RECEIVED
AUG 06 2014
NORTHFIELD TOWNSHIP

FLEIS&VANDENBRINK

MEMO

VIA EMAIL

To:	**Mr. John Damrath, Principal** **Damrath Group**
From:	**Michael J. Labadie, PE** **Steven J. Russo, E.I.T.** **Fleis & VandenBrink**
CC:	**Mr. Tom Nowatzke** **Nowatzke Truck & Trailer, Inc.**
Date:	**August 5, 2014**
Re:	**Proposed Nowatzke Truck & Trailer Fuel Station** **Northfield Township, Michigan** **Traffic Impact Assessment**

Introduction

This memorandum presents the results of a Traffic Impact Assessment (TIA) for the Nowatzke Truck & Trailer dealership in Northfield Township, Michigan. The project site is located on the east side of Whitmore Lake Road approximately 700 feet south of N. Territorial Road with site access provided via one driveway directly to Whitmore Lake Road and two connections with the Tractor Supply driveway which also connects to Whitmore Lake Road. The proposed development plans include a new fuel station to include 12 gasoline pumps, 4 diesel pumps, and a 2,285 square feet (SF) convenience store. No modifications to site access are proposed as part of the development.

The purpose of this study is to evaluate traffic operations with the proposed project. This TIA has been completed to identify the impacts (if any) of this project on the US-23 & N. Territorial Road interchange, intersection of N. Territorial Road & Whitmore Lake Road, and the site access points. Additionally, vehicle queue lengths from the N. Territorial Road & Whitmore Lake Road intersection were evaluated with respect to the site access points.

The scope of the study was developed based on Fleis & VandenBrink (F&V) knowledge of the study area, understanding of the development program, accepted traffic engineering practice, and methodologies published by the Institute of Transportation Engineers (ITE). The study analyses were completed using Synchro and SimTraffic, Version 8 traffic analysis software.

Data Collection

Existing weekday traffic volume data were collected by F&V between July 16th and 17th, 2014. Vehicular turning movement counts were collected during the AM (7:00 AM to 9:00 AM) and PM (4:00 PM to 6:00 PM) peak periods at all study intersections. The count data at the intersection of N. Territorial Road & Whitmore Lake Road was compared to recent 24-hour count information collected between June 5th and 6th, 2014 obtained from the Southeast Michigan Council of Governments (SEMCOG) website. The results of this comparison indicate that during the AM peak hour traffic volumes on the southbound approach were

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

significantly higher in June than July. This can most likely be attributed to school traffic from Whitmore Lake High School located approximately one mile north of the intersection. In order to account for this, traffic volumes on the southbound approach were adjusted upward and distributed through the intersection and study network based on existing traffic patterns.

These data were used as a baseline to establish existing traffic conditions without the proposed redevelopment. F&V also collected an inventory of existing lane use and traffic controls and obtained existing traffic signal timing information from the Washtenaw Country Road Commission (WCRC) and Michigan Department of Transportation (MDOT).

Existing Conditions

The existing AM and PM peak hour traffic volumes were identified based on the data collected. Peak hour volumes for each intersection were used and through volumes were balanced upward through the study intersections. Existing peak hour vehicle delays and Levels of Service (LOS) were calculated based on the existing lane use and traffic control, the existing peak hour traffic volumes, and the methodologies presented in the *Highway Capacity Manual, 2000* (HCM). Typically, LOS D is considered acceptable, with LOS A representing minimal delay, and LOS F indicating failing conditions. Additionally, SimTraffic network simulations were reviewed to evaluate network operations and vehicle queues. The results of the existing conditions analysis are attached and summarized in Table 1.

These results indicate acceptable vehicle delay and LOS at the Nowatzke and Tractor Supply driveways during both peak hours. At the intersection of N. Territorial Road & Whitmore Lake Road, the intersection operates at an overall LOS E during both peak hours with several approaches and movements operating at a LOS E or F. At the N. Territorial Road & US-23 interchange, the eastbound approach at the northbound entrance / exit ramps operates at a LOS F during the PM peak hour.

Review of network simulations indicates that the eastbound approach at the intersection of N. Territorial Road & Whitmore Lake Road currently experiences a long vehicle queue throughout the duration of the AM peak hour. During the PM peak hour, long vehicle queues are observed for eastbound N. Territorial Road from the US-23 interchange that periodically extend back to Whitmore Lake Road. Further, long vehicle queues are observed for the northbound and westbound approaches at the intersection of N. Territorial Road & Whitmore Lake Road.

As this development is proposed within the next year, and based on stagnant traffic growth patterns in southeast Michigan, future background conditions (without the proposed development) are assumed equal to existing conditions.

Existing Improvements

In order to mitigate current traffic operations at the intersection of N. Territorial Road & Whitmore Lake Road, signal cycle length and timing changes were evaluated; however, the signal at this intersection is fully actuated and responds to allocate green time according to vehicle demands. Therefore, cycle length and signal timing changes would not sufficiently reduce vehicle delays. Subsequently, geometric improvements were evaluated. The results of this analysis indicate that right turn lanes should be constructed on all approaches at the intersection.

With the right turn lanes, intersection operations would be improved to a LOS D during both peak hours and vehicle delay would be reduced on all approaches as shown in Table 2. Several left turn movements would

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

continue to operate at a LOS E or F; however, review of network simulations indicates acceptable traffic operations and significant vehicle queues are not observed for these movements.

At the N. Territorial Road & US-23 interchange, exclusive left turn lanes are not provided at the entrance ramps to US-23 due to the physical constraints of the bridge, which causes the poor operations of the eastbound approach at the northbound ramps during the PM peak hour. MDOT is currently investigating improvements at the interchange which would include replacement of the bridge and roundabouts at the ramp terminals. Based on the low number of site-generated traffic from the proposed fuel station that would travel through the US-23 & N. Territorial Road interchange and the MDOT plan to improve the interchange, it is determined that improvements required to mitigate existing operations are considered to be regional and beyond the scope of this study.

Table 1

Existing Intersection Operations

			AM Peak		PM Peak	
Intersection	Control	Approach	Delay (s/veh)	LOS	Delay (s/veh)	LOS
1. N. Territorial Road & Whitmore Lake Road	Signalized	EB	84.9	F	35.8	D
		WB	33.2	C	64.2	E
		NB	45.5	D	70.1	E
		SB	60.8	E	41.8	D
		Overall	**66.1**	**E**	**59.2**	**E**
2. N. Territorial Road & US-23 SB Ramps	Signalized	EB	10.8	B	5.5	A
		WB	7.3	A	6.1	A
		SB	28.4	C	27.8	C
		Overall	**15.0**	**B**	**9.9**	**A**
3. N. Territorial Road & US-23 NB Ramps	Signalized	EB	8.8	A	96.6	F
		WB	4.3	A	14.1	B
		NB	26.6	C	26.8	C
		SB	24.2	C	21.9	C
		Overall	**10.9**	**B**	**37.7**	**D**
4. Whitmore Lake Road & Nowatzke Drive	STOP (Minor)	WB	20.2	C	14.0	B
		NB	Free		Free	
		SB	0.2	A	0.3	A
5. Whitmore Lake Road & Tractor Supply Drive	STOP (Minor)	WB	9.2	A	14.1	B
		NB	Free		Free	
		SB LT	7.4	A	9.3	A

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

FLEIS&VANDENBRINK

MEMO

Table 2

Existing Intersection Operations With Improvements

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. N. Territorial Road	Signalized	EB	37.4	D	33.1	C
& Whitmore Lake Road		WB	31.7	C	42.5	D
		NB	44.9	D	37.3	D
		SB	54.4	D	42.7	D
		Overall	**42.2**	**D**	**38.6**	**D**

Site Trip Generation and Assignment

The number of AM and PM peak hour vehicle trips that would be generated by the proposed fuel station was forecast based on data published by the Institute of Transportation Engineers (ITE) in *Trip Generation, 9th Edition* and the *Trip Generation Handbook, 2nd Edition.*

As is typical of fuel stations, a portion of the site-generated trips are already present on the adjacent road network and are interrupted to visit the site. These trips are known as "pass-by" trips and account for a percentage of the total site-generated traffic. Pass-by trips result in turning movements at the site driveways, but do not increase traffic volumes on the adjacent road network. The site trip generation forecast is shown in Table 3.

Table 3
Site Trip Generation

Land Use	ITE Code	Amount	Units	Average Daily Traffic	AM Peak Hour In	AM Peak Hour Out	AM Peak Hour Total	PM Peak Hour In	PM Peak Hour Out	PM Peak Hour Total
Gas Station W / Convenience Market	945	16	Pumps	2,604	82	81	163	108	108	216
Pass-By	*AM: 62% PM: 56%*				*51*	*50*	*101*	*60*	*61*	*121*
New Trips					**31**	**31**	**62**	**48**	**47**	**95**

The vehicle trips that would be generated by the proposed redevelopment were assigned to the study road network based on existing peak hour traffic patterns, the proposed site access plan, and the methodologies published by ITE. This methodology indicates that pass-by trips enter and exit the development in their original direction of travel, while new trips will return to their direction of origin. The assumed distribution of new site traffic is summarized in Table 4. Pass-by trips were distributed based on existing traffic patterns along Whitmore Lake Road. These patterns indicate that 85% and 15% of pass-by trips would enter the site from the north / south and exit to the south / north during the AM peak hour, respectively, with the opposite distribution during the PM peak hour.

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

Table 4
New Site Trip Distribution

To / From	via	AM	PM
North	Whitmore Lake Road	31%	5%
South	Whitmore Lake Road	5%	40%
East	N. Territorial Road	14%	34%
West	N. Territorial Road	50%	21%
		100%	100%

Future Conditions

Future peak hour vehicle delays and LOS were calculated at the study intersections based on the future traffic volumes with the proposed fuel station and convenience market. The results of this analysis indicate that the proposed project would not have a significant impact on the intersection of N. Territorial Road & Whitmore Lake Road, as shown in Table 5. With the construction of right turn lanes on all approaches, intersection approaches would continue to operate at a LOS D or better during the AM and PM peak hours, except the southbound approach which would operate at a LOS E during the AM peak hour. However, this approach is three seconds away from being a LOS D and the traffic volumes on this approach used in the analysis were calculated based on 24-hour count information and not actual observed volumes in order to account for school traffic. Therefore, this approach may operate at a LOS D under future conditions based on actual vehicle demands for the southbound approach.

At the site driveways to Whitmore Lake Road, all approaches and movements would operate acceptably at a LOS C or better during both peak hours. Review of the network simulations indicates acceptable traffic operations during the AM peak hour. During the PM peak hour, a long vehicle queue is still observed for the eastbound approach at the N. Territorial Road & US-23 northbound ramps which periodically extends back to Whitmore Lake Road. Further, long vehicle queues are observed for the northbound approach at the intersection of N. Territorial Road & Whitmore Lake Road which periodically blocks the north site driveway. However, these queues dissipate and are not present throughout the duration of the peak hour.

Driveway Turn Lane Warrants

According to WCRC Driveway Standards Section 3.14.1, MDOT Traffic & Safety Notes 603A, 604A, and 605A shall be utilized in order to determine where turn lanes or passing flares shall be required. These standards were utilized to determine the future access configuration at the Nowatzke Driveway to Whitmore Lake Road. The results of this analysis indicate that a left turn lane should be provided at the north Nowatzke Driveway for traffic entering the site off of Whitmore Lake Road.

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

FLEIS&VANDENBRINK

MEMO

improvements required to mitigate existing operations are considered to be regional and beyond the scope of this study.

4. At the intersection of N. Territorial Road & Whitmore Lake Road, right turn lanes should be constructed on all approaches to improve existing traffic operations to a LOS D or better for all approaches during both peak hours.
5. The proposed development would not have a significant impact on the study road network.
6. The site driveways with Whitmore Lake Road will operate acceptably and an ingress left turn lane should be constructed at the north Nowatzke Driveway.

Any questions related to this memorandum, study, analyses, and results should be addressed to Fleis & VandenBrink.

Attached: Traffic Volume Data
SEMCOG Data
Synchro / SimTraffic Results
Driveway Warrants

SJR:mjl

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

FLEIS&VANDENBRINK

MEMO

Table 5

Future Intersection Operations

Intersection	Control	Approach	AM Peak Delay (s/veh)	AM Peak LOS	PM Peak Delay (s/veh)	PM Peak LOS
1. N. Territorial Road & Whitmore Lake Road	Signalized	EB	42.1	D	35.1	D
		WB	34.7	C	41.5	D
		NB	46.2	D	37.7	D
		SB	57.7	E	43.1	D
		Overall	**45.9**	**D**	**38.8**	**D**
2. N. Territorial Road & US-23 SB Ramps	Signalized	EB	10.8	B	5.7	A
		WB	7.4	A	6.7	A
		SB	28.4	C	27.9	C
		Overall	**15.0**	**B**	**10.2**	**B**
3. N. Territorial Road & US-23 NB Ramps	Signalized	EB	8.9	A	135.2	F
		WB	4.3	A	14.6	B
		NB	26.6	C	26.9	C
		SB	24.2	C	21.9	C
		Overall	**10.9**	**B**	**48.4**	**D**
4. Whitmore Lake Road & Nowatzke Drive	STOP (Minor)	WB	11.6	B	16.0	C
		NB	Free		Free	
		SB LT	1.3	A	9.5	A
5. Whitmore Lake Road & Tractor Supply Drive	STOP (Minor)	WB	9.9	A	14.7	B
		NB	Free		Free	
		SB LT	7.4	A	9.4	A

Conclusions

The conclusions of this Traffic Impact Assessment are as follows:

1. **Currently, the intersection of N. Territorial Road & Whitmore Lake Road operates at an overall LOS E during both peak hours with several approaches and movements operating at a LOS E or F.**
2. Currently, the eastbound approach at the US-23 northbound ramps & N. Territorial Road operates at a LOS F during the PM peak hour.
3. Based on the low number of site-generated traffic from the proposed fuel station that would travel through the US-23 & N. Territorial Road interchange and MDOT's plan to improve the interchange,

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334
P: 248.536.0080
F: 248.536.0079
www.fveng.com

Fleis & VandenBrink Engineering, Inc.

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

Project: Nowatzke Truck & Trailer
Weather: Sunny, 70's
Location: Whitmore Lake & Tractor Supply

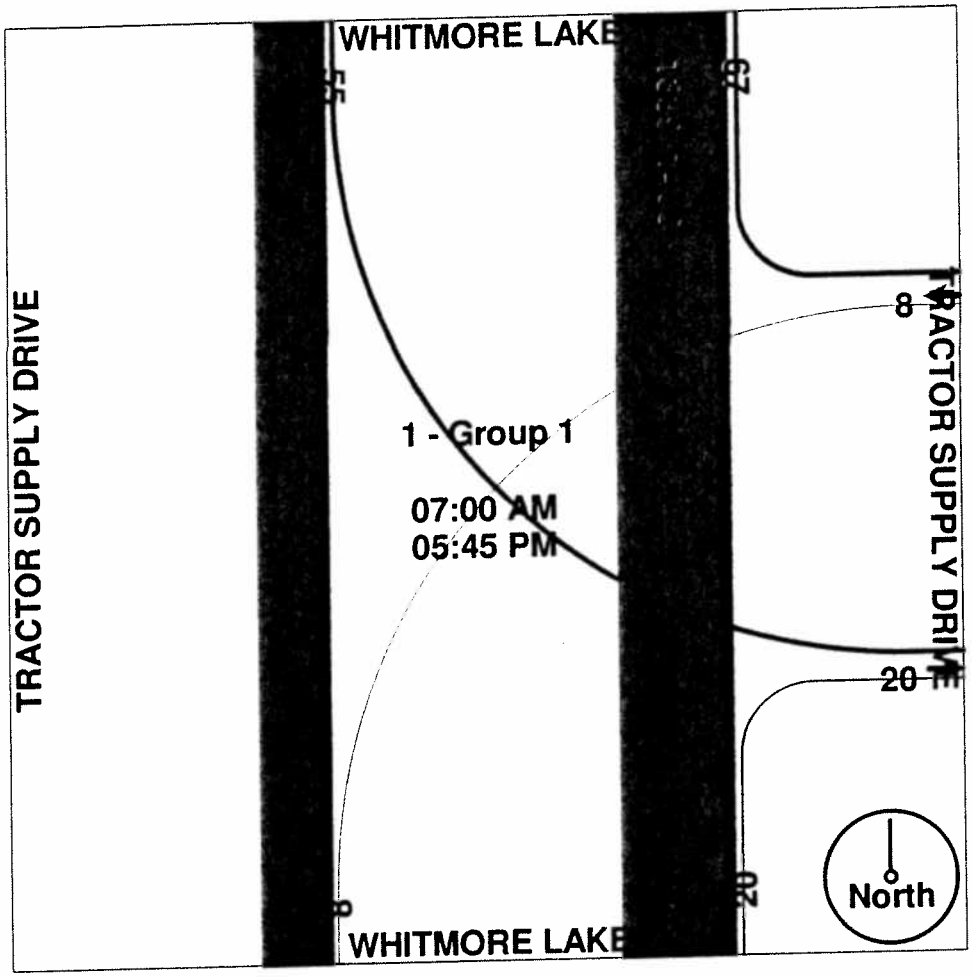
File Name : WHITMO~2
Site Code : 00000000
Start Date : 7/17/2014
Page No : 1

