July 12, 2018

Mr. Alan Haines, Director of Public Service
City of Pataskala
621 W. Broad Street, Suite 2B
Pataskala, OH 43062

Re: Review Comments/Questions
Traffic Impact Study – Licking Heights High School

Dear Mr. Haines:

At the request of the city, Jobes Henderson & Associates, Inc. (JHA) has reviewed the Traffic Impact Study for the Licking Heights High School development dated May 24, 2018. We also attended a meeting on June 28 with representatives of the school district and the city.

The purpose of this memo is to offer comments on the Traffic Impact Study itself. To that end, we offer the following comments:

TIS Comments:

1. Pataskala is located within the boundaries of the Mid Ohio Regional Planning Commission (MORPC). MORPC has traffic models in place for all of their coverage area. Therefore, Hull has requested information on the anticipated growth rate for this type of study in this location to confirm or refute the 1% growth rate used on this study. A reply to this request has not yet been received, but will be forwarded as soon as it is.
2. The TIS indicates that all of the school related recommendations apply only if the High School and Middle School operate on staggered start times. To work effectively, this stagger must be a minimum of 30 minutes. The city will need confirmation from the district that these staggered times will be implemented and maintained. Otherwise, the study and recommendations will need to be revisited and revised.
3. While the study addresses flow and capacity issues, it does not address crash history. JHA acquired the crash data for the study area for the past 3 years, and the majority of crashes have occurred at the intersection of Cable Road and Summit Street. There have been 10 total crashes there, with 6 being rear end and 2 being angle. The study needs to further analyze this intersection to address any safety issues that could arise with the recommendations.
4. We are curious about the methodology where the study analyzed the area with the current school removed. Please provide additional detail for this part of the study.
5. What is the current enrollment of the existing high school?
6. A new drive to the complex off of Mink Street is mentioned. There is an existing school facility on Mink Street with 3 existing drives onto Mink Street. As part of this project, these three drives and the proposed new drive will all need to be consolidated into one drive off of Mink Street.
7. The study is not clear about how internal traffic will flow and how this will help with the public access points. It was mentioned in the meeting that internal traffic will be optimized for use by the facility to reduce traffic on the public roadways. Details of how this will work will need to be presented to the city to confirm the expectations from the study.
8. On page 24, the streets in this area are listed as 'urban streets'. This should be discussed to determine if that is the correct determination since this impacts study decisions.
9. On several of the exhibits for traffic counts, numbers do not add up correctly. Again, this raises the concern that decisions and conclusions were reached with incorrect numbers (Figure 3.5, etc.).

10. On some of the projections into 2040, numbers have not changed from current. This does not seem realistic.
11. We observed several typographical issues that should not change the results of the study but introduce enough confusion that they should be addressed:
    a. On page vi, notations for years 2020 and 2040 are reversed in some locations (note this applies in other locations within the study as well and becomes confusing)
    b. Table 3.1 on page 14 reverses the ITE description for High School and Middle School.
    c. State Route 44 is referred to on page 25?
    d. On page 35, 'left turn lane' should be 'right turn lane'.

Other Factors for City of Pataskala Consideration:

12. It should be noted that the location where the city and school district get the most complaints about traffic currently (with the operation of the current high school) is the intersection of Summit Road and Havens Corner Road. This area is not addressed by the study and will only get worse with the additional traffic generated by the proposed project. The school district will need to take an active role in addressing the future traffic concerns that are inevitable for this intersection with the project.
13. By definition, the school district is a developer. Pataskala has many policies and regulations that apply to developer led projects. Since the school district is another public entity, the city can choose to partner differently with the school district, but the formal relationship of developer and city, by definition, still applies.
14. The TIS indicates that some improvements will be required even if this project does not occur. However, it is an important consideration that most of the traffic in the area that causes this need is for the existing high school. Absent the high school being there, no improvement to city facilities would be needed.
15. It should be noted that a roundabout is proposed at the intersection of Summit and Cable under several of the analyzed scenarios. While we do agree that roundabouts are efficient and safe, the applicability of a roundabout at this location will need to be seriously considered by the city before final approval.
16. A very important consideration for this study is that school traffic impacts are very different than any other type of development. The study is based on the traffic conditions at peak hours for the schools, one in the morning and on in the afternoon. At all other times (other than possibly a football game or other large event), traffic is not nearly as high as is reflected in the study. Any other development would be generating heavier traffic for a 12-15-hour window daily and possibly more on weekends. This allows the city some level of flexibility on what upgrades or improvements to require.

We thank you for the opportunity to offer our thoughts on this study. Please let us know if there are any questions or if we can assist in any other way.

Sincerely,
Jobes Henderson & Associates, Inc.

James G. Roberts, P.E.
President

TMS Engineers, Inc.

Traffic Impact Study

Licking Heights High School
Licking Heights Local School District

May 24, 2018

Prepared for:
BSHM Architects
15 Central Square
Suite 300
Youngstown, OH 44503

TRAFFIC IMPACT STUDY

LICKING HEIGHTS HIGH SCHOOL

Licking Heights Local School District

May 24, 2018

Prepared For:

BSHM Architects
15 Central Square
Suite 300
Youngstown, Ohio 44503

Prepared By:

TMS Engineers, Inc.
2112 Case Parkway S.
Unit #7
Twinsburg, Ohio 44087

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Executive Summary

This traffic impact study has been prepared at the request of BSHM Architects, Inc. for the construction of a new Licking Heights School and the conversion of the existing high school to a middle school. The project site is located in Pataskala, Licking County, Ohio. The site is bordered by Summit Road SW to the west, Cable Road SW to the south, and Mink Street SW to the east. The development site is currently occupied by the existing Licking Heights High School.

The high school is being designed for an enrollment of 1,800 students and 80 staff members. The existing high school is being renovated for a middle school enrollment of 900 students and 40 staff members. The site plan for the proposed high school can be seen in **Figure 1.2, Page 3**.

Licking Heights High School is currently served by one full access driveway along the north side of Cable Road SW.

The proposed project is expected to create one new access location along the east side of Summit Road SW, one new access location along the north side of Cable Road SW, and one access location along the west side of Mink Street SW. The existing driveway along Cable Road SW will continue to be used with the proposed project. The location and layout of the proposed access driveways for the high school development can be seen in **Figure 1.2, Page 3**.

The year 2020 will be analyzed for the opening year conditions, and the year 2040 will be analyzed as the design year for the twenty year conditions analysis.

Based on the collected traffic data and the existing bell schedules for the high school and the middle school, the weekday AM peak hour of traffic was determined to be 7:00 AM to 8:00 AM. The weekday PM peak hour of traffic was found to be 2:00 PM to 3:00 PM. These periods will be analyzed since they reflect the period of the highest volume of traffic flow for the study area roadways and the proposed schools.

The proposed high school and middle school are expected to generate the following average hourly traffic during the AM and PM peak periods:

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)	
522	Middle School/Junior High School	900	327	267	133	157
530	High School	1,800	627	309	164	350
TOTAL NEW GENERATED TRIPS			**954**	**576**	**297**	**507**
			1530		**804**	

Recommend Improvements to Serve Future Conditions without the Development

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the existing 2018 conditions:

Cable Road SW & High School Access Driveway

- Westbound Right Turn Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the existing 2018 conditions.

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2020 No-Build conditions:

Cable Road SW & High School Access Driveway

- Single Lane Roundabout

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2040 No-Build conditions:

Summit Road SW & Cable Road SW

- Northbound Right Turn Lane

Cable Road SW & High School Access Driveway

- Single Lane Roundabout

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

Recommended Improvements to Mitigate the Site Generated Traffic

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2020 Build conditions:

Summit Road SW & Cable Road SW

- Single Lane Roundabout w/ Northbound Right Turn By-Pass Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 Build conditions.

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2040 Build conditions:

Summit Road SW & Cable Road SW

- Single Lane Roundabout w/ Northbound Right Turn By-Pass Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

Development Access Recommendations

The use of a staggered start time for the high school and the middle school is recommended to lessen the impact of the site generated traffic on the study area intersections. It is recommended that the schools have a minimum of 30 minutes between there start times.

The following lane use and traffic control are recommended to accommodate the 2020 and 2040 site generated (Build) traffic at the development access locations based on the site plan shown in **Figure 1.2** and the results of the previous analyses:

Summit Road SW & Proposed High School Access Driveway

- Construct the proposed access driveway with one egress lane and one ingress lane.
- Install stop sign control for the proposed east approach.

Cable Road SW & High School Access Driveway

- Construct the proposed access driveway with two egress lanes and one ingress lane.
- Construct an exclusive westbound right turn lane.
- Construct an exclusive eastbound left turn lane.
- Install stop sign control for the proposed north approach.

Cable Road SW & Middle School Access Driveway

- Extend the existing eastbound left turn lane to 290 feet including a 50 taper.

Mink Street SW & Middle School Access Driveway

- Construct the proposed access driveway with one egress lane and one ingress lane.
- Install stop sign control for the proposed west approach.

Conclusion

Based upon the results of the analysis in this study and the corresponding recommendations, it can be seen that the site generated traffic can be accommodated by the study area roadway network.

Chapter 1
Introduction

1.1 Purpose of Report

This traffic impact study has been prepared at the request of BSHM Architects, Inc. for the construction of a new Licking Heights High School and the conversion of the existing high school to a middle school. The project site is located in Pataskala, Licking County, Ohio. The site is bordered by Summit Road SW to the west, Cable Road SW to the south, and Mink Street SW to the east. The development site is currently occupied by the existing Licking Heights High School. **Figure 1.1, Page 2** shows the location of the existing and new Licking Heights High School.

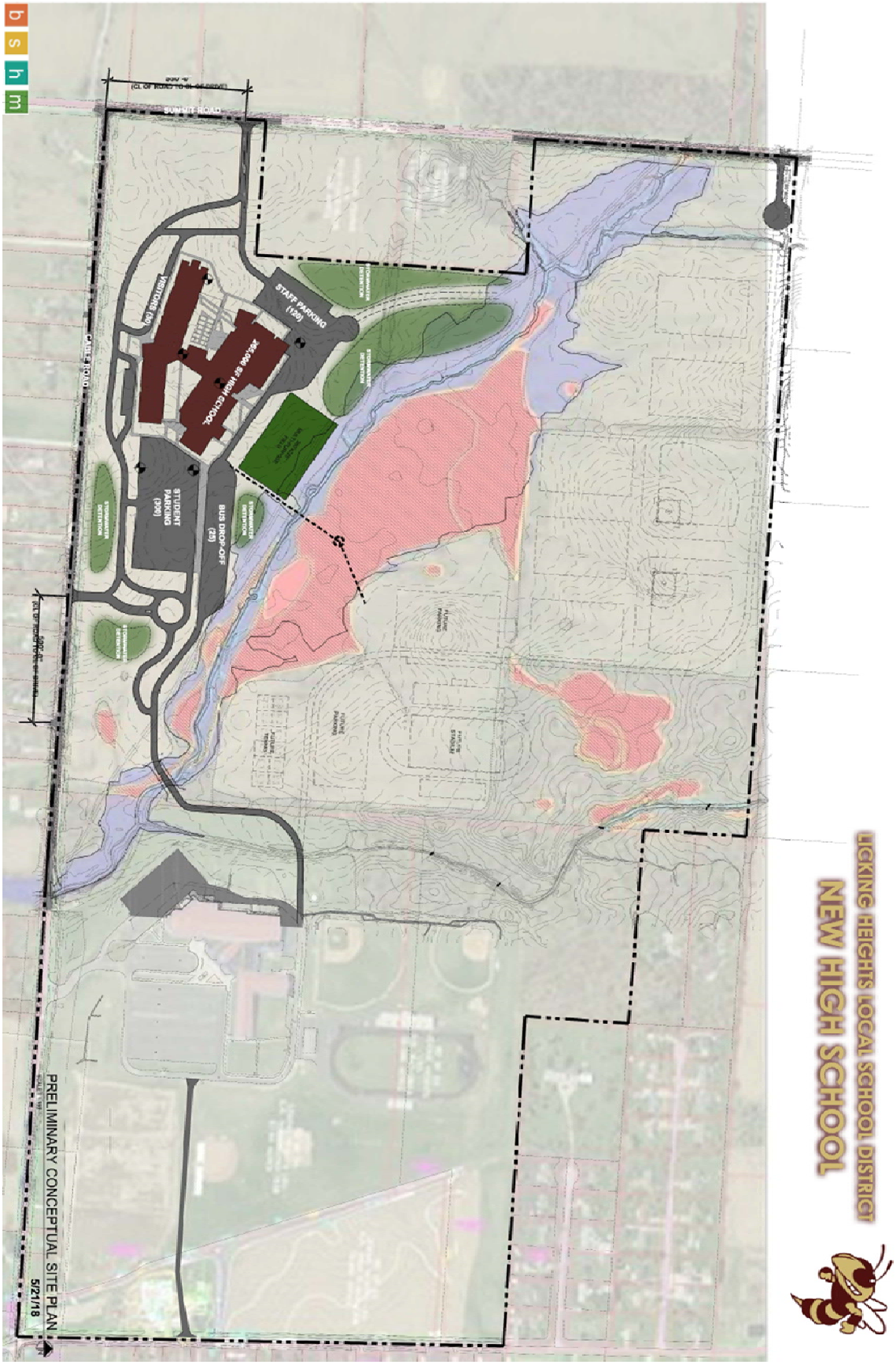
The high school is being designed for an enrollment of 1,800 students and 80 staff members. The existing high school is being renovated for a middle school enrollment of 900 students and 40 staff members. The site plan for the proposed high school can be seen in **Figure 1.2, Page 3**.

Licking Heights High School is currently served by one full access driveway along the north side of Cable Road SW. The driveway will continue to serve the re-developed site under the expected future conditions.

The proposed project is expected to create one new access location along the east side of Summit Road SW, one new access location along the north side of Cable Road SW, and one access location along the west side of Mink Street SW. The existing driveway along Cable Road SW will continue to be used with the proposed project. The location and layout of the proposed access driveways for the high school development can be seen in **Figure 1.2, Page 3**.

The year 2020 will be analyzed for the opening year conditions, and the year 2040 will be analyzed as the design year for the twenty year conditions analysis. The opening year and twenty year design analyses will use the full high school and middle school enrollments as previously discussed.

TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Licking Heights Schools Traffic Impact Study Pataskala, Ohio	Location Map	NORTH NOT TO SCALE	Figure 1.1 Page 2



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1.2 Study Objectives

This study is structured for the following purposes;

- to adequately assess the traffic impacts associated with the proposed school project and to 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 procedures and guidelines found in the ODOT **Access Management Manual (AMM)** will be used in the development of the traffic impact study.

The traffic impacts will be determined by comparing the existing intersection levels-of-service before the development of the proposed high school to the anticipated levels-of-service after the high school is completed. Levels-of-service for the study area and access driveway intersections will be calculated using the computerized version of the Transportation Research Board's **Highway Capacity Manual 6TH Edition, HCM6E (HCS7, Release 7.4)**.

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** 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**.

Chapter 2
Area Conditions

2.1 Transportation Network Study Area

The Ohio Department of Transportation functionally classify 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 ODOT functional classification of the roadways in the study area can be seen on ODOT's website.

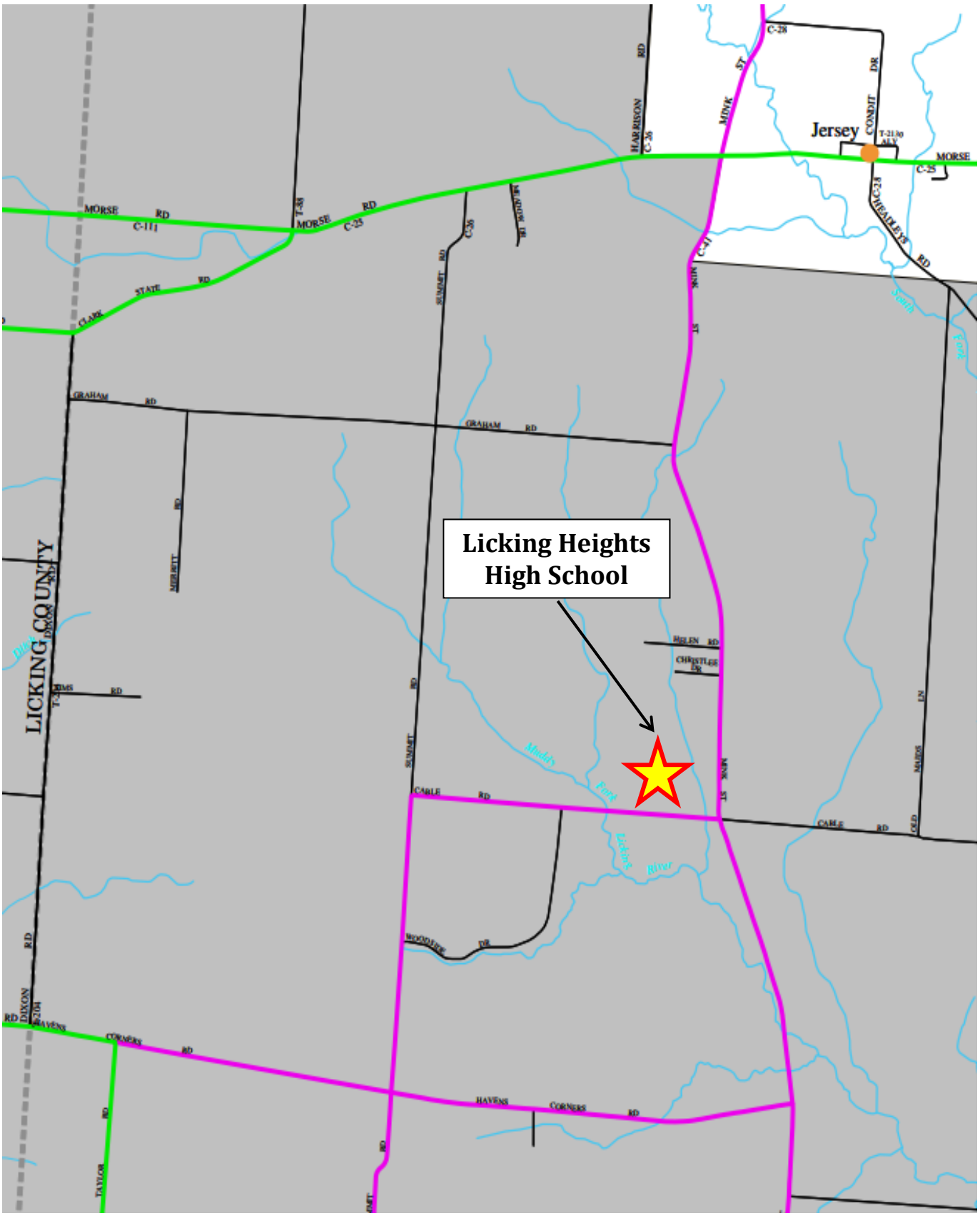
The following table lists the study roadways that have an assigned functional classification as determined by ODOT and local government entities. Roadways that are not listed as having a functional classification can be assigned into one of two categories. The first category is a local roadway and the second category is that of an access drive.

Table 2.1 Functional Classification

ROADWAY	AREA	FC #	CLASSIFICATION
Summit Road SW (North of Cable)	Urban	7	Local Roadway
Summit Road SW (South of Cable)	Urban	5	Major Collector
Cable Road SW (West of Mink)	Urban	5	Major Collector
Cable Road SW (East of Mink)	Urban	7	Local Roadway
Mink Street SW	Urban	5	Major Collector

Figure 2.1, Page 6 details the section of the functional classification map for the study area. The classification maps can currently be found online at the following ODOT web address:

http://www.dot.state.oh.us/Divisions/Planning/ProgramManagement/MajorPrograms/MapRoom/Forms/AllItems.aspx



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

Table 2.2 Roadway Characteristics

ROADWAY	# OF LANES	ORIENTATION	SPEED LIMIT (MPH)	ADT* (VPD)
Summit Road SW	2	North-South	35	3,010[A]
Cable Road SW	2	East-West	35	1,780[B]
Mink Street SW	2	North-South	35	4,400[C]

*** 2018 Collected Traffic Data/Rounded to nearest 10**
A - @ Cable Road SW
B - @ LHHS Access
C - @ Cable Road SW

The following sections detail the lane use and traffic control at each location under study for this report.

SUMMIT ROAD SW & CABLE ROAD SW

Summit Road SW North Approach
- 1 Shared Through & Left Turn Lane

Summit Road SW South Approach
- 1 Shared Through & Right Turn Lane

Cable Road SW East Approach
- 1 Shared Left & Right Turn Lane

The intersection is controlled by a stop sign on the Cable Road SW east approach. The Summit Road SW approaches operate under free-flow conditions with the southbound left turn movement yielding to the northbound movements.

CABLE ROAD SW & LICKING HEIGHTS HIGH SCHOOL (LHHS) DRIVEWAY

Cable Road SW West Approach
- 1 Through Lane
- 1 Exclusive Left Turn Lane

Cable Road SW East Approach
- 1 Shared Through & Right Turn Lane

LHHS Driveway North Approach
- 1 Exclusive Left Turn Lane
- 1 Exclusive Right Turn Lane

The intersection is controlled by a stop sign on the LHHS driveway approach. The Cable Road SW approaches operate under free-flow conditions with the eastbound left turn movement yielding to the westbound movements. The existing eastbound left turn lane on Cable Road SW is approximately 240 feet long including the taper. There are also existing transitions upstream and downstream of the turn lane that move the through traffic lanes around the left turn lane.

MINK STREET SW & CABLE ROAD SW

Mink Street SW North Approach
- 1 Shared Left, Through & Right Turn Lane

Mink Street SW South Approach
- 1 Shared Left, Through & Right Turn Lane

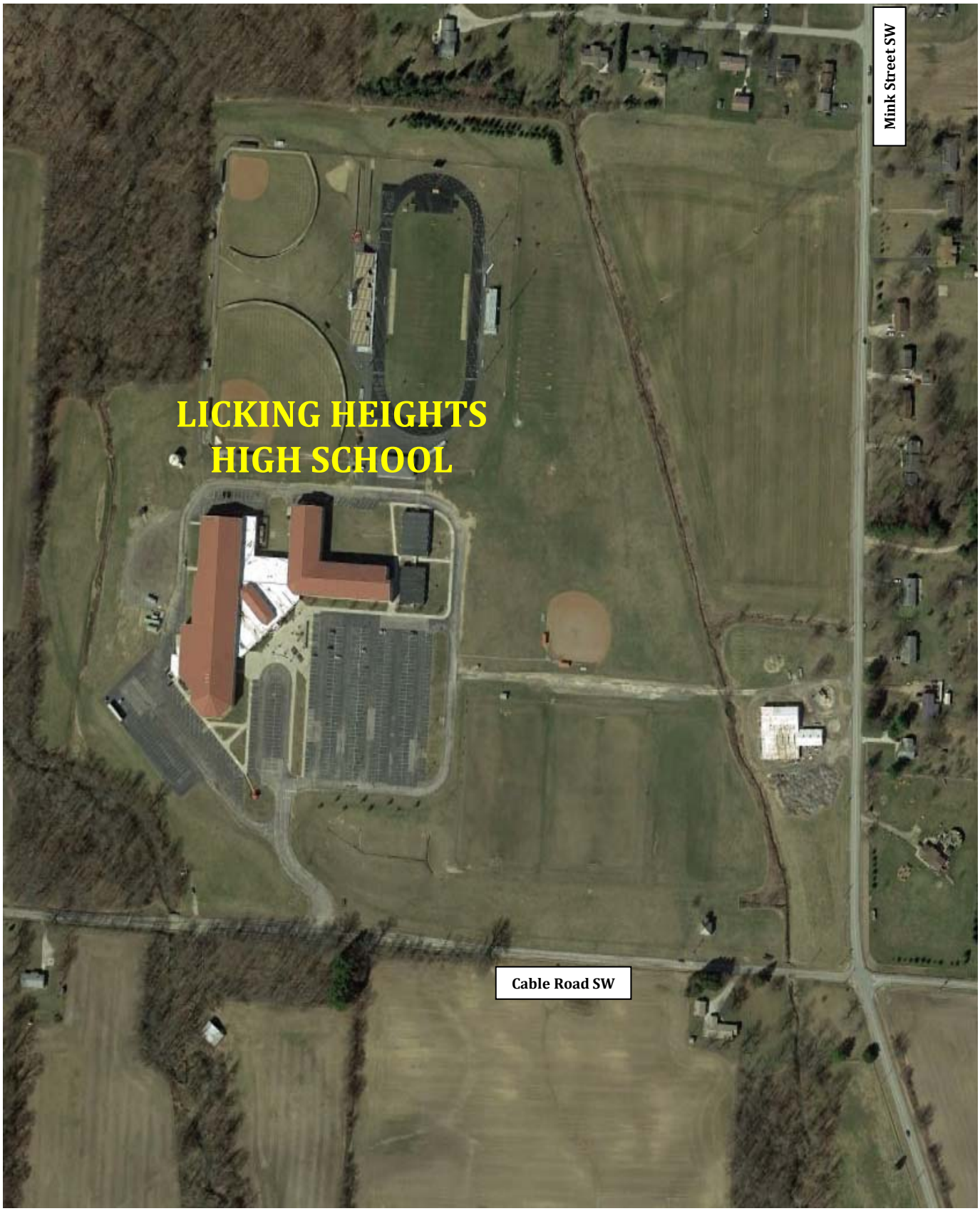
Cable Road SW West Approach
- 1 Shared Left, Through & Right Turn Lane

Cable Road SW East Approach
- 1 Shared Left, Through & Right Turn Lane

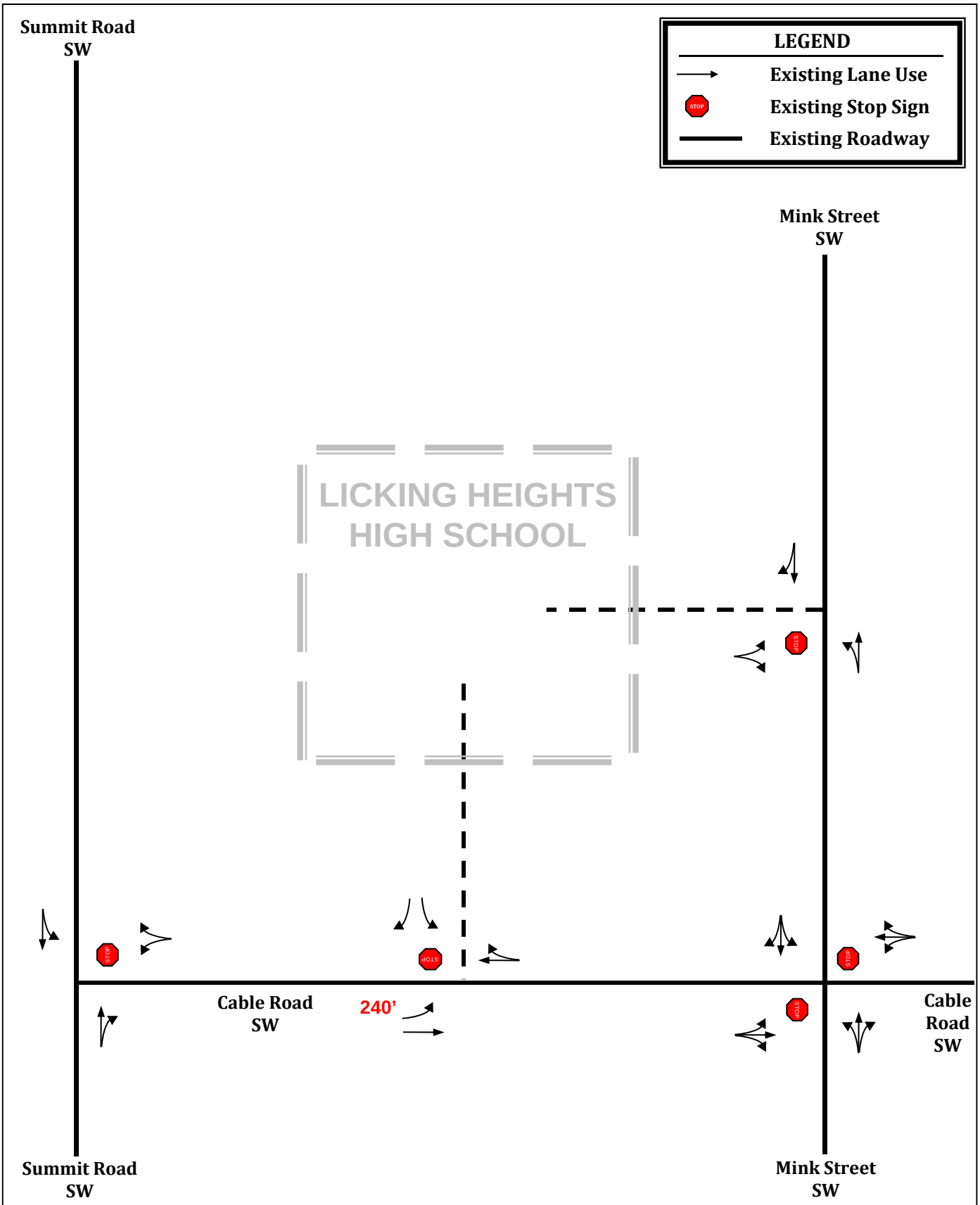
The intersection is controlled by a stop sign on the Cable Road SW approaches. The Mink Street SW approaches operate under free-flow conditions with the left turn movements yielding to the opposing through and right turn movements.

Figure 2.2, Page 9 shows an aerial view of the study area.

Figure 2.3, Page 10 shows the existing lane use and traffic control conditions in the study area. These will be considered the existing base conditions for this report.



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Licking Heights Schools Traffic Impact Study Pataskala, Ohio	Aerial View	NORTH NOT TO SCALE	Figure 2.2
				Page 9



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2.2 Traffic

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

1. Summit Road SW & Cable Road SW
2. Cable Road SW & LHHS Driveway
3. Mink Street SW & Cable Road SW
4. Mink Street SW & LHHS Access

The traffic counts were performed on Thursday, March 22, 2018 and Thursday, May 3, 2018.

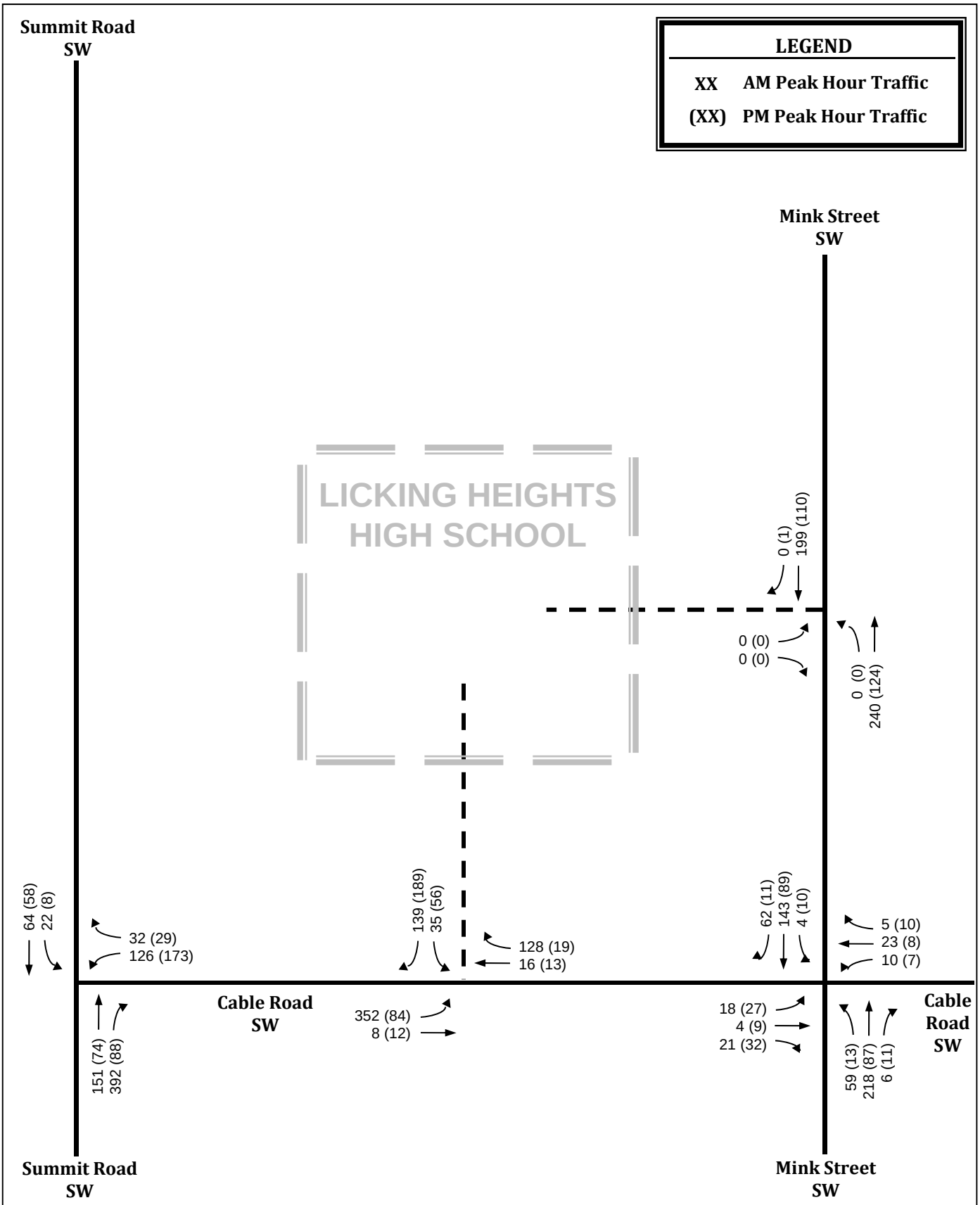
The weekday traffic counts were conducted in fifteen (15) minute intervals between the hours of 7 AM - 10 AM, 11 AM - 1 PM, and 2 PM - 6 PM, then hourly totals were calculated. A copy of the intersection turn movement counts are included in **Appendix A**.

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.

The first period begins at 7:25 AM for the high school and 7:33 AM for the middle school. Based on the collected traffic data and the existing bell schedules for the high school and the middle school, the weekday AM peak hour of traffic was determined to be 7:00 AM to 8:00 AM. The weekday PM peak hour of traffic was found to be 2:00 PM to 3:00 PM. These periods will be analyzed since they reflect the period of the highest volume of traffic flow for the study area roadways and the proposed schools.

There were minor differences between the entering and exiting volumes at the adjacent count locations along Cable Road SW and Mink Street SW. The through traffic volumes between these intersections have been "balanced" to account for this difference in entering and exiting volumes at the adjacent intersection locations in order to provide a consistent and conservative analysis of the study area volumes. The existing AM and PM peak hour traffic volumes are shown in **Figure 2.4, Page 12**.

In order to determine future Build traffic volumes with the new high school and the middle school on site it will be necessary to determine study area traffic volumes with out the site generated traffic volumes from the existing high school. **Figure 2.5, Page 13** details the study area volumes with the removal of the site generated traffic volumes from the existing high school. These are the expected existing traffic volumes if there was no high school present at the site.



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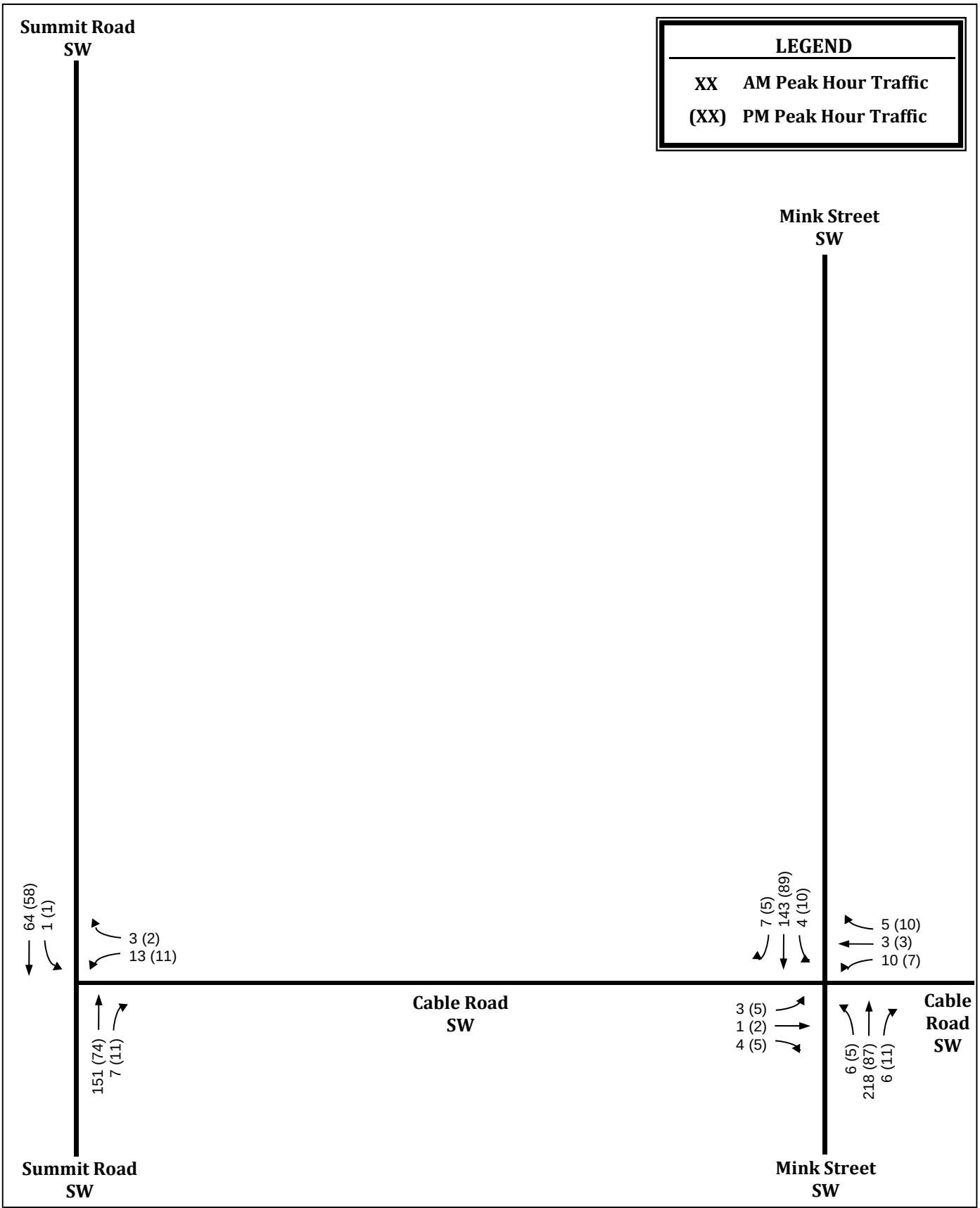
Licking Heights Schools
Traffic Impact Study
Pataskala, Ohio

Existing Weekday
Peak Hour
Traffic Volumes

NORTH
NOT TO SCALE

Figure 2.4



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Licking Heights Schools
Traffic Impact Study
Pataskala, Ohio

No High-School
Peak Hour
Traffic Volumes

NORTH
NOT TO SCALE

Figure 2.5

Chapter 3
Projected Traffic Conditions

3.1 Site Traffic

Trip Generation

An estimate of the traffic generated by the proposed development usually requires determining total trips. 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**", 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 10TH edition and was utilized for this study.

The following table details the development land use from the site plan (**Figure 1.2**) and the corresponding ITE land use 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
Middle School	Institutional	900	522	High School
High School	Institutional	1,800	530	Middle School/Junior High School

The following table details the development generated traffic volumes based on the previously described methods as outlined in the (ITE) **Trip Generation Handbook**. Calculations were prepared based on the number of students. Copies of the trip generation worksheets can be seen in **Appendix B**.

Table 3.2 ITE 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)	
522	Middle School/Junior High School	900	327	267	133	157
530	High School	1,800	627	309	164	350
TOTAL NEW GENERATED TRIPS			954	576	297	507
			1530		804	

Distribution of Generated 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 high school and study area traffic volumes during the peak hours shown in **Figure 2.4**.

The following tables detail the distribution of the AM and PM peak hour new trips for the proposed development.

Table 3.3 AM New Trip Origins & Destinations

ORIGIN/ DESTINATION	ROUTE	ENTER % TOTAL	NEW TRIPS	EXIT % TOTAL	NEW TRIPS
NORTH	Summit	5%	48	16%	92
SOUTH	Summit	68%	649	64%	369
NORTH	Mink	12%	114	8%	46
SOUTH	Mink	11%	105	10%	58
EAST	Cable	4%	38	2%	11
	TOTALS	**100%**	**954**	**100%**	**576**

Table 3.4 PM New Trip Origins and Destinations

ORIGIN/ DESTINATION	ROUTE	ENTER % TOTAL	NEW TRIPS	EXIT % TOTAL	NEW TRIPS
NORTH	Summit	7%	20	11%	56
SOUTH	Summit	75%	223	66%	335
NORTH	Mink	6%	18	9%	45
SOUTH	Mink	7%	20	11%	55
EAST	Cable	5%	16	3%	16
	TOTALS	**100%**	**297**	**100%**	**507**

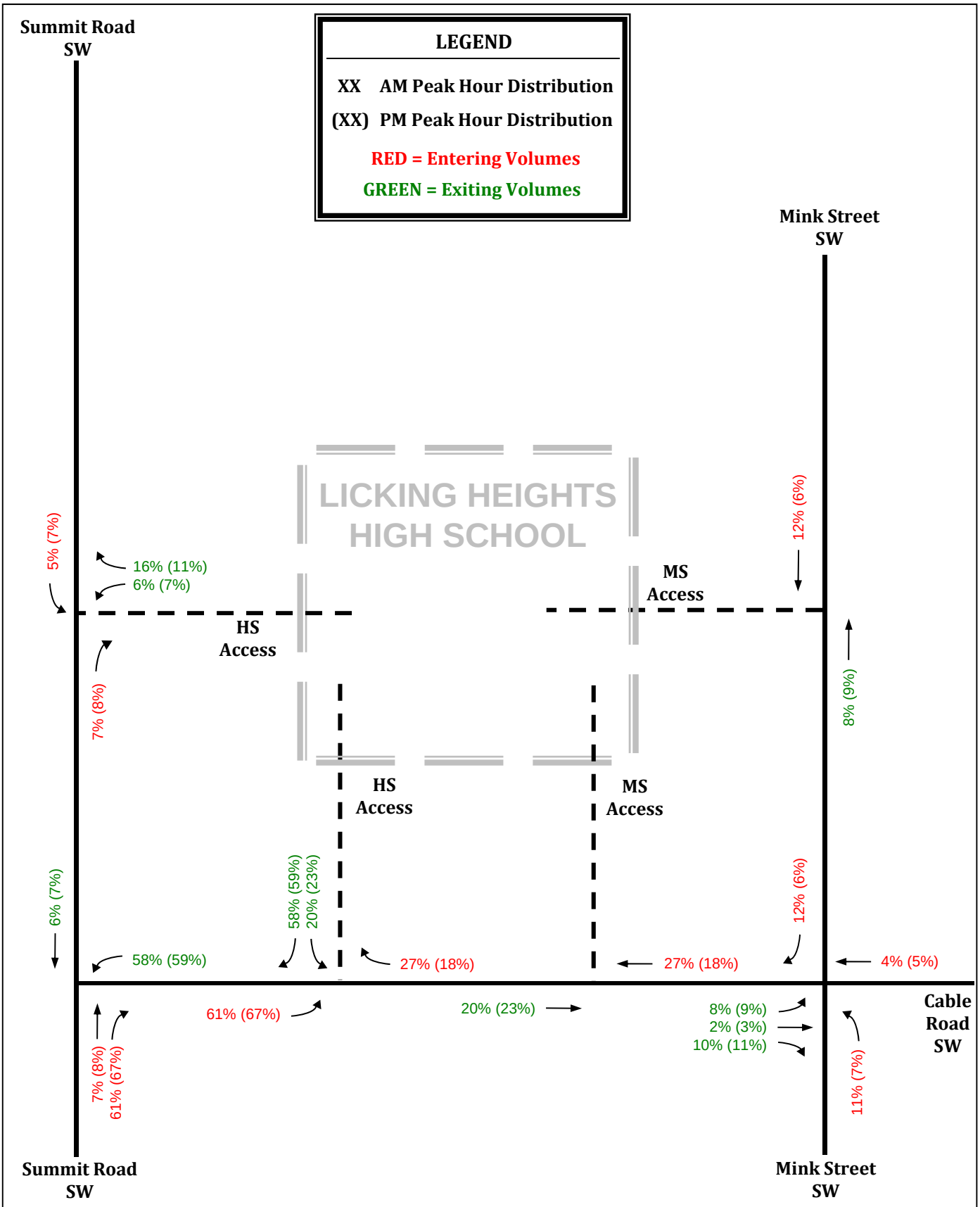
The directional distribution for the new AM and PM peak hour high school generated traffic is shown graphically in **Figure 3.1, Page 18**.

The directional distribution for the new AM and PM peak hour middle school generated traffic is shown graphically in **Figure 3.2, Page 19**.

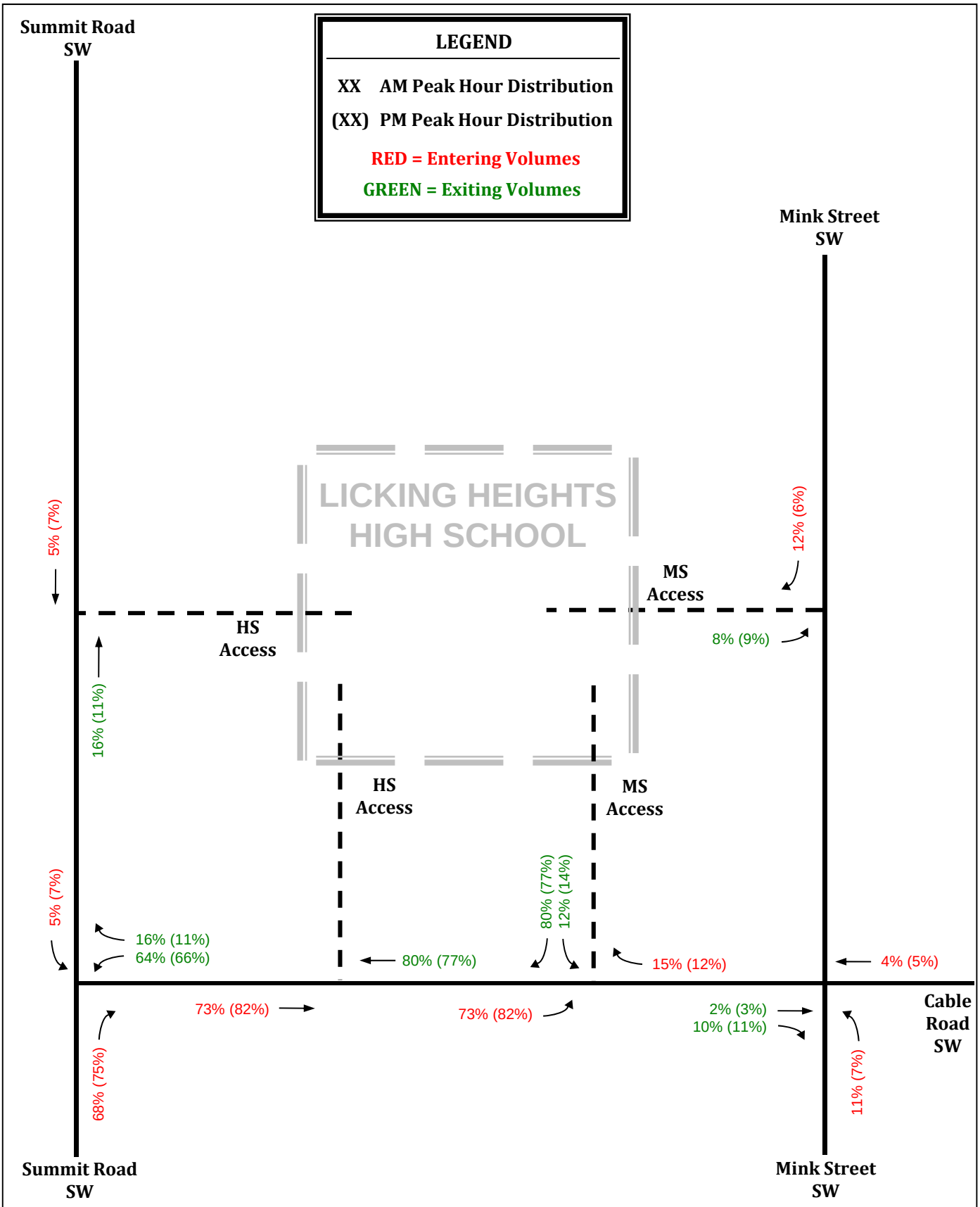
Assignment of Generated Traffic

Based upon the distribution patterns shown in **Figures 3.1**, the new AM and PM peak hour high school generated traffic were assigned to the study intersections. The assignments of the estimated new generated traffic for the proposed high school are shown graphically in **Figure 3.3, Page 20**.

