



TMS Engineers, Inc



PK-8 School Canfield, Ohio

November 3, 2022

Prepared for:

**Canfield Local School District
100 Wadsworth Street
Canfield, Ohio 44406**

TRAFFIC IMPACT STUDY

PK-8 School

Canfield, Ohio

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Prepared For:

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Canfield, Ohio 44406

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**"This document was prepared consistent with local agency requirements
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Executive Summary

This Traffic Impact Study (TIS) has been prepared at the request of the Canfield Local School District for a proposed PK-8 school. The project site is located in Canfield Township, Mahoning County, Ohio. The site is located along the south side of Shields Road (US Route 62) to the east of S. Canfield-Niles Road (US Route 62/State Route 46) and north of McCune Park.

The project is expected to consist of a PK-8 school for approximately 1,739 students and 162 staff with an expected opening year of 2027.

The development will be analyzed with access available at the existing McCune Park driveway along Shields Road (US 62) for the purpose of this report and the analysis contained within.

The weekday AM peak hour was determined to 7:30 AM to 8:30 AM. The period was determined to coincide with the current middle school AM arrival time, is on close proximity to the current elementary school arrival time, and begins only 15 minutes after the existing AM peak hour of the roadway.

The weekday PM peak hour was determined to 2:30 AM to 3:30 PM. The period was determined to coincide with the current middle school PM dismissal time, is on close proximity to the current elementary school dismissal time and begins only 15 minutes after the existing PM peak hour of the roadway.

The proposed school is expected to generate the following hourly traffic volumes during the peak periods as shown in the table below:

ITE TRIP GENERATION			TRIP ENDS			
ITE Code	Land Use Description	SIZE (Students)	AM Peak Hour of Generator (Enter/Exit)		PM Peak Hour of Generator (Enter/Exit)	
520	Elementary School	950	385	328	197	231
522	Middle School	790	333	272	134	157
TOTAL GENERATED TRIPS			718	600	331	388
			1318		719	

The proposed school under the expected full build conditions is expected to generate a total of 1,318 driveway trips in the AM peak hour and a total of 719 driveway trips in the PM peak hour. The ODOT **State Highway Access Management Manual** ⁽⁷⁾ requires that twenty year design hour traffic volumes be analyzed for a proposed development when the number of generated trips is greater than 500 in the peak hour. The year 2047 was therefore analyzed for the twenty year design hour conditions.

Recommended Improvements to Mitigate the Traffic Associated without the Development

No intersection improvements were recommended to accommodate the No-Build traffic at the study area intersections.

Recommended Improvements to Serve Future Conditions without the Development

The following improvements were determined to improve the levels-of-service at the intersection of US 62/SR 46 and Shields Road under the forecasted 2027 and 2047 Build conditions.

- Construct a northbound right turn lane.
- Construct a southbound right turn lane.
- Construct an eastbound right turn lane.
- Construct a westbound right turn lane.
- Update signal sequence to include right turn overlap phases with protected left turn phases.

The construction of additional turn lanes and proposed changes to the signal sequencing are not expected to completely mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 and 2047 Build conditions. In order to further improve the levels-of-service dual left turn lanes would likely be necessary which would require additional through lanes on the adjacent approach to receive traffic turning from two lanes. Due to the existing lane use, adjacent land uses and the bridge over Interstate 76, this type of geometric improvement at the intersection would be high cost and would likely impact the adjacent intersections/driveways and land uses. This type of improvement at the intersection may be unfeasible due to construction costs and right-of-way impacts.

The use of staggered arrival and dismissal times would also be another option that may disperse traffic over a greater period of time and help to mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 and 2047 Build conditions.

Development Access Recommendations

The proposed school is recommended to be served by two access locations. A west access location would serve all entering traffic to the site. An east access location would serve all exiting traffic from the site. The access driveways would also be expected to provide access to McCune Park.

The following lane use and traffic control is recommended at the proposed intersection of Shields Road (US 62) and the west access driveway under the 2027 and 2047 peak hour Build conditions:

- Construct an eastbound right turn lane.
- Construct a westbound left turn lane.
- Construct the proposed access driveway with one ingress lane.

The unsignalized west access driveway should be located at least 564 feet west of the east access driveway.

The following lane use and traffic control is recommended at the proposed intersection of Shields Road (US 62) and the east access driveway under the 2027 and 2047 peak hour Build conditions:

- Install traffic signal control.
 - Interconnect to adjacent traffic signal at US 62/SR 46 & Shields Road
- Construct the proposed access driveway with two egress lanes.
 - Exclusive northbound left turn lane.
 - Exclusive northbound right turn lane.

The signalized east access driveway should be located a minimum of a ½ mile from the existing signalized intersection at US 62/SR 46 and Shields Road.

Chapter 1

Introduction

1.1 Purpose of Report

This Traffic Impact Study (TIS) has been prepared at the request of the Canfield Local School District for a proposed PK-8 school. The project site is located in Canfield Township, Mahoning County, Ohio. The site is located along the south side of Shields Road (US Route 62) to the east of S. Canfield-Niles Road (US Route 62/State Route 46) and north of McCune Park. **Figure 1.1, Appendix A** shows the proposed location of the school.

The project is expected to consist of a PK-8 school for approximately 1,739 students and 162 staff.

The development will be analyzed with access available at the existing McCune Park driveway along Shields Road (US 62) for the purpose of this report and the analysis contained within. **Figure 1.2, Appendix A** shows a conceptual plan for the proposed PK-8 school and the site.

The year 2027 will be analyzed as the expected Opening Year for the proposed school. The future design year for the proposed project will be based on the expected volume of new site generated traffic.

1.2 Study Objectives

This study is structured for the following purposes;

- to adequately assess the traffic impacts associated with the proposed school and identify the level of off-site access and traffic,
- to provide a comprehensive study which evaluates and documents the traffic impacts and off-site improvements, where warranted,
- and to provide a technically sound basis to identify mitigation requirements to off-site traffic impacts.

This study documents the methodologies, findings and conclusions of the analysis, including the basis for all assumptions, traffic parameters utilized and conclusions reached.

The development of future traffic volumes will be based on the forecasting guidelines and methodology found in the Ohio Department of Transportation's **Ohio Traffic Forecasting Manual, Volume 1** ⁽⁴⁾ & **Volume 2** ⁽⁵⁾.

The traffic impacts will be determined by comparing the existing intersection levels-of-service, delay or density, volume to capacity ratio and queue storage ratio before the construction of the proposed development to the anticipated measures after the development is completed. Traffic analyses for the study area and access intersections will be calculated using the computerized version of the Transportation Research Board's **Highway Capacity Manual 7TH Edition** ⁽¹⁾, (**HCS2023, Release 8.2**). Data inputs for the HCS software program will be based on the guidance found in the Ohio Department of Transportation's **Analysis & Traffic Simulation Manual (OATS)** ⁽⁶⁾.

The justification for any changes in the intersections will be determined by comparing data collected of the existing traffic conditions to the criteria established by the **Ohio Manual of Uniform Traffic Control Devices** ⁽²⁾ and professional engineering judgment from an on-site field review.

Intersection geometric design guidelines will be based in the information and procedures found in the Ohio Department of Transportation's **Location & Design Manual, Volume 1** ⁽³⁾. The left and right turn lane warrants provided in Section 401-6 of the **Location & Design Manual, Volume 1** ⁽³⁾ will be used in addition to the capacity analyses to determine the need for deceleration and exclusive turn lanes at stop sign controlled intersections.

1.3 Intersection Capacity & Levels-of-Service

Intersection capacity analyses will be performed at the study area and development access intersections using the procedures outlined in the computerized version of the Transportation Research Board's **Highway Capacity Manual** ⁽¹⁾.

The **HCM** ⁽¹⁾ is the most widely used document in the transportation industry. It contains a set of methodologies and application procedures for evaluating the capacity and quality of service of various transportation facilities. The **HCM** ⁽¹⁾ is built from more than 60 years of research work and represents a body of expert transportation consensus.

The capacity analysis procedures provide a calculated "average vehicle delay", which is based on traffic volumes, number of lanes, type of traffic control, channelization, grade, and percentage of large vehicles in the traffic stream at each intersection. The average delay calculated at an intersection is then assigned a "grade" or level of service (LOS) ranging from LOS A, the best, to LOS F, the worst based upon driver expectation. The intersection LOS "grades" as defined by the Transportation Research Board are as follows:

Table 1.1 Intersection Levels-of-Service

LOS	UNSIGNALIZED AVERAGE DELAY PER VEHICLE (sec)	SIGNALIZED AVERAGE DELAY PER VEHICLE (sec)
A	≤ 10.0	≤ 10.0
B	10.1 to 15.0	10.1 to 20.0
C	15.1 to 25.0	20.1 to 35.0
D	25.1 to 35.0	35.1 to 55.0
E	35.1 to 50.0	55.1 to 80.0
F	> 50	> 80

Intersection capacity analyses will be performed in order to estimate the maximum amount of traffic that can be accommodated by the intersection while maintaining recommended operational qualities. No-Build and Build peak hour traffic volumes will be analyzed to determine the level-of-service (LOS) at the study area intersections.

The selection of the design level-of-service is most frequently chosen from *Section 5.9* of the Ohio Department of Transportation's **OATS Manual** ⁽⁶⁾. In most cases, a level-of-service E is considered the maximum delay threshold after which improvements should be investigated to determine if the delay can be reduced to a level of E or better. The following table from *Section 5.9* details the operation goals for intersection analyses (All-Way Stop Control, Two-Way Stop Control, Signalized, & Roundabout).

Table 1.2 Intersection Operational Goals

RESULT	INSIDE AN MPO	OUTSIDE AN MPO
Intersection LOS	D or BETTER	C or BETTER
Approach LOS	E or BETTER	
Control LOS	E or BETTER	
v/c	All movements < 1.0 (<= 0.93 preferred)	
QSR	All movements <1.0 from HCS analysis, TransModeler may be needed to determine if queuing impacts upstream intersections.	

MPO = Metropolitan Planning Organization

v/c = Volume to Capacity Ratio

QSR = Queue Storage Ratio

An evaluation of the capacity analyses will determine if there are any locations, approaches or movements in which the delay, v/c, and QSR exceeds the operational goals shown in **Table 1.2**.

The capacity analyses for signalized intersections will be based on the process detailed in *Section 6.2.2.1* of the ODOT **OATS Manual** ⁽⁶⁾. The optimization of the signal timings will be based on the delay minimization function with the objective of Overall Delay.

It should be noted that any values for queue length, shown in the HCS analysis summary sheets that are displayed in red, indicate that the movement is expected to experience a "spillback" condition where the queue may exceed the existing length of the turn lane and extend into the adjacent through lane. These instances, if they occur, will be investigated for mitigation.

1.4 Intersection Turn Lanes

Turn Lane Warrants

The ODOT **Location and Design Manual, Volume 1** ⁽³⁾ and the **State Highway Access Management Manual** ⁽⁷⁾ describes the need for auxiliary turn lanes at unsignalized intersections. The Auxiliary Lane Graphs found in *Section 401-6* of the **Location and Design Manual, Volume 1** ⁽⁴⁾ are used for this determination. This applies to the free-flow approaches at unsignalized intersections. *Section 401.6.3* of the ODOT **Location and Design Manual** ⁽⁴⁾ states that:

“To determine the number and use of left (right) turn lanes, intersection capacity analysis procedures of the current edition of the Highway Capacity Manual should be used. For unsignalized intersections, left (right) turn lanes may also be needed if they meet warrants provided in Figures 401-5(6)a, b, c and d. The warrants apply only to the free-flow approach of the unsignalized intersection.”

It is the intent of this analysis to evaluate the need for exclusive deceleration and turn lanes on Shields Road (US 62) at any proposed site access locations.

Turn Lane Length

Proposed turn lanes and existing turn lanes will be analyzed to determine the necessary turn lane storage length in accordance with the procedure found in the Ohio Department of Transportation’s **Location and Design Manual, Volume 1** ⁽³⁾, *Section 401*. The ODOT criteria and procedures are furnished in **Appendix B**.

It should be noted that the recommended maximum length is 800 feet for a right turn lane and 600 feet for a left turn lane, however if the calculated turn lane length is lower than these values, the maximum length will not be applicable.

Design Speed

The procedure for determining the necessary turn lane storage length with the procedure found in the Ohio Department of Transportation's **Location and Design Manual, Volume 1** ⁽³⁾, *Section 401* is in part based on the design speed of the roadway.

The AASHTO publication, **A Policy on Geometric Design of Highway Streets (Green Book)** ⁽¹¹⁾, defines design speed as a selected speed used to determine the various geometric design features of the roadway. The assumed design speed should be a logical one with respect to the topography, anticipated operating speed, the adjacent land use and the functional classification of highway.

The ODOT **Location and Design Manual, Volume 1** ⁽³⁾ provides guidance for determining the design speed of a roadway. *Section 104.2* of the ODOT **Location and Design Manual** ⁽³⁾ states that:

"The design speed should match the legal speed for facilities with a legal speed of 35 mph or less. For facilities with a legal speed of 40 or 45 mph the design speed should either match the legal speed, or be 5 mph greater than the legal speed, depending on the context of the area. For facilities with a legal speed 50 mph or greater, the design speed should be 5 mph greater than the legal speed."

1.5 References

The following list of references will be utilized for this report and the analysis contained within it:

1. *Highway Capacity Manual*, 6th Edition. Transportation Research Board of the National Academies, Washington, D.C.
2. *Ohio Manual of Uniform Traffic Control Devices for Streets and Highways*, 2012 Edition. Ohio Department of Transportation, Office of Traffic Engineering, Columbus, Ohio.
3. *Location and Design Manual*, Volume 1, Roadway Design. Ohio Department of Transportation, Office of Roadway Engineering, Columbus, Ohio.
4. *Ohio Traffic Forecasting Manual*, Volume 1, Traffic Forecasting Background. Ohio Department of Transportation, Office of Statewide Planning & Research, Columbus, Ohio.
5. *Ohio Traffic Forecasting Manual*, Volume 2, Traffic Forecasting Methodologies. Ohio Department of Transportation, Office of Statewide Planning & Research, Columbus, Ohio.
6. *ODOT Analysis and Traffic Simulation Manual (OATS)*, Ohio Department of Transportation, Office of Roadway Engineering, Columbus, Ohio.
7. *State Highway Access Management Manual*, Ohio Department of Transportation, Office of Roadway Engineering, Columbus, Ohio.
8. *Trip Generation Manual*, 11th Edition, September 2021, Institute of Transportation Engineers, (ITE), Washington, D.C.
9. *Trip Generation Handbook*, 3rd Edition, September 2017, Institute of Transportation Engineers, (ITE), Washington, D.C.
10. *Traffic Engineering Manual*, October 21, 2022 Edition, Ohio Department of Transportation, Office of Roadway Engineering, Columbus, Ohio.
11. *A Policy on Geometric Design of Highways and Streets (Green Book)*, 7TH Edition, September 2018, American Association of State Highway and Transportation Officials, Washington, D.C.

Chapter 2

Area Conditions

2.1 Transportation Network Study Area

The study area for the proposed development includes the following intersections:

1. **S. Canfield-Niles Road (US 62/SR46) & Shields Road (US 62)**
2. **Sheilds Road (US 62) & McCune Park Access Driveway**

The intersections listed above will be analyzed for this report.

An aerial view of the of the study area can be seen in **Figure 2.1, Appendix A**.

The following table details the primary characteristics of the study area roadways:

Table 2.1 Intersection & Roadway Characteristics

INTERSECTION		ORIENTATION	LANE USE		SPEED LIMIT	TRAFFIC CONTROL
#	ROADWAYS		THROUGH LANES	TURN LANES		
1	US 62/SR46	North-South	1	NB/SB LT	45	Traffic Signal
	Shields Road	East-West	1	EB/WB RT	45	
2	Shields Road	East-West	1	NONE	45	Minor Street Stop Sign
	McCune Park Access	North-South	1	NONE	25	

The following section details the lane use and traffic control for the intersections under study for this report.

S. CANFIELD-NILES ROAD (US 62/SR46) & SHIELDS ROAD

State Route 46 North Approach

- 1 Exclusive Left Turn Lane
- 1 Shared Through & Right Turn Lane

US Route 62/State Route 46 South Approach

- 1 Exclusive Left Turn Lane
- 1 Shared Through & Right Turn Lane

Herbert Road West Approach

- 1 Exclusive Left Turn Lane
- 1 Shared Through & Right Turn Lane

Shields Road (US 62) East Approach

- 1 Exclusive Left Turn Lane
- 1 Shared Through & Right Turn Lane

The intersection is controlled by a traffic signal. The signal sequence starts with the southbound movements as the first phase. The second phase is both northbound and southbound movements. The third phase is all westbound movements. The fourth phase is all eastbound and westbound movements. The left turn movements from the south and west approaches can be made during the green ball indication when there is a gap in the opposing through traffic movements (permissive movement). The left turn movements from the north and east approaches can be made during a green arrow indication (protected movement) or during a green ball indication when there is a gap in the opposing through traffic movements (permissive movement).

SHIELDS ROAD (US 62) & McCUNE PARK DRIVEWAY

Shields Road (US 62) West Approach

- 1 Shared Through & Right Turn Lane

Shields Road (US 62) East Approach

- 1 Shared Through & Left Turn Lane

McCune Park Driveway South Approach

- 1 Shared Left & Right Turn Lane

The intersection is stop controlled on the driveway approach. The Shields Road (US 62) approaches operate under free-flow conditions with the westbound left turn movement yielding to the opposing eastbound traffic.

Figure 2.2, Appendix A shows the lane use and traffic control conditions based upon the existing conditions in the study area. These will be considered the existing base conditions for this report.

2.2 Functional Classification

The Ohio Department of Transportation functionally classifies roadways to help define a roadway's characteristics as well as identify roadways that are eligible for federal funds. Functional classification is the grouping of roads, streets, and highways in a hierarchy based on the type of highway service they provide. Generally, streets and highways perform two types of service. They provide either traffic mobility or land access and can be ranked in terms of the proportion of service they provide.

The functional classification as determined by ODOT will be used in this report to apply growth and design hour factors to the study area roadways for use in forecasting the future traffic volumes in the study area. These factors are determined using data, guidelines, and methodology supplied by ODOT. These methods and the corresponding data are based on the roadways assigned functional classification. The ODOT methods for forecasting future traffic volumes are a recognized traffic engineering standard.

Roadways that are not listed as having a functional classification can be assigned into one of two categories. The first category is a local roadway and the second category is that of an access drive.

The ODOT functional classification of the roadways in the study area can currently be found using the ODOT Transportation Information Mapping System (TIMS). TIMS is ODOT's web-mapping portal where information about Ohio's transportation system can be found. TIMS can currently be found at the following web address:

<https://gis.dot.state.oh.us/tims/>

The following table lists the study area roadways that have an assigned functional classification as determined by ODOT and local government entities.

Table 2.2 Functional Classification

INTERSECTION		AREA	FC #	FUNCTIONAL CLASSIFICATION
#	ROADWAYS (Approach)			
1	US 62/SR 46 (North/South)	Urban	4	Minor Arterial
	Herbert Road (West)		5	Major Collector
	Shields Road (East)		4	Minor Arterial
2	Shields Road (West/East)	Urban	4	Minor Arterial
	McCune Park Access (South)		7	Local Access

Figure 2.3, Appendix A illustrates the section of the TIMS functional classification map for the study area.

2.3 Traffic

Weekday Peak Hours

Weekday nine hour turning movement counts were performed at the following locations:

1. **US 62/SR 42 & Herbert Road/Shields Road - Tuesday, September 27, 2022**
2. **Shields Road (SR 46) & McCune Park Driveway - Tuesday, September 27, 2022**

The weekday traffic count was conducted in fifteen (15) minute intervals between the hours of 7 AM - 10 AM, 11 AM - 1 PM, and 2 PM - 6 PM, then hourly totals were calculated. Average daily traffic was calculated for the roadways using expansion factors to account for daily and seasonal variations according to the recommendations and latest data from the Ohio Department of Transportation. A copy of the intersection turn movement counts are included in **Appendix C**.

The following arrival and dismissal times for the elementary and middle schools in the Canfield Local School District were determined through the district's website:

	<u>FIRST BELL</u>	<u>DISMISSAL</u>
Canfield Village Middle School:	7:55 AM	2:40 PM
Campbell Elementary School:	8:45 AM	3:30 PM
Hilltop Elementary School:	8:45 AM	3:30 PM

The AM and PM intersection peak hours for the study area roadways are selected by reviewing data in 15-minute intervals. When there is more than one intersection within the study area, a consistent time period should be used for all intersections within the study area in order to develop an existing conditions traffic volume set, the system peak hour. The following questions should be considered when choosing the peak hours for a study area with multiple intersections:

- What are the individual intersection peak hours?
- Are the individual peak hours the same time or close to each other?
- Would it result in significantly fewer vehicles to use a different peak hour for intersections that are not the same?
- What is the peak hour for intersections with the highest overall volume?
- What peak hour contributes the highest volume to the entire system?

The use of summary tables for the entering traffic volumes during the AM and PM time periods are used to evaluate the previously discussed questions, to identify the peak hours for each intersection, and to determine the peak hour of the system.

The following tables detail a breakdown of the hourly volumes during the AM and PM hours that were determined to experience the highest traffic volumes in conjunction with the previously listed school bell schedules.

Table 2.3 AM Peak Hour Traffic Volumes
(Total Entering Volume - Vehicles per Hour)

INTERSECTION	HOUR BEGINS								
	7:00	7:15	7:30	7:45	8:00	8:15	8:30	8:45	9:00
US 62 & Shields	1438	1508	1470	1272	1198	1147	1065	1001	939
Shields & McCune	865	895	850	741	684	633	589	526	466
TOTAL	2303	2403	2320	2013	1882	1780	1654	1527	1405

Table 2.4 PM Peak Hour Traffic Volumes
(Total Entering Volume - Vehicles per Hour)

INTERSECTION	HOUR BEGINS							
	2:00	2:15	2:30	2:45	3:00	3:15	3:30	3:45
US 62 & Shields	1465	1586	1597	1609	1567	1577	1541	1528
Shields & McCune	819	862	847	784	748	785	787	818
TOTAL	2284	2448	2444	2393	2315	2362	2328	2346

The AM and PM peak hours will be determined using the existing bell schedules for schools and the collected traffic data in order to provide a conservative estimate of traffic for a single arrival and dismissal period for the proposed PK-8 school.

The weekday AM peak hour was determined to 7:30 AM to 8:30 AM. The period was determined to coincide with the current middle school AM arrival time, is in close proximity to the current elementary school arrival time and begins only 15 minutes after the existing AM peak hour of the roadway.

The weekday PM peak hour was determined to 2:30 PM to 3:30 PM. The period was determined to coincide with the current middle school PM dismissal time, is in close proximity to the current elementary school dismissal time, and begins only 15 minutes after the existing PM peak hour of the roadway.

The two peak periods will be analyzed since they reflect the period of the highest volume of traffic flow for the study area roadways and the proposed PK-8 school.

The existing AM and PM peak hour traffic volumes are shown in **Figure 2.4, Appendix A.**

Chapter 3

Projected Traffic Conditions

3.1 Site Traffic

Trip Generation

Calculating future total driveway trips requires an estimate of the traffic generated by the proposed development. The most widely accepted method of determining the amount of traffic that the proposed development will generate is to compare the proposed land use with existing facilities of the same use. The Institute of Transportation Engineers (ITE) has prepared a manual titled “**Trip Generation Manual**”⁽⁸⁾, which is a compilation of similar traffic generation studies to aide in making such a comparison. The most recent update of this manual is the 11TH edition and was utilized for this study.

The following table details the expected development land uses and the corresponding ITE land uses that will be used to forecast the site generated traffic volumes for the Build conditions:

Table 3.1 ITE Land Use Codes

SITE PLAN DESCRIPTION	LAND USE	SIZE (Students)	ITE CODE	ITE DESCRIPTION
Elementary School	Institutional	950	520	Elementary School
Middle School	Institutional	790	522	Middle School/Junior High School

Trip Generation Summary

The following table details a summary of the generated weekday peak hour traffic volumes utilizing data contained in the **(ITE) Trip Generation Manual**⁽⁸⁾ and the methods outlined in the **(ITE) Trip Generation Handbook**⁽⁹⁾. Copies of the trip generation worksheets can be found in **Appendix D**.

Table 3.2 New Trip Generation

ITE TRIP GENERATION		SIZE (Students)	TRIP ENDS			
ITE Code	Land Use Description		AM Peak Hour of Generator (Enter/Exit)		PM Peak Hour of Generator (Enter/Exit)	
520	Elementary School	950	385	328	197	231
522	Middle School	790	333	272	134	157
TOTAL GENERATED TRIPS			718	600	331	388
			1318		719	

The proposed PK-8 school under the expected full build conditions is expected to generate a total of 1,318 driveway trips in the AM peak hour and a total of 719 driveway trips in the PM peak hour.

The ODOT **State Highway Access Management Manual**⁽⁷⁾ requires that ten year design hour traffic volumes be analyzed for a proposed development when the number of generated trips is below 500 in the peak hour and twenty year design hour traffic volumes when the number of generated trips is greater than 500 in the peak hour. The year 2047 will therefore be analyzed for the twenty year design hour conditions from the opening year of the development.

Distribution of New Generated Weekday Traffic

The directional distribution for the new generated traffic is a function of the prevailing operating conditions on the existing roadways. The distribution pattern that was assumed is shown in the tables that follow and is based upon the existing traffic volumes entering and exiting the intersection of US Route 62/State Route 46 and Shields Road during the AM and PM peak hours shown in **Figure 2.4, Appendix A**.

The following tables detail the distribution of new generated trips for the proposed development.

Table 3.3 AM New Trip Origins & Destinations

ORIGIN/ DESTINATION	ROUTE	FROM (ENTER)	% TOTAL	NEW TRIPS	TO (EXIT)	% TOTAL	NEW TRIPS
EAST	Herbert Road	467	32%	228	457	31%	187
WEST	Shields Road	283	19%	138	146	10%	60
NORTH	SR 46	358	24%	175	376	26%	153
SOUTH	US 62/SR 46	362	25%	177	491	33%	200
TOTALS		1470	100%	718	1470	100%	600

Table 3.4 PM New Trip Origins & Destinations

ORIGIN/ DESTINATION	ROUTE	FROM (ENTER)	% TOTAL	NEW TRIPS	TO (EXIT)	% TOTAL	NEW TRIPS
EAST	Herbert Road	493	31%	102	432	27%	105
WEST	Shields Road	242	15%	50	193	12%	47
NORTH	SR 46	371	23%	77	499	31%	121
SOUTH	US 62/SR 46	491	31%	102	473	30%	115
TOTALS		1597	100%	331	1597	100%	388

Directional Distribution

The directional distribution for the AM and PM peak hour generated vehicular traffic is shown graphically in **Figure 3.1, Appendix A** and was based on the previous tables and assumptions.

Assignment of Generated Traffic

Based upon the distribution patterns shown in **Figure 3.1**, the PK-8 school AM and PM peak hour generated vehicular traffic was assigned to the study intersections. The assignments of the estimated generated traffic during the peak hours are shown graphically in **Figure 3.2, Appendix A**.

3.2 Non-Site Traffic

Background Traffic Growth

Design of new roadways or improvements to existing roadways should not usually be based on current traffic volumes alone, but should consider future traffic volumes expected to make use of the facilities. Roadways should be designed to accommodate the traffic volume that is likely to occur within the design life of the facility. In a practical sense, this design volume should be a value that can be estimated with reasonable accuracy. It is believed that the maximum design period is in the range of 15 to 24 years. Therefore, a period of twenty years is widely used as a basis for design for large projects. A period of ten years is currently specified by the Ohio Department of Transportation for smaller projects. Traffic cannot usually be forecasted accurately beyond this period on a specific facility because of probable changes in the general regional economy, population, and land development along the roadway.

The ODOT **State Highway Access Management Manual** ⁽⁷⁾ requires that opening year and twenty year design hour traffic volumes be analyzed for a proposed development when the number of generated trips is greater than 500 in the peak hour.

The years 2027(Opening Year) and 2047(Design Year) will be analyzed for the proposed development as the peak hour site generated traffic volumes are greater than 500 trips. Therefore, it is necessary to estimate historical growth rates in order to establish the future traffic on the study area roadways due to non-site related conditions.

Roadways, like those found in the study area carry a significant amount of through traffic due to their functional characteristics. This through traffic component generally increases as regional growth occurs. Therefore, it is anticipated that existing traffic on these roadways will increase in future years.

The ODOT Traffic Monitoring Management System (TMMS) was consulted to determine past historical trends on the study area roadways. The ODOT Traffic Monitoring Management System (TMMS) can be currently accessed at the following web address:

<http://www.dot.state.oh.us/Divisions/Planning/TechServ/traffic/Pages/TMMS.aspx>

The TMMS provided data at the following locations that were used to determine a study area growth rate:

1. **State Route 46 (North of Shields Road) - Location ID 40650**
2. **State Route 46/US Route 62 (South of Shields Road) - Location ID 40950**
3. **Shields Road (East of SR 46) - Location ID 46550**

A linear regression equation was developed for each location based on the available historical data. The growth rate for the location was then developed based on the procedure detailed in *Section 4.2* of the **Ohio Traffic Forecasting Manual, Volume 2** ⁽⁵⁾. A copy of the ODOT historical traffic data analysis and the growth rate calculations for each location can be seen in **Appendix E**.

Based on the historical traffic data from the ODOT website, the State Route 46 locations were found to have a negative/declining growth rate and the Shields Road location was found to have a positive growth rate, therefore, the Shields Road location growth rate will be applied to all study area roadways with the exception of the McCune Park access driveway.

The growth rates and factors for they study area can be seen in the following table:

Table 3.5 - Growth Rates & Factors

ROADWAY (Approach)	GROWTH RATE (Annual Growth)	2027 GROWTH FACTOR	2047 GROWTH FACTOR
SR 46 (North)	0.538%	1.027	1.135
SR 46/US 62 (South)	0.538%	1.027	1.135
Herbert Road (West)	0.538%	1.027	1.135
Shields Road (East)	0.538%	1.027	1.135

Design Hour Traffic

The traffic patterns on any roadway typically show considerable variation in the traffic volumes experienced during the various hours of the day and in the hourly volumes experienced throughout the year. A key decision in the design process involves determining which of these hourly traffic volumes should be used as the basis for the design.

It would be wasteful to predicate a design on the maximum peak hour traffic that occurs during the year and the use of the average hourly traffic would result in an inadequate design. The hourly traffic volumes used in a design should not be exceeded very often or by very much. However, the hourly traffic volumes should not be so high that traffic would rarely be sufficient to make full use of the designed facility.

Normal design policy in the State of Ohio is based upon a review of curves that depict the variation in hourly traffic volumes during the year. The Ohio Department of Transportation recommends using the 30TH highest hour as a design control for rural streets. There is typically very little difference between the volumes in this range. The Ohio Department of Transportation provides factors or a methodology to determine factors that are applied to counted daily traffic volumes to determine appropriate design hour traffic volumes.

Following guidelines set forth in the ODOT **State Highway Access Management Manual** ⁽⁷⁾, all analyses are required to examine the design hour volume for the adjacent roadway and peak hour traffic volume of the proposed development. The **Ohio Traffic Forecasting Manual** ^(4 & 5) will be used to determine peak hour factors for the study area roadways.

The design hour volumes are determined by multiplying the AM and PM peak hour volumes by the appropriate factors from the ODOT Peak Hour to Design Hour Factor Report based on the functional classification of the roadway, the day of the week and the month that the traffic data was collected. A copy of the ODOT's Peak Hour to Design Hour Factor Report can be seen in **Appendix F**.

The following table details the peak hour to design hour factors for the study area roadways.

Table 3.6 - Peak Hour to Design Hour Factors

INTERSECTION		MONTH	DAY	URBAN FUNCTIONAL CLASSIFICATION	DHV FACTOR
#	ROADWAYS				
1	SR 46/US 62	September	Tuesday	Minor Arterial	1.11
	Shields Road			Minor Arterial	1.11
	Herbert Road			Major Collector	1.11
2	Shields Road	September	Tuesday	Minor Arterial	1.11
	McCune Park Driveway			Local Access	1.11

Intersection Peak Hour Factors

The intersection peak hour factor (PHF) is used to convert the hourly traffic volume into the flow rate that represents the busiest 15 minutes of the peak hour. The PHF is the sum of the traffic entering the intersection during the peak hour divided by four times the highest 15 minute volume during the peak hour. A PHF of 1 indicates that the traffic volume in each 15 minute volume is the same and therefore traffic flow is consistent throughout the hour. A lower PHF indicates a more variable traffic flow and that traffic volume has a spike during the peak 15 minute interval. PHF's under 0.80 occur in locations with highly peaked demand, such as at schools and factories during shift changes.

The ODOT **Analysis and Traffic Simulation Manual** ⁽⁶⁾ provides guidance to use the existing year PHF for all intersections from traffic counts collected for the project. The PHF is calculated for the intersection as a whole and not individual approaches or movements. A minimum of 0.80 for the PHF is required to be utilized unless justified by highly peaked demands such as for schools and factories noted above. If project specific counts are not available, a default value of 0.92 is to be utilized for arterials.

The following table shows the PHF's calculated for the study area intersections during the AM and PM peak hours based on the traffic data collected and shown in **Appendix C**:

**Table 3.7 - Intersection Peak Hour Factors
(Existing Conditions)**

ROADWAY/INTERSECTION	AM PHF	PM PHF
US 62/SR 46 & Shields Road	0.800*	0.986
Shields Road & McCune Park Driveway	0.800*	0.861*

* Existing PHF was less than 0.80

The peak hour factors detailed in *Table 3.7* will be used in the forthcoming intersection capacity calculations in Chapter 4 of this report for the forecasted No-Build conditions.

The following table shows the PHF's calculated for the study area intersections during the AM and PM peak hours based on the addition of the site generated traffic during the AM and PM peak hours:

**Table 3.8 - Intersection Peak Hour Factors
(Future Conditions)**

ROADWAY/INTERSECTION	AM PHF	PM PHF
US 62/SR 46 & Shields Road	0.800	0.870
Shields Road & McCune Park Driveway	0.730	0.790

The peak hour factors detailed in *Table 3.8* will be used in the forthcoming intersection capacity calculations in Chapter 4 of this report for the forecasted Build conditions. It should be noted that due to the presence of a school under the expected Build conditions that a PHF less than 0.80 will be considered suitable for use in the Build analysis.

3.3 Future Traffic

No-Build Conditions

The previously discussed calculation of growth rates and design hour factors for each movement were applied to the existing 2022 traffic volumes shown in **Figure 2.4, Appendix A** in order to estimate the future traffic considering non-project traffic conditions.

Printouts of our Excel spreadsheets detailing the use of the design hour factors, growth rates, and the resulting expected 2027 and 2047 traffic volumes can be found in **Appendix G**.

The estimated 2027 and 2047 No-Build traffic volumes for the study area are shown graphically in **Figures 3.3 and 3.4, Appendix A**. This is the expected traffic if the proposed PK-8 school **IS NOT** constructed, the “**No-Build**” condition.

The forecasted traffic volumes have been rounded to the nearest 10 to adhere to preferred ODOT practices.

Build Condition

The sum of the 2027 and 2047 No-Build volumes, shown in **Figures 3.3 & 3.4**, were added to the new generated traffic (**Figure 3.2**) to equal the future Build peak hour volumes in order to estimate the future traffic considering project traffic conditions under the opening and design year conditions.

The estimated 2027 and 2047 Build traffic volumes for the study area are shown graphically in **Figures 3.5 & 3.6, Appendix A** for the proposed PK-8 school. These are the expected volumes if the proposed school **IS** constructed, or the “**Build**” condition.

Chapter 4

Traffic Analysis

4.1 Capacity & LOS at Study Area Intersections

2027 Traffic Analysis - No-Build & Build Conditions

Traffic analyses were performed for the projected 2027 opening year conditions under the No-Build and Build scenarios so that:

1. any existing roadway/intersection deficiencies can be identified in the No-Build scenario which would not be attributable to the proposed school, and;
2. a comparison can be made to determine the changes in the traffic operations which may be attributed to the proposed school.

The traffic volumes used in the No-Build analyses can be seen in **Figure 3.3, Appendix A**. Copies of the capacity worksheets for the No-Build analyses are included in **Appendix H**.

The traffic volumes used in the Build analyses can be seen in **Figure 3.5, Appendix A**. Copies of the capacity worksheets for the Build analyses are included in **Appendix I**.

Comparison tables of the 2027 No-Build versus Build traffic analyses for the study area intersections are shown in the following tables.

US 62/SR 42 & Shields Road**Table 4.1 - 2027 AM Peak Hour Traffic Analysis Results
(SR 46/US 62 & Shields Road)**

Intersection #1	2027 AM No-Build Conditions					Intersection #1	2027 AM Build Conditions				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBL	B	15.7	0.209	0.22	32	EBL	E	57.0	0.737	0.67	101
EBT	B	11.9	0.440	0.00	94	EBT	C	25.1	0.736	0.00	302
EB Approach	B	12.7	-	-	-	EB Approach	C	30.0	-	-	-
WBL	D	42.0	0.896	1.55	279	WBL	F	933.1	2.966	13.66	2458
WBT	B	12.0	0.454	0.00	92	WBT	D	47.5	0.945	0.00	476
WB Approach	C	28.6	-	-	-	WB Approach	F	512.1	-	-	-
NBL	B	15.7	0.098	0.08	14	NBL	B	15.9	0.080	0.10	19
NBT	B	15.5	0.788	0.00	195	NBT	C	21.2	0.926	0.00	412
NB Approach	B	15.5	-	-	-	NB Approach	C	20.9	-	-	-
SBL	D	47.3	0.845	0.95	172	SBL	F	953.0	2.992	9.75	1755
SBT	B	12.6	0.463	0.00	100	SBT	B	12.7	0.363	0.00	134
SB Approach	C	26.2	-	-	-	SB Approach	F	551.2	-	-	-
Intersection	C	21.8	-	-	-	Intersection	F	322.7	-	-	-

The AM peak hour analysis shows that the intersection of US 62/SR 46 and Shields Road is expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 No-Build conditions with the exception of the QSR for the westbound left turn lane. The comparison table indicates that the storage length of the westbound right turn lane may be inadequate for the future 2027 No-Build conditions.

The analysis indicates that intersection is not expected to meet the operational goals shown in **Table 1.2** under the forecasted 2027 Build conditions. The Build levels-of-service for the intersection, approaches, and movements are not within the acceptable ranges as stated in the ODOT **OATS Manual**. The AM peak hour capacity analyses indicate levels-of-service where it is recommended to investigate improvements that could meet the operational goals shown in **Table 1.2**.

**Table 4.2 - 2027 PM Peak Hour Traffic Analysis Results
(SR 46/US 62 & Shields Road)**

Intersection #1	2027 PM No-Build Conditions					Intersection #1	2027 PM Build Conditions				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBL	B	18.0	0.217	0.18	28	EBL	F	87.8	0.812	0.95	143
EBT	B	12.2	0.373	0.00	65	EBT	C	25.4	0.479	0.00	247
EB Approach	B	13.6	-	-	-	EB Approach	D	38.3	-	-	-
WBL	B	17.8	0.542	0.52	93	WBL	F	180.6	1.254	4.51	812
WBT	B	13.5	0.582	0.00	106	WBT	D	53.1	0.934	0.00	600
WB Approach	B	15.3	-	-	-	WB Approach	F	105.3	-	-	-
NBL	B	12.4	0.086	0.06	12	NBL	B	19.6	0.095	0.17	31
NBT	B	12.9	0.746	0.00	163	NBT	C	22.3	0.823	0.00	499
NB Approach	B	12.9	-	-	-	NB Approach	C	22.2	-	-	-
SBL	C	21.4	0.502	0.36	64	SBL	F	242.9	1.366	3.58	644
SBT	B	10.3	0.400	0.00	74	SBT	B	15.3	0.363	0.00	201
SB Approach	B	13.9	-	-	-	SB Approach	F	112.7	-	-	-
Intersection	B	14.0	-	-	-	Intersection	E	73.8	-	-	-

The PM peak hour analysis shows that the intersection of US 62/SR 46 and Shields Road is expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 No-Build conditions.

The analysis indicates that intersection is not expected to meet the operational goals shown in **Table 1.2** under the forecasted 2027 Build conditions. The Build levels-of-service for the intersection, approaches, and movements are not within the acceptable ranges as stated in the ODOT **OATS Manual**. The PM peak hour capacity analyses indicate levels-of-service where it is recommended to investigate improvements that could meet the operational goals shown in **Table 1.2**.

Analyses will be performed in a later section of this report to determine what improvements will provide an acceptable level-of-service in the peak periods that will adhere to the acceptable ranges shown in **Table 1.2** as stated in the ODOT **OATS Manual**.

Shields Road (US 62) & McCune/Site Access Driveway**Table 4.3 - 2027 AM Peak Hour Traffic Analysis Results
(Shields Road & McCune/Site Access Driveway)**

Intersection #2	2027 AM No-Build Conditions				Intersection #2	2027 AM Build Conditions			
Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)	Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)
WBL	A	8.8	0.01	0.0	WBL	C	24.9	0.66	4.7
WB Approach	A	0.3	--	--	WB Approach	C	24.9	--	--
NBT	C	19.2	0.09	0.3	NBT	F	--	--	--
NB Approach	C	19.2	--	--	NB Approach	F	--	--	--

**Table 4.4 - 2027 PM Peak Hour Traffic Analysis Results
(Shields Road & McCune/Site Access Driveway)**

Intersection #2	2027 PM No-Build Conditions				Intersection #2	2027 PM Build Conditions			
Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)	Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)
WBL	A	8.6	0.01	0.0	WBL	B	11.1	0.19	0.7
WB Approach	A	0.3	--	--	WB Approach	A	4.7	--	--
NBT	C	22.4	0.05	0.2	NBT	F	1988.3	5.22	54.4
NB Approach	C	22.4	--	--	NB Approach	F	1988.3	--	--

The peak hour analyses show that the intersection of Shields Road and McCune/Site Access Driveway is expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 No-Build conditions.

The analysis indicates that intersection is not expected to meet the operational goals shown in **Table 1.2** under the forecasted 2027 Build conditions. The Build levels-of-service for the approaches and movements are not within the acceptable ranges as stated in the ODOT **OATS Manual**. The peak hour capacity analyses indicate levels-of-service where it is recommended to investigate improvements that could meet the operational goals shown in **Table 1.2**.

Analyses will be performed in a later section of this report to determine what improvements will provide an acceptable level-of-service in the peak periods that will adhere to the acceptable ranges shown in **Table 1.2** as stated in the ODOT **OATS Manual**.

2047 Traffic Analysis - No-Build & Build Conditions

Traffic analyses were performed for the projected 2047 design year conditions under the No-Build and Build scenarios so that:

1. any existing roadway/intersection deficiencies can be identified in the No-Build scenario which would not be attributable to the proposed school, and;
2. a comparison can be made to determine the changes in the traffic operations which may be attributed to the proposed school.

The traffic volumes used in the No-Build analyses can be seen in **Figure 3.4, Appendix A**. Copies of the capacity worksheets for the No-Build analyses are included in **Appendix J**.

The traffic volumes used in the Build analyses can be seen in **Figure 3.6, Appendix A**. Copies of the capacity worksheets for the Build analyses are included in **Appendix K**.

Comparison tables of the 2047 No-Build versus Build traffic analyses for the study area intersections are shown in the following tables.

