

OSTRANDER RD (CR 163) AT US 36 SAFETY STUDY

DEL-US36-1.93

FEBRUARY 21, 2025

PREPARED FOR:

ODOT DISTRICT 6
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EXECUTIVE SUMMARY

The Ostrander Road (CR 163) and US 36 (Marysville Road) intersection in Delaware County has experienced a consistent trend of injury crashes over the past 4 years at the 4-leg, unsignalized intersection. Other higher priority locations within Delaware County have improvements already planned to mitigate safety issues.

Growth (1.5% per year) in the region (Delaware and Licking counties) is attributed to additional residential, commercial, and industrial developments.

A total of 11 crashes over a 4-year period (2021-2024) were documented having a high percentage of angle crashes (9 crashes or 82%) resulting in 8 injury crashes. The limits of the study area extended to 250 feet in advance of the existing 2-way stop controlled intersection as shown on **Figure 6** and was the basis of the most recent crash data obtained from the ODOT TIMS database.

Note that the 4-year crash dataset does not include a fatality occurred on 07/09/20 when a pickup truck ran the stop sign on the SB approach and was struck by a WB semi-truck. The crash occurred at 10:39 AM on a Thursday with weather conditions clear and dry. The at-fault driver was from Reynoldsburg and may not have been familiar with the stop control condition on the SB Ostrander Road approach.

A roundabout is proposed as an effective countermeasure to mitigate the high percentage of angle crashes resulting in angle injuries with vehicles not yielding on the minor street approaches. Existing traffic control devices (stop signs with post reflectors northbound/southbound and dual advance stop ahead signs with post reflectors eastbound/westbound) have not achieved the desired effect of mitigating crashes. The proposed design will utilize a single-lane roundabout to accommodate the existing 4-leg intersection. Other factors considered when selecting a roundabout include the following:

- Capacity analysis of all way stop control analysis determined that poor levels of service (LOS E) were experienced with design year 2050 traffic volumes.
- Angle crashes result in a high percentage of injury crashes.

The capacity analysis found that a single lane roundabout operates at level of service (LOS) A with 6.6 seconds of delay during the AM peak hour and 8.2 seconds of delay during PM peak hour of operation. The 2050 design hour volumes (**Figure 3**) were used for the capacity analyses.

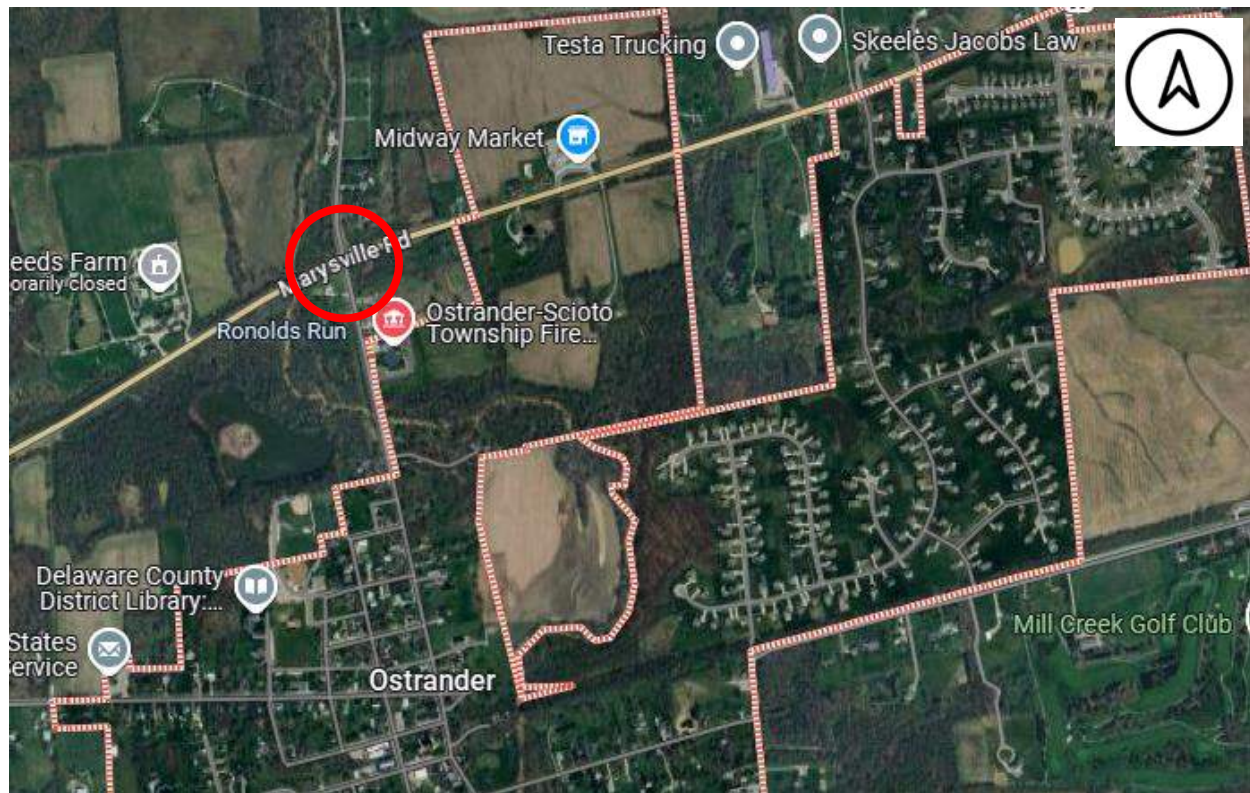
The conceptual design assumes the existing bridge 400 ft west of the subject intersection can be avoided but does assume a variable width shoulder on the structure. Construction costs account for the added embankment and guardrail needed on the roadway edge due to the elevation of the intersection with respect to the adjacent ground/ Blues Creek. The Ostrander Road approaches are based on low speed design criteria.

The proposed countermeasures result in a construction cost of \$3.53 million and a benefit cost ratio of 1.37. A safety application has also been prepared resulting in a score of 70 (see **Appendix G**).

INTRODUCTION

The purpose of this study is to evaluate existing safety performance and to refine potential countermeasures to reduce traffic crashes at the Ostrander Road (CR 163) and US36/ Marysville Road intersection in Delaware County, Ohio. **Figure 1** shows the study area with respect to the Village of Ostrander (population 1,094 at the 2020 census). The subject intersection is also referred to as DEL-US36-1.93 using the county-route-section designation.

FIGURE 1: STUDY AREA



The segment of US Route 36 within the study limits does appear on a Roadway Departure Priority list (low priority) for a roadway having 2 ft shoulders. The existing intersection does not appear on the MORPC high crash location list or the CEAO priority list. The absence of the DEL-US36-1.93 intersection on a local, regional or statewide priority listing is attributed to the gradual increase of crash frequency.

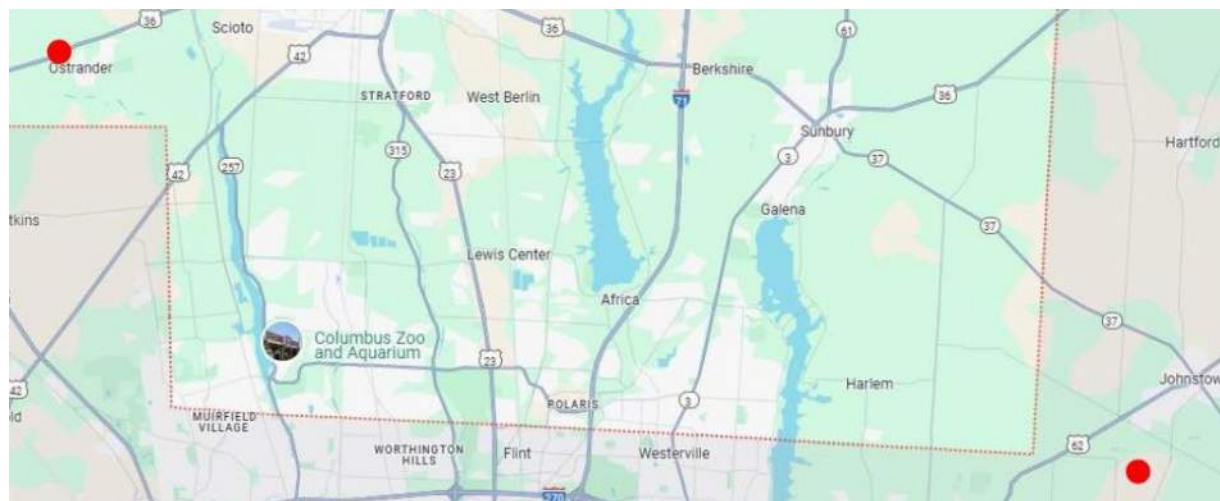
The average number of crashes per year is 2.75 crashes/ year (11 crashes) over a 4-year period (2021-2024). See the Safety Analysis section for additional information.

According to the Delaware County Regional Planning Commission (DCRPC), Delaware County was the fastest growing county in Ohio from 2010-2021. This growth trend is expected to continue, due to the proximity of Delaware County is to the City of New Albany (Licking County). The City has annexed 1,390 acres in Jersey Township, Licking County for the New Albany International Business Park which will include the new Intel semiconductor factory. A total of 7,000 workers are anticipated to construct the plant and 3,000 permanent jobs are anticipated with only the Intel development. Chip production is expected to start in 2025.

Growth in the region will be attributed to additional residential and commercial development to support the new business park is not yet quantified.

Figure 2 provides a regional map of the local roadway network in Delaware County. The distance between the new business park and Ostrander Road (red dots) is 28 miles.