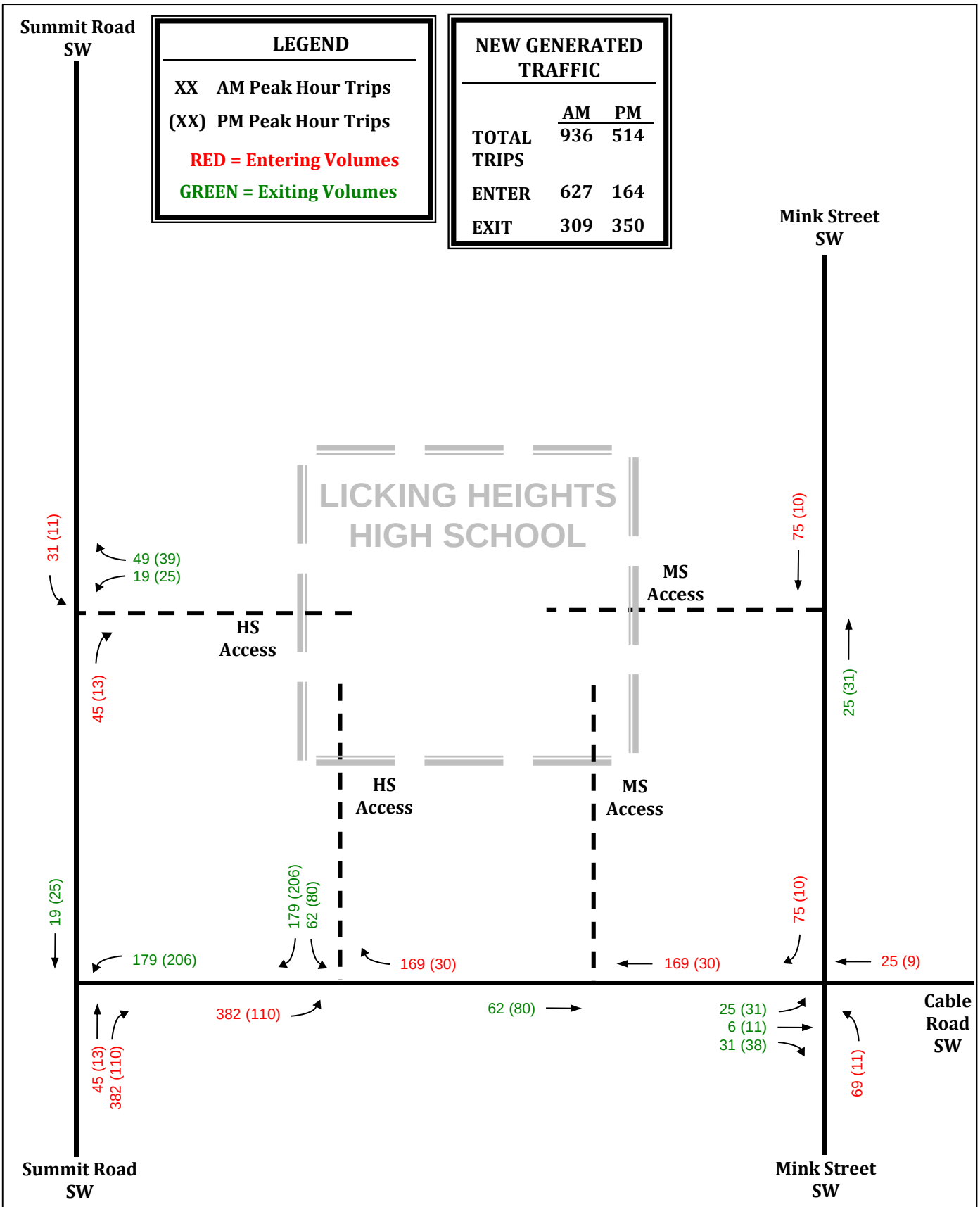
Based upon the distribution patterns shown in **Figures 3.2**, the new AM and PM peak hour middle school generated traffic were assigned to the study intersections. The assignments of the estimated new generated traffic for the proposed middle school are shown graphically in **Figure 3.4, Page 21**.



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Licking Heights Schools Traffic Impact Study Pataskala, Ohio	New High School Generated Traffic Distribution	NORTH NOT TO SCALE	Figure 3.1
				Page 18



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Licking Heights Schools Traffic Impact Study Pataskala, Ohio	New Middle School Generated Traffic Distribution	NORTH NOT TO SCALE	Figure 3.2
				Page 19



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Generated Traffic

NORTH
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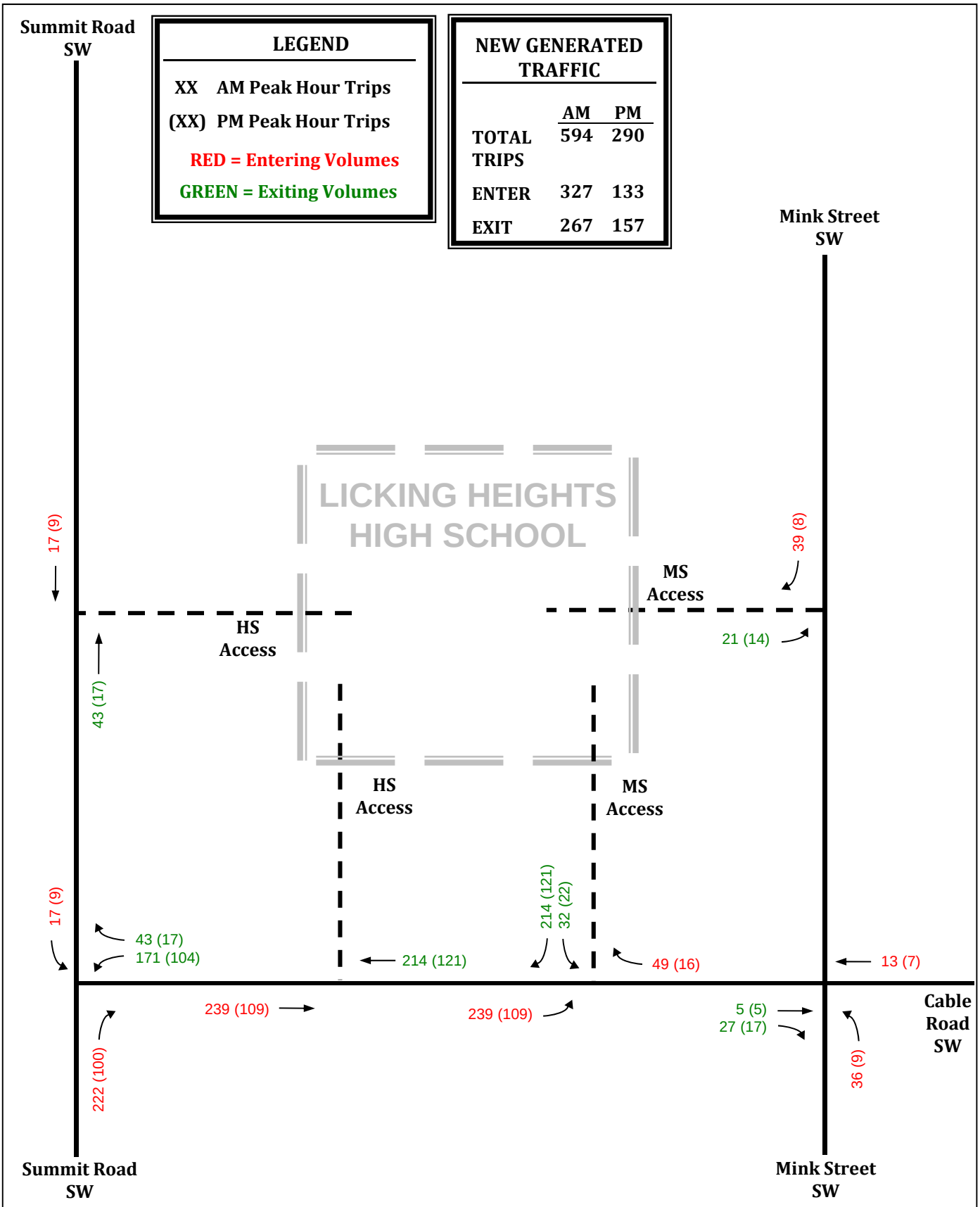
Figure 3.3



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Licking Heights Schools Traffic Impact Study Pataskala, Ohio	New Middle School Generated Traffic	NORTH NOT TO SCALE	Figure 3.4
				Page 21

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. 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 **Access Management Manual** requires that opening year and twenty year design hour traffic volumes be analyzed for a proposed development.

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 the study area roadways will increase in future years.

Any recommended improvements for these intersections should adequately handle the transportation needs of the intersections for twenty years from the opening of the project based upon sound engineering practice and the likelihood of traffic growth due to the functional characteristics of the roadways.

The years 2020 and 2040 will be analyzed for the proposed high school. 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.

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 currently be accessed at the following web address:

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

The TMMS did not provide suitable data within a close enough proximity to use for forecasting future traffic in the study area, therefore a linear growth rate of 1.0% per year will be used to determine the anticipated study area volumes under the 2020 and 2040 No-Build conditions for Summit Road SW, Cable Road SW, and Mink Street SW. No growth rate will be applied to the turn movements at the high school access driveway along Cable Road SW.

A linear growth rate was utilized to estimate non-site related traffic growth. These growth rates will be applied to the existing traffic volumes (**Figures 2.4 & 2.5**). The growth rate and factors for the study area roadways can be seen in the following table:

Table 3.5 - Growth Rates & Factors

ROADWAY	GROWTH RATE (Annual Growth)	2020 GROWTH FACTOR	2040 GROWTH FACTOR
Summit Road (SW)	1.00%	1.02	1.22
Cable Road (SW)	1.00%	1.02	1.22
Mink Street (SW)	1.00%	1.02	1.22

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. On the other side of the spectrum, 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 urban 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 Access Management Manual**, all analyses are required to examine the design hour volume for the adjacent roadway and peak hour traffic volume of the proposed development.

The ODOT **Certified Traffic Manual** provides the methods for estimating design hour volumes. The preferred method is to compute the ratio of the peak hour volume against the daily traffic volume for the study area roadways. A K-factor is then selected from available ODOT data for routes with the same functional classification and a similar ADT. The selected K-factor is then divided by the ratio to determine the DHV factor that will be used to compute the design hour volumes.

For roadways without comparable site-specific data, the design hour factor is determined using the ODOT Peak Hour to Design Hour charts. These charts are based on the functional classification of the roadway, the day of the week and the month that the traffic data was collected.

K-factors were determined using site specific data available on the ODOT Traffic Monitoring Management System (TMMS). The ODOT TMMS can be found at the following web address:

http://odot.ms2soft.com/tcds/tsearch.asp?loc=Odot&mod=

For roadways classified as major collectors, Site 167 from the 2016 ODOT K & D Report was chosen as a route with a similar functional classification (U5) and ADT to make a comparison between the previously calculated ratio and K-factor for study area roadways. Site 167 was reported to have a K-factor of 13.40%.

The following table details the calculation of the design hour factor for the sections of State Route 44 under study:

Table 3.6 - DHV Factor Calculations

LOCATION	PEAK HOUR VOLUME	ADT	RATIO	K-FACTOR	DHV FACTOR*
Summit Road SW	643	3,629	0.1772	0.1340	0.76
Cable Road SW	504	1,776	0.2838	0.1340	0.47
Mink Street SW	588	4,398	0.1337	0.1340	1.00

*** - If the resultant value is less than 1.00, the peak hour volumes should be used as the design hour volumes making the DHV factor 1.00.**

The resultant values for the major collectors in the study area was determined to be equal to or below 1.0. The peak hour volumes will be used as the design hour volumes for these sections of the study area roadways.

The local roadways in the study area were determined to lack comparable site specific data as compared to the available data and the ODOT K & D Reports in order to use the preferred method of using site specific data. The ODOT Peak Hour to Design Hour charts will be used to determine the design hour factors for the study area local roadways. The following table details the design hour factors for the local roadways in the study area:

Table 3.7 - Peak Hour to Design Hour Factors

LOCATION	FUNCTIONAL CLASSIFICATION	MONTH	DAY	DHV FACTOR
Summit North of Cable	Urban Local Roadway	May	Thursday	1.14
Cable East of Mink	Urban Local Roadway	March	Thursday	1.27

3.3 Future Traffic

No-Build Condition

In order to estimate the future traffic considering non-project traffic conditions, the previously discussed calculation of design hour factors and growth rates for each movement were applied to the existing 2018 traffic volumes shown in **Figure 2.4**.

The estimated 2020 and 2040 No-Build traffic volumes for the study area are shown graphically in **Figures 3.5 and 3.6, Pages 27 and 28**. This traffic is the expected traffic if the proposed high school **is not** constructed, the **"No-Build"** condition.

The No-Build traffic volumes have been rounded to the nearest 10 to adhere to preferred ODOT practices

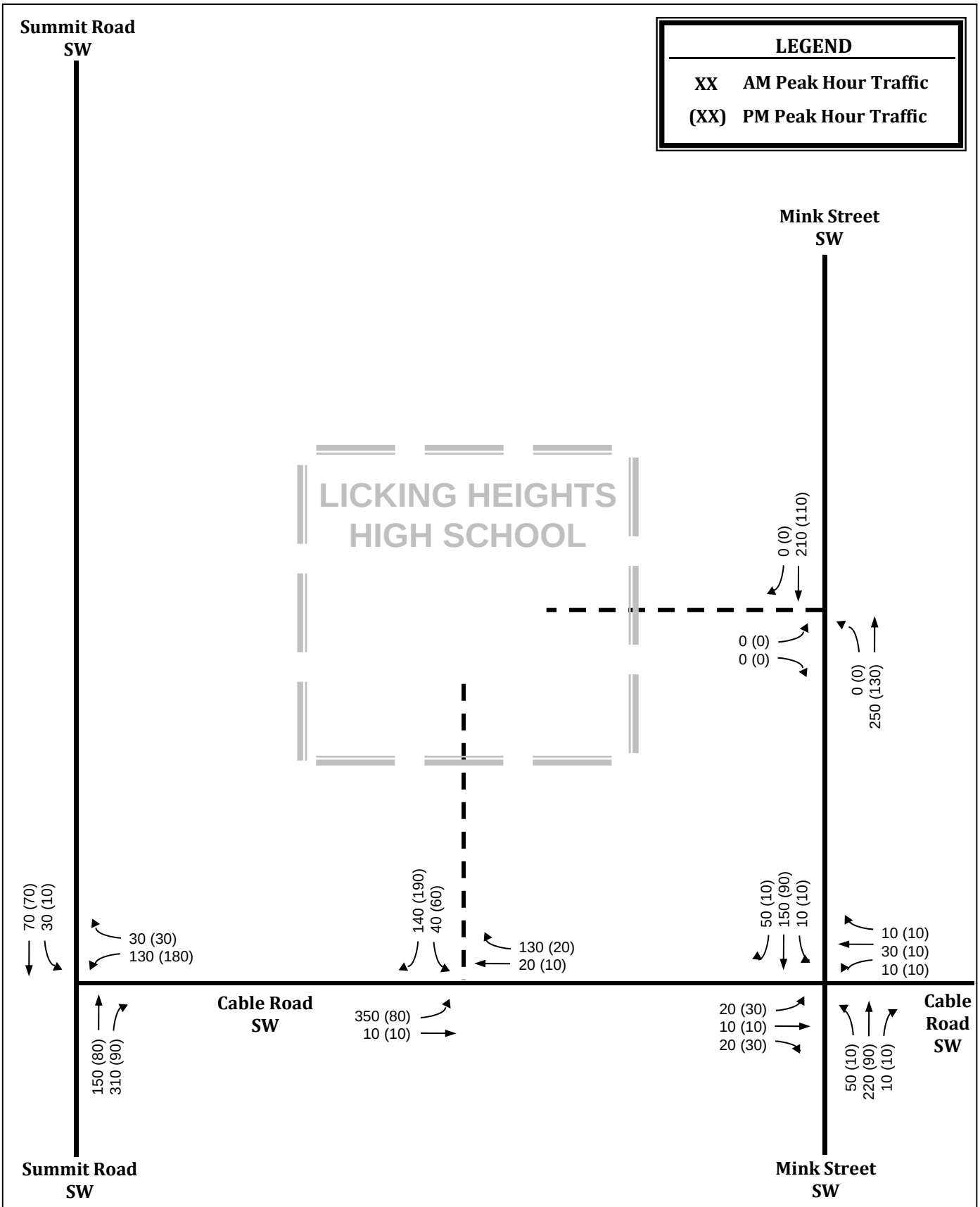
The design hour factors and growth rates for each movement were also applied to the existing 2018 traffic with no high school traffic shown in **Figure 2.5**.

The estimated 2020 and 2040 traffic volumes with no high school at the site are shown graphically in **Figures 3.7 and 3.8, Pages 29 and 30**. This traffic is the expected traffic if the development site was not generating any traffic. The traffic volumes have been rounded to the nearest 10 to adhere to preferred ODOT practices.

Build Condition

In order to estimate the future traffic considering project traffic conditions, the sum of the 2020 and 2040 volumes, shown in **Figures 3.7 and 3.8**, were added to the new generated traffic, shown in **Figures 3.3 and 3.4**, to equal the future Build peak hour volumes.

The estimated 2020 and 2040 Build traffic volumes for the study area are shown graphically in **Figures 3.9 and 3.10, Pages 31 and 32** for the proposed high school and middle school. These traffic volumes are the expected volumes if the proposed high school **is** constructed, or the **"Build"** condition.



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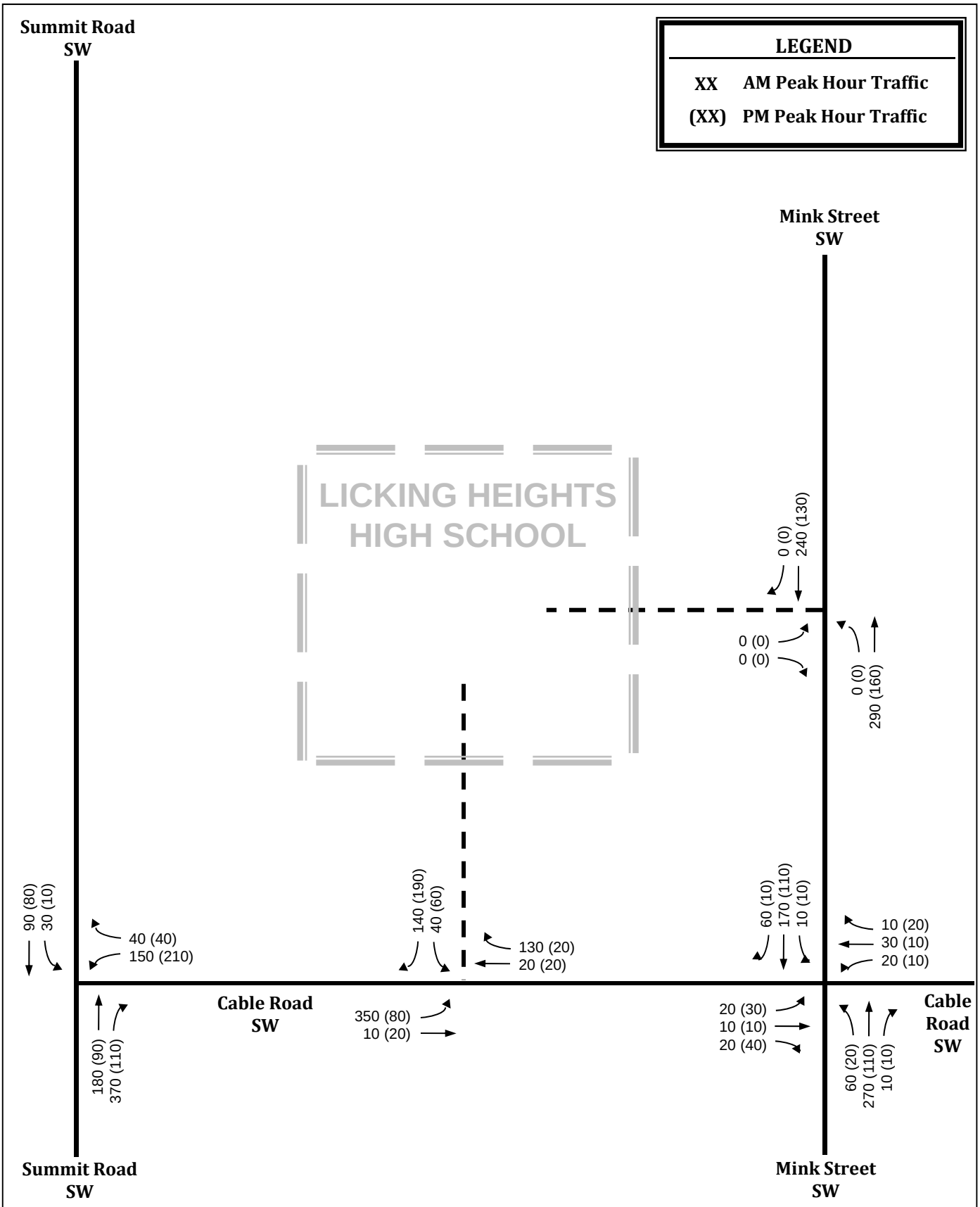
				Page 27



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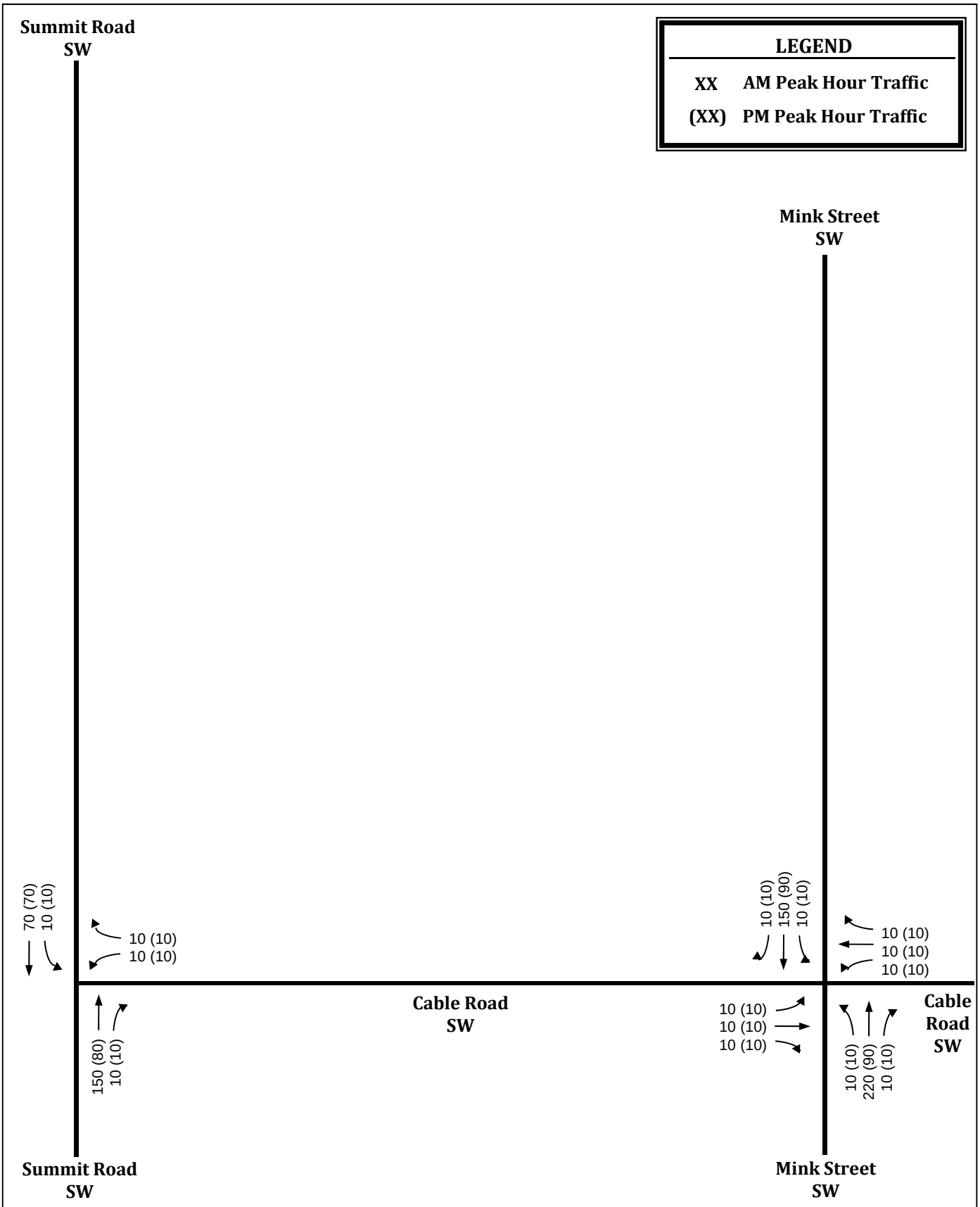
				Page 28



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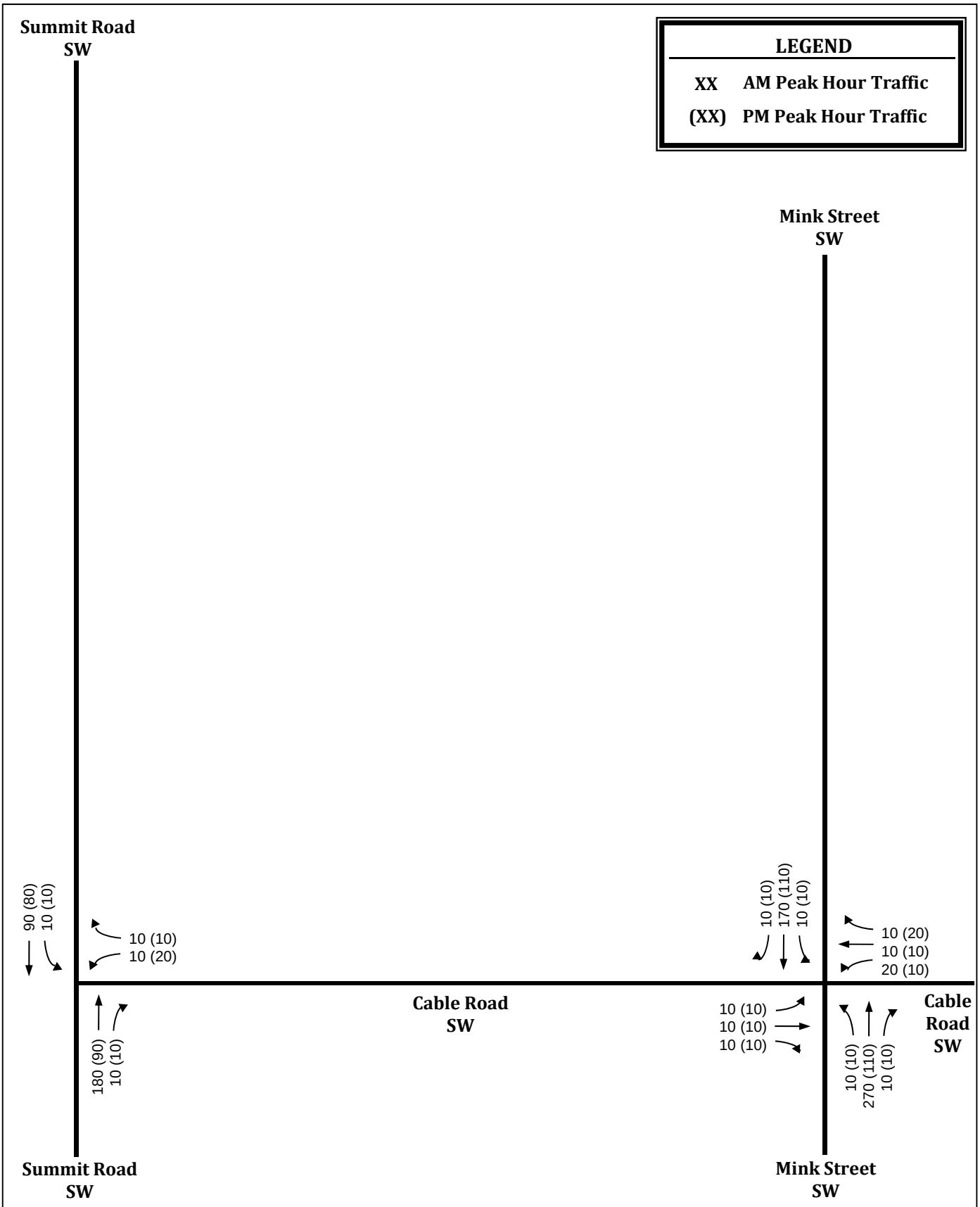
Peak Hour
Traffic Volumes

NORTH
NOT TO SCALE

Figure 3.7



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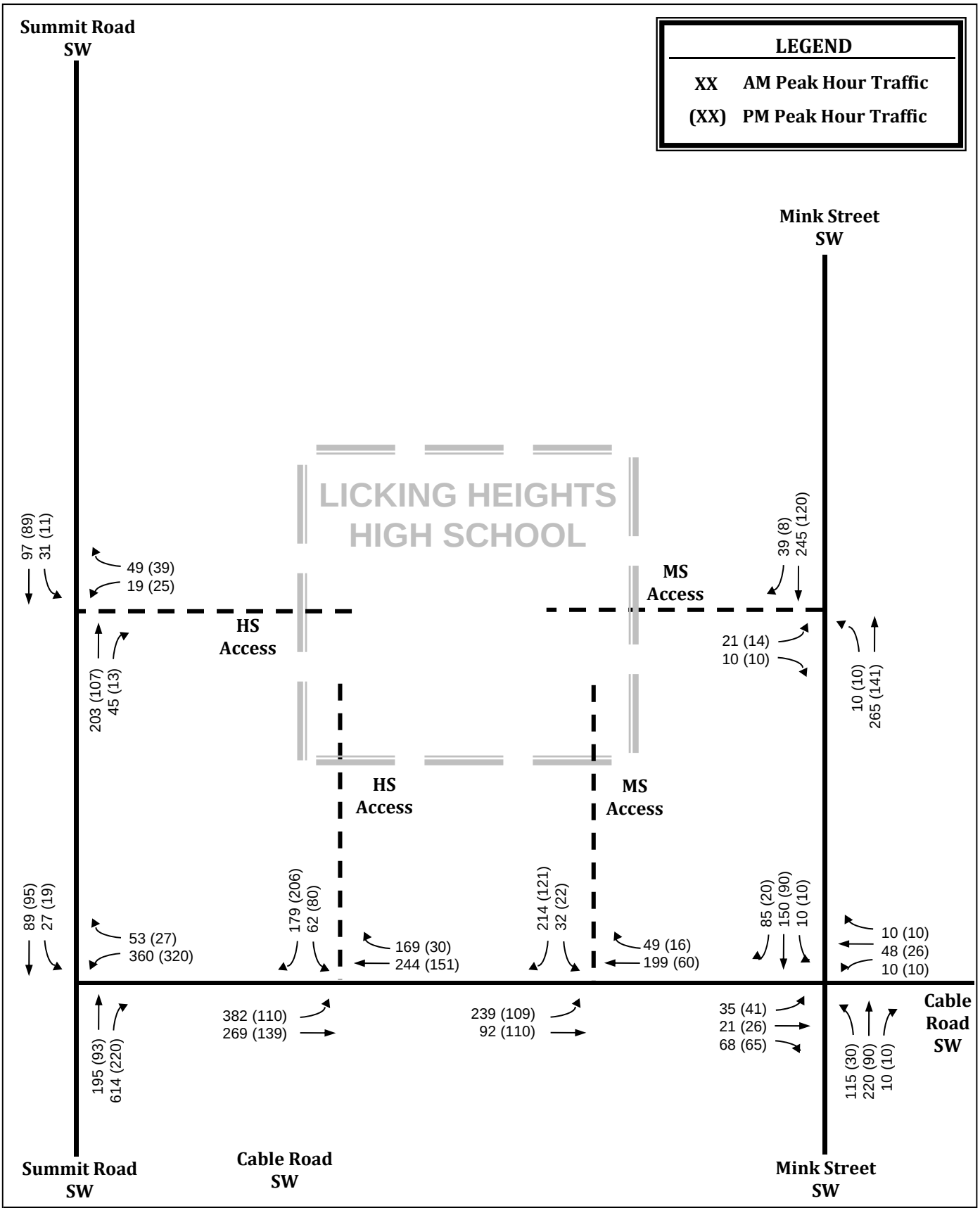
Peak Hour
Traffic Volumes

NORTH
NOT TO SCALE

Figure 3.8



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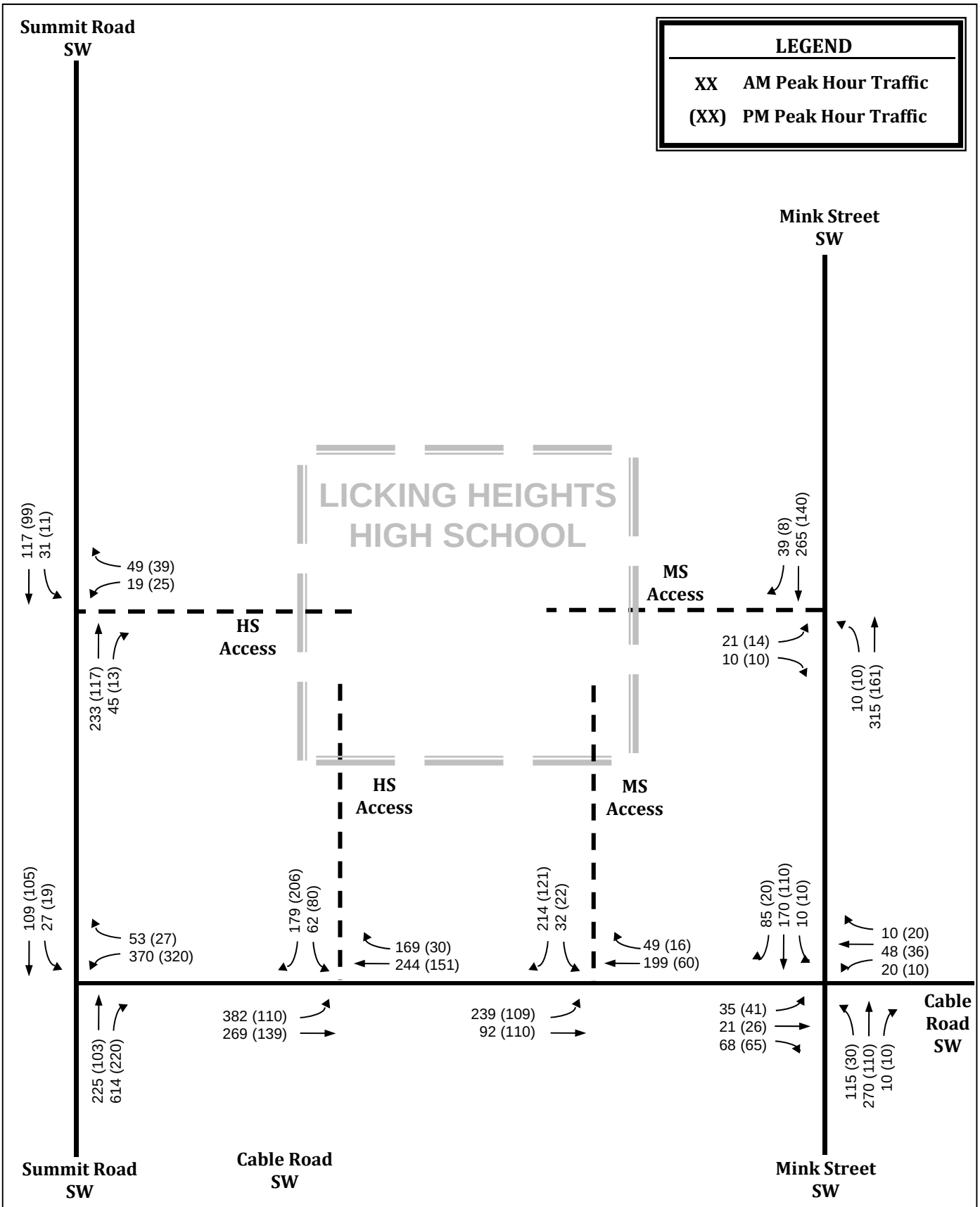
2020 Build
Peak Hour
Traffic Volumes

NORTH
NOT TO SCALE

Figure 3.9



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Licking Heights Schools Traffic Impact Study Pataskala, Ohio	2040 Build Peak Hour Traffic Volumes	NORTH NOT TO SCALE	Figure 3.10
				Page 32

Chapter 4
Traffic Analysis

4.1 Capacity and LOS at Study Area Intersections

Intersection capacity analyses were performed at the study intersections using the procedures outlined in the computerized version of the **Highway Capacity Manual, 6TH Edition, HCM6E (HCS7, Release 7.4)**. The capacity analyses were performed in order to estimate the maximum amount of traffic that can be accommodated by a roadway facility while maintaining recommended operational qualities. Existing, No-Build, and Build peak hour traffic volumes were analyzed to determine the level-of-service (LOS) at the study area intersections.

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 4.1 Intersection LOS

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

The capacity analysis procedures and the resulting level-of-service grades and delays are a recognized traffic engineering standard for measuring the efficiency of intersection operations by such organizations as the Institute of Transportation Engineers, American Association of State Highway and Transportation Officials, and the Ohio Department of Transportation.

Existing Conditions - 2018 Capacity Analysis

Analyses were performed for the existing 2018 conditions. The traffic volumes used in the analyses can be seen in **Figure 2.4**. Copies of the capacity worksheets are included in **Appendix C.** The results of the Year 2018 Existing Conditions analyses are shown in the following table:

Table 4.2 - 2018 Levels-of-Service
(Existing Conditions)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Stop Sign	Westbound	D (26.2)	B (12.6)
		Southbound Left	A (9.3)	A (7.7)
Cable & HS Access	Stop Sign	Eastbound Left	B (10.3)	A (7.7)
		Southbound	E (39.7)	B (10.5)
Cable & Mink	Stop Sign	Eastbound	B (13.7)	B (10.5)
		Westbound	C (15.8)	B (10.4)
		Northbound Left	A (7.9)	A (7.5)
		Southbound Left	A (7.8)	A (7.4)

(XX.X) = Average vehicle delay in seconds per vehicle

The study area intersections are operating with levels-of-service D or better during the peak hours under study for this report with the exception of the southbound approach at Cable Road SW and the high school access driveway during the AM peak hour.

The high delay and resulting level-of-service for the southbound approach at the intersection of Cable Road SW and the high school access driveway during the AM peak hour is a caused by the lack of adequate gaps in the east-west traffic stream on Cable Road SW for the exiting left turn vehicles.

In order to determine what mitigation would be necessary to improve the level-of-service of the southbound approach at the intersection of Cable Road SW and the high school access driveway, the following improvement was tested with further capacity analyses:

- Construct a westbound right turn lane.

The traffic volumes used in the analyses can be seen in **Figure 2.4**. Copies of the capacity worksheets are included in **Appendix D.** The results of the capacity analyses with the improvement are shown in the following table:

Table 4.3 - 2018 Levels-of-Service
(Intersection Improvement - Westbound Right Turn Lane)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & HS Access	Stop Sign	Eastbound Left	B (10.3)	A (7.7)
		Southbound	D (30.3)	B (10.4)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection of Cable Road SW and the existing high school access driveway is expected to operate with levels-of-service D or better during the peak hours with the addition of an exclusive westbound left turn lane on Cable Road SW.

No-Build Conditions - 2020 Capacity Analysis

Analyses were performed for the projected 2020 opening day conditions under the No-Build scenario. These analyses will be used to compare to the conditions expected under the Build scenario. The analysis does not include recommended improvements from the previous section. The traffic volumes used in the analyses can be seen in **Figure 3.5**. Copies of the capacity worksheets are included in **Appendix E.** The results of the Year 2020 No-Build analyses are shown in the following table:

Table 4.4 - 2020 Levels-of-Service
(No-Build Conditions)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Stop Sign	Westbound	D (30.6)	B (13.3)
		Southbound Left	A (9.4)	A (7.7)
Cable & HS Access	Stop Sign	Eastbound Left	B (10.4)	A (7.7)
		Southbound	F (50.9)	B (10.5)
Cable & Mink	Stop Sign	Eastbound	B (14.8)	B (10.6)
		Westbound	C (15.6)	B (10.6)
		Northbound Left	A (7.9)	A (7.4)
		Southbound Left	A (7.8)	A (7.4)

(XX.X) = Average vehicle delay in seconds per vehicle

The study area intersections are expected to operate with levels-of-service D or better during the peak hours under study for this report with the exception of the southbound approach at Cable Road SW and the high school access driveway during the AM peak hour.

The high delay and resulting level-of-service for the southbound approach at the intersection of Cable Road SW and the high school access driveway during the AM peak hour is a caused by the lack of adequate gaps in the east-west traffic stream on Cable Road SW for the exiting left turn vehicles.

It was previously determined under the existing conditions analysis that the addition of a westbound right turn lane at the intersection would improve the southbound delay and level-of-service. The following table details the analysis results with the right turn lane improvement under the 2020 No-Build conditions.

The traffic volumes used in the analyses can be seen in **Figure 3.5**. Copies of the capacity worksheets are included in **Appendix F.** The results of the capacity analyses with the improvement are shown in the following table:

Table 4.5 - 2020 No-Build Levels-of-Service
(Intersection Improvement - Westbound Right Turn Lane)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & HS Access	Stop Sign	Eastbound Left	B (10.4)	A (7.7)
		Southbound	E (37.6)	B (10.3)

(XX.X) = Average vehicle delay in seconds per vehicle

The addition of a westbound right turn lane at the intersection is expected to improve the southbound approach level-of-service one letter grade from LOS F to LOS E.

In order to determine what mitigation would be necessary to further improve the level-of-service of the southbound approach at the intersection of Cable Road SW and the high school access driveway a change in the intersection control method would be necessary. The following changes in intersection control were tested with further capacity analyses:

- Install traffic signal control.
- Construct a single lane roundabout.

The traffic volumes used in the analyses can be seen in **Figure 3.5**. Copies of the capacity worksheets are included in **Appendix F.** The results of the capacity analyses with the improvement are shown in the following table:

Table 4.6 - 2020 No-Build Levels-of-Service
(Intersection Control Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & HS Access	Traffic Signal	Intersection	C (23.8)	B (14.5)
		Eastbound	C (26.8)	B (11.4)
		Northbound	B (12.3)	B (17.1)
		Southbound	C (27.2)	B (15.3)
Cable & HS Access	Roundabout	Intersection	A (8.1)	A (5.4)
		Eastbound	A (8.6)	A (4.8)
		Northbound	B (10.4)	A (3.6)
		Southbound	A (5.3)	A (5.8)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection is expected to operate with levels-of-service C or better for each approach and the overall intersection under traffic signal control. It should be noted that the addition of a westbound right turn lane at the intersection is not necessary with traffic signal control in order to improve the intersection.

The intersection is expected to operate with level-of-service B or better for each approach and the overall intersection under the roundabout control method.

Traffic Signal Warrant Analysis - 2020 No-Build Conditions

In order to determine if the forecasted 2020 No-Build conditions are expected to meet one of the traffic signal warrants found in the **Ohio Manual of Uniform Traffic Control Devices (OMUTCD)**, the previously discussed growth rates (Section 3.2) were applied to the collected nine hour traffic count data for Cable Road SW and the high school access driveway.

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD**. Warrants 1 - 9 were evaluated for this analysis of the expected No-Build conditions.

The following table details the results of the traffic signal warrant analysis for the 2020 No-Build conditions at the intersection of Cable Road SW and the high school access driveway. Copies of the signal warrant analysis worksheets can be found **Appendix G**.

Table 4.7 2020 No-Build Traffic Signal Warrant Analysis
Cable Road SW & HS Access Driveway

CONDITIONS	WARRANTS								
	1	2	3	4	5	6	7	8	9
2020 NO-BUILD	NO	NO	NO	NO	NO	n/a	NO	n/a	n/a

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices**, we conclude that traffic signal control is not justified as required by the Ohio Revised Code based upon the expected 2020 No-Build conditions and therefore will not be considering as a viable improvement at the intersection of Cable Road SW and the high school access driveway.

No-Build Conditions - 2040 Capacity Analysis

Analyses were performed for the projected 2040 design year conditions under the No-Build scenario. These analyses will be used to compare to the conditions expected under the Build scenario. The analysis does not include recommended improvements from the previous sections. The traffic volumes used in the analyses can be seen in **Figure 3.6**. Copies of the capacity worksheets are included in **Appendix H.** The results of the Year 2040 No-Build analyses are shown in the following table:

Table 4.8 - 2040 Levels-of-Service
(No-Build Conditions)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Stop Sign	Westbound	F (70.9)	C (15.4)
		Southbound Left	B (10.0)	A (7.8)
Cable & HS Access	Stop Sign	Eastbound Left	B (10.4)	A (7.8)
		Southbound	F (50.9)	B (10.7)
Cable & Mink	Stop Sign	Eastbound	C (16.9)	B (11.2)
		Westbound	C (19.3)	B (10.8)
		Northbound Left	A (8.0)	A (7.5)
		Southbound Left	A (7.9)	A (7.5)

(XX.X) = Average vehicle delay in seconds per vehicle

The study area intersections are expected to operate with levels-of-service D or better during the peak hours under study for this report with the exception of the southbound approach at Cable Road SW and the high school access driveway and the southbound approach at Cable Road SW And Summit Road SW during the AM peak hour.

The high delay and resulting level-of-service for these approaches during the AM peak hour is a caused by the lack of adequate gaps in the main street traffic stream for the minor street left turn vehicles.

In order to determine what mitigation would be necessary to improve the level-of-service of the westbound approach at the intersection of Summit Road SW and Cable Road SW, the following improvement was tested with further capacity analyses:

- Construct a northbound right turn lane.

It was determined under the previous analyses that the addition of a westbound right turn lane at the intersection of Cable Road SW and the high school access driveway would improve the southbound delay and level-of-service.

The traffic volumes used in the analyses can be seen in **Figure 3.6**. Copies of the capacity worksheets are included in **Appendix I.** The results of the capacity analyses with the improvement are shown in the following table:

Table 4.9 - 2040 No-Build Levels-of-Service
(Intersection Improvement - Right Turn Lanes)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Stop Sign	Westbound	C (23.3)	B (13.7)
		Southbound Left	B (10.0)	A (7.8)
Cable & HS Access	Stop Sign	Eastbound Left	B (10.4)	A (7.8)
		Southbound	E (37.6)	B (10.5)

(XX.X) = Average vehicle delay in seconds per vehicle

The addition of a northbound right turn lane at the intersection of Summit Road SW and Cable Road SW is expected to improve the westbound approach level-of-service to an LOS C.

The addition of a westbound right turn lane at the intersection of Cable Road SW and the high school access driveway is expected to improve the southbound approach level-of-service one letter grade from LOS F to LOS E.

In order to determine what mitigation would be necessary to further improve the level-of-service of the southbound approach at the intersection of Cable Road SW and the high school access driveway a change in the intersection control method would be necessary. The following changes in intersection control were tested with further capacity analyses:

- Install traffic signal control.
- Construct a single lane roundabout.

The traffic volumes used in the analyses can be seen in **Figure 3.6**. Copies of the capacity worksheets are included in **Appendix I.** The results of the capacity analyses with the improvements are shown in the following table:

Table 4.10 - 2040 No-Build Levels-of-Service
(Intersection Control Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & HS Access	Traffic Signal	Intersection	C (23.8)	B (14.6)
		Eastbound	C (26.8)	B (11.1)
		Northbound	B (12.3)	B (17.2)
		Southbound	C (27.2)	B (15.6)
Cable & HS Access	Roundabout	Intersection	A (8.1)	A (5.5)
		Eastbound	A (8.6)	A (5.0)
		Northbound	B (10.4)	A (3.8)
		Southbound	A (5.3)	A (5.9)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection of Cable Road SW and the high school access driveway is expected to operate with levels-of-service C or better for each approach and the overall intersection under traffic signal control. It should be noted that the addition of a westbound right turn lane at the intersection is not necessary with traffic signal control in order to improve the intersection.

The intersection of Cable Road SW and the high school access driveway is expected to operate with level-of-service B or better for each approach and the overall intersection under the roundabout control method.

Traffic Signal Warrant Analysis - 2040 No-Build Conditions

In order to determine if the forecasted 2040 No-Build conditions are expected to meet one of the traffic signal warrants found in the **OMUTCD**, the previously discussed growth rates (Section 3.2) were applied to the collected nine hour traffic count data for Cable Road SW and the high school access driveway.

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD**. Warrants 1 - 9 were evaluated for this analysis of the expected No-Build conditions.

The following table details the results of the traffic signal warrant analysis for the 2040 No-Build conditions at the intersection of Cable Road SW and the high school access driveway. Copies of the signal warrant analysis worksheets can be found **Appendix G**.

Table 4.11 2040 No-Build Traffic Signal Warrant Analysis
Cable Road SW & HS Access Driveway

CONDITIONS	WARRANTS								
	1	2	3	4	5	6	7	8	9
2040 NO-BUILD	NO	NO	NO	NO	NO	n/a	NO	n/a	n/a

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices**, we conclude that traffic signal control is not justified as required by the Ohio Revised Code based upon the expected 2040 No-Build conditions and therefore will not be considering as a viable improvement at the intersection of Cable Road SW and the high school access driveway.

Build Condition - 2020 Capacity Analysis

Analyses were performed for the projected 2020 opening day Build conditions. The analyses will be used to determine the future levels-of-service at the study intersections under the anticipated Build conditions. The intersections analyzed in this section only include the intersections that do not provide direct access to the development site. The traffic volumes used in the analyses can be seen in **Figure 3.9**. Copies of the capacity worksheets are included in **Appendix J**. The results of the 2020 Build analyses are shown in the following tables:

Table 4.12 - 2020 Levels-of-Service
(Build Conditions)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Stop Sign	Westbound	F (892.0)	D (34.7)
		Southbound Left	B (12.4)	A (8.2)
Cable & Mink	Stop Sign	Eastbound	C (22.1)	B (11.8)
		Westbound	C (23.9)	B (12.0)
		Northbound	A (8.2)	A (7.5)
		Southbound	A (7.8)	A (7.4)

(XX.X) = Average vehicle delay in seconds per vehicle

The study area intersections are expected to operate with levels-of-service D or better during the peak hours under study for this report with the exception of the westbound approach at the intersection of Summit Road SW and Cable Road SW during the AM peak hour.

A comparison was performed to show the incremental effects on the capacity of the study area intersections due to the development of the proposed high school/middle school and to identify where improvements may be necessary to accommodate Build traffic.

The following tables show a side by side comparison of the Build versus No-Build conditions for the 2020 AM and PM peak hours.

