

State of Wisconsin Department of Transportation

Traffic Signal Design Manual

ORIGINATOR Director, Burea	ı of Highway Operations	2-4-1
CHAPTER 2	Signal Investigation Study	
SECTION 4	Documentation	
SUBJECT 1	Sample Study	

The following study has been prepared as a sample for this manual.

Sample cover letter (Consultant to Region) Sample memorandum (Region to Central Office)

Sample Investigation Study

DT1199 Traffic Control Signal Approval Request

Analysis (Reason/Need for Study/Recommendation)

- a. Existing Physical Conditions and Control Devices
- b. Traffic Conditions (see TSDM Subject 2-2-1)
- c. Warrants met
- d. Crash History (see TSDM Subject 2-2-2)

Appendix

Site Map Hourly Traffic Volume Counts Vehicle Volume Count Graphic Summary Sheet (optional) Warrant Analysis Worksheets Signalized Intersection Capacity Analysis Crash Record Extract

Collision Diagram (optional)

SAMPLE COVER LETTER (CONSULTANT TO REGION)

Date

(Region Office)

Re: Signal Investigation Study S.T.H. XX and C.T.H. YY Town of Somewhere Here County

Dear XXXXXX:

Attached for your review and approval is a signal investigation study for the intersection of S.T.H. XX and C.T.H. YY. The proposed installation is requested due to an increase in traffic, accidents, and congestion. In addition, there have been several requests from area residents to consider a traffic signal at this location.

In the fall of 1993 acceleration and deceleration tapers were installed on STH XX. This was an interim improvement prior to a signal being installed.

Traffic signal warrants 1, 2, 3 and 7 as stated in the *Wisconsin Manual on Uniform Traffic Control Devices*, are satisfied for the required number of hours for this location.

A signal capacity analysis was performed based on common signal phasing and timing parameters as described in TSDM Subject 3-2-2, existing turning movement counts, and current intersection geometrics. Results of the analysis (included in the appendix) have determined that the intersection will operate with acceptable levels-of-service, and the expected queues will not exceed intersection storage currently provided or planned for.

We recommend approval of this installation.

Sincerely, Private Consultant

SAMPLE MEMORANDUM (REGION TO BUREAU OF HIGHWAY OPERATIONS)

Date:

To: (State Traffic Signal Engineer)

- From: (Regional Traffic Engineer)
- Subject: Signal Investigation Study Project ID (number) S.T.H. XX and C.T.H. YY Town of Somewhere Here County

Attached for your review and approval is a signal investigation study for the intersection of S.T.H. XX and C.T.H. YY. The proposed installation is requested due to an increase in traffic, accidents, and congestion. In addition, there have been several requests from area residents to consider a traffic signal at this location.

In the fall of 1993 acceleration and deceleration tapers were installed on STH XX. This was an interim improvement prior to a signal being installed.

Traffic signal warrants 1, 2, 3, and 7, as stated in the *Wisconsin Manual on Uniform Traffic Control Devices*, are satisfied for the required number of hours for this location.

A signal capacity analysis was performed based on common signal phasing and timing parameters as described in TSDM Subject 3-2-2, existing turning movement counts, and current intersection geometrics. Results of the analysis (included in the appendix) have determined that expected queues will not exceed intersection storage currently provided. Based on the analysis, left turn phasing will not need to be provided at this time.

Contracted forces will complete aboveground and underground work. Operations and maintenance of the installation will be at the expense of the Department.

The total estimated cost is \$___, ___.

The project will be funded through (state funding source(s)).

We recommend approval of this installation.

DT 1199 – TRAFFIC CONTROL SIGNAL APPROVAL REQUEST

TRAFFIC CONTROL SIGNAL APPROVAL REQUEST

Wisconsin Department of Transportation

DT1199 5/2006 s.86.32(1) Wis. Stats.

Municipality	County
State Trunk Highway	Intersecting Road

Check if connecting highway - Requires authorized municipal and departmental approval below Approval of installation on the connecting highway system is required under s.86.32(1) Wis. Stats.

The Region requests approval of a traffic control signal at the location indicated above. Traffic volumes, crash experience and physical conditions at the described intersection have been reviewed. A traffic control signal is justified.

