

# ***TRAFFIC SIGNAL WARRANT STUDY***



**5<sup>th</sup> STREET & ENCHANTED PINES DRIVE**

**JANUARY 2013**

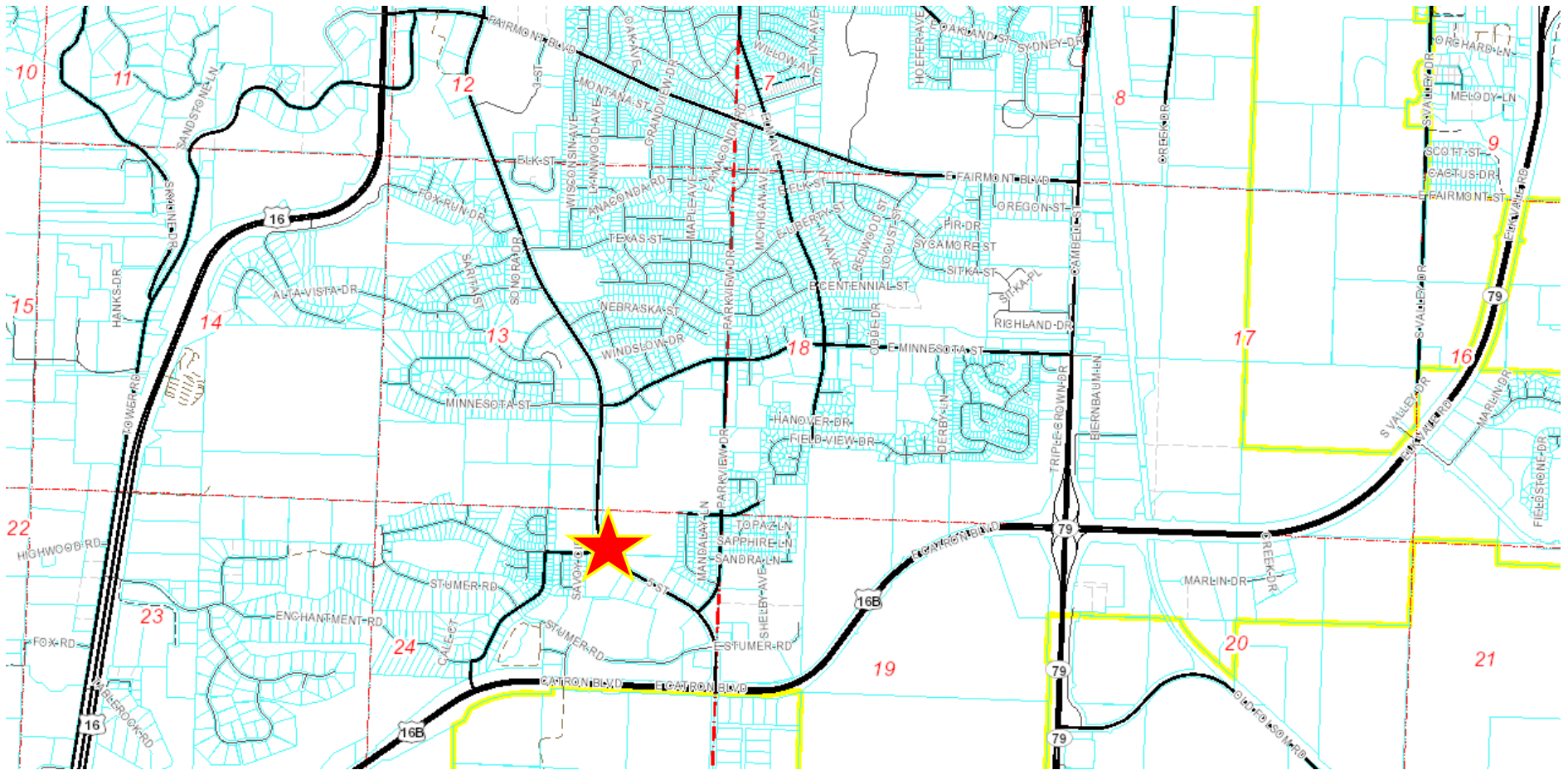


TRAFFIC OPERATIONS  
ENGINEERING SERVICES/PUBLIC WORKS DEPARTMENT

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# INTERSECTION LOCATION MAP



## **INTRODUCTION**

The objective of this engineering report is to assess the need for a traffic signal at the intersection of 5<sup>th</sup> Street and Enchanted Pines Drive. This report presents an overview of the existing conditions of the intersection, a summary of the crash history, traffic volume data, an evaluation of each of the nine traffic signal warrants presented in the Manual on Uniform Traffic Control Devices for Streets and Highways (2009 Edition), and ends with conclusions and recommendations.