Table 4.13 2020 AM Peak Hour Comparison
No-Build vs Build Scenario

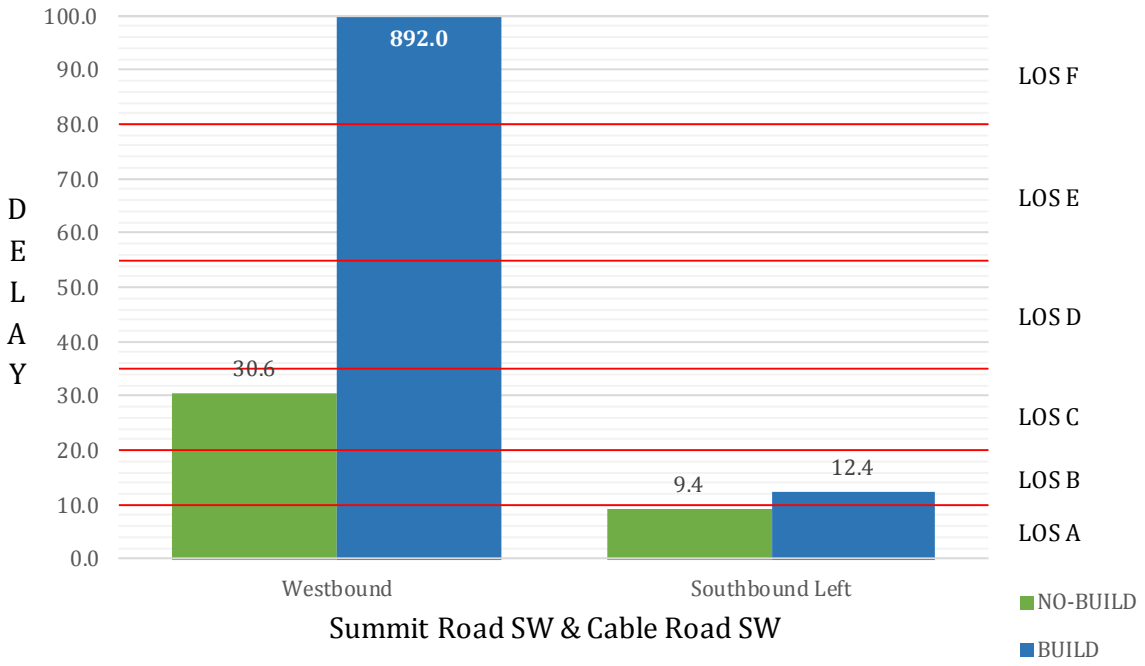


Table 4.14 2020 AM Peak Hour Comparison
No-Build vs Build Scenario

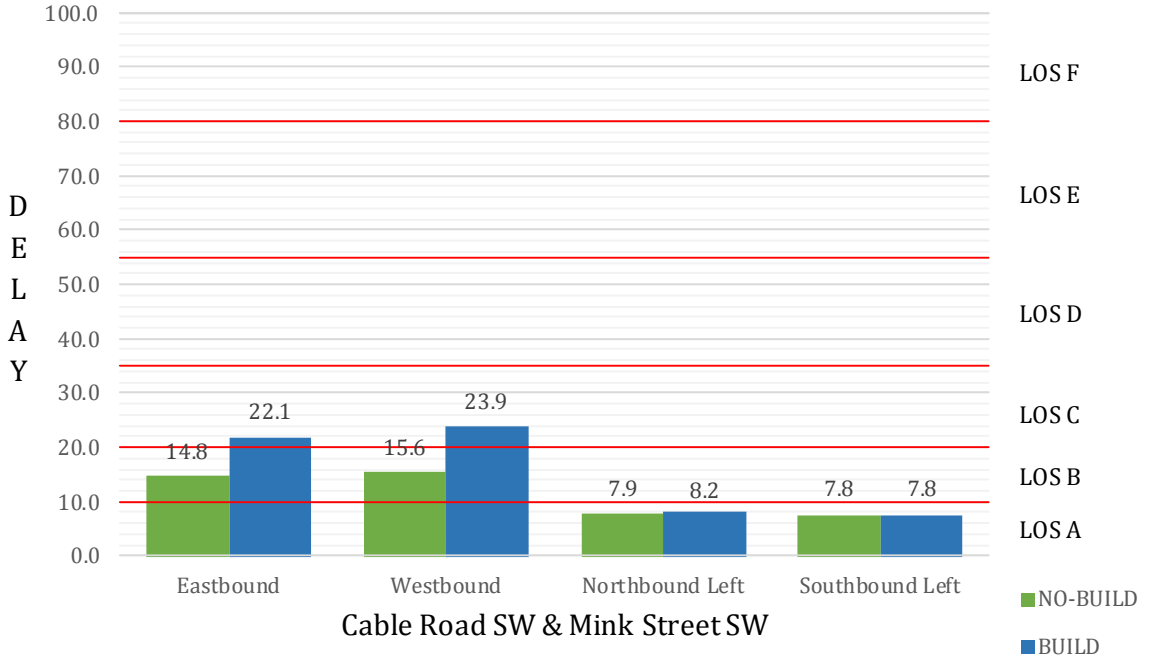


Table 4.15 2020 PM Peak Hour Comparison
No-Build vs Build Scenario

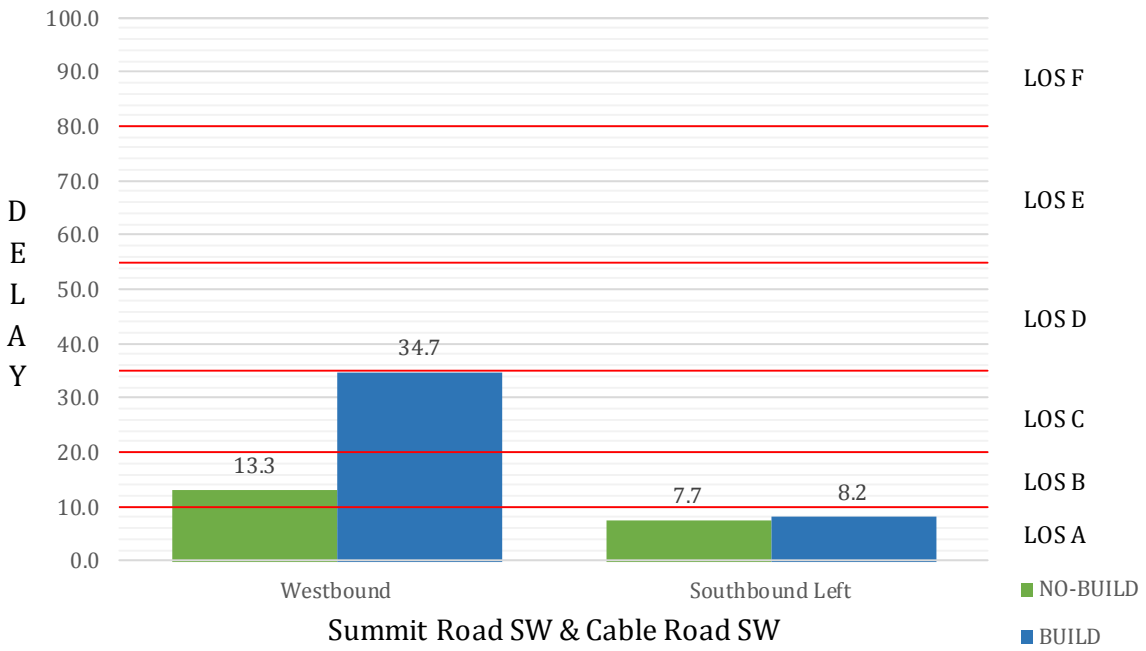
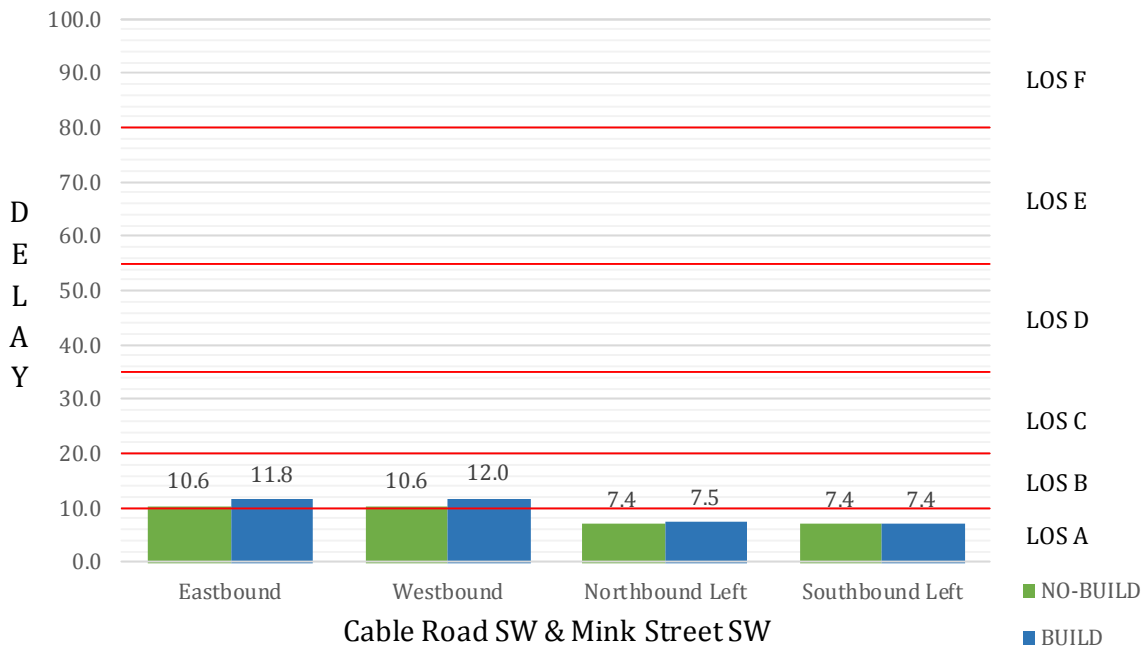


Table 4.16 2020 PM Peak Hour Comparison
No-Build vs Build Scenario



Based on the results shown in the 2020 peak hour No-Build versus Build comparison tables improvements are recommended at the intersection of Summit Road SW and Cable Road SW due to the impact of the site generated traffic under the forecasted 2020 year conditions.

In order to determine what mitigation would be necessary to further improve the level-of-service of the westbound approach at the intersection of Cable Road SW and Summit Road SW a change in the intersection control method would be necessary. The following changes in intersection control were tested with further capacity analysis:

- Install traffic signal control.
- Construct a single lane roundabout.

The traffic volumes used in the analyses can be seen in **Figure 3.9**. Copies of the capacity worksheets are included in **Appendix K.** The results of the capacity analyses with the improvement are shown in the following table:

Table 4.17 - 2020 Build Levels-of-Service
(Intersection Control Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Traffic Signal	Intersection	B (13.6)	A (10.0)
		Westbound	C (20.4)	B (13.1)
		Northbound	A (9.2)	A (5.3)
		Southbound	B (19.5)	B (13.6)
Cable & Summit	Roundabout	Intersection	B (14.6)	A (5.9)
		Westbound	C (17.7)	A (7.3)
		Northbound	B (13.9)	A (4.3)
		Southbound	A (8.6)	A (6.1)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection is expected to operate with levels-of-service C or better for each approach and the overall intersection under traffic signal control. It should be noted that the addition of a northbound right turn lane at the intersection is also necessary with traffic signal control in order to improve the intersection.

The intersection is expected to operate with level-of-service C or better for each approach and the overall intersection under the roundabout control method. It should be noted that the addition of a northbound right turn by-pass lane at the intersection is also necessary with the single lane roundabout configuration in order to improve the intersection.

Traffic Signal Warrant Analysis - 2020 Build Conditions

In order to determine if the forecasted 2020 Build conditions are expected to meet one of the traffic signal warrants found in the **OMUTCD**, the previously discussed growth rates (Section 3.2) and site generated traffic were applied to the collected nine hour traffic count data for Summit Road SW and Cable Road SW.

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD**. Warrants 1 - 9 were evaluated for this analysis of the expected No-Build conditions.

The following table details the results of the traffic signal warrant analysis for the 2020 Build conditions at the intersection of Summit Road SW and Cable Road SW. Copies of the signal warrant analysis worksheets can be found **Appendix G**.

Table 4.18 2020 Build Traffic Signal Warrant Analysis
Summit Road SW & Cable Road SW

CONDITIONS	WARRANTS								
	1	2	3	4	5	6	7	8	9
2020 BUILD	NO	NO	n/a	NO	NO	n/a	NO	n/a	n/a

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices**, we conclude that traffic signal control is not justified as required by the Ohio Revised Code based upon the expected 2020 Build conditions and therefore will not be considering as a viable improvement at the intersection of Summit Road SW and Cable Road SW.

Build Condition - 2040 Capacity Analysis

Analyses were performed for the projected 2040 design year Build conditions. The analyses will be used to determine the future levels-of-service at the study intersections under the anticipated build conditions. The intersections analyzed in this section only include the intersections that do not provide access to the development. The traffic volumes used in the analyses can be seen in **Figure 3.10**. Copies of the capacity worksheets are included in **Appendix L**. The results of the 2040 Build analyses are shown in the following table:

Table 4.19 - 2040 Levels-of-Service
(Build Conditions)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Stop Sign	Westbound	F (1089.3)	E (39.1)
		Southbound Left	B (12.8)	A (8.3)
Cable & Mink	Stop Sign	Eastbound	D (26.3)	B (12.5)
		Westbound	D (31.6)	B (12.4)
		Northbound Left	A (8.3)	A (7.6)
		Southbound Left	A (7.9)	A (7.5)

(XX.X) = Average vehicle delay in seconds per vehicle

The study area intersections are expected to operate with levels-of-service D or better during the peak hours under study for this report with the exception of the westbound approach at the intersection of Summit Road SW and Cable Road SW during the peak hours.

A comparison was performed to show the incremental effects on the capacity of the study area intersections due to the development of the proposed high school/middle school and to identify where improvements may be necessary to accommodate Build traffic.

The following tables show a side by side comparison of the Build versus No-Build conditions for the 2040 AM and PM peak hours.

Table 4.20 2040 AM Peak Hour Comparison
No-Build vs Build Scenario

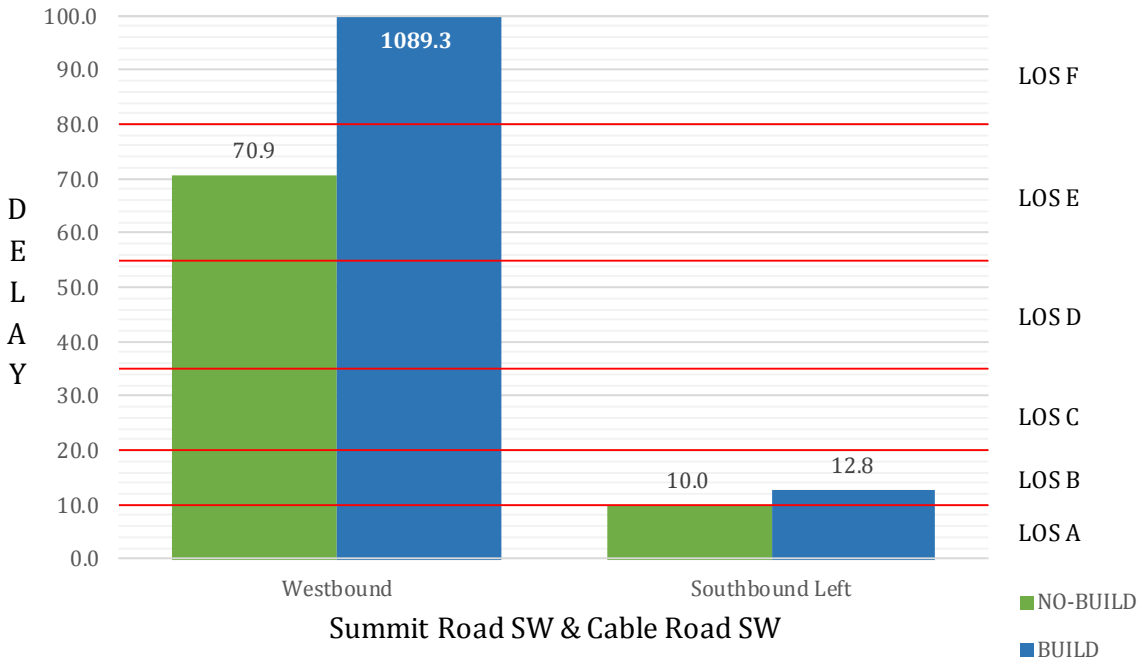


Table 4.21 2040 AM Peak Hour Comparison
No-Build vs Build Scenario

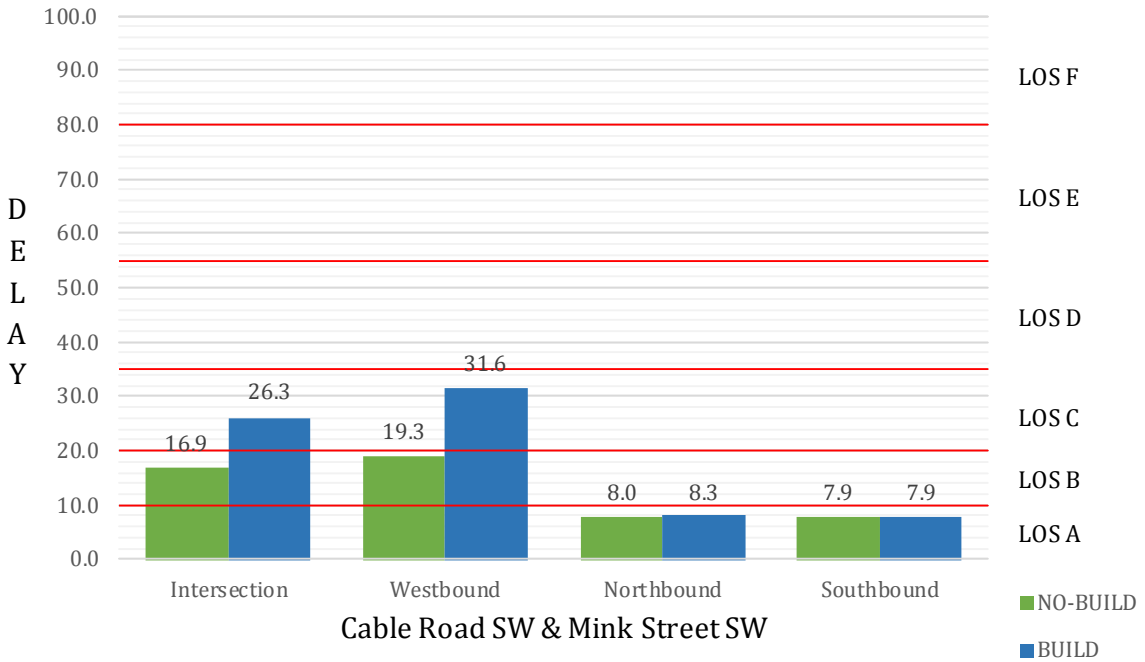


Table 4.22 2040 PM Peak Hour Comparison
No-Build vs Build Scenario

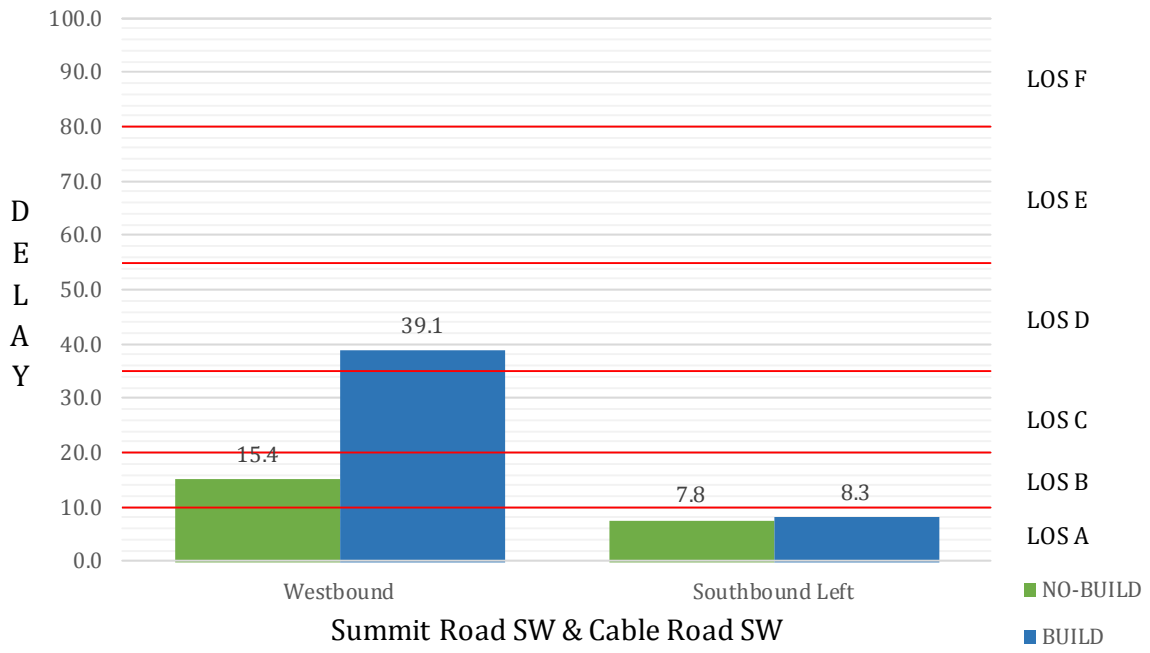
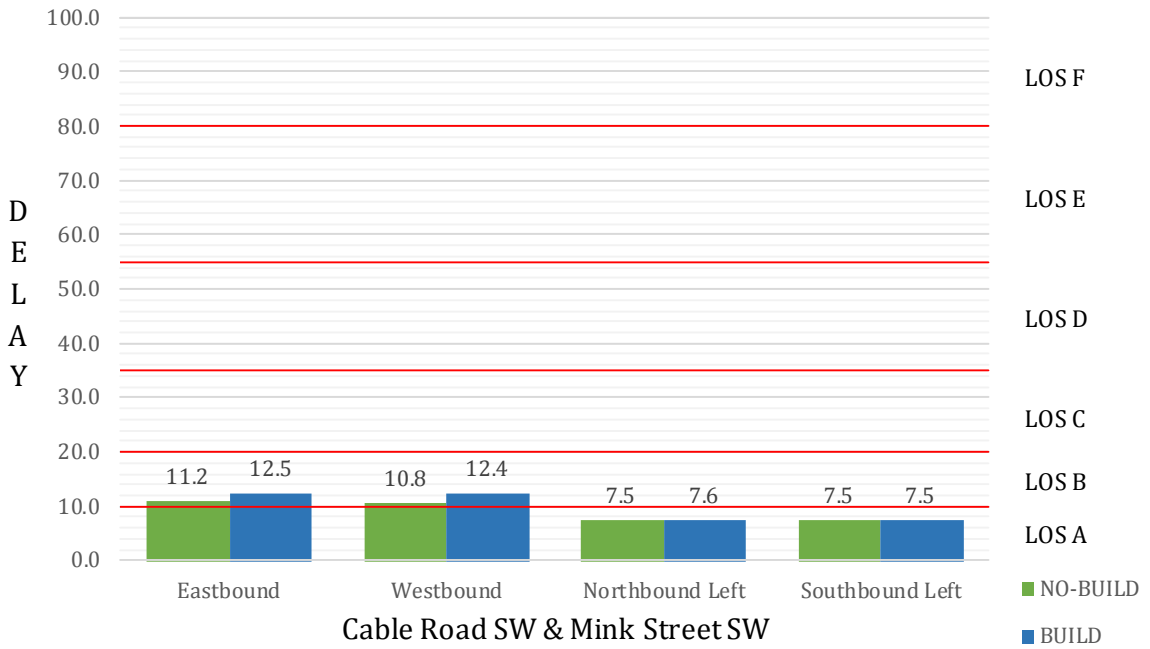


Table 4.23 2040 PM Peak Hour Comparison
No-Build vs Build Scenario



Based on the results shown in the 2040 peak hour No-Build versus Build comparison tables improvements are recommended at the intersection of Summit Road SW and Cable Road SW due to the impact of the site generated traffic under the forecasted 2040 year conditions.

In order to determine what mitigation would be necessary to further improve the level-of-service of the westbound approach at the intersection of Cable Road SW and Summit Road SW a change in the intersection control method would be necessary. The following changes in intersection control were tested with additional capacity analyses:

- Install traffic signal control.
- Construct a single lane roundabout.

The traffic volumes used in the analyses can be seen in **Figure 3.10**. Copies of the capacity worksheets are included in **Appendix M.** The results of the capacity analyses with the improvements are shown in the following table:

Table 4.24 - 2040 Build Levels-of-Service
(Intersection Control Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Traffic Signal	Intersection	B (14.3)	B (10.1)
		Westbound	C (21.3)	B (13.2)
		Northbound	A (9.9)	A (5.6)
		Southbound	C (20.1)	B (13.7)
Cable & Summit	Roundabout	Intersection	C (15.8)	A (6.0)
		Westbound	C (22.0)	A (7.4)
		Northbound	B (13.6)	A (4.3)
		Southbound	A (9.6)	A (6.3)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection is expected to operate with levels-of-service C or better for each approach and the overall intersection under traffic signal control. It should be noted that the addition of a northbound right turn lane at the intersection is also necessary with traffic signal control in order to improve the intersection.

The intersection is expected to operate with level-of-service C or better for each approach and the overall intersection under the roundabout control method. It should be noted that the addition of a northbound right turn by-pass lane at the intersection is also necessary with the single lane roundabout configuration in order to improve the intersection.

Traffic Signal Warrant Analysis - 2040 Build Conditions

In order to determine if the forecasted 2040 Build conditions are expected to meet one of the traffic signal warrants found in the **OMUTCD**, the previously discussed growth rates (Section 3.2) and the site generated traffic were applied to the collected nine hour traffic count data for Summit Road SW and Cable Road SW.

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD**. Warrants 1 - 9 were evaluated for this analysis of the expected 2040 Build conditions.

The following table details the results of the traffic signal warrant analysis for the 2040 Build conditions at the intersection of Summit Road SW and Cable Road SW. Copies of the signal warrant analysis worksheets can be found **Appendix G**.

Table 4.25 2040 Build Traffic Signal Warrant Analysis
Cable Road SW & Summit Road SW

CONDITIONS	WARRANTS								
	1	2	3	4	5	6	7	8	9
2040 BUILD	NO	NO	n/a	NO	NO	n/a	NO	n/a	n/a

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices**, we conclude that traffic signal control is not justified as required by the Ohio Revised Code based upon the expected 2040 Build conditions and therefore will not be considering as a viable improvement at the intersection of Summit Road SW and Cable Road SW.

The previous analyses were based on the existing high school and middle school bell schedules that have first period starting at approximately the same time. The use of a staggered start time would be expected to lessen the impact of the site generated traffic on the study area intersections. The following table details the impact on the capacity and level-of-service at the intersection of Summit Road SW and Cable Road SW if the start times for the high school and the middle school were separated by a minimum of 30 minutes.

The traffic volumes used in the analyses can be seen in **Figure 3.10**. Copies of the capacity worksheets are included in **Appendix N.** The results of the capacity analyses with the improvement are shown in the following table:

Table 4.26 - 2040 Levels-of-Service
(Staggered School Start Times)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & Summit	Stop Sign	Westbound	F (68.7)	C (19.3)
		Southbound Left	B (10.6)	A (8.2)
Cable & Summit	Traffic Signal	Intersection	B (11.8)	A (10.0)
		Westbound	B (18.6)	B (13.1)
		Northbound	A (7.4)	A (5.4)
		Southbound	B (17.4)	B (13.3)
Cable & Summit	Roundabout	Intersection	B (14.7)	A (6.2)
		Westbound	B (11.1)	A (7.0)
		Northbound	C (17.9)	A (5.5)
		Southbound	A (6.9)	A (5.9)

(XX.X) = Average vehicle delay in seconds per vehicle

The use of staggered start times is expected to decrease the delay experienced during the AM peak hour from 1089.3 seconds per vehicle to 68.7 seconds per vehicle with the intersection under stop sign control. It should be noted that the addition of a northbound right turn lane at the intersection is also necessary to achieve the expected reduction in delay experienced.

The intersection is expected to operate with levels-of-service B or better for each approach and the overall intersection under traffic signal control. The addition of a northbound right turn lane at the intersection is also necessary with traffic signal control in order to improve the intersection to better than a level-of-service E. It should be noted that traffic signal control was previously found to not be warranted at the intersection.

The intersection is expected to operate with level-of-service C or better for each approach and the overall intersection under the roundabout control method. No additional geometric improvements are necessary with the use of a single lane roundabout with the use of staggered start times.

4.2 Capacity & LOS at Development Access Intersections

Capacity analyses were performed for the intersections located along Summit Road SW, Cable Road SW, and Mink Street SW that provide access to the development site using the procedures outlined in the computerized version of the Transportation Research Board's **Highway Capacity Manual 6TH Edition, HCM6E (HCS7, Release 7.4)**. The initial operating conditions for the proposed intersections will include stop sign control on all access driveways and permit all ingress and egress movements.

Build Condition - 2020 Capacity Analysis

Analyses were performed for the projected 2020 opening day conditions under the Build scenario to determine the future level-of-service at the intersections where access is available to the development site. The results of the 2020 Build analyses are shown in the following table. Copies of the capacity worksheets are included in **Appendix O**.

Table 4.27 - 2020 Build Levels-of-Service (Access Locations)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Summit & HS Access	Stop Sign	Westbound	B (11.4)	B (10.1)
		Southbound Left	A (8.1)	A (7.6)
Cable & HS Access	Stop Sign	Eastbound Left	B (11.3)	A (8.1)
		Southbound	F (85.2)	B (13.4)
Cable & MS Access	Stop Sign	Eastbound Left	A (9.0)	A (7.7)
		Southbound	C (15.2)	B (10.1)
Mink & MS Access	Stop Sign	Eastbound	B (13.9)	A (9.9)
		Northbound Left	A (8.1)	A (7.6)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersections where access to the development site is available are expected to operate with levels-of-service D or better under the 2020 Build conditions during the AM and PM peak hours with the exception of the southbound approach at the intersection of Cable Road SW and the proposed high school access driveway during the AM peak hour.

It should be noted that the addition of an eastbound right turn lane and two southbound lanes at the intersection of Cable Road SW and the high school access driveway is necessary for the intersection to operate with the level-of-service and delay shown above in Table 4.27.

The high delay experienced by the southbound high school access driveway at Cable Road SW can be attributed to the lack of adequate gaps in the Cable Road SW east-west traffic stream for vehicles exiting the high school access driveway to turn left in to.

In order to determine what mitigation would be necessary to further improve the level-of-service of the southbound approach at the intersection of Cable Road SW and the high school access driveway a change in the intersection control method would be necessary. The following change in intersection control was tested with further capacity analyses:

- Install traffic signal control.

The traffic volumes used in the analyses can be seen in **Figure 3.9**. Copies of the capacity worksheets are included in **Appendix P.** The results of the capacity analyses with the improvements are shown in the following table:

Table 4.28 - 2020 Build Levels-of-Service
(Access Intersection Control Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & HS Access	Traffic Signal	Intersection	C (25.9)	B (15.1)
		Eastbound	C (23.3)	B (10.4)
		Northbound	C (32.6)	B (16.9)
		Southbound	C (21.7)	B (18.1)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection of Cable Road SW and the high school access driveway is expected to operate with levels-of-service C or better for each approach and the overall intersection under traffic signal control. It should be noted that the addition of a westbound right turn lane and an eastbound left turn lane at the intersection are necessary with traffic signal control in order to improve the intersection.

Traffic Signal Warrant Analysis - 2020 Access Build Conditions

In order to determine if the forecasted 2020 Build conditions are expected to meet one of the traffic signal warrants found in the **Ohio Manual of Uniform Traffic Control Devices (OMUTCD)**, the previously discussed high school driveway and Build conditions traffic data for Cable Road SW and the high school access driveway were used.

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD**. Warrants 1 - 9 were evaluated for this analysis of the expected No-Build conditions.

The following table details the results of the traffic signal warrant analysis for the 2020 Build conditions at the intersection of Cable Road SW and the proposed high school access driveway. Copies of the signal warrant analysis worksheets can be found **Appendix G**.

Table 4.29 2020 Build Traffic Signal Warrant Analysis
Cable Road SW & Proposed HS Access Driveway

CONDITIONS	WARRANTS								
	1	2	3	4	5	6	7	8	9
2020 NO-BUILD	NO	NO	NO	NO	NO	n/a	NO	n/a	n/a

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices**, we conclude that traffic signal control is not justified as required by the Ohio Revised Code based upon the expected 2020 Build conditions and therefore will not be considering as a viable improvement at the intersection of Cable Road SW and the proposed high school access driveway.

Build Condition - 2040 Capacity Analysis

Analyses were performed for the projected 2040 design year conditions under the Build scenario to determine the future level-of-service at the intersections where access is available to the development site. The results of the 2040 Build analyses are shown in the following table. Copies of the capacity worksheets are included in **Appendix Q**.

Table 4.30 - 2040 Build Levels-of-Service (Access Locations)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Summit & HS Access	Stop Sign	Westbound	B (11.9)	B (10,2)
		Southbound Left	A (8.2)	A (7.6)
Cable & HS Access	Stop Sign	Eastbound Left	B (11.3)	A (8.1)
		Southbound	F (85.2)	B (13.4)
Cable & MS Access	Stop Sign	Eastbound Left	A (9.0)	A (7.7)
		Southbound	C (15.2)	B (10.1)
Mink & MS Access	Stop Sign	Eastbound	C (15.0)	B (10.1)
		Northbound Left	A (8.2)	A (7.7)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersections where access to the development site is available are expected to operate with levels-of-service D or better under the 2040 Build conditions during the AM and PM peak hours with the exception of the southbound approach at the intersection of Cable Road SW and the proposed high school access driveway during the AM peak hour.

It should be noted that the addition of an eastbound right turn lane and two southbound lanes at the intersection of Cable Road SW and the high school access driveway is necessary for the intersection to operate with the level-of-service and delay shown above in Table 4.30.

The high delay experienced by the southbound high school access driveway at Cable Road SW can be attributed to the lack of adequate gaps in the Cable Road SW east-west traffic stream for vehicles exiting the high school access driveway to turn left in to.

In order to determine what mitigation would be necessary to further improve the level-of-service of the southbound approach at the intersection of Cable Road SW and the proposed high school access driveway a change in the intersection control method would be necessary. The following change in intersection control was tested with further capacity analyses:

- Install traffic signal control.

The traffic volumes used in the analyses can be seen in **Figure 3.10**. Copies of the capacity worksheets are included in **Appendix R.** The results of the capacity analyses with the improvements are shown in the following table:

Table 4.31 - 2040 Build Levels-of-Service
(Access Intersection Control Improvements)

LOCATION	TRAFFIC CONTROL	MOVEMENT	AM PEAK LOS (DELAY)	PM PEAK LOS (DELAY)
Cable & HS Access	Traffic Signal	Intersection	C (25.9)	B (15.1)
		Eastbound	C (23.3)	B (10.4)
		Northbound	C (32.6)	B (16.9)
		Southbound	C (21.7)	B (18.1)

(XX.X) = Average vehicle delay in seconds per vehicle

The intersection of Cable Road SW and the high school access driveway is expected to operate with levels-of-service C or better for each approach and the overall intersection under traffic signal control. It should be noted that the addition of a westbound right turn lane and an eastbound left turn lane at the intersection are necessary with traffic signal control in order to improve the intersection.

Traffic Signal Warrant Analysis - 2040 Access Build Conditions

In order to determine if the forecasted 2040 Build conditions are expected to meet one of the traffic signal warrants found in the **Ohio Manual of Uniform Traffic Control Devices (OMUTCD)**, the previously discussed high school driveway and Build conditions traffic data for Cable Road SW and the high school access driveway were used.

All of the collected data and forecasted traffic volumes were analyzed and compared to the thresholds established by the criteria from the **OMUTCD**. Warrants 1 - 9 were evaluated for this analysis of the expected No-Build conditions.

The following table details the results of the traffic signal warrant analysis for the 2020 Build conditions at the intersection of Cable Road SW and the proposed high school access driveway. Copies of the signal warrant analysis worksheets can be found **Appendix G**.

Table 4.32 2040 Build Traffic Signal Warrant Analysis
Cable Road SW & Proposed HS Access Driveway

CONDITIONS	WARRANTS								
	1	2	3	4	5	6	7	8	9
2020 NO-BUILD	NO	NO	NO	NO	NO	n/a	NO	n/a	n/a

Based upon the evaluation of the warrants established by the **Ohio Manual of Uniform Traffic Control Devices**, we conclude that traffic signal control is not justified as required by the Ohio Revised Code based upon the expected 2040 Build conditions and therefore will not be considering as a viable improvement at the intersection of Cable Road SW and the proposed high school access driveway.

4.3 Auxiliary Turning Lane Warrant Analysis

The ODOT **Location and Design Manual, Volume 1** and the **Access Management Manual** recommend that the need for auxiliary turn lanes at unsignalized intersections be determined by using the Auxiliary Lane Graphs found in Section 401-6 of the **Location and Design Manual, Volume 1**. This recommendation is made for the free-flow approaches at unsignalized intersections. Section 401.6.3 of the ODOT **Location and Design Manual** states that:

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

It is the intent of this report to evaluate the need for exclusive deceleration lanes at the proposed access driveways along Summit Road SW, Cable Road SW, and Mink Street SW based on the following conditions:

- The need for exclusive left and right turn lanes along Summit Road SW will be analyzed based on a two-lane roadway and posted speed limit of 35 miles per hour.
- The need for exclusive left and right turn lanes along Cable Road SW will be analyzed based on a two-lane roadway and posted speed limit of 35 miles per hour.
- The need for exclusive left and right turn lanes along Mink Street SW will be analyzed based on a two-lane roadway and posted speed limit of 35 miles per hour.

The following tables shows the results of the analysis of the need for an exclusive turn lanes at the school access driveways. Copies of the ODOT turn lane warrant graphs can be seen in **Appendix S**.

Table 4.33 Turning Lane Warrants
Summit Road SW & High School Access Driveway

TURN LANE & LOCATION	2020		2040	
	AM PEAK	PM PEAK	AM PEAK	PM PEAK
Left Turn Lane @ HS Access	NO	NO	NO	NO
Right Turn Lane @ HS Access	NO	NO	NO	NO

The results of the turn lane analyses at the proposed intersection of Summit Road SW and the proposed high school access driveway indicate that exclusive left and right turn lanes on Summit Road SW are not warranted under the expected 2020 and 2040 Build conditions.

Table 4.34 Turning Lane Warrants
Cable Road SW & Proposed High School Access Driveway

TURN LANE & LOCATION	2020		2040	
	AM PEAK	PM PEAK	AM PEAK	PM PEAK
Left Turn Lane @ HS Access	**YES**	**YES**	**YES**	**YES**
Right Turn Lane @ HS Access	**YES**	NO	**YES**	NO

The results of the turn lane analyses at the proposed intersection of Cable Road SW and the high school access driveway indicate that an exclusive left turn lane on Cable Road SW is warranted under the expected 2020 and 2040 Build conditions.

The turn lane analyses determined that an exclusive westbound right turn lane on Cable Road SW at the proposed high school access driveway is warranted under the forecasted 2020 and 2040 Build conditions.

Table 4.35 Turning Lane Warrants
Cable Road SW & Middle School Access Driveway

TURN LANE & LOCATION	2020		2040	
	AM PEAK	PM PEAK	AM PEAK	PM PEAK
Left Turn Lane @ MS Access	**YES**	NO	**YES**	NO
Right Turn Lane @ MS Access	NO	NO	NO	NO

The results of the turn lane analyses at the existing intersection of Cable Road SW and the middle school access driveway indicate that an exclusive left turn lane on Cable Road SW is warranted under the expected 2020 and 2040 Build conditions. It should be noted that an eastbound left turn lane currently exists at this location.

The turn lane analyses determined that an exclusive westbound right turn lane on Cable Road SW at the middle school access driveway is not warranted under the forecasted 2020 and 2040 Build conditions.

Table 4.36 Turning Lane Warrants
Mink Street SW & Middle School Access Driveway

TURN LANE & LOCATION	2020		2040	
	AM PEAK	PM PEAK	AM PEAK	PM PEAK
Left Turn Lane @ MS Access	NO	NO	NO	NO
Right Turn Lane @ MS Access	NO	NO	NO	NO

The results of the turn lane analyses at the proposed intersection of Mink Street SW and the proposed middle school access driveway indicate that exclusive left and right turn lanes on Mink Street SW are not warranted under the expected 2020 and 2040 Build conditions.

4.4 Turn Lane Length Analysis

An analysis was performed to determine the necessary turn lane storage lengths in order to accommodate the exclusive left and right turn lanes that were determined to be warranted at the proposed access driveways for the high school and middle school. The analysis also will include any recommended turn lane improvements at the study area intersections.

The analysis was performed in accordance with the procedure recommended by the Ohio Department of Transportation in their **Location and Design Manual, Volume 1**, Section 401. The ODOT criteria and procedures are furnished in **Appendix T**. It should be noted that the recommended maximum left turn lane length is 600 feet and the right turn lane length is 800 feet, however if the calculated turn lane length is lower than this value, the maximum length will not be applicable.

The following tables detail the results of the analyses based upon the highest anticipated turn volumes at the respective intersections under the expected 2040 Build conditions.

Table 4.37 - Turn Lane Length Analysis
Summit Road SW & Cable Road SW

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)
							A*	B*	C*		
NB RT	614	1	60	10.2	40	400	--	--	515	--	**515***

* Includes 50' taper

The right turn lane length at the intersection of Summit Road SW and Cable Road SW is provided for the existing stop sign control currently present at the intersection.

Table 4.38 - Turn Lane Length Analysis
Cable Road SW & Proposed High School 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)
							A*	B*	C*		
SB LT	80	1	60	1.3	30	100	--	--	--	100	**--**
SB RT	206	1	60	3.4	30	175	225	--	--	--	**225***
EB LT	382	1	60	6.4	40	275	--	--	390	--	**390***
WB RT	169	1	60	2.8	40	150	--	--	265	--	**265***

* Includes 50' taper

Table 4.39 - Turn Lane Length Analysis
Cable Road SW & Middle School 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)
							A*	B*	C*		
EB LT	239	1	60	4.0	40	175	--	--	290	--	**290***

* Includes 50' taper

The existing eastbound left turn lane on Cable Road SW at the access driveway is approximately 240 feet long including the taper. The turn lane should be lengthened to by 50 feet to accommodate the expected traffic volumes forecasted for the 2020 and 2040 Build conditions.

4.5 Improvements to Accommodate Study Area Traffic

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the existing 2018 conditions:

Cable Road SW & High School Access Driveway

- Westbound Right Turn Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the existing 2018 conditions.

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2020 No-Build conditions:

Cable Road SW & High School Access Driveway

- Single Lane Roundabout

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2040 No-Build conditions:

Summit Road SW & Cable Road SW

- Northbound Right Turn Lane

Cable Road SW & High School Access Driveway

- Single Lane Roundabout

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

The use of a staggered start time for the high school and the middle school is recommended to lessen the impact of the site generated traffic on the study area intersections. It is recommended that the schools have a minimum of 30 minutes between the high school and middle school start times.

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2020 Build conditions:

Summit Road SW & Cable Road SW

- Single Lane Roundabout w/ Northbound Right Turn By-Pass Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 Build conditions.

The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2040 Build conditions:

Summit Road SW & Cable Road SW

- Single Lane Roundabout w/ Northbound Right Turn By-Pass Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2040 No-Build conditions.

The following lane use and traffic control are recommended to accommodate the 2020 and 2040 site generated (Build) traffic at the development access locations based on the site plan shown in **Figure 1.2** and the results of the previous analyses:

Summit Road SW & Proposed High School Access Driveway

- Construct the proposed access driveway with one egress lane and one ingress lane.
- Install stop sign control for the proposed east approach.

Cable Road SW & High School Access Driveway

- Construct the proposed access driveway with two egress lanes and one ingress lane.
- Construct an exclusive westbound right turn lane.
- Construct an exclusive eastbound left turn lane.
- Install stop sign control for the proposed north approach.

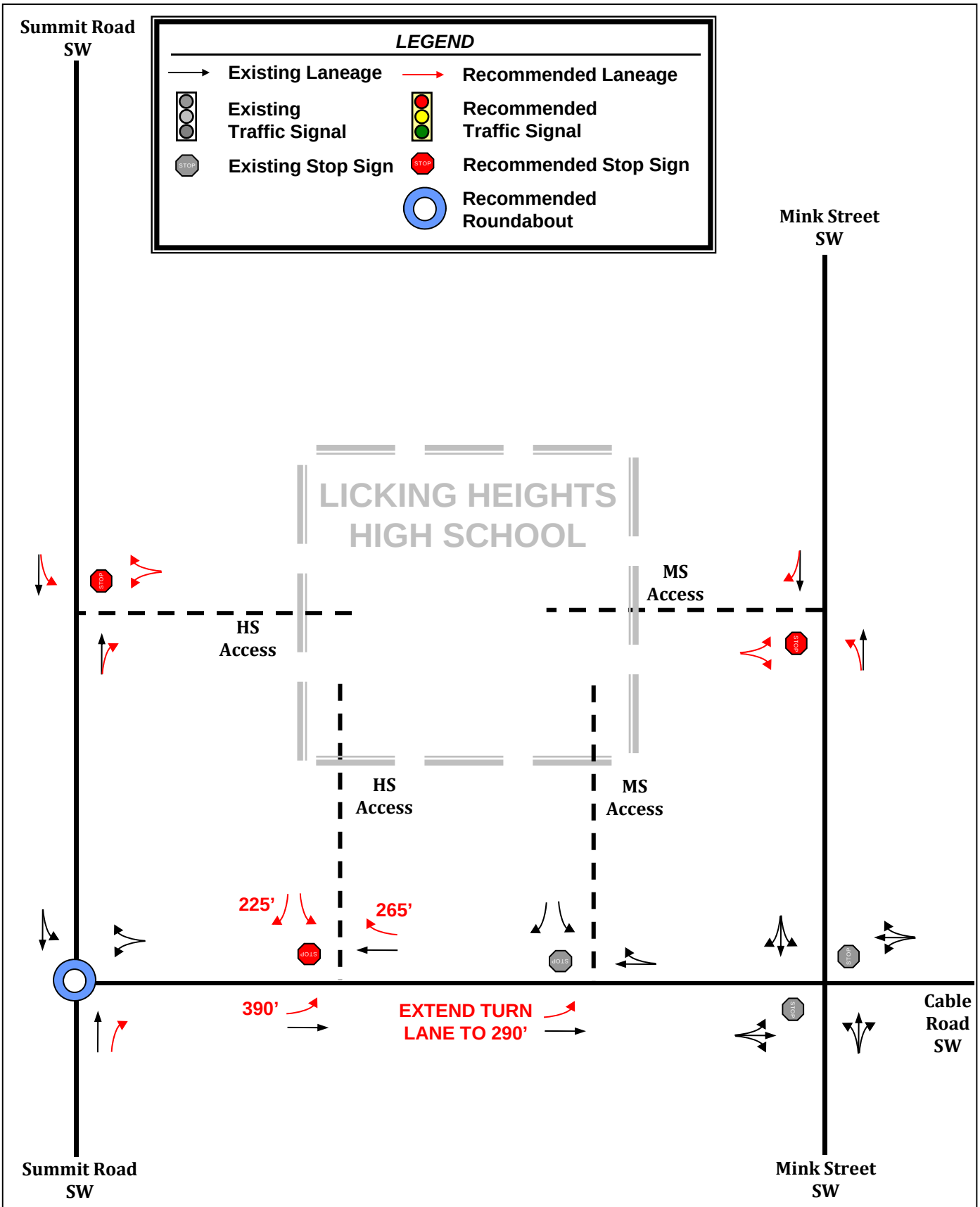
Cable Road SW & Middle School Access Driveway

- Extend the existing eastbound left turn lane to 290 feet including a 50 taper.

Mink Street SW & Middle School Access Driveway

- Construct the proposed access driveway with one egress lane and one ingress lane.
- Install stop sign control for the proposed west approach.

The recommended lane use and traffic control for the study area to accommodate the proposed high school can be seen in **Figure 4.1, Page 70**.



TMS Engineers, Inc. Transportation Management Services 2112 Case Parkway S., Unit 7, Twinsburg, Ohio 44087 www.TMSEngineers.com	Licking Heights Schools Traffic Impact Study Pataskala, Ohio	Recommended Lane Use & Traffic Control – Site Plan	NORTH NOT TO SCALE	Figure 4.1
				Page 70

Chapter 5
Conclusions

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

5.1 This traffic impact study has been prepared at the request of BSHM Architects, Inc. for the construction of a new Licking Heights School and the conversion of the existing high school to a middle school. The project site is located in Pataskala, Licking County, Ohio. The site is bordered by Summit Road SW to the west, Cable Road SW to the south, and Mink Street SW to the east. The development site is currently occupied by the existing Licking Heights High School.

5.2 The high school is being designed for an enrollment of 1,800 students and 80 staff members. The existing high school is being renovated for a middle school enrollment of 900 students and 40 staff members. The site plan for the proposed high school can be seen in **Figure 1.2, Page 3**.

5.3 Licking Heights High School is currently served by one full access driveway along the north side of Cable Road SW.

5.4 The proposed project is expected to create one new access location along the east side of Summit Road SW, one new access location along the north side of Cable Road SW, and one access location along the west side of Mink Street SW. The existing driveway along Cable Road SW will continue to be used with the proposed project. The location and layout of the proposed access driveways for the high school development can be seen in **Figure 1.2, Page 3**.

5.5 The year 2020 will be analyzed for the opening year conditions, and the year 2040 will be analyzed as the design year for the twenty year conditions analysis.

5.6 Based on the collected traffic data and the existing bell schedules for the high school and the middle school, the weekday AM peak hour of traffic was determined to be 7:00 AM to 8:00 AM. The weekday PM peak hour of traffic was found to be 2:00 PM to 3:00 PM. These periods will be analyzed since they reflect the period of the highest volume of traffic flow for the study area roadways and the proposed schools.

5.7 The proposed high school and middle school are expected to generate the following average hourly traffic during the AM and PM peak periods:

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)	
522	Middle School/Junior High School	900	327	267	133	157
530	High School	1,800	627	309	164	350
TOTAL NEW GENERATED TRIPS			**954**	**576**	**297**	**507**
			1530		**804**	

5.8 The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the existing 2018 conditions:

Cable Road SW & High School Access Driveway

- Westbound Right Turn Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the existing 2018 conditions.