Approval Recommended		
	(Regional Traffic Engineer)	(Date)
Approval Granted		
••	(Bureau of Highway Operations)	(Date)

TRAFFIC CONTROL SIGNAL INSTALLATION, OPERATION, AND MAINTENANCE AGREEMENT

The municipality identified above agrees to install, operate and maintain a traffic control signal at the specified intersection for the purpose of controlling the flow of traffic.

The following conditions precedent to approval of the signal are acknowledged and accepted by the municipality:

- 1. The design, installation and operation of the signal will comply with the Wisconsin Manual on Uniform Traffic Control Devices.
- 2. The cost of maintenance and operation of the signal will be the responsibility of the municipality or in any case will not be an obligation of the Wisconsin Department of Transportation.
- Parking will be restricted by the municipality at locations on the identified intersecting streets in accordance with the need to provide adequate capacity and normal flow of traffic. Specific restrictions, if needed, are as follows:
- 4. The municipality, with the approval or at the request of the Department of Transportation, and at the municipality's expense, shall make such adjustments in the equipment and manner of operation of these signals as are deemed necessary for public safety and facilitation of traffic movement.

Yes	
Yes	

Further provisions are stated on the back of this document. Attachments

Agreed on behalf of the Municipality

No

🗌 No

Agreed on behalf of the Department

(Signature of Authorized Representative for Municipality) (Date)

(Bureau of Highway Operations)

(Date)

SIGNAL INVESTIGATION STUDY

MAIN LINE (STH XX) & SIDE ROAD (CTH YY) INTERSECTION

1. <u>REASON/NEED FOR STUDY</u>

The traffic volume in this area has tended to increase rapidly over the last few years. In addition, we have received numerous requests (letters attached), mostly from area residents, to consider the installation of a traffic control signal at the intersection of STH XX and CTH YY. Accidents and congestion are increasing along with the increase in area development and traffic.

2. EXISTING PHYSICAL CONDITIONS AND CONTROL DEVICES

Each of these roadways is a two-lane road with 10-foot shoulders on STH XX and a minimal of 2 to 4 foot shoulders on the CTH YY. The Main Line (STH XX) has 150-ft left-turn bays at the intersection. STH XX has a 55 mph speed limit while CTH YY has 35 mph limits on each side of the intersection. Existing traffic control at the intersection consists of two-way STOP control for CTH YY. New acceleration and deceleration tapers were installed September of 2002 on STH XX as an interim operational improvement prior to a signal being installed.

3. TRAFFIC CONDITIONS

A 16-hour manual traffic count was made at this intersection on Tuesday, October 21, 2003 and Wednesday, October 22, 2003. The results of this traffic count are summarized in Figure 1; the actual count data is included in the Appendix.

4. <u>CRASH HISTORY</u>

The crash history shows an increase in crashes and a minimum of 5 crashes in a 12-month period which are correctable by installation of a traffic control signal. There was one fatality crash at the intersection.

5. WARRANT MET

The following signal warrants are met and are summarized on the Warrant sheets:

