Traffic Impact Study

Grooms Road Multifamily
Sycamore Township
Hamilton County, OH

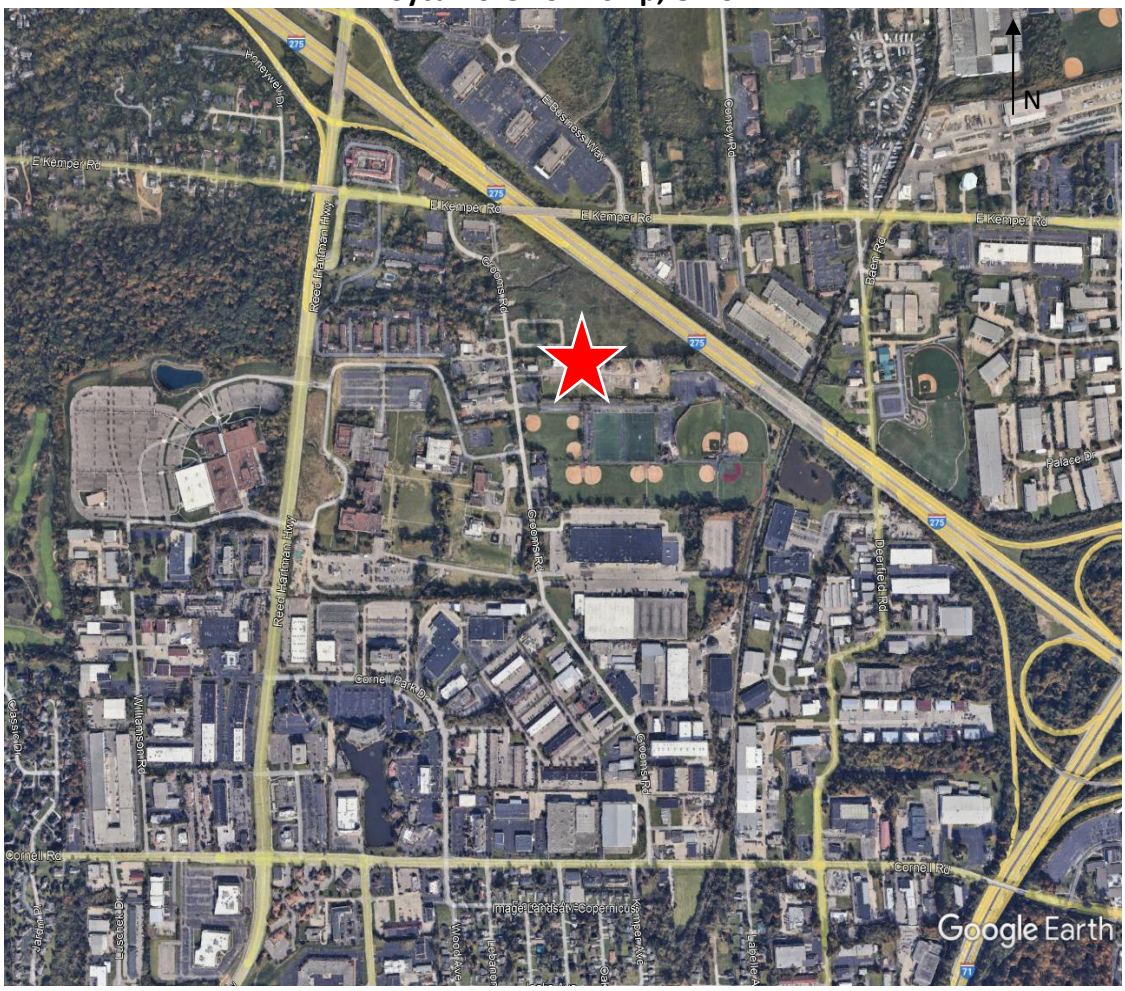
Report V 1.0
December 2022

TEC PN: 22256-001

TEC Engineering, Inc.

The Traffic Impact Study

Kemper Road & Grooms Road
Sycamore Township, Ohio



Prepared for:

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Prepared By:

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Mason – Cincinnati – Dayton - Columbus

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Qualifications

TEC Engineering, Inc. is a consulting engineering firm established in 1992 specializing in the fields of Transportation Planning, Traffic Engineering, and Roadway and Highway Design, including all ancillary services. In its thirty-year history, the firm has completed a variety of transportation improvement and enhancement projects across a wide spectrum, including: Traffic Signal Design, Intelligent Transportation Systems Planning, Design and Operations, Roadway/Highway Design, Engineering Studies, and Roadway/Highway and Parking Lighting Systems. TEC has conducted a wide variety of Traffic Studies throughout Ohio, Kentucky, and Indiana.

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

Andrea Harth, PE, PTOE, RSP
OH Registration #74335
TEC Engineering, Inc.

1.0 Executive Summary

TEC Engineering, Inc. was retained to conduct a Traffic Impact Study for a proposed development at the intersection of Kemper Road and Grooms Road in Sycamore Township, Ohio. The development is proposed to have two full accesses located Grooms Road.

Trip Generation and Distribution

The proposed development is anticipated to generate 144 New Trips (34 inbound and 110 outbound) in the AM peak hour. The proposed development is anticipated to generate 189 New Trips (119 inbound and 70 outbound) in the PM peak hour. The new trips were distributed throughout the project area.

Traffic Analysis

Queue analysis and capacity analysis were used to develop the conclusions and recommendations pertinent to the impact of traffic in the vicinity of the proposed development.

Roadway Network Conclusions

Using the data from the No Build and Build analysis, TEC has determined that the proposed Development will not cause any significant changes to the LOS or delay within the study area. No improvements to the existing corridor are required.

2.0 Introduction

TEC Engineering, Inc. was retained to conduct a Traffic Impact Study for a proposed development at the intersection of Kemper Road and Grooms Road in Sycamore Township, Ohio. The development is proposed to have two full accesses located Grooms Road.

The following sources were referenced:

- *Institute of Transportation Engineers (ITE) Trip Generation Manual, 11th Edition*
- *ODOT Location and Design Manual, Volume One*
- *ODOT State Highway Access Management Manual (SHAMM), July 2021*
- *ODOT's Analysis and Traffic Simulation (OATS) Manual, July 2021*
- *HCEO Access Management Regulations, Jan 1, 2005*

Traffic Counts
Manual turning movement counts were collected at the intersection of Kemper Road and Grooms Road during the weekday AM and PM peak periods in November 2022. The peak hour for the weekday AM was determined to be 7:30-8:30am and the peak hour for the PM was determined to be 4:45-5:45pm. This traffic count data is provided in ***Appendix B*** and further discussed in Section 3.2.

Generated Traffic
Trip Generation was completed using the proposed land use type to estimate the number of trips that will be generated due to the new development. The projected traffic volumes entering and exiting the development was determined using the *Institute of Transportation Engineers (ITE) Trip Generation Handbook*. Once the trips were generated, the directional distribution of the proposed development site was determined based on existing traffic patterns in the area. The generated traffic was used to develop full build year traffic for analysis. This data is provided in ***Appendix C***

Analysis & Recommendations
All of the aforementioned steps provided the information used to analyze the impact of the proposed development. Storage lane length/queue analysis and capacity analysis were used to develop the conclusions and recommendations pertinent to the impact of traffic in the vicinity of the proposed development.

This report summarizes the findings of the traffic impact study conducted by TEC Engineering, Inc.

3.0 Area Conditions

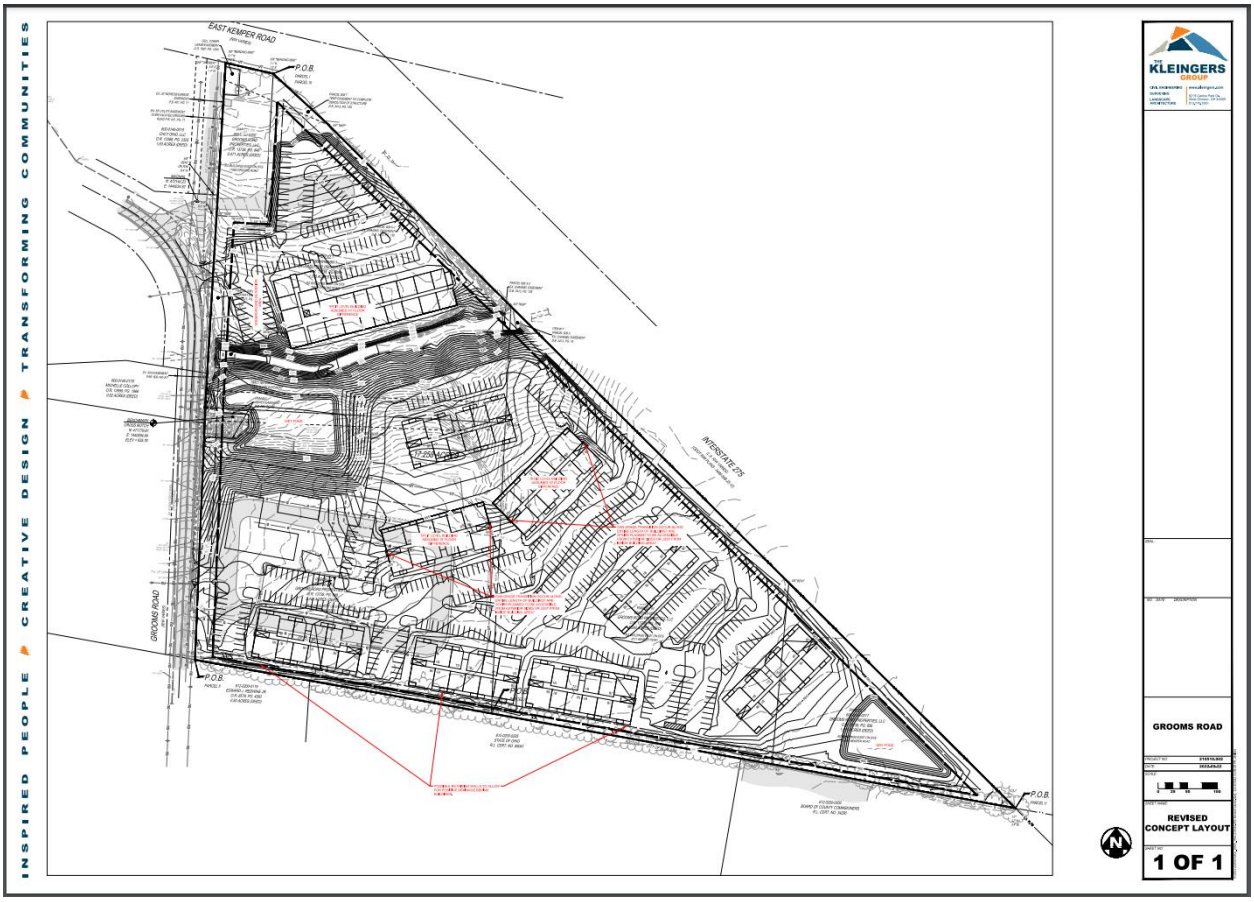
3.1 Study Area

The development will be located on Grooms Road South of Kemper Road. The development consists of Multi Family Low-Rise apartments. The site plan can be seen below in *Figure 2*.