5.9 The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2020 No-Build conditions:

Cable Road SW & High School Access Driveway

- Single Lane Roundabout

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

5.10 The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2040 No-Build conditions:

Summit Road SW & Cable Road SW

- Northbound Right Turn Lane

Cable Road SW & High School Access Driveway

- Single Lane Roundabout

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

5.11 The use of a staggered start time for the high school and the middle school is recommended to lessen the impact of the site generated traffic on the study area intersections. It is recommended that the schools have a minimum of 30 minutes between the start times.

5.12 The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2020 Build conditions:

Summit Road SW & Cable Road SW

- Single Lane Roundabout w/ Northbound Right Turn By-Pass Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 Build conditions.

5.13 The following intersection improvements were determined to improve the delay experienced and the levels-of-service at the study area intersections under the forecasted 2040 Build conditions:

Summit Road SW & Cable Road SW

- Single Lane Roundabout w/ Northbound Right Turn By-Pass Lane

The remaining study area intersections were determined to not require any intersection improvements to improve the delay experienced and the levels-of-service under the forecasted 2020 No-Build conditions.

5.14 The following lane use and traffic control are recommended to accommodate the 2020 and 2040 site generated (Build) traffic at the development access locations based on the site plan shown in **Figure 1.2** and the results of the previous analyses:

Summit Road SW & Proposed High School Access Driveway

- Construct the proposed access driveway with one egress lane and one ingress lane.
- Install stop sign control for the proposed east approach.

Cable Road SW & Proposed High School Access Driveway

- Construct the proposed access driveway with two egress lanes and one ingress lane.
- Construct an exclusive westbound right turn lane.
- Construct an exclusive eastbound left turn lane.
- Install stop sign control for the proposed north approach.

Cable Road SW & Middle School Access Driveway

- Extend the existing eastbound left turn lane to 290 feet including a 50 taper.

Mink Street SW & Middle School Access Driveway

- Construct the proposed access driveway with one egress lane and one ingress lane.
- Install stop sign control for the proposed west approach.

5.15 Based upon the results of the analysis in this study and the corresponding recommendations, it can be seen that the site generated traffic can be accommodated by the study area roadway network.

Appendix A
Traffic Count Data

VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Pataskala **At Intersection of:** Cable Road **and** Summit Road

Date: 5/3/2018 **Day:** Thu. **Comments:** Clear **Project:** 18-038

Weather: #REF! **Recorder(s):** DJS **Data entry by:** JJO **Date entered:** May. 4, 2018 Cable Rd & Summit Rd 050418

TIME BEGINS	Summit Rd. FROM NORTH						Summit Rd. FROM SOUTH						TOTAL NORTH SOUTH	Cable Rd. FROM EAST						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	Left	Thru	Right	Total	Trk	Bus			North	South	East	West
06:00																															
07:00	22	64	0	86	4	0	0	151	302	453	4	11	539	126	0	32	158	1	10							158	697	0.741	0.584	0.564	
08:00	3	88	0	91	3	3	0	90	28	118	1	5	209	34	0	9	43	0	7							43	252	0.734	0.819	0.768	
09:00	0	40	0	40	2	0	0	60	29	89	0	2	129	28	0	2	30	2	1							30	159	0.625	0.890	0.682	
10:00																															
11:00	2	44	0	46	2	0	0	40	17	57	3	3	103	24	0	3	27	0	3							27	130	0.719	0.838	0.675	
12:00	7	43	0	50	3	2	0	41	23	64	4	3	114	66	0	9	75	2	2							75	189	0.658	0.696	0.625	
1:00	2	52	0	54	3	0	0	39	33	72	3	2	126	39	0	2	41	1	0							41	167	0.844	0.750	0.603	
2:00	8	58	0	66	0	0	0	74	88	162	0	0	228	173	0	29	202	0	0							202	430	0.250	0.250	0.250	
3:00	5	70	0	75	1	1	0	89	52	141	3	4	216	66	0	11	77	0	3							77	293	0.852	0.820	0.770	
4:00	15	120	0	135	0	3	0	94	76	170	5	4	305	57	0	2	59	0	2							59	364	0.785	0.817	0.641	
5:00	13	150	0	163	1	0	0	90	68	158	1	0	321	55	0	3	58	0	0							58	379	0.948	0.840	0.558	
6:00																															
7:00																															
8:00																															
9:00																															
TOTALS	77	729	0	806	19	9	0	768	716	1484	24	34	2290	668	0	102	770	6	28							770	3060				
ADT	112	1063	0	1175	3.5%		0	1120	1044	2164	3.9%		3340	974	0	149	1123	4.4%								1123	4463				

N-S HOURLY FACTOR: 1.69 **E-W HOURLY FACTOR:** 1.69 **MONTHLY FACTOR:** 0.87 **N-S COMBINED FACTOR:** 1.46 **E-W COMBINED FACTOR:** 1.46

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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Pataskala **At Intersection of:** Cable Road **and** cking Heights High School Drivew

Date: 3/22/2018 **Day:** Thu. **Comments:** Clear **Project:** 18-038

Weather: #REF! **Recorder(s):** DJS **Data entry by:** JJO **Date entered:** Mar. 23, 2018 Rd & Licking Heights HS Driveway 03

TIME BEGINS	Licking Heights HS Driveway FROM NORTH						FROM SOUTH						TOTAL NORTH SOUTH	Cable Rd. FROM EAST						Cable 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	Left	Thru	Right	Total	Trk	Bus			North	South	East	West
06:00																															
07:00	35	0	139	174	1	13							174	0	16	128	144	0	5	352	8	0	360	0	11	504	678	0.537		0.480	0.552
08:00	0	0	15	15	0	4							15	0	16	8	24	0	2	15	8	0	23	0	3	47	62	0.625		0.750	0.821
09:00	9	0	22	31	0	0							31	0	6	13	19	0	1	20	7	0	27	1	1	46	77	0.705		0.792	0.614
10:00																															
11:00	3	0	16	19	0	0							19	0	12	10	22	0	0	11	2	0	13	1	0	35	54	0.792		0.688	0.813
12:00	8	0	78	86	0	0							86	0	12	6	18	1	0	28	9	0	37	0	2	55	141	0.551		0.563	0.712
1:00																															
2:00	56	0	189	245	0	18							245	0	13	19	32	1	1	84	12	0	96	1	19	128	373	0.552		0.615	0.706
3:00	36	0	65	101	0	1							101	0	19	14	33	0	5	34	12	0	46	0	1	79	180	0.743		0.516	0.676
4:00	11	0	24	35	0	1							35	0	17	36	53	2	1	53	13	0	66	1	4	119	154	0.515		0.530	0.688
5:00	5	0	30	35	0	0							35	0	24	30	54	0	0	51	26	0	77	1	0	131	166	0.673		0.794	0.875
6:00																															
7:00																															
8:00																															
9:00																															
TOTALS	163	0	578	741	1	37							741	0	135	264	399	4	15	648	97	0	745	5	41	1144	1885				
ADT	244	0	864	1108	5.1%					#####			1108	0	210	410	620	4.8%		1006	151	0	1157	6.2%		1776	2884				

N-S HOURLY FACTOR: 1.62 **E-W HOURLY FACTOR:** 1.69 **MONTHLY FACTOR:** 0.92 **N-S COMBINED FACTOR:** 1.49 **E-W COMBINED FACTOR:** 1.55

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VEHICULAR TRAFFIC COUNT SUMMARY

Municipality: Pataskala **At Intersection of:** Cable Road **and** Mink Street

Date: 3/22/2018 **Day:** Thu. **Comments:** Clear **Project:** 18-038

Weather: #REF! **Recorder(s):** GFA **Data entry by:** JJO **Date entered:** Mar. 23, 2018 Cable Rd & Mink St 032218

TIME BEGINS	Mink St. FROM NORTH						Mink St. FROM SOUTH						TOTAL NORTH SOUTH	Cable Rd. FROM EAST						Cable 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	Left	Thru	Right	Total	Trk	Bus			North	South	East	West
06:00																															
07:00	4	143	52	199	2	3	50	218	6	274	3	3	473	10	19	5	34	1	0	17	3	19	39	0	4	73	546	0.754	0.913	0.607	0.750
08:00	6	167	9	182	3	3	9	193	5	207	4	1	389	9	5	6	20	1	1	6	1	2	9	0	3	29	418	0.771	0.761	0.625	0.563
09:00	4	88	11	103	4	0	3	97	3	103	3	1	206	4	0	5	9	0	0	8	4	3	15	0	1	24	230	0.678	0.831	0.450	0.750
10:00																															
11:00	4	55	2	61	3	0	7	40	2	49	5	0	110	4	11	3	18	0	0	4	3	1	8	0	0	26	136	0.953	0.817	0.900	0.667
12:00	8	52	6	66	1	0	3	36	3	42	3	0	108	5	4	6	15	1	0	5	9	6	20	0	2	35	143	0.917	0.875	0.625	0.625
1:00																															
2:00	10	89	11	110	2	2	13	87	11	111	3	0	221	7	8	10	25	2	1	27	9	31	67	0	7	92	313	0.887	0.841	0.521	0.540
3:00	11	143	14	168	2	4	8	122	8	138	4	3	306	4	13	11	28	2	2	22	18	11	51	0	2	79	385	0.857	0.841	0.700	0.850
4:00	3	226	26	255	3	1	21	144	11	176	7	1	431	4	13	12	29	1	1	11	11	5	27	1	1	56	487	0.839	0.863	0.906	0.563
5:00	9	310	24	343	3	0	21	218	6	245	2	0	588	6	11	9	26	0	0	14	12	6	32	1	0	58	646	0.849	0.795	0.722	0.667
6:00																															
7:00																															
8:00																															
9:00																															
TOTALS	59	1273	155	1487	23	13	135	1155	55	1345	34	9	2832	53	84	67	204	8	5	114	70	84	268	2	20	472	3304				
ADT	92	1977	241	2309	2.4%		210	1793	85	2089	3.2%		4398	82	130	104	317	6.4%		177	109	130	416	8.2%		733	5130				

N-S HOURLY FACTOR: 1.69 **E-W HOURLY FACTOR:** 1.69 **MONTHLY FACTOR:** 0.92 **N-S COMBINED FACTOR:** 1.55 **E-W COMBINED FACTOR:** 1.55

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Appendix B
Trip Generation Data

Middle School/Junior High School

ITE Code = 522

Date: **4/30/2018**

Trip Generation based on: Size of Analysis Area: **900** **Students**

Students	Average Rate	Standard Deviation	Adjustment Factor	Driveway Volume
Average Weekday 2-way Volume	2.18	0.00	1.00	1966
Weekday Peak Hour of Adjacent Street Traffic				
7-9 AM Peak Hour Enter	0.31	0.00	1.00	282
7-9 AM Peak Hour Exit	0.27	0.00	1.00	240
7-9 AM Peak Hour Total	0.58	0.32	1.00	522
4-6 PM Peak Hour Enter	0.08	0.00	1.00	75
4-6 PM Peak Hour Exit	0.09	0.00	1.00	78
4-6 PM Peak Hour Total	0.17	0.12	1.00	153
Weekday Peak Hour of Generator				
AM Peak Hour Enter	0.36	0.00	1.00	327
AM Peak Hour Exit	0.30	0.00	1.00	267
AM Peak Hour Total	0.66	0.00	1.00	594
PM Peak Hour Enter	0.15	0.00	1.00	133
PM Peak Hour Exit	0.17	0.00	1.00	157
PM Peak Hour Total	0.32	0.00	1.00	290

Middle School/Junior High School

ITE Code = 522

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

Average Weekday 2-way Volume	$\text{Ln (T)} = 0.79 \text{ Ln (X)} + 2.21$		
Weekday Peak Hour of Adjacent Street Traffic			
7-9 AM Peak Hour Total	$Not\ Given\ -Use\ ITE\ Rates$	Enter	0.54
		Exit	0.46
4-6 PM Peak Hour Total	$Not\ Given\ -Use\ ITE\ Rates$	Enter	0.49
		Exit	0.51
Weekday Peak Hour of Generator			
7-9 AM Peak Hour Total	$\text{Ln (T)} = 0.93 \text{ Ln (X)} + 0.06$	Enter	0.55
		Exit	0.45
4-6 PM Peak Hour Total	$\text{Ln (T)} = 0.96 \text{ Ln (X)} - 0.86$	Enter	0.46
		Exit	0.54

Source: **Institute of Transportation Engineers**
Trip Generation Manual, 10th Edition, September 2017

High School

ITE Code = 530

Date: **4/30/2018**

Trip Generation based on: Size of Analysis Area: **1,800** **Students**

Students	Average Rate	Standard Deviation	Adjustment Factor	Driveway Volume
Average Weekday 2-way Volume	1.94	0.00	1.00	3486
Weekday Peak Hour of Adjacent Street Traffic				
7-9 AM Peak Hour Enter	0.35	0.00	1.00	627
7-9 AM Peak Hour Exit	0.17	0.00	1.00	309
7-9 AM Peak Hour Total	0.52	0.23	1.00	936
4-6 PM Peak Hour Enter	0.07	0.00	1.00	121
4-6 PM Peak Hour Exit	0.07	0.00	1.00	131
4-6 PM Peak Hour Total	0.14	0.12	1.00	252
Weekday Peak Hour of Generator				
AM Peak Hour Enter	0.32	0.00	1.00	576
AM Peak Hour Exit	0.15	0.00	1.00	271
AM Peak Hour Total	0.47	0.00	1.00	847
PM Peak Hour Enter	0.09	0.00	1.00	164
PM Peak Hour Exit	0.19	0.00	1.00	350
PM Peak Hour Total	0.29	0.00	1.00	514
Average Saturday 2-way Volume	0.58	0.42	1.00	1044
Saturday Peak Hour of Generator				
SAT Peak Hour Enter	0.06	0.00	1.00	113
SAT Peak Hour Exit	0.04	0.00	1.00	67
SAT Peak Hour Total	0.10	0.08	1.00	180
Average Sunday 2-way Volume	0.25	0.24	1.00	450
Sunday Peak Hour of Generator				
SUN Peak Hour Enter	0.02	0.00	1.00	37
SUN Peak Hour Exit	0.03	0.00	1.00	53
SUN Peak Hour Total	0.05	0.05	1.00	90

High School

ITE Code = 530

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

Average Weekday 2-way Volume	$\text{Ln (T)} = 0.76 \text{ Ln (X)} + 2.46$		
Weekday Peak Hour of Adjacent Street Traffic			
7-9 AM Peak Hour Total	$Not\ Given\ -Use\ ITE\ Rates$	Enter	0.67
		Exit	0.33
4-6 PM Peak Hour Total	$Not\ Given\ -Use\ ITE\ Rates$	Enter	0.48
		Exit	0.52
Weekday Peak Hour of Generator			
7-9 AM Peak Hour Total	$\text{Ln (T)} = 0.67 \text{ Ln (X)} + 1.72$	Enter	0.68
		Exit	0.32
4-6 PM Peak Hour Total	$\text{Ln (T)} = 0.69 \text{ Ln (X)} + 1.07$	Enter	0.32
		Exit	0.68
Saturday			
Average Saturday 2-way Volume	$Not\ Given\ -Use\ ITE\ Rates$		
Peak Hour of Generator	$Not\ Given\ -Use\ ITE\ Rates$	Enter	0.63
		Exit	0.37
Sunday			
Average Sunday 2-way Volume	$Not\ Given\ -Use\ ITE\ Rates$		
Peak Hour of Generator	$Not\ Given\ -Use\ ITE\ Rates$	Enter	0.41
		Exit	0.59

Source: **Institute of Transportation Engineers**
Trip Generation Manual, 10th Edition, September 2017

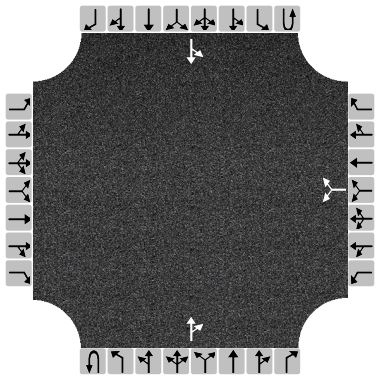
Appendix D
Existing Capacity Analyses Worksheets
2018 w/ Improvements

HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2018	North/South Street	Summit Road SW
Time Analyzed	AM Peak	Peak Hour Factor	0.61
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Existing Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						126		32			151	302		22	64	
Percent Heavy Vehicles (%)						8		3						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.48		6.23						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.57		3.33						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							259							36		
Capacity, c (veh/h)							422							874		
v/c Ratio							0.61							0.04		
95% Queue Length, Q_{95} (veh)							4.0							0.1		
Control Delay (s/veh)							26.2							9.3		
Level of Service, LOS							D							A		
Approach Delay (s/veh)						26.2								2.7		
Approach LOS						D										

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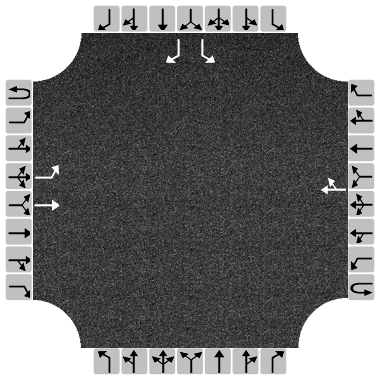
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Cable & HS
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2018	North/South Street	LHHS Access Driveway
Time Analyzed	AM Peak	Peak Hour Factor	0.56
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Existing Conditions		

Lanes



Major Street: East-West

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	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		352	8				16	128						35		139
Percent Heavy Vehicles (%)		3												11		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.51		6.27
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.60		3.36

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		629												63		248
Capacity, c (veh/h)		1301												75		892
v/c Ratio		0.48												0.83		0.28
95% Queue Length, Q_{95} (veh)		2.7												4.1		1.1
Control Delay (s/veh)		10.3												155.3		10.6
Level of Service, LOS		B												F		B
Approach Delay (s/veh)	10.1												39.7			
Approach LOS													E			

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HCS7 Two-Way Stop-Control Report

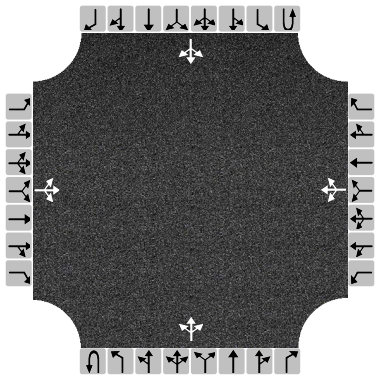
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2018
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Existing Conditions

Site Information

Intersection	Mink & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Mink Street SW
Peak Hour Factor	0.83
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		18	4	21		10	23	5		59	218	6		4	143	62
Percent Heavy Vehicles (%)		12	33	5		10	0	0		4				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.22	6.83	6.25		7.20	6.50	6.20		4.14				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.61	4.30	3.34		3.59	4.00	3.30		2.24				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			52				46			71				5		
Capacity, c (veh/h)			467				379			1305				1305		
v/c Ratio			0.11				0.12			0.05				0.00		
95% Queue Length, Q_{95} (veh)			0.4				0.4			0.2				0.0		
Control Delay (s/veh)			13.7				15.8			7.9				7.8		
Level of Service, LOS			B				C			A				A		
Approach Delay (s/veh)	13.7				15.8				2.1				0.2			
Approach LOS	B				C											

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HCS7 Two-Way Stop-Control Report

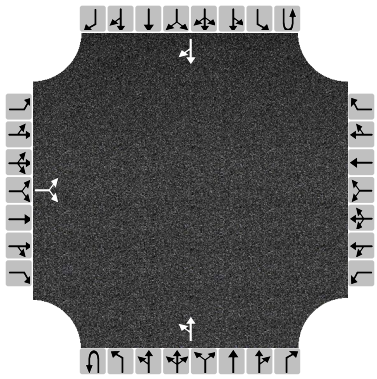
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2018
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Existing Conditions

Site Information

Intersection	Mink & HS Access
Jurisdiction	Pataskala, OH
East/West Street	HS Access Driveway
North/South Street	Mink Street SW
Peak Hour Factor	0.85
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		1		1						1	231				188	1
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			2							1						
Capacity, c (veh/h)			649							1359						
v/c Ratio			0.00							0.00						
95% Queue Length, Q_{95} (veh)			0.0							0.0						
Control Delay (s/veh)			10.6							7.7						
Level of Service, LOS			B							A						
Approach Delay (s/veh)	10.6								0.0							
Approach LOS	B															

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HCS7 Two-Way Stop-Control Report

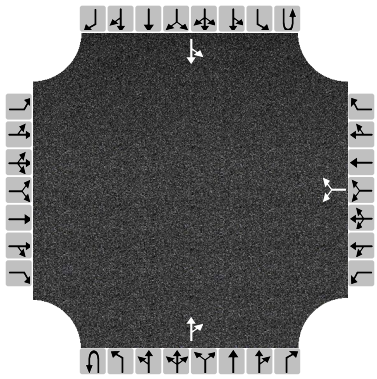
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2018
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Existing Conditions

Site Information

Intersection	Summit & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Summit Road SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						173		29			74	88		8	58	
Percent Heavy Vehicles (%)						6		6						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							269							11		
Capacity, c (veh/h)							738							1346		
v/c Ratio							0.36							0.01		
95% Queue Length, Q_{95} (veh)							1.7							0.0		
Control Delay (s/veh)							12.6							7.7		
Level of Service, LOS							B							A		
Approach Delay (s/veh)						12.6							1.0			
Approach LOS						B										

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HCS7 Two-Way Stop-Control Report

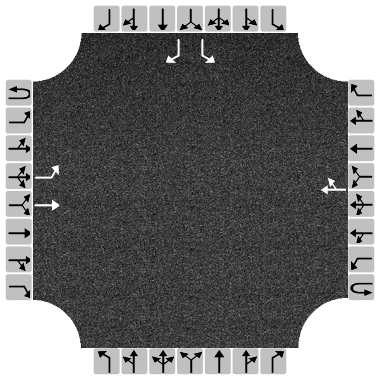
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2018
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Existing Conditions

Site Information

Intersection	Cable & HS
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	LHHS Access Driveway
Peak Hour Factor	0.62
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		84	12				13	19						56		189
Percent Heavy Vehicles (%)		20												9		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.30												6.49		6.27
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.38												3.58		3.36

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		135												90		305
Capacity, c (veh/h)		1446												592		1023
v/c Ratio		0.09												0.15		0.30
95% Queue Length, Q_{95} (veh)		0.3												0.5		1.3
Control Delay (s/veh)		7.7												12.2		10.0
Level of Service, LOS		A												B		B
Approach Delay (s/veh)	6.8												10.5			
Approach LOS													B			

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HCS7 Two-Way Stop-Control Report

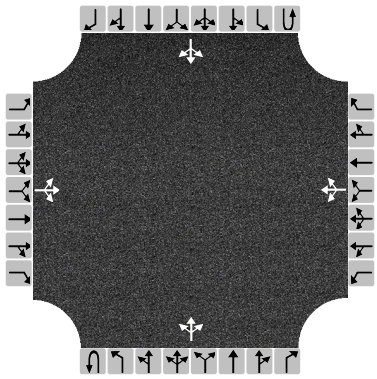
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2018
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Existing Conditions

Site Information

Intersection	Mink & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Mink Street SW
Peak Hour Factor	0.85
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		27	9	32		7	8	10		13	87	11		10	89	11
Percent Heavy Vehicles (%)		7	22	10		14	25	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.17	6.72	6.30		7.24	6.75	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.56	4.20	3.39		3.63	4.22	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			80				29			15				12		
Capacity, c (veh/h)			732				690			1483				1487		
v/c Ratio			0.11				0.04			0.01				0.01		
95% Queue Length, Q_{95} (veh)			0.4				0.1			0.0				0.0		
Control Delay (s/veh)			10.5				10.4			7.5				7.4		
Level of Service, LOS			B				B			A				A		
Approach Delay (s/veh)	10.5				10.4				0.9				0.7			
Approach LOS	B				B											

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HCS7 Two-Way Stop-Control Report

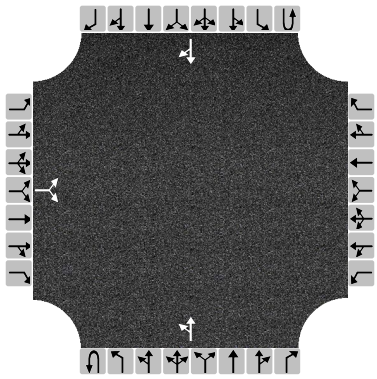
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2018
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Existing Conditions

Site Information

Intersection	Mink & HS Access
Jurisdiction	Pataskala, OH
East/West Street	HS Access Driveway
North/South Street	Mink Street SW
Peak Hour Factor	0.90
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		1		1						1	121				107	1
Percent Heavy Vehicles (%)		0		0						0						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

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

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			2							1						
Capacity, c (veh/h)			825							1480						
v/c Ratio			0.00							0.00						
95% Queue Length, Q_{95} (veh)			0.0							0.0						
Control Delay (s/veh)			9.4							7.4						
Level of Service, LOS			A							A						
Approach Delay (s/veh)	9.4								0.1							
Approach LOS	A															

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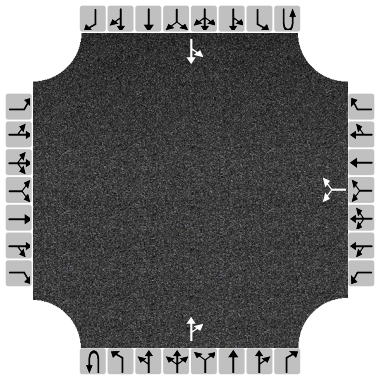
Appendix E
No-Build Capacity Analysis Worksheets
2020

HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2020	North/South Street	Summit Road SW
Time Analyzed	AM Peak	Peak Hour Factor	0.61
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						130		30			150	310		30	70	
Percent Heavy Vehicles (%)						8		3						0		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.48		6.23						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.57		3.33						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							262							49		
Capacity, c (veh/h)							394							865		
v/c Ratio							0.67							0.06		
95% Queue Length, Q_{95} (veh)							4.7							0.2		
Control Delay (s/veh)							30.6							9.4		
Level of Service, LOS							D							A		
Approach Delay (s/veh)					30.6								3.2			
Approach LOS					D											

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HCS7 Two-Way Stop-Control Report

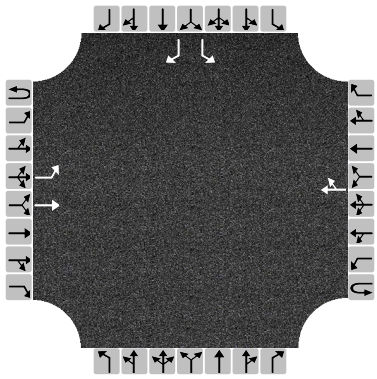
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	No-Build Conditions

Site Information

Intersection	Cable & HS
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	LHHS Access Driveway
Peak Hour Factor	0.56
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		350	10				20	130						40		140
Percent Heavy Vehicles (%)		3												11		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.51		6.27
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.60		3.36

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		625												71		250
Capacity, c (veh/h)		1288												74		882
v/c Ratio		0.49												0.97		0.28
95% Queue Length, Q_{95} (veh)		2.7												5.0		1.2
Control Delay (s/veh)		10.4												191.5		10.7
Level of Service, LOS		B												F		B
Approach Delay (s/veh)	10.1												50.9			
Approach LOS													F			

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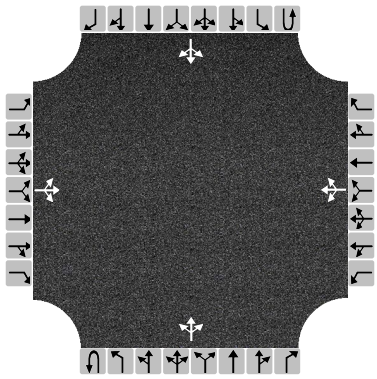
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Mink & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2020	North/South Street	Mink Street SW
Time Analyzed	AM Peak	Peak Hour Factor	0.83
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		20	10	20		10	30	10		50	220	10		10	150	50
Percent Heavy Vehicles (%)		12	33	5		10	0	0		4				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.22	6.83	6.25		7.20	6.50	6.20		4.14				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.61	4.30	3.34		3.59	4.00	3.30		2.24				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			60				60			60				12		
Capacity, c (veh/h)			428				398			1312				1298		
v/c Ratio			0.14				0.15			0.05				0.01		
95% Queue Length, Q_{95} (veh)			0.5				0.5			0.1				0.0		
Control Delay (s/veh)			14.8				15.6			7.9				7.8		
Level of Service, LOS			B				C			A				A		
Approach Delay (s/veh)	14.8				15.6				1.8				0.5			
Approach LOS	B				C											

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HCS7 Two-Way Stop-Control Report

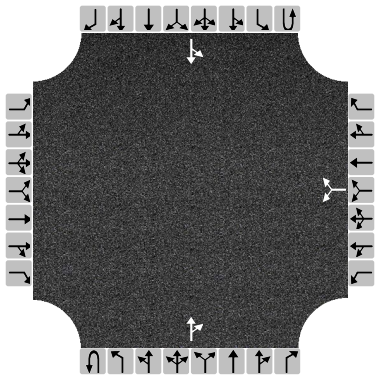
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	No-Build Conditions

Site Information

Intersection	Summit & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Summit Road SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						180		30			80	90		10	70	
Percent Heavy Vehicles (%)						6		6						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.46		6.26						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.55		3.35						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							280							13		
Capacity, c (veh/h)							710							1334		
v/c Ratio							0.39							0.01		
95% Queue Length, Q_{95} (veh)							1.9							0.0		
Control Delay (s/veh)							13.3							7.7		
Level of Service, LOS							B							A		
Approach Delay (s/veh)						13.3								1.0		
Approach LOS						B										

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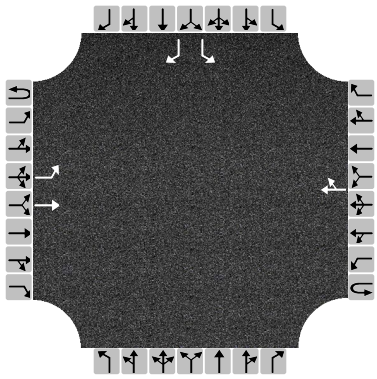
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Cable & HS
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2020	North/South Street	LHHS Access Driveway
Time Analyzed	PM Peak	Peak Hour Factor	0.62
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: East-West

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	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		80	10				10	20						60		190
Percent Heavy Vehicles (%)		20												9		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.30												6.49		6.27
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.38												3.58		3.36

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		129												97		306
Capacity, c (veh/h)		1451												612		1029
v/c Ratio		0.09												0.16		0.30
95% Queue Length, Q_{95} (veh)		0.3												0.6		1.3
Control Delay (s/veh)		7.7												12.0		10.0
Level of Service, LOS		A												B		A
Approach Delay (s/veh)	6.9												10.5			
Approach LOS													B			

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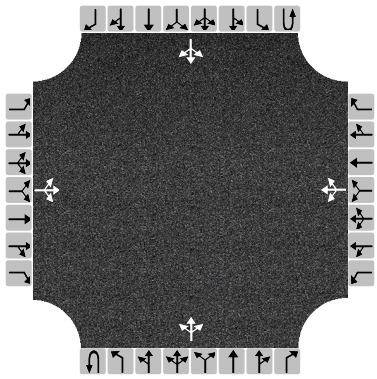
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Mink & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2020	North/South Street	Mink Street SW
Time Analyzed	PM Peak	Peak Hour Factor	0.85
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		30	10	30		10	10	10		10	90	10		10	90	10
Percent Heavy Vehicles (%)		7	22	10		14	25	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.17	6.72	6.30		7.24	6.75	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.56	4.20	3.39		3.63	4.22	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			82				35			12				12		
Capacity, c (veh/h)			723				674			1483				1483		
v/c Ratio			0.11				0.05			0.01				0.01		
95% Queue Length, Q_{95} (veh)			0.4				0.2			0.0				0.0		
Control Delay (s/veh)			10.6				10.6			7.4				7.4		
Level of Service, LOS			B				B			A				A		
Approach Delay (s/veh)	10.6				10.6				0.7				0.7			
Approach LOS	B				B											

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Appendix F
No-Build Capacity Analysis Worksheets
2020 w/ Improvements

HCS7 Two-Way Stop-Control Report

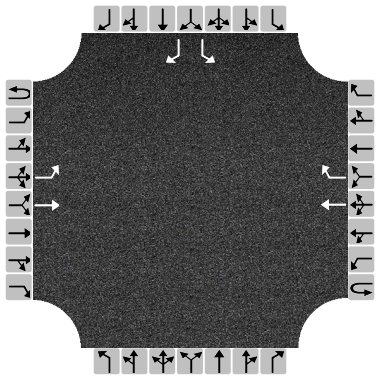
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	WB RTL

Site Information

Intersection	Cable & HS
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	LHHS Access Driveway
Peak Hour Factor	0.56
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	1	1	0	0	0	1	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		350	10				20	130						40		140
Percent Heavy Vehicles (%)		3												11		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		625												71		250
Capacity, c (veh/h)		1288												87		1023
v/c Ratio		0.49												0.82		0.24
95% Queue Length, Q_{95} (veh)		2.7												4.3		1.0
Control Delay (s/veh)		10.4												135.4		9.7
Level of Service, LOS		B												F		A
Approach Delay (s/veh)	10.1												37.6			
Approach LOS													E			

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HCS7 Two-Way Stop-Control Report

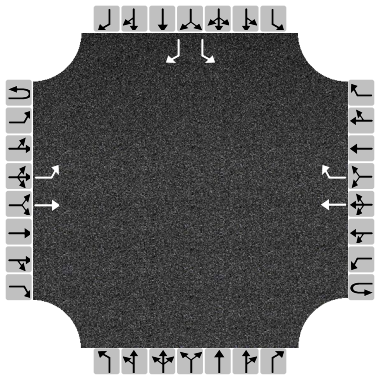
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	WB RTL

Site Information

Intersection	Cable & HS
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	LHHS Access Driveway
Peak Hour Factor	0.62
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	1	1	0	0	0	1	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		80	10				10	20						60		190
Percent Heavy Vehicles (%)		20												9		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		129												97		306
Capacity, c (veh/h)		1451												625		1050
v/c Ratio		0.09												0.15		0.29
95% Queue Length, Q_{95} (veh)		0.3												0.5		1.2
Control Delay (s/veh)		7.7												11.8		9.8
Level of Service, LOS		A												B		A
Approach Delay (s/veh)	6.9												10.3			
Approach LOS													B			

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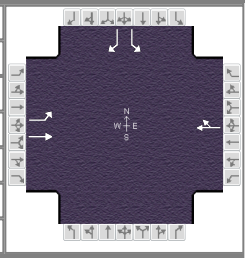
HCS7 Signalized Intersection Results Summary

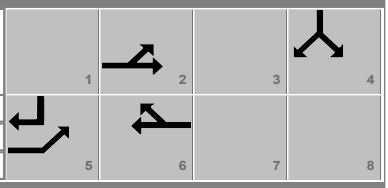
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	AM Peak	PHF	0.56
Urban Street	Cable Road SW	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	AM 20NB CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	10			20	130				40		140

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.0	34.7	10.3	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	13.0	53.7		40.7				16.3
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	9.0							12.3
Green Extension Time (g_e), s	0.0	0.0		0.0				0.0
Phase Call Probability	1.00							1.00
Max Out Probability	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	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	625	18			268					71		250
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1767	1900			1477					1654		1522
Queue Service Time (g_s), s	7.0	0.2			7.8					2.7		10.3
Cycle Queue Clearance Time (g_c), s	7.0	0.2			7.8					2.7		10.3
Green Ratio (*g/C*)	0.62	0.68			0.50					0.15		0.25
Capacity (*c*), veh/h	703	1295			732					243		376
Volume-to-Capacity Ratio (*X*)	0.889	0.014			0.366					0.293		0.665
Back of Queue (*Q*), ft/ln (85 th percentile)	262.2	2.8			113.7					50		154.3
Back of Queue (*Q*), veh/ln (85 th percentile)	10.2	0.1			4.1					1.8		5.8
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00					0.00		0.00
Uniform Delay (d_1), s/veh	14.5	3.6			10.9					26.6		23.7
Incremental Delay (d_2), s/veh	13.0	0.0			1.4					0.2		3.5
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0					0.0		0.0
Control Delay (*d*), s/veh	27.5	3.6			12.3					26.9		27.3
Level of Service (LOS)	C	A			B					C		C
Approach Delay, s/veh / LOS	26.8	C		12.3	B		0.0			27.2	C	
Intersection Delay, s/veh / LOS	23.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.65	A	1.89	B	1.72	B	1.95	B
Bicycle LOS Score / LOS	1.55	B	0.93	A				F

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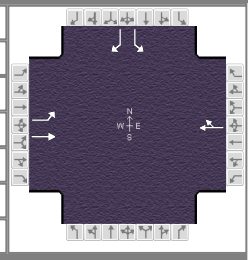
HCS7 Signalized Intersection Results Summary

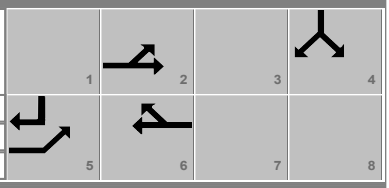
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	PM Peak	PHF	0.62
Urban Street	Cable Road SW	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	PM 20NB CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



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	10			10	20				60		190

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.0	22.4	22.6	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	13.0	41.4		28.4				28.6
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	5.6							12.2
Green Extension Time (g_e), s	0.0	0.0		0.0				0.7
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							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	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	129	16			48					97		306
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1527	1530			1498					1682		1522
Queue Service Time (g_s), s	3.6	0.4			1.6					2.9		10.2
Cycle Queue Clearance Time (g_c), s	3.6	0.4			1.6					2.9		10.2
Green Ratio (*g/C*)	0.45	0.51			0.32					0.32		0.42
Capacity (*c*), veh/h	601	773			479					543		644
Volume-to-Capacity Ratio (*X*)	0.215	0.021			0.101					0.178		0.476
Back of Queue (*Q*), ft/ln (85 th percentile)	56.1	6.3			28.4					50.2		131.7
Back of Queue (*Q*), veh/ln (85 th percentile)	1.9	0.2			1.0					1.9		5.0
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00					0.00		0.00
Uniform Delay (d_1), s/veh	11.7	8.6			16.7					17.0		14.6
Incremental Delay (d_2), s/veh	0.1	0.0			0.4					0.1		0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0					0.0		0.0
Control Delay (*d*), s/veh	11.8	8.7			17.1					17.1		14.8
Level of Service (LOS)	B	A			B					B		B
Approach Delay, s/veh / LOS	11.4	B		17.1	B		0.0			15.3	B	
Intersection Delay, s/veh / LOS	14.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.69	A	1.91	B	1.72	B	1.95	B
Bicycle LOS Score / LOS	0.73	A	0.57	A				F

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Project Description	Improvement - Roundabout

Site Information

Intersection	Cable & HS Access
E/W Street Name	Cable Road SW
N/S Street Name	LHHS Access Driveway
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.56
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0
Lane Assignment			LT				TR								LR	
Volume (V), veh/h	0	350	10		0		20	130					0	40		140
Percent Heavy Vehicles, %	0	3	0		0		13	2					0	11		7
Flow Rate (v_{PCE}), pc/h	0	644	18		0		40	237					0	79		268
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								1			
Pedestrians Crossing, p/h	0				0								0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763						4.9763	
Follow-Up Headway (s)		2.6087			2.6087						2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		662			277						347	
Entry Volume veh/h		643			268						322	
Circulating Flow (v_c), pc/h	79			644			741			40		
Exiting Flow (v_{ex}), pc/h	97			308			881			0		
Capacity (c_{pce}), pc/h		1273			715						1325	
Capacity (c), veh/h		1237			692						1228	
v/c Ratio (x)		0.52			0.39						0.26	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		8.6			10.4						5.3	
Lane LOS		A			B						A	
95% Queue, veh		3.1			1.8						1.1	
Approach Delay, s/veh	8.6			10.4						5.3		
Approach LOS	A			B						A		
Intersection Delay, s/veh | LOS	8.1						A					

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Project Description	Improvement - Roundabout

Site Information

Intersection	Cable & HS Access
E/W Street Name	Cable Road SW
N/S Street Name	LHHS Access Driveway
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.62
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0
Lane Assignment			LT				TR								LR	
Volume (V), veh/h	0	80	10		0		10	20					0	60		190
Percent Heavy Vehicles, %	0	20	25		0		15	0					0	9		7
Flow Rate (v_{PCE}), pc/h	0	155	20		0		19	32					0	105		328
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								1			
Pedestrians Crossing, p/h	0				0								0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763						4.9763	
Follow-Up Headway (s)		2.6087			2.6087						2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		175			51						433	
Entry Volume veh/h		145			49						403	
Circulating Flow (v_c), pc/h	105			155			280			19		
Exiting Flow (v_{ex}), pc/h	125			347			187			0		
Capacity (c_{pce}), pc/h		1240			1178						1354	
Capacity (c), veh/h		1028			1121						1259	
v/c Ratio (x)		0.14			0.04						0.32	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		4.8			3.6						5.8	
Lane LOS		A			A						A	
95% Queue, veh		0.5			0.1						1.4	
Approach Delay, s/veh	4.8			3.6						5.8		
Approach LOS	A			A						A		
Intersection Delay, s/veh | LOS	5.4						A					

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Appendix G
Traffic Signal Warrant Analysis Worksheets

2020 NO-BUILD CONDITIONS
TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS 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 1 - EIGHT-HOUR VEHICULAR VOLUME

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

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.

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**500 (400)**	350	600 (480)	420	**504**	47	43	55	129	80	120	132
Highest Approach on Minor Street	**150 (120)**	105	200 (160)	140	**174**	15	31	86	**245**	101	35	35

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**750 (600)**	525	900 (720)	630	504	47	43	55	129	80	120	132
Highest Approach on Minor Street	**75 (60)**	53	100 (80)	70	**174**	15	31	**86**	**245**	**101**	35	35

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.

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS 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

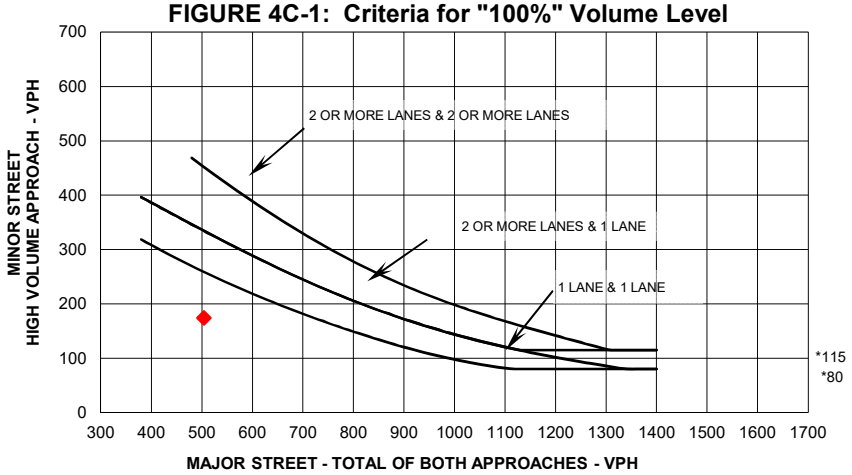
If all four points lie above the appropriate line, then the warrant is satisfied.

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	504	174
2:00 PM - 3:00 PM	129	245
3:00 PM - 4:00 PM	80	101
5:00 PM - 6:00 PM	132	35

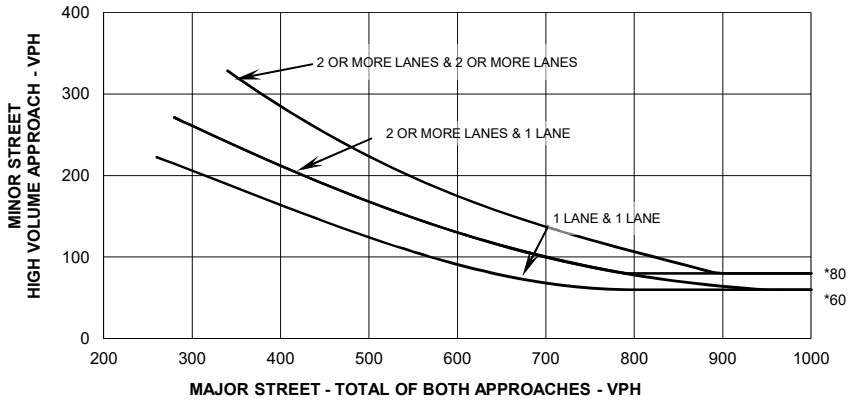
FIGURE 4C-1: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS 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 3 - PEAK HOUR

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

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

Unusual condition justifying use of warrant:

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

Peak Hour		
7:00	504	174

Criteria

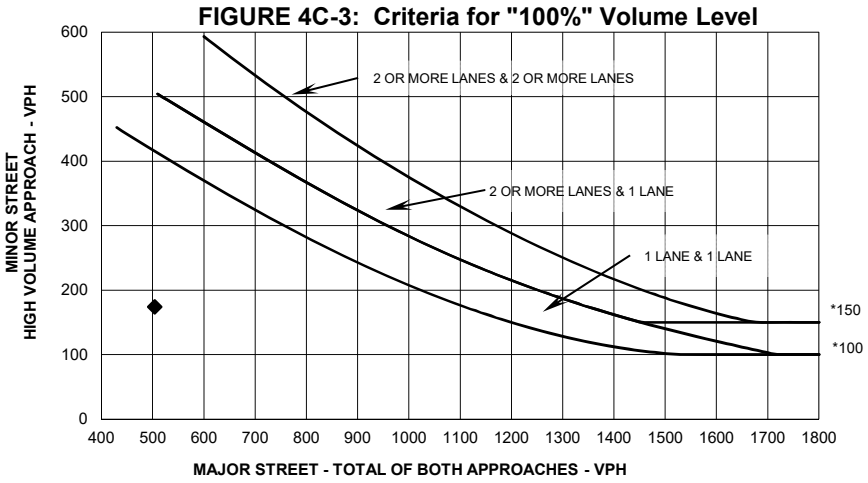
1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*		
Fulfilled?: ☐ Yes	☐ No	

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

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

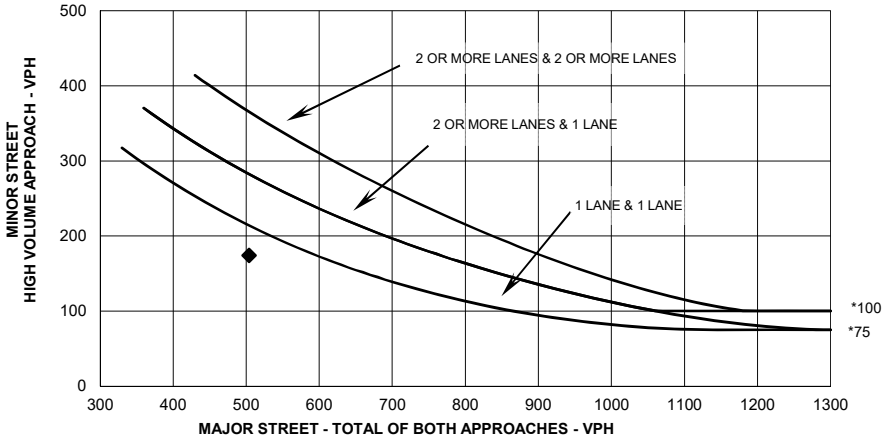
Plot volume combination on the applicable figure below.

FIGURE 4C-3: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-4: Criteria for "70%" Volume Level
(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS Access Driveway — Lanes: 1

WARRANT 4 - PEDESTRIAN VOLUME

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if condition 1 or 2 is fulfilled and condition 3 is fulfilled.

Criteria	Hour	Pedestrian Volume	Pedestrian Gaps	Fulfilled? Yes	Fulfilled? No
1. Pedestrian volume crossing the major street is 100 ped/hr or more for each of any four hours and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
	2:00 - 3:00 PM	0			
	3:00 - 4:00 PM	0			
	4:00 - 5:00 PM	0			
2. Pedestrian volume crossing the major street is 190 ped/hr or more for any one hour and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				☒	

WARRANT 5 - SCHOOL CROSSING

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria			Fulfilled? Yes	Fulfilled? No
1. There are a minimum of 20 students crossing the major street during the highest crossing hour.	Students: 8	Hour: 7:00 - 8:00 AM		x
2. There are fewer adequate gaps in the major street traffic stream during the period when the children are using the crossing than the number of minutes in the same period.	Minutes:	Gaps:		
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				

WARRANT 6 - COORDINATED SIGNAL SYSTEM

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

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1,000 ft).

Criteria	Fulfilled? Yes	Fulfilled? No
1. On a one-way street or a street that has traffic predominately in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.		
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning, and the proposed and adjacent signals will collectively provide a progressive operation.		

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS Access Driveway — Lanes: 1

WARRANT 7 - CRASH EXPERIENCE

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

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria		Hour	Volume	Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. One of the warrants to the right is met.	Warrant 1, Condition A (80% satisfied)				☒		☒
	Warrant 1, Condition B (80% satisfied)				☒		
	Warrant 4, Pedestrian Volume at 80% of volume requirements: 80 ped/hr for four (4) hours or 152 ped/hr for one (1) hour				☒		
2. Adequate trial of other remedial measure has failed to reduce crash frequency.		Measure tried:	NONE				☒
3. Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12-mo. period.		Number of crashes per 12 months:					

WARRANT 8 - ROADWAY NETWORK

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

Record hours where criteria are fulfilled, and the corresponding volume or other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

Criteria							Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Both of the criteria to the right are met.	a. Total entering volume of at least 1,000 veh/hr during a typical weekday peak hour.			Entering Volume:						
	b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		Warrant:	1	2	3				
			Satisfied?:							
2. Total entering volume at least 1,000 veh/hr for each of any 5 hrs of a non-normal business day (Sat. or Sun.)							← Hour			
							← Volume			

Characteristics of Major Routes		Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Part of the street or highway system that serves as the principal roadway network for through traffic flow.	Major Street:				
	Minor Street:				
2. Rural or suburban highway outside of, entering, or traversing a city.	Major Street:				
	Minor Street:				
3. Appears as a major route on an official plan.	Major Street:				
	Minor Street:				

CONCLUSIONS

Warrants Satisfied: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Remarks: TRAFFIC SIGNAL CONTROL IS NOT WARRANTED

Source: Revised from NCHRP Report 457

2040 NO-BUILD CONDITIONS
TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS 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 1 - EIGHT-HOUR VEHICULAR VOLUME

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

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.

