

Traffic Study

Park Place

Proposed Residential Development

prepared for:

Eller & Detrich

Midway Road

Broken Arrow, Oklahoma



A handwritten signature in black ink, appearing to read "Ernest J. Peters".

Project No.: P-1789-A

December 10, 2019



PETERS & ASSOCIATES
ENGINEERS, INC.

• CIVIL & TRAFFIC ENGINEERING •

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INTRODUCTION

Peters & Associates Engineers, Inc., has conducted a traffic engineering study relating to a single-family residential development on approximately 80 acres proposed to be located on the east side of Midway Road (S. 257th Avenue), approximately 0.3 mile north of E. 71st Street in Broken Arrow, Oklahoma. Access to the residential site is proposed to be provided by three fully-directional new streets intersecting Midway Road. The primary focus of this study is to assess traffic operational characteristics of E. 71st Street and Midway Road and of the three new street intersections along Midway Road proposed to serve the development so they provide safe and acceptable operation. The residential single-family site is proposed to consist of approximately 261 lots as indicated on the project site plan (a reduced copy of the plan is included in the Appendix for reference).

This is a report of methodology and findings relating to a traffic engineering study undertaken to:

- Evaluate existing traffic conditions in the vicinity of the site.
- Determine projected traffic volumes entering and exiting the proposed development at the new street intersections along Midway Road proposed to serve the site and the intersection of E. 71st Street and Midway Road.
- Identify the effects on traffic operations for existing traffic in combination with site-generated traffic associated with the single-family residential development as proposed.
- Evaluate traffic operations for the study intersections and make recommendations for improvements which may be necessary and appropriate for acceptable traffic operations.

In the following sections of this traffic study report are traffic data, study methods, findings and recommendations. The study is technical in nature. Analysis techniques employed are those most commonly used in the traffic engineering profession for traffic impact analysis. Certain data and calculations relative to traffic operational analysis are referenced in the report. Complete calculations and data are included in the Appendix of the report.



THE SITE

The location of the development is within the city limits of Broken Arrow in Wagoner County, Oklahoma. The single-family residential development is proposed to be located on approximately 80 acres on the east side of Midway Road, approximately 0.3 mile north of E. 71st Street. The residential single-family site is proposed to consist of approximately 261 lots plus new streets as indicated on the project site plan. The proposed development site location and vicinity are shown on Figures 1 and 2, which follow.



Figure 1 – Vicinity Map



Figure 2 – Site Location Map

Access to the single-family residential development site, as shown on the site plan, is proposed from three new streets (New Street 1 (northernmost street), New Street 4 (middle street) and New Street 16 (southernmost street) intersecting Midway Road. Each of the new streets at Midway Road are proposed as fully-directional and each are to consist of one inbound lane and one outbound lane.

The following photos show the general layout of the intersection of E. 71st Street and Midway Road and Midway Road in the vicinity of the site. Photos were taken at locations as indicated on the captions.

E. 71st Street and Midway Road



Looking west on E. 71st Street
toward Midway Road.



Looking north on Midway Road
toward E. 71st Street.

Midway Road In the Vicinity of the Site



The Site

Looking south on Midway Road
at the site.

EXISTING TRAFFIC CONDITIONS

Traffic count data collected as a part of this study include AM and PM peak hours vehicle turning movement counts at the intersection of E. 71st Street and Midway Road.

The AM and PM peak hours vehicle turning movement counts made as a part of this study are shown on Figure 3A, "Existing Traffic Volumes - AM Peak Hour," and Figure 3B, "Existing Traffic Volumes - PM Peak Hour." The peak hours vehicle turning movement count data for this intersection are presented in more detail in the Appendix of this report.



Traffic Study

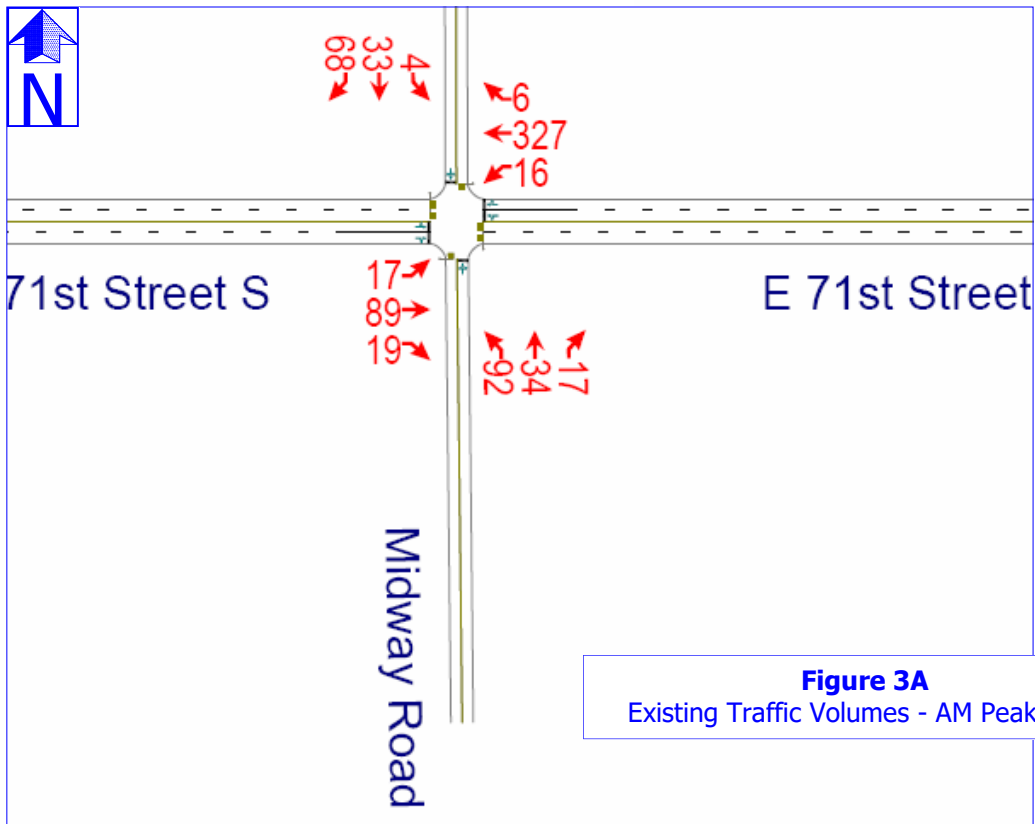


Figure 3A
Existing Traffic Volumes - AM Peak Hour

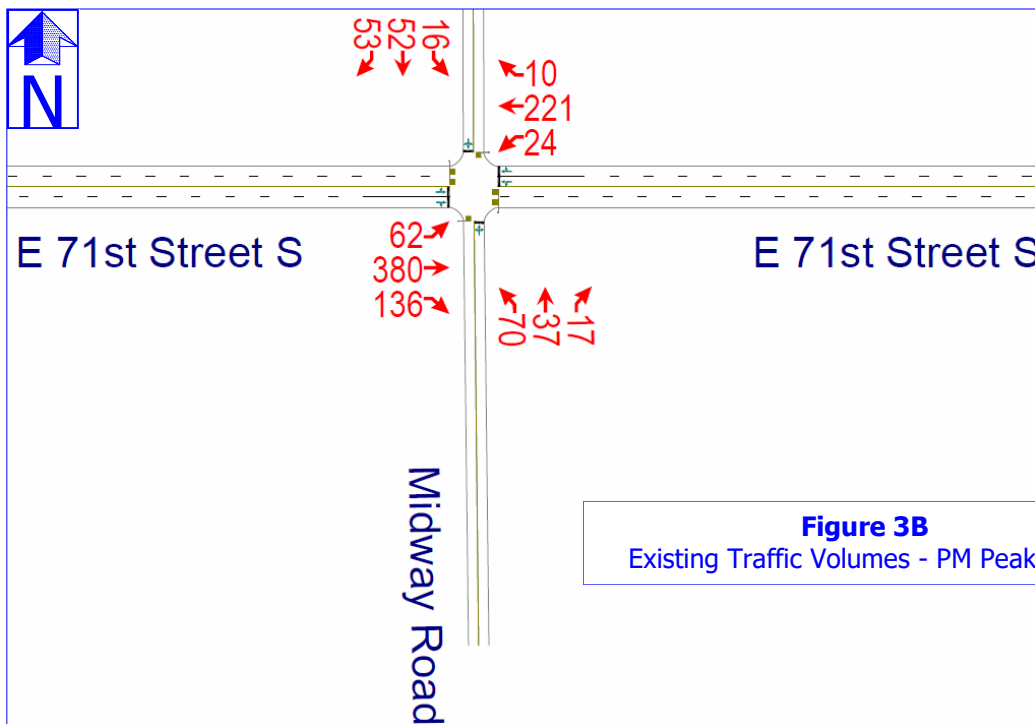


Figure 3B
Existing Traffic Volumes - PM Peak Hour

TRIP GENERATION and SITE TRAFFIC PROJECTIONS

The Trip Generation, an Informational Report, published by the Institute of Transportation Engineers (ITE) and The Trip Generation Manual 10th Edition, 2017, were utilized in calculating the magnitude of traffic volumes expected to be generated by the proposed land-use of the single-family residential development. These are reliable sources for this information and are commonly used in the traffic engineering profession.

Using the selected trip generation rates, calculations were made as a part of this study to provide a reliable estimate of traffic volumes that can be expected to be associated with the development as proposed. These calculations entail applying the appropriate trip-generation rates to the land use proposed for the development. Results of this calculation are summarized on Table 1, "Summary of Trip-Generation."

These calculations indicate that approximately 2,464 vehicle trips (combined in and out) per average weekday are projected to be generated by the proposed single-family residential development land use on this site. Of this total, approximately 193 vehicle trips are estimated during the traffic conditions of the AM peak hour and approximately 258 vehicle trips are estimated during the traffic conditions of the PM peak hour.

Residential traffic, as will be associated with site, ordinarily contributes to the adjacent street traffic conditions during the on-street AM and PM peak traffic hours. Accordingly, the AM and PM peak traffic periods of the adjacent streets are the traffic operating conditions which have warranted primary traffic analysis as a part of this study.

PROPOSED LAND USE	APPROXIMATE SIZE	ITE CODE	24-HOUR TWO-WAY WEEKDAY VOLUME	AM PEAK HOUR VOLUME		PM PEAK HOUR VOLUME	
				ENTER	EXIT	ENTER	EXIT
Planned Residential Single-Family	261 Lots	210	2,464	48	145	162	96
TOTAL ENTERING + EXITING				193		258	

Table 1 – Summary of Trip-Generation



TRAFFIC VOLUME ASSIGNMENTS

Once projected traffic was estimated for the site, directional distributions were made to reflect the percent of anticipated left-turns, right-turns and thru vehicle movements at the study intersections. Vehicle trip distribution was developed based on current traffic counts and travel patterns in the immediate vicinity of the proposed development. Directional distribution percentages used in this report are shown on Figure 3, "Directional Distribution - Site Traffic." The directional distribution percentages for site traffic have been equated to percentage turns for each movement at the study intersections.



Traffic Study

The directional distribution percentages for site traffic have been equated to percentage turns for each movement at the study intersections. The site-generated traffic volumes result from applying the directional distribution percentages to the corresponding projected site-generated traffic volumes summarized on Table 1, "Summary of Trip-Generation." The site-generated traffic volumes and corresponding existing background traffic volumes have been combined and the results are depicted on Figure 5A, "Projected Traffic Volumes - AM Peak Hour," and Figure 5B, "Projected Traffic Volumes - PM Peak Hour."