FIGURE 2: REGIONAL MAP (DELAWARE CO)



EXISTING CONDITIONS

The Ostrander Road and US36 intersection is located five miles west of the City of Delaware and is located seven miles east of the City of Marysville. Both roads are approximately 20 feet wide with variable width shoulders (0-2 feet). The posted speed limit on US36 is 55 MPH; a posted speed limit of 45 MPH applies to the south leg of Ostrander Road (CR 163). The north leg has a legal speed limit of 55 MPH. Note that a speed limit of 25 MPH exists within the village limits which are 1,500 feet south of the US36 intersection.

US36 is a rural minor arterial roadway oriented in the east-west direction that connects Delaware and Marysville. The US36 approaches to Ostrander Road have intersection ahead signs (dual) with a post reflector. The dual advance signs are located 1,000 ft in advance on both approaches to the intersection (see **Photo 1**).

PHOTO 1: EB ADVANCE INTERSECTION AHEAD SIGN



There are dual advance warning signs for the stop condition on the County Line Road approaches that are located approximately 500 feet NB approach and 375 feet SB approach. **Photo 2** shows the northbound advance stop ahead warning signs on the northbound approach.

PHOTO 2: NB ADVANCE STOP AHEAD SIGN



Ostrander Road is a 2-lane county-maintained roadway oriented in the north-south direction. The terrain is relatively flat in the study area. County Line Road is classified as a rural minor collector roadway. The vertical alignment of Ostrander Road crests 50 feet north of the US36 intersection (see **Photo 3**) with a 6% slope on the NB and SB approaches to the intersection as shown in **Figure 3**.

PHOTO 3: OSTRANDER ROAD PROFILE (LOOKING NORTH)



FIGURE 3: OSTRANDER ROAD PROFILE



All approaches to the intersection have guardrail adjacent to the edge of pavement due to the intersection being elevated. US 36 crosses Blues Creek 400 feet west of the Ostrander Road intersection which contributes to the intersection being at a higher elevation than the adjacent property.

The horizontal alignment of US36 has a 3,820 ft curve west of the intersection resulting in the roadway being superelevated through the Ostrander Road intersection. The superelevation of 0.37 is estimated to meet a design speed of 60 MPH per Figure 202-8 in the ODOT L&D manual, Volume 1. The superelevation contributes to the crest of the vertical curve being located on the north leg of Ostrander Road. See **Figure 4** for the estimated limits of the horizontal curve on US36.

FIGURE 4: HORIZONTAL CURVE ON US₃₆ (WEST LEG)



US36 intersects Ostrander Road at an 80-degree angle.

DATA COLLECTION

A manual turning movement count (TMC) was collected at the Ostrander Road/ US 36 intersection on Thursday, November 21, 2024 for a 12-hour periods (6:00 AM –6:00 PM). Study area peak hours were determined by analyzing the total intersection volumes and taking into consideration the peak volumes on the Ostrander Road approaches. Peak traffic volumes were documented during the following hours: 7:30 – 8:30 AM and 3:00-4:00 PM.

Peak hour volumes for the 2050 design year were developed using turning movement counts (TMC) collected on 11/21/24 and applying adjustment factors. Adjustment factors were then applied to the TMC data to estimate 2050 design hour volumes (DHV), which include *Growth Factors* and *Peak-to-DHV Factors*. Various *growth factors* were applied based on the annual growth rate provided by the ODOT Traffic Forecast Management System (TFMS) to grow traffic to 2050 levels.

TFMS calculated an annual growth rate of 1.8% (west of int) and 1.2% (east of int). These count stations used to develop these growth rates are over 1.9 mile away from the US36/Ostrander Rd intersection. The average 1.5% rate is used along with Peak-to-DHV factor, which result in a 68% increase in volumes in 2050.

The latest ODOT 2022 *Peak-to-DHV Factor* (1.21) was applied to each roadway.

To better capture the vehicle routing impacts of the Intel development, annual linear growth rate was calculated at each approach of the intersection and then applied to the respective approach in the TMC. **Figure 5** shows the 2050 AM and PM peak hour traffic respectively. See **Appendix A** for raw traffic volume data and future year plates.

FIGURE 5: 2050 DESIGN HOURLY VOLUMES

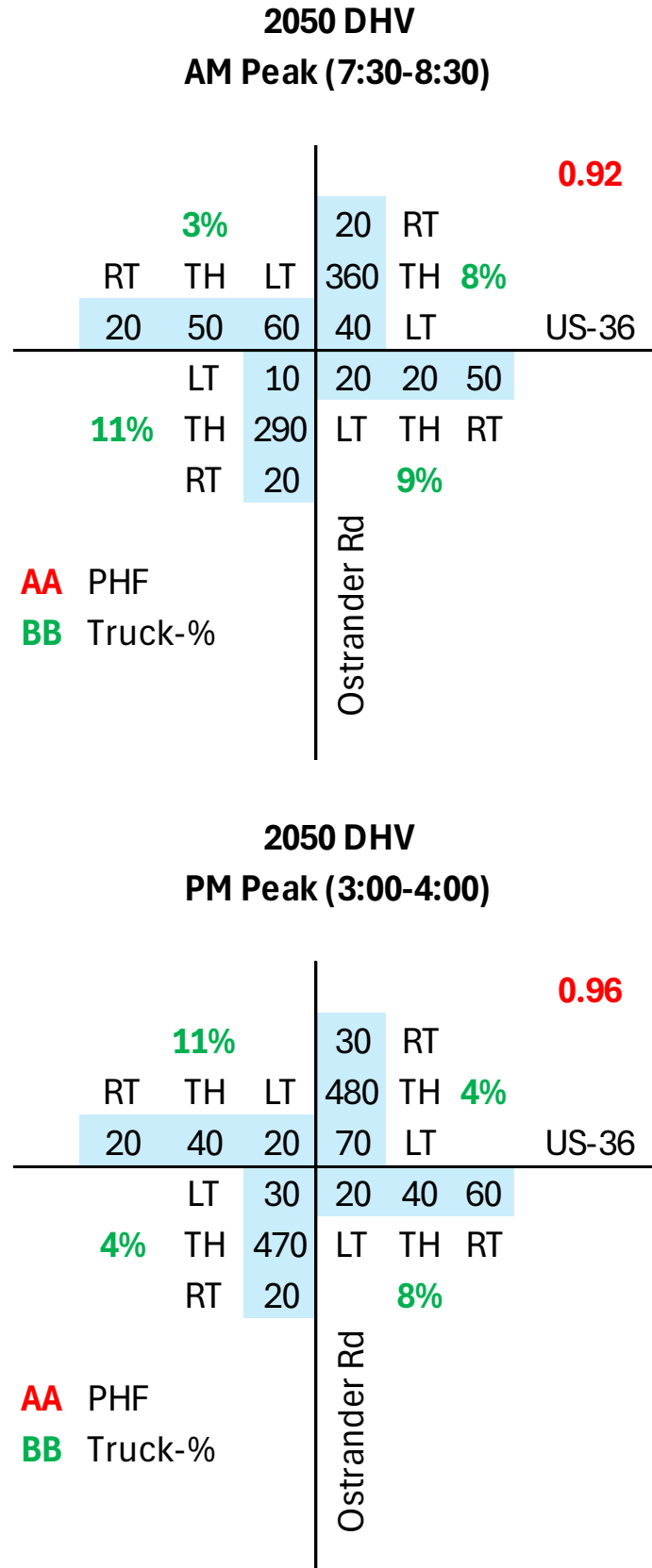


Table 1 below summarizes the calculated growth rate applied at each approach to generate the 2050 design year volumes shown in **Figure 5**.

TABLE 1: EXISTING VOLUME SUMMARY

ADJUSTMENT FACTORS		
TFMS Growth Rates		Growth Factors
Location	%/yr	26-yr
US-36	1.5%	1.39
Ostrander Rd*	1.5%	1.39

**No TFMS rate, assume equals US-36 rate (1.5%/year)*

ODOT Pk-to-DHV Factor	
Location	Factor
US-36	1.21
Ostrander Rd	1.21

SAFETY ANALYSIS

Crash data was obtained using the Transportation Information Mapping System (TIMS). The crash data included five years of data from 2020 to 2024 for the Ostrander Road and US 36 intersection. The limits of the current safety study extended 500 feet on the US36 approaches and 350 feet on the Ostrander Road approaches. **Figure 6** shows the study limits of the safety analyses. The OH-1 crash report for each documented crash was reviewed to confirm accuracy and to locate crashes properly within the study limits. Output of crash statistics is contained in **Appendix B**.

A total of 12 crashes occurred within the study area over a 5-year period (2020-2024). The frequency of crashes varies by year over the 5-year timeline, but the dataset shows frequency consistent since 2021 with an increasing trend line. The intersection nearly meets the minimum number of average crashes per year (2.75 crashes/ yr) for a 4-year period (2021-2024).

FIGURE 6 SAFETY ANALYSIS STUDY LIMITS



Statewide averages for crashes at a rural, 4-leg intersection where the minor roadway has stop control is shown in parenthesis. The comparison is based on the 5-year crash dataset having 12 total crashes.

- 1 fatal crash or 8.3% (1.19%)
- 8 injury crashes or 66.7% (35.1 %)
- 10 angle crashes or 84.6% (29.4 %)

The fatality occurred on 07/09/20 when a pickup truck ran the stop sign on the SB approach and was struck by a WB semi-truck. The crash occurred at 10:39 AM on a Thursday with weather conditions clear and dry. The at-fault driver was from Reynoldsburg and may not have been familiar with the stop control condition on the SB Ostrander Road approach.