US 62/SR 42 & Shields Road**Table 4.5 - 2047 AM Peak Hour Traffic Analysis Results
(SR 46/US 62 & Shields Road)**

Intersection #1	2047 AM No-Build Conditions					Intersection #1	2047 AM Build Conditions				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBL	C	20.2	0.265	0.35	52	EBL	C	26.1	0.457	0.38	57
EBT	B	14.5	0.479	0.00	148	EBT	B	14.2	0.659	0.00	196
EB Approach	B	15.8	-	-	-	EB Approach	B	16.1	-	-	-
WBL	F	98.7	1.088	2.89	521	WBL	F	552.2	2.148	11.91	2144
WBT	B	14.7	0.496	0.00	145	WBT	C	22.1	0.835	0.00	282
WB Approach	E	60.9	-	-	-	WB Approach	F	299.4	-	-	-
NBL	B	18.8	0.135	0.14	26	NBL	B	19.6	0.159	0.13	24
NBT	B	17.7	0.782	0.00	260	NBT	F	180.5	1.333	0.00	1267
NB Approach	B	17.8	-	-	-	NB Approach	F	170.4	-	-	-
SBL	F	95.6	1.016	1.69	304	SBL	F	1178.9	3.513	10.38	1869
SBT	B	14.5	0.477	0.00	149	SBT	B	15.6	0.556	0.00	141
SB Approach	D	46.2	-	-	-	SB Approach	F	665.9	-	-	-
Intersection	D	38.1	-	-	-	Intersection	F	302.8	-	-	-

The AM peak hour analysis shows that the intersection of US 62/SR 46 and Shields Road is not expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2047 No-Build conditions.

The analysis indicates that intersection is not expected to meet the operational goals shown in **Table 1.2** under the forecasted 2047 Build conditions. The Build levels-of-service for the intersection, approaches, and movements are not within the acceptable ranges as stated in the ODOT **OATS Manual**. The AM peak hour capacity analyses indicate levels-of-service where it is recommended to investigate improvements that could meet the operational goals shown in **Table 1.2**.

**Table 4.6 - 2047 PM Peak Hour Traffic Analysis Results
(SR 46/US 62 & Shields Road)**

Intersection #1	2047 PM No-Build Conditions					Intersection #1	2047 PM Build Conditions				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBL	B	19.1	0.219	0.21	31	EBL	E	76.8	0.827	0.76	114
EBT	B	12.3	0.357	0.00	74	EBT	C	20.5	0.545	0.00	190
EB Approach	B	13.9	-	-	-	EB Approach	C	31.7	-	-	-
WBL	B	18.3	0.574	0.65	116	WBL	F	261.2	1.469	5.50	991
WBT	B	13.9	0.597	0.00	132	WBT	F	95.5	1.108	0.00	735
WB Approach	B	15.7	-	-	-	WB Approach	F	163.5	-	-	-
NBL	B	14.3	0.115	0.10	18	NBL	B	15.6	0.123	0.15	27
NBT	B	15.9	0.851	0.00	226	NBT	B	19.6	0.929	0.00	404
NB Approach	B	15.8	-	-	-	NB Approach	B	19.3	-	-	-
SBL	C	33.7	0.699	0.57	103	SBL	F	437.2	1.833	4.71	848
SBT	B	12.0	0.449	0.00	101	SBT	B	11.8	0.411	0.00	146
SB Approach	B	18.9	-	-	-	SB Approach	F	188.3	-	-	-
Intersection	B	16.2	-	-	-	Intersection	F	109.2	-	-	-

The PM peak hour analysis shows that the intersection of US 62/SR 46 and Shields Road is expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2047 No-Build conditions.

The analysis indicates that intersection is not expected to meet the operational goals shown in **Table 1.2** under the forecasted 2047 Build conditions. The Build levels-of-service for the intersection, approaches, and movements are not within the acceptable ranges as stated in the ODOT **OATS Manual**. The PM peak hour capacity analyses indicate levels-of-service where it is recommended to investigate improvements that could meet the operational goals shown in **Table 1.2**.

Analyses will be performed in a later section of this report to determine what improvements will provide an acceptable level-of-service in the peak periods that will adhere to the acceptable ranges shown in **Table 1.2** as stated in the ODOT **OATS Manual**.

Shields Road (US 62) & McCune/Site Access Driveway**Table 4.7 - 2047 AM Peak Hour Traffic Analysis Results
(Shields Road & McCune/Site Access Driveway)**

Intersection #2	2047 AM No-Build Conditions				Intersection #2	2047 AM Build Conditions			
Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)	Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)
WBL	A	9.0	0.01	0.0	WBL	D	29.3	0.70	5.4
WB Approach	A	0.4	--	--	WB Approach	D	29.3	--	--
NBT	C	22.1	0.11	0.4	NBT	F	--	--	--
NB Approach	C	22.1	--	--	NB Approach	F	--	--	--

**Table 4.8 - 2047 PM Peak Hour Traffic Analysis Results
(Shields Road & McCune/Site Access Driveway)**

Intersection #2	2047 PM No-Build Conditions				Intersection #2	2047 PM Build Conditions			
Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)	Shields & McCune Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)
WBL	A	8.8	0.01	0.0	WBL	B	11.5	0.20	0.8
WB Approach	A	0.3	--	--	WB Approach	A	5.1	--	--
NBT	D	25.6	0.06	0.2	NBT	F	2588.6	6.52	56.6
NB Approach	D	25.6	--	--	NB Approach	F	2588.6	--	--

The peak hour analyses show that the intersection of Shields Road and McCune/Site Access Driveway is expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 No-Build conditions.

The analysis indicates that intersection is not expected to meet the operational goals shown in **Table 1.2** under the forecasted 2027 Build conditions. The Build levels-of-service for the approaches and movements are not within the acceptable ranges as stated in the ODOT **OATS Manual**. The peak hour capacity analyses indicate levels-of-service where it is recommended to investigate improvements that could meet the operational goals shown in **Table 1.2**.

Analyses will be performed in a later section of this report to determine what improvements will provide an acceptable level-of-service in the peak periods that will adhere to the acceptable ranges shown in **Table 1.2** as stated in the ODOT **OATS Manual**.

4.2 Improvements for Capacity & LOS at Study Area Intersections

2027 Traffic Analysis - Improvements

Traffic analyses for the 2027 Build conditions revealed issues at the study area intersections where intersection, movement, and approach levels-of-service failed to meet the operational goals shown in **Table 1.2, Page 4**.

Certain improvements were tested with further capacity analyses in order to determine what mitigation would be necessary to improve the levels-of-service at the intersections under the forecasted 2027 Build conditions.

The following improvements were determined to improve the poor levels-of-service at the study area intersections under the forecasted 2027 Build conditions.

US 62/SR 46 & Shields Road

- Construct a northbound right turn lane.
- Construct a southbound right turn lane.
- Construct an eastbound right turn lane.
- Construct a westbound right turn lane.
- Update signal sequence to include right turn overlap phases with protected left turn phases.

Shields Road & McCune/Site Access Driveway

- Construct a westbound left turn lane.
- Construct an eastbound right turn lane.
- Construct a northbound left turn lane.
- Install traffic signal control.

The following table shows the capacity analysis results of the recommended improvements at the intersection of US 62/SR 46 and Shields Road. Copies of the capacity worksheets for the intersection are included in **Appendix L**.

**Table 4.9 - 2027 Peak Hour Traffic Improvement Analysis Results
(SR 46/US 62 & Shields Road)**

Intersection #1	2027 AM Build Conditions w/ Imp. Traffic Signal Control					Intersection #1	2027 PM Build Conditions w/ Imp. Traffic Signal Control				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBL	D	36.0	0.200	0.67	101	EBL	C	23.9	0.200	0.34	51
EBT	D	53.8	0.908	0.00	527	EBT	C	33.5	0.816	0.00	185
EBR	D	37.4	0.136	0.00	71	EBR	C	25.1	0.236	0.00	51
EB Approach	D	49.3	-	-	-	EB Approach	C	29.8	-	-	-
WBL	F	135.0	1.173	6.55	1179	WBL	C	20.7	0.789	1.24	223
WBT	C	23.3	0.238	0.00	184	WBT	C	21.8	0.380	0.00	123
WBR	B	17.4	0.404	0.00	264	WBR	C	20.0	0.599	0.00	209
WB Approach	F	80.1	-	-	-	WB Approach	C	20.7	-	-	-
NBL	D	39.3	0.126	0.26	47	NBL	B	19.2	0.134	0.14	24
NBT	D	50.2	0.681	0.00	363	NBT	C	27.5	0.761	0.00	244
NBR	C	25.7	0.555	0.00	375	NBR	B	14.2	0.478	0.00	163
NB Approach	D	35.4	-	-	-	NB Approach	C	20.7	-	-	-
SBL	F	169.8	1.225	3.62	652	SBL	C	31.1	0.754	0.97	175
SBT	D	40.1	0.472	0.00	302	SBT	C	23.1	0.519	0.00	177
SBR	C	30.3	0.088	0.00	50	SBR	B	16.1	0.098	0.00	27
SB Approach	F	113.7	-	-	-	SB Approach	C	25.8	-	-	-
Intersection	E	72.0	-	-	-	Intersection	C	23.1	-	-	-

The construction of additional turn lanes and proposed changes to the signal sequencing are not expected to completely mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2, Page 4** under the AM peak hour forecasted 2027 Build conditions.

In order to further improve the levels-of-service dual left turn lanes would likely be necessary which would require additional through lanes on the adjacent approach to receive traffic turning from two lanes. Due to the existing lane use, adjacent land uses and the bridge over Interstate 76, this type of geometric improvement at the intersection would be high cost and would likely impact the adjacent intersections/driveways and land uses. This type of improvement at the intersection may be unfeasible due to construction costs and right-of-way impacts.

The following table shows the capacity analysis results of the recommended improvements at the intersection of Shields Road and McCune/Site Access Driveway. Copies of the capacity worksheets for the intersection are included in **Appendix L**.

**Table 4.10 - 2027 Peak Hour Traffic Improvement Analysis Results
(Shields Road & McCune/Site Access Driveway)**

Intersection #1	2027 AM Traffic Signal Control Build Conditions w/ Imp.					Intersection #1	2027 PM Traffic Signal Control Build Conditions w/ Imp.				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBT	F	80.3	1.010	0.00	962	EBT	C	21.4	0.888	0.00	293
EBR	B	10.8	0.621	0.00	365	EBR	A	5.3	0.313	0.00	47
EB Approach	D	45.2	-	-	-	EB Approach	B	16.1	-	-	-
WBL	E	75.5	0.939	0.00	513	WBL	B	12.2	0.399	0.00	34
WBT	C	20.8	0.627	0.00	492	WBT	A	9.9	0.607	0.00	177
WB Approach	D	39.2	-	-	-	WB Approach	B	10.3	-	-	-
NBL	E	66.2	0.957	0.00	772	NBL	C	23.1	0.850	0.00	203
NBR	B	19.1	0.337	0.00	217	NBR	B	13.6	0.241	0.00	49
NB Approach	D	51.2	-	-	-	NB Approach	C	20.6	-	-	-
Intersection	D	45.0	-	-	-	Intersection	B	15.1	-	-	-

It should be noted that the improvements are not expected to fully mitigate the poor levels-of-service at the intersection of Shields Road and McCune/Site Access Driveway in the AM peak hour. In order to further improve the levels-of-service a second site access driveway would likely be necessary.

Analyses will be performed in a later section of this report to determine if a second site access driveway will provide acceptable levels-of-service in the peak periods that will adhere to the acceptable ranges shown in **Table 1.2** as stated in the ODOT **OATS Manual**.

2047 Traffic Analysis - Improvements

Traffic analyses for 2047 Build conditions revealed issues at the study area intersections where intersection, movement, and approach levels-of-service failed to meet the operational goals shown in **Table 1.2, Page 4**.

Certain improvements were tested with further capacity analyses in order to determine what mitigation would be necessary to improve the levels-of-service at the intersections under the forecasted 2047 Build conditions.

The following improvements were determined to improve the poor levels-of-service at the study area intersections under the forecasted 2047 conditions.

US 62/SR 46 & Shields Road

- Construct a northbound right turn lane.
- Construct a southbound right turn lane.
- Construct an eastbound right turn lane.
- Construct a westbound right turn lane.
- Update signal sequence to include right turn overlap phases with protected left turn phases.

Shields Road & McCune/Site Access Driveway

- Construct a westbound left turn lane.
- Construct an eastbound right turn lane.
- Construct a northbound left turn lane.
- Install traffic signal control.

The following table shows the capacity analysis results of the recommended improvements at the intersection of US 62/SR 46 and Shields Road. Copies of the capacity worksheets for the intersection are included in **Appendix M**.

**Table 4.11 - 2047 Peak Hour Traffic Improvement Analysis Results
(SR 46/US 62 & Shields Road)**

Intersection #1	2047 AM Traffic Signal Control Build Conditions w/ Imp.					Intersection #1	2047 PM Traffic Signal Control Build Conditions w/ Imp.				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBL	D	36.0	0.219	0.79	118	EBL	C	26.2	0.208	0.38	57
EBT	E	55.1	0.911	0.00	577	EBT	D	36.6	0.833	0.00	213
EBR	D	37.7	0.155	0.00	89	EBR	C	27.0	0.227	0.00	56
EB Approach	D	49.9	-	-	-	EB Approach	C	32.6	-	-	-
WBL	F	189.1	1.297	8.17	1470	WBL	C	22.1	0.834	1.44	259
WBT	C	24.8	0.255	0.00	206	WBT	C	22.7	0.392	0.00	150
WBR	B	19.3	0.437	0.00	302	WBR	B	19.4	0.578	0.00	226
WB Approach	F	109.0	-	-	-	WB Approach	C	21.2	-	-	-
NBL	D	40.4	0.181	0.36	65	NBL	C	21.6	0.177	0.19	35
NBT	D	52.2	0.714	0.00	408	NBT	C	32.3	0.865	0.00	300
NBR	C	27.4	0.574	0.00	407	NBR	B	15.7	0.517	0.00	203
NB Approach	D	37.5	-	-	-	NB Approach	C	23.8	-	-	-
SBL	F	231.0	1.368	4.66	839	SBL	D	38.6	0.828	1.21	217
SBT	D	42.8	0.536	0.00	357	SBT	C	26.4	0.579	0.00	223
SBR	C	31.0	0.086	0.00	52	SBR	B	17.7	0.099	0.00	31
SB Approach	F	147.2	-	-	-	SB Approach	C	30.7	-	-	-
Intersection	F	90.8	-	-	-	Intersection	C	25.6	-	-	-

The construction of additional turn lanes and proposed changes to the signal sequencing are not expected to completely mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2, Page 4** under the AM peak hour forecasted 2047 Build conditions.

In order to further improve the levels-of-service dual left turn lanes would likely be necessary which would require additional through lanes on the adjacent approach to receive traffic turning from two lanes. Due to the existing lane use, adjacent land uses and the bridge over Interstate 76, this type of geometric improvement at the intersection would be high cost and would likely impact the adjacent intersections/driveways and land uses. This type of improvement at the intersection may be unfeasible due to construction costs and right-of-way impacts.

The following table shows the capacity analysis results of the recommended improvements at the intersection of Shields Road and McCune/Site Access Driveway. Copies of the capacity worksheets for the intersection are included in **Appendix M**.

**Table 4.12 - 2047 Peak Hour Traffic Improvement Analysis Results
(Shields Road & McCune/Site Access Driveway)**

Intersection #1	2047 AM Traffic Signal Control Build Conditions w/ Imp.					Intersection #1	2047 PM Traffic Signal Control Build Conditions w/ Imp.				
Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & SR 46/US62	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBT	F	91.2	1.059	0.00	1125	EBT	C	22.4	0.904	0.00	345
EBR	A	8.9	0.600	0.00	321	EBR	A	4.9	0.299	0.00	48
EB Approach	D	52.0	-	-	-	EB Approach	B	17.0	-	-	-
WBL	F	119.8	1.081	0.00	614	WBL	B	13.5	0.430	0.00	36
WBT	C	21.3	0.694	0.00	552	WBT	B	10.7	0.648	0.00	219
WB Approach	D	52.3	-	-	-	WB Approach	B	11.2	-	-	-
NBL	E	66.3	0.957	0.00	769	NBL	C	25.4	0.859	0.00	224
NBR	C	21.1	0.356	0.00	226	NBR	B	15.2	0.247	0.00	56
NB Approach	D	51.9	-	-	-	NB Approach	C	22.7	-	-	-
Intersection	D	52.1	-	-	-	Intersection	B	16.2	-	-	-

It should be noted that the improvements are not expected to fully mitigate the poor levels-of-service at the intersection of Shields Road and McCune/Site Access Driveway in the AM peak hour. In order to further improve the levels-of-service a second site access driveway would likely be necessary.

Analyses will be performed in a later section of this report to determine if a second site access driveway will provide acceptable levels-of-service in the peak periods that will adhere to the acceptable ranges shown in **Table 1.2** as stated in the ODOT **OATS Manual**.

Traffic Signal Warrant Analysis - Build Conditions

Traffic signal warrants were reviewed to determine if traffic signal control is warranted at the intersection of Shields Road (US 62) and McCune/Site Access Driveway. The Build conditions at the intersection will be analyzed and compared to the criteria established by the **Ohio Manual of Uniform Traffic Control Devices** ⁽²⁾ and professional engineering judgement to determine if traffic signal control is warranted at the intersection under the proposed conditions.

The **OMUTCD** ⁽²⁾ provides nine (9) sets of criteria, called warrants for the justification of traffic signal control. The warrants are;

- Warrant 1 - Eight Hour Vehicular Volume
- Warrant 2 - Four Hour Vehicular Volume
- Warrant 3 - Peak Hour Vehicular Volume
- Warrant 4 - Pedestrian Volume
- Warrant 5 - School Crossing
- Warrant 6 - Coordinated Signal System
- Warrant 7 - Crash Experience
- Warrant 8 - Roadway Network
- Warrant 9 - Intersection Near a Grade Crossing

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD** ⁽²⁾ for signal warrants 1-3.

The **OMUTCD** ⁽²⁾ provides an "Option" that if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, or the speed limit exceeds 40 miles per hour the minimum thresholds may be reduced to 70% levels. The posted speed limit along Shields Road (US 62) Road is 45 miles per hour.

The ODOT **Traffic Engineering Manual (TEM)** ⁽¹⁰⁾ Section 402-3.2 provides the following additional guidance regarding the use of the 100 percent and 70 percent values in signal warrants 1-3:

*"For new ODOT signals, Warrants 1, 2 and 3 shall be based on the 100 percent values (**OMUTCD** ⁽²⁾ Chapter 4C) and right-turn reduction factors except in the following circumstance. If there are five or more crashes in one year that can be corrected with the addition of a signal, and the speed exceeds 40 miles per hour on the major street, Warrants 1, 2 and 3 may be based on the 70 percent values combined with engineering judgment and right-turn reduction factors."*

The signal warrant analysis will review all conditions for the 100%.

The volume of right turn traffic for the minor street approach (access driveway) should be analyzed to determine how much, if any, right-turning traffic from the minor street to remove from the signal warrant analysis. The right turns are analyzed following the procedures found in *Section 402-5* from the ODOT **TEM** ⁽¹⁰⁾.

In order to determine if the anticipated 2027 Build conditions are expected to meet one of these warrants, the intersection volumes were first forecasted to 2027 No-Build conditions.

In order to determine if the forecasted 2023 No-Build conditions are expected to meet one of the traffic signal warrants found in the **OMUTCD** ⁽²⁾. The previously discussed growth rate (*Section 3.2*) was applied to the collected nine hour traffic count data for Shields Road and the McCune Site Access Driveway. A spreadsheet detailing the collected hourly traffic volumes, the use of the calculated growth rate, and the resulting expected 2027 No-Build traffic volumes can be found in **Appendix N**.

In order to determine the anticipated 2023 Build conditions, the forecasted 2027 No-Build traffic volumes were added to the expected site generated traffic. The volume of site generated traffic at the intersection was determined using the hourly percentages from the time-of-day distribution chart from the **ITE Trip Generation Manual** for land uses #520 and #522. The turn movements shown in **Figure 3.1** and their corresponding percentage of the daily traffic were used to determine the hourly volume for each movement. A spreadsheet detailing the calculation of the expected hourly intersection volumes for the anticipated 2027 Build conditions can be found in **Appendix N**.

The intersection was found to meet the criteria at the 100% levels under the Build conditions for Warrants 1 and 2. A copy of the signal warrant analysis worksheets can be found **Appendix N**.

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices** ⁽²⁾, we conclude that traffic signal control is justified as required by the **Ohio Revised Code** based upon the forecasted 2027 Build conditions and therefore will be considered as a viable improvement at the intersection of Shields Road (US 62) and McCune/Site Access Driveway in the years 2027 and 2047.

4.3 Two Site Access Driveways

It was previously shown that geometric and traffic control improvements are not expected to fully mitigate the poor levels-of-service at the intersection of Shields Road and McCune/Site Access Driveway in the AM peak hour.

The site was analyzed with two access driveways to determine if the intersection levels-of-service could be further improved. The site was analyzed with a West Access Driveway to serve the entering traffic. The analysis also included a second East Access Driveway that would serve the exiting site traffic. It was assumed that the East Access Driveway would require traffic signal control.

Figure 4.1 and 4.2, Appendix A detail the expected study area traffic volumes for the two access scenario. It should be noted that the two access driveways do not impact the traffic volumes at the intersection of US 62/SR 46 and Shields Road.

The following tables show the capacity analysis results of the two access driveway intersections that would serve the site under the 2027 Build conditions. Copies of the capacity worksheets for the intersection are included in **Appendix O**.

**Table 4.13 - 2027 Peak Hour Traffic 2 Access Analysis Results
(Shields Road & West Site Access Driveway)**

Access #1	2027 AM Build Conditions				Access #1	2027 PM Build Conditions			
	2 Access Scenario No Traffic Control					2 Access Scenario No Traffic Control			
Shields & West Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)	Shields & West Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)
WBL	C	24.9	0.66	4.7	WBL	B	11.1	0.19	0.7
WB Approach	A	5.2	--	--	WB Approach	A	1.4	--	--

Table 4.14 - 2027 Peak Hour Traffic 2 Access Analysis Results
(Shields Road & East Site Access Driveway)

Access #2	2027 AM Build Conditions 2 Access Scenario Traffic Signal Control					Access #2	2027 PM Build Conditions 2 Access Scenario Traffic Signal Control				
Shields & East Access	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & East Access	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBT	C	20.3	0.676	0.00	460	EBT	B	12.0	0.715	0.00	155
EB Approach	C	20.3	-	-	-	EB Approach	B	12.0	-	-	-
WBT	D	47.1	0.976	0.00	971	WBT	B	13.8	0.882	0.00	208
WB Approach	D	47.1	-	-	-	WB Approach	B	13.8	-	-	-
NBL	E	57.6	0.949	0.00	663	NBL	B	16.6	0.811	0.00	129
NBR	C	29.4	0.497	0.00	247	NBR	B	13.3	0.326	0.00	38
NB Approach	D	48.6	-	-	-	NB Approach	B	15.7	-	-	-
Intersection	D	40.4	-	-	-	Intersection	B	13.7	-	-	-

The peak hour analyses show that the site access driveways are expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 Build conditions with two access driveways.

The following tables show the capacity analysis results of the two access driveway intersections that would serve the site under the 2047 Build conditions. Copies of the capacity worksheets for the intersection are included in **Appendix P**.

Table 4.15 - 2047 Peak Hour Traffic 2 Access Analysis Results
(Shields Road & West Site Access Driveway)

Access #1	2047 AM Build Conditions 2 Access Scenario No Traffic Control				Access #1	2047 PM Build Conditions 2 Access Scenario No Traffic Control			
Shields & West Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)	Shields & West Access	LOS	Delay (sec/veh)	v/c	Q ₉₅ %tile (Veh/Ln)
WBL	D	29.3	0.70	5.4	WBL	B	11.5	0.20	0.8
WB Approach	A	5.9	--	--	WB Approach	A	1.4	--	--

**Table 4.16 - 2047 Peak Hour Traffic Improvement Analysis Results
(Shields Road & East Site Access Driveway)**

Access #2	2047 AM Build Conditions					Access #2	2047 PM Build Conditions				
Shields & East Access	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)	Shields & East Access	LOS	Delay (sec/veh)	v/c	QSR	95th %tile Queue (ft)
EBT	C	23.2	0.747	0.00	564	EBT	B	13.1	0.752	0.00	197
EB Approach	C	23.2	-	-	-	EB Approach	B	13.1	-	-	-
WBT	F	63.0	1.030	0.00	1211	WBT	B	14.9	0.911	0.00	247
WB Approach	E	63.0	-	-	-	WB Approach	B	14.9	-	-	-
NBL	E	63.6	0.959	0.00	710	NBL	B	18.0	0.819	0.00	146
NBR	C	31.1	0.502	0.00	259	NBR	B	14.5	0.330	0.00	43
NB Approach	D	53.3	-	-	-	NB Approach	B	17.1	-	-	-
Intersection	D	48.5	-	-	-	Intersection	B	14.9	-	-	-

The peak hour analyses show that the site access driveways are expected to meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2047 Build conditions with two access driveways with the exception of the westbound through movement during the AM peak hour at the east access driveway.

The westbound through movement is expected to operate with an LOS F due to a V/C ratio greater than 1.0 while the delay experienced is consistent with an LOS E.

Traffic Signal Warrant Analysis - Build Conditions

Traffic signal warrants were reviewed to determine if traffic signal control is warranted at the intersection of Shields Road (US 62) and the East Site Access Driveway. The Build conditions at the intersection will be analyzed and compared to the criteria established by the **Ohio Manual of Uniform Traffic Control Devices** ⁽²⁾ and professional engineering judgement to determine if traffic signal control is warranted at the intersection under the proposed conditions.

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD** ⁽²⁾ and analyzed under the same procedures and assumptions as the previous traffic signal warrant analysis.

A spreadsheet detailing the calculation of the expected hourly intersection volumes for the anticipated 2027 and 2047 Build conditions with two access locations can be found in **Appendix N**.

The east site access intersection was found to meet the criteria at the 100% levels under the Build conditions for Warrants 1 and 2. A copy of the signal warrant analysis worksheets can be found **Appendix N**.

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices** ⁽²⁾, we conclude that traffic signal control is justified as required by the **Ohio Revised Code** based upon the forecasted 2027 Build conditions and therefore will be considered as a viable improvement at the intersection of Shields Road (US 62) and the East Site Access Driveway in the years 2027 and 2047.

4.4 Auxiliary Turning Lane Warrant Analysis

It is the intent of this report to evaluate the need for exclusive deceleration and turning lanes at the recommended west access location along Shields Road (US 62). The turn lane warrants will be evaluated based on the following conditions:

Shields Road (US 62) Turn Lanes @ West Access Driveway

- Two-lane roadway
- Posted speed limit of 45 miles per hour.

The following table shows the results of the analysis of the need for exclusive deceleration and turn lanes at the proposed west access driveway along Shields Road (US 62). Copies of the ODOT turn lane warrant graphs can be seen in **Appendix Q**.

Table 4.17 Turning Lane Warrants

US 62 TURN LANE & LOCATION	2027 BUILD		2047 BUILD	
	AM PEAK	PM PEAK	AM PEAK	PM PEAK
WB Left Turn Lane @ West Access Driveway	YES	YES	YES	YES
EB Right Turn Lane @ West Access Driveway	YES	YES	YES	YES

The results of the left turn lane warrant analyses indicate that an exclusive westbound left turn lane **IS** warranted on Shields Road (US 62) at the proposed west access driveway under the expected 2027 and 2047 Build conditions.

The results of the right turn lane warrant analyses indicate that an exclusive eastbound right turn lane **IS** warranted on Shields Road (US 62) at the proposed west access driveway under the expected 2027 and 2047 Build conditions.

4.5 Turn Lane Length Analysis

Analyses were performed to determine the necessary turn lane storage lengths at all existing and proposed turn lanes in the study area.

The turn lane calculations will be based on year 2047 Build traffic volumes and the following conditions:

US 62/SR 46 & Shields Road

- Traffic Signal Control (Signalized)
- Design Speed $\leq$ 45 Miles Per Hour
- Condition B or C (Whichever is greater)

Shields Road (US 62) @ West Access Driveway

- No Traffic Control (Unsignalized)
- Design Speed $\leq$ 45 Miles Per Hour
- Turn Movement $> 10\%$ of Approach Volume = High Turn Demand Volume
 - Condition B or C (Whichever is greater)

East Access Driveway @ Shields Road (US 62)

- Stop Sign Control (Unsignalized)
- Design Speed < 35 Miles Per Hour
- Condition A

The following tables details the results of the turn lane length analyses based upon the highest anticipated turn volumes at the intersections under the expected 2047 Build peak hour conditions.

**Table 4.18 - Turn Lane Length Analysis
(US 62/SR 46 & Shields Road)**

Movement Direction	DHV	No. of Lanes	Cycles / Hour	Average Veh/ Cycle/ Lane	Design Speed (mph)	Fig. 401-10 Storage Length (ft)	Fig. 401-9 Condition		Backup Length (ft)	Turn Lane Length* (ft)
							B*	C*		
EB LT	80	1	30	2.67	50	150	225	295		450*
EB T	358	1	30	11.93	50	450			450	
EB RT	70	1	30	2.33	50	150	255	295		450*
WB LT	530	1	30	17.67	50	625	225	770		600*
WB T	197	1	30	6.57	50	275			275	
WB RT	341	1	30	11.37	50	450	225	595		595*
NB LT	50	1	30	1.67	50	100	225	245		450*
NB T	340	1	30	11.33	50	450			450	
NB RT	357	1	30	11.90	50	450	225	595		595*
SB LT	355	1	30	11.83	50	450	225	595		595*
SB T	270	1	30	9.00	50	350			350	
SB RT	50	1	30	1.67	50	100	225	245		350*

* Includes 50' Taper

**Table 4.19 - Turn Lane Length Analysis
(Shields Road & West Access Driveway)**

Movement Direction	DHV	No. of Lanes	Cycles / Hour	Average Veh/ Cycle/ Lane	Design Speed (mph)	Fig. 401-10 Storage Length (ft)	Fig. 401-9 Condition		Backup Length (ft)	Turn Lane Length* (ft)
							B*	C*		
EB RT	500	1	60	8.33	50	350	225	495		495*
WB LT	238	1	60	3.97	50	175	225	320		320*

* Includes 50' Taper

**Table 4.20 - Turn Lane Length Analysis
(Shields Road & East Access Driveway)**

Movement Direction	DHV	No. of Lanes	Cycles / Hour	Average Veh/ Cycle/ Lane	Design Speed (mph)	Fig. 401-10 Storage Length (ft)	Figure 401-9 Condition	Backup Length (ft)	Turn Lane Length (ft)
							A*		
NB LT	423	1	60	7.05	35	325	375		375*
NB RT	197	1	60	3.28	35	175		175	

* Includes Taper

4.6 Driveway Location & Spacing

The spacing of driveways and intersections is a key component of access management. The location of an access driveway in relationship to an intersection or adjacent driveway can have an impact on safety in vicinity of the intersection and the driveway location.

Section 4.4 of the ODOT **State Highway Access Management Manual** ⁽⁷⁾ (**SHAMM**) provides the following guidance related to the location of an access driveway and an intersection:

“Driveways located too close to intersections can cause operational and/or safety problems. Table 4-2 should be used to determine the appropriate corner clearance distance. In most cases driveways near intersections shouldn’t allow full movements in/out if those movements are required to cross left turn lanes serving the intersection on the adjacent primary street. Driveways should not be permitted within the boundaries of a turn lane, but if there is no other option, consideration should be given to limiting the drive to right-in/right out or right-in only. It may also be desirable to locate a drive as far as possible from the intersection; even though this would result in the proposed drive being located closer to the drive on the adjacent property.”

Table 4-2 of the ODOT **SHAMM** ⁽⁷⁾ details a recommended minimum spacing of 360 feet between driveways for a posted speed limit of 45 miles.

Table 5-1 of the ODOT **SHAMM** ⁽⁷⁾ details a recommended minimum spacing of a ½ mile between intersections.

The location of the proposed school driveways should be based on the recommended spacing as detailed in the ODOT **SHAMM** ⁽⁷⁾, turn lane lengths for west access driveway, and queue lengths from the proposed signalized east access driveway.

The signalized east access driveway should be located a minimum of a ½ mile from the existing signalized intersection at US 62/SR 46 and Shields Road.

The 2047 Build capacity analysis determined that the eastbound movement at the east access driveway has a 95TH percentile queue length of 564 feet. The unsignalized west access driveway should be located at least 564 feet west of the east access driveway so as the driveway will not be blocked by the eastbound traffic queued from the signalized east driveway. The 564 feet spacing will meet the ODOT **SHAMM** ⁽⁷⁾ recommended minimum spacing of 360 feet and also be outside the recommended westbound left turn lane length of 320 feet at the west access driveway.

4.7 Improvements to Accommodate Study Area Traffic

Recommended Improvements to Mitigate the Traffic Associated without the Development

No intersection improvements were recommended to accommodate the No-Build traffic at the study area intersections.

Recommended Improvements to Serve Future Conditions without the Development

The following improvements were determined to improve the levels-of-service at the intersection of US 62/SR 46 and Shields Road under the forecasted 2027 and 2047 Build conditions.

- Construct a northbound right turn lane.
- Construct a southbound right turn lane.
- Construct an eastbound right turn lane.
- Construct a westbound right turn lane.
- Update signal sequence to include right turn overlap phases with protected left turn phases.

The construction of additional turn lanes and proposed changes to the signal sequencing are not expected to completely mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 and 2047 Build conditions.

In order to further improve the levels-of-service dual left turn lanes would likely be necessary which would require additional through lanes on the adjacent approach to receive traffic turning from two lanes. Due to the existing lane use, adjacent land uses and the bridge over Interstate 76, this type of geometric improvement at the intersection would be high cost and would likely impact the adjacent intersections/driveways and land uses. This type of improvement at the intersection may be unfeasible due to construction costs and right-of-way impacts.

The use of staggered arrival and dismissal times would also be another option that may disperse traffic over a greater period of time and help to mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2** under the forecasted 2027 and 2047 Build conditions.

Development Access Recommendations

The proposed school is recommended to be served by two access locations. A west access location is proposed to serve all entering traffic to the site. An east access location is proposed to serve all exiting traffic from the site. The access driveways would also be expected to provide access to McCune Park.

The following lane use and traffic control is recommended at the proposed intersections along Shields Road (US 62) where access to the school is proposed under the 2027 and 2047 AM and PM peak hour Build conditions:

Shields Road (US 62) & West Site Access Driveway

- Construct an eastbound right turn lane.
- Construct a westbound left turn lane.
- Construct the proposed access driveway with one ingress lane.

Shields Road (US 62) & East Site Access Driveway

- Install traffic signal control.
 - Interconnect to adjacent traffic signal at US 62/SR 46 & Shields Road
- Construct the proposed access driveway with two egress lanes.
 - Exclusive northbound left turn lane.
 - Exclusive northbound right turn lane.

Interconnecting the proposed traffic signal at the east access driveway to the existing traffic signal at US 62/SR 46 and Shields Road is intended to provide coordinated signal timing between the adjacent signalized intersections.

The signalized east access driveway should be located a minimum of a ½ mile from the existing signalized intersection at US 62/SR 46 and Shields Road.

The unsignalized west access driveway should be located at least 564 feet west of the east access driveway.

The proposed lane use and traffic control for the study area intersections to accommodate expected traffic volumes can be seen in **Figure 4.3, Appendix A**.

Chapter 5

Conclusions

Based on the results of the analyses, we offer the following conclusions and recommendations:

- 5.1 This Traffic Impact Study (TIS) has been prepared at the request of the Canfield Local School District for a proposed PK-8 school. The project site is located in Canfield Township, Mahoning County, Ohio. The site is located along the south side of Shields Road (US Route 62) to the east of S. Canfield-Niles Road (US Route 62/State Route 46) and north of McCune Park.
- 5.2 The project is expected to consist of a PK-8 school for approximately 1,739 students and 162 staff.
- 5.3 The development was analyzed with access available at the existing McCune Park driveway along Shields Road (US 62) for the purpose of this report and the analysis contained within.
- 5.4 The year 2027 was analyzed as the expected Opening Year for the proposed school.
- 5.5 The weekday AM peak hour was determined to 7:30 AM to 8:30 AM. The period was determined to coincide with the current middle school AM arrival time, is within close proximity to the current elementary school arrival time, and begins only 15 minutes after the existing AM peak hour of the roadway.
- 5.6 The weekday PM peak hour was determined to 2:30 PM to 3:30 PM. The period was determined to coincide with the current middle school PM dismissal time, is within close proximity to the current elementary school dismissal time, and begins only 15 minutes after the existing PM peak hour of the roadway.

- 5.7 The proposed school is expected to generate the following hourly traffic volumes during the peak periods as shown in the table below:

ITE TRIP GENERATION		SIZE (Students)	TRIP ENDS			
ITE Code	Land Use Description		AM Peak Hour of Generator (Enter/Exit)		PM Peak Hour of Generator (Enter/Exit)	
520	Elementary School	950	385	328	197	231
522	Middle School	790	333	272	134	157
TOTAL GENERATED TRIPS			718	600	331	388
			1318		719	

- 5.8 The proposed school under the expected full build conditions is expected to generate a total of 1,318 driveway trips in the AM peak hour and a total of 719 driveway trips in the PM peak hour. The ODOT **State Highway Access Management Manual** ⁽⁷⁾ requires that twenty year design hour traffic volumes be analyzed for a proposed development when the number of generated trips is greater than 500 in the peak hour. The year 2047 was therefore analyzed for the twenty year design hour conditions.
- 5.9 No intersection improvements were recommended to accommodate the No-Build traffic at the study area intersections.
- 5.10 The following improvements were determined to improve the levels-of-service at the intersection of US 62/SR 46 and Shields Road under the forecasted 2027 and 2047 Build conditions.
- Construct a northbound right turn lane.
 - Construct a southbound right turn lane.
 - Construct an eastbound right turn lane.
 - Construct a westbound right turn lane.
 - Update signal sequence to include right turn overlap phases with protected left turn phases.

- 5.11 The construction of additional turn lanes and proposed changes to the signal sequencing at the intersection of US 62/SR 46 and Shields Road are not expected to completely mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2, Page 4** under the forecasted 2027 and 2047 Build conditions. In order to further improve the levels-of-service dual left turn lanes would likely be necessary which would require additional through lanes on the adjacent approach to receive traffic turning from two lanes. Due to the existing lane use, adjacent land uses and the bridge over Interstate 76, this type of geometric improvement at the intersection would be high cost and would likely impact the adjacent intersections/driveways and land uses. This type of improvement at the intersection may be unfeasible due to construction costs and right-of-way impacts.
- 5.12 The use of staggered arrival and dismissal times would also be another option that may disperse traffic over a greater period of time and help to mitigate the poor levels-of-service and meet the operational goals shown in **Table 1.2** under the forecasted 2027 and 2047 Build conditions.
- 5.13 The proposed school is recommended to be served by two access locations. A west access location is recommended to serve all entering traffic to the site. An east access location is recommended to serve all exiting traffic from the site. The access driveways would also be expected to provide access to McCune Park.
- 5.14 The following lane use is recommended at the proposed intersection of Shields Road (US 62) and the west site access driveway under the 2027 and 2047 peak hour Build conditions:
- Construct an eastbound right turn lane.
 - Construct a westbound left turn lane.
 - Construct the proposed access driveway with one ingress lane.
- 5.15 The unsignalized west access driveway should be located at least 564 feet west of the east access driveway.

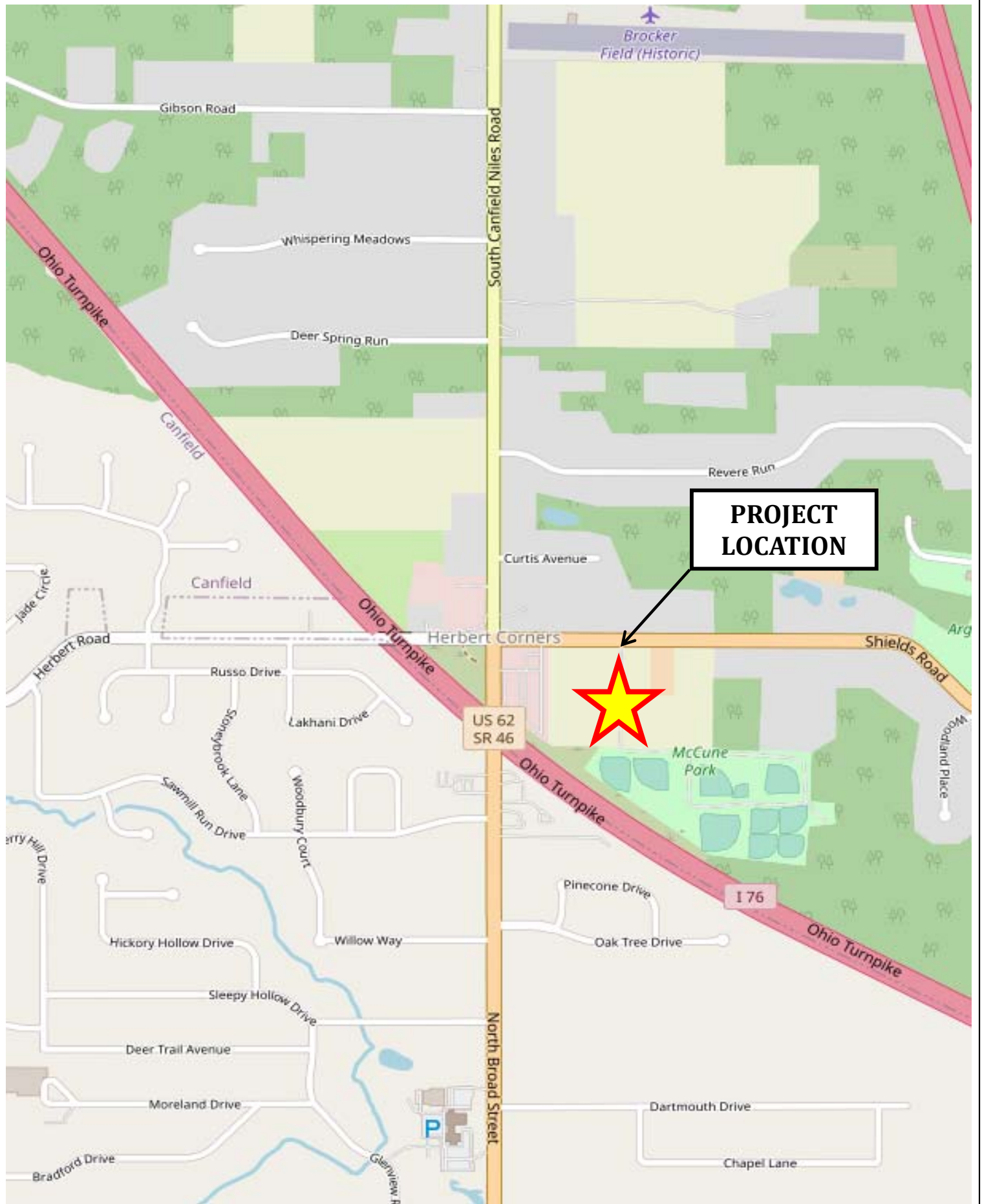
5.16 The following lane use and traffic control is recommended at the proposed intersection of Shields Road (US 62) and the east site access driveway under the 2027 and 2047 peak hour Build conditions:

- Install traffic signal control.
 - Interconnect to adjacent traffic signal at US 62/SR 46 & Shields Road
- Construct the proposed access driveway with two egress lanes.
 - Exclusive northbound left turn lane.
 - Exclusive northbound right turn lane.

5.17 The signalized east access driveway should be located a minimum of a ½ mile from the existing signalized intersection at US 62/SR 46 and Shields Road.