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**500 (400)**	350	600 (480)	420	**509**	52	49	60	134	86	126	142
Highest Approach on Minor Street	**150 (120)**	105	200 (160)	140	**174**	15	31	86	**245**	101	35	35

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**750 (600)**	525	900 (720)	630	509	52	49	60	134	86	126	142
Highest Approach on Minor Street	**75 (60)**	53	100 (80)	70	**174**	15	31	**86**	**245**	**101**	35	35

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.

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS 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

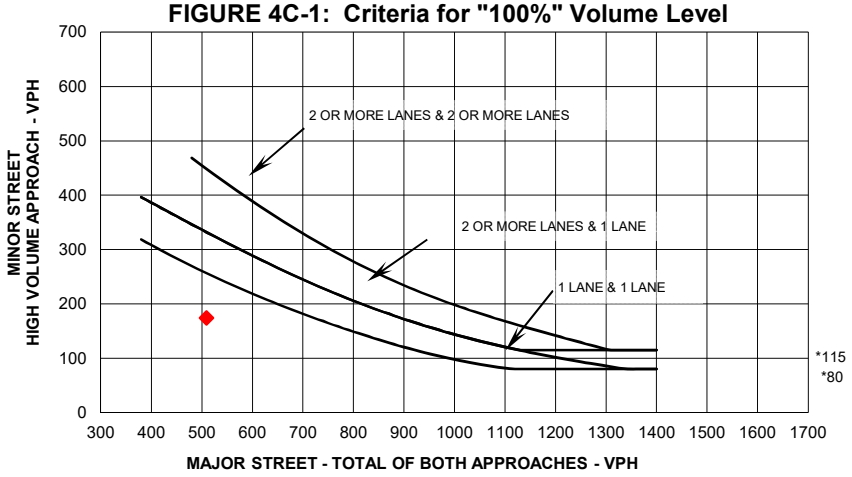
If all four points lie above the appropriate line, then the warrant is satisfied.

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	509	174
2:00 PM - 3:00 PM	134	245
3:00 PM - 4:00 PM	86	101
5:00 PM - 6:00 PM	142	35

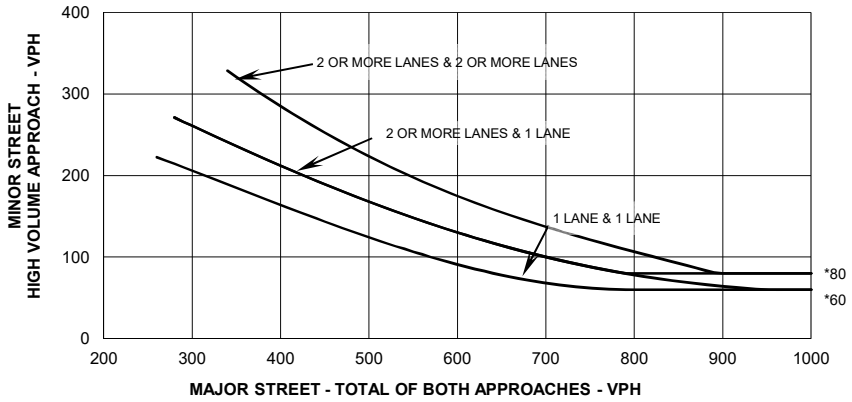
FIGURE 4C-1: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS 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 3 - PEAK HOUR

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

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

Unusual condition justifying use of warrant:

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

Peak Hour		
7:00	509	174

Criteria

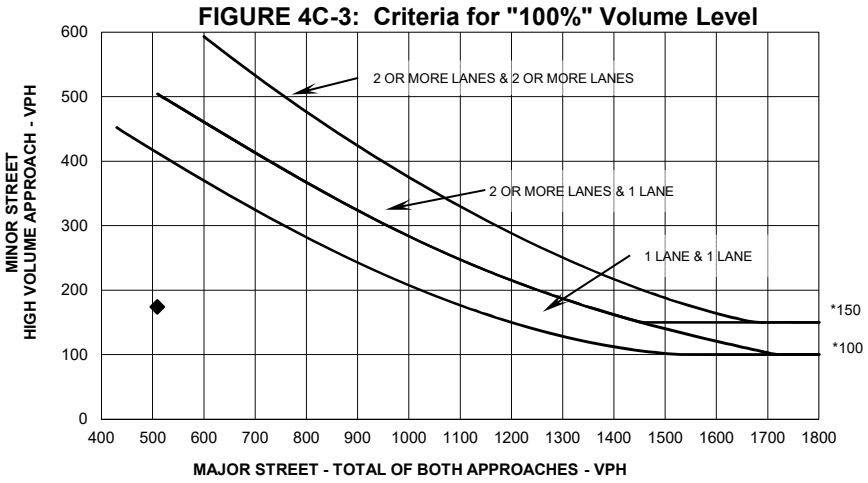
1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*		
Fulfilled?: ☐ Yes	☐ No	

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

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

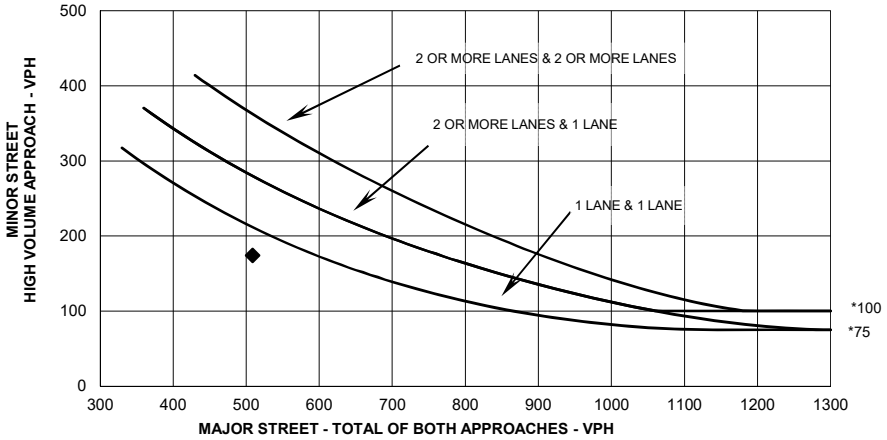
Plot volume combination on the applicable figure below.

FIGURE 4C-3: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-4: Criteria for "70%" Volume Level
(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS Access Driveway — Lanes: 1

WARRANT 4 - PEDESTRIAN VOLUME

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if condition 1 or 2 is fulfilled and condition 3 is fulfilled.

Criteria	Hour	Pedestrian Volume	Pedestrian Gaps	Fulfilled? Yes	Fulfilled? No
1. Pedestrian volume crossing the major street is 100 ped/hr or more for each of any four hours and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
	2:00 - 3:00 PM	0			
	3:00 - 4:00 PM	0			
	4:00 - 5:00 PM	0			
2. Pedestrian volume crossing the major street is 190 ped/hr or more for any one hour and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				☒	

WARRANT 5 - SCHOOL CROSSING

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria			Fulfilled? Yes	Fulfilled? No
1. There are a minimum of 20 students crossing the major street during the highest crossing hour.	Students: 8	Hour: 7:00 - 8:00 AM		x
2. There are fewer adequate gaps in the major street traffic stream during the period when the children are using the crossing than the number of minutes in the same period.	Minutes:	Gaps:		
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				

WARRANT 6 - COORDINATED SIGNAL SYSTEM

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

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1,000 ft).

Criteria	Fulfilled? Yes	Fulfilled? No
1. On a one-way street or a street that has traffic predominately in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.		
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning, and the proposed and adjacent signals will collectively provide a progressive operation.		

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: LHHS Access Driveway — Lanes: 1

WARRANT 7 - CRASH EXPERIENCE

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

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria		Hour	Volume	Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. One of the warrants to the right is met.	Warrant 1, Condition A (80% satisfied)				☒		☒
	Warrant 1, Condition B (80% satisfied)				☒		
	Warrant 4, Pedestrian Volume at 80% of volume requirements: 80 ped/hr for four (4) hours or 152 ped/hr for one (1) hour				☒		
2. Adequate trial of other remedial measure has failed to reduce crash frequency.		Measure tried:	NONE				☒
3. Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12-mo. period.		Number of crashes per 12 months:					

WARRANT 8 - ROADWAY NETWORK

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

Record hours where criteria are fulfilled, and the corresponding volume or other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

Criteria							Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Both of the criteria to the right are met.	a. Total entering volume of at least 1,000 veh/hr during a typical weekday peak hour.			Entering Volume:						
	b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		Warrant:	1	2	3				
			Satisfied?:							
2. Total entering volume at least 1,000 veh/hr for each of any 5 hrs of a non-normal business day (Sat. or Sun.)							← Hour			
							← Volume			

Characteristics of Major Routes		Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Part of the street or highway system that serves as the principal roadway network for through traffic flow.	Major Street:				
	Minor Street:				
2. Rural or suburban highway outside of, entering, or traversing a city.	Major Street:				
	Minor Street:				
3. Appears as a major route on an official plan.	Major Street:				
	Minor Street:				

CONCLUSIONS

Warrants Satisfied: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Remarks: TRAFFIC SIGNAL CONTROL IS NOT WARRANTED

Source: Revised from NCHRP Report 457

2020 BUILD CONDITIONS
TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — 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

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

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.

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	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
Both Approaches on Major Street	**500 (400)**	350	600 (480)	420	**925**	213	116	129	427	220	311	327
Highest Approach on Minor Street	**150 (120)**	105	200 (160)	140	**413**	44	77	42	**347**	79	60	59

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	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
Both Approaches on Major Street	**750 (600)**	525	900 (720)	630	**925**	213	116	129	427	220	311	327
Highest Approach on Minor Street	**75 (60)**	53	100 (80)	70	**413**	44	**77**	42	**347**	**79**	60	59

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.

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — 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

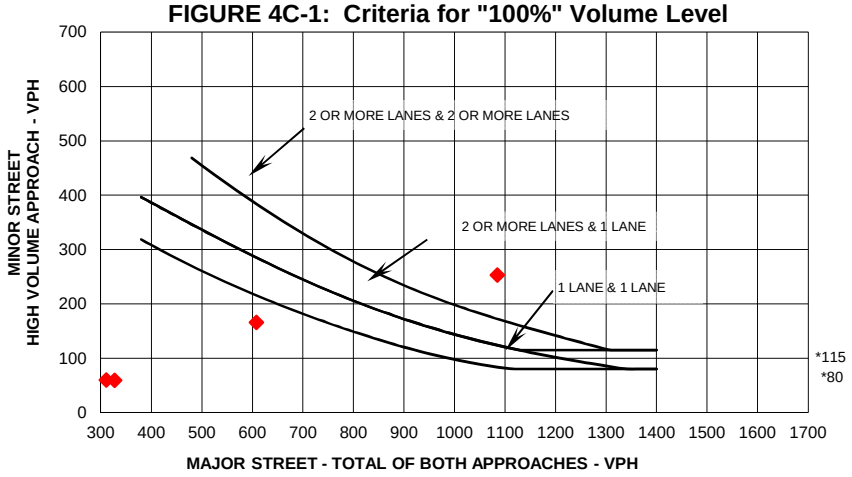
If all four points lie above the appropriate line, then the warrant is satisfied.

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	1,085	253
2:00 PM - 3:00 PM	608	166
4:00 PM - 5:00 PM	311	60
5:00 PM - 6:00 PM	327	59

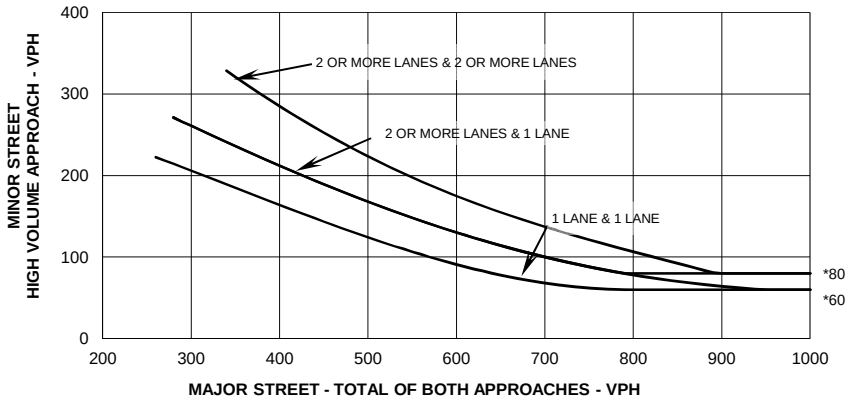
FIGURE 4C-1: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — 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

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

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

Unusual condition justifying use of warrant:
NO UNUSUAL CONDITION

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

Peak Hour		

Criteria

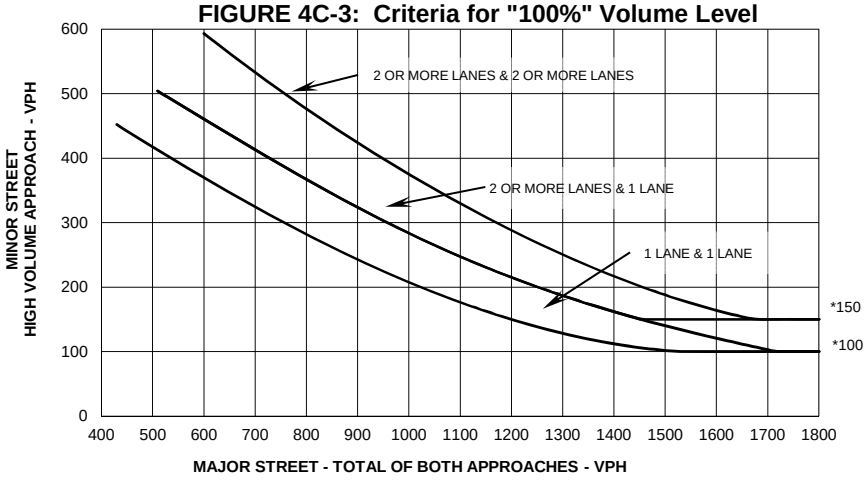
1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*		
Fulfilled?: ☐ Yes	☐ No	

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

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

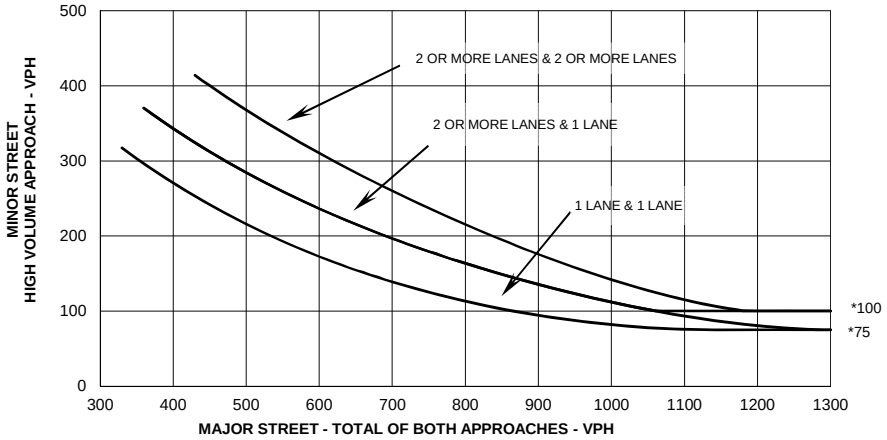
Plot volume combination on the applicable figure below.

FIGURE 4C-3: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-4: Criteria for "70%" Volume Level
(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — Lanes: 1

WARRANT 4 - PEDESTRIAN VOLUME

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if condition 1 or 2 is fulfilled and condition 3 is fulfilled.

Criteria	Hour	Pedestrian Volume	Pedestrian Gaps	Fulfilled? Yes	Fulfilled? No
1. Pedestrian volume crossing the major street is 100 ped/hr or more for each of any four hours and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	0			☒
	2:00 - 3:00 PM	0			
	3:00 - 4:00 PM	0			
	4:00 - 5:00 PM	0			
2. Pedestrian volume crossing the major street is 190 ped/hr or more for any one hour and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	0			☒
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				☒	

WARRANT 5 - SCHOOL CROSSING

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria				Fulfilled? Yes	Fulfilled? No
1. There are a minimum of 20 students crossing the major street during the highest crossing hour.	Students: 0	Hour:			x
2. There are fewer adequate gaps in the major street traffic stream during the period when the children are using the crossing than the number of minutes in the same period.		Minutes:	Gaps:		
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.					

WARRANT 6 - COORDINATED SIGNAL SYSTEM

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

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1,000 ft).

Criteria	Fulfilled? Yes	Fulfilled? No
1. On a one-way street or a street that has traffic predominately in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.		
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning, and the proposed and adjacent signals will collectively provide a progressive operation.		

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — Lanes: 1

WARRANT 7 - CRASH EXPERIENCE

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

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria		Hour	Volume	Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. One of the warrants to the right is met.	Warrant 1, Condition A (80% satisfied)				☒		☒
	Warrant 1, Condition B (80% satisfied)				☒		
	Warrant 4, Pedestrian Volume at 80% of volume requirements: 80 ped/hr for four (4) hours or 152 ped/hr for one (1) hour				☒		
2. Adequate trial of other remedial measure has failed to reduce crash frequency.		Measure tried:	NONE				☒
3. Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12-mo. period.		Number of crashes per 12 months:					

WARRANT 8 - ROADWAY NETWORK

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

Record hours where criteria are fulfilled, and the corresponding volume or other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

Criteria							Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Both of the criteria to the right are met.	a. Total entering volume of at least 1,000 veh/hr during a typical weekday peak hour.			Entering Volume:						
	b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		Warrant:	1	2	3				
			Satisfied?:							
2. Total entering volume at least 1,000 veh/hr for each of any 5 hrs of a non-normal business day (Sat. or Sun.)							← Hour			
							← Volume			

Characteristics of Major Routes		Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Part of the street or highway system that serves as the principal roadway network for through traffic flow.	Major Street:				
	Minor Street:				
2. Rural or suburban highway outside of, entering, or traversing a city.	Major Street:				
	Minor Street:				
3. Appears as a major route on an official plan.	Major Street:				
	Minor Street:				

CONCLUSIONS

Warrants Satisfied: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Remarks: TRAFFIC SIGNAL CONTROL IS NOT WARRANTED

Source: Revised from NCHRP Report 457

2040 BUILD CONDITIONS
TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — 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

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

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.

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	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
Both Approaches on Major Street	**500 (400)**	350	600 (480)	420	**975**	255	139	154	427	264	372	392
Highest Approach on Minor Street	**150 (120)**	105	200 (160)	140	**423**	44	77	42	**347**	79	60	59

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	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
Both Approaches on Major Street	**750 (600)**	525	900 (720)	630	**975**	255	139	154	427	264	372	392
Highest Approach on Minor Street	**75 (60)**	53	100 (80)	70	**423**	44	**77**	42	**347**	**79**	60	59

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.

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — 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

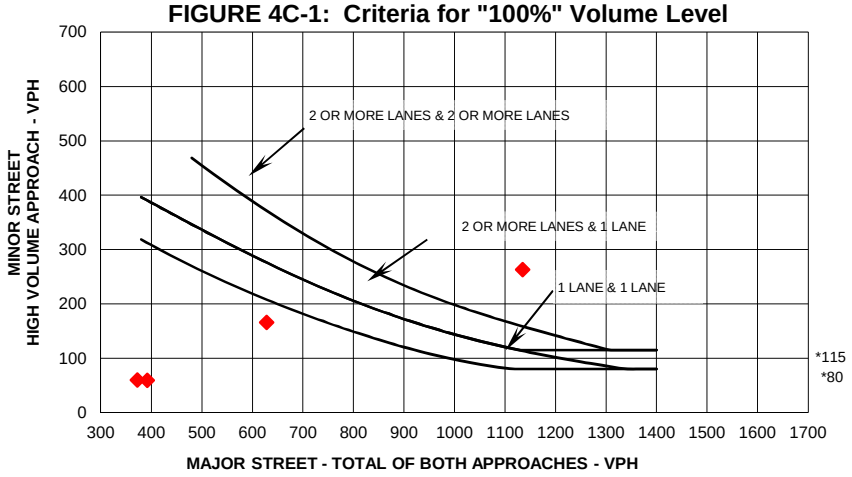
If all four points lie above the appropriate line, then the warrant is satisfied.

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	1,135	263
2:00 PM - 3:00 PM	628	166
4:00 PM - 5:00 PM	372	60
5:00 PM - 6:00 PM	392	59

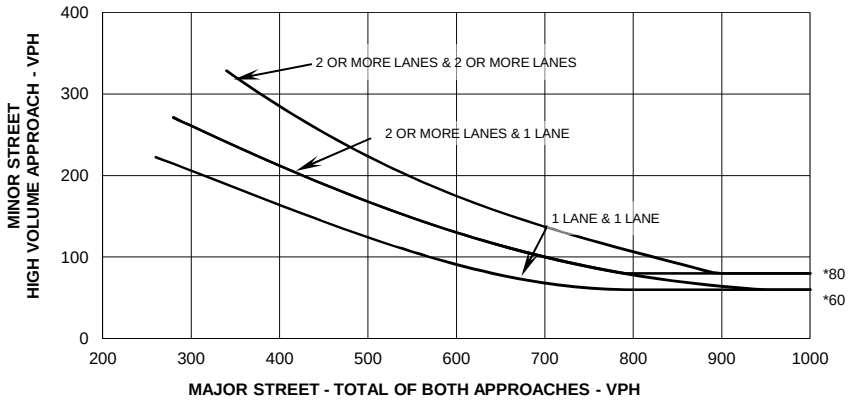
FIGURE 4C-1: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — 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

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

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

Unusual condition justifying use of warrant:
NO UNUSUAL CONDITION

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

Peak Hour		

Criteria

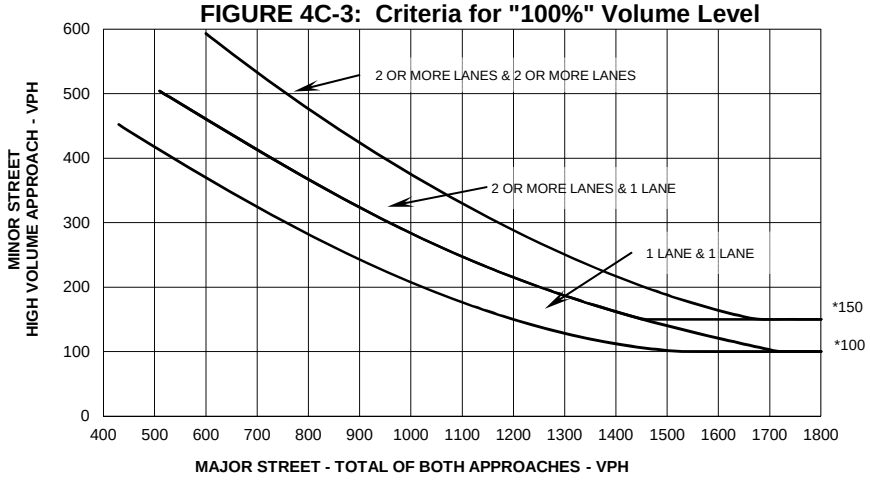
1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*		
Fulfilled?: ☐ Yes	☐ No	

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

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

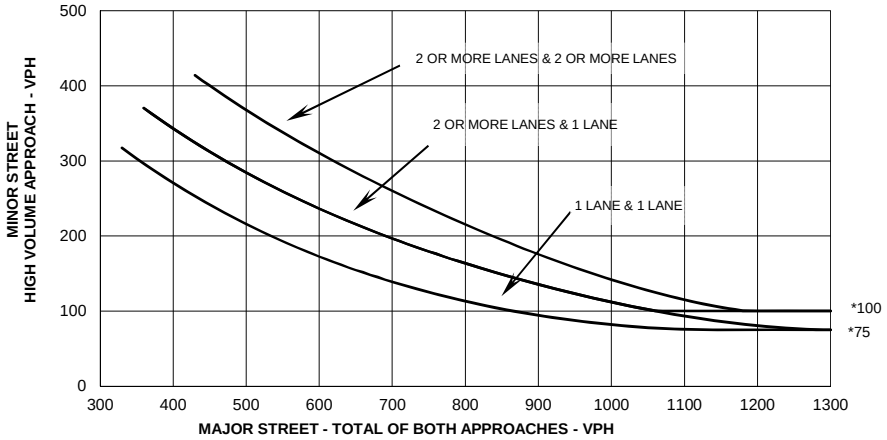
Plot volume combination on the applicable figure below.

FIGURE 4C-3: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-4: Criteria for "70%" Volume Level
(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — Lanes: 1

WARRANT 4 - PEDESTRIAN VOLUME

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if condition 1 or 2 is fulfilled and condition 3 is fulfilled.

Criteria	Hour	Pedestrian Volume	Pedestrian Gaps	Fulfilled? Yes	Fulfilled? No
1. Pedestrian volume crossing the major street is 100 ped/hr or more for each of any four hours and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	0			☒
	2:00 - 3:00 PM	0			
	3:00 - 4:00 PM	0			
	4:00 - 5:00 PM	0			
2. Pedestrian volume crossing the major street is 190 ped/hr or more for any one hour and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	0			☒
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				☒	

WARRANT 5 - SCHOOL CROSSING

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria				Fulfilled? Yes	Fulfilled? No
1. There are a minimum of 20 students crossing the major street during the highest crossing hour.	Students: 0	Hour:			x
2. There are fewer adequate gaps in the major street traffic stream during the period when the children are using the crossing than the number of minutes in the same period.		Minutes:	Gaps:		
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.					

WARRANT 6 - COORDINATED SIGNAL SYSTEM

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

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1,000 ft).

Criteria	Fulfilled? Yes	Fulfilled? No
1. On a one-way street or a street that has traffic predominately in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.		
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning, and the proposed and adjacent signals will collectively provide a progressive operation.		

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Summit Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Cable Road SW — Lanes: 1

WARRANT 7 - CRASH EXPERIENCE

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

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria		Hour	Volume	Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. One of the warrants to the right is met.	Warrant 1, Condition A (80% satisfied)				☒		☒
	Warrant 1, Condition B (80% satisfied)				☒		
	Warrant 4, Pedestrian Volume at 80% of volume requirements: 80 ped/hr for four (4) hours or 152 ped/hr for one (1) hour				☒		
2. Adequate trial of other remedial measure has failed to reduce crash frequency.		Measure tried:	NONE				☒
3. Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12-mo. period.		Number of crashes per 12 months:					

WARRANT 8 - ROADWAY NETWORK

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

Record hours where criteria are fulfilled, and the corresponding volume or other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

Criteria							Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Both of the criteria to the right are met.	a. Total entering volume of at least 1,000 veh/hr during a typical weekday peak hour.			Entering Volume:						
	b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		Warrant:	1	2	3				
			Satisfied?:							
2. Total entering volume at least 1,000 veh/hr for each of any 5 hrs of a non-normal business day (Sat. or Sun.)							← Hour			
							← Volume			

Characteristics of Major Routes		Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Part of the street or highway system that serves as the principal roadway network for through traffic flow.	Major Street:				
	Minor Street:				
2. Rural or suburban highway outside of, entering, or traversing a city.	Major Street:				
	Minor Street:				
3. Appears as a major route on an official plan.	Major Street:				
	Minor Street:				

CONCLUSIONS

Warrants Satisfied: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Remarks: TRAFFIC SIGNAL CONTROL IS NOT WARRANTED

Source: Revised from NCHRP Report 457

2020 BUILD CONDITIONS
TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS 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 1 - EIGHT-HOUR VEHICULAR VOLUME

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

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.

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**500 (400)**	350	600 (480)	420	**1,064**	47	43	55	430	80	120	132
Highest Approach on Minor Street	**150 (120)**	105	200 (160)	140	143	15	31	86	**162**	101	35	35

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**750 (600)**	525	900 (720)	630	**1,064**	47	43	55	430	80	120	132
Highest Approach on Minor Street	**75 (60)**	53	100 (80)	70	**143**	15	31	**86**	**162**	**101**	35	35

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.

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS 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

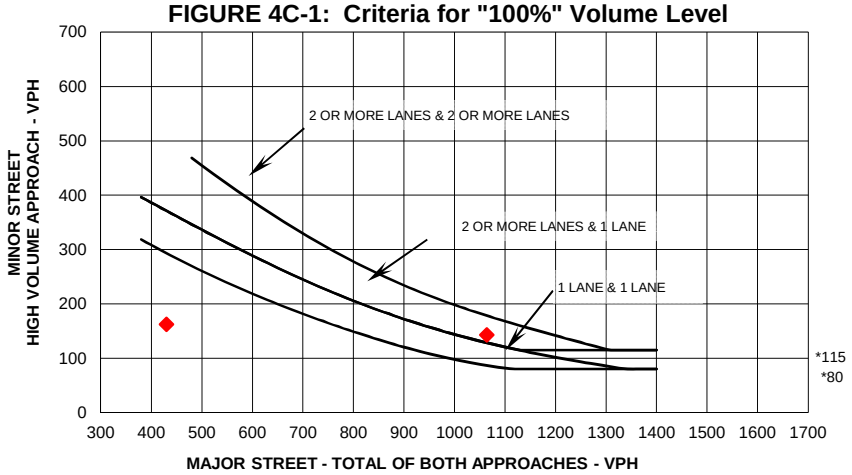
If all four points lie above the appropriate line, then the warrant is satisfied.

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	1,064	143
2:00 PM - 3:00 PM	430	162
3:00 PM - 4:00 PM	80	101
5:00 PM - 6:00 PM	132	35

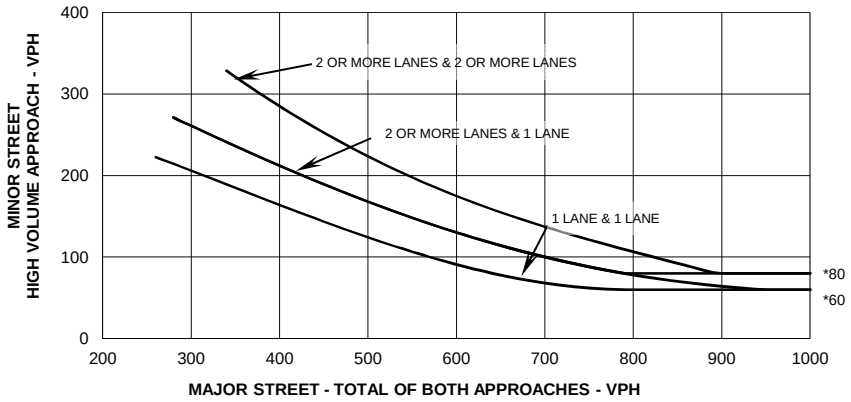
FIGURE 4C-1: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS 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 3 - PEAK HOUR

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

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

Unusual condition justifying use of warrant:

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

Peak Hour		
7:00	1064	143

Criteria

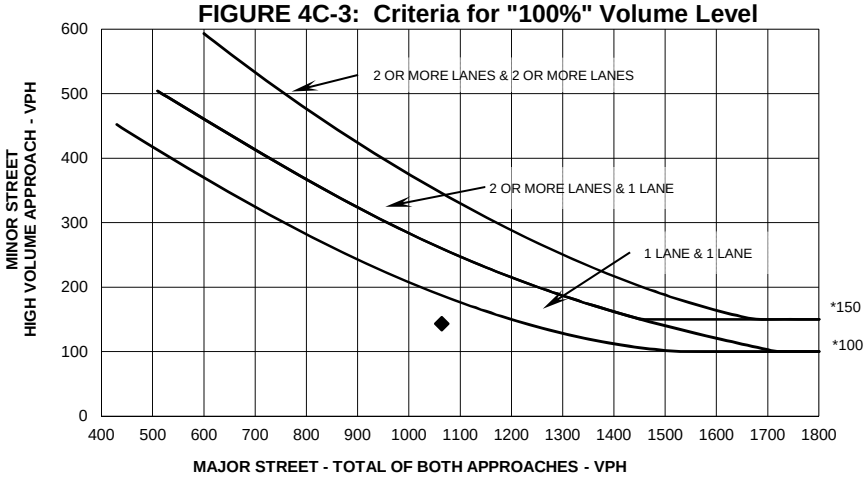
1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*		
Fulfilled?: ☐ Yes	☐ No	

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

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

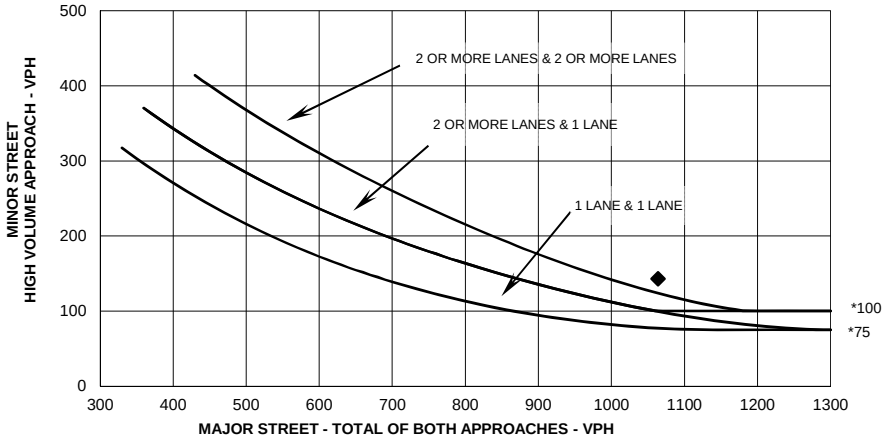
Plot volume combination on the applicable figure below.

FIGURE 4C-3: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-4: Criteria for "70%" Volume Level
(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS Access Driveway — Lanes: 1

WARRANT 4 - PEDESTRIAN VOLUME

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if condition 1 or 2 is fulfilled and condition 3 is fulfilled.

Criteria	Hour	Pedestrian Volume	Pedestrian Gaps	Fulfilled? Yes	Fulfilled? No
1. Pedestrian volume crossing the major street is 100 ped/hr or more for each of any four hours and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
	2:00 - 3:00 PM	0			
	3:00 - 4:00 PM	0			
	4:00 - 5:00 PM	0			
2. Pedestrian volume crossing the major street is 190 ped/hr or more for any one hour and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				☒	

WARRANT 5 - SCHOOL CROSSING

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria				Fulfilled? Yes	Fulfilled? No
1. There are a minimum of 20 students crossing the major street during the highest crossing hour.	Students: 8	Hour: 7:00 - 8:00 AM			x
2. There are fewer adequate gaps in the major street traffic stream during the period when the children are using the crossing than the number of minutes in the same period.		Minutes:	Gaps:		
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.					

WARRANT 6 - COORDINATED SIGNAL SYSTEM

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

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1,000 ft).

Criteria	Fulfilled? Yes	Fulfilled? No
1. On a one-way street or a street that has traffic predominately in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.		
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning, and the proposed and adjacent signals will collectively provide a progressive operation.		

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS Access Driveway — Lanes: 1

WARRANT 7 - CRASH EXPERIENCE

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

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria		Hour	Volume	Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. One of the warrants to the right is met.	Warrant 1, Condition A (80% satisfied)				☒		☒
	Warrant 1, Condition B (80% satisfied)				☒		
	Warrant 4, Pedestrian Volume at 80% of volume requirements: 80 ped/hr for four (4) hours or 152 ped/hr for one (1) hour				☒		
2. Adequate trial of other remedial measure has failed to reduce crash frequency.		Measure tried:	NONE				☒
3. Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12-mo. period.		Number of crashes per 12 months:					

WARRANT 8 - ROADWAY NETWORK

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

Record hours where criteria are fulfilled, and the corresponding volume or other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

Criteria							Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Both of the criteria to the right are met.	a. Total entering volume of at least 1,000 veh/hr during a typical weekday peak hour.			Entering Volume:						
	b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		Warrant:	1	2	3				
			Satisfied?:							
2. Total entering volume at least 1,000 veh/hr for each of any 5 hrs of a non-normal business day (Sat. or Sun.)							← Hour			
							← Volume			

Characteristics of Major Routes		Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Part of the street or highway system that serves as the principal roadway network for through traffic flow.	Major Street:				
	Minor Street:				
2. Rural or suburban highway outside of, entering, or traversing a city.	Major Street:				
	Minor Street:				
3. Appears as a major route on an official plan.	Major Street:				
	Minor Street:				

CONCLUSIONS

Warrants Satisfied: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Remarks: TRAFFIC SIGNAL CONTROL IS NOT WARRANTED

Source: Revised from NCHRP Report 457

2040 BUILD CONDITIONS
TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS 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 1 - EIGHT-HOUR VEHICULAR VOLUME

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

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.

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**500 (400)**	350	600 (480)	420	**1,064**	47	43	55	430	80	120	132
Highest Approach on Minor Street	**150 (120)**	105	200 (160)	140	143	15	31	86	**162**	101	35	35

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							
Approach Lanes	1		2 or more									
Volume Level	100%	70%	100%	70%	7:00 AM - 8:00 AM	8:00 AM - 9:00 AM	9:00 AM - 10:00 AM	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
Both Approaches on Major Street	**750 (600)**	525	900 (720)	630	**1,064**	47	43	55	430	80	120	132
Highest Approach on Minor Street	**75 (60)**	53	100 (80)	70	**143**	15	31	**86**	**162**	**101**	35	35

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.

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS 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

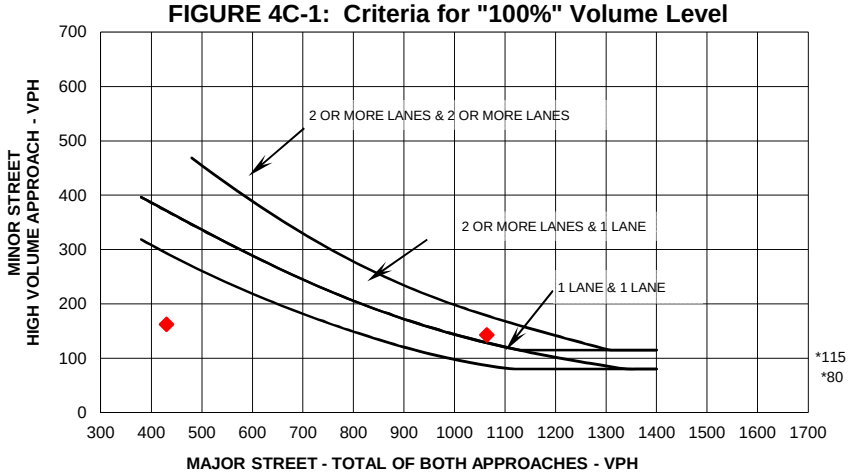
If all four points lie above the appropriate line, then the warrant is satisfied.

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	1,064	143
2:00 PM - 3:00 PM	430	162
3:00 PM - 4:00 PM	80	101
5:00 PM - 6:00 PM	132	35

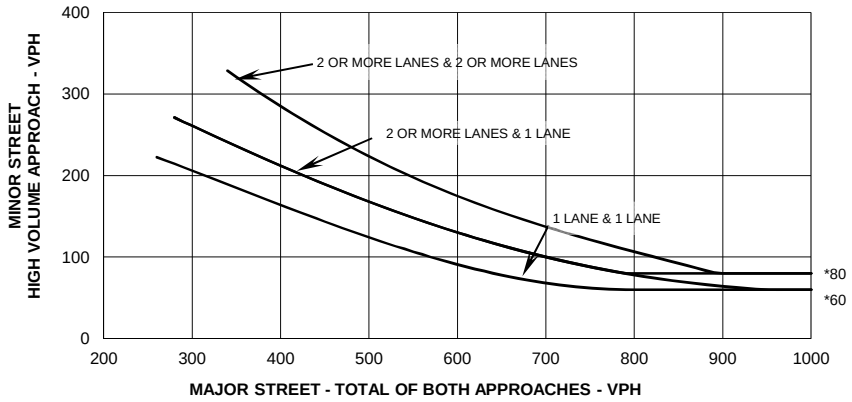
FIGURE 4C-1: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-2: Criteria for "70%" Volume Level

(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking
Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS 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 3 - PEAK HOUR

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

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

Unusual condition justifying use of warrant:

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

Peak Hour		
7:00	1064	143

Criteria

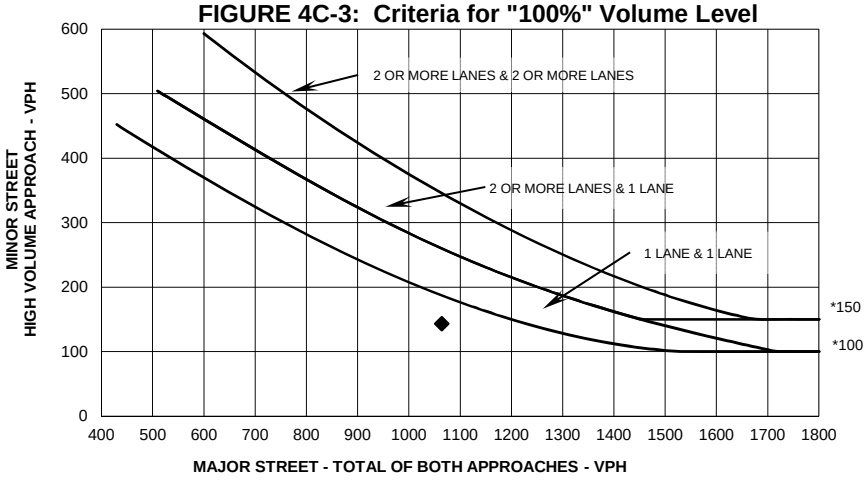
1. Delay on Minor Approach *(vehicle-hours)		
Approach Lanes	1	2
Delay Criteria*	4.0	5.0
Delay*		
Fulfilled?: ☐ Yes	☐ No	

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

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

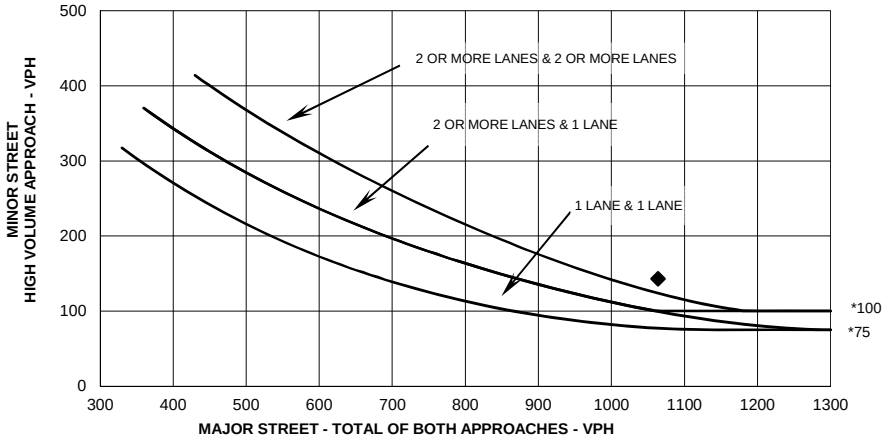
Plot volume combination on the applicable figure below.

FIGURE 4C-3: Criteria for "100%" Volume Level



** 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.*

FIGURE 4C-4: Criteria for "70%" Volume Level
(Community Less than 10,000 population or above 70 km/hr (40 mph) on Major Street)



** 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.*

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS Access Driveway — Lanes: 1

WARRANT 4 - PEDESTRIAN VOLUME

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if condition 1 or 2 is fulfilled and condition 3 is fulfilled.

Criteria	Hour	Pedestrian Volume	Pedestrian Gaps	Fulfilled? Yes	Fulfilled? No
1. Pedestrian volume crossing the major street is 100 ped/hr or more for each of any four hours and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
	2:00 - 3:00 PM	0			
	3:00 - 4:00 PM	0			
	4:00 - 5:00 PM	0			
2. Pedestrian volume crossing the major street is 190 ped/hr or more for any one hour and there are less than 60 gaps per hour in the major street traffic stream of adequate length.	7:00 - 8:00 AM	8			☒
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.				☒	

WARRANT 5 - SCHOOL CROSSING

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

Record hours where criteria are fulfilled and the corresponding volume or gap frequency in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria				Fulfilled? Yes	Fulfilled? No
1. There are a minimum of 20 students crossing the major street during the highest crossing hour.	Students: 8	Hour: 7:00 - 8:00 AM			x
2. There are fewer adequate gaps in the major street traffic stream during the period when the children are using the crossing than the number of minutes in the same period.		Minutes:	Gaps:		
3. The nearest traffic signal along the major street is located more than 90 m (300 ft) away, or the nearest signal is within 90 m (300 ft) but the proposed traffic signal will not restrict the progressive movement of traffic.					

WARRANT 6 - COORDINATED SIGNAL SYSTEM

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

Indicate if the criteria are fulfilled in the boxes provided. The warrant is satisfied if either criterion is fulfilled. This warrant should not be applied when the resulting signal spacing would be less than 300 m (1,000 ft).

Criteria	Fulfilled? Yes	Fulfilled? No
1. On a one-way street or a street that has traffic predominately in one direction, the adjacent signals are so far apart that they do not provide the necessary degree of vehicle platooning.		
2. On a two-way street, adjacent signals do not provide the necessary degree of platooning, and the proposed and adjacent signals will collectively provide a progressive operation.		

Source: Revised from NCHRP Report 457

TRAFFIC SIGNAL WARRANT SUMMARY

City: Pataskala
County: Licking

Engineer: ABC
Date: May 4, 2018

Major Street: Cable Road SW — Lanes: 1 — Critical Approach Speed: 35
Minor Street: Proposed LHHS Access Driveway — Lanes: 1

WARRANT 7 - CRASH EXPERIENCE

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

Record hours where criteria are fulfilled, the corresponding volume, and other information in the boxes provided. The warrant is satisfied if all three of the criteria are fulfilled.

Criteria		Hour	Volume	Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. One of the warrants to the right is met.	Warrant 1, Condition A (80% satisfied)				☒		☒
	Warrant 1, Condition B (80% satisfied)				☒		
	Warrant 4, Pedestrian Volume at 80% of volume requirements: 80 ped/hr for four (4) hours or 152 ped/hr for one (1) hour				☒		
2. Adequate trial of other remedial measure has failed to reduce crash frequency.		Measure tried:	NONE				☒
3. Five or more reported crashes, of types susceptible to correction by signal, have occurred within a 12-mo. period.		Number of crashes per 12 months:					

WARRANT 8 - ROADWAY NETWORK

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

Record hours where criteria are fulfilled, and the corresponding volume or other information in the boxes provided. The warrant is satisfied if at least one of the criteria is fulfilled and if all intersecting routes have one or more of the characteristics listed.