Groups Printed- Group 1

	WHITMORE LAKE Southbound			TRACTOR SUPPLY DRIVE Westbound			WHITMORE LAKE Northbound			TRACTOR SUPPLY DRIVE Eastbound			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
07:00 AM	0	75	1	0	0	0	0	11	0	0	0	0	87
07:15 AM	0	80	1	0	0	0	0	10	0	0	0	0	91
07:30 AM	0	89	1	2	0	0	0	10	0	0	0	0	102
07:45 AM	0	83	3	0	0	1	1	16	0	0	0	0	104
Total	0	327	6	2	0	1	1	47	0	0	0	0	384
08:00 AM	0	75	1	5	0	0	1	15	0	0	0	0	97
08:15 AM	0	76	4	3	0	1	1	15	0	0	0	0	100
08:30 AM	0	83	2	0	0	0	0	18	0	0	0	0	103
08:45 AM	0	72	3	3	0	1	2	20	0	0	0	0	101
Total	0	306	10	11	0	2	4	68	0	0	0	0	401
*** BREAK ***													
04:00 PM	0	38	4	7	0	0	2	118	0	0	0	0	169
04:15 PM	0	37	5	6	0	1	3	139	0	0	0	0	191
04:30 PM	0	28	7	7	0	2	2	161	0	0	0	0	207
04:45 PM	0	24	5	7	0	0	2	182	0	0	0	0	220
Total	0	127	21	27	0	3	9	600	0	0	0	0	787
05:00 PM	0	27	5	5	0	1	4	157	0	0	0	0	199
05:15 PM	0	16	3	7	0	1	1	154	0	0	0	0	182
05:30 PM	0	14	6	8	0	0	1	161	0	0	0	0	190
05:45 PM	0	21	4	7	0	0	0	152	0	0	0	0	184
Total	0	78	18	27	0	2	6	624	0	0	0	0	755
Grand Total	0	838	55	67	0	8	20	1339	0	0	0	0	2327
Apprch %	0.0	93.8	6.2	89.3	0.0	10.7	1.5	98.5	0.0	0.0	0.0	0.0	
Total %	0.0	36.0	2.4	2.9	0.0	0.3	0.9	57.5	0.0	0.0	0.0	0.0	

Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

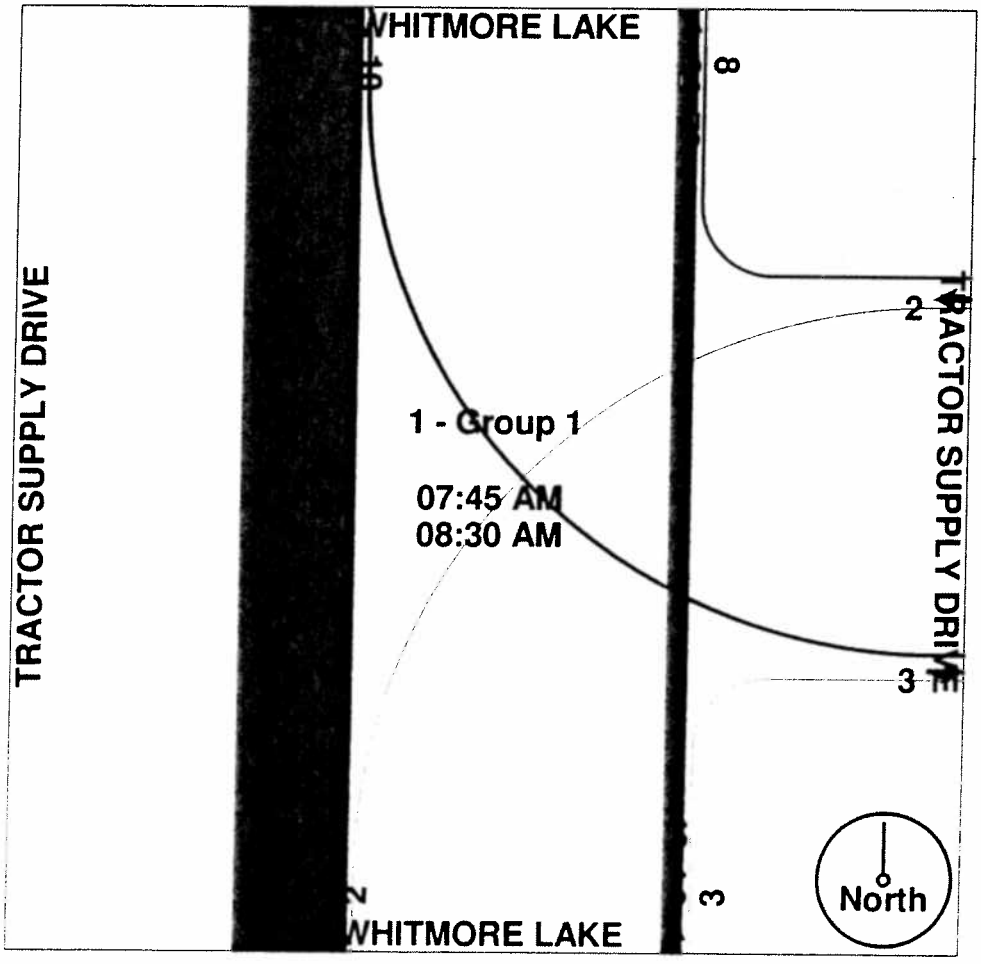
File Name : WHITMO~2
Site Code : 00000000
Start Date : 7/17/2014
Page No : 2



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : WHITMO~2
Site Code : 00000000
Start Date : 7/17/2014
Page No : 3

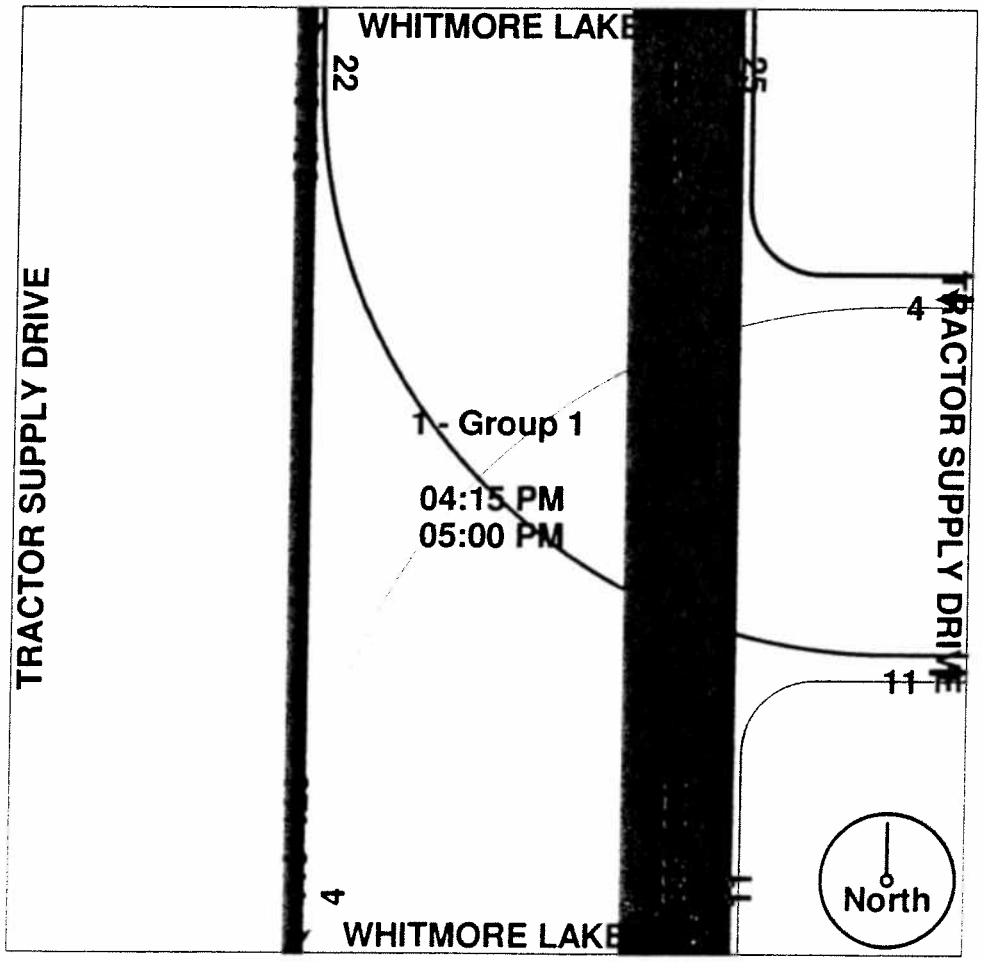
	WHITMORE LAKE Southbound				TRACTOR SUPPLY DRIVE Westbound				WHITMORE LAKE Northbound				TRACTOR SUPPLY DRIVE Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Intersection	07:45 AM																
Volume	0	317	10	327	8	0	2	10	3	64	0	67	0	0	0	0	404
Percent	0.0	96.9	3.1		80.0	0.0	20.0		4.5	95.5	0.0		0.0	0.0	0.0		
07:45 Volume	0	83	3	86	0	0	1	1	1	16	0	17	0	0	0	0	104
Peak Factor																	0.971
High Int.	07:45 AM				08:00 AM				08:30 AM				6:45:00 AM				
Volume	0	83	3	86	5	0	0	5	0	18	0	18					
Peak Factor				0.951				0.500				0.931					



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : WHITMO~2
Site Code : 00000000
Start Date : 7/17/2014
Page No : 4

	WHITMORE LAKE Southbound				TRACTOR SUPPLY DRIVE Westbound				WHITMORE LAKE Northbound				TRACTOR SUPPLY DRIVE Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection 04:15 PM																	
Volume	0	116	22	138	25	0	4	29	11	639	0	650	0	0	0	0	817
Percent	0.0	84.1	15.9		86.2	0.0	13.8		1.7	98.3	0.0		0.0	0.0	0.0		
04:45 Volume	0	24	5	29	7	0	0	7	2	182	0	184	0	0	0	0	220
Peak Factor																	0.928
High Int.	04:15 PM				04:30 PM				04:45 PM								
Volume	0	37	5	42	7	0	2	9	2	182	0	184					
Peak Factor				0.821				0.806				0.883					



Fleis & VandenBrink Engineering, Inc.

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

Project: Nowatzke Truck & Trailer
Weather: Sunny, 70's
Location: Whitmore Lake & Nowatzke Drive

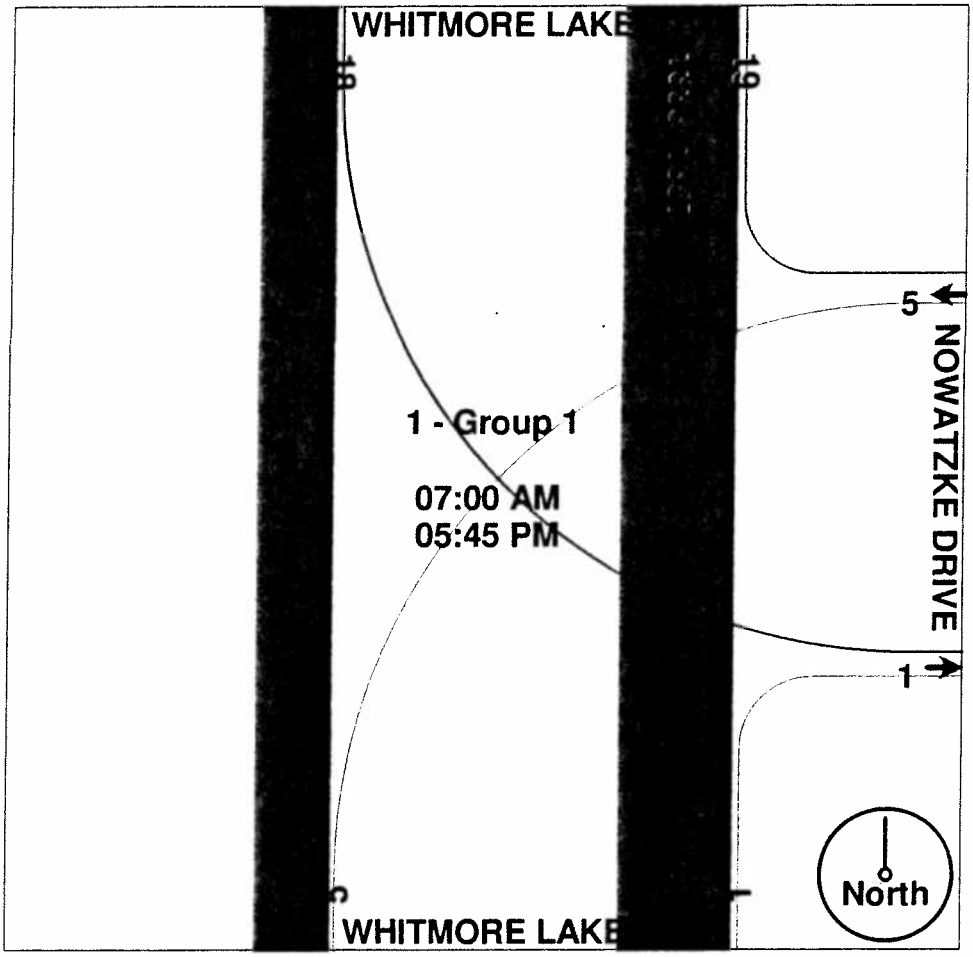
File Name : WHITMO~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 1

Groups Printed- Group 1

	WHITMORE LAKE Southbound			NOWATZKE DRIVE Westbound			WHITMORE LAKE Northbound			Eastbound			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
07:00 AM	0	74	0	0	0	0	0	12	0	0	0	0	86
07:15 AM	0	82	0	0	0	0	0	10	0	0	0	0	92
07:30 AM	0	91	1	1	0	0	0	9	0	0	0	0	102
07:45 AM	0	82	5	0	0	0	0	16	0	0	0	0	103
Total	0	329	6	1	0	0	0	47	0	0	0	0	383
08:00 AM	0	74	1	2	0	0	0	14	0	0	0	0	91
08:15 AM	0	76	2	1	0	0	0	15	0	0	0	0	94
08:30 AM	0	81	1	1	0	0	0	17	0	0	0	0	100
08:45 AM	0	71	1	2	0	0	0	21	0	0	0	0	95
Total	0	302	5	6	0	0	0	67	0	0	0	0	380
*** BREAK ***													
04:00 PM	0	40	0	1	0	0	0	115	0	0	0	0	156
04:15 PM	0	41	2	3	0	0	0	141	0	0	0	0	187
04:30 PM	0	29	1	6	0	3	0	158	0	0	0	0	197
04:45 PM	0	25	0	1	0	1	0	184	0	0	0	0	211
Total	0	135	3	11	0	4	0	598	0	0	0	0	751
05:00 PM	0	31	1	0	0	0	0	159	0	0	0	0	191
05:15 PM	0	18	1	0	0	0	0	154	0	0	0	0	173
05:30 PM	0	19	2	1	0	1	0	162	0	0	0	0	185
05:45 PM	0	22	0	0	0	0	1	151	0	0	0	0	174
Total	0	90	4	1	0	1	1	626	0	0	0	0	723
Grand Total	0	856	18	19	0	5	1	1338	0	0	0	0	2237
Apprch %	0.0	97.9	2.1	79.2	0.0	20.8	0.1	99.9	0.0	0.0	0.0	0.0	
Total %	0.0	38.3	0.8	0.8	0.0	0.2	0.0	59.8	0.0	0.0	0.0	0.0	

Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

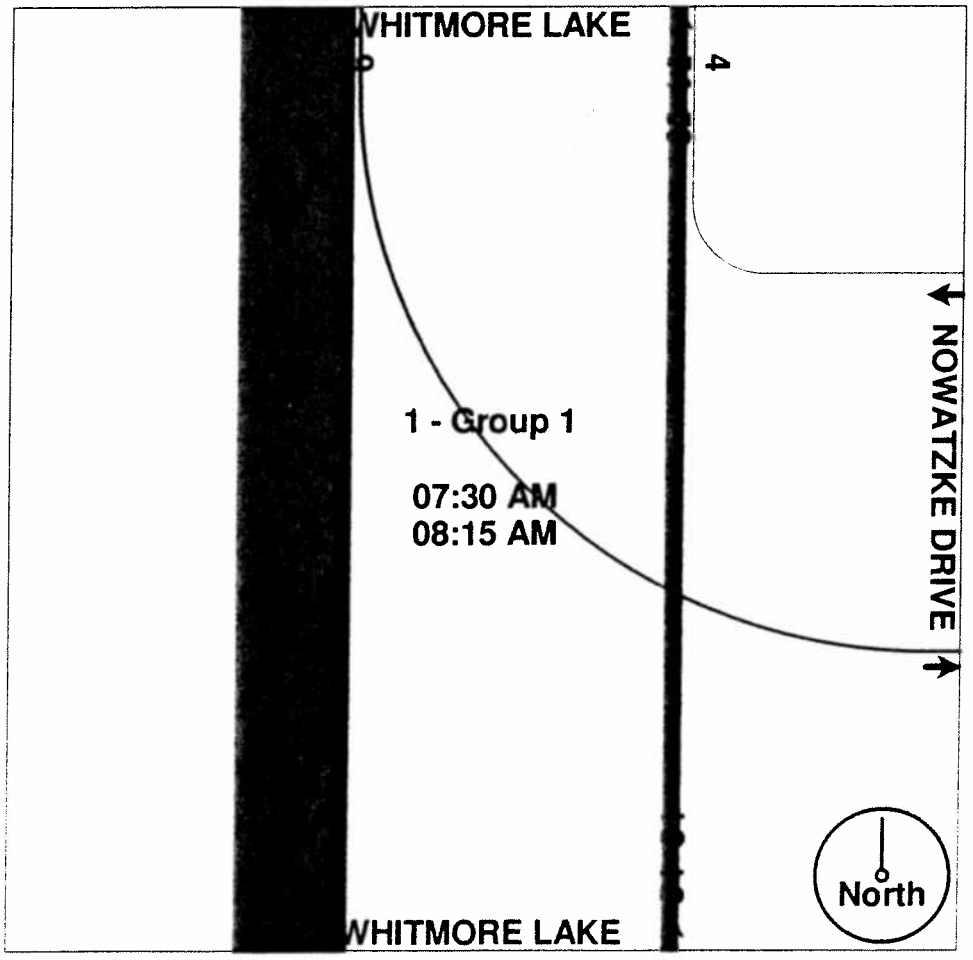
File Name : WHITMO~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 2



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : WHITMO~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 3

