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Traffic Study

City of Perrysburg, Wood County, Ohio

Prepared for
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1. EXECUTIVE SUMMARY

1a. Background

The study area lies within the City of Perrysburg, approximately one mile west of the downtown. The segment of US-20/SR-25 being studied is a four-lane, undivided roadway functionally classified as a Principal Arterial with a posted speed limit of 45 MPH. It serves as a regional connector linking the downtowns of the City of Perrysburg in Wood County to the City of Maumee across the Maumee River in Lucas County. US-20/SR-25 is commonly used as an alternative to other east-west routes such as I-80/I-90 and is one of the non-interstate routes that connect Wood and Lucas counties.

DGL Consulting Engineers, LLC (DGL) was commissioned by the City of Perrysburg to analyze the safety performance of US-20, Maumee Western Reserve Road, from the intersection of SR-25 to the city's corporation limits on the Maumee River. The primary focus of the study is to evaluate the safety performance of US-20 at the driveway entrance to Orleans Park on the north side of the roadway while also evaluating the safety performance of the intersection of US-20, SR-25, and W Front Street. The city has expressed interest in improving the existing park by increasing the number of amenities offered while preserving portions of the existing woodlands and wetland area. To confirm that the proposed park improvements will be an efficient use of available funds, the city wanted to pursue a study to ensure that traffic movements entering and exiting the park were safe for road users.

1b. Purpose & Need

According to the HSIP Priority Location List provided by ODOT, the only location within the study area that is listed is the intersection of US-20 and SR-25. This signalized intersection is ranked #881 for suburban intersections.

From 2017-2021, a total of 96 crashes occurred within the study area. According to ODOT's *Economic Crash Analysis Tool* (ECAT) the study area has a predicted crash frequency of 13.6 and an expected crash frequency of 17.1. Therefore, there is the potential for safety improvement.

1c. Overview of Possible Causes

Throughout the corridor, rear end crashes make up a majority of the crashes that occurred from 2017 to 2021 with a majority of crashes having a contributing factor of following too close. In terms of crash severity, the entire corridor had a crash result in injury approximately 30% of the time. One notable statistic is the intersection of US-20 & SR-25 had 46% of crashes occur on wet pavement, a higher percentage than dry pavement.

The travel lanes in the study area are 13 feet wide for the curb lanes and 12 feet for the inside travel lane. The intersections of Rapids Road and Orleans Park are minor road stop controlled while the intersection of US-20 & SR-25 is signalized.

The most prevalent contributing factor for crashes in the study area was following too close. This may be caused by the high-speed limit or the amount of traffic traveling through the corridor on a daily basis. There is a permanent counter, supplied by ODOT, on US-20 just west of the driveway for Orleans Park. Traffic count data was gathered for May 18th, 2022, with an AADT of 25,586.

1d. Recommended Countermeasures & Related Costs

Based on the results outlined in this study, the alternative that was found to offer the most positive outcomes is a Multi-Lane Roundabout at the intersection of US-20, SR-25, and W Front with the proposed connection to Southbound W Boundary. With this alternative, it can also be supplemented with pavement resurfacing to reduce the number of crashes that occur on wet pavement. This combination of alternatives offers the best results as it improves the average crash frequency of the corridor the most out of all of the alternatives presented and is the only alternative that is projected to operate at an acceptable Level of Service (LOS) for the intersection in the year 2042. While this alternative is projected to cost approximately $5.8 million and is the most expensive out of the alternatives presented, it offers the most operational and safety benefits for the corridor.

2. PURPOSE & NEED

DGL Consulting Engineers, LLC (DGL) was commissioned by the City of Perrysburg to analyze the safety performance of US-20, Maumee Western Reserve Road, from the intersection of SR-25 to the city's corporation limits on the Maumee River. The primary focus of the study is to evaluate the safety performance of US-20 at the driveway entrance to Orleans Park on the north side of the roadway while also evaluating the safety performance of the intersection of US-20, SR-25, and W Front Street.

The city has expressed interest to improve the existing park by increasing the number of amenities offered while preserving portions of the existing woodlands and wetland area. To confirm that the proposed park improvements will be an efficient use of available funds, the city wanted to pursue a study to ensure that traffic movements entering and exiting the park were safe for road users. In terms of the entrance to Orleans Park on US-20, the city expressed concerns regarding sight distance issues to the East and West of the park driveway as the segment being studied transitions from a mainly east-west travel direction at the driveway to a northeast-southwest travel direction to the east, and mainly a north-south travel direction to the west at the bridge.

Another concern brought forward by the city is the ability for vehicles to exit the park driveway given the amount of traffic present on US-20, especially during peak hours. Orleans Park currently has a boat launch onto the Maumee River toward the back of the park, behind the water treatment plant. Therefore, the likelihood of trucks with trailers entering and exiting this driveway is greater than the average study location and will be a major consideration throughout the study.

According to ODOT's GIS Crash Analysis Tool, a total of 96 crashes occurred within the stated study area from 2017-2021. The high frequency of crashes has contributed to the intersection of Maumee Western Reserve (US-20/SR-25), W Front, and W Boundary (SR-25) being ranked as the #881 suburban intersection on ODOT's HSIP Priority Location List. Using ODOT's *Economic Crash Analysis Tool* (ECAT), the study area has a predicted crash frequency of 13.6 and an expected crash frequency of 17.1 which suggests that there is the potential for safety improvement.

3. EXISTING CONDITIONS & BACKGROUND

The study area lies within the City of Perrysburg, approximately one mile west of the downtown. The segment of US-20/SR-25 being studied is a four-lane, undivided roadway functionally classified as a Principal Arterial with a posted speed limit of 45 MPH. It serves as a regional connector linking the downtowns of the City of Perrysburg to the City of Maumee across the Maumee River in Lucas County. US-20/SR-25 is commonly used as an alternative to other east-west routes such as I-80/I-90 and is one of the non-interstate routes that connect Wood and Lucas counties. The City of Perrysburg is one of the areas within the TMACOG region that continues to experience growth in business, population, and industrial development.

Included in the study area, is the intersection of US-20 and SR-25 which is a four-leg, signalized intersection. Similar to US-20, SR-25 is functionally classified as a Principal Arterial but has a posted speed limit of 40 MPH. While SR-25 primarily serves residential neighborhoods near the intersection with US-20, further south SR-25 serves a major commercial corridor which includes three car dealerships, a hospital, restaurants, and the Town Center at Levis Commons. According to ODOT's Highway Safety Improvement Program, this intersection ranks #881 for priority locations.

It should be noted that due to the study area's proximity to the Maumee River, portions of the roadway, most notably north of the US-20/SR-25, are as close as 50 feet to flood zones, according to FEMA. The boundaries of these flood zones are shown in the following figure.

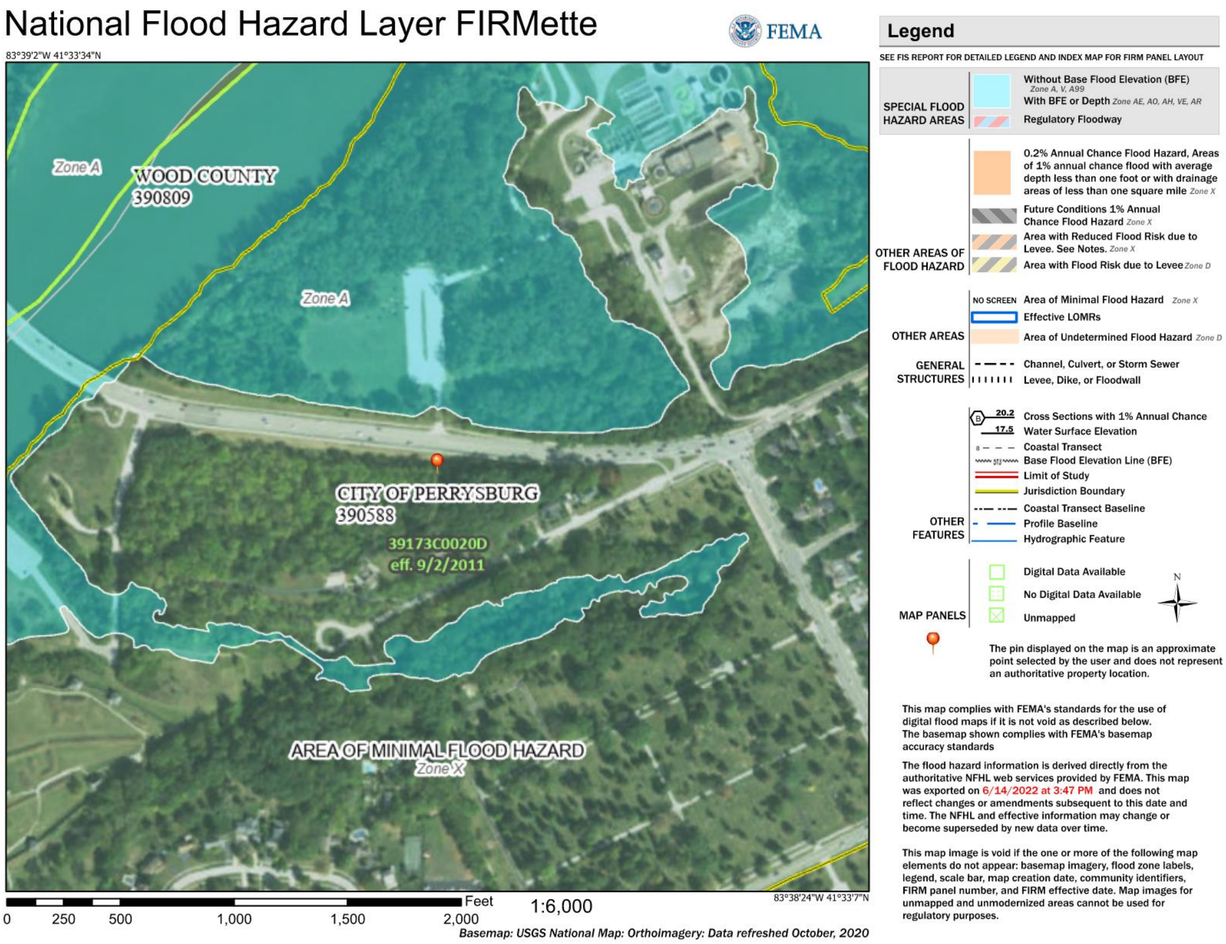


Figure 1 FEMA Firm Map

3a. Study Area Speed Limits

One aspect of the study that should be noted is the number of times a driver will experience changes in speed limits when entering, exiting, and traveling through the study area. East of the US-20 and SR-25 intersection, US-20 has a posted speed limit of 35 MPH and connects to the downtown of Perrysburg. As noted previously, the SR-25 approach to the intersection has a posted speed limit of 40 MPH and the western segment of the US-20 approach has a posted speed limit of 45 MPH. When driving westbound on US-20 toward the City of Maumee, the speed limit drops to 35 MPH on the bridge and then drops again to 25 MPH at Maumee's Downtown District where the city has pursued a streetscape projects that reduced the previous four lane roadway to three The speed limit sign locations can be seen in *Figure 2* to give added context.

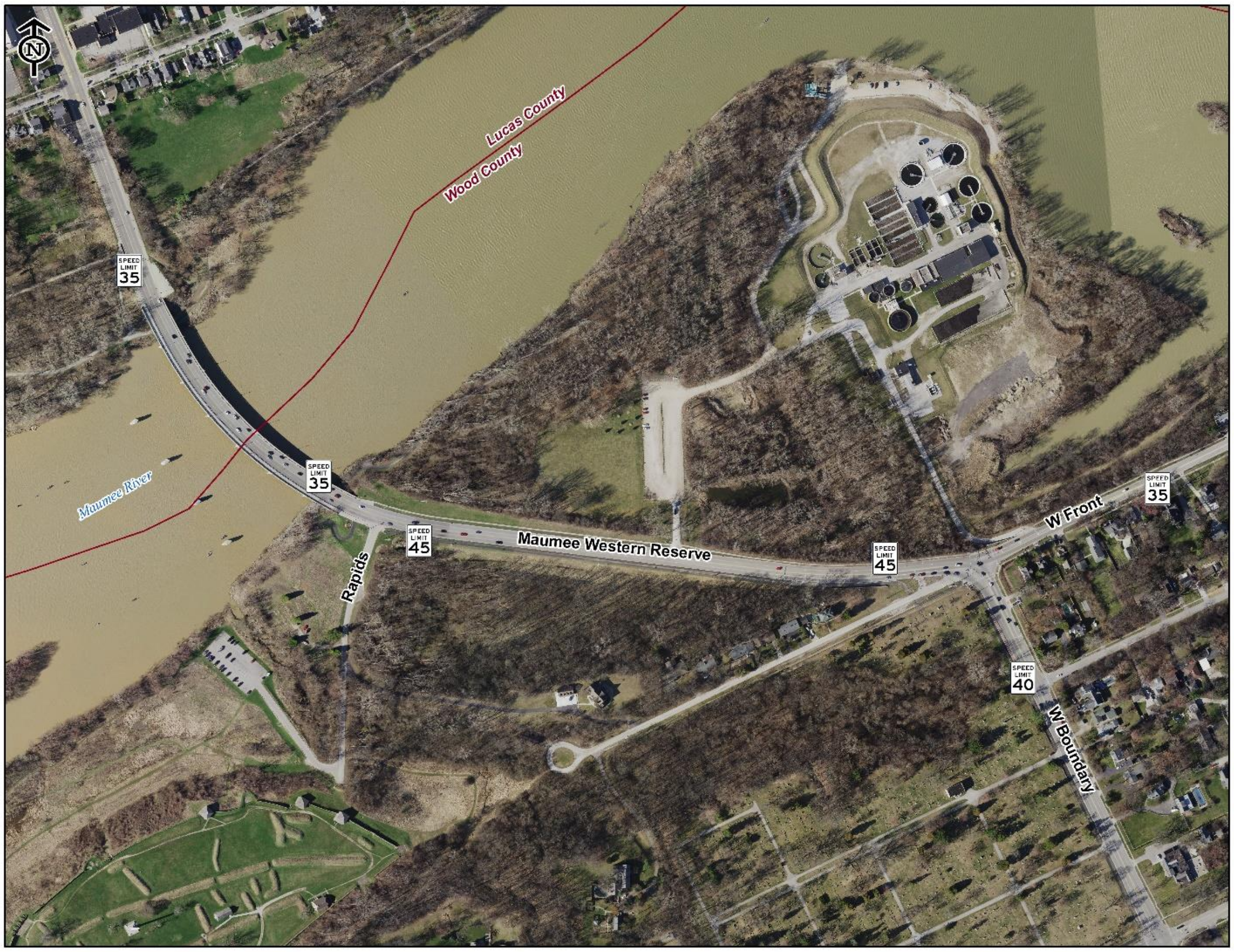


Figure 2 Maumee Western Reserve Corridor Speed Limits

3b. Existing Intersection Sight Distance

Prior to conducting the study, it was noted by the City of Perrysburg personnel that sight distance, particularly to the east, is an issue when drivers try to exit Orleans Park onto US-20. While the western half of the corridor doesn't have any notable sight distance concerns besides limited overgrowth, the eastern portion of US-20 slightly curves to the north when approaching the intersection with SR-25. This curve, when coupled with dense vegetation on the northern side of US-20 close to the sidewalk, creates sight distance issues and may inhibit a driver's ability to adequately judge gaps for the westbound, oncoming traffic. Therefore, DGL conducted a sight distance analysis for the driveway to Orleans Park to determine if the existing conditions are adequate based on standards outlined in the Location & Design Manual.

This analysis utilized the Intersection Sight Distance (ISD) metric that is included in the Location & Design Manual. As stated on ODOT's website, ISD is "the distance a motorist should be able to see other traffic operating on the intersecting roadway in order to enter or cross the roadway safely and to avoid or stop short of any unexpected conflicts in the intersection area

Because of the roadway geometry and the vegetation along the north side of US-20, there are two locations on the driveway that will be analyzed. It should be noted that there is no stop bar present on the driveway to Orleans Park. From an engineering perspective, vehicles should stop to check for gaps in traffic before the sidewalk. However, it was observed, through video and site visits, that almost every vehicle that exits Orleans Park onto US-20 stops in the driveway apron after the sidewalk. The existing sight distances for these two locations are included in the table below which also shows the ISD for various design speeds provided in the Location & Design Manual. Images taken by DGL staff are also included to provide added context to the sight distances for the existing conditions at Orleans Park. The sections of the Location & Design Manual used for this analysis, as well as other design standards used throughout this report, can be found in *Appendix A*.

Table 1 Orleans Park Driveway Sight Distance Data

Existing Conditions	
West Leg Approach	
Location	Sight Distance (feet)
Behind Sidewalk (20 ft. from edge)	982
On Sidewalk (14 ft. from edge)	1,180
East Leg Approach	
Location	Sight Distance (feet)
Behind Sidewalk (20 ft. from edge)	245
On Sidewalk (14 ft. from edge)	465

Location & Design Standards		
Major Road Design Speed (MPH)	ISD (feet) for Left Turn	ISD (feet) for Right Turn
35	390	335
40	445	385
45 *(Posted Speed Limit)*	**500**	**430**
50 *(85th Percentile Speed)*	**555**	**480**

Figure 3 Orleans Park Driveway Sight Distance – Behind sidewalk, looking East

Figure 4 Orleans Park Drive Sight Distance – Behind sidewalk, looking West

Figure 5 Orleans Park Drive Sight Distance – On sidewalk, looking East

Figure 6 Orleans Park Drive Sight Distance – On sidewalk, looking West

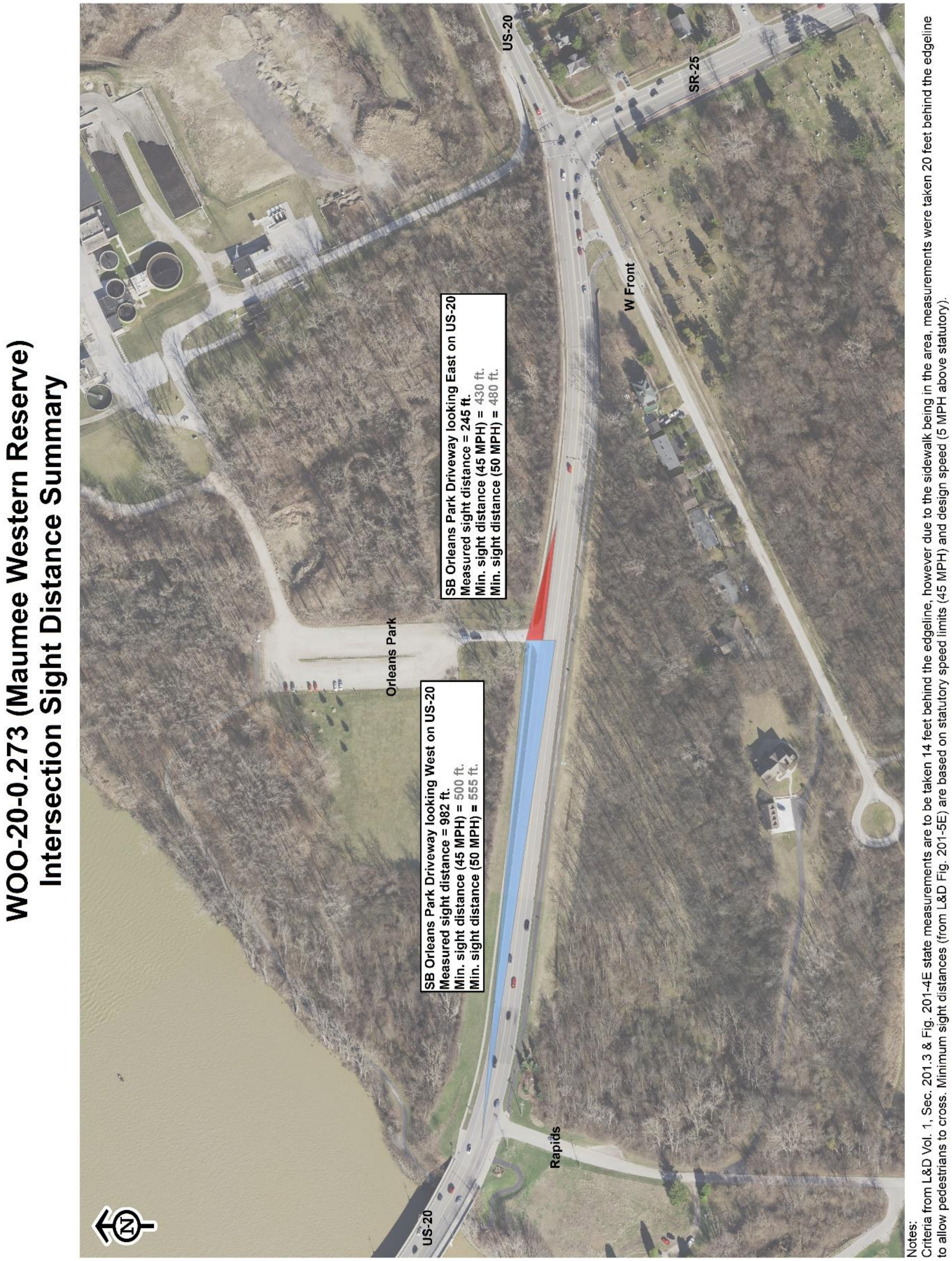


Figure 7 Orleans Park Driveway Intersection Sight Distance Summary

4. TRAFFIC VOLUMES

According to ODOT's *Transportation Data Management System* (TDMS, or MS2), Annual Average Daily Traffic (AADT) information for each leg of the intersection of US-20 & SR-25, as well as the segment of US-20/SR-25 being studied, is shown in the table below during the most recent year traffic volume data was collected.

