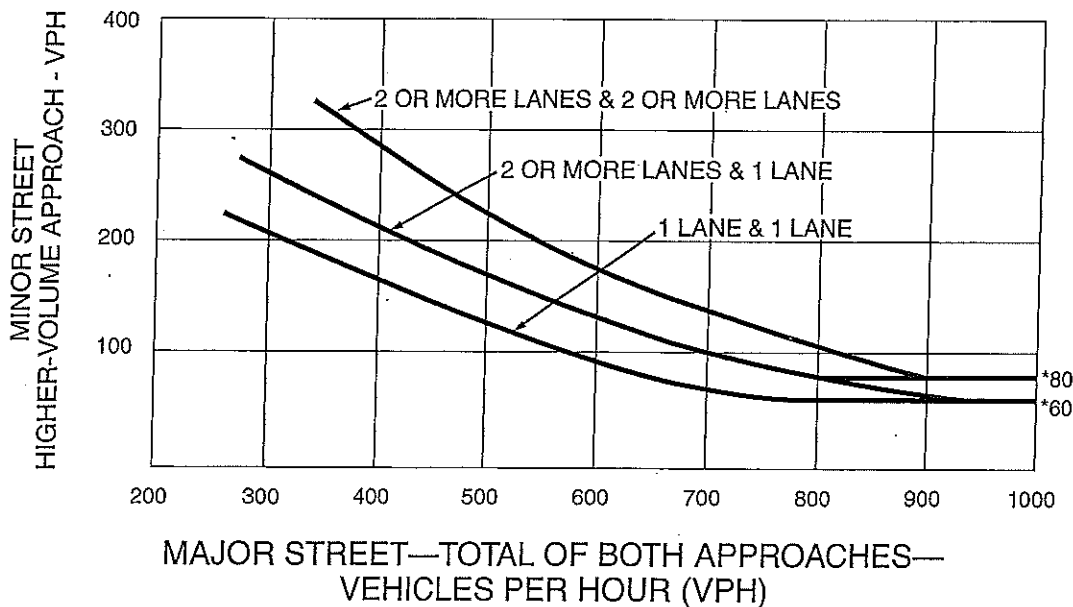
Minor street does not exceed 80 vph.

*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.

Warrant is NOT MET.

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

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h 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.

ATTACHMENT D

PEAK HOUR INTERSECTION DELAY WORKSHEETS

HCM Unsignalized Intersection Capacity Analysis
 1: Excalibur Way & Towne Center Drive

1/17/2008



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕		↗	↕		↗	↕	
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Volume (veh/h)	6	0	13	8	0	1	20	271	4	9	1022	4
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	0	14	9	0	1	22	295	4	10	1111	4
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	1324	1475	558	929	1475	149	1115			299		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1324	1475	558	929	1475	149	1115			299		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	94	100	97	96	100	100	97			99		
cM capacity (veh/h)	110	120	473	209	120	870	622			1259		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	21	10	22	196	103	10	741	375				
Volume Left	7	9	22	0	0	10	0	0				
Volume Right	14	1	0	0	4	0	0	4				
cSH	232	228	622	1700	1700	1259	1700	1700				
Volume to Capacity	0.09	0.04	0.03	0.12	0.06	0.01	0.44	0.22				
Queue Length 95th (ft)	7	3	3	0	0	1	0	0				
Control Delay (s)	22.1	21.5	11.0	0.0	0.0	7.9	0.0	0.0				
Lane LOS	C	C	B			A						
Approach Delay (s)	22.1	21.5	0.7			0.1						
Approach LOS	C	C										
Intersection Summary												
Average Delay			0.7									
Intersection Capacity Utilization			38.4%								A	
ICU Level of Service												
Analysis Period (min)			15									

