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TRAFFIC IMPACT STUDY

PROPOSED RESIDENTIAL DEVELOPMENT

161ST STREET & OAK ROAD

WESTFIELD, INDIANA

PREPARED FOR

M/I HOMES

JUNE 2015

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TABLE OF CONTENTS

TABLE OF CONTENTS II
LIST OF FIGURES II
CERTIFICATION III
INTRODUCTION 1
PURPOSE 1
SCOPE OF WORK 1
DESCRIPTION OF THE PROPOSED DEVELOPMENT 2
STUDY AREA 2
DESCRIPTION OF ABUTTING STREET SYSTEM 2
EXISTING TRAFFIC DATA 4
TABLE 1 – NEARBY SIMILAR DEVELOPMENT TRIP DATA 4
ITE TRIP GENERATION DATA 6
TABLE 2 – TRIP RATE COMPARISON 6
TABLE 3 – TOTAL GENERATED TRIPS FOR PROPOSED DEVELOPMENT 7
ASSIGNMENT AND DISTRIBUTION OF GENERATED TRIPS 7
GENERATED TRIPS ADDED TO THE STREET SYSTEM 9
CAPACITY ANALYSIS 9
CAPACITY ANALYSIS SCENARIOS 12
TABLE 4 – LEVEL OF SERVICE AND DELAY SUMMARY: 161ST STREET & OAK ROAD 15
TABLE 5 – LEVEL OF SERVICE SUMMARY: 161ST STREET & PROPOSED ACCESS DRIVE 15
TABLE 6 – LEVEL OF SERVICE SUMMARY: OAK ROAD & PROPOSED ACCESS DRIVE / OAK WOODS LANE 16
CONCLUSIONS 16
RECOMMENDATIONS 19

LIST OF FIGURES

FIGURE 1: AREA MAP 3
FIGURE 2: EXISTING TRAFFIC VOLUMES 5
FIGURE 3: ASSIGNMENT AND DISTRIBUTION OF GENERATED TRAFFIC VOLUMES 8
FIGURE 4A: GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (LOW SCENARIO) 10
FIGURE 4B: GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (HIGH SCENARIO) 11
FIGURE 5A: SUM OF EXISTING TRAFFIC VOLUMES & GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (LOW SCENARIO) 13
FIGURE 5B: SUM OF EXISTING TRAFFIC VOLUMES & GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (HIGH SCENARIO) 14

CERTIFICATION

I certify that this **TRAFFIC IMPACT STUDY** has been prepared by me and under my immediate supervision and that I have experience and training in the field of traffic and transportation engineering.

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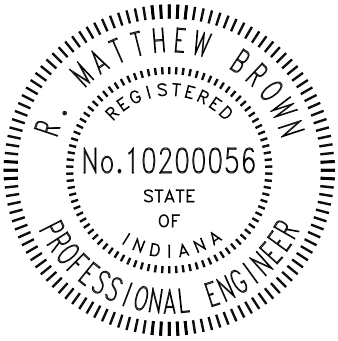

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INTRODUCTION

This **TRAFFIC IMPACT STUDY**, prepared for the City of Westfield, on behalf of M/I Homes is for a proposed residential development called "Tamarack" that is to be located in the northeast corner of 161st Street & Oak Road in Westfield, Indiana.

PURPOSE

The purpose of this analysis is to determine what effect traffic generated by the proposed development will have on the existing adjacent roadway system. This analysis will identify any roadway deficiencies that may exist today or that may occur when this site is developed.

Based on the traffic analysis, conclusions will be drawn to determine whether the abutting roadway system can efficiently accommodate the change in traffic volumes. Possible strategies to improve the system performance and/or to address any deficiencies caused by the new traffic patterns will be investigated.

Recommendations will be made on the basis of the traffic impact study findings, to present feasible roadway improvements, which would enable safe ingress and egress, to and from the proposed development, with minimal interference to traffic on the public street system.

SCOPE OF WORK

The scope of work for this analysis is as follows:

First, obtain peak hour turning movement traffic volume counts between the hours of 6:00 A.M. to 9:00 AM and 3:00 PM to 7:00 PM during a typical weekday, at the intersection of 161st Street & Oak Road.

Second, collect AM and PM peak hour trip generation data at similar residential developments.

Third, estimate the number of peak hour trips that will be generated by the proposed development.

Fourth, assign and distribute the generated peak hour traffic volumes from the proposed development to the study intersections and driveways that will serve to provide access to the subject site.

Fifth, conduct a capacity analysis and level of service analysis at the study intersections for each of the following scenarios:

> *Scenario 1: Existing Traffic Volumes* – Based on existing roadway conditions and existing peak hour traffic volumes.

Scenario 2: Existing Traffic Volumes + Proposed Development Generated Traffic Volumes – Traffic volumes generated by the proposed development added to the existing traffic volumes.

Sixth, prepare recommendations for the roadway cross-sections that will be needed to accommodate the total volumes for each of the scenarios previously identified.

Finally, prepare a **TRAFFIC IMPACT STUDY** report documenting all data, analyses, and conclusions to best provide for the safe and efficient movement of traffic through the study area.

DESCRIPTION OF THE PROPOSED DEVELOPMENT

The proposed development is to be a residential development with 50 homes. The site will be served via a full access drive on 161st Street and a full access drive on Oak Road to be aligned with Oak Woods Lane. **Figure 1** is an area map showing the location and general layout of the proposed development.

STUDY AREA

The study area for this analysis has been defined to include the following intersections:

- 161st Street & Oak Road
- 161st Street & Proposed Access Drive
- Oak Road & Proposed Access Drive / Oak Woods Lane

DESCRIPTION OF ABUTTING STREET SYSTEM

161ST STREET – is an east/west, two-lane roadway with a posted speed limit of 40 mph. According to the City of Westfield Thoroughfare Plan, 161st Street in this area is classified as a Secondary Arterial.

OAK ROAD – is a north/south, two-lane roadway with a posted speed limit of 30 mph. According to the City of Westfield Thoroughfare Plan, Oak Road in this area is classified as a Collector.

161ST STREET & OAK ROAD – This intersection is controlled with a 4-way stop. All approaches to this intersection are a single lane for all movements.

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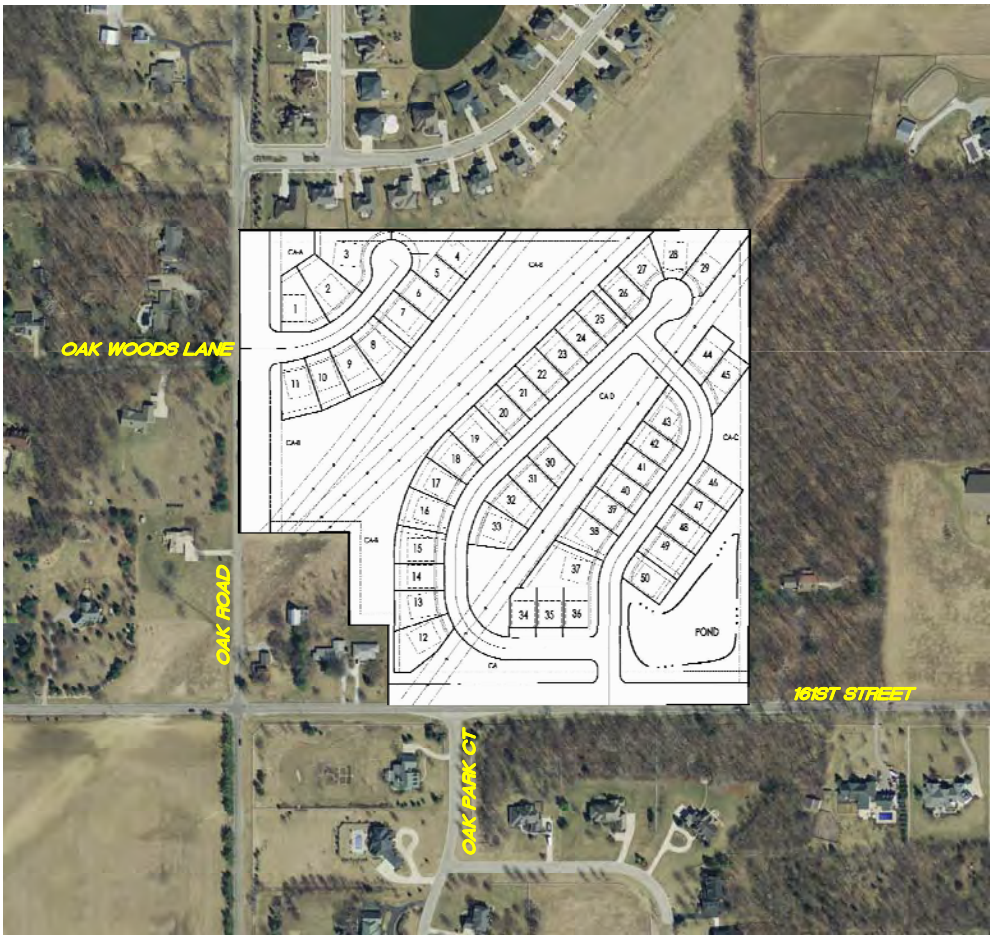