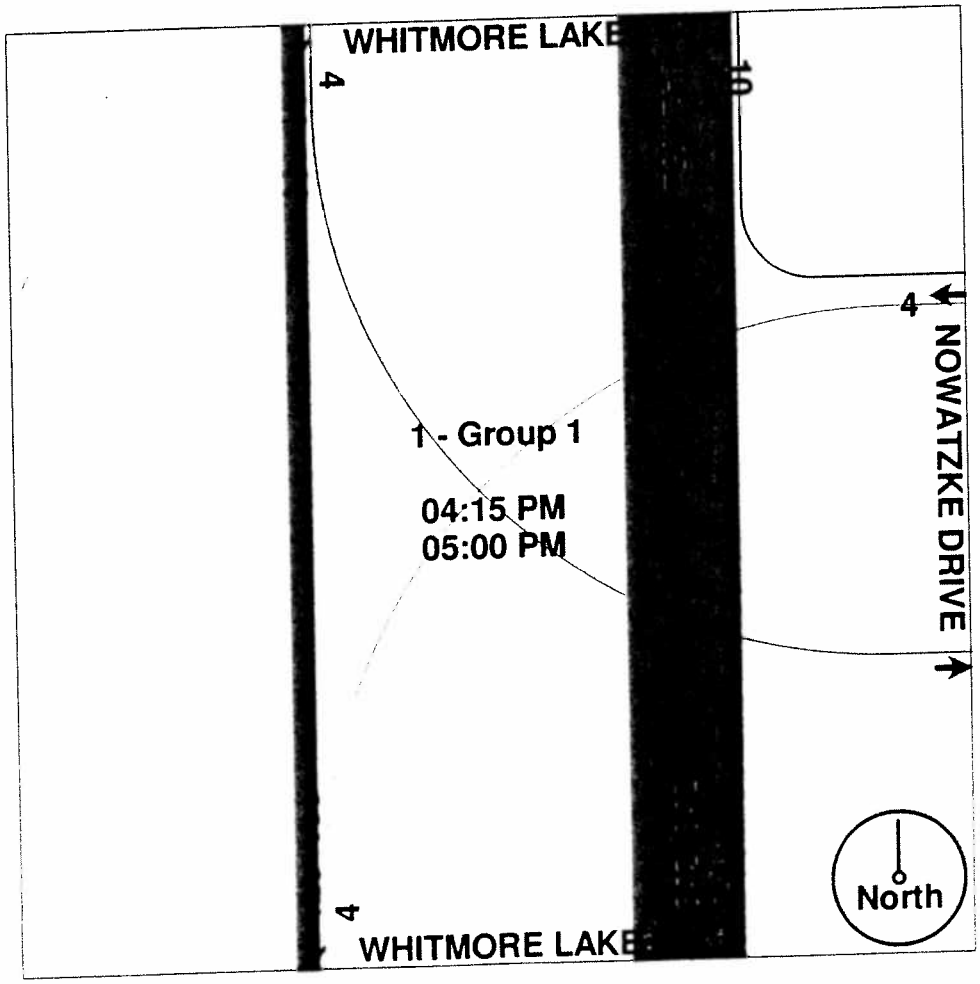
	WHITMORE LAKE Southbound				NOWATZKE DRIVE Westbound				WHITMORE LAKE Northbound				Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Intersection	07:30 AM																
Volume	0	323	9	332	4	0	0	4	0	54	0	54	0	0	0	0	390
Percent	0.0	97.3	2.7		100.0	0.0	0.0		0.0	100.0	0.0		0.0	0.0	0.0		
07:45 Volume	0	82	5	87	0	0	0	0	0	16	0	16	0	0	0	0	103
Peak Factor																	0.947
High Int.	07:30 AM				08:00 AM				07:45 AM				6:45:00 AM				
Volume	0	91	1	92	2	0	0	2	0	16	0	16					
Peak Factor				0.902				0.500				0.844					



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : WHITMO~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 4

	WHITMORE LAKE Southbound				NOWATZKE DRIVE Westbound				WHITMORE LAKE Northbound				Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection 04:15 PM																	
Volume	0	126	4	130	10	0	4	14	0	642	0	642	0	0	0	0	786
Percent	0.0	96.9	3.1		71.4	0.0	28.6		0.0	100.0	0.0		0.0	0.0	0.0		
04:45 Volume	0	25	0	25	1	0	1	2	0	184	0	184	0	0	0	0	211
Peak Factor																	0.931
High Int.	04:15 PM				04:30 PM				04:45 PM								
Volume	0	41	2	43	6	0	3	9	0	184	0	184					
Peak Factor				0.756				0.389				0.872					



Fleis & VandenBrink Engineering, Inc.

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : N. Territorial & Whitmore Lake
Site Code : 00000000
Start Date : 7/16/2014
Page No : 1

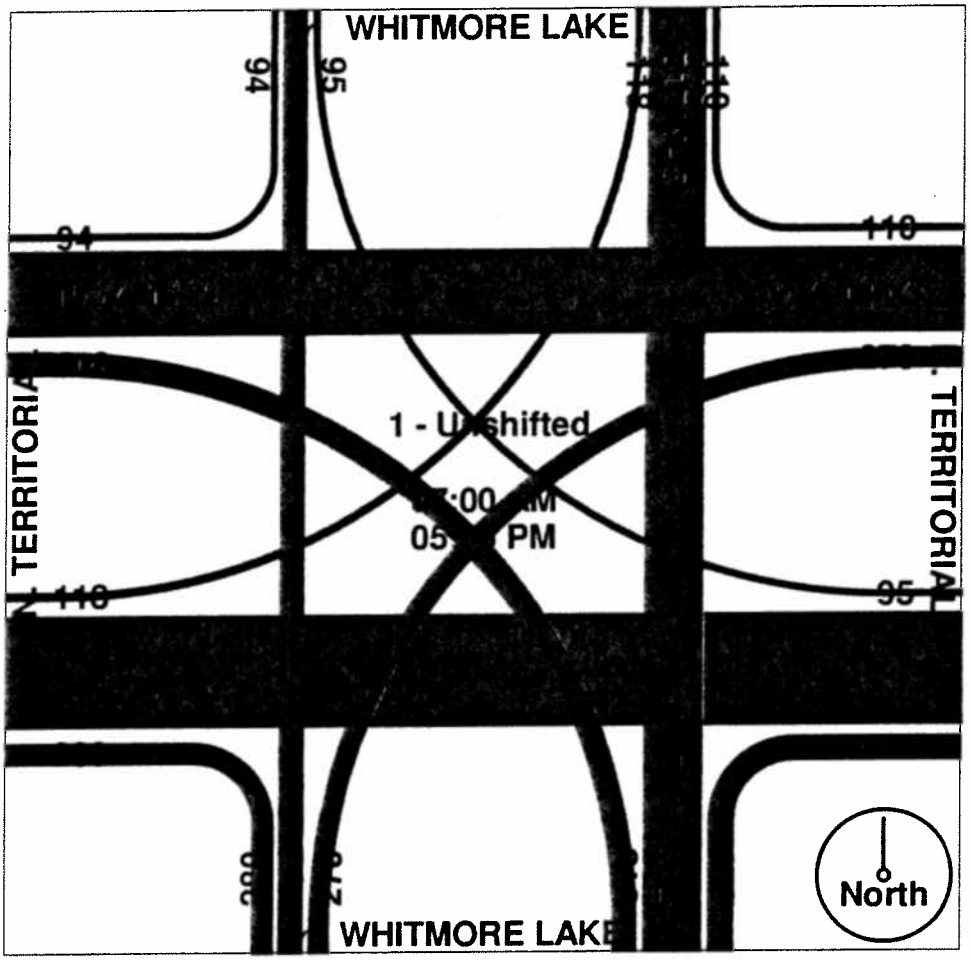
Project: Nowatzke Truck & Trailer
Weather: Sunny, 70's
Location: N. Territorial & Whitmore Lake

Groups Printed- Unshifted

	WHITMORE LAKE Southbound			N. TERRITORIAL Westbound			WHITMORE LAKE Northbound			N. TERRITORIAL Eastbound			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
07:00 AM	4	27	9	1	22	12	4	2	3	37	147	3	271
07:15 AM	5	44	4	2	37	14	4	2	2	29	147	2	292
07:30 AM	5	38	12	1	25	14	7	1	3	33	142	1	282
07:45 AM	5	32	11	0	15	19	9	5	7	28	144	3	278
Total	19	141	36	4	99	59	24	10	15	127	580	9	1123
08:00 AM	4	27	11	1	36	23	7	3	1	32	113	0	258
08:15 AM	3	30	9	3	36	16	12	2	2	27	83	2	225
08:30 AM	2	31	3	1	36	16	11	5	2	29	107	0	243
08:45 AM	6	20	8	5	38	23	17	1	1	24	98	2	243
Total	15	108	31	10	146	78	47	11	6	112	401	4	969
*** BREAK ***													
04:00 PM	3	12	3	12	90	19	36	41	32	11	52	8	319
04:15 PM	5	11	5	4	87	25	37	76	37	7	50	11	355
04:30 PM	9	4	3	10	94	20	43	88	38	4	57	11	381
04:45 PM	7	5	2	11	99	17	42	111	39	2	63	16	414
Total	24	32	13	37	370	81	158	316	146	24	222	46	1469
05:00 PM	13	6	2	25	122	20	19	107	37	3	48	9	411
05:15 PM	7	1	1	11	106	12	19	94	33	4	62	21	371
05:30 PM	8	6	8	7	104	11	28	91	43	3	42	12	363
05:45 PM	8	5	4	16	110	9	32	88	38	7	39	17	373
Total	36	18	15	59	442	52	98	380	151	17	191	59	1518
Grand Total	94	299	95	110	1057	270	327	717	318	280	1394	118	5079
Apprch %	19.3	61.3	19.5	7.7	73.6	18.8	24.0	52.6	23.3	15.6	77.8	6.6	
Total %	1.9	5.9	1.9	2.2	20.8	5.3	6.4	14.1	6.3	5.5	27.4	2.3	

Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

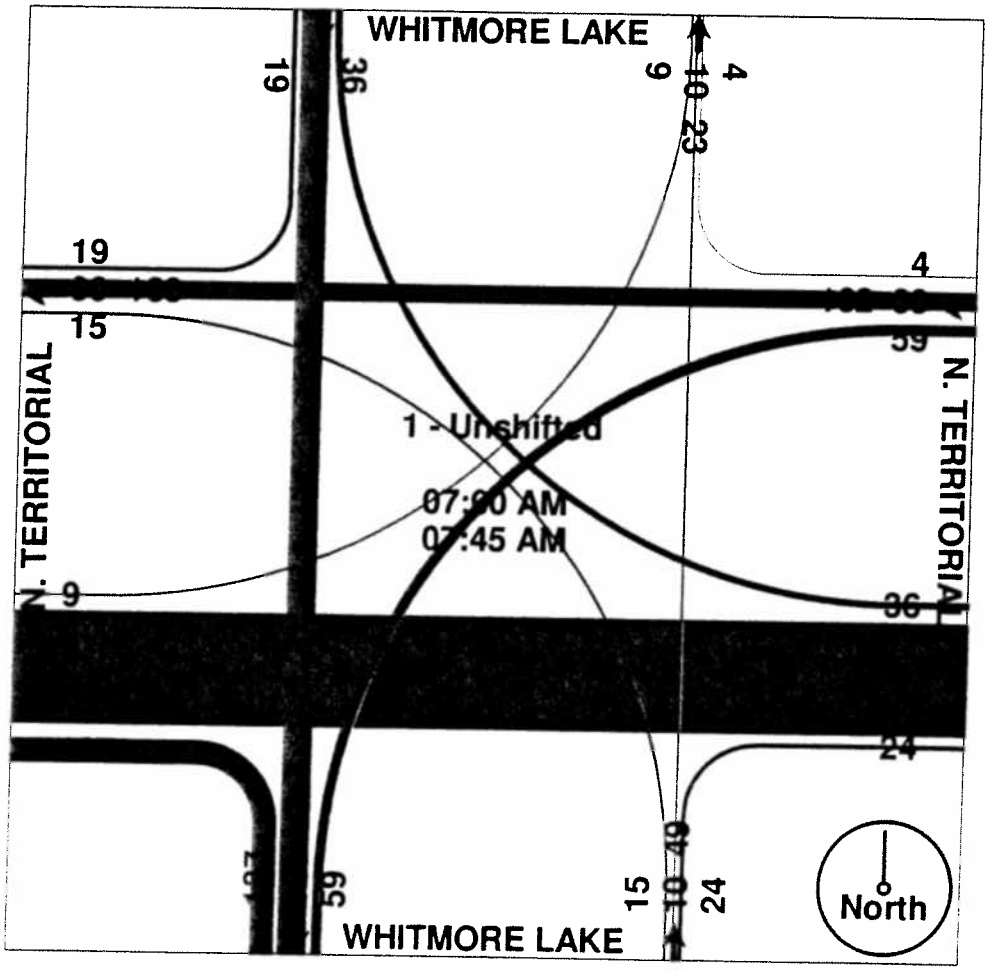
File Name : N. Territorial & Whitmore Lake
Site Code : 00000000
Start Date : 7/16/2014
Page No : 2



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : N. Territorial & Whitmore Lake
Site Code : 00000000
Start Date : 7/16/2014
Page No : 3

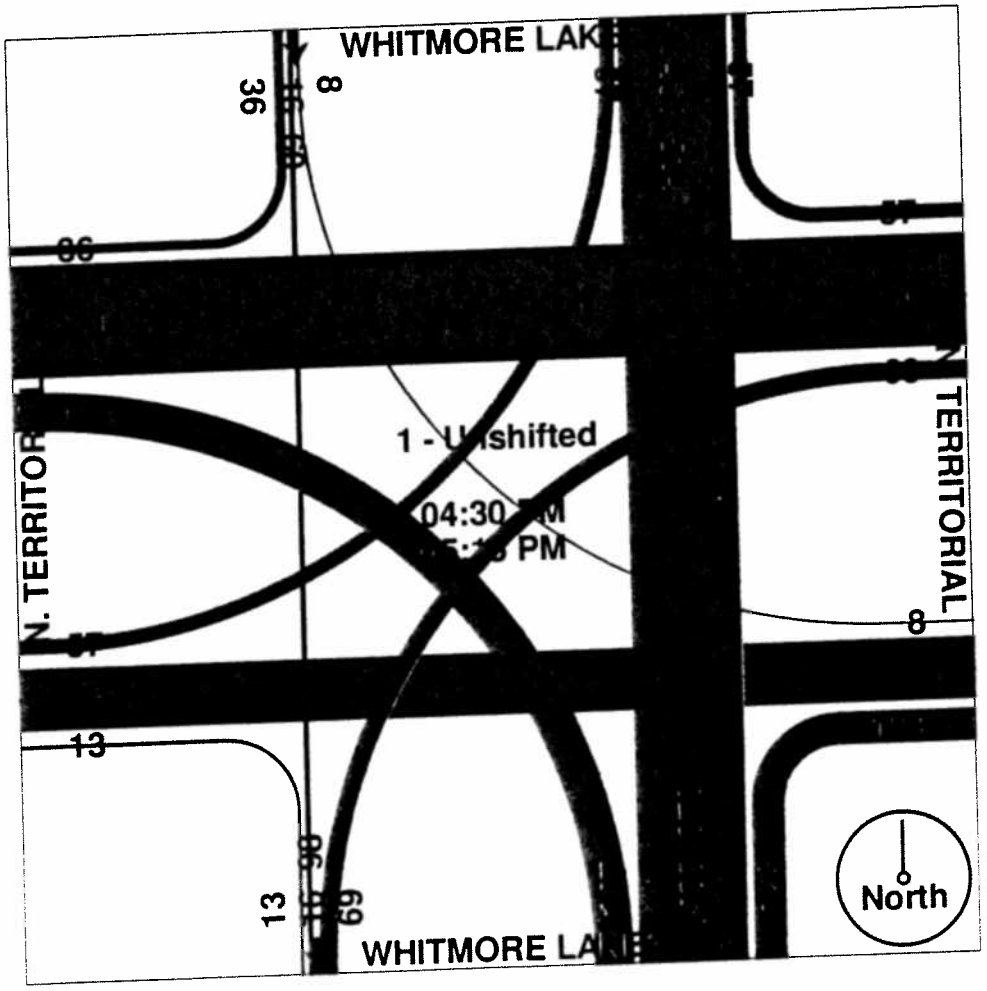
	WHITMORE LAKE Southbound				N. TERRITORIAL Westbound				WHITMORE LAKE Northbound				N. TERRITORIAL Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Intersection 07:00 AM																	
Volume	19	141	36	196	4	99	59	162	24	10	15	49	127	580	9	716	1123
Percent	9.7	71.9	18.4		2.5	61.1	36.4		49.0	20.4	30.6		17.7	81.0	1.3		
07:15 Volume	5	44	4	53	2	37	14	53	4	2	2	8	29	147	2	178	292
Peak Factor																	0.961
High Int.	07:30 AM				07:15 AM				07:45 AM				07:00 AM				
Volume	5	38	12	55	2	37	14	53	9	5	7	21	37	147	3	187	
Peak Factor				0.891				0.764				0.583				0.957	



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : N. Territorial & Whitmore Lake
Site Code : 00000000
Start Date : 7/16/2014
Page No : 4

	WHITMORE LAKE Southbound				N. TERRITORIAL Westbound				WHITMORE LAKE Northbound				N. TERRITORIAL Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:30 PM																
Volume	36	16	8	60	57	421	69	547	123	400	147	670	13	230	57	300	1577
Percent	60.0	26.7	13.3		10.4	77.0	12.6		18.4	59.7	21.9		4.3	76.7	19.0		
04:45 Volume	7	5	2	14	11	99	17	127	42	111	39	192	2	63	16	81	414
Peak Factor																	0.952
High Int.	05:00 PM				05:00 PM				04:45 PM				05:15 PM				
Volume	13	6	2	21	25	122	20	167	42	111	39	192	4	62	21	87	
Peak Factor				0.714				0.819				0.872				0.862	



Fleis & VandenBrink Engineering, Inc.