ATTACHMENT E

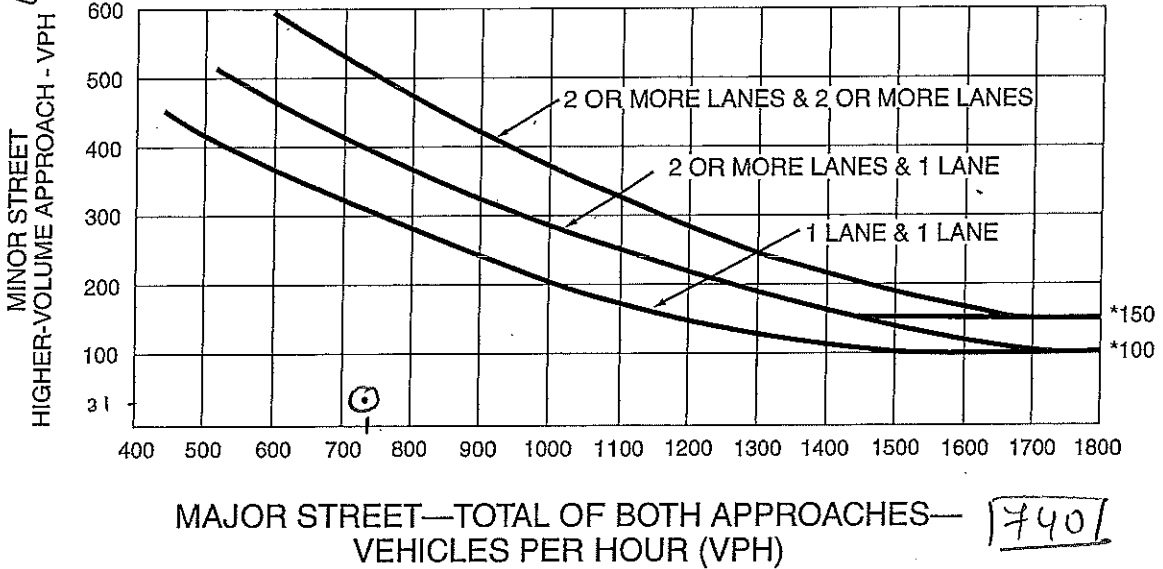
WARRANT 3: PEAK HOUR VOLUME WARRANT GRAPHS

Towne Center Dr / Encalibur Way

Figure 4C-3. Warrant 3, Peak Hour

AM peak hour.

2209
22710
125915
311

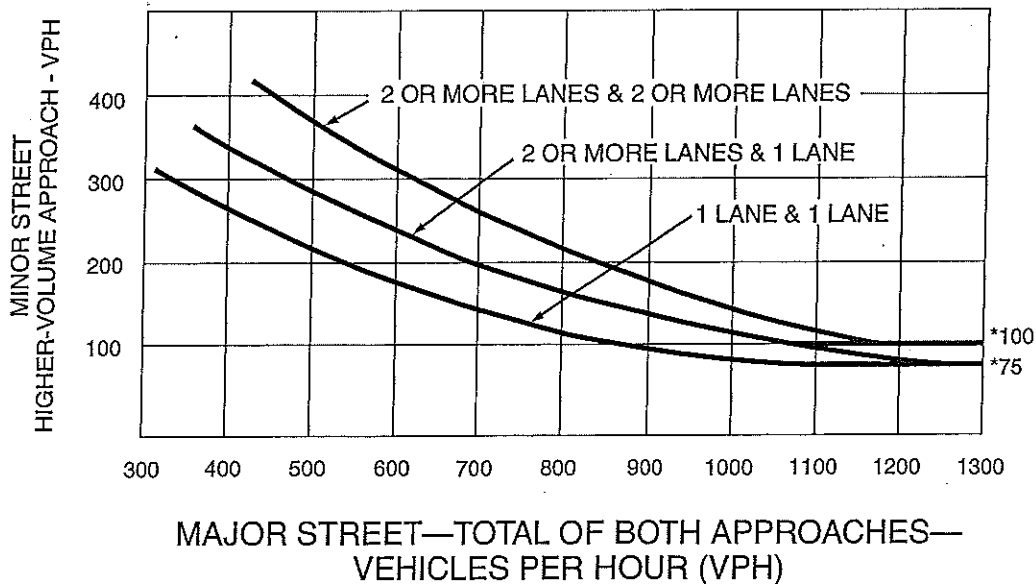


*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

AM peak hour Warrant NOT MET.

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

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h OR ABOVE 40 mph ON MAJOR STREET)