FIGURE 1

AREA MAP

TRAFFIC IMPACT STUDY
MI HOMES-WESTFIELD, IN

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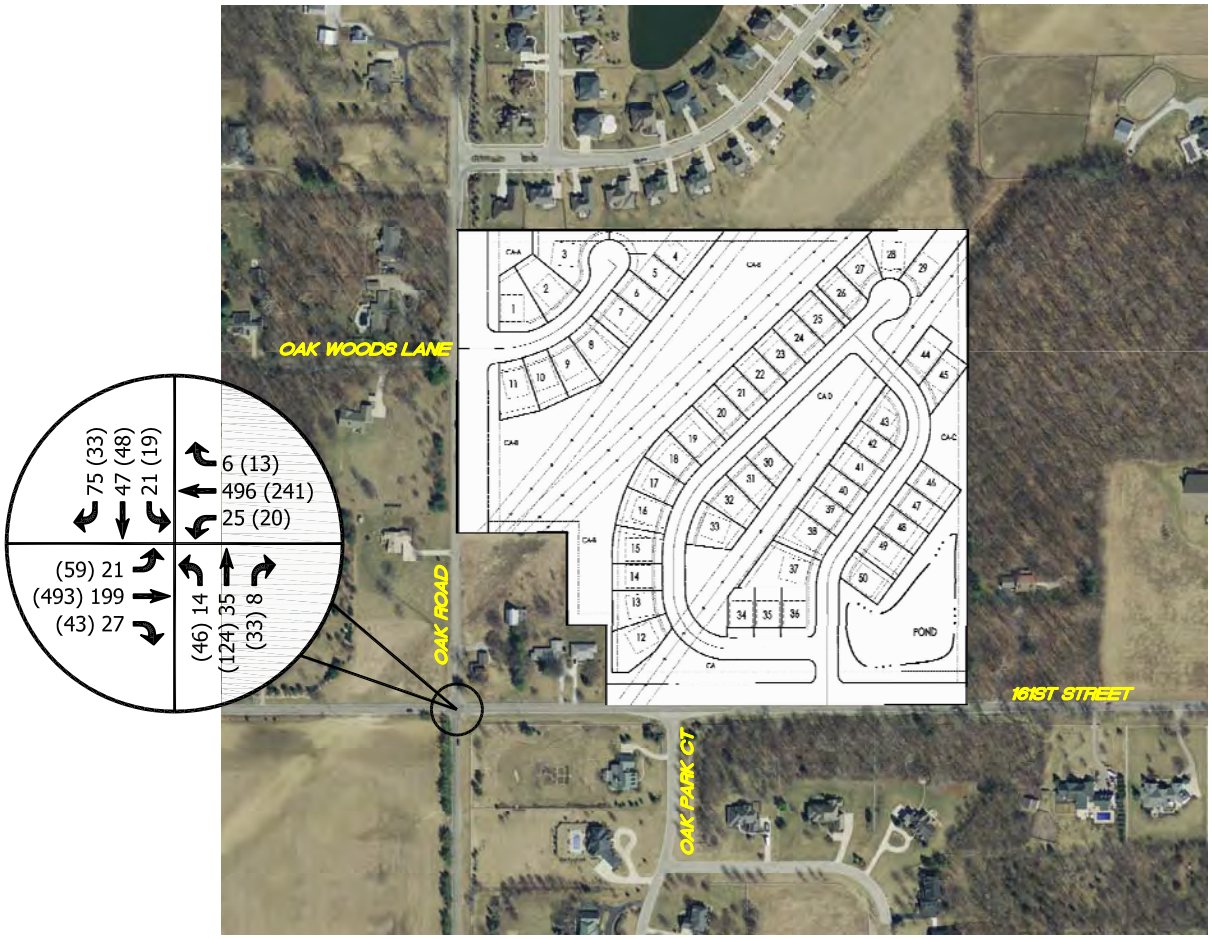
EXISTING TRAFFIC DATA

Peak hour turning movement traffic volume counts were conducted at the intersection of 161st Street and Oak Road by A&F Engineering Co., LLC in May 2015. The counts include an hourly total of all "through" traffic and all "turning" traffic at the intersection. These counts were collected under good weather conditions while school was in session. However, construction along US 31, particularly the closing of US 31 and SR 32 heavily influenced these counts. It is believed that these counts are 15%-20% higher than what would be typical under a non construction scenario. Therefore, the results posted within this study are likely much worse than what would be typical. The count output summary sheets are included in the **Appendix** and a summary of the existing peak hour intersection counts is shown on **Figure 2**.

In addition to the intersection counts, A&F Engineering collected AM and PM peak hour entering and exiting traffic volume counts at two existing neighborhoods that have similar demographics to what is expected to occupy Tamarack. It is expected that Tamarack will not generally attract the typical single family. Instead, it is likely that many of the home buyers will be without children and/or will have travel patterns that are different from a typical single family unit. Therefore, A&F Engineering collected data at two communities that are believed to have similar trip generation characteristics that will be exhibited by Tamarack. The following table summarizes the collected trip data and the calculated per unit trip rates for these developments.

TABLE 1 – NEARBY SIMILAR DEVELOPMENT TRIP DATA

DEVELOPMENT INFORMATION		OBSERVED TRIPS				CACLULATED TRIP RATE PER DWELLING UNIT			
DEVELOPMENT	OCCUPIED UNITS	AM Peak		PM Peak		AM PEAK		PM PEAK	
		Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
Maples at Springmill	101	8	25	22	25	.079	.248	.218	.248
Villas at Geist	98	5	11	16	16	.051	.112	.163	.163
Average						.065	.181	.191	.206



LEGEND

XX = A.M. PEAK HOUR
(XX) = P.M. PEAK HOUR
* = NEGLIGIBLE

FIGURE 2

EXISTING TRAFFIC VOLUMES

TRAFFIC IMPACT STUDY
MI HOMES-WESTFIELD, IN

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ITE TRIP GENERATION DATA

The ITE *Trip Generation Manual*[1] is the typical resource used by traffic engineers when estimating the amount of traffic that could be generated by a new development. This report is a compilation of trip data for various land uses as collected by transportation professionals throughout the United States in order to establish the average number of trips generated by those land uses. The ITE manual does not have a land use category that matches the expected trip generation characteristics of Tamarack. Therefore, the standard single family residential use was used in order to compare data from typical single family land uses to the data collected at the existing nearby developments. The following table summarizes the rate comparison.

TABLE 2 – TRIP RATE COMPARISON

DEVELOPMENT INFORMATION	AVERAGE TRIP RATE PER DWELLING UNIT					
	AM Peak			PM Peak		
	Enter	Exit	Total	Enter	Exit	Total
A&F Collected Data @ Nearby Sites	.065	.181	.246	.191	.206	.397
ITE Trip Data for Single Family	.188	.562	.750	.630	.370	1.000

From the table above it can be seen that the ITE trip rates are roughly two and a half to three times than those of the data collected locally. Thus, it should be expected that the proposed Tamarack development will generate significantly less traffic than would be typical of a single family development. For trip generation purposes, a high and low trip scenario is created. The high scenario will utilize the trip generation rates for a typical single family development, while the low scenario will utilize the trip generation based on the local data collected by A&F Engineering.

The rates in **Table 2** are applied to the number of proposed units in Tamarack to yield the estimated AM and PM peak hour volumes that will be generated by the development. These total peak hour trip estimates are shown in the following table.

[1] *Trip Generation Manual*, Institute of Transportation Engineers, Ninth Edition, 2012.

TABLE 3 – TOTAL GENERATED TRIPS FOR PROPOSED DEVELOPMENT

	GENERATED TRIPS			
	AM Peak		PM Peak	
	Enter	Exit	Enter	Exit
A&F Data for 50 Dwelling Units (Low Scenario)	3	9	9	10
ITE Data for 50 Dwelling Units (High Scenario)	10	28	32	18

ASSIGNMENT AND DISTRIBUTION OF GENERATED TRIPS

The study methodology used to determine the traffic volumes from the proposed development that will be added to the street system is defined as follows:

1. The volume of traffic that will enter and exit the proposed site must be assigned to the access points and to the public street system. Using the traffic volume data collected for this analysis, traffic to and from the proposed development has been assigned to the proposed driveways and to the public street system that will be serving the site.
2. To determine the volumes of traffic that will be added to the public roadway system, the generated traffic must be distributed by direction to the public roadways at their intersection with the driveways. For the proposed development, the trip distribution was based on the location of the development, the existing traffic patterns, and the assignment of generated traffic.

The assignment and distribution for the generated traffic volumes (both high and low scenarios) from the proposed development is shown in **Figure 3**.