Appendix A

Traffic Volume Figures







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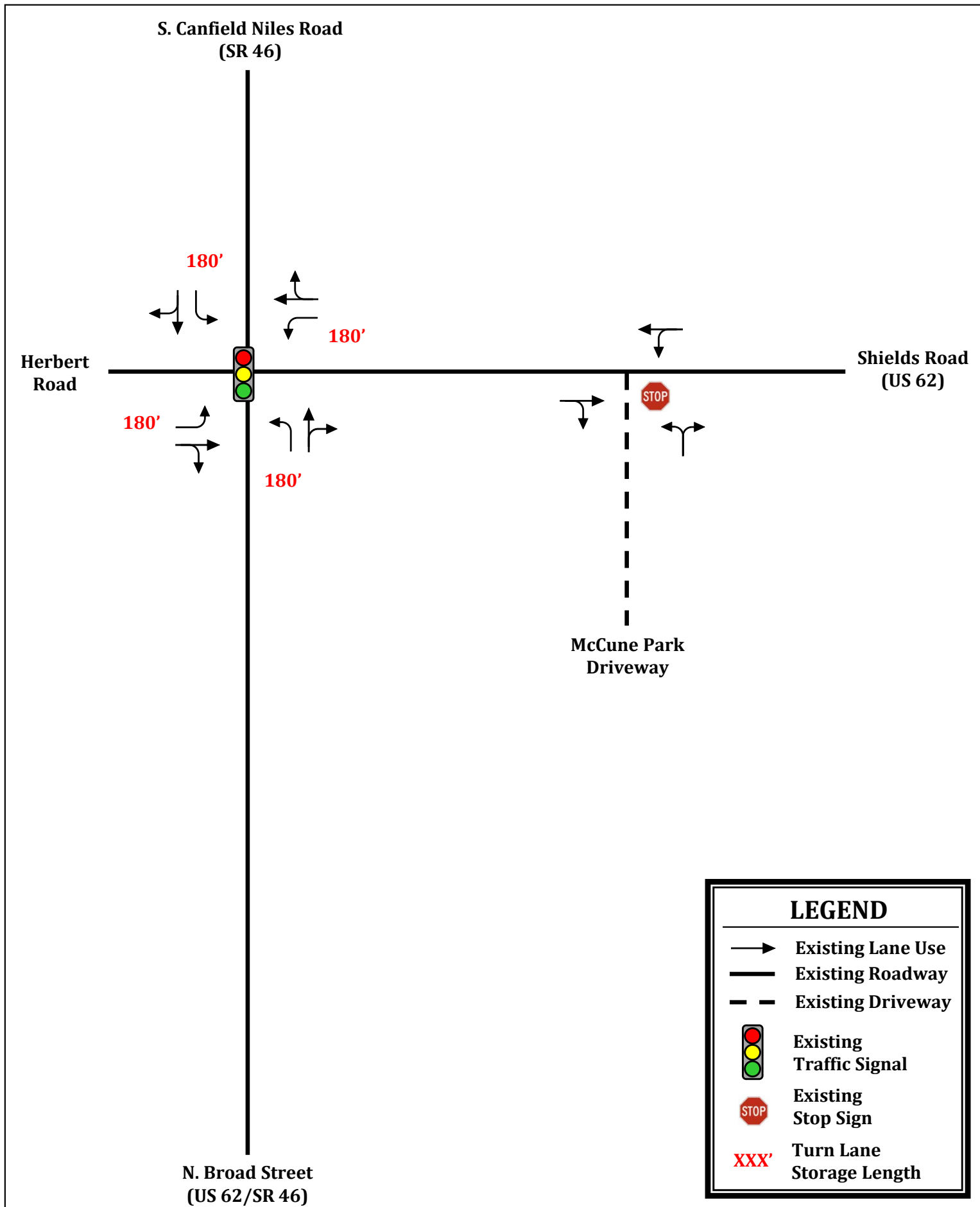
**PK – 8 School
Canfield, Ohio
Traffic Impact Study**