Surrounding the development, Kemper Road is a 4-lane minor arterial. It has a posted speed limit of 35 MPH and carries approximately 12,312 vehicles per day (ADT from the Ohio Department of Transportation records). Grooms Road is a local road with a posted speed limit of 35 MPH and carries approximately 4,773 vehicles per day (ADT from the Ohio Department of Transportation records).

Figure 1: Study Area

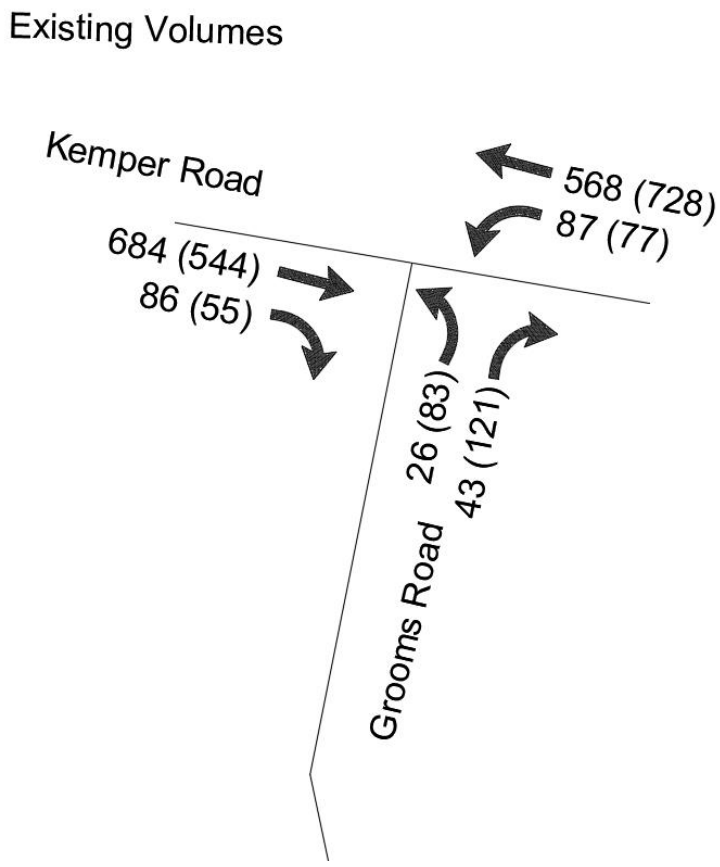
Figure 2: Site Plan



3.2 Existing Volumes

Manual turning movement counts were collected at the intersection of Kemper Road and Grooms Road during the weekday AM and PM peak periods in November 2022. The peak hour for the weekday AM was determined to be 7:30-8:30am and the peak hour for the PM was determined to be 4:45-5:45pm. Traffic count data is provided in ***Appendix B***. The collected traffic volumes are shown in ***Figure 3.***

Figure 3: 2022 Existing Counts AM(PM)



A straight-line growth rate of 2% per year was applied to the existing volumes to create the No Build 2024 and 2034 scenarios. The no build volumes are located below in *Figure 4* and *Figure 5.*

Figure 4: 2024 No Build Volumes AM(PM)

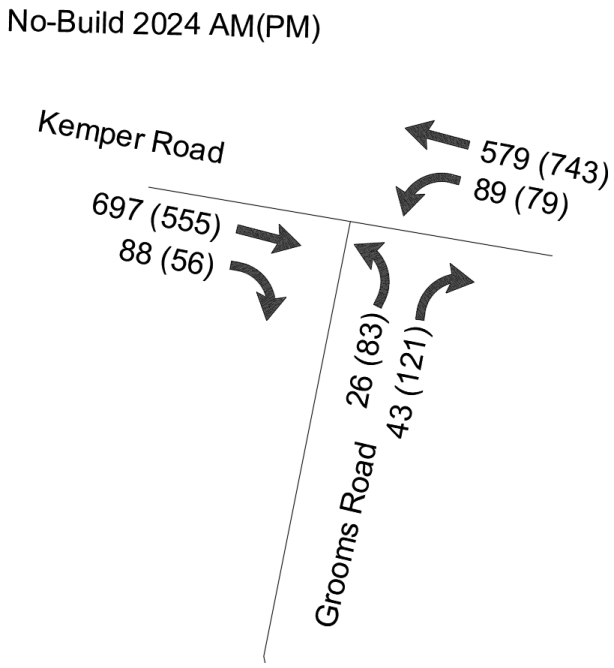
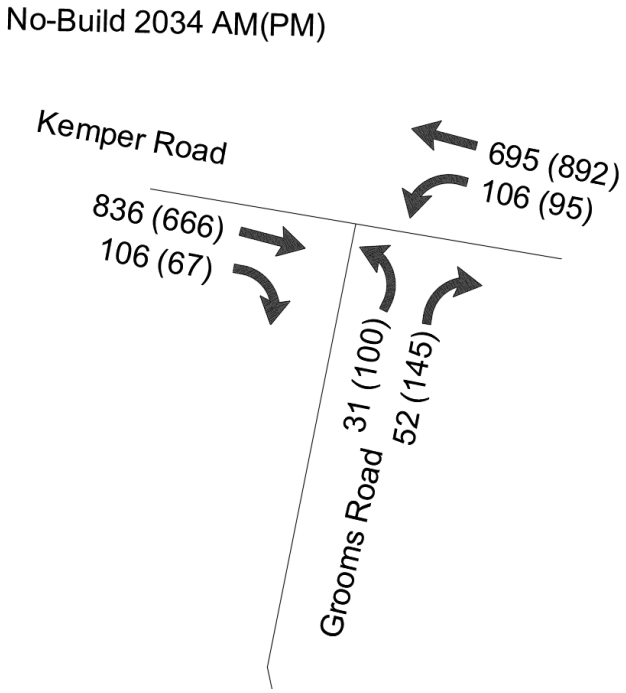


Figure 5: 2034 No Build Volumes AM(PM)



4.0 Proposed Site Development

The proposed development is located south of the intersection of Kemper Road & Grooms Road in Sycamore Township, Ohio. The development is proposed to two full accesses along Grooms Road. The development consists of a 392 Units of Multi-Family Apartments (Low-Rise).

5.0 Traffic Projections

5.1 Trip Generation

Total Trips

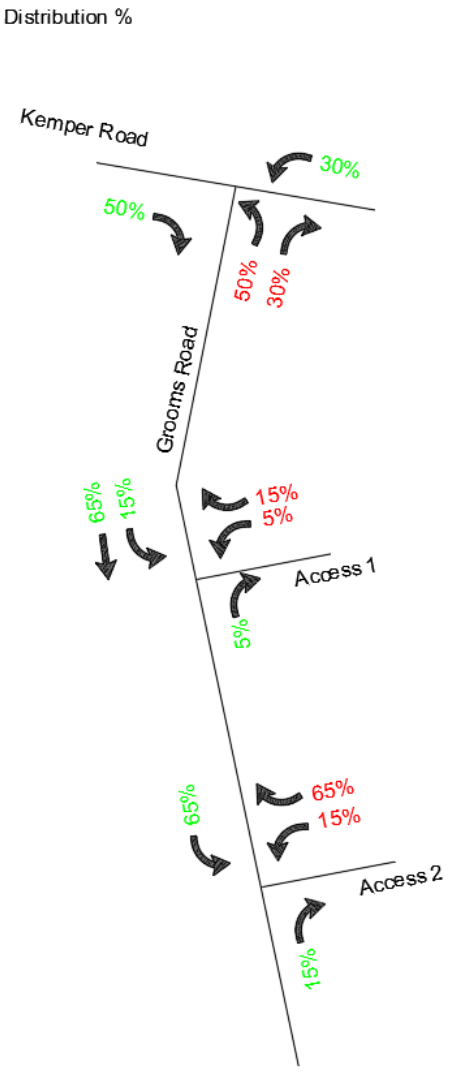
The development consists of a 392 Units of Multi-Family Apartments (Low-Rise). The *Institute of Transportation Engineers (ITE) Trip Generation Manual* is the most widely accepted publication for projecting traffic volumes; specifically related to how the site is used. The trips generated by the development were projected using the trip generation rates and equations provided in Version 11 of the manual. ***Table 1*** shows the total projected trips to be generated by the development during the average weekday AM and PM peak hours.

Table 1: Generated Trips

ITE Code	Land Use	Units	Quantity	Peak Hour	Generation Rate	Total Trips	Enter %	Exit %	Enter Trips	Exit Trips	Total Trips
220	Multifamily Housing (Low-Rise)	Dwellings	392	AM	T=0.31(X)+22.85	144	24%	76%	34	110	144
				PM	T=0.43(X)+20.55	189	63%	37%	119	70	189

The basis for the directional distribution of the proposed development was based upon existing traffic patterns in the area. The study team evaluated existing peak hour count data to determine the overall distribution patterns for the area. For this site, the following directional distribution percentages were determined:

Figure 6: Directional Distribution Percentages



5.2 Scenario Evaluation

To determine any area modifications necessary to accommodate the traffic generated by the proposed development, the following four scenarios were compared:

- *2024 Opening Year – No Build*
- *2024 Opening Year – Build*
- *2034 Design Year – No Build*
- *2034 Design Year – Build*