3
5
3
3
3
\$





VEHICLE AND I Location : S.T.I Day and Date: Weather: Sunn	U-TUR 1. XX al Tues 10 Y. Cold	INS VOLL	UME SI YY Wed	UMMARY 10-21-9	~	•			ALLV	EHICLE	8 989 780 780	SERVE! OCE88(R NAME: OR NAME	J. Doe E: D. 8m	돌		·.	EXPANS HOUR E MONTHI	JON FAC	110H	1.2000		á .	** BRVIN	
Street Name	ר <u>י</u>	T.H. XX Iom North A	ء د	OTAL		s.T.H. X From So A	×f	TOTAL		F.o.	.H. YY m East	10	TAL	01	.T.H. YY om West	- E	DTAL	0 - N	E- K	ALL	Z-Tur		Ψ		otal
6-7 7-8 8-9	14 23 18	346 324 300	50 13 15 50 13 15	379 360 338	9 53 6	637 800 497	604	672 829 506	===	***	16 16 11	5 8 8	62 67 67	62 61 79	35	83 13 13	187 157 110	1,061 1,169 845	250 224 186	1,301	000	000	000		1000
8-10 10-11 11-12	32 34	286 289 344	30 58 30 58	346 353 430	6 6 6	359 355	0	370 362 362	===	~ 2 ~	2 e ș	52 4 8	833	898	53.6	8 9 3	117	715 715 715	177	662	000	000	-00		-00
12-1 PM 1-2 2-3	34 34	340 359 300	35 25	390 433 367	- 5 - 5	407 295 294	0 - 7 7	304 304 304	====	N~~~	53 52 ²	28 4 3 6	878	858	5 2 8 2 5 4 5 5 4	33 0	122 47 72	697 697	13 1 19 19	1.001 828 828					
3 - 4 - 5 - 5 - 6 - 5	35 78 92	695 728 827	74 98 95	804 905 1.014	28 38 45 8	497 516 618	<u>6 - 0</u>	541 556 666	===	7 4 20	4 88	88 83 88 83	76 150 148	888	27 34	52 4 2 53 54	138 78 86	1,345 1,460 1,680	214 227 232	1,559 1,688 1,912	•••	000		000	
6-7 7-8 8-9 9-10	65 32 20 20	500 481 228 108	2 8 7 2 2 8 7 2	646 592 301 140	02 0 4	488 321 224 ,228	80-0	527 341 234 235		6044	59 1 52 28 1 28	2442	127 95 73 30	2885	22.2	9099	23 37 37	1,173 933 535 375	198 162 120 76	1,371 1,095 1,005 1,00	0000	0000		0000	0000
Approach to: Departing From	628	6,454	724	7,806 8,200	272	6,903	64	7,259 6,956 EXPANI	DED TC	97 924 HOU	483 6 URS	1 1	217	659	804	405	1.466	15,065 15,156	2,583	17.749	0	0	-	- =	-
Approach Ueparting	810	8,326	934	10,070	351	6,905	108	9,364 8,974	==	126	623	22	438	920	510	622	1,802	19,434 19,551	3,462	22,896 22,896	0	0	-	10	-

APPENDIX II – HOURLY VOLUME COUNTS (continued)

APPENDIX III – WARRANT ANALYSIS WORKSHEETS

Wisconsin Department of Transportation Traffic Signal Warrant Summary Sheet

The Workshe	et(s) attached are provided as an attachment to the Engineering Investigation Study for:
Intersection:	STH XX & CTH YY Date: 5/8/04
County:	XXXXXX
Town	XXXXXX
Village	
City	
Major Street	STH XX Critical Approach Speed 55 Lanes 1
Minor Street	CTH YY Critical Approach Speed 35 Lanes 1
THIS INTER	SECTION IS ANALYZED FOR RURAL WARRANTS. COMMENTS:
Note: The w	varrants for rural areas (70% of urban warrant) are used when the 85% speed on the major street exceeds 40 m.p.h. or when the
intersection 1	ies within the built-up area of an isolated community having a population of less than 10,000.
	$10/21 \& 10/22 20.03 T.W 6:00 \frac{A}{M} 10:00$
IE ANALYSIS IS	BASED ON COUNTS CONDUCTED ON TO
	DATES DAYS
50% Right Tu	ns Included
Warrant Eval	uation Summary VES/NO/NOT EVALUATED
<u></u>	
Warrant 1	Eight-Hour Vehicular VolumeYES
Condition A	Minimum Vehicular VolumeYES
Condition B	Interruption of Continuous TrafficNO
Condition C	Combination: 80% of A and BYES
Warrant 2	Four Hour Volume
Warrant 3	Peak Hour VolumeNOT-EVALUATED
Warrant 4	Pedestrian VolumeNO
Warrant 5	School CrossingNO
Warrant 6	Coordinated Signal System
Warrant 7	Crash Experience
Warrant 8	Roadway networkNOT-EVALUATED
	Left Turn Conflict AnalysisNOT-EVALUATED
This analysis w	vas conducted by:
	James C. Doe
	(Name)
	Private Consultant
	10/29/03