Table 2 US-20 & SR-25 Traffic Volumes

	US-20 West Leg	SR-25 South Leg	US-20 East Leg
Year	2022	2021	2021
AADT	25,586	15,996	12,789
% Trucks	2%	2%	1%

Turning movement counts were also conducted by DGL for the intersection of US-20 & SR-25 and the intersection of US-20 and the driveway for Orleans Park on Wednesday, 5/18/2022 to collect the traffic count data for the 9 highest hourly volumes (7:00-9:00, 11:00-13:00, and 15:00-20:00). The drive to the Wastewater Treatment Plant was included in the US-20 & SR-25 intersection count. It was desired to collect the traffic count data before the end of the school year so that school traffic was included. A summary of this traffic count data can be found in Appendix B.

Traffic was expanded to the Design Year 2042 using an annual growth rate of 0.6% collected from the ODOT SHIFT Tool.

Since the intersection of US-20 & SR-25 is already signalized, this study will evaluate the design criteria for a roundabout. For the intersection of US-20 and the Orleans Park driveway, the following countermeasures were considered during this study:

- All-way Stop Control
- Traffic Signal
- Two-Way-Left-Turn-Lane (TWLTL)
- Roundabout

The traffic volumes were analyzed to determine if any of the countermeasures met warrants. The warrant evaluations for each countermeasure followed the procedures according to the applicable various ODOT manuals, including the following:

- *Location & Design Manual* (L&D)
- *Ohio Manual of Uniform Traffic Control Devices* (OMUTCD)
- *Traffic Engineering Manual* (TEM)

A table comparing the results of the warrants for each countermeasure is provided below. Details of the warrant summaries for each countermeasure can be found in Appendix C.

Table 3 US-20 & Orleans Park Driveway Intersection Countermeasures	
Countermeasure	**Warrants Met**
All-way Stop Control	No [A]
Traffic Signal	No [B]
Left Turn Lane	Yes [C]
Roundabout	Multi-lane Roundabout required [D]

[A] The vehicular volume for the major street approaches was above the warrant threshold, but the minor street approach does not meet the warrant threshold of at least 200 units per hour, as set forth in the OMUTCD Section 2B.07

[B] Warrant 8, Roadway Network was the only signal warrant met based on the traffic counted. Warrant 8 cannot be used as the sole warrant in the analysis.

[C] Left Turn Lanes were not warranted for a 4-lane Highway but were warranted for 2-lane Highways with any posted speed limit.

[D] A Multi-lane Roundabout was suggested based on the thresholds stated in the L&D Figure 403-1 and confirmed through traffic modeling based on the results from the LOS/Delay analysis.

5. CRASH DATA

Since this study includes an approximately half-mile segment of US-20/SR-25 and the intersection of US-20, W Front and SR-25, each location's crash data will be presented separately to provide a more detailed and accurate picture of the crash trends. Crash data was gathered from 2017-2021 using ODOT's GIS Crash Analysis Tool (GCAT). Crash data was then evaluated to ensure the data presented is as accurate as possible. The locations of crashes can be seen in the following section called Collision Diagrams.

Table 4 US-20 & SR-25 Crash Data

YEAR	CRASHES
2017	11
2018	13
2019	13
2020	12
2021	12

TYPE OF CRASH	
59%	Rear End
16%	Fixed Object
7%	Sideswipe - Passing
7%	Left Turn
5%	Right Turn

TIME OF DAY	
62%	Day
38%	Night

CRASH SEVERITY	
72%	Property Damage Only
28%	Injury
0%	Fatal

PAVEMENT CONDITION	
46%	Wet
43%	Dry
5%	Snow
5%	Ice

CONTRIBUTING FACTOR	
54%	Following too close
18%	Other Improper Action
7%	Drove off Road
5%	Improper Lane Change
5%	Improper Turn

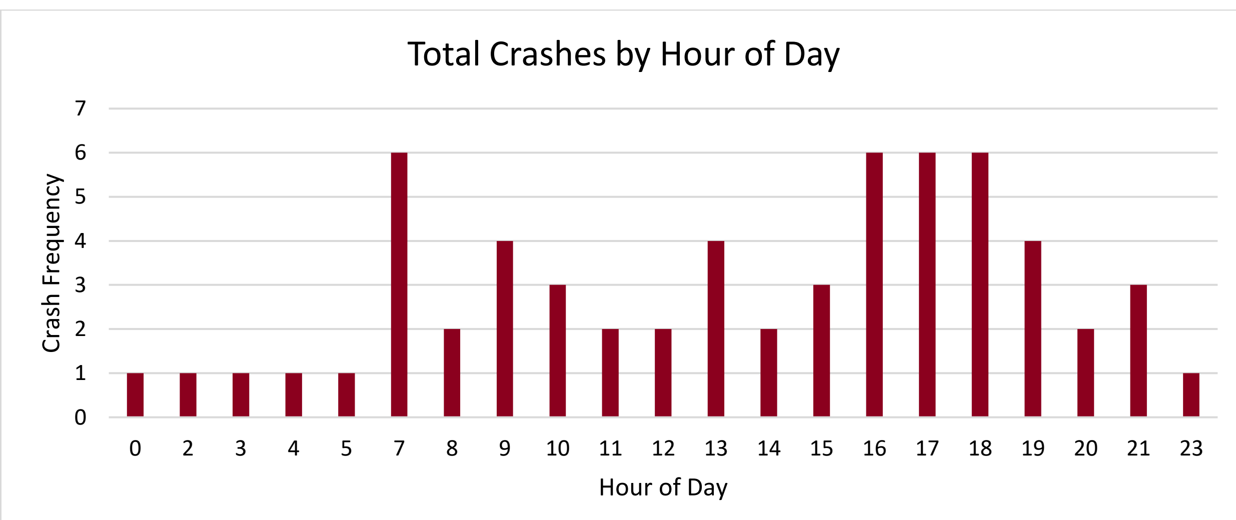


Table 5 US-20 (0.056 - 0.44) Crash Data

YEAR	CRASHES
2017	7
2018	8
2019	5
2020	6
2021	9

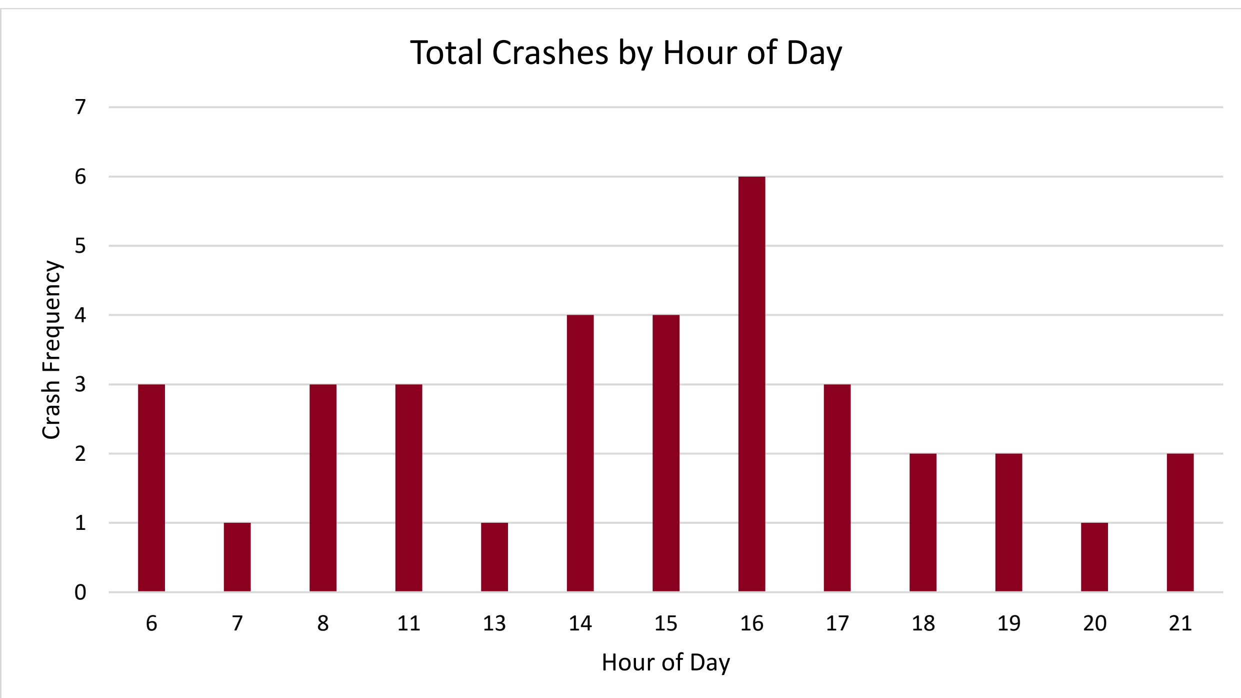
TYPE OF CRASH	
60%	Rear End
14%	Fixed Object
14%	Sideswipe - Passing
3%	Pedalcycles
3%	Left Turn

TIME OF DAY	
91%	Day
9%	Night

CRASH SEVERITY	
63%	Property Damage Only
37%	Injury
0%	Fatal

PAVEMENT CONDITION	
17%	Wet
71%	Dry
6%	Snow
6%	Ice

CONTRIBUTING FACTOR	
57%	Following too close
9%	Improper Lane Change
9%	Other Improper Action
6%	Drove off Road
6%	Failure to yield