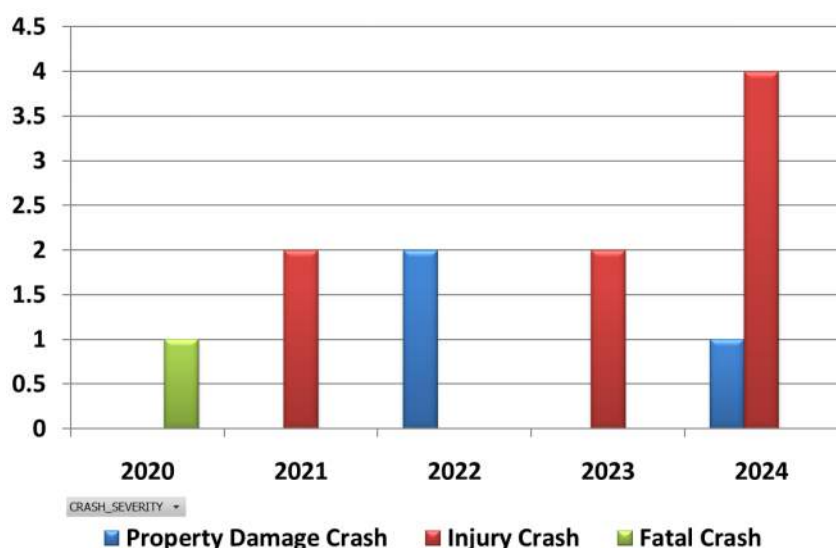
The statewide average comparison based on a 4-year dataset (2021-2024) having 11 total crashes without the single fatal crash in 2020 is summarized below:

- 8 injury crashes or 72.7% (36.3 %)
- 9 angle crashes or 81.8% (29.4 %)

Several factors contribute to the safety performance of the two-way stop controlled intersection resulting in the following noteworthy crash patterns:

- Guardrail on all 4-approaches obscure lower profile vehicles. Seven of the 11 crashes involved a passenger car (sedan) versus a pickup truck, SUV or larger vehicle.
- Four of the angle crashes occurred when a vehicle ran the stop sign on the Ostrander Road approach. 75% of the running stop signs involved SB vehicles. Not included in this statistic is the fatal crash that also involved a SB vehicle running the stop sign.
- The majority of crashes (50 - 60%) involved either older drivers (+65 years old) or young drivers (15-25) for the 4-year period. The vertical curve (Ostrander), horizontal curve (US36), approach speeds, and sight distance restrictions requires an increase of driver workload.

FIGURE 7: FREQUENCY OF CRASHES BY YEAR AND SEVERITY (2020-2024)



The frequency of crashes by year and severity for the 5-year period are summarized in **Figure 7**.

Crashes are distributed across many hours of the day as shown in **Figure 8**. Increased crashes around mid-day are noted and may be attributed to free flow speeds being higher than during peak periods.

FIGURE 8: FREQUENCY OF CRASHES BY TIME OF DAY (2018-2022)

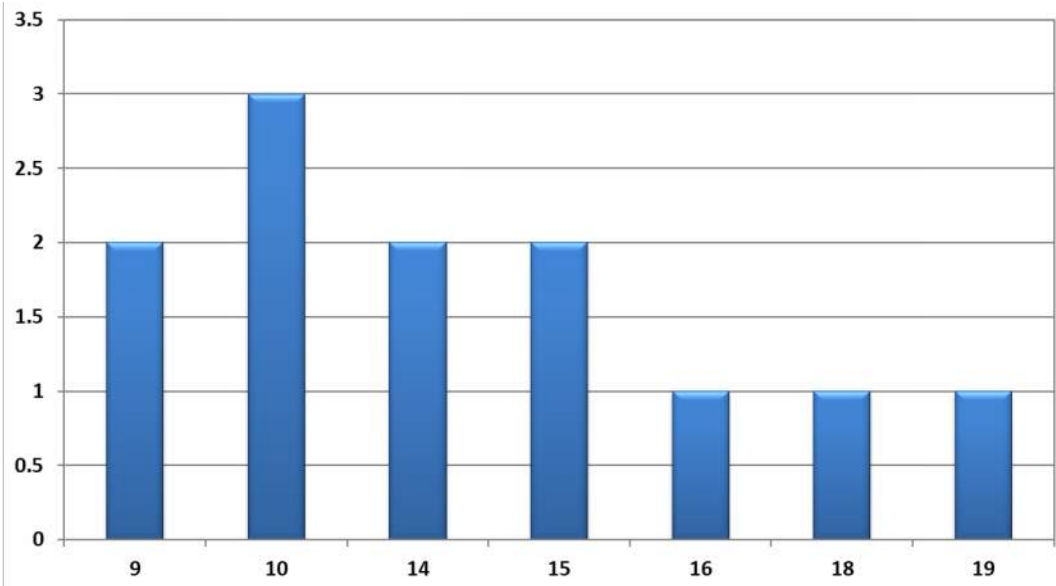
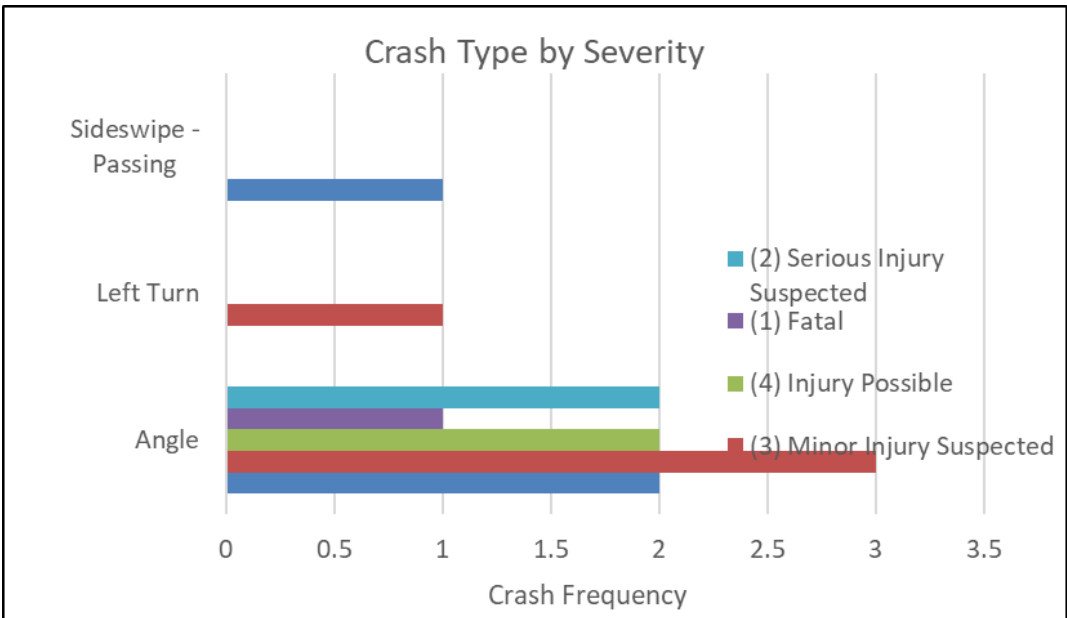


Figure 9 summarizes the crash type by severity. All except one injury crash (7 of 8 crashes) were attributed to the angle crash type. The legal speed limit of 55 MPH on US36 contributes to the injury rate.

FIGURE 9: CRASH SEVERITY BY CRASH TYPE



The crash diagram for the County Line Road and US36 intersection is shown in **Figure 10**. The blue crash arrows indicate injury crashes. Asterisks denote the at-fault driver.

Year	Crash Type	Location	Driver Status
2020	1	10 Dry/24/I/(1) TR 163	At-Fault
2021	2	10 Dry/20/F/(5) US36	At-Fault
2022	2	14 Dry/24/I/(7) US36 *	At-Fault
2023	2	15 Wet/22/P/(2) US36 *	At-Fault
2024	5	14 Dry/21/I/(5) US36 *	At-Fault
2024	9	9 Dry/24/P/(4) US36	Not At-Fault
2024	16	16 Dry/23/I/(7) US36	Not At-Fault
2024	18	18 Dry/24/I/(7) US36	Not At-Fault
2024	19	19 Dry/23/I/(7) US36 *	At-Fault

* Denotes At-Fault Driver

COUNTERMEASURES/RECOMMENDATIONS

A roundabout is proposed as an effective countermeasure to mitigate the high percentage of injury crashes resulting from angle crashes with vehicles not yielding on the Ostrander Road approaches. Other factors considered when selecting a roundabout include the following:

1. Existing traffic control devices (dual stop signs and dual intersection warning signs) have not achieved the desired effect of eliminating injury crashes over the past 5 years.
2. All-way stop control (AWSC) analysis determined that poor levels of service (LOS F) were experienced with design year 2024 traffic volumes.
3. The three primary volume based warrant (Warrants #1, #2 or #3) were not met using 2024 volumes. Therefore a signalized intersection option was not advanced. See **Appendix C** for signal warrant and AWSC warrant analyses.
4. Angle crashes result in a high percentage of injury crashes.

CAPACITY ANALYSIS

The 2050 design hourly volumes (DHV) shown in **Figure 5** were used for capacity analysis of three alternatives:

- No Build (two way stop control of Ostrander Rd approaches).
- All way stop control (AWSC)
- Roundabout

Speed reduction and long-term capacity of a roundabout are desirable to improve safety performance regardless of current traffic demands. Actual truck percentages and peak hour factor (PHF) from the TMC were used following OATS Section 5.2 and Section 5.5 guidance.

The capacity analysis found that a single lane roundabout operates at level of service (LOS) A with 6.6 seconds of delay during the AM peak hour and 8.2 seconds of delay during PM peak hour of operation. The maximum 95th percentile queue is estimated to be approximately 75 feet on the EB approach. See **Table 2** for a summary of the level of service and estimated queue lengths on each approach for the Build (roundabout) alternative. **Appendix D** contains HCS analysis output for all alternatives.