Traffic volumes shown on Figures 3A, 3B, 5A and 5B are the values used in capacity and level of service calculations conducted as a part of this study. The effect of existing background traffic (i.e. the adjacent street non-site traffic which exists) and projected traffic associated with the site development have thus been accounted for in this analysis.



Traffic Study

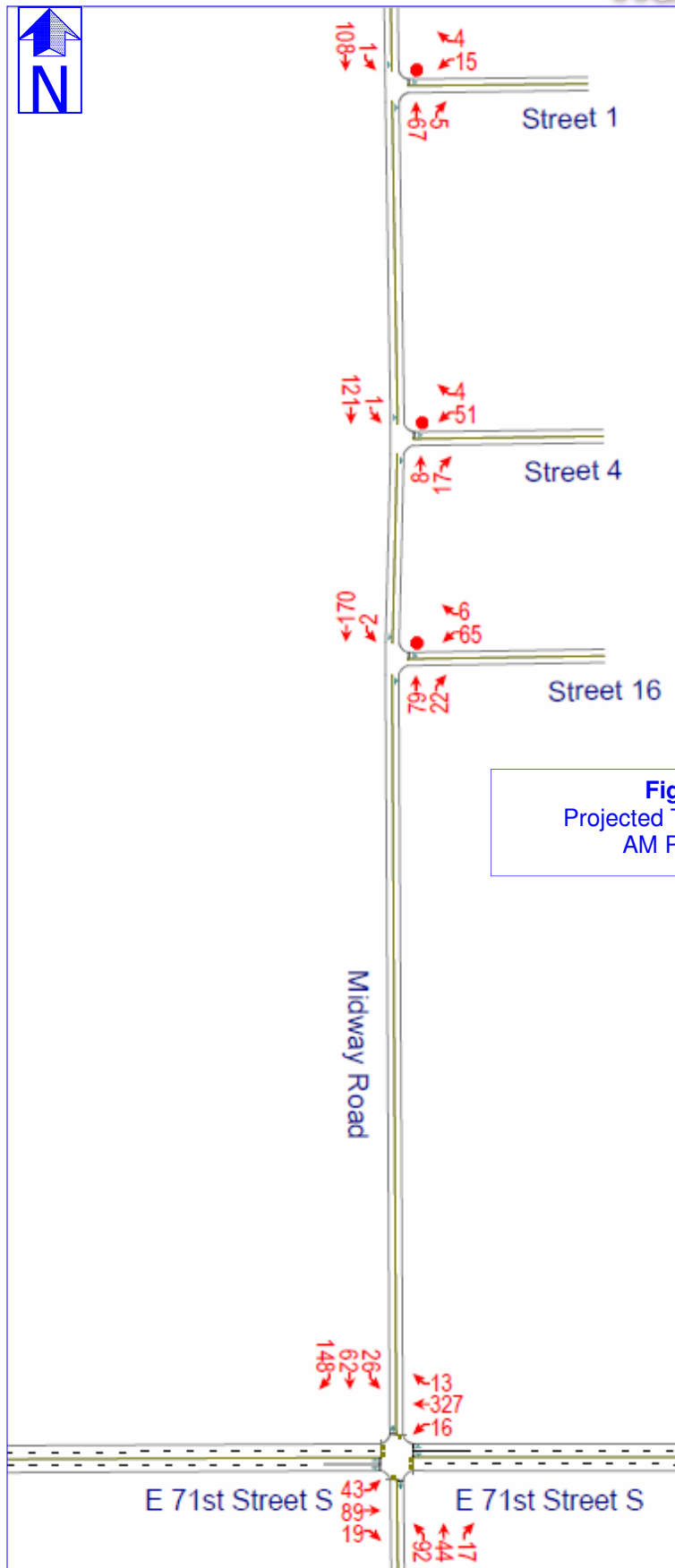


Figure 5A
Projected Traffic Volumes
AM Peak Hour



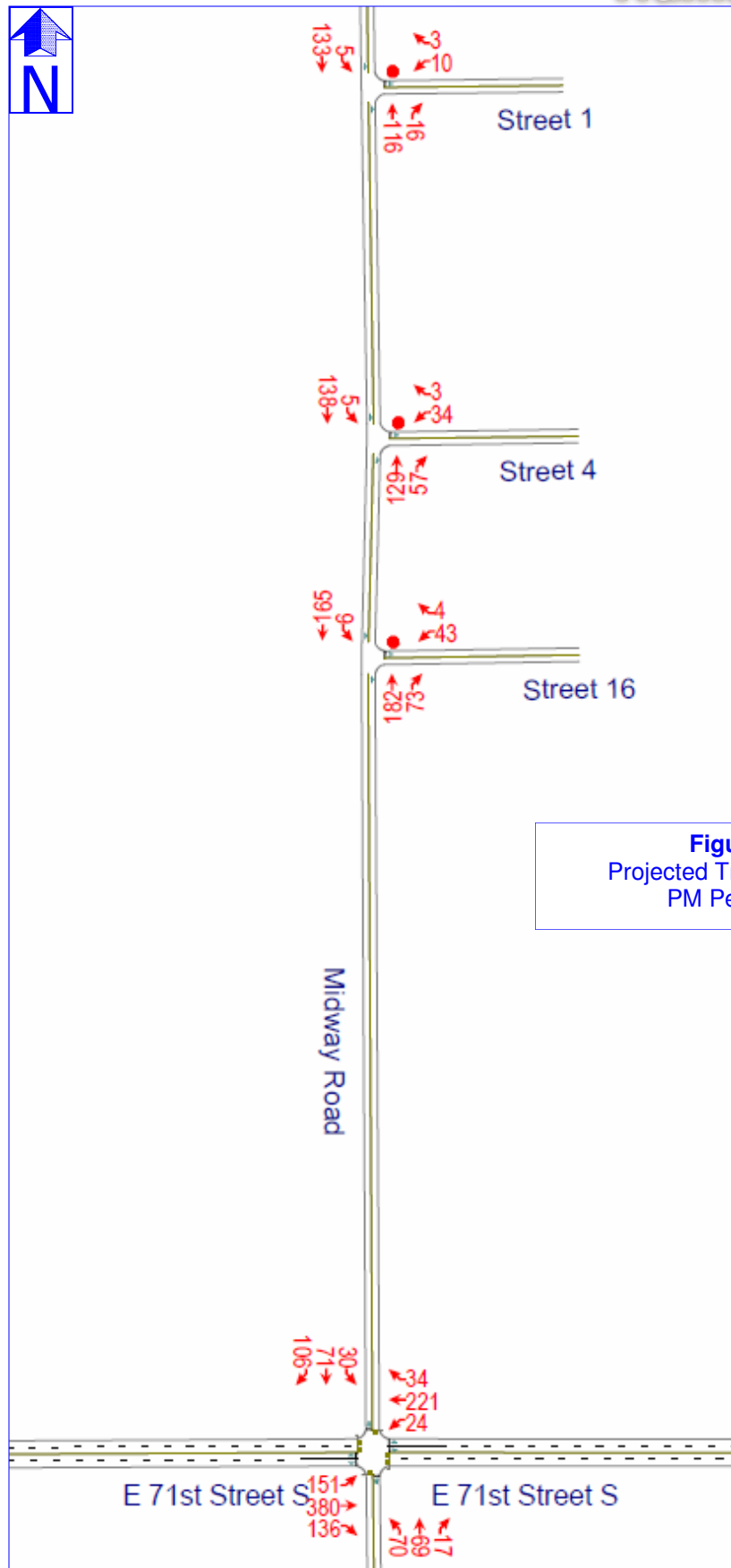


Figure 5B
Projected Traffic Volumes
PM Peak Hour

CAPACITY and LEVEL OF SERVICE

Generally, the "capacity" of a street is a measure of its ability to accommodate a certain magnitude of moving vehicles. It is a rate as opposed to a quantity, measured in terms of vehicles per hour. More specifically, street capacity refers to the maximum number of vehicles that a street element (e.g. an intersection) can be expected to accommodate in a given time period under the prevailing roadway and traffic conditions.

Traffic operational analysis for the study intersections were evaluated based on the methodologies outlined in the Highway Capacity Manual, 2010 Edition, published by the Transportation Research Board. The operating conditions at an intersection are graded by the "level of service" experienced by drivers. Level of service (LOS) describes the quality of traffic operating conditions and is rated from "A" to "F". LOS "A" represents the most desirable condition with free-flow movement of traffic with minimal delays. LOS "F" generally indicates severely congested conditions with excessive delays to motorists. Intermediate grades of B, C, D, and E reflect incremental increases in the average delay per stopped vehicle. Delay is measured in seconds per vehicle. The table below shows the upper limit of delay associated with each level of service for signalized and un-signalized intersections.

Intersection Level of Service Delay Thresholds

Level of Service

(LOS)	Signalized	Un-Signalized
A	< 10 Seconds	< 10 Seconds
B	< 20 Seconds	< 15 Seconds
C	< 35 Seconds	< 25 Seconds
D	< 55 Seconds	< 35 Seconds
E	< 80 Seconds	< 50 Seconds
F	≥ 80 Seconds	≥ 50 Seconds



The LOS rating deemed acceptable varies by community, facility type and traffic control device. LOS "D" is the desirable goal for movements at un-signalized intersections that must yield to other movements; however, a LOS "E" or "F" is often accepted for low to moderate traffic volumes where the installation of a traffic signal is not warranted by the conditions at the intersection or the location is deemed undesirable for signalization for other reasons. Other reasons may include the close proximity of an existing traffic signal or the presence of a convenient alternative route. For signalized intersections, level of service and average delay relate to all vehicles using the intersection. LOS "D" is the typical desirable standard for signalized intersections. The study intersections were evaluated using the Synchro analysis software package based on Highway Capacity Manual methods. This computer program has been proven to be reliable when used to analyze capacity and levels of traffic service under various operating conditions. Detailed results for all capacity calculations are included in the Appendix. The adjacent street weekday AM and PM peak traffic periods were used for these calculations. Factors included in the analysis are as follows:

- Existing traffic volumes and patterns.
- Directional distribution of projected traffic volumes.
- Existing and proposed intersection geometry (including elements such as turn lanes, curb radii, etc.).
- Existing background traffic volumes and projected site-generated volumes for projected traffic conditions.
- Existing and proposed traffic control.

CAPACITY ANALYSIS

Level of Service Analysis Results

Existing Traffic Conditions

Capacity and level of service analysis was performed for existing traffic volumes, lane geometry and traffic control for the AM and PM peak hours for the study intersection of E. 71st Street and Midway Road.

As indicated in Table 2, "Level of Service Summary – Existing Traffic Conditions," the traffic signal controlled study intersection of E. 71st Street and Midway Road currently operates at what calculates as an acceptable LOS "A" during the existing conditions of the AM and PM peak hours. Additionally, all vehicle movements at this intersection currently operate at what calculates as an acceptable LOS "B" or better for existing traffic conditions for the AM and PM peak hours.

Traffic volumes used for this analysis are shown on Figure 3A, "Existing Traffic Volumes - AM Peak Hour," and Figure 3B, "Existing Traffic Volumes - PM Peak Hour."