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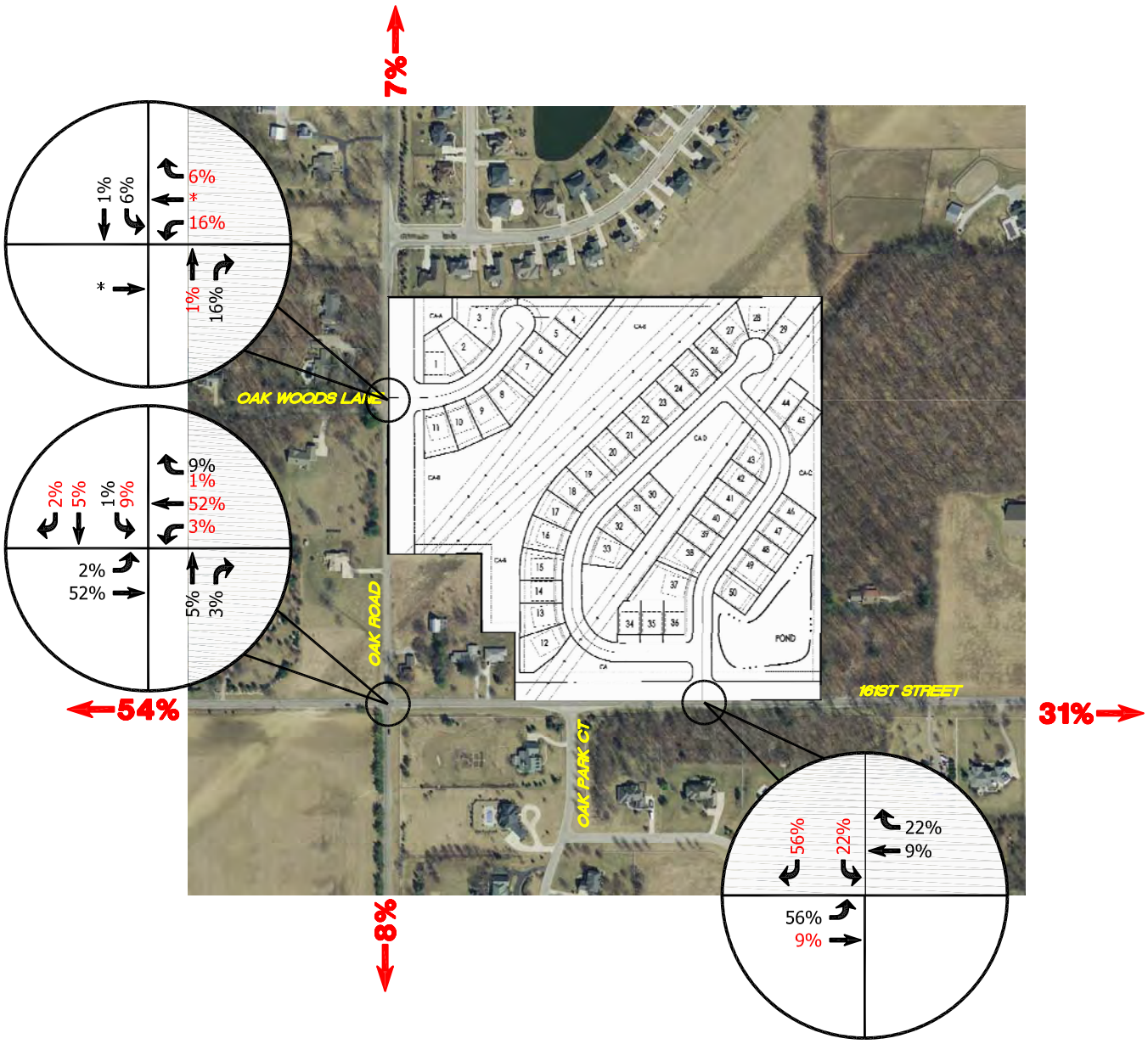

LEGEND

XX = INBOUND TRAFFIC
XX = OUTBOUND TRAFFIC
* = NEGLIGIBLE

FIGURE 3

ASSIGNMENT & DISTRIBUTION OF GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT

TRAFFIC IMPACT STUDY MI HOMES-WESTFIELD, IN

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GENERATED TRIPS ADDED TO THE STREET SYSTEM

The total generated traffic volumes that can be expected from the proposed development have been assigned to each of the study intersections based on the peak hour trip generation and the assignment and distribution assumptions. The generated peak hour traffic volumes for the low scenario are summarized in **Figure 4A** while the peak hour volumes for the high scenario are shown in **Figure 4B**.

CAPACITY ANALYSIS

The "efficiency" of an intersection is based on its ability to accommodate the traffic volumes that approach the intersection. It is defined by the Level-of-Service (LOS) of the intersection. The LOS is determined by a series of calculations commonly called a "capacity analysis". To determine the LOS at each of the study intersections, a capacity analysis has been made using the recognized computer program *Synchro/SimTraffic*[2]. This program allows multiple intersections to be optimized and analyzed using the capacity calculation methods outlined within the *Highway Capacity Manual (HCM)*[3]. The following list shows the delays related to the levels of service for unsignalized and signalized intersections:

Level of Service	Control Delay (seconds/vehicle)	
	UNSIGNALIZED	SIGNALIZED
A	Less than or equal to 10	Less than or equal to 10
B	Between 10.1 and 15	Between 10.1 and 20
C	Between 15.1 and 25	Between 20.1 and 35
D	Between 25.1 and 35	Between 35.1 and 55
E	Between 35.1 and 50	Between 55.1 and 80
F	greater than 50	greater than 80

[2] *Synchro/SimTraffic 8.0*, Trafficware, 2011.
[3] *Highway Capacity Manual (HCM)* Transportation Research Board, National Research Council, Washington, DC, 2010.

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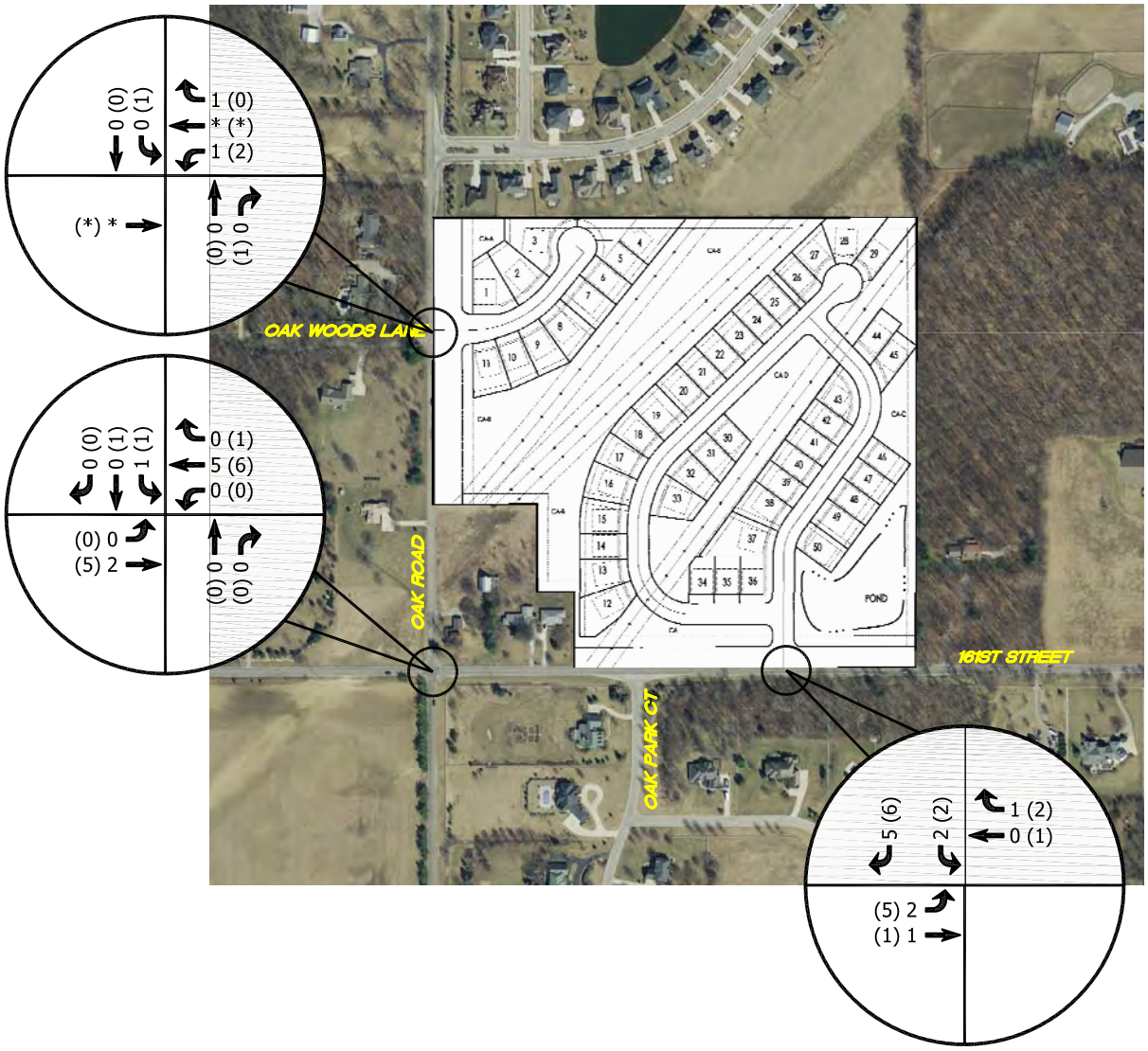

LEGEND

XX = A.M. PEAK HOUR
(XX) = P.M. PEAK HOUR
* = NEGLIGIBLE

FIGURE 4A

GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (LOW SCENARIO)