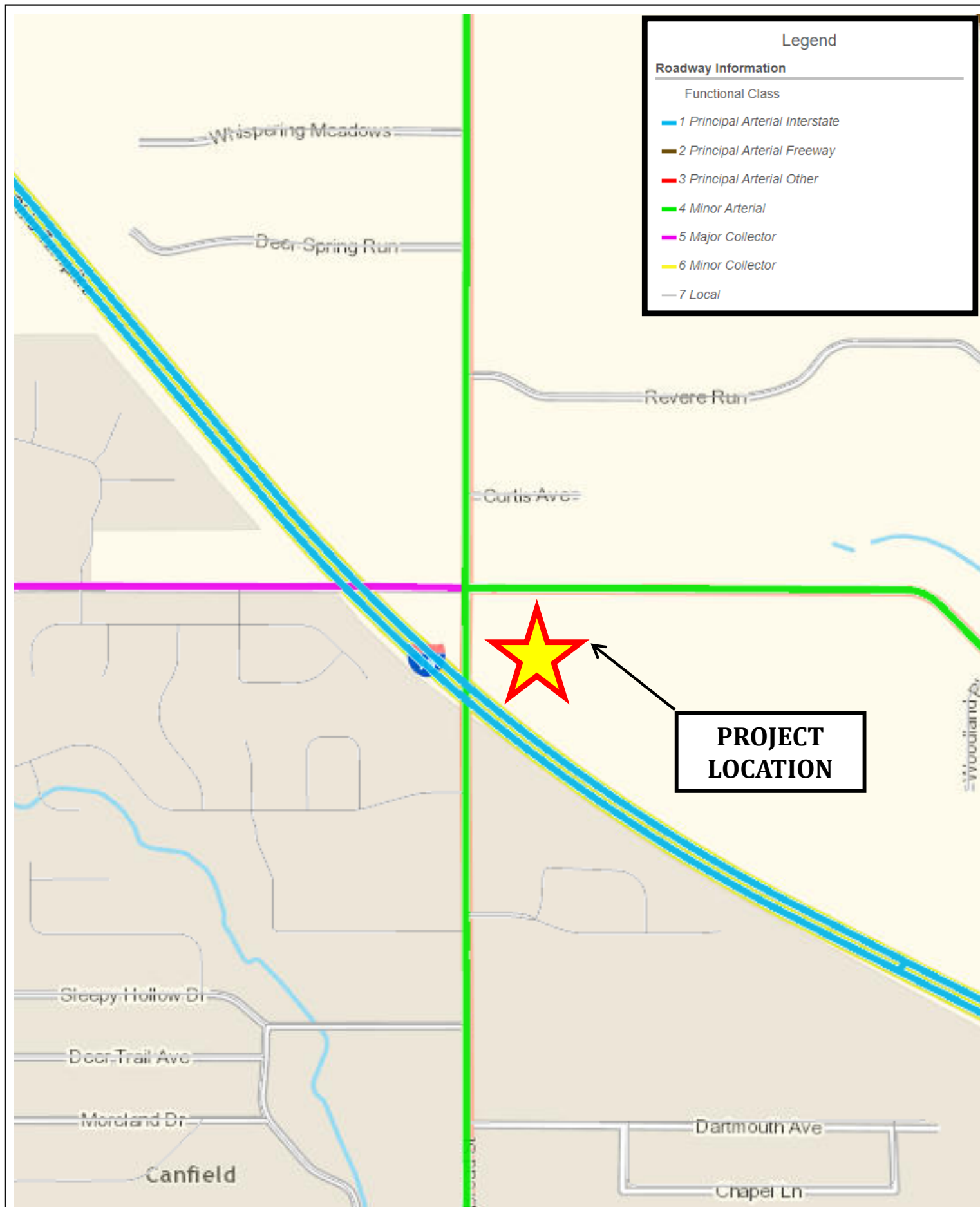
Aerial View

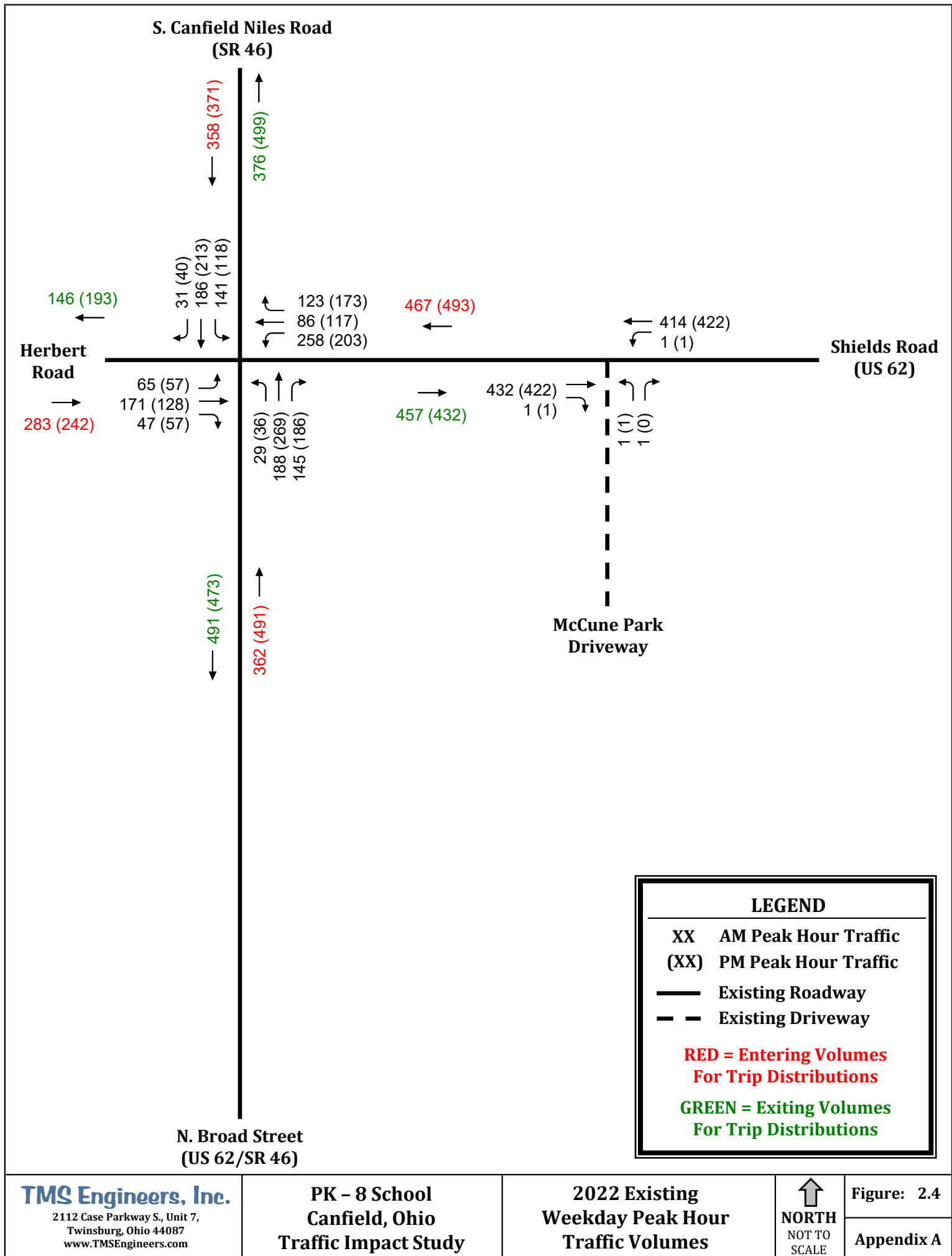
←
NORTH
NOT TO
SCALE

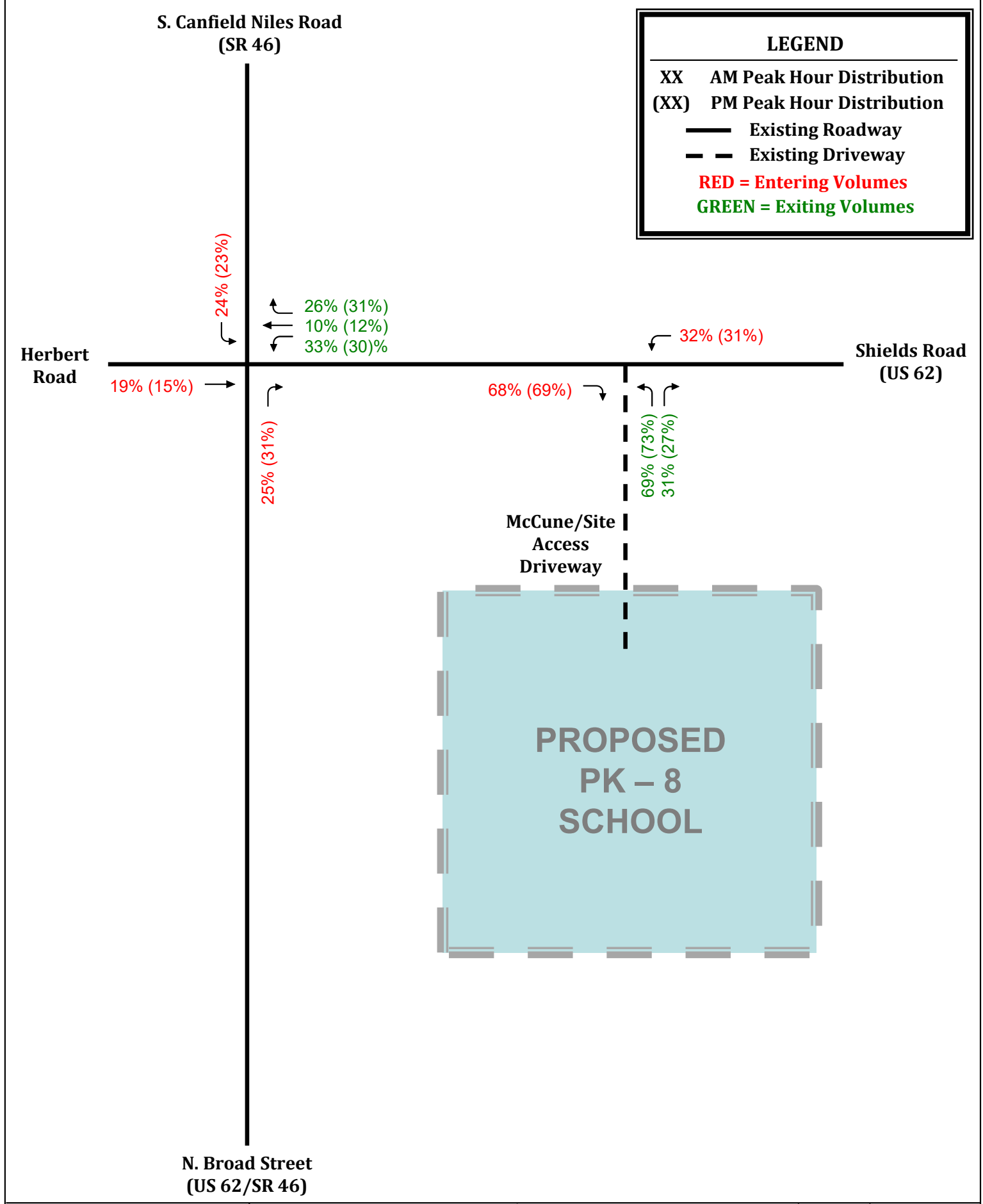
Figure: 2.1

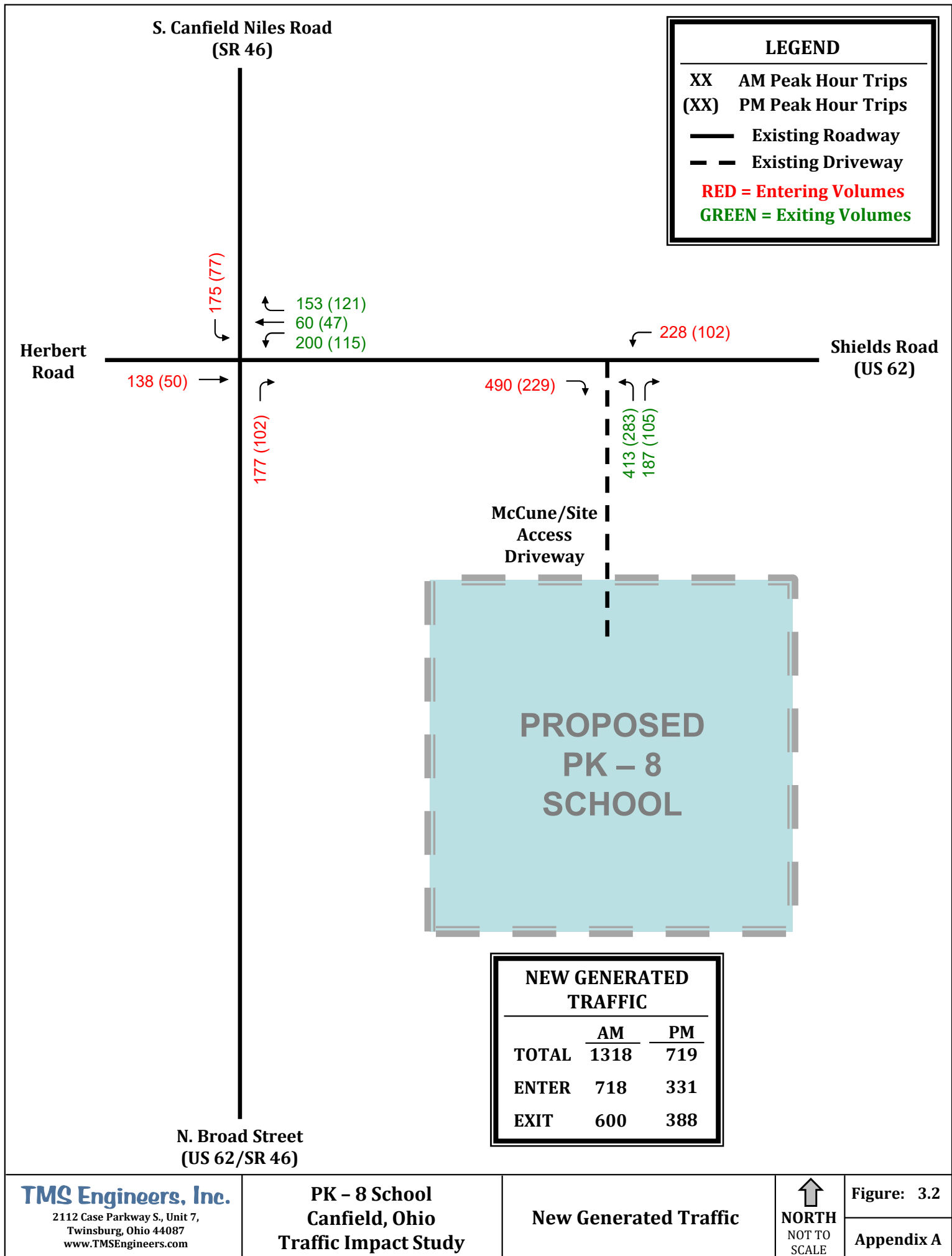
Appendix A

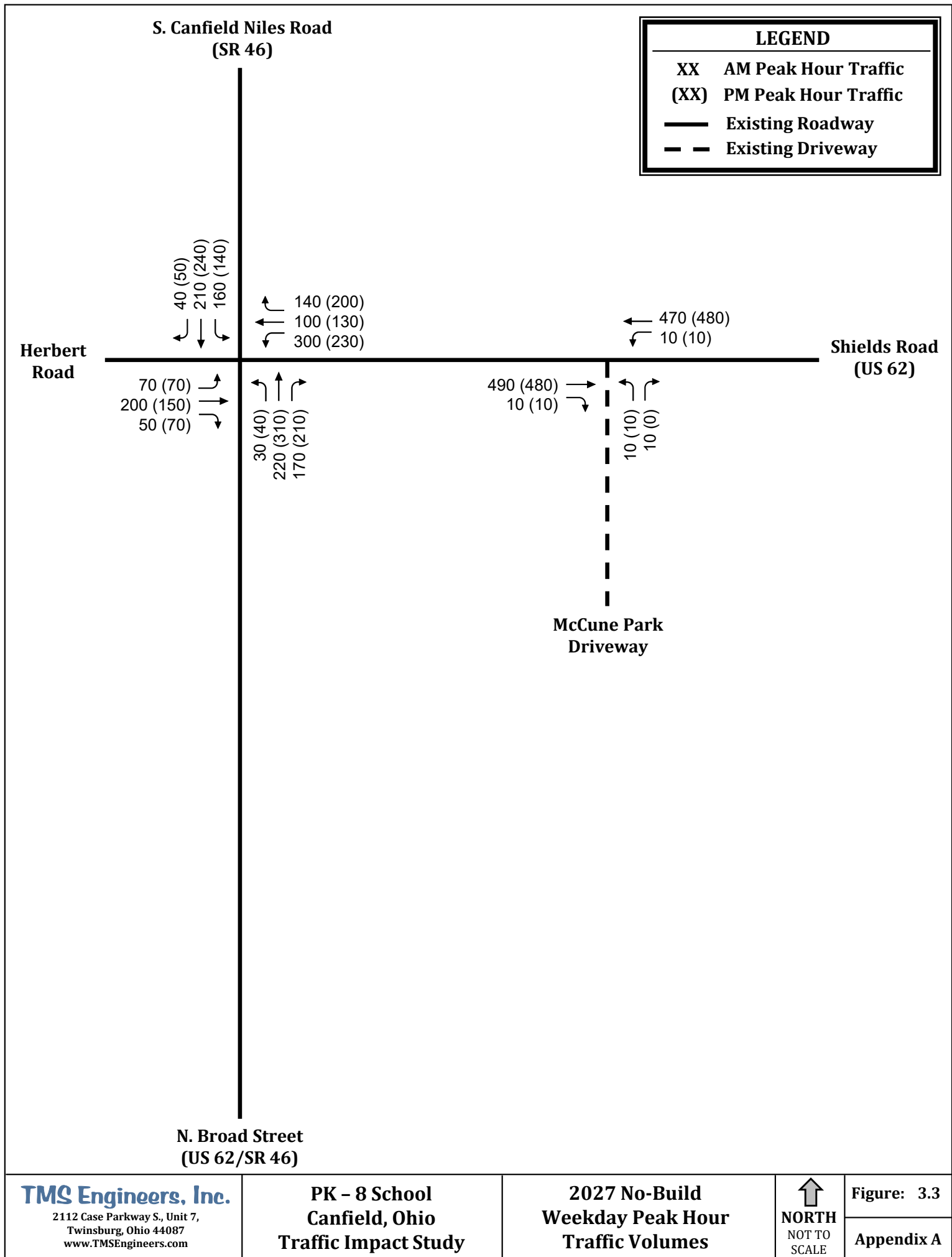


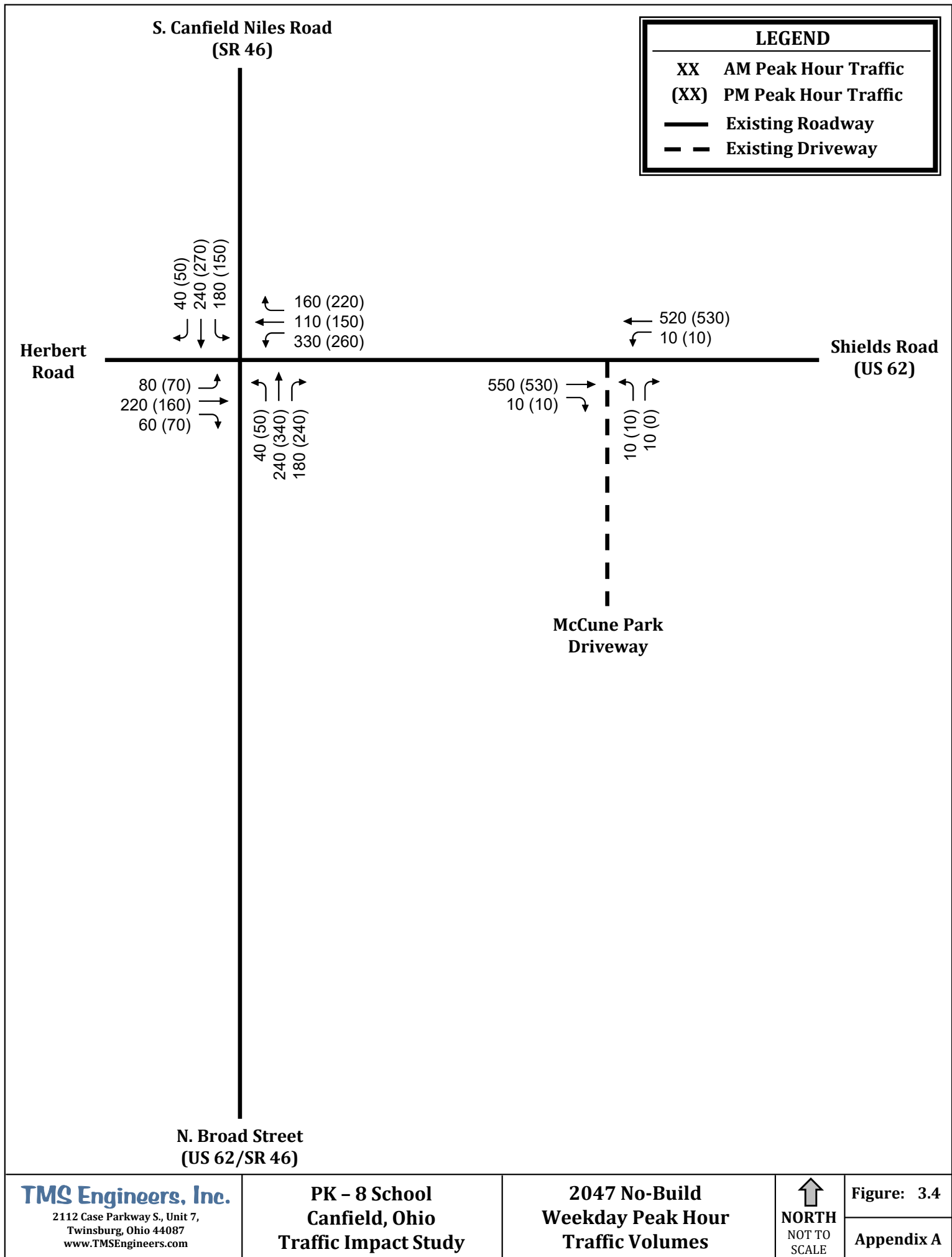


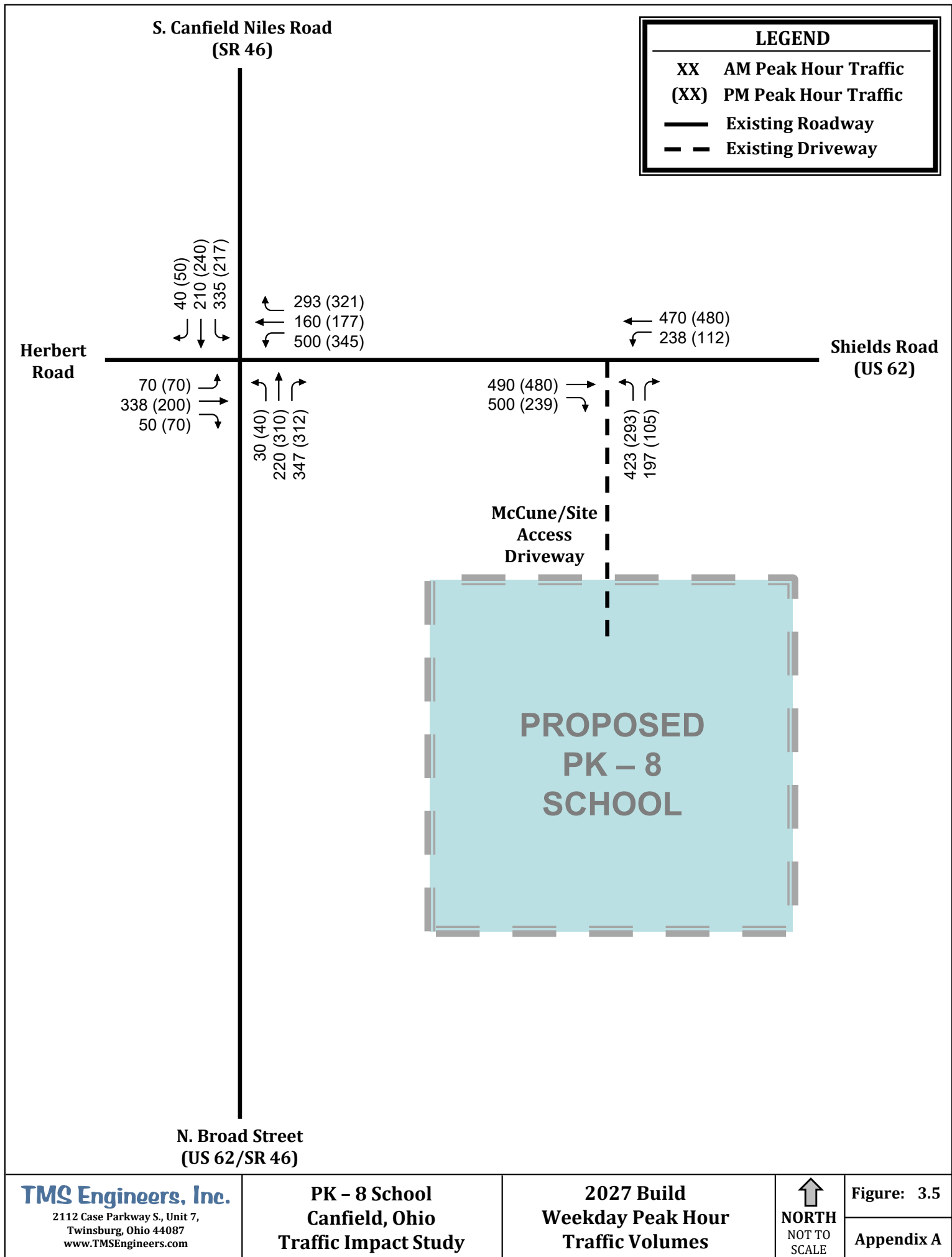


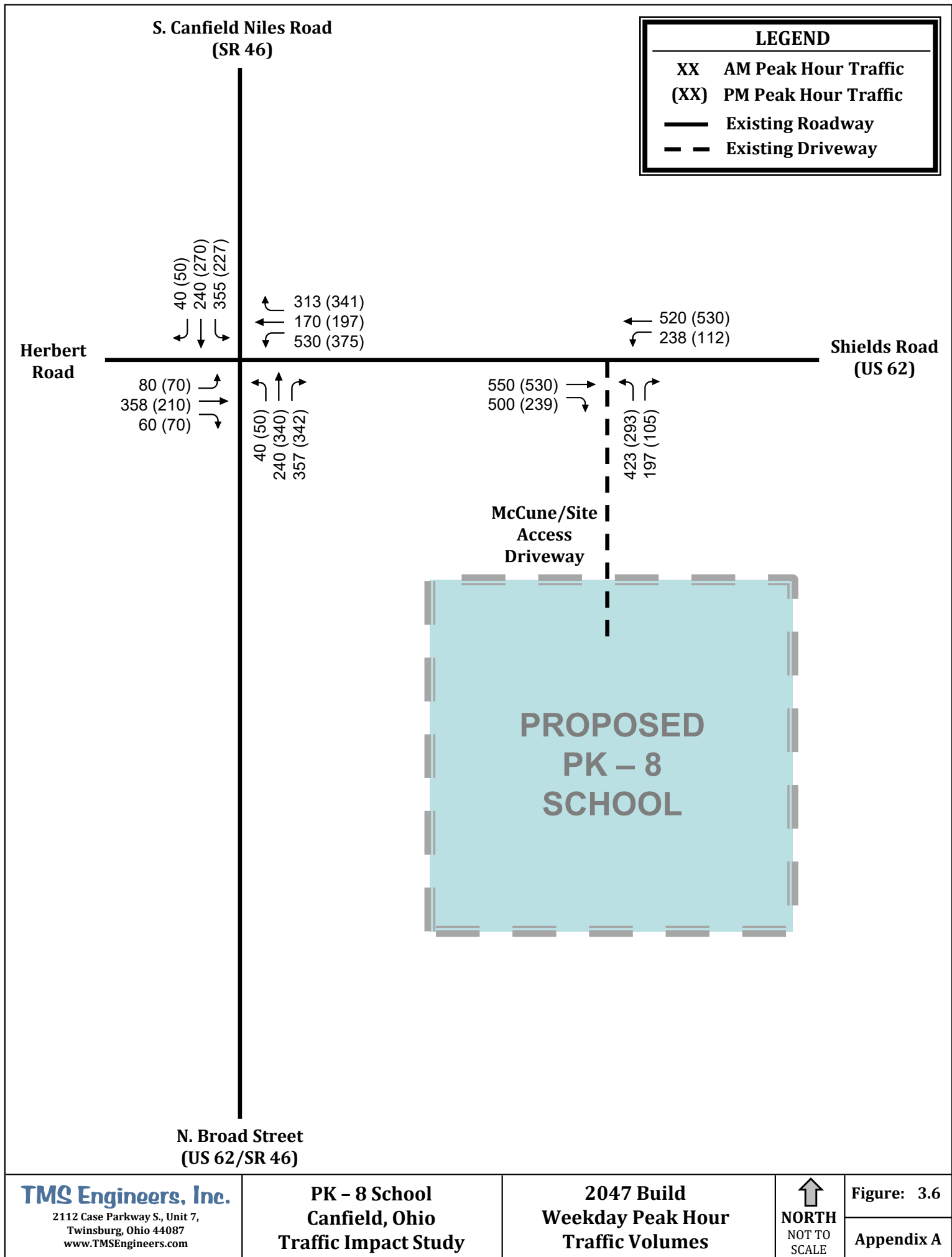


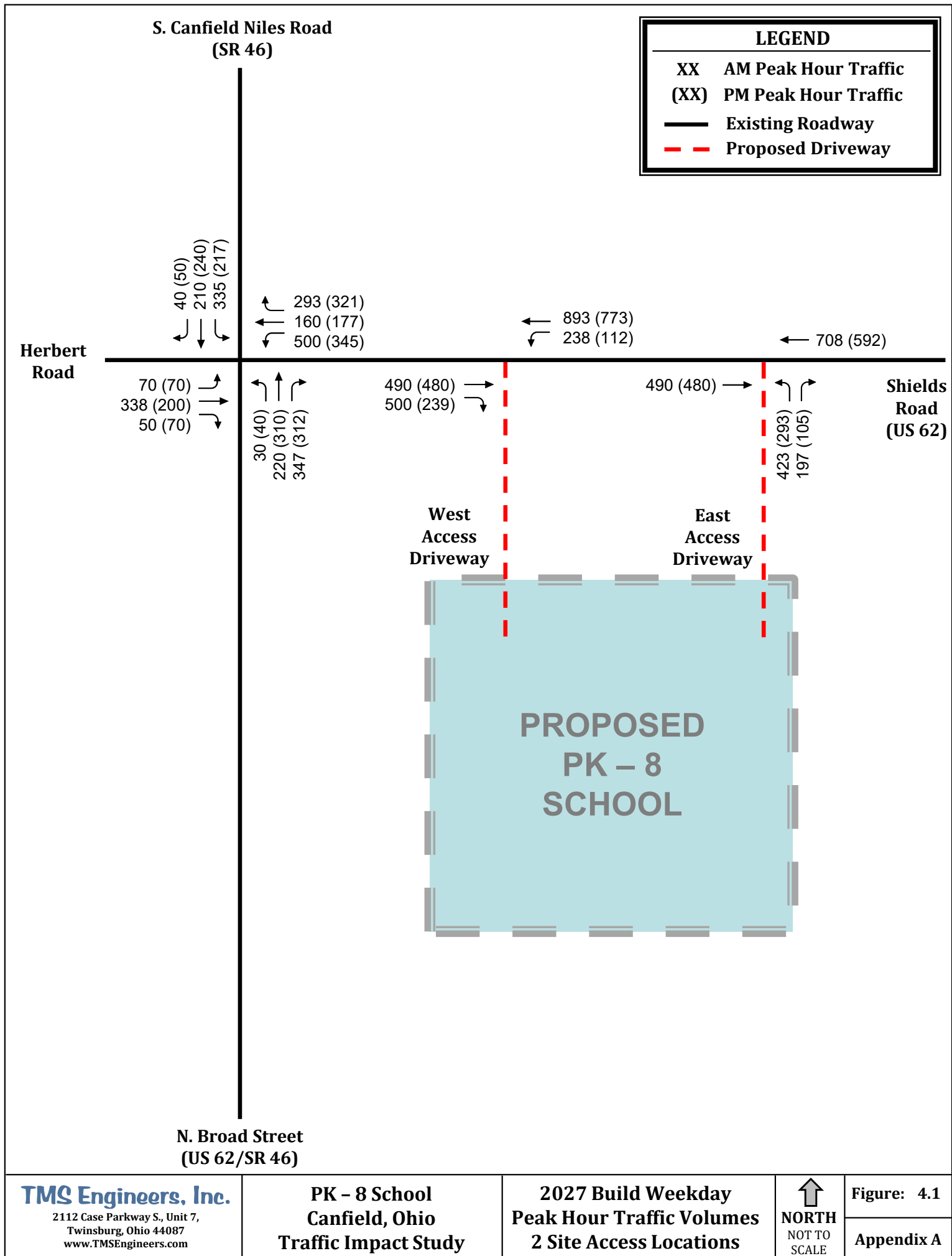


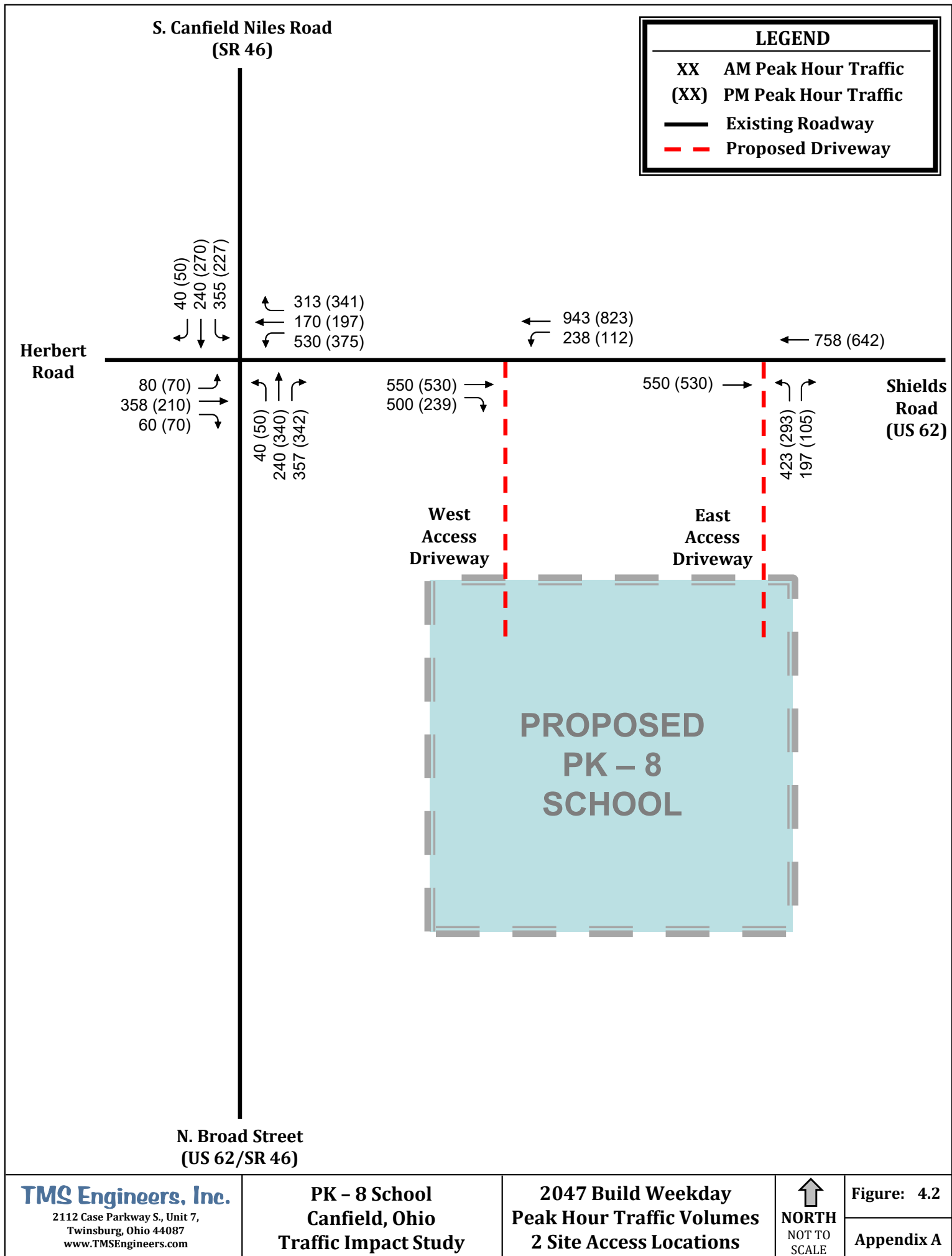


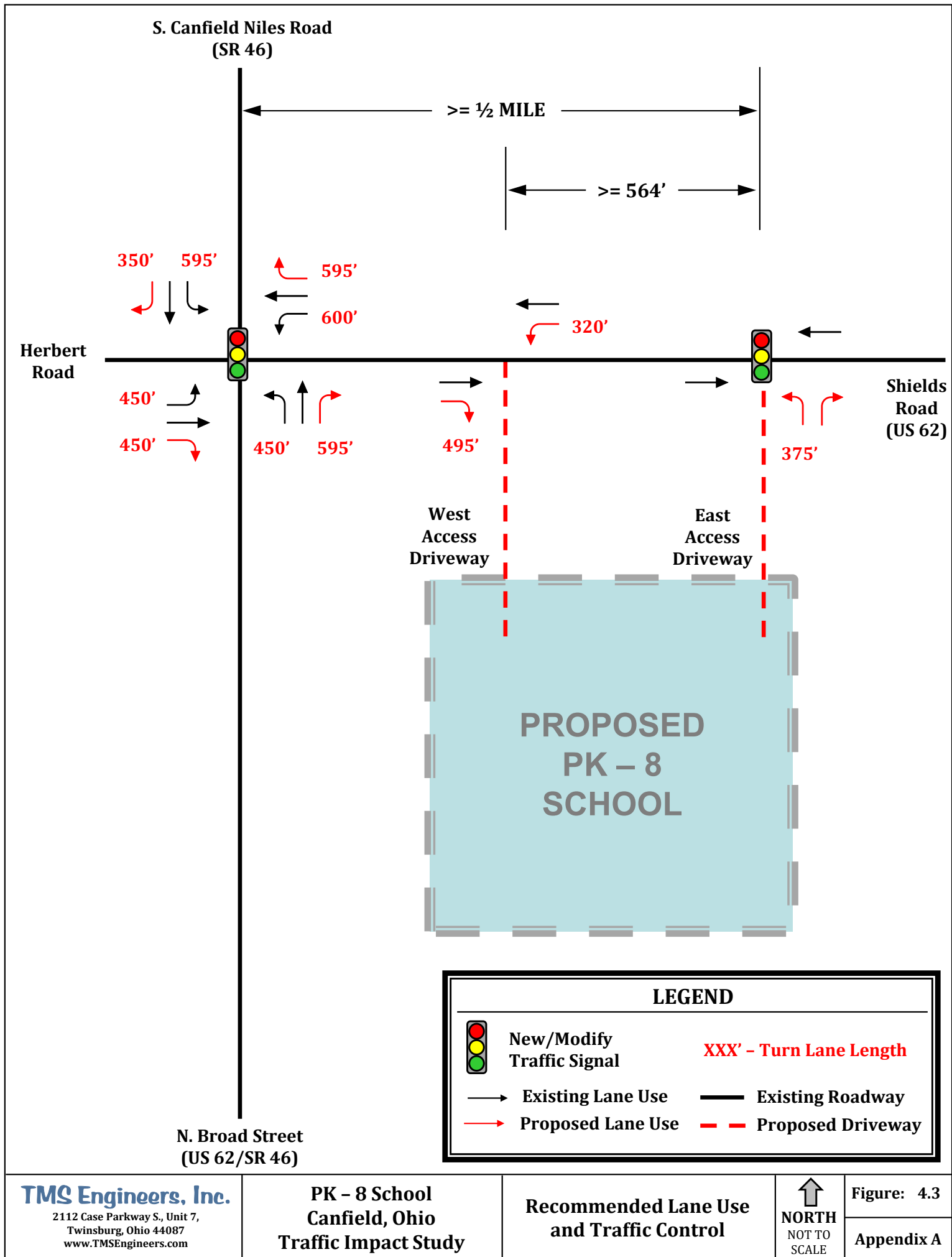








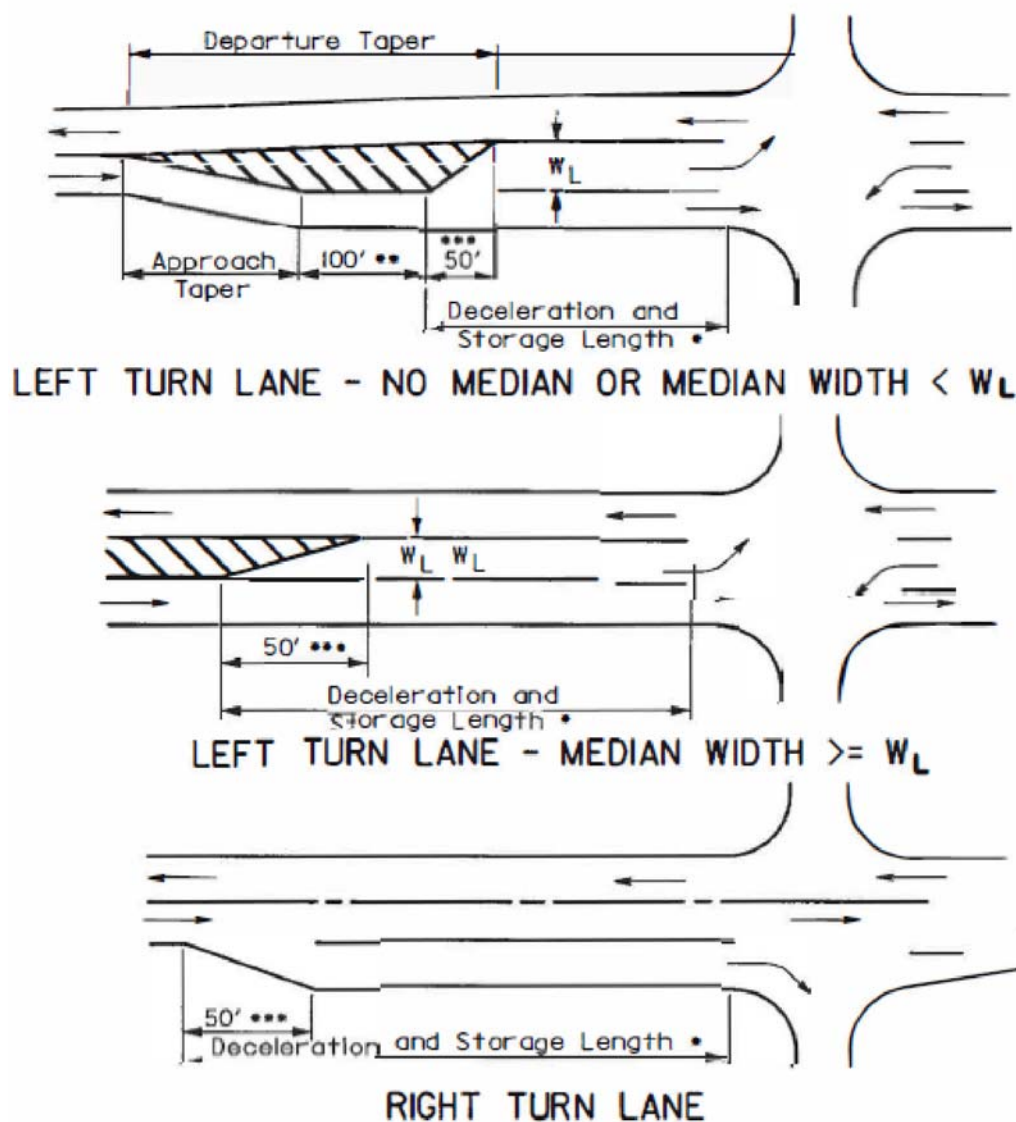




Appendix B

ODOT Turn Lane Design Criteria

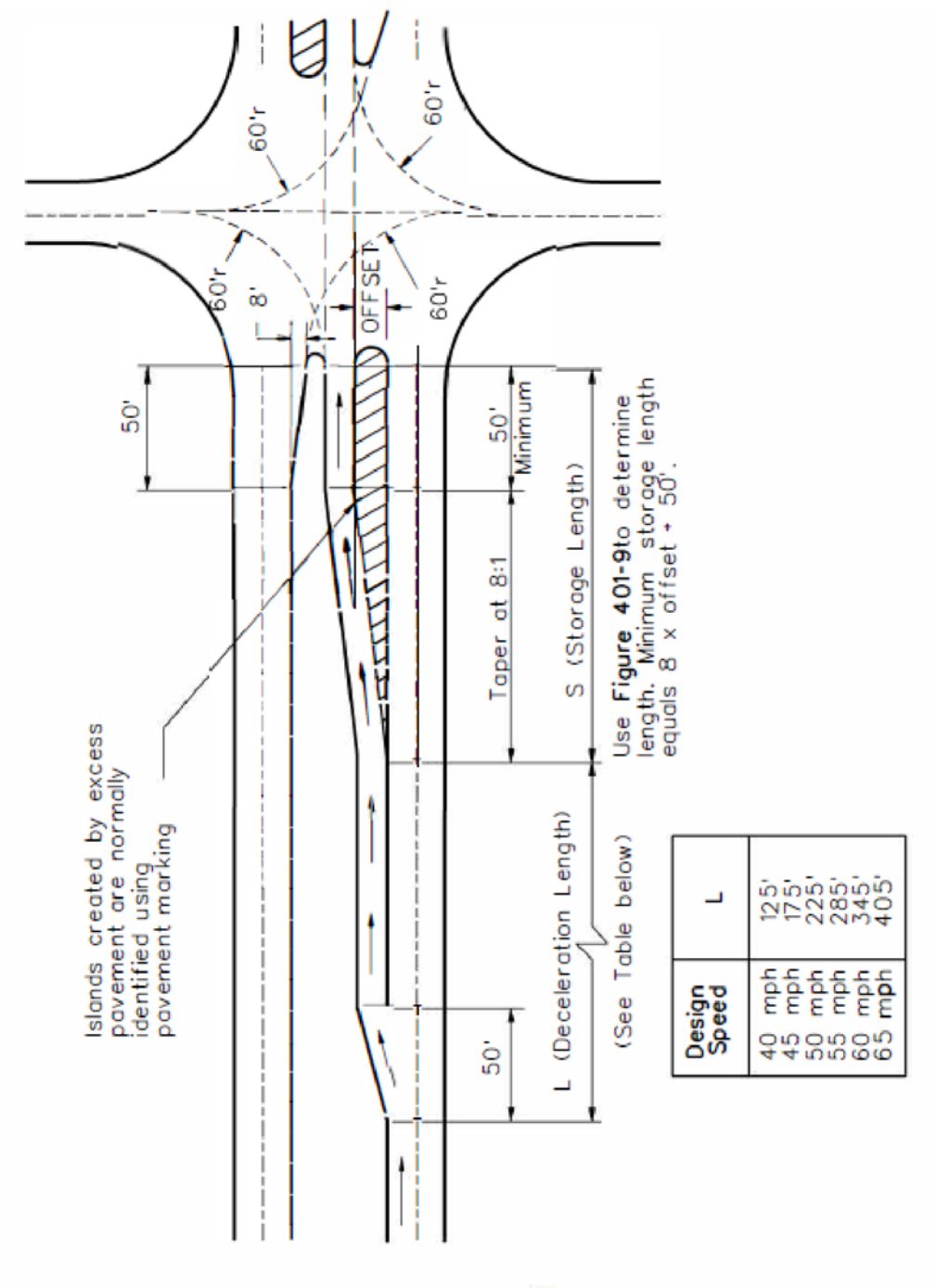
TURNING LANE DESIGN	401-7
	REFERENCE SECTION 401.6.1 & 401.6.3



- See Figures 401-9 and 401-10 to compute length.
 - ** May be reduced or eliminated in urban areas if intersection spacing or storage is constraining
 - *** Diverging taper
- W_L = Turn Lane Width

October 2004

OFFSET LEFT TURN LANE	401-8
	REFERENCE SECTION 401.6.1 & 401.6.3



400 Intersection Design

BASIS FOR COMPUTING LENGTH OF TURN LANES	401-9
	REFERENCE SECTION 401.6.1 & 401.6.3

Type of Traffic Control	Design Speed		
	30-35	40-65	
	Turn Demand Volume		
	All	Low*	High
Signalized	A	** B or C	** B or C
Unsignalized Stopped Crossroad	A	A	A
Unsignalized Through Road	A	B	** B or C

* Low is considered 10% or less of approach traffic volume

** Whichever is greater

CONDITION A	STORAGE ONLY
Length = 50' (diverging taper) + Storage Length (Figure 401-10)	

CONDITION B	HIGH SPEED DECELERATION ONLY
Design Speed	Length (including 50' Diverging Taper)
40	125
45	175
50	225
55	285
60	345
65	405

CONDITION C	MODERATE SPEED DECELERATION AND STORAGE
Design Speed	Length (including 50' Diverging Taper)
40	115 + Storage Length (Figure 401-10)
45	125 "
50	145 "
55	165 "
60	185 "
65	205 "

For explanation, see Turn Lane Design Example

400 Intersection Design

STORAGE LENGTH AT INTERSECTIONS	401-10
	REFERENCE SECTION 401.6.1 & 401.6.3

* AVERAGE NO. OF VEHICLES/CYCLE	REQUIRED LENGTH (FT.)
1	50
2	100
3	150
4	175
5	200
6	250
7	275
8	325
9	350
10	375
11	400
12	450
13	475
14	500
15	525
16	550

* AVERAGE NO. OF VEHICLES/CYCLE	REQUIRED LENGTH (FT.)
17	600
18	625
19	650
20	675
21	725
22	750
23	775
24	800
25	825
30	975
35	1125
40	1250
45	1400
50	1550
55	1700
60	1850

$$* \text{ AVERAGE VEHICLES PER CYCLE} = \frac{\text{DHV (TURNING LANE)}}{\text{CYCLES/HOUR}}$$

IF CYCLES ARE UNKNOWN ASSUME:

UNSIGNALIZED OR 2 PHASE = 60 CYCLES/HOUR
 3 PHASE = 40 CYCLES/HOUR
 4 PHASE = 30 CYCLES/HOUR

400 Intersection Design

Example - Turn Lane Design Using Figures 401-9 and 401-10

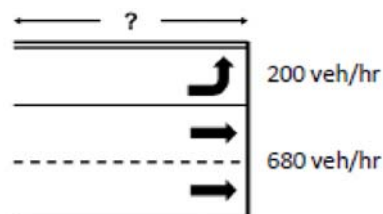
Problem

Calculate the length of an exclusive left turn lane.

Traffic Control: **Signalized**

Design Speed: **55 mph**

Cycle Length: **90 sec**



Determine Storage and Turn Lane Lengths

$$\text{Turn Lane Demand (High/Low)} = \frac{\left(200 \frac{\text{veh}}{\text{hr}}\right)}{200 \frac{\text{veh}}{\text{hr}} + 680 \frac{\text{veh}}{\text{hr}}} = 23\% = \text{High Demand}$$

Refer to the matrix in **Figure 401-9**.

For Signalized, 55 mph, High Demand, use Method B or C, whichever is greater.

Method B - For 55 mph, a **285'** turn lane length is required (235' storage + 50' taper).

Method C - For 55 mph, 165' + calculated storage length in **Figure 401-10**.

$$\text{Average Vehicles per Cycle} = \frac{\left(200 \frac{\text{veh}}{\text{hr}}\right) \cdot \left(90 \frac{\text{sec}}{\text{cyc}}\right)}{3600 \text{ sec/hr}} = 5 \text{ veh/cyc} \rightarrow 200'$$

$$\text{Total Length} = 165' + 200' = \mathbf{365'} \text{ (315' storage + 50' taper)}$$

$$\text{Method C} = 365' > \text{Method B} = 285'$$

Use Method C

Check Length for Thru-Block

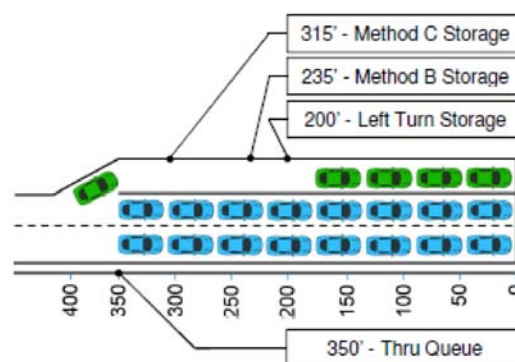
Refer to **Figure 401-10** to calculate thru lane(s) queue distance.

$$680 \text{ veh/hr} / 2 \text{ lanes} = 340 \text{ veh/hr/ln}$$

$$\text{Average Vehicles per Cycle} = \frac{\left(340 \frac{\text{veh}}{\text{hr}}\right) \cdot \left(90 \frac{\text{sec}}{\text{cyc}}\right)}{3600 \text{ sec/hr}} = 9 \text{ veh/cyc/ln} \rightarrow \mathbf{350 \text{ ft/ln}}$$

$$\text{Thru Block} = \mathbf{350'} > \text{Method C Storage} = 315' \rightarrow \text{Turn Lane Blocked}$$

$$\text{Use } \mathbf{350'} \text{ storage} + \mathbf{50'} \text{ taper} = \mathbf{400'} \text{ Turn Lane Length}$$



Appendix C

Traffic Count Data

VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: <u>Canfield</u>		At Intersection of: <u>South Canfield Niles Road</u> and <u>Shields Road</u>	
Date: <u>9/27/2022</u>	Day: <u>Tue.</u>	Comments: _____	Project: <u>22-124</u>
Weather: <u>Clear</u>	Recorder(s): <u>DJS</u>	Date entry by: <u>JUO</u>	Date entered: <u>Sep. 28, 2022</u>
		Location: <u>Canfield Niles Rd & Shields Rd 092722</u>	

TIME BEGINS	S.Canfield Niles Rd. FROM NORTH				S.Canfield Niles Rd. FROM SOUTH				TOTAL NORTH SOUTH				Shields Rd. FROM EAST				Shields Rd. FROM WEST				TOTAL EAST WEST		TOTAL ALL DIREC.	PEAK HOUR FACTOR						
	Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus	Left	Thru	Right	Total	Trk	Bus	North	South	East	West								
06:00																														
07:00	126	189	20	335	8	6	25	180	134	339	15	12	271	105	105	481	8	9	70	166	47	283	4	2	764	1438	0.741	0.718	0.676	0.700
08:00	138	162	25	325	14	3	23	183	117	323	14	4	166	64	97	327	7	8	46	135	42	223	6	2	550	1198	0.903	0.841	0.852	0.929
09:00	107	157	27	291	20	3	17	170	85	272	16	1	82	53	77	212	10	0	41	94	29	164	9	0	376	939	0.909	0.919	0.869	0.872
10:00																														
11:00	90	170	25	285	15	0	25	177	89	291	14	2	90	63	94	252	12	0	30	77	28	135	5	0	387	963	0.720	0.808	0.969	0.888
12:00	106	175	23	304	17	0	33	210	107	350	24	1	115	63	123	301	9	0	31	86	34	151	8	0	452	1106	0.854	0.761	0.724	0.878
1:00																														
2:00	125	202	40	367	10	2	29	212	148	389	10	11	204	100	135	439	13	1	52	153	65	270	8	2	709	1465	1.043	1.231	1.860	1.227
3:00	129	256	47	432	17	4	45	296	170	511	14	13	159	109	175	443	6	6	50	98	33	181	4	3	624	1567	0.947	0.819	0.900	0.808
4:00	160	228	60	448	5	2	52	271	162	485	12	1	174	123	196	493	5	10	44	147	44	235	4	3	728	1661	0.862	0.848	0.900	0.794
5:00	143	221	53	417	4	0	46	255	170	471	5	0	175	137	194	506	8	0	30	101	41	172	1	0	678	1566	0.891	0.755	0.958	0.843
6:00																														
7:00																														
8:00																														
9:00																														
TOTALS	1124	1760	320	3204	110	20	295	1954	1182	3431	124	45	1436	822	1196	3454	78	34	394	1057	363	1814	49	12	5268	11903				
ADT	1513	2370	431	4314	4.1%	397	2631	1592	4620	4.9%			1934	1107	1610	4651	3.2%	527	1414	486	2427	3.4%			7078	16012				

N Leg Hourly Factor:	1.57
S Leg Hourly Factor:	1.57
N Leg Monthly Factor:	0.86
S Leg Monthly Factor:	0.86

E Leg Hourly Factor:	1.57
W Leg Hourly Factor:	1.56
E Leg Monthly Factor:	0.86
W Leg Monthly Factor:	0.86

N Leg Combined Factor:	1.35
S Leg Combined Factor:	1.35

E Leg Combined Factor:	1.35
W Leg Combined Factor:	1.34

TMS ENGINEERS, INC.

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Twinsburg, Ohio 44087

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Figure #:

Page #:

Transportation Management Services

Page No : 1

[illegible]

TMS Engineers, Inc.

2112 Case Parkway South #7

Twinsburg, Ohio 44087

Transportation Management Services

File Name : TC 1 Shields Rd and S. Canfield Niles Rd 09222 DJS

Site Code : 00000000

Start Date : 9/27/2022

Page No : 2

Groups Printed- Cars - Trucks - Buses

	S. CANFIELD NILES ROAD From North						SHIELDS ROAD From East						S. CANFIELD NILES ROAD From South						SHIELDS ROAD 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			
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
11:00 AM	5	38	21	0	64	18	16	29	0	63	22	45	6	0	73	8	24	6	0	38	238			
11:15 AM	9	41	22	0	72	24	18	23	0	65	18	43	7	0	68	4	17	5	0	26	231			
11:30 AM	6	30	14	0	50	19	22	20	0	61	21	51	9	0	81	9	18	9	0	36	228			
11:45 AM	5	61	33	0	99	33	12	18	0	63	28	38	3	0	69	7	18	10	0	35	266			
Total	25	170	90	0	285	94	68	90	0	252	89	177	25	0	291	28	77	30	0	135	963			
12:00 PM	6	38	29	0	73	27	12	25	0	64	30	52	6	0	88	5	21	8	0	34	259			
12:15 PM	4	29	21	0	54	26	17	20	0	63	25	35	6	0	66	8	21	9	0	38	221			
12:30 PM	7	51	31	0	89	47	17	40	0	104	34	71	10	0	115	13	23	7	0	43	351			
12:45 PM	6	57	25	0	88	23	17	30	0	70	18	52	11	0	81	8	21	7	0	36	275			
Total	23	175	106	0	304	123	63	115	0	301	107	210	33	0	350	34	86	31	0	151	1106			
01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
01:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
01:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
01:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
02:00 PM	7	53	28	0	88	21	13	25	0	59	23	51	5	0	79	11	27	17	0	55	281			
02:15 PM	13	60	40	0	113	32	28	60	0	120	23	49	8	0	80	17	47	9	0	73	386			
02:30 PM	12	49	19	0	80	34	33	71	0	138	52	43	9	0	104	19	46	18	0	83	405			
02:45 PM	8	40	38	0	86	48	26	48	0	122	50	69	7	0	126	18	33	8	0	59	393			
Total	40	202	125	0	367	135	100	204	0	439	148	212	29	0	389	65	153	52	0	270	1465			

TMS Engineers, Inc.

2112 Case Parkway South #7

Twinsburg, Ohio 44087

Transportation Management Services

File Name : TC 1 Shields Rd and S. Canfield Niles Rd 09222 DJS

Site Code : 00000000

Start Date : 9/27/2022

Page No : 3

Groups Printed- Cars - Trucks - Buses

	S. CANFIELD NILES ROAD From North						SHIELDS ROAD From East						S. CANFIELD NILES ROAD From South						SHIELDS ROAD 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
03:00 PM	10	54	27	0	91		48	35	40	0	123		43	89	12	0	144		12	22	10	0	44	402
03:15 PM	10	70	34	0	114		43	23	44	0	110		41	68	8	0	117		8	27	21	0	56	397
03:30 PM	13	72	29	0	114		43	19	35	0	97		57	81	18	0	156		7	31	12	0	50	417
03:45 PM	14	60	39	0	113		41	32	40	0	113		29	58	7	0	94		6	18	7	0	31	351
Total	47	256	129	0	432		175	109	159	0	443		170	296	45	0	511		33	98	50	0	181	1567
04:00 PM	17	44	37	1	99		55	32	40	0	127		50	66	13	0	129		14	34	10	0	58	413
04:15 PM	7	60	33	0	100		45	34	32	0	111		38	57	7	0	102		9	32	7	0	48	361
04:30 PM	20	66	34	0	120		46	30	42	0	118		30	66	15	0	111		3	40	12	0	55	404
04:45 PM	16	58	56	0	130		50	27	60	0	137		44	82	17	0	143		18	41	15	0	74	484
Total	60	228	160	1	449		196	123	174	0	493		162	271	52	0	485		44	147	44	0	235	1662
05:00 PM	14	46	46	0	106		52	26	45	0	123		50	64	17	0	131		9	25	7	0	41	401
05:15 PM	15	67	35	0	117		54	40	38	0	132		51	94	11	0	156		10	22	10	0	42	447
05:30 PM	13	56	38	0	107		46	44	36	0	126		37	57	8	0	102		14	29	8	0	51	386
05:45 PM	11	52	24	0	87		42	27	56	0	125		32	40	10	0	82		8	25	5	0	38	332
Total	53	221	143	0	417		194	137	175	0	506		170	255	46	0	471		41	101	30	0	172	1566
Grand Total	320	1760	1124	1	3205		1196	822	1436	2	3456		1182	1954	295	0	3431		363	1057	394	0	1814	11906
Apprch %	10	54.9	35.1	0			34.6	23.8	41.6	0.1			34.5	57	8.6	0			20	58.3	21.7	0		
Total %	2.7	14.8	9.4	0	26.9		10	6.9	12.1	0	29		9.9	16.4	2.5	0	28.8		3	8.9	3.3	0	15.2	
Cars	303	1678	1093	1	3075		1174	806	1362	2	3344		1126	1868	268	0	3262		337	1039	377	0	1753	11434
% Cars	94.7	95.3	97.2	100	95.9		98.2	98.1	94.8	100	96.8		95.3	95.6	90.8	0	95.1		92.8	98.3	95.7	0	96.6	96
Trucks	15	65	30	0	110		20	15	43	0	78		35	73	16	0	124		17	17	15	0	49	361
% Trucks	4.7	3.7	2.7	0	3.4		1.7	1.8	3	0	2.3		3	3.7	5.4	0	3.6		4.7	1.6	3.8	0	2.7	3
Buses	2	17	1	0	20		2	1	31	0	34		21	13	11	0	45		9	1	2	0	12	111
% Buses	0.6	1	0.1	0	0.6		0.2	0.1	2.2	0	1		1.8	0.7	3.7	0	1.3		2.5	0.1	0.5	0	0.7	0.9

TMS Engineers, Inc.

2112 Case Parkway South #7

Twinsburg, Ohio 44087

Transportation Management Services

File Name : TC 1 Shields Rd and S. Canfield Niles Rd 09222 DJS

Site Code : 00000000

Start Date : 9/27/2022

Page No : 4

Start Time	S. CANFIELD NILES ROAD From North					SHIELDS ROAD From East					S. CANFIELD NILES ROAD From South					SHIELDS ROAD From West				
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total
Peak Hour Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1																				
Peak Hour for Entire Intersection Begins at 07:30 AM																				
07:30 AM	8	57	48	0	113	32	33	113	0	178	39	44	8	0	91	17	64	20	0	101
07:45 AM	5	48	30	0	83	35	21	57	0	113	50	61	7	0	118	11	43	16	0	70
08:00 AM	11	37	26	0	74	30	14	36	0	80	26	44	11	0	81	11	28	13	0	52
08:15 AM	7	44	37	0	88	26	18	52	0	96	30	39	3	0	72	8	36	16	0	60
Total Volume	31	186	141	0	358	123	86	258	0	467	145	188	29	0	362	47	171	65	0	283
% App. Total	8.7	52	39.4	0		26.3	18.4	55.2	0		40.1	51.9	8	0		16.6	60.4	23	0	
PHF	.705	.816	.734	.000	.792	.879	.652	.571	.000	.656	.725	.770	.659	.000	.767	.691	.668	.813	.000	.700
Cars	27	178	138	0	343	121	83	244	0	448	131	178	22	0	331	46	167	63	0	276
% Cars	87.1	95.7	97.9	0	95.8	98.4	96.5	94.6	0	95.9	90.3	94.7	75.9	0	91.4	97.9	97.7	96.9	0	97.5
Trucks	4	4	3	0	11	2	3	7	0	12	7	8	5	0	20	0	3	1	0	4
% Trucks	12.9	2.2	2.1	0	3.1	1.6	3.5	2.7	0	2.6	4.8	4.3	17.2	0	5.5	0	1.8	1.5	0	1.4
Buses	0	4	0	0	4	0	0	7	0	7	7	2	2	0	11	1	1	1	0	3
% Buses	0	2.2	0	0	1.1	0	0	2.7	0	1.5	4.8	1.1	6.9	0	3.0	2.1	0.6	1.5	0	1.1
PHF	.761	.816	.734	.000	.792	.879	.652	.571	.000	.656	.725	.770	.659	.000	.767	.691	.668	.813	.000	.700
Cars	27	178	138	0	343	121	83	244	0	448	131	178	22	0	331	46	167	63	0	276
% Cars	87.1	95.7	97.9	0	95.8	98.4	96.5	94.6	0	95.9	90.3	94.7	75.9	0	91.4	97.9	97.7	96.9	0	97.5
Trucks	4	4	3	0	11	2	3	7	0	12	7	8	5	0	20	0	3	1	0	4
% Trucks	12.9	2.2	2.1	0	3.1	1.6	3.5	2.7	0	2.6	4.8	4.3	17.2	0	5.5	0	1.8	1.5	0	1.4
Buses	0	4	0	0	4	0	0	7	0	7	7	2	2	0	11	1	1	1	0	3
% Buses	0	2.2	0	0	1.1	0	0	2.7	0	1.5	4.8	1.1	6.9	0	3.0	2.1	0.6	1.5	0	1.1

Peak Hour Analysis From 02:30 PM to 03:15 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 02:30 PM

Start Time	S. CANFIELD NILES ROAD From North					SHIELDS ROAD From East					S. CANFIELD NILES ROAD From South					SHIELDS ROAD From West				
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total
Peak Hour Analysis From 02:30 PM to 03:15 PM - Peak 1 of 1																				
Peak Hour for Entire Intersection Begins at 02:30 PM																				
02:30 PM	12	49	19	0	80	34	33	71	0	138	52	43	9	0	104	19	46	18	0	83
02:45 PM	8	40	38	0	86	48	26	48	0	122	50	69	7	0	126	18	33	8	0	59
03:00 PM	10	54	27	0	91	48	35	40	0	123	43	89	12	0	144	12	22	10	0	44
03:15 PM	10	70	34	0	114	43	23	44	0	110	41	68	8	0	117	8	27	21	0	56
Total Volume	40	213	118	0	371	173	117	203	0	493	186	269	36	0	491	57	128	57	0	242
% App. Total	10.8	57.4	31.8	0		35.1	23.7	41.2	0		37.9	54.8	7.3	0		23.6	52.9	23.6	0	
PHF	.833	.761	.776	.000	.814	.901	.836	.715	.000	.893	.894	.756	.750	.000	.852	.750	.696	.679	.000	.729
Cars	39	205	113	0	357	169	114	191	0	474	179	260	31	0	470	51	127	53	0	231
% Cars	97.5	96.2	95.8	0	96.2	97.7	97.4	94.1	0	96.1	96.2	96.7	86.1	0	95.7	89.5	99.2	93.0	0	95.5
Trucks	1	5	4	0	10	3	3	7	0	13	2	6	1	0	9	2	1	3	0	6
% Trucks	2.5	2.3	3.4	0	2.7	1.7	2.6	3.4	0	2.6	1.1	2.2	2.8	0	1.8	3.5	0.8	5.3	0	2.5
Buses	0	3	1	0	4	1	0	5	0	6	5	3	4	0	12	4	0	1	0	5
% Buses	0	1.4	0.8	0	1.1	0.6	0	2.5	0	1.2	2.7	1.1	11.1	0	2.4	7.0	0	1.8	0	2.1

VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: <u>Canfield</u>		At Intersection of: <u>McCune Park Access Road</u> and <u>Shields Road</u>	
Date: <u>9/27/2022</u>	Day: <u>Tue.</u>	Comments: _____	Project: <u>22-124</u>
Weather: <u>Clear</u>	Recorder(s): <u>JFS</u>	Date entry by: <u>JUO</u>	Date entered: <u>Sep. 28, 2022</u>

Site Rd. s. McCune Park Access Road 092

TIME BEGINS	FROM NORTH				McCune Park Access Road FROM SOUTH				TOTAL NORTH SOUTH	Shields Rd. FROM EAST				Shields Rd. FROM WEST				TOTAL EAST WEST	TOTAL ALL DIREC.	PEAK HOUR FACTOR									
	Left	Thru	Right	Total	Trk	Bus	Left	Thru		Right	Total	Trk	Bus	Left	Thru	Right	Total			Trk	Bus	North	South	East	West				
06:00																													
07:00							0	0	0	0	0	0	1	456	0	457	10	6	0	408	0	408	10	8	0.000	0.000	0.810	0.708	
08:00							1	0	1	2	0	0	0	306	0	306	9	8	0	375	1	376	10	0	0.000	0.250	0.890	0.855	
09:00							1	0	0	1	0	0	0	205	0	205	6	0	0	258	2	260	13	0	0.000	0.250	0.854	0.903	
10:00																													
11:00							1	0	1	2	1	0	0	239	0	239	6	0	0	254	2	256	13	1	0.000	0.500	0.934	0.744	
12:00							0	0	1	1	0	0	0	276	0	276	7	0	0	280	3	283	7	0	0.000	0.250	0.758	0.852	
1:00																													
2:00													1	399	0	400	11	2	0	418	1	419	9	6			1.389	1.416	
3:00							1	0	1	2	0	0	0	382	0	383	5	10	0	362	1	363	5	7	0.000	0.500	0.887	0.833	
4:00							2	0	0	2	0	0	0	440	0	440	9	2	0	442	1	443	4	0	0.000	0.500	0.924	0.859	
5:00							2	0	2	4	0	0	4	452	0	456	3	0	0	395	8	403	3	0	0.000	0.500	0.864	0.833	
6:00																													
7:00																													
8:00																													
9:00																													
TOTALS							8	0	6	14	1	0	14	7	3155	0	3162	66	28	0	3192	19	3211	74	22		6387		
ADT							11	0	8	19		7.1%	19	9	4248	0	4257		3.0%	0	4298	26	4323		3.0%		8581	8600	

N Log Hourly Factor:	0.00
S Log Hourly Factor:	1.56
N Log Monthly Factor:	0.00
S Log Monthly Factor:	0.86

E Log Hourly Factor:	1.57
W Log Hourly Factor:	1.57
E Log Monthly Factor:	0.86
W Log Monthly Factor:	0.86

N Log Combined Factor:	
S Log Combined Factor:	1.34

E Log Combined Factor:	
W Log Combined Factor:	1.35

TMS ENGINEERS, INC.

2112 Case Parkway South #7

Twinsburg, Ohio 44087

(330) 686-6402 FAX: (330) 686-6417

Figure #:

Page #:

Day of the Week: Tuesday

Page No : 1

[illegible]

TMS Engineers, Inc.

2112 Case Parkway South #7

Twinsburg, Ohio 44087

Transportation Management Services

File Name : Shields Rd & McCune Park Access 092722 JFS

Site Code : 00000000

Start Date : 9/27/2022

Page No : 2

Groups Printed- Cars - Trucks - Buses

Start Time	From North				SHIELDS ROAD				MC CUNE PARK ACCESS ROAD				SHIELDS ROAD			
	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Right	Thru	Left	Peds	App. Total	Int. Total
10:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:00 AM	0	0	0	0	0	0	55	0	0	55	0	0	0	0	0	112
11:15 AM	0	0	0	0	0	0	64	0	0	64	1	0	0	0	1	123
11:30 AM	0	0	0	0	0	0	61	0	0	61	0	0	1	0	1	117
11:45 AM	0	0	0	0	0	0	59	0	0	59	0	0	0	0	0	145
Total	0	0	0	0	0	0	239	0	0	239	1	0	1	0	2	497
12:00 PM	0	0	0	0	0	0	55	0	0	55	0	0	0	0	0	127
12:15 PM	0	0	0	0	0	0	62	0	0	62	0	0	0	0	0	127
12:30 PM	0	0	0	0	0	0	91	0	0	91	0	0	0	0	0	174
12:45 PM	0	0	0	0	0	0	68	0	0	68	1	0	0	0	1	132
Total	0	0	0	0	0	0	276	0	0	276	1	0	0	0	1	560
01:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01:45 PM	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4
Total	0	0	0	0	0	0	2	0	0	2	0	0	0	0	0	4
02:00 PM	0	0	0	0	0	0	72	0	0	72	0	0	0	0	0	146
02:15 PM	0	0	0	0	0	0	106	0	0	106	0	0	0	0	0	217
02:30 PM	0	0	0	0	0	0	120	0	0	120	0	0	0	0	1	246
02:45 PM	0	0	0	0	0	0	101	1	0	102	0	0	0	0	0	210
Total	0	0	0	0	0	0	399	1	0	400	0	0	0	0	1	819

TMS Engineers, Inc.

2112 Case Parkway South #7

Twinsburg, Ohio 44087

Transportation Management Services

File Name : Shields Rd & McCune Park Access 092722 JFS

Site Code : 00000000

Start Date : 9/27/2022

Page No : 3

Groups Printed- Cars - Trucks - Buses

	From North						SHIELDS ROAD From East						MC CUNE PARK ACCESS ROAD From South						SHIELDS ROAD 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	
03:00 PM	0	0	0	0	0		0	108	0	0	108		0	0	1	0	1	0	0	80	0	0	0	80	189
03:15 PM	0	0	0	0	0		0	93	0	0	93		0	0	0	0	0	0	109	0	0	0	109	202	
03:30 PM	0	0	0	0	0		0	77	1	0	78		0	0	0	0	0	0	105	0	0	0	105	183	
03:45 PM	0	0	0	0	0		0	104	0	0	104		1	0	0	0	1	1	68	0	0	0	69	174	
Total	0	0	0	0	0		0	382	1	0	383		1	0	1	0	2	1	362	0	0	0	363	748	
04:00 PM	0	0	0	0	0		0	108	0	0	108		0	0	0	0	0	0	118	0	0	0	118	226	
04:15 PM	0	0	0	0	0		0	102	0	0	102		0	0	1	0	1	0	101	0	0	0	101	204	
04:30 PM	0	0	0	0	0		0	119	0	0	119		0	0	0	0	0	0	95	0	0	0	95	214	
04:45 PM	0	0	0	0	0		0	111	0	0	111		0	0	1	0	1	1	128	0	0	0	129	241	
Total	0	0	0	0	0		0	440	0	0	440		0	0	2	0	2	1	442	0	0	0	443	885	
05:00 PM	0	0	0	0	0		0	97	0	0	97		0	0	0	0	0	0	120	0	0	0	121	218	
05:15 PM	0	0	0	0	0		0	131	1	0	132		0	0	0	0	0	7	113	0	0	0	120	252	
05:30 PM	0	0	0	0	0		0	116	3	0	119		1	0	1	0	2	0	94	0	0	0	94	215	
05:45 PM	0	0	0	0	0		0	108	0	0	108		1	0	1	0	2	0	68	0	0	0	68	178	
Total	0	0	0	0	0		0	452	4	0	456		2	0	2	0	4	8	395	0	0	0	403	863	
Grand Total	0	0	0	0	0		0	3157	7	0	3164		6	0	8	0	14	19	3194	0	0	0	3213	6391	
Approch %	0	0	0	0			0	99.8	0.2	0			42.9	0	57.1	0		0.6	99.4	0	0	0			
Total %	0	0	0	0	0		0	49.4	0.1	0	49.5		0.1	0	0.1	0	0.2	0.3	50	0	0	0	50.3		
Cars	0	0	0	0	0		0	3061	7	0	3068		6	0	7	0	13	17	3098	0	0	0	3115	6196	
% Cars	0	0	0	0	0		0	97	100	0	97		100	0	87.5	0	92.9	89.5	97	0	0	0	96.9	96.9	
Trucks	0	0	0	0	0		0	68	0	0	68		0	0	1	0	1	2	73	0	0	0	75	144	
% Trucks	0	0	0	0	0		0	2.2	0	0	2.1		0	0	12.5	0	7.1	10.5	2.3	0	0	0	2.3	2.3	
Buses	0	0	0	0	0		0	28	0	0	28		0	0	0	0	0	0	23	0	0	0	23	51	
% Buses	0	0	0	0	0		0	0.9	0	0	0.9		0	0	0	0	0	0	0.7	0	0	0	0.7	0.8	

TMS Engineers, Inc.