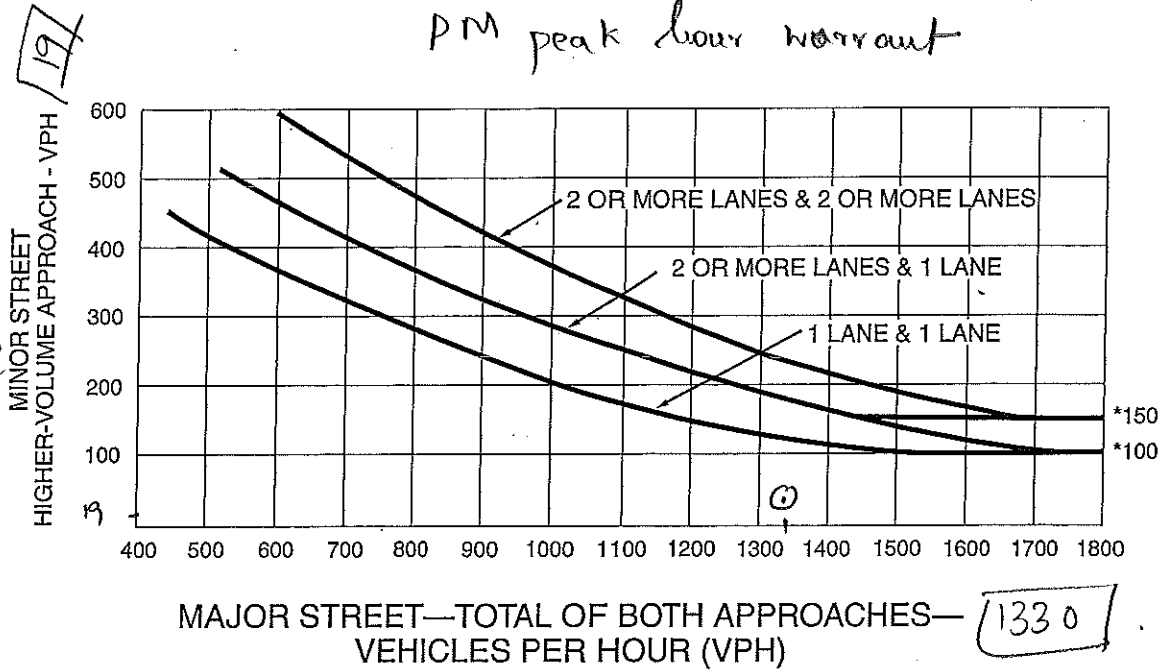


*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Towhee Center Dr / Escalibus Way

Figure 4C-3. Warrant 3, Peak Hour

PM peak hour warrant

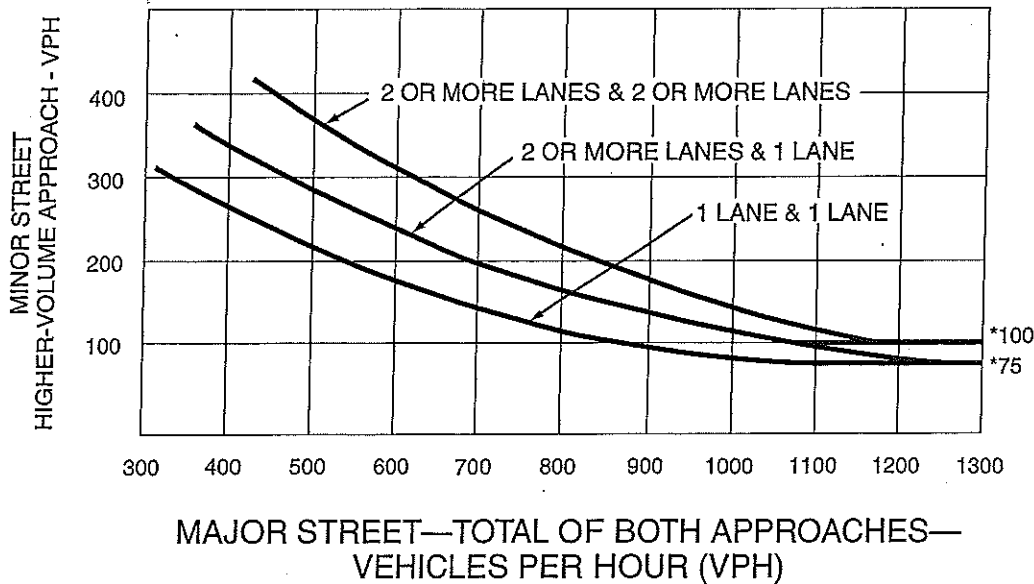


*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

PM peak hour warrant NOT MET

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

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h 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.

ATTACHMENT F

WARRANT 12: AVERAGE DAILY WARRANT CALCULATION SHEET

**Figure 9-4
TRAFFIC SIGNAL WARRANTS**

(Based on Estimated Average Daily Traffic - See Note)

URBAN <input checked="" type="checkbox"/> RURAL		Minimum Requirements EADT			
1. Minimum Vehicular Satisfied _____ Not Satisfied _____		Vehicles per day on major street (total of both approaches)		Vehicles per day on higher-volume minor street approach (one direction only)	
Number of lanes for moving traffic on each approach		Urban	Rural	Urban	Rural
Major Street	Minor Street				
1.....	1.....	8,000	5,600	2,400	1,680
2 or more <i>Towne Center</i>	1 <i>Escalibur Way</i>	<u>9,600</u>	6,720	<u>2,400</u>	1,680
2 or more	2 or more	9,600	6,720	3,200	2,240
1	2 or more	8,000	5,600	3,200	2,240
2. Interruption of Continuous Traffic Satisfied _____ Not Satisfied _____		Vehicles per day on major street (total of both approaches)		Vehicles per day on higher-volume minor street approach (one direction only)	
Number of lanes for moving traffic on each approach		Urban	Rural	Urban	Rural
Major Street	Minor Street				
1.....	1.....	12,000	8,400	1,200	850
2 or more	1.....	14,400	10,080	1,200	850
2 or more	2 or more	14,400	10,080	1,600	1,120
1	2 or more	12,000	8,400	1,600	1,120
3. Combination Satisfied _____ Not Satisfied _____ <u>No one warrant satisfied</u> , but following warrants fulfilled 80% or more <u>1</u> <u>2</u>		2 Warrants		2 Warrants	