6. COLLISION DIAGRAMS

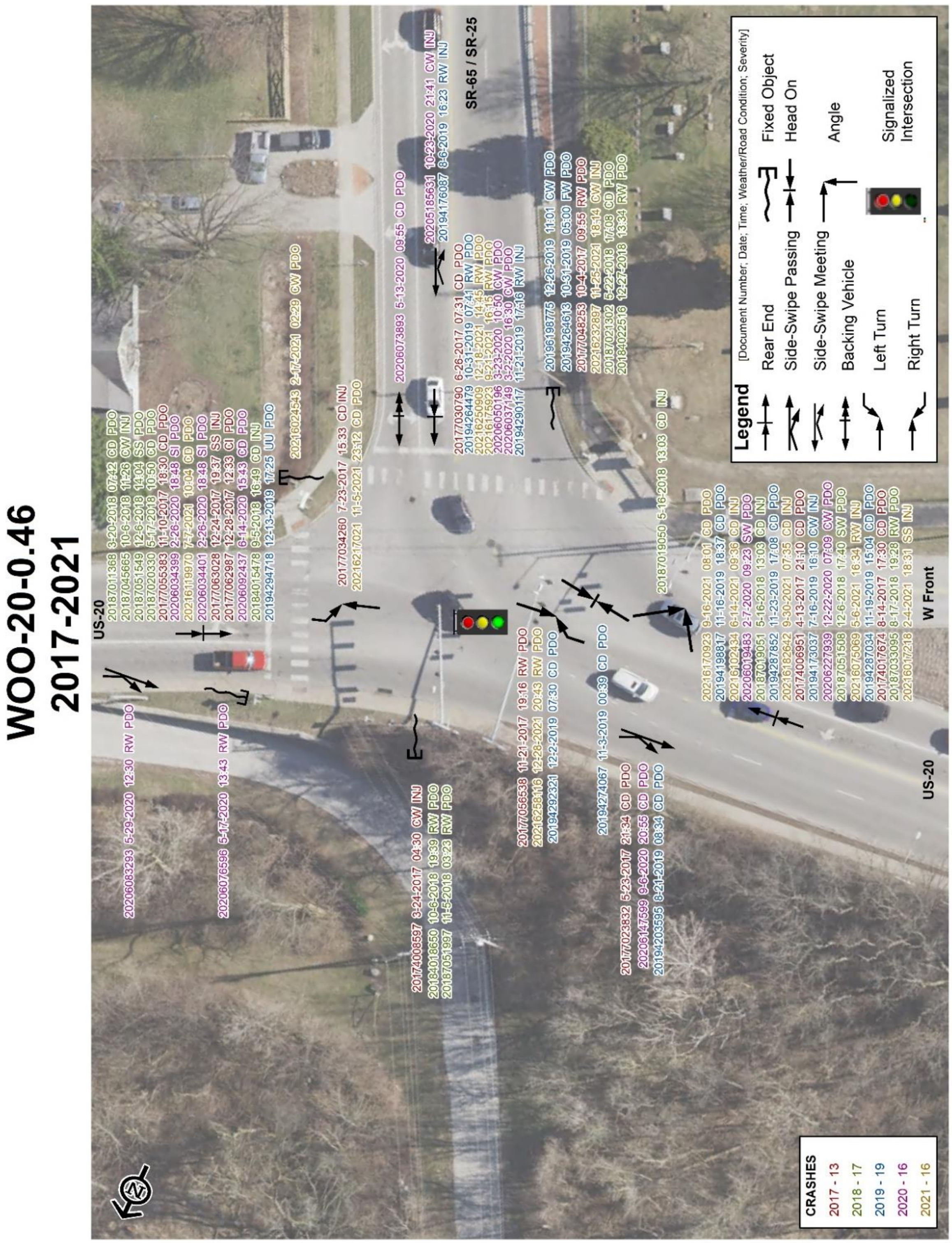


Figure 8 US-20 & SR-25 2017-2021 Collision Diagram

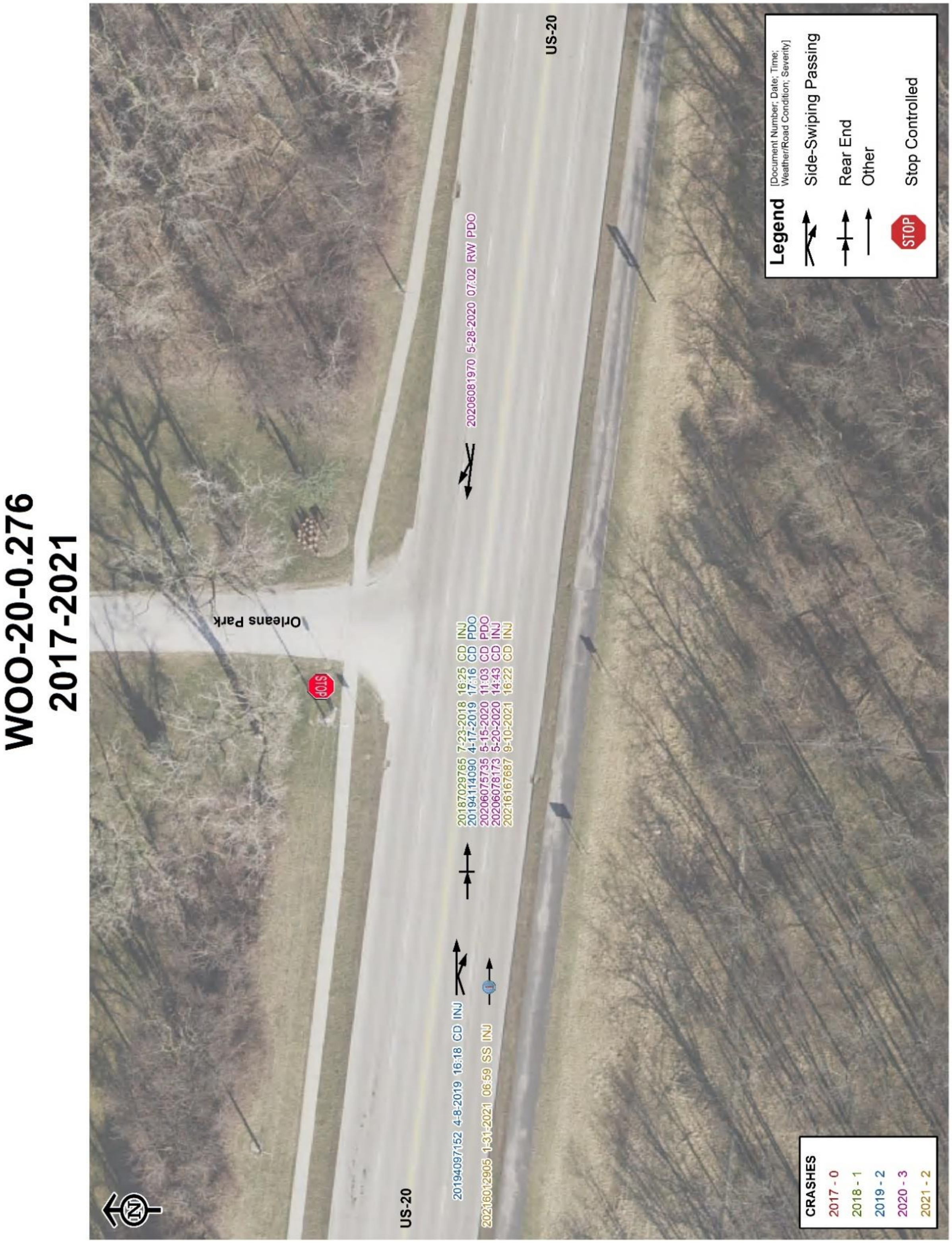


Figure 9 US-20 & Orleans Park Driveway 2017-2021 Collision Diagram

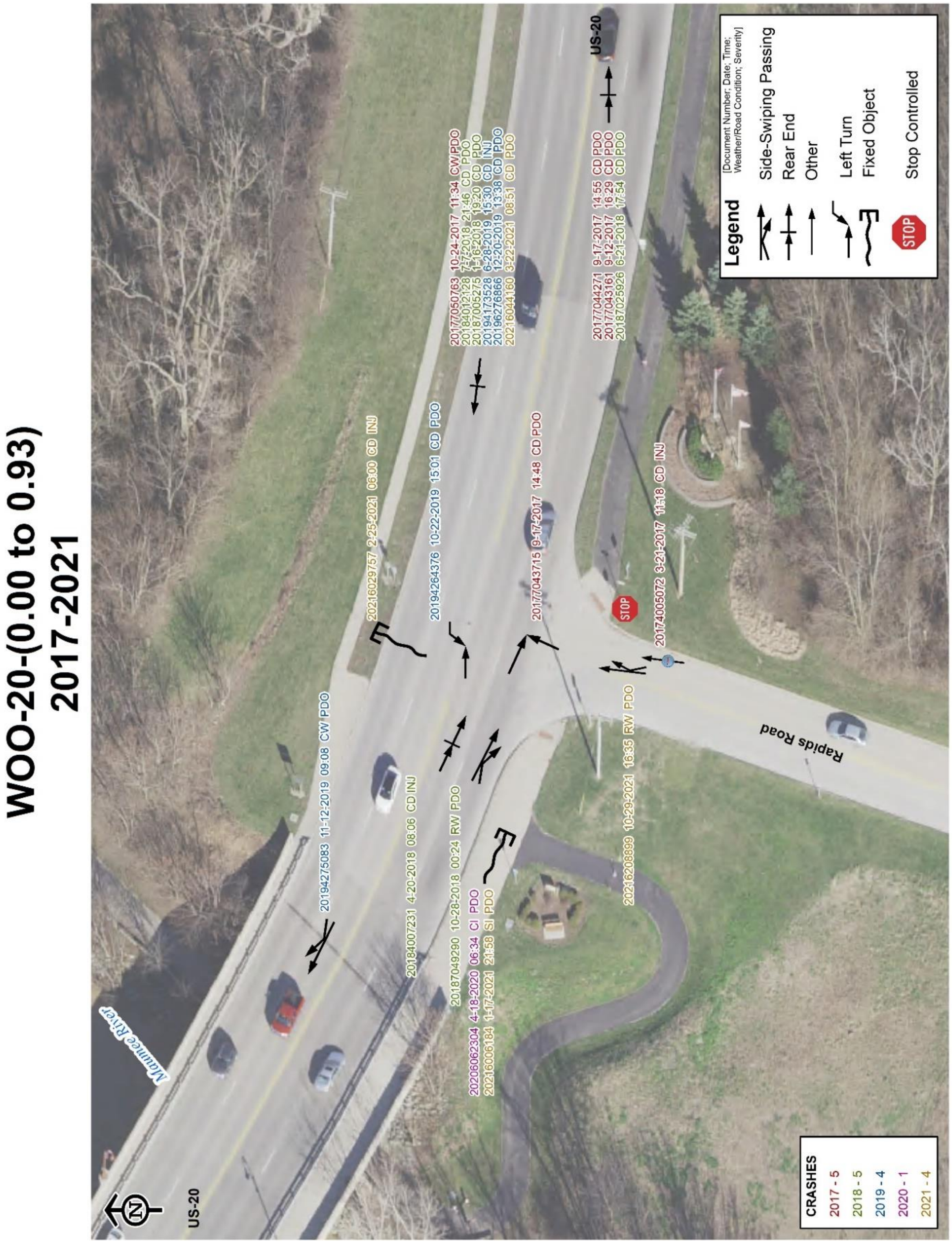


Figure 10 ***US-20 & Rapids Road 2017-2021 Collision Diagram***

7. PROBABLE CAUSES

Since the study area is not homogenous throughout the entire corridor, the probable causes for vehicle crashes will be separated. The first set of causes will include the crashes that occurred at the intersection of US-20 and SR-25 and the second set will include the crashes that occurred throughout the corridor of US-20 from the Perrysburg-Maumee bridge to intersection of US-20 and SR-25.

Probably Causes: US-20 & SR-25

1. The majority of crashes happen in the afternoon and evening (13:00-19:00), which roughly coincides with the hours which have the highest traffic volumes. This could mean that many of the crashes are correlated to the relatively higher traffic volumes during those hours.
2. The majority of crashes occurred when the pavement was wet or had snow or ice, which is about 24% over the statewide average. This could mean that the pavement friction is not sufficient to keep cars on the roadway.
3. The contributing factor for a majority of the crashes was following too close on each approach. This could mean that drivers are going too fast and cannot brake in time to avoid a collision.
4. The roadway geometry is slightly skewed on the eastbound approach of US-20. This could inhibit a driver's ability to judge oncoming traffic and contribute to left turn and angle crashes.
5. Fixed object crashes accounted for approximately 16% of crashes, 13% more than the statewide average. These departures from the roadway could be caused by a variety of factors including, low friction pavement (item #2), the skew angle of the intersection (item #4), and/or unsafe speeds (item #3).

Probable Causes: US-20 Corridor

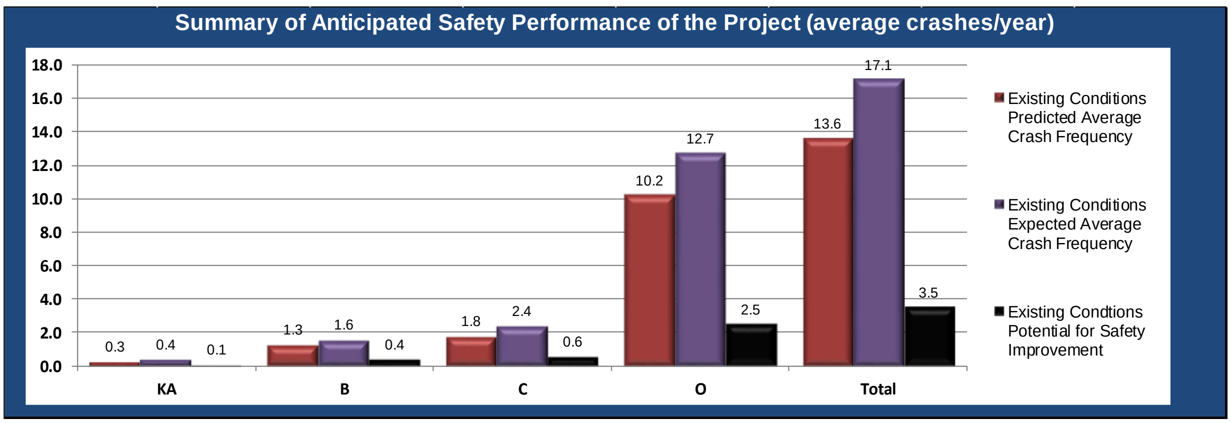
1. The majority of crashes happen in the afternoon and evening (14:00-19:00), which aligns with the hours which have the highest traffic volumes. This could mean that many of the crashes are correlated to the relatively higher traffic volumes during those hours.
2. The majority of crashes were rear end crashes and, for the most part, occurred at the driveway to Orleans Park or the intersection at Rapids Road. This could mean that drivers are travelling too fast to brake for a stopped vehicle in front of them that is attempting to turn onto those roadways.
3. Drivers on US-20 trying to turn left into Orleans Park or Rapids Road may find it difficult to find gaps in traffic to make their turn. They may become impatient and cross during insufficient gaps in traffic, resulting in angle or left turn crashes.
4. Injury crashes accounted for 37% of all crashes in the corridor, an increase of 9% when compared to the intersection of US-20 & SR-25. This could be caused by an increase in the speed limit to 45 MPH from 35 MPH (Front Street) and 40 MPH (W Boundary Street).

8. HIGHWAY SAFETY MANUAL EXISTING CONDITIONS

Highway Safety Manual (HSM) calculations were completed using the methodology for urban & suburban arterial segments and intersections. A table and bar graph summarizing the calculated crash frequencies are provided below.

Table 6 HSM Analysis: Existing Conditions

	US-20 Corridor & US-20/SR-25 Intersection
Predicted Average Crash Frequency	13.6
Expected Average Crash Frequency	17.1
Expected Excess Crashes	3.5
Potential for Safety Improvement?	**YES**



9. RECOMMENDED COUNTERMEASURES

The following table outlines the recommended countermeasures for the study area. Further discussion of the countermeasures can be found in the following sections.

ID #	Countermeasure	Crash Type Affected	Crash Reduction	Timeline
Alt. 1	Lane Reconfiguration	All	56%	Short Term
Alt. 2	All-Way Stop Control @ US-20/SR-25 & Orleans Park	Injury; PDO	23%; 32%	Short Term
Alt. 3	Improve pavement friction	Wet Road	57%	Medium Term
Alt. 4	Install median on US-20/SR-25 Corridor	All	29%	Long Term
Alt. 5	Roundabout @ US-20 & SR-25	Injury; PDO	29%; 74%	Long Term
Alt. 6	Roundabout @ US-20/SR-25 & Orleans Park	Injury; PDO	22%; 71%	Long Term

Table 7 Recommended Countermeasures

9a. Short Term Countermeasures

Alternative 1: Convert 4-lane corridor into 2-lane with Two-way Left Turn Lane (TWLTL) and reduce speed limit

This conversion is considered a short-term countermeasure because of the low cost and short time it can take to implement. According to the HSM, converting the existing 4-lane roadway into a 2-lane roadway with a two-way left turn lane would reduce all crash types by 19% - 47% within the segment being studied. This traffic calming strategy affects the roadway and its users in a few main ways. First, it limits drivers' ability to travel in ways that increase the risk of a crash such as passing sideswipes and excessive speeding. Second, it provides a refuge for vehicles that are pursuing conflicting turning movements into areas along the corridor such as left turns into Orleans Park or onto Rapids Road where rear ends are a common occurrence at these intersections. It is also possible to include refuge islands for pedestrians in the design when left turn lanes are not necessary. Third, this strategy provides better integration of the roadway into surrounding uses that result in an enhanced quality of life. As mentioned previously, a driver would go through several speed limit changes driving through the corridor based on where they started. This reconfiguration and reduction in speed limit would better align with the surrounding roads and make it safer for other modes of transportation to travel to and through the area.

This roadway reconfiguration is considered, by the Federal Highway Administration (FHWA), a Proven Safety Countermeasure and provides safer roadway conditions and supports mobility for all users. With Orleans Park on the north side of the corridor, and the City of Perrysburg's intentions to improve the park, it may be desirable to accommodate other modes of travel and align to the 'Complete Streets' policies supported by the FHWA and ODOT. By reducing the number of lanes and the speed limit, the roadway is much safer for other users and improves the accessibility to Orleans Park and the trails surrounding Fort Meigs that is serviced by Rapids Road.

ODOT's *Economic Crash Analysis Tool*, or ECAT, was used to evaluate the safety impacts of this countermeasure. The results show that the number of average annual crashes would decrease from 17.1 expected crashes per year to 15.6 predicted crashes per year. This is summarized in the following figure.

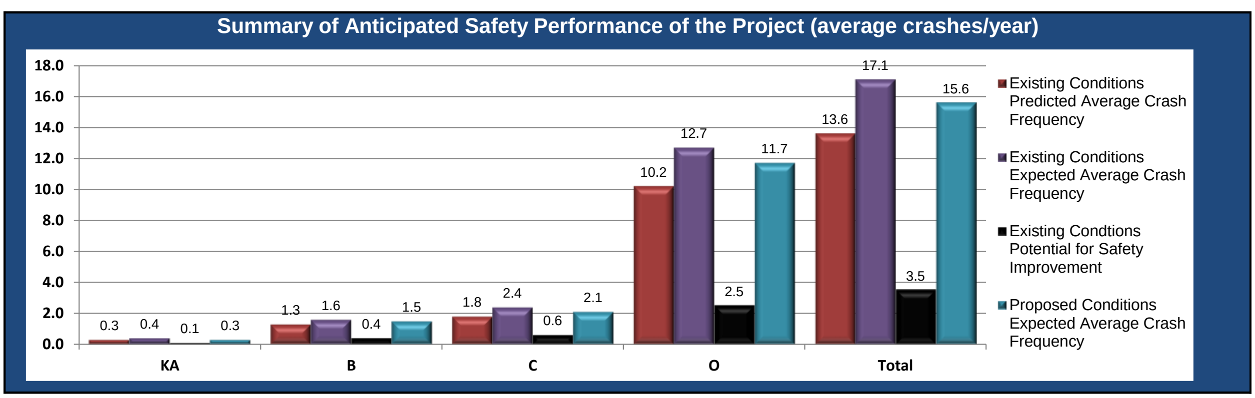


Figure 11 Alternative 1 ECAT

There is one notable caveat from a traffic perspective worth mentioning for this alternative. Because a lane is being dropped in each direction of travel, the effective storage capacity of the roadway is reduced and the possibility of backups could increase, most notably on the eastbound movement east of the Orleans Park entrance. This is because the approach at the intersection of SR-25 has dedicated lanes for the through movement to continue onto US-20 and the right turn movement onto SR-25 that must remain intact to adequately serve the intersection. If one of the lanes backs up to the diverging taper then the backup will continue down the approach since vehicles may not be able to access one lane or the other.

Alternative 2: Convert the intersection at US-20 & Orleans Park Driveway to all-way stop control

All-way stop control is considered a short-term countermeasure because of the low cost and short time it can take to implement, although it could also be implemented as an interim solution during the time it takes to design and construct one of the long term countermeasures. While this alternative addresses the concerns of drivers attempting to make left turns out of Orleans Park, it does not address many of the crashes that occurred over the past 5 years. The all-way stop control typically has the largest crash reductions for angle and left turn crashes, none of which occurred according to the crash data gathered. It is also not recommended to combine this alternative with the lane reconfiguration stated previously. The *ECAT* evaluation supports this by showing that the number of average annual crashes would decrease from 17.1 expected crashes per year to 16.5 predicted crashes per year. This is summarized in the following figure.

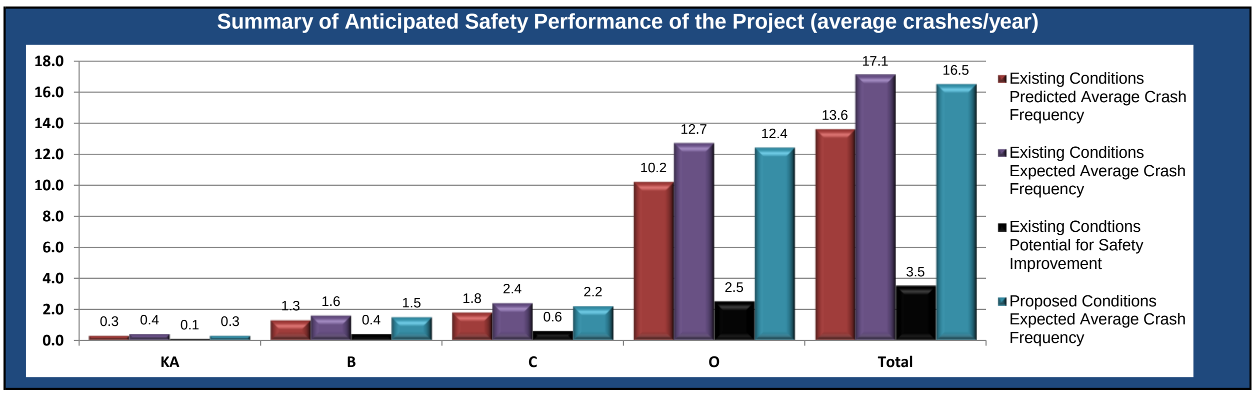


Figure 12 Alternative 2 ECAT

While this alternative does increase the safety performance of the intersection and the ability for traffic leaving Orleans Park to safely make left turns to return to the City of Perrysburg, an all-way-stop-control intersection does not make sense from a traffic perspective. This is because almost all of the traffic at this intersection are using the through movements when compared to the turning movements for both approaches. By making all traffic stop at the entrance to Orleans Park, congestion and delay would drastically increase and cascade to negatively impact the traffic to the east at the intersection of US-20 & SR-25 as well as to the west as vehicles travel from Maumee to Perrysburg.

9b. Medium Term Countermeasures

Alternative 3: Improve pavement friction at intersections

Improving the pavement friction would reduce the number of rear end crashes as well as crashes that occur on wet roads. The increase in pavement friction would assist drivers that lose control of their vehicle during or immediately following inclement weather or drivers that attempt to brake before hitting another vehicle or object that is in front of them or in a different lane. This countermeasure can also be used in conjunction with other recommended countermeasures to further mitigate the risk of crashes throughout the corridor.

By improving the pavement friction at key areas, most notably at the intersection of US-20 & SR-25, the risk of crashes on wet roads crashes is reduced by approximately 43% according to the HSM. The *ECAT* evaluation for this countermeasure showed that the number of average annual crashes would decrease from 17.1 expected crashes per year to 15.9 predicted crashes per year. This is summarized in the following figure.

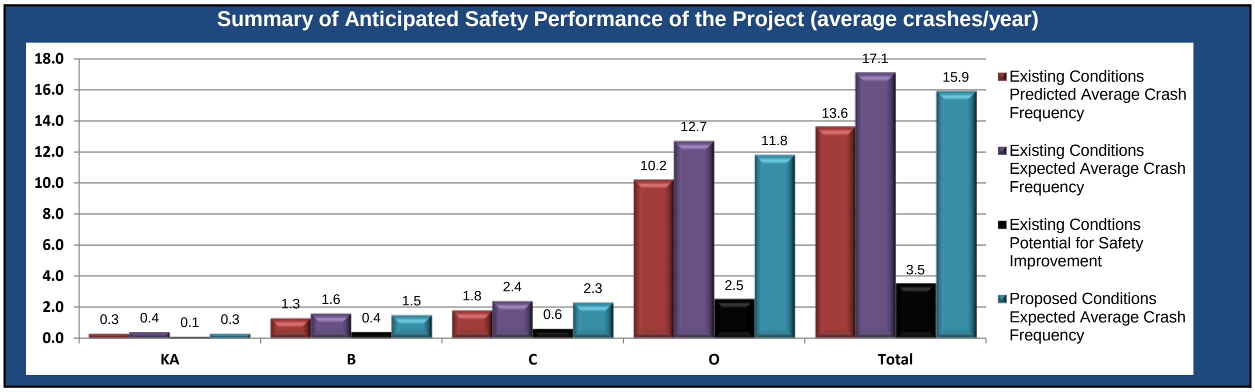


Figure 13 Alternative 3 ECAT

9c. Long Term Countermeasures

Alternative 4: Construct median in the US-20 corridor (and reduce speed limit) and connect Southbound W Boundary Street/Orleans Park Entrance to signalized intersection at US-20 & SR-25

Installing a median in the US-20 corridor would prohibit left turns throughout the corridor, including at the current Orleans Park entrance, and limit the conflicts associated with those movements. This would mitigate crashes resulting from those prohibited left turns such as angle crashes or rear end crashes that specifically occur at the two intersections in the corridor. Based on the HSM, the median would reduce crashes within the corridor by 29%. The *ECAT* evaluation for this alternative showed that the number of average crashes would decrease from 17.1 expected crashes per year to 14.5 predicted crashes per year. This is summarized in the following figure.