TRAFFIC IMPACT STUDY MI HOMES-WESTFIELD, IN

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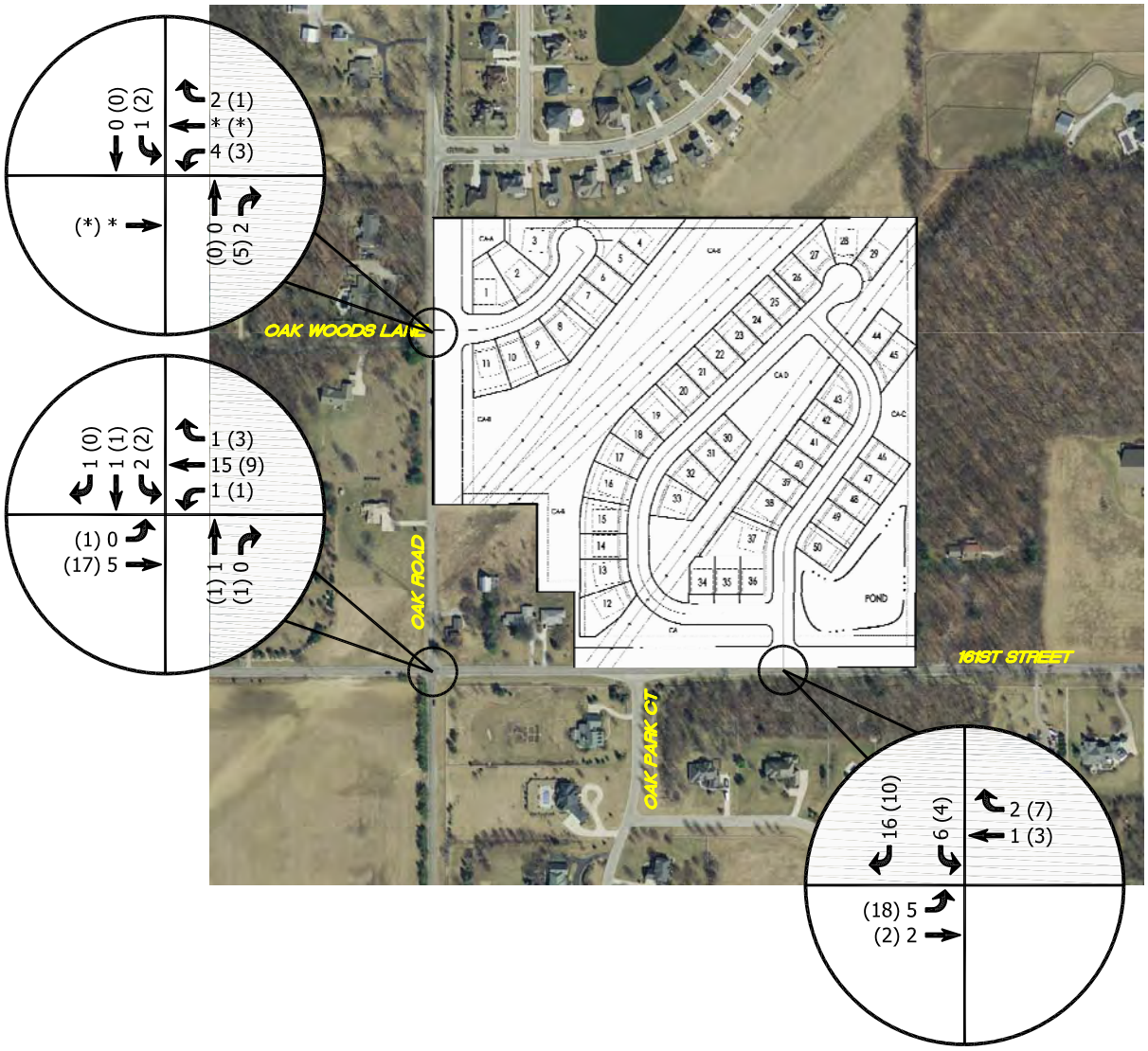

LEGEND

XX = A.M. PEAK HOUR
(XX) = P.M. PEAK HOUR
* = NEGLIGIBLE

FIGURE 4B

GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (HIGH SCENARIO)

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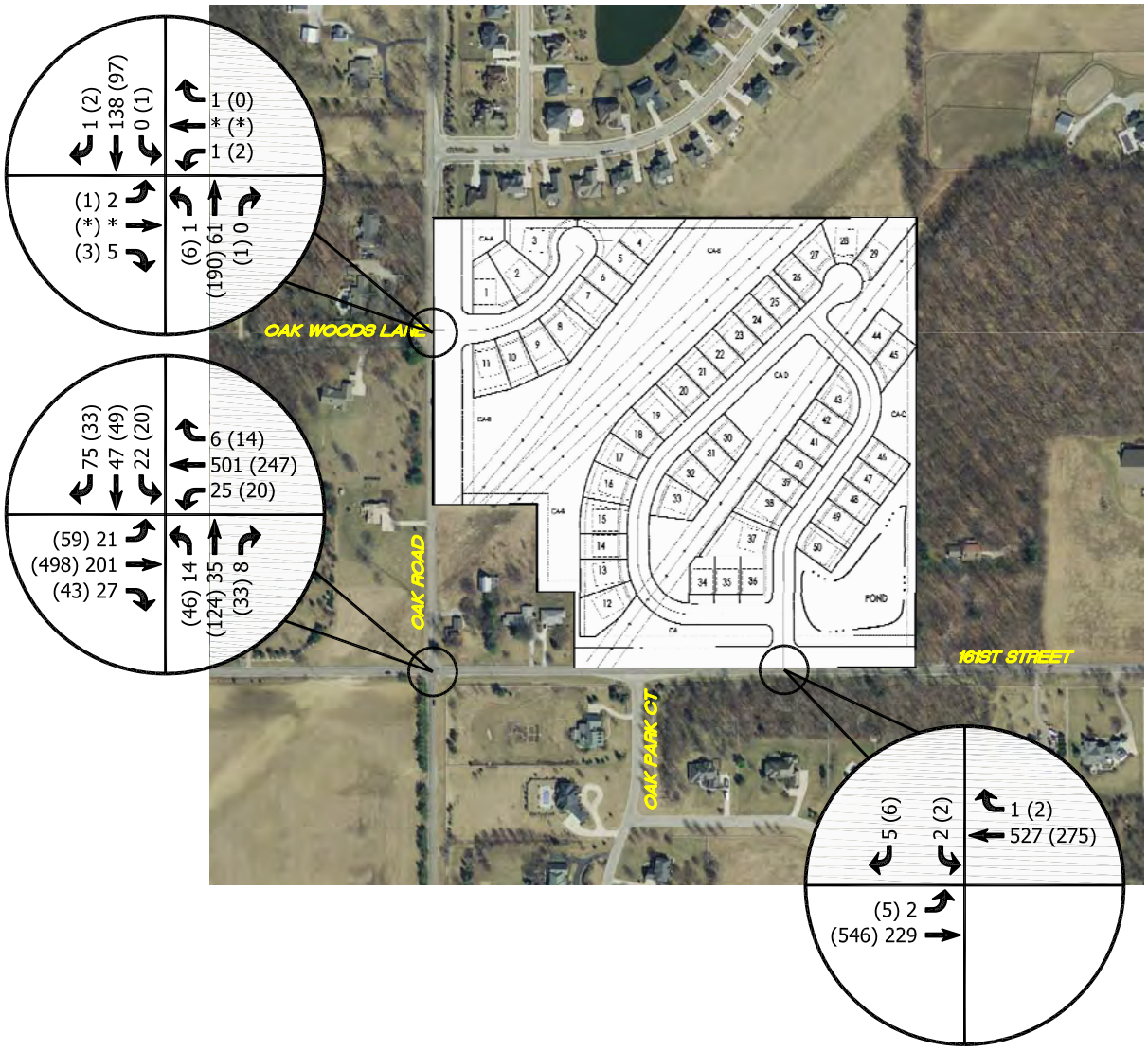
CAPACITY ANALYSIS SCENARIOS

To evaluate the proposed developments impact on the public street system, the total generated traffic volumes from the development must be added to the existing traffic volumes to form a series of scenarios that can be analyzed to determine the adequacy of the existing roadway network. Roadway improvements, if necessary, can then be formulated in order to accommodate the increased traffic volumes. An analysis has been made for AM and PM peak hour at the study intersections for the following scenarios.

SCENARIO 1: *Existing Traffic Volumes* – Based on existing roadway conditions and existing traffic volumes. **Figure 2** is a summary of the AM and PM peak hour traffic volumes for the study intersections.

SCENARIO 2A: *Existing Traffic Volumes + Proposed Development Generated Traffic Volumes (Low Scenario)* – Generated traffic volumes from the proposed development added to the existing traffic volumes. **Figure 5A** is a summary of these traffic volumes at the study intersections for the AM and PM peak hours.

SCENARIO 2B: *Existing Traffic Volumes + Proposed Development Generated Traffic Volumes (High Scenario)* – Generated traffic volumes from the proposed development added to the existing traffic volumes. **Figure 5B** is a summary of these traffic volumes at the study intersections for the AM and PM peak hours.