2112 Case Parkway South #7

Twinsburg, Ohio 44087

Transportation Management Services

File Name : Shields Rd & McCune Park Access 092722 JFS

Site Code : 00000000

Start Date : 9/27/2022

Page No : 4

	From North					SHIELDS ROAD From East					MC CUNE PARK ACCESS ROAD From South					SHIELDS ROAD 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 Analysis From 07:30 AM to 08:15 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 07:30 AM																					
07:30 AM	0	0	0	0	0	0	139	1	0	140	0	0	0	0	0	0	144	0	0	144	284
07:45 AM	0	0	0	0	0	0	108	0	0	108	0	0	0	0	0	0	115	0	0	115	223
08:00 AM	0	0	0	0	0	0	81	0	0	81	1	0	1	0	2	1	83	0	0	84	167
08:15 AM	0	0	0	0	0	0	86	0	0	86	0	0	0	0	0	0	90	0	0	90	176
Total Volume	0	0	0	0	0	0	414	1	0	415	1	0	1	0	2	1	432	0	0	433	850
% App. Total	0	0	0	0	0	0	99.8	0.2	0	99.8	50	0	50	0	0	0.2	99.8	0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.745	.250	.000	.741	.250	.000	.250	.000	.250	.250	.750	.000	.000	.752	.748
Cars	0	0	0	0	0	0	397	1	0	398	1	0	1	0	2	1	416	0	0	417	817
% Cars	0	0	0	0	0	0	95.9	100	0	95.9	100	0	100	0	100	100	96.3	0	0	96.3	96.1
Trucks	0	0	0	0	0	0	8	0	0	8	0	0	0	0	0	0	10	0	0	10	18
% Trucks	0	0	0	0	0	0	1.9	0	0	1.9	0	0	0	0	0	0	2.3	0	0	2.3	2.1
Buses	0	0	0	0	0	0	9	0	0	9	0	0	0	0	0	0	6	0	0	6	15
% Buses	0	0	0	0	0	0	2.2	0	0	2.2	0	0	0	0	0	0	1.4	0	0	1.4	1.8

Peak Hour Analysis From 02:30 PM to 03:15 PM - Peak 1 of 1

Peak Hour for Entire Intersection Begins at 02:30 PM

02:30 PM	0	0	0	0	0	0	120	0	0	120	0	0	0	0	0	1	125	0	0	126	246
02:45 PM	0	0	0	0	0	0	101	1	0	102	0	0	0	0	0	0	108	0	0	108	210
03:00 PM	0	0	0	0	0	0	108	0	0	108	0	0	1	0	1	0	80	0	0	80	189
03:15 PM	0	0	0	0	0	0	93	0	0	93	0	0	0	0	0	0	109	0	0	109	202
Total Volume	0	0	0	0	0	0	422	1	0	423	0	0	1	0	1	1	422	0	0	423	847
% App. Total	0	0	0	0	0	0	99.8	0.2	0	99.8	0	0	100	0	0	0.2	99.8	0	0	0	
PHF	.000	.000	.000	.000	.000	.000	.879	.250	.000	.881	.000	.000	.250	.000	.250	.250	.844	.000	.000	.839	.861
Cars	0	0	0	0	0	0	407	1	0	408	0	0	1	0	1	1	401	0	0	402	811
% Cars	0	0	0	0	0	0	96.4	100	0	96.5	0	0	100	0	100	100	95.0	0	0	95.0	95.7
Trucks	0	0	0	0	0	0	10	0	0	10	0	0	0	0	0	0	8	0	0	8	18
% Trucks	0	0	0	0	0	0	2.4	0	0	2.4	0	0	0	0	0	0	1.9	0	0	1.9	2.1
Buses	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	0	13	0	0	13	18
% Buses	0	0	0	0	0	0	1.2	0	0	1.2	0	0	0	0	0	0	3.1	0	0	3.1	2.1

Appendix D

Trip Generation Data

Elementary School

ITE Code = 520

Date:

10/20/2022

Trip Generation based on:

Size of Analysis Area:

950

Students

Students	Average Rate	Standard Deviation	Adjustment Factor	Driveway Volume
WEEKDAY				
Average Weekday 2-way Volume	2.27	0.93	1.00	2157
Weekday Peak Hour of Adjacent Street Traffic				
7-9 AM Peak Hour Enter	0.40	0.00	1.00	380
7-9 AM Peak Hour Exit	0.34	0.00	1.00	323
7-9 AM Peak Hour Total	0.74	0.25	1.00	703
4-6 PM Peak Hour Enter	0.07	0.00	1.00	70
4-6 PM Peak Hour Exit	0.09	0.00	1.00	82
4-6 PM Peak Hour Total	0.16	0.10	1.00	152
Weekday Peak Hour of Generator				
AM Peak Hour Enter	0.41	0.00	1.00	385
AM Peak Hour Exit	0.35	0.00	1.00	328
AM Peak Hour Total	0.75	0.27	1.00	713
PM Peak Hour Enter	0.21	0.00	1.00	197
PM Peak Hour Exit	0.24	0.00	1.00	231
PM Peak Hour Total	0.45	0.19	1.00	428
SATURDAY				
Average Saturday 2-way Volume	DATA NOT AVAILABLE			
Saturday Peak Hour of Generator				
Saturday Peak Hour Enter	DATA NOT AVAILABLE			
Saturday Peak Hour Exit	DATA NOT AVAILABLE			
Saturday Peak Hour Total	DATA NOT AVAILABLE			
SUNDAY				
Average Sunday 2-way Volume	DATA NOT AVAILABLE			
Sunday Peak Hour of Generator				
Sunday Peak Hour Enter	DATA NOT AVAILABLE			
Sunday Peak Hour Exit	DATA NOT AVAILABLE			
Sunday Peak Hour Total	DATA NOT AVAILABLE			

Elementary School

ITE Code = 520

*****The above rates were calculated from the equations shown below:***

		% ENTER	% EXIT
WEEKDAY			
Average Weekday 2-way Volume	<i>Not Given – Use ITE Rates</i>	50%	50%
Weekday Peak Hour of Adjacent Street Traffic			
7-9 AM Peak Hour Total	<i>Not Given – Use ITE Rates</i>	54%	46%
4-6 PM Peak Hour Total	<i>Not Given – Use ITE Rates</i>	46%	54%
Weekday Peak Hour of Generator			
AM Peak Hour Total	<i>Not Given – Use ITE Rates</i>	54%	46%
PM Peak Hour Total	<i>Not Given – Use ITE Rates</i>	46%	54%
SATURDAY			
Average Saturday 2-way Volume	<i>Data Not Available</i>		
Saturday Peak Hour of Generator			
Saturday Peak Hour Volume	<i>Data Not Available</i>		
SUNDAY			
Average Sunday 2-way Volume	<i>Data Not Available</i>		
Sunday Peak Hour of Generator			
Sunday Peak Hour Volume	<i>Data Not Available</i>		

Source: Institute of Transportation Engineers
Trip Generation Manual, 11TH Edition, September 2021

Middle School/Junior High School

ITE Code = 522

Date:

10/20/2022

Trip Generation based on:

Size of Analysis Area:

790

Students

Students	Average Rate	Standard Deviation	Adjustment Factor	Driveway Volume
WEEKDAY				
Average Weekday 2-way Volume	2.12	0.00	1.00	1672
Weekday Peak Hour of Adjacent Street Traffic				
7-9 AM Peak Hour Enter	0.36	0.00	1.00	286
7-9 AM Peak Hour Exit	0.31	0.00	1.00	243
7-9 AM Peak Hour Total	0.67	0.24	1.00	529
4-6 PM Peak Hour Enter	0.07	0.00	1.00	57
4-6 PM Peak Hour Exit	0.08	0.00	1.00	62
4-6 PM Peak Hour Total	0.15	0.07	1.00	119
Weekday Peak Hour of Generator				
AM Peak Hour Enter	0.42	0.00	1.00	333
AM Peak Hour Exit	0.34	0.00	1.00	272
AM Peak Hour Total	0.77	0.00	1.00	605
PM Peak Hour Enter	0.17	0.00	1.00	134
PM Peak Hour Exit	0.20	0.00	1.00	157
PM Peak Hour Total	0.37	0.00	1.00	290
SATURDAY				
Average Saturday 2-way Volume	DATA NOT AVAILABLE			
Saturday Peak Hour of Generator				
Saturday Peak Hour Enter	DATA NOT AVAILABLE			
Saturday Peak Hour Exit	DATA NOT AVAILABLE			
Saturday Peak Hour Total	DATA NOT AVAILABLE			
SUNDAY				
Average Sunday 2-way Volume	DATA NOT AVAILABLE			
Sunday Peak Hour of Generator				
Sunday Peak Hour Enter	DATA NOT AVAILABLE			
Sunday Peak Hour Exit	DATA NOT AVAILABLE			
Sunday Peak Hour Total	DATA NOT AVAILABLE			

Middle School/Junior High School
ITE Code = 522

*****The above rates were calculated from the equations shown below:***

		% ENTER	% EXIT
WEEKDAY			
Average Weekday 2-way Volume	$\text{Ln}(T) = 0.97 \text{Ln}(X) + 0.95$	50%	50%
Weekday Peak Hour of Adjacent Street Traffic			
7-9 AM Peak Hour Total	<i>Not Given – Use ITE Rates</i>	54%	46%
4-6 PM Peak Hour Total	<i>Not Given – Use ITE Rates</i>	48%	52%
Weekday Peak Hour of Generator			
AM Peak Hour Total	$T = 0.65(X) + 97.79$	55%	45%
PM Peak Hour Total	$T = 0.33(X) + 29.58$	46%	54%
SATURDAY			
Average Saturday 2-way Volume	<i>Data Not Available</i>		
Saturday Peak Hour of Generator			
Saturday Peak Hour Volume	<i>Data Not Available</i>		
SUNDAY			
Average Sunday 2-way Volume	<i>Data Not Available</i>		
Sunday Peak Hour of Generator			
Sunday Peak Hour Volume	<i>Data Not Available</i>		

Source: Institute of Transportation Engineers
Trip Generation Manual, 11TH Edition, September 2021

Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use			
Source: ITE <i>Trip Generation Manual</i> , 11th Edition			
Land Use Code	520		
Land Use	Elementary School		
Setting	General Urban/Suburban		
Time Period	Weekday		
# Data Sites	13		
	% of 24-Hour Vehicle Trips		
Time	Total	Entering	Exiting
12:00 - 1:00 AM	0.0%	0.0%	0.0%
1:00 - 2:00 AM	0.0%	0.0%	0.0%
2:00 - 3:00 AM	0.0%	0.0%	0.0%
3:00 - 4:00 AM	0.0%	0.0%	0.0%
4:00 - 5:00 AM	0.0%	0.0%	0.0%
5:00 - 6:00 AM	0.0%	0.1%	0.0%
6:00 - 7:00 AM	2.3%	3.2%	1.4%
7:00 - 8:00 AM	31.0%	35.7%	26.3%
8:00 - 9:00 AM	13.0%	11.6%	14.4%
9:00 - 10:00 AM	2.0%	2.1%	2.0%
10:00 - 11:00 AM	2.0%	1.9%	2.1%
11:00 - 12:00 PM	2.7%	2.5%	2.8%
12:00 - 1:00 PM	2.4%	2.7%	2.2%
1:00 - 2:00 PM	3.7%	3.6%	3.9%
2:00 - 3:00 PM	15.4%	14.7%	16.0%
3:00 - 4:00 PM	10.3%	8.5%	12.1%
4:00 - 5:00 PM	8.2%	7.0%	9.4%
5:00 - 6:00 PM	5.2%	4.9%	5.6%
6:00 - 7:00 PM	1.1%	1.1%	1.1%
7:00 - 8:00 PM	0.2%	0.2%	0.2%
8:00 - 9:00 PM	0.2%	0.1%	0.3%
9:00 - 10:00 PM	0.0%	0.0%	0.0%
10:00 - 11:00 PM	0.0%	0.0%	0.0%
11:00 - 12:00 AM	0.0%	0.0%	0.0%

Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use			
Source: ITE <i>Trip Generation Manual</i> , 11th Edition			
Land Use Code	522		
Land Use	Middle School/Junior High School		
Setting	General Urban/Suburban		
Time Period	Weekday		
# Data Sites	3		
	% of 24-Hour Vehicle Trips		
Time	Total	Entering	Exiting
12:00 - 1:00 AM	0.1%	0.1%	0.1%
1:00 - 2:00 AM	0.0%	0.0%	0.1%
2:00 - 3:00 AM	0.1%	0.0%	0.1%
3:00 - 4:00 AM	0.0%	0.0%	0.0%
4:00 - 5:00 AM	0.0%	0.1%	0.0%
5:00 - 6:00 AM	0.2%	0.3%	0.1%
6:00 - 7:00 AM	1.2%	1.7%	0.7%
7:00 - 8:00 AM	28.7%	33.4%	24.0%
8:00 - 9:00 AM	12.1%	11.5%	12.7%
9:00 - 10:00 AM	1.4%	1.4%	1.4%
10:00 - 11:00 AM	1.3%	1.3%	1.4%
11:00 - 12:00 PM	1.4%	1.4%	1.3%
12:00 - 1:00 PM	1.4%	1.5%	1.4%
1:00 - 2:00 PM	1.6%	1.5%	1.8%
2:00 - 3:00 PM	6.2%	8.3%	4.1%
3:00 - 4:00 PM	13.8%	10.1%	17.5%
4:00 - 5:00 PM	5.9%	6.0%	5.8%
5:00 - 6:00 PM	7.6%	7.7%	7.4%
6:00 - 7:00 PM	7.7%	8.5%	7.0%
7:00 - 8:00 PM	4.9%	3.2%	6.6%
8:00 - 9:00 PM	3.4%	1.4%	5.4%
9:00 - 10:00 PM	0.7%	0.6%	0.9%
10:00 - 11:00 PM	0.2%	0.1%	0.3%
11:00 - 12:00 AM	0.1%	0.0%	0.1%

Appendix E

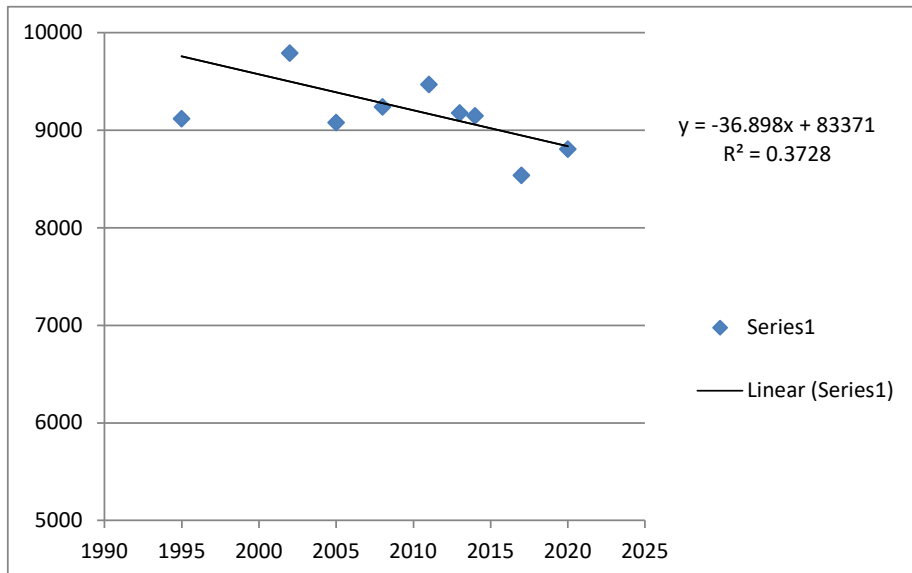
Growth Rate Data & Calculations

WORKSHEET FOR N-S GROWTH RATES

SR46 - NORTH OF SHIELDS ROAD: ID 40650 - COUNT DATA FROM ODOT MS2 WEBSITE

Year	Volume	% Diff per Yr to Prev Yr Count	% Diff per Yr Since 2020	AVG/YEAR Since 2014
2020	8807	1.05%		
2017	8538	-2.23%	1.05%	-0.623%
2014	9149	-0.31%	-0.62%	
2013	9177	-1.55%	-0.58%	AVG/YEAR Since 2008
2011	9470	0.83%	-0.78%	
2008	9240	0.59%	-0.39%	-0.39%
2005	9080	-2.42%	-0.20%	
2002	9790	-2.20%	-0.56%	AVG/YEAR Since 2000
2000	10240	2.46%	-0.70%	
1995	9120		-0.29%	-0.70%

Coefficient (b) of Regression Equation:	-36.898
Growth Rate =	b / Most Recent Count x 100%
Growth Rate =	-36.898 / 8807 X 100%
Growth Rate =	-0.4190%

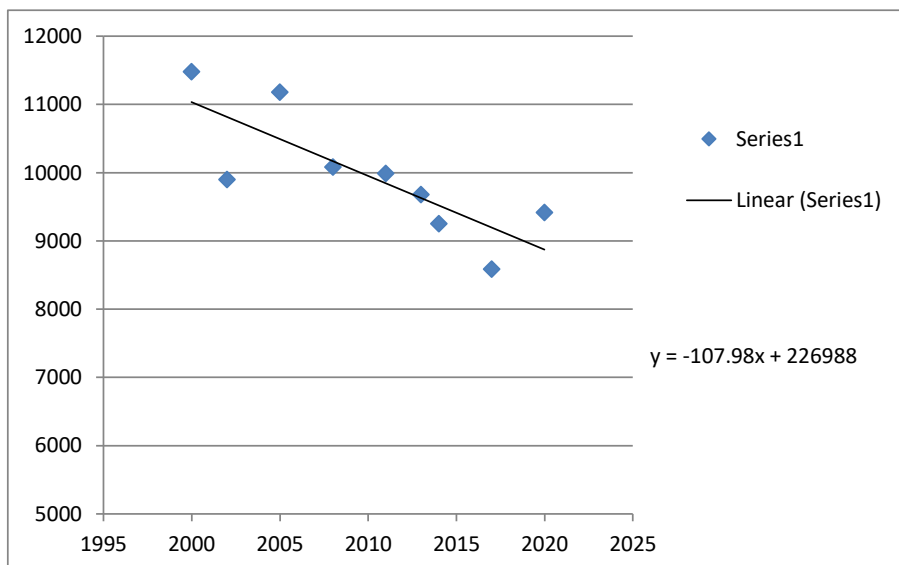


WORKSHEET FOR N-S GROWTH RATES

SR46 - SOUTH OF SHIELDS ROAD: ID 40950 - COUNT DATA FROM ODOT MS2 WEBSITE

Year	Volume	% Diff per Yr to Prev Yr Count	% Diff per Yr Since 2020	AVG/YEAR Since 2014
2020	9417	3.22%		
2017	8587	-2.40%	3.22%	0.295%
2014	9253	-4.42%	0.30%	
2013	9681	-1.55%	-0.39%	AVG/YEAR Since
2011	9990	-0.30%	-0.64%	2008
2008	10080	-3.28%	-0.55%	-0.55%
2005	11180	4.31%	-1.05%	
2002	9900	-6.88%	-0.27%	AVG/YEAR Since
2000	11480	5.09%	-0.90%	2000
1995	9150		-0.28%	-0.90%

Coefficient (b) of Regression Equation:	-50.673
Growth Rate =	b / Most Recent Count x 100%
Growth Rate =	-50.673 / 9417 X 100%
Growth Rate =	-0.5381%

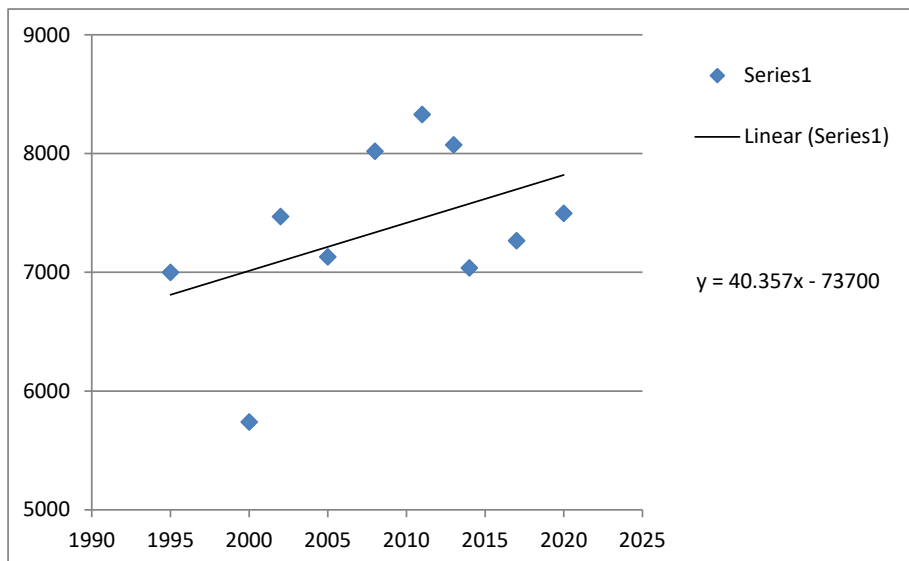


WORKSHEET FOR E-W GROWTH RATES

SHIELDS ROAD (US 62) - EAST OF SR 46: ID 46550 - COUNT DATA FROM ODOT MS2 WEBSITE

Year	Volume	% Diff per Yr to Prev Yr Count	% Diff per Yr Since 2020	AVG/YEAR Since 2014
2020	7497	1.06%		
2017	7266	1.08%	1.06%	1.089%
2014	7037	-12.83%	1.09%	
2013	8073	-1.54%	-1.02%	AVG/YEAR Since 2008
2011	8330	1.29%	-1.11%	
2008	8020	4.16%	-0.54%	-0.54%
2005	7130	-1.52%	0.34%	
2002	7470	15.07%	0.02%	AVG/YEAR Since 2000
2000	5740	-3.60%	1.53%	
1995	7000		0.17%	1.53%

Coefficient (b) of Regression Equation:	40.357
Growth Rate =	b / Most Recent Count x 100%
Growth Rate =	40.357 / 7497 X 100%
Growth Rate =	0.5383%



Appendix F

ODOT Peak Hour to Design Hour Charts

PEAK HOUR to DESIGN HOUR FACTORS
FUNCTIONAL CLASSIFICATION = 03, 04, 05u
 (Urban Principal Arterial, Urban Minor Arterial, & Urban Minor Collector)

Day Month		Monthly Average by Day-of-Week							
		WEEKDAY MON-THUR	Sun	Mon	Tue	Wed	Thu	Fri	Sat
		0	1	2	3	4	5	6	7
January	1	1.20	1.72	1.22	1.21	1.20	1.17	1.15	1.56
February	2	1.17	1.63	1.19	1.16	1.17	1.16	1.11	1.48
March	3	1.15	1.57	1.16	1.16	1.16	1.13	1.11	1.45
April	4	1.11	1.52	1.13	1.12	1.09	1.09	1.06	1.41
May	5	1.08	1.44	1.10	1.09	1.08	1.06	1.04	1.35
June	6	1.14	1.51	1.16	1.15	1.14	1.11	1.09	1.39
July	7	1.16	1.54	1.19	1.17	1.15	1.15	1.13	1.44
August	8	1.13	1.51	1.15	1.14	1.13	1.11	1.08	1.40
September	9	1.12	1.53	1.15	1.11	1.12	1.09	1.04	1.40
October	10	1.10	1.53	1.13	1.10	1.10	1.08	1.05	1.40
November	11	1.13	1.56	1.16	1.12	1.13	1.11	1.06	1.48
December	12	1.13	1.58	1.14	1.13	1.12	1.12	1.09	1.44

peak hour volume * factor = design hour volume

source: year 2016, 2017, & 2018 Automatic Traffic Recorders (ATR) Data

ATR Stations:

2018: 21, 28, 123, 131, 134, 166, 169, 517, 523, 543, 544, 550,
565, 605, 765

2017: 21, 123, 523, 538, 543, 544, 550, 565, 605, 725, 765, 28,
134, 169, 517, 131, 166

Ohio Department of Transportation

Modeling & Forecasting Section

June 2019

NOTE: These are NOT seasonal adjustment factors!!!

Note: Insufficient data exists to produce factors for functional classes 06 and 07 Urban.

Appendix G

Background Traffic Volume Forecast Calculations

WORKSHEET FOR NO BUILD VEHICULAR TRAFFIC VOLUME CALCULATIONS

S.Canfield Niles Rd & Shields Rd 092722

[illegible]

WORKSHEET FOR NO BUILD VEHICULAR TRAFFIC VOLUME CALCULATIONS

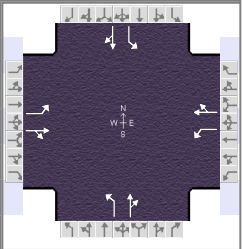
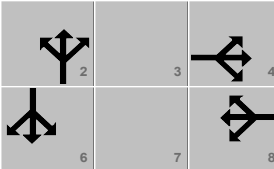
Shields Rd & McCune Park Access Road 092722

[illegible]

Appendix H

No-Build Capacity Analysis Worksheets - 2027

HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency	TMS Engineers, Inc.					Duration, h		0.250											
Analyst	ABC		Analysis Date	Oct 24, 2022		Area Type		Other											
Jurisdiction	Canfield, OH		Time Period	AM Peak		PHF		0.80											
Urban Street	US 62/SR 46		Analysis Year	2027		Analysis Period		1> 7:00											
Intersection	@ Shields Road		File Name	1_AM 27NB SR62.xus															
Project Description	No-Build Conditions																		
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h				70	200	50	300	100	140	30	220	170	160	210	40				
Signal Information																			
Cycle, s	53.0	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	20.0	21.0	0.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0									
				Red	2.0	2.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8				2				6	
Case Number						6.0				6.0				6.0				6.0	
Phase Duration, s						27.0				27.0				26.0				26.0	
Change Period, (Y+R c), s						6.0				6.0				6.0				6.0	
Max Allow Headway (MAH), s						3.4				3.4				3.3				3.3	
Queue Clearance Time (g s), s						12.5				23.0				16.0				22.0	
Green Extension Time (g e), s						2.6				0.0				2.5				0.0	
Phase Call Probability						1.00				1.00				1.00				1.00	
Max Out Probability						0.01				1.00				0.00				1.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate (v), veh/h				88	313		375	300		38	488		200	313					
Adjusted Saturation Flow Rate (s), veh/h/ln				1071	1791		1050	1666		1008	1638		894	1789					
Queue Service Time (g s), s				3.5	6.8		14.3	7.0		1.5	14.0		6.0	7.0					
Cycle Queue Clearance Time (g c), s				10.5	6.8		21.0	7.0		8.5	14.0		20.0	7.0					
Green Ratio (g/C)				0.40	0.40		0.40	0.40		0.38	0.38		0.38	0.38					
Capacity (c), veh/h				419	710		418	660		384	618		237	675					
Volume-to-Capacity Ratio (X)				0.209	0.440		0.896	0.454		0.098	0.788		0.845	0.463					
Back of Queue (Q), ft/ln (95 th percentile)				32.4	94.3		278.9	92.1		14.3	195.3		171.7	100					
Back of Queue (Q), veh/ln (95 th percentile)				1.3	3.7		10.8	3.6		0.5	7.3		6.7	3.9					
Queue Storage Ratio (RQ) (95 th percentile)				0.22	0.00		1.55	0.00		0.08	0.00		0.95	0.00					
Uniform Delay (d 1), s/veh				15.6	11.7		21.1	11.8		15.6	14.6		25.0	12.5					
Incremental Delay (d 2), s/veh				0.1	0.2		20.8	0.2		0.0	0.9		22.3	0.2					
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0					
Control Delay (d), s/veh				15.7	11.9		42.0	12.0		15.7	15.5		47.3	12.6					
Level of Service (LOS)				B	B		D	B		B	B		D	B					
Approach Delay, s/veh / LOS				12.7	B		28.6	C		15.5	B		26.2	C					
Intersection Delay, s/veh / LOS				21.8						C									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

HCS Two-Way Stop-Control Report

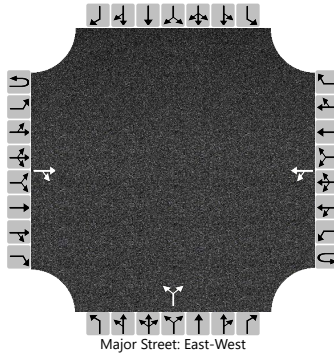
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2027
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	No-Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.80
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			490	10		10	470			10		10				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

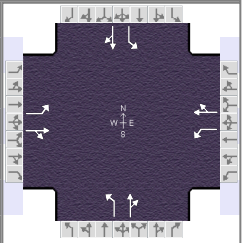
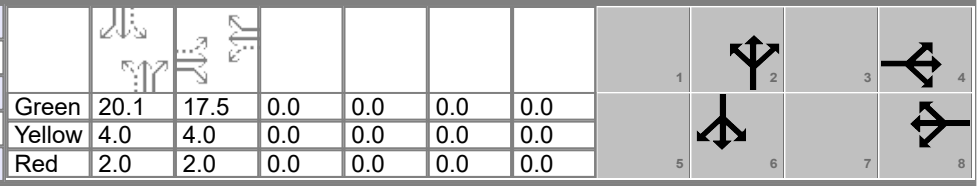
Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						13					25					
Capacity, c (veh/h)						966					278					
v/c Ratio						0.01					0.09					
95% Queue Length, Q ₉₅ (veh)						0.0					0.3					
Control Delay (s/veh)						8.8	0.2				19.2					
Level of Service (LOS)						A	A				C					
Approach Delay (s/veh)					0.3				19.2							
Approach LOS					A				C							

HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		TMS Engineers, Inc.				Duration, h		0.250											
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other									
Jurisdiction		Canfield, OH		Time Period		AM Peak		PHF		0.99									
Urban Street		US 62/SR 46		Analysis Year		2027		Analysis Period		1> 7:00									
Intersection		@ Shields Road		File Name		3_PM 27NB SR62.xus													
Project Description		No-Build Conditions																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h				70	150	70	230	130	200	40	310	210	140	240	50				
Signal Information																			
Cycle, s	49.6	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	20.1	17.5	0.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0									
				Red	2.0	2.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8				2				6	
Case Number						6.0				6.0				6.0				6.0	
Phase Duration, s						23.5				23.5				26.1				26.1	
Change Period, (Y+R c), s						6.0				6.0				6.0				6.0	
Max Allow Headway (MAH), s						3.3				3.3				3.3				3.3	
Queue Clearance Time (g s), s						13.3				16.2				14.8				22.1	
Green Extension Time (g e), s						1.8				1.9				2.3				0.0	
Phase Call Probability						1.00				1.00				1.00				1.00	
Max Out Probability						0.01				0.00				0.00				1.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate (v), veh/h				71	222		232	333		40	525		141	293					
Adjusted Saturation Flow Rate (s), veh/h/ln				1022	1727		1140	1660		1069	1716		863	1785					
Queue Service Time (g s), s				3.0	4.7		9.4	8.1		1.3	12.8		7.7	5.7					
Cycle Queue Clearance Time (g c), s				11.3	4.7		14.2	8.1		6.6	12.8		20.1	5.7					
Green Ratio (g/C)				0.35	0.35		0.35	0.35		0.40	0.40		0.40	0.40					
Capacity (c), veh/h				326	595		429	572		470	704		282	732					
Volume-to-Capacity Ratio (X)				0.217	0.373		0.542	0.582		0.086	0.746		0.502	0.400					
Back of Queue (Q), ft/ln (95 th percentile)				27.7	65		92.7	106.2		11.7	162.6		64.1	73.8					
Back of Queue (Q), veh/ln (95 th percentile)				1.1	2.5		3.6	4.1		0.5	6.3		2.5	2.9					
Queue Storage Ratio (RQ) (95 th percentile)				0.18	0.00		0.52	0.00		0.06	0.00		0.36	0.00					
Uniform Delay (d 1), s/veh				17.9	12.1		17.4	13.2		12.4	12.3		20.9	10.2					
Incremental Delay (d 2), s/veh				0.1	0.1		0.4	0.4		0.0	0.6		0.5	0.1					
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0					
Control Delay (d), s/veh				18.0	12.2		17.8	13.5		12.4	12.9		21.4	10.3					
Level of Service (LOS)				B	B		B	B		B	B		C	B					
Approach Delay, s/veh / LOS				13.6		B	15.3		B	12.9		B	13.9		B				
Intersection Delay, s/veh / LOS				14.0						B									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

HCS Two-Way Stop-Control Report

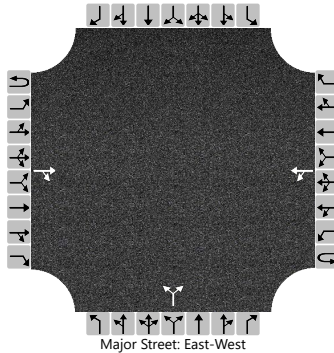
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2027
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	No-Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.86
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			480	10		10	480			10		0				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

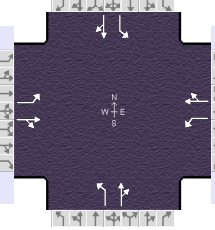
Flow Rate, v (veh/h)						12					12					
Capacity, c (veh/h)						1013					219					
v/c Ratio						0.01					0.05					
95% Queue Length, Q ₉₅ (veh)						0.0					0.2					
Control Delay (s/veh)						8.6	0.1				22.4					
Level of Service (LOS)						A	A				C					
Approach Delay (s/veh)					0.3				22.4							
Approach LOS					A				C							

Appendix I

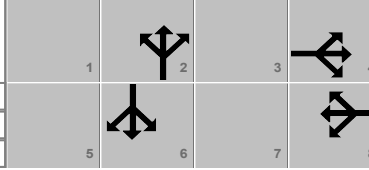
Build Capacity Analysis Worksheets - 2027

HCS Signalized Intersection Results Summary

General Information					Intersection Information					
Agency	TMS Engineers, Inc.					Duration, h	0.250			
Analyst	ABC	Analysis Date	Oct 24, 2022		Area Type	Other				
Jurisdiction	Canfield, OH	Time Period	AM Peak		PHF	0.80				
Urban Street	US 62/SR 46	Analysis Year	2027		Analysis Period	1> 7:00				
Intersection	@ Shields Road	File Name	1_AM 27 SR62.xus							
Project Description	Build Conditions									



Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				70	338	50	500	160	293	30	220	347	335	210	40

Signal Information						
Cycle, s	77.0	Reference Phase	2			
Offset, s	0	Reference Point	End			
Uncoordinated	Yes	Simult. Gap E/W	On			
Force Mode	Fixed	Simult. Gap N/S	On			
Green	37.0	28.0	0.0	0.0	0.0	0.0
Yellow	4.0	4.0	0.0	0.0	0.0	0.0
Red	2.0	2.0	0.0	0.0	0.0	0.0

Timer Results		EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase			4		8		2		6
Case Number			6.0		6.0		6.0		6.0
Phase Duration, s			34.0		34.0		43.0		43.0
Change Period, (Y+R c), s			6.0		6.0		6.0		6.0
Max Allow Headway (MAH), s			3.6		3.6		3.7		3.7
Queue Clearance Time (g s), s			30.0		30.0		34.1		39.0
Green Extension Time (g e), s			0.0		0.0		2.9		0.0
Phase Call Probability			1.00		1.00		1.00		1.00
Max Out Probability			1.00		1.00		0.02		1.00

Movement Group Results		EB			WB			NB			SB		
Approach Movement		L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement		7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h		88	485		625	566		38	709		419	313	
Adjusted Saturation Flow Rate (s), veh/h/ln		838	1813		896	1649		1008	1591		728	1789	
Queue Service Time (g s), s		2.3	17.9		10.1	25.7		1.9	32.1		4.9	8.5	
Cycle Queue Clearance Time (g c), s		28.0	17.9		28.0	25.7		10.3	32.1		37.0	8.5	
Green Ratio (g/C)		0.36	0.36		0.36	0.36		0.48	0.48		0.48	0.48	
Capacity (c), veh/h		119	659		211	599		467	765		140	860	
Volume-to-Capacity Ratio (X)		0.737	0.736		2.966	0.945		0.080	0.926		2.992	0.363	
Back of Queue (Q), ft/ln (95 th percentile)		100.5	302		2458.1	475.6		18.7	411.9		1755	133.7	
Back of Queue (Q), veh/ln (95 th percentile)		3.9	11.8		95.3	18.4		0.7	15.4		68.0	5.2	
Queue Storage Ratio (RQ) (95 th percentile)		0.67	0.00		13.66	0.00		0.10	0.00		9.75	0.00	
Uniform Delay (d 1), s/veh		38.2	21.3		35.7	23.8		15.8	18.7		37.7	12.6	
Incremental Delay (d 2), s/veh		18.9	3.8		897.4	23.7		0.0	2.4		915.3	0.1	
Initial Queue Delay (d 3), s/veh		0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (d), s/veh		57.0	25.1		933.1	47.5		15.9	21.2		953.0	12.7	
Level of Service (LOS)		E	C		F	D		B	C		F	B	
Approach Delay, s/veh / LOS		30.0		C	512.1		F	20.9		C	551.2		F
Intersection Delay, s/veh / LOS		322.7						F					

Multimodal Results		EB		WB		NB		SB	
Pedestrian LOS Score / LOS									
Bicycle LOS Score / LOS									

HCS Two-Way Stop-Control Report

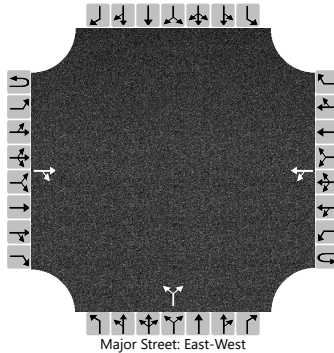
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2027
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.73
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			490	500		238	470			423		197				
Percent Heavy Vehicles (%)						5				5		5				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

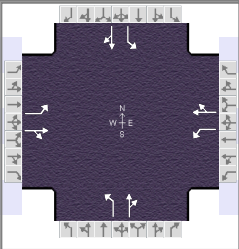
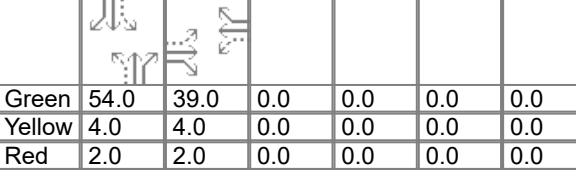
Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.15				6.45		6.25				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.25				3.55		3.35				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						326					849					
Capacity, c (veh/h)						498					0					
v/c Ratio						0.66										
95% Queue Length, Q ₉₅ (veh)						4.7										
Control Delay (s/veh)						24.9	24.9									
Level of Service (LOS)						C	C									
Approach Delay (s/veh)					24.9											
Approach LOS					C											

HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		TMS Engineers, Inc.				Duration, h		0.250											
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other									
Jurisdiction		Canfield, OH		Time Period		AM Peak		PHF		0.87									
Urban Street		US 62/SR 46		Analysis Year		2027		Analysis Period		1> 7:00									
Intersection		@ Shields Road		File Name		3_PM 27 SR62.xus													
Project Description		Build Conditions																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h				70	200	70	345	177	321	40	310	312	217	240	50				
Signal Information																			
Cycle, s	105.0	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	54.0	39.0	0.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0									
				Red	2.0	2.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8				2				6	
Case Number						6.0				6.0				6.0				6.0	
Phase Duration, s						45.0				45.0				60.0				60.0	
Change Period, (Y+R c), s						6.0				6.0				6.0				6.0	
Max Allow Headway (MAH), s						3.4				3.4				3.5				3.5	
Queue Clearance Time (g s), s						41.0				41.0				39.5				56.0	
Green Extension Time (g e), s						0.0				0.0				4.1				0.0	
Phase Call Probability						1.00				1.00				1.00				1.00	
Max Out Probability						1.00				1.00				0.00				1.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate (v), veh/h				80	310		397	572		46	715		249	333					
Adjusted Saturation Flow Rate (s), veh/h/ln				820	1744		1052	1649		1030	1688		724	1785					
Queue Service Time (g s), s				3.9	14.3		24.7	35.1		2.9	37.5		16.5	11.7					
Cycle Queue Clearance Time (g c), s				39.0	14.3		39.0	35.1		14.6	37.5		54.0	11.7					
Green Ratio (g/C)				0.37	0.37		0.37	0.37		0.51	0.51		0.51	0.51					
Capacity (c), veh/h				99	648		316	613		484	868		183	918					
Volume-to-Capacity Ratio (X)				0.812	0.479		1.254	0.934		0.095	0.823		1.366	0.363					
Back of Queue (Q), ft/ln (95 th percentile)				142.7	247		811.7	600.4		31.2	498.5		643.9	201					
Back of Queue (Q), veh/ln (95 th percentile)				5.5	9.5		31.5	23.3		1.2	19.3		25.0	7.8					
Queue Storage Ratio (RQ) (95 th percentile)				0.95	0.00		4.51	0.00		0.17	0.00		3.58	0.00					
Uniform Delay (d 1), s/veh				51.8	25.2		42.8	31.8		19.6	21.5		47.3	15.2					
Incremental Delay (d 2), s/veh				36.1	0.2		137.7	21.4		0.0	0.9		195.5	0.1					
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0					
Control Delay (d), s/veh				87.8	25.4		180.6	53.1		19.6	22.3		242.9	15.3					
Level of Service (LOS)				F	C		F	D		B	C		F	B					
Approach Delay, s/veh / LOS				38.3		D		105.3		F		22.2		C		112.7		F	
Intersection Delay, s/veh / LOS				73.8						E									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

HCS Two-Way Stop-Control Report

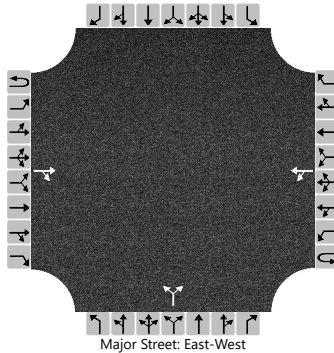
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2027
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.79
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			480	239		112	480			293		105				
Percent Heavy Vehicles (%)						5				5		5				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.15				6.45		6.25				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.25				3.55		3.35				

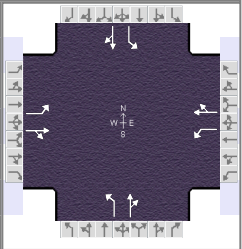
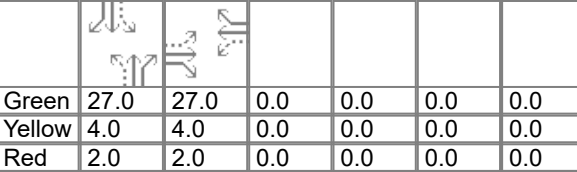
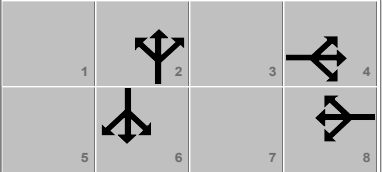
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						142					504					
Capacity, c (veh/h)						736					96					
v/c Ratio						0.19					5.22					
95% Queue Length, Q ₉₅ (veh)						0.7					54.4					
Control Delay (s/veh)						11.1	3.2				1988.3					
Level of Service (LOS)						B	A				F					
Approach Delay (s/veh)					4.7				1988.3							
Approach LOS					A				F							

Appendix J

No-Build Capacity Analysis Worksheets - 2047

HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		TMS Engineers, Inc.				Duration, h		0.250											
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other									
Jurisdiction		Canfield, OH		Time Period		AM Peak		PHF		0.80									
Urban Street		US 62/SR 46		Analysis Year		2047		Analysis Period		1> 7:00									
Intersection		@ Shields Road		File Name		1_AM 47NB SR62.xus													
Project Description		No-Build Conditions																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h				80	220	60	330	110	160	40	240	180	180	240	40				
Signal Information																			
Cycle, s	66.0	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	27.0	27.0	0.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0									
				Red	2.0	2.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8				2				6	
Case Number						6.0				6.0				6.0				6.0	
Phase Duration, s						33.0				33.0				33.0				33.0	
Change Period, (Y+R c), s						6.0				6.0				6.0				6.0	
Max Allow Headway (MAH), s						3.4				3.4				3.4				3.4	
Queue Clearance Time (g s), s						17.1				29.0				20.4				29.0	
Green Extension Time (g e), s						3.2				0.0				3.0				0.0	
Phase Call Probability						1.00				1.00				1.00				1.00	
Max Out Probability						0.00				1.00				0.00				1.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate (v), veh/h				100	350		413	338		50	525		225	350					
Adjusted Saturation Flow Rate (s), veh/h/ln				1035	1787		1015	1663		974	1640		864	1795					
Queue Service Time (g s), s				5.2	9.5		17.6	9.9		2.6	18.4		8.6	9.5					
Cycle Queue Clearance Time (g c), s				15.1	9.5		27.0	9.9		12.0	18.4		27.0	9.5					
Green Ratio (g/C)				0.41	0.41		0.41	0.41		0.41	0.41		0.41	0.41					
Capacity (c), veh/h				378	731		379	681		369	671		221	734					
Volume-to-Capacity Ratio (X)				0.265	0.479		1.088	0.496		0.135	0.782		1.016	0.477					
Back of Queue (Q), ft/ln (95 th percentile)				51.8	148.1		521	145		25.5	260.2		304.1	148.8					
Back of Queue (Q), veh/ln (95 th percentile)				2.0	5.8		20.2	5.6		1.0	9.7		11.8	5.8					
Queue Storage Ratio (RQ) (95 th percentile)				0.35	0.00		2.89	0.00		0.14	0.00		1.69	0.00					
Uniform Delay (d 1), s/veh				20.0	14.3		26.8	14.5		18.7	17.0		30.9	14.3					
Incremental Delay (d 2), s/veh				0.1	0.2		71.9	0.2		0.1	0.8		64.7	0.2					
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0					
Control Delay (d), s/veh				20.2	14.5		98.7	14.7		18.8	17.7		95.6	14.5					
Level of Service (LOS)				C	B		F	B		B	B		F	B					
Approach Delay, s/veh / LOS				15.8	B		60.9	E		17.8	B		46.2	D					
Intersection Delay, s/veh / LOS				38.1						D									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

HCS Two-Way Stop-Control Report

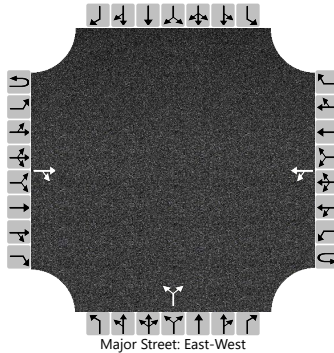
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2047
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	No-Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.80
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			550	10		10	520			10		10				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

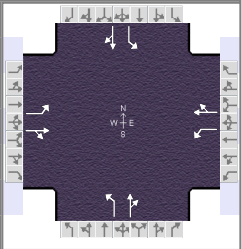
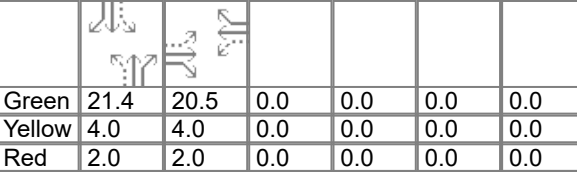
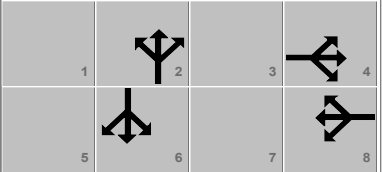
Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						13					25					
Capacity, c (veh/h)						906					235					
v/c Ratio						0.01					0.11					
95% Queue Length, Q ₉₅ (veh)						0.0					0.4					
Control Delay (s/veh)						9.0	0.2				22.1					
Level of Service (LOS)						A	A				C					
Approach Delay (s/veh)					0.4				22.1							
Approach LOS					A				C							

HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		TMS Engineers, Inc.				Duration, h		0.250											
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other									
Jurisdiction		Canfield, OH		Time Period		AM Peak		PHF		0.99									
Urban Street		US 62/SR 46		Analysis Year		2047		Analysis Period		1> 7:00									
Intersection		@ Shields Road		File Name		3_PM 47NB SR62.xus													
Project Description		No-Build Conditions																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h				70	160	70	260	150	220	50	340	240	150	270	50				
Signal Information																			
Cycle, s	53.9	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	21.4	20.5	0.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0									
				Red	2.0	2.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8				2				6	
Case Number						6.0				6.0				6.0				6.0	
Phase Duration, s						26.5				26.5				27.4				27.4	
Change Period, (Y+R c), s						6.0				6.0				6.0				6.0	
Max Allow Headway (MAH), s						3.3				3.3				3.3				3.3	
Queue Clearance Time (g s), s						15.3				18.5				18.8				23.8	
Green Extension Time (g e), s						2.1				2.2				2.1				0.0	
Phase Call Probability						1.00				1.00				1.00				1.00	
Max Out Probability						0.00				0.00				0.00				1.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate (v), veh/h				71	232		263	374		51	586		152	323					
Adjusted Saturation Flow Rate (s), veh/h/ln				985	1731		1130	1663		1040	1713		816	1790					
Queue Service Time (g s), s				3.4	5.2		11.7	9.8		2.0	16.8		5.6	7.1					
Cycle Queue Clearance Time (g c), s				13.3	5.2		16.5	9.8		7.8	16.8		21.8	7.1					
Green Ratio (g/C)				0.38	0.38		0.38	0.38		0.40	0.40		0.40	0.40					
Capacity (c), veh/h				323	652		458	626		438	689		217	719					
Volume-to-Capacity Ratio (X)				0.219	0.357		0.574	0.597		0.115	0.851		0.699	0.449					
Back of Queue (Q), ft/ln (95 th percentile)				31	74.1		116.3	132.4		17.7	226.2		103.3	101.2					
Back of Queue (Q), veh/ln (95 th percentile)				1.2	2.9		4.5	5.1		0.7	8.8		4.0	3.9					
Queue Storage Ratio (RQ) (95 th percentile)				0.21	0.00		0.65	0.00		0.10	0.00		0.57	0.00					
Uniform Delay (d 1), s/veh				19.0	12.2		17.9	13.6		14.2	14.7		25.6	11.8					
Incremental Delay (d 2), s/veh				0.1	0.1		0.4	0.3		0.0	1.2		8.1	0.2					
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0					
Control Delay (d), s/veh				19.1	12.3		18.3	13.9		14.3	15.9		33.7	12.0					
Level of Service (LOS)				B	B		B	B		B	B		C	B					
Approach Delay, s/veh / LOS				13.9		B		15.7		B		15.8		B		18.9		B	
Intersection Delay, s/veh / LOS				16.2										B					
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