TABLE 2: CAPACITY SUMMARY (2050)

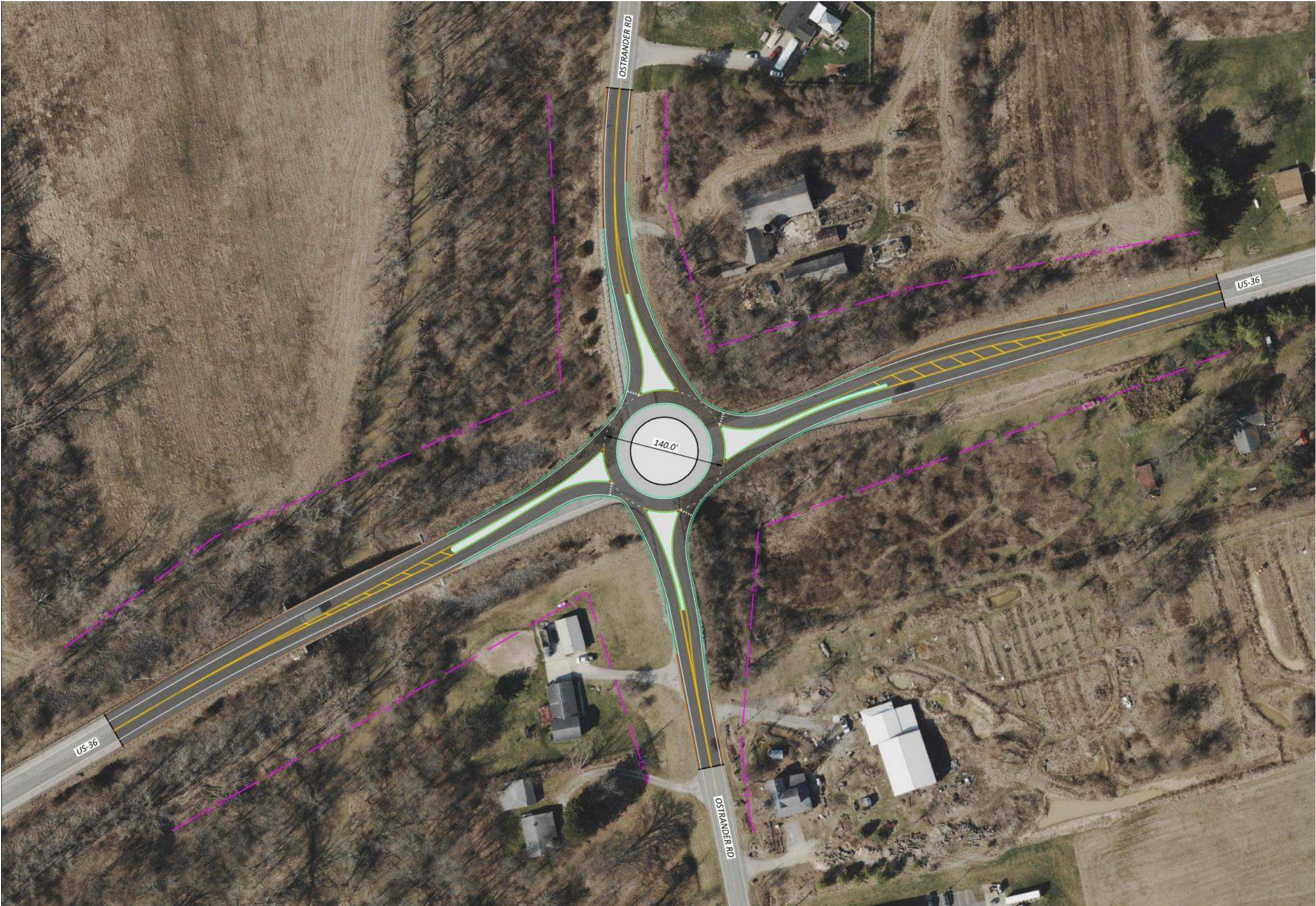
Intersection/Approach	2050 AM											
	No Build (TWSC)*				Build AWSC with Ex Lanes				Build 1x1 Roundabout			
	LOS (Delay, in sec)	v/c	QSR	95th%ile Queue (ft/ln)	LOS (Delay, in sec)	v/c	QSR	95th%ile Queue (ft/ln)	LOS (Delay, in sec)	v/c	QSR	95th%ile Queue (ft/ln)
US-36 at Ostrander Rd	D (32.8)	-	-	-	C (15.8)	-	-	-	A (6.6)	-	-	-
EB-LTR	A (8.3)	0.01	0.00	0	B (14.8)	0.54	0.02	87	A (6.8)	0.33	0.01	40.8
EB Approach	A (8.3)	-	-	-	B (14.8)	-	-	-	A (6.8)	-	-	-
WB-LTR	A (8.1)	0.04	0.00	2.5	C (19.0)	0.68	0.04	141	A (6.7)	0.38	0.01	47.9
WB Approach	A (8.1)	-	-	-	C (19.0)	-	-	-	A (6.7)	-	-	-
NB-LTR	C (18.5)	0.27	0.02	29.5	B (10.6)	0.17	0.01	16.1	A (5.6)	0.12	0.01	10.7
NB Approach	C (18.5)	-	-	-	B (10.6)	-	-	-	A (5.6)	-	-	-
SB-LTR	D (32.8)	0.53	0.02	74.2	B (11.4)	0.25	0.01	25.6	A (6.3)	0.17	0.00	15.4
SB Approach	D (32.8)	-	-	-	B (11.4)	-	-	-	A (6.3)	-	-	-

Intersection/Approach	2050 PM											
	No Build (TWSC)*				Build AWSC with Ex Lanes				Build 1x1 Roundabout			
	LOS (Delay, in sec)	v/c	QSR	95th%ile Queue (ft/ln)	LOS (Delay, in sec)	v/c	QSR	95th%ile Queue (ft/ln)	LOS (Delay, in sec)	v/c	QSR	95th%ile Queue (ft/ln)
US-36 at Ostrander Rd	F (61.6)	-	-	-	E (36.5)	-	-	-	A (8.2)	-	-	-
EB-LTR	A (8.6)	0.03	0.00	2.5	D (34.0)	0.86	0.05	252.8	A (8.3)	0.47	0.01	67.1
EB Approach	A (8.6)	-	-	-	D (34.0)	-	-	-	A (8.3)	-	-	-
WB-LTR	A (8.7)	0.07	0.00	5	E (47.1)	0.95	0.10	338	A (8.5)	0.50	0.02	74.8
WB Approach	A (8.7)	-	-	-	E (47.1)	-	-	-	A (8.5)	-	-	-
NB-LTR	E (49.7)	0.63	0.05	95.8	B (12.4)	0.25	0.01	26.6	A (6.9)	0.18	0.01	16
NB Approach	E (49.7)	-	-	-	B (12.4)	-	-	-	A (6.9)	-	-	-
SB-LTR	F (61.6)	0.59	0.02	81.6	B (12.1)	0.17	0.00	16.3	A (6.8)	0.13	0.00	10.9
SB Approach	F (61.6)	-	-	-	B (12.1)	-	-	-	A (6.8)	-	-	-

*Worst movement LOS shown in the table

Figure 11 is a conceptual plan of the proposed, single-lane roundabout at the Ostrander Road and US36 intersection. The conceptual design assumes the existing bridge west of the subject intersection can be avoided but does assume a variable width shoulder on the structure.

FIGURE 11: CONCEPTUAL PLAN



BENEFIT COST ANALYSIS

A benefit cost analysis for the proposed countermeasures was prepared using the ECAT spreadsheet. The financial benefits of these improvements were determined by comparing the net present value of the project construction costs to the safety benefits provided by the recommended improvements.

Since the fundamental operation of the proposed roundabout differs to the existing TWSC intersection, safety benefits of a roundabout were calculated only based on demand volumes and its physical characteristics. No existing crash data nor CMFs were applied when estimating safety benefits provided by the improvement.

An alternative approach to calculating safety benefits that was not used for this location is based on existing crash data and CMFs. The FHWA CMF Clearinghouse provides a 5-star CMF for conversion of a rural, stop-controlled intersection to a single lane roundabout. The CMF list for all crashes is 0.29 and 0.13 for A, B, C, Injury crashes. The lower operating speed of the roundabout combined with mitigating angle crashes is expected to address all angle crashes at the intersection. In addition, the improved levels of service will also function to mitigate crashes resulting from turning vehicles at the intersection. The resulting safety application score is expected to remain the same regardless of either methodology.

CMT used a useful life of 25 years on the roundabout construction as this is expected to be a permanent modification of the intersection. Construction costs were estimated for the proposed safety countermeasures as shown in **Figure 11**.

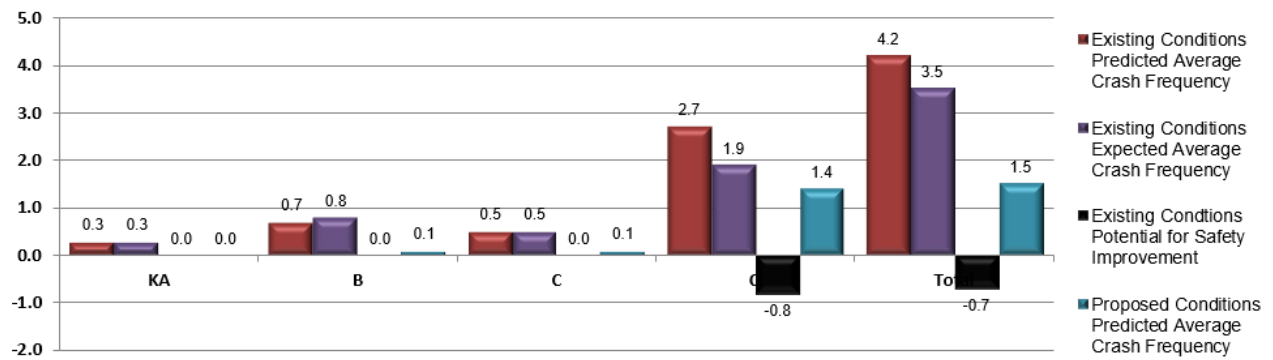
A summary of costs is shown in **Table 3**. A cost estimate can be found in **Appendix E**.