LEGEND

XX = A.M. PEAK HOUR
(XX) = P.M. PEAK HOUR
* = NEGLIGIBLE

FIGURE 5A

SUM OF EXISTING TRAFFIC VOLUMES & GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (LOW SCENARIO)

TRAFFIC IMPACT STUDY MI HOMES-WESTFIELD, IN

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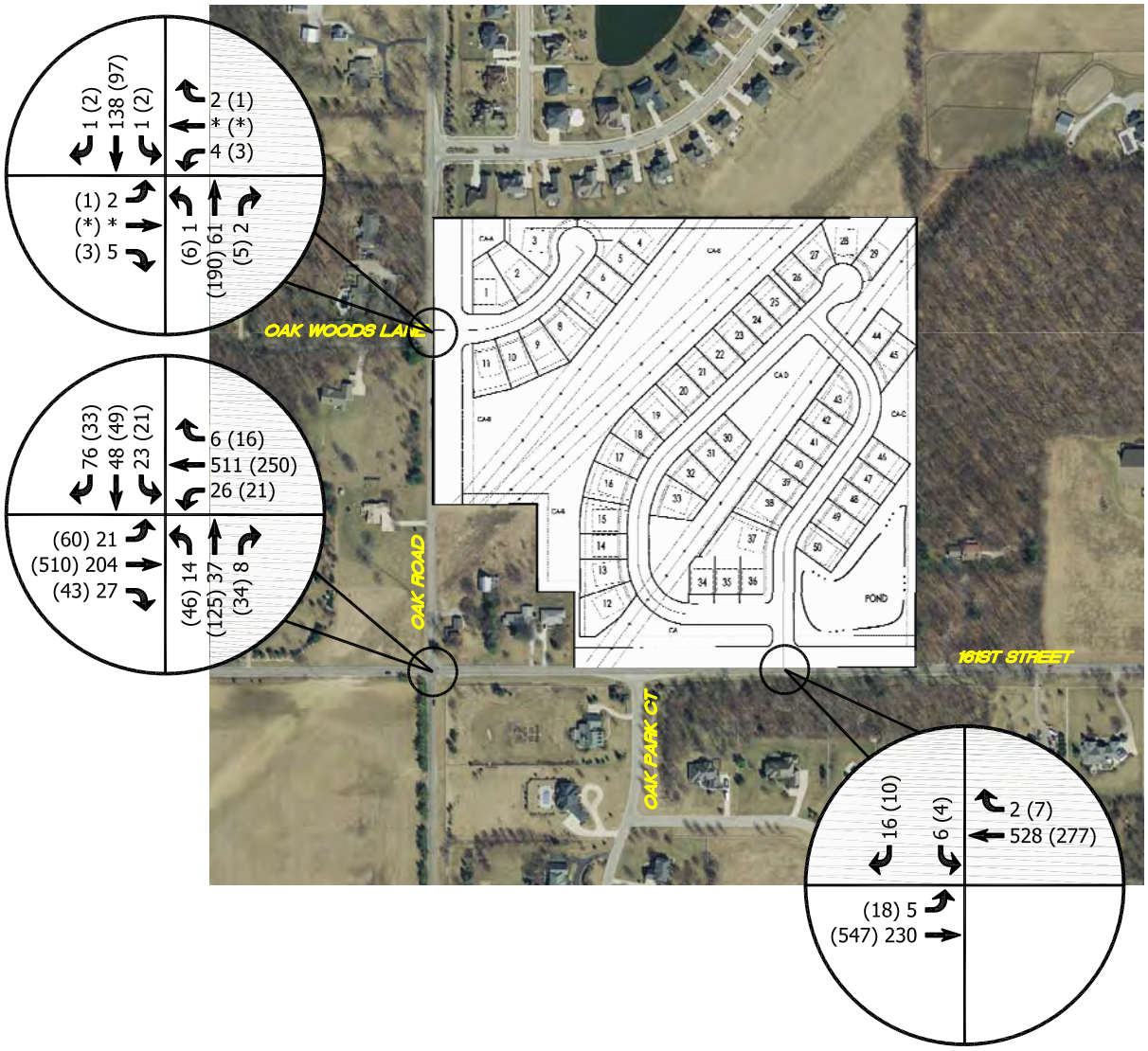

LEGEND

XX = A.M. PEAK HOUR
(XX) = P.M. PEAK HOUR
* = NEGLIGIBLE

FIGURE 5B

SUM OF EXISTING TRAFFIC VOLUMES & GENERATED TRAFFIC VOLUMES FOR PROPOSED DEVELOPMENT (HIGH SCENARIO)

TRAFFIC IMPACT STUDY MI HOMES-WESTFIELD, IN

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The following tables summarize the level of service results at each of the study intersections. The capacity analysis computer output results for each scenario are included in the **Appendix**.

TABLE 4 – LEVEL OF SERVICE AND DELAY SUMMARY: 161ST STREET & OAK ROAD

MOVEMENT	AM PEAK HOUR			PM PEAK HOUR		
	Scenario 1	Scenario 2A	Scenario 2B	Scenario 1	Scenario 2A	Scenario 2B
Northbound Approach	B (10.5 s/v)	B (10.5 s/v)	B (10.6 s/v)	B (14.5 s/v)	B (14.5 s/v)	B (14.5 s/v)
Southbound Approach	B (11.3 s/v)	B (11.3 s/v)	B (11.5 s/v)	B (12.0 s/v)	B (12.0 s/v)	B (12.0 s/v)
Eastbound Approach	B (12.8 s/v)	B (12.9 s/v)	B (13.2 s/v)	F (53.7 s/v)	F (59.2 s/v)	F (59.3 s/v)
Westbound Approach	D (30.6 s/v)	D (31.8 s/v)	D (35.0 s/v)	C (15.4 s/v)	C (15.7 s/v)	C (15.8 s/v)
Intersection	**C (22.1 s/v)**	**C (22.8 s/v)**	**C (24.6 s/v)**	**D (34.4 s/v)**	**E (37.2 s/v)**	**E (37.3 s/v)**

Note: s/v = seconds/vehicle

DESCRIPTION OF SCENARIOS:

SCENARIO 1: Existing Traffic Volumes with Existing Intersection Geometrics and Control

SCENARIO 2A: Sum of Existing and Generated Traffic Volumes from Proposed Development with Existing Intersection Geometrics and Control (Low Scenario)

SCENARIO 2B: Sum of Existing and Generated Traffic Volumes from Proposed Development with Existing Intersection Geometrics and Control (High Scenario)

TABLE 5 – LEVEL OF SERVICE SUMMARY: 161ST STREET & PROPOSED ACCESS DRIVE

MOVEMENT	AM PEAK HOUR		PM PEAK HOUR	
	Scenario 2A	Scenario 2B	Scenario 2A	Scenario 2B
Southbound Approach	B	B	B	B
Eastbound Left-Turn	A	A	A	A

Note: Intersection level-of-service is not calculated for two-way stop intersections

DESCRIPTION OF SCENARIOS:

SCENARIO 2A: Sum of Existing and Generated Traffic Volumes from Proposed Development with Proposed Intersection Geometrics* and Control (Low Scenario)

SCENARIO 2B: Sum of Existing and Generated Traffic Volumes from Proposed Development with Proposed Intersection Geometrics* and Control (High Scenario)

*The proposed intersection geometrics include the construction of the proposed access drive with one inbound lane and one outbound lane stopping for 161st Street and a westbound right-turn taper along 161st Street.

TABLE 6 – LEVEL OF SERVICE SUMMARY: OAK ROAD & PROPOSED ACCESS DRIVE / OAK WOODS LANE

MOVEMENT	AM PEAK HOUR		PM PEAK HOUR	
	Scenario 2A	Scenario 2B	Scenario 2A	Scenario 2B
Northbound Left-Turn	A	A	A	A
Southbound Left-Turn	A	A	A	A
Eastbound Approach	A	A	A	A
Westbound Approach	A	A	B	B

Note: Intersection level-of-service is not calculated for two-way stop intersections

DESCRIPTION OF SCENARIOS:

SCENARIO 2A: Sum of Existing and Generated Traffic Volumes from Proposed Development with Proposed Intersection Geometrics* and Control (Low Scenario)

SCENARIO 2B: Sum of Existing and Generated Traffic Volumes from Proposed Development with Proposed Intersection Geometrics* and Control (High Scenario)

*The proposed intersection geometrics include the construction of the proposed access drive to be aligned with Oak Woods Lane with one inbound lane and a one outbound lane stopping for Oak Road and a northbound right-turn taper along Oak Road.

CONCLUSIONS

The conclusions that follow are based on existing traffic volume data, trip generation, assignment and distribution of generated traffic, capacity analyses/level of service results and a field review conducted at the site.

EXISTING TRAFFIC COUNTS

As previously mentioned, the traffic counts taken at 161st Street & Oak Road were collected when the US 31/SR 32 intersection was closed. Many of the vehicles that would typically use that intersection have diverted to the 161st Street interchange and thus counts along 161st Street are highly exaggerated. It is believed that the counts used in this analysis are 15% to 20% higher than what would be typical under a normal, non construction scenario. Therefore, the level of service results presented in this report at the intersection of 161st and Oak Road are likely 10 seconds to 15 seconds higher than typical values and likely at least one letter grade worse than what should be expected under normal circumstances.

TRIP GENERATION

Based on traffic projections, the peak hour traffic volumes at the intersection of 161st Street & Oak Road could increase by approximately 1 to 3 percent during the AM peak hour and PM peak hours with the addition of traffic from the proposed Tamarack development. It is anticipated that due to the nature of trip generation from this type of development that the amount of trips

generated by 50 units within Tamarack would be similar to the number trips generated by approximately 30 typical single family homes.

161ST STREET & OAK ROAD

Scenario 1 – Existing Traffic Volumes

A capacity analysis for the existing traffic volumes has shown that this intersection operates at LOS C and LOS D during the AM and PM peak hours respectively, with the existing intersection geometrics, and all-way stop control.