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

Project: Nowatzke Truck & Trailer
Weather: Sunny, 70's
Location: N. Territorial & SB US-23

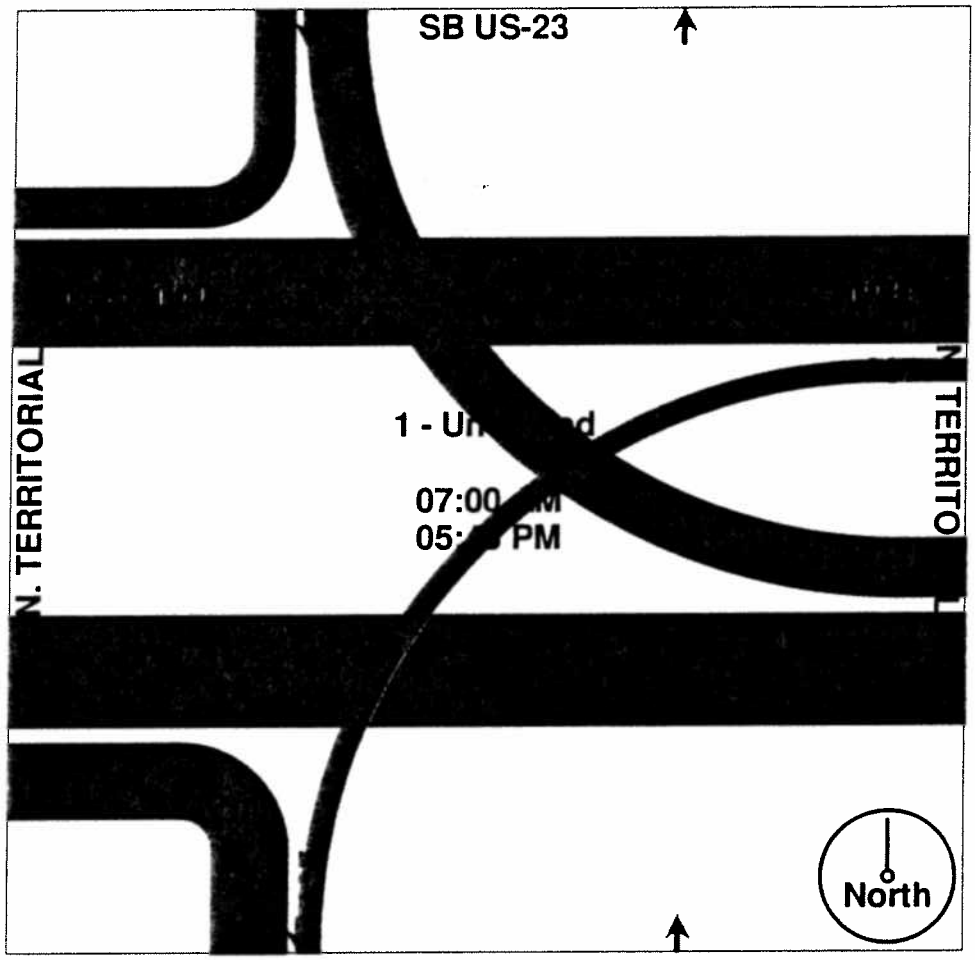
File Name : N. Territorial & SB US-23
Site Code : 00000000
Start Date : 7/16/2014
Page No : 1

Groups Printed- Unshifted

	SB US-23 Southbound			N. TERRITORIAL Westbound			Northbound			N. TERRITORIAL Eastbound			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
07:00 AM	19	0	60	0	18	12	0	0	0	66	68	0	243
07:15 AM	23	0	64	0	32	10	0	0	0	82	93	0	304
07:30 AM	19	0	57	0	22	7	0	0	0	78	86	0	269
07:45 AM	21	0	59	0	32	13	0	0	0	63	96	0	284
Total	82	0	240	0	104	42	0	0	0	289	343	0	1100
08:00 AM	24	0	55	0	33	13	0	0	0	64	83	0	272
08:15 AM	30	0	38	0	37	15	0	0	0	57	60	0	237
08:30 AM	29	0	25	0	23	15	0	0	0	71	56	0	219
08:45 AM	29	0	45	0	34	15	0	0	0	70	54	0	247
Total	112	0	163	0	127	58	0	0	0	262	253	0	975
*** BREAK ***													
04:00 PM	29	0	18	0	98	15	0	0	0	30	61	0	251
04:15 PM	37	0	20	0	87	6	0	0	0	25	60	0	235
04:30 PM	32	0	23	0	99	27	0	0	0	35	91	0	307
04:45 PM	29	0	32	0	112	20	0	0	0	30	81	0	304
Total	127	0	93	0	396	68	0	0	0	120	293	0	1097
05:00 PM	31	0	17	0	113	22	0	0	0	22	71	0	276
05:15 PM	22	0	33	0	126	15	0	0	0	30	55	0	281
05:30 PM	23	0	36	0	105	16	0	0	0	23	44	0	247
05:45 PM	20	0	22	0	120	16	0	0	0	29	77	0	284
Total	96	0	108	0	464	69	0	0	0	104	247	0	1088
Grand Total	417	0	604	0	1091	237	0	0	0	775	1136	0	4260
Apprch %	40.8	0.0	59.2	0.0	82.2	17.8	0.0	0.0	0.0	40.6	59.4	0.0	
Total %	9.8	0.0	14.2	0.0	25.6	5.6	0.0	0.0	0.0	18.2	26.7	0.0	

Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

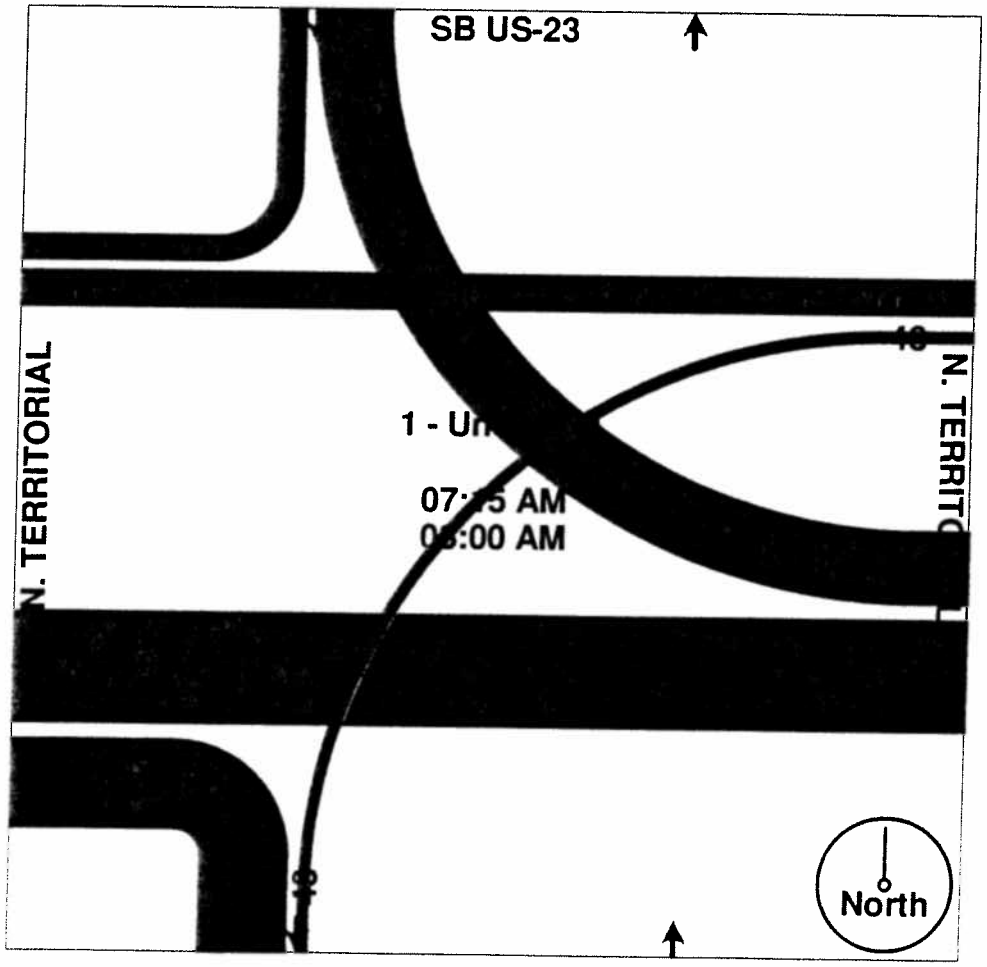
File Name : N. Territorial & SB US-23
Site Code : 00000000
Start Date : 7/16/2014
Page No : 2



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : N. Territorial & SB US-23
Site Code : 00000000
Start Date : 7/16/2014
Page No : 3

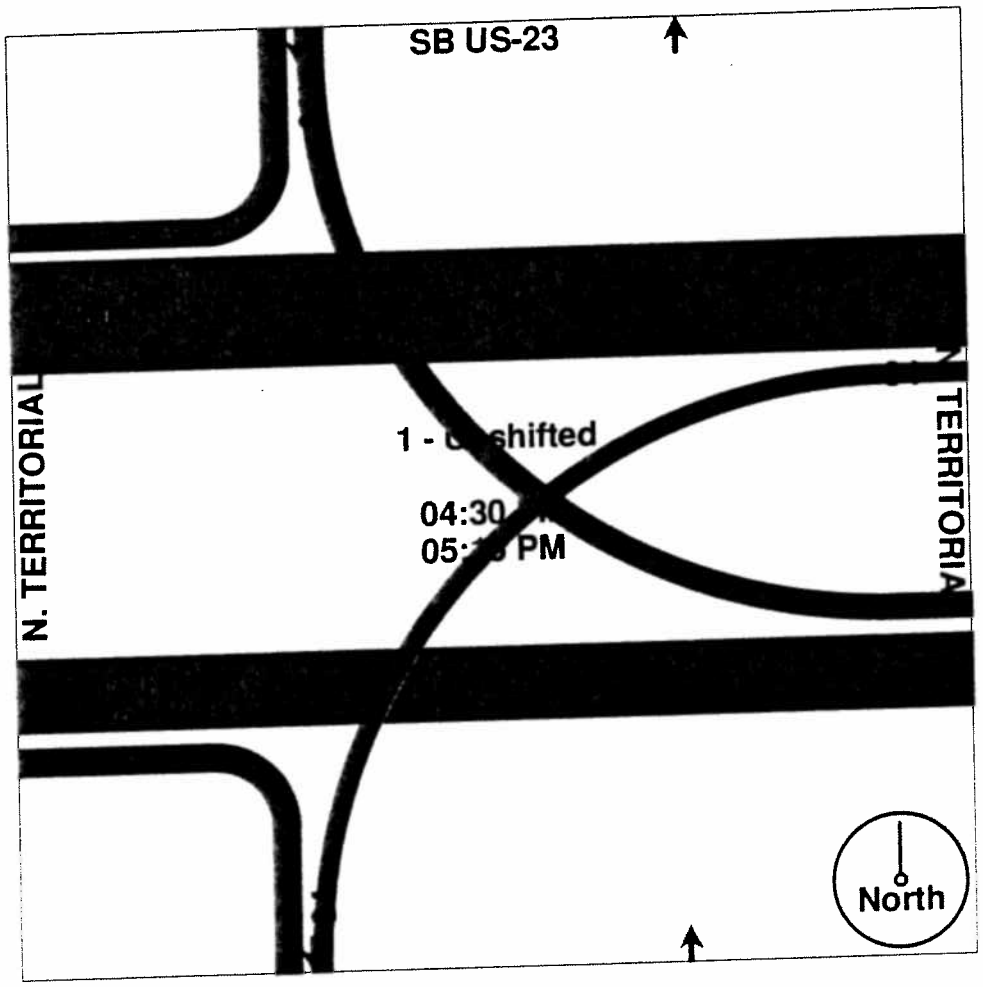
	SB US-23 Southbound				N. TERRITORIAL Westbound				Northbound				N. TERRITORIAL Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	87	0	235	322	0	119	43	162	0	0	0	0	287	358	0	645	1129
Percent	27.0	0.0	73.0		0.0	73.5	26.5		0.0	0.0	0.0		44.5	55.5	0.0		
07:15 Volume	23	0	64	87	0	32	10	42	0	0	0	0	82	93	0	175	304
Peak Factor																	0.928
High Int.	07:15 AM				08:00 AM				6:45:00 AM				07:15 AM				
Volume	23	0	64	87	0	33	13	46	0	0	0	0	82	93	0	175	
Peak Factor				0.925				0.880								0.921	



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : N. Territorial & SB US-23
Site Code : 00000000
Start Date : 7/16/2014
Page No : 4

	SB US-23 Southbound				N. TERRITORIAL Westbound				Northbound				N. TERRITORIAL Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	04:30 PM																
Volume	114	0	105	219	0	450	84	534	0	0	0	0	117	298	0	415	1168
Percent	52.1	0.0	47.9		0.0	84.3	15.7		0.0	0.0	0.0		28.2	71.8	0.0		
04:30 Volume	32	0	23	55	0	99	27	126	0	0	0	0	35	91	0	126	307
Peak Factor																	0.951
High Int.	04:45 PM				05:15 PM								04:30 PM				
Volume	29	0	32	61	0	126	15	141	0	0	0	0	35	91	0	126	
Peak Factor				0.898				0.947								0.823	



Fleis & VandenBrink Engineering, Inc.

27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : NTERRI~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 1

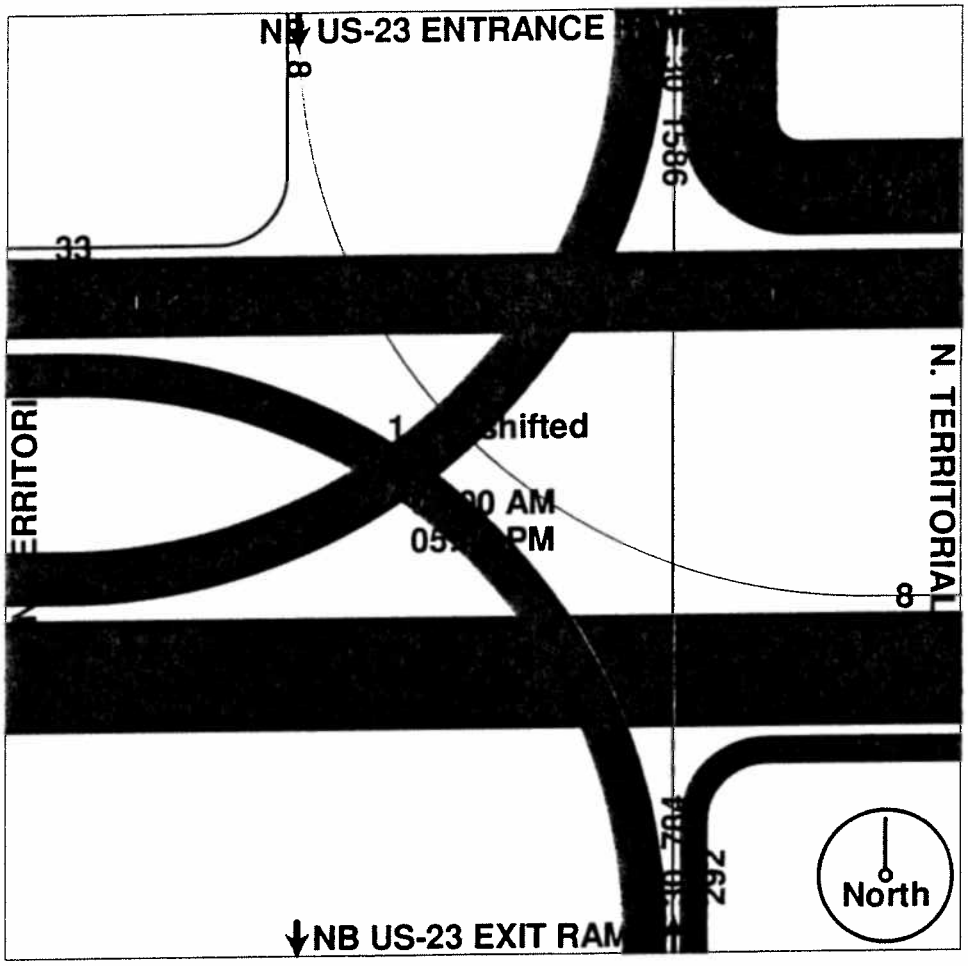
Project: Nowatzke Truck & Trailer
Weather: Sunny, 70's
Location: N. Territorial & US-23 NB

Groups Printed- Unshifted

	NB US-23 ENTRANCE RAMP Southbound			N. TERRITORIAL Westbound			NB US-23 EXIT RAMP Northbound			N. TERRITORIAL Eastbound			
Start Time	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Int. Total
07:00 AM	0	0	0	23	18	0	15	0	9	0	88	15	168
07:15 AM	0	0	0	21	17	0	18	1	15	0	97	36	205
07:30 AM	3	0	2	21	18	0	12	4	10	0	103	25	198
07:45 AM	1	0	0	25	24	0	23	1	20	0	124	27	245
Total	4	0	2	90	77	0	68	6	54	0	412	103	816
08:00 AM	2	0	0	25	32	0	21	5	14	0	99	28	226
08:15 AM	0	0	0	28	26	0	14	2	20	0	91	19	200
08:30 AM	0	0	0	22	24	0	17	2	21	0	81	25	192
08:45 AM	2	0	0	26	20	0	16	0	29	0	73	26	192
Total	4	0	0	101	102	0	68	9	84	0	344	98	810
*** BREAK ***													
04:00 PM	1	0	2	68	58	0	16	3	44	0	48	60	300
04:15 PM	3	0	0	82	74	0	12	2	47	0	54	53	327
04:30 PM	3	0	0	87	88	0	13	3	39	0	50	46	329
04:45 PM	5	0	0	96	62	0	23	3	37	0	44	59	329
Total	12	0	2	333	282	0	64	11	167	0	196	218	1285
05:00 PM	1	0	1	122	108	0	17	2	40	0	64	31	386
05:15 PM	5	0	0	124	76	0	26	1	41	0	47	48	368
05:30 PM	5	0	1	115	93	0	27	0	41	0	51	38	371
05:45 PM	2	0	2	102	95	0	22	1	35	0	63	33	355
Total	13	0	4	463	372	0	92	4	157	0	225	150	1480
Grand Total	33	0	8	987	833	0	292	30	462	0	1177	569	4391
Apprch %	80.5	0.0	19.5	54.2	45.8	0.0	37.2	3.8	58.9	0.0	67.4	32.6	
Total %	0.8	0.0	0.2	22.5	19.0	0.0	6.6	0.7	10.5	0.0	26.8	13.0	

Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

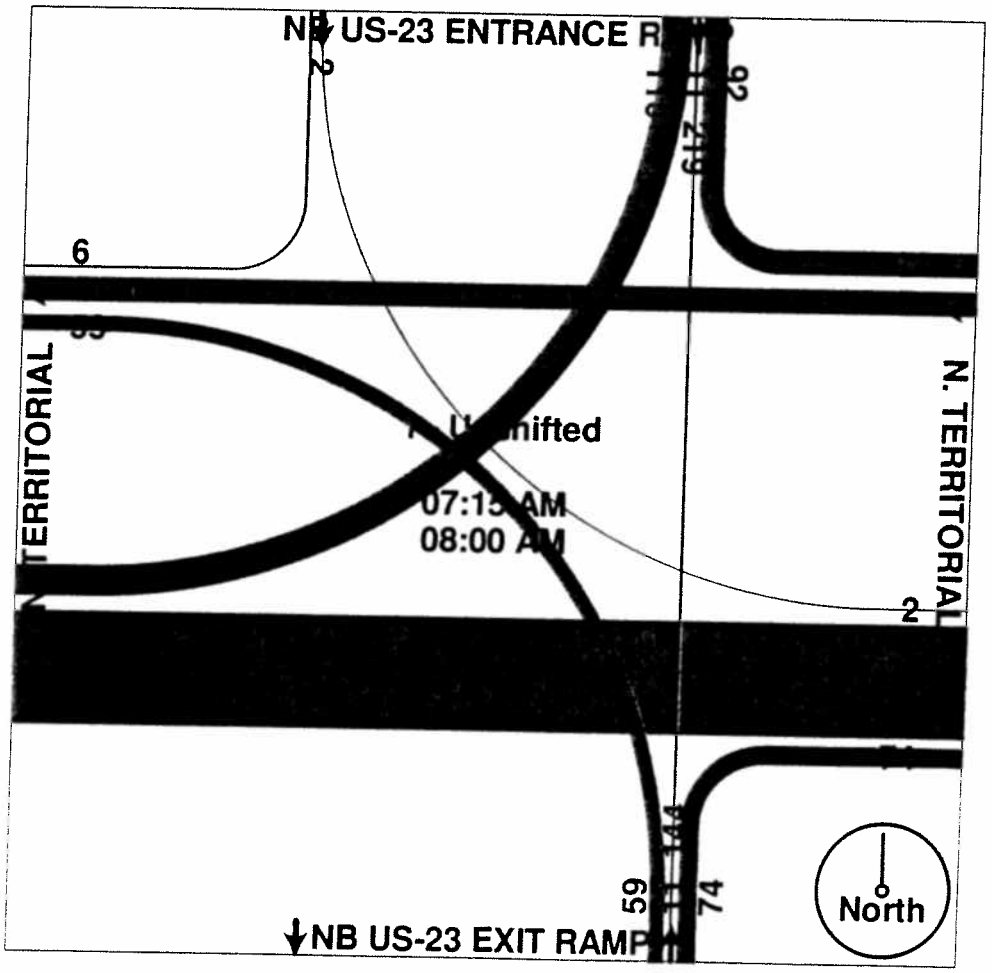
File Name : NTERRI~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 2



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

File Name : NTERRI~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 3

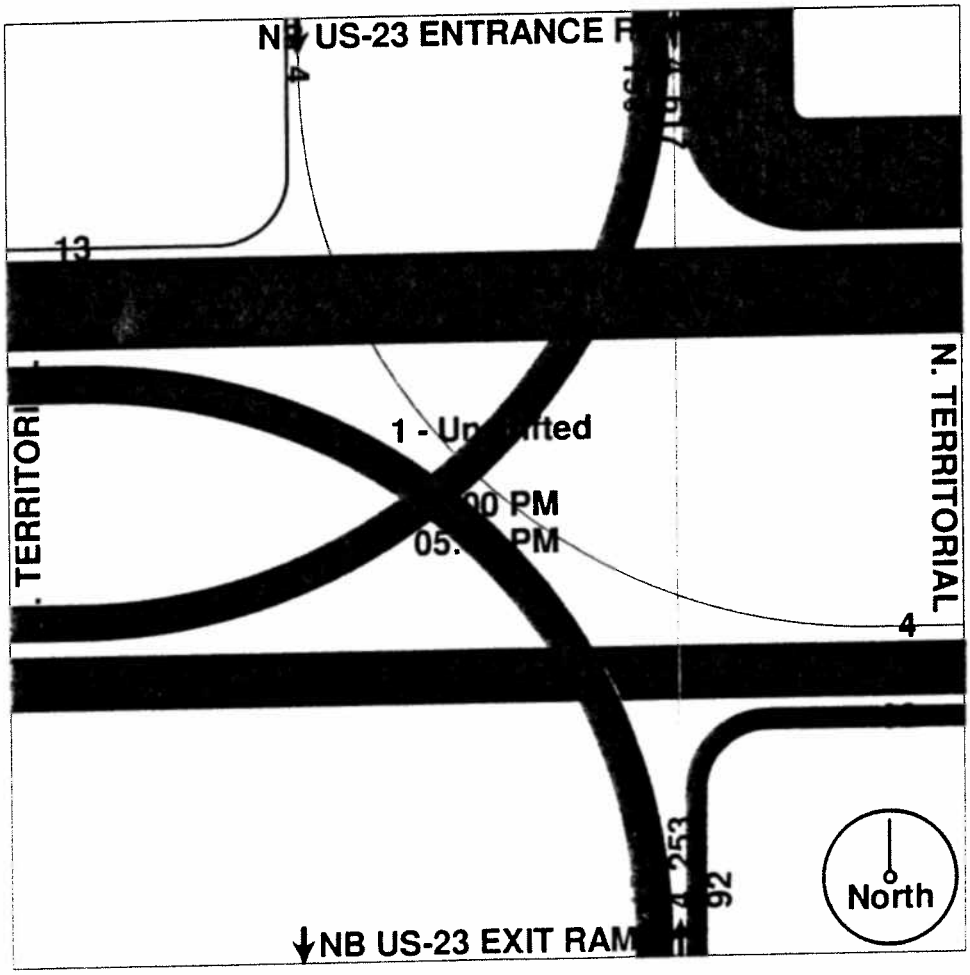
	NB US-23 ENTRANCE RAMP Southbound				N. TERRITORIAL Westbound				NB US-23 EXIT RAMP Northbound				N. TERRITORIAL Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 07:00 AM to 11:45 AM - Peak 1 of 1																	
Intersection	07:15 AM																
Volume	6	0	2	8	92	91	0	183	74	11	59	144	0	423	116	539	874
Percent	75.0	0.0	25.0		50.3	49.7	0.0		51.4	7.6	41.0		0.0	78.5	21.5		
07:45 Volume	1	0	0	1	25	24	0	49	23	1	20	44	0	124	27	151	245
Peak Factor																	0.892
High Int.	07:30 AM				08:00 AM				07:45 AM				07:45 AM				
Volume	3	0	2	5	25	32	0	57	23	1	20	44	0	124	27	151	
Peak Factor				0.400				0.803				0.818				0.892	



Fleis & VandenBrink Engineering, Inc.
27725 Stansbury Boulevard, Suite 150
Farmington Hills, MI 48334

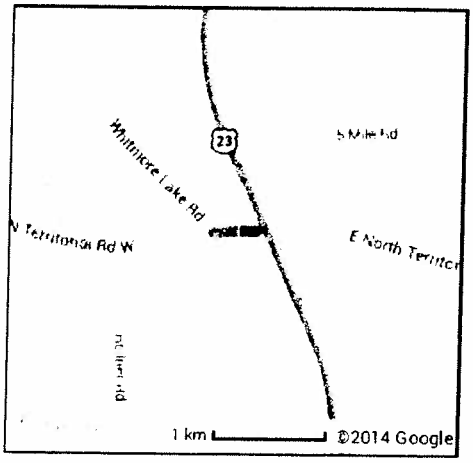
File Name : NTERRI~1
Site Code : 00000000
Start Date : 7/17/2014
Page No : 4

	NB US-23 ENTRANCE RAMP Southbound				N. TERRITORIAL Westbound				NB US-23 EXIT RAMP Northbound				N. TERRITORIAL Eastbound				
Start Time	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Right	Thru	Left	App. Total	Int. Total
Peak Hour From 12:00 PM to 05:45 PM - Peak 1 of 1																	
Intersection	05:00 PM																
Volume	13	0	4	17	463	372	0	835	92	4	157	253	0	225	150	375	1480
Percent	76.5	0.0	23.5		55.4	44.6	0.0		36.4	1.6	62.1		0.0	60.0	40.0		
05:00 Volume	1	0	1	2	122	108	0	230	17	2	40	59	0	64	31	95	386
Peak Factor																	0.959
High Int.	05:30 PM				05:00 PM				05:15 PM				05:45 PM				
Volume	5	0	1	6	122	108	0	230	26	1	41	68	0	63	33	96	
Peak Factor				0.708				0.908				0.930				0.977	



SEMCOG Road Segment Report

Street View



North Territorial Rd from Whitmore Lake Rd to Territorial/S US 23 Ramp

PR 1426409 from mile point 16.903 to mile point 17.126

FALINK ID: 7782

Community: Northfield Twp
County: Washtenaw

Functional Class: 6 - Rural Minor Arterial

Direction:	-
Length:	0.223 miles
Number Lanes, 2012:	2
Posted Speed:	50 (Source:TCO)
Route Classification:	Not a route
Annual Crash Average, 2009-2013:	3
Traffic Volume, 2012:	8,500 (Observed AADT) AADT values are derived from Traffic Counts.
Pavement Type, 2012:	Asphalt
Pavement Rating, 2012:	Poor

Corridor Priorities
Type: Local
Safety: No High Crash Locations
Pavement: High
Bridges: Low
Congestion: Less than 15% of Corridor Congested

Short-Range (TIP) Projects
No TIP projects for this segment.

Long-Range Projects
No long-range projects for this segment.

1001 Woodward Ave Suite 1400 Detroit Michigan 48226 (313) 961-4266

SEMCOG Road Segment Report

Whitmore Lake Rd from Warren Rd to North Territorial Rd

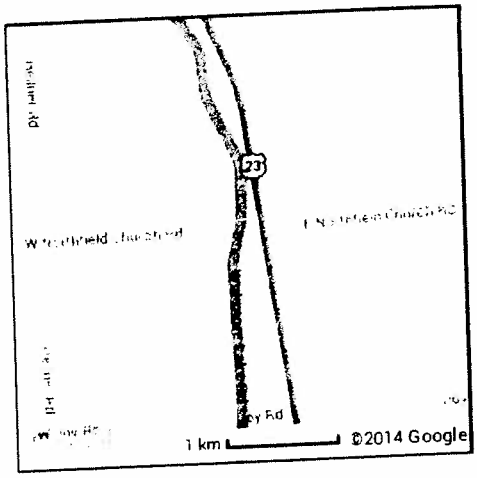
PR 4603187 from mile point 1.900 to mile point 5.456

FALINK ID: 19912

Community: Ann Arbor Twp, Northfield Twp
County: Washtenaw

Functional Class: 6 - Rural Minor Arterial

Street View



Direction:	-
Length:	3.556 miles
Number Lanes, 2012:	2
Posted Speed:	55 (Source:TCO)
Route Classification:	Not a route
Annual Crash Average, 2009-2013:	16
Traffic Volume, 2012:	3,300 (Observed AADT) AADT values are derived from Traffic Counts.
Pavement Type, 2012:	Asphalt
Pavement Rating, 2012:	Fair

Corridor Priorities
Type: Higher Local
Safety: Low
Pavement: Medium
Bridges: Medium
Congestion: Less than 15% of Corridor Congested

Short-Range (TIP) Projects
No TIP projects for this segment.

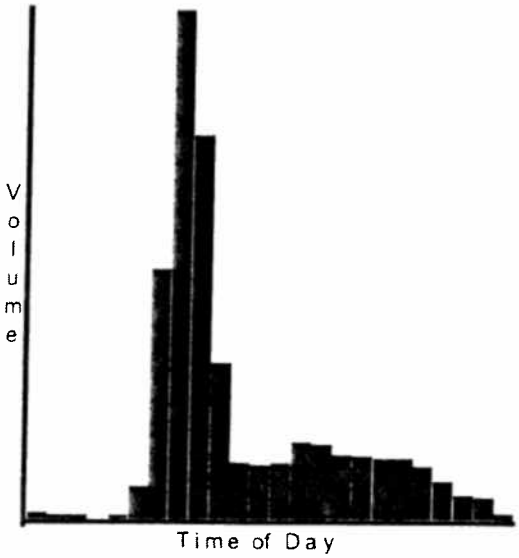
Long-Range Projects
No long-range projects for this segment.

SEMCOG

Transportation Data Management System

Compare Another Count | Close Window

VOLUME COUNT DATA INFO	
Location	0021910011_SB
Type	SPOT
Fnct'l Class	-
County	Northfield Twp
Community	Washtenaw
Located On	Whitmore Lake Rd
From Road	
To Road	
NORTH OF	North Territorial Rd
Loc Dir	SB
Start Date	6/4/2014 12:00:00 PM
End Date	6/5/2014 12:00:00 PM
Start Time	12:00:00 PM
End Time	12:00:00 PM
Count Dir	
Count Source	0021910011
Filename	0021910011.txt
Notes	
Study	
Weather	
Bar	



view detail

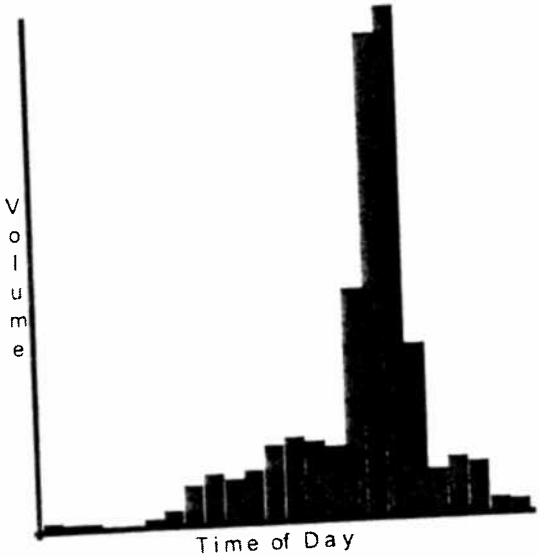
INTERVAL: 15-MIN					
TIME	15-MIN INTERVAL 1st	2nd	3rd	4th	HOURLY COUNT
0:00-1:00	2	0	1	1	4
1:00-2:00	2	0	1	0	3
2:00-3:00	1	2	0	0	3
3:00-4:00	0	1	0	0	1
4:00-5:00	0	0	0	2	2
5:00-6:00	6	4	10	10	30
6:00-7:00	11	20	58	158	247
7:00-8:00	172	111	115	110	508
8:00-9:00	124	112	68	77	381
9:00-10:00	39	62	41	12	154
10:00-11:00	13	16	10	16	55
11:00-12:00	12	13	13	15	53
12:00-13:00	8	10	17	20	55
13:00-14:00	16	17	27	15	75
14:00-15:00	14	14	12	34	74
15:00-16:00	12	17	18	15	62
16:00-17:00	8	17	17	18	60
17:00-18:00	10	14	16	18	58
18:00-19:00	18	11	15	15	59
19:00-20:00	11	6	22	11	50
20:00-21:00	12	5	9	10	36
21:00-22:00	13	6	2	2	23
22:00-23:00	7	3	6	4	20
23:00-24:00	3	0	0	1	4
TOTAL					2,017

SEMCOG

Transportation Data Management System

Compare Another Count | Close Window

VOLUME COUNT DATA INFO	
Location	0022020012_NB
Type	SPOT
Fnct'l Class	-
County	Northfield Twp
Community	Washtenaw
Located On	Whitmore Lake Rd
From Road	
To Road	
SOUTH OF	North Territorial Rd
Loc Dir	NB
Start Date	6/5/2014 9:00:00 AM
End Date	6/6/2014 9:00:00 AM
Start Time	9:00:00 AM
End Time	9:00:00 AM
Count Dir	
Count Source	0022020012
Filename	0022020012.txt
Notes	
Study	
Weather	
Bar	



view detail

INTERVAL: 15-MIN					
TIME	15-MIN INTERVAL				HOURLY COUNT
	1st	2nd	3rd	4th	
0:00-1:00	2	2	2	0	6
1:00-2:00	2	2	0	0	4
2:00-3:00	1	0	1	0	2
3:00-4:00	0	0	1	0	1
4:00-5:00	0	0	0	0	0
5:00-6:00	1	0	0	4	5
6:00-7:00	2	3	7	3	15
7:00-8:00	7	13	13	16	49
8:00-9:00	19	17	11	14	61
9:00-10:00	11	17	13	12	53
10:00-11:00	12	26	12	14	64
11:00-12:00	25	26	22	24	97
12:00-13:00	27	27	21	30	105
13:00-14:00	22	24	23	30	99
14:00-15:00	16	20	28	27	91
15:00-16:00	40	51	85	122	298
16:00-17:00	113	170	170	185	638
17:00-18:00	178	186	171	138	673
18:00-19:00	99	70	34	21	224
19:00-20:00	22	14	13	7	56
20:00-21:00	13	17	13	30	73
21:00-22:00	21	13	15	15	64
22:00-23:00	6	4	4	2	16
23:00-24:00	4	5	1	3	13
TOTAL					2,707

HCM Signalized Intersection Capacity Analysis
1: Whitmore Lake Road & N. Territorial Road