70% RURAL

Date: 5/8/04 County: XXXXX Town Village City XXXXXX Major Street STH XX Critical Approach Speed Minor Street CTH YY Approach Speed Street Volume Level Street STH XX				Sheet 1
County: XXXXXX Town XXXXXX Village City Major Street STH XX Critical Approach Speed 55 Lanes 1 Volume Level Volume Level	a		Date: 5/8/04	
Town Village CityXXXXXMajor Street Minor StreetSTH XX Critical Approach Speed Approach Speed Speed55 Lanes 1Volume Level	County:	XXXXXX		
Major Street STH XX Critical Approach Speed 55 Lanes 1 Minor Street CTH YY Approach Speed 35 Lanes 1 Volume Level Image: Comparison of the stress of the stres of the stress of the stres of the stress	Town Village City	XXXXXX		
Major Street STH XX Critical Approach Speed 55 Lanes 1 Minor Street CTH YY Approach Speed 35 Lanes 1	Maine Officiat	OTHXX	Critical Annual Strend 55	1
Minor Street CTH YY Approach Speed 35 Lanes 1 Volume Level Image: Street St	Major Street	SIHXX	Critical Approach Speed 55 Lanes	1
Volume Level	Minor Street	СТН ҮҮ	Approach Speed 35 Lanes	1
	Volume Leve			
1. Critical speed of major road traffic > 40 mph : X Yes \Box No		1. Critical speed	of major road traffic > 40 mph : Xes	No No
2. In built-up area of isolated community of $< 10,000$ pop.: \square Yes \square No		2. In built-up area	a of isolated community of < 10.000 pop.: \overline{X} Yes	ΠNο
If Question 1 or 2 above is answered "Yes" then use "70%" volume level: $X 70\%$ 100%	If Ones	stion 1 or 2 above	is answered "Ves" then use "70%" volume level: \overline{X} 70%	100%

WARRANT 1 – Eight-Hour Vehicular Volume

Warrant is satisfied if Condition A or B is "100 % satisfied." Warrant also satisfied if Condition C (80% of A and B) is satisfied.

		8 Hig	hest Hour	s				
Hour	5-6p	4-5p	3-4p	7-8a	6-7p	6-7a	7-8p	8-9a
Major Road Both App. vph	1680	1460	1345	1189	1173	1051	933	845
Minor Road High App. vph	232	227	214	224	198	250	162	186

Record hours where condition is met and the corresponding volumes in boxes provided. Condition is 100% satisfied if the minimum volumes are met for eight hours.

Condition A – Minimum Vehicular Volume

(volumes in veh/h)	M (8)	linimum R 0% Shown	equiremen in Bracke	nts ets)
Approach Lanes:		1	2 or	more
Volume Level:	100%	Hours	100%	Hours
Major Road-Both	350	16	420	
Approaches	(280)	16	(335)	
Minor Road-	105	8	140	
Highest Approach	(85)	9	(110)	

100% Satisfied: YES 80% Satisfied: YES **Condition B – Interruption of Continuous Traffic**

(volumes in veh/h)	M (80	linimum R 0% Showr	equirement in Bracke	nts ets)
Approach Lanes:		1	2 or	more
Volume Level:	100%	Hours	100%	Hours
Major Road-Both	525	15	630	
Approaches	(420)	15	(505)	
Minor Road-	50	14	70	
Highest Approach	(40)	15	(55)	

100% Satisfied: NO 80 % Satisfied: NO

Condition C - Combination of Condition A and B: Condition A and B Both 80% Satisfied?: YES

Warrant Satisfied?: YES

% Right Turns Included: 50

Sheet 2

Warrant 2 - Four-Hour Vehicular Volume

Plot four volume combinations on the applicable figure below. If four points lie above the appropriate line, then the warrant is satisfied.



Warrant 3 - Peak Hour

Unusual condition justifying use of warrant:

Record hour where criteria are fulfilled and the corresponding delay or volume in boxes provided. Plot the peak hour volume combination on the applicable figure below. If all three criteria are fulfilled or the plotted point lies above the appropriate line, then the warrant is satisfied.

Criteria	Approa	ch Lanes	No. of Ap	proaches	Hour	Fulfi	lled?
	1	2	3	4		Yes	No
1. Delay on Minor Approach (veh-h)	4	5			,		
2. Volume on Minor Approach (veh/h)	100	150					
3. Total Entering Volume (veh/h)			650	800			



Warrant 4 – Pedestrian Volume

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Critoria	He	Fulf	illed?			
Criteria			Yes	No		
1. Pedestrian volume crossing the major road is 100 ped/h or	Vol	Volume				
during any one hour.				\square		
2. There are less than 60 gaps per hour in the major road traffic	GA	APS				
same hours as the pedestrian volume criterion is satisfied.						
3. The nearest traffic signal along the major road is located						
300 ft but the proposed traffic signal will not restrict the				\square		
progressive movement of traffic.						