NOTE: To be used only for NEW INTERSECTIONS or other locations where it is not reasonable to count actual traffic volumes.

ADT for Towne Center Dr = 11488 > 9600
 ADT for Escalibur Way = 518 < 2400
 WARRANT NOT MET

ATTACHMENT G

PLANNING WARRANT WORKSHEETS

**Figure 9-4
TRAFFIC SIGNAL WARRANTS**

(Based on Estimated Average Daily Traffic - See Note)

URBAN <input checked="" type="checkbox"/> RURAL		Minimum Requirements EADT			
1. Minimum Vehicular Satisfied _____ Not Satisfied _____		Vehicles per day on major street (total of both approaches)		Vehicles per day on higher-volume minor street approach (one direction only)	
Number of lanes for moving traffic on each approach		Urban	Rural	Urban	Rural
Major Street	Minor Street				
1.....	1.....	8,000	5,600	2,400	1,680
2 or more <i>Towne Center</i>	1 <i>Erecalibus Way</i>	<u>9,600</u>	6,720	<u>2,400</u>	1,680
2 or more	2 or more	9,600	6,720	3,200	2,240
1	2 or more	8,000	5,600	3,200	2,240
2. Interruption of Continuous Traffic Satisfied _____ Not Satisfied _____		Vehicles per day on major street (total of both approaches)		Vehicles per day on higher-volume minor street approach (one direction only)	
Number of lanes for moving traffic on each approach		Urban	Rural	Urban	Rural
Major Street	Minor Street				
1.....	1.....	12,000	8,400	1,200	850
2 or more	1	14,400	10,080	1,200	850
2 or more	2 or more	14,400	10,080	1,600	1,120
1	2 or more	12,000	8,400	1,600	1,120
3. Combination Satisfied _____ Not Satisfied _____ <u>No one warrant satisfied</u> , but following warrants fulfilled 80% or more 1 _____ 2 _____		2 Warrants		2 Warrants	

NOTE: To be used only for NEW INTERSECTIONS or other locations where it is not reasonable to count actual traffic volumes.

ADT for Towne Center Dr = 13,410 > 9600
 ADT for Erecalibus Way = 520 < 2400
WARRANT NOT MET

**Figure 9-4
TRAFFIC SIGNAL WARRANTS**

(Based on Estimated Average Daily Traffic - See Note)

URBAN <input checked="" type="checkbox"/> RURAL		Minimum Requirements EADT			
1. Minimum Vehicular Satisfied _____ Not Satisfied _____		Vehicles per day on major street (total of both approaches)		Vehicles per day on higher-volume minor street approach (one direction only)	
Number of lanes for moving traffic on each approach		Urban	Rural	Urban	Rural
Major Street	Minor Street				
1.....	1.....	8,000	5,600	2,400	1,680
2 or more ..Towne Center	1 ..Erecalibus way	<u>9,600</u>	6,720	<u>2,400</u>	1,680
2 or more	2 or more	9,600	6,720	3,200	2,240
1	2 or more	8,000	5,600	3,200	2,240
2. Interruption of Continuous Traffic Satisfied _____ Not Satisfied _____		Vehicles per day on major street (total of both approaches)		Vehicles per day on higher-volume minor street approach (one direction only)	
Number of lanes for moving traffic on each approach		Urban	Rural	Urban	Rural
Major Street	Minor Street				
1.....	1.....	12,000	8,400	1,200	850
2 or more	1	14,400	10,080	1,200	850
2 or more	2 or more	14,400	10,080	1,600	1,120
1	2 or more	12,000	8,400	1,600	1,120
3. Combination Satisfied _____ Not Satisfied _____ <u>No one warrant satisfied</u> , but following warrants fulfilled 80% or more		2 Warrants		2 Warrants	
		1		2	

NOTE: To be used only for NEW INTERSECTIONS or other locations where it is not reasonable to count actual traffic volumes.

ADT for Towne Center Dr = 14,750 > 9600
ADT for Erecalibus Way = 520 < 2400
WARRANT NOT MET