Criteria							Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Both of the criteria to the right are met.	a. Total entering volume of at least 1,000 veh/hr during a typical weekday peak hour.			Entering Volume:						
	b. Five-year projected volumes that satisfy one or more of Warrants 1, 2, or 3.		Warrant:	1	2	3				
			Satisfied?:							
2. Total entering volume at least 1,000 veh/hr for each of any 5 hrs of a non-normal business day (Sat. or Sun.)							← Hour			
							← Volume			

Characteristics of Major Routes		Met? Yes	Met? No	Fulfilled? Yes	Fulfilled? No
1. Part of the street or highway system that serves as the principal roadway network for through traffic flow.	Major Street:				
	Minor Street:				
2. Rural or suburban highway outside of, entering, or traversing a city.	Major Street:				
	Minor Street:				
3. Appears as a major route on an official plan.	Major Street:				
	Minor Street:				

CONCLUSIONS

Warrants Satisfied: ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

Remarks: TRAFFIC SIGNAL CONTROL IS NOT WARRANTED

Source: Revised from NCHRP Report 457

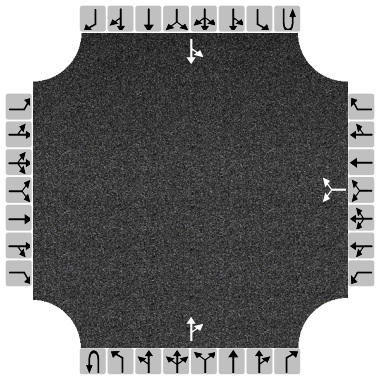
Appendix H
No-Build Capacity Analysis Worksheets
2040

HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	AM Peak	Peak Hour Factor	0.61
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						150		40			180	370		30	90	
Percent Heavy Vehicles (%)						8		3						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.48		6.23						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.57		3.33						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							311							49		
Capacity, c (veh/h)							332							762		
v/c Ratio							0.94							0.06		
95% Queue Length, Q_{95} (veh)							9.6							0.2		
Control Delay (s/veh)							70.9							10.0		
Level of Service, LOS							F							B		
Approach Delay (s/veh)						70.9								3.0		
Approach LOS						F										

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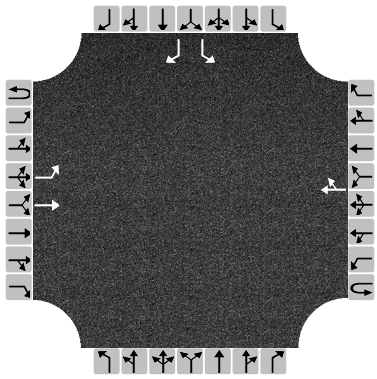
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Cable & HS
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	LHHS Access Driveway
Time Analyzed	AM Peak	Peak Hour Factor	0.56
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: East-West

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	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		350	10				20	130						40		140
Percent Heavy Vehicles (%)		3												11		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.51		6.27
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.60		3.36

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		625												71		250
Capacity, c (veh/h)		1288												74		882
v/c Ratio		0.49												0.97		0.28
95% Queue Length, Q_{95} (veh)		2.7												5.0		1.2
Control Delay (s/veh)		10.4												191.5		10.7
Level of Service, LOS		B												F		B
Approach Delay (s/veh)	10.1												50.9			
Approach LOS													F			

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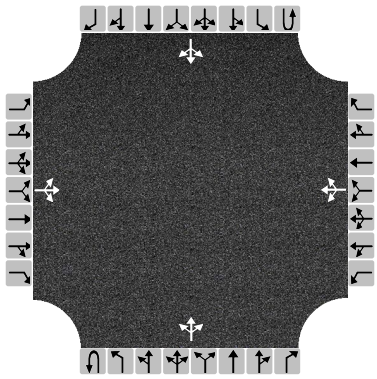
HCS7 Two-Way Stop-Control Report

General Information / Site Information

General Information		Site Information	
Analyst	ABC	Intersection	Mink & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Mink Street SW
Time Analyzed	AM Peak	Peak Hour Factor	0.83
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		20	10	20		20	30	10		60	270	10		10	170	60
Percent Heavy Vehicles (%)		12	33	5		10	0	0		4				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			60				72			72				12		
Capacity, c (veh/h)			362				324			1272				1234		
v/c Ratio			0.17				0.22			0.06				0.01		
95% Queue Length, Q_{95} (veh)			0.6				0.8			0.2				0.0		
Control Delay (s/veh)			16.9				19.3			8.0				7.9		
Level of Service, LOS			C				C			A				A		
Approach Delay (s/veh)	16.9				19.3				1.9				0.4			
Approach LOS	C				C											

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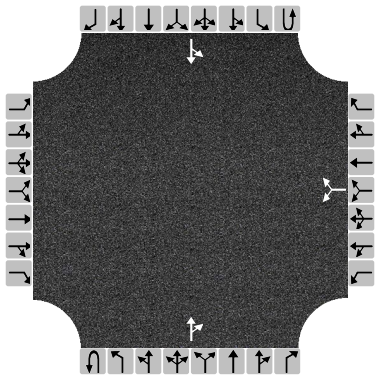
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	PM Peak	Peak Hour Factor	0.75
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						210		40			90	110		10	80	
Percent Heavy Vehicles (%)						6		6						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.46		6.26						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.55		3.35						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							333							13		
Capacity, c (veh/h)							677							1290		
v/c Ratio							0.49							0.01		
95% Queue Length, Q_{95} (veh)							2.7							0.0		
Control Delay (s/veh)							15.4							7.8		
Level of Service, LOS							C							A		
Approach Delay (s/veh)						15.4								0.9		
Approach LOS						C										

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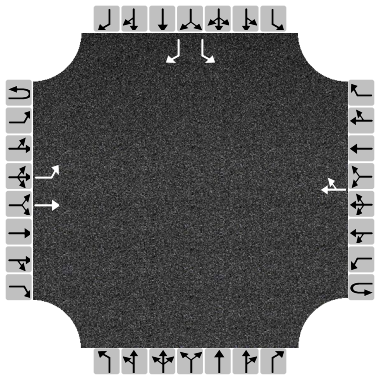
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Cable & HS
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	LHHS Access Driveway
Time Analyzed	PM Peak	Peak Hour Factor	0.62
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: East-West

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	1	1	0	0	0	1	0		0	0	0		1	0	1
Configuration		L	T					TR						L		R
Volume, V (veh/h)		80	20				20	20						60		190
Percent Heavy Vehicles (%)		20												9		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.30												6.49		6.27
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.38												3.58		3.36

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		129												97		306
Capacity, c (veh/h)		1430												585		1008
v/c Ratio		0.09												0.17		0.30
95% Queue Length, Q_{95} (veh)		0.3												0.6		1.3
Control Delay (s/veh)		7.8												12.4		10.1
Level of Service, LOS		A												B		B
Approach Delay (s/veh)	6.2												10.7			
Approach LOS													B			

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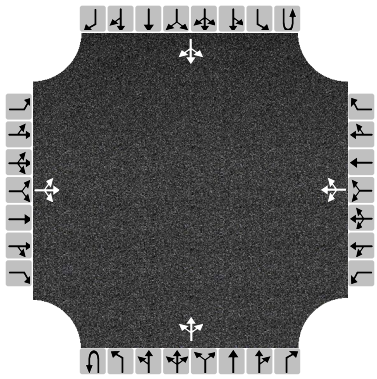
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Mink & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Mink Street SW
Time Analyzed	PM Peak	Peak Hour Factor	0.85
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	No-Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		30	10	40		10	10	20		20	110	10		10	110	10
Percent Heavy Vehicles (%)		7	22	10		14	25	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.17	6.72	6.30		7.24	6.75	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.56	4.20	3.39		3.63	4.22	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			94				47			24				12		
Capacity, c (veh/h)			678				665			1455				1455		
v/c Ratio			0.14				0.07			0.02				0.01		
95% Queue Length, Q_{95} (veh)			0.5				0.2			0.0				0.0		
Control Delay (s/veh)			11.2				10.8			7.5				7.5		
Level of Service, LOS			B				B			A				A		
Approach Delay (s/veh)	11.2				10.8				1.2				0.6			
Approach LOS	B				B											

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Appendix I
No-Build Capacity Analysis Worksheets
2040 w/ Improvements

HCS7 Two-Way Stop-Control Report

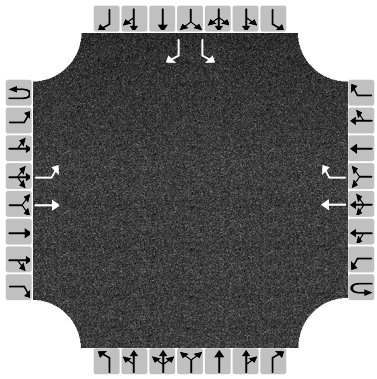
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	WB RTL

Site Information

Intersection	Cable & HS
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	LHHS Access Driveway
Peak Hour Factor	0.56
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	1	1	0	0	0	1	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		350	10				20	130						40		140
Percent Heavy Vehicles (%)		3												11		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		625												71		250
Capacity, c (veh/h)		1288												87		1023
v/c Ratio		0.49												0.82		0.24
95% Queue Length, Q_{95} (veh)		2.7												4.3		1.0
Control Delay (s/veh)		10.4												135.4		9.7
Level of Service, LOS		B												F		A
Approach Delay (s/veh)	10.1												37.6			
Approach LOS													E			

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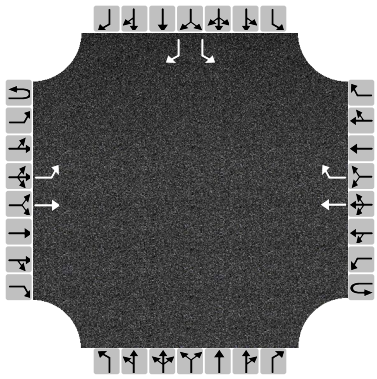
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Cable & HS
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	LHHS Access Driveway
Time Analyzed	PM Peak	Peak Hour Factor	0.62
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	WB RTL		

Lanes



Major Street: East-West

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	1	1	0	0	0	1	1		0	0	0		1	0	1
Configuration		L	T				T	R						L		R
Volume, V (veh/h)		80	20				20	20						60		190
Percent Heavy Vehicles (%)		20												9		7
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.30												6.49		6.27
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.38												3.58		3.36

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		129												97		306
Capacity, c (veh/h)		1430												598		1029
v/c Ratio		0.09												0.16		0.30
95% Queue Length, Q_{95} (veh)		0.3												0.6		1.3
Control Delay (s/veh)		7.8												12.2		10.0
Level of Service, LOS		A												B		A
Approach Delay (s/veh)	6.2												10.5			
Approach LOS													B			

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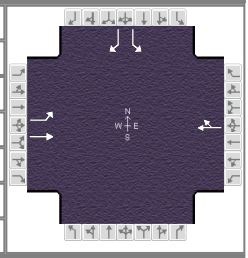
HCS7 Signalized Intersection Results Summary

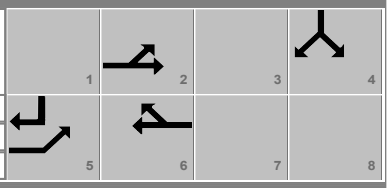
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	AM Peak	PHF	0.56
Urban Street	Cable Road SW	Analysis Year	2040	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	AM 40NB CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	350	10			20	130				40		140

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.0	34.7	10.3	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	13.0	53.7		40.7				16.3
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	9.0							12.3
Green Extension Time (g_e), s	0.0	0.0		0.0				0.0
Phase Call Probability	1.00							1.00
Max Out Probability	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	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	625	18			268					71		250
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1767	1900			1477					1654		1522
Queue Service Time (g_s), s	7.0	0.2			7.8					2.7		10.3
Cycle Queue Clearance Time (g_c), s	7.0	0.2			7.8					2.7		10.3
Green Ratio (*g/C*)	0.62	0.68			0.50					0.15		0.25
Capacity (*c*), veh/h	703	1295			732					243		376
Volume-to-Capacity Ratio (*X*)	0.889	0.014			0.366					0.293		0.665
Back of Queue (*Q*), ft/ln (85 th percentile)	262.2	2.8			113.7					50		154.3
Back of Queue (*Q*), veh/ln (85 th percentile)	10.2	0.1			4.1					1.8		5.8
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00					0.00		0.00
Uniform Delay (d_1), s/veh	14.5	3.6			10.9					26.6		23.7
Incremental Delay (d_2), s/veh	13.0	0.0			1.4					0.2		3.5
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0					0.0		0.0
Control Delay (*d*), s/veh	27.5	3.6			12.3					26.9		27.3
Level of Service (LOS)	C	A			B					C		C
Approach Delay, s/veh / LOS	26.8	C		12.3	B		0.0			27.2	C	
Intersection Delay, s/veh / LOS	23.8						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.65	A	1.89	B	1.72	B	1.95	B
Bicycle LOS Score / LOS	1.55	B	0.93	A				F

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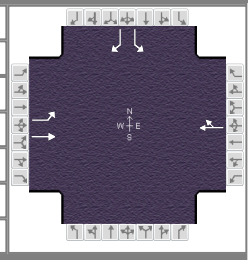
HCS7 Signalized Intersection Results Summary

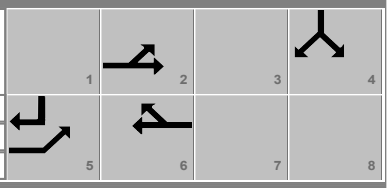
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	PM Peak	PHF	0.62
Urban Street	Cable Road SW	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	PM 40NB CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



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	20			20	20				60		190

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.0	22.7	22.3	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		8.3				9.0
Phase Duration, s	13.0	41.7		28.7				28.3
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	5.5							12.3
Green Extension Time (g_e), s	0.0	0.0		0.0				0.7
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							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	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	129	32			65					97		306
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1527	1530			1539					1682		1522
Queue Service Time (g_s), s	3.5	0.7			2.1					2.9		10.3
Cycle Queue Clearance Time (g_c), s	3.5	0.7			2.1					2.9		10.3
Green Ratio (*g/C*)	0.45	0.51			0.32					0.32		0.42
Capacity (*c*), veh/h	593	780			499					536		637
Volume-to-Capacity Ratio (*X*)	0.217	0.041			0.129					0.181		0.481
Back of Queue (*Q*), ft/ln (85 th percentile)	55.4	12.6			37.8					50.6		132.9
Back of Queue (*Q*), veh/ln (85 th percentile)	1.9	0.4			1.3					1.9		5.0
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00					0.00		0.00
Uniform Delay (d_1), s/veh	11.6	8.6			16.7					17.2		14.8
Incremental Delay (d_2), s/veh	0.1	0.1			0.5					0.1		0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0					0.0		0.0
Control Delay (*d*), s/veh	11.6	8.7			17.2					17.3		15.0
Level of Service (LOS)	B	A			B					B		B
Approach Delay, s/veh / LOS	11.1	B		17.2	B		0.0			15.6	B	
Intersection Delay, s/veh / LOS	14.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.69	A	1.91	B	1.72	B	1.95	B
Bicycle LOS Score / LOS	0.75	A	0.59	A				F

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	AM Peak
Project Description	Improvement - Roundabout

Site Information

Intersection	Cable & HS Access
E/W Street Name	Cable Road SW
N/S Street Name	LHHS Access Driveway
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.56
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0
Lane Assignment			LT				TR								LR	
Volume (V), veh/h	0	350	10		0		20	130					0	40		140
Percent Heavy Vehicles, %	0	3	0		0		13	2					0	11		7
Flow Rate (v_{PCE}), pc/h	0	644	18		0		40	237					0	79		268
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								1			
Pedestrians Crossing, p/h	0				0								0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763						4.9763	
Follow-Up Headway (s)		2.6087			2.6087						2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		662			277						347	
Entry Volume veh/h		643			268						322	
Circulating Flow (v_c), pc/h	79			644			741			40		
Exiting Flow (v_{ex}), pc/h	97			308			881			0		
Capacity (c_{pce}), pc/h		1273			715						1325	
Capacity (c), veh/h		1237			692						1228	
v/c Ratio (x)		0.52			0.39						0.26	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		8.6			10.4						5.3	
Lane LOS		A			B						A	
95% Queue, veh		3.1			1.8						1.1	
Approach Delay, s/veh	8.6			10.4						5.3		
Approach LOS	A			B						A		
Intersection Delay, s/veh | LOS	8.1						A					

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	PM Peak
Project Description	Improvement - Roundabout

Site Information

Intersection	Cable & HS Access
E/W Street Name	Cable Road SW
N/S Street Name	LHHS Access Driveway
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.62
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0
Lane Assignment			LT				TR								LR	
Volume (V), veh/h	0	80	20		0		20	20					0	60		190
Percent Heavy Vehicles, %	0	20	25		0		15	0					0	9		7
Flow Rate (v_{PCE}), pc/h	0	155	40		0		37	32					0	105		328
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								1			
Pedestrians Crossing, p/h	0				0								0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763						4.9763	
Follow-Up Headway (s)		2.6087			2.6087						2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		195			69						433	
Entry Volume veh/h		161			64						403	
Circulating Flow (v_c), pc/h	105			155			300			37		
Exiting Flow (v_{ex}), pc/h	145			365			187			0		
Capacity (c_{pce}), pc/h		1240			1178						1329	
Capacity (c), veh/h		1025			1096						1236	
v/c Ratio (x)		0.16			0.06						0.33	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.0			3.8						5.9	
Lane LOS		A			A						A	
95% Queue, veh		0.6			0.2						1.4	
Approach Delay, s/veh	5.0			3.8						5.9		
Approach LOS	A			A						A		
Intersection Delay, s/veh | LOS	5.5						A					

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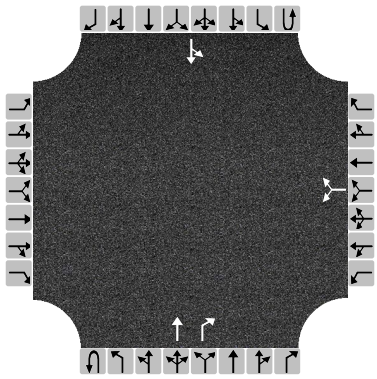
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	AM Peak	Peak Hour Factor	0.61
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	NB RTL		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	1	0	0	1	0
Configuration							LR				T	R		LT		
Volume, V (veh/h)						150		40			180	370		30	90	
Percent Heavy Vehicles (%)						8		3						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							311							49		
Capacity, c (veh/h)							500							762		
v/c Ratio							0.62							0.06		
95% Queue Length, Q_{95} (veh)							4.2							0.2		
Control Delay (s/veh)							23.3							10.0		
Level of Service, LOS							C							B		
Approach Delay (s/veh)						23.3							3.0			
Approach LOS						C										

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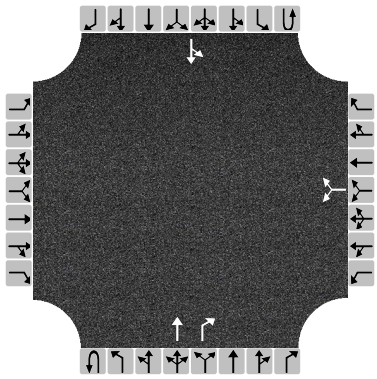
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	PM Peak	Peak Hour Factor	0.75
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	NB RTL		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	1	0	0	1	0
Configuration							LR				T	R		LT		
Volume, V (veh/h)						210		40			90	110		10	80	
Percent Heavy Vehicles (%)						6		6						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							333							13		
Capacity, c (veh/h)							746							1290		
v/c Ratio							0.45							0.01		
95% Queue Length, Q_{95} (veh)							2.3							0.0		
Control Delay (s/veh)							13.7							7.8		
Level of Service, LOS							B							A		
Approach Delay (s/veh)						13.7							0.9			
Approach LOS						B										

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Appendix J
Build Capacity Analysis Worksheets
2020

HCS7 Two-Way Stop-Control Report

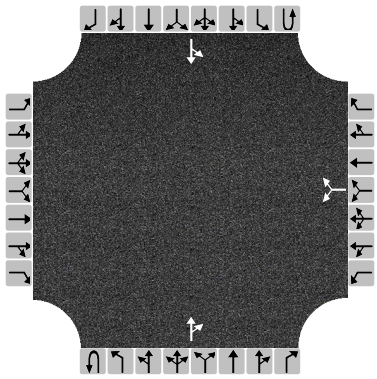
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Summit & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Summit Road SW
Peak Hour Factor	0.61
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						360		53			195	614		27	89	
Percent Heavy Vehicles (%)						8		3						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.48		6.23						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.57		3.33						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							677							44		
Capacity, c (veh/h)							235							528		
v/c Ratio							2.89							0.08		
95% Queue Length, Q_{95} (veh)							59.6							0.3		
Control Delay (s/veh)							892.0							12.4		
Level of Service, LOS							F							B		
Approach Delay (s/veh)						892.0								3.8		
Approach LOS						F										

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HCS7 Two-Way Stop-Control Report

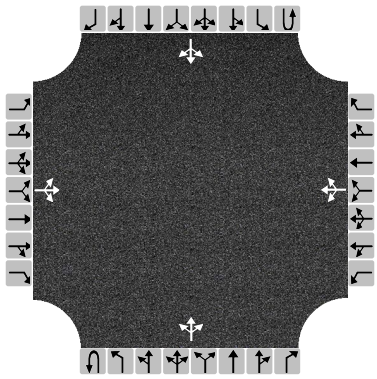
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Mink & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Mink Street SW
Peak Hour Factor	0.83
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		35	21	68		10	48	10		115	220	10		10	150	85
Percent Heavy Vehicles (%)		12	33	5		10	0	0		4				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.22	6.83	6.25		7.20	6.50	6.20		4.14				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.61	4.30	3.34		3.59	4.00	3.30		2.24				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			149				82			139				12		
Capacity, c (veh/h)			358				271			1266				1298		
v/c Ratio			0.42				0.30			0.11				0.01		
95% Queue Length, Q_{95} (veh)			2.0				1.2			0.4				0.0		
Control Delay (s/veh)			22.1				23.9			8.2				7.8		
Level of Service, LOS			C				C			A				A		
Approach Delay (s/veh)	22.1				23.9				3.4				0.4			
Approach LOS	C				C											

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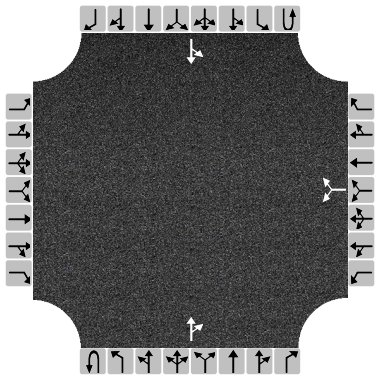
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2020	North/South Street	Summit Road SW
Time Analyzed	PM Peak	Peak Hour Factor	0.75
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						320		27			93	220		19	95	
Percent Heavy Vehicles (%)						6		6						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.46		6.26						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.55		3.35						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							463							25		
Capacity, c (veh/h)							561							1135		
v/c Ratio							0.82							0.02		
95% Queue Length, Q_{95} (veh)							8.4							0.1		
Control Delay (s/veh)							34.7							8.2		
Level of Service, LOS							D							A		
Approach Delay (s/veh)						34.7								1.5		
Approach LOS						D										

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HCS7 Two-Way Stop-Control Report

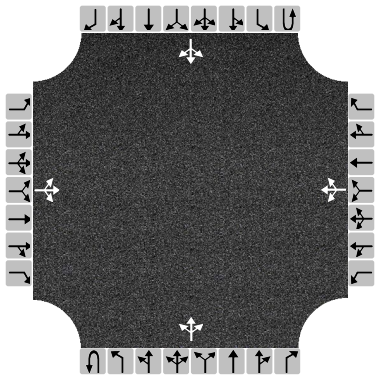
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Mink & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Mink Street SW
Peak Hour Factor	0.85
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		41	26	65		10	26	10		30	90	10		10	90	20
Percent Heavy Vehicles (%)		7	22	10		14	25	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.17	6.72	6.30		7.24	6.75	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.56	4.20	3.39		3.63	4.22	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			155				54			35				12		
Capacity, c (veh/h)			682				572			1469				1483		
v/c Ratio			0.23				0.09			0.02				0.01		
95% Queue Length, Q_{95} (veh)			0.9				0.3			0.1				0.0		
Control Delay (s/veh)			11.8				12.0			7.5				7.4		
Level of Service, LOS			B				B			A				A		
Approach Delay (s/veh)	11.8				12.0				1.9				0.7			
Approach LOS	B				B											

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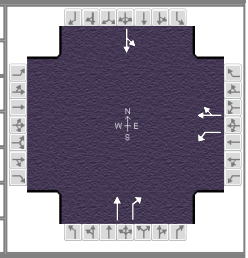
Appendix K
Build Capacity Analysis Worksheets
2020 w/ Improvements

HCS 2010 Signalized Intersection Results Summary

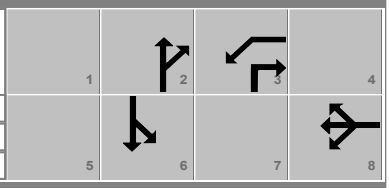
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	AM Peak	PHF	0.61
Urban Street	Summit Road SW	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	@ Cable Road SW	File Name	AM 20 SummitCable - TSC.xus		
Project Description	Traffic Signal Control				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				360	0	53		195	614	27	89	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	36.2	41.8	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				8		2		6
Case Number				10.0		7.0		8.0
Phase Duration, s				47.8		42.2		42.2
Change Period, ($Y+R_c$), s				6.0		6.0		6.0
Max Allow Headway (*MAH*), s				3.2		0.0		0.0
Queue Clearance Time (g_s), s				25.3				
Green Extension Time (g_e), s				1.4		0.0		0.0
Phase Call Probability				1.00				
Max Out Probability				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				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				590	87			320	1007		190	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1810	1505			1845	1610		1384	
Queue Service Time (g_s), s				23.3	3.0			11.3	20.0		0.7	
Cycle Queue Clearance Time (g_c), s				23.3	3.0			11.3	20.0		11.9	
Green Ratio (*g/C*)				0.46	0.46			0.40	0.87		0.40	
Capacity (*c*), veh/h				840	699			742	1395		606	
Volume-to-Capacity Ratio (*X*)				0.702	0.124			0.431	0.721		0.314	
Back of Queue (*Q*), ft/ln (85 th percentile)				318.4	45.2			186.2	81.6		116.2	
Back of Queue (*Q*), veh/ln (85 th percentile)				12.7	1.7			7.3	3.3		4.5	
Queue Storage Ratio (*RQ*) (85 th percentile)				0.00	0.00			0.00	0.00		0.00	
Uniform Delay (d_1), s/veh				19.2	13.7			19.5	2.1		18.1	
Incremental Delay (d_2), s/veh				2.2	0.0			1.8	3.3		1.4	
Initial Queue Delay (d_3), s/veh				0.0	0.0			0.0	0.0		0.0	
Control Delay (*d*), s/veh				21.4	13.7			21.3	5.4		19.5	
Level of Service (LOS)				C	B			C	A		B	
Approach Delay, s/veh / LOS	0.0			20.4		C	9.2		A	19.5		B
Intersection Delay, s/veh / LOS	13.6						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.1	B	2.3	B	1.9	A
Bicycle LOS Score / LOS			1.6	A	2.7	B	0.8	A

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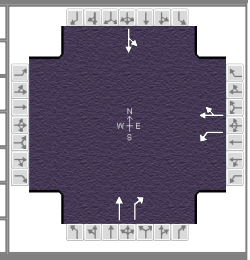
HCS 2010 Signalized Intersection Results Summary

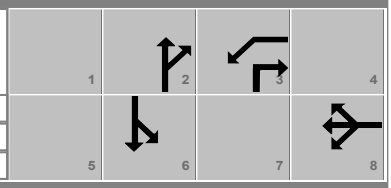
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	PM Peak	PHF	0.75
Urban Street	Summit Road SW	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	@ Cable Road SW	File Name	PM 20 SummitCable - TSC.xus		
Project Description	Traffic Signal Control				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				320	0	27		93	220	19	95	

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	22.3	25.7	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				8		2		6
Case Number				10.0		7.0		8.0
Phase Duration, s				31.7		28.3		28.3
Change Period, ($Y+R_c$), s				6.0		6.0		6.0
Max Allow Headway (*MAH*), s				3.1		0.0		0.0
Queue Clearance Time (g_s), s				12.6				
Green Extension Time (g_e), s				0.8		0.0		0.0
Phase Call Probability				1.00				
Max Out Probability				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				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				427	36			124	293		152	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1810	1519			1827	1610		1745	
Queue Service Time (g_s), s				10.6	0.8			2.7	2.7		0.0	
Cycle Queue Clearance Time (g_c), s				10.6	0.8			2.7	2.7		3.4	
Green Ratio (*g/C*)				0.43	0.43			0.37	0.80		0.37	
Capacity (*c*), veh/h				775	651			679	1288		719	
Volume-to-Capacity Ratio (*X*)				0.550	0.055			0.183	0.228		0.212	
Back of Queue (*Q*), ft/ln (85 th percentile)				142.4	11.3			50.6	9.9		62.9	
Back of Queue (*Q*), veh/ln (85 th percentile)				5.7	0.4			2.0	0.4		2.4	
Queue Storage Ratio (*RQ*) (85 th percentile)				0.00	0.00			0.00	0.00		0.00	
Uniform Delay (d_1), s/veh				12.8	10.0			12.7	1.5		12.9	
Incremental Delay (d_2), s/veh				0.5	0.0			0.6	0.4		0.7	
Initial Queue Delay (d_3), s/veh				0.0	0.0			0.0	0.0		0.0	
Control Delay (*d*), s/veh				13.3	10.1			13.3	1.9		13.6	
Level of Service (LOS)				B	B			B	A		B	
Approach Delay, s/veh / LOS	0.0			13.1		B	5.3		A	13.6		B
Intersection Delay, s/veh / LOS	10.0						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.1	B	2.3	B	1.9	A
Bicycle LOS Score / LOS			1.3	A	1.2	A	0.7	A

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Project Description	Build Conditions

Site Information

Intersection	Cable & Summit
E/W Street Name	Cable Road SW
N/S Street Name	Summit Road SW
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.61
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment							LR				T				LT	
Volume (V), veh/h					0	360		53	0		195	614	0	27	89	
Percent Heavy Vehicles, %					0	8		3	0		3	4	0	0	6	
Flow Rate (v_{PCE}), pc/h					0	637		89	0		329	1047	0	44	155	
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes					1				1				1			
Pedestrians Crossing, p/h					0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)					4.9763			4.9763	4.9763		4.9763	
Follow-Up Headway (s)					2.6087			2.6087	2.6087		2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h					726			329	1047		199	
Entry Volume veh/h					676			319	1007		190	
Circulating Flow (v_c), pc/h	836			329			44			637		
Exiting Flow (v_{ex}), pc/h	44			0			418			792		
Capacity (c_{pce}), pc/h					987			1319	1319		721	
Capacity (c), veh/h					919			1281	1269		689	
v/c Ratio (x)					0.74			0.25	0.79		0.28	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh					17.7			5.0	16.7		8.6	
Lane LOS					C			A	C		A	
95% Queue, veh					6.8			1.0	9.0		1.1	
Approach Delay, s/veh				17.7			13.9			8.6		
Approach LOS				C			B			A		
Intersection Delay, s/veh | LOS	14.6						B					

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Project Description	Build Conditions

Site Information

Intersection	Cable & Summit
E/W Street Name	Cable Road SW
N/S Street Name	Summit Road SW
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.75
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment							LR				T				LT	
Volume (V), veh/h					0	320		27	0		93	220	0	19	95	
Percent Heavy Vehicles, %					0	6		6	0		3	3	0	3	3	
Flow Rate (v_{PCE}), pc/h					0	452		38	0		128	302	0	26	130	
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes					1				1				1			
Pedestrians Crossing, p/h					0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)					4.9763			4.9763	4.9763		4.9763	
Follow-Up Headway (s)					2.6087			2.6087	2.6087		2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h					490			128	302		156	
Entry Volume veh/h					462			124	293		151	
Circulating Flow (v_c), pc/h	608			128			26			452		
Exiting Flow (v_{ex}), pc/h	26			0			166			582		
Capacity (c_{pce}), pc/h					1211			1344	1344		870	
Capacity (c), veh/h					1143			1305	1305		845	
v/c Ratio (x)					0.40			0.10	0.22		0.18	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh					7.3			3.5	4.7		6.1	
Lane LOS					A			A	A		A	
95% Queue, veh					2.0			0.3	0.9		0.7	
Approach Delay, s/veh				7.3			4.3			6.1		
Approach LOS				A			A			A		
Intersection Delay, s/veh | LOS	5.9						A					

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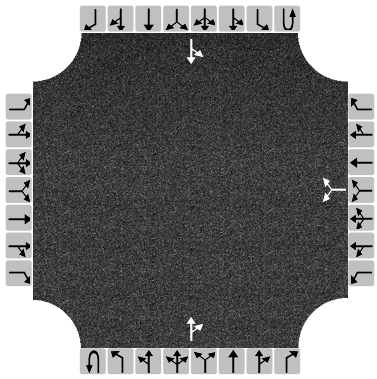
Appendix L
Build Capacity Analysis Worksheets
2040

HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	AM Peak	Peak Hour Factor	0.61
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						370		53			225	614		27	109	
Percent Heavy Vehicles (%)						8		3						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.48		6.23						4.10		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.57		3.33						2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							693							44		
Capacity, c (veh/h)							209							505		
v/c Ratio							3.32							0.09		
95% Queue Length, Q_{95} (veh)							64.6							0.3		
Control Delay (s/veh)							1089.3							12.8		
Level of Service, LOS							F							B		
Approach Delay (s/veh)						1089.3								3.5		
Approach LOS						F										

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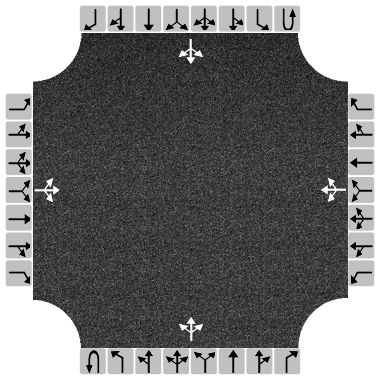
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Mink & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Mink Street SW
Time Analyzed	AM Peak	Peak Hour Factor	0.83
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		35	21	68		20	48	10		115	270	10		10	170	85
Percent Heavy Vehicles (%)		12	33	5		10	0	0		4				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.22	6.83	6.25		7.20	6.50	6.20		4.14				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.61	4.30	3.34		3.59	4.00	3.30		2.24				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			149				94			139				12		
Capacity, c (veh/h)			315				227			1241				1234		
v/c Ratio			0.47				0.41			0.11				0.01		
95% Queue Length, Q_{95} (veh)			2.4				1.9			0.4				0.0		
Control Delay (s/veh)			26.3				31.6			8.3				7.9		
Level of Service, LOS			D				D			A				A		
Approach Delay (s/veh)	26.3				31.6				3.2				0.4			
Approach LOS	D				D											

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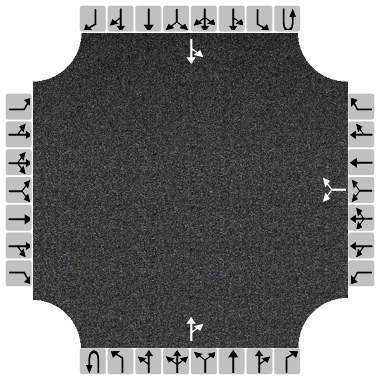
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	PM Peak	Peak Hour Factor	0.75
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						320		27			103	220		19	105	
Percent Heavy Vehicles (%)						6		6						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							463							25		
Capacity, c (veh/h)							542							1122		
v/c Ratio							0.85							0.02		
95% Queue Length, Q_{95} (veh)							9.1							0.1		
Control Delay (s/veh)							39.1							8.3		
Level of Service, LOS							E							A		
Approach Delay (s/veh)					39.1								1.4			
Approach LOS					E											

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HCS7 Two-Way Stop-Control Report

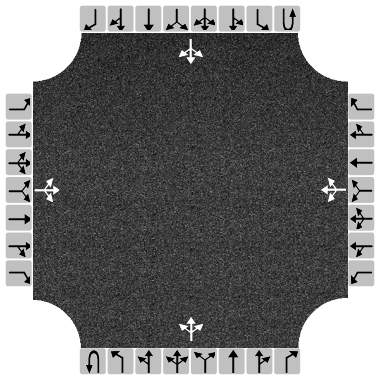
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Mink & Cable
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	Mink Street SW
Peak Hour Factor	0.85
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	1	0	0	0	1	0	0	0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume, V (veh/h)		41	26	65		10	36	20		30	110	10		10	110	20
Percent Heavy Vehicles (%)		7	22	10		14	25	0		0				0		
Proportion Time Blocked																
Percent Grade (%)	0				0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2		7.1	6.5	6.2		4.1				4.1		
Critical Headway (sec)		7.17	6.72	6.30		7.24	6.75	6.20		4.10				4.10		
Base Follow-Up Headway (sec)		3.5	4.0	3.3		3.5	4.0	3.3		2.2				2.2		
Follow-Up Headway (sec)		3.56	4.20	3.39		3.63	4.22	3.30		2.20				2.20		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			155				78			35				12		
Capacity, c (veh/h)			632				566			1440				1455		
v/c Ratio			0.25				0.14			0.02				0.01		
95% Queue Length, Q_{95} (veh)			1.0				0.5			0.1				0.0		
Control Delay (s/veh)			12.5				12.4			7.6				7.5		
Level of Service, LOS			B				B			A				A		
Approach Delay (s/veh)	12.5				12.4				1.7				0.6			
Approach LOS	B				B											

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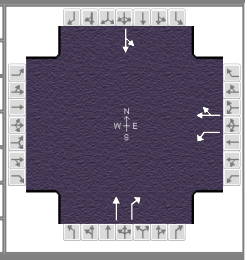
Appendix M
Build Capacity Analysis Worksheets
2040 w/ Improvements

HCS 2010 Signalized Intersection Results Summary

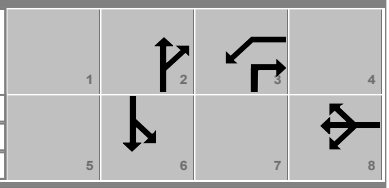
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	AM Peak	PHF	0.61
Urban Street	Summit Road SW	Analysis Year	2040	Analysis Period	1> 7:00
Intersection	@ Cable Road SW	File Name	AM 40 SummitCable - TSC.xus		
Project Description	Traffic Signal Control				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				370	0	53		225	614	27	109	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	36.4	41.6	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				8		2		6
Case Number				10.0		7.0		8.0
Phase Duration, s				47.6		42.4		42.4
Change Period, ($Y+R_c$), s				6.0		6.0		6.0
Max Allow Headway (*MAH*), s				3.1		0.0		0.0
Queue Clearance Time (g_s), s				26.4				
Green Extension Time (g_e), s				1.4		0.0		0.0
Phase Call Probability				1.00				
Max Out Probability				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				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				607	87			369	1007		223	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1810	1505			1845	1610		1373	
Queue Service Time (g_s), s				24.4	3.0			13.4	20.0		0.9	
Cycle Queue Clearance Time (g_c), s				24.4	3.0			13.4	20.0		14.3	
Green Ratio (*g/C*)				0.46	0.46			0.40	0.87		0.40	
Capacity (*c*), veh/h				836	696			746	1395		603	
Volume-to-Capacity Ratio (*X*)				0.725	0.125			0.494	0.721		0.369	
Back of Queue (*Q*), ft/ln (85 th percentile)				333.9	45.5			216.5	81.6		134.5	
Back of Queue (*Q*), veh/ln (85 th percentile)				13.4	1.7			8.5	3.3		5.2	
Queue Storage Ratio (*RQ*) (85 th percentile)				0.00	0.00			0.00	0.00		0.00	
Uniform Delay (d_1), s/veh				19.6	13.8			20.0	2.1		18.4	
Incremental Delay (d_2), s/veh				2.7	0.0			2.3	3.3		1.7	
Initial Queue Delay (d_3), s/veh				0.0	0.0			0.0	0.0		0.0	
Control Delay (*d*), s/veh				22.3	13.8			22.3	5.4		20.1	
Level of Service (LOS)				C	B			C	A		C	
Approach Delay, s/veh / LOS	0.0			21.3		C	9.9		A	20.1		C
Intersection Delay, s/veh / LOS	14.3						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.1	B	2.3	B	1.9	A
Bicycle LOS Score / LOS			1.6	A	2.8	C	0.9	A

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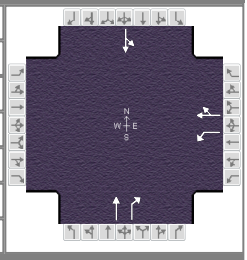
HCS 2010 Signalized Intersection Results Summary

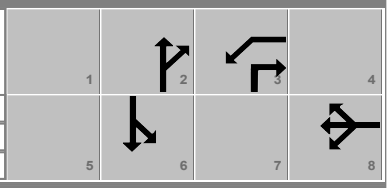
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	PM Peak	PHF	0.75
Urban Street	Summit Road SW	Analysis Year	2040	Analysis Period	1> 7:00
Intersection	@ Cable Road SW	File Name	PM 40 SummitCable - TSC.xus		
Project Description	Traffic Signal Control				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				320	0	27		103	220	19	105	

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	22.4	25.6	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				8		2		6
Case Number				10.0		7.0		8.0
Phase Duration, s				31.6		28.4		28.4
Change Period, ($Y+R_c$), s				6.0		6.0		6.0
Max Allow Headway (*MAH*), s				3.1		0.0		0.0
Queue Clearance Time (g_s), s				12.6				
Green Extension Time (g_e), s				0.8		0.0		0.0
Phase Call Probability				1.00				
Max Out Probability				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				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				427	36			137	293		165	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1810	1519			1827	1610		1752	
Queue Service Time (g_s), s				10.6	0.8			3.1	2.7		0.0	
Cycle Queue Clearance Time (g_c), s				10.6	0.8			3.1	2.7		3.7	
Green Ratio (*g/C*)				0.43	0.43			0.37	0.80		0.37	
Capacity (*c*), veh/h				772	648			682	1288		723	
Volume-to-Capacity Ratio (*X*)				0.553	0.056			0.201	0.228		0.229	
Back of Queue (*Q*), ft/ln (85 th percentile)				142.5	11.3			56.5	9.9		68.9	
Back of Queue (*Q*), veh/ln (85 th percentile)				5.7	0.4			2.2	0.4		2.7	
Queue Storage Ratio (*RQ*) (85 th percentile)				0.00	0.00			0.00	0.00		0.00	
Uniform Delay (d_1), s/veh				12.9	10.1			12.7	1.5		13.0	
Incremental Delay (d_2), s/veh				0.5	0.0			0.7	0.4		0.7	
Initial Queue Delay (d_3), s/veh				0.0	0.0			0.0	0.0		0.0	
Control Delay (*d*), s/veh				13.4	10.1			13.4	1.9		13.7	
Level of Service (LOS)				B	B			B	A		B	
Approach Delay, s/veh / LOS	0.0			13.2		B	5.6		A	13.7		B
Intersection Delay, s/veh / LOS	10.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.1	B	2.3	B	1.9	A
Bicycle LOS Score / LOS			1.3	A	1.2	A	0.8	A

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	AM Peak
Project Description	Build Conditions

Site Information

Intersection	Cable & Summit
E/W Street Name	Cable Road SW
N/S Street Name	Summit Road SW
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.61
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment							LR				T				LT	
Volume (V), veh/h					0	370		53	0		225	614	0	27	109	
Percent Heavy Vehicles, %					0	8		3	0		3	4	0	0	6	
Flow Rate (v_{PCE}), pc/h					0	655		89	0		380	1047	0	44	189	
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes					1				1				1			
Pedestrians Crossing, p/h					0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)					4.9763			4.9763	4.9763		4.9763	
Follow-Up Headway (s)					2.6087			2.6087	2.6087		2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h					744			380	1047		233	
Entry Volume veh/h					693			369	1007		222	
Circulating Flow (v_c), pc/h	888			380			44			655		
Exiting Flow (v_{ex}), pc/h	44			0			469			844		
Capacity (c_{pce}), pc/h					937			1319	1319		708	
Capacity (c), veh/h					872			1281	1269		675	
v/c Ratio (x)					0.79			0.29	0.79		0.33	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh					22.0			5.4	16.7		9.6	
Lane LOS					C			A	C		A	
95% Queue, veh					8.4			1.2	9.0		1.4	
Approach Delay, s/veh				22.0			13.6			9.6		
Approach LOS				C			B			A		
Intersection Delay, s/veh | LOS	15.8						C					

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	PM Peak
Project Description	Build Conditions

Site Information

Intersection	Cable & Summit
E/W Street Name	Cable Road SW
N/S Street Name	Summit Road SW
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.75
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment							LR				T				LT	
Volume (V), veh/h					0	320		27	0		103	220	0	19	105	
Percent Heavy Vehicles, %					0	6		6	0		3	3	0	3	3	
Flow Rate (v_{PCE}), pc/h					0	452		38	0		141	302	0	26	144	
Right-Turn Bypass	None				None				Yielding				None			
Conflicting Lanes					1				1				1			
Pedestrians Crossing, p/h					0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)					4.9763			4.9763	4.9763		4.9763	
Follow-Up Headway (s)					2.6087			2.6087	2.6087		2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h					490			141	302		170	
Entry Volume veh/h					462			137	293		165	
Circulating Flow (v_c), pc/h	622			141			26			452		
Exiting Flow (v_{ex}), pc/h	26			0			179			596		
Capacity (c_{pce}), pc/h					1195			1344	1344		870	
Capacity (c), veh/h					1127			1305	1305		845	
v/c Ratio (x)					0.41			0.10	0.22		0.20	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh					7.4			3.6	4.7		6.3	
Lane LOS					A			A	A		A	
95% Queue, veh					2.0			0.4	0.9		0.7	
Approach Delay, s/veh				7.4			4.3			6.3		
Approach LOS				A			A			A		
Intersection Delay, s/veh | LOS	6.0						A					

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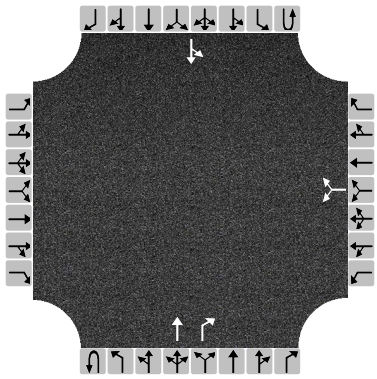
Appendix N
Build Capacity Analysis Worksheets
2040 w/ Staggered Start Times

HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	AM Peak	Peak Hour Factor	0.80
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Staggered Start Time		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	1	0	0	1	0
Configuration							LR				T	R		LT		
Volume, V (veh/h)						370		53			225	614		27	109	
Percent Heavy Vehicles (%)						8		3						0		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							529							34		
Capacity, c (veh/h)							526							671		
v/c Ratio							1.01							0.05		
95% Queue Length, Q_{95} (veh)							14.3							0.2		
Control Delay (s/veh)							68.7							10.6		
Level of Service, LOS							F							B		
Approach Delay (s/veh)						68.7								2.6		
Approach LOS						F										

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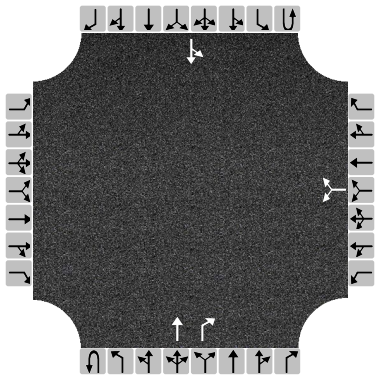
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & Cable
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	PM Peak	Peak Hour Factor	0.80
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Staggered Start Time		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	1	0	0	1	0
Configuration							LR				T	R		LT		
Volume, V (veh/h)						320		27			103	220		19	105	
Percent Heavy Vehicles (%)						6		6						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.46		6.26						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.55		3.35						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							434							24		
Capacity, c (veh/h)							677							1148		
v/c Ratio							0.64							0.02		
95% Queue Length, Q_{95} (veh)							4.6							0.1		
Control Delay (s/veh)							19.3							8.2		
Level of Service, LOS							C							A		
Approach Delay (s/veh)						19.3								1.4		
Approach LOS						C										

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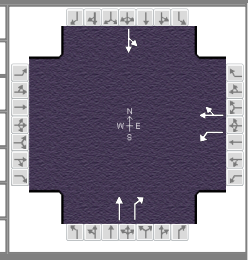
HCS 2010 Signalized Intersection Results Summary

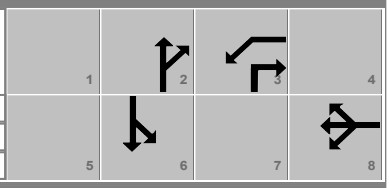
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	AM Peak	PHF	0.80
Urban Street	Summit Road SW	Analysis Year	2040	Analysis Period	1> 7:00
Intersection	@ Cable Road SW	File Name	AM 40 SummitCable - TSC.xus		
Project Description	Traffic Signal Control				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				370	0	53		225	614	27	109	

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	37.9	40.1	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				8		2		6
Case Number				10.0		7.0		8.0
Phase Duration, s				46.1		43.9		43.9
Change Period, ($Y+R_c$), s				6.0		6.0		6.0
Max Allow Headway (*MAH*), s				3.2		0.0		0.0
Queue Clearance Time (g_s), s				19.1				
Green Extension Time (g_e), s				1.1		0.0		0.0
Phase Call Probability				1.00				
Max Out Probability				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				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				463	66			281	768		170	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1810	1505			1845	1610		1575	
Queue Service Time (g_s), s				17.1	2.3			9.4	10.9		0.2	
Cycle Queue Clearance Time (g_c), s				17.1	2.3			9.4	10.9		9.5	
Green Ratio (*g/C*)				0.45	0.45			0.42	0.87		0.42	
Capacity (*c*), veh/h				806	670			777	1395		711	
Volume-to-Capacity Ratio (*X*)				0.574	0.099			0.362	0.550		0.239	
Back of Queue (*Q*), ft/ln (85 th percentile)				238.2	35.5			157.5	41.7		100.5	
Back of Queue (*Q*), veh/ln (85 th percentile)				9.5	1.3			6.2	1.7		3.9	
Queue Storage Ratio (*RQ*) (85 th percentile)				0.00	0.00			0.00	0.00		0.00	
Uniform Delay (d_1), s/veh				18.6	14.5			17.8	1.5		16.7	
Incremental Delay (d_2), s/veh				0.6	0.0			1.3	1.6		0.8	
Initial Queue Delay (d_3), s/veh				0.0	0.0			0.0	0.0		0.0	
Control Delay (*d*), s/veh				19.2	14.5			19.1	3.1		17.4	
Level of Service (LOS)				B	B			B	A		B	
Approach Delay, s/veh / LOS	0.0			18.6		B	7.4		A	17.4		B
Intersection Delay, s/veh / LOS	11.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.1	B	2.3	B	1.9	A
Bicycle LOS Score / LOS			1.4	A	2.2	B	0.8	A

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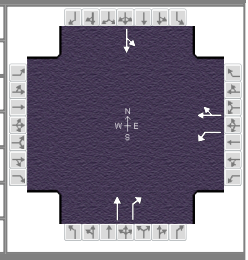
HCS 2010 Signalized Intersection Results Summary

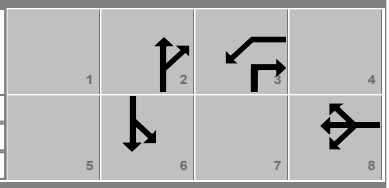
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	PM Peak	PHF	0.80
Urban Street	Summit Road SW	Analysis Year	2040	Analysis Period	1> 7:00
Intersection	@ Cable Road SW	File Name	PM 40 SummitCable - TSC.xus		
Project Description	Traffic Signal Control				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h				320	0	27		103	220	19	105	

Signal Information			
Cycle, s	60.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	22.8	25.2	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				8		2		6
Case Number				10.0		7.0		8.0
Phase Duration, s				31.2		28.8		28.8
Change Period, ($Y+R_c$), s				6.0		6.0		6.0
Max Allow Headway (*MAH*), s				3.1		0.0		0.0
Queue Clearance Time (g_s), s				11.9				
Green Extension Time (g_e), s				0.8		0.0		0.0
Phase Call Probability				1.00				
Max Out Probability				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				3	8	18		2	12	1	6	
Adjusted Flow Rate (*v*), veh/h				400	34			129	275		155	
Adjusted Saturation Flow Rate (*s*), veh/h/ln				1810	1519			1827	1610		1753	
Queue Service Time (g_s), s				9.9	0.8			2.8	2.5		0.0	
Cycle Queue Clearance Time (g_c), s				9.9	0.8			2.8	2.5		3.4	
Green Ratio (*g/C*)				0.42	0.42			0.38	0.80		0.38	
Capacity (*c*), veh/h				760	638			694	1288		735	
Volume-to-Capacity Ratio (*X*)				0.526	0.053			0.185	0.213		0.211	
Back of Queue (*Q*), ft/ln (85 th percentile)				134.5	10.8			51.6	9.2		63	
Back of Queue (*Q*), veh/ln (85 th percentile)				5.4	0.4			2.0	0.4		2.4	
Queue Storage Ratio (*RQ*) (85 th percentile)				0.00	0.00			0.00	0.00		0.00	
Uniform Delay (d_1), s/veh				13.0	10.3			12.4	1.4		12.6	
Incremental Delay (d_2), s/veh				0.3	0.0			0.6	0.4		0.7	
Initial Queue Delay (d_3), s/veh				0.0	0.0			0.0	0.0		0.0	
Control Delay (*d*), s/veh				13.3	10.3			13.0	1.8		13.3	
Level of Service (LOS)				B	B			B	A		B	
Approach Delay, s/veh / LOS	0.0			13.1		B	5.4		A	13.3		B
Intersection Delay, s/veh / LOS	10.0						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.3	B	2.1	B	2.3	B	1.9	A
Bicycle LOS Score / LOS			1.2	A	1.2	A	0.7	A