A 2% straight line growth rate was used to determine future traffic volumes

Figure 7: Generated Trips

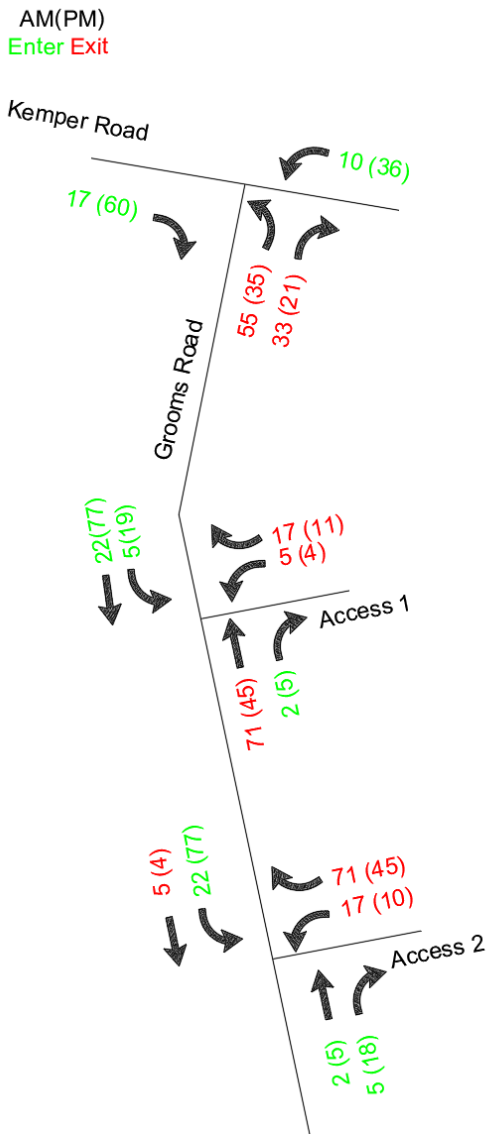


Figure 8: 2024 Opening Year AM(PM) Volumes

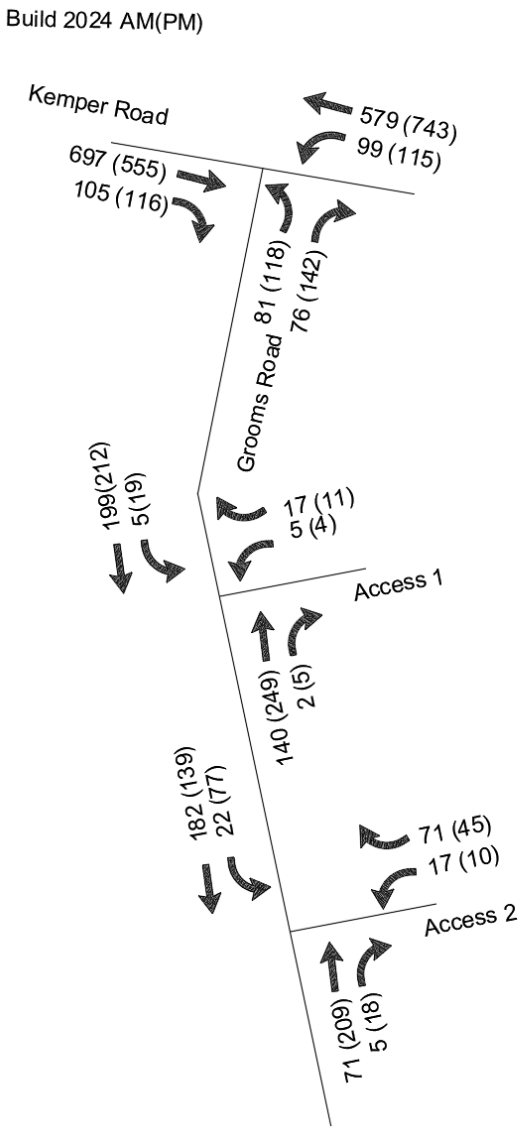
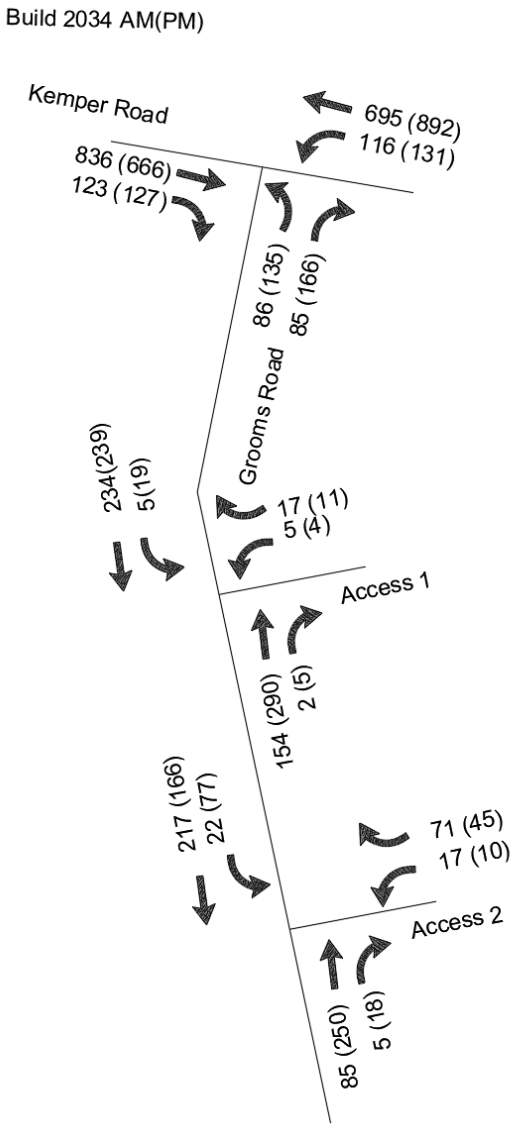


Figure 9: 2034 Design Year AM(PM) Volumes



6.0 Turn Lane Warrants

A turn lane warrant analysis was performed to determine the need for a right turn lane or left turn on Grooms Road at the proposed site accesses. The table below displays the results of that analysis. Turn Lane Warrant graphs are included in Appendix D.

Table 2: Turn Lane Warrants

Turn Lane	Warrants?
Access 1 Northbound Right	No
Access 1 Southbound Left	No
Access 2 Northbound Right	No
Access 2 Southbound Left	No

7.0 Traffic Analysis

TEC used the software program *Synchro 11* to evaluate the traffic scenarios listed previously. The Level of Service (LOS) for the intersection is directly related to the average total delay per vehicle. The total delay is the sum of control delay and queue delay. Control delay is the component of delay caused by the downstream control device and is calculated using the Percentile Delay Method. Queue delay is an analysis of the effects of queues and blocking on short links and short turning bays. LOS is defined in terms of delay and is a measure of driver discomfort and intersection performance with respect to vehicular capacity and quality of service provided to road users. Delay refers to total average stopped delay experienced by motorists at the referenced intersection. The level of service is classified into six different levels, ranging from A to F, and is Tables 3 & 4. Capacity analysis reports from *Synchro 11* can be found in *Appendix E.*

Table 3: Signalized Level of Service Classifications

Level of Service	Description	Delay
A	Very low delay	<10 seconds per vehicle
B	Good progression	10-20 seconds per vehicle
C	Limit of acceptable delay	20-35 seconds per vehicle
D	Start of traffic breakdown	35-55 seconds per vehicle
E	High delay	55-80 seconds per vehicle
F	Congested conditions, unacceptable delay	>80 seconds per vehicle

Table 4: Unsignalized Level of Service Classifications

Level of Service	Description	Delay
A	Very low delay	<10 seconds per vehicle
B	Good progression	10-15 seconds per vehicle
C	Limit of acceptable delay	15-25 seconds per vehicle
D	Start of traffic breakdown	25-35 seconds per vehicle
E	High delay	35-50 seconds per vehicle
F	Congested conditions, unacceptable delay	>50 seconds per vehicle

A summary of the traffic analysis has been included in the following tables**.** The traffic analysis worksheets have been included in ***Appendix E***. For consistency in comparing results, the timing for No Build was matched in the Build Condition.

Table 5: LOS Kemper Road & Grooms Road

Kemper Road & Grooms Road									
Peak	Scenario	EB Kemper Road		WB Kemper Road		NB Grooms Road		Total Intersection	
AM	2024 No Build	2.8	A	2.7	A	31.3	C	4.1	A
	2024 Build	4.1	A	4.1	A	30.9	C	6.7	A
	2034 No Build	3.1	A	3.2	A	31.5	C	4.5	A
	2034 Build	4.7	A	4.9	A	31.3	C	7.1	A
PM	2024 No Build	4.1	A	4.6	A	32	C	7.8	A
	2024 Build	5.2	A	6.3	A	34.8	C	10	B
	2034 No Build	5	A	6.2	A	34.3	C	9.3	A
	2034 Build	6.4	A	9.2	A	35.2	D	11.8	B

Table 6: LOS Grooms Road & Access 1 (Unsignalized)

Grooms & Access 1									
Peak	Scenario	WB Access		NB Grooms Rd.		SB Grooms Rd.		Total Intersection	
AM	2024 Build	9.5	A	0.0	A	0.2	A	0.7	A
	2034 Build	9.7	A	0.0	A	0.2	A	0.6	A
PM	2024 Build	10.5	B	0.0	A	0.8	A	0.7	A
	2034 Build	10.9	B	0.0	A	0.7	A	0.6	A

Table 7: LOS Grooms Road & Access 2 (Unsignalized)

Grooms & Access 2									
Peak	Scenario	WB Access		NB Grooms Rd.		SB Grooms Rd.		Total Intersection	
AM	2024 Build	9.5	A	0.0	A	0.9	A	2.8	A
	2034 Build	9.6	A	0.0	A	0.8	A	2.5	A
PM	2024 Build	10.6	B	0.0	A	3.2	A	2.6	A
	2034 Build	11.0	B	0.0	A	3.0	A	2.3	A

SimTraffic was used to provide a simulation of the area. For queue reporting purposes, the simulation was set with a 60-minute interval and 5 simulations runs were recorded and averaged.

Table 8: 95th Percentile Queue (ft)

		AM				PM			
Intersection	Movement	2024 No Build	2024 Build	2034 No Build	2034 Build	2024 No Build	2024 Build	2034 No Build	2034 Build
Kemper Road & Grooms Road	EBT	88	112	105	136	95	121	127	144
	EBTR	63	93	97	117	73	95	95	126
	WBLT	107	136	159	159	128	162	174	217
	WBT	74	113	144	143	111	147	158	215
	NBLR	61	134	62	139	142	184	154	212
Grooms Road Access 1	WBLR	-	41	-	40	-	36	-	35
	NBTR	-	3	-	8	-	10	-	8
	SBLT	-	6	-	6	-	24	-	28
Grooms Road Access 2	WBLR	-	53	-	53	-	50	-	49
	SBLT	-	11	-	16	-	41	-	55

Overall, the LOS remains at an acceptable level. At Kemper and Grooms, the northbound approach degrades from a LOS C to a low LOS D with less than 1 second increase in delay Overall, the intersection operates at a LOS B which well above the acceptable threshold. The maximum 95th percentile queue for the northbound approach in the Build condition is 212' (a 70' increase from No Build). This is within the existing link distance and will not block any driveways.

8.0 Sight Distance Requirements

TEC preformed an intersection sight distance study at both accesses in order to determine if the existing sight distance at the proposed accesses allowed for safe entering and exiting. TEC used the sight distance triangles provided in the ODOT L & D manual.