TABLE 3: COST SUMMARY

DESCRIPTION	COST
Construction Cost	\$1,925,000
Contingency 25%	\$481,000
PE, Enviro and Construction Eng (30%)	\$580,000
Property Acquisition/ Utility	\$75,000
Inflation (18%)	\$540,000
TOTAL	\$3,530,000

The crash reduction analysis is summarized in **Table 4** and results in a benefit cost ratio of 1.37. ECAT output is included in **Appendix F**.

TABLE 4: ECAT ANALYSIS SUMMARY



A safety funding application has been completed for the March 2025 round resulting in a score of 70. The application can be found in **Appendix G**.

DEL-US36-1.93 SAFETY STUDY

APPENDIX A: TRAFFIC DATA



ADJUSTMENT FACTORS

TFMS Growth Rates		Growth Factors
Location	%/yr	26-yr
US-36	1.5%	1.39
Ostrander Rd*	1.5%	1.39

*No TFMS rate, assume equals US-36 rate
(1.5%/year)

ODOT Pk-to-DHV Factor	
Location	Factor
US-36	1.21
Ostrander Rd	1.21

Notes:

1. Developed 2050 DHVs are rounded up to the nearest 10 vehicles.
2. Rural criteria used for Peak-to-DHV factor.

2024 Counts (Thurs 11/21/24) AM Peak (7:30-8:30)

									0.92
			3%	10	RT				
RT	TH	LT	211	TH	8%				
6	27	30	23	LT	US-36				
			LT	5	8	9	27		
11%	TH	168	LT	TH	RT				
			RT	6	9%				
						Ostrander Rd			

2024 Counts (Thurs 11/21/24) PM Peak (3:00-4:00)

									0.96
			11%	17	RT				
RT	TH	LT	281	TH	4%				
8	19	8	37	LT	US-36				
			LT	13	8	23	33		
4%	TH	276	LT	TH	RT				
			RT	9	8%				
						Ostrander Rd			

2050 DHV AM Peak (7:30-8:30)

									0.92
			3%	20	RT				
RT	TH	LT	360	TH	8%				
20	50	60	40	LT	US-36				
			LT	10	20	20	50		
11%	TH	290	LT	TH	RT				
			RT	20	9%				
						Ostrander Rd			

2050 DHV PM Peak (3:00-4:00)

									0.96
			11%	30	RT				
RT	TH	LT	480	TH	4%				
20	40	20	70	LT	US-36				
			LT	30	20	40	60		
4%	TH	470	LT	TH	RT				
			RT	20	8%				
						Ostrander Rd			

US36 and Ostrander Rd - TMC

Thu Nov 21, 2024

Full Length (6 AM-6 PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)

All Movements

ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :

Columbus OH

8101 N. High Street, Columbus, OH, 43235, US

Leg Direction	Ostrander Rd Southbound					US36 Westbound					Ostrander Rd Northbound					US36 Eastbound					
Time	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	Int
2024-11-21 6:00AM	2	5	4	0	11	1	24	2	0	27	1	0	1	0	2	1	22	0	0	23	63
6:15AM	0	6	6	0	12	1	38	11	0	50	5	0	1	0	6	0	35	0	0	35	103
6:30AM	2	4	4	0	10	0	60	11	0	71	4	0	0	0	4	1	29	1	0	31	116
6:45AM	3	5	4	0	12	1	43	10	0	54	4	2	0	0	6	0	43	0	0	43	115
Hourly Total	7	20	18	0	45	3	165	34	0	202	14	2	2	0	18	2	129	1	0	132	397
7:00AM	0	8	2	0	10	1	51	7	0	59	11	0	3	0	14	1	40	0	0	41	124
7:15AM	0	4	4	0	8	0	52	3	0	55	5	1	2	0	8	1	38	0	0	39	110
7:30AM	3	9	4	0	16	1	55	2	0	58	7	1	4	0	12	3	44	3	0	50	136
7:45AM	2	6	9	0	17	1	50	8	0	59	9	3	2	0	14	2	37	1	0	40	130
Hourly Total	5	27	19	0	51	3	208	20	0	231	32	5	11	0	48	7	159	4	0	170	500
8:00AM	1	3	13	0	17	2	51	9	0	62	6	1	2	0	9	1	55	0	0	56	144
8:15AM	0	9	4	0	13	6	55	4	0	65	5	4	0	0	9	0	32	1	0	33	120
8:30AM	4	2	6	0	12	2	42	7	0	51	7	1	3	0	11	0	33	0	0	33	107
8:45AM	3	8	5	0	16	1	36	3	0	40	9	1	0	0	10	0	50	0	0	50	116
Hourly Total	8	22	28	0	58	11	184	23	0	218	27	7	5	0	39	1	170	1	0	172	487
9:00AM	1	3	0	0	4	1	31	3	0	35	3	2	2	0	7	0	34	1	0	35	81
9:15AM	2	7	3	0	12	1	29	4	0	34	6	4	2	0	12	2	39	2	0	43	101
9:30AM	0	3	0	0	3	2	27	3	0	32	0	6	1	0	7	1	34	2	0	37	79
9:45AM	2	1	2	0	5	2	35	1	0	38	8	2	3	0	13	3	36	1	0	40	96
Hourly Total	5	14	5	0	24	6	122	11	0	139	17	14	8	0	39	6	143	6	0	155	357
10:00AM	1	3	3	0	7	1	31	7	0	39	4	2	0	0	6	0	26	1	0	27	79
10:15AM	1	6	1	0	8	1	33	5	0	39	3	1	3	0	7	3	31	1	0	35	89
10:30AM	1	2	1	0	4	1	27	1	0	29	4	3	1	0	8	2	31	2	0	35	76
10:45AM	1	1	1	0	3	0	24	6	0	30	5	1	2	0	8	5	35	2	0	42	83
Hourly Total	4	12	6	0	22	3	115	19	0	137	16	7	6	0	29	10	123	6	0	139	327
11:00AM	1	5	3	0	9	4	36	6	0	46	6	3	1	0	10	2	30	0	0	32	97
11:15AM	3	2	1	0	6	3	37	3	0	43	7	1	1	0	9	6	34	0	0	40	98
11:30AM	2	7	4	0	13	1	28	3	0	32	11	0	4	0	15	2	24	3	0	29	89
11:45AM	0	2	1	0	3	2	34	5	0	41	9	3	4	0	16	3	30	2	0	35	95
Hourly Total	6	16	9	0	31	10	135	17	0	162	33	7	10	0	50	13	118	5	0	136	379
12:00PM	1	2	3	0	6	3	33	7	0	43	10	5	2	0	17	0	32	1	0	33	99
12:15PM	2	1	3	0	6	1	43	8	0	52	9	7	2	0	18	2	32	4	0	38	114
12:30PM	3	1	0	0	4	4	24	9	0	37	7	3	2	0	12	4	34	2	0	40	93
12:45PM	0	7	1	0	8	5	33	5	0	43	6	3	2	0	11	2	47	1	0	50	112
Hourly Total	6	11	7	0	24	13	133	29	0	175	32	18	8	0	58	8	145	8	0	161	418
1:00PM	4	1	2	0	7	5	43	5	0	53	7	1	2	0	10	0	28	1	0	29	99
1:15PM	0	0	7	0	7	0	37	7	0	44	5	3	2	0	10	3	38	0	0	41	102
1:30PM	1	3	1	0	5	0	31	2	0	33	5	2	2	0	9	1	41	2	0	44	91
1:45PM	3	3	2	0	8	0	31	3	0	34	9	1	2	0	12	0	39	1	0	40	94
Hourly Total	8	7	12	0	27	5	142	17	0	164	26	7	8	0	41	4	146	4	0	154	386
2:00PM	2	0	2	0	4	4	40	5	0	49	1	3	0	0	4	1	39	3	0	43	100
2:15PM	1	1	2	0	4	3	45	7	0	55	7	4	2	0	13	4	44	1	0	49	121
2:30PM	2	3	3	0	8	1	38	5	0	44	9	7	0	0	16	2	37	1	0	40	108
2:45PM	2	1	4	0	7	2	43	5	0	50	8	3	1	0	12	2	61	5	0	68	137
Hourly Total	7	5	11	0	23	10	166	22	0	198	25	17	3	0	45	9	181	10	0	200	466
3:00PM	0	4	2	0	6	2	66	10	0	78	3	6	2	0	11	2	75	6	0	83	178
3:15PM	3	6	2	0	11	6	62	8	0	76	8	4	3	0	15	1	82	3	0	86	188
3:30PM	2	1	1	0	4	6	70	8	0	84	12	6	0	0	18	6	75	3	0	84	190
3:45PM	3	8	3	0	14	3	83	11	0	97	10	7	3	0	20	0	44	1	0	45	176
Hourly Total	8	19	8	0	35	17	281	37	0	335	33	23	8	0	64	9	276	13	0	298	732
4:00PM	2	1	4	0	7	9	58	11	0	78	11	8	4	0	23	4	61	2	0	67	175
4:15PM	3	4	0	0	7	7	62	9	0	78	8	8	1	0	17	3	72	0	0	75	177
4:30PM	2	4	6	0	12	10	52	9	0	71	15	5	5	0	25	3	75	3	0	81	189