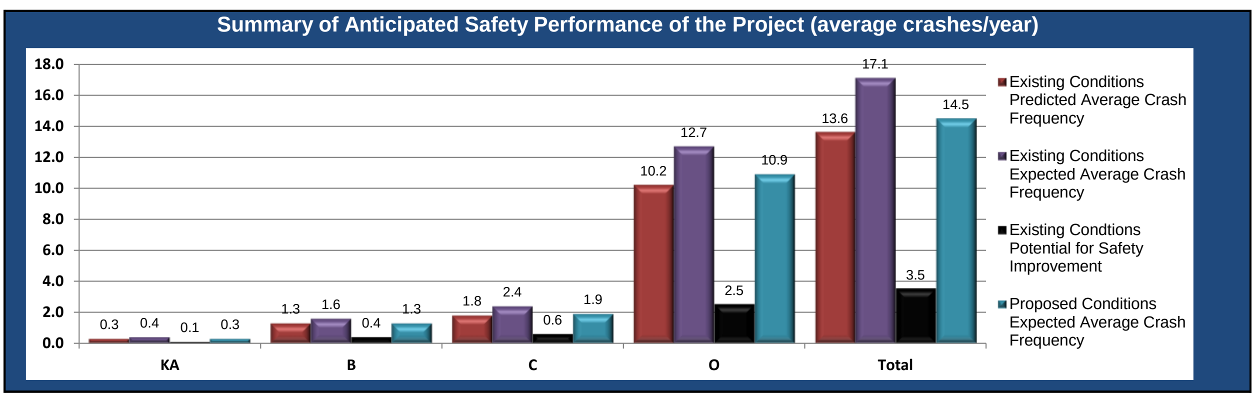


Figure 14 Alternative 4 ECAT

The construction of a median can also be supplemented with the lane reconfiguration mentioned in the short term countermeasures. By pursuing this strategy, drivers would be even more limited in the number of conflicting movements they can make on US-20. With the addition of the median to the lane reconfiguration, the *ECAT* evaluation for this alternative showed the number of average annual crashes would decrease from 17.1 expected crashes per year to 14.3 predicted crashes per year. The addition of the lane reconfiguration only reduces the expected average crash frequency by 0.2 because the median and lane reconfiguration address similar crash types thus having a level of diminishing returns.

This alternative would not be desirable for a few main reasons. First, connecting southbound W Boundary into the signalized intersection at US-20 & SR-25 would be difficult to implement due to the wetland area north of the current intersection. Second, the drop in elevation from the current intersection to the current ground level of southbound W Boundary would require approximately 450 of new road to be constructed. Third, the introduction of an additional approach to the already 5-leg intersection at US-20 & SR-25 would require adjusting the current signal timing and possibly increasing the amount of congestion at the intersection by reducing the amount of green time on the eastbound, northbound, and westbound approaches. An increase in congestion has the potential to lead to more crashes if this alternative is pursued.

Alternative 5: Construct multi-lane roundabout at the intersection of US-20 & SR-25

Of all the alternatives, the multi-lane roundabout by far provides the most improvement to the safety and operational performance of the intersection. The slow entry speed and geometrics of the roundabout reduce 74% of PDO crashes and 29% of fatal and injury crashes, according to the HSM. The *ECAT* evaluation for this alternative showed that the number of average annual crashes throughout the corridor would decrease from 17.1 expected crashes per year to 9.6 predicted crashes per year, a 44% reduction in total crashes.

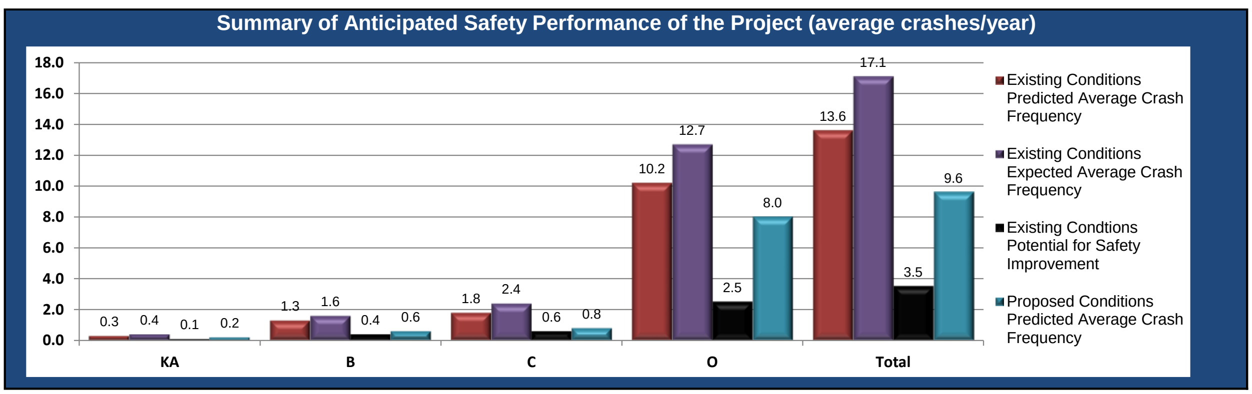


Figure 15 Alternative 5 ECAT

Alternative 6: Construct multi-lane roundabout at US-20 and Orleans Park Driveway and reduce speed limit

Installing a multi-lane roundabout at the Orleans Park Driveway would mitigate several risk factors that have been observed or noted by city officials. The roundabout would make the park more accessible to drivers as well as easier to exit the park. First, the roundabout makes the driver have to judge gaps from only one direction, thereby making left turns an easier movement to pursue. The slow entry speed also makes judging gaps easier by slowing traffic down on the approach, rather than vehicles speeding on SR-25/US-20 up as they currently do. The slower speeds also effectively reduces the sight distance needed to make the movement into the roundabout, thereby reducing the impact of the sight distance issue previously noted. Additionally, the roundabout would be designed to accommodate trucks and trailers, so movements pursued by those vehicles would be easier to make. The *ECAT* evaluation for this alternative showed that the number of average annual crashes throughout the corridor would decrease from 17.1 expected crashes per year to 13.2 predicted crashes per year, a 23% reduction in total crashes.

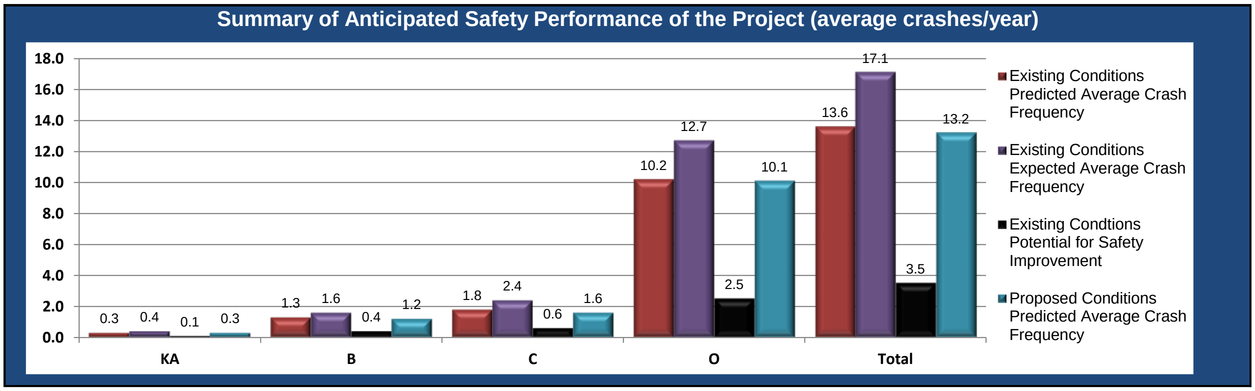


Figure 16 Alternative 6 ECAT

Based on the guidance provided for roundabout sizing in the L&D, it is recommended that the roundabout would require two or more entry lanes because of the high number of vehicles that travel through the area. This is supported by the HCS analysis when comparing a single lane to a multi-lane roundabout. A single lane is projected to have a 33.9 second delay and a LOS of D on the eastbound approach and a 302.9 second delay and LOS of F on the westbound approach during the PM peak hour. Because of this, a single lane roundabout should not be included in a road reconfiguration at the Orleans Park Driveway.

From a traffic perspective, a multi-lane roundabout accomplishes many of the goals outlined by the City of Perrysburg. A roundabout would lower vehicle speeds entering the intersection and reduce the crashes that occur because of vehicle turning movements. The roundabout would also make traffic movements exiting Orleans Park easier to pursue since drivers have to only negotiate gaps on one approach, rather than two. The roundabout can also be designed to accommodate vehicles towing trailers which is a major benefit since the park has a boat launch behind the water treatment plant.

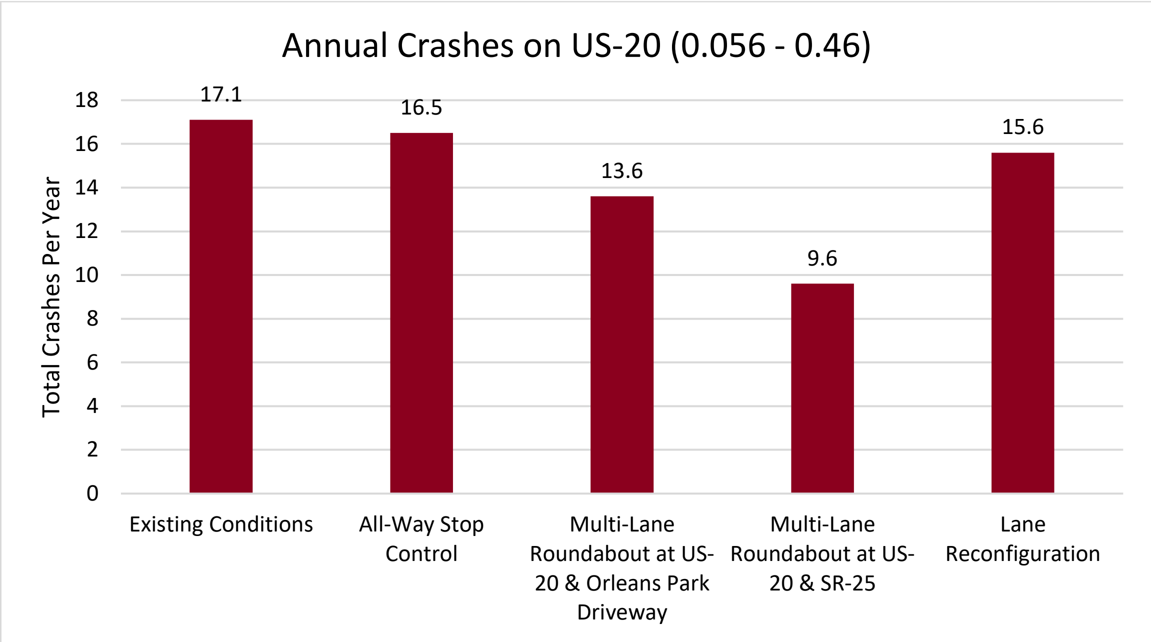
9d. Comparison of Alternatives

The figure on this page compares the predicted annual number of crashes for each alternative in relation to the current conditions.

Table 7 Comparison of Alternative Countermeasures

Alternative Options	Annual Crashes	Estimated Cost	Problem(s) Addressed
Existing Conditions	17.1[E]	$0	N/A
(1) Convert 4-lane undivided highway to 2-lane highway with TWLTL	15.6[P]	$170,000	Reduce conflict points for park traffic
(2) All-Way Stop Control at Orleans Park Entrance	16.5[P]	$5,000	Safer and easier ingress/egress to park
(3) Resurface roadways to increase pavement friction at intersections	15.9[P]	$185,000	Reduce wet pavement crashes
(4) Construct Median on US-20 with RIRO at Orleans Park and connect SB W Boundary to existing intersection	14.3[P]	$1M	Safer and easier ingress/egress to park
(5) Multi-Lane Roundabout at US-20 & SR-25	9.6[P]	$5.8M	Safer and easier ingress/egress to park and improve LOS/Delay, Reduce wet pavement crashes
(6) Multi-Lane Roundabout at US-20 & Orleans Park Driveway	13.6[P]	$2.5M	Safer and easier ingress/egress to park

E = Expected Crashes; P = Predicted Crashes



9e. Intersection Analysis

The level of service (LOS) is a way to classify the intersection on a scale of A to F, from a functional standpoint. Intersections and approaches are assigned an overall grade based on traffic volumes, capacity, and overall delay experienced by drivers.

Capacity Analysis was conducted for various geometric and traffic control alternatives for the intersections of US-20 at Orleans Park and SR-25/W Boundary Street. Synchro 9 Software was used to determine the LOS for signalized scenarios at all intersections, while the stop-controlled intersections were analyzed using HCS 2022. LOS is generally identified for each movement or approach. LOS C is considered acceptable in all conditions, while LOS D is considered acceptable in congested urban areas, such as interchanges and commuter corridors. For Two-Way Stop controlled intersections, the LOS is undefined for the overall intersection.

Table 8 Intersection Level Of Service And Delay (in seconds)

Signalized Intersection				Unsignalized Intersection		
A	<=	10s		A	<=	10s
B	>	10-20s		B	>	10-15s
C	>	20-35s		C	>	15-25s
D	**>**	**35-55s**		**D**	**>**	**25-35s**
E	**>**	**55-80s**		**E**	**>**	**35-50s**
F	**>**	**80s**		**F**	**>**	**50s**

The following table compares the HCS delay results for each alternative by approach during the AM & PM peak hours. Detailed summaries of the HCS evaluations can be found in Appendix D.

Table 9 LOS/Delay Analysis

		2022 Existing Conditions	2042 Existing Conditions	2022 Alt.1 Road Reconfiguration	2042 Alt. 1 Road Reconfiguration	2022 Alt. 2 All-Way Stop Control	2042 Alt. 2 All-Way Stop Control	2022 Alt. 4 Construct Median with Prop. Intersection	2042 Alt. 4 Construct Median with Prop. Intersection	2022 Alt. 5 Roundabout at US-20 & SR-25	2042 Alt. 5 Roundabout at US-20 & SR-25	2022 Alt. 6 Roundabout at US-20 & Orleans Park	2042 Alt. 6 Roundabout at US-20 & Orleans Park
US-20 & Orleans Park - Unsignalized													
AM Peak	EB	A (0.0)	A (0.0)	A (0.0)	A (0.0)	F (59.2)	F (100.6)	A (0.0)	A (0.0)	-	-	A (6.3)	A (6.5)
	WB	A (0.0)	A (0.0)	A (0.0)	A (0.0)	F (71.3)	F (178.2)	A (0.0)	A (0.0)	-	-	A (6.7)	A (7.0)
	SB	C (21.9)	B (12.9)	C (24.9)	D (33.8)	A (9.8)	A (9.7)	B (14.2)	A (2.0)	-	-	A (7.1)	A (7.8)
	Overall	**A (0.1)**	**A (0.1)**	**A (0.1)**	**A (0.2)**	**F (65.2)**	**F (140.5)**	**A (0.0)**	**A (0.0)**	**-**	**-**	**A (6.5)**	**A (6.8)**
PM Peak	EB	A (0.0)	A (0.0)	A (0.0)	F (70.4)	F (424.3)	F (585.5)	A (0.9)	A (0.0)	-	-	A (7.1)	A (8.6)
	WB	A (0.0)	A (0.0)	A (0.0)	F (70.4)	F (803.7)	F (1,162.8)	A (0.9)	A (0.0)	-	-	A (9.5)	B (11.8)
	SB	E (39.5)	F (52.7)	C (24.9)	F (169.9)	A (9.5)	A (9.5)	E (45.5)	D (34.3)	-	-	B (10.4)	B (14.0)
	Overall	**A (0.1)**	**A (0.1)**	**A (0.0)**	**F (70.8)**	**F (628.7)**	**F (904.7)**	**A (1.0)**	**A (0.1)**	**-**	**-**	**A (8.4)**	**B (10.4)**
US-20 & SR-25 - Signalized													
AM Peak	EB	C (22.0)	D (43.1)	B (19.4)	B (15.3)	-	-	B (19.1)	D (35.7)	A (6.9)	A (7.6)	-	-
	WB	B (15.7)	B (15.5)	B (18.9)	B (17.4)	-	-	C (28.1)	A (7.0)	B (9.7)	B (11.5)	-	-
	SB	-	-	-	-	-	-	D (41.5)	F (81.0)	A (7.3)	A (8.2)	-	-
	NB	C (20.1)	C (22.2)	C (26.8)	B (17.8)	-	-	B (19.3)	F (100.8)	A (7.5)	A (8.4)	-	-
	Overall	**B (19.6)**	**C (29.8)**	**C (21.1)**	**B (16.6)**	**-**	**-**	**C (21.8)**	**D (51.8)**	**A (7.8)**	**A (8.9)**	**-**	**-**
PM Peak	EB	D (52.7)	F (90.1)	D (48.6)	B (12.6)	-	-	B (10.0)	B (10.9)	A (8.5)	B (10.5)	-	-
	WB	B (14.9)	B (14.2)	D (35.1)	F (431.1)	-	-	B (12.6)	D (36.2)	C (19.5)	E (44.0)	-	-
	SB	-	-	-	-	-	-	F (81.7)	E (55.6)	B (11.3)	B (14.2)	-	-
	NB	C (29.9)	D (37.7)	F (112.1)	F (131.6)	-	-	F (143.7)	F (154.4)	B (12.5)	C (18.9)	-	-
	Overall	**D (35.4)**	**D (51.1)**	**E (65.6)**	**F (146.2)**	**-**	**-**	**D (47.7)**	**E (57.9)**	**B (12.7)**	**C (22.1)**	**-**	**-**

10. RECOMMENDATIONS

Based on the results presented in this study, the alternative that offers the most positive outcomes is the Multi-Lane Roundabout at US-20 & SR-25 (Alternative 5) with the proposed connection of Southbound W Boundary to the intersection. The proposed roundabout can also be supplemented with the resurfacing of the roadway (Alternative 3) since the pavement will need to be redone to do the roundabout. This alternative offers the best results as it improves the average crash frequency of the corridor the most and is the only alternative that is projected to operate at an acceptable LOS for the intersection of US-20 & SR-25 in the year 2042. While this alternative is the most expensive out of the alternatives presented, it offers the most operational and safety benefits for the corridor. A preliminary design for the roundabout can be found in Appendix E.

11. POTENTIAL GRANT OPPORTUNITIES

Below is a list of grants that could be used to leverage funding for the alternatives outlined in this report. It is important to note that some of these grant opportunities have minimum requirements to be eligible for funding and need to be considered before applying.