HCS Two-Way Stop-Control Report

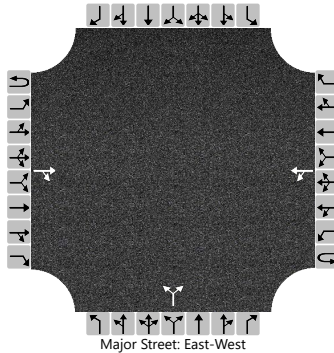
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2047
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	No-Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.86
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			530	10		10	530			10		0				
Percent Heavy Vehicles (%)						0				0		0				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.10				6.40		6.20				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.20				3.50		3.30				

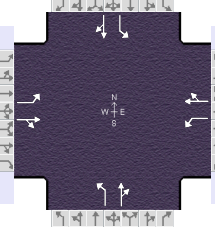
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						12					12					
Capacity, c (veh/h)						964					186					
v/c Ratio						0.01					0.06					
95% Queue Length, Q ₉₅ (veh)						0.0					0.2					
Control Delay (s/veh)						8.8	0.2				25.6					
Level of Service (LOS)						A	A				D					
Approach Delay (s/veh)					0.3				25.6							
Approach LOS					A				D							

Appendix K

Build Capacity Analysis Worksheets - 2047

HCS Signalized Intersection Results Summary

General Information					Intersection Information												
Agency	TMS Engineers, Inc.					Duration, h	0.250										
Analyst	ABC	Analysis Date	Oct 24, 2022		Area Type	Other											
Jurisdiction	Canfield, OH	Time Period	AM Peak		PHF	0.80											
Urban Street	US 62/SR 46	Analysis Year	2047		Analysis Period	1> 7:00											
Intersection	@ Shields Road	File Name	1_AM 47 SR62.xus														
Project Description	Build Conditions																
																	
Demand Information				EB			WB			NB			SB				
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R		
Demand (v), veh/h				80	358	60	530	170	313	40	240	357	355	240	40		
Signal Information																	
Cycle, s	57.0	Reference Phase	2														
Offset, s	0	Reference Point	End														
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	25.0	0.0	0.0	0.0	0.0							
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0							
Force Mode	Fixed	Simult. Gap N/S	On	Red	2.0	2.0	0.0	0.0	0.0	0.0							
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT						
Assigned Phase					4		8		2		6						
Case Number					6.0		6.0		6.0		6.0						
Phase Duration, s					31.0		31.0		26.0		26.0						
Change Period, (Y+R c), s					6.0		6.0		6.0		6.0						
Max Allow Headway (MAH), s					3.7		3.7		3.8		3.8						
Queue Clearance Time (g s), s					27.0		27.0		22.0		22.0						
Green Extension Time (g e), s					0.0		0.0		0.0		0.0						
Phase Call Probability					1.00		1.00		1.00		1.00						
Max Out Probability					1.00		1.00		1.00		1.00						
Movement Group Results				EB			WB			NB			SB				
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R		
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16		
Adjusted Flow Rate (v), veh/h				100	523		663	604		50	746		444	350			
Adjusted Saturation Flow Rate (s), veh/h/ln				809	1809		866	1648		974	1595		703	1795			
Queue Service Time (g s), s				6.5	13.0		12.0	18.5		2.5	20.0		0.0	9.0			
Cycle Queue Clearance Time (g c), s				25.0	13.0		25.0	18.5		11.5	20.0		20.0	9.0			
Green Ratio (g/C)				0.44	0.44		0.44	0.44		0.35	0.35		0.35	0.35			
Capacity (c), veh/h				219	793		308	723		315	560		126	630			
Volume-to-Capacity Ratio (X)				0.457	0.659		2.148	0.835		0.159	1.333		3.513	0.556			
Back of Queue (Q), ft/ln (95 th percentile)				56.7	195.7		2143.6	282.1		23.7	1267.4		1869	140.7			
Back of Queue (Q), veh/ln (95 th percentile)				2.2	7.6		83.1	10.9		0.9	47.3		72.4	5.5			
Queue Storage Ratio (RQ) (95 th percentile)				0.38	0.00		11.91	0.00		0.13	0.00		10.38	0.00			
Uniform Delay (d 1), s/veh				25.5	12.6		25.0	14.2		19.5	18.5		28.5	14.9			
Incremental Delay (d 2), s/veh				0.6	1.6		527.2	7.9		0.1	162.0		1150.4	0.7			
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0			
Control Delay (d), s/veh				26.1	14.2		552.2	22.1		19.6	180.5		1178.9	15.6			
Level of Service (LOS)				C	B		F	C		B	F		F	B			
Approach Delay, s/veh / LOS				16.1	B		299.4	F		170.4	F		665.9	F			
Intersection Delay, s/veh / LOS				302.8					F								
Multimodal Results				EB			WB			NB			SB				
Pedestrian LOS Score / LOS																	
Bicycle LOS Score / LOS																	

HCS Two-Way Stop-Control Report

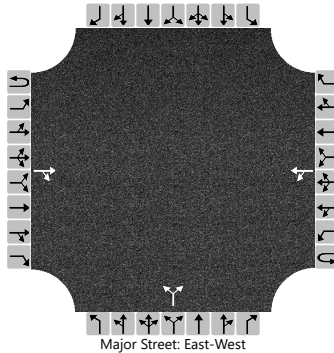
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2047
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.73
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			550	500		238	520			423		197				
Percent Heavy Vehicles (%)						5				5		5				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

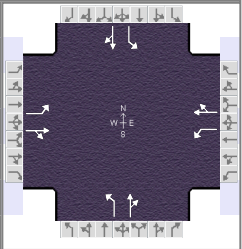
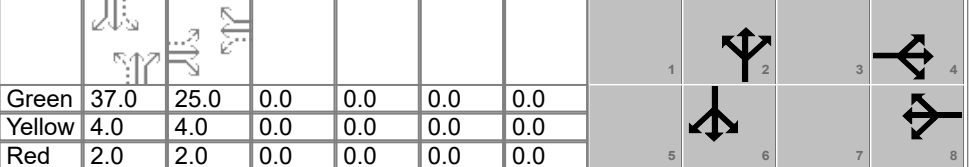
Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.15				6.45		6.25				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.25				3.55		3.35				

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						326					849					
Capacity, c (veh/h)						463					0					
v/c Ratio						0.70										
95% Queue Length, Q ₉₅ (veh)						5.4										
Control Delay (s/veh)						29.3	29.3									
Level of Service (LOS)						D	D									
Approach Delay (s/veh)					29.3											
Approach LOS					D											

HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		TMS Engineers, Inc.				Duration, h		0.250											
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other									
Jurisdiction		Canfield, OH		Time Period		AM Peak		PHF		0.87									
Urban Street		US 62/SR 46		Analysis Year		2047		Analysis Period		1> 7:00									
Intersection		@ Shields Road		File Name		3_PM 47 SR62.xus													
Project Description		Build Conditions																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h				70	210	70	375	197	341	50	340	342	227	270	50				
Signal Information																			
Cycle, s	74.0	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	37.0	25.0	0.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0									
				Red	2.0	2.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						4				8				2				6	
Case Number						6.0				6.0				6.0				6.0	
Phase Duration, s						31.0				31.0				43.0				43.0	
Change Period, (Y+R c), s						6.0				6.0				6.0				6.0	
Max Allow Headway (MAH), s						3.4				3.4				3.5				3.5	
Queue Clearance Time (g s), s						27.0				27.0				34.1				39.0	
Green Extension Time (g e), s						0.0				0.0				2.9				0.0	
Phase Call Probability						1.00				1.00				1.00				1.00	
Max Out Probability						1.00				1.00				0.01				1.00	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate (v), veh/h				80	322		431	618		57	784		261	368					
Adjusted Saturation Flow Rate (s), veh/h/ln				786	1747		1041	1652		998	1688		679	1790					
Queue Service Time (g s), s				0.0	11.1		13.9	25.0		2.8	32.1		4.9	9.6					
Cycle Queue Clearance Time (g c), s				25.0	11.1		25.0	25.0		12.4	32.1		37.0	9.6					
Green Ratio (g/C)				0.34	0.34		0.34	0.34		0.50	0.50		0.50	0.50					
Capacity (c), veh/h				97	590		293	558		467	844		142	895					
Volume-to-Capacity Ratio (X)				0.827	0.545		1.469	1.108		0.123	0.929		1.833	0.411					
Back of Queue (Q), ft/ln (95 th percentile)				114.2	189.8		990.5	735.3		26.8	403.6		848.4	145.9					
Back of Queue (Q), veh/ln (95 th percentile)				4.4	7.3		38.4	28.5		1.0	15.6		32.9	5.7					
Queue Storage Ratio (RQ) (95 th percentile)				0.76	0.00		5.50	0.00		0.15	0.00		4.71	0.00					
Uniform Delay (d 1), s/veh				37.0	19.9		32.3	24.5		15.5	17.3		36.2	11.6					
Incremental Delay (d 2), s/veh				39.8	0.6		228.8	71.0		0.0	2.3		401.0	0.1					
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0					
Control Delay (d), s/veh				76.8	20.5		261.2	95.5		15.6	19.6		437.2	11.8					
Level of Service (LOS)				E	C		F	F		B	B		F	B					
Approach Delay, s/veh / LOS				31.7		C	163.5		F	19.3		B	188.3		F				
Intersection Delay, s/veh / LOS				109.2						F									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

HCS Two-Way Stop-Control Report

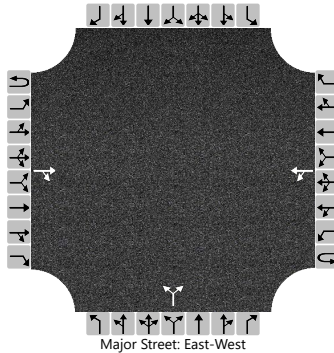
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2047
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	McCune Access Driveway
Peak Hour Factor	0.79
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	0	0
Configuration				TR		LT					LR					
Volume (veh/h)			530	239		112	530			293		105				
Percent Heavy Vehicles (%)						5				5		5				
Proportion Time Blocked																
Percent Grade (%)									0							
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1				7.1		6.2				
Critical Headway (sec)						4.15				6.45		6.25				
Base Follow-Up Headway (sec)						2.2				3.5		3.3				
Follow-Up Headway (sec)						2.25				3.55		3.35				

Delay, Queue Length, and Level of Service

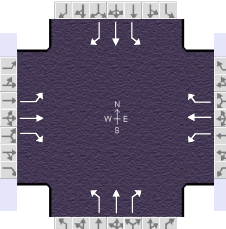
Flow Rate, v (veh/h)						142					504					
Capacity, c (veh/h)						696					77					
v/c Ratio						0.20					6.52					
95% Queue Length, Q ₉₅ (veh)						0.8					56.6					
Control Delay (s/veh)						11.5	3.7				2588.6					
Level of Service (LOS)						B	A				F					
Approach Delay (s/veh)					5.1				2588.6							
Approach LOS					A				F							

Appendix L

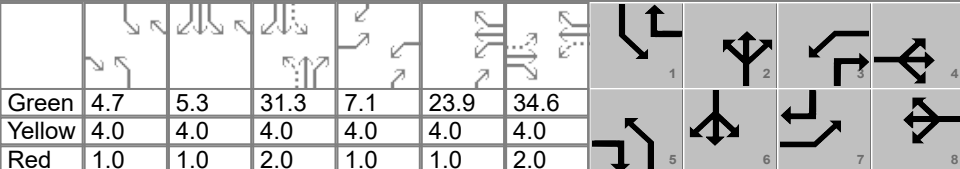
Capacity Analysis Worksheets - 2027 w/ Improvements

HCS Signalized Intersection Results Summary

General Information					Intersection Information					
Agency	TMS Engineers, Inc.					Duration, h	0.250			
Analyst	ABC	Analysis Date	Oct 24, 2022		Area Type	Other				
Jurisdiction	Canfield, OH	Time Period	AM Peak		PHF	0.80				
Urban Street	US 62/SR 46	Analysis Year	2027		Analysis Period	1> 7:00				
Intersection	@ Shields Road	File Name	1_AM 27 SR62 IMP.xus							
Project Description	Build Conditions w/ Imp.									



Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				70	338	50	500	160	293	30	220	347	335	210	40

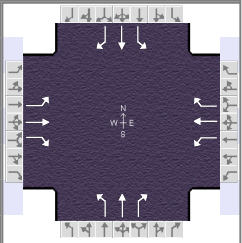
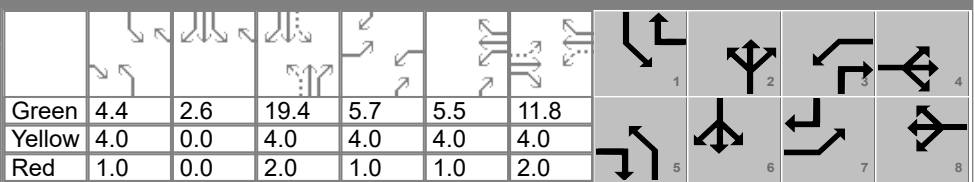
Signal Information																
Cycle, s	138.9	Reference Phase	2	Green	4.7	5.3	31.3	7.1	23.9	34.6						
Offset, s	0	Reference Point	End	Yellow	4.0	4.0	4.0	4.0	4.0	4.0						
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	2.0	1.0	1.0	2.0						
Force Mode	Fixed	Simult. Gap N/S	On													

Timer Results		EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		7	4	3	8	5	2	1	6
Case Number		1.1	3.0	1.1	3.0	1.1	3.0	1.1	3.0
Phase Duration, s		12.1	40.6	41.0	69.4	9.7	37.3	20.0	47.7
Change Period, (Y+R c), s		5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0
Max Allow Headway (MAH), s		3.0	3.1	3.0	3.1	3.0	3.1	3.0	3.1
Queue Clearance Time (g s), s		7.1	33.0	38.0	20.0	4.4	28.6	17.0	18.3
Green Extension Time (g e), s		0.1	0.9	0.0	2.0	0.1	2.0	0.0	2.0
Phase Call Probability		0.97	1.00	1.00	1.00	0.77	1.00	1.00	1.00
Max Out Probability		0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00

Movement Group Results		EB			WB			NB			SB			
Approach Movement		L	T	R	L	T	R	L	T	R	L	T	R	
Assigned Movement		7	4	14	3	8	18	5	2	12	1	6	16	
Adjusted Flow Rate (v), veh/h		88	423	63	625	200	366	38	275	434	419	263	50	
Adjusted Saturation Flow Rate (s), veh/h/ln		1767	1856	1610	1753	1841	1610	1682	1767	1610	1753	1841	1610	
Queue Service Time (g s), s		5.1	31.0	4.1	36.0	9.3	18.0	2.4	20.0	26.6	15.0	16.3	2.9	
Cycle Queue Clearance Time (g c), s		5.1	31.0	4.1	36.0	9.3	18.0	2.4	20.0	26.6	15.0	16.3	2.9	
Green Ratio (g/C)		0.30	0.25	0.28	0.53	0.46	0.56	0.26	0.23	0.48	0.35	0.30	0.35	
Capacity (c), veh/h		437	465	458	533	839	906	298	404	781	342	556	569	
Volume-to-Capacity Ratio (X)		0.200	0.908	0.136	1.173	0.238	0.404	0.126	0.681	0.555	1.225	0.472	0.088	
Back of Queue (Q), ft/ln (95 th percentile)		100.6	527.4	71.3	1178.6	184	263.9	46.8	363.4	374.8	651.8	301.6	50.3	
Back of Queue (Q), veh/ln (95 th percentile)		3.9	20.6	2.9	45.7	7.1	10.6	1.7	13.6	15.0	25.3	11.7	2.0	
Queue Storage Ratio (RQ) (95 th percentile)		0.67	0.00	0.00	6.55	0.00	0.00	0.26	0.00	0.00	3.62	0.00	0.00	
Uniform Delay (d 1), s/veh		35.9	51.0	37.3	38.7	23.3	17.3	39.2	49.4	25.4	45.3	39.9	30.3	
Incremental Delay (d 2), s/veh		0.1	2.9	0.0	96.3	0.1	0.1	0.1	0.8	0.2	124.5	0.2	0.0	
Initial Queue Delay (d 3), s/veh		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (d), s/veh		36.0	53.8	37.4	135.0	23.3	17.4	39.3	50.2	25.7	169.8	40.1	30.3	
Level of Service (LOS)		D	D	D	F	C	B	D	D	C	F	D	C	
Approach Delay, s/veh / LOS		49.3	D		80.1	F		35.4	D		113.7	F		
Intersection Delay, s/veh / LOS		72.0							E					

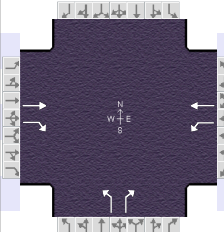
Multimodal Results		EB		WB		NB		SB	
Pedestrian LOS Score / LOS									
Bicycle LOS Score / LOS									

HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency	TMS Engineers, Inc.					Duration, h		0.250											
Analyst	ABC		Analysis Date	Oct 24, 2022		Area Type		Other											
Jurisdiction	Canfield, OH		Time Period	AM Peak		PHF		0.87											
Urban Street	US 62/SR 46		Analysis Year	2027		Analysis Period		1> 7:00											
Intersection	@ Shields Road		File Name	3_PM 27 SR62 IMP.xus															
Project Description	Build Conditions w/ Imp.																		
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h				70	200	70	345	177	321	40	310	312	217	240	50				
Signal Information																			
Cycle, s	76.4	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	4.4	2.6	19.4	5.7	5.5	11.8									
				Yellow	4.0	0.0	4.0	4.0	4.0	4.0									
				Red	1.0	0.0	2.0	1.0	1.0	2.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase				7		4		3		8		5		2		1		6	
Case Number				1.1		3.0		1.1		3.0		1.1		3.0		1.1		3.0	
Phase Duration, s				10.7		17.8		21.2		28.2		9.4		25.4		12.0		28.1	
Change Period, (Y+R c), s				5.0		6.0		5.0		6.0		5.0		6.0		5.0		6.0	
Max Allow Headway (MAH), s				3.0		3.1		3.0		3.1		3.0		3.1		3.0		3.1	
Queue Clearance Time (g s), s				4.9		11.3		15.6		16.0		3.4		15.7		9.0		11.6	
Green Extension Time (g e), s				0.0		0.5		0.6		0.0		0.0		1.3		0.0		1.6	
Phase Call Probability				0.82		1.00		1.00		1.00		0.62		1.00		0.99		1.00	
Max Out Probability				1.00		0.11		0.00		1.00		0.37		0.03		1.00		0.16	
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16				
Adjusted Flow Rate (v), veh/h				80	230	80	397	203	369	46	356	359	249	276	57				
Adjusted Saturation Flow Rate (s), veh/h/ln				1739	1826	1610	1753	1841	1610	1753	1841	1610	1753	1841	1610				
Queue Service Time (g s), s				2.9	9.3	3.2	13.6	6.7	14.0	1.4	13.7	11.7	7.0	9.6	1.8				
Cycle Queue Clearance Time (g c), s				2.9	9.3	3.2	13.6	6.7	14.0	1.4	13.7	11.7	7.0	9.6	1.8				
Green Ratio (g/C)				0.23	0.15	0.21	0.39	0.29	0.38	0.31	0.25	0.47	0.35	0.29	0.36				
Capacity (c), veh/h				402	282	340	503	536	616	343	468	751	331	532	586				
Volume-to-Capacity Ratio (X)				0.200	0.816	0.236	0.789	0.380	0.599	0.134	0.761	0.478	0.754	0.519	0.098				
Back of Queue (Q), ft/ln (95 th percentile)				50.9	185.3	50.6	222.6	123.2	208.5	24.4	243.9	163	174.9	176.9	26.8				
Back of Queue (Q), veh/ln (95 th percentile)				2.0	7.1	2.0	8.6	4.8	8.3	0.9	9.5	6.5	6.8	6.9	1.1				
Queue Storage Ratio (RQ) (95 th percentile)				0.34	0.00	0.00	1.24	0.00	0.00	0.14	0.00	0.00	0.97	0.00	0.00				
Uniform Delay (d 1), s/veh				23.8	31.3	25.0	19.4	21.6	18.9	19.1	26.3	14.0	22.6	22.7	16.0				
Incremental Delay (d 2), s/veh				0.1	2.2	0.1	1.4	0.2	1.1	0.1	1.2	0.2	8.5	0.4	0.0				
Initial Queue Delay (d 3), s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0				
Control Delay (d), s/veh				23.9	33.5	25.1	20.7	21.8	20.0	19.2	27.5	14.2	31.1	23.1	16.1				
Level of Service (LOS)				C	C	C	C	C	C	B	C	B	C	C	B				
Approach Delay, s/veh / LOS				29.8		C		20.7		C		20.7		C		25.8		C	
Intersection Delay, s/veh / LOS				23.1									C						
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

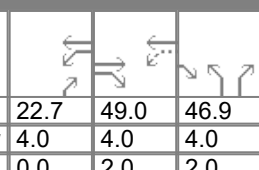
HCS Signalized Intersection Results Summary

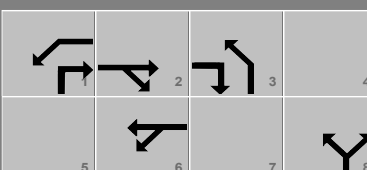
General Information						Intersection Information					
Agency	TMS Engineers, Inc.					Duration, h	0.250				
Analyst	ABC		Analysis Date	Oct 24, 2022		Area Type	Other				
Jurisdiction	Canfield, Ohio		Time Period	AM Peak		PHF	0.73				
Urban Street	Shields Road (US 62)		Analysis Year	2027		Analysis Period	1> 7:00				
Intersection	@ Site Access (McCune)		File Name	2_AM 27 McCune IMP.xus							
Project Description	Build Conditions - IMP										



Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h					490	500	238	470		423		197			

Signal Information														
Cycle, s	134.7	Reference Phase	2											
Offset, s	0	Reference Point	End											
Uncoordinated	Yes	Simult. Gap E/W	On	Green	22.7	49.0	46.9	0.0	0.0	0.0				
				Yellow	4.0	4.0	4.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On	Red	0.0	2.0	2.0	0.0	0.0	0.0				



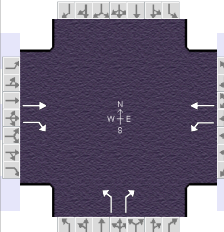
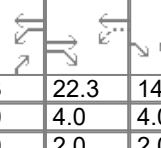
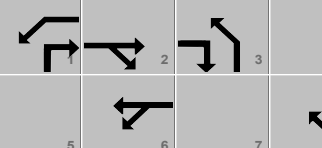


Timer Results		EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase			2	1	6		8		
Case Number			7.3	1.0	4.0		9.0		
Phase Duration, s			55.0	26.7	81.7		52.9		
Change Period, (Y+R c), s			6.0	4.0	6.0		6.0		
Max Allow Headway (MAH), s			3.0	3.0	3.0		3.1		
Queue Clearance Time (g s), s			51.0	22.7	34.1		45.9		
Green Extension Time (g e), s			0.0	0.0	0.0		1.0		
Phase Call Probability			1.00	1.00	1.00		1.00		
Max Out Probability			1.00	1.00	1.00		0.45		

Movement Group Results		EB			WB			NB			SB		
Approach Movement		L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement			2	12	1	6		3		18			
Adjusted Flow Rate (v), veh/h			671	685	326	644		579		270			
Adjusted Saturation Flow Rate (s), veh/h/ln			1826	1547	1739	1826		1739		1547			
Queue Service Time (g s), s			49.0	30.8	20.7	32.1		43.9		13.7			
Cycle Queue Clearance Time (g c), s			49.0	30.8	20.7	32.1		43.9		13.7			
Green Ratio (g/C)			0.36	0.71	0.55	0.56		0.35		0.52			
Capacity (c), veh/h			664	1102	347	1027		606		800			
Volume-to-Capacity Ratio (X)			1.010	0.621	0.939	0.627		0.957		0.337			
Back of Queue (Q), ft/ln (95 th percentile)			962.2	365.4	513	491.6		771.8		216.6			
Back of Queue (Q), veh/ln (95 th percentile)			37.0	14.1	19.7	18.9		29.7		8.3			
Queue Storage Ratio (RQ) (95 th percentile)			0.00	0.00	0.00	0.00		0.00		0.00			
Uniform Delay (d 1), s/veh			42.8	10.0	43.4	19.9		42.9		19.0			
Incremental Delay (d 2), s/veh			37.5	0.8	32.0	0.9		23.3		0.1			
Initial Queue Delay (d 3), s/veh			0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (d), s/veh			80.3	10.8	75.5	20.8		66.2		19.1			
Level of Service (LOS)			F	B	E	C		E		B			
Approach Delay, s/veh / LOS		45.2	D		39.2	D		51.2	D		0.0		
Intersection Delay, s/veh / LOS		45.0						D					

Multimodal Results		EB		WB		NB		SB	
Pedestrian LOS Score / LOS									
Bicycle LOS Score / LOS									

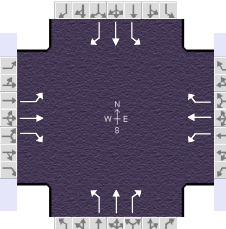
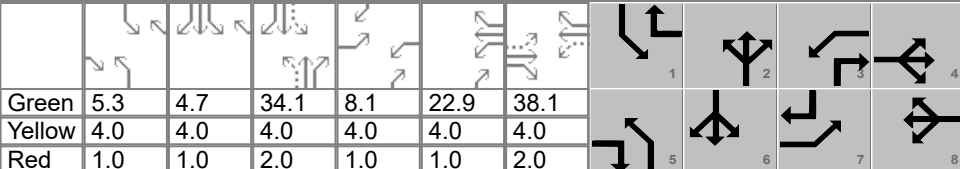
HCS Signalized Intersection Results Summary

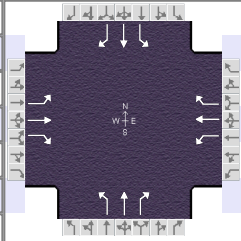
General Information						Intersection Information													
Agency		TMS Engineers, Inc.				Duration, h		0.250											
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other									
Jurisdiction		Canfield, Ohio		Time Period		PM Peak		PHF		0.79									
Urban Street		Shields Road (US 62)		Analysis Year		2027		Analysis Period		1> 7:00									
Intersection		@ Site Access (McCune)		File Name		4_PM 27 McCune IMP.xus													
Project Description		Build Conditions - IMP																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h					480	239	112	480		293		105							
Signal Information																			
Cycle, s	59.6	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	6.3	22.3	14.9	0.0	0.0	0.0									
				Yellow	4.0	4.0	4.0	0.0	0.0	0.0									
				Red	0.0	2.0	2.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						2		1		6				8					
Case Number						7.3		1.0		4.0				9.0					
Phase Duration, s						28.3		10.3		38.7				20.9					
Change Period, (Y+R c), s						6.0		4.0		6.0				6.0					
Max Allow Headway (MAH), s						3.0		3.0		3.0				3.1					
Queue Clearance Time (g s), s						20.6		4.6		15.4				14.1					
Green Extension Time (g e), s						1.7		0.0		1.7				0.8					
Phase Call Probability						1.00		0.90		1.00				1.00					
Max Out Probability						0.08		1.00		0.71				0.00					
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement					2	12	1	6		3		18							
Adjusted Flow Rate (v), veh/h					608	303	142	608		371		133							
Adjusted Saturation Flow Rate (s), veh/h/ln					1826	1547	1739	1826		1739		1547							
Queue Service Time (g s), s					18.6	5.4	2.6	13.4		12.1		3.6							
Cycle Queue Clearance Time (g c), s					18.6	5.4	2.6	13.4		12.1		3.6							
Green Ratio (g/C)					0.37	0.63	0.51	0.55		0.25		0.36							
Capacity (c), veh/h					684	968	355	1000		436		553							
Volume-to-Capacity Ratio (X)					0.888	0.313	0.399	0.607		0.850		0.241							
Back of Queue (Q), ft/ln (95 th percentile)					292.9	46.9	33.5	176.7		203.3		48.5							
Back of Queue (Q), veh/ln (95 th percentile)					11.3	1.8	1.3	6.8		7.8		1.9							
Queue Storage Ratio (RQ) (95 th percentile)					0.00	0.00	0.00	0.00		0.00		0.00							
Uniform Delay (d 1), s/veh					17.5	5.2	12.0	9.1		21.3		13.5							
Incremental Delay (d 2), s/veh					3.9	0.1	0.3	0.8		1.8		0.1							
Initial Queue Delay (d 3), s/veh					0.0	0.0	0.0	0.0		0.0		0.0							
Control Delay (d), s/veh					21.4	5.3	12.2	9.9		23.1		13.6							
Level of Service (LOS)					C	A	B	A		C		B							
Approach Delay, s/veh / LOS				16.1		B		10.3		B		20.6		C		0.0			
Intersection Delay, s/veh / LOS				15.1										B					
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

Appendix M

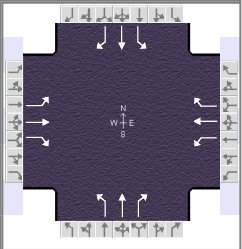
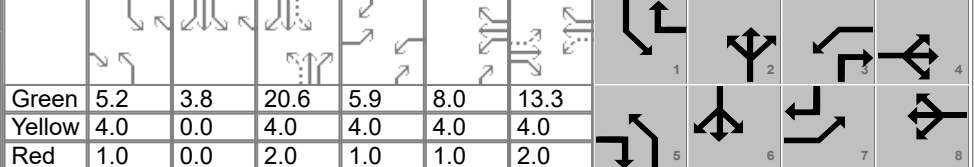
Capacity Analysis Worksheets - 2047 w/ Improvements

HCS Signalized Intersection Results Summary

General Information					Intersection Information										
Agency	TMS Engineers, Inc.					Duration, h	0.250								
Analyst	ABC	Analysis Date	Oct 24, 2022		Area Type	Other									
Jurisdiction	Canfield, OH	Time Period	AM Peak		PHF	0.80									
Urban Street	US 62/SR 46	Analysis Year	2047		Analysis Period	1> 7:00									
Intersection	@ Shields Road	File Name	1_AM 47 SR62 IMP.xus												
Project Description	Build Conditions w/ Imp.														
															
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				80	358	60	530	170	313	40	240	357	355	240	40
Signal Information															
Cycle, s	145.2	Reference Phase	2	Green	5.3	4.7	34.1	8.1	22.9	38.1					
Offset, s	0	Reference Point	End	Yellow	4.0	4.0	4.0	4.0	4.0	4.0					
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	2.0	1.0	1.0	2.0					
Force Mode	Fixed	Simult. Gap N/S	On												
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase				7	4	3	8	5	2	1	6				
Case Number				1.1	3.0	1.1	3.0	1.1	3.0	1.1	3.0				
Phase Duration, s				13.1	44.1	41.0	71.9	10.3	40.1	20.0	49.8				
Change Period, (Y+R c), s				5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0				
Max Allow Headway (MAH), s				3.0	3.1	3.0	3.1	3.0	3.1	3.0	3.1				
Queue Clearance Time (g s), s				8.0	36.3	38.0	22.9	5.3	31.1	17.0	21.9				
Green Extension Time (g e), s				0.2	1.0	0.0	2.2	0.1	2.2	0.0	2.2				
Phase Call Probability				0.98	1.00	1.00	1.00	0.87	1.00	1.00	1.00				
Max Out Probability				0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00				
Movement Group Results				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h				100	448	75	663	213	391	50	300	446	444	300	50
Adjusted Saturation Flow Rate (s), veh/h/ln				1767	1856	1610	1753	1841	1610	1682	1767	1610	1753	1841	1610
Queue Service Time (g s), s				6.0	34.3	5.0	36.0	10.5	20.9	3.3	22.9	29.1	15.0	19.9	3.0
Cycle Queue Clearance Time (g c), s				6.0	34.3	5.0	36.0	10.5	20.9	3.3	22.9	29.1	15.0	19.9	3.0
Green Ratio (g/C)				0.32	0.26	0.30	0.53	0.45	0.56	0.28	0.23	0.48	0.36	0.30	0.36
Capacity (c), veh/h				456	491	485	511	835	895	276	420	778	324	559	580
Volume-to-Capacity Ratio (X)				0.219	0.911	0.155	1.297	0.255	0.437	0.181	0.714	0.574	1.368	0.536	0.086
Back of Queue (Q), ft/ln (95 th percentile)				118.2	576.6	88.5	1469.9	206.4	301.5	65	408.3	406.6	838.5	357.3	52.4
Back of Queue (Q), veh/ln (95 th percentile)				4.6	22.5	3.5	57.0	8.0	12.1	2.4	15.2	16.3	32.5	13.8	2.1
Queue Storage Ratio (RQ) (95 th percentile)				0.79	0.00	0.00	8.17	0.00	0.00	0.36	0.00	0.00	4.66	0.00	0.00
Uniform Delay (d 1), s/veh				35.9	52.3	37.6	41.3	24.8	19.1	40.3	51.4	27.1	46.9	42.5	31.0
Incremental Delay (d 2), s/veh				0.1	2.8	0.1	147.7	0.1	0.1	0.1	0.9	0.2	184.1	0.3	0.0
Initial Queue Delay (d 3), s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh				36.0	55.1	37.7	189.1	24.8	19.3	40.4	52.2	27.4	231.0	42.8	31.0
Level of Service (LOS)				D	E	D	F	C	B	D	D	C	F	D	C
Approach Delay, s/veh / LOS				49.9	D		109.0	F		37.5	D		147.2	F	
Intersection Delay, s/veh / LOS				90.8						F					
Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS															
Bicycle LOS Score / LOS															

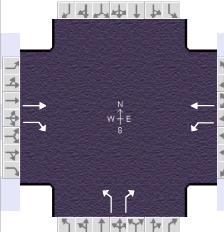


HCS Signalized Intersection Results Summary

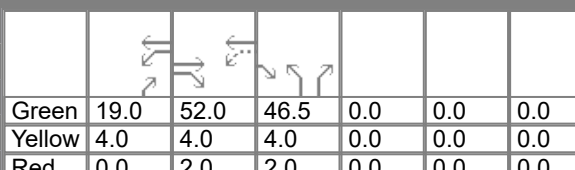
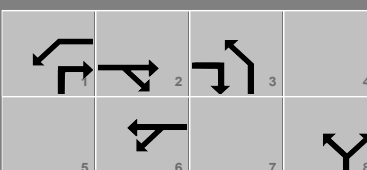
General Information						Intersection Information									
Agency		TMS Engineers, Inc.				Duration, h		0.250							
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other					
Jurisdiction		Canfield, OH		Time Period		AM Peak		PHF		0.87					
Urban Street		US 62/SR 46		Analysis Year		2047		Analysis Period		1> 7:00					
Intersection		@ Shields Road		File Name		3_PM 47 SR62 IMP.xus									
Project Description		Build Conditions w/ Imp.													
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				70	210	70	375	197	341	50	340	342	227	270	50
Signal Information															
Cycle, s	83.8	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On												
Force Mode	Fixed	Simult. Gap N/S	On												
Green	5.2	3.8	20.6	5.9	8.0	13.3									
Yellow	4.0	0.0	4.0	4.0	4.0	4.0									
Red	1.0	0.0	2.0	1.0	1.0	2.0									
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase				7	4	3	8	5	2	1	6				
Case Number				1.1	3.0	1.1	3.0	1.1	3.0	1.1	3.0				
Phase Duration, s				10.9	19.3	24.0	32.3	10.2	26.6	14.0	30.4				
Change Period, (Y+R c), s				5.0	6.0	5.0	6.0	5.0	6.0	5.0	6.0				
Max Allow Headway (MAH), s				3.0	3.1	3.0	3.1	3.0	3.1	3.0	3.1				
Queue Clearance Time (g s), s				5.1	12.8	18.2	17.6	4.0	19.1	11.0	14.1				
Green Extension Time (g e), s				0.0	0.5	0.8	0.0	0.0	1.5	0.0	1.5				
Phase Call Probability				0.85	1.00	1.00	1.00	0.74	1.00	1.00	1.00				
Max Out Probability				1.00	0.07	0.00	1.00	0.98	0.01	1.00	0.41				
Movement Group Results				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement				7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h				80	241	80	431	226	392	57	391	393	261	310	57
Adjusted Saturation Flow Rate (s), veh/h/ln				1739	1826	1610	1753	1841	1610	1753	1841	1610	1753	1841	1610
Queue Service Time (g s), s				3.1	10.8	3.4	16.2	8.1	15.6	2.0	17.1	14.3	9.0	12.1	2.0
Cycle Queue Clearance Time (g c), s				3.1	10.8	3.4	16.2	8.1	15.6	2.0	17.1	14.3	9.0	12.1	2.0
Green Ratio (g/C)				0.23	0.16	0.22	0.41	0.31	0.42	0.31	0.25	0.47	0.36	0.29	0.36
Capacity (c), veh/h				388	290	355	517	578	679	324	452	760	315	536	583
Volume-to-Capacity Ratio (X)				0.208	0.833	0.227	0.834	0.392	0.578	0.177	0.865	0.517	0.828	0.579	0.099
Back of Queue (Q), ft/ln (95 th percentile)				57.2	212.9	56.1	259	149.9	226.3	35	299.5	202.5	217.1	223	30.5
Back of Queue (Q), veh/ln (95 th percentile)				2.2	8.2	2.2	10.0	5.8	9.1	1.4	11.6	8.1	8.4	8.6	1.2
Queue Storage Ratio (RQ) (95 th percentile)				0.38	0.00	0.00	1.44	0.00	0.00	0.19	0.00	0.00	1.21	0.00	0.00
Uniform Delay (d 1), s/veh				26.1	34.2	26.8	20.7	22.5	18.6	21.5	30.3	15.5	23.0	25.4	17.7
Incremental Delay (d 2), s/veh				0.1	2.4	0.1	1.4	0.2	0.8	0.1	2.0	0.2	15.6	1.0	0.0
Initial Queue Delay (d 3), s/veh				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (d), s/veh				26.2	36.6	27.0	22.1	22.7	19.4	21.6	32.3	15.7	38.6	26.4	17.7
Level of Service (LOS)				C	D	C	C	C	B	C	C	B	D	C	B
Approach Delay, s/veh / LOS				32.6	C		21.2	C		23.8	C		30.7	C	
Intersection Delay, s/veh / LOS				25.6						C					
Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS															
Bicycle LOS Score / LOS															

HCS Signalized Intersection Results Summary

General Information						Intersection Information					
Agency	TMS Engineers, Inc.					Duration, h	0.250				
Analyst	ABC		Analysis Date	Oct 24, 2022		Area Type	Other				
Jurisdiction	Canfield, Ohio		Time Period	AM Peak		PHF	0.73				
Urban Street	Shields Road (US 62)		Analysis Year	2047		Analysis Period	1> 7:00				
Intersection	@ Site Access (McCune)		File Name	2_AM 47 McCune IMP.xus							
Project Description	Build Conditions - IMP										



Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h					550	500	238	520		423		197			

Signal Information						
Cycle, s	133.5	Reference Phase	2			
Offset, s	0	Reference Point	End			
Uncoordinated	Yes	Simult. Gap E/W	On			
Force Mode	Fixed	Simult. Gap N/S	On			
Green	19.0	52.0	46.5	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	0.0	2.0	2.0	0.0	0.0	0.0

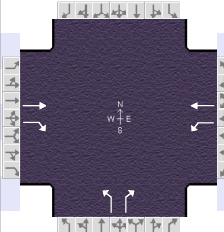
Timer Results		EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase			2	1	6		8		
Case Number			7.3	1.0	4.0		9.0		
Phase Duration, s			58.0	23.0	81.0		52.5		
Change Period, (Y+R c), s			6.0	4.0	6.0		6.0		
Max Allow Headway (MAH), s			3.0	3.0	3.0		3.1		
Queue Clearance Time (g s), s			54.0	21.0	39.4		45.5		
Green Extension Time (g e), s			0.0	0.0	5.5		1.0		
Phase Call Probability			1.00	1.00	1.00		1.00		
Max Out Probability			1.00	1.00	0.00		0.57		

Movement Group Results		EB			WB			NB			SB		
Approach Movement		L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement			2	12	1	6		3		18			
Adjusted Flow Rate (v), veh/h			753	685	326	712		579		270			
Adjusted Saturation Flow Rate (s), veh/h/ln			1826	1547	1739	1826		1739		1547			
Queue Service Time (g s), s			52.0	27.8	19.0	37.4		43.5		14.4			
Cycle Queue Clearance Time (g c), s			52.0	27.8	19.0	37.4		43.5		14.4			
Green Ratio (g/C)			0.39	0.74	0.55	0.56		0.35		0.49			
Capacity (c), veh/h			711	1142	302	1026		605		759			
Volume-to-Capacity Ratio (X)			1.059	0.600	1.081	0.694		0.957		0.356			
Back of Queue (Q), ft/ln (95 th percentile)			1124.8	320.9	613.9	552.1		769.2		226.3			
Back of Queue (Q), veh/ln (95 th percentile)			43.3	12.3	23.6	21.2		29.6		8.7			
Queue Storage Ratio (RQ) (95 th percentile)			0.00	0.00	0.00	0.00		0.00		0.00			
Uniform Delay (d 1), s/veh			40.7	8.2	44.7	21.0		42.5		21.0			
Incremental Delay (d 2), s/veh			50.5	0.6	75.1	0.4		23.7		0.1			
Initial Queue Delay (d 3), s/veh			0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (d), s/veh			91.2	8.9	119.8	21.3		66.3		21.1			
Level of Service (LOS)			F	A	F	C		E		C			
Approach Delay, s/veh / LOS		52.0	D		52.3	D		51.9	D		0.0		
Intersection Delay, s/veh / LOS		52.1						D					

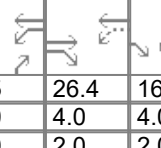
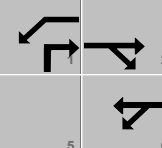
Multimodal Results		EB		WB		NB		SB	
Pedestrian LOS Score / LOS									
Bicycle LOS Score / LOS									

HCS Signalized Intersection Results Summary

General Information						Intersection Information					
Agency	TMS Engineers, Inc.					Duration, h	0.250				
Analyst	ABC		Analysis Date	Oct 24, 2022		Area Type	Other				
Jurisdiction	Canfield, Ohio		Time Period	PM Peak		PHF	0.79				
Urban Street	Shields Road (US 62)		Analysis Year	2047		Analysis Period	1> 7:00				
Intersection	@ Site Access (McCune)		File Name	4_PM 47 McCune IMP.xus							
Project Description	Build Conditions - IMP										



Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h					530	239	112	530		293		105			

Signal Information																	
Cycle, s	65.0	Reference Phase	2	Green	6.5	26.4	16.1	0.0	0.0	0.0							
Offset, s	0	Reference Point	End	Yellow	4.0	4.0	4.0	0.0	0.0	0.0							
Uncoordinated	Yes	Simult. Gap E/W	On	Red	0.0	2.0	2.0	0.0	0.0	0.0							
Force Mode	Fixed	Simult. Gap N/S	On														

Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase					2	1	6		8		
Case Number					7.3	1.0	4.0		9.0		
Phase Duration, s					32.4	10.5	42.9		22.1		
Change Period, (Y+R c), s					6.0	4.0	6.0		6.0		
Max Allow Headway (MAH), s					3.0	3.0	3.0		3.1		
Queue Clearance Time (g s), s					24.4	4.7	18.3		15.3		
Green Extension Time (g e), s					1.9	0.0	0.8		0.8		
Phase Call Probability					1.00	0.92	1.00		1.00		
Max Out Probability					0.06	1.00	1.00		0.00		