Satisfied?: NO Warrant 5 – School Crossing

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Creitorio	Fulfi	Fulfilled?		
	Yes	No		
1. There are a minimum of 20 students during the highest crossing hour.		\boxtimes		
2. There are fewer adequate gaps in the major road traffic stream during the period when the children are using the crossing than the number of minutes in the same period.				
3. The nearest traffic signal along the major road is located more than 300 ft away. Or, the nearest traffic signal is within 300 ft but the proposed traffic signal will not restrict the progressive movement of traffic.				

Satisfied?: NO Warrant 6 – Coordinated Signal System

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1000 ft).

Critorio	Fulfilled?		
Списна	Yes	No	
1. On a one-way road or a road that has traffic predominantly in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.			
2. On a two-way road, adjacent signals do not provide the necessary degree of platooning and the proposed, adjacent signals will collectively provide a progressive operation.		\boxtimes	

Satisfied?: NO

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Sheet 3

Warrant 7 – Crash Experience

8 Highest Hours								
Hour	5-6р	4-5p	3-4p	7-8a	6-7p	6-7a	7-8p	8-9a
Major Road - Both App. vph	1680	1460	1345	1189	1173	1051	933	845
Minor Road High App. vph	232	227	214	224	198	250	162	186

Table 1: 80% Volume Comparison Criteria

(Volumes in veh/h)	Minimum Requirements						
Ap	proach Lanes:		1	2 or more			
V	olume Level:	80%	Hours	80%	Hours		
Major Road Both App.	1A	280	16	335			
vph	1B	420	16	505			
Minor Road High App.	1A	85	8	110			
vph	1B	40	9	55			

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

	Criteria	-	Hour			et?	Fulfilled?	
(Must use 80				Yes	No	Yes	No	
1. One of the warrants	the Warrant 4.1 is 80% of volume requirements: 56 ped/h for 4 hrs or 106 ped/h for 1 hr							
to the right	to the right Warrant 1, Condition A (80% satisfied from Table 1 above)							
is met.	Warrant 1, Condition B (80% satisfied from T	able 1	above)	, , , , , , , , , , , , , , , , , , ,			\square	
2. Adequate transferreduce crash	ial of other remedial measures has failed to a frequency.	Meas	sures tr	ied:				
3. Five or mor correction b Period.	e reported crashes, of types susceptible to y signal, have occurred within a 12-mo.	Number of crashes per 12 months:					\boxtimes	

Warrant Satisfied?: YES

Sheet 4

Warrant 8 – Roadway Network

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

	Criteria									illed?
							Yes	No	Yes	No
1. Both of the criteria to the right are met.a. Total entering volume of at least 1,000 veh/h during typical weekday peak hour.Entering volume:b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.Warrant(s) satisfied:										
						l:				
2. Total entering	2. Total entering volume at least 1,000 veh/h									
day (Sat. or Su	n.)							-Vol.		
	Characteristics of Major Poutos									lled?
							,		Yes	No
1. Part of the r	oad or highway system that serves	as the princi	pal ro	oadway r	network f	òr th	rougł	1		
traffic flow	•									
2. Rural or suburban highway outside of, entering, or traversing a city.										
3. Appears as a	a major route on an official plan.					, , ,				

Warrant Satisfied?: NOT-EVALUATED

Left Turn Conflict Analysis

Criteria									
	(Condition satisfied when the product of the mainline left turns in one direction and the opposing traffic exceed the thresholds given. NOTE: This is not a signal warrant.)								
	А		В	Product of pe vehicles (A plus right tu					
No. of Left Turn Lanes	Peak Volume Left Turns	No. of Opposing Lanes	Peak Opposing Volume in Same Hour	A x B	A x B Threshold		eded? No		
1		1		0	80,000				
1		2		0	100,000				

Condition Satisfied?: NOT-EVALUATED

CONCLUSIONS:

Sheet 5

HCM Signalized Intersection Capacity Analysis 3: CTH YY & STH XX

	٢	-	\mathbf{F}	1		•	-	1	1	1	Ļ	1
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		•			4		ሻ	1		٦	t ,	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		3.0			3.0		3.0	3.0	an an an an Anna Anna Anna	3.0	3.0	
Lane Util. Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Frt		0.96			0.94		1.00	1.00		1.00	0.98	
Flt Protected		0.98			0.99		0.95	1.00	and a long	0.95	1.00	
Satd. Flow (prot)		1766			1748		1770	1758		1770	1742	
Fit Permitted		0.90			0.95		0.16	1.00		0.33	1.00	de alta
Satd. Flow (perm)		1609			1672		290	1758		621	1742	oorgoo googaalaa ayaa a
Volume (vph)	30	34	23	20	66	59	42	618	6	92	- 827	95
Peak-hour factor, PHF	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Adj. Flow (vph)	32	36	24	21	69	62		651	6	97	871	100
RTOR Reduction (vph)	0	19	0	0	49	0	0	0	0	0	5	0
Lane Group Flow (vph)	0	73	0	0	103	0	44	657	• • • •	97	966	0
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	2%	8%	2%	2%	8%	2%
Turn Type	Perm			Perm		diana te 1	Perm		di dina ser	Perm		
Protected Phases	i si ç	2			6	r -		8			4	
Permitted Phases	2		12.16	6			8			4		
Actuated Green, G (s)		8.2	l vetil d		8.2		30.1	30.1		30.1	30.1	
Effective Green, g (s)		10.2			10.2		32.1	32.1	ann airte an san an San an san an	32.1	32.1	
Actuated g/C Ratio		0.21			0.21		0.66	0.66	-	0.66	0.66	
Clearance Time (s)		5.0	199		5.0		5.0	5.0		5.0	5.0	
Vehicle Extension (s)		3.0			3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)		340		1.00	353		193	1168		413	1158	36.6
v/s Ratio Prot								0.37	ta series de	1.0	c0.55	
v/s Ratio Perm		0.05			c0.06		0,15		1.451	0.16		
v/c Ratio		0.21			0.29		0.23	0.56		0.23	0.83	
Uniform Delay, d1		15.7	at the state		16,0		3.2	4.3		3.2	6.1	
Progression Factor		1.00			1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2		0.3			0.5		0.6	0.6	T percent	0.3	5.3	1997 (S. 1997)
Delay (s)		16.1			16.5		3.8	5.0		3.5	11.4	
Level of Service		В			В		A	A		A	В	1006.0
Approach Delay (s)		16.1			16.5	fata in Facto Socialism		4.9			10.7	
Approach LOS		B			В			A			В	
Intersection Summary	ar that		E HAR	ALC: NO.	and the state							
HCM Average Control D	elav		9.4	H	CMLev	el of Se	rvice		A			
HCM Volume to Capacity	v ratio		0.70									
Actuated Cycle Length (s	s) · · · ·		48.3	S	um of lo	st time	(s)		6.0	Second and		
Intersection Capacity Uti	lization		72.6%		CU Leve	l of Ser	vice		С			
Analysis Period (min)			15							1. J. C.		
c Critical Lane Group												