Figure 10: Intersection Sight Triangles

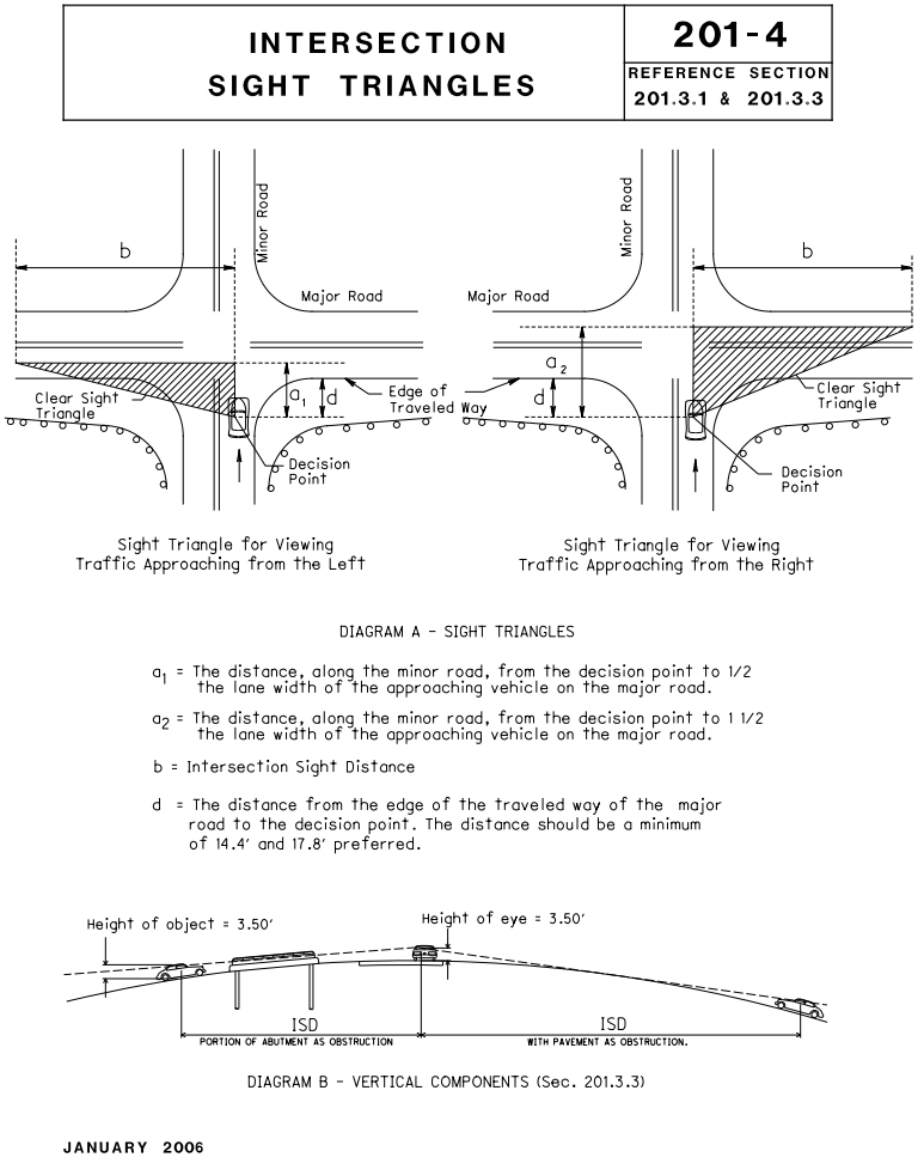


Figure 11: Intersection Sight Triangles

INTERSECTION SIGHT DISTANCE	201-5 REFERENCE SECTION 201.3, 201.3.1, 201.3.2 & 201.3.3

(See Following Page for Additional Figures & Notes)

HEIGHT OF EYE 3.50′ HEIGHT OF OBJECT 3.50′

DESIGN SPEED (mph)	Passenger Cars Completing a Left Turn from a Stop (assuming a t_g of 7.5 sec.)		Passenger Cars Completing a Right Turn from a Stop or Crossing Maneuver (assuming a t_g of 6.5 sec.)	
	ISD (ft.)	K-CREST VERT. CURVE	ISD (ft.)	K-CREST VERT. CURVE
15	170	10	145	8
20	225	18	195	14
25	280	28	240	21
30	335	40	290	30
35	390	54	335	40
40	445	71	385	53
45	500	89	430	66
50	555	110	480	82
55	610	133	530	100
60	665	158	575	118
65	720	185	625	140
70	775	214	670	160

If ISD cannot be provided due to environmental or R/W constraints, then as a minimum, the SSD for vehicles on the major road should be provided.

Table 9: Field Measured Sight Distance

Location	Looking South	Looking North
Access 1	669′	502′
Access 2	321′	531′

TEC found that using the existing grades, Access 2 did not meet the criteria for intersection sight distance of 390′. Further investigation was completed using the elevation and profile details from Google Earth. Based on the proposed grading plan the elevation at the access is approximately 852.5′. This was used for the ground elevation of the proposed access at the intersection sight distance decision point. An exhibit showing the profile and sight line can be found in Appendix F . Therefore, sight distance will be met.

The stopping sight distance requirement for 35 mph is 225′. Based on field conditions stopping sight distance is met for all approaches.

9.0 Access Management

The Access Locations were reviewed for compliance with the Hamilton County Access Management Regulations. Since the terrain of the area necessitates two separate accesses without a connection, both accesses were evaluated separately. Grooms Road was considered "Minor Collector" based on the Hamilton County Thoroughfare Plan.

Access 1
- 42 Peak hour trips → Low Volume Driveway
- Min Access Spacing- 140'
- Existing spacing= 80' from the access to the north

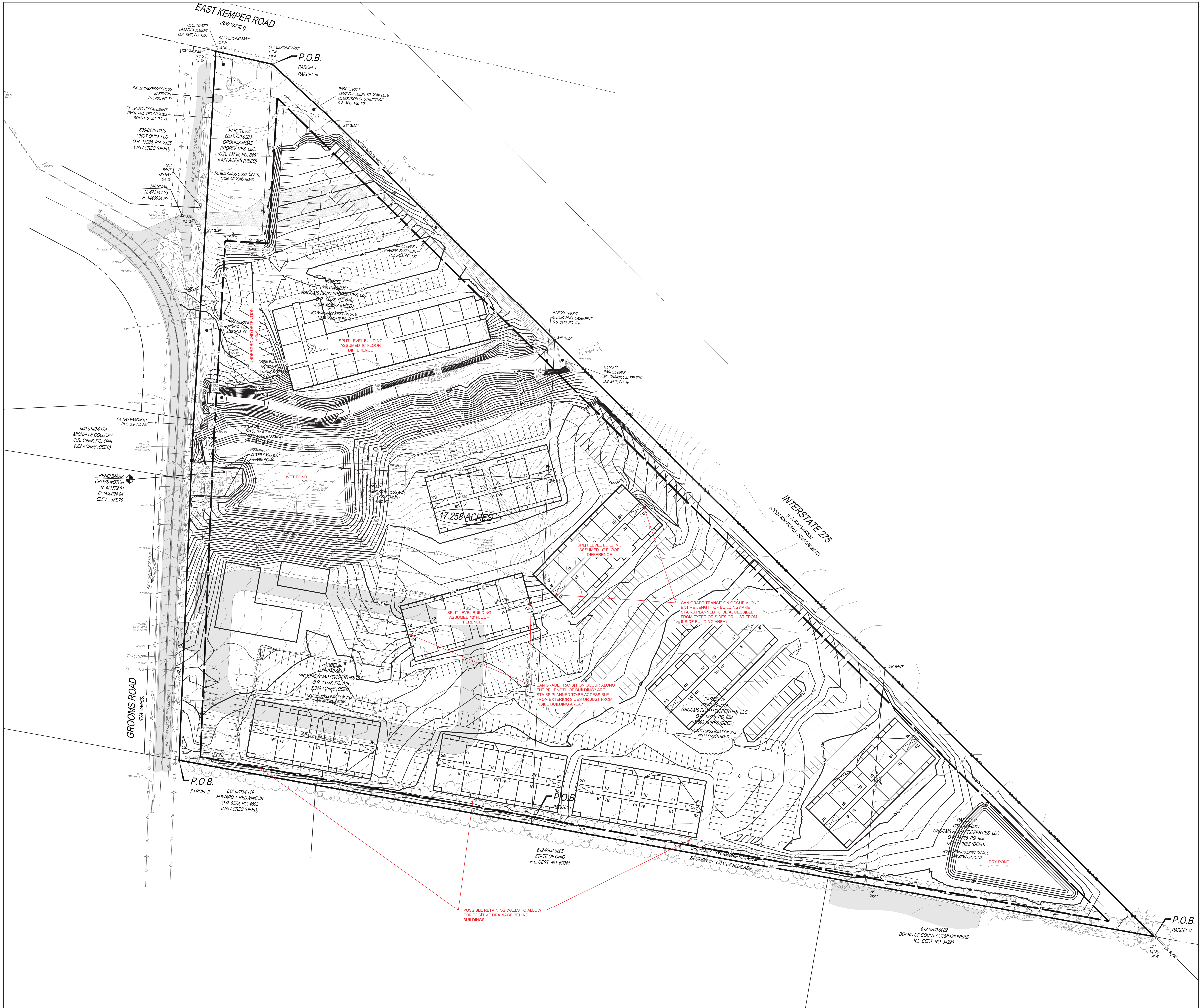
Access 2
- 138 Peak hour trips → Medium Volume Driveway
- Min Access Spacing- 140'
- Existing spacing= 145' from the residential access to the south

Access 1 does not meet the minimum spacing requirements. However, moving the access to the south to increase spacing would have a negative effect on the sight distance at the access due to the horizontal curve. The adjacent access provides parking for just 20 vehicles and is a low volume access. The location shown is the recommended location.

10.0 Conclusion

Using the data from the No Build and Build analysis, TEC has determined that the proposed Development will not cause any significant changes to the LOS or delay at the intersection of Kemper and Grooms. Turn lanes are not warranted at either access point and intersection sight distance will be adequate.

APPENDIX A : SITE PLAN



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SEAL:

NO.	DATE	DESCRIPTION

GROOMS ROAD

PROJECT NO: 210510.002

DATE: 2022-09-22

SCALE: 0 25 50 100

SHEET NAME:

REVISED CONCEPT LAYOUT

SHEET NO.