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	AM Peak
Project Description	Staggered Start Time

Site Information

Intersection	Cable & Summit
E/W Street Name	Cable Road SW
N/S Street Name	Summit Road SW
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.80
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment							LR				TR				LT	
Volume (V), veh/h					0	370		53	0		225	614	0	27	109	
Percent Heavy Vehicles, %					0	8		3	0		3	4	0	0	6	
Flow Rate (v_{PCE}), pc/h					0	500		68	0		290	798	0	34	144	
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes					1				1				1			
Pedestrians Crossing, p/h					0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)					4.9763			4.9763			4.9763	
Follow-Up Headway (s)					2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h					568			1088			178	
Entry Volume veh/h					529			1049			170	
Circulating Flow (v_c), pc/h	678			290			34			500		
Exiting Flow (v_{ex}), pc/h	832			0			358			644		
Capacity (c_{pce}), pc/h					1027			1333			829	
Capacity (c), veh/h					956			1285			791	
v/c Ratio (x)					0.55			0.82			0.21	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh					11.1			17.9			6.9	
Lane LOS					B			C			A	
95% Queue, veh					3.5			10.0			0.8	
Approach Delay, s/veh				11.1			17.9			6.9		
Approach LOS				B			C			A		
Intersection Delay, s/veh | LOS	14.7						B					

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HCS7 Roundabouts Report

General Information

Analyst	ABC
Agency or Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	PM Peak
Project Description	Staggered Start Time

Site Information

Intersection	Cable & Summit
E/W Street Name	Cable Road SW
N/S Street Name	Summit Road SW
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.80
Jurisdiction	Pataskala, OH

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment							LR				TR				LT	
Volume (V), veh/h					0	320		27	0		103	220	0	19	105	
Percent Heavy Vehicles, %					0	6		6	0		3	3	0	3	3	
Flow Rate (v_{PCE}), pc/h					0	424		36	0		133	283	0	24	135	
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes					1				1				1			
Pedestrians Crossing, p/h					0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)					4.9763			4.9763			4.9763	
Follow-Up Headway (s)					2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h					460			416			159	
Entry Volume veh/h					434			404			154	
Circulating Flow (v_c), pc/h	583			133			24			424		
Exiting Flow (v_{ex}), pc/h	307			0			169			559		
Capacity (c_{pce}), pc/h					1205			1347			895	
Capacity (c), veh/h					1137			1307			869	
v/c Ratio (x)					0.38			0.31			0.18	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh					7.0			5.5			5.9	
Lane LOS					A			A			A	
95% Queue, veh					1.8			1.3			0.6	
Approach Delay, s/veh				7.0			5.5			5.9		
Approach LOS				A			A			A		
Intersection Delay, s/veh | LOS	6.2						A					

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Appendix O
Access Capacity Analysis Worksheets
2020

HCS7 Two-Way Stop-Control Report

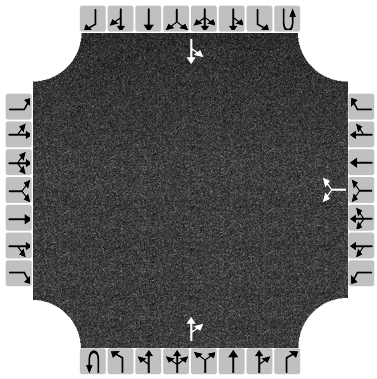
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Summit & South Access
Jurisdiction	Pataskala, OH
East/West Street	South Access Driveway
North/South Street	Summit Road SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						19		49			203	45		31	97	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							91							41		
Capacity, c (veh/h)							651							1222		
v/c Ratio							0.14							0.03		
95% Queue Length, Q_{95} (veh)							0.5							0.1		
Control Delay (s/veh)							11.4							8.1		
Level of Service, LOS							B							A		
Approach Delay (s/veh)						11.4								2.2		
Approach LOS						B										

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HCS7 Two-Way Stop-Control Report

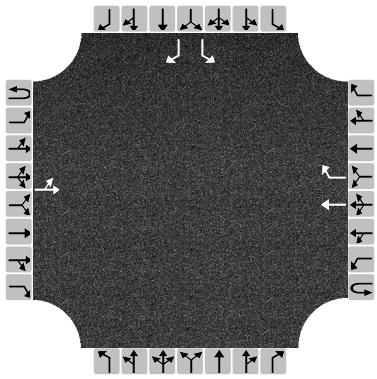
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Cable & HS Access
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	HS Access Driveway
Peak Hour Factor	0.80
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	1		0	0	0		1	0	1
Configuration		LT					T	R						L		R
Volume, V (veh/h)		382	269				244	169						62		179
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		478												78		224
Capacity, c (veh/h)		1044												63		732
v/c Ratio		0.46												1.22		0.31
95% Queue Length, Q_{95} (veh)		2.4												6.4		1.3
Control Delay (s/veh)		11.3												296.4		12.1
Level of Service, LOS		B												F		B
Approach Delay (s/veh)	9.3												85.2			
Approach LOS													F			

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HCS7 Two-Way Stop-Control Report

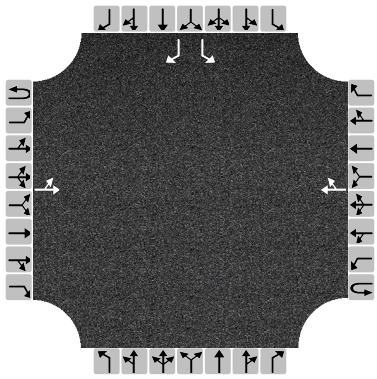
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Cable & MS Access
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	MS Access Driveway
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	0	0		1	0	1
Configuration		LT						TR						L		R
Volume, V (veh/h)		239	92				199	49						32		214
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		319												43		285
Capacity, c (veh/h)		1222												183		739
v/c Ratio		0.26												0.23		0.39
95% Queue Length, Q_{95} (veh)		1.0												0.9		1.8
Control Delay (s/veh)		9.0												30.5		12.9
Level of Service, LOS		A												D		B
Approach Delay (s/veh)	7.2												15.2			
Approach LOS													C			

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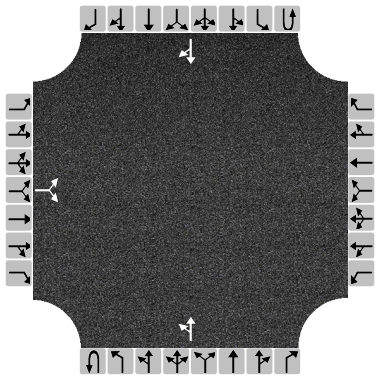
HCS7 Two-Way Stop-Control Report

General Information / Site Information

General Information		Site Information	
Analyst	ABC	Intersection	Mink & MS Access
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	MS Access Driveway
Analysis Year	2020	North/South Street	Mink Street SW
Time Analyzed	AM Peak	Peak Hour Factor	0.75
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		21		10						10	265				245	39
Percent Heavy Vehicles (%)		3		3						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.43		6.23						4.13						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.53		3.33						2.23						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			41							13						
Capacity, c (veh/h)			446							1173						
v/c Ratio			0.09							0.01						
95% Queue Length, Q_{95} (veh)			0.3							0.0						
Control Delay (s/veh)			13.9							8.1						
Level of Service, LOS			B							A						
Approach Delay (s/veh)	13.9								0.4							
Approach LOS	B															

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HCS7 Two-Way Stop-Control Report

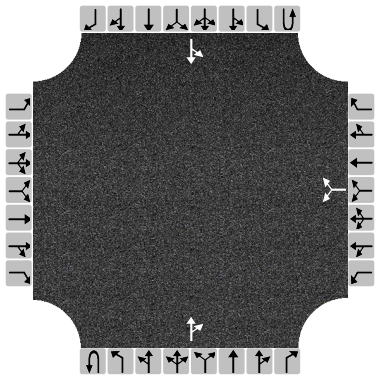
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Summit & South Access
Jurisdiction	Pataskala, OH
East/West Street	South Access Driveway
North/South Street	Summit Road SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						25		39			107	13		11	89	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)						0										
Right Turn Channelized		No				No				No				No		
Median Type/Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							85							15		
Capacity, c (veh/h)							797							1411		
v/c Ratio							0.11							0.01		
95% Queue Length, Q_{95} (veh)							0.4							0.0		
Control Delay (s/veh)							10.1							7.6		
Level of Service, LOS							B							A		
Approach Delay (s/veh)						10.1								0.9		
Approach LOS						B										

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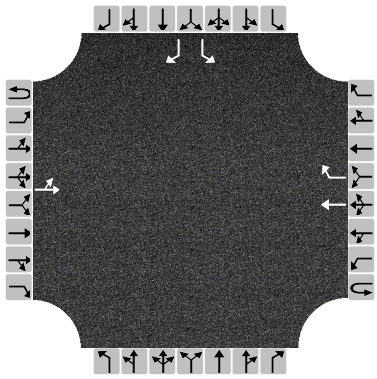
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Cable & HS Access
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2020	North/South Street	HS Access Driveway
Time Analyzed	PM Peak	Peak Hour Factor	0.75
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: East-West

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	1		0	0	0		1	0	1
Configuration		LT					T	R						L		R
Volume, V (veh/h)		110	139				151	30						80		206
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		147												107		275
Capacity, c (veh/h)		1318												369		837
v/c Ratio		0.11												0.29		0.33
95% Queue Length, Q_{95} (veh)		0.4												1.2		1.4
Control Delay (s/veh)		8.1												18.7		11.4
Level of Service, LOS		A												C		B
Approach Delay (s/veh)	4.1												13.4			
Approach LOS													B			

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HCS7 Two-Way Stop-Control Report

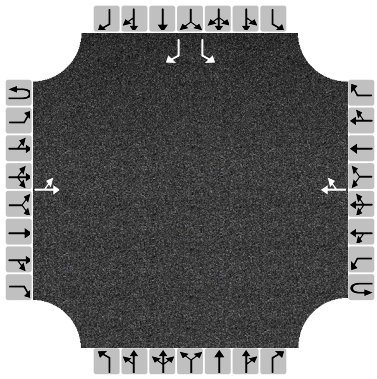
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Cable & MS Access
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	MS Access Driveway
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	0	0		1	0	1
Configuration		LT						TR						L		R
Volume, V (veh/h)		109	110				60	16						22		121
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		145												29		161
Capacity, c (veh/h)		1483												459		963
v/c Ratio		0.10												0.06		0.17
95% Queue Length, Q_{95} (veh)		0.3												0.2		0.6
Control Delay (s/veh)		7.7												13.4		9.5
Level of Service, LOS		A												B		A
Approach Delay (s/veh)	4.2												10.1			
Approach LOS													B			

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HCS7 Two-Way Stop-Control Report

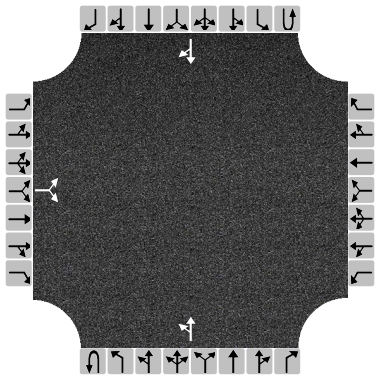
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2020
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Mink & MS Access
Jurisdiction	Pataskala, OH
East/West Street	MS Access Driveway
North/South Street	Mink Street SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		14		10						10	141				8	120
Percent Heavy Vehicles (%)		3		3						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1		6.2						4.1						
Critical Headway (sec)		6.43		6.23						4.13						
Base Follow-Up Headway (sec)		3.5		3.3						2.2						
Follow-Up Headway (sec)		3.53		3.33						2.23						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			32							13						
Capacity, c (veh/h)			773							1398						
v/c Ratio			0.04							0.01						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			9.9							7.6						
Level of Service, LOS			A							A						
Approach Delay (s/veh)	9.9								0.6							
Approach LOS	A															

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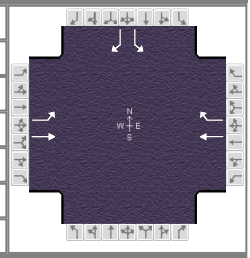
Appendix P
Access Capacity Analysis Worksheets
2020 w/ Improvements

HCS 2010 Signalized Intersection Results Summary

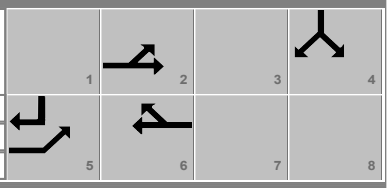
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	AM Peak	PHF	0.56
Urban Street	Cable Road SW	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	AM 20 CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	382	269			244	169				62		179

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	28.2	30.6	13.2	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		7.3				9.0
Phase Duration, s	34.2	70.8		36.6				19.2
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	25.9							15.1
Green Extension Time (g_e), s	0.5	0.0		0.0				0.0
Phase Call Probability	1.00							1.00
Max Out Probability	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	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	682	480			436	302				111		320
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1757	1900			1681	1610				1630		1505
Queue Service Time (g_s), s	23.9	8.5			20.8	13.7				5.6		13.1
Cycle Queue Clearance Time (g_c), s	23.9	8.5			20.8	13.7				5.6		13.1
Green Ratio (*g/C*)	0.68	0.72			0.34	0.34				0.15		0.46
Capacity (*c*), veh/h	733	1368			572	547				239		692
Volume-to-Capacity Ratio (*X*)	0.931	0.351			0.762	0.551				0.463		0.462
Back of Queue (*Q*), ft/ln (85 th percentile)	566.7	112.4			345.6	200.7				101.7		168.6
Back of Queue (*Q*), veh/ln (85 th percentile)	22.1	4.5			12.5	8.0				3.7		6.4
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	17.7	4.7			26.5	24.1				35.2		16.7
Incremental Delay (d_2), s/veh	18.2	0.7			9.3	4.0				0.5		0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	35.8	5.4			35.7	28.1				35.7		16.8
Level of Service (LOS)	D	A			D	C				D		B
Approach Delay, s/veh / LOS	23.3	C		32.6	C		0.0			21.7	C	
Intersection Delay, s/veh / LOS	25.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.3	B	2.3	B	2.3	B
Bicycle LOS Score / LOS	2.4	B	1.7	A				F

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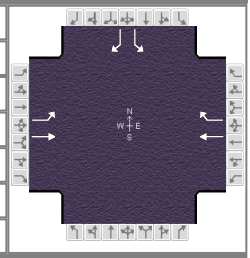
HCS 2010 Signalized Intersection Results Summary

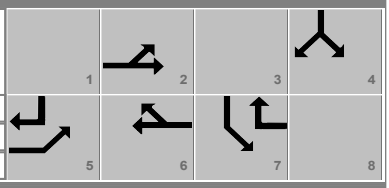
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	PM Peak	PHF	0.62
Urban Street	Cable Road SW	Analysis Year	2020	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	PM 20 CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	139			151	30				80		206

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.0	24.8	20.2	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		7.3				9.0
Phase Duration, s	13.0	43.8		30.8				26.2
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	6.8							14.1
Green Extension Time (g_e), s	0.0	0.0		0.0				0.6
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							0.20

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	177	224			244	48				129		332
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1508	1520			1652	1610				1660		1505
Queue Service Time (g_s), s	4.8	5.6			7.8	0.8				4.2		12.1
Cycle Queue Clearance Time (g_c), s	4.8	5.6			7.8	0.8				4.2		12.1
Green Ratio (*g/C*)	0.48	0.54			0.35	0.64				0.29		0.39
Capacity (*c*), veh/h	487	821			585	1035				479		585
Volume-to-Capacity Ratio (*X*)	0.364	0.273			0.416	0.047				0.269		0.568
Back of Queue (*Q*), ft/ln (85 th percentile)	73.5	92.5			136.1	9.7				73.2		156.3
Back of Queue (*Q*), veh/ln (85 th percentile)	2.5	3.1			4.9	0.4				2.7		5.9
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	11.5	8.7			17.1	4.6				19.2		16.8
Incremental Delay (d_2), s/veh	0.2	0.8			2.2	0.1				0.1		0.8
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	11.6	9.5			19.3	4.7				19.3		17.6
Level of Service (LOS)	B	A			B	A				B		B
Approach Delay, s/veh / LOS	10.4	B		16.9	B		0.0			18.1	B	
Intersection Delay, s/veh / LOS	15.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.3	B	2.3	B	2.3	B
Bicycle LOS Score / LOS	1.2	A	1.0	A				F

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Appendix Q
Access Capacity Analysis Worksheets
2040

HCS7 Two-Way Stop-Control Report

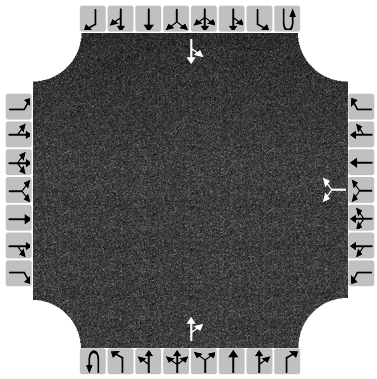
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Summit & South Access
Jurisdiction	Pataskala, OH
East/West Street	South Access Driveway
North/South Street	Summit Road SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						19		49			233	45		31	117	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)						7.1		6.2						4.1		
Critical Headway (sec)						6.43		6.23						4.13		
Base Follow-Up Headway (sec)						3.5		3.3						2.2		
Follow-Up Headway (sec)						3.53		3.33						2.23		

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							91							41		
Capacity, c (veh/h)							610							1181		
v/c Ratio							0.15							0.04		
95% Queue Length, Q_{95} (veh)							0.5							0.1		
Control Delay (s/veh)							11.9							8.2		
Level of Service, LOS							B							A		
Approach Delay (s/veh)					11.9								2.0			
Approach LOS					B											

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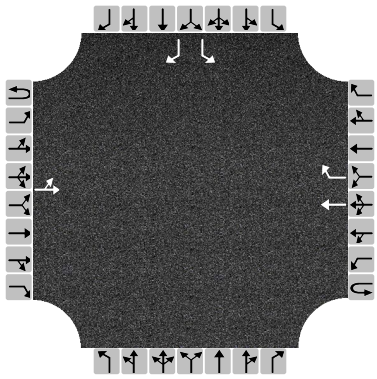
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Cable & HS Access
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	Cable Road SW
Analysis Year	2040	North/South Street	HS Access Driveway
Time Analyzed	AM Peak	Peak Hour Factor	0.80
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: East-West

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	1		0	0	0		1	0	1
Configuration		LT					T	R						L		R
Volume, V (veh/h)		382	269				244	169						62		179
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		478												78		224
Capacity, c (veh/h)		1044												63		732
v/c Ratio		0.46												1.22		0.31
95% Queue Length, Q_{95} (veh)		2.4												6.4		1.3
Control Delay (s/veh)		11.3												296.4		12.1
Level of Service, LOS		B												F		B
Approach Delay (s/veh)	9.3												85.2			
Approach LOS													F			

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HCS7 Two-Way Stop-Control Report

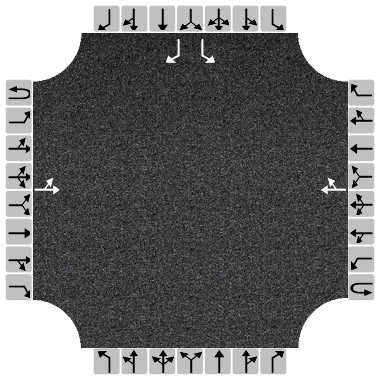
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	AM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Cable & MS Access
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	MS Access Driveway
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	0	0		1	0	1
Configuration		LT						TR						L		R
Volume, V (veh/h)		239	92				199	49						32		214
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		319												43		285
Capacity, c (veh/h)		1222												183		739
v/c Ratio		0.26												0.23		0.39
95% Queue Length, Q_{95} (veh)		1.0												0.9		1.8
Control Delay (s/veh)		9.0												30.5		12.9
Level of Service, LOS		A												D		B
Approach Delay (s/veh)	7.2												15.2			
Approach LOS													C			

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HCS7 Two-Way Stop-Control Report

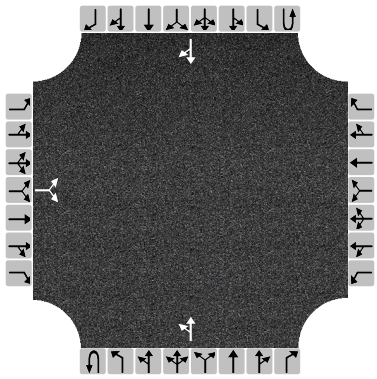
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	AM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Mink & MS Access
Jurisdiction	Pataskala, OH
East/West Street	MS Access Driveway
North/South Street	Mink Street SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		21		10						10	315				265	39
Percent Heavy Vehicles (%)		3		3						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			41							13						
Capacity, c (veh/h)			400							1147						
v/c Ratio			0.10							0.01						
95% Queue Length, Q_{95} (veh)			0.3							0.0						
Control Delay (s/veh)			15.0							8.2						
Level of Service, LOS			C							A						
Approach Delay (s/veh)	15.0								0.4							
Approach LOS	C															

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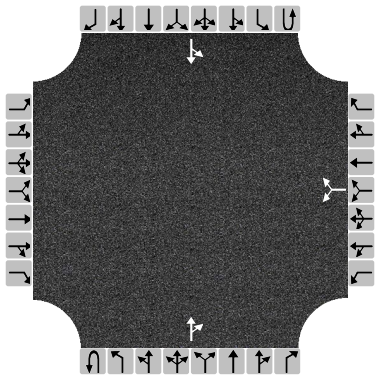
HCS7 Two-Way Stop-Control Report

General Information

Analyst	ABC	Intersection	Summit & South Access
Agency/Co.	TMS Engineers, Inc.	Jurisdiction	Pataskala, OH
Date Performed	5/4/2018	East/West Street	South Access Driveway
Analysis Year	2040	North/South Street	Summit Road SW
Time Analyzed	PM Peak	Peak Hour Factor	0.75
Intersection Orientation	North-South	Analysis Time Period (hrs)	0.25
Project Description	Build Conditions		

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	0	0		0	1	0	0	0	1	0	0	0	1	0
Configuration							LR					TR		LT		
Volume, V (veh/h)						25		39			117	13		11	99	
Percent Heavy Vehicles (%)						3		3						3		
Proportion Time Blocked																
Percent Grade (%)					0											
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)							85							15		
Capacity, c (veh/h)							776							1396		
v/c Ratio							0.11							0.01		
95% Queue Length, Q_{95} (veh)							0.4							0.0		
Control Delay (s/veh)							10.2							7.6		
Level of Service, LOS							B							A		
Approach Delay (s/veh)					10.2								0.8			
Approach LOS					B											

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HCS7 Two-Way Stop-Control Report

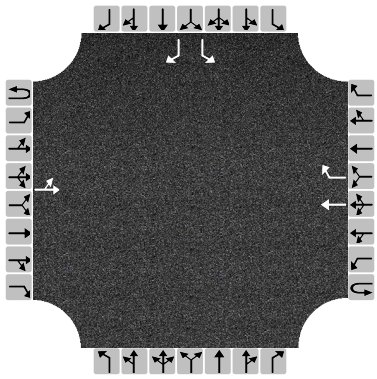
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Cable & HS Access
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	HS Access Driveway
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	1		0	0	0		1	0	1
Configuration		LT					T	R						L		R
Volume, V (veh/h)		110	139				151	30						80		206
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		147												107		275
Capacity, c (veh/h)		1318												369		837
v/c Ratio		0.11												0.29		0.33
95% Queue Length, Q_{95} (veh)		0.4												1.2		1.4
Control Delay (s/veh)		8.1												18.7		11.4
Level of Service, LOS		A												C		B
Approach Delay (s/veh)	4.1												13.4			
Approach LOS													B			

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HCS7 Two-Way Stop-Control Report

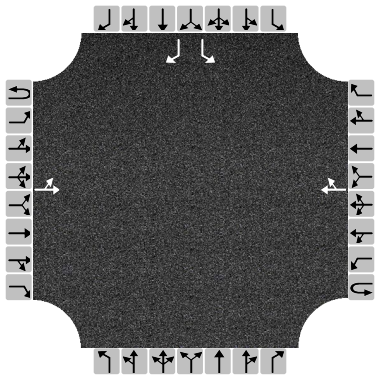
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	PM Peak
Intersection Orientation	East-West
Project Description	Build Conditions

Site Information

Intersection	Cable & MS Access
Jurisdiction	Pataskala, OH
East/West Street	Cable Road SW
North/South Street	MS Access Driveway
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: East-West

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	0	0		1	0	1
Configuration		LT						TR						L		R
Volume, V (veh/h)		109	110				60	16						22		121
Percent Heavy Vehicles (%)		3												3		3
Proportion Time Blocked																
Percent Grade (%)													0			
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		4.1												7.1		6.2
Critical Headway (sec)		4.13												6.43		6.23
Base Follow-Up Headway (sec)		2.2												3.5		3.3
Follow-Up Headway (sec)		2.23												3.53		3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		145												29		161
Capacity, c (veh/h)		1483												459		963
v/c Ratio		0.10												0.06		0.17
95% Queue Length, Q_{95} (veh)		0.3												0.2		0.6
Control Delay (s/veh)		7.7												13.4		9.5
Level of Service, LOS		A												B		A
Approach Delay (s/veh)	4.2												10.1			
Approach LOS													B			

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HCS7 Two-Way Stop-Control Report

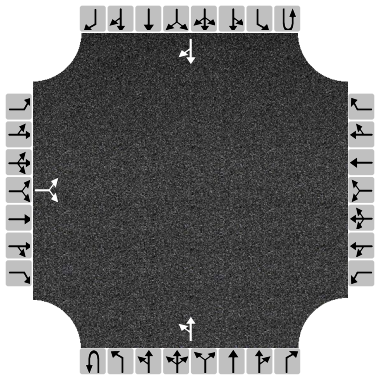
General Information

Analyst	ABC
Agency/Co.	TMS Engineers, Inc.
Date Performed	5/4/2018
Analysis Year	2040
Time Analyzed	PM Peak
Intersection Orientation	North-South
Project Description	Build Conditions

Site Information

Intersection	Mink & MS Access
Jurisdiction	Pataskala, OH
East/West Street	MS Access Driveway
North/South Street	Mink Street SW
Peak Hour Factor	0.75
Analysis Time Period (hrs)	0.25

Lanes



Major Street: North-South

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		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	0	1	0	0	0	1	0
Configuration			LR							LT						TR
Volume, V (veh/h)		14		10						10	161				8	140
Percent Heavy Vehicles (%)		3		3						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized	No				No				No				No			
Median Type/Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)																
Critical Headway (sec)																
Base Follow-Up Headway (sec)																
Follow-Up Headway (sec)																

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			32							13						
Capacity, c (veh/h)			742							1368						
v/c Ratio			0.04							0.01						
95% Queue Length, Q_{95} (veh)			0.1							0.0						
Control Delay (s/veh)			10.1							7.7						
Level of Service, LOS			B							A						
Approach Delay (s/veh)	10.1								0.5							
Approach LOS	B															

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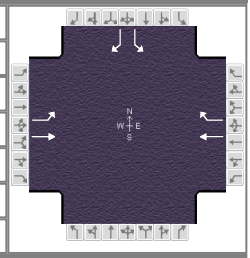
Appendix R
Access Capacity Analysis Worksheets
2040 w/ Improvements

HCS 2010 Signalized Intersection Results Summary

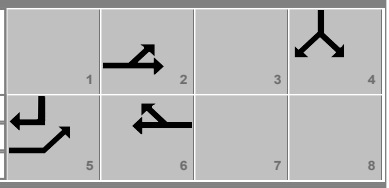
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	AM Peak	PHF	0.56
Urban Street	Cable Road SW	Analysis Year	2040	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	AM 40 CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	382	269			244	169				62		179

Signal Information			
Cycle, s	90.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	28.2	30.6	13.2	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		7.3				9.0
Phase Duration, s	34.2	70.8		36.6				19.2
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	25.9							15.1
Green Extension Time (g_e), s	0.5	0.0		0.0				0.0
Phase Call Probability	1.00							1.00
Max Out Probability	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	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	682	480			436	302				111		320
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1757	1900			1681	1610				1630		1505
Queue Service Time (g_s), s	23.9	8.5			20.8	13.7				5.6		13.1
Cycle Queue Clearance Time (g_c), s	23.9	8.5			20.8	13.7				5.6		13.1
Green Ratio (*g/C*)	0.68	0.72			0.34	0.34				0.15		0.46
Capacity (*c*), veh/h	733	1368			572	547				239		692
Volume-to-Capacity Ratio (*X*)	0.931	0.351			0.762	0.551				0.463		0.462
Back of Queue (*Q*), ft/ln (85 th percentile)	566.7	112.4			345.6	200.7				101.7		168.6
Back of Queue (*Q*), veh/ln (85 th percentile)	22.1	4.5			12.5	8.0				3.7		6.4
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	17.7	4.7			26.5	24.1				35.2		16.7
Incremental Delay (d_2), s/veh	18.2	0.7			9.3	4.0				0.5		0.2
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	35.8	5.4			35.7	28.1				35.7		16.8
Level of Service (LOS)	D	A			D	C				D		B
Approach Delay, s/veh / LOS	23.3	C		32.6	C		0.0			21.7	C	
Intersection Delay, s/veh / LOS	25.9						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.3	B	2.3	B	2.3	B
Bicycle LOS Score / LOS	2.4	B	1.7	A				F

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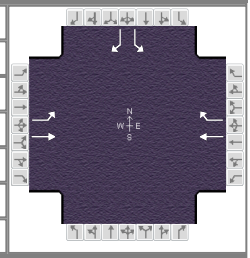
HCS 2010 Signalized Intersection Results Summary

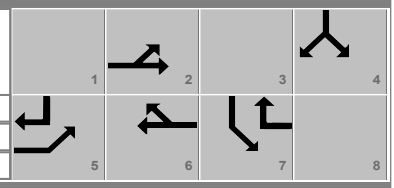
General Information				Intersection Information	
Agency	TMS Engineers, Inc.			Duration, h	0.25
Analyst	ABC	Analysis Date	May 4, 2018	Area Type	Other
Jurisdiction	Pataskala, OH	Time Period	PM Peak	PHF	0.62
Urban Street	Cable Road SW	Analysis Year	2040	Analysis Period	1> 7:00
Intersection	@ LHHS Access Driveway	File Name	PM 40 CableHS - TSC.xus		
Project Description	Improvement - Traffic Signal				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	110	139			151	30				80		206

Signal Information			
Cycle, s	70.0	Reference Phase	2
Offset, s	0	Reference Point	End
Uncoordinated	No	Simult. Gap E/W	On
Force Mode	Fixed	Simult. Gap N/S	On

Green	7.0	24.8	20.2	0.0	0.0	0.0
Yellow	4.0	4.0	4.0	0.0	0.0	0.0
Red	2.0	2.0	2.0	0.0	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	5	2		6				4
Case Number	1.0	4.0		7.3				9.0
Phase Duration, s	13.0	43.8		30.8				26.2
Change Period, ($Y+R_c$), s	6.0	6.0		6.0				6.0
Max Allow Headway (*MAH*), s	3.1	0.0		0.0				3.3
Queue Clearance Time (g_s), s	6.8							14.1
Green Extension Time (g_e), s	0.0	0.0		0.0				0.6
Phase Call Probability	1.00							1.00
Max Out Probability	1.00							0.20

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2			6	16				7		14
Adjusted Flow Rate (*v*), veh/h	177	224			244	48				129		332
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1508	1520			1652	1610				1660		1505
Queue Service Time (g_s), s	4.8	5.6			7.8	0.8				4.2		12.1
Cycle Queue Clearance Time (g_c), s	4.8	5.6			7.8	0.8				4.2		12.1
Green Ratio (*g/C*)	0.48	0.54			0.35	0.64				0.29		0.39
Capacity (*c*), veh/h	487	821			585	1035				479		585
Volume-to-Capacity Ratio (*X*)	0.364	0.273			0.416	0.047				0.269		0.568
Back of Queue (*Q*), ft/ln (85 th percentile)	73.5	92.5			136.1	9.7				73.2		156.3
Back of Queue (*Q*), veh/ln (85 th percentile)	2.5	3.1			4.9	0.4				2.7		5.9
Queue Storage Ratio (*RQ*) (85 th percentile)	0.00	0.00			0.00	0.00				0.00		0.00
Uniform Delay (d_1), s/veh	11.5	8.7			17.1	4.6				19.2		16.8
Incremental Delay (d_2), s/veh	0.2	0.8			2.2	0.1				0.1		0.8
Initial Queue Delay (d_3), s/veh	0.0	0.0			0.0	0.0				0.0		0.0
Control Delay (*d*), s/veh	11.6	9.5			19.3	4.7				19.3		17.6
Level of Service (LOS)	B	A			B	A				B		B
Approach Delay, s/veh / LOS	10.4	B		16.9	B		0.0			18.1	B	
Intersection Delay, s/veh / LOS	15.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	0.7	A	2.3	B	2.3	B	2.3	B
Bicycle LOS Score / LOS	1.2	A	1.0	A				F

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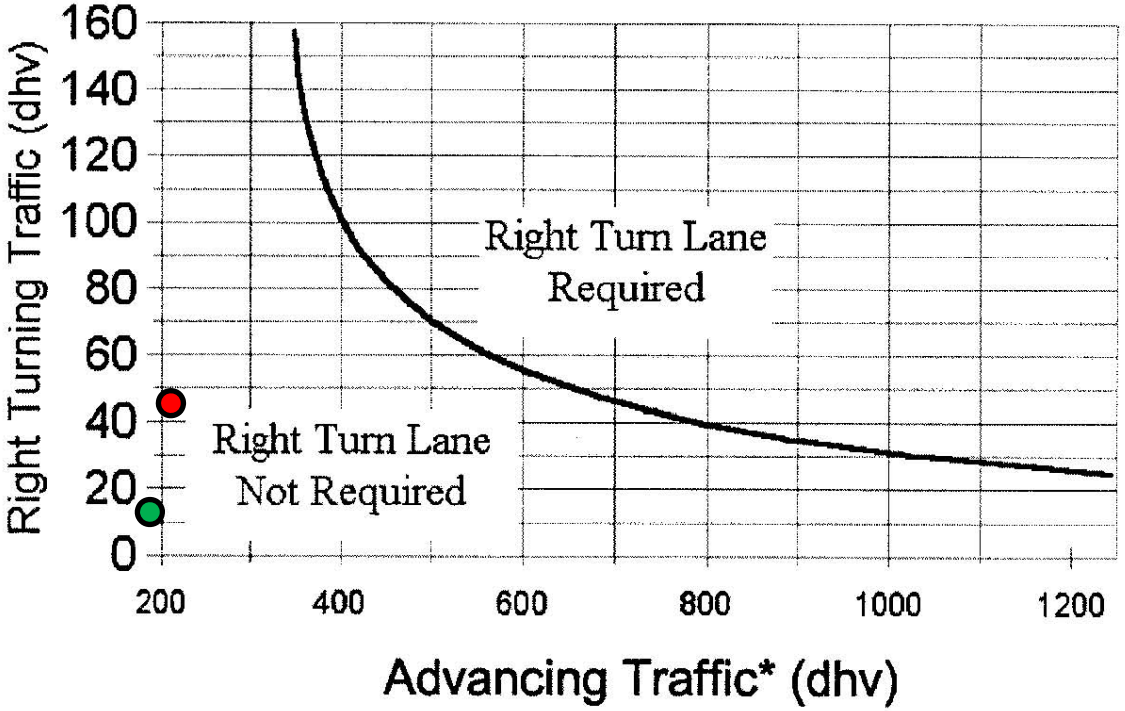
Appendix S
ODOT Turn Lane Warrant Graphs

SUMMIT ROAD SW & HS ACCESS

2020 BUILD – *WARRANT IS NOT MET*

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	NB THRU	NB RT	ADVANCING	WARRANT
AM	203	45	248	NOT MET
PM	107	13	120	NOT MET

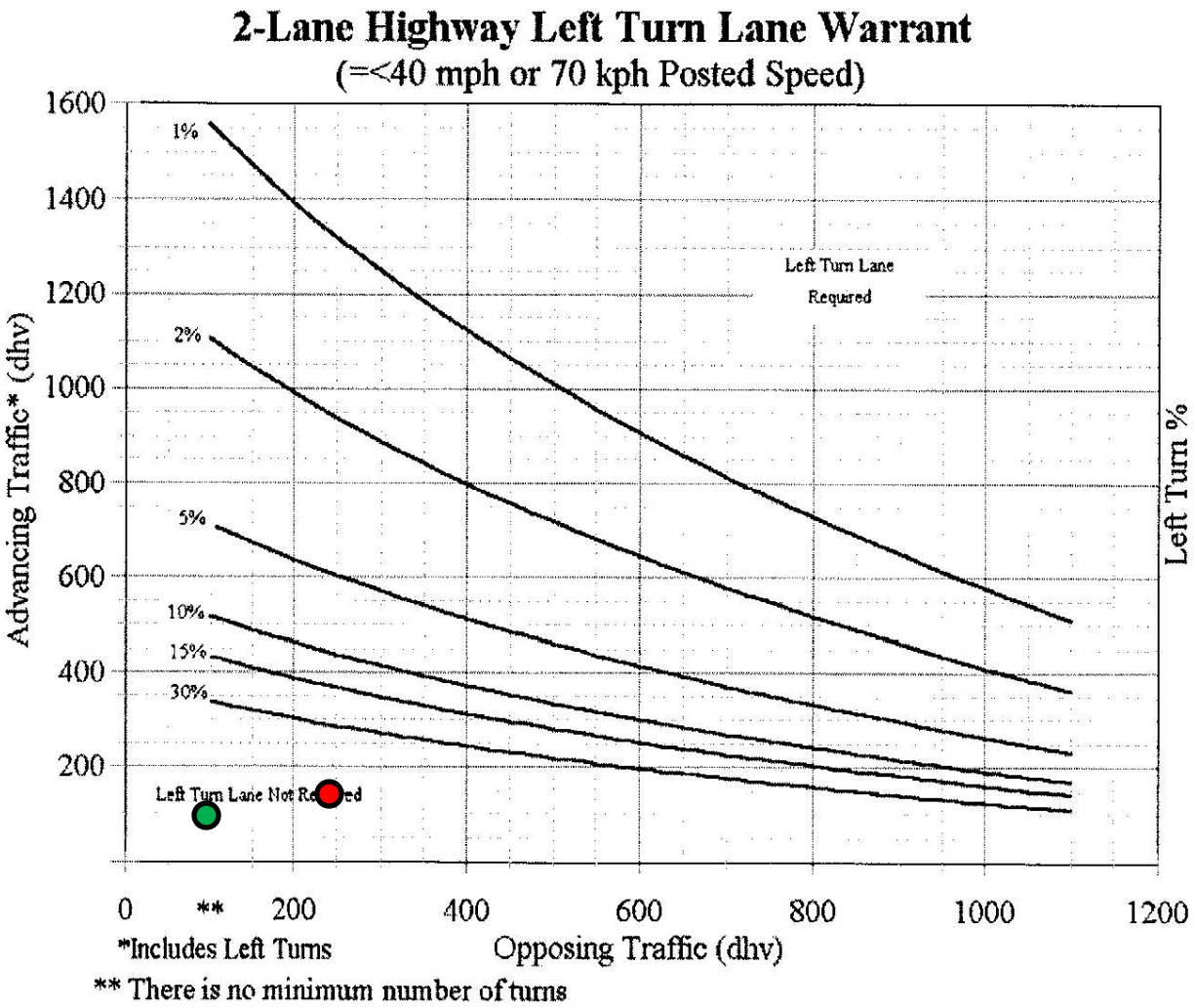
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

SUMMIT ROAD SW & HS ACCESS

2020 BUILD – *WARRANT IS NOT MET*



TIME	NB THRU	NB RT	SB THRU	SB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	203	45	97	31	128	248	24.2%	NOT MET
PM	107	13	89	11	100	120	11.0%	NOT MET

2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

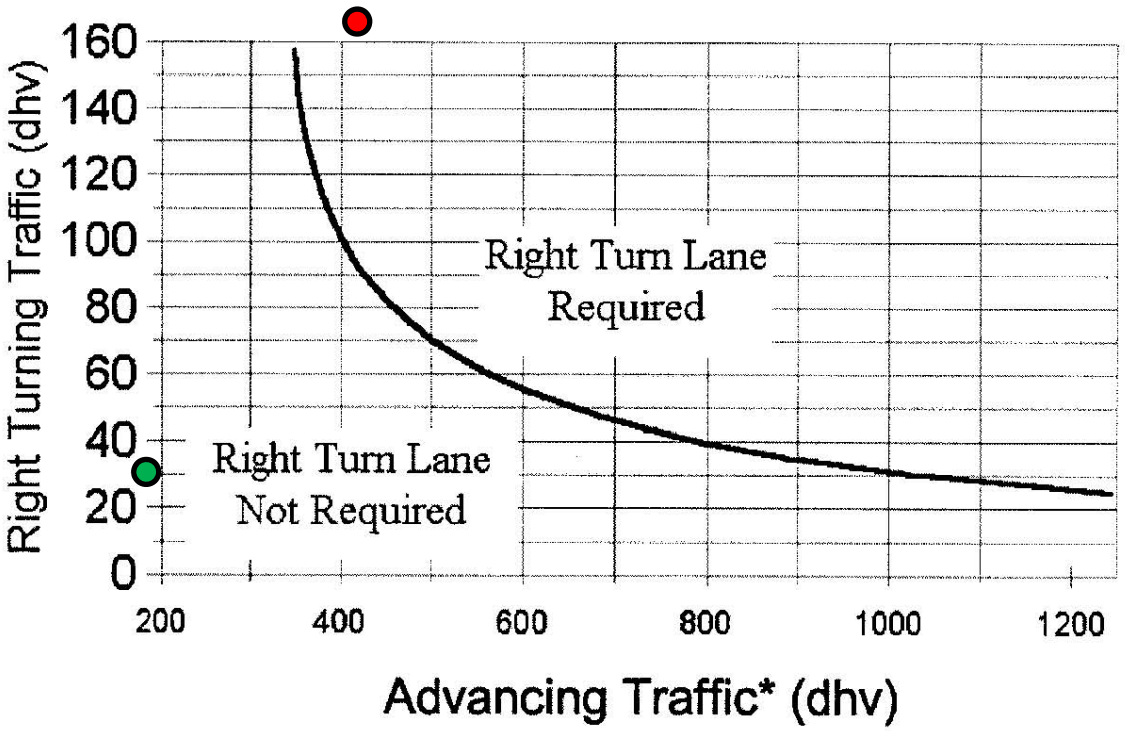
REFERENCE SECTION 401.6.1

CABLE ROAD SW & HS ACCESS

2020 BUILD – *WARRANT IS MET*

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	WB THRU	WB RT	ADVANCING	WARRANT
AM	244	169	413	MET
PM	151	30	181	NOT MET

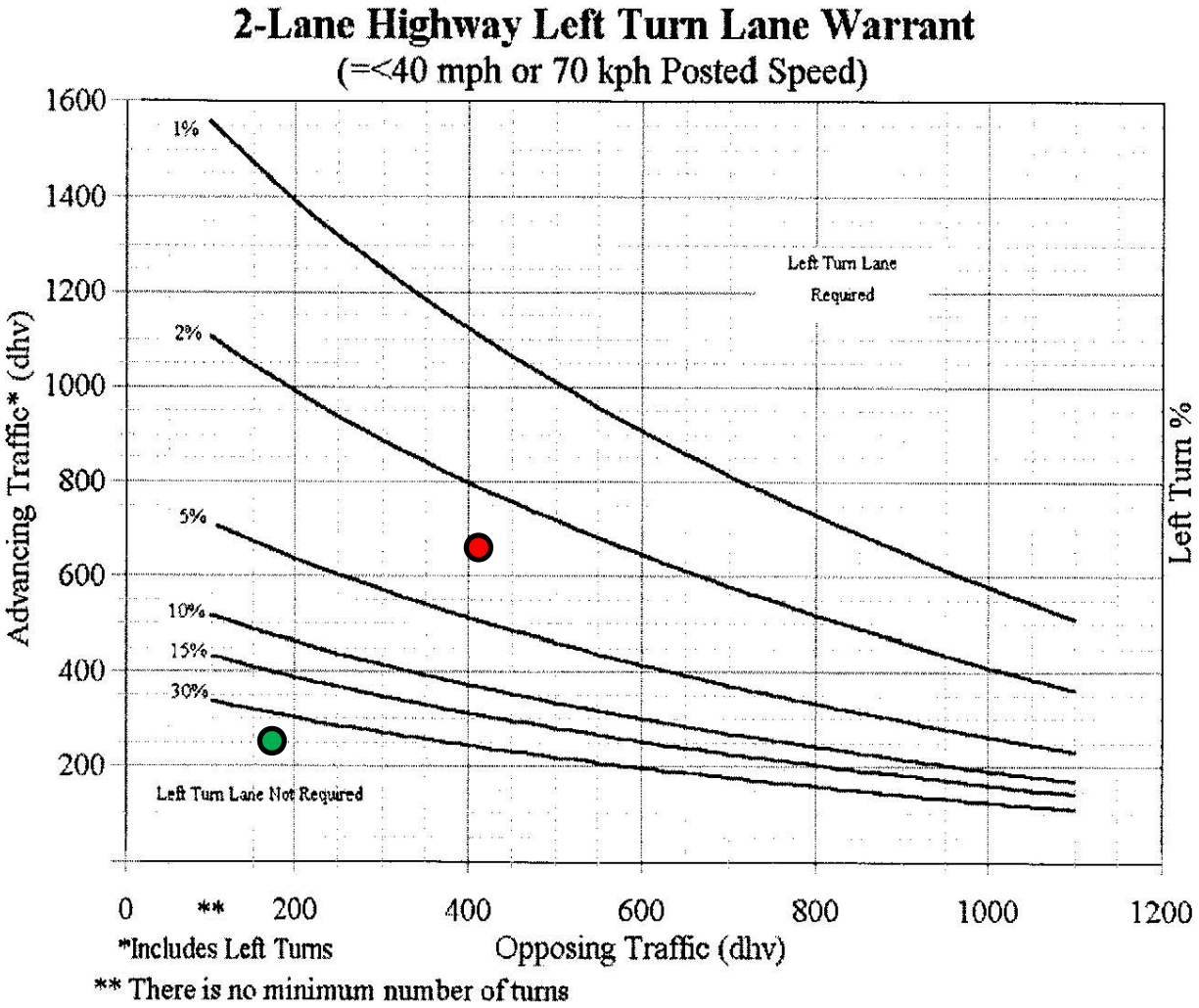
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

CABLE ROAD SW & HS ACCESS

2020 BUILD – ***WARRANT IS MET***



TIME	WB THRU	WB RT	EB THRU	EB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	244	169	269	382	651	413	58.7%	MET
PM	151	30	139	110	249	181	44.2%	MET

2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

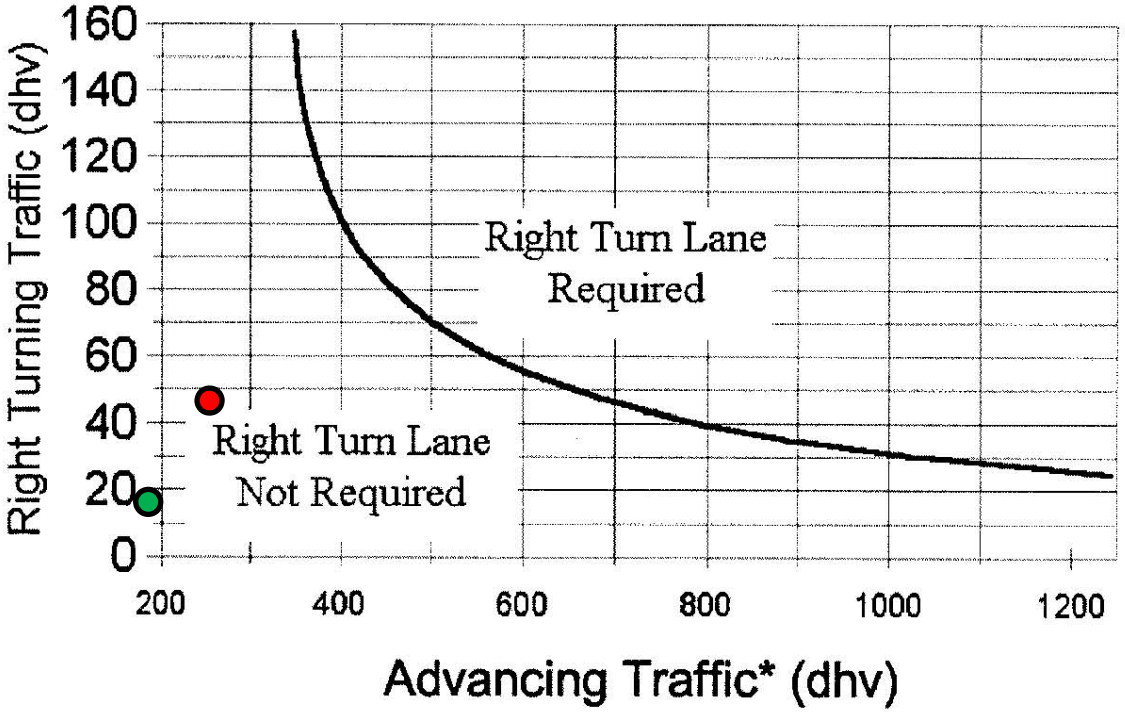
REFERENCE SECTION 401.6.1

CABLE ROAD SW & MS ACCESS

2020 BUILD – ***WARRANT IS NOT MET***

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	WB THRU	WB RT	ADVANCING	WARRANT
AM	199	49	248	NOT MET
PM	60	16	76	NOT MET