Projected Traffic Conditions

Capacity and LOS analysis was performed for projected traffic conditions at full build-out of the site for the AM and PM peak hours for the following intersections:

- E. 71st Street and Midway Road.
- Midway Road and New Street 1 (northernmost street).
- Midway Road and New Street 4 (middle street).
- Midway Road and New Street 16 (southernmost street).

Traffic volumes used for these projected traffic conditions are shown on Figure 5A, "Projected Traffic Volumes - AM Peak Hour," and Figure 5B, "Projected Traffic Volumes - PM Peak Hour." The operating conditions projected to exist at the study intersections are summarized in Table 3, "Level of Service Summary - Projected Traffic Conditions."

As indicated in Table 3, the overall LOS for traffic signal controlled study intersection of E. 71st Street and Midway Road is expected to operate at what calculates as an acceptable LOS "B" or better during projected conditions for the AM and PM peak hours. Additionally, all vehicle movements at the traffic signal controlled intersection and the "Stop" sign controlled new site street intersections are expected to operate at what calculates as an acceptable LOS "B" or better for these projected traffic conditions for the AM and PM peak hours.

Projected average control delay (seconds per vehicle) and are found to be acceptable for each of the study intersections during the AM and PM peak hours for the projected traffic conditions with the development as proposed.



EXISTING TRAFFIC CONDITIONS		PEAK HR		PEAK HOUR - LEVEL OF SERVICE												Traffic Control	Intersection Capacity Utilization (%)		
		INTERSECTION		Left-Turn	Eastbound Thru	Eastbound Right-Turn	Westbound Left-Turn	Westbound Thru	Westbound Right-Turn	Northbound Left-Turn	Northbound Thru	Northbound Right-Turn	Southbound Left-Turn	Southbound Thru	Southbound Right-Turn	Overall Intersection			
E. 71st Street and Midway Road				AM	A			A			A			A			A	7.3	39.7%
				PM	A			A			B			A			A	7.8	49.9%

Table 2 - Level of Service Summary - Existing Traffic Conditions

PROJECTED TRAFFIC CONDITIONS		INTERSECTION		PEAK HOUR - LEVEL OF SERVICE														Traffic Control	PEAK HOUR - LEVEL OF SERVICE										Overall Intersection	Avg. Control Delay Seconds / Vehicle	Intersection Capacity Utilization (%)
		PEAK HR																													
E. 71st Street and Midway Road		AM	PM	SIGNAL		A		A		A		A		A		A		A		A		A		A		7.4	52.9%				
						B																				10.5	61.5%				
Midway Road and New Street 1 (Northernmost Street)		AM	PM	1-WAY "STOP" SIGN		A		A								A		A		A		A		A		1.0	17.0%				
						B		B																		0.6	22.0%				
Midway Road and New Street 4 (Middle Street)		AM	PM	1-WAY "STOP" SIGN		A		A								A		A		A		A		A		2.6	17.8%				
						B		B																		1.2	22.3%				
Midway Road and New Street 16 (Southernmost Street)		AM	PM	1-WAY "STOP" SIGN		B		B								A		A		A		A		A		2.2	22.4%				
						B		B																		1.3	25.2%				

Table 3 - Level of Service Summary - Projected Traffic Conditions

PROPOSED NEW STREET INTERSECTIONS

With the acceptable traffic operations for the projected traffic conditions (each vehicle movement is expected to operate at what calculates to an acceptable LOS "B" or better during the AM and PM peak hours), the proposed locations of the new streets (Streets 1, 4 and 16) can be expected to serve access at the site well. There are no sight distance issues at the proposed new street locations. The three new street intersections should each function safely as proposed.

The City of Broken Arrow has criteria guidelines for deceleration lanes at proposed new street intersections. The requirements have been reviewed for each of the three proposed new street intersections as a part of this study. Per the City's criteria the *National Cooperative Highway Research Report 279, INTERSECTION CHANNELIZATION DESIGN GUIDE*, Transportation Research Board, National Research Council, latest edition, states the following in Section 4006.4 DECELERATION LANES:

A deceleration lane is required when:

1. The number of vehicles making a right turn from the arterial is 100 vehicles per hour (vph) or more during the peak period.
2. Topography makes the deceleration lane necessary for safety.
3. Un-signalized capacity analysis indicates the need for it.

None of the new streets (Streets 1, 4 and 16) meet any of the aforementioned criteria guidelines. The maximum number of vehicles projected to turn right in the site at the new Street 1 is 16, the new Street 4 is 57 and at the new Street 16 is 73; each below the 100 vehicles per hour criteria. There are no sight distance issues at any of the proposed new street locations and capacity and LOS results indicate each of these proposed new street intersections are expected to operate satisfactorily without the addition of a deceleration lane.

If the three new street intersection locations are constructed as proposed, they would allow acceptable traffic operations and provide safety and convenience for vehicles entering and exiting the site.



SUMMARY OF FINDINGS

Findings of this study are summarized as follows:

- For the development as proposed, approximately 2,464 vehicle trips (combined in and out) per average weekday are projected to be generated by the proposed single-family residential development land use on this site. Of this total, approximately 193 vehicle trips are estimated during the traffic conditions of the AM peak hour and approximately 258 vehicle trips are estimated during the traffic conditions of the PM peak hour.
- Capacity and level of service analysis was performed for existing traffic volumes, lane geometry and traffic control for the AM and PM peak hours for the study intersection of E. 71st Street and Midway Road. The traffic signal controlled study intersection of E. 71st Street and Midway Road currently operates at what calculates as an acceptable LOS "A" during the existing conditions of the AM and PM peak hours. Additionally, all vehicle movements at this intersection currently operate at what calculates as an acceptable LOS "B" or better for existing traffic conditions for the AM and PM peak hours.
- Capacity and LOS analysis was performed for projected traffic conditions for the AM and PM peak hours for the study intersections. The overall LOS for traffic signal controlled study intersection of E. 71st Street and Midway Road is expected to operate at what calculates as an acceptable LOS "B" or better during projected conditions for the AM and PM peak hours. Additionally, all vehicle movements at the traffic signal controlled intersection and the "Stop" sign controlled new site street intersections are expected to operate at what calculates as an acceptable LOS "B" or better for these projected traffic conditions for the AM and PM peak hours.
- Projected average control delay (seconds per vehicle) and intersection capacity utilization are found to be acceptable for each of the study intersections during the AM and PM peak hours for the projected traffic conditions with the development as proposed.



- None of the new streets (Streets 1, 4 and 16) meet any of the aforementioned criteria guidelines. The maximum number of vehicles projected to turn right in the site at the new Street 1 is 16, the new Street 4 is 57 and at the new Street 16 is 73; each below the 100 vehicles per hour criteria. There are no sight distance issues at any of the proposed new street locations and capacity and LOS results indicate each of these proposed new street intersections are expected to operate satisfactorily without the addition of a deceleration lane.
- If the three new street intersection locations are constructed as proposed, they would allow acceptable traffic operations and provide safety and convenience for vehicles entering and exiting the site.



APPENDIX



PETERS & ASSOCIATES
ENGINEERS, INC.

Site Plan



PETERS & ASSOCIATES
ENGINEERS, INC.

FIRM PANEL NO. 40145C0105H DATED APRIL 17, 2012 AND FIRM PANEL NO. 40145C0110H DATED APRIL 17, 2012 CLASSIFIES THE PROPERTY DESCRIBED HEREON AS ZONE "UNSHADED X", AN AREA DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.

THE ABOVE STATEMENT IS FOR INFORMATION ONLY AND THIS SURVEYOR ASSUMES NO LIABILITY FOR THE CORRECTNESS OF THE CITED MAP(S). IN ADDITION, THE ABOVE STATEMENT DOES NOT REPRESENT THIS SURVEYOR'S OPINION OF THE PROBABILITY OF FLOODING.

N/2 SW/4 OF SECTION 2, TOWNSHIP 18 NORTH,
RANGE 15 EAST OF INDIAN BASE AND MERIDIAN,
WAGONER COUNTY, STATE OF OKLAHOMA

WEST LINE OF THE N/2 SW/4 OF SECTION 2,
TOWNSHIP 18 NORTH, RANGE 15 EAST OF THE
INDIAN BASE AND MERIDIAN, WAGONER COUNTY,
STATE OF OKLAHOMA. S 01°30'07" E

ADS MONUMENT "BA 31"
HORIZONTAL DATUM: NAD83 (1993)
NORTHING: 394388.867
EASTING: 2656401.822

VERTICAL DATUM: NAVD 1988
ELEV. 699.44

DESCRIPTION: 5/8" REBAR-1 1/2"
ALUMINUM CAP-FLUSH-STAMPED "BA 31",
SET N.E. OF 71ST ST AND 273RD E AVE

27691 EAST 56th STREET
BROKEN ARROW, OK 74011
NORA GORDON
PH 918.808.5930
ENGINEER/SURVEYOR:
CRAFTON TULL
220 E. 8th ST.
TULSA, OK 74119
OU. 019.694.0747

PHASE 1 70 LOTS
PHASE 2 52 LOTS
PHASE 3 50 LOTS
PHASE 4 89 LOTS
TOTAL LOTS 261

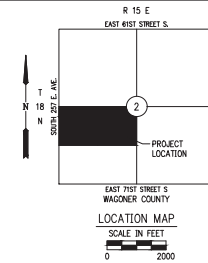
AN ADDITION TO THE CITY OF
BROKEN ARROW, OKLAHOMA
N/2, SW/4, SECTION 2, T-18-N, R-15-E
WAGONER COUNTY, OKLAHOMA

ADDRESS	67TH ST S & MIDWAY RD
ZONING	RS-2 & RS-3
LOTS	261
PHASES	4
AREA	80.23 ACRES
WATER SUPPLY	RURAL WATER DISTRICT 4
MINIMUM LOT SF (EA)	8,009 RS-2 7,009 RS-3
FRONT BUILDING SETBACK	25 FT
REAR BUILDING SETBACK	20 FT
SIDE SETBACKS	5 FT
FRONT LOT UTILITY ESMT	15 FT
REAR LOT UTILITY ESMT	11 FT
PROPERTY PERIMETER ESMT	17.5 FT
CREEK AND OPEN SPACE	15.40 ACRES
NEIGHBORHOOD GREEN	0.77 ACRES

81-PLANNING AREA 1 70' LOTS MIN. 8,000 SQFT.

180-PLANNING AREA 2 60' LOTS MIN. 7,000 SQ.FT.