Existing Conditions
AM Peak Hour

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	580	127	75	126	5	23	16	37	82	321	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8		6.8	6.8		6.8	6.8		6.8	6.8	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.99		1.00	0.90		1.00	0.98	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1812		1770	1851		1770	1668		1770	1830	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1812		1770	1851		1770	1668		1770	1830	
Peak-hour factor, PHF	0.95	0.95	0.95	0.76	0.76	0.76	0.60	0.60	0.60	0.89	0.89	0.89
Adj. Flow (vph)	9	611	134	99	166	7	38	27	62	92	361	48
RTOR Reduction (vph)	0	6	0	0	1	0	0	48	0	0	4	0
Lane Group Flow (vph)	9	739	0	99	172	0	38	41	0	92	405	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	1.2	46.5		10.8	56.1		4.5	26.5		8.8	30.8	
Effective Green, g (s)	1.2	46.5		10.8	56.1		4.5	26.5		8.8	30.8	
Actuated g/C Ratio	0.01	0.39		0.09	0.47		0.04	0.22		0.07	0.26	
Clearance Time (s)	6.8	6.8		6.8	6.8		6.8	6.8		6.8	6.8	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		2.0	6.0		2.0	6.0	
Lane Grp Cap (vph)	17	703		159	866		66	368		130	470	
v/s Ratio Prot	0.01	c0.41		c0.06	0.09		0.02	0.02		c0.05	c0.22	
v/s Ratio Perm												
v/c Ratio	0.53	1.05		0.62	0.20		0.58	0.11		0.71	0.86	
Uniform Delay, d1	59.0	36.6		52.5	18.7		56.7	37.2		54.2	42.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.0	48.4		5.4	0.3		7.3	0.4		13.4	16.8	
Delay (s)	72.0	85.1		57.9	19.0		64.1	37.6		67.6	59.3	
Level of Service	E	F		E	B		E	D		E	E	
Approach Delay (s)		84.9			33.2			45.5			60.8	
Approach LOS		F			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	66.1	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	0.95		
Actuated Cycle Length (s)	119.8	Sum of lost time (s)	27.2
Intersection Capacity Utilization	80.6%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
2: US-23 SB Entrance Ramp/US-23 SB Exit Ramp & N. Territorial Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	388	311	43	119	0	0	0	0	235	0	87
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5					5.2		5.2
Lane Util. Factor		1.00			1.00					1.00		1.00
Frt		0.94			1.00					1.00		0.85
Flt Protected		1.00			0.99					0.95		1.00
Satd. Flow (prot)		1751			1838					1770		1583
Flt Permitted		1.00			0.76					0.95		1.00
Satd. Flow (perm)		1751			1422					1770		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.92	0.92	0.92	0.93	0.93	0.93
Adj. Flow (vph)	0	422	338	49	135	0	0	0	0	253	0	94
RTOR Reduction (vph)	0	41	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	719	0	0	184	0	0	0	0	253	0	94
Turn Type		NA		Perm	NA					Perm		Perm
Protected Phases		1			1							
Permitted Phases				1						2		2
Actuated Green, G (s)		44.0			44.0					14.6		14.6
Effective Green, g (s)		44.0			44.0					14.6		14.6
Actuated g/C Ratio		0.63			0.63					0.21		0.21
Clearance Time (s)		5.5			5.5					5.2		5.2
Vehicle Extension (s)		0.2			0.2					3.0		3.0
Lane Grp Cap (vph)		1111			902					372		333
v/s Ratio Prot		c0.41										
v/s Ratio Perm					0.13					c0.14		0.06
v/c Ratio		0.65			0.20					0.68		0.28
Uniform Delay, d1		7.8			5.3					25.2		23.0
Progression Factor		1.00			1.29					1.00		1.00
Incremental Delay, d2		2.9			0.5					5.0		0.5
Delay (s)		10.8			7.3					30.2		23.4
Level of Service		B			A					C		C
Approach Delay (s)		10.8			7.3			0.0			28.4	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.65		
Actuated Cycle Length (s)	69.3	Sum of lost time (s)	10.7
Intersection Capacity Utilization	64.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	134	489	0	0	95	92	61	11	74	2	0	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5		5.2	5.2			5.2	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		1.00			0.93		1.00	0.87			0.90	
Flt Protected		0.99			1.00		0.95	1.00			0.99	
Satd. Flow (prot)		1843			1739		1770	1619			1650	
Flt Permitted		0.87			1.00		0.75	1.00			0.94	
Satd. Flow (perm)		1619			1739		1395	1619			1561	
Peak-hour factor, PHF	0.89	0.89	0.89	0.80	0.80	0.80	0.82	0.82	0.82	0.60	0.60	0.60
Adj. Flow (vph)	151	549	0	0	119	115	74	13	90	3	0	10
RTOR Reduction (vph)	0	0	0	0	37	0	0	0	0	0	11	0
Lane Group Flow (vph)	0	700	0	0	197	0	74	103	0	0	2	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		5			5			6			6	
Permitted Phases	5						6			6		
Actuated Green, G (s)		47.2			47.2		11.4	11.4			11.4	
Effective Green, g (s)		47.2			47.2		11.4	11.4			11.4	
Actuated g/C Ratio		0.68			0.68		0.16	0.16			0.16	
Clearance Time (s)		5.5			5.5		5.2	5.2			5.2	
Vehicle Extension (s)		0.2			0.2		3.0	3.0			3.0	
Lane Grp Cap (vph)		1102			1184		229	266			256	
v/s Ratio Prot					0.11			c0.06				
v/s Ratio Perm		c0.43					0.05				0.00	
v/c Ratio		0.64			0.17		0.32	0.39			0.01	
Uniform Delay, d1		6.2			4.0		25.5	25.8			24.2	
Progression Factor		1.07			1.00		1.00	1.00			1.00	
Incremental Delay, d2		2.2			0.3		0.8	0.9			0.0	
Delay (s)		8.8			4.3		26.4	26.8			24.2	
Level of Service		A			A		C	C			C	
Approach Delay (s)		8.8			4.3			26.6			24.2	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.58		
Actuated Cycle Length (s)	69.3	Sum of lost time (s)	10.7
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
4: Whitmore Lake Road & Nowatzke Drive

Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	0	4	9	514	72	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.60	0.60	0.90	0.90	0.84	0.84
Hourly flow rate (vph)	0	7	10	571	86	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type				TWLTL	TWLTL	
Median storage veh)				2	2	
Upstream signal (ft)				433		
pX, platoon unblocked	0.79					
vC, conflicting volume	677	86	86			
vC1, stage 1 conf vol	86					
vC2, stage 2 conf vol	591					
vCu, unblocked vol	461	86	86			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	100	99	99			
cM capacity (veh/h)	541	973	1511			

Direction, Lane #	WB 1	SE 1	NW 1
Volume Total	7	581	86
Volume Left	0	10	0
Volume Right	7	0	0
cSH	243	1511	1700
Volume to Capacity	0.03	0.01	0.05
Queue Length 95th (ft)	2	0	0
Control Delay (s)	20.2	0.2	0.0
Lane LOS	C	A	
Approach Delay (s)	20.2	0.2	0.0
Approach LOS	C		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	37.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	10	504	64	3	2	8
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.93	0.93	0.60	0.60
Hourly flow rate (vph)	11	531	69	3	3	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1008				
pX, platoon unblocked					0.81	
vC, conflicting volume	72				622	70
vC1, stage 1 conf vol					70	
vC2, stage 2 conf vol					552	
vCu, unblocked vol	72				415	70
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	99
cM capacity (veh/h)	1528				568	992

Direction, Lane #	SE 1	SE 2	NW 1	SW 1
Volume Total	11	531	72	17
Volume Left	11	0	0	3
Volume Right	0	0	3	13
cSH	1528	1700	1700	1240
Volume to Capacity	0.01	0.31	0.04	0.01
Queue Length 95th (ft)	1	0	0	1
Control Delay (s)	7.4	0.0	0.0	9.2
Lane LOS	A			A
Approach Delay (s)	0.1		0.0	9.2
Approach LOS				A

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	36.5%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	283	19	73	440	59	148	402	124	8	46	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8		6.8	6.8		6.8	6.8		6.8	6.8	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.96		1.00	0.93	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1770	1845		1770	1830		1770	1797		1770	1740	
Flt Permitted	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (perm)	1770	1845		1770	1830		1770	1797		1770	1740	
Peak-hour factor, PHF	0.86	0.86	0.86	0.82	0.82	0.82	0.87	0.87	0.87	0.71	0.71	0.71
Adj. Flow (vph)	66	329	22	89	537	72	170	462	143	11	65	51
RTOR Reduction (vph)	0	2	0	0	3	0	0	7	0	0	23	0
Lane Group Flow (vph)	66	349	0	89	606	0	170	598	0	11	93	0
Turn Type	Prot	NA		Prot	NA		Prot	NA		Prot	NA	
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases												
Actuated Green, G (s)	7.1	35.7		8.2	36.8		13.6	36.0		1.1	23.5	
Effective Green, g (s)	7.1	35.7		8.2	36.8		13.6	36.0		1.1	23.5	
Actuated g/C Ratio	0.07	0.33		0.08	0.34		0.13	0.33		0.01	0.22	
Clearance Time (s)	6.8	6.8		6.8	6.8		6.8	6.8		6.8	6.8	
Vehicle Extension (s)	2.0	6.0		2.0	6.0		2.0	6.0		2.0	6.0	
Lane Grp Cap (vph)	116	608		134	622		222	597		17	377	
v/s Ratio Prot	0.04	0.19		c0.05	c0.33		c0.10	c0.33		0.01	0.05	
v/s Ratio Perm												
v/c Ratio	0.57	0.57		0.66	0.97		0.77	1.00		0.65	0.25	
Uniform Delay, d1	49.1	30.0		48.7	35.2		45.8	36.1		53.4	35.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.8	2.6		9.2	29.9		13.2	37.1		49.2	1.0	
Delay (s)	52.8	32.6		57.9	65.1		59.0	73.2		102.6	36.0	
Level of Service	D	C		E	E		E	E		F	D	
Approach Delay (s)		35.8			64.2			70.1			41.8	
Approach LOS		D			E			E			D	

Intersection Summary			
HCM 2000 Control Delay	59.2	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	108.2	Sum of lost time (s)	27.2
Intersection Capacity Utilization	78.3%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	298	117	84	458	0	0	0	0	105	0	114
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5					5.2		5.2
Lane Util. Factor		1.00			1.00					1.00		1.00
Frt		0.96			1.00					1.00		0.85
Flt Protected		1.00			0.99					0.95		1.00
Satd. Flow (prot)		1792			1848					1770		1583
Flt Permitted		1.00			0.86					0.95		1.00
Satd. Flow (perm)		1792			1608					1770		1583
Peak-hour factor, PHF	0.82	0.82	0.82	0.95	0.95	0.95	0.92	0.92	0.92	0.90	0.90	0.90
Adj. Flow (vph)	0	363	143	88	482	0	0	0	0	117	0	127
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	489	0	0	570	0	0	0	0	117	0	127
Turn Type		NA		Perm	NA					Perm		Perm
Protected Phases		1			1							
Permitted Phases				1						2		2
Actuated Green, G (s)		47.2			47.2					10.7		10.7
Effective Green, g (s)		47.2			47.2					10.7		10.7
Actuated g/C Ratio		0.69			0.69					0.16		0.16
Clearance Time (s)		5.5			5.5					5.2		5.2
Vehicle Extension (s)		0.2			0.2					3.0		3.0
Lane Grp Cap (vph)		1232			1106					276		246
v/s Ratio Prot		0.27			c0.35					0.07		c0.08
v/s Ratio Perm												
v/c Ratio		0.40			0.52					0.42		0.52
Uniform Delay, d1		4.6			5.2					26.2		26.6
Progression Factor		1.00			0.93					1.00		1.00
Incremental Delay, d2		1.0			1.2					1.1		1.8
Delay (s)		5.5			6.1					27.2		28.4
Level of Service		A			A					C		C
Approach Delay (s)		5.5			6.1			0.0			27.8	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	9.9	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.51		
Actuated Cycle Length (s)	68.6	Sum of lost time (s)	10.7
Intersection Capacity Utilization	69.9%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	161	242	0	0	372	463	157	4	92	4	0	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5		5.2	5.2			5.2	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		1.00			0.93		1.00	0.86			0.90	
Flt Protected		0.98			1.00		0.95	1.00			0.99	
Satd. Flow (prot)		1826			1723		1770	1594			1653	
Flt Permitted		0.32			1.00		0.74	1.00			0.93	
Satd. Flow (perm)		588			1723		1381	1594			1561	
Peak-hour factor, PHF	0.95	0.95	0.95	0.91	0.91	0.91	0.93	0.93	0.93	0.71	0.71	0.71
Adj. Flow (vph)	169	255	0	0	409	509	169	4	99	6	0	18
RTOR Reduction (vph)	0	0	0	0	62	0	0	0	0	0	19	0
Lane Group Flow (vph)	0	424	0	0	856	0	169	103	0	0	5	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		5			5			6			6	
Permitted Phases	5						6			6		
Actuated Green, G (s)		44.0			44.0		13.9	13.9			13.9	
Effective Green, g (s)		44.0			44.0		13.9	13.9			13.9	
Actuated g/C Ratio		0.64			0.64		0.20	0.20			0.20	
Clearance Time (s)		5.5			5.5		5.2	5.2			5.2	
Vehicle Extension (s)		0.2			0.2		3.0	3.0			3.0	
Lane Grp Cap (vph)		377			1105		279	322			316	
v/s Ratio Prot					0.50			0.06				
v/s Ratio Perm		c0.72					c0.12				0.00	
v/c Ratio		1.12			0.77		0.61	0.32			0.02	
Uniform Delay, d1		12.3			8.8		24.9	23.3			21.9	
Progression Factor		1.06			1.00		1.00	1.00			1.00	
Incremental Delay, d2		83.5			5.3		3.7	0.6			0.0	
Delay (s)		96.6			14.1		28.5	23.9			21.9	
Level of Service		F			B		C	C			C	
Approach Delay (s)		96.6			14.1			26.8			21.9	
Approach LOS		F			B			C			C	

Intersection Summary

HCM 2000 Control Delay	37.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.00		
Actuated Cycle Length (s)	68.6	Sum of lost time (s)	10.7
Intersection Capacity Utilization	98.4%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	4	10	4	134	664	0
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.60	0.60	0.76	0.76	0.87	0.87
Hourly flow rate (vph)	7	17	5	176	763	0
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type				TWLTL	TWLTL	
Median storage veh)				2	2	
Upstream signal (ft)				433		
pX, platoon unblocked						
vC, conflicting volume	950	763	763			
vC1, stage 1 conf vol	763					
vC2, stage 2 conf vol	187					
vCu, unblocked vol	950	763	763			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	96	99			
cM capacity (veh/h)	437	404	849			

Direction, Lane #	WB 1	SE 1	NW 1
Volume Total	23	182	763
Volume Left	7	5	0
Volume Right	17	0	0
cSH	566	849	1700
Volume to Capacity	0.04	0.01	0.45
Queue Length 95th (ft)	3	0	0
Control Delay (s)	14.0	0.3	0.0
Lane LOS	B	A	
Approach Delay (s)	14.0	0.3	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	0.4		
Intersection Capacity Utilization	44.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
5: Whitmore Lake Road & Tractor Supply Drive

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	22	116	639	11	4	25
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.82	0.82	0.88	0.88	0.80	0.80
Hourly flow rate (vph)	27	141	726	12	5	31
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						2
Right turn flare (veh)						
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1008				
pX, platoon unblocked						
vC, conflicting volume	739				928	732
vC1, stage 1 conf vol					732	
vC2, stage 2 conf vol					195	
vCu, unblocked vol	739				928	732
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	97				99	93
cM capacity (veh/h)	868				449	421

Direction, Lane #	SE 1	SE 2	NW 1	SW 1
Volume Total	27	141	739	36
Volume Left	27	0	0	5
Volume Right	0	0	12	31
cSH	868	1700	1700	488
Volume to Capacity	0.03	0.08	0.43	0.07
Queue Length 95th (ft)	2	0	0	6
Control Delay (s)	9.3	0.0	0.0	14.1
Lane LOS	A			B
Approach Delay (s)	1.5		0.0	14.1
Approach LOS				B

Intersection Summary			
Average Delay	0.8		
Intersection Capacity Utilization	44.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	580	127	75	126	5	23	16	37	82	321	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.76	0.76	0.76	0.60	0.60	0.60	0.89	0.89	0.89
Adj. Flow (vph)	9	611	134	99	166	7	38	27	62	92	361	48
RTOR Reduction (vph)	0	0	81	0	0	4	0	0	49	0	0	36
Lane Group Flow (vph)	9	611	53	99	166	3	38	27	13	92	361	12
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases			8			4			6			2
Actuated Green, G (s)	1.2	46.8	46.8	10.7	56.3	56.3	4.5	24.1	24.1	8.7	28.3	28.3
Effective Green, g (s)	1.2	46.8	46.8	10.7	56.3	56.3	4.5	24.1	24.1	8.7	28.3	28.3
Actuated g/C Ratio	0.01	0.40	0.40	0.09	0.48	0.48	0.04	0.21	0.21	0.07	0.24	0.24
Clearance Time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Vehicle Extension (s)	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0
Lane Grp Cap (vph)	18	742	630	161	892	758	67	382	324	131	448	381
v/s Ratio Prot	0.01	c0.33		c0.06	0.09		0.02	0.01		c0.05	c0.19	
v/s Ratio Perm			0.03			0.00			0.01			0.01
v/c Ratio	0.50	0.82	0.08	0.61	0.19	0.00	0.57	0.07	0.04	0.70	0.81	0.03
Uniform Delay, d1	57.9	31.7	22.0	51.4	17.5	16.0	55.5	37.7	37.4	53.1	42.0	34.1
Progression 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
Incremental Delay, d2	7.7	8.6	0.2	4.8	0.3	0.0	6.4	0.2	0.1	13.0	12.0	0.1
Delay (s)	65.6	40.3	22.2	56.2	17.8	16.0	62.0	37.9	37.6	66.1	54.0	34.2
Level of Service	E	D	C	E	B	B	E	D	D	E	D	C
Approach Delay (s)		37.4			31.7			44.9			54.4	
Approach LOS		D			C			D			D	