Leg Direction	Ostrander Rd Southbound					US36 Westbound					Ostrander Rd Northbound					US36 Eastbound					
Time	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	Int
4:45PM	0	6	4	0	10	7	52	9	0	68	7	8	5	0	20	3	69	4	0	76	174
Hourly Total	7	15	14	0	36	33	224	38	0	295	41	29	15	0	85	13	277	9	0	299	715
5:00PM	5	2	2	0	9	8	55	11	0	74	8	15	3	0	26	2	68	4	0	74	183
5:15PM	0	5	1	0	6	6	53	12	0	71	15	3	1	0	19	2	62	3	0	67	163
5:30PM	2	1	6	0	9	7	43	9	0	59	9	5	2	0	16	1	51	5	0	57	141
5:45PM	2	4	1	0	7	6	50	7	0	63	9	6	1	0	16	2	54	2	0	58	144
Hourly Total	9	12	10	0	31	27	201	39	0	267	41	29	7	0	77	7	235	14	0	256	631
Total	80	180	147	0	407	141	2076	306	0	2523	337	165	91	0	593	89	2102	81	0	2272	5795
% Approach	19.7%	44.2%	36.1%	0%	-	5.6%	82.3%	12.1%	0%	-	56.8%	27.8%	15.3%	0%	-	3.9%	92.5%	3.6%	0%	-	-
% Total	1.4%	3.1%	2.5%	0%	7.0%	2.4%	35.8%	5.3%	0%	43.5%	5.8%	2.8%	1.6%	0%	10.2%	1.5%	36.3%	1.4%	0%	39.2%	-
Lights	75	173	140	0	388	135	1935	281	0	2351	311	159	90	0	560	87	1968	69	0	2124	5423
% Lights	93.8%	96.1%	95.2%	0%	95.3%	95.7%	93.2%	91.8%	0%	93.2%	92.3%	96.4%	98.9%	0%	94.4%	97.8%	93.6%	85.2%	0%	93.5%	93.6%
Articulated Trucks	0	0	1	0	1	0	61	2	0	63	3	0	0	0	3	0	59	0	0	59	126
% Articulated Trucks	0%	0%	0.7%	0%	0.2%	0%	2.9%	0.7%	0%	2.5%	0.9%	0%	0%	0%	0.5%	0%	2.8%	0%	0%	2.6%	2.2%
Buses and Single-Unit Trucks	5	7	6	0	18	6	80	23	0	109	23	6	1	0	30	2	75	12	0	89	246
% Buses and Single-Unit Trucks	6.3%	3.9%	4.1%	0%	4.4%	4.3%	3.9%	7.5%	0%	4.3%	6.8%	3.6%	1.1%	0%	5.1%	2.2%	3.6%	14.8%	0%	3.9%	4.2%

* L: Left, R: Right, T: Thru, U: U-Turn

US36 and Ostrander Rd - TMC

Thu Nov 21, 2024

Full Length (6 AM-6 PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)

All Movements

ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :

Columbus OH

8101 N. High Street, Columbus, OH, 43235, US

[N] Ostrander Rd

Total: 794

In: 407 Out: 387

80
180
147

[W] US36

Total: 4519

Out: 2247

In: 2272

81
2102

89

141
2076
306

Out: 2586 In: 2523

Total: 5109

[E] US36

Out: 575 In: 593

Total: 1168

[S] Ostrander Rd

91
165
337

US36 and Ostrander Rd - TMC

Thu Nov 21, 2024

AM Peak (7:30 AM - 8:30 AM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)

All Movements

ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and

Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :

Columbus OH

8101 N. High Street, Columbus, OH, 43235, US

Leg Direction	Ostrander Rd Southbound					US36 Westbound					Ostrander Rd Northbound					US36 Eastbound					
Time	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	Int
2024-11-21 7:30AM	3	9	4	0	16	1	55	2	0	58	7	1	4	0	12	3	44	3	0	50	136
7:45AM	2	6	9	0	17	1	50	8	0	59	9	3	2	0	14	2	37	1	0	40	130
8:00AM	1	3	13	0	17	2	51	9	0	62	6	1	2	0	9	1	55	0	0	56	144
8:15AM	0	9	4	0	13	6	55	4	0	65	5	4	0	0	9	0	32	1	0	33	120
Total	6	27	30	0	63	10	211	23	0	244	27	9	8	0	44	6	168	5	0	179	530
% Approach	9.5%	42.9%	47.6%	0%	-	4.1%	86.5%	9.4%	0%	-	61.4%	20.5%	18.2%	0%	-	3.4%	93.9%	2.8%	0%	-	-
% Total	1.1%	5.1%	5.7%	0%	11.9%	1.9%	39.8%	4.3%	0%	46.0%	5.1%	1.7%	1.5%	0%	8.3%	1.1%	31.7%	0.9%	0%	33.8%	-
PHF	0.500	0.750	0.577	-	0.926	0.417	0.959	0.639	-	0.938	0.750	0.563	0.500	-	0.786	0.500	0.764	0.417	-	0.799	0.920
Lights	6	27	28	0	61	8	195	22	0	225	26	6	8	0	40	5	150	4	0	159	485
% Lights	100%	100%	93.3%	0%	96.8%	80.0%	92.4%	95.7%	0%	92.2%	96.3%	66.7%	100%	0%	90.9%	83.3%	89.3%	80.0%	0%	88.8%	91.5%
Articulated Trucks	0	0	0	0	0	0	7	0	0	7	1	0	0	0	1	0	8	0	0	8	16
% Articulated Trucks	0%	0%	0%	0%	0%	0%	3.3%	0%	0%	2.9%	3.7%	0%	0%	0%	2.3%	0%	4.8%	0%	0%	4.5%	3.0%
Buses and Single-Unit Trucks	0	0	2	0	2	2	9	1	0	12	0	3	0	0	3	1	10	1	0	12	29
% Buses and Single-Unit Trucks	0%	0%	6.7%	0%	3.2%	20.0%	4.3%	4.3%	0%	4.9%	0%	33.3%	0%	0%	6.8%	16.7%	6.0%	20.0%	0%	6.7%	5.5%

*L: Left, R: Right, T: Thru, U: U-Turn

US36 and Ostrander Rd - TMC

Thu Nov 21, 2024

AM Peak (7:30 AM - 8:30 AM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)

All Movements

ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :

Columbus OH

8101 N. High Street, Columbus, OH, 43235, US

[N] Ostrander Rd

Total: 87

In: 63 Out: 24

6 27 30

[W] US36

Total: 404

In: 179 Out: 225

5 168 6

10 211 23

Out: 225 In: 244

Total: 469

[E] US36

Out: 56 In: 44

Total: 100

[S] Ostrander Rd

8 9 27

US36 and Ostrander Rd - TMC

Thu Nov 21, 2024

Midday Peak (12 PM - 1 PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)

All Movements

ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and

Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :

Columbus OH

8101 N. High Street, Columbus, OH, 43235, US

Leg Direction	Ostrander Rd Southbound					US36 Westbound					Ostrander Rd Northbound					US36 Eastbound					
Time	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	Int
2024-11-21 12:00PM	1	2	3	0	6	3	33	7	0	43	10	5	2	0	17	0	32	1	0	33	99
12:15PM	2	1	3	0	6	1	43	8	0	52	9	7	2	0	18	2	32	4	0	38	114
12:30PM	3	1	0	0	4	4	24	9	0	37	7	3	2	0	12	4	34	2	0	40	93
12:45PM	0	7	1	0	8	5	33	5	0	43	6	3	2	0	11	2	47	1	0	50	112
Total	6	11	7	0	24	13	133	29	0	175	32	18	8	0	58	8	145	8	0	161	418
% Approach	25.0%	45.8%	29.2%	0%	-	7.4%	76.0%	16.6%	0%	-	55.2%	31.0%	13.8%	0%	-	5.0%	90.1%	5.0%	0%	-	-
% Total	1.4%	2.6%	1.7%	0%	5.7%	3.1%	31.8%	6.9%	0%	41.9%	7.7%	4.3%	1.9%	0%	13.9%	1.9%	34.7%	1.9%	0%	38.5%	-
PHF	0.500	0.393	0.583	-	0.750	0.650	0.773	0.806	-	0.841	0.800	0.643	1.000	-	0.806	0.500	0.771	0.500	-	0.805	0.917
Lights	6	10	6	0	22	13	121	28	0	162	28	18	8	0	54	8	129	8	0	145	383
% Lights	100%	90.9%	85.7%	0%	91.7%	100%	91.0%	96.6%	0%	92.6%	87.5%	100%	100%	0%	93.1%	100%	89.0%	100%	0%	90.1%	91.6%
Articulated Trucks	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	0	7	0	0	7	14
% Articulated Trucks	0%	0%	0%	0%	0%	0%	5.3%	0%	0%	4.0%	0%	0%	0%	0%	0%	0%	4.8%	0%	0%	4.3%	3.3%
Buses and Single-Unit Trucks	0	1	1	0	2	0	5	1	0	6	4	0	0	0	4	0	9	0	0	9	21
% Buses and Single-Unit Trucks	0%	9.1%	14.3%	0%	8.3%	0%	3.8%	3.4%	0%	3.4%	12.5%	0%	0%	0%	6.9%	0%	6.2%	0%	0%	5.6%	5.0%

*L: Left, R: Right, T: Thru, U: U-Turn

US36 and Ostrander Rd - TMC

Thu Nov 21, 2024

Midday Peak (12 PM - 1 PM)

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)

All Movements

ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :

Columbus OH

8101 N. High Street, Columbus, OH, 43235, US

[N] Ostrander Rd

Total: 63

In: 24 Out: 39

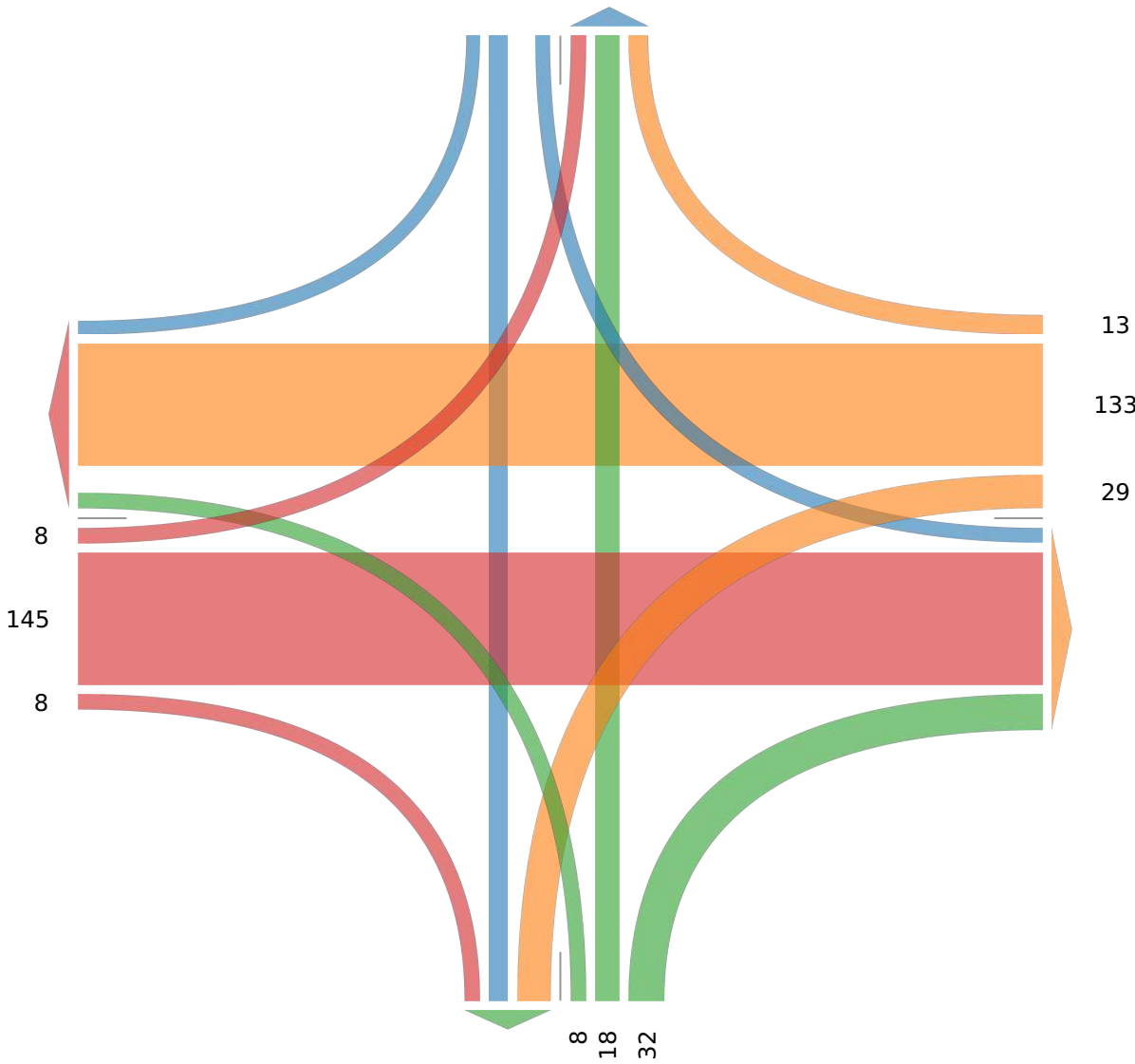
6 11 7

[W] US36

Total: 308

Out: 147

In: 161



Out: 48 In: 58

Total: 106

[S] Ostrander Rd

US36 and Ostrander Rd - TMC

Thu Nov 21, 2024

PM Peak (3 PM - 4 PM) - Overall Peak Hour

All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)

All Movements

ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :

Columbus OH

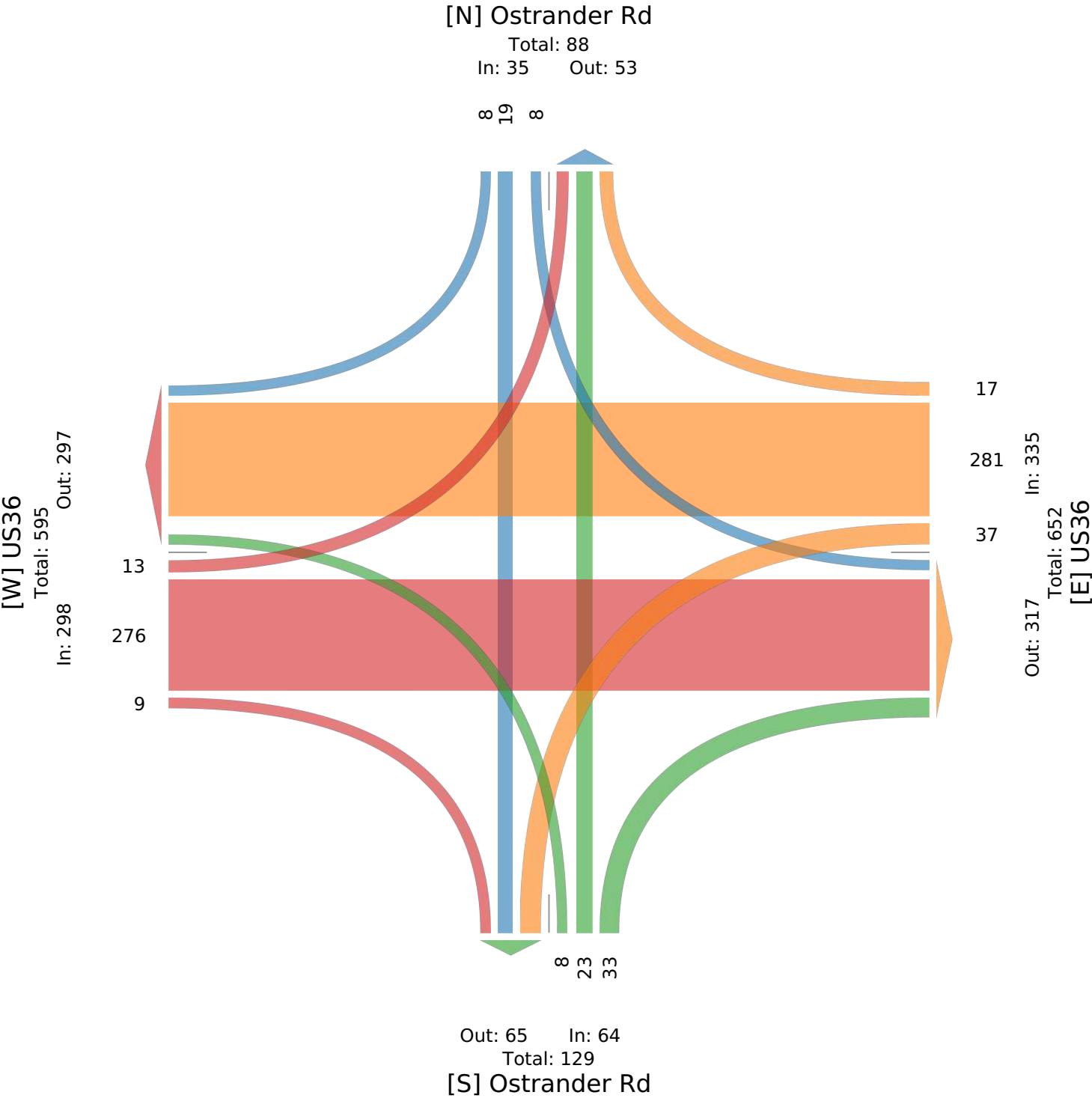
8101 N. High Street, Columbus, OH, 43235, US

Leg Direction	Ostrander Rd Southbound					US36 Westbound					Ostrander Rd Northbound					US36 Eastbound					
Time	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	R	T	L	U	App	Int
2024-11-21 3:00PM	0	4	2	0	6	2	66	10	0	78	3	6	2	0	11	2	75	6	0	83	178
3:15PM	3	6	2	0	11	6	62	8	0	76	8	4	3	0	15	1	82	3	0	86	188
3:30PM	2	1	1	0	4	6	70	8	0	84	12	6	0	0	18	6	75	3	0	84	190
3:45PM	3	8	3	0	14	3	83	11	0	97	10	7	3	0	20	0	44	1	0	45	176
Total	8	19	8	0	35	17	281	37	0	335	33	23	8	0	64	9	276	13	0	298	732
% Approach	22.9%	54.3%	22.9%	0%	-	5.1%	83.9%	11.0%	0%	-	51.6%	35.9%	12.5%	0%	-	3.0%	92.6%	4.4%	0%	-	-
% Total	1.1%	2.6%	1.1%	0%	4.8%	2.3%	38.4%	5.1%	0%	45.8%	4.5%	3.1%	1.1%	0%	8.7%	1.2%	37.7%	1.8%	0%	40.7%	-
PHF	0.667	0.594	0.667	-	0.625	0.708	0.846	0.841	-	0.863	0.688	0.821	0.667	-	0.800	0.375	0.841	0.542	-	0.866	0.963
Lights	6	18	7	0	31	16	270	34	0	320	28	23	8	0	59	9	264	12	0	285	695
% Lights	75.0%	94.7%	87.5%	0%	88.6%	94.1%	96.1%	91.9%	0%	95.5%	84.8%	100%	100%	0%	92.2%	100%	95.7%	92.3%	0%	95.6%	94.9%
Articulated Trucks	0	0	0	0	0	0	2	1	0	3	0	0	0	0	0	0	7	0	0	7	10
% Articulated Trucks	0%	0%	0%	0%	0%	0%	0.7%	2.7%	0%	0.9%	0%	0%	0%	0%	0%	0%	2.5%	0%	0%	2.3%	1.4%
Buses and Single-Unit Trucks	2	1	1	0	4	1	9	2	0	12	5	0	0	0	5	0	5	1	0	6	27
% Buses and Single-Unit Trucks	25.0%	5.3%	12.5%	0%	11.4%	5.9%	3.2%	5.4%	0%	3.6%	15.2%	0%	0%	0%	7.8%	0%	1.8%	7.7%	0%	2.0%	3.7%