Table 10 Potential Funding Sources

Funding Source	Type of Funding	Additional Information
ODOT	HSIP Formal Safety Funding	https://www.transportation.ohio.gov/programs/highway+safety/highway-safety-improvement-program/03-formal-safety-application
ODOT	HSIP Abbreviated Safety Funding	https://www.transportation.ohio.gov/programs/highway+safety/highway-safety-improvement-program/02-abbreviated-safety-funding-application
ODOT	Urban Paving Program	https://www.transportation.ohio.gov/working/funding/resources/urban-paving
TMACOG	Congestion Mitigation and Air Quality Program (CMAQ)	https://tmacog.org/transportation/regional-transportation-improvement-plan
TMACOG	Surface Transportation Block Grant Program (STBG)	https://tmacog.org/transportation/regional-transportation-improvement-plan
FHWA	Safe Streets and Roads for All (SS4A)	https://www.transportation.gov/grants/SS4A

12. PROJECT INFORMATION

12a. Previous Projects:

PID: 23470
Project Name: WOO Bike P 01.000
Description: Construct new pavement for bicycle trail bypass on the south side of US-20.
Construction: 2004

PID: 92731
Project Name: WOO 20/25 0.0/21.81 Safety/Urban Paving
Description: Construct new pavement for bicycle trail bypass on the south side of US-20.
Construction: April 2014 – July 2014

12b. Future Projects:

PID: 105633
Project Name: WOO Sign FY2023
Description: Upgrade roadway signage of SR-25 in Wood County.
Construction: Spring 2023

PID: 117262
Project Name: WOO Sign FY2024
Description: Upgrade roadway signage of US-20 in Wood County.
Construction: April 2024

PID: 109388
Project Name: WOO Maumee River MUP Phase 3
Description: Upgrade bicycle facilities along the Maumee River
Construction: April 2024

Appendix A Design Standards

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

(See Following Page for Additional Figures & Notes)

HEIGHT OF EYE 3.50' HEIGHT OF OBJECT 3.50'

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

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

$$ISD = 1.47 \times V_{major} \times t_g$$

ISD = intersection sight distance (ft.)

V_{major} = design speed of major road (mph)

t_g = time gap for minor road vehicle to enter the major road (sec.)

Using: S = Intersection Sight Distance
L = Length of Crest Vertical Curve
A = Algebraic Difference in Grades (%), Absolute Value
K = Rate of Vertical Curvature

- For a given design speed and an "A" value, the calculated length "L" = K x A

- To determine "S" with a given "L" and "A", use the following:

For S<L: $S = 52.92\sqrt{K}$, where K = L/A

For S>L: S = 1400/A + L/2

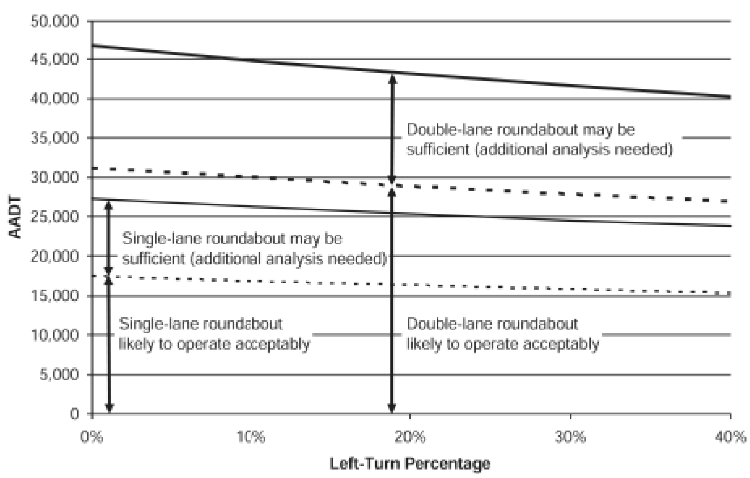
JANUARY 2006

ROUNDABOUT SIZING THRESHOLDS	403-1
	REFERENCE SECTION 403.3

NHRP Report 672 - Exhibit 3-14
Volume Thresholds for Determining the Number of Entry Lanes Required (Planning Level)

Volume Range Entry + Circulating (veh/hr)	Number of Lanes Required
0 - 1,000	• Single-lane entry likely to be sufficient
1,000 - 1,300	• Two lane entry may be needed • Single-lane may be sufficient based upon more detailed anaylsis
1,300 - 1,800	• Two lane entry is likely to be sufficient
1,800+	• More than two entry lanes may be required • A more detailed capacity evaluation should be conducted to verify lane number and arrangements

NHRP Report 672 - Exhibit 3-12
Planning-Level Daily Intersection Volumes



July 2019

Appendix B Turning Movement Counts

DGL Consulting Engineers, LLC
3455 Briarfield Blvd, Suite E
Maumee, Ohio 43537

Leg	Maumee Western Reserve						Maumee Western Reserve						Orleans Park Dr						
Direction	Eastbound						Westbound						Southbound						
Start Time	Left	Thru	U-Turn	App Total	Peds CW	Peds CCW	Thru	Right	U-Turn	App Total	Peds CW	Peds CCW	Left	Right	U-Turn	App Total	Peds CW	Peds CCW	Int Total
2022-05-18 07:00:00	0	181	0	181	0	0	172	0	0	172	0	0	0	0	0	0	0	0	353
2022-05-18 07:15:00	1	200	0	201	0	0	221	0	0	221	0	0	0	0	0	0	1	0	422
2022-05-18 07:30:00	1	231	0	232	0	0	264	1	0	265	0	0	1	0	0	1	0	0	498
2022-05-18 07:45:00	3	247	0	250	0	0	272	3	0	275	0	0	1	3	0	4	0	0	529
2022-05-18 08:00:00	2	234	0	236	0	0	193	1	0	194	0	0	0	0	0	0	0	0	430
2022-05-18 08:15:00	0	223	0	223	0	0	176	0	0	176	0	0	1	2	0	3	0	0	402
2022-05-18 08:30:00	0	208	0	208	0	0	191	0	0	191	0	0	2	0	0	2	1	0	401
2022-05-18 08:45:00	0	250	0	250	0	0	222	1	0	223	0	0	0	1	0	1	0	0	474
2022-05-18 11:00:00	0	190	0	190	0	0	204	2	0	206	0	0	0	2	0	2	0	0	398
2022-05-18 11:15:00	1	201	0	202	0	0	235	1	0	236	0	0	0	1	0	1	0	0	439
2022-05-18 11:30:00	0	229	0	229	0	0	238	2	0	240	0	0	1	1	0	2	1	0	471
2022-05-18 11:45:00	0	291	0	291	0	0	220	1	0	221	0	0	0	2	0	2	0	0	514
2022-05-18 12:00:00	2	262	0	264	0	0	240	0	0	240	0	0	0	0	0	0	0	0	504
2022-05-18 12:15:00	1	243	0	244	0	0	191	0	0	191	0	0	0	0	0	0	0	0	435
2022-05-18 12:30:00	1	234	0	235	0	0	242	2	0	244	0	0	0	2	0	2	0	0	481
2022-05-18 12:45:00	0	282	0	282	0	0	207	1	0	208	0	0	0	1	0	1	0	0	491
2022-05-18 15:00:00	1	222	0	223	0	0	282	2	0	284	0	0	1	2	0	3	0	0	510
2022-05-18 15:15:00	2	287	0	289	0	0	230	0	0	230	0	0	0	2	0	2	0	0	521
2022-05-18 15:30:00	2	280	0	282	0	0	332	0	0	332	0	0	1	1	0	2	0	0	616
2022-05-18 15:45:00	1	281	1	283	0	0	290	0	0	290	0	0	0	0	0	0	0	0	573
2022-05-18 16:00:00	0	284	0	284	0	0	279	1	0	280	0	0	1	2	0	3	0	0	567
2022-05-18 16:15:00	0	289	0	289	0	0	275	1	0	276	0	0	0	4	0	4	0	0	569
2022-05-18 16:30:00	0	263	0	263	0	0	371	1	0	372	0	0	0	2	0	2	0	0	637
2022-05-18 16:45:00	0	292	0	292	0	0	331	1	0	332	0	0	0	2	0	2	0	0	626
2022-05-18 17:00:00	0	280	0	280	0	0	372	1	0	373	0	0	0	1	0	1	0	0	654
2022-05-18 17:15:00	0	313	0	313	0	0	359	0	0	359	0	0	0	0	0	0	0	0	672
2022-05-18 17:30:00	1	302	0	303	0	0	337	0	0	337	0	0	0	1	0	1	0	1	641
2022-05-18 17:45:00	0	278	0	278	0	0	234	2	0	236	0	0	2	2	0	4	0	0	518
2022-05-18 18:00:00	0	243	0	243	0	0	236	1	0	237	0	0	1	0	0	1	0	0	481
2022-05-18 18:15:00	0	214	0	214	0	0	290	0	0	290	0	0	0	1	0	1	0	0	505
2022-05-18 18:30:00	2	166	0	168	0	0	189	1	0	190	0	0	0	1	0	1	0	0	359
2022-05-18 18:45:00	0	183	0	183	0	0	182	1	0	183	0	0	0	2	0	2	0	0	368
2022-05-18 19:00:00	0	157	0	157	0	0	171	1	0	172	0	0	0	1	0	1	0	0	330
2022-05-18 19:15:00	1	149	0	150	0	0	162	0	0	162	0	0	0	1	0	1	0	0	313
2022-05-18 19:30:00	1	139	0	140	0	0	122	0	0	122	0	0	0	3	0	3	0	0	265
2022-05-18 19:45:00	0	137	0	137	0	0	131	0	0	131	0	0	0	0	0	0	0	0	268
Grand Total	23	8465	1	**8489**	0	0	8663	28	0	**8691**	0	0	12	43	0	**55**	3	1	**17235**
% Approach	0.3%	99.7%	0.0%				99.7%	0.3%	0.0%				21.8%	78.2%	0.0%				
% Total	0.1%	49.1%	0.0%	**49.3%**			50.3%	0.2%	0.0%	**50.4%**			0.1%	0.2%	0.0%	**0.3%**			
Lights	20	8344	1	**8365**			8508	28	0	**8536**			11	42	0	**53**			**16954**
% Lights	87.0%	98.6%	100.0%	**98.5%**			98.2%	100.0%	0.0%	**98.2%**			91.7%	97.7%	0.0%	**96.4%**			**98.4%**
Articulated Trucks	0	30	0	**30**			35	0	0	**35**			0	0	0	**0**			**65**
% Articulated Trucks	0.0%	0.4%	0.0%	**0.4%**			0.4%	0.0%	0.0%	**0.4%**			0.0%	0.0%	0.0%	**0.0%**			**0.4%**
Buses and Single-Unit Trucks	3	91	0	**94**			120	0	0	**120**			1	1	0	**2**			**216**
% Buses and Single-Unit Trucks	13.0%	1.1%	0.0%	**1.1%**			1.4%	0.0%	0.0%	**1.4%**			8.3%	2.3%	0.0%	**3.6%**			**1.3%**
Pedestrians					0	0					0	0					1	0	
% Pedestrians					0.0%	0.0%					0.0%	0.0%					33.3%	0.0%	
Bicycles on Crosswalk					0	0					0	0					2	1	
% Bicycles on Crosswalk					0.0%	0.0%					0.0%	0.0%					66.7%	100.0%	

DGL Consulting Engineers, LLC
3455 Briarfield Blvd, Suite E
Maumee, Ohio 43537

Leg	W Boundary Street (To Water Treatment Plant)						W Front St						W Front St						
Direction	Southeastbound						Northeastbound						Southwestbound						
Start Time	Left	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	U-Turn	**App Total**	Peds CW	Peds CCW	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	**Int Total**
2022-05-18 07:00:00	0	0	0	**0**	1	0	0	83	0	**83**	0	0	94	0	0	**94**	0	0	**177**
2022-05-18 07:15:00	0	0	0	**0**	1	0	1	95	0	**96**	0	0	134	0	0	**134**	0	0	**230**
2022-05-18 07:30:00	0	0	0	**0**	0	0	0	119	0	**119**	0	0	160	0	0	**160**	0	0	**279**
2022-05-18 07:45:00	0	0	0	**0**	0	0	0	121	0	**121**	0	0	145	0	0	**145**	0	0	**266**
2022-05-18 08:00:00	0	0	0	**0**	0	0	0	105	0	**105**	0	0	139	0	0	**139**	0	0	**244**
2022-05-18 08:15:00	0	0	0	**0**	0	0	0	106	0	**106**	0	0	98	0	0	**98**	0	0	**204**
2022-05-18 08:30:00	0	0	0	**0**	1	0	0	130	0	**130**	0	0	120	0	0	**120**	0	0	**250**
2022-05-18 08:45:00	0	0	0	**0**	0	0	0	147	0	**147**	0	0	141	0	0	**141**	0	0	**288**
2022-05-18 11:00:00	0	0	0	**0**	0	0	0	88	0	**88**	0	0	105	1	0	**106**	0	0	**194**
2022-05-18 11:15:00	0	0	0	**0**	0	0	0	107	0	**107**	0	0	127	0	0	**127**	0	0	**234**
2022-05-18 11:30:00	0	0	0	**0**	0	0	0	101	0	**101**	0	0	141	0	0	**141**	0	0	**242**
2022-05-18 11:45:00	0	0	0	**0**	0	0	0	116	0	**116**	0	0	140	0	0	**140**	0	0	**256**
2022-05-18 12:00:00	0	0	0	**0**	0	0	0	109	0	**109**	0	0	112	0	0	**112**	0	0	**221**
2022-05-18 12:15:00	0	0	0	**0**	0	0	0	114	0	**114**	0	0	104	0	0	**104**	0	0	**218**
2022-05-18 12:30:00	0	0	0	**0**	0	0	0	96	0	**96**	0	0	131	0	0	**131**	0	0	**227**
2022-05-18 12:45:00	0	0	0	**0**	0	0	0	133	0	**133**	0	0	107	1	0	**108**	0	0	**241**
2022-05-18 15:00:00	0	0	0	**0**	0	0	0	130	0	**130**	0	0	154	0	0	**154**	0	0	**284**
2022-05-18 15:15:00	3	1	0	**4**	0	0	0	143	0	**143**	0	0	136	1	0	**137**	0	0	**284**
2022-05-18 15:30:00	0	0	0	**0**	0	0	0	123	0	**123**	0	0	182	0	0	**182**	0	0	**305**
2022-05-18 15:45:00	0	1	0	**1**	0	0	0	148	0	**148**	0	0	165	0	0	**165**	0	0	**314**
2022-05-18 16:00:00	0	0	0	**0**	0	0	0	128	0	**128**	0	0	169	1	0	**170**	0	0	**298**
2022-05-18 16:15:00	0	0	0	**0**	0	0	0	129	0	**129**	0	0	149	0	0	**149**	0	0	**278**
2022-05-18 16:30:00	0	0	0	**0**	0	0	0	112	0	**112**	0	0	168	1	0	**169**	0	0	**281**
2022-05-18 16:45:00	0	0	0	**0**	0	0	0	129	0	**129**	0	0	185	0	0	**185**	0	0	**314**
2022-05-18 17:00:00	0	0	0	**0**	0	0	0	144	0	**144**	0	0	199	1	0	**200**	0	0	**344**
2022-05-18 17:15:00	0	0	0	**0**	0	0	0	148	0	**148**	0	0	189	0	0	**189**	0	0	**337**
2022-05-18 17:30:00	0	0	0	**0**	0	1	0	135	0	**135**	0	0	162	1	0	**163**	0	0	**298**
2022-05-18 17:45:00	0	0	0	**0**	0	0	0	140	0	**140**	0	0	136	1	0	**137**	0	0	**277**
2022-05-18 18:00:00	1	0	0	**1**	0	0	0	114	0	**114**	0	0	125	0	0	**125**	0	0	**240**
2022-05-18 18:15:00	1	0	0	**1**	0	0	0	104	0	**104**	0	0	164	0	0	**164**	0	0	**269**
2022-05-18 18:30:00	0	0	0	**0**	0	0	0	92	0	**92**	0	0	109	0	0	**109**	0	0	**201**
2022-05-18 18:45:00	0	0	0	**0**	0	0	0	81	0	**81**	0	0	99	0	0	**99**	0	0	**180**
2022-05-18 19:00:00	0	0	0	**0**	0	0	0	75	0	**75**	0	0	80	0	0	**80**	0	0	**155**
2022-05-18 19:15:00	0	0	0	**0**	0	0	0	66	0	**66**	0	0	81	0	0	**81**	0	0	**147**
2022-05-18 19:30:00	0	0	0	**0**	0	0	0	67	0	**67**	0	0	70	0	0	**70**	0	0	**137**
2022-05-18 19:45:00	1	0	0	**1**	0	0	0	63	0	**63**	0	0	82	2	0	**84**	0	0	**148**
Grand Total	6	2	0	**8**	3	1	1	4041	0	**4042**	0	0	4802	10	0	**4812**	0	0	**8862**
% Approach	75.0%	25.0%	0.0%				0.0%	100.0%	0.0%				99.8%	0.2%	0.0%				
% Total	0.1%	0.0%	0.0%	**0.1%**			0.0%	45.6%	0.0%	**45.6%**			54.2%	0.1%	0.0%	**54.3%**			
Lights	6	2	0	**8**			1	3961	0	**3962**			4710	10	0	**4720**			**8690**
% Lights	100.0%	100.0%	0.0%	**100.0%**			100.0%	98.0%	0.0%	**98.0%**			98.1%	100.0%	0.0%	**98.1%**			**98.1%**
Articulated Trucks	0	0	0	**0**			0	22	0	**22**			17	0	0	**17**			**39**
% Articulated Trucks	0.0%	0.0%	0.0%	**0.0%**			0.0%	0.5%	0.0%	**0.5%**			0.4%	0.0%	0.0%	**0.4%**			**0.4%**
Buses and Single-Unit Trucks	0	0	0	**0**			0	58	0	**58**			75	0	0	**75**			**133**
% Buses and Single-Unit Trucks	0.0%	0.0%	0.0%	**0.0%**			0.0%	1.4%	0.0%	**1.4%**			1.6%	0.0%	0.0%	**1.6%**			**1.5%**
Pedestrians					2	0					0	0					0	0	
% Pedestrians					66.7%	0.0%					0.0%	0.0%					0.0%	0.0%	
Bicycles on Crosswalk					1	1					0	0					0	0	
% Bicycles on Crosswalk					33.3%	100.0%					0.0%	0.0%					0.0%	0.0%	