Movement Group Results				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement					2	12	1	6		3		18			
Adjusted Flow Rate (v), veh/h					671	303	142	671		371		133			
Adjusted Saturation Flow Rate (s), veh/h/ln					1826	1547	1739	1826		1739		1547			
Queue Service Time (g s), s					22.4	5.5	2.7	16.3		13.3		4.0			
Cycle Queue Clearance Time (g c), s					22.4	5.5	2.7	16.3		13.3		4.0			
Green Ratio (g/C)					0.41	0.65	0.54	0.57		0.25		0.35			
Capacity (c), veh/h					742	1013	330	1036		432		538			
Volume-to-Capacity Ratio (X)					0.904	0.299	0.430	0.648		0.859		0.247			
Back of Queue (Q), ft/ln (95 th percentile)					345	47.6	35.9	219.3		224.2		56.3			
Back of Queue (Q), veh/ln (95 th percentile)					13.3	1.8	1.4	8.4		8.6		2.2			
Queue Storage Ratio (RQ) (95 th percentile)					0.00	0.00	0.00	0.00		0.00		0.00			
Uniform Delay (d 1), s/veh					18.1	4.8	13.2	9.6		23.4		15.1			
Incremental Delay (d 2), s/veh					4.3	0.1	0.3	1.1		2.0		0.1			
Initial Queue Delay (d 3), s/veh					0.0	0.0	0.0	0.0		0.0		0.0			
Control Delay (d), s/veh					22.4	4.9	13.5	10.7		25.4		15.2			
Level of Service (LOS)					C	A	B	B		C		B			
Approach Delay, s/veh / LOS				17.0	B		11.2	B		22.7	C		0.0		
Intersection Delay, s/veh / LOS				16.2						B					

Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS															
Bicycle LOS Score / LOS															

Appendix N

Traffic Signal Warrant Analysis Worksheets

SHIELDS ROAD (US 62) - EXISTING NO-BUILD VOLUMES

TIME BEGINS	2022 EXISTING		FACTOR: 1.027 2027 NO-BUILD		FACTOR: 1.135 2047 NO-BUILD	
	EB THRU	WB THRU	EB THRU	WB THRU	EB THRU	WB THRU
7:00	408	456	419	468	463	517
8:00	375	306	385	314	425	347
9:00	258	205	265	211	293	233
11:00	254	239	261	245	288	271
12:00	280	276	288	283	318	313
2:00	418	399	429	410	474	453
3:00	362	382	372	392	411	433
4:00	442	440	454	452	501	499
5:00	395	452	406	464	448	513
AM PEAK	432	414	444	425	490	470
PM PEAK	422	422	433	433	479	479

ELEMENTARY SCHOOL VOLUMES

TIME BEGINS	ADT: 1079 Vehicles/Day Entering		1079 Vehicles/Day Exiting		SHIELDS ROAD (US 62)		SITE ACCESS DRIVEWAY	
	ENTERING	EXITING	ENTERING	EXITING	EASTBOUND RIGHT	WESTBOUND LEFT	NORTHBOUND LEFT	NORTHBOUND RIGHT
	%	VOLUME	%	VOLUME	%	VOLUME	%	VOLUME
7:00	35.7%	385	26.3%	284	68%	262	69%	196
8:00	11.6%	125	14.4%	155	68%	85	69%	107
9:00	2.1%	23	2.0%	22	68%	15	69%	15
11:00	2.5%	27	2.8%	30	69%	19	71%	21
12:00	2.7%	29	2.2%	24	69%	20	73%	17
2:00	14.7%	159	16.0%	173	69%	109	73%	126
3:00	8.5%	92	12.1%	131	69%	63	73%	95
4:00	7.0%	76	9.4%	101	69%	52	73%	74
5:00	4.9%	53	5.6%	60	69%	36	73%	44
AM PEAK		385		328		263		225
PM PEAK		197		231		137		168

MIDDLE SCHOOL VOLUMES

TIME BEGINS	ADT: 836 Vehicles/Day Entering		836 Vehicles/Day Exiting		SHIELDS ROAD (US 62)		SITE ACCESS DRIVEWAY	
	ENTERING	EXITING	ENTERING	EXITING	EASTBOUND RIGHT	WESTBOUND LEFT	NORTHBOUND LEFT	NORTHBOUND RIGHT
	%	VOLUME	%	VOLUME	%	VOLUME	%	VOLUME
7:00	33.4%	279	24.0%	201	68%	190	69%	138
8:00	11.5%	96	12.7%	106	68%	65	69%	73
9:00	1.4%	12	1.4%	12	68%	8	69%	8
11:00	1.4%	12	1.3%	11	69%	8	71%	8
12:00	1.5%	13	1.4%	12	69%	9	73%	9
2:00	8.3%	69	4.1%	34	69%	48	73%	25
3:00	10.1%	84	17.5%	146	69%	58	73%	107
4:00	6.0%	50	5.8%	48	69%	35	73%	35
5:00	7.7%	64	7.4%	62	69%	44	73%	45
AM PEAK		333		272		227		188
PM PEAK		134		157		92		115

2027 BUILD VOLUMES - SHIELDS ROAD & McCUNE/SITE ACCESS DRIVEWAY

TIME BEGINS	EASTBOUND			WESTBOUND			NORTHBOUND			2027 BUILD	
	THRU	RIGHT	TOTAL	LEFT	THRU	TOTAL	LEFT	RIGHT	FACTORED RIGHT	TOTAL	MAJOR MINOR
7:00	419	452	871	213	468	681	334	150	45	379	1552 379
8:00	385	150	536	71	314	385	180	81	20	200	921 200
9:00	265	23	288	11	211	222	23	10	3	26	510 26
11:00	261	27	288	12	245	257	29	12	3	32	545 32
12:00	288	29	316	13	283	296	26	10	3	29	613 29
2:00	429	157	587	71	410	480	151	60	18	169	1067 169
3:00	372	122	493	55	392	447	202	75	19	221	940 221
4:00	454	87	541	39	452	491	109	40	12	121	1031 121
5:00	406	81	487	36	464	501	89	33	10	99	987 99
AM PEAK	444	490	934	228	425	653	413	187	56	469	1587 469
PM PEAK	433	229	662	102	433	535	283	105	32	315	1198 315

2047 BUILD VOLUMES - SHIELDS ROAD & McCUNE/SITE ACCESS DRIVEWAY

TIME BEGINS	EASTBOUND			WESTBOUND			NORTHBOUND			2027 BUILD	
	THRU	RIGHT	TOTAL	LEFT	THRU	TOTAL	LEFT	RIGHT	FACTORED RIGHT	TOTAL	MAJOR MINOR
7:00	463	452	915	213	517	730	334	150	45	379	1645 379
8:00	425	150	576	71	347	418	180	81	20	200	994 200
9:00	293	23	316	11	233	244	23	10	3	26	560 26
11:00	288	27	315	12	271	283	29	12	3	32	598 32
12:00	318	29	346	13	313	326	26	10	3	29	672 29
2:00	474	157	632	71	453	523	151	60	18	169	1155 169
3:00	411	122	532	55	433	488	202	75	19	221	1020 221
4:00	501	87	588	39	499	538	109	40	12	121	1126 121
5:00	448	81	529	36	513	549	89	33	10	99	1078 99
AM PEAK	490	490	980	228	470	698	413	187	56	469	1678 469
PM PEAK	479	229	708	102	479	581	283	105	32	315	1289 315

RIGHT TURN FACTORIZATION SHEET

Intersection: SHIELDS & ACCESS DRIVEWAY
Municipality: CANFIELD, OHIO

Conditions: 2027 BUILD
County: MAHONING

DIR	HOUR BEGIN	MINOR STREET NB 3				MAINLINE APPROACH VOLUME PER LANE	BASE RIGHT TURN REDUCTION %	MAINLINE CONGESTION FACTOR %	ADJUSTED RIGHT TURN REDUCTION %	ADJUSTED RIGHT TURNS	ADJUSTED MINOR STREET VOLUMES	TOTAL														BASE REDUCTION
		VOLUMES										THRU T	RIGHT R	TOTAL A	0.7A	0.35A	3T	T/3	(T+L)	(T+R)	3R	3L	T/2	T/4		
		LEFT	THRU	RIGHT	TOTAL																					
					0	75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	7:00	334	0	150	484	419	75%	5%	70%	45	379	334	0	150	484	339	169	0	334	150	450	1002	0	0	0	75%
	8:00	160	0	81	261	385	75%	0%	75%	20	200	180	0	81	261	183	91	0	180	81	243	540	0	0	0	75%
	9:00	23	0	10	33	265	75%	0%	75%	3	26	23	0	10	33	23	12	0	23	10	30	69	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%
	11:00	29	0	12	41	261	75%	0%	75%	3	32	29	0	12	41	29	14	0	29	12	36	87	0	0	0	75%
	12:00	26	0	10	36	288	75%	0%	75%	3	29	26	0	10	36	25	13	0	26	10	30	78	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%
	2:00	151	0	60	211	429	75%	5%	70%	18	169	151	0	60	211	148	74	0	151	60	180	453	0	0	0	75%
	3:00	202	0	75	277	372	75%	0%	75%	19	221	202	0	75	277	194	97	0	202	75	225	606	0	0	0	75%
	4:00	109	0	40	149	454	75%	5%	70%	12	121	109	0	40	149	104	52	0	109	40	120	327	0	0	0	75%
	5:00	89	0	33	122	406	75%	5%	70%	10	99	89	0	33	122	85	43	0	89	33	99	267	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%
	AM PEAK	413		187	600	444	75%	5%	70%	56	469	413	0	187	600	420	210	0	413	187	561	1239	0	0	0	75%
	PM PEAK	283		105	388	433	75%	5%	70%	32	315	283	0	105	388	272	136	0	283	105	315	849	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%

Mainline Congestion Factors	
Volume	Factor (%)
0-399	0%
400-499	5%
500-599	10%
600-699	15%
700-799	20%
800-899	25%
900-999	30%
1000-1099	35%
1100-1199	40%
1200-1299	45%
1300-1399	50%
1400-1499	55%

REVIEW INFORMATION

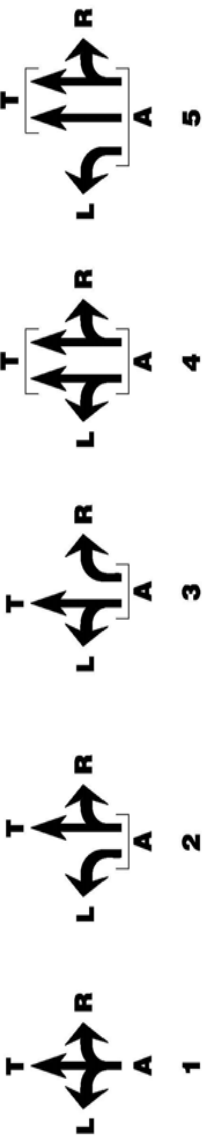
Counts Used: _____

Count Dated: _____

Date Reviewed: _____

Reviewed By: _____

LANE CONFIGURATIONS



Any Configuration with
any exclusive right turn lane
(usually >= to 600 ft. long)

RIGHT TURN FACTORIZATION SHEET

Intersection: SHIELDS & ACCESS DRIVEWAY
Municipality: CANFIELD, OHIO

Conditions: 2047 BUILD
County: MAHONING

DIR	HOUR BEGIN	MINOR STREET NB 3				MAINLINE APPROACH VOLUME PER LANE	BASE RIGHT TURN REDUCTION %	MAINLINE CONGESTION FACTOR %	ADJUSTED RIGHT TURN REDUCTION %	ADJUSTED RIGHT TURNS	ADJUSTED MINOR STREET VOLUMES	TOTAL										BASE REDUCTION				
		VOLUMES										LEFT L	THRU T	RIGHT R	TOTAL A	0.7A	0.35A	3T	T/3	(T+L)	(T+R)		3R	3L	T/2	T/4
		LEFT	THRU	RIGHT	TOTAL																					
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	7:00	334	0	150	484	463	75%	5%	70%	45	379	334	0	150	484	339	169	0	0	334	150	450	1002	0	0	75%
	8:00	180	0	81	261	425	75%	0%	75%	20	200	180	0	81	261	183	91	0	0	180	81	243	540	0	0	75%
	9:00	23	0	10	33	293	75%	0%	75%	3	26	23	0	10	33	23	12	0	0	23	10	30	69	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	11:00	29	0	12	41	288	75%	0%	75%	3	32	29	0	12	41	29	14	0	0	29	12	36	87	0	0	75%
	12:00	26	0	10	36	318	75%	0%	75%	3	29	26	0	10	36	25	13	0	0	26	10	30	78	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	2:00	151	0	60	211	474	75%	5%	70%	18	169	151	0	60	211	148	74	0	0	151	60	180	453	0	0	75%
	3:00	202	0	75	277	411	75%	0%	75%	19	221	202	0	75	277	194	97	0	0	202	75	225	606	0	0	75%
	4:00	109	0	40	149	501	75%	5%	70%	12	121	109	0	40	149	104	52	0	0	109	40	120	327	0	0	75%
	5:00	89	0	33	122	448	75%	5%	70%	10	99	89	0	33	122	85	43	0	0	89	33	99	267	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	AM PEAK	413		187	600	490	75%	5%	70%	56	469	413	0	187	600	420	210	0	0	413	187	561	1239	0	0	75%
	PM PEAK	283		105	388	479	75%	5%	70%	32	315	283	0	105	388	272	136	0	0	283	105	315	849	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	

Mainline Congestion Factors	
Volume	Factor (%)
0-399	0%
400-499	5%
500-599	10%
600-699	15%
700-799	20%
800-899	25%
900-999	30%
1000-1099	35%
1100-1199	40%
1200-1299	45%
1300-1399	50%
1400-1499	55%

REVIEW INFORMATION

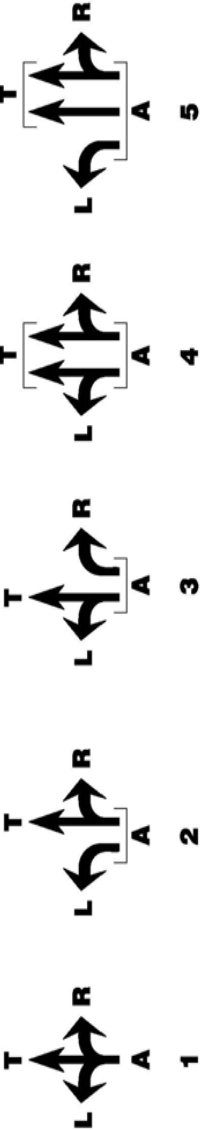
Counts Used: _____

Count Dated: _____

Date Reviewed: _____

Reviewed By: _____

LANE CONFIGURATIONS



Any Configuration with
any exclusive right turn lane
(usually >= to 600 ft. long)

2027 BUILD CONDITIONS

TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01
TRAFFIC ENGINEERING - 07/99
Page 1 of 5

City: CANFIELD
County: MAHONING

Engineer: ABC
Date: November 1, 2022

Major Street: SHIELDS ROAD
Minor Street: ACCESS DRIVEWAY

Lanes: 1 Critical Approach Speed: 45
Lanes: 1

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☒ Yes ☐ No
 2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ☒ No
- If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ☒ 100%

WARRANT 1 - EIGHT-HOUR VEHICULAR VOLUME

Warrant 1 is satisfied if Condition A or Condition B is "100%" satisfied.
Warrant is also satisfied if both Condition A and Condition B are "80%" satisfied.

Applicable: ☒ Yes ☐ No
Satisfied: ☐ Yes ☒ No

Condition A - Minimum Vehicular Volume

100% Satisfied: ☐ Yes ☒ No
80% Satisfied: ☐ Yes ☒ No

(volumes in veh/hr)	Minimum Requirements (80% Shown in Brackets)				Eight Highest Hours													
					7:00 AM -	8:00 AM	8:00 AM -	9:00 AM	11:00 AM -	12:00 PM	12:00 PM -	1:00 PM	2:00 PM -	3:00 PM	3:00 PM -	4:00 PM	4:00 PM -	5:00 PM
	Approach Lanes	1		2 or more														
Volume Level	100%	70%	100%	70%														
Both Approaches on Major Street	500 (400)	350 (280)	600 (480)	420 (336)	1,552	921			545	613			1,067	940			1,031	987
Highest Approach on Minor Street	150 (120)	105 (84)	200 (160)	140 (112)	379	200			32	29			169	221			121	99

Record 8 highest hours and the corresponding volumes in boxes provided. Condition is 100% satisfied if the minimum volumes are met for eight hours. Condition is 80% satisfied if parenthetical volumes are met for eight hours.

Condition B - Interruption of Continuous Traffic

Condition B is intended for application where the traffic volume is so heavy that traffic on the minor street suffers excessive delay.

Applicable: ☒ Yes ☐ No
Excessive Delay: ☒ Yes ☐ No
100% Satisfied: ☐ Yes ☒ No
80% Satisfied: ☐ Yes ☒ No

(volumes in veh/hr)	Minimum Requirements (80% Shown in Brackets)				Eight Highest Hours															
					7:00 AM -	8:00 AM -	8:00 AM -	9:00 AM -	11:00 AM -	12:00 PM -	12:00 PM -	1:00 PM -	2:00 PM -	3:00 PM -	3:00 PM -	4:00 PM -	4:00 PM -	5:00 PM -	5:00 PM -	6:00 PM -
	Approach Lanes	1		2 or more																
Volume Level	100%	70%	100%	70%																
Both Approaches on Major Street	750 (600)	525 (420)	900 (720)	630 (504)	1,552	921			545	613			1,067	940			1,031	987		
Highest Approach on Minor Street	75 (60)	53 (42)	100 (80)	70 (56)	379	200			32	29			169	221			121	99		

Record 8 highest hours and the corresponding volumes in boxes provided. Condition is 100% satisfied if the minimum volumes are met for eight hours. Condition is 80% satisfied if parenthetical volumes are met for eight hours.

2027 BUILD CONDITIONS

TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01
TRAFFIC ENGINEERING - 07/99
Page 2 of 5

City: CANFIELD Engineer: ABC
 County: MAHONING Date: November 1, 2022
 Major Street: SHIELDS ROAD Lanes: 1 Critical Approach Speed: 45
 Minor Street: ACCESS DRIVEWAY Lanes: 1

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☒ Yes ☐ No
 2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ☒ No
 If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ☒ 100%

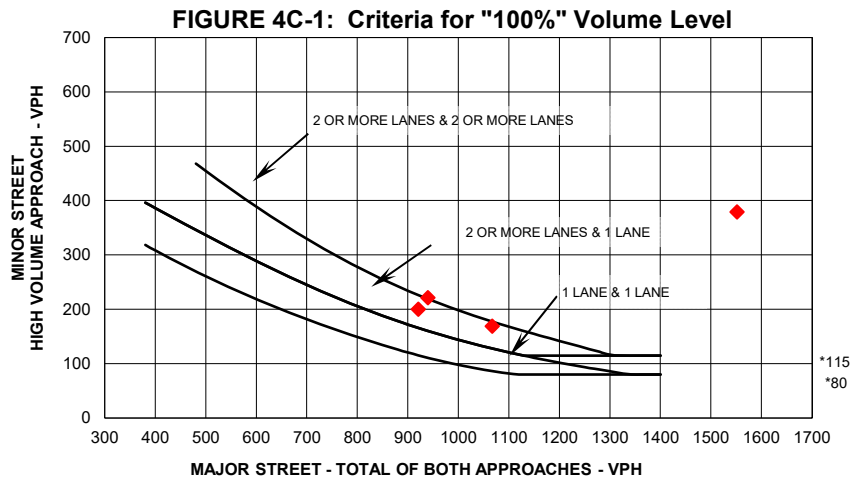
WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME

If all four points lie above the appropriate line, then the warrant is satisfied.

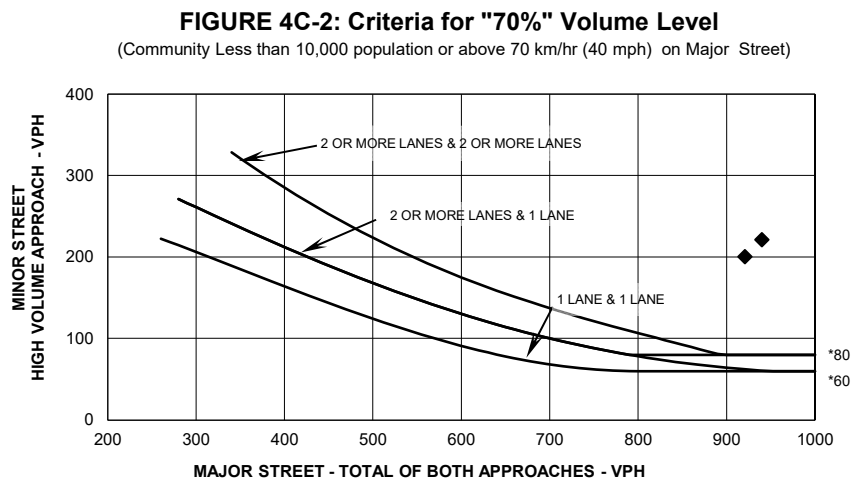
Applicable: ☒ Yes ☐ No
 Satisfied: ☒ Yes ☐ No

Plot four volume combinations on the applicable figure below.

Four Highest Hours	Volumes	
	Major Street	Minor Street
7:00 AM - 8:00 AM	1,552	379
8:00 AM - 9:00 AM	921	200
2:00 PM - 3:00 PM	1,067	169
3:00 PM - 4:00 PM	940	221



* Note: 115 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 80 vph applies as the lower threshold volume threshold for a minor street approach with one lane.



* Note: 80 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 60 vph applies as the lower threshold volume threshold for a minor street approach with one lane.

2027 BUILD CONDITIONS

TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01
TRAFFIC ENGINEERING - 07/99
Page 3 of 5

City: CANFIELD
County: MAHONING

Engineer: ABC
Date: November 1, 2022

Major Street: SHIELDS ROAD
Minor Street: ACCESS DRIVEWAY

Lanes: 1 Critical Approach Speed: 45
Lanes: 1

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☒ Yes ☐ No
 2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ☒ No
- If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ☒ 100%

WARRANT 3 - PEAK HOUR

If all three criteria are fulfilled or the plotted point lies above the appropriate line, then the warrant is satisfied.

Applicable: ☒ Yes ☐ No
Satisfied: ☒ Yes ☐ No

Unusual condition justifying
use of warrant:

School
Arrival & Dismissal

Record hour when criteria are fulfilled
and the corresponding delay or volume
in boxes provided.

Peak Hour		
AM Peak	1587	469

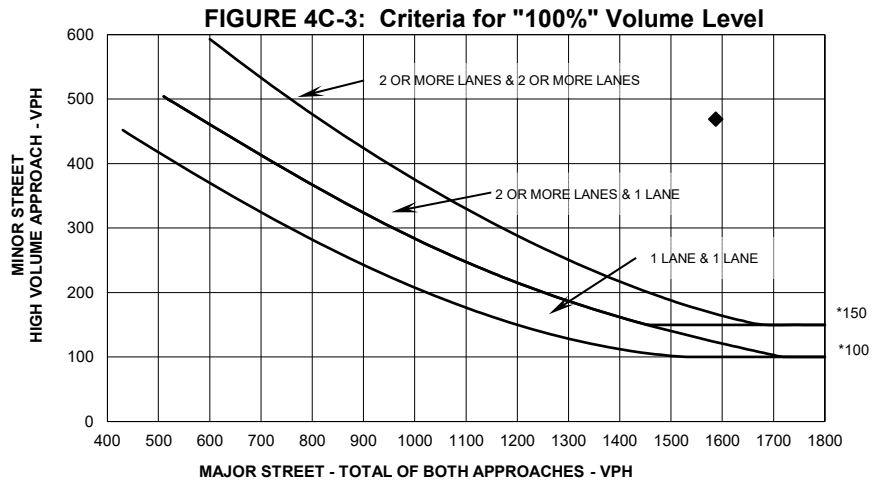
Criteria

1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*	>4.0	
Fulfilled?:	☒ Yes	☐ No

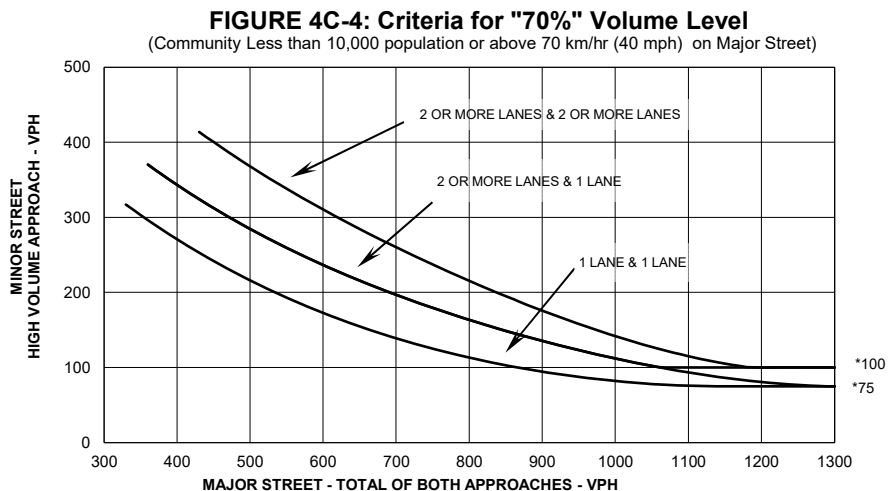
2. Volume on Minor Approach *(vehicles per hour)		
Approach Lanes	1	2
Volume Criteria*	100	150
Volume*		469
Fulfilled?:	☒ Yes	☐ No

3. Total Entering Volume *(vehicles per hour)		
No. of Approaches	3	4
Volume Criteria*	650	800
Volume*	2,056	
Fulfilled?:	☒ Yes	☐ No

Plot volume combination on the applicable figure below.



* Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume threshold for a minor street approach with one lane.



* Note: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 75 vph applies as the lower threshold volume threshold for a minor street approach with one lane.

SHIELDS ROAD (US 62) - EXISTING NO-BUILD VOLUMES

TIME BEGINS	2022 EXISTING		FACTOR: 1.027 2027 NO-BUILD		FACTOR: 1.135 2047 NO-BUILD	
	EB THRU	WB THRU	EB THRU	WB THRU	EB THRU	WB THRU
7:00	408	456	419	468	463	517
8:00	375	306	385	314	425	347
9:00	258	205	265	211	293	233
11:00	254	239	261	245	288	271
12:00	280	276	288	283	318	313
2:00	418	399	429	410	474	453
3:00	362	382	372	392	411	433
4:00	442	440	454	452	501	499
5:00	395	452	406	464	448	513
AM PEAK	432	414	444	425	490	470
PM PEAK	422	422	433	433	479	479

ELEMENTARY SCHOOL VOLUMES

TIME BEGINS	ADT: 1079 Vehicles/Day Entering		1079 Vehicles/Day Exiting		SHIELDS ROAD (US 62) WESTBOUND THRU		SITE ACCESS DRIVEWAY NORTHBOUND LEFT		NORTHBOUND RIGHT	
	%	VOLUME	%	VOLUME	%	VOLUME	%	VOLUME	%	VOLUME
7:00	35.7%	385	26.3%	284	32%	123	69%	196	31%	88
8:00	11.6%	125	14.4%	155	32%	40	69%	107	31%	48
9:00	2.1%	23	2.0%	22	32%	7	69%	15	31%	7
11:00	2.5%	27	2.8%	30	31%	8	71%	21	29%	9
12:00	2.7%	29	2.2%	24	31%	9	73%	17	29%	7
2:00	14.7%	159	16.0%	173	31%	49	73%	126	29%	50
3:00	8.5%	92	12.1%	131	31%	28	73%	95	27%	35
4:00	7.0%	76	9.4%	101	31%	23	73%	74	27%	27
5:00	4.9%	53	5.6%	60	31%	16	73%	44	27%	16
AM PEAK		385		328		122		225		102
PM PEAK		197		231		60		168		63

MIDDLE SCHOOL VOLUMES

TIME BEGINS	ADT: 836 Vehicles/Day Entering		836 Vehicles/Day Exiting		SHIELDS ROAD (US 62) WESTBOUND THRU		SITE ACCESS DRIVEWAY NORTHBOUND LEFT		NORTHBOUND RIGHT	
	%	VOLUME	%	VOLUME	%	VOLUME	%	VOLUME	%	VOLUME
7:00	33.4%	279	24.0%	201	32%	89	69%	138	31%	62
8:00	11.5%	96	12.7%	106	32%	31	69%	73	31%	33
9:00	1.4%	12	1.4%	12	32%	4	69%	8	31%	4
11:00	1.4%	12	1.3%	11	31%	4	71%	8	29%	3
12:00	1.5%	13	1.4%	12	31%	4	73%	9	29%	3
2:00	8.3%	69	4.1%	34	31%	22	73%	25	29%	10
3:00	10.1%	84	17.5%	146	31%	26	73%	107	27%	40
4:00	6.0%	50	5.8%	48	31%	16	73%	35	27%	13
5:00	7.7%	64	7.4%	62	31%	20	73%	45	27%	17
AM PEAK		333		272		106		188		85
PM PEAK		134		157		42		115		42

2027 BUILD VOLUMES - SHIELDS ROAD & EAST ACCESS DRIVEWAY

TIME BEGINS	EASTBOUND			WESTBOUND			NORTHBOUND			2027 BUILD		
	THRU	TOTAL		THRU	TOTAL		LEFT	RIGHT	FACTORED RIGHT	TOTAL	MAJOR	MINOR
7:00	419	419		681	681		334	150	45	379	1100	379
8:00	385	385		385	385		180	81	20	200	770	200
9:00	265	265		222	222		23	10	3	26	486	26
11:00	261	261		257	257		29	12	3	32	518	32
12:00	288	288		296	296		26	10	3	29	584	29
2:00	429	429		480	480		151	60	18	169	910	169
3:00	372	372		447	447		202	75	19	221	819	221
4:00	454	454		491	491		109	40	12	121	945	121
5:00	406	406		501	501		89	33	10	99	906	99
AM PEAK	444	444		653	653		413	187	56	469	1097	469
PM PEAK	433	433		535	535		283	105	32	315	969	315

2047 BUILD VOLUMES - SHIELDS ROAD & EAST ACCESS DRIVEWAY

TIME BEGINS	EASTBOUND			WESTBOUND			NORTHBOUND			2027 BUILD		
	THRU	TOTAL		THRU	TOTAL		LEFT	RIGHT	FACTORED RIGHT	TOTAL	MAJOR	MINOR
7:00	463	463		730	730		334	150	45	379	1193	379
8:00	425	425		418	418		180	81	20	200	843	200
9:00	293	293		244	244		23	10	3	26	536	26
11:00	288	288		283	283		29	12	3	32	571	32
12:00	318	318		326	326		26	10	3	29	644	29
2:00	474	474		523	523		151	60	18	169	998	169
3:00	411	411		488	488		202	75	19	221	899	221
4:00	501	501		538	538		109	40	12	121	1040	121
5:00	448	448		549	549		89	33	10	99	997	99
AM PEAK	490	490		698	698		413	187	56	469	1188	469
PM PEAK	479	479		581	581		283	105	32	315	1060	315

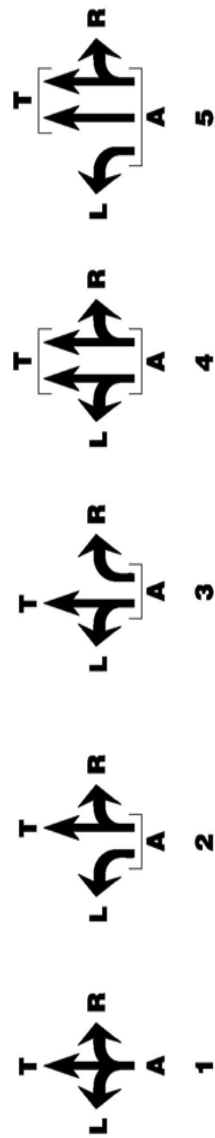
RIGHT TURN FACTORIZATION SHEET

Intersection: SHIELDS & EAST ACCESS DRIVEWAY
Municipality: CANFIELD, OHIO

Conditions: 2027 BUILD
County: MAHONING

DIR	HOUR BEGIN	Approach: <u>MINOR STREET</u> Config: <u>NB</u> <u>3</u>				MAINLINE APPROACH VOLUME PER LANE	BASE RIGHT TURN REDUCTION %	MAINLINE CONGESTION FACTOR %	ADJUSTED RIGHT TURN REDUCTION %	ADJUSTED RIGHT TURNS	ADJUSTED MINOR STREET VOLUMES	TOTAL										T/4	T/2	BASE REDUCTION			
		VOLUMES										LEFT	THRU	RIGHT	TOTAL A	0.7A	0.35A	3T	T/3	(T+L)	(T+R)				3R	3L	
		LEFT	THRU	RIGHT	TOTAL																						
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	7:00	334	0	150	484	419	75%	5%	70%	45	379	334	0	150	484	339	169	0	0	334	150	450	1002	0	0	0	75%
	8:00	180	0	81	261	385	75%	0%	75%	20	200	180	0	81	261	183	91	0	0	180	81	243	540	0	0	0	75%
	9:00	23	0	10	33	265	75%	0%	75%	3	26	23	0	10	33	23	12	0	0	23	10	30	69	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	11:00	29	0	12	41	261	75%	0%	75%	3	32	29	0	12	41	29	14	0	0	29	12	36	87	0	0	0	75%
	12:00	26	0	10	36	288	75%	0%	75%	3	29	26	0	10	36	25	13	0	0	26	10	30	78	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	2:00	151	0	60	211	429	75%	5%	70%	18	169	151	0	60	211	148	74	0	0	151	60	180	453	0	0	0	75%
	3:00	202	0	75	277	372	75%	0%	75%	19	221	202	0	75	277	194	97	0	0	202	75	225	606	0	0	0	75%
	4:00	109	0	40	149	454	75%	5%	70%	12	121	109	0	40	149	104	52	0	0	109	40	120	327	0	0	0	75%
	5:00	89	0	33	122	406	75%	5%	70%	10	99	89	0	33	122	85	43	0	0	89	33	99	267	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	AM PEAK	413		187	600	444	75%	5%	70%	56	469	413	0	187	600	420	210	0	0	413	187	561	1239	0	0	0	75%
	PM PEAK	283		105	388	433	75%	5%	70%	32	315	283	0	105	388	272	136	0	0	283	105	315	849	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	

LANE CONFIGURATIONS



REVIEW INFORMATION

Counts Used: _____
Count Dated: _____
Date Reviewed: _____
Reviewed By: _____

Any Configuration with
any exclusive right turn lane
(usually >= to 600 ft. long)

Mainline Congestion Factors	
Volume	Factor (%)
0-399	0%
400-499	5%
500-599	10%
600-699	15%
700-799	20%
800-899	25%
900-999	30%
1000-1099	35%
1100-1199	40%
1200-1299	45%
1300-1399	50%
1400-1499	55%

RIGHT TURN FACTORIZATION SHEET

Intersection: SHIELDS & EAST ACCESS DRIVEWAY
Municipality: CANFIELD, OHIO

Conditions: 2047 BUILD
County: MAHONING

DIR	HOUR BEGIN	Approach: Config: <u>MINOR STREET</u> <u>NB</u> <u>3</u>				MAINLINE APPROACH VOLUME PER LANE	BASE RIGHT TURN REDUCTION %	MAINLINE CONGESTION FACTOR %	ADJUSTED RIGHT TURN REDUCTION %	ADJUSTED RIGHT TURNS	ADJUSTED MINOR STREET VOLUMES	TOTAL										T/4	T/2	BASE REDUCTION				
		VOLUMES										LEFT	THRU	RIGHT	TOTAL A	0.7A	0.35A	3T	T/3	(T+L)	(T+R)				3R	3L		
		LEFT	THRU	RIGHT	TOTAL																							
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	7:00	334	0	150	484	463	75%	5%	70%	45	379	334	0	150	484	339	169	0	0	334	150	450	1002	0	0	0	0	75%
	8:00	180	0	81	261	425	75%	0%	75%	20	200	180	0	81	261	183	91	0	0	180	81	243	540	0	0	0	0	75%
	9:00	23	0	10	33	293	75%	0%	75%	3	26	23	0	10	33	23	12	0	0	23	10	30	69	0	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	11:00	29	0	12	41	288	75%	0%	75%	3	32	29	0	12	41	29	14	0	0	29	12	36	87	0	0	0	0	75%
	12:00	26	0	10	36	318	75%	0%	75%	3	29	26	0	10	36	25	13	0	0	26	10	30	78	0	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	2:00	151	0	60	211	474	75%	5%	70%	18	169	151	0	60	211	148	74	0	0	151	60	180	453	0	0	0	0	75%
	3:00	202	0	75	277	411	75%	0%	75%	19	221	202	0	75	277	194	97	0	0	202	75	225	606	0	0	0	0	75%
	4:00	109	0	40	149	501	75%	5%	70%	12	121	109	0	40	149	104	52	0	0	109	40	120	327	0	0	0	0	75%
	5:00	89	0	33	122	448	75%	5%	70%	10	99	89	0	33	122	85	43	0	0	89	33	99	267	0	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	
	AM PEAK	413		187	600	490	75%	5%	70%	56	469	413	0	187	600	420	210	0	0	413	187	561	1239	0	0	0	0	75%
	PM PEAK	283		105	388	479	75%	5%	70%	32	315	283	0	105	388	272	136	0	0	283	105	315	849	0	0	0	0	75%
					0		75%	0%	75%	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	75%	

Mainline Congestion Factors	
Volume	Factor (%)
0-399	0%
400-499	5%
500-599	10%
600-699	15%
700-799	20%
800-899	25%
900-999	30%
1000-1099	35%
1100-1199	40%
1200-1299	45%
1300-1399	50%
1400-1499	55%

REVIEW INFORMATION

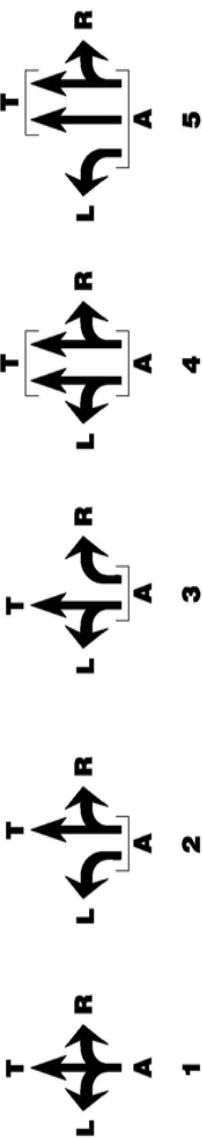
Counts Used: _____

Count Dated: _____

Date Reviewed: _____

Reviewed By: _____

LANE CONFIGURATIONS



Any Configuration with
any exclusive right turn lane
(usually >= to 600 ft. long)

2027 BUILD CONDITIONS

TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01
TRAFFIC ENGINEERING - 07/99
Page 1 of 5

City: CANFIELD
County: MAHONING

Engineer: ABC
Date: November 1, 2022

Major Street: SHIELDS ROAD
Minor Street: EAST ACCESS DRIVEWAY

Lanes: 1 Critical Approach Speed: 45
Lanes: 1

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☒ Yes ☐ No
 2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ☒ No
- If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ☒ 100%

WARRANT 1 - EIGHT-HOUR VEHICULAR VOLUME

Warrant 1 is satisfied if Condition A or Condition B is "100%" satisfied.
Warrant is also satisfied if both Condition A and Condition B are "80%" satisfied.

Applicable: ☒ Yes ☐ No
Satisfied: ☐ Yes ☒ No

Condition A - Minimum Vehicular Volume

100% Satisfied: ☐ Yes ☒ No
80% Satisfied: ☐ Yes ☒ No

(volumes in veh/hr)	Minimum Requirements (80% Shown in Brackets)				Eight Highest Hours											
					7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	11:00 AM - 12:00 PM	12:00 PM - 1:00 PM	2:00 PM - 3:00 PM	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM				
Approach Lanes	1		2 or more													
Volume Level	100%	70%	100%	70%												
Both Approaches on Major Street	500 (400)	350 (280)	600 (480)	420 (336)	1,100	770	518	584	910	819	945	906				
Highest Approach on Minor Street	150 (120)	105 (84)	200 (160)	140 (112)	379	200	32	29	169	221	121	99				

Record 8 highest hours and the corresponding volumes in boxes provided. Condition is 100% satisfied if the minimum volumes are met for eight hours. Condition is 80% satisfied if parenthetical volumes are met for eight hours.

Condition B - Interruption of Continuous Traffic

Condition B is intended for application where the traffic volume is so heavy that traffic on the minor street suffers excessive delay.

Applicable: ☒ Yes ☐ No
Excessive Delay: ☒ Yes ☐ No
100% Satisfied: ☐ Yes ☒ No
80% Satisfied: ☐ Yes ☒ No

(volumes in veh/hr)	Minimum Requirements (80% Shown in Brackets)				Eight Highest Hours											
					7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	11:00 AM - 12:00 PM	12:00 PM - 1:00 PM	2:00 PM - 3:00 PM	3:00 PM - 4:00 PM	4:00 PM - 5:00 PM	5:00 PM - 6:00 PM				
	Approach Lanes		1		2 or more											
	Volume Level	100%	70%	100%	70%											
Both Approaches on Major Street	750 (600)	525 (420)	900 (720)	630 (504)	1,100	770	518	584	910	819	945	906				
Highest Approach on Minor Street	75 (60)	53 (42)	100 (80)	70 (56)	379	200	32	29	169	221	121	99				

Record 8 highest hours and the corresponding volumes in boxes provided. Condition is 100% satisfied if the minimum volumes are met for eight hours. Condition is 80% satisfied if parenthetical volumes are met for eight hours.

2027 BUILD CONDITIONS TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01
TRAFFIC ENGINEERING - 07/99
Page 2 of 5

City: CANFIELD Engineer: ABC
County: MAHONING Date: November 1, 2022
Major Street: SHIELDS ROAD Lanes: 1 Critical Approach Speed: 45
Minor Street: EAST ACCESS DRIVEWAY Lanes: 1

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☒ Yes ☐ No
2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ☒ No
If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ☒ 100%

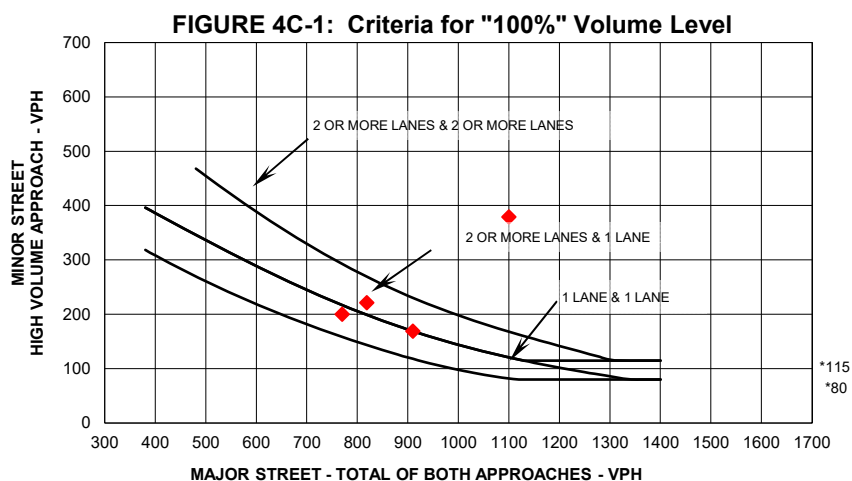
WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME

If all four points lie above the appropriate line, then the warrant is satisfied.