Intersection Summary

HCM 2000 Control Delay	42.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	117.5	Sum of lost time (s)	27.2
Intersection Capacity Utilization	72.5%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	283	19	73	440	59	148	402	124	8	46	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.86	0.86	0.86	0.82	0.82	0.82	0.87	0.87	0.87	0.71	0.71	0.71
Adj. Flow (vph)	66	329	22	89	537	72	170	462	143	11	65	51
RTOR Reduction (vph)	0	0	15	0	0	47	0	0	97	0	0	43
Lane Group Flow (vph)	66	329	7	89	537	25	170	462	46	11	65	8
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases			8			4			6			2
Actuated Green, G (s)	6.8	34.4	34.4	7.9	35.5	35.5	18.0	33.1	33.1	1.1	16.2	16.2
Effective Green, g (s)	6.8	34.4	34.4	7.9	35.5	35.5	18.0	33.1	33.1	1.1	16.2	16.2
Actuated g/C Ratio	0.07	0.33	0.33	0.08	0.34	0.34	0.17	0.32	0.32	0.01	0.16	0.16
Clearance Time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Vehicle Extension (s)	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0
Lane Grp Cap (vph)	116	618	525	134	637	541	307	594	505	18	291	247
v/s Ratio Prot	0.04	0.18		c0.05	c0.29		c0.10	c0.25		0.01	0.03	
v/s Ratio Perm			0.00			0.02			0.03			0.01
v/c Ratio	0.57	0.53	0.01	0.66	0.84	0.05	0.55	0.78	0.09	0.61	0.22	0.03
Uniform Delay, d1	47.0	28.1	23.3	46.6	31.5	22.8	39.2	32.0	24.7	51.1	38.3	37.1
Progression 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
Incremental Delay, d2	3.8	2.1	0.0	9.2	11.3	0.1	1.2	8.0	0.2	36.2	1.1	0.2
Delay (s)	50.8	30.2	23.3	55.8	42.9	22.9	40.4	40.0	25.0	87.3	39.3	37.3
Level of Service	D	C	C	E	D	C	D	D	C	F	D	D
Approach Delay (s)		33.1			42.5			37.3			42.7	
Approach LOS		C			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.6	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.83		
Actuated Cycle Length (s)	103.7	Sum of lost time (s)	27.2
Intersection Capacity Utilization	67.1%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	9	580	143	79	126	5	39	26	41	82	331	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.95	0.95	0.95	0.76	0.76	0.76	0.60	0.60	0.60	0.89	0.89	0.89
Adj. Flow (vph)	9	611	151	104	166	7	65	43	68	92	372	48
RTOR Reduction (vph)	0	0	89	0	0	4	0	0	52	0	0	36
Lane Group Flow (vph)	9	611	62	104	166	3	65	43	16	92	372	12
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases			8			4			6			2
Actuated Green, G (s)	1.2	46.6	46.6	11.1	56.5	56.5	7.4	28.1	28.1	8.8	29.5	29.5
Effective Green, g (s)	1.2	46.6	46.6	11.1	56.5	56.5	7.4	28.1	28.1	8.8	29.5	29.5
Actuated g/C Ratio	0.01	0.38	0.38	0.09	0.46	0.46	0.06	0.23	0.23	0.07	0.24	0.24
Clearance Time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Vehicle Extension (s)	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0
Lane Grp Cap (vph)	17	712	605	161	864	734	107	429	365	127	451	383
v/s Ratio Prot	0.01	c0.33		c0.06	0.09		0.04	0.02		c0.05	c0.20	
v/s Ratio Perm			0.04			0.00			0.01			0.01
v/c Ratio	0.53	0.86	0.10	0.65	0.19	0.00	0.61	0.10	0.04	0.72	0.82	0.03
Uniform Delay, d1	60.0	34.6	24.2	53.5	19.2	17.5	55.8	36.9	36.4	55.3	43.7	35.2
Progression 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
Incremental Delay, d2	13.0	11.4	0.2	6.5	0.3	0.0	6.5	0.3	0.1	15.9	13.5	0.1
Delay (s)	73.0	46.0	24.4	60.0	19.5	17.5	62.3	37.2	36.5	71.2	57.2	35.3
Level of Service	E	D	C	E	B	B	E	D	D	E	E	D
Approach Delay (s)		42.1			34.7			46.2			57.7	
Approach LOS		D			C			D			E	

Intersection Summary			
HCM 2000 Control Delay	45.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.82		
Actuated Cycle Length (s)	121.8	Sum of lost time (s)	27.2
Intersection Capacity Utilization	82.3%	ICU Level of Service	E
Analysis Period (min)	15		
c Critical Lane Group			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	391	312	43	121	0	0	0	0	235	0	89
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5					5.2		5.2
Lane Util. Factor		1.00			1.00					1.00		1.00
Frt		0.94			1.00					1.00		0.85
Flt Protected		1.00			0.99					0.95		1.00
Satd. Flow (prot)		1751			1839					1770		1583
Flt Permitted		1.00			0.77					0.95		1.00
Satd. Flow (perm)		1751			1425					1770		1583
Peak-hour factor, PHF	0.92	0.92	0.92	0.88	0.88	0.88	0.92	0.92	0.92	0.93	0.93	0.93
Adj. Flow (vph)	0	425	339	49	138	0	0	0	0	253	0	96
RTOR Reduction (vph)	0	41	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	723	0	0	187	0	0	0	0	253	0	96
Turn Type		NA		Perm	NA					Perm		Perm
Protected Phases		1			1							
Permitted Phases				1						2		2
Actuated Green, G (s)		44.0			44.0					14.6		14.6
Effective Green, g (s)		44.0			44.0					14.6		14.6
Actuated g/C Ratio		0.63			0.63					0.21		0.21
Clearance Time (s)		5.5			5.5					5.2		5.2
Vehicle Extension (s)		0.2			0.2					3.0		3.0
Lane Grp Cap (vph)		1111			904					372		333
v/s Ratio Prot		c0.41										
v/s Ratio Perm					0.13					c0.14		0.06
v/c Ratio		0.65			0.21					0.68		0.29
Uniform Delay, d1		7.9			5.3					25.2		23.0
Progression Factor		1.00			1.29					1.00		1.00
Incremental Delay, d2		3.0			0.5					5.0		0.5
Delay (s)		10.8			7.4					30.2		23.5
Level of Service		B			A					C		C
Approach Delay (s)		10.8			7.4			0.0			28.4	
Approach LOS		B			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	15.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	69.3	Sum of lost time (s)	10.7
Intersection Capacity Utilization	65.0%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	136	490	0	0	96	92	62	11	74	2	0	6
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5		5.2	5.2			5.2	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		1.00			0.93		1.00	0.87			0.90	
Flt Protected		0.99			1.00		0.95	1.00			0.99	
Satd. Flow (prot)		1843			1740		1770	1619			1650	
Flt Permitted		0.87			1.00		0.75	1.00			0.94	
Satd. Flow (perm)		1616			1740		1395	1619			1561	
Peak-hour factor, PHF	0.89	0.89	0.89	0.80	0.80	0.80	0.82	0.82	0.82	0.60	0.60	0.60
Adj. Flow (vph)	153	551	0	0	120	115	76	13	90	3	0	10
RTOR Reduction (vph)	0	0	0	0	37	0	0	0	0	0	11	0
Lane Group Flow (vph)	0	704	0	0	198	0	76	103	0	0	2	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		5			5			6			6	
Permitted Phases	5						6			6		
Actuated Green, G (s)		47.2			47.2		11.4	11.4			11.4	
Effective Green, g (s)		47.2			47.2		11.4	11.4			11.4	
Actuated g/C Ratio		0.68			0.68		0.16	0.16			0.16	
Clearance Time (s)		5.5			5.5		5.2	5.2			5.2	
Vehicle Extension (s)		0.2			0.2		3.0	3.0			3.0	
Lane Grp Cap (vph)		1100			1185		229	266			256	
v/s Ratio Prot					0.11			c0.06				
v/s Ratio Perm		c0.44					0.05				0.00	
v/c Ratio		0.64			0.17		0.33	0.39			0.01	
Uniform Delay, d1		6.2			4.0		25.6	25.8			24.2	
Progression Factor		1.07			1.00		1.00	1.00			1.00	
Incremental Delay, d2		2.2			0.3		0.9	0.9			0.0	
Delay (s)		8.9			4.3		26.4	26.8			24.2	
Level of Service		A			A		C	C			C	
Approach Delay (s)		8.9			4.3			26.6			24.2	
Approach LOS		A			A			C			C	

Intersection Summary			
HCM 2000 Control Delay	10.9	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	69.3	Sum of lost time (s)	10.7
Intersection Capacity Utilization	67.6%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	33	29	64	489	77	3
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.60	0.60	0.90	0.90	0.84	0.84
Hourly flow rate (vph)	55	48	71	543	92	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type				TWLTL	TWLTL	
Median storage veh)				2	2	
Upstream signal (ft)				433		
pX, platoon unblocked	0.81					
vC, conflicting volume	779	93	95			
vC1, stage 1 conf vol	93					
vC2, stage 2 conf vol	686					
vCu, unblocked vol	610	93	95			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	88	95	95			
cM capacity (veh/h)	458	964	1499			

Direction, Lane #	WB 1	SE 1	NW 1
Volume Total	103	614	95
Volume Left	55	71	0
Volume Right	48	0	4
cSH	860	1499	1700
Volume to Capacity	0.12	0.05	0.06
Queue Length 95th (ft)	10	4	0
Control Delay (s)	11.6	1.3	0.0
Lane LOS	B	A	
Approach Delay (s)	11.6	1.3	0.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	45.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	28	494	59	9	12	21
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.95	0.95	0.93	0.93	0.60	0.60
Hourly flow rate (vph)	29	520	63	10	20	35
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1008				
pX, platoon unblocked					0.84	
vC, conflicting volume	73				647	68
vC1, stage 1 conf vol					68	
vC2, stage 2 conf vol					579	
vCu, unblocked vol	73				482	68
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	98				96	96
cM capacity (veh/h)	1527				539	995

Direction, Lane #	SE 1	SE 2	NW 1	SW 1
Volume Total	29	520	73	55
Volume Left	29	0	0	20
Volume Right	0	0	10	35
cSH	1527	1700	1700	1481
Volume to Capacity	0.02	0.31	0.04	0.04
Queue Length 95th (ft)	1	0	0	3
Control Delay (s)	7.4	0.0	0.0	9.9
Lane LOS	A			A
Approach Delay (s)	0.4		0.0	9.9
Approach LOS				A

Intersection Summary			
Average Delay	1.1		
Intersection Capacity Utilization	36.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	57	283	29	89	440	59	158	404	140	8	49	36
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (perm)	1770	1863	1583	1770	1863	1583	1770	1863	1583	1770	1863	1583
Peak-hour factor, PHF	0.86	0.86	0.86	0.82	0.82	0.82	0.87	0.87	0.87	0.71	0.71	0.71
Adj. Flow (vph)	66	329	34	109	537	72	182	464	161	11	69	51
RTOR Reduction (vph)	0	0	23	0	0	47	0	0	98	0	0	43
Lane Group Flow (vph)	66	329	11	109	537	25	182	464	63	11	69	8
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm	Prot	NA	Perm
Protected Phases	3	8		7	4		1	6		5	2	
Permitted Phases			8			4			6			2
Actuated Green, G (s)	6.9	32.2	32.2	10.5	35.8	35.8	18.3	33.2	33.2	1.1	16.0	16.0
Effective Green, g (s)	6.9	32.2	32.2	10.5	35.8	35.8	18.3	33.2	33.2	1.1	16.0	16.0
Actuated g/C Ratio	0.07	0.31	0.31	0.10	0.34	0.34	0.18	0.32	0.32	0.01	0.15	0.15
Clearance Time (s)	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8	6.8
Vehicle Extension (s)	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0	2.0	6.0	6.0
Lane Grp Cap (vph)	117	575	489	178	640	543	310	593	504	18	286	243
v/s Ratio Prot	0.04	0.18		c0.06	c0.29		c0.10	c0.25		0.01	0.04	
v/s Ratio Perm			0.01			0.02			0.04			0.00
v/c Ratio	0.56	0.57	0.02	0.61	0.84	0.05	0.59	0.78	0.12	0.61	0.24	0.03
Uniform Delay, d1	47.2	30.2	25.0	44.9	31.5	22.8	39.5	32.2	25.2	51.3	38.8	37.5
Progression 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
Incremental Delay, d2	3.7	2.7	0.1	4.3	10.9	0.1	1.8	8.2	0.3	36.2	1.2	0.2
Delay (s)	50.9	33.0	25.1	49.2	42.5	22.9	41.3	40.4	25.5	87.5	40.0	37.7
Level of Service	D	C	C	D	D	C	D	D	C	F	D	D
Approach Delay (s)		35.1			41.5			37.7			43.1	
Approach LOS		D			D			D			D	

Intersection Summary			
HCM 2000 Control Delay	38.8	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.85		
Actuated Cycle Length (s)	104.2	Sum of lost time (s)	27.2
Intersection Capacity Utilization	67.3%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	0	311	120	84	471	0	0	0	0	105	0	117
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5					5.2		5.2
Lane Util. Factor		1.00			1.00					1.00		1.00
Frt		0.96			1.00					1.00		0.85
Flt Protected		1.00			0.99					0.95		1.00
Satd. Flow (prot)		1793			1849					1770		1583
Flt Permitted		1.00			0.86					0.95		1.00
Satd. Flow (perm)		1793			1606					1770		1583
Peak-hour factor, PHF	0.82	0.82	0.82	0.95	0.95	0.95	0.92	0.92	0.92	0.90	0.90	0.90
Adj. Flow (vph)	0	379	146	88	496	0	0	0	0	117	0	130
RTOR Reduction (vph)	0	17	0	0	0	0	0	0	0	0	0	0
Lane Group Flow (vph)	0	508	0	0	584	0	0	0	0	117	0	130
Turn Type		NA		Perm	NA					Perm		Perm
Protected Phases		1			1							
Permitted Phases				1						2		2
Actuated Green, G (s)		47.2			47.2					10.8		10.8
Effective Green, g (s)		47.2			47.2					10.8		10.8
Actuated g/C Ratio		0.69			0.69					0.16		0.16
Clearance Time (s)		5.5			5.5					5.2		5.2
Vehicle Extension (s)		0.2			0.2					3.0		3.0
Lane Grp Cap (vph)		1231			1103					278		248
v/s Ratio Prot		0.28										
v/s Ratio Perm					c0.36					0.07		c0.08
v/c Ratio		0.41			0.53					0.42		0.52
Uniform Delay, d1		4.7			5.3					26.1		26.6
Progression Factor		1.00			1.02					1.00		1.00
Incremental Delay, d2		1.0			1.3					1.0		2.0
Delay (s)		5.7			6.7					27.2		28.6
Level of Service		A			A					C		C
Approach Delay (s)		5.7			6.7			0.0			27.9	
Approach LOS		A			A			A			C	

Intersection Summary			
HCM 2000 Control Delay	10.2	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.53		
Actuated Cycle Length (s)	68.7	Sum of lost time (s)	10.7
Intersection Capacity Utilization	71.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	164	252	0	0	382	463	160	4	92	4	0	13
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		5.5			5.5		5.2	5.2			5.2	
Lane Util. Factor		1.00			1.00		1.00	1.00			1.00	
Frt		1.00			0.93		1.00	0.86			0.90	
Flt Protected		0.98			1.00		0.95	1.00			0.99	
Satd. Flow (prot)		1827			1725		1770	1594			1653	
Flt Permitted		0.30			1.00		0.74	1.00			0.93	
Satd. Flow (perm)		563			1725		1381	1594			1562	
Peak-hour factor, PHF	0.95	0.95	0.95	0.91	0.91	0.91	0.93	0.93	0.93	0.71	0.71	0.71
Adj. Flow (vph)	173	265	0	0	420	509	172	4	99	6	0	18
RTOR Reduction (vph)	0	0	0	0	61	0	0	0	0	0	19	0
Lane Group Flow (vph)	0	438	0	0	868	0	172	103	0	0	5	0
Turn Type	Perm	NA			NA		Perm	NA		Perm	NA	
Protected Phases		5			5			6			6	
Permitted Phases	5						6			6		
Actuated Green, G (s)		44.0			44.0		14.0	14.0			14.0	
Effective Green, g (s)		44.0			44.0		14.0	14.0			14.0	
Actuated g/C Ratio		0.64			0.64		0.20	0.20			0.20	
Clearance Time (s)		5.5			5.5		5.2	5.2			5.2	
Vehicle Extension (s)		0.2			0.2		3.0	3.0			3.0	
Lane Grp Cap (vph)		360			1104		281	324			318	
v/s Ratio Prot					0.50			0.06				
v/s Ratio Perm		c0.78					c0.12				0.00	
v/c Ratio		1.22			0.79		0.61	0.32			0.02	
Uniform Delay, d1		12.4			8.9		24.9	23.3			21.8	
Progression Factor		1.29			1.00		1.00	1.00			1.00	
Incremental Delay, d2		119.2			5.7		3.9	0.6			0.0	
Delay (s)		135.2			14.6		28.8	23.9			21.9	
Level of Service		F			B		C	C			C	
Approach Delay (s)		135.2			14.6			26.9			21.9	
Approach LOS		F			B			C			C	

Intersection Summary

HCM 2000 Control Delay	48.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.07		
Actuated Cycle Length (s)	68.7	Sum of lost time (s)	10.7
Intersection Capacity Utilization	99.8%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	SEL	SET	NWT	NWR
Lane Configurations						
Volume (veh/h)	13	57	33	134	655	11
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.60	0.60	0.76	0.76	0.87	0.87
Hourly flow rate (vph)	22	95	43	176	753	13
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)		3				
Median type				TWLTL	TWLTL	
Median storage veh)				2	2	
Upstream signal (ft)				433		
pX, platoon unblocked	0.98					
vC, conflicting volume	1022	759	766			
vC1, stage 1 conf vol	759					
vC2, stage 2 conf vol	263					
vCu, unblocked vol	1015	759	766			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)	5.4					
tF (s)	3.5	3.3	2.2			
p0 queue free %	95	77	95			
cM capacity (veh/h)	427	406	848			

Direction, Lane #	WB 1	SE 1	SE 2	NW 1
Volume Total	117	43	176	766
Volume Left	22	43	0	0
Volume Right	95	0	0	13
cSH	499	848	1700	1700
Volume to Capacity	0.23	0.05	0.10	0.45
Queue Length 95th (ft)	22	4	0	0
Control Delay (s)	16.0	9.5	0.0	0.0
Lane LOS	C	A		
Approach Delay (s)	16.0	1.9		0.0
Approach LOS	C			