## **EXISTING INTERSECTION CONDITIONS**

### **Topography**

Neither the horizontal nor the vertical alignment of 5<sup>th</sup> Street has a significant effect on traffic operations of the intersection.

### **Land Use**

Land uses near the intersection include vacant land, commercial and residential. The immediate vicinity can be characterized as medium density.

### **Geometric Configuration**

5<sup>th</sup> Street and Enchanted Pines Drive form a tee intersection. 5<sup>th</sup> Street has two lanes of travel in both directions with a dedicated turn lane provided for northbound left turns on to Enchanted Pines Drive. The 5<sup>th</sup> Street pavement is in very good condition. Enchanted Pines Drive is marked for two turning lanes of turning traffic at its intersection with 5<sup>th</sup> Street. The pavement is in fair condition.

### **Traffic Control Devices / Operating Speeds**

Enchanted Pines Drive is required to stop at 5<sup>th</sup> Street. The posted speed limit for 5<sup>th</sup> Street is 45 MPH; the speed limit for Enchanted Pines Drive is 25 MPH.

A speed survey was conducted for 5<sup>th</sup> Street concurrent with the collection of volume data. The following are the results of the survey:

DIRECTION	POSTED SPEED	AVERAGE SPEED	85 <sup>TH</sup> PERCENTILE SPEED
NB	45 MPH	42.3 MPH	47.9 MPH
SB	45 MPH	38.7 MPH	43.6 MPH

The observed speed data correlates very well with the posted speed limit.

### **Intersection Sight Distance**

There is adequate intersection sight distance from Enchanted Pines Drive for both left-turn and right-turn maneuvers on to 5<sup>th</sup> Street.

### **Adjacent Traffic Control Signals**

The intersection of 5<sup>th</sup> Street and Stumer Road is signalized and is approximately 0.5 miles south of the study intersection. The intersection of 5<sup>th</sup> Street and Minnesota Street is signalized and is approximately 0.4 miles north of the study intersection.

### **CRASH HISTORY**

There were no State reportable crashes at the study intersection between 01/01/2009 and 11/30/2012.

### **TRAFFIC SIGNAL WARRANTS**

The Manual on Uniform Traffic Control Devices for Streets and Highways 2009 Edition (MUTCD) specifies nine warrants to be considered when evaluating an intersection for signalization. The MUTCD further specifies that a traffic signal should not be installed unless at least one of the signal warrants is met and an engineering study indicates that the installation of a traffic signal would improve the overall safety and operation of the intersection. The MUTCD also states that a signal should not be installed if the installation would disrupt the progressive flow of traffic. An evaluation of each traffic

signal warrants follows. Note that the evaluations are conservative in that the approach volumes for Enchanted Pines Drive have not been reduced to account for right turn volumes (as allowed by the MUTCD and as per the criteria of National Cooperative Highway Research Program Report 457).

### **Warrant 1, Eight-Hour Vehicular Volume**

Warrant 1 includes three parts, Condition A, Condition B and a combination of the two. It is intended that Warrant 1 be treated as a single warrant. If either Condition A, Condition B or the combination of A and B is satisfied, then Warrant 1 is satisfied.

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. Condition A is satisfied if for at least eight hours of the day there is a combined traffic volume of at least 420 vehicles per hour (vph) for both approaches of 5<sup>th</sup> Street and at least 105 vph on Enchanted Pines Drive. As shown in Table 1, the existing traffic volumes do not satisfy Condition A.

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. Condition B is satisfied if for at least eight hours of the day there is a combined traffic volume of at least 630 vph for both approaches of 5<sup>th</sup> Street and at least 53 vph on Enchanted Pines Drive. As shown in Table 2, the existing traffic volumes do not satisfy Condition B.