DGL Consulting Engineers, LLC
3455 Briarfield Blvd, Suite E
Maumee, Ohio 43537

Leg	Maumee Western Reserve Rd							W Boundary Street						
Direction	Eastbound							Northwestbound						
Start Time	Bear left	Bear right	Hard right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Bear left	Right	U-Turn	**App Total**	Peds CW	Peds CCW
2022-05-18 07:00:00	74	99	0	0	**173**	0	0	0	88	5	0	**93**	0	0
2022-05-18 07:15:00	87	114	0	0	**201**	0	0	0	100	13	0	**113**	0	0
2022-05-18 07:30:00	98	134	0	0	**232**	0	0	0	113	18	0	**131**	0	0
2022-05-18 07:45:00	101	147	0	0	**248**	0	0	0	142	21	0	**163**	0	0
2022-05-18 08:00:00	100	131	0	0	**231**	0	0	0	78	4	0	**82**	0	0
2022-05-18 08:15:00	90	127	1	0	**218**	0	0	0	96	14	0	**110**	0	0
2022-05-18 08:30:00	90	126	0	0	**216**	0	0	0	81	40	0	**121**	0	0
2022-05-18 08:45:00	104	144	0	0	**248**	0	0	0	110	37	0	**147**	0	0
2022-05-18 11:00:00	71	120	0	0	**191**	0	0	0	115	15	0	**130**	0	0
2022-05-18 11:15:00	89	111	0	0	**200**	0	0	0	131	12	0	**143**	1	0
2022-05-18 11:30:00	94	129	0	0	**223**	0	0	0	107	9	0	**116**	0	1
2022-05-18 11:45:00	99	182	0	0	**281**	0	0	0	100	15	0	**115**	0	0
2022-05-18 12:00:00	98	162	0	0	**260**	0	0	1	135	7	0	**143**	1	0
2022-05-18 12:15:00	100	148	0	0	**248**	0	0	0	96	13	0	**109**	0	0
2022-05-18 12:30:00	82	139	0	0	**221**	0	0	0	121	14	0	**135**	0	0
2022-05-18 12:45:00	113	153	0	0	**266**	0	0	0	109	20	0	**129**	0	0
2022-05-18 15:00:00	111	110	0	0	**221**	0	0	0	146	16	0	**162**	0	0
2022-05-18 15:15:00	123	160	0	0	**283**	0	0	0	108	20	0	**128**	0	0
2022-05-18 15:30:00	105	166	0	0	**271**	0	0	0	174	17	0	**191**	0	0
2022-05-18 15:45:00	133	152	0	0	**285**	0	0	0	139	14	0	**153**	0	0
2022-05-18 16:00:00	109	169	0	0	**278**	0	0	0	125	18	0	**143**	0	0
2022-05-18 16:15:00	122	177	0	0	**299**	0	0	0	131	12	0	**143**	0	0
2022-05-18 16:30:00	91	163	1	0	**255**	0	0	0	216	16	0	**232**	0	0
2022-05-18 16:45:00	119	168	0	0	**287**	0	0	0	166	12	0	**178**	0	0
2022-05-18 17:00:00	125	162	0	0	**287**	0	0	0	188	21	0	**209**	0	0
2022-05-18 17:15:00	130	173	0	0	**303**	0	0	0	189	18	0	**207**	0	1
2022-05-18 17:30:00	119	178	0	0	**297**	0	0	0	195	18	0	**213**	0	0
2022-05-18 17:45:00	123	162	2	0	**287**	0	0	0	105	15	0	**120**	0	0
2022-05-18 18:00:00	108	144	0	0	**252**	0	0	0	112	6	0	**118**	0	0
2022-05-18 18:15:00	87	128	0	0	**215**	0	0	0	138	18	0	**156**	0	0
2022-05-18 18:30:00	76	97	0	0	**173**	0	0	0	86	16	0	**102**	0	0
2022-05-18 18:45:00	61	114	0	0	**175**	0	0	0	92	14	0	**106**	0	0
2022-05-18 19:00:00	70	92	0	0	**162**	0	0	0	96	9	0	**105**	1	0
2022-05-18 19:15:00	66	92	0	0	**158**	0	0	0	89	4	0	**93**	0	0
2022-05-18 19:30:00	51	81	0	0	**132**	0	0	0	65	16	0	**81**	0	0
2022-05-18 19:45:00	54	95	2	0	**151**	0	0	0	59	8	0	**67**	0	0
Grand Total	3473	4949	6	0	**8428**	0	0	1	4341	545	0	**4887**	3	2
% Approach	41.2%	58.7%	0.1%	0.0%				0.0%	88.8%	11.2%	0.0%			
% Total	19.2%	27.3%	0.0%	0.0%	**46.5%**			0.0%	24.0%	3.0%	0.0%	**27.0%**		
Lights	3420	4877	6	0	**8303**			1	4261	518	0	**4780**		
% Lights	98.5%	98.5%	100.0%	0.0%	**98.5%**			100.0%	98.2%	95.0%	0.0%	**97.8%**		
Articulated Trucks	12	18	0	0	**30**			0	21	10	0	**31**		
% Articulated Trucks	0.3%	0.4%	0.0%	0.0%	**0.4%**			0.0%	0.5%	1.8%	0.0%	**0.6%**		
Buses and Single-Unit Trucks	41	54	0	0	**95**			0	59	17	0	**76**		
% Buses and Single-Unit Trucks	1.2%	1.1%	0.0%	0.0%	**1.1%**			0.0%	1.4%	3.1%	0.0%	**1.6%**		
Pedestrians						0	0						3	2
% Pedestrians						0.0%	0.0%						100.0%	100.0%
Bicycles on Crosswalk						0	0						0	0
% Bicycles on Crosswalk						0.0%	0.0%						0.0%	0.0%

Leg	W Front St							W Front St							
Direction	Northeastbound							Southwestbound							
Start Time	Hard left	Thru	Right	U-Turn	**App Total**	Peds CW	Peds CCW	Left	Thru	Bear right	U-Turn	**App Total**	Peds CW	Peds CCW	**Int Total**
2022-05-18 07:00:00	0	0	0	0	**0**	0	0	9	0	89	0	**98**	0	0	**364**
2022-05-18 07:15:00	0	0	1	0	**1**	0	0	12	1	104	0	**117**	0	0	**432**
2022-05-18 07:30:00	0	1	1	0	**2**	0	0	15	0	148	0	**163**	0	0	**528**
2022-05-18 07:45:00	0	0	0	0	**0**	0	0	10	0	133	0	**143**	0	0	**554**
2022-05-18 08:00:00	0	0	2	0	**2**	0	0	19	1	115	0	**135**	0	0	**450**
2022-05-18 08:15:00	0	0	0	0	**0**	0	0	13	1	82	0	**96**	0	0	**424**
2022-05-18 08:30:00	1	0	1	0	**2**	0	0	14	1	103	0	**118**	0	0	**457**
2022-05-18 08:45:00	0	4	0	0	**4**	0	0	29	0	110	0	**139**	0	0	**538**
2022-05-18 11:00:00	0	0	0	0	**0**	0	0	10	0	97	0	**107**	2	0	**428**
2022-05-18 11:15:00	0	1	0	0	**1**	0	0	23	1	103	0	**127**	0	0	**471**
2022-05-18 11:30:00	0	0	1	0	**1**	0	0	11	0	128	0	**139**	0	0	**479**
2022-05-18 11:45:00	0	1	0	0	**1**	0	0	19	0	119	0	**138**	0	0	**535**
2022-05-18 12:00:00	0	0	0	0	**0**	0	0	7	0	100	0	**107**	0	0	**510**
2022-05-18 12:15:00	0	0	2	0	**2**	0	0	7	0	99	0	**106**	0	0	**465**
2022-05-18 12:30:00	0	0	0	0	**0**	0	0	9	1	119	0	**129**	0	0	**485**
2022-05-18 12:45:00	0	0	1	0	**1**	0	0	6	0	100	0	**106**	0	0	**502**
2022-05-18 15:00:00	0	0	1	0	**1**	0	0	15	0	131	0	**146**	0	0	**530**
2022-05-18 15:15:00	0	0	1	0	**1**	0	0	17	0	115	0	**132**	0	0	**544**
2022-05-18 15:30:00	0	1	0	0	**1**	0	0	24	0	160	0	**184**	0	0	**647**
2022-05-18 15:45:00	0	0	1	0	**1**	0	0	23	1	143	0	**167**	0	0	**606**
2022-05-18 16:00:00	0	0	1	0	**1**	0	0	13	0	158	0	**171**	0	0	**593**
2022-05-18 16:15:00	0	0	4	0	**4**	0	0	12	0	138	0	**150**	0	0	**596**
2022-05-18 16:30:00	0	0	0	0	**0**	0	0	9	0	153	0	**162**	0	0	**649**
2022-05-18 16:45:00	0	0	0	0	**0**	0	0	16	0	168	0	**184**	0	0	**649**
2022-05-18 17:00:00	0	0	0	0	**0**	0	0	12	0	189	0	**201**	0	0	**697**
2022-05-18 17:15:00	0	0	4	0	**4**	0	0	21	1	166	0	**188**	0	0	**702**
2022-05-18 17:30:00	0	0	0	0	**0**	0	0	14	1	150	0	**165**	0	0	**675**
2022-05-18 17:45:00	0	0	6	0	**6**	0	0	12	0	126	0	**138**	0	0	**551**
2022-05-18 18:00:00	0	0	0	0	**0**	0	0	6	0	116	0	**122**	0	0	**492**
2022-05-18 18:15:00	0	0	0	0	**0**	0	0	9	0	161	0	**170**	0	0	**541**
2022-05-18 18:30:00	1	0	0	0	**1**	0	0	5	0	101	0	**106**	0	0	**382**
2022-05-18 18:45:00	0	0	0	0	**0**	0	0	8	0	91	0	**99**	0	2	**380**
2022-05-18 19:00:00	1	0	0	0	**1**	0	0	6	1	75	0	**82**	0	0	**350**
2022-05-18 19:15:00	0	0	1	0	**1**	0	0	10	0	74	0	**84**	0	0	**336**
2022-05-18 19:30:00	0	0	0	0	**0**	0	0	13	0	59	0	**72**	0	0	**285**
2022-05-18 19:45:00	0	0	0	0	**0**	0	0	6	0	74	0	**80**	0	0	**298**
Grand Total	3	8	28	0	**39**	0	0	464	10	4297	0	**4771**	2	2	**18125**
% Approach	7.7%	20.5%	71.8%	0.0%				9.7%	0.2%	90.1%	0.0%				
% Total	0.0%	0.0%	0.2%	0.0%	**0.2%**			2.6%	0.1%	23.7%	0.0%	**26.3%**			
Lights	3	7	27	0	**37**			447	7	4224	0	**4678**			**17798**
% Lights	100.0%	87.5%	96.4%	0.0%	**94.9%**			96.3%	70.0%	98.3%	0.0%	**98.1%**			**98.2%**
Articulated Trucks	0	0	0	0	**0**			3	0	14	0	**17**			**78**
% Articulated Trucks	0.0%	0.0%	0.0%	0.0%	**0.0%**			0.6%	0.0%	0.3%	0.0%	**0.4%**			**0.4%**
Buses and Single-Unit Trucks	0	1	1	0	**2**			14	3	59	0	**76**			**249**
% Buses and Single-Unit Trucks	0.0%	12.5%	3.6%	0.0%	**5.1%**			3.0%	30.0%	1.4%	0.0%	**1.6%**			**1.4%**
Pedestrians						0	0						2	2	
% Pedestrians						0.0%	0.0%						100.0%	100.0%	
Bicycles on Crosswalk						0	0						0	0	
% Bicycles on Crosswalk						0.0%	0.0%						0.0%	0.0%	

Appendix C Warrant Evaluations

Multi-Way Stop Application

OMUTCD Section 2B.07

Criterion	Warranted ?
A. Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.	No
B. Five or more reported crashes in a 12-month period that are susceptible to correction by a multiway stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.	No
C. Minimum Volumes:	
1 The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day.	Yes
2 The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour.* *If this condition is satisfied, there must also be an average delay of at least 30 seconds per vehicle during the peak hour.	No
3 If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum volume warrants are 70 percent of the values provided in Items 1 and 2.	Yes
D. Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.	No
Other criteria that may be considered in an engineering study include:	
A. The need to control left-turn conflicts;	Yes
B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;	No
C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and	Yes
D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.	No

Are the requirements for Multi-Way Stop Satisfied?: Yes

22090_ODOT+Signal+Warrant+Spreadsheet_March2022.xlsx

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Applicable?	Warrant Satisfied?	Notes and Comments:	
Warrant 1, Eight-Hour Vehicular Volume	Yes	No		
Warrant 2, Four-Hour Vehicular Volume	Yes	No		
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated.	Peak Hour 7:45 AM 8:45 AM
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)				
Warrant 4, Pedestrian Volume	Yes	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD.	Peak Hour 11:45 AM 12:45 PM
Warrant 5, School Crossing	N/A	No	N/A	
Warrant 6, Coordinated Signal System	Yes	No	(Shall not be used as the sole warrant in the analysis)	
Warrant 7, Crash Experience	Yes	No	If this is the sole warrant, signal must be semi-actuated with control devices which provide proper coordination if installed at an intersection within a coordinated system and normally should be fully traffic actuated if installed at an isolated intersection.	
Warrant 8, Roadway Network	Yes	Yes	(Shall not be used as the sole warrant in the analysis)	
Warrant 9, Intersection Near a Grade Crossing	N/A	No		
Multi-Way Stop Warrant	Yes	Yes	May be used as an interim measure if traffic signal warrants are satisfied.	

The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.

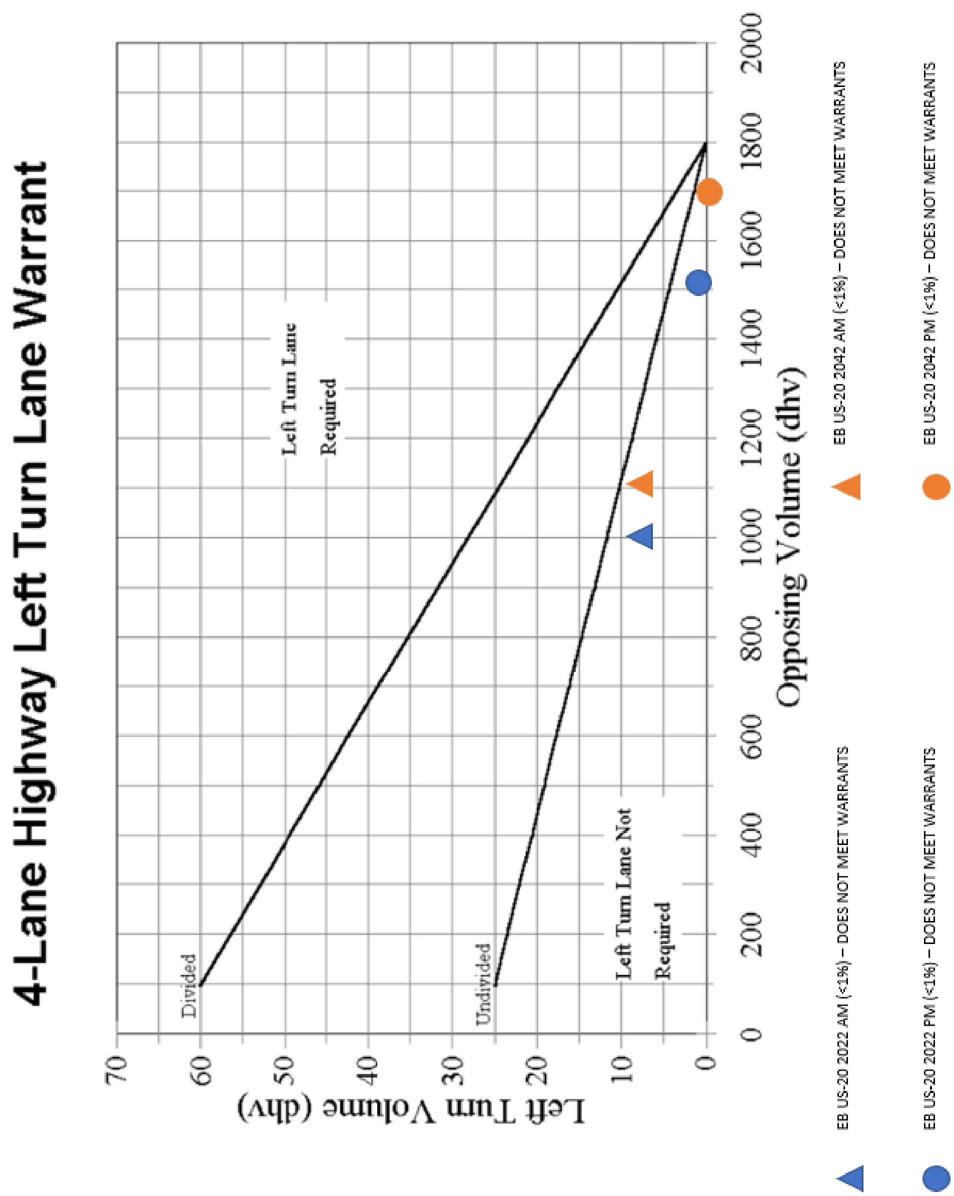
If no warrants are satisfied, additional options may be considered:
1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks.
2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The **Modeling and Forecasting Section** should provide the projected traffic volumes.
3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. **Please fill inputs on PHB Score Sheet and submit to ODOT.**

Considerations such as geometrics and lack of sight distance generally have not been accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at **100 percent** local cost. Please review TEM 402-4 for details.