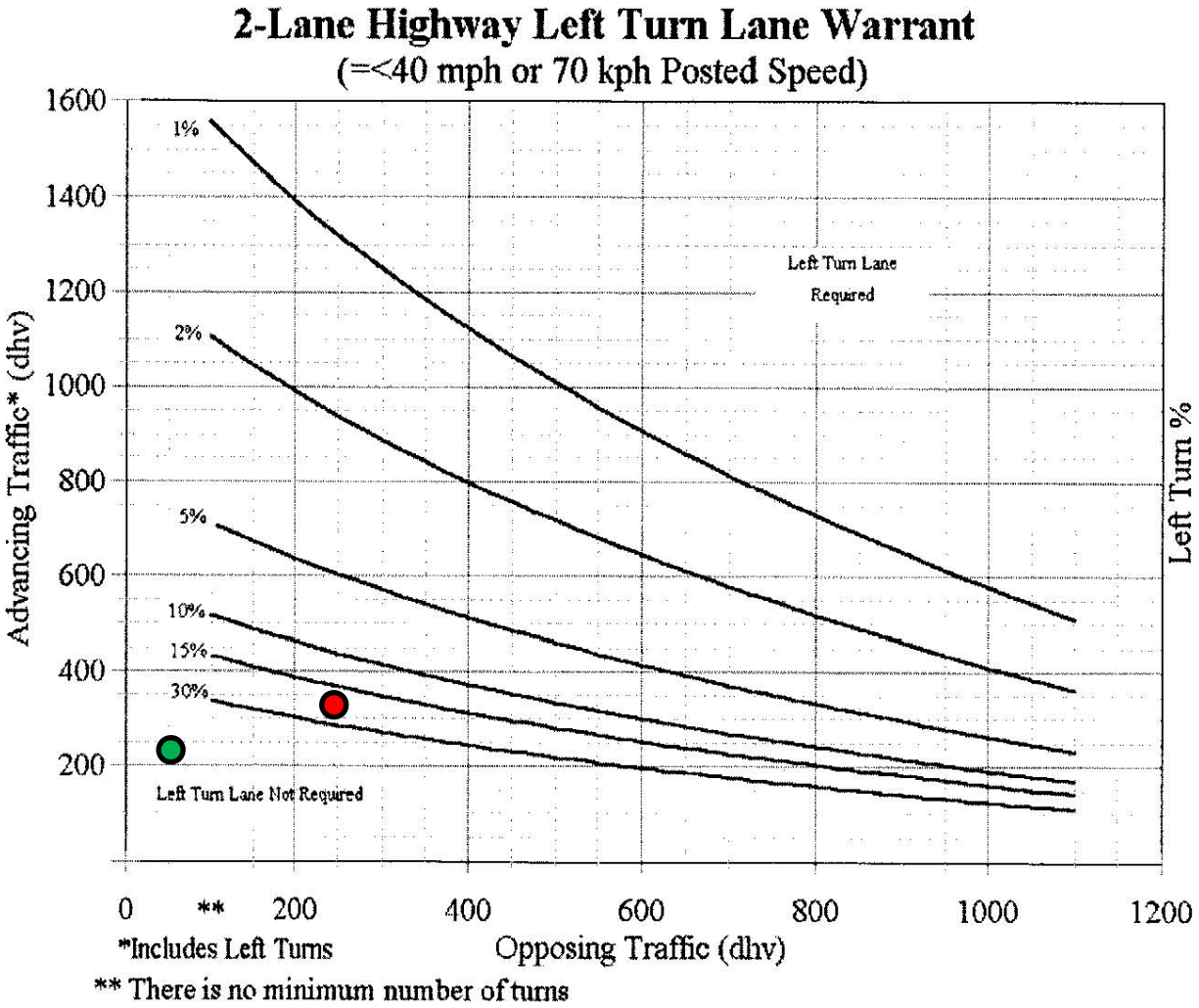
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

CABLE ROAD SW & MS ACCESS

2020 BUILD – ***WARRANT IS MET***



2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

REFERENCE SECTION 401.6.1

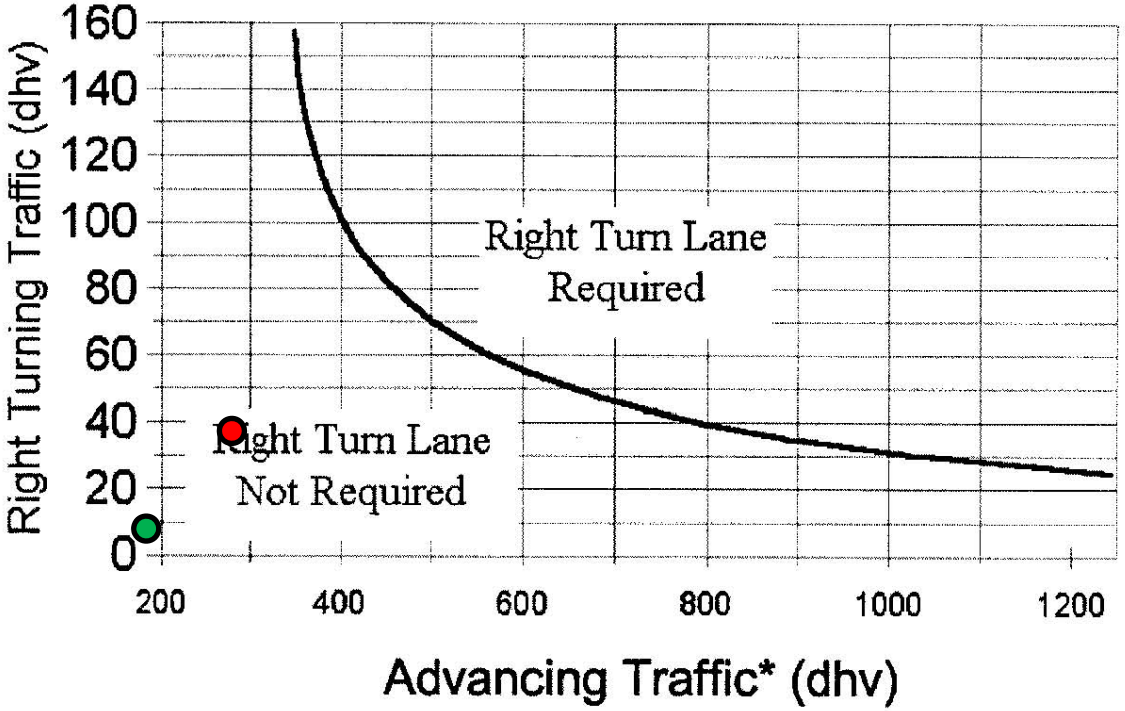
TIME	WB THRU	WB RT	EB THRU	EB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	199	49	92	239	331	248	72.2%	MET
PM	60	16	110	109	219	76	49.8%	NOT MET

MINK STREET SW & MS ACCESS

2020 BUILD – ***WARRANT IS NOT MET***

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	SB THRU	SB RT	ADVANCING	WARRANT
AM	245	39	284	NOT MET
PM	120	8	128	NOT MET

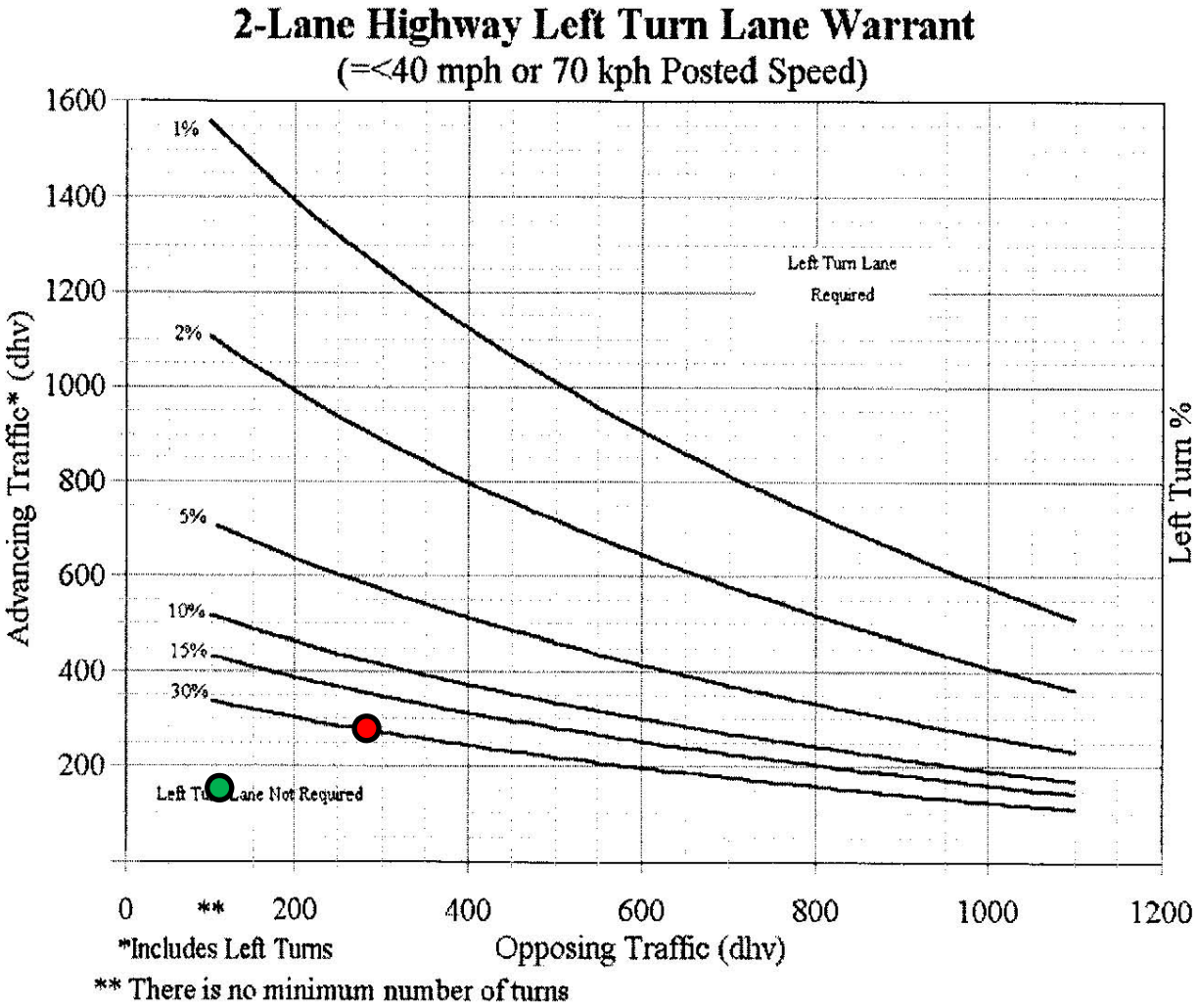
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

MINK STREET SW & MS ACCESS

2020 BUILD – ***WARRANT IS NOT MET***



2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

REFERENCE SECTION 401.6.1

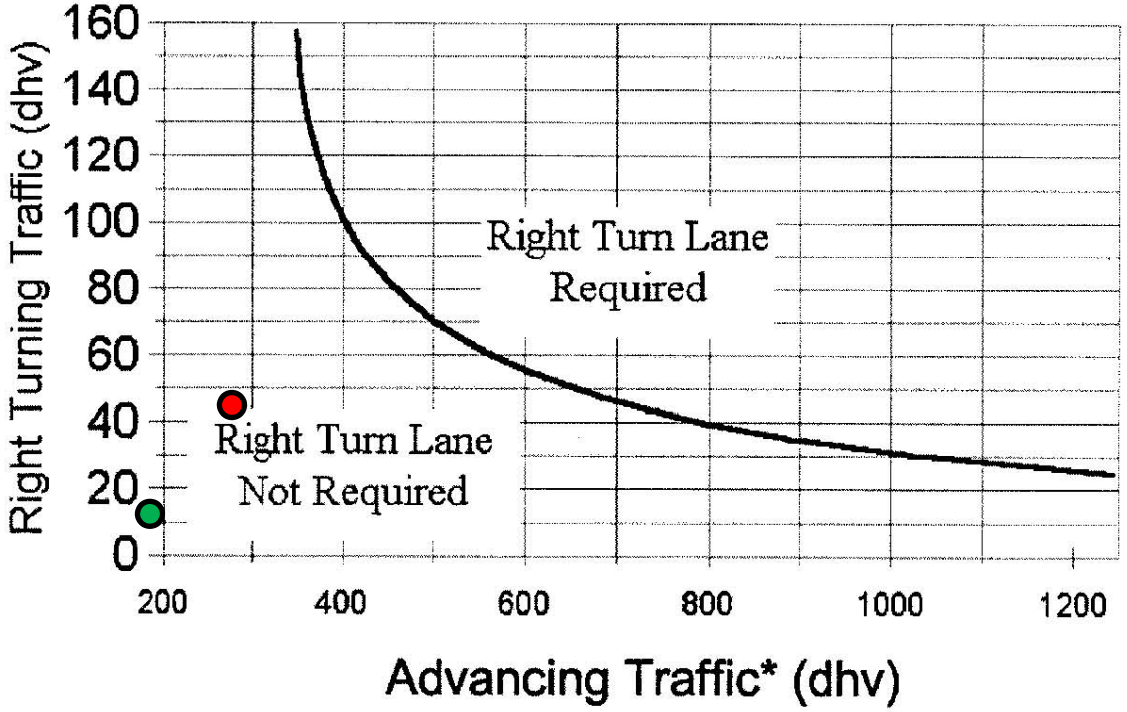
TIME	SB THRU	SB RT	NB THRU	NB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	245	39	265	10	275	284	3.6%	NOT MET
PM	120	8	141	10	151	128	6.6%	NOT MET

SUMMIT ROAD SW & HS ACCESS

2040 BUILD – ***WARRANT IS NOT MET***

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	NB THRU	NB RT	ADVANCING	WARRANT
AM	233	45	278	NOT MET
PM	117	13	130	NOT MET

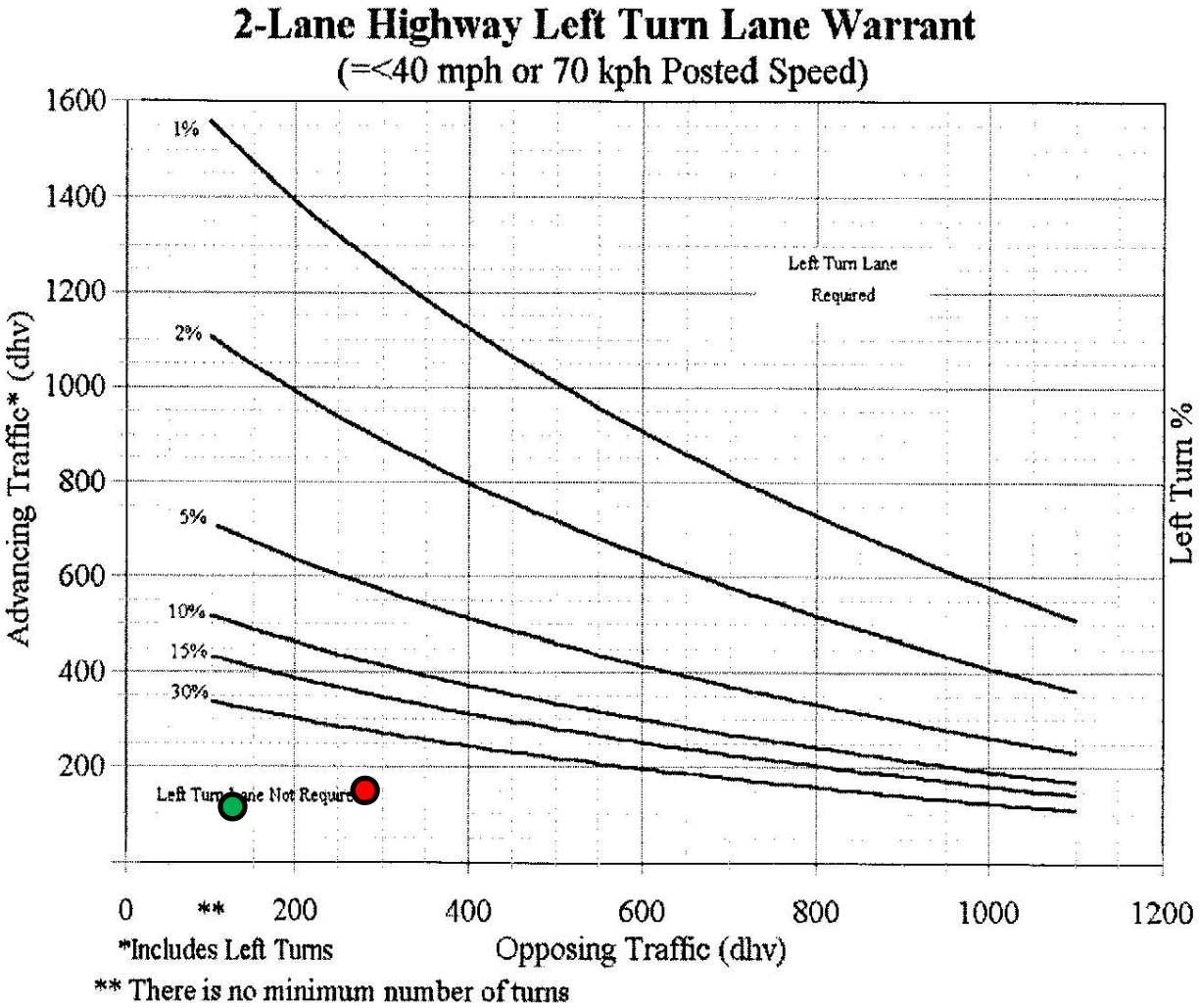
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

SUMMIT ROAD SW & HS ACCESS

2040 BUILD – *WARRANT IS NOT MET*



2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

REFERENCE SECTION 401.6.1

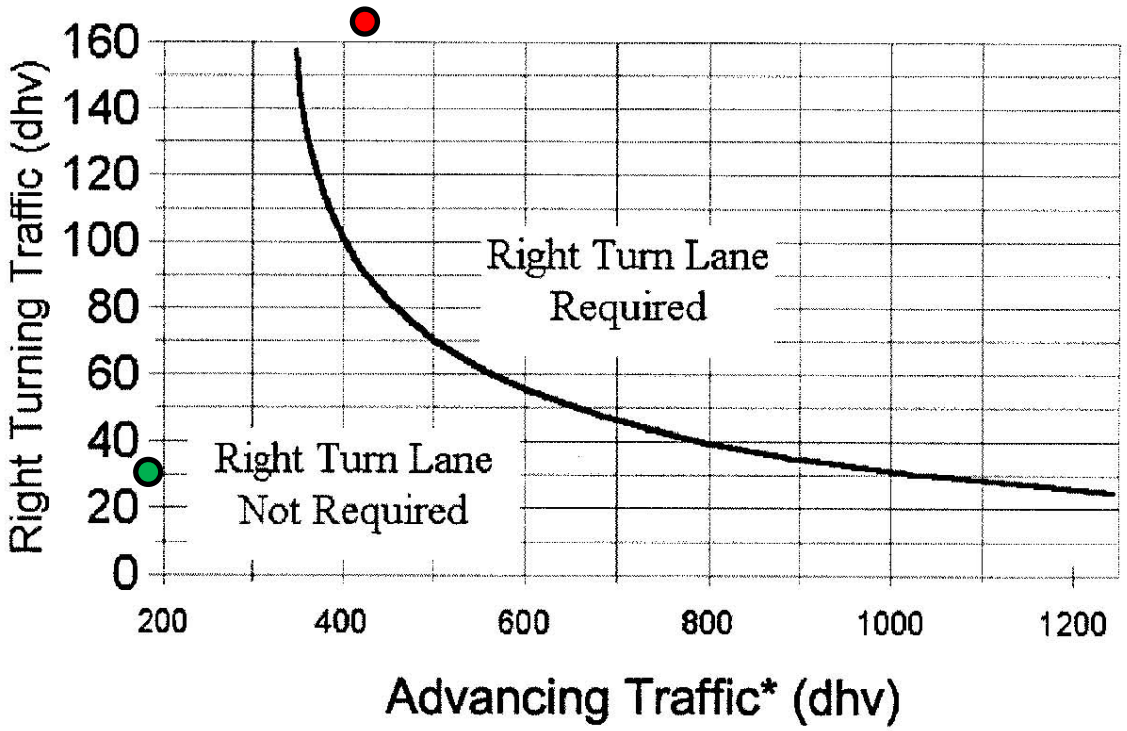
TIME	NB THRU	NB RT	SB THRU	SB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	233	45	117	31	148	278	20.9%	NOT MET
PM	117	13	99	11	110	130	10.0%	NOT MET

CABLE ROAD SW & HS ACCESS

2040 BUILD – *WARRANT IS MET*

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	WB THRU	WB RT	ADVANCING	WARRANT
AM	244	169	413	MET
PM	151	30	181	NOT MET

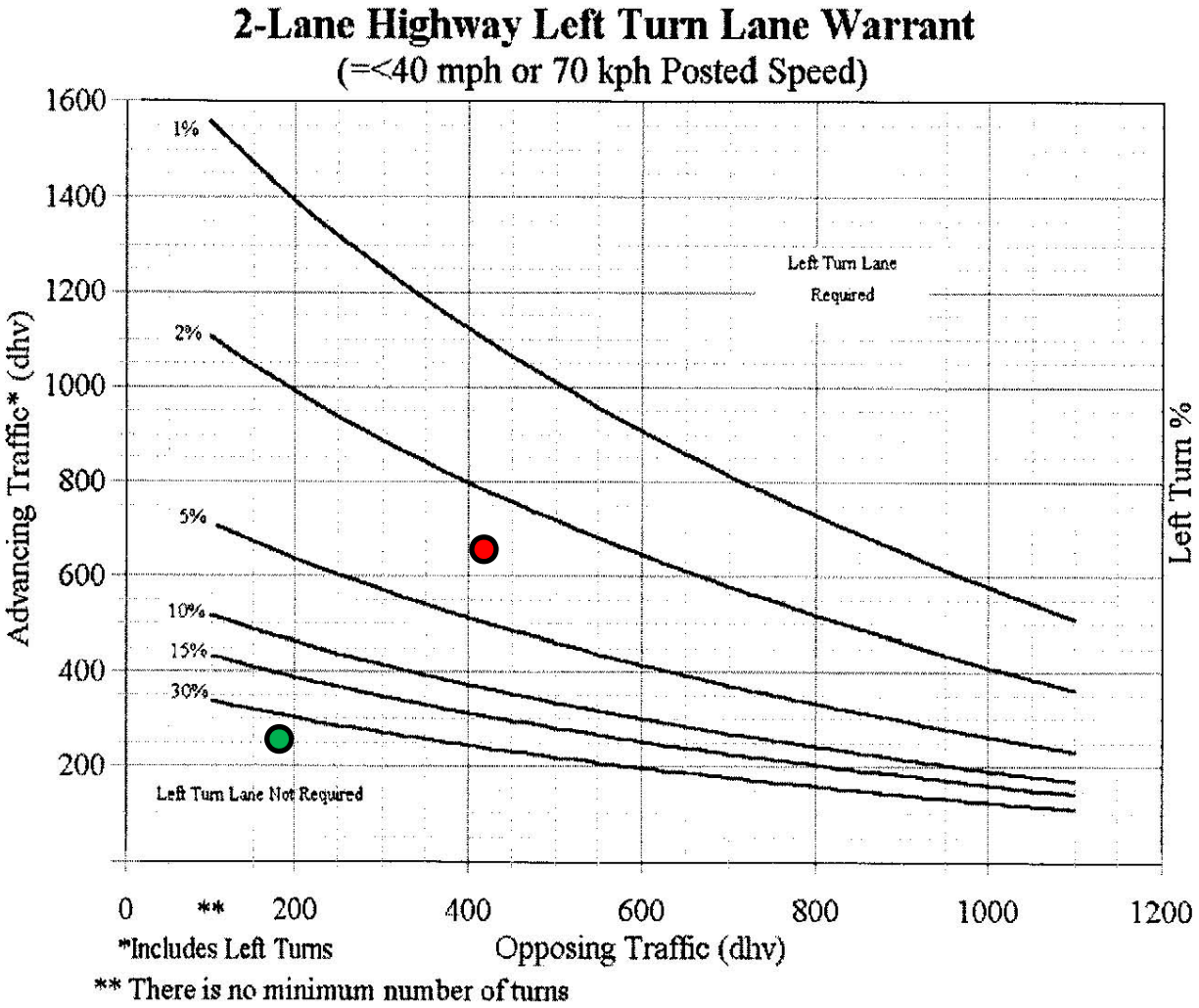
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

CABLE ROAD SW & HS ACCESS

2040 BUILD – ***WARRANT IS MET***



TIME	WB THRU	WB RT	EB THRU	EB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	244	169	269	382	651	413	58.7%	MET
PM	151	30	139	110	249	181	44.2%	MET

2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

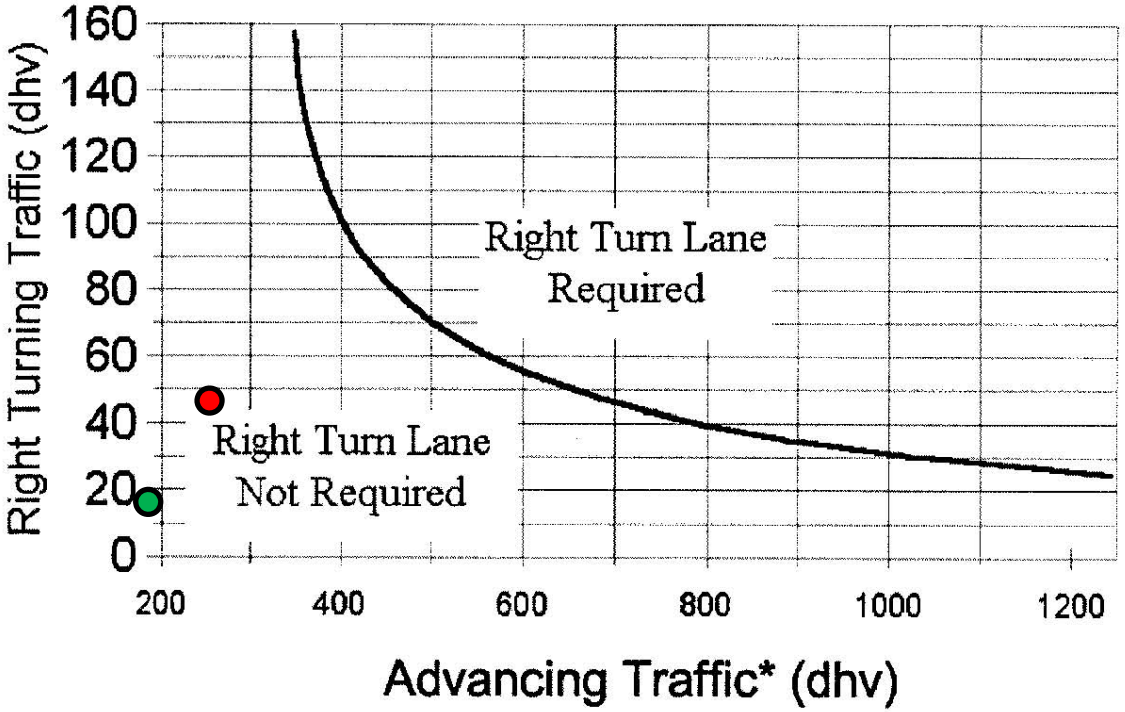
REFERENCE SECTION 401.6.1

CABLE ROAD SW & MS ACCESS

2040 BUILD – ***WARRANT IS NOT MET***

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	WB THRU	WB RT	ADVANCING	WARRANT
AM	199	49	248	NOT MET
PM	60	16	76	NOT MET

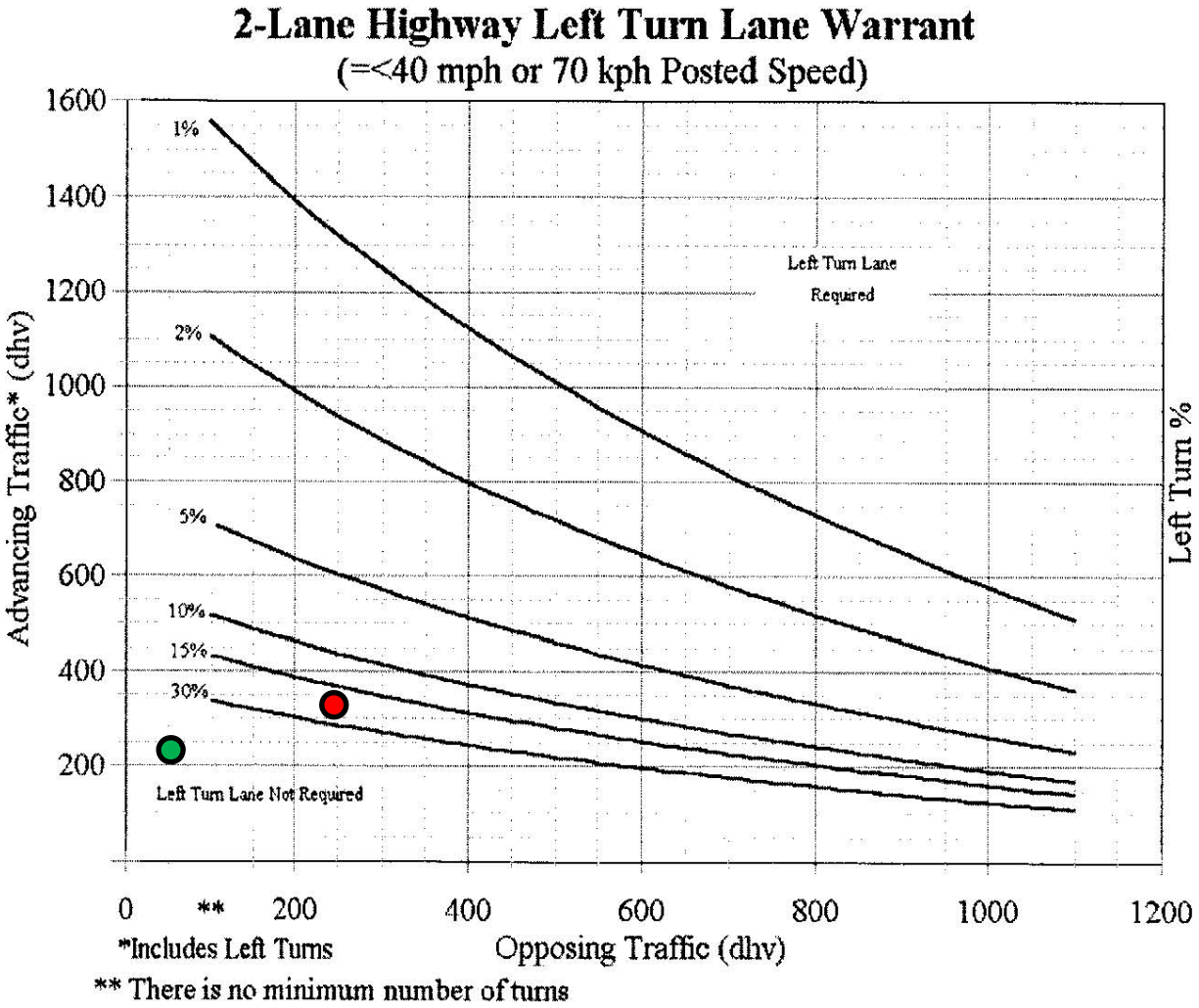
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

CABLE ROAD SW & MS ACCESS

2040 BUILD – *WARRANT IS MET*



TIME	WB THRU	WB RT	EB THRU	EB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	199	49	92	239	331	248	72.2%	MET
PM	60	16	110	109	219	76	49.8%	NOT MET

2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

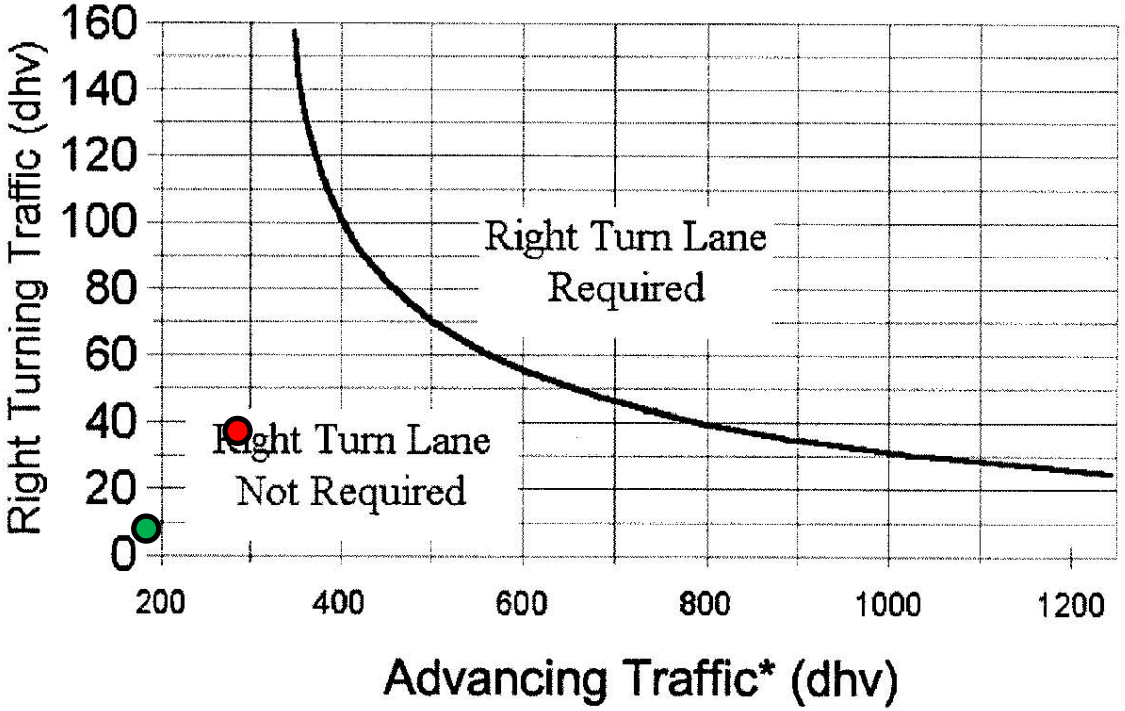
REFERENCE SECTION 401.6.1

MINK STREET SW & MS ACCESS

2040 BUILD – *WARRANT IS NOT MET*

2-Lane Highway Right Turn Lane Warrant

=< 40 mph or 70 kph Posted Speed



*Includes Right Turns

TIME	SB THRU	SB RT	ADVANCING	WARRANT
AM	265	39	304	NOT MET
PM	140	8	148	NOT MET

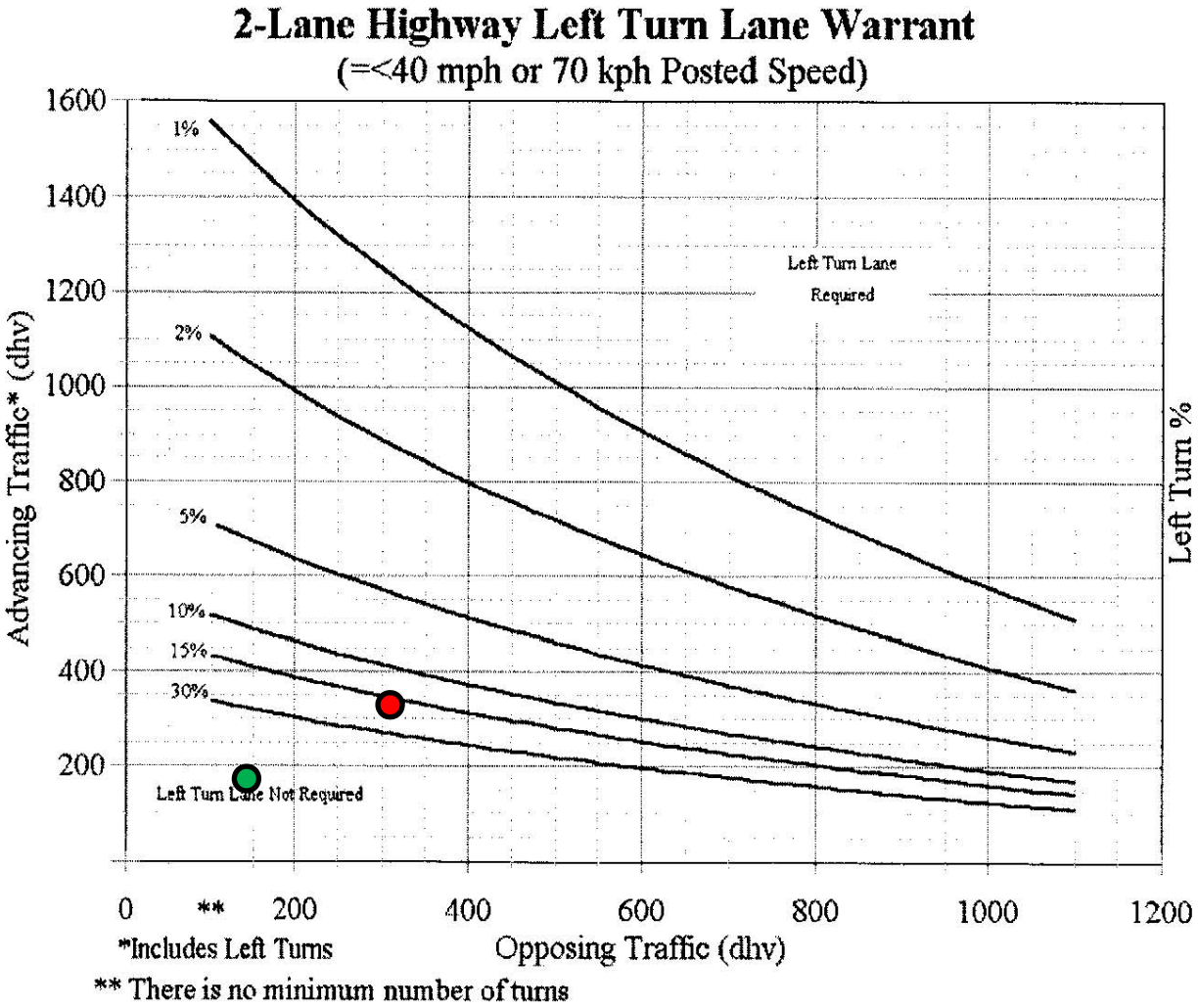
2-LANE RIGHT TURN LANE WARRANT (LOW SPEED)

401-6aE

REFERENCE SECTION 401.6.3

MINK STREET SW & MS ACCESS

2040 BUILD – ***WARRANT IS NOT MET***



2-LANE LEFT TURN LANE WARRANT (LOW SPEED)

401-5aE

REFERENCE SECTION 401.6.1

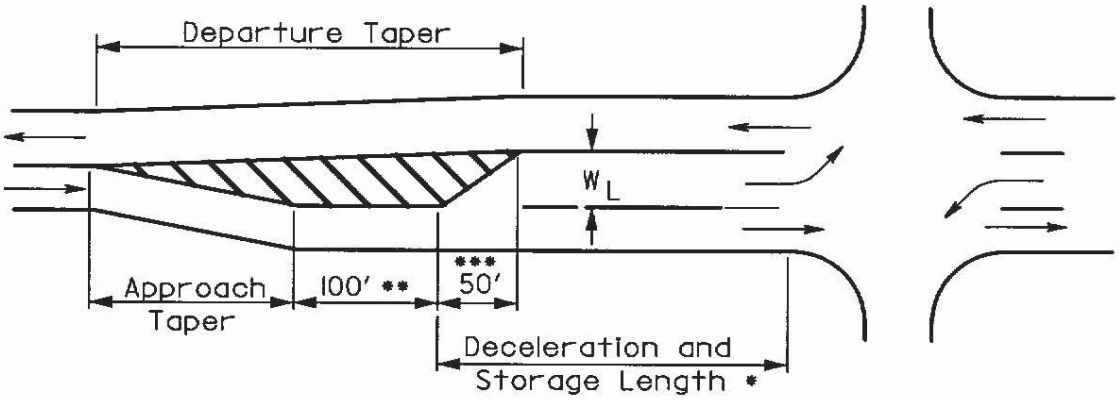
TIME	SB THRU	SB RT	NB THRU	NB LT	ADVANCING	OPPOSING	LT %	WARRANT
AM	265	39	315	10	325	304	3.1%	NOT MET
PM	140	8	161	10	171	148	5.8%	NOT MET

Appendix T
ODOT Turn Lane Design Criteria

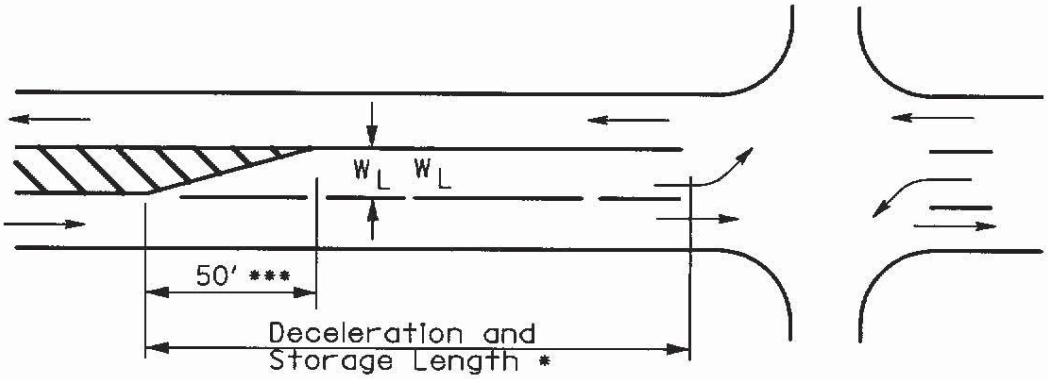
TURNING LANE DESIGN

401-7E

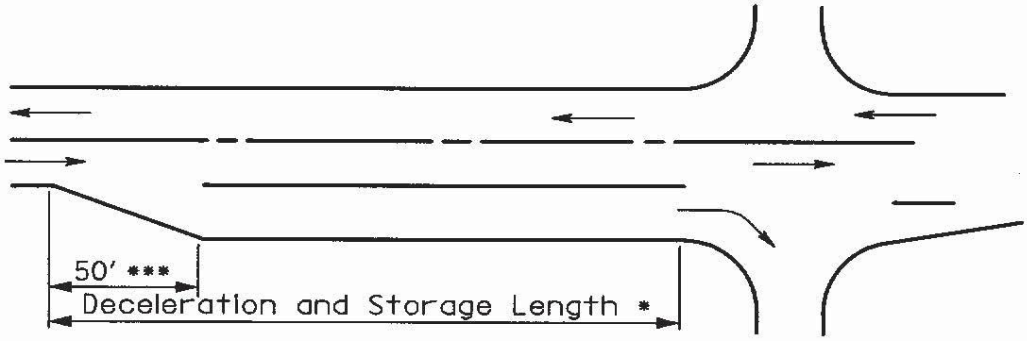
REFERENCE SECTIONS
401.6.1, 401.6.3



LEFT TURN LANE - NO MEDIAN OR MEDIAN WIDTH < W_L



LEFT TURN LANE - MEDIAN WIDTH >= W_L



RIGHT TURN LANE

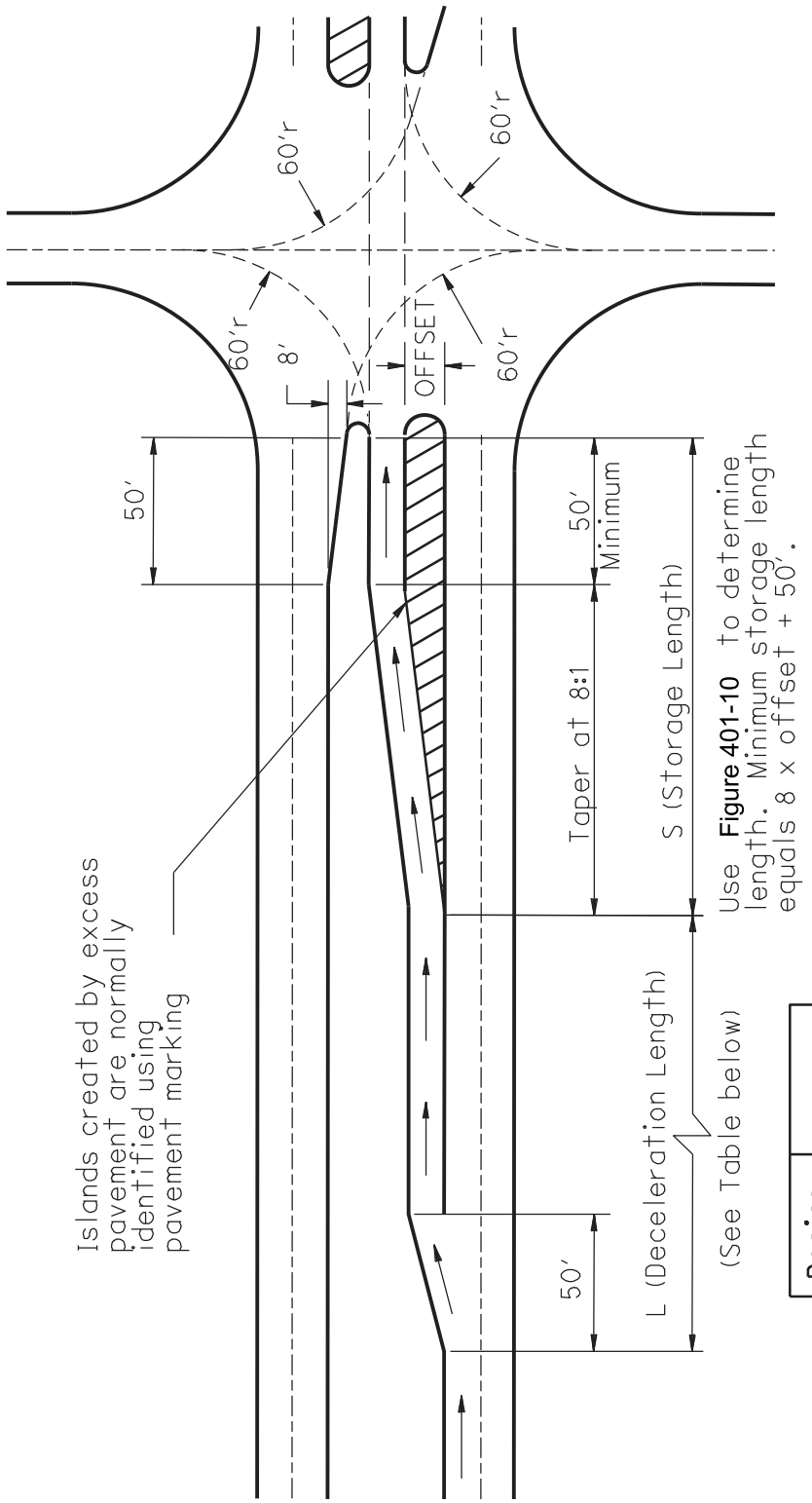
- * See **Figures 401-9 and 401-10** to copmpute length.
- ** May be reduced or eliminated in urban areas if intersection spacing or storage is constraining
- *** Diverging taper

W_L = Turn Lane Width

OFFSET LEFT TURN LANE

401-8E

REFERENCE SECTIONS
401.6.1, 401.6.3



Design Speed	L
40 mph	125'
45 mph	175'
50 mph	225'
55 mph	285'
60 mph	345'

BASIS FOR COMPUTING LENGTH OF TURN LANES

401-9E

REFERENCE SECTIONS 401.6.1, 401.6.3

TYPE OF TRAFFIC CONTROL	DESIGN SPEED (mph)					
	30 - 35		40 - 45		50 - 60	
	TURN DEMAND VOLUME					
	HIGH	LOW*	HIGH	LOW*	HIGH	LOW*
SIGNALIZED	A	A	B** or C	B** or C	B** or C	B** or C
UNSIGNALIZED STOPPED CROSSROAD	A	A	A	A	A	A
UNSIGNALIZED THROUGH ROAD	A	A	C	B	B** or C	B

* 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

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' "

For Explanation, See Turn Lane Design Example

STORAGE LENGTH AT INTERSECTIONS

401-10E

REFERENCE SECTIONS
401.6.1, 401.6.3

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

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

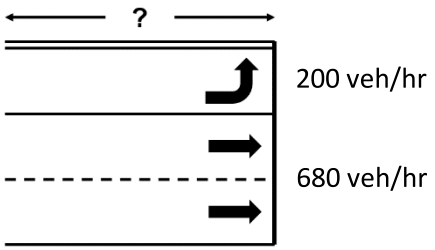
$$* \text{ Average Vehicles per Cycle} = \frac{\text{DHV (TURNING LANE)}}{\text{CYCLES/HOUR}}$$

If Cycleis are unknown, assume:
UNSIGNALIZED OR 2 PHASE - 60 CYCLES/HR
3 PHASE - 40 CYCLES/HR
4 PHASE - 30 CYCLES/HR

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

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

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).

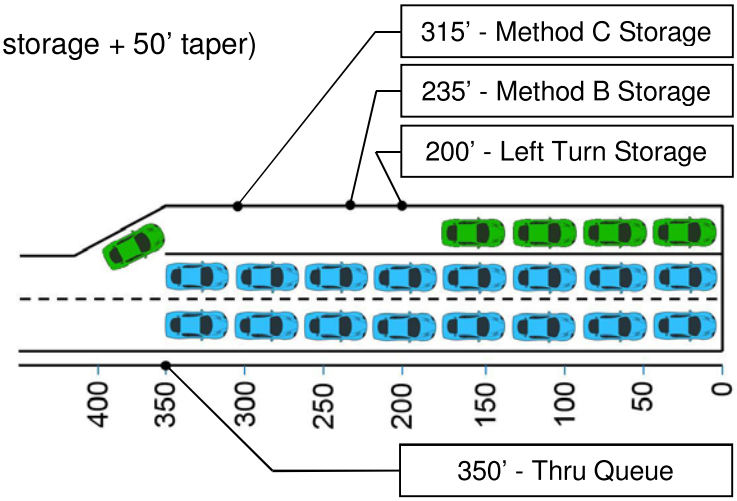
Method C – For 55 mph, 165' + calculated storage length in **Figure 401-10**.

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

Total Length = 165' + 200' = **365'** (315' storage + 50' taper)

Method C = **365'** > Method B = **285'**

Use Method C



Check Length for Thru-Block

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

680 veh/hr / 2 lanes = 340 veh/hr/ln

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

Thru Block = **350'** > Method C Storage = **315'** → **Turn Lane Blocked**

Use **350'** storage + **50'** taper = **400' Turn Lane Length**

TRAFFIC IMPACT STUDY

Licking Heights High School

Licking Heights Local School District

May 24, 2018

Prepared For:

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