**WARRANT 1  
CONDITION A**

**TABLE 1**

NUMBER OF LANES FOR MOVING TRAFFIC		MAJOR ROAD SPEED LIMIT		ENCHANTED PINES DR. MINOR ROAD VOLUMES			5TH ST. MAJOR ROAD VOLUMES			WARRANT MET?	
MAJOR	MINOR			MAXIMUM	REQUIRED FOR WARRANT	NB	SB	TOTAL	REQUIRED FOR WARRANT		
2	1		45								
0000	3	3	105	8	28	36	420	NO	0		
0100	0	0	105	13	17	30	420	NO	0		
0200	0	0	105	11	11	22	420	NO	0		
0300	0	0	105	9	12	21	420	NO	0		
0400	1	1	105	23	14	37	420	NO	0		
0500	13	13	105	68	29	97	420	NO	0		
0600	54	54	105	217	85	302	420	NO	0		
0700	119	119	105	378	199	577	420	<b>YES</b>	1		
0800	69	69	105	233	178	411	420	NO	0		
0900	46	46	105	210	208	418	420	NO	0		
1000	54	54	105	228	221	449	420	NO	0		
1100	59	59	105	277	304	581	420	NO	0		
1200	52	52	105	289	315	604	420	NO	0		
1300	48	48	105	276	345	621	420	NO	0		
1400	41	41	105	267	319	586	420	NO	0		
1500	63	63	105	310	389	699	420	NO	0		
1600	82	82	105	297	413	710	420	NO	0		
1700	58	58	105	248	452	700	420	NO	0		
1800	35	35	105	200	296	496	420	NO	0		
1900	20	20	105	146	200	346	420	NO	0		
2000	14	14	105	136	182	318	420	NO	0		
2100	13	13	105	98	125	223	420	NO	0		
2200	4	4	105	53	94	147	420	NO	0		
2300	2	2	105	74	72	146	420	NO	0		
<b>TOTAL</b>	<b>850</b>	<b>0</b>		<b>4069</b>	<b>4508</b>						
# OF HOURS MET	1										
<b>WARRANT MET?</b>	<b>NO</b>										

**WARRANT 1  
CONDITION B**

**TABLE 2**

NUMBER OF LANES FOR MOVING TRAFFIC		MAJOR ROAD SPEED LIMIT				5TH ST. MAJOR ROAD VOLUMES			
MAJOR	MINOR		ENCHANTED PINES DR. MINOR ROAD VOLUMES						
2	1	45							
			REQUIRED FOR	WARRANT MET?				REQUIRED FOR	WARRANT MET?
HOUR BEGINNING	EB	MAXIMUM	WARRANT		NB	SB	TOTAL	WARRANT	
0000	3	3	53	NO	8	28	36	630	NO
0100	0	0	53	NO	13	17	30	630	NO
0200	0	0	53	NO	11	11	22	630	NO
0300	0	0	53	NO	9	12	21	630	NO
0400	1	1	53	NO	23	14	37	630	NO
0500	13	13	53	NO	68	29	97	630	NO
0600	54	54	53	YES	217	85	302	630	NO
0700	119	119	53	YES	378	199	577	630	NO
0800	69	69	53	YES	233	178	411	630	NO
0900	46	46	53	NO	210	208	418	630	NO
1000	54	54	53	YES	228	221	449	630	NO
1100	59	59	53	YES	277	304	581	630	NO
1200	52	52	53	NO	289	315	604	630	NO
1300	48	48	53	NO	276	345	621	630	NO
1400	41	41	53	NO	267	319	586	630	NO
1500	63	63	53	YES	310	389	699	630	<b>YES</b>
1600	82	82	53	YES	297	413	710	630	<b>YES</b>
1700	58	58	53	YES	248	452	700	630	<b>YES</b>
1800	35	35	53	NO	200	296	496	630	NO
1900	20	20	53	NO	146	200	346	630	NO
2000	14	14	53	NO	136	182	318	630	NO
2100	13	13	53	NO	98	125	223	630	NO
2200	4	4	53	NO	53	94	147	630	NO
2300	2	2	53	NO	74	72	146	630	NO
<b>TOTAL</b>	<b>850</b>	<b>0</b>			<b>4069</b>	<b>4508</b>			
# OF HOURS WARRANT MET?	3								<b>NO</b>



The combination of Conditions A and B is intended for application at locations where neither Condition A nor Condition B is satisfied. The combination is satisfied if for at least eight hours of the day, both of the following be met:

A combined traffic volume of at least 336 vph for both approaches of 5<sup>th</sup> Street and at least 84 vph on Enchanted Pines Drive.