1 OF 1

INSPIRED PEOPLE ▸ CREATIVE DESIGN ▸ TRANSFORMING COMMUNITIES

APPENDIX B : TRAFFIC COUNTS

TEC Engineering, Inc.
Turning Movement Counts
7288 Central Parke Boulevard
Mason, Ohio 45040
PH: 513-771-8828

Kemper Road and Grooms Road
Specific Hour Data

TEC PN: 22256-001
Wednesday, November 9, 2022

Peak Hour Start 1		Kemper Road - Eastbound				Kemper Road - Westbound				Grooms Road - Northbound				- Southbound				
		Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
7:30 AM	7:30 AM	0	160	17	177	23	175	0	198	5	0	5	10	0	0	0	0	385
	7:45 AM	0	190	26	216	25	143	0	168	8	0	17	25	0	0	0	0	409
	8:00 AM	0	166	26	192	26	104	0	130	4	0	11	15	0	0	0	0	337
	8:15 AM	0	168	17	185	13	146	0	159	9	0	10	19	0	0	0	0	363
	Total	**0**	**684**	**86**	**770**	**87**	**568**	**0**	**655**	**26**	**0**	**43**	**69**	**0**	**0**	**0**	**0**	**1494**
	PHF	-	0.9	0.83	0.89	0.84	0.81	-	0.83	0.72	-	0.63	0.69	-	-	-	-	0.91
	HV%	-	0%	-	0%	-	-	-	-	-	-	-	-	-	-	-	-	0%

Peak Hour Start 2		Kemper Road - Eastbound				Kemper Road - Westbound				Grooms Road - Northbound				- Southbound				
		Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Left	Thru	Right	App Total	Int Total
4:45 PM	4:45 PM	0	134	10	144	34	157	0	191	23	0	35	58	0	0	0	0	393
	5:00 PM	0	128	31	159	17	222	0	239	26	0	34	60	0	0	0	0	458
	5:15 PM	1	132	8	141	10	154	0	164	16	0	20	36	0	0	0	0	341
	5:30 PM	0	150	6	156	16	195	0	211	18	0	32	50	0	0	0	0	417
	Total	**1**	**544**	**55**	**600**	**77**	**728**	**0**	**805**	**83**	**0**	**121**	**204**	**0**	**0**	**0**	**0**	**1609**
	PHF	0.25	0.91	0.44	0.94	0.57	0.82	-	0.84	0.8	-	0.86	0.85	-	-	-	-	0.88
	HV%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

APPENDIX C : TRIP GENERATION

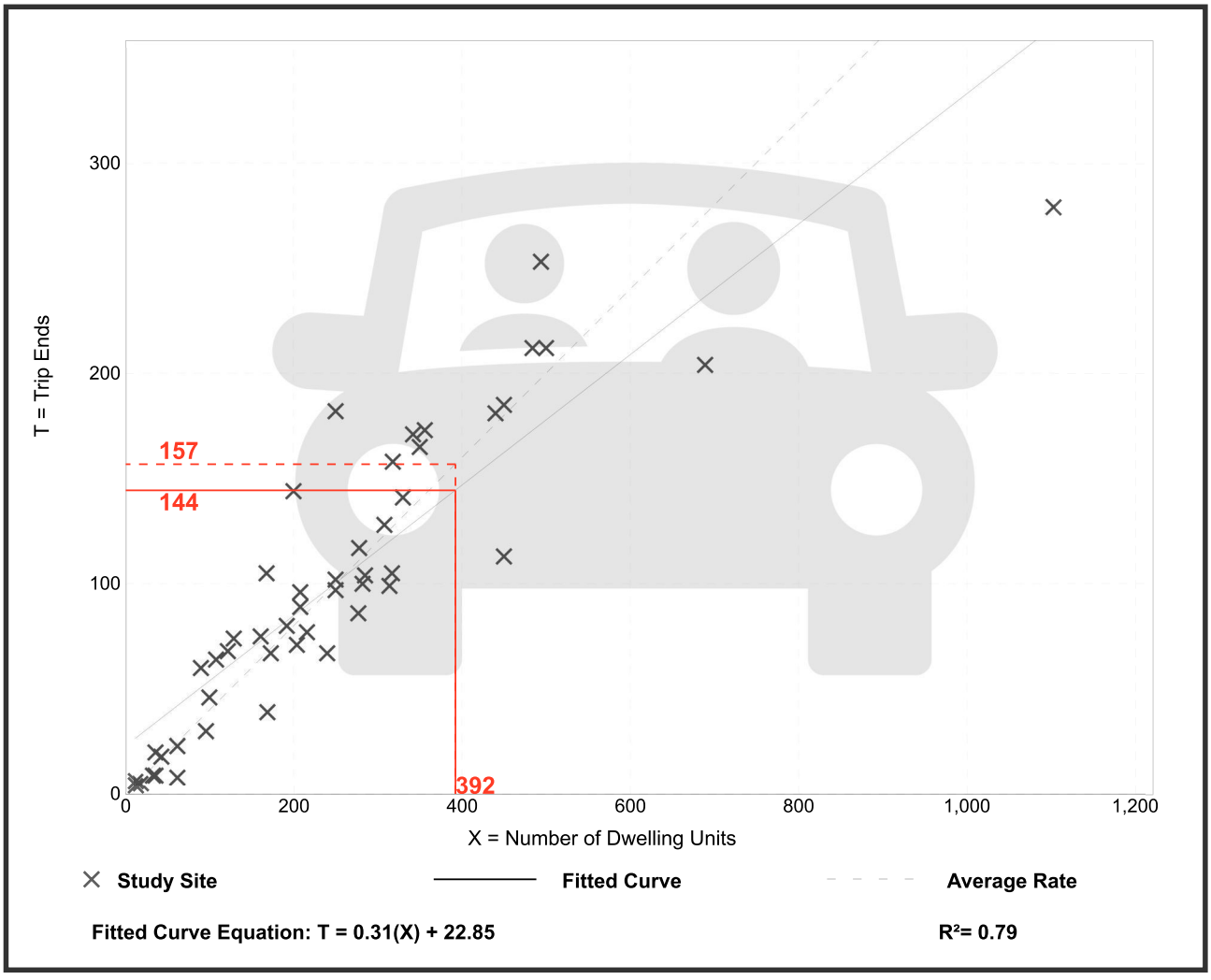
Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 49
Avg. Num. of Dwelling Units: 249
Directional Distribution: 24% entering, 76% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.40	0.13 - 0.73	0.12

Data Plot and Equation



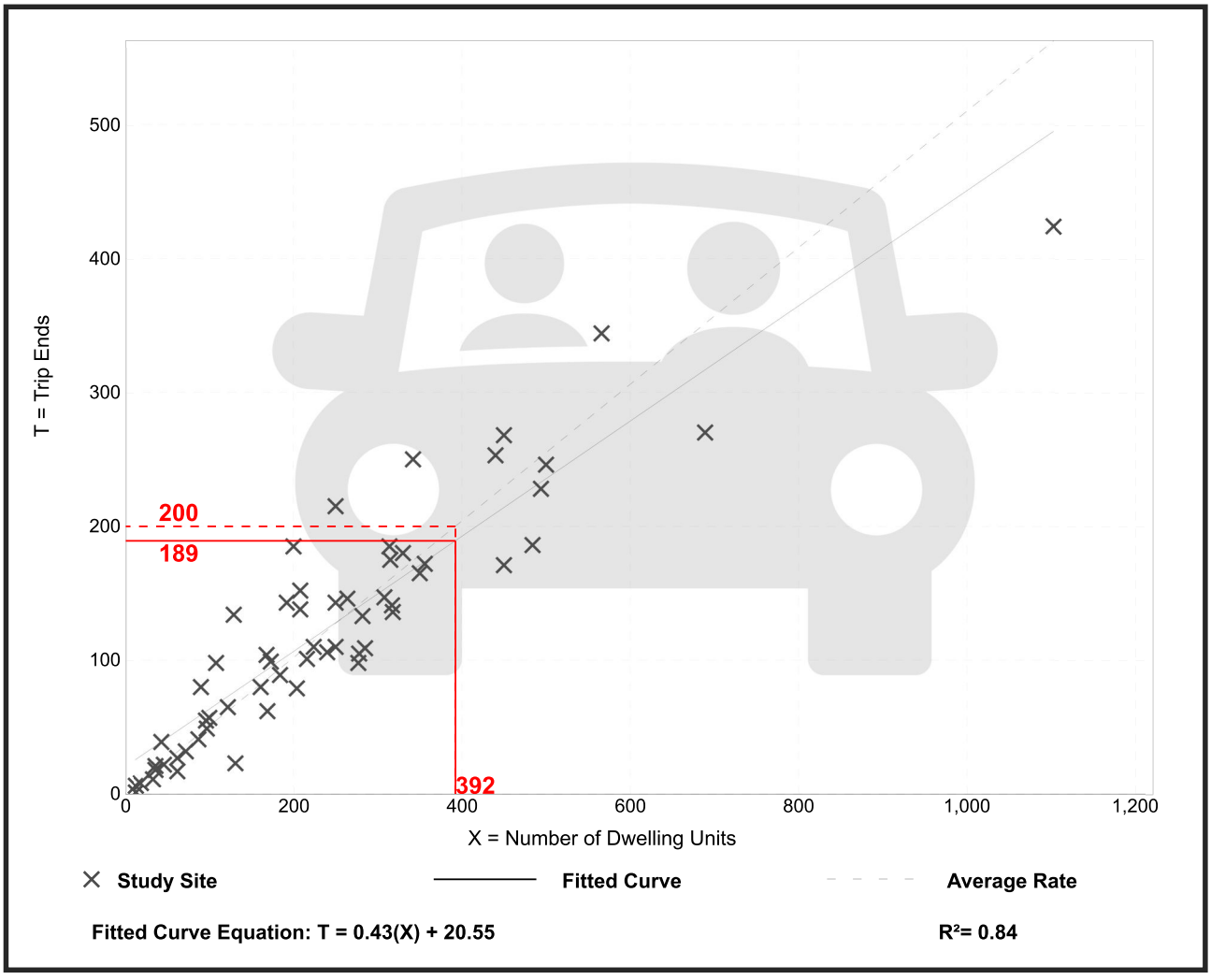
Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 59
Avg. Num. of Dwelling Units: 241
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.51	0.08 - 1.04	0.15