5:00 pm Baseline Wisconsin DOT

Synchro 6 Report Page 1

6/1/2005

6/1/2005

Lanes, Volumes, Timings <u>3: CTH YY & STH XX</u>

	× .	->	\sim	1	1 + -		1	1	1		i ↓ s	-
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		∔	23 - 18 S				۲, K	t .		۲	ሴ	
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	250		250	250		250	200		0	200	· .	0
Storage Lanes	0		0	0		0	1		0	1		0
Total Lost Time (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
Leading Detector (ff)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trailing Detector (ft)	- O	0		0	0	10. 25. Sub	0	0 0		0	0	
Turning Sneed (mnh)	15	, in the second s	q	15		q	15		G Q	15		q
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
Edite Otil: 7 dotor	1.00	0.965	1.00	1.00	0.945	1.00	1.00	0 999	1.00	1.00	0.985	1.00
Fit Protected		0.000			0.010		0.950	0.000		0.950	0.000	1. N. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
Satd Flow (prot)	<u> </u>	1767	۰ ۱	n	1748	0	1770	1758	n i	1770	1743	0
Flt Permitted		0.889			0.963		0 125	11.00	v	0 245	1140	v
Satd Flow (parm)	n	1508	0	0	1695	0	233	1758	0	456	17/3	n
Right Turn on Red	and an	1000	Ves	9.900 - 9	1000	Ves	200	1700	Vec	400	1175	Ves
Sate Flow (PTOP)	an Castratal	24	103		62	103		1	103	. Talkarra	15	103
Headway Eactor	1.00	1.00	1.00	1.00	1 00	1.00	1 00	1 00	1.00	1.00	1.00	1 00
Link Speed (moh)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Link Dietanco (ft)		1000			1000	- 10 - 10		1000			1000	
Travel Time (c)	Sec. Market Sec. Market	15.2			15.2		0.000	15.2			45.2	
Volume (vnh)	20	10.2	23	20	10.2	50	12	619	6	02	927	05
Dook Hour Easter	0.05	0.05	0.05	0.05	00	0.05	42	0.05	0.05	92	021	90 06
Hoover Vehicles (9/)	0.90	0.90	0.90	20/	0.90	0.90	0.90	0.90	20/	0.90	0.90	20.90
Adi Elaw (upb)	270	270	270	270	270	270 60	270	070 GE1	270	2.70	070	270
Auj. Flow (vpn)) 0	00	24	21	152	02	44	657	0	97	071	100
Turn Turn) U	92	U	Dorm	152	U	Dorm	057	U	· 97	971	Ų
Protected Phases	генн	2		гыш	6		Femi	8		генн	. 4	i an
Permitted Phases	2			6			8			4	E. Cast	
Detector Phases	2	2		6	6		8	8		4	4	2
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0	$h_{i}, h_{i} \in \mathbb{R}^{n}$	4.0	4.0	la sur e
Minimum Split (s)	15.0	15.0		15.0	15.0		10.0	10.0		20.0	20.0	
Total Split (s)	25.0	25.0	0.0	25.0	25.0	0.0	35.0	35.0	0.0	35.0	35.0	0.0
Total Split (%)	41.7%	41.7%	0.0%	41.7%	41.7%	0.0%	58.3%	58.3%	0.0%	58.3%	58.3%	0.0%
Maximum Green (s)	20.0	20.0		20.0	20.0		30.0	30.0	1.11	30.0	30.0	
Yellow Time (s)	4.0	4.0		4.0	4.0	· .	4.0	4.0		4.0	4.0	
All-Red Time (s)	1.0	1.0		1.0	1.0		1.0	1.0		1.0	1.0	
Lead/Lag								and the second second				
Lead-Lag Optimize?	8 2 C											
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	- -
Minimum Gap (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	a an
Time Before Reduce (s) 10.0	10.0		10.0	10.0		15.0	15.0		15.0	15.0	
Time To Reduce (s)	10.0	10.0		10.0	10.0	and an anna an	10.0	10.0		10.0	10.0	
Recall Mode	Min	Min		Min	Min		Min	Min		Min	Min	
Act Effct Green (s)		10.2			10.2		32.1	32.1		32.1	32.1	
Actuated g/C Ratio		0.21			0.21		0.66	0.66		0.66	0.66	1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 - 1997 -
v/c Ratio		0.26			0.37		0.28	0.56		0.32	0.83	2.2.3
Control Delay		13.0	analas (C. 197		11.3		10.2	73		7 8	16.4	
		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay	• 2.5	13.0			11.3		10.2	73		78	16.4	
		10.0					10.2	1.5			.0.4	
5:00 pm Baseline Wisconsin DOT										Syr	nchro 6 F F	Report Page 1

Lanes, Volumes, Til	mings						10005
<u>3: CIHYY&SIHX</u>	X					6/	1/2005
	≯ →	` 	* *	1	1	a↓ ↓	1
Lane Group 👘 👘	EBU EBT E	BR WBL WBT	WBR NBL	NBT	NER SEL	SBT	ISB R
LOS	В	B	В	A	A	В	(V ^a riek)
Approach Delay	13.0	11.3		7.4		15.6	
Approach LOS	Β	В		A		В	
Queue Length 50th (ft)	16	21	4	72	8	148	
Queue Length 95th (ft)	44	58		183	- 38	#484	de ver
Internal Link Dist (ft)	920	920	1	920		920	
Turn Bay Length (ft)			200		200		
Base Capacity (vph)	601	661	155	1168	303	1163	
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	0.15	0.23	0.28	0.56	0.32	0.83	
Intersection Summary	PLOENT DE MU						
Area Type: C	Other						
Cycle Length: 60					V. A. C. C.		1
Actuated Cycle Length:	48.3						
Natural Cycle: 60							
Control Type: Actuated-	Uncoordinated			1811	1		
Maximum v/c Ratio: 0.8	3						
Intersection Signal Delay	y: 12.3	Intersect	ion LOS: B				
Intersection Capacity Ut	ilization 72.6%	ICU Leve	of Service C	a de la contraction de			
Analysis Period (min) 15	5						
# 95th percentile volur	me exceeds capac	ity, queue may be lo	nger.				
Queue shown is max	timum after two cy	cles.			· · .		