Scenario 2A – Sum of Existing and Proposed Development Generated Traffic Volumes (Low Scenario)

A capacity analysis for the sum of existing and generated traffic volumes from the proposed development has shown that this intersection will operate at LOS C and LOS E during the AM and PM peak hours, with the existing intersection geometrics and all way stop control. However, the increase in delay at this intersection is only anticipated to increase by about 1 second per vehicle in the AM peak hour and 3 seconds per vehicle during the PM peak hour.

Scenario 2B – Sum of Existing and Proposed Development Generated Traffic Volumes (High Scenario)

A capacity analysis for the sum of existing and generated traffic volumes from the proposed development has shown that this intersection will operate at LOS C and LOS E during the AM and PM peak hours, with the existing intersection geometrics and all way stop control. However, the increase in delay at this intersection is only anticipated to increase by about 2.5 seconds per vehicle in the AM peak hour and 3 seconds per vehicle during the PM peak hour.

161ST STREET & PROPOSED ACCESS DRIVE

Scenario 2A – Sum of Existing and Proposed Development Generated Traffic Volumes (Low Scenario)

A capacity analysis for the sum of existing and generated traffic volumes from the proposed development has shown that all approaches to this intersection will operate at acceptable levels of service during the AM and PM peak hours, with proposed intersection geometrics and stop control.

Scenario 2B – Sum of Existing and Proposed Development Generated Traffic Volumes (High Scenario)

A capacity analysis for the sum of existing and generated traffic volumes from the proposed development has shown that all approaches to this intersection will operate at acceptable levels of service during the AM and PM peak hours, with proposed intersection geometrics and stop control.

OAK ROAD & PROPOSED ACCESS DRIVE / OAK WOODS LANE

Scenario 2A – Sum of Existing and Proposed Development Generated Traffic Volumes (Low Scenario)

A capacity analysis for the sum of existing and generated traffic volumes from the proposed development has shown that all approaches to this intersection will operate at acceptable levels of service during the AM and PM peak hours, with proposed intersection geometrics and stop control.

Scenario 2B – Sum of Existing and Proposed Development Generated Traffic Volumes (High Scenario)

A capacity analysis for the sum of existing and generated traffic volumes from the proposed development has shown that all approaches to this intersection will operate at acceptable levels of service during the AM and PM peak hours, with proposed intersection geometrics and stop control.

RECOMMENDATIONS

Based on the analyses and the conclusions within this study, the following recommendations are made to ensure that the roadway system can accommodate the increased traffic volumes resulting from the proposed development.

161ST STREET & OAK ROAD

- There are no short term recommendations for this intersection at this time. However, a future installation of a roundabout should be considered as traffic increases over time to improve operations at this intersection and along the 161st Street corridor.

161ST STREET & PROPOSED ACCESS DRIVE

- Construction of the proposed access drive with one inbound lane and one outbound lane stopping for 161st Street.
- Construction of a westbound right-turn taper along 161st Street.

OAK ROAD & PROPOSED ACCESS DRIVE / OAK WOODS LANE

- Construction of the proposed access drive to be aligned with Oak Woods Lane with one inbound lane and a minimum of one outbound lane stopping for Oak Road.
- Construction of a northbound right-turn taper along Oak Road.

TRAFFIC IMPACT STUDY

APPENDIX

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161ST STREET & OAK ROAD

INTERSECTION DATA

TRAFFIC VOLUME COUNTS

CAPACITY ANALYSIS

A & F ENGINEERING CO., LLC
TRAFFIC VOLUME SUMMARY

CLIENT :	Westfield
INTERSECTION :	161st St & Oak Rd
DATE :	5/20/2015
COUNTED BY :	Justin

	TOTAL VEHICLES (PASSENGER CARS + TRUCKS)											
	AM PEAK HOUR VOLUMES BEGINS 7:00 AM				OFF PEAK HOUR VOLUMES BEGINS				PM PEAK HOUR VOLUMES BEGINS 4:45 PM			
	L	T	R	TOTAL	L	T	R	TOTAL	L	T	R	TOTAL
NORTHBOUND	14	35	8	**57**					46	124	33	**203**
SOUTHBOUND	21	47	75	**143**					19	48	33	**100**
EASTBOUND	21	199	27	**247**					59	493	43	**595**
WESTBOUND	25	496	6	**527**					20	241	13	**274**

	PEAK HOUR FACTOR					
	AM PEAK HOUR FACTOR		OFF PEAK HOUR FACTOR		PM PEAK HOUR FACTOR	
	APPROACH	INTERSECTION	APPROACH	INTERSECTION	APPROACH	INTERSECTION
NORTHBOUND	0.79	0.89			0.86	0.93
SOUTHBOUND	0.85				0.93	
EASTBOUND	0.85				0.91	
WESTBOUND	0.90				0.91	

	TRUCK PERCENTAGE											
	AM PEAK HOUR PERCENTAGE				OFF PEAK HOUR PERCENTAGE				PM PEAK HOUR PERCENTAGE			
	L	T	R	TOTAL	L	T	R	TOTAL	L	T	R	TOTAL
NORTHBOUND	0.0%	2.9%	0.0%	1.8%					0.0%	0.0%	0.0%	0.0%
SOUTHBOUND	0.0%	2.1%	0.0%	0.7%					0.0%	0.0%	0.0%	0.0%
EASTBOUND	9.5%	2.5%	7.4%	3.6%					0.0%	1.0%	0.0%	0.8%
WESTBOUND	8.0%	2.6%	0.0%	2.8%					0.0%	2.1%	0.0%	1.8%

HOURLY SUMMARY									
HOUR			NB	SB	NB+SB	EB	WB	EB+WB	TOTAL
6:00 AM	TO	7:00 AM	26	51	77	75	256	331	408
7:00 AM	TO	8:00 AM	57	143	200	247	527	774	974
8:00 AM	TO	9:00 AM	53	101	154	225	401	626	780
3:00 PM	TO	4:00 PM	104	60	164	322	211	533	697
4:00 PM	TO	5:00 PM	146	79	225	466	206	672	897
5:00 PM	TO	6:00 PM	197	102	299	584	288	872	1171
6:00 PM	TO	7:00 PM	179	77	256	440	247	687	943
TOTAL VOLUME			762	613	1375	2359		4495	5870
PERCENTAGE			13.0%	10.4%	23.4%	40.2%		76.6%	100.0%

A & F ENGINEERING CO., LLC
TRAFFIC VOLUME SUMMARY

CLIENT : Westfield
INTERSECTION : 161st St & Oak Rd
DATE : 5/20/2015

DIRECTION OF TRAVEL : NORTHBOUND

HOUR	LEFT			THROUGH			RIGHT			TOTAL		
AM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
6:00 AM - 7:00 AM	10	0	10	14	0	14	2	0	2	26	0	26
7:00 AM - 8:00 AM	14	0	14	34	1	35	8	0	8	56	1	57
8:00 AM - 9:00 AM	13	1	14	31	1	32	7	0	7	51	2	53
PM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
3:00 PM - 4:00 PM	30	0	30	57	0	57	17	0	17	104	0	104
4:00 PM - 5:00 PM	38	0	38	86	1	87	21	0	21	145	1	146
5:00 PM - 6:00 PM	40	0	40	126	1	127	30	0	30	196	1	197
6:00 PM - 7:00 PM	50	0	50	108	0	108	21	0	21	179	0	179
PASSENGER	195 99.5%			456 99.1%			106 100.0%			757 99.3%		
TRUCK	1 0.5%			4 0.9%			0 0.0%			5 0.7%		
BOTH	196 25.7%			460 60.4%			106 13.9%			762 100.0%		

DIRECTION OF TRAVEL : SOUTHBOUND

HOUR	LEFT			THROUGH			RIGHT			TOTAL		
AM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
6:00 AM - 7:00 AM	8	0	8	15	0	15	28	0	28	51	0	51
7:00 AM - 8:00 AM	21	0	21	46	1	47	75	0	75	142	1	143
8:00 AM - 9:00 AM	12	1	13	38	1	39	48	1	49	98	3	101
PM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
3:00 PM - 4:00 PM	7	1	8	30	0	30	21	1	22	58	2	60
4:00 PM - 5:00 PM	14	0	14	34	1	35	29	1	30	77	2	79
5:00 PM - 6:00 PM	18	0	18	53	1	54	30	0	30	101	1	102
6:00 PM - 7:00 PM	7	0	7	38	1	39	31	0	31	76	1	77
PASSENGER	87 97.8%			254 98.1%			262 98.9%			603 98.4%		
TRUCK	2 2.2%			5 1.9%			3 1.1%			10 1.6%		
BOTH	89 14.5%			259 42.3%			265 43.2%			613 100.0%		

DIRECTION OF TRAVEL : EASTBOUND

HOUR	LEFT			THROUGH			RIGHT			TOTAL		
AM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
6:00 AM - 7:00 AM	4	2	6	63	0	63	6	0	6	73	2	75
7:00 AM - 8:00 AM	19	2	21	194	5	199	25	2	27	238	9	247
8:00 AM - 9:00 AM	13	1	14	184	7	191	20	0	20	217	8	225
PM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
3:00 PM - 4:00 PM	22	1	23	258	11	269	30	0	30	310	12	322
4:00 PM - 5:00 PM	40	0	40	392	2	394	32	0	32	464	2	466
5:00 PM - 6:00 PM	56	0	56	481	4	485	43	0	43	580	4	584
6:00 PM - 7:00 PM	38	0	38	356	11	367	35	0	35	429	11	440
PASSENGER	192 97.0%			1928 98.0%			191 99.0%			2311 98.0%		
TRUCK	6 3.0%			40 2.0%			2 1.0%			48 2.0%		
BOTH	198 8.4%			1968 83.4%			193 8.2%			2359 100.0%		