CREEK, OPEN SPACE & NEIGHBORHOOD GREEN



201 W. 5th Street, Suite 302
Tulsa, Oklahoma 74103

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OKIE 811

GRAPHIC SCALE IN FEET



100' 0 100'

PARK PLACE SUBDIVISION
BROKEN ARROW, OK

[illegible]

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PROJECT NO: 18106600
ISSUE DATE: 12/13/19
CONTACT: D. ELLIS
CHECKED BY: _____

**PRELIMINARY
PLANS**

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DOCUMENT IS
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OVERALL PRELIMINARY PLAT

C-101

Vehicle Turning Movement Count Data



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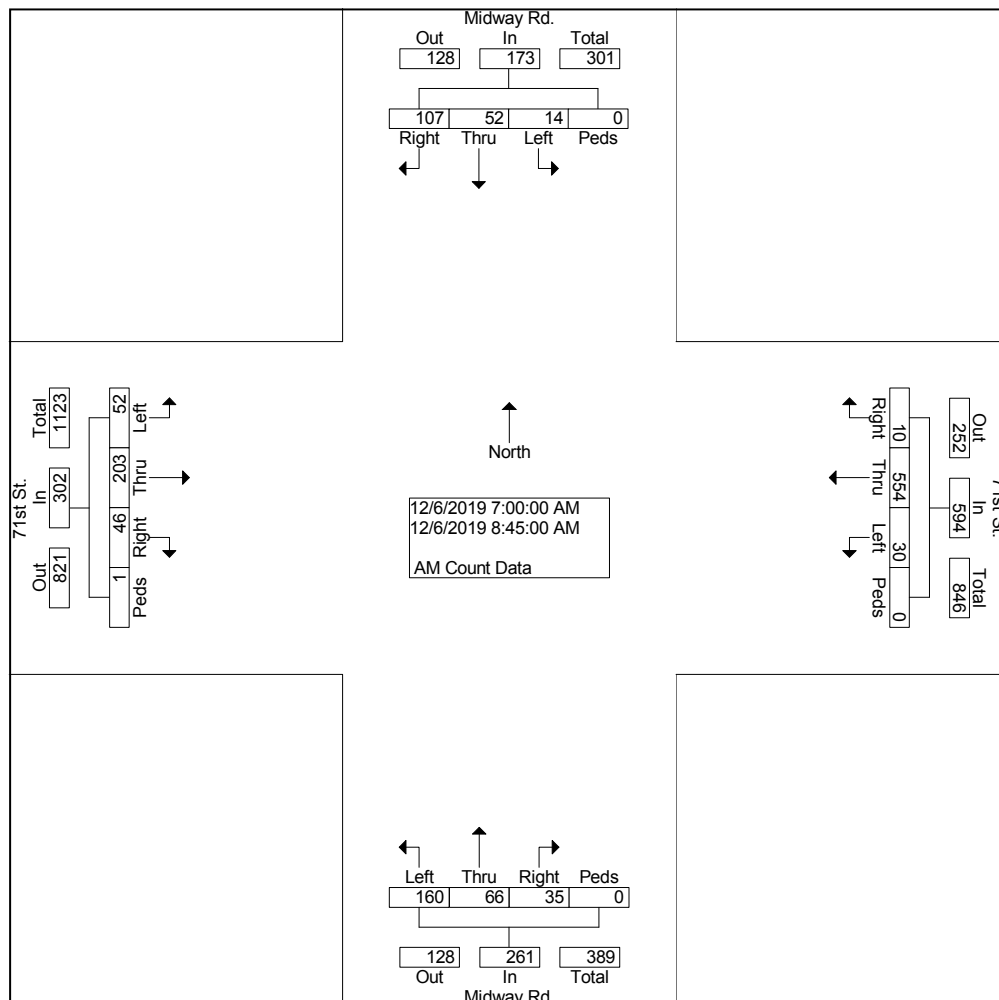
Peters & Associates Engineers, Inc.
Peak Hour Turning Movement Count Data

AM Hour Turning Movement Count Data
71st Street and Midway Road
Broken Arrow, OK
P1789-A

File Name : AM-Updat
Site Code : 00000000
Start Date : 12/06/2019
Page No : 1

Groups Printed- AM Count Data

	Midway Rd. From North					71st St. From East					Midway Rd. From South					71st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00 AM	8	8	0	0	16	0	55	0	0	55	4	15	19	0	38	4	12	7	0	23	132
07:15 AM	17	9	1	0	27	2	87	1	0	90	5	14	24	0	43	4	26	4	0	34	194
07:30 AM	14	7	1	0	22	2	62	6	0	70	1	5	31	0	37	7	18	3	0	28	157
07:45 AM	15	8	1	0	24	1	87	5	0	93	7	7	15	0	29	6	20	3	0	29	175
Total	54	32	3	0	89	5	291	12	0	308	17	41	89	0	147	21	76	17	0	114	658
08:00 AM	22	9	1	0	32	1	91	4	0	96	4	8	22	0	34	2	25	7	0	34	196
08:15 AM	8	3	2	0	13	0	51	6	0	57	5	3	10	0	18	7	33	2	0	42	130
08:30 AM	11	5	7	0	23	2	56	4	0	62	6	9	21	0	36	6	27	9	1	43	164
08:45 AM	12	3	1	0	16	2	65	4	0	71	3	5	18	0	26	10	42	17	0	69	182
Total	53	20	11	0	84	5	263	18	0	286	18	25	71	0	114	25	127	35	1	188	672
Grand Total	107	52	14	0	173	10	554	30	0	594	35	66	160	0	261	46	203	52	1	302	1330
Apprch %	61.8	30.1	8.1	0.0		1.7	93.3	5.1	0.0		13.4	25.3	61.3	0.0		15.2	67.2	17.2	0.3		
Total %	8.0	3.9	1.1	0.0	13.0	0.8	41.7	2.3	0.0	44.7	2.6	5.0	12.0	0.0	19.6	3.5	15.3	3.9	0.1	22.7	

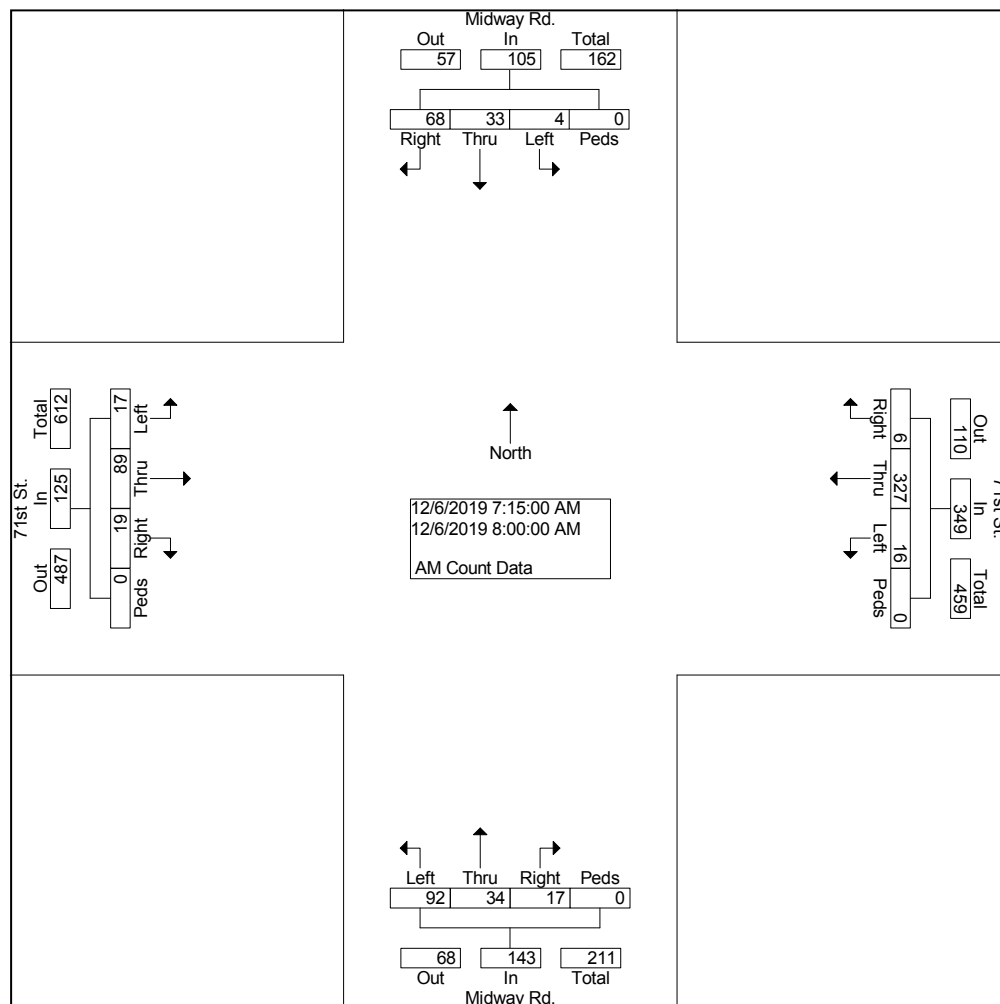


Peters & Associates Engineers, Inc.
Peak Hour Turning Movement Count Data

AM Hour Turning Movement Count Data
71st Street and Midway Road
Broken Arrow, OK
P1789-A

File Name : AM-Updat
Site Code : 00000000
Start Date : 12/06/2019
Page No : 2

	Midway Rd. From North					71st St. From East					Midway Rd. From South					71st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Intersection	07:15 AM																				
Volume	68	33	4	0	105	6	327	16	0	349	17	34	92	0	143	19	89	17	0	125	722
Percent	64.8	31.4	3.8	0.0		1.7	93.7	4.6	0.0		11.9	23.8	64.3	0.0		15.2	71.2	13.6	0.0		
08:00 Volume	22	9	1	0	32	1	91	4	0	96	4	8	22	0	34	2	25	7	0	34	196
Peak Factor																					0.921
High Int. Volume	08:00 AM					08:00 AM					07:15 AM					07:15 AM					
Peak Factor	22	9	1	0	32	1	91	4	0	96	5	14	24	0	43	4	26	4	0	34	
	0.82					0.90					0.83					0.91					
	0					9					1					9					



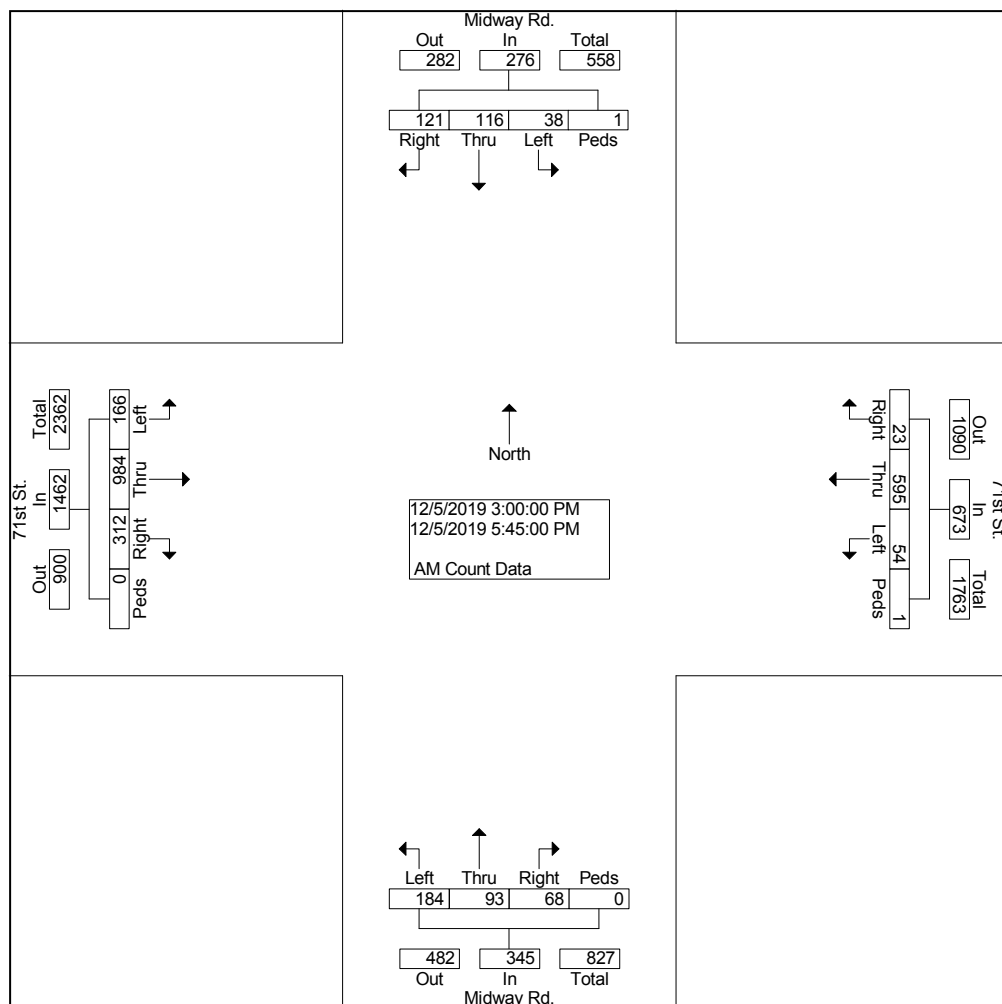
Peters & Associates Engineers, Inc.
Peak Hour Turning Movement Count Data