A combined volume of at least 504 vph for both approaches of 5<sup>th</sup> Street and at least 42 vph on Enchanted Pines Drive.

As shown in Table 3, the existing traffic volumes do not satisfy the combination of Condition A and Condition B.

Warrant 1 is not satisfied.

### **Warrant 2, Four-Hour Vehicular Volume**

The Four-Hour Vehicular Volume signal warrant is applied where the volume of intersecting traffic is the principal reason to consider installing a traffic signal. This warrant is satisfied when, for any four hours of the day, the plotted points representing the total vehicles per hour on both the approaches of major road and the corresponding vehicles per hour on the higher-volume approach of minor road (one direction only) fall above the appropriate curve of Figure 4C-2 of the 2009 MUTCD. None of the hourly volumes are above the appropriate curve, therefore, Warrant 2 is not satisfied.

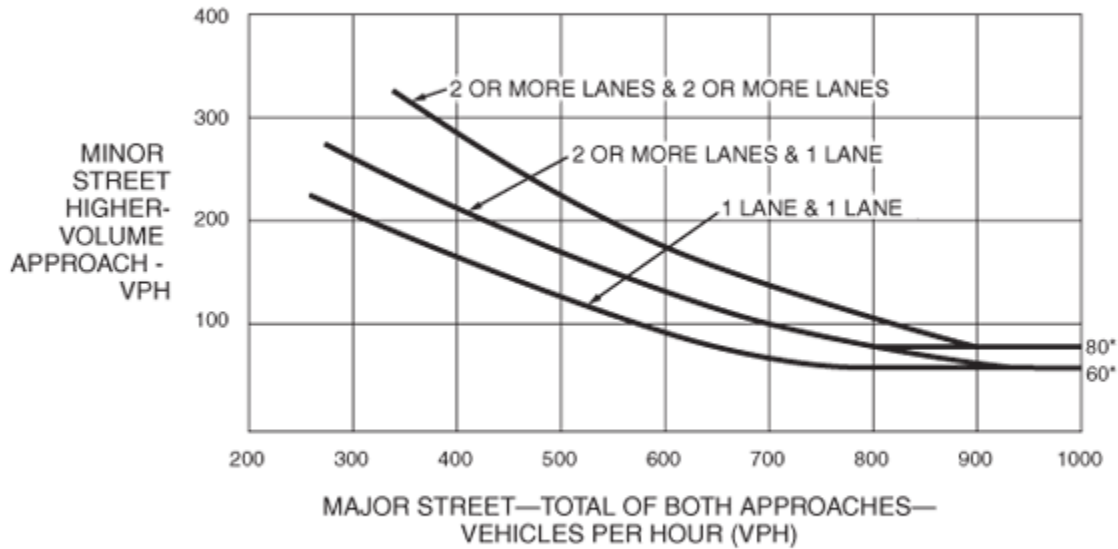
**WARRANT 1  
COMBINATION**

**TABLE 3**

NUMBER OF LANES FOR MOVING TRAFFIC		MAJOR ROAD SPEED LIMIT		ENCHANTED PINES DR. MINOR ROAD VOLUMES				5TH ST. MAJOR ROAD VOLUMES			
MAJOR	MINOR									80% WARRANT A	80% WARRANT B
2	1		45								
HOUR BEGINNING	EB	MAXIMUM	80% VALUE WARRANT A	80% VALUE WARRANT B	NB	SB	TOTAL	80% VALUE WARRANT A	80% VALUE WARRANT B	80% WARRANT A MET?	80% WARRANT B MET?
0000	3	3	84	42	8	28	36	336	504	NO	NO
0100	0	0	84	42	13	17	30	336	504	NO	NO
0200	0	0	84	42	11	11	22	336	504	NO	NO
0300	0	0	84	42	9	12	21	336	504	NO	NO
0400	1	1	84	42	23	14	37	336	504	NO	NO
0500	13	13	84	42	68	29	97	336	504	NO	NO
0600	54	54	84	42	217	85	302	336	504	NO	NO
0700	119	119	84	42	378	199	577	336	504	<b>YES</b>	<b>YES</b>
0800	69	69	84	42	233	178	411	336	504	NO	NO
0900	46	46	84	42	210	208	418	336	504	NO	NO
1000	54	54	84	42	228	221	449	336	504	NO	NO
1100	59	59	84	42	277	304	581	336	504	NO	<b>YES</b>
1200	52	52	84	42	289	315	604	336	504	NO	<b>YES</b>
1300	48	48	84	42	276	345	621	336	504	NO	<b>YES</b>
1400	41	41	84	42	267	319	586	336	504	NO	NO
1500	63	63	84	42	310	389	699	336	504	NO	<b>YES</b>
1600	82	82	84	42	297	413	710	336	504	NO	<b>YES</b>
1700	58	58	84	42	248	452	700	336	504	NO	<b>YES</b>
1800	35	35	84	42	200	296	496	336	504	NO	NO
1900	20	20	84	42	146	200	346	336	504	NO	NO
2000	14	14	84	42	136	182	318	336	504	NO	NO
2100	13	13	84	42	98	125	223	336	504	NO	NO
2200	4	4	84	42	53	94	147	336	504	NO	NO
2300	2	2	84	42	74	72	146	336	504	NO	NO
<b>TOTAL</b>	<b>850</b>	<b>0</b>			<b>4069</b>	<b>4508</b>					
# HOURS 80% WARRANT A MET	1										
# HOURS 80% WARRANT B MET	7										
<b>WARRANT 1C MET?</b>	<b>NO</b>										

**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.

Source: [Figure 4C-2, MUTCD, Federal Highway Administration, 2009]

### Warrant 3, Peak Hour

The Peak Hour signal warrant is applied 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. The MUTCD specifies that this 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 study intersection does not meet the criteria described, therefore, Warrant 3 is not applicable and hence, not satisfied.