DIRECTION OF TRAVEL : WESTBOUND

HOUR	LEFT			THROUGH			RIGHT			TOTAL		
AM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
6:00 AM - 7:00 AM	4	0	4	249	1	250	1	1	2	254	2	256
7:00 AM - 8:00 AM	23	2	25	483	13	496	6	0	6	512	15	527
8:00 AM - 9:00 AM	13	0	13	362	19	381	6	1	7	381	20	401
PM TIME PERIOD	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH	PASS	TRUCK	BOTH
3:00 PM - 4:00 PM	12	1	13	174	11	185	11	2	13	197	14	211
4:00 PM - 5:00 PM	13	0	13	172	6	178	15	0	15	200	6	206
5:00 PM - 6:00 PM	21	0	21	248	4	252	15	0	15	284	4	288
6:00 PM - 7:00 PM	16	0	16	217	6	223	8	0	8	241	6	247
PASSENGER	102 97.1%			1905 96.9%			62 93.9%			2069 96.9%		
TRUCK	3 2.9%			60 3.1%			4 6.1%			67 3.1%		
BOTH	105 4.9%			1965 92.0%			66 3.1%			2136 100.0%		

Intersection	
Intersection Delay, s/veh	22.1
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	21	199	27	0	25	496	6	0	14	35	8
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	10	3	7	2	8	3	0	2	0	3	0
Mvmt Flow	0	24	224	30	0	28	557	7	0	16	39	9
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	12.8	30.6	10.5
HCM LOS	B	D	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	9%	5%	15%
Vol Thru, %	61%	81%	94%	33%
Vol Right, %	14%	11%	1%	52%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	57	247	527	143
LT Vol	14	21	25	21
Through Vol	35	199	496	47
RT Vol	8	27	6	75
Lane Flow Rate	64	278	592	161
Geometry Grp	1	1	1	1
Degree of Util (X)	0.116	0.43	0.851	0.268
Departure Headway (Hd)	6.51	5.578	5.174	6.003
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	548	644	699	596
Service Time	4.589	3.631	3.214	4.068
HCM Lane V/C Ratio	0.117	0.432	0.847	0.27
HCM Control Delay	10.5	12.8	30.6	11.3
HCM Lane LOS	B	B	D	B
HCM 95th-tile Q	0.4	2.2	9.7	1.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	21	47	75
Peak Hour Factor	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	0	2	0
Mvmt Flow	0	24	53	84
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.3
HCM LOS	B

Lane

Intersection	
Intersection Delay, s/veh	34.4
Intersection LOS	D

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	59	493	43	0	20	241	13	0	46	124	33
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	0	1	0	2	0	2	0	2	0	0	0
Mvmt Flow	0	63	530	46	0	22	259	14	0	49	133	35
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	53.7	15.4	14.5
HCM LOS	F	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	23%	10%	7%	19%
Vol Thru, %	61%	83%	88%	48%
Vol Right, %	16%	7%	5%	33%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	203	595	274	100
LT Vol	46	59	20	19
Through Vol	124	493	241	48
RT Vol	33	43	13	33
Lane Flow Rate	218	640	295	108
Geometry Grp	1	1	1	1
Degree of Util (X)	0.412	0.978	0.506	0.211
Departure Headway (Hd)	6.799	5.638	6.177	7.071
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	530	646	583	509
Service Time	4.826	3.638	4.209	5.107
HCM Lane V/C Ratio	0.411	0.991	0.506	0.212
HCM Control Delay	14.5	53.7	15.4	12
HCM Lane LOS	B	F	C	B
HCM 95th-tile Q	2	14.5	2.8	0.8

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	19	48	33
Peak Hour Factor	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	0	0	0
Mvmt Flow	0	20	52	35
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	12
HCM LOS	B

Lane

Intersection	
Intersection Delay, s/veh	22.8
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	21	201	27	0	25	501	6	0	14	35	8
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	10	3	7	2	8	3	0	2	0	3	0
Mvmt Flow	0	24	226	30	0	28	563	7	0	16	39	9
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	12.9	31.8	10.5
HCM LOS	B	D	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	25%	8%	5%	15%
Vol Thru, %	61%	81%	94%	33%
Vol Right, %	14%	11%	1%	52%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	57	249	532	144
LT Vol	14	21	25	22
Through Vol	35	201	501	47
RT Vol	8	27	6	75
Lane Flow Rate	64	280	598	162
Geometry Grp	1	1	1	1
Degree of Util (X)	0.116	0.435	0.861	0.271
Departure Headway (Hd)	6.539	5.595	5.184	6.028
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	544	641	699	592
Service Time	4.622	3.649	3.226	4.097
HCM Lane V/C Ratio	0.118	0.437	0.856	0.274
HCM Control Delay	10.5	12.9	31.8	11.3
HCM Lane LOS	B	B	D	B
HCM 95th-tile Q	0.4	2.2	10.1	1.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	22	47	75
Peak Hour Factor	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	0	2	0
Mvmt Flow	0	25	53	84
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.3
HCM LOS	B

Lane

Intersection	
Intersection Delay, s/veh	37.2
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	59	498	43	0	20	247	14	0	46	124	33
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	0	1	0	2	0	2	0	2	0	0	0
Mvmt Flow	0	63	535	46	0	22	266	15	0	49	133	35
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	59.2	15.7	14.5
HCM LOS	F	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	23%	10%	7%	20%
Vol Thru, %	61%	83%	88%	48%
Vol Right, %	16%	7%	5%	32%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	203	600	281	102
LT Vol	46	59	20	20
Through Vol	124	498	247	49
RT Vol	33	43	14	33
Lane Flow Rate	218	645	302	110
Geometry Grp	1	1	1	1
Degree of Util (X)	0.416	1	0.521	0.217
Departure Headway (Hd)	6.857	5.635	6.213	7.136
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	535	645	589	511
Service Time	4.787	3.677	4.169	5.07
HCM Lane V/C Ratio	0.407	1	0.513	0.215
HCM Control Delay	14.5	59.2	15.7	12
HCM Lane LOS	B	F	C	B
HCM 95th-tile Q	2	15.4	3	0.8

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	20	49	33
Peak Hour Factor	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	0	0	0
Mvmt Flow	0	22	53	35
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	12
HCM LOS	B

Lane

Intersection	
Intersection Delay, s/veh	24.6
Intersection LOS	C

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	21	204	27	0	26	511	6	0	14	37	8
Peak Hour Factor	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	10	3	7	2	8	3	0	2	0	3	0
Mvmt Flow	0	24	229	30	0	29	574	7	0	16	42	9
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	13.2	35	10.6
HCM LOS	B	D	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	24%	8%	5%	16%
Vol Thru, %	63%	81%	94%	33%
Vol Right, %	14%	11%	1%	52%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	59	252	543	147
LT Vol	14	21	26	23
Through Vol	37	204	511	48
RT Vol	8	27	6	76
Lane Flow Rate	66	283	610	165
Geometry Grp	1	1	1	1
Degree of Util (X)	0.122	0.444	0.885	0.28
Departure Headway (Hd)	6.611	5.648	5.221	6.092
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	538	634	696	586
Service Time	4.7	3.71	3.267	4.166
HCM Lane V/C Ratio	0.123	0.446	0.876	0.282
HCM Control Delay	10.6	13.2	35	11.5
HCM Lane LOS	B	B	D	B
HCM 95th-tile Q	0.4	2.3	10.9	1.1

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	23	48	76
Peak Hour Factor	0.89	0.89	0.89	0.89
Heavy Vehicles, %	2	0	2	0
Mvmt Flow	0	26	54	85
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	11.5
HCM LOS	B

Lane

Intersection	
Intersection Delay, s/veh	37.3
Intersection LOS	E

Movement	EBU	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBU	NBL	NBT	NBR
Vol, veh/h	0	60	510	43	0	21	250	16	0	46	125	34
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	0	1	0	2	0	2	0	2	0	0	0
Mvmt Flow	0	65	548	46	0	23	269	17	0	49	134	37
Number of Lanes	0	0	1	0	0	0	1	0	0	0	1	0

Approach	EB	WB	NB
Opposing Approach	WB	EB	SB
Opposing Lanes	1	1	1
Conflicting Approach Left	SB	NB	EB
Conflicting Lanes Left	1	1	1
Conflicting Approach Right	NB	SB	WB
Conflicting Lanes Right	1	1	1
HCM Control Delay	59.3	15.8	14.5
HCM LOS	F	C	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	22%	10%	7%	20%
Vol Thru, %	61%	83%	87%	48%
Vol Right, %	17%	7%	6%	32%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	205	613	287	103
LT Vol	46	60	21	21
Through Vol	125	510	250	49
RT Vol	34	43	16	33
Lane Flow Rate	220	659	309	111
Geometry Grp	1	1	1	1
Degree of Util (X)	0.416	1	0.526	0.217
Departure Headway (Hd)	6.788	5.684	6.135	7.055
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	533	646	589	509
Service Time	4.792	3.684	4.166	5.083
HCM Lane V/C Ratio	0.413	1.02	0.525	0.218
HCM Control Delay	14.5	59.3	15.8	12
HCM Lane LOS	B	F	C	B
HCM 95th-tile Q	2	15.4	3.1	0.8