PM Hour Turning Movement Count Data
71st Street and Midway Road
Broken Arrow, OK
P1789-A

File Name : PM-Updat
Site Code : 00000000
Start Date : 12/05/2019
Page No : 1

Groups Printed- AM Count Data

	Midway Rd. From North					71st St. From East					Midway Rd. From South					71st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
03:00 PM	14	5	2	0	21	2	41	2	0	45	2	4	12	0	18	19	59	8	0	86	170
03:15 PM	8	1	4	0	13	0	37	4	0	41	8	5	21	0	34	14	58	4	0	76	164
03:30 PM	6	5	2	0	13	2	45	1	0	48	2	11	15	0	28	15	71	17	0	103	192
03:45 PM	6	14	2	0	22	2	39	6	0	47	9	4	6	0	19	22	70	18	0	110	198
Total	34	25	10	0	69	6	162	13	0	181	21	24	54	0	99	70	258	47	0	375	724
04:00 PM	6	9	2	0	17	3	41	10	0	54	10	5	8	0	23	24	87	17	0	128	222
04:15 PM	8	8	4	0	20	1	55	1	0	57	9	9	13	0	31	33	76	15	0	124	232
04:30 PM	9	13	3	0	25	1	62	2	0	65	7	8	20	0	35	17	92	12	0	121	246
04:45 PM	11	9	3	0	23	2	54	4	0	60	4	10	19	0	33	32	91	13	0	136	252
Total	34	39	12	0	85	7	212	17	0	236	30	32	60	0	122	106	346	57	0	509	952
05:00 PM	7	13	3	0	23	1	58	3	1	63	6	12	19	0	37	34	90	18	0	142	265
05:15 PM	13	15	4	0	32	4	52	4	0	60	5	14	23	0	42	29	93	24	0	146	280
05:30 PM	14	14	5	1	34	3	63	9	0	75	2	5	14	0	21	30	76	8	0	114	244
05:45 PM	19	10	4	0	33	2	48	8	0	58	4	6	14	0	24	43	121	12	0	176	291
Total	53	52	16	1	122	10	221	24	1	256	17	37	70	0	124	136	380	62	0	578	1080
Grand Total	121	116	38	1	276	23	595	54	1	673	68	93	184	0	345	312	984	166	0	1462	2756
Apprch %	43.8	42.0	13.8	0.4		3.4	88.4	8.0	0.1		19.7	27.0	53.3	0.0		21.3	67.3	11.4	0.0		
Total %	4.4	4.2	1.4	0.0	10.0	0.8	21.6	2.0	0.0	24.4	2.5	3.4	6.7	0.0	12.5	11.3	35.7	6.0	0.0	53.0	

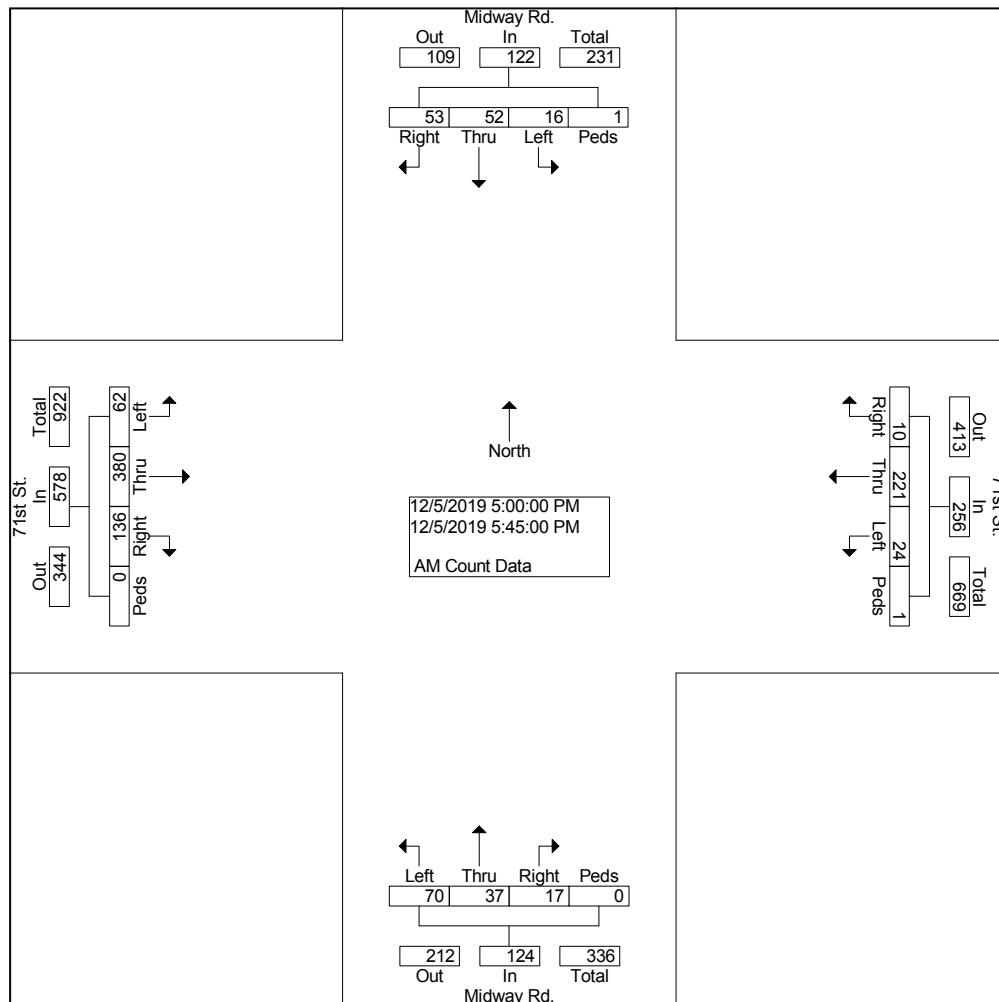


Peters & Associates Engineers, Inc.
Peak Hour Turning Movement Count Data

PM Hour Turning Movement Count Data
71st Street and Midway Road
Broken Arrow, OK
P1789-A

File Name : PM-Updat
Site Code : 00000000
Start Date : 12/05/2019
Page No : 2

	Midway Rd. From North					71st St. From East					Midway Rd. From South					71st St. From West					
Start Time	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
Peak Hour From 03:00 PM to 05:45 PM - Peak 1 of 1																					
Intersection	05:00 PM																				
Volume	53	52	16	1	122	10	221	24	1	256	17	37	70	0	124	136	380	62	0	578	1080
Percent	43.4	42.6	13.1	0.8		3.9	86.3	9.4	0.4		13.7	29.8	56.5	0.0		23.5	65.7	10.7	0.0		
05:45	19	10	4	0	33	2	48	8	0	58	4	6	14	0	24	43	121	12	0	176	291
Volume																					
Peak Factor																					0.928
High Int. Volume	05:30 PM					05:30 PM					05:15 PM					05:45 PM					
Peak Factor	14	14	5	1	34	3	63	9	0	75	5	14	23	0	42	43	121	12	0	176	
					0.89					0.85					0.73					0.82	1
					7					3					8						





Trip-Generation Data

ITE TRIP-GENERATION 10TH EDITION
261 Single-Family Residential Units (ITE 210)
12/10/2019
P1789-A

Weekday Daily Volume

DATA STATISTICS

Land Use:

Single-Family Detached Housing (210) [Click for more details](#)

Independent Variable:

Dwelling Units

Time Period:

Weekday

Setting/Location:

General Urban/Suburban

Trip Type:

Vehicle

Number of Studies:

159

Avg. Num. of Dwelling Units:

264

Average Rate:

9.44

Range of Rates:

4.81 - 19.39

Standard Deviation:

2.10

Fitted Curve Equation:

$\ln(T) = 0.92 \ln(X) + 2.71$

R²:

0.95

Directional Distribution:

50% entering, 50% exiting

Calculated Trip Ends:

Average Rate: 2464 (Total), 1232 (Entry), 1232 (Exit)

Fitted Curve: 2513 (Total), 1256 (Entry), 1257 (Exit)

Weekday AM Peak Hour
of Adjacent Street

Directional Distribution:

25% entering, 75% exiting

Calculated Trip Ends:

Average Rate: 193 (Total), 48 (Entry), 145 (Exit)

Fitted Curve: 190 (Total), 47 (Entry), 143 (Exit)

Weekday PM Peak Hour
of Adjacent Street

Directional Distribution:

63% entering, 37% exiting

Calculated Trip Ends:

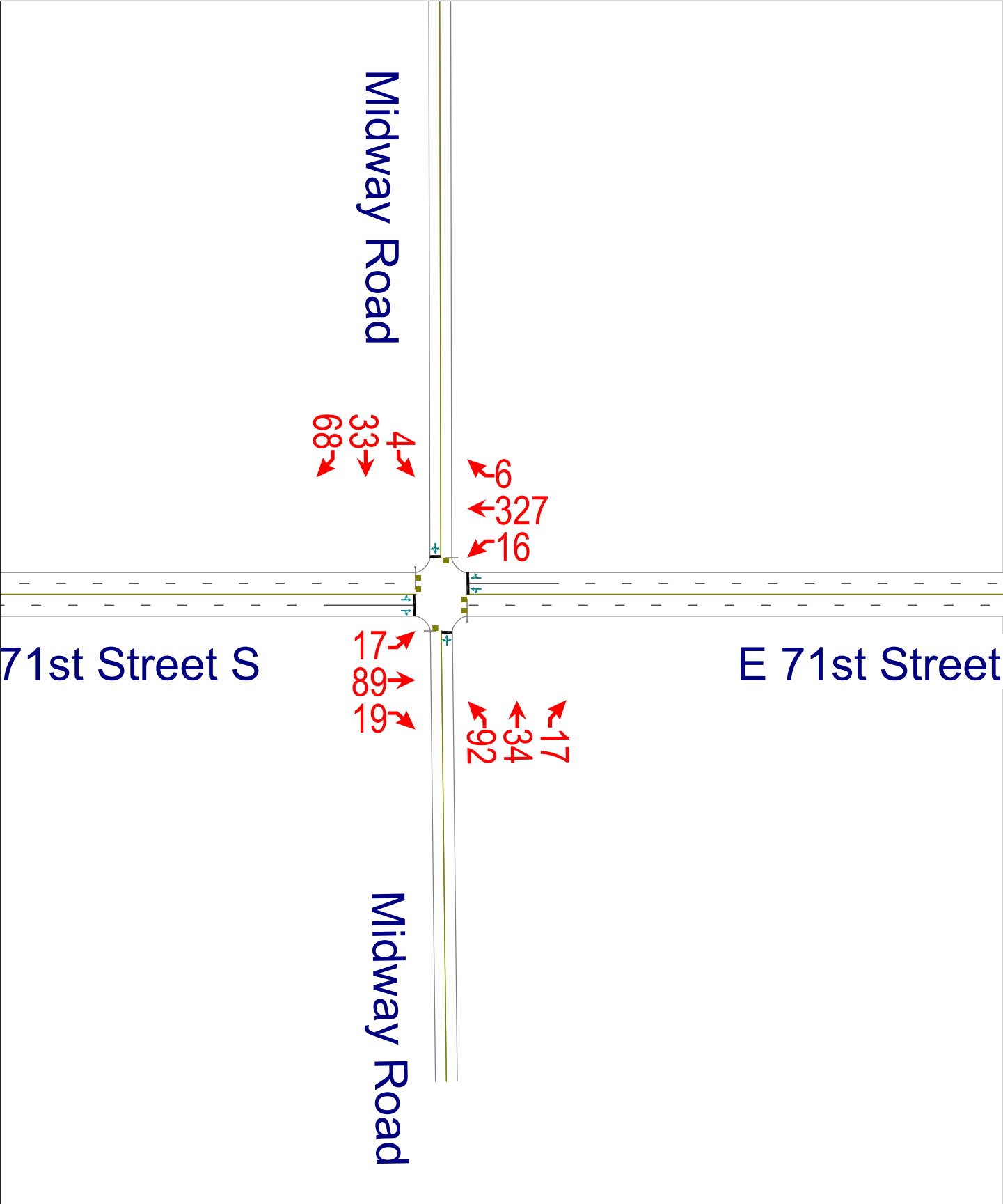
Average Rate: 258 (Total), 162 (Entry), 96 (Exit)

Fitted Curve: 255 (Total), 161 (Entry), 94 (Exit)

Capacity & Level of Service Calculations








PETERS & ASSOCIATES
ENGINEERS, INC.















Lanes, Volumes, Timings

3: Midway Road & E 71st Street S

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	17	89	19	16	327	6	92	34	17	4	33	68
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	0	3163	0	0	3244	0	0	1634	0	0	1562	0
Flt Permitted		0.890			0.940			0.736			0.988	
Satd. Flow (perm)	0	2834	0	0	3055	0	0	1244	0	0	1546	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			5			18			83	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1331			1991			533			1549	
Travel Time (s)		30.3			45.3			12.1			35.2	
Peak Hour Factor	0.92	0.92	0.92	0.90	0.90	0.90	0.83	1.00	0.92	0.82	0.82	0.82
Adj. Flow (vph)	18	97	21	18	363	7	111	34	18	5	40	83
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	136	0	0	388	0	0	163	0	0	128	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Detector Phase	4	4		4	4		2	2		2	2	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	16.0	16.0		16.0	16.0		16.0	16.0		16.0	16.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		9.9			9.9			10.2			10.2	
Actuated g/C Ratio		0.35			0.35			0.36			0.36	
v/c Ratio		0.14			0.36			0.36			0.21	
Control Delay		5.8			7.8			9.4			4.6	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		5.8			7.8			9.4			4.6	
LOS		A			A			A			A	
Approach Delay		5.8			7.8			9.4			4.6	
Approach LOS		A			A			A			A	
Queue Length 50th (ft)		4			16			13			4	
Queue Length 95th (ft)		17			47			51			23	
Internal Link Dist (ft)		1251			1911			453			1469	
Turn Bay Length (ft)												

Lanes, Volumes, Timings 3: Midway Road & E 71st Street S

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)		1663			1786			734			937	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.08			0.22			0.22			0.14	

Intersection Summary

Area Type: Other

Cycle Length: 40

Actuated Cycle Length: 28.4

Natural Cycle: 40

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.36

Intersection Signal Delay: 7.3

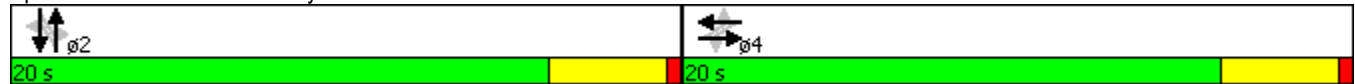
Intersection LOS: A

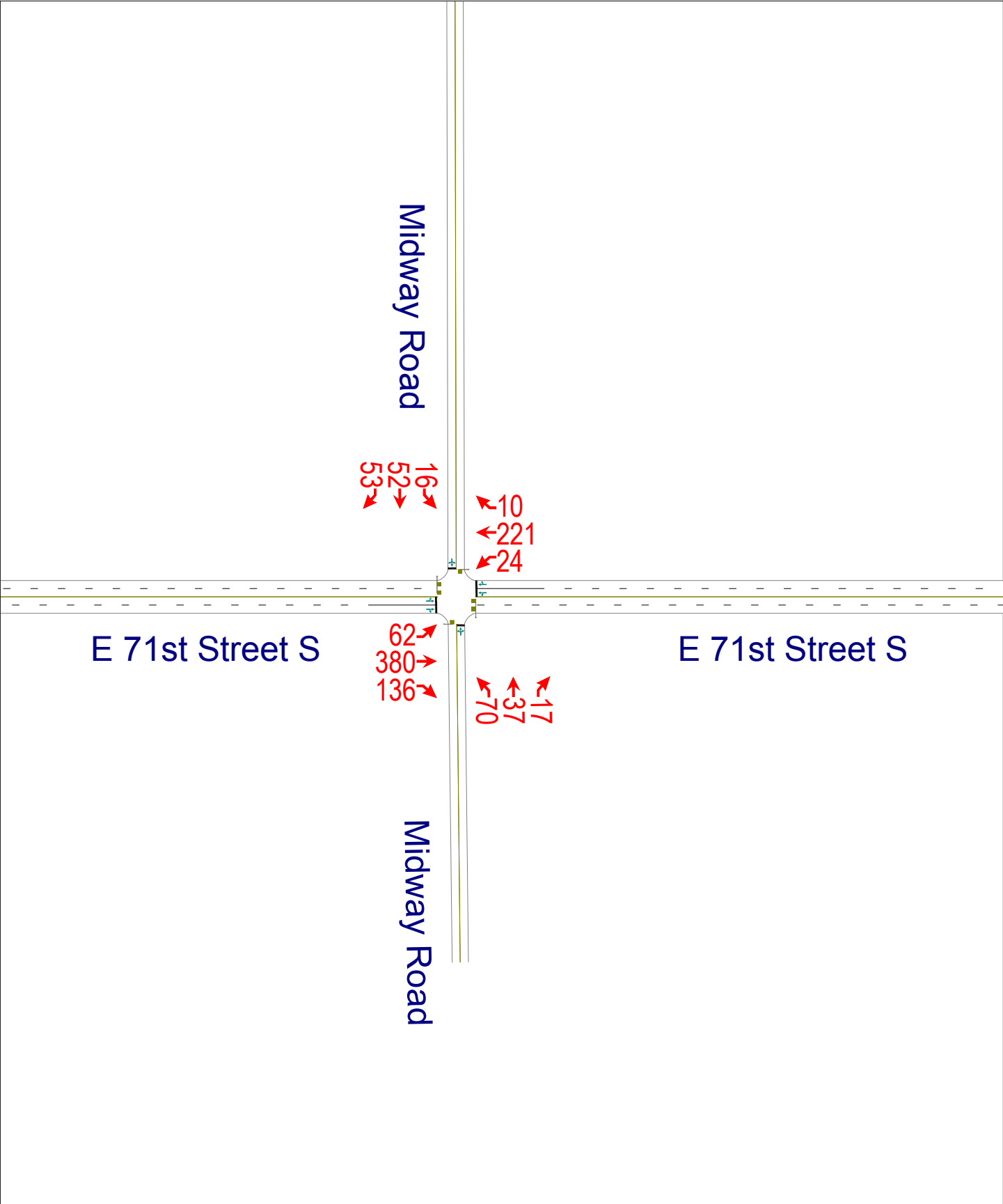
Intersection Capacity Utilization 39.7%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Midway Road & E 71st Street S





















Lanes, Volumes, Timings

3: Midway Road & E 71st Street S













12/9/2019

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	62	380	136	24	221	10	70	37	17	16	52	53
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	0	3130	0	0	3224	0	0	1639	0	0	1601	0
Flt Permitted		0.890			0.879			0.758			0.947	
Satd. Flow (perm)	0	2800	0	0	2848	0	0	1277	0	0	1527	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		121			12			23			60	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1331			1991			533			1549	
Travel Time (s)		30.3			45.3			12.1			35.2	
Peak Hour Factor	0.82	0.82	0.82	0.85	0.85	0.85	0.73	0.73	0.73	0.89	0.89	0.89
Adj. Flow (vph)	76	463	166	28	260	12	96	51	23	18	58	60
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	705	0	0	300	0	0	170	0	0	136	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Detector Phase	4	4		4	4		2	2		2	2	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	16.0	16.0		16.0	16.0		16.0	16.0		16.0	16.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		13.5			13.5			9.1			9.1	
Actuated g/C Ratio		0.44			0.44			0.29			0.29	
v/c Ratio		0.55			0.24			0.44			0.28	
Control Delay		7.5			6.3			12.0			7.2	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		7.5			6.3			12.0			7.2	
LOS		A			A			B			A	
Approach Delay		7.5			6.3			12.0			7.2	
Approach LOS		A			A			B			A	
Queue Length 50th (ft)		28			12			21			10	
Queue Length 95th (ft)		67			34			39			33	
Internal Link Dist (ft)		1251			1911			453			1469	
Turn Bay Length (ft)												

Lanes, Volumes, Timings

3: Midway Road & E 71st Street S

12/9/2019

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)		1563			1539			698			849	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.45			0.19			0.24			0.16	