Data Plot and Equation

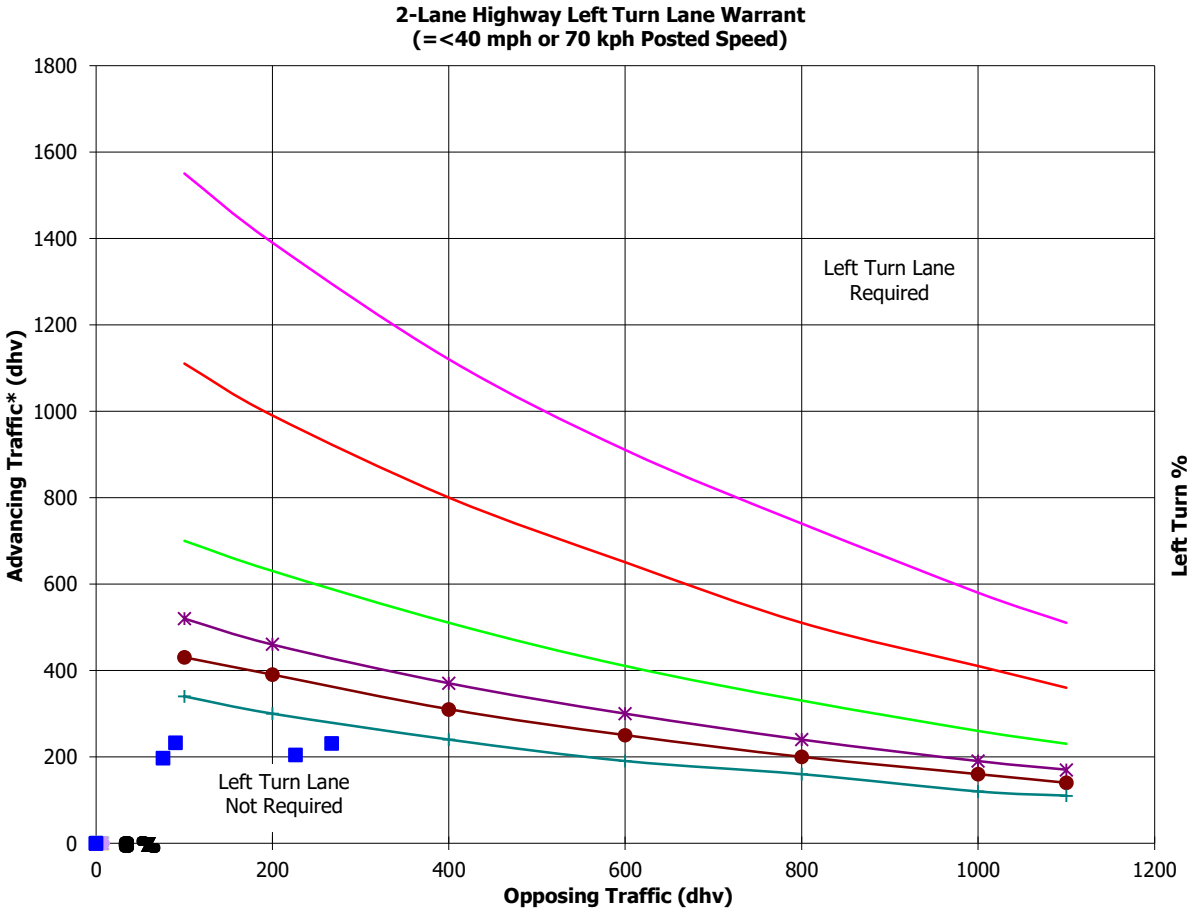


APPENDIX D: TURN LANE WARRANTS

2-Way LT Graphs

FIGURE A: 2-LANE HIGHWAY LEFT TURN LANE WARRANT (=<40 MPH OR 70 KPH POSTED SPEED)

Location	Advancing Traffic					Opposing Traffic			
	Left	Thru	Right	Total	% Left	Left	Thru	Right	Total
Access Am 2024	20	177	0	197	10%	0	72	4	76
Access Pm 2024	70	134	0	204	34%	0	209	17	226
Access Am 2034	20	212	0	232	9%	0	86	4	90
Access Pm 2034	70	161	0	231	30%	0	250	17	267
	0	0	0	0		0	0	0	0
	0	0	0	0		0	0	0	0
	0	0	0	0		0	0	0	0



*Includes Left Turns

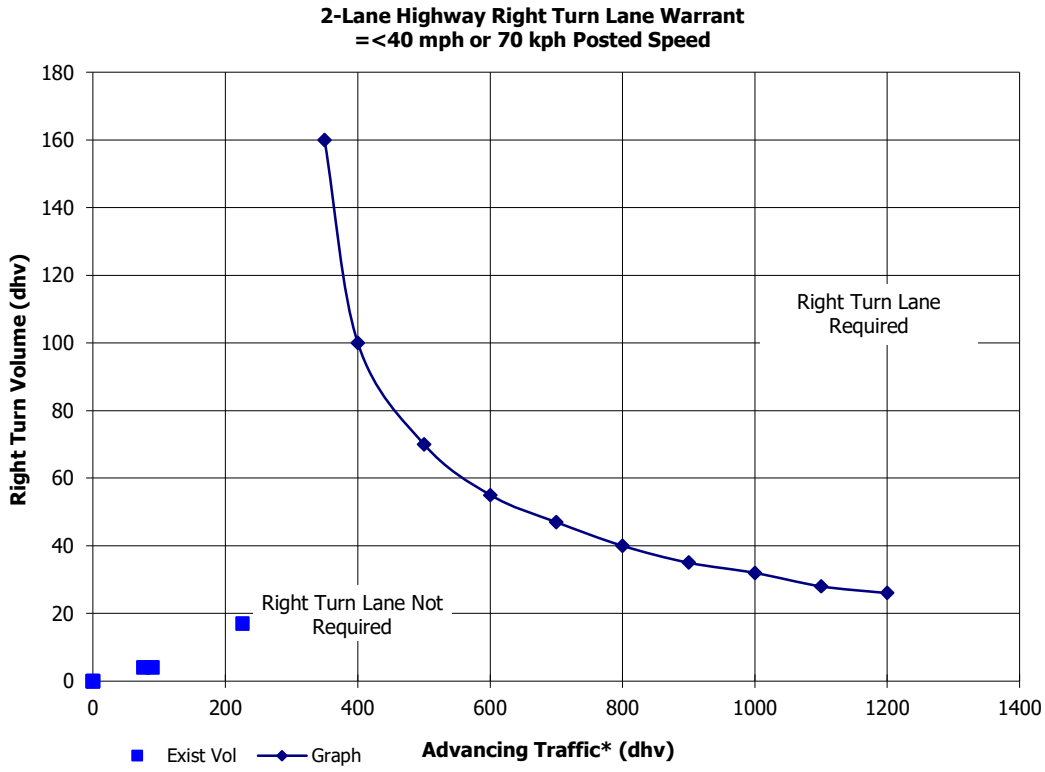
**There is no minimum number of turns

Is Left Turn Lane Warrant met? NO

2-Way RT Graphs

2-LANE HIGHWAY RIGHT TURN LANE WARRANT
=<40 MPH OR 70 KPH POSTED SPEED

Location	Right Turn Volume	Advancing Traffic			
	Right	Left	Thru	Right	Total
Access Am 2024	4	0	72	4	76
Access Pm 2024	17	0	209	17	226
Access Am 2034	4	0	86	4	90
Access Pm 2034	17	0	250	17	267
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0



*Includes Right Turns

Is Right Turn Lane Warrant met? NO

APPENDIX E: CAPACITY ANALYSIS

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	697	88	89	579	26	43
Future Volume (vph)	697	88	89	579	26	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.98			1.00	0.92	
Flt Protected	1.00			0.99	0.98	
Satd. Flow (prot)	3480			3516	1674	
Flt Permitted	1.00			0.74	0.98	
Satd. Flow (perm)	3480			2635	1674	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	758	96	97	629	28	47
RTOR Reduction (vph)	5	0	0	0	42	0
Lane Group Flow (vph)	849	0	0	726	33	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	58.5			58.5	8.0	
Effective Green, g (s)	58.5			58.5	8.0	
Actuated g/C Ratio	0.77			0.77	0.11	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2696			2041	177	
v/s Ratio Prot	0.24				c0.02	
v/s Ratio Perm				c0.28		
v/c Ratio	0.32			0.36	0.19	
Uniform Delay, d1	2.5			2.6	30.8	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.3			0.1	0.5	
Delay (s)	2.8			2.7	31.3	
Level of Service	A			A	C	
Approach Delay (s)	2.8			2.7	31.3	
Approach LOS	A			A	C	

Intersection Summary			
HCM 2000 Control Delay	4.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.36		
Actuated Cycle Length (s)	75.5	Sum of lost time (s)	13.5
Intersection Capacity Utilization	60.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	836	106	106	695	31	52
Future Volume (vph)	836	106	106	695	31	52
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.98			1.00	0.92	
Flt Protected	1.00			0.99	0.98	
Satd. Flow (prot)	3480			3516	1674	
Flt Permitted	1.00			0.70	0.98	
Satd. Flow (perm)	3480			2470	1674	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	909	115	115	755	34	57
RTOR Reduction (vph)	5	0	0	0	51	0
Lane Group Flow (vph)	1019	0	0	870	40	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	58.5			58.5	8.1	
Effective Green, g (s)	58.5			58.5	8.1	
Actuated g/C Ratio	0.77			0.77	0.11	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2692			1911	179	
v/s Ratio Prot	0.29				c0.02	
v/s Ratio Perm				c0.35		
v/c Ratio	0.38			0.46	0.22	
Uniform Delay, d1	2.7			3.0	30.9	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.4			0.2	0.6	
Delay (s)	3.1			3.2	31.5	
Level of Service	A			A	C	
Approach Delay (s)	3.1			3.2	31.5	
Approach LOS	A			A	C	

Intersection Summary			
HCM 2000 Control Delay	4.5	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.46		
Actuated Cycle Length (s)	75.6	Sum of lost time (s)	13.5
Intersection Capacity Utilization	68.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	555	56	79	743	83	121
Future Volume (vph)	555	56	79	743	83	121
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.99			1.00	0.92	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	3490			3522	1679	
Flt Permitted	1.00			0.82	0.98	
Satd. Flow (perm)	3490			2899	1679	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	61	86	808	90	132
RTOR Reduction (vph)	5	0	0	0	68	0
Lane Group Flow (vph)	659	0	0	894	154	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.6			55.6	12.9	
Effective Green, g (s)	55.6			55.6	12.9	
Actuated g/C Ratio	0.72			0.72	0.17	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2503			2079	279	
v/s Ratio Prot	0.19				c0.09	
v/s Ratio Perm				c0.31		
v/c Ratio	0.26			0.43	0.55	
Uniform Delay, d1	3.8			4.5	29.6	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.3			0.1	2.3	
Delay (s)	4.1			4.6	32.0	
Level of Service	A			A	C	
Approach Delay (s)	4.1			4.6	32.0	
Approach LOS	A			A	C	