Conclusion: Do Not Install New Traffic Signal

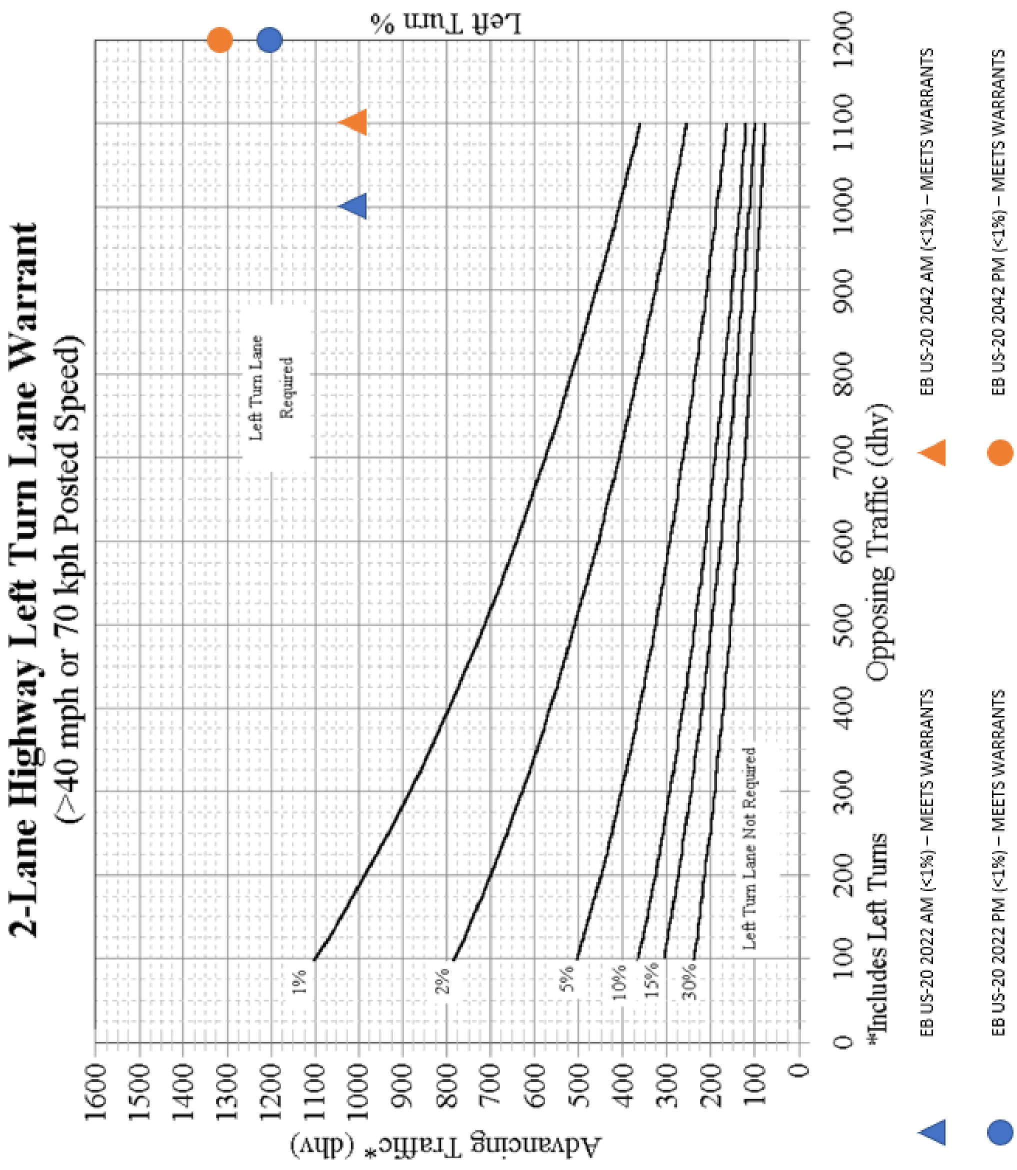
Notes:

4-LANE LEFT TURN LANE WARRANT	401-5c
	REFERENCE SECTION 401.6.1



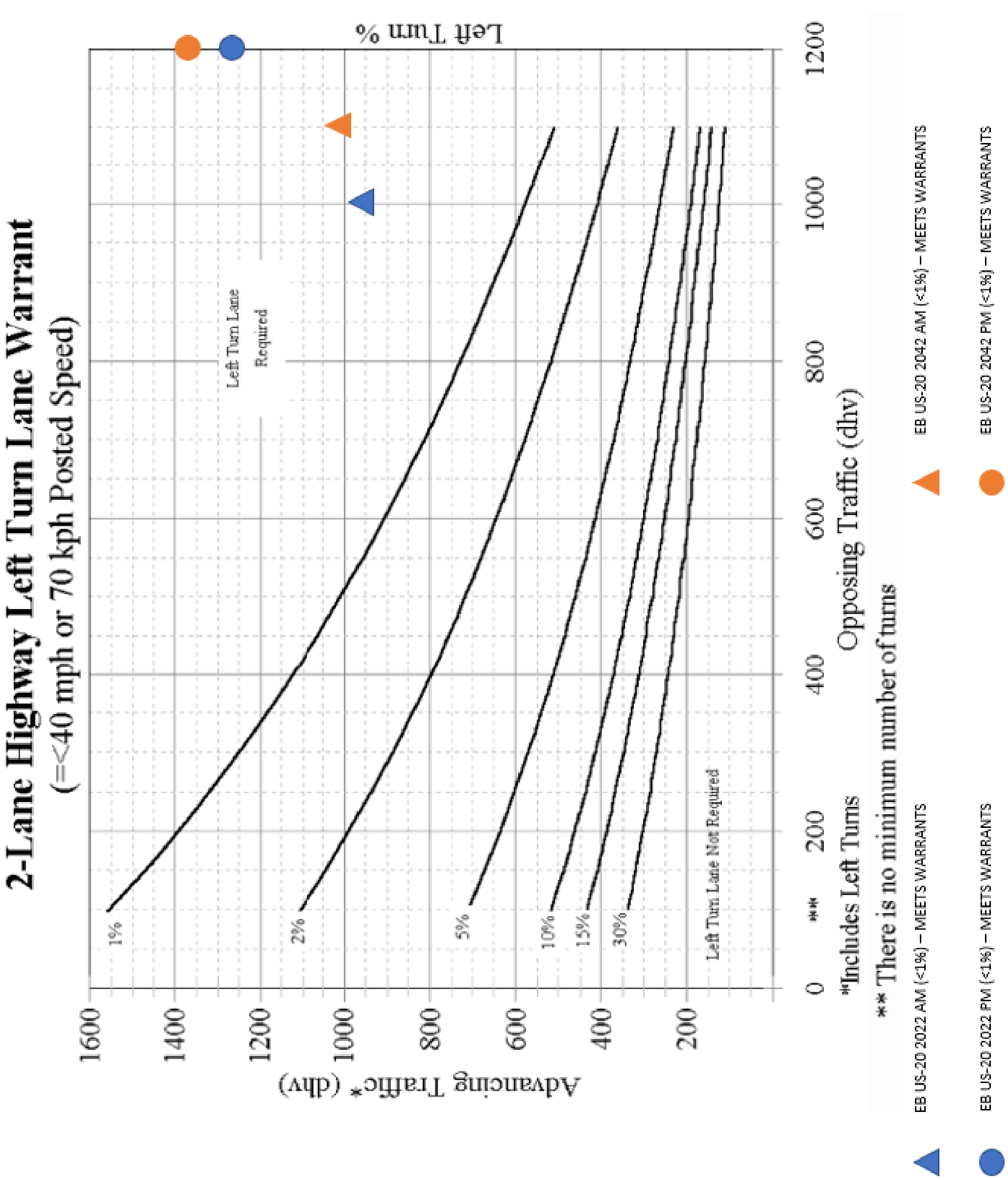
October 2004

2-LANE LEFT TURN LANE WARRANT (HIGH SPEED)	401-5b
	REFERENCE SECTION 401.6.1



October 2004

2-LANE LEFT TURN LANE WARRANT (LOW SPEED)	401-5a
	REFERENCE SECTION 401.6.1

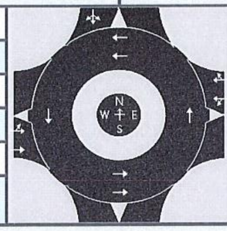


October 2004

Appendix D HCS Evaluations

HCS Roundabouts Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve &...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve
Date Performed	6/22/2022	N/S Street Name	Orleans Park Driveway
Analysis Year	2022	Analysis Time Period, hrs	1.00
Time Analyzed	AM Peak Hour - Build	Peak Hour Factor	0.92
Project Description	Multi-Lane RAB	Jurisdiction	Perrysburg



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	2	0	0	0	2	0	0	0	0	0	0	0	1	0
Lane Assignment	LT		T		LT		TR								LTR	
Volume (V), veh/h	0	7	990		0	0	1033	5					0	2	0	3
Percent Heavy Vehicles, %	2	2	2		2	2	2	2					4	4	4	4
Flow Rate (v_{PCE}), pc/h	0	8	1098		0	0	1145	6					0	2	0	3
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								2			
Pedestrians Crossing, p/h	0				0								0			
Proportion of CAVs	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	4.5436	4.5436		4.5436	4.5436						4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.5352	2.5352						2.5352	

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	476	630		691	460						5	
Entry Volume, veh/h	466	618		677	451						5	
Circulating Flow (v_c), pc/h	2			8			1108			1145		
Exiting Flow (v_{ex}), pc/h	1100			1148			14			0		
Capacity (c_{pce}), pc/h	1417	1417		1410	1410						537	
Capacity (c), veh/h	1390	1390		1382	1382						516	
v/c Ratio (x)	0.34	0.44		0.49	0.33						0.01	

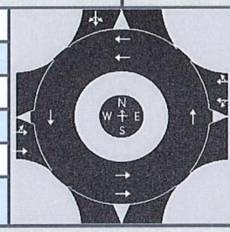
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	5.6	6.9		7.5	5.5						7.1	
Lane LOS	A	A		A	A						A	
95% Queue, veh	1.5	2.4		2.9	1.5						0.0	
Approach Delay, s/veh	6.3			6.7						7.1		
Approach LOS	A			A						A		
Intersection Delay, s/veh | LOS	6.5						A					

HCS Roundabouts Report

General Information / Site Information

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve &...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve
Date Performed	6/22/2022	N/S Street Name	Orleans Park Driveway
Analysis Year	2022	Analysis Time Period, hrs	1.00
Time Analyzed	PM Peak Hour - Build	Peak Hour Factor	0.92
Project Description	Multi-Lane RAB	Jurisdiction	Perrysburg



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	2	0	0	0	2	0	0	0	0	0	0	0	1	0
Lane Assignment	LT		T		LT		TR								LTR	
Volume (V), veh/h	0	0	1148		0	0	1433	3					0	0	0	5
Percent Heavy Vehicles, %	2	2	2		2	2	2	2					4	4	4	4
Flow Rate (v_{PCE}), pc/h	0	0	1273		0	0	1589	3					0	0	0	6
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								2			
Pedestrians Crossing, p/h	0				0								0			
Proportion of CAVs	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	4.5436	4.5436		4.5436	4.5436						4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.5352	2.5352						2.5352	

Flow Computations, Capacity and v/c Ratios

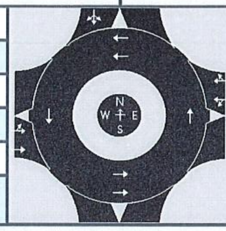
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	547	726		955	637						6	
Entry Volume, veh/h	537	711		936	624						6	
Circulating Flow (v_c), pc/h	0			0			1273			1589		
Exiting Flow (v_{ex}), pc/h	1273			1595			3			0		
Capacity (c_{pce}), pc/h	1420	1420		1420	1420						368	
Capacity (c), veh/h	1392	1392		1392	1392						354	
v/c Ratio (x)	0.39	0.51		0.67	0.45						0.02	

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	6.1	7.8		11.2	6.9						10.4	
Lane LOS	A	A		B	A						B	
95% Queue, veh	1.9	3.1		6.0	2.4						0.0	
Approach Delay, s/veh	7.1			9.5						10.4		
Approach LOS	A			A						B		
Intersection Delay, s/veh | LOS	8.4						A					

HCS Roundabouts Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve &...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve
Date Performed	7/19/2022	N/S Street Name	Orleans Park
Analysis Year	2042	Analysis Time Period, hrs	1.00
Time Analyzed	2042 - AM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane Roundabout	Jurisdiction	City of Perrysburg



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	2	0	0	0	2	0	0	0	0	0	0	0	1	0
Lane Assignment	LT		T		LT		TR								LTR	
Volume (V), veh/h	0	6	1039		0	0	1123	5					0	2	0	4
Percent Heavy Vehicles, %	3	3	3		3	3	3	3					3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	7	1163		0	0	1257	6					0	2	0	4
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								2			
Pedestrians Crossing, p/h	0				0								0			
Proportion of CAVs	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	4.5436	4.5436		4.5436	4.5436						4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.5352	2.5352						2.5352	

Flow Computations, Capacity and v/c Ratios

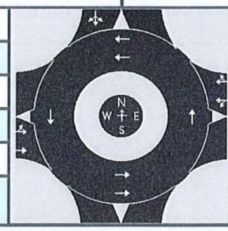
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	550	620		594	669						6	
Entry Volume, veh/h	534	602		576	650						6	
Circulating Flow (v_c), pc/h	2			7			1172			1257		
Exiting Flow (v_{ex}), pc/h	1165			1261			13			0		
Capacity (c_{pce}), pc/h	1417	1417		1411	1411						488	
Capacity (c), veh/h	1376	1376		1370	1370						474	
v/c Ratio (x)	0.39	0.44		0.42	0.47						0.01	

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	6.2	6.8		6.6	7.4						7.8	
Lane LOS	A	A		A	A						A	
95% Queue, veh	1.9	2.3		2.2	2.7						0.0	
Approach Delay, s/veh	6.5			7.0						7.8		
Approach LOS	A			A						A		
Intersection Delay, s/veh | LOS	6.8						A					

HCS Roundabouts Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve &...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve
Date Performed	7/19/2022	N/S Street Name	Orleans Park
Analysis Year	2042	Analysis Time Period, hrs	1.00
Time Analyzed	2042 - PM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane Roundabout	Jurisdiction	City of Perrysburg



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	2	0	0	0	2	0	0	0	0	0	0	0	1	0
Lane Assignment	LT		T		LT		TR								LTR	
Volume (V), veh/h	0	0	1389		0	0	1733	3					0	0	0	5
Percent Heavy Vehicles, %	3	3	3		3	3	3	3					3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	0	1555		0	0	1940	3					0	0	0	6
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1								2			
Pedestrians Crossing, p/h	0				0								0			
Proportion of CAVs	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	4.5436	4.5436		4.5436	4.5436						4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.5352	2.5352						2.5352	

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	731	824		913	1030						6	
Entry Volume, veh/h	710	800		887	1000						6	
Circulating Flow (v_c), pc/h	0			0			1555			1940		
Exiting Flow (v_{ex}), pc/h	1555			1946			3			0		
Capacity (C_{pce}), pc/h	1420	1420		1420	1420						273	
Capacity (c), veh/h	1379	1379		1379	1379						265	
v/c Ratio (x)	0.51	0.58		0.64	0.73						0.02	

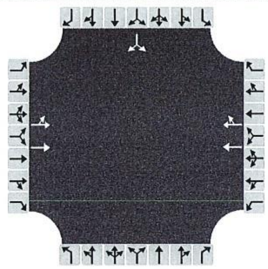
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	7.9	9.1		10.5	13.0						14.0	
Lane LOS	A	A		B	B						B	
95% Queue, veh	3.2	4.1		5.3	7.6						0.1	
Approach Delay, s/veh	8.6			11.8						14.0		
Approach LOS	A			B						B		
Intersection Delay, s/veh | LOS	10.4						B					

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	tsj	Intersection	US-20 & Orleans Park
Agency/Co.	DGL Consulting Engineers	Jurisdiction	City of Perrysburg
Date Performed	7/13/2022	East/West Street	US-20
Analysis Year	2022	North/South Street	Orleans Park
Analysis Time Period (hrs)	1.00	Peak Hour Factor	0.92
Time Analyzed	AM Peak		
Project Description	AWSC at Orleans Park		

Lanes



Vehicle Volume and Adjustments

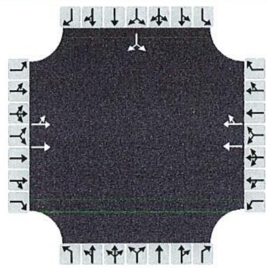
Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	7	990			1033	5				2		3
% Thrus in Shared Lane	50					50						
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	T		T	TR					LR		
Flow Rate, v (veh/h)	546	538		561	567					5		
Percent Heavy Vehicles	2	2		2	2					2		
Departure Headway and Service Time												
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20					3.20		
Initial Degree of Utilization, x	0.485	0.478		0.499	0.504					0.005		
Final Departure Headway, hd (s)	6.09	6.09		6.03	6.02					6.77		
Final Degree of Utilization, x	0.924	0.910		0.940	0.948					0.010		
Move-Up Time, m (s)	2.3	2.3		2.3	2.3					2.0		
Service Time, ts (s)	3.79	3.79		3.73	3.72					4.77		
Capacity, Delay and Level of Service												
Flow Rate, v (veh/h)	546	538		561	567					5		
Capacity	591	591		597	598					532		
95% Queue Length, Q_{95} (veh)	19.5	18.0		21.4	22.4					0.0		
Control Delay (s/veh)	62.0	56.3		69.1	73.5					9.8		
Level of Service, LOS	F	F		F	F					A		
Approach Delay (s/veh)		59.2			71.3						9.8	
Approach LOS		F			F						A	
Intersection Delay, s/veh | LOS	65.2						F					

HCS All-Way Stop Control Report

General Information / Site Information

General Information		Site Information	
Analyst	tsj	Intersection	US-20 & Orleans Park
Agency/Co.	DGL Consulting Engineers	Jurisdiction	City of Perrysburg
Date Performed	7/13/2022	East/West Street	US-20
Analysis Year	2022	North/South Street	Orleans Park
Analysis Time Period (hrs)	1.00	Peak Hour Factor	0.92
Time Analyzed	PM Peak		
Project Description	AWSC at Orleans Park		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	1	1289			1520	2				0		4
% Thrus in Shared Lane	50					50						
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	T		T	TR					LR		
Flow Rate, v (veh/h)	702	701		826	828					4		
Percent Heavy Vehicles	2	2		2	2					2		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20					3.20		
Initial Degree of Utilization, x	0.624	0.623		0.734	0.736					0.004		
Final Departure Headway, hd (s)	6.23	6.23		6.23	6.22					6.42		
Final Degree of Utilization, x	1.214	1.212		1.429	1.432					0.008		
Move-Up Time, m (s)	2.3	2.3		2.3	2.3					2.0		
Service Time, ts (s)	3.93	3.93		3.93	3.92					4.42		

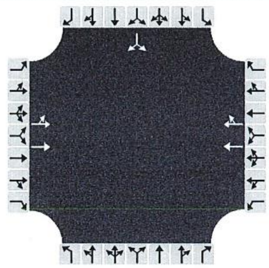
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	702	701		826	828					4		
Capacity	578	578		578	578					561		
95% Queue Length, Q_{95} (veh)	75.7	75.1		133.2	134.2					0.0		
Control Delay (s/veh)	426.0	422.5		800.7	806.6					9.5		
Level of Service, LOS	F	F		F	F					A		
Approach Delay (s/veh)	424.3			803.7						9.5		
Approach LOS	F			F						A		
Intersection Delay, s/veh | LOS	628.7						F					

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve & Orleans...
Agency/Co.	DGL Consulting Engineers	Jurisdiction	City of Perrysburg
Date Performed	7/19/2022	East/West Street	Maumee Western Reserve
Analysis Year	2042	North/South Street	Orleans Park
Analysis Time Period (hrs)	1.00	Peak Hour Factor	0.92
Time Analyzed	2042 - AM Peak		
Project Description	AWSC @ Orleans Park		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	6	1039			1123	5				2		4
% Thrus in Shared Lane	50					50						
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	T		T	TR					LR		
Flow Rate, v (veh/h)	571	565		610	616					7		
Percent Heavy Vehicles	2	2		2	2					2		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20					3.20		
Initial Degree of Utilization, x	0.508	0.502		0.543	0.547					0.006		
Final Departure Headway, hd (s)	6.24	6.23		6.20	6.19					6.66		
Final Degree of Utilization, x	0.990	0.978		1.051	1.060					0.012		
Move-Up Time, m (s)	2.3	2.3		2.3	2.3					2.0		
Service Time, ts (s)	3.94	3.93		3.90	3.89					4.66		

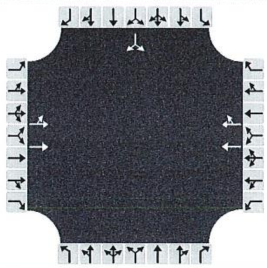
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	571	565		610	616					7		
Capacity	577	578		581	581					540		
95% Queue Length, Q_{95} (veh)	27.8	26.1		38.6	40.2					0.0		
Control Delay (s/veh)	105.7	95.5		172.7	183.6					9.7		
Level of Service, LOS	F	F		F	F					A		
Approach Delay (s/veh)	100.6			178.2						9.7		
Approach LOS	F			F						A		
Intersection Delay, s/veh | LOS	140.5						F					