### Warrant 4, Pedestrian Volume

The purpose of this warrant is to allow pedestrians to cross a major street at an intersection where sufficient gaps in traffic are not presently available for pedestrians to

cross. There is not a crosswalk crossing 5<sup>th</sup> Street, therefore, pedestrians crossing are not a significant factor and Warrant 4 is not satisfied.

### **Warrant 5, School Crossing**

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. The study intersection is not an established school crossing, therefore, Warrant 5 is not satisfied.

### **Warrant 6, Coordinated Signal System**

Traffic signals may be warranted if the combination of proposed and existing signals will collectively provide a progressive operation where no progressive movement presently exists. The study intersection is not being considered for signalization based on progression needs, therefore, Warrant 6 is not satisfied.

### **Warrant 7, Crash Experience**

This warrant is intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal. The MUTCD specifies that one of the conditions for this warrant to be met is that five or more reported crashes, of types susceptible to correction by a traffic control signal, must have occurred within a 12-month period. There have not any crashes at the study intersection within a 12-month period. Therefore, Warrant 7 is not satisfied.

### **Warrant 8, Roadway Network**

Installing a traffic signal may be justified to encourage concentration and organization of traffic flow on a roadway network. This warrant is only applicable to intersections of major routes on a road system. Enchanted Pines Drive does not meet the definition of a major route, therefore, Warrant 8 is not satisfied.

### **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. No grade crossing exists near the study intersection, therefore, Warrant 9 is not satisfied.

### **CONCLUSIONS**

- 1) None of the warrants presented in the Manual of Uniform Traffic Control Devices were satisfied for the existing traffic conditions. The evaluation did not exclude right turning vehicles from the Enchanted Pines Drive volumes and was therefore conservative in judgment. The MUTCD specifies that a traffic signal should not be installed unless one or more of the signal warrants are met and an engineering study indicates that the installation of a traffic signal would improve the overall safety and operation of the intersection.
- 2) Traffic crashes are not a factor at the intersection.

### **RECOMMENDATIONS**

- 1) A traffic signal should not be installed at this time.
- 2) The intersection should be re-evaluated at appropriate intervals as development conditions change along the corridor.

**REFERENCES:**

*Manual on Uniform Traffic Control Devices.* U.S. Department of Transportation, Federal Highway Administration, Washington, D.C., 2009.

*A Policy on Geometric Design of Highways and Streets, 5th edition.* American Association of State Highway Officials (AASHTO), Washington, D.C., 2004.

*Report 457, Evaluating Intersection Improvements: An Engineering Study Guide.* National Cooperative Highway Research Program, Washington, D.C., 2001.