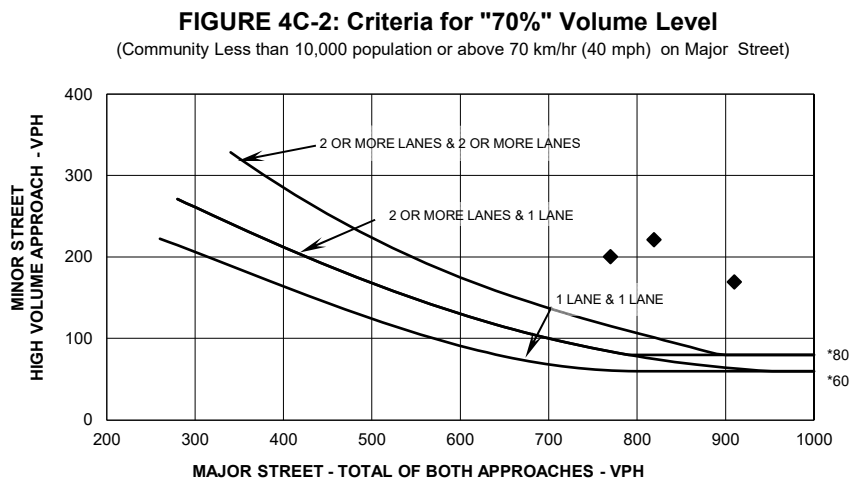
Applicable: ☒ Yes ☐ No
Satisfied: ☒ Yes ☐ No

Plot four volume combinations on the applicable figure below.

Four Highest Hours	Volumes	
	Major Street	Minor Street
7:00 AM - 8:00 AM	1,100	379
8:00 AM - 9:00 AM	770	200
2:00 PM - 3:00 PM	910	169
3:00 PM - 4:00 PM	819	221



* Note: 115 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 80 vph applies as the lower threshold volume threshold for a minor street approach with one lane.



* Note: 80 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 60 vph applies as the lower threshold volume threshold for a minor street approach with one lane.

2027 BUILD CONDITIONS

TRAFFIC SIGNAL WARRANT SUMMARY

Form 750-020-01
TRAFFIC ENGINEERING - 07/99
Page 3 of 5

City: CANFIELD
County: MAHONING

Engineer: ABC
Date: November 1, 2022

Major Street: SHIELDS ROAD
Minor Street: EAST ACCESS DRIVEWAY

Lanes: 1 Critical Approach Speed: 45
Lanes: 1

Volume Level Criteria

1. Is the critical speed of major street traffic > 70 km/h (40 mph) ? ☒ Yes ☐ No
2. Is the intersection in a built-up area of isolated community of <10,000 population? ☐ Yes ☒ No
- If Question 1 or 2 above is answered "Yes", then use "70%" volume level ☐ 70% ☒ 100%

WARRANT 3 - PEAK HOUR

If all three criteria are fulfilled or the plotted point lies above the appropriate line, then the warrant is satisfied.

Applicable: ☒ Yes ☐ No
Satisfied: ☒ Yes ☐ No

Unusual condition justifying
use of warrant:

School
Arrival & Dismissal

Record hour when criteria are fulfilled
and the corresponding delay or volume
in boxes provided.

Peak Hour		
AM Peak	1097	469

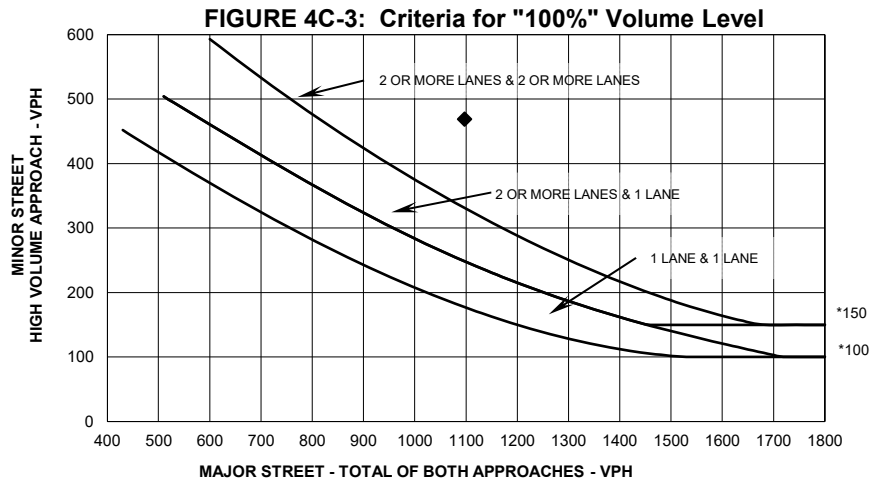
Criteria

1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*	>4.0	
Fulfilled?:	☒ Yes	☐ No

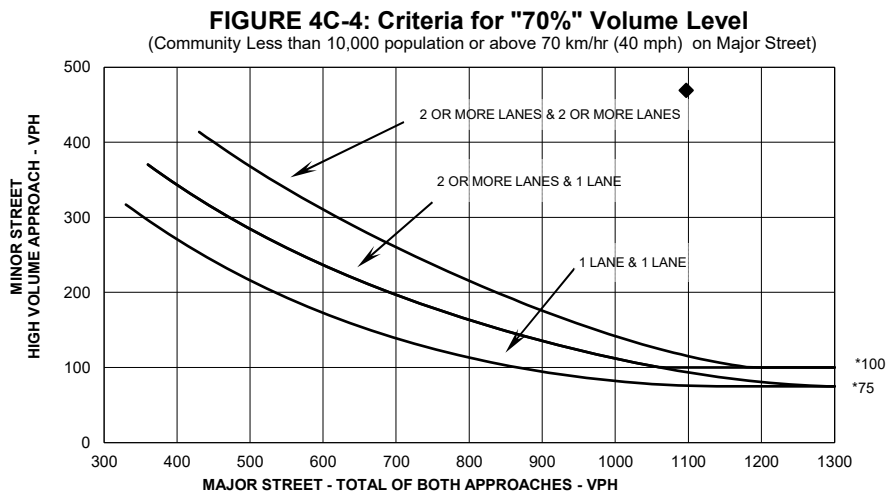
2. Volume on Minor Approach *(vehicles per hour)		
Approach Lanes	1	2
Volume Criteria*	100	150
Volume*		469
Fulfilled?:	☒ Yes	☐ No

3. Total Entering Volume *(vehicles per hour)		
No. of Approaches	3	4
Volume Criteria*	650	800
Volume*	2,056	
Fulfilled?:	☒ Yes	☐ No

Plot volume combination on the applicable figure below.



* Note: 150 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 100 vph applies as the lower threshold volume threshold for a minor street approach with one lane.



* Note: 100 vph applies as the lower threshold volume for a minor street approach with two or more lanes and 75 vph applies as the lower threshold volume threshold for a minor street approach with one lane.

Appendix O

Capacity Analysis Worksheets - 2027 w/ 2 Access Locations

HCS Two-Way Stop-Control Report

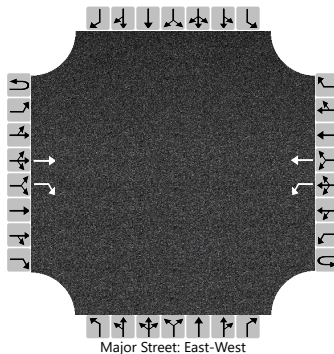
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2027
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	Build Conditions - 2 Access

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	West Site Access Driveway
Peak Hour Factor	0.73
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	1	0	1	1	0		0	0	0		0	0	0
Configuration			T	R		L	T									
Volume (veh/h)			490	500		238	893									
Percent Heavy Vehicles (%)						5										
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized	No															
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1										
Critical Headway (sec)						4.15										
Base Follow-Up Headway (sec)						2.2										
Follow-Up Headway (sec)						2.25										

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						326										
Capacity, c (veh/h)						498										
v/c Ratio						0.66										
95% Queue Length, Q ₉₅ (veh)						4.7										
Control Delay (s/veh)						24.9										
Level of Service (LOS)						C										
Approach Delay (s/veh)					5.2											
Approach LOS					A											

HCS Two-Way Stop-Control Report

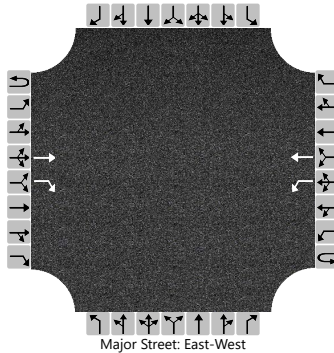
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2027
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Build Conditions - 2 Access

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	West Site Access Driveway
Peak Hour Factor	0.79
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	1	0	1	1	0		0	0	0		0	0	0
Configuration			T	R		L	T									
Volume (veh/h)			480	239		112	773									
Percent Heavy Vehicles (%)						5										
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized	No															
Median Type Storage	Undivided															

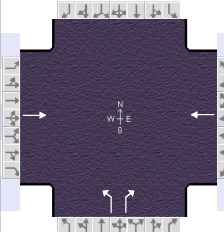
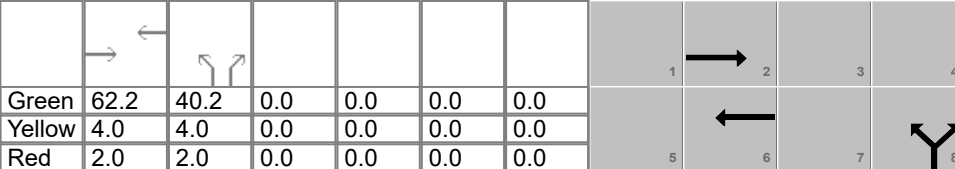
Critical and Follow-up Headways

Base Critical Headway (sec)						4.1										
Critical Headway (sec)						4.15										
Base Follow-Up Headway (sec)						2.2										
Follow-Up Headway (sec)						2.25										

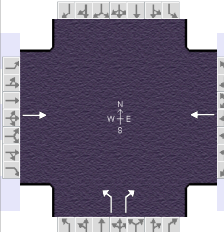
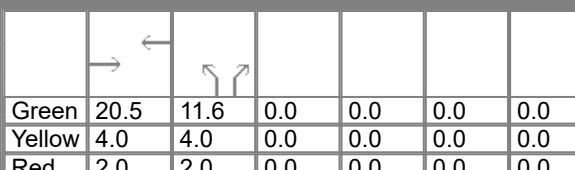
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						142										
Capacity, c (veh/h)						736										
v/c Ratio						0.19										
95% Queue Length, Q ₉₅ (veh)						0.7										
Control Delay (s/veh)						11.1										
Level of Service (LOS)						B										
Approach Delay (s/veh)					1.4											
Approach LOS					A											

HCS Signalized Intersection Results Summary

General Information						Intersection Information											
Agency	TMS Engineers, Inc.					Duration, h	0.250										
Analyst	ABC		Analysis Date	Oct 24, 2022		Area Type	Other										
Jurisdiction	Canfield, Ohio		Time Period	AM Peak		PHF	0.73										
Urban Street	Shields Road (US 62)		Analysis Year	2027		Analysis Period	1> 7:00										
Intersection	@ East Site Access		File Name	3_AM 27 East IMP2.xus													
Project Description	Build Conditions - IMP w/ 2 Access																
Demand Information						EB			WB			NB			SB		
Approach Movement						L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h							490			708		423		197			
Signal Information																	
Cycle, s	114.4	Reference Phase	2														
Offset, s	0	Reference Point	End														
Uncoordinated	Yes	Simult. Gap E/W	On														
Force Mode	Fixed	Simult. Gap N/S	On														
						Green	62.2	40.2	0.0	0.0	0.0	0.0					
						Yellow	4.0	4.0	0.0	0.0	0.0	0.0					
						Red	2.0	2.0	0.0	0.0	0.0	0.0					
Timer Results						EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase							2		6		8						
Case Number							8.0		8.0		9.0						
Phase Duration, s							68.2		68.2		46.2						
Change Period, (Y+R c), s							6.0		6.0		6.0						
Max Allow Headway (MAH), s							2.9		2.9		3.1						
Queue Clearance Time (g s), s							32.3		61.1		39.1						
Green Extension Time (g e), s							0.0		1.1		1.0						
Phase Call Probability							1.00		1.00		1.00						
Max Out Probability							1.00		0.83		0.49						
Movement Group Results						EB			WB			NB			SB		
Approach Movement						L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement							2			6		3		18			
Adjusted Flow Rate (v), veh/h							671			970		579		270			
Adjusted Saturation Flow Rate (s), veh/h/ln							1826			1826		1739		1547			
Queue Service Time (g s), s							30.3			59.1		37.1		15.7			
Cycle Queue Clearance Time (g c), s							30.3			59.1		37.1		15.7			
Green Ratio (g/C)							0.54			0.54		0.35		0.35			
Capacity (c), veh/h							993			993		611		543			
Volume-to-Capacity Ratio (X)							0.676			0.976		0.949		0.497			
Back of Queue (Q), ft/ln (95 th percentile)							460.1			971.3		663.1		246.8			
Back of Queue (Q), veh/ln (95 th percentile)							17.7			37.4		25.5		9.5			
Queue Storage Ratio (RQ) (95 th percentile)							0.00			0.00		0.00		0.00			
Uniform Delay (d 1), s/veh							18.8			25.4		36.1		29.2			
Incremental Delay (d 2), s/veh							1.5			21.7		21.4		0.3			
Initial Queue Delay (d 3), s/veh							0.0			0.0		0.0		0.0			
Control Delay (d), s/veh							20.3			47.1		57.6		29.4			
Level of Service (LOS)							C			D		E		C			
Approach Delay, s/veh / LOS						20.3	C	47.1	D	48.6	D	0.0					
Intersection Delay, s/veh / LOS						40.4					D						
Multimodal Results						EB			WB			NB			SB		
Pedestrian LOS Score / LOS																	
Bicycle LOS Score / LOS																	

HCS Signalized Intersection Results Summary

General Information					Intersection Information															
Agency	TMS Engineers, Inc.				Duration, h		0.250													
Analyst	ABC		Analysis Date	Oct 24, 2022		Area Type		Other												
Jurisdiction	Canfield, Ohio		Time Period	PM Peak		PHF		0.79												
Urban Street	Shields Road (US 62)		Analysis Year	2027		Analysis Period		1> 7:00												
Intersection	@ East Site Access		File Name	4_PM 27 East IMP2.xus																
Project Description	Build Conditions - 2 Access																			
Demand Information					EB			WB			NB			SB						
Approach Movement					L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h						480			592		293		105							
Signal Information																				
Cycle, s	44.1	Reference Phase	2																	
Offset, s	0	Reference Point	End																	
Uncoordinated	Yes	Simult. Gap E/W	On																	
Force Mode	Fixed	Simult. Gap N/S	On																	
				Green	20.5	11.6	0.0	0.0	0.0	0.0										
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0										
				Red	2.0	2.0	0.0	0.0	0.0	0.0										
Timer Results					EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase							2				6				8					
Case Number							8.0				8.0				9.0					
Phase Duration, s							26.5				26.5				17.6					
Change Period, (Y+R c), s							6.0				6.0				6.0					
Max Allow Headway (MAH), s							2.9				2.9				3.1					
Queue Clearance Time (g s), s							13.8				18.4				10.8					
Green Extension Time (g e), s							1.8				2.1				0.8					
Phase Call Probability							1.00				1.00				1.00					
Max Out Probability							0.43				0.06				0.01					
Movement Group Results					EB			WB			NB			SB						
Approach Movement					L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement						2			6		3		18							
Adjusted Flow Rate (v), veh/h						608			749		371		133							
Adjusted Saturation Flow Rate (s), veh/h/ln						1826			1826		1739		1547							
Queue Service Time (g s), s						11.8			16.4		8.8		3.1							
Cycle Queue Clearance Time (g c), s						11.8			16.4		8.8		3.1							
Green Ratio (g/C)						0.47			0.47		0.26		0.26							
Capacity (c), veh/h						849			849		458		407							
Volume-to-Capacity Ratio (X)						0.715			0.882		0.811		0.326							
Back of Queue (Q), ft/ln (95 th percentile)						155.4			208.4		128.5		38.1							
Back of Queue (Q), veh/ln (95 th percentile)						6.0			8.0		4.9		1.5							
Queue Storage Ratio (RQ) (95 th percentile)						0.00			0.00		0.00		0.00							
Uniform Delay (d 1), s/veh						9.5			10.7		15.2		13.1							
Incremental Delay (d 2), s/veh						2.5			3.0		1.3		0.2							
Initial Queue Delay (d 3), s/veh						0.0			0.0		0.0		0.0							
Control Delay (d), s/veh						12.0			13.8		16.6		13.3							
Level of Service (LOS)						B			B		B		B							
Approach Delay, s/veh / LOS					12.0		B		13.8		B		15.7		B		0.0			
Intersection Delay, s/veh / LOS					13.7										B					
Multimodal Results					EB			WB			NB			SB						
Pedestrian LOS Score / LOS																				
Bicycle LOS Score / LOS																				

Appendix P

Capacity Analysis Worksheets - 2047 w/ 2 Access Locations

HCS Two-Way Stop-Control Report

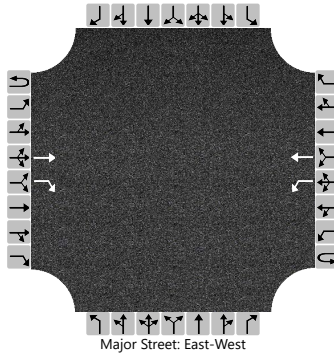
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2047
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	Build Conditions - 2 Access

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	West Site Access Driveway
Peak Hour Factor	0.73
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	1	0	1	1	0		0	0	0		0	0	0
Configuration			T	R		L	T									
Volume (veh/h)			550	500		238	943									
Percent Heavy Vehicles (%)						5										
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized	No															
Median Type Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						4.1										
Critical Headway (sec)						4.15										
Base Follow-Up Headway (sec)						2.2										
Follow-Up Headway (sec)						2.25										

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)						326										
Capacity, c (veh/h)						463										
v/c Ratio						0.70										
95% Queue Length, Q ₉₅ (veh)						5.4										
Control Delay (s/veh)						29.3										
Level of Service (LOS)						D										
Approach Delay (s/veh)					5.9											
Approach LOS					A											

HCS Two-Way Stop-Control Report

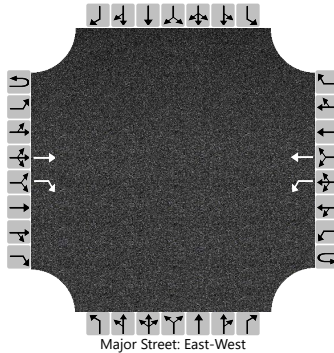
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	10/4/2022
Analysis Year	2047
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Build Conditions - 2 Access

Site Information

Intersection	Shields Road & McCune Access
Jurisdiction	Canfield, OH
East/West Street	Shields Road (US 62)
North/South Street	West Site Access Driveway
Peak Hour Factor	0.79
Analysis Time Period (hrs)	0.25

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	1	0	1	1	0		0	0	0		0	0	0
Configuration			T	R		L	T									
Volume (veh/h)			530	239		112	823									
Percent Heavy Vehicles (%)						5										
Proportion Time Blocked																
Percent Grade (%)																
Right Turn Channelized	No															
Median Type Storage	Undivided															

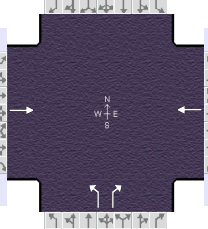
Critical and Follow-up Headways

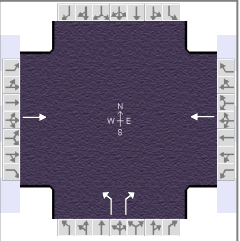
Base Critical Headway (sec)						4.1										
Critical Headway (sec)						4.15										
Base Follow-Up Headway (sec)						2.2										
Follow-Up Headway (sec)						2.25										

Delay, Queue Length, and Level of Service

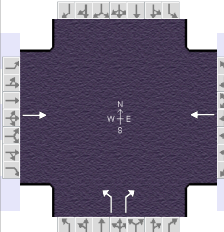
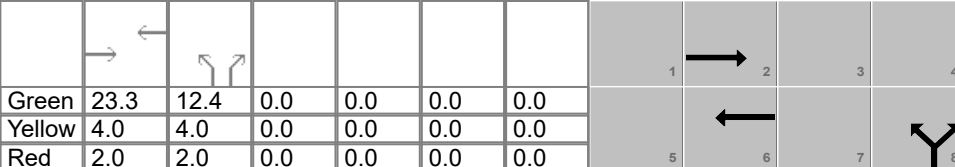
Flow Rate, v (veh/h)						142										
Capacity, c (veh/h)						696										
v/c Ratio						0.20										
95% Queue Length, Q ₉₅ (veh)						0.8										
Control Delay (s/veh)						11.5										
Level of Service (LOS)						B										
Approach Delay (s/veh)					1.4											
Approach LOS					A											

HCS Signalized Intersection Results Summary

General Information					Intersection Information											
Agency	TMS Engineers, Inc.				Duration, h	0.250										
Analyst	ABC	Analysis Date	Oct 24, 2022		Area Type	Other										
Jurisdiction	Canfield, Ohio	Time Period	AM Peak		PHF	0.73										
Urban Street	Shields Road (US 62)	Analysis Year	2047		Analysis Period	1> 7:00										
Intersection	@ East Site Access	File Name	3_AM 47 East IMP2.xus													
Project Description	Build Conditions - IMP w/ 2 Access															
																
Demand Information				EB			WB			NB			SB			
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R	
Demand (v), veh/h					550			758		423		197				
Signal Information																
Cycle, s	119.5	Reference Phase	2													
Offset, s	0	Reference Point	Begin													
Uncoordinated	Yes	Simult. Gap E/W	On													
Force Mode	Fixed	Simult. Gap N/S	On	Green	66.0	41.5	0.0	0.0	0.0	0.0						
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0						
				Red	2.0	2.0	0.0	0.0	0.0	0.0						
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT					
Assigned Phase					2		6		8							
Case Number					8.0		8.0		9.0							
Phase Duration, s					72.0		72.0		47.5							
Change Period, (Y+R c), s					6.0		6.0		6.0							
Max Allow Headway (MAH), s					2.9		2.9		3.1							
Queue Clearance Time (g s), s					39.6		68.0		41.0							
Green Extension Time (g e), s					0.0		0.0		0.5							
Phase Call Probability					1.00		1.00		1.00							
Max Out Probability					1.00		1.00		1.00							
Movement Group Results				EB			WB			NB			SB			
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R	
Assigned Movement					2			6		3		18				
Adjusted Flow Rate (v), veh/h					753			1038		579		270				
Adjusted Saturation Flow Rate (s), veh/h/ln					1826			1826		1739		1547				
Queue Service Time (g s), s					37.6			66.0		39.0		16.5				
Cycle Queue Clearance Time (g c), s					37.6			66.0		39.0		16.5				
Green Ratio (g/C)					0.55			0.55		0.35		0.35				
Capacity (c), veh/h					1008			1008		604		537				
Volume-to-Capacity Ratio (X)					0.747			1.030		0.959		0.502				
Back of Queue (Q), ft/ln (95 th percentile)					563.8			1210.7		710		258.6				
Back of Queue (Q), veh/ln (95 th percentile)					21.7			46.6		27.3		9.9				
Queue Storage Ratio (RQ) (95 th percentile)					0.00			0.00		0.00		0.00				
Uniform Delay (d 1), s/veh					20.4			26.8		38.2		30.8				
Incremental Delay (d 2), s/veh					2.8			36.2		25.4		0.3				
Initial Queue Delay (d 3), s/veh					0.0			0.0		0.0		0.0				
Control Delay (d), s/veh					23.2			63.0		63.6		31.1				
Level of Service (LOS)					C			F		E		C				
Approach Delay, s/veh / LOS				23.2	C	63.0	E	53.3	D	0.0						
Intersection Delay, s/veh / LOS				48.5					D							
Multimodal Results				EB			WB			NB			SB			
Pedestrian LOS Score / LOS																
Bicycle LOS Score / LOS																



HCS Signalized Intersection Results Summary

General Information						Intersection Information													
Agency		TMS Engineers, Inc.				Duration, h		0.250											
Analyst		ABC		Analysis Date		Oct 24, 2022		Area Type		Other									
Jurisdiction		Canfield, Ohio		Time Period		PM Peak		PHF		0.79									
Urban Street		Shields Road (US 62)		Analysis Year		2047		Analysis Period		1> 7:00									
Intersection		@ East Site Access		File Name		4_PM 47 East IMP2.xus													
Project Description		Build Conditions - 2 Access																	
Demand Information				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Demand (v), veh/h					530			642		293		105							
Signal Information																			
Cycle, s	47.7	Reference Phase	2																
Offset, s	0	Reference Point	End																
Uncoordinated	Yes	Simult. Gap E/W	On																
Force Mode	Fixed	Simult. Gap N/S	On																
				Green	23.3	12.4	0.0	0.0	0.0	0.0									
				Yellow	4.0	4.0	0.0	0.0	0.0	0.0									
				Red	2.0	2.0	0.0	0.0	0.0	0.0									
Timer Results				EBL		EBT		WBL		WBT		NBL		NBT		SBL		SBT	
Assigned Phase						2				6				8					
Case Number						8.0				8.0				9.0					
Phase Duration, s						29.3				29.3				18.4					
Change Period, (Y+R c), s						6.0				6.0				6.0					
Max Allow Headway (MAH), s						2.9				2.9				3.1					
Queue Clearance Time (g s), s						16.2				21.6				11.6					
Green Extension Time (g e), s						1.5				1.6				0.8					
Phase Call Probability						1.00				1.00				1.00					
Max Out Probability						0.82				0.05				0.00					
Movement Group Results				EB			WB			NB			SB						
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R				
Assigned Movement					2			6		3		18							
Adjusted Flow Rate (v), veh/h					671			813		371		133							
Adjusted Saturation Flow Rate (s), veh/h/ln					1826			1826		1739		1547							
Queue Service Time (g s), s					14.2			19.6		9.6		3.3							
Cycle Queue Clearance Time (g c), s					14.2			19.6		9.6		3.3							
Green Ratio (g/C)					0.49			0.49		0.26		0.26							
Capacity (c), veh/h					892			892		453		403							
Volume-to-Capacity Ratio (X)					0.752			0.911		0.819		0.330							
Back of Queue (Q), ft/ln (95 th percentile)					197			247		146.2		43.4							
Back of Queue (Q), veh/ln (95 th percentile)					7.6			9.5		5.6		1.7							
Queue Storage Ratio (RQ) (95 th percentile)					0.00			0.00		0.00		0.00							
Uniform Delay (d 1), s/veh					9.9			11.3		16.6		14.3							
Incremental Delay (d 2), s/veh					3.2			3.6		1.4		0.2							
Initial Queue Delay (d 3), s/veh					0.0			0.0		0.0		0.0							
Control Delay (d), s/veh					13.1			14.9		18.0		14.5							
Level of Service (LOS)					B			B		B		B							
Approach Delay, s/veh / LOS				13.1	B		14.9	B		17.1	B		0.0						
Intersection Delay, s/veh / LOS				14.9						B									
Multimodal Results				EB			WB			NB			SB						
Pedestrian LOS Score / LOS																			
Bicycle LOS Score / LOS																			

Appendix Q

Auxiliary Turning Lane Warrant Graphs

AUXILLIARY TURN LANE WARRANTS

PROJECT INFORMATION

1. Client	CANFIELD LOCAL SCHOOL DISTRICT								
2. Job Number	22-124								
3. Jurisdiction	CANFIELD, OHIO								
4. Name of roadway where turn lanes are to be analyzed	US 62 @ WEST ACCESS DRIVEWAY								
5. Roadway speed limit	45								
6. Number of Lanes	2								
7. Analysis Condition (Year / Build)	2027 BUILD								
8. Direction of Roadway	EB/WB								
9. Direction of Side Street Approach	NB								
10. Is the Roadway Divided or Undivided	Undivided								
11. Enter Volume Data for Intersection									
			EASTBOUND						
- Right Turn			Right	Thru	Advancing				
	AM		500	490	990				
	PM		239	480	719				
			WESTBOUND		EASTBOUND				
- Left Turn			Left	Thru	Thru	Right	Advancing	Opposing	LT%
	AM		238	893	490	500	1131	990	21.0%
	PM		112	773	480	239	885	719	12.7%

Notes:

1. Analyst to fill in all blue areas.
2. Green areas are calculated for the analyst

US 62 @ WEST ACCESS DRIVEWAY

2027 BUILD

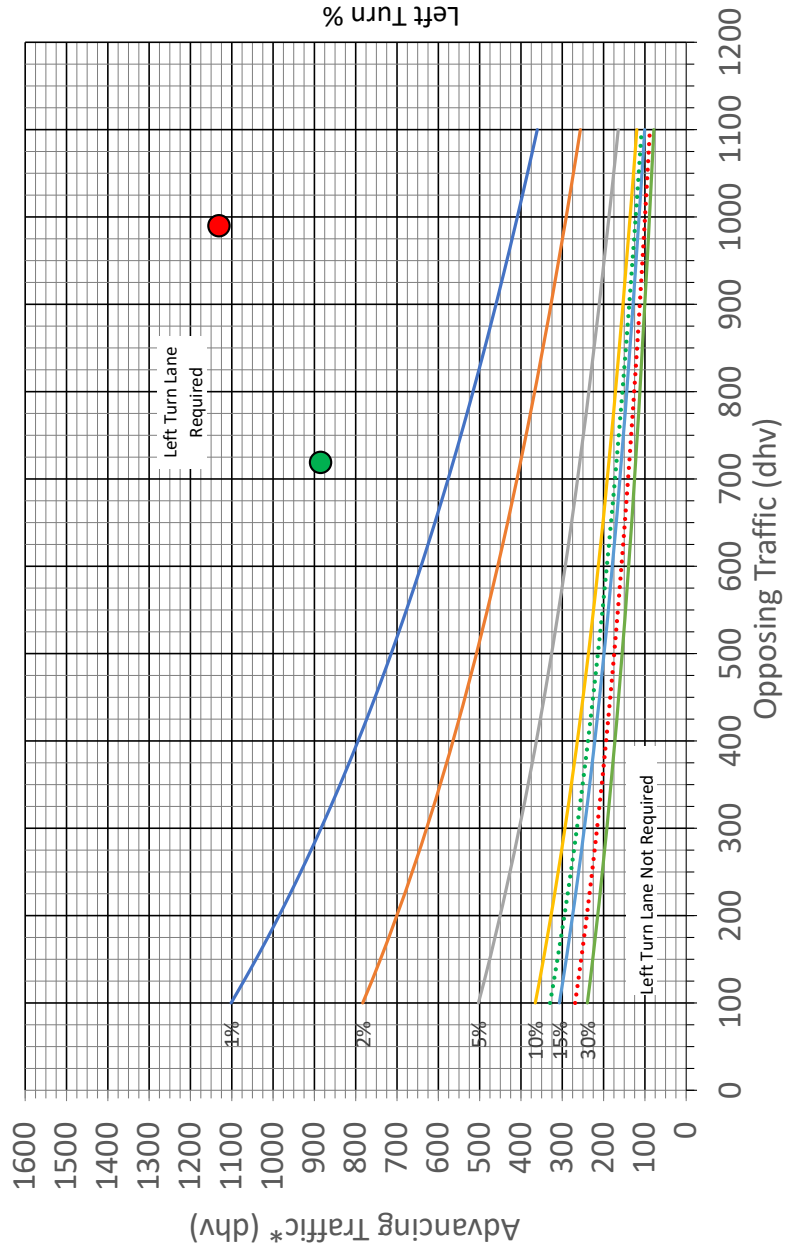
WARRANT IS MET

Left turn lane is warranted in the AM when the red dot is located on or above the dotted red line.

Left turn lane is warranted in the PM when the green dot is located on or above the dotted green line.

2-Lane Highway Left Turn Lane Warrant

(>40 mph or 70 kph Posted Speed)



2-LANE LEFT TURN LANE WARRANT (HIGHSPEED)

401-5bM

REFERENCE SECTION
401.6.1

TIME	WESTBOUND		EASTBOUND		ADVANCING	OPPOSING	LT%	WARRANT?
	LEFT	THRU	THRU	RIGHT				
AM	238	893	490	500	1131	990	21.0%	YES
PM	112	773	480	239	885	719	12.7%	YES

2-LANE RIGHT TURN LANE WARRANT (HIGH SPEED)

401-6bM

REFERENCE SECTION
401.6.3

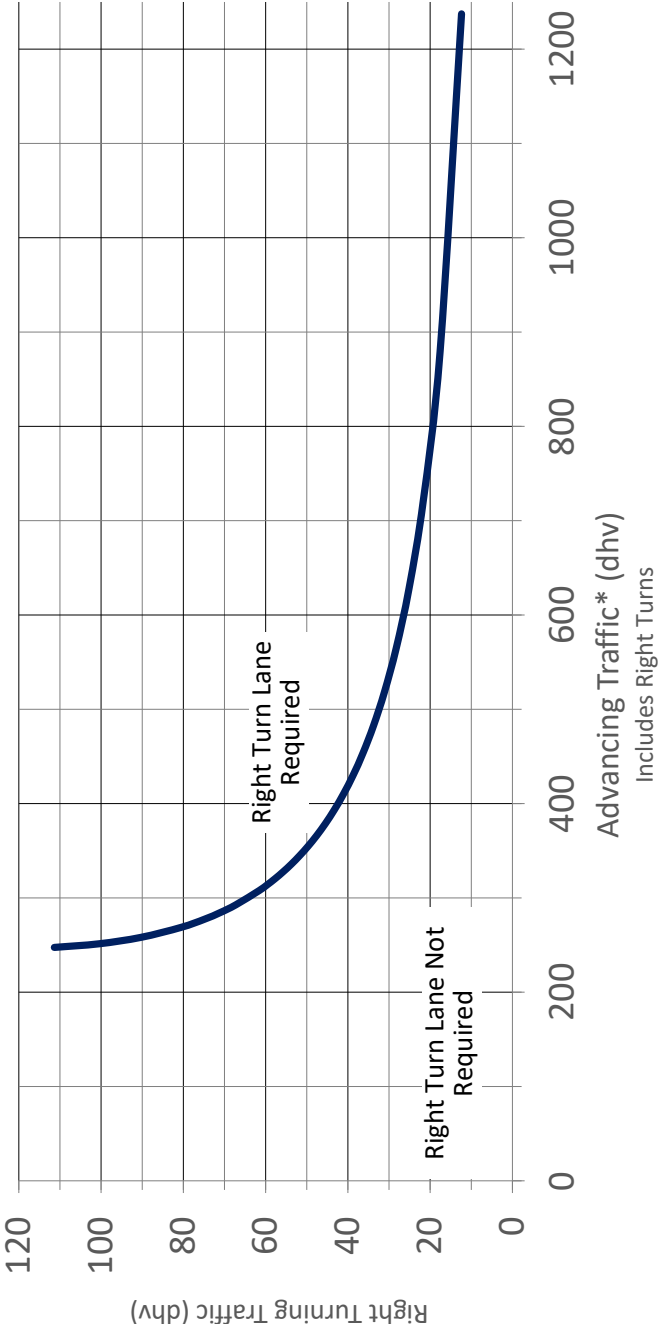
US 62 @ WEST ACCESS DRIVEWAY

2027 BUILD

WARRANT IS MET

2-Lane Highway Right Turn Lane Warrant

(>40 mph or 70 kph Posted Speed)



TIME	EASTBOUND			WARRANT?
	THRU	RIGHT	ADVANCING	
AM	490	500	990	YES
PM	480	239	719	YES

AUXILLIARY TURN LANE WARRANTS

PROJECT INFORMATION

1. Client	CANFIELD LOCAL SCHOOL DISTRICT									
2. Job Number	22-124									
3. Jurisdiction	CANFIELD, OHIO									
4. Name of roadway where turn lanes are to be analyzed	US 62 @ WEST ACCESS DRIVEWAY									
5. Roadway speed limit	45									
6. Number of Lanes	2									
7. Analysis Condition (Year / Build)	2047 BUILD									
8. Direction of Roadway	EB/WB									
9. Direction of Side Street Approach	NB									
10. Is the Roadway Divided or Undivided	Undivided									
11. Enter Volume Data for Intersection										
- Right Turn	EASTBOUND									
		Right	Thru	Advancing						
	AM	500	550	1050						
	PM	239	530	769						
- Left Turn	WESTBOUND									
		Left	Thru	EASTBOUND						
				Thru	Right	Advancing	Opposing	LT%		
	AM	238	943	550	500	1181	1050	20.2%		
	PM	112	823	530	239	935	769	12.0%		

Notes:

1. Analyst to fill in all blue areas.
2. Green areas are calculated for the analyst

US 62 @ WEST ACCESS DRIVEWAY

2047 BUILD

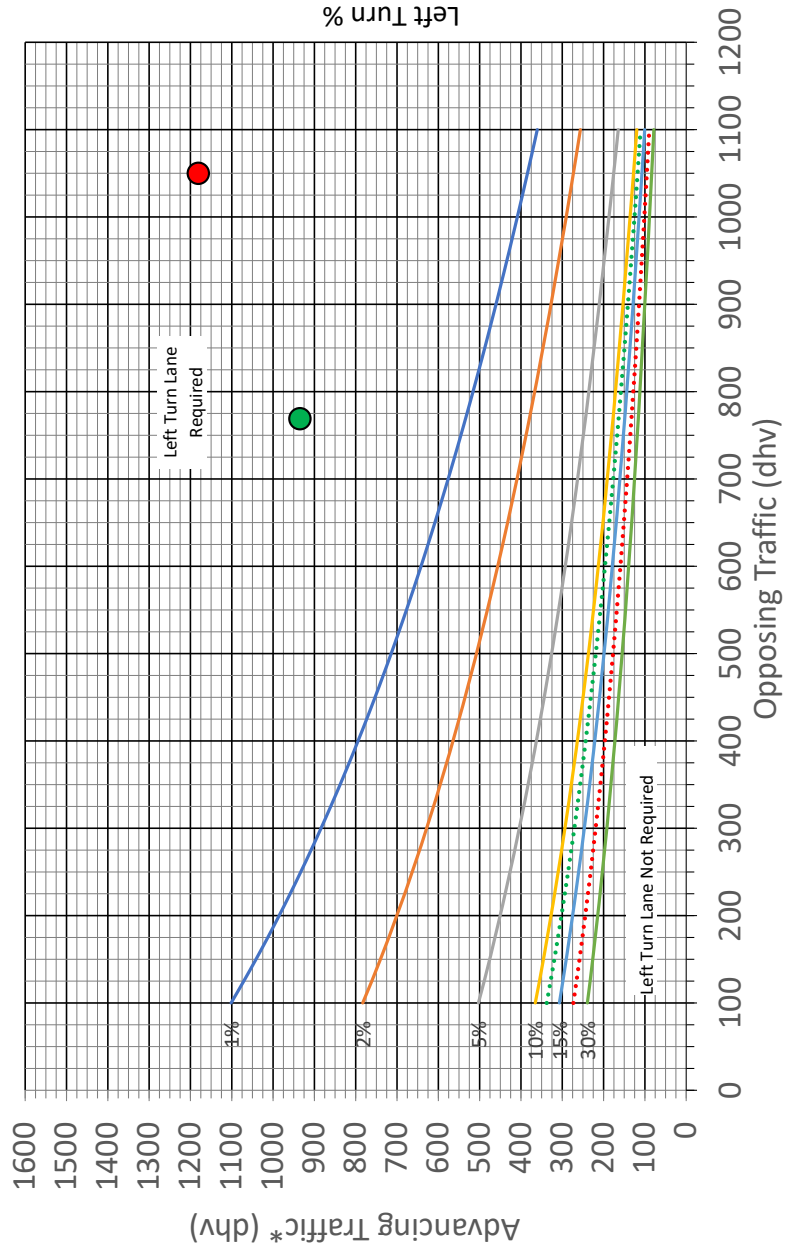
WARRANT IS MET

Left turn lane is warranted in the AM when the red dot is located on or above the dotted red line.

Left turn lane is warranted in the PM when the green dot is located on or above the dotted green line.

2-Lane Highway Left Turn Lane Warrant

(>40 mph or 70 kph Posted Speed)



* Includes Left Turns

2-LANE LEFT TURN LANE WARRANT (HIGHSPEED)

401-5bM

REFERENCE SECTION
401.6.1

TIME	WESTBOUND		EASTBOUND		ADVANCING	OPPOSING	LT%	WARRANT?
	LEFT	THRU	THRU	RIGHT				
AM	238	943	550	500	1181	1050	20.2%	YES
PM	112	823	530	239	935	769	12.0%	YES

2-LANE RIGHT TURN LANE WARRANT (HIGH SPEED)

401-6bM

REFERENCE SECTION
401.6.3

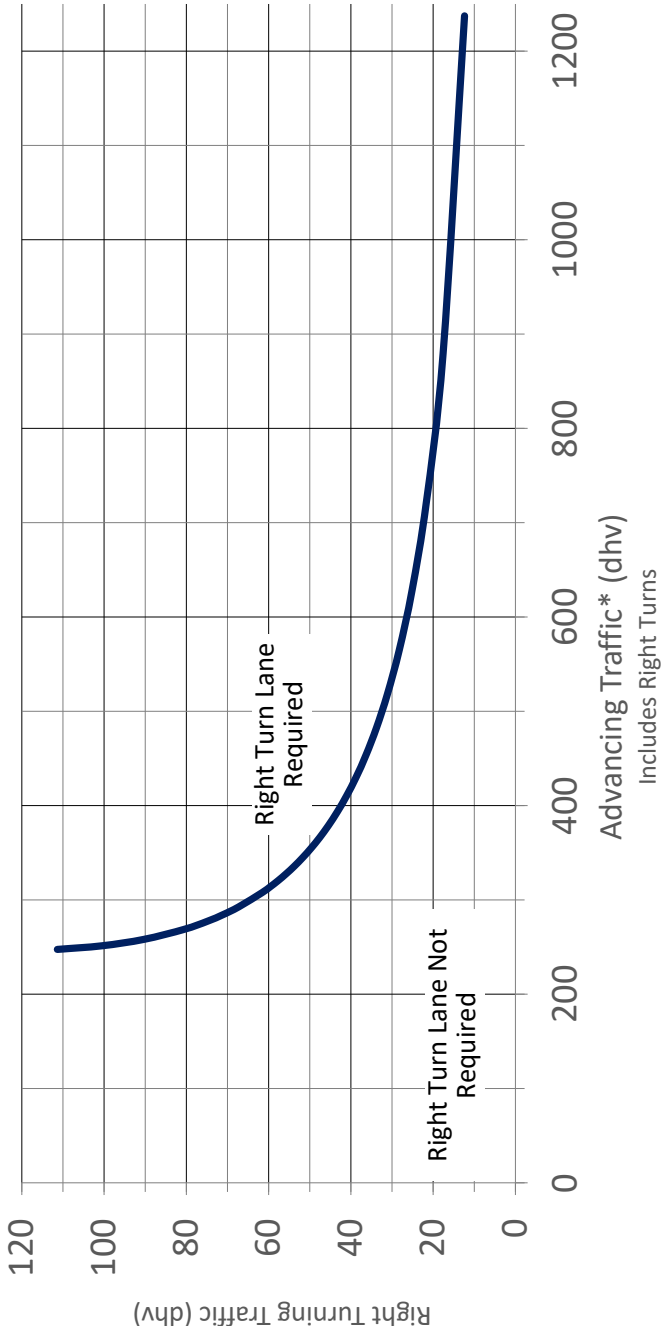
US 62 @ WEST ACCESS DRIVEWAY

2047 BUILD

WARRANT IS MET

2-Lane Highway Right Turn Lane Warrant

(>40 mph or 70 kph Posted Speed)



TIME	EASTBOUND			WARRANT?
	THRU	RIGHT	ADVANCING	
AM	550	500	1050	YES
PM	530	239	769	YES