Intersection Summary			
HCM 2000 Control Delay	7.8	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.48		
Actuated Cycle Length (s)	77.5	Sum of lost time (s)	13.5
Intersection Capacity Utilization	63.2%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	666	67	95	892	100	145
Future Volume (vph)	666	67	95	892	100	145
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.99			1.00	0.92	
Flt Protected	1.00			1.00	0.98	
Satd. Flow (prot)	3491			3522	1680	
Flt Permitted	1.00			0.78	0.98	
Satd. Flow (perm)	3491			2764	1680	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	724	73	103	970	109	158
RTOR Reduction (vph)	5	0	0	0	66	0
Lane Group Flow (vph)	792	0	0	1073	201	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.7			55.7	14.9	
Effective Green, g (s)	55.7			55.7	14.9	
Actuated g/C Ratio	0.70			0.70	0.19	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2442			1934	314	
v/s Ratio Prot	0.23				c0.12	
v/s Ratio Perm				c0.39		
v/c Ratio	0.32			0.55	0.64	
Uniform Delay, d1	4.6			5.9	29.9	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.4			0.3	4.4	
Delay (s)	5.0			6.2	34.3	
Level of Service	A			A	C	
Approach Delay (s)	5.0			6.2	34.3	
Approach LOS	A			A	C	

Intersection Summary			
HCM 2000 Control Delay	9.3	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	79.6	Sum of lost time (s)	13.5
Intersection Capacity Utilization	73.7%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	697	105	99	579	81	76
Future Volume (vph)	697	105	99	579	81	76
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.98			1.00	0.93	
Flt Protected	1.00			0.99	0.97	
Satd. Flow (prot)	3470			3513	1697	
Flt Permitted	1.00			0.72	0.97	
Satd. Flow (perm)	3470			2547	1697	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	758	114	108	629	88	83
RTOR Reduction (vph)	7	0	0	0	45	0
Lane Group Flow (vph)	865	0	0	737	126	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.5			55.5	11.8	
Effective Green, g (s)	55.5			55.5	11.8	
Actuated g/C Ratio	0.73			0.73	0.15	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2524			1852	262	
v/s Ratio Prot	0.25				c0.07	
v/s Ratio Perm				c0.29		
v/c Ratio	0.34			0.40	0.48	
Uniform Delay, d1	3.8			4.0	29.5	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.4			0.1	1.4	
Delay (s)	4.1			4.1	30.9	
Level of Service	A			A	C	
Approach Delay (s)	4.1			4.1	30.9	
Approach LOS	A			A	C	

Intersection Summary			
HCM 2000 Control Delay	6.7	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.44		
Actuated Cycle Length (s)	76.3	Sum of lost time (s)	13.5
Intersection Capacity Utilization	61.9%	ICU Level of Service	B
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	17	71	71	5	22	182
Future Volume (Veh/h)	17	71	71	5	22	182
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	77	77	5	24	198
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						873
pX, platoon unblocked						
vC, conflicting volume	326	80			82	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	326	80			82	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	92			98	
cM capacity (veh/h)	658	981			1515	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	95	82	222
Volume Left	18	0	24
Volume Right	77	5	0
cSH	897	1700	1515
Volume to Capacity	0.11	0.05	0.02
Queue Length 95th (ft)	9	0	1
Control Delay (s)	9.5	0.0	0.9
Lane LOS	A		A
Approach Delay (s)	9.5	0.0	0.9
Approach LOS	A		

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	29.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	17	140	2	5	199
Future Volume (Veh/h)	5	17	140	2	5	199
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	18	152	2	5	216
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						723
pX, platoon unblocked						
vC, conflicting volume	379	153			154	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	379	153			154	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			100	
cM capacity (veh/h)	621	893			1426	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	23	154	221
Volume Left	5	0	5
Volume Right	18	2	0
cSH	815	1700	1426
Volume to Capacity	0.03	0.09	0.00
Queue Length 95th (ft)	2	0	0
Control Delay (s)	9.5	0.0	0.2
Lane LOS	A		A
Approach Delay (s)	9.5	0.0	0.2
Approach LOS	A		

Intersection Summary			
Average Delay		0.7	
Intersection Capacity Utilization		24.5%	ICU Level of Service A
Analysis Period (min)		15	

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	555	116	115	743	118	142
Future Volume (vph)	555	116	115	743	118	142
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.97			1.00	0.93	
Flt Protected	1.00			0.99	0.98	
Satd. Flow (prot)	3447			3516	1687	
Flt Permitted	1.00			0.74	0.98	
Satd. Flow (perm)	3447			2636	1687	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	603	126	125	808	128	154
RTOR Reduction (vph)	11	0	0	0	54	0
Lane Group Flow (vph)	718	0	0	933	228	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	54.7			54.7	15.9	
Effective Green, g (s)	54.7			54.7	15.9	
Actuated g/C Ratio	0.69			0.69	0.20	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2368			1811	336	
v/s Ratio Prot	0.21				c0.13	
v/s Ratio Perm				c0.35		
v/c Ratio	0.30			0.52	0.68	
Uniform Delay, d1	4.9			6.0	29.5	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.3			0.2	5.3	
Delay (s)	5.2			6.3	34.8	
Level of Service	A			A	C	
Approach Delay (s)	5.2			6.3	34.8	
Approach LOS	A			A	C	

Intersection Summary			
HCM 2000 Control Delay	10.0	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.59		
Actuated Cycle Length (s)	79.6	Sum of lost time (s)	13.5
Intersection Capacity Utilization	69.4%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	45	209	18	77	139
Future Volume (Veh/h)	10	45	209	18	77	139
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	49	227	20	84	151
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						873
pX, platoon unblocked						
vC, conflicting volume	556	237			247	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	556	237			247	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	98	94			94	
cM capacity (veh/h)	461	802			1319	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	60	247	235
Volume Left	11	0	84
Volume Right	49	20	0
cSH	706	1700	1319
Volume to Capacity	0.08	0.15	0.06
Queue Length 95th (ft)	7	0	5
Control Delay (s)	10.6	0.0	3.2
Lane LOS	B		A
Approach Delay (s)	10.6	0.0	3.2
Approach LOS	B		

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	37.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	11	249	5	19	212
Future Volume (Veh/h)	4	11	249	5	19	212
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	12	271	5	21	230
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						773
pX, platoon unblocked						
vC, conflicting volume	546	274			276	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	546	274			276	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			98	
cM capacity (veh/h)	491	765			1287	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	276	251
Volume Left	4	0	21
Volume Right	12	5	0
cSH	671	1700	1287
Volume to Capacity	0.02	0.16	0.02
Queue Length 95th (ft)	2	0	1
Control Delay (s)	10.5	0.0	0.8
Lane LOS	B		A
Approach Delay (s)	10.5	0.0	0.8
Approach LOS	B		

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	36.9%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	836	123	116	695	86	85
Future Volume (vph)	836	123	116	695	86	85
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.98			1.00	0.93	
Flt Protected	1.00			0.99	0.98	
Satd. Flow (prot)	3471			3514	1695	
Flt Permitted	1.00			0.67	0.98	
Satd. Flow (perm)	3471			2385	1695	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	909	134	126	755	93	92
RTOR Reduction (vph)	7	0	0	0	46	0
Lane Group Flow (vph)	1036	0	0	881	139	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	55.6			55.6	12.2	
Effective Green, g (s)	55.6			55.6	12.2	
Actuated g/C Ratio	0.72			0.72	0.16	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2512			1726	269	
v/s Ratio Prot	0.30				c0.08	
v/s Ratio Perm				c0.37		
v/c Ratio	0.41			0.51	0.52	
Uniform Delay, d1	4.2			4.6	29.6	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.5			0.3	1.7	
Delay (s)	4.7			4.9	31.3	
Level of Service	A			A	C	
Approach Delay (s)	4.7			4.9	31.3	
Approach LOS	A			A	C	

Intersection Summary			
HCM 2000 Control Delay	7.1	HCM 2000 Level of Service	A
HCM 2000 Volume to Capacity ratio	0.55		
Actuated Cycle Length (s)	76.8	Sum of lost time (s)	13.5
Intersection Capacity Utilization	70.8%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	16	71	85	5	22	217
Future Volume (Veh/h)	16	71	85	5	22	217
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	77	92	5	24	236
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						873
pX, platoon unblocked						
vC, conflicting volume	378	94			97	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	378	94			97	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	92			98	
cM capacity (veh/h)	613	962			1496	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	94	97	260
Volume Left	17	0	24
Volume Right	77	5	0
cSH	872	1700	1496
Volume to Capacity	0.11	0.06	0.02
Queue Length 95th (ft)	9	0	1
Control Delay (s)	9.6	0.0	0.8
Lane LOS	A		A
Approach Delay (s)	9.6	0.0	0.8
Approach LOS	A		

Intersection Summary			
Average Delay	2.5		
Intersection Capacity Utilization	31.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	5	17	154	2	5	234
Future Volume (Veh/h)	5	17	154	2	5	234
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	18	167	2	5	254
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						773
pX, platoon unblocked						
vC, conflicting volume	432	168			169	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	432	168			169	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			100	
cM capacity (veh/h)	579	876			1409	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	23	169	259
Volume Left	5	0	5
Volume Right	18	2	0
cSH	788	1700	1409
Volume to Capacity	0.03	0.10	0.00
Queue Length 95th (ft)	2	0	0
Control Delay (s)	9.7	0.0	0.2
Lane LOS	A		A
Approach Delay (s)	9.7	0.0	0.2
Approach LOS	A		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	26.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	666	127	131	892	135	166
Future Volume (vph)	666	127	131	892	135	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.5			4.5	4.5	
Lane Util. Factor	0.95			0.95	1.00	
Frt	0.98			1.00	0.93	
Flt Protected	1.00			0.99	0.98	
Satd. Flow (prot)	3454			3517	1686	
Flt Permitted	1.00			0.70	0.98	
Satd. Flow (perm)	3454			2479	1686	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	724	138	142	970	147	180
RTOR Reduction (vph)	11	0	0	0	56	0
Lane Group Flow (vph)	851	0	0	1112	271	0
Turn Type	NA		pm+pt	NA	Prot	
Protected Phases	2		1	6	4	
Permitted Phases			6			
Actuated Green, G (s)	52.3			52.3	17.5	
Effective Green, g (s)	52.3			52.3	17.5	
Actuated g/C Ratio	0.66			0.66	0.22	
Clearance Time (s)	4.5			4.5	4.5	
Vehicle Extension (s)	3.0			3.0	3.0	
Lane Grp Cap (vph)	2292			1645	374	
v/s Ratio Prot	0.25				c0.16	
v/s Ratio Perm				c0.45		
v/c Ratio	0.37			0.68	0.72	
Uniform Delay, d1	5.9			8.1	28.4	
Progression Factor	1.00			1.00	1.00	
Incremental Delay, d2	0.5			1.1	6.8	
Delay (s)	6.4			9.2	35.2	
Level of Service	A			A	D	
Approach Delay (s)	6.4			9.2	35.2	
Approach LOS	A			A	D	