Intersection Summary

Area Type: Other

Cycle Length: 40

Actuated Cycle Length: 30.9

Natural Cycle: 40

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.55

Intersection Signal Delay: 7.8

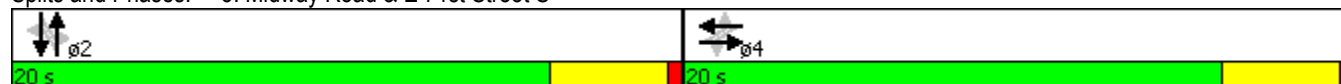
Intersection LOS: A

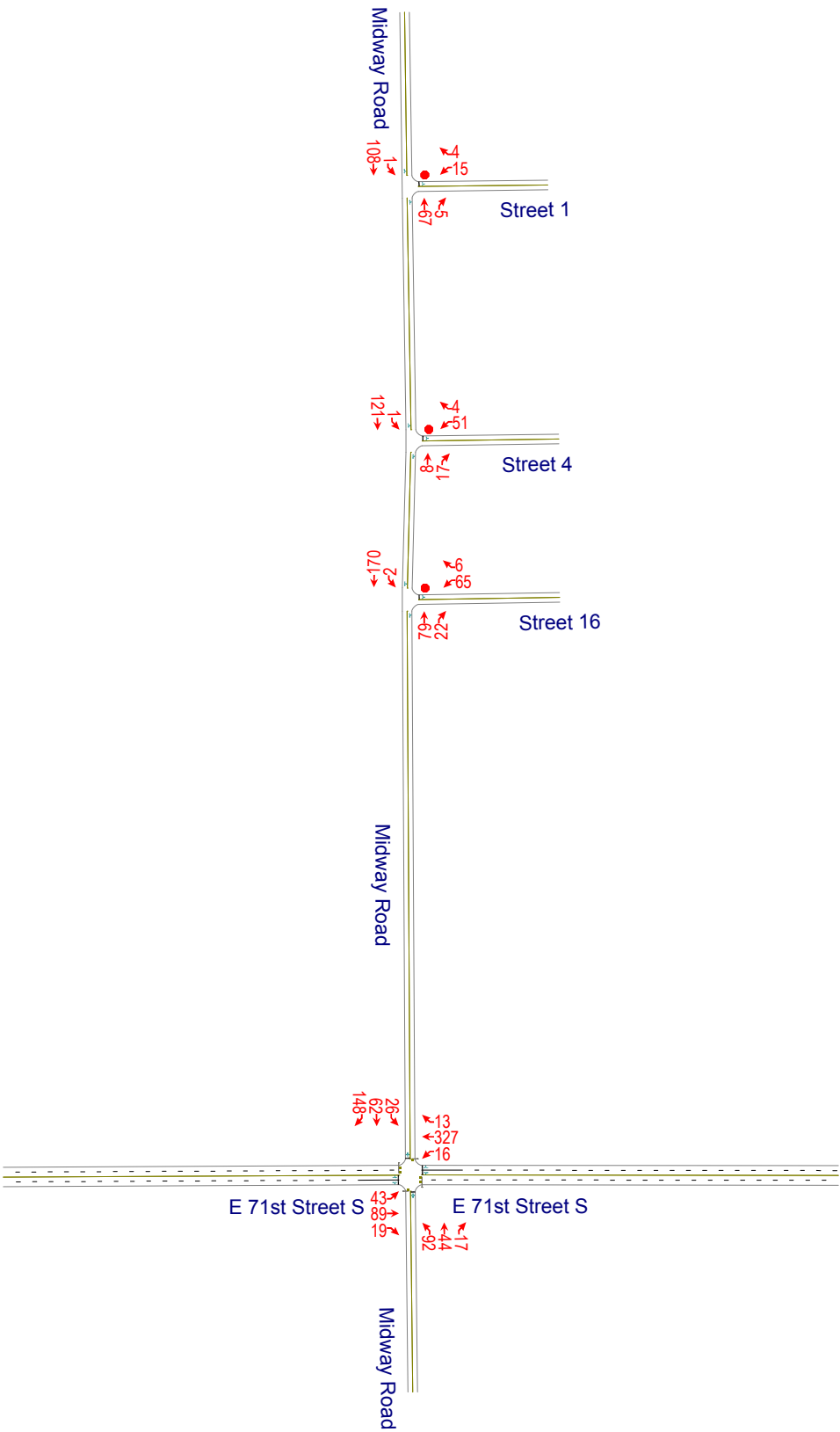
Intersection Capacity Utilization 49.9%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: Midway Road & E 71st Street S





















Lanes, Volumes, Timings

3: Midway Road & E 71st Street S













12/10/2019

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	43	89	19	16	327	13	92	44	17	26	62	148
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	0	3153	0	0	3237	0	0	1639	0	0	1562	0
Flt Permitted		0.810			0.940			0.746			0.954	
Satd. Flow (perm)	0	2590	0	0	3049	0	0	1262	0	0	1499	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		21			11			17			180	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1052			533			1419	
Travel Time (s)		22.7			23.9			12.1			32.3	
Peak Hour Factor	0.92	0.92	0.92	0.90	0.90	0.90	0.83	1.00	0.92	0.82	0.82	0.82
Adj. Flow (vph)	47	97	21	18	363	14	111	44	18	32	76	180
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	165	0	0	395	0	0	173	0	0	288	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Detector Phase	4	4		4	4		2	2		2	2	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	16.0	16.0		16.0	16.0		16.0	16.0		16.0	16.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		10.0			10.0			10.6			10.6	
Actuated g/C Ratio		0.35			0.35			0.37			0.37	
v/c Ratio		0.18			0.37			0.37			0.44	
Control Delay		6.5			8.1			9.4			5.7	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		6.5			8.1			9.4			5.7	
LOS		A			A			A			A	
Approach Delay		6.5			8.1			9.4			5.7	
Approach LOS		A			A			A			A	
Queue Length 50th (ft)		5			16			14			9	
Queue Length 95th (ft)		23			51			54			42	
Internal Link Dist (ft)		920			972			453			1339	
Turn Bay Length (ft)												

Lanes, Volumes, Timings

3: Midway Road & E 71st Street S

12/10/2019

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)		1507			1768			737			942	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.11			0.22			0.23			0.31	

Intersection Summary

Area Type: Other

Cycle Length: 40

Actuated Cycle Length: 28.9

Natural Cycle: 40

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.44

Intersection Signal Delay: 7.4

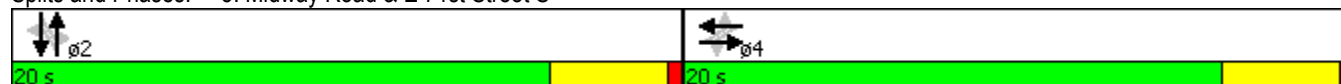
Intersection LOS: A

Intersection Capacity Utilization 52.9%

ICU Level of Service A










Analysis Period (min) 15

Splits and Phases: 3: Midway Road & E 71st Street S



Lanes, Volumes, Timings
6: Midway Road & Street 16










12/10/2019

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	65	6	79	22	2	170
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	1621	0	1666	0	0	1714
Flt Permitted	0.956					0.999
Satd. Flow (perm)	1621	0	1666	0	0	1714
Link Speed (mph)	30		30			30
Link Distance (ft)	375		1419			390
Travel Time (s)	8.5		32.3			8.9
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	71	7	86	24	2	185
Shared Lane Traffic (%)						
Lane Group Flow (vph)	78	0	110	0	0	187
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	22.4%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Intersection Delay, s/veh	2.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	65	6	79	22	2	170
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
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	71	7	86	24	2	185
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	287	98	0	0	110	0
Stage 1	98	-	-	-	-	-
Stage 2	189	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	703	958	-	-	1480	-
Stage 1	926	-	-	-	-	-
Stage 2	843	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	702	958	-	-	1480	-
Mov Capacity-2 Maneuver	702	-	-	-	-	-
Stage 1	926	-	-	-	-	-
Stage 2	841	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	10.6	0		0.1		
HCM LOS	B					
Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT	
Capacity (veh/h)	-	-	718	1480	-	
HCM Lane V/C Ratio	-	-	0.107	0.001	-	
HCM Control Delay (s)	-	-	10.6	7.436	0	
HCM Lane LOS			B	A	A	
HCM 95th %tile Q(veh)	-	-	0.36	0.004	-	
Notes						
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined						

Lanes, Volumes, Timings
8: Midway Road & Street 1










12/10/2019

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	15	4	67	5	1	108
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	1606	0	1700	0	0	1716
Fit Permitted	0.962					
Satd. Flow (perm)	1606	0	1700	0	0	1716
Link Speed (mph)	30		30			30
Link Distance (ft)	346		625			422
Travel Time (s)	7.9		14.2			9.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	4	73	5	1	117
Shared Lane Traffic (%)						
Lane Group Flow (vph)	20	0	78	0	0	118
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	17.0%			ICU Level of Service A		
Analysis Period (min)	15					

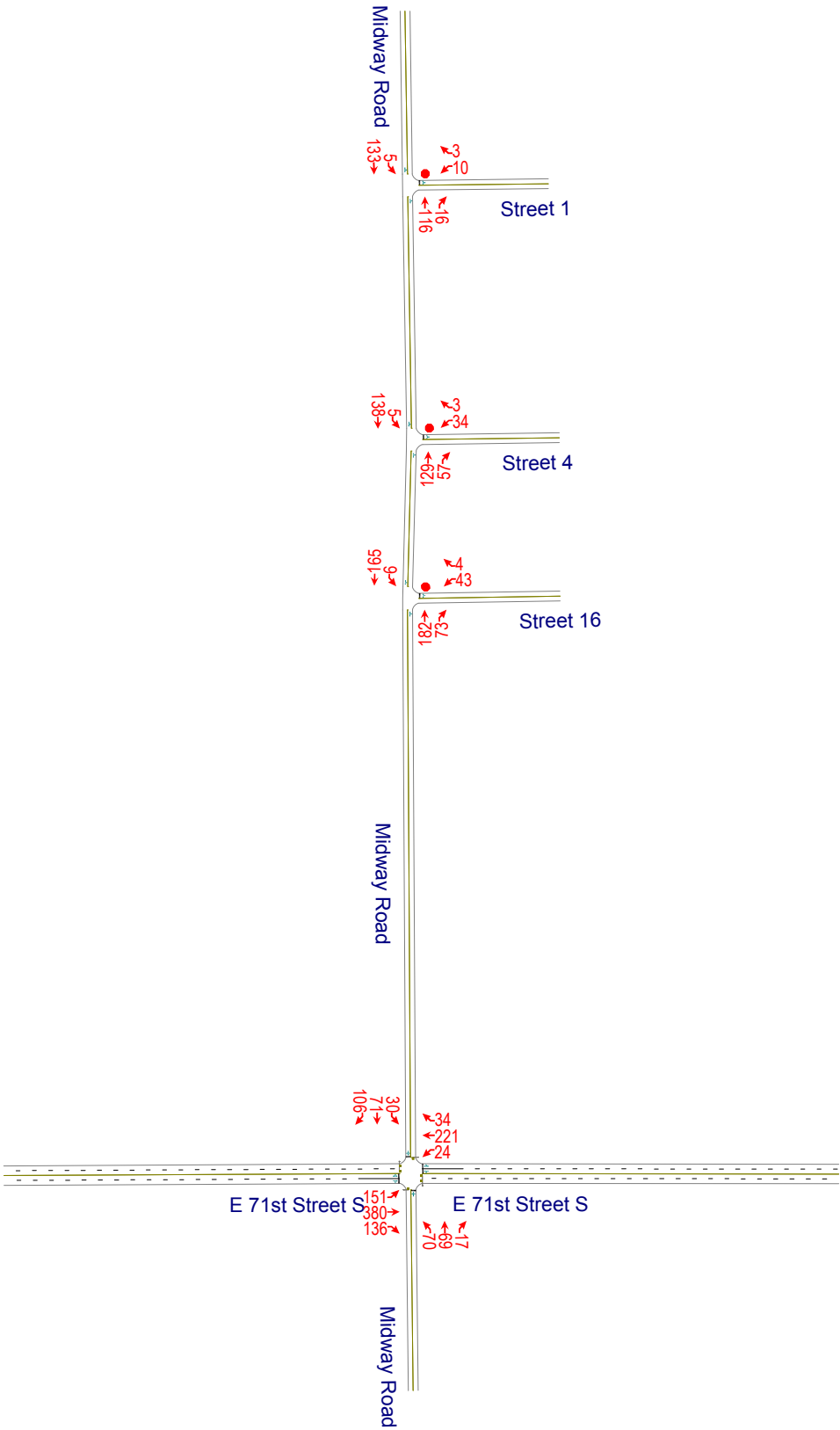
Intersection						
Intersection Delay, s/veh	1					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	15	4	67	5	1	108
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	16	4	73	5	1	117
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	196	76	0	0	78	0
Stage 1	76	-	-	-	-	-
Stage 2	120	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	793	985	-	-	1520	-
Stage 1	947	-	-	-	-	-
Stage 2	905	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	792	985	-	-	1520	-
Mov Capacity-2 Maneuver	792	-	-	-	-	-
Stage 1	947	-	-	-	-	-
Stage 2	904	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	9.5	0		0.1		
HCM LOS	A					
Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT	
Capacity (veh/h)	-	-	826	1520	-	
HCM Lane V/C Ratio	-	-	0.025	0.001	-	
HCM Control Delay (s)	-	-	9.5	7.37	0	
HCM Lane LOS			A	A	A	
HCM 95th %tile Q(veh)	-	-	0.077	0.002	-	
Notes						
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined						