Splits and Phases:	3: CTH YY &	STH XX

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5:00 pm Baseline Wisconsin DOT Synchro 6 Report Page 2 **APPENDIX IV – CRASH REPORTS**

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	Υ V	И А Д Т С А О Ц Н R – – С А F С L А G	W P R N N A A C Y Y D C D T	Y N P T T T D N H D F C C	D M D D H S L M O A L O C	IBIIIW T O B U T A N	R R S R S Y R C R R E G D D	RD E 122 0.71 000 YY SIDESTREET ST I MON 13 04/04/00 N	RD E 122 0.71 000 YY SIDESTREET ST I SAT 13 09/09/00 N	EET ST N 122 0.71 000 XX MAINLINE RD I TUE 13 12/26/00 N	EET ST N 122 0.71 000 XX MAINLINE RD I THU 17 06/20/01 N	RD E 122 0.71 000 YY SIDESTREET ST I WED 10 01/15/02 N SNOW	RD 122 0.73 N 002 I FRI 23 04/10/02 Y DAR	RD E 122 0.71 000 YY SIDESTREET ST I THU 9 02/11/02 N WET	RD E 122 0.70 N 001 I SUN 20 11/05/01 N ICE	RD E 122 0.67 N 004 F SUN 20 09/06/02 N - DAR	RD E 122 0.71 000 YY SIDESTREET ST I FRI 8 01/31/03 N SNOW	RD E 122 0.71 000 YY SIDESTREET ST I TUE 16 06/24/03 N	
	R S	H R I I C A O C A F C L A G	O W P R N N A A C Y Y D C D T	N Y N P T T T T D N H D F C C	S D M D D H S L M O A L O C	T I B I I W T O B U T A N	R R R S R S Y R C R R E G D D	INE RD E 122 0.71 000 YY SIDESTREET ST I MON 13 04/04/00 N	INE RD E 122 0.71 000 YY SIDESTREET ST I SAT 13 09/09/00 N	STREET ST N 122 0.71 000 XX MAINLINE RD I TUE 13 12/26/00 N	TREET ST N 122 0.71 000 XX MAINLINE RD I THU 17 06/20/01 N	INE RD E 122 0.71 000 YY SIDESTREET ST I WED 10 01/15/02 N SNOW	INE RD 122 0.73 N 002 I FRI 23 04/10/02 Y DAR	INE RD E 122 0.71 000 YY SIDESTREET ST I THU 9 02/11/02 N WET	INERD E 122 0.70 N 001 I SUN 20 11/05/01 N ICE	<b></b>	INE RD E 122 0.71 000 YY SIDESTREET ST I FRI 8 01/31/03 N SNOW	INE RD E 122 0.71 000 YY SIDESTREET ST I TUE 16 06/24/03 N	
	R A	H R I I C A O C A F C L A G	O W P R N N A A C Y Y D C D T	N Y N P T T T D N H D F C C	S D M D D H S L M O A L O C	T I B I I W T O B U T A N	R R R S R S Y R C R R E G D D	AINLINE RD E 122 0.71 000 YY SIDESTREET ST I MON 13 04/04/00 N	AINLINE RD E 122 0.71 000 YY SIDESTREET ST I SAT 13 09/09/00 N	DESTREET ST N 122 0.71 000 XX MAINLINE RD I TUE 13 12/26/00 N	DESTREET ST N 122 0.71 000 XX MAINLINE RD I THU 17 06/20/01 N	AINLINE RD E 122 0.71 000 YY SIDESTREET ST I WED 10 01/15/02 N SNOW	AINLINE RD 122 0.73 N 002 I FRI 23 04/10/02 Y DAR	AINLINE RD E 122 0.71 000 YY SIDESTREET ST I THU 9 02/11/02 N WET	AINLINE RD E 122 0.70 N 001 I SUN 20 11/05/01 N ICE	ANLINE PD E 422 0.67 N 004 E 1 SUN 20 00/05/02 N - DAR	AINLINE RD E 122 0.71 000 YY SIDESTREET ST I FRI 8 01/31/03 N SNOW	AINLINE RD E 122 0.71 000 YY SIDESTREET ST I TUE 16 06/24/03 N	
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# **APPENDIX V – COLLISION DIAGRAM (OPTIONAL)**