Intersection Summary			
HCM 2000 Control Delay	11.8	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	78.8	Sum of lost time (s)	13.5
Intersection Capacity Utilization	79.8%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	10	45	250	18	77	166
Future Volume (Veh/h)	10	45	250	18	77	166
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	49	272	20	84	180
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						873
pX, platoon unblocked						
vC, conflicting volume	630	282			292	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	630	282			292	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	97	94			93	
cM capacity (veh/h)	416	757			1270	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	60	292	264
Volume Left	11	0	84
Volume Right	49	20	0
cSH	658	1700	1270
Volume to Capacity	0.09	0.17	0.07
Queue Length 95th (ft)	7	0	5
Control Delay (s)	11.0	0.0	3.0
Lane LOS	B		A
Approach Delay (s)	11.0	0.0	3.0
Approach LOS	B		

Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	40.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	4	11	290	5	19	239
Future Volume (Veh/h)	4	11	290	5	19	239
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	12	315	5	21	260
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh)						
Upstream signal (ft)						773
pX, platoon unblocked						
vC, conflicting volume	620	318			320	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	620	318			320	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	99	98			98	
cM capacity (veh/h)	444	723			1240	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	16	320	281
Volume Left	4	0	21
Volume Right	12	5	0
cSH	625	1700	1240
Volume to Capacity	0.03	0.19	0.02
Queue Length 95th (ft)	2	0	1
Control Delay (s)	10.9	0.0	0.7
Lane LOS	B		A
Approach Delay (s)	10.9	0.0	0.7
Approach LOS	B		

Intersection Summary			
Average Delay	0.6		
Intersection Capacity Utilization	38.3%	ICU Level of Service	A
Analysis Period (min)	15		

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	102	101	135	122	92
Average Queue (ft)	46	26	63	33	35
95th Queue (ft)	95	69	114	85	69
Link Distance (ft)	1212	1212	1878	1878	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	140	116	177	167	103
Average Queue (ft)	59	42	89	52	38
95th Queue (ft)	115	95	158	131	72
Link Distance (ft)	1212	1212	1878	1878	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	82	62	128	92	123
Average Queue (ft)	55	31	70	55	84
95th Queue (ft)	95	73	128	111	142
Link Distance (ft)	1212	1212	1878	1878	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	150	142	211	208	233
Average Queue (ft)	74	49	107	85	103
95th Queue (ft)	134	108	170	163	187
Link Distance (ft)	1212	1212	1878	1878	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access

Movement
Directions Served
Maximum Queue (ft)
Average Queue (ft)
95th Queue (ft)
Link Distance (ft)
Upstream Blk Time (%)
Queuing Penalty (veh)
Storage Bay Dist (ft)
Storage Blk Time (%)
Queuing Penalty (veh)

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	128	114	165	139	164
Average Queue (ft)	65	45	79	50	73
95th Queue (ft)	112	93	136	113	134
Link Distance (ft)	1212	1212	1878	1878	581
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access 2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	55	23
Average Queue (ft)	34	1
95th Queue (ft)	53	11
Link Distance (ft)	468	94
Upstream Blk Time (%)		
Queuing Penalty (veh)		
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: Grooms Road & Access 1

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	40	5	12
Average Queue (ft)	15	0	0
95th Queue (ft)	41	3	6
Link Distance (ft)	422	94	22
Upstream Blk Time (%)			0
Queuing Penalty (veh)			0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	170	148	186	172	168
Average Queue (ft)	77	58	94	69	75
95th Queue (ft)	136	117	159	143	139
Link Distance (ft)	1212	1212	1878	1878	592
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access 2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	62	42
Average Queue (ft)	33	2
95th Queue (ft)	53	16
Link Distance (ft)	468	44
Upstream Blk Time (%)		0
Queuing Penalty (veh)		0
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: Grooms Road & Access 1

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	48	11	12
Average Queue (ft)	15	0	0
95th Queue (ft)	40	8	6
Link Distance (ft)	450	44	81
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 0

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	135	110	204	197	223
Average Queue (ft)	70	48	100	72	109
95th Queue (ft)	121	95	162	147	184
Link Distance (ft)	1212	1212	1878	1878	592
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access 2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	59	44
Average Queue (ft)	26	13
95th Queue (ft)	50	41
Link Distance (ft)	468	44
Upstream Blk Time (%)		0
Queuing Penalty (veh)		1
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

Intersection: 8: Grooms Road & Access 1

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	30	24	39
Average Queue (ft)	12	1	4
95th Queue (ft)	36	10	24
Link Distance (ft)	450	44	81
Upstream Blk Time (%)		0	
Queuing Penalty (veh)		0	
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 1

Intersection: 2: Grooms Road & Kemper Road

Movement	EB	EB	WB	WB	NB
Directions Served	T	TR	LT	T	LR
Maximum Queue (ft)	164	161	244	236	250
Average Queue (ft)	83	62	137	118	121
95th Queue (ft)	144	126	217	215	212
Link Distance (ft)	1212	1212	1878	1878	592
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)					
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 6: Grooms Road & Access 2

Movement	WB	SB
Directions Served	LR	LT
Maximum Queue (ft)	48	58
Average Queue (ft)	27	21
95th Queue (ft)	49	55
Link Distance (ft)	468	44
Upstream Blk Time (%)		1
Queuing Penalty (veh)		2
Storage Bay Dist (ft)		
Storage Blk Time (%)		
Queuing Penalty (veh)		

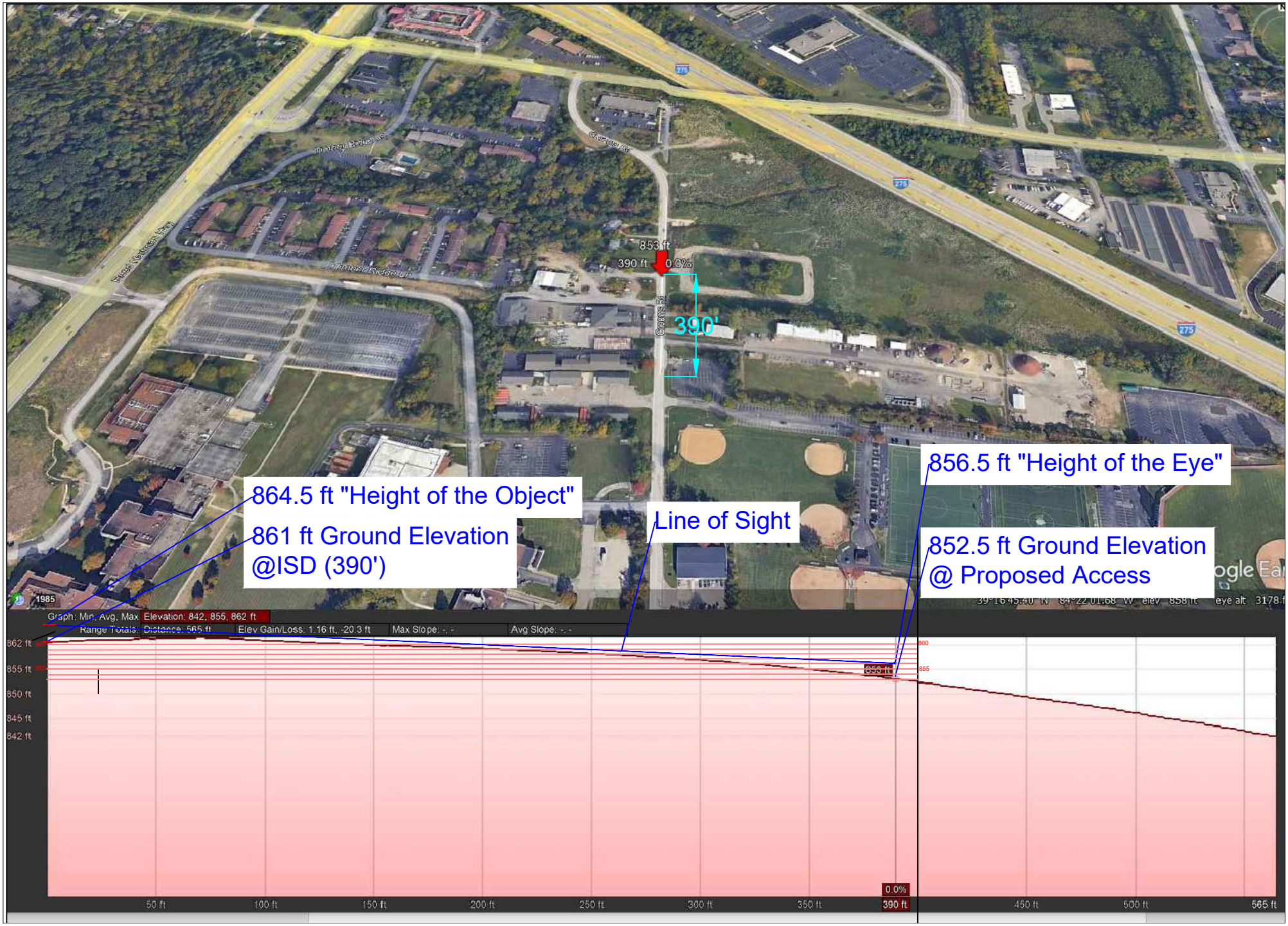
Intersection: 8: Grooms Road & Access 1

Movement	WB	NB	SB
Directions Served	LR	TR	LT
Maximum Queue (ft)	34	15	48
Average Queue (ft)	12	1	6
95th Queue (ft)	35	8	28
Link Distance (ft)	450	44	81
Upstream Blk Time (%)		0	0
Queuing Penalty (veh)		0	0
Storage Bay Dist (ft)			
Storage Blk Time (%)			
Queuing Penalty (veh)			

Network Summary

Network wide Queuing Penalty: 3

APPENDIX F: SIGHT DISTANCE


853 ft
390 ft 0.0%
390'
Timber Ridge Ln
Glenn Rd
275
856.5 ft "Height of the Eye"
852.5 ft Ground Elevation
@ Proposed Access
Line of Sight
864.5 ft "Height of the Object"
861 ft Ground Elevation
@ISD (390')
Graph: Min, Avg, Max Elevation: 842, 855, 862 ft
Range Totals: Distance: 565 ft
Elev Gain/Loss: 1.16 ft, -20.3 ft
Max Slope: -, -
Avg Slope: -, -
862 ft
855 ft
850 ft
845 ft
842 ft
853 ft
0.0%
50 ft
100 ft
150 ft
200 ft
250 ft
300 ft
350 ft
390 ft
450 ft
500 ft
565 ft