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve & Orleans...
Agency/Co.	DGL Consulting Engineers	Jurisdiction	City of Perrysburg
Date Performed	7/19/2022	East/West Street	Maumee Western Reserve
Analysis Year	2042	North/South Street	Orleans Park
Analysis Time Period (hrs)	1.00	Peak Hour Factor	0.92
Time Analyzed	2042 - PM Peak		
Project Description	AWSC @ Orleans Park		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume	0	1389			1733	3				0		5
% Thrus in Shared Lane	50					50						
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LT	T		T	TR					LR		
Flow Rate, v (veh/h)	755	755		942	945					5		
Percent Heavy Vehicles	2	2		2	2					2		

Departure Headway and Service Time

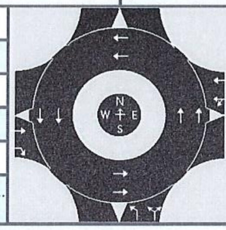
Initial Departure Headway, hd (s)	3.20	3.20		3.20	3.20					3.20		
Initial Degree of Utilization, x	0.671	0.671		0.837	0.840					0.005		
Final Departure Headway, hd (s)	6.23	6.23		6.23	6.23					6.42		
Final Degree of Utilization, x	1.306	1.306		1.630	1.635					0.010		
Move-Up Time, m (s)	2.3	2.3		2.3	2.3					2.0		
Service Time, ts (s)	3.93	3.93		3.93	3.93					4.42		

Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	755	755		942	945					5		
Capacity	578	578		578	578					561		
95% Queue Length, Q_{95} (veh)	99.8	99.8		189.4	190.9					0.0		
Control Delay (s/veh)	585.5	585.5		1158.3	1167.2					9.5		
Level of Service, LOS	F	F		F	F					A		
Approach Delay (s/veh)	585.5			1162.8						9.5		
Approach LOS	F			F						A		
Intersection Delay, s/veh | LOS	904.7						F					

HCS Roundabouts Report

General Information / Site Information



General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve &...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve/Fr...
Date Performed	7/19/2022	N/S Street Name	W Boundary
Analysis Year	2022	Analysis Time Period, hrs	1.00
Time Analyzed	2022 - AM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane Roundabout - Exi...	Jurisdiction	City of Perrysburg

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	1	0	0	2	0	0	1	1	0	0	0	0	0
Lane Assignment	T		R		LT		T		L		LR					
Volume (V), veh/h	0		417	568	0	61	540		0	467		60				
Percent Heavy Vehicles, %	3		3	3	3	3	3		3	3		3				
Flow Rate (v_{PCE}), pc/h	0		467	636	0	68	605		0	523		67				
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2							
Pedestrians Crossing, p/h	0				0				0							
Proportion of CAVs	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	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276				
Follow-Up Headway, s	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352				

Flow Computations, Capacity and v/c Ratios

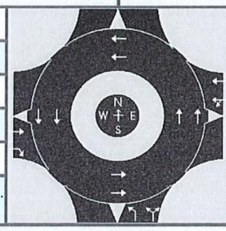
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	467	636		316	357		313	277				
Entry Volume, veh/h	453	617		307	346		304	269				
Circulating Flow (v_c), pc/h	68			523			467			1196		
Exiting Flow (v_{ex}), pc/h	534			1128			0			704		
Capacity (c_{pce}), pc/h	1268	1340		834	910		878	955				
Capacity (c), veh/h	1231	1301		810	884		853	927				
v/c Ratio (x)	0.37	0.47		0.38	0.39		0.36	0.29				

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	6.5	7.6		9.0	8.6		8.3	6.9				
Lane LOS	A	A		A	A		A	A				
95% Queue, veh	1.7	2.7		1.8	1.9		1.6	1.2				
Approach Delay, s/veh	7.1			8.8			7.7					
Approach LOS	A			A			A					
Intersection Delay, s/veh | LOS	7.8						A					

HCS Roundabouts Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve &...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve/Fr...
Date Performed	7/19/2022	N/S Street Name	W Boundary
Analysis Year	2022	Analysis Time Period, hrs	1.00
Time Analyzed	2022 - PM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane Roundabout - Exi...	Jurisdiction	City of Perrysburg



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	1	0	0	2	0	0	1	1	0	0	0	0	0
Lane Assignment	T		R		LT		T		L		LR					
Volume (V), veh/h	0		533	735	0	68	726		0	797		74				
Percent Heavy Vehicles, %	3		3	3	3	3	3		3	3		3				
Flow Rate (v_{PCE}), pc/h	0		597	823	0	76	813		0	892		83				
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2							
Pedestrians Crossing, p/h	0				0				0							
Proportion of CAVs	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	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276				
Follow-Up Headway, s	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352				

Flow Computations, Capacity and v/c Ratios

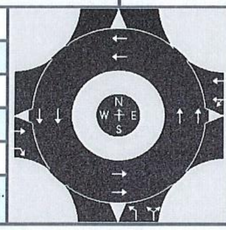
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	597	823		418	471		517	458				
Entry Volume, veh/h	580	799		406	457		502	445				
Circulating Flow (v_c), pc/h	76			892			597			1781		
Exiting Flow (v_{ex}), pc/h	680			1705			0			899		
Capacity (c_{pce}), pc/h	1259	1331		594	665		779	855				
Capacity (c), veh/h	1222	1292		577	646		757	830				
v/c Ratio (x)	0.47	0.62		0.70	0.71		0.66	0.54				

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	8.0	10.4		24.2	22.3		17.3	12.0				
Lane LOS	A	B		C	C		C	B				
95% Queue, veh	2.7	4.8		6.6	6.8		5.7	3.4				
Approach Delay, s/veh	9.4			23.2			14.8					
Approach LOS	A			C			B					
Intersection Delay, s/veh | LOS	14.7						B					

HCS Roundabouts Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve &...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve/Fr...
Date Performed	7/19/2022	N/S Street Name	W Boundary
Analysis Year	2042	Analysis Time Period, hrs	1.00
Time Analyzed	2042 - AM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane Roundabout - Exi...	Jurisdiction	City of Perrysburg



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	1	0	0	2	0	0	1	1	0	0	0	0	0
Lane Assignment	T		R		LT		T		L		LR					
Volume (V), veh/h	0		467	636	0	68	605		0	524		68				
Percent Heavy Vehicles, %	3		3	3	3	3	3		3	3		3				
Flow Rate (v_{PCE}), pc/h	0		523	712	0	76	677		0	587		76				
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2							
Pedestrians Crossing, p/h	0				0				0							
Proportion of CAVs	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	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276				
Follow-Up Headway, s	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352				

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	523	712		354	399		351	312				
Entry Volume, veh/h	508	691		344	387		341	303				
Circulating Flow (v_c), pc/h	76			587			523			1340		
Exiting Flow (v_{ex}), pc/h	599			1264			0			788		
Capacity (c_{pce}), pc/h	1259	1331		787	862		834	910				
Capacity (c), veh/h	1222	1292		764	837		810	884				
v/c Ratio (x)	0.42	0.53		0.45	0.46		0.42	0.34				

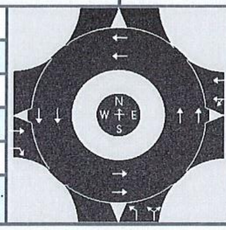
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	7.1	8.7		10.8	10.3		9.8	7.9				
Lane LOS	A	A		B	B		A	A				
95% Queue, veh	2.1	3.4		2.4	2.6		2.2	1.6				
Approach Delay, s/veh	8.0			10.5			8.9					
Approach LOS	A			B			A					
Intersection Delay, s/veh | LOS	8.9						A					

HCS Roundabouts Report

General Information

Analyst	tsj
Agency or Co.	DGL Consulting Engineers
Date Performed	7/19/2022
Analysis Year	2042
Time Analyzed	2042 - PM Peak
Project Description	Multi-Lane Roundabout - Exi...



Site Information

Intersection	Maumee Western Reserve &...
E/W Street Name	Maumee Western Reserve/Fr...
N/S Street Name	W Boundary
Analysis Time Period, hrs	1.00
Peak Hour Factor	0.92
Jurisdiction	City of Perrysburg

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	1	0	0	2	0	0	1	1	0	0	0	0	0
Lane Assignment	T		R		LT		T		L		LR					
Volume (V), veh/h	0		596	823	0	76	814		0	893		84				
Percent Heavy Vehicles, %	3		3	3	3	3	3		3	3		3				
Flow Rate (v_{PCE}), pc/h	0		667	921	0	85	911		0	1000		94				
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				2							
Pedestrians Crossing, p/h	0				0				0							
Proportion of CAVs	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	4.6453	4.3276		4.6453	4.3276		4.6453	4.3276				
Follow-Up Headway, s	2.6667	2.5352		2.6667	2.5352		2.6667	2.5352				

Flow Computations, Capacity and v/c Ratios

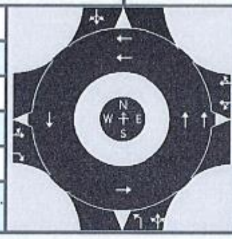
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	667	921		468	528		580	514				
Entry Volume, veh/h	648	894		454	513		563	499				
Circulating Flow (v_c), pc/h	85			1000			667			1996		
Exiting Flow (v_{ex}), pc/h	761			1911			0			1006		
Capacity (c_{pce}), pc/h	1248	1321		538	607		731	806				
Capacity (c), veh/h	1212	1283		522	589		710	782				
v/c Ratio (x)	0.53	0.70		0.87	0.87		0.79	0.64				

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	9.0	12.7		50.7	45.9		27.6	15.8				
Lane LOS	A	B		F	E		D	C				
95% Queue, veh	3.4	6.7		14.2	14.5		10.1	5.1				
Approach Delay, s/veh	11.1			48.2			22.1					
Approach LOS	B			E			C					
Intersection Delay, s/veh | LOS	24.4						C					

HCS Roundabouts Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve-Fr...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve/Fr...
Date Performed	8/25/2022	N/S Street Name	W Boundary
Analysis Year	2022	Analysis Time Period, hrs	1.00
Time Analyzed	2022 - AM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane RAB Prop. Interse...	Jurisdiction	City of Perrysburg



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	1	0	0	2	0	0	1	1	0	0	0	1	0
Lane Assignment	LT		R		LT		TR		L		LTR				LTR	
Volume (V), veh/h	0	0	425	578	0	62	550	0	0	476	61	0	0	1	1	0
Percent Heavy Vehicles, %	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	0	467	635	0	69	610	0	0	528	68	0	0	1	1	0
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				2				1				2			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs	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	4.5436	4.5436		4.6453	4.3276		4.5436	4.5436			4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.6667	2.5352		2.5352	2.5352			2.5352	

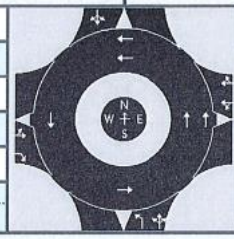
Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	467	635		319	360		316	280			2	
Entry Volume, veh/h	462	629		313	353		310	275			2	
Circulating Flow (v_c), pc/h	71			596			468			1207		
Exiting Flow (v_{ex}), pc/h	468			1138			68			705		
Capacity (c_{pce}), pc/h	1331	1331		780	856		928	928			509	
Capacity (c), veh/h	1318	1318		765	839		909	909			494	
v/c Ratio (x)	0.35	0.48		0.41	0.42		0.34	0.30			0.00	

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	6.0	7.6		10.0	9.5		7.7	7.2			7.3	
Lane LOS	A	A		A	A		A	A			A	
95% Queue, veh	1.6	2.7		2.1	2.2		1.5	1.3			0.0	
Approach Delay, s/veh	6.9			9.7			7.5			7.3		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	7.8						A					

HCS Roundabouts Report



General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve-Fr...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve/Fr...
Date Performed	8/25/2022	N/S Street Name	W Boundary
Analysis Year	2022	Analysis Time Period, hrs	1.00
Time Analyzed	2022 - PM Peak	Peak Hour Factor	0.97
Project Description	Multi-Lane RAB Prop. Interse...	Jurisdiction	City of Perrysburg

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	1	0	0	2	0	0	1	1	0	0	0	1	0
Lane Assignment	LT		R		LT		TR		L		LTR				LTR	
Volume (V), veh/h	0	0	543	749	0	69	741	2	0	813	0	76	0	2	1	0
Percent Heavy Vehicles, %	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	0	565	780	0	73	779	2	0	855	0	80	0	2	1	0
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				2				1				2			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs	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	4.5436	4.5436		4.6453	4.3276		4.5436	4.5436			4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.6667	2.5352		2.5352	2.5352			2.5352	

Flow Computations, Capacity and v/c Ratios

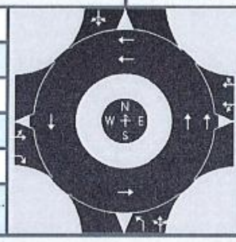
Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h	565	780		401	453		496	439			3	
Entry Volume, veh/h	559	772		394	444		486	431			3	
Circulating Flow (v_c), pc/h	76			855			567			1707		
Exiting Flow (v_{ex}), pc/h	647			1634			2			854		
Capacity (c_{pce}), pc/h	1325	1325		615	687		848	848			333	
Capacity (c), veh/h	1312	1312		603	673		831	831			323	
v/c Ratio (x)	0.43	0.59		0.65	0.66		0.58	0.52			0.01	

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	6.9	9.6		20.3	18.8		13.3	11.6			11.3	
Lane LOS	A	A		C	C		B	B			B	
95% Queue, veh	2.2	4.2		5.4	5.5		4.1	3.2			0.0	
Approach Delay, s/veh	8.5			19.5			12.5			11.3		
Approach LOS	A			C			B			B		
Intersection Delay, s/veh | LOS	12.7						B					

HCS Roundabouts Report

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve-Fr...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve/Fr...
Date Performed	8/25/2022	N/S Street Name	W Boundary
Analysis Year	2042	Analysis Time Period, hrs	1.00
Time Analyzed	2042 - AM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane RAB Prop. Interse...	Jurisdiction	City of Perrysburg



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	1	0	0	2	0	0	1	1	0	0	0	1	0
Lane Assignment	LT		R		LT		TR		L		LTR				LTR	
Volume (V), veh/h	0	0	467	637	0	68	605	0	0	524	68	0	0	2	1	0
Percent Heavy Vehicles, %	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	0	513	699	0	75	671	0	0	581	75	0	0	2	1	0
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				2				1				2			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs	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	4.5436	4.5436		4.6453	4.3276		4.5436	4.5436			4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.6667	2.5352		2.5352	2.5352			2.5352	

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	513	699		351	395		348	308			3	
Entry Volume, veh/h	508	692		344	388		341	302			3	
Circulating Flow (v_c), pc/h	78			656			515			1327		
Exiting Flow (v_{ex}), pc/h	515			1252			75			775		
Capacity (c_{pce}), pc/h	1323	1323		738	813		889	889			460	
Capacity (c), veh/h	1310	1310		724	797		871	871			446	
v/c Ratio (x)	0.39	0.53		0.47	0.49		0.39	0.35			0.01	

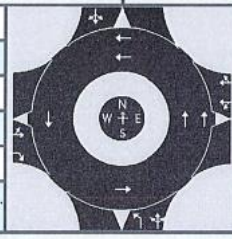
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh	6.4	8.5		11.8	11.2		8.7	8.1			8.2	
Lane LOS	A	A		B	B		A	A			A	
95% Queue, veh	1.9	3.3		2.7	2.8		1.9	1.6			0.0	
Approach Delay, s/veh	7.6			11.5			8.4			8.2		
Approach LOS	A			B			A			A		
Intersection Delay, s/veh | LOS	8.9						A					

HCS Roundabouts Report

General Information / Site Information

General Information		Site Information	
Analyst	tsj	Intersection	Maumee Western Reserve-Fr...
Agency or Co.	DGL Consulting Engineers	E/W Street Name	Maumee Western Reserve/Fr...
Date Performed	8/25/2022	N/S Street Name	W Boundary
Analysis Year	2042	Analysis Time Period, hrs	1.00
Time Analyzed	2042 - PM Peak	Peak Hour Factor	0.92
Project Description	Multi-Lane RAB Prop. Interse...	Jurisdiction	City of Perrysburg



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	1	0	0	2	0	0	1	1	0	0	0	1	0
Lane Assignment	LT		R		LT		TR		L		LTR				LTR	
Volume (V), veh/h	0	0	596	823	0	76	815	0	0	893	0	84	0	2	1	0
Percent Heavy Vehicles, %	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3
Flow Rate (v_{PCE}), pc/h	0	0	654	904	0	84	904	0	0	990	0	93	0	2	1	0
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				2				1				2			
Pedestrians Crossing, p/h	0				0				0				0			
Proportion of CAVs	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	4.5436	4.5436		4.6453	4.3276		4.5436	4.5436			4.3276	
Follow-Up Headway, s	2.5352	2.5352		2.6667	2.5352		2.5352	2.5352			2.5352	

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	654	904		464	524		574	509			3	
Entry Volume, veh/h	648	895		455	513		563	499			3	
Circulating Flow (v_c), pc/h	87			990			656			1978		
Exiting Flow (v_{ex}), pc/h	749			1894			0			989		
Capacity (c_{pce}), pc/h	1312	1312		543	612		782	782			264	
Capacity (c), veh/h	1299	1299		532	600		766	766			257	
v/c Ratio (x)	0.50	0.69		0.86	0.86		0.73	0.65			0.01	

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	8.0	12.3		46.2	41.9		21.0	16.6			14.2	
Lane LOS	A	B		E	E		C	C			B	
95% Queue, veh	3.0	6.4		13.2	13.5		7.7	5.4			0.0	
Approach Delay, s/veh	10.5			44.0			18.9			14.2		
Approach LOS	B			E			C			B		
Intersection Delay, s/veh | LOS	22.1						C					

Appendix E Roundabout Preliminary Design

3455 Briarfield Blvd., Suite E
Maumee, OH 43537
(419) 535-1015
www.dgl-ltd.com

Engineer's Cost Estimate

Project: MAUMEE WESTERN TRAFFIC STUDY
Preliminary Estimate
Calculated By: CML
Checked By: LLA
Date: September 20, 2022

Description	Quantity	Unit	@	Unit Cost	=	Total Cost
Section 001 Roundabout						
Construction (Includes incidentals)	1	LS	@	$ 2,253,238.08	=	$ 2,253,238.08
Retaining Wall	21000.00	SQFT	@	$ 65.00	=	$ 1,365,000.00
Embankment	44000	CY	@	$ 15.00	=	$ 660,000.00
Roadway Total						$ 4,278,238.08
Section 004 New Park Road						
Construction	1	LS	@	$ 161,730.00	=	$ 161,730.00
Embankment	2520	CY	@	$ 15.00	=	$ 37,800.00
Pavement Total						$ 199,530.00
Subtotal (Sections 001 - 011)						$ 4,477,768.08
Contingency					30%	$ 1,343,330.42
PROJECT TOTAL						**$ 5,821,098.51**

CALCULATED TSJ
CHECKED CML

SR 25 & MAUMEE WESTERN ROAD/FRONT STREET PRELIMINARY ROUNDABOUT LAYOUT

CITY OF PERRYSBURG