Lanes, Volumes, Timings
10: Midway Road & Street 4

12/10/2019

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	51	4	8	17	1	121
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	1624	0	1561	0	0	1716
Flt Permitted	0.955					
Satd. Flow (perm)	1624	0	1561	0	0	1716
Link Speed (mph)	30		30			30
Link Distance (ft)	363		390			625
Travel Time (s)	8.3		8.9			14.2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	55	4	9	18	1	132
Shared Lane Traffic (%)						
Lane Group Flow (vph)	59	0	27	0	0	133
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	17.8%			ICU Level of Service A		
Analysis Period (min)	15					

















Intersection						
Intersection Delay, s/veh	2.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	51	4	8	17	1	121
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
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	55	4	9	18	1	132
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	152	18	0	0	27	0
Stage 1	18	-	-	-	-	-
Stage 2	134	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	840	1061	-	-	1587	-
Stage 1	1005	-	-	-	-	-
Stage 2	892	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	839	1061	-	-	1587	-
Mov Capacity-2 Maneuver	839	-	-	-	-	-
Stage 1	1005	-	-	-	-	-
Stage 2	891	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	9.5	0		0.1		
HCM LOS	A					
Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT	
Capacity (veh/h)	-	-	852	1587	-	
HCM Lane V/C Ratio	-	-	0.07	0.001	-	
HCM Control Delay (s)	-	-	9.5	7.27	0	
HCM Lane LOS			A	A	A	
HCM 95th %tile Q(veh)	-	-	0.226	0.002	-	
Notes						
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined						



Lanes, Volumes, Timings

3: Midway Road & E 71st Street S













12/10/2019

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	151	380	136	24	221	34	70	69	17	30	71	106
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	0	3124	0	0	3188	0	0	1653	0	0	1586	0
Flt Permitted		0.790			0.875			0.817			0.931	
Satd. Flow (perm)	0	2495	0	0	2801	0	0	1381	0	0	1487	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		95			40			18			119	
Link Speed (mph)		30			30			30			30	
Link Distance (ft)		1000			1052			533			1419	
Travel Time (s)		22.7			23.9			12.1			32.3	
Peak Hour Factor	0.82	0.82	0.82	0.85	0.85	0.85	0.73	0.73	0.73	0.89	0.89	0.89
Adj. Flow (vph)	184	463	166	28	260	40	96	95	23	34	80	119
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	813	0	0	328	0	0	214	0	0	233	0
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			4			2			2	
Permitted Phases	4			4			2			2		
Detector Phase	4	4		4	4		2	2		2	2	
Switch Phase												
Minimum Initial (s)	4.0	4.0		4.0	4.0		4.0	4.0		4.0	4.0	
Minimum Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (s)	20.0	20.0		20.0	20.0		20.0	20.0		20.0	20.0	
Total Split (%)	50.0%	50.0%		50.0%	50.0%		50.0%	50.0%		50.0%	50.0%	
Maximum Green (s)	16.0	16.0		16.0	16.0		16.0	16.0		16.0	16.0	
Yellow Time (s)	3.5	3.5		3.5	3.5		3.5	3.5		3.5	3.5	
All-Red Time (s)	0.5	0.5		0.5	0.5		0.5	0.5		0.5	0.5	
Lost Time Adjust (s)		0.0			0.0			0.0			0.0	
Total Lost Time (s)		4.0			4.0			4.0			4.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Min	Min		Min	Min	
Walk Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		14.8			14.8			10.4			10.4	
Actuated g/C Ratio		0.44			0.44			0.31			0.31	
v/c Ratio		0.70			0.26			0.49			0.43	
Control Delay		12.4			6.5			12.7			7.5	
Queue Delay		0.0			0.0			0.0			0.0	
Total Delay		12.4			6.5			12.7			7.5	
LOS		B			A			B			A	
Approach Delay		12.4			6.5			12.7			7.5	
Approach LOS		B			A			B			A	
Queue Length 50th (ft)		44			14			29			15	
Queue Length 95th (ft)		101			37			49			47	
Internal Link Dist (ft)		920			972			453			1339	
Turn Bay Length (ft)												

Lanes, Volumes, Timings

3: Midway Road & E 71st Street S

12/10/2019

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Base Capacity (vph)		1279			1402			690			793	
Starvation Cap Reductn		0			0			0			0	
Spillback Cap Reductn		0			0			0			0	
Storage Cap Reductn		0			0			0			0	
Reduced v/c Ratio		0.64			0.23			0.31			0.29	

Intersection Summary

Area Type: Other

Cycle Length: 40

Actuated Cycle Length: 33.5

Natural Cycle: 40

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.70

Intersection Signal Delay: 10.5

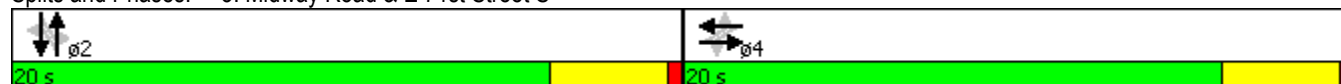
Intersection LOS: B

Intersection Capacity Utilization 61.8%

ICU Level of Service B










Analysis Period (min) 15

Splits and Phases: 3: Midway Road & E 71st Street S



Lanes, Volumes, Timings
6: Midway Road & Street 16










12/10/2019

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	43	4	182	73	6	165
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	1622	0	1649	0	0	1712
Flt Permitted	0.956					0.998
Satd. Flow (perm)	1622	0	1649	0	0	1712
Link Speed (mph)	30		30			30
Link Distance (ft)	375		1419			390
Travel Time (s)	8.5		32.3			8.9
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	47	4	198	79	7	179
Shared Lane Traffic (%)						
Lane Group Flow (vph)	51	0	277	0	0	186
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	25.2%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Intersection Delay, s/veh	1.3					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	43	4	182	73	6	165
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
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	47	4	198	79	7	179
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	429	237	0	0	277	0
Stage 1	237	-	-	-	-	-
Stage 2	192	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	583	802	-	-	1286	-
Stage 1	802	-	-	-	-	-
Stage 2	841	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	580	802	-	-	1286	-
Mov Capacity-2 Maneuver	580	-	-	-	-	-
Stage 1	802	-	-	-	-	-
Stage 2	836	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	11.6	0		0.3		
HCM LOS	B					
Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT	
Capacity (veh/h)	-	-	594	1286	-	
HCM Lane V/C Ratio	-	-	0.086	0.005	-	
HCM Control Delay (s)	-	-	11.6	7.814	0	
HCM Lane LOS			B	A	A	
HCM 95th %tile Q(veh)	-	-	0.281	0.015	-	
Notes						
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined						

Lanes, Volumes, Timings
8: Midway Road & Street 1










12/10/2019

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	10	3	116	16	5	133
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	1603	0	1688	0	0	1712
Flt Permitted	0.962					0.998
Satd. Flow (perm)	1603	0	1688	0	0	1712
Link Speed (mph)	30		30			30
Link Distance (ft)	346		625			422
Travel Time (s)	7.9		14.2			9.6
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	11	3	126	17	5	145
Shared Lane Traffic (%)						
Lane Group Flow (vph)	14	0	143	0	0	150
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	22.0%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Intersection Delay, s/veh	0.6					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	10	3	116	16	5	133
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
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	11	3	126	17	5	145
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	290	135	0	0	143	0
Stage 1	135	-	-	-	-	-
Stage 2	155	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	701	914	-	-	1440	-
Stage 1	891	-	-	-	-	-
Stage 2	873	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	698	914	-	-	1440	-
Mov Capacity-2 Maneuver	698	-	-	-	-	-
Stage 1	891	-	-	-	-	-
Stage 2	870	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	10	0		0.3		
HCM LOS	B					
Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT	
Capacity (veh/h)	-	-	738	1440	-	
HCM Lane V/C Ratio	-	-	0.019	0.004	-	
HCM Control Delay (s)	-	-	10	7.509	0	
HCM Lane LOS			B	A	A	
HCM 95th %tile Q(veh)	-	-	0.059	0.011	-	
Notes						
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined						

Lanes, Volumes, Timings
10: Midway Road & Street 4

12/10/2019

						
Lane Group	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Volume (vph)	34	3	129	57	5	138
Ideal Flow (vphpl)	1750	1750	1750	1750	1750	1750
Satd. Flow (prot)	1624	0	1645	0	0	1712
Flt Permitted	0.956					0.998
Satd. Flow (perm)	1624	0	1645	0	0	1712
Link Speed (mph)	30		30			30
Link Distance (ft)	363		390			625
Travel Time (s)	8.3		8.9			14.2
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	37	3	140	62	5	150
Shared Lane Traffic (%)						
Lane Group Flow (vph)	40	0	202	0	0	155
Sign Control	Stop		Free			Free
Intersection Summary						
Area Type:	Other					
Control Type:	Unsignalized					
Intersection Capacity Utilization	22.3%			ICU Level of Service A		
Analysis Period (min)	15					

Intersection						
Intersection Delay, s/veh	1.2					
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Vol, veh/h	34	3	129	57	5	138
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
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	37	3	140	62	5	150
Major/Minor	Minor1	Major1		Major2		
Conflicting Flow All	332	171	0	0	202	0
Stage 1	171	-	-	-	-	-
Stage 2	161	-	-	-	-	-
Follow-up Headway	3.518	3.318	-	-	2.218	-
Pot Capacity-1 Maneuver	663	873	-	-	1370	-
Stage 1	859	-	-	-	-	-
Stage 2	868	-	-	-	-	-
Time blocked-Platoon, %			-	-		-
Mov Capacity-1 Maneuver	660	873	-	-	1370	-
Mov Capacity-2 Maneuver	660	-	-	-	-	-
Stage 1	859	-	-	-	-	-
Stage 2	865	-	-	-	-	-
Approach	WB	NB		SB		
HCM Control Delay, s	10.7	0		0.3		
HCM LOS	B					
Minor Lane / Major Mvmt	NBT	NBR	WBLn1	SBL	SBT	
Capacity (veh/h)	-	-	673	1370	-	
HCM Lane V/C Ratio	-	-	0.06	0.004	-	
HCM Control Delay (s)	-	-	10.7	7.638	0	
HCM Lane LOS			B	A	A	
HCM 95th %tile Q(veh)	-	-	0.19	0.012	-	
Notes						
~ : Volume Exceeds Capacity; \$: Delay Exceeds 300 Seconds; Error : Computation Not Defined						



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