Intersection	
Intersection Delay, s/veh	
Intersection LOS	

Movement	SBU	SBL	SBT	SBR
Vol, veh/h	0	21	49	33
Peak Hour Factor	0.93	0.93	0.93	0.93
Heavy Vehicles, %	2	0	0	0
Mvmt Flow	0	23	53	35
Number of Lanes	0	0	1	0

Approach	SB
Opposing Approach	NB
Opposing Lanes	1
Conflicting Approach Left	WB
Conflicting Lanes Left	1
Conflicting Approach Right	EB
Conflicting Lanes Right	1
HCM Control Delay	12
HCM LOS	B

Lane

161ST STREET & PROPOSED ACCESS DRIVE

CAPACITY ANALYSIS

Intersection	
Int Delay, s/veh	0.1

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	2	229	527	1	2	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	249	573	1	2	5

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	574	0	-	0	826	573
Stage 1	-	-	-	-	573	-
Stage 2	-	-	-	-	253	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	999	-	-	-	342	519
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	789	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	999	-	-	-	341	519
Mov Cap-2 Maneuver	-	-	-	-	341	-
Stage 1	-	-	-	-	564	-
Stage 2	-	-	-	-	787	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	13.1
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	999	-	-	-	452
HCM Lane V/C Ratio	0.002	-	-	-	0.017
HCM Control Delay (s)	8.6	0	-	-	13.1
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection	
Int Delay, s/veh	0.2

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	5	546	275	2	2	6
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	593	299	2	2	7

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	301	0	-	0	904	300
Stage 1	-	-	-	-	300	-
Stage 2	-	-	-	-	604	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1260	-	-	-	307	740
Stage 1	-	-	-	-	752	-
Stage 2	-	-	-	-	546	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1260	-	-	-	305	740
Mov Cap-2 Maneuver	-	-	-	-	305	-
Stage 1	-	-	-	-	752	-
Stage 2	-	-	-	-	543	-

Approach	EB	WB	SB
HCM Control Delay, s	0.1	0	11.7
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1260	-	-	-	545
HCM Lane V/C Ratio	0.004	-	-	-	0.016
HCM Control Delay (s)	7.9	0	-	-	11.7
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	5	230	528	2	6	16
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	250	574	2	7	17

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	576	0	-	0	836	575
Stage 1	-	-	-	-	575	-
Stage 2	-	-	-	-	261	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	997	-	-	-	337	518
Stage 1	-	-	-	-	563	-
Stage 2	-	-	-	-	783	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	997	-	-	-	335	518
Mov Cap-2 Maneuver	-	-	-	-	335	-
Stage 1	-	-	-	-	563	-
Stage 2	-	-	-	-	778	-

Approach	EB	WB	SB
HCM Control Delay, s	0.2	0	13.4
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	997	-	-	-	451
HCM Lane V/C Ratio	0.005	-	-	-	0.053
HCM Control Delay (s)	8.6	0	-	-	13.4
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Vol, veh/h	18	547	277	7	4	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	20	595	301	8	4	11

Major/Minor	Major1		Major2		Minor2	
Conflicting Flow All	309	0	-	0	939	305
Stage 1	-	-	-	-	305	-
Stage 2	-	-	-	-	634	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1252	-	-	-	293	735
Stage 1	-	-	-	-	748	-
Stage 2	-	-	-	-	529	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1252	-	-	-	286	735
Mov Cap-2 Maneuver	-	-	-	-	286	-
Stage 1	-	-	-	-	748	-
Stage 2	-	-	-	-	516	-

Approach	EB	WB	SB
HCM Control Delay, s	0.3	0	12.3
HCM LOS			B

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1252	-	-	-	507
HCM Lane V/C Ratio	0.016	-	-	-	0.03
HCM Control Delay (s)	7.9	0	-	-	12.3
HCM Lane LOS	A	A	-	-	B
HCM 95th %tile Q(veh)	0	-	-	-	0.1

OAK ROAD & PROPOSED ACCESS DRIVE / OAK WOODS LANE

CAPACITY ANALYSIS

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	0	5	1	0	1	1	61	0	0	138	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	92	89	92	89	92	92	92	92	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	0	6	1	0	1	1	66	0	0	150	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	220	220	151	222	220	66	151	0	0	66	0	0
Stage 1	151	151	-	69	69	-	-	-	-	-	-	-
Stage 2	69	69	-	153	151	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	736	678	895	734	678	998	1430	-	-	1536	-	-
Stage 1	851	772	-	941	837	-	-	-	-	-	-	-
Stage 2	941	837	-	849	772	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	735	677	895	729	677	998	1430	-	-	1536	-	-
Mov Cap-2 Maneuver	735	677	-	729	677	-	-	-	-	-	-	-
Stage 1	850	772	-	940	836	-	-	-	-	-	-	-
Stage 2	939	836	-	844	772	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	9.3	0.1	0
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1430	-	-	843	843	1536	-	-
HCM Lane V/C Ratio	0.001	-	-	0.009	0.003	-	-	-
HCM Control Delay (s)	7.5	0	-	9.3	9.3	0	-	-
HCM Lane LOS	A	A	-	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	0	3	2	0	0	6	190	1	1	97	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	92	93	92	93	92	92	92	92	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	3	2	0	0	6	207	1	1	105	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	329	330	107	330	330	207	108	0	0	208	0	0
Stage 1	109	109	-	220	220	-	-	-	-	-	-	-
Stage 2	220	221	-	110	110	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	624	589	947	623	589	833	1483	-	-	1363	-	-
Stage 1	896	805	-	782	721	-	-	-	-	-	-	-
Stage 2	782	720	-	895	804	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	621	585	947	618	585	833	1483	-	-	1363	-	-
Mov Cap-2 Maneuver	621	585	-	618	585	-	-	-	-	-	-	-
Stage 1	892	804	-	778	717	-	-	-	-	-	-	-
Stage 2	778	716	-	891	803	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	10.8	0.2	0.1
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1483	-	-	837	618	1363	-	-
HCM Lane V/C Ratio	0.004	-	-	0.005	0.004	0.001	-	-
HCM Control Delay (s)	7.4	0	-	9.3	10.8	7.6	0	-
HCM Lane LOS	A	A	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	2	0	5	4	0	2	1	61	2	1	138	1
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	89	89	89	92	89	92	89	92	92	92	92	89
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	2	0	6	4	0	2	1	66	2	1	150	1

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	224	224	151	226	223	67	151	0	0	68	0	0
Stage 1	153	153	-	70	70	-	-	-	-	-	-	-
Stage 2	71	71	-	156	153	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	732	675	895	729	676	997	1430	-	-	1533	-	-
Stage 1	849	771	-	940	837	-	-	-	-	-	-	-
Stage 2	939	836	-	846	771	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	729	674	895	723	675	997	1430	-	-	1533	-	-
Mov Cap-2 Maneuver	729	674	-	723	675	-	-	-	-	-	-	-
Stage 1	848	770	-	939	836	-	-	-	-	-	-	-
Stage 2	936	835	-	840	770	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	9.6	0.1	0.1
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1430	-	-	840	796	1533	-	-
HCM Lane V/C Ratio	0.001	-	-	0.009	0.008	0.001	-	-
HCM Control Delay (s)	7.5	0	-	9.3	9.6	7.4	0	-
HCM Lane LOS	A	A	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-

Intersection	
Int Delay, s/veh	0.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Vol, veh/h	1	0	3	3	0	1	6	190	5	2	97	2
Conflicting Peds, #/hr	0	0	0	0	0	0	0	0	0	0	0	0
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	93	93	93	92	93	92	93	92	92	92	92	93
Heavy Vehicles, %	2	2	2	2	2	2	2	2	2	2	2	2
Mvmt Flow	1	0	3	3	0	1	6	207	5	2	105	2

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	334	336	107	334	334	209	108	0	0	212	0	0
Stage 1	111	111	-	222	222	-	-	-	-	-	-	-
Stage 2	223	225	-	112	112	-	-	-	-	-	-	-
Critical Hdwy	7.12	6.52	6.22	7.12	6.52	6.22	4.12	-	-	4.12	-	-
Critical Hdwy Stg 1	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.12	5.52	-	6.12	5.52	-	-	-	-	-	-	-
Follow-up Hdwy	3.518	4.018	3.318	3.518	4.018	3.318	2.218	-	-	2.218	-	-
Pot Cap-1 Maneuver	620	585	947	620	586	831	1483	-	-	1358	-	-
Stage 1	894	804	-	780	720	-	-	-	-	-	-	-
Stage 2	780	718	-	893	803	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	616	581	947	615	582	831	1483	-	-	1358	-	-
Mov Cap-2 Maneuver	616	581	-	615	582	-	-	-	-	-	-	-
Stage 1	890	802	-	776	716	-	-	-	-	-	-	-
Stage 2	775	714	-	888	801	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	10.5	0.2	0.2
HCM LOS	A	B		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1483	-	-	835	658	1358	-	-
HCM Lane V/C Ratio	0.004	-	-	0.005	0.007	0.002	-	-
HCM Control Delay (s)	7.4	0	-	9.3	10.5	7.7	0	-
HCM Lane LOS	A	A	-	A	B	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0	0	0	-	-