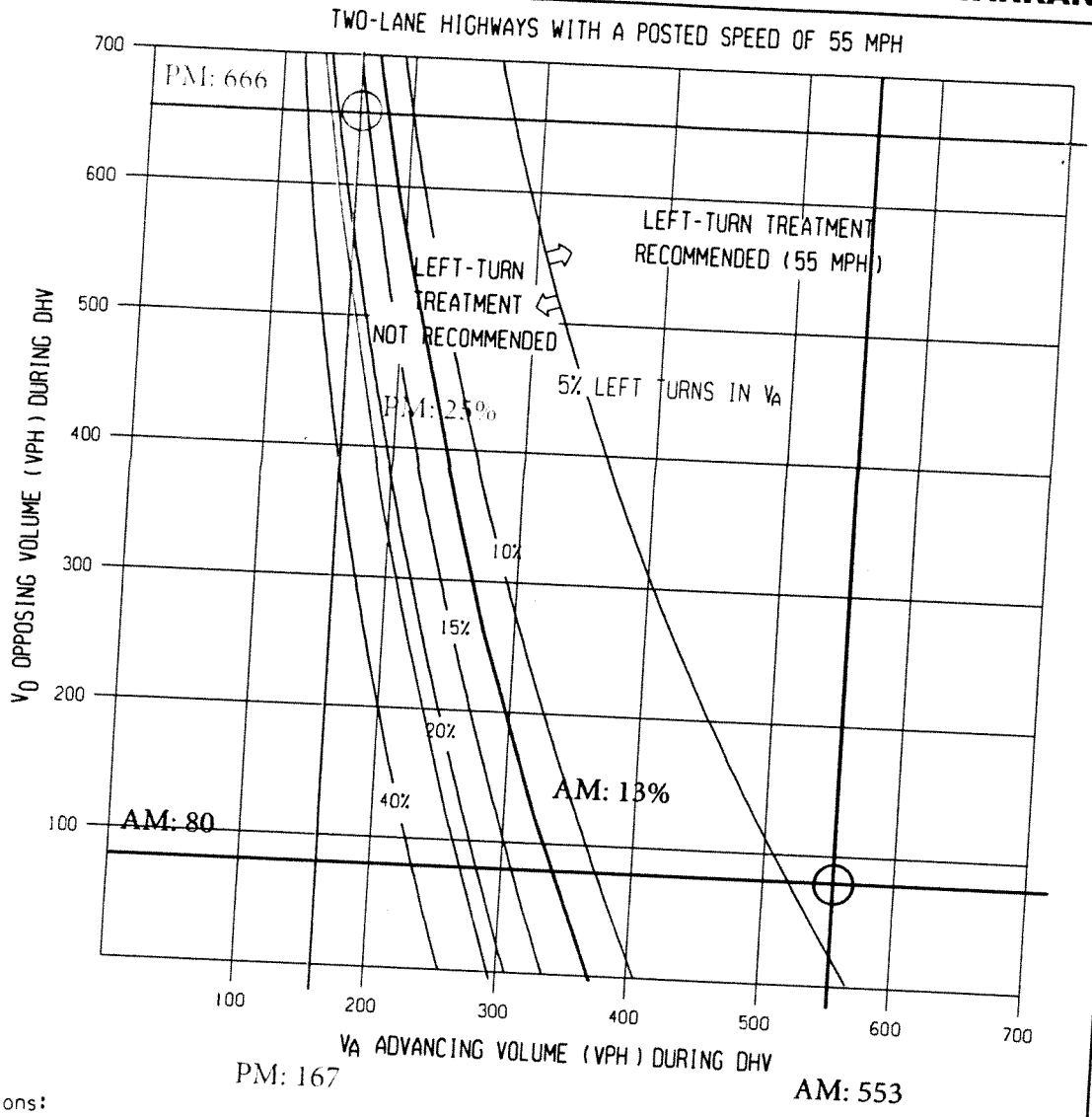
Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	45.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	SEL	SET	NWT	NWR	SWL	SWR
Lane Configurations						
Volume (veh/h)	31	116	599	70	23	58
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.82	0.82	0.88	0.88	0.80	0.80
Hourly flow rate (vph)	38	141	681	80	29	72
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						2
Median type		TWLTL	TWLTL			
Median storage veh)		2	2			
Upstream signal (ft)		1008				
pX, platoon unblocked						
vC, conflicting volume	760				938	720
vC1, stage 1 conf vol					720	
vC2, stage 2 conf vol					217	
vCu, unblocked vol	760				938	720
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)					5.4	
tF (s)	2.2				3.5	3.3
p0 queue free %	96				94	83
cM capacity (veh/h)	852				450	428

Direction, Lane #	SE 1	SE 2	NW 1	SW 1
Volume Total	38	141	760	101
Volume Left	38	0	0	29
Volume Right	0	0	80	72
cSH	852	1700	1700	597
Volume to Capacity	0.04	0.08	0.45	0.17
Queue Length 95th (ft)	3	0	0	15
Control Delay (s)	9.4	0.0	0.0	14.7
Lane LOS	A			B
Approach Delay (s)	2.0		0.0	14.7
Approach LOS				B

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	46.0%	ICU Level of Service	A
Analysis Period (min)	15		

WHITMORE LAKE ROAD & NOWATZKE DRIVE LT LANE WARRANT



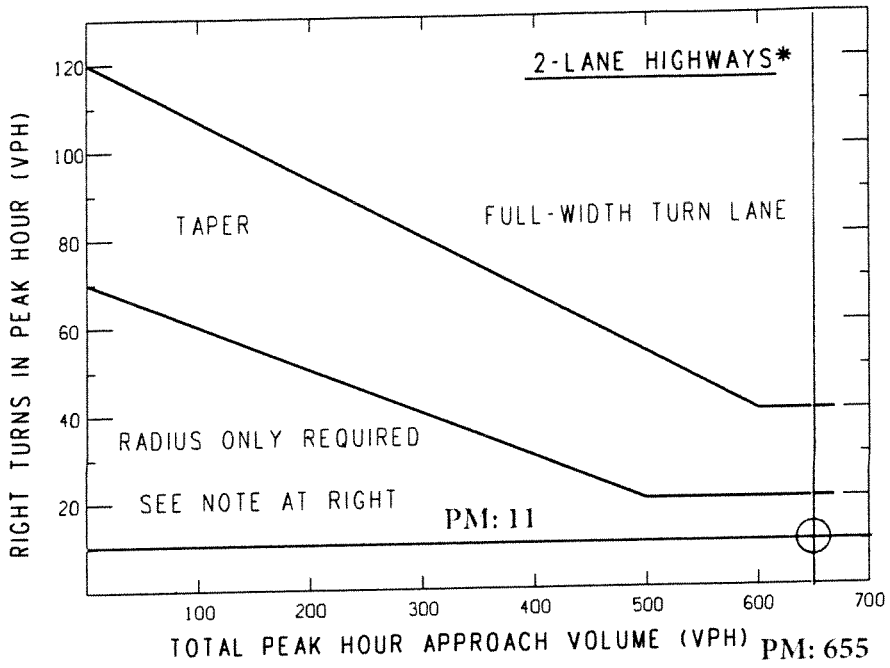
Instructions:

1. The family of curves represent the percentage of left turns in the advancing volume (V_A). The designer should locate the curve for the actual percentage of left turns. When this is not an even increment of 5, the designer should estimate where the curve lies.
2. Read V_A and V_O into the chart and locate the intersection of the two volumes.
3. Note the location of the point in #2 relative to the line in #1. If the point is to the right of the line, then a left-turn lane is recommended. If the point is to the left of the line, then a left-turn is not recommended based on traffic volumes.

LEFT TURN LANE SHOULD BE CONSIDERED

MDOT Michigan Department of Transportation TRAFFIC AND SAFETY NOTE	TRAFFIC VOLUME GUIDELINES FOR LEFT-TURN LANES AT UNSIGNALIZED INTERSECTIONS		
DRAWN BY: MTS CHECKED BY: JAT	08/05/2004 PLAN DATE:	605A	SHEET 5 OF 6
FILE: K:/DGN/ts notes/Note605A tsn.dgn	REV. 08/05/2004		

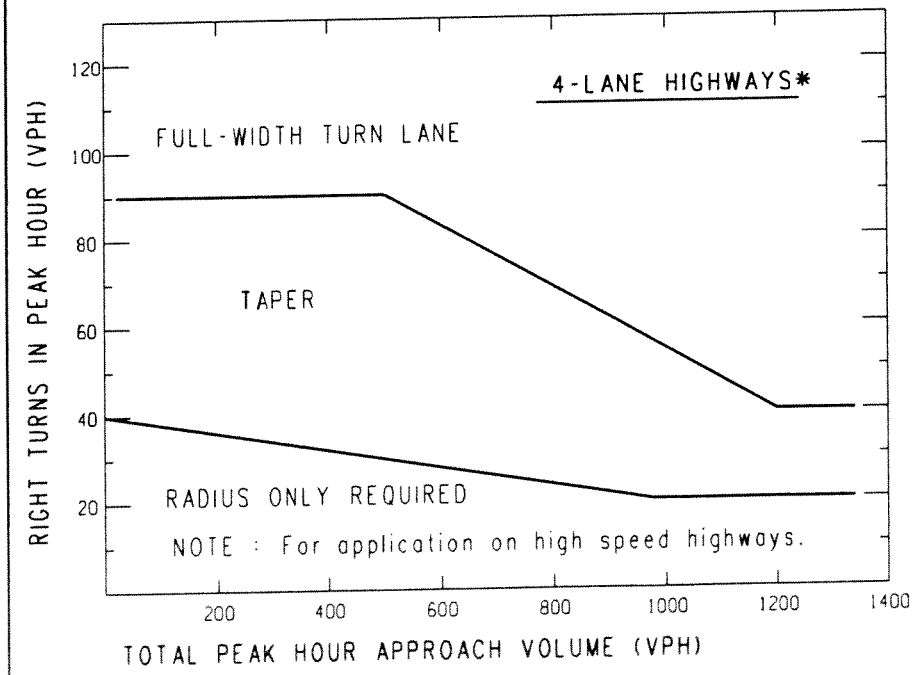
WHITMORE LAKE ROAD & NOWATZKE DRIVE RT LANE WARRANT



NOTE:
For posted speeds at or under 45 mph, peak hour right turns greater than 40 vph, and total peak hour approach less than 300 vph, adjust right turn volumes.

Adjust peak hour right turns = Peak hour right turns - 20

RADIUS ONLY REQUIRED



*If a center left-turn lane exists(i.e. 3 or 5 lane highway), subtract the number of left turns in approach volume from the total approach volume to get an adjusted total approach volume.

Sample Problem:
The Design Speed is 55 mph. The Peak Hour Approach Volume is 300 vph. The Number of Right Turns in the Peak Hour is 100 vph. Determine if a right turn lane is recommended.

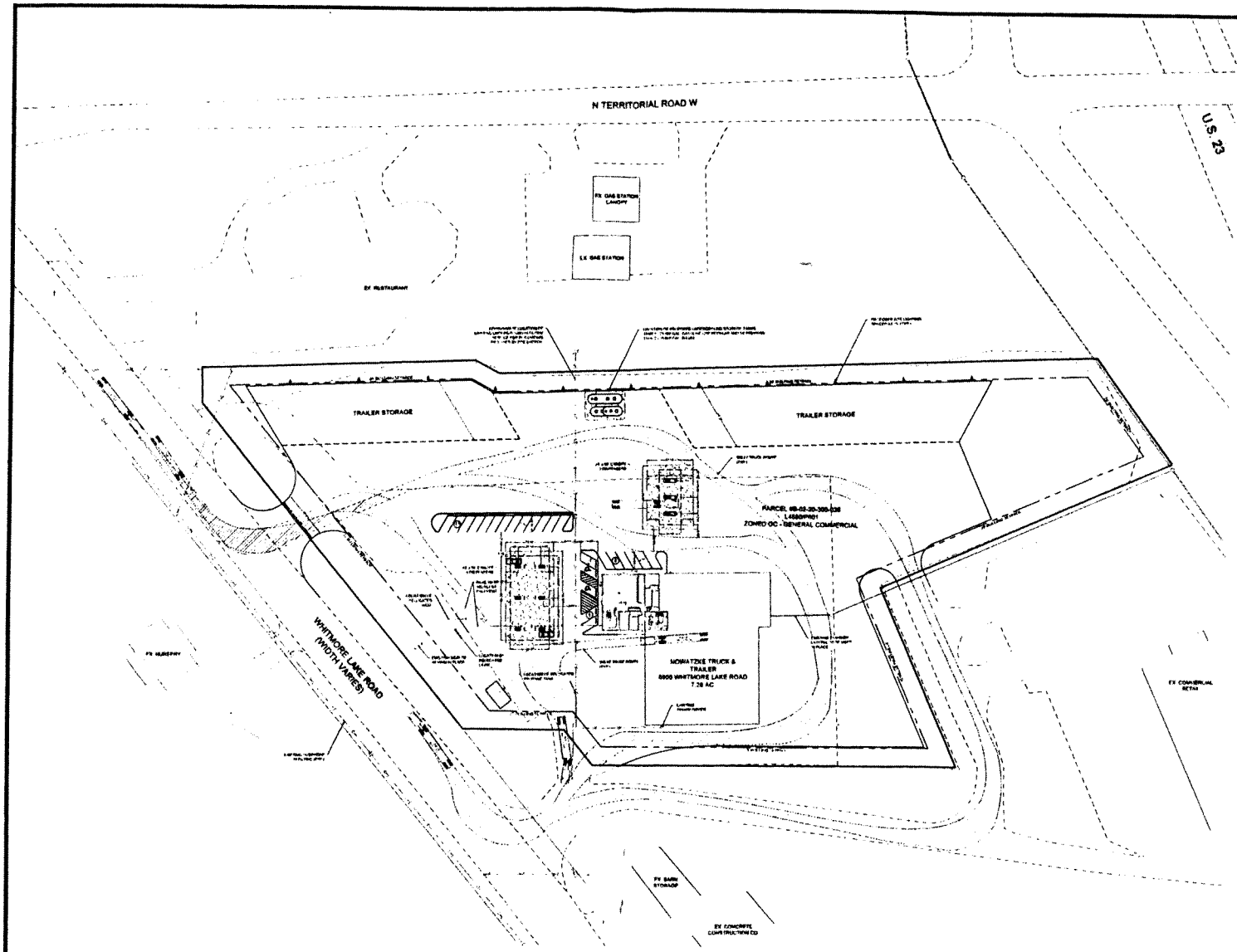
Solution:
Figure indicates that the intersection of 300 vph and 100 vph is located above the upper trend line; thus,a right-turn lane may be recommended.

MDOT Michigan Department of Transportation

TRAFFIC AND SAFETY NOTE

TRAFFIC VOLUME GUIDELINES FOR RIGHT-TURN LANES AND TAPERS

DRAWN BY: MTS	08/05/2004 PLAN DATE:	604A	SHEET 2 OF 2
CHECKED BY: JAT			
FILE: K:/DGN/ts notes/Note604A tsn.dgn		REV. 08/05/2004	



PARKING NOTES
REQUIRED AUTO SERVICE PARKING:
1 PER 600 SQ. FT. OF FLOOR AREA
1 PER FOUR EMPLOYEES
5 PER SERVICE BAY
5 PER BAY IF TOWING PROVIDED
REQUIRED RESTAURANT PARKING:
1 PER 2 PATRONS
1 PER 2 EMPLOYEES
REQUIRED MAJOR VEHICLE REPAIR PARKING:
10 PER BAY
1 PER TWO EMPLOYEES

PROPOSED PARKING:
24 STRNDARD STALLS

SETBACKS FOR GENERAL COMMERCIAL
FRONT: 35'
SIDE: 20'
REAR: 30'

MAXIMUM BUILDING HEIGHT:
45'

USING AERIAL IMAGERY AND PLAT INFORMATION, ALL INFORMATION PERTAINING TO ACREAGE, LOT DIMENSIONS, EXISTING STRUCTURES AND STREET INFRASTRUCTURE IS PRELIMINARY. A TOPOGRAPHIC SURVEY IS PENDING.

2. PARCEL # 8-02-20300-036 - 7.28 AC.
3. LANDSCAPING SHALL BE DONE IN ACCORDANCE WITH NORTHFIELD TWP. ORDINANCE.
4. LIGHTING SHALL BE DONE IN ACCORDANCE WITH NORTHFIELD TWP. ORDINANCE.

ROAD JURISDICTION
WHITMORE LAKE ROAD:
WASTENAW COUNTY PRIMARY ROAD
N TERRITORIAL ROAD W:
WASTENAW COUNTY PRIMARY ROAD

LANDSCAPING
REQUIRED:
AT EVERY 20 PARKING BRACES, ONE CANOPY TREE PER 8 STALLS.
10' GREENBELT PER 10,000 SF FLOOR AREA.

SIGNAGE
ALLOWED:
1 SF PER FRONT FOOT OR BUILDING, NO MORE THAN 20 SF (FOR COMMERCIAL GROUP)
1 SIGN FOR ADVERTISING GAS PRICES ALONG FRONTAGE STREET, NO MORE THAN 6 SF (FOR AUTOMOBILE SERVICE STATIONS)

OWNER
TOM NOWATZKE
NOWATZKY TRUCK AND TRAILER, INC.
6900 WHITMORE LAKE RD.
WHITMORE LAKE, MI 48189
(734) 995-9600

APPLICANT
JOHN DAMRATH
PREMIER CIVIL ENGINEERING
308 TCW CT.
LAKE SAINT LOUIS, MO 63367
(248) 880-2158

N

1" = 50'

50 25 0 50 100

SCALE IN FEET

PCE PROJECT NUMBER: 134401M

NOTE
Underground utilities and structures have been plotted from available information and therefore, their location must be considered approximate only. It is the responsibility of the individual contractors to notify the utility companies before actual construction.

CONSULTANT:
PREMIER CIVIL ENGINEERING

NOWATZKE TRUCK & TRAILER

REV	DATE	DESCRIPTION

5.09.14

134401

DRAWN BY: J.M.WINTERS

CHECKED BY: J.DAMRATH

VERSION 2

SITE PLAN

1 OF 1