*L: Left, R: Right, T: Thru, U: U-Turn

US36 and Ostrander Rd - TMC
Thu Nov 21, 2024
PM Peak (3 PM - 4 PM) - Overall Peak Hour
All Classes (Lights, Articulated Trucks, Buses and Single-Unit Trucks)
All Movements
ID: 1250988, Location: 40.273849, -83.214846, Site Code: US36 and
Ostrander Rd

Provided by: Crawford Murphy & Tilly Inc. (CMT) :
Columbus OH
8101 N. High Street, Columbus, OH, 43235, US



Location Info							Count Data Info	
Location ID	9921_EB						Start Date	2/13/2025
Type	I-SECTION						End Date	2/14/2025
Functional Class	4						Start Time	12:00 AM
Located On	MARYSVILLE RD						End Time	12:00 AM
							Direction	
Direction	EB						Notes	
Community	W OF DELAWARE						Count Source	
MPO_ID							File Name	
HPMS ID							Weather	
Agency	Ohio Department of Transportation						Study	
							Owner	OdotAuto
							QC Status	Accepted
Interval: 15 mins								
Time	15 Min				Hourly Count			
	1st	2nd	3rd	4th				
00:00 - 01:00	2	4	3	2	11			
01:00 - 02:00	4	2	4	15	25			
02:00 - 03:00	23	14	4	2	43			
03:00 - 04:00	3	7	8	1	19			
04:00 - 05:00	6	8	11	10	35			
05:00 - 06:00	8	22	33	24	87			
06:00 - 07:00	24	40	56	72	192			
07:00 - 08:00	82	79	84	79	324			
08:00 - 09:00	60	60	69	58	247			
09:00 - 10:00	60	49	50	40	199			
10:00 - 11:00	35	48	42	29	154			
11:00 - 12:00	48	40	37	42	167			
12:00 - 13:00	54	40	44	48	186			
13:00 - 14:00	46	34	32	49	161			
14:00 - 15:00	60	56	43	62	221			
15:00 - 16:00	57	81	94	70	302			
16:00 - 17:00	80	86	80	78	324			
17:00 - 18:00	74	77	76	90	317			
18:00 - 19:00	57	58	52	42	209			
19:00 - 20:00	43	45	21	22	131			
20:00 - 21:00	35	37	28	19	119			
21:00 - 22:00	19	25	10	9	63			
22:00 - 23:00	14	10	10	4	38			
23:00 - 24:00	8	6	3	4	21			
TOTAL					3595			

Location Info						Count Data Info	
Location ID	9921_WB					Start Date	2/13/2025
Type	I-SECTION					End Date	2/14/2025
Functional Class	4					Start Time	12:00 AM
Located On	MARYSVILLE RD					End Time	12:00 AM
						Direction	
Direction	WB					Notes	
Community	W OF DELAWARE					Count Source	
MPO_ID						File Name	
HPMS ID						Weather	
Agency	Ohio Department of Transportation					Study	
						Owner	OdotAuto
						QC Status	Accepted
Interval: 15 mins							
Time	15 Min				Hourly Count		
	1st	2nd	3rd	4th			
00:00 - 01:00	5	3	10	12	30		
01:00 - 02:00	2	1	1	2	6		
02:00 - 03:00	2	3	3	1	9		
03:00 - 04:00	2	3	7	6	18		
04:00 - 05:00	10	11	12	27	60		
05:00 - 06:00	28	42	27	31	128		
06:00 - 07:00	29	45	58	43	175		
07:00 - 08:00	48	52	69	55	224		
08:00 - 09:00	44	66	46	25	181		
09:00 - 10:00	64	57	57	43	221		
10:00 - 11:00	33	38	43	41	155		
11:00 - 12:00	45	46	48	38	177		
12:00 - 13:00	42	52	40	51	185		
13:00 - 14:00	54	41	54	45	194		
14:00 - 15:00	35	44	73	80	232		
15:00 - 16:00	79	84	89	93	345		
16:00 - 17:00	75	80	84	68	307		
17:00 - 18:00	66	79	58	56	259		
18:00 - 19:00	52	60	39	45	196		
19:00 - 20:00	56	29	36	45	166		
20:00 - 21:00	42	34	31	27	134		
21:00 - 22:00	36	25	21	22	104		
22:00 - 23:00	9	9	8	9	35		
23:00 - 24:00	8	8	9	10	35		
TOTAL					3576		

Location Info						Count Data Info	
Location ID	9921					Start Date	2/13/2025
Type	I-SECTION					End Date	2/14/2025
Functional Class	4					Start Time	12:00 AM
Located On	MARYSVILLE RD					End Time	12:00 AM
						Direction	
Direction	2-WAY					Notes	
Community	W OF DELAWARE					Count Source	
MPO_ID						File Name	
HPMS ID						Weather	
Agency	Ohio Department of Transportation					Study	
						Owner	OdotAuto
						QC Status	Accepted
Interval: 15 mins							
Time	15 Min				Hourly Count		
	1st	2nd	3rd	4th			
00:00 - 01:00	7	7	13	14	41		
01:00 - 02:00	6	3	5	17	31		
02:00 - 03:00	25	17	7	3	52		
03:00 - 04:00	5	10	15	7	37		
04:00 - 05:00	16	19	23	37	95		
05:00 - 06:00	36	64	60	55	215		
06:00 - 07:00	53	85	114	115	367		
07:00 - 08:00	130	131	153	134	548		
08:00 - 09:00	104	126	115	83	428		
09:00 - 10:00	124	106	107	83	420		
10:00 - 11:00	68	86	85	70	309		
11:00 - 12:00	93	86	85	80	344		
12:00 - 13:00	96	92	84	99	371		
13:00 - 14:00	100	75	86	94	355		
14:00 - 15:00	95	100	116	142	453		
15:00 - 16:00	136	165	183	163	647		
16:00 - 17:00	155	166	164	146	631		
17:00 - 18:00	140	156	134	146	576		
18:00 - 19:00	109	118	91	87	405		
19:00 - 20:00	99	74	57	67	297		
20:00 - 21:00	77	71	59	46	253		
21:00 - 22:00	55	50	31	31	167		
22:00 - 23:00	23	19	18	13	73		
23:00 - 24:00	16	14	12	14	56		
TOTAL					7171		

Location ID	9921_WB			Located On			MARYSVILLE RD						Community			W OF DELAWARE														
Counted By	TCDS_Combined												County			Delaware														
Start Date	2/13/2025												Module																	
Start Time	12:00:00 AM			Direction			WB						Agency			ODOT														
Source	TCDS_BIN_IMPORT_COMBINE			QC Status			Accepted						Location ID			9921_WB			Located On			MARYSVILLE RD			County			Delaware		
Speed Range (mph)												Counted By			TCDS_Combined									Community			W OF DELAWARE			
												Start Date			Thu 2/13/2025			Loc On Alias			515			Station						
												Start Time			12:00:00 AM			Direction			WB			Agency			ODOT			
												Source			TCDS_BIN_IMPORT_COMBINE			Sensor Type			ATR Class									
Start Time	0-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	85%tile Speed			59			Count Status			Accepted			Holiday			No		
												Pace Speed			50 - 60															
												Display Interval:			60 Min ▾															
12:00 AM	1	3	10	6	6	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18		
1:00 AM	1	0	1	0	2	1	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	60		
2:00 AM	0	0	1	2	3	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	128		
3:00 AM	0	1	2	0	3	8	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	175		
4:00 AM	1	0	2	5	11	25	13	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	224		
5:00 AM	0	0	13	12	36	48	18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	181		
6:00 AM	0	7	17	41	53	36	18	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	221		
7:00 AM	17	7	33	61	53	44	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155		
8:00 AM	6	6	25	45	60	34	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	177		
9:00 AM	14	19	28	45	76	27	7	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	185		
10:00 AM	7	2	22	27	49	36	11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	194		
11:00 AM	3	8	19	40	60	31	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	232		
12:00 PM	5	3	14	37	66	49	9	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	345		
1:00 PM	1	4	26	44	54	55	7	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	307		
2:00 PM	0	5	14	58	85	57	10	2	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	259		
3:00 PM	0	15	44	93	89	86	17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	196		
4:00 PM	8	16	17	59	110	78	16	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	166		
5:00 PM	0	0	25	82	78	57	17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	134		
6:00 PM	0	5	19	49	76	35	10	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104		
7:00 PM	0	4	12	32	56	41	20	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35		
8:00 PM	1	0	7	18	51	39	11	5	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	35		
9:00 PM	1	1	7	18	27	34	11	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
10:00 PM	0	0	0	6	8	11	8	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
11:00 PM	0	0	3	8	8	12	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
TOTAL	66	106	361	788	1120	848	240	36	7	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3576		



TFMS - Segment Forecast Report

Username	Email	Script Import Date	Script Version	Model Version
Ghansel	ghansel@cmtengr.com	4/14/2020 5:30:19 PM	2020.001	2024.1900

Forecast Summary

Project ID	Project Name	Opening Year	Design Year
		2025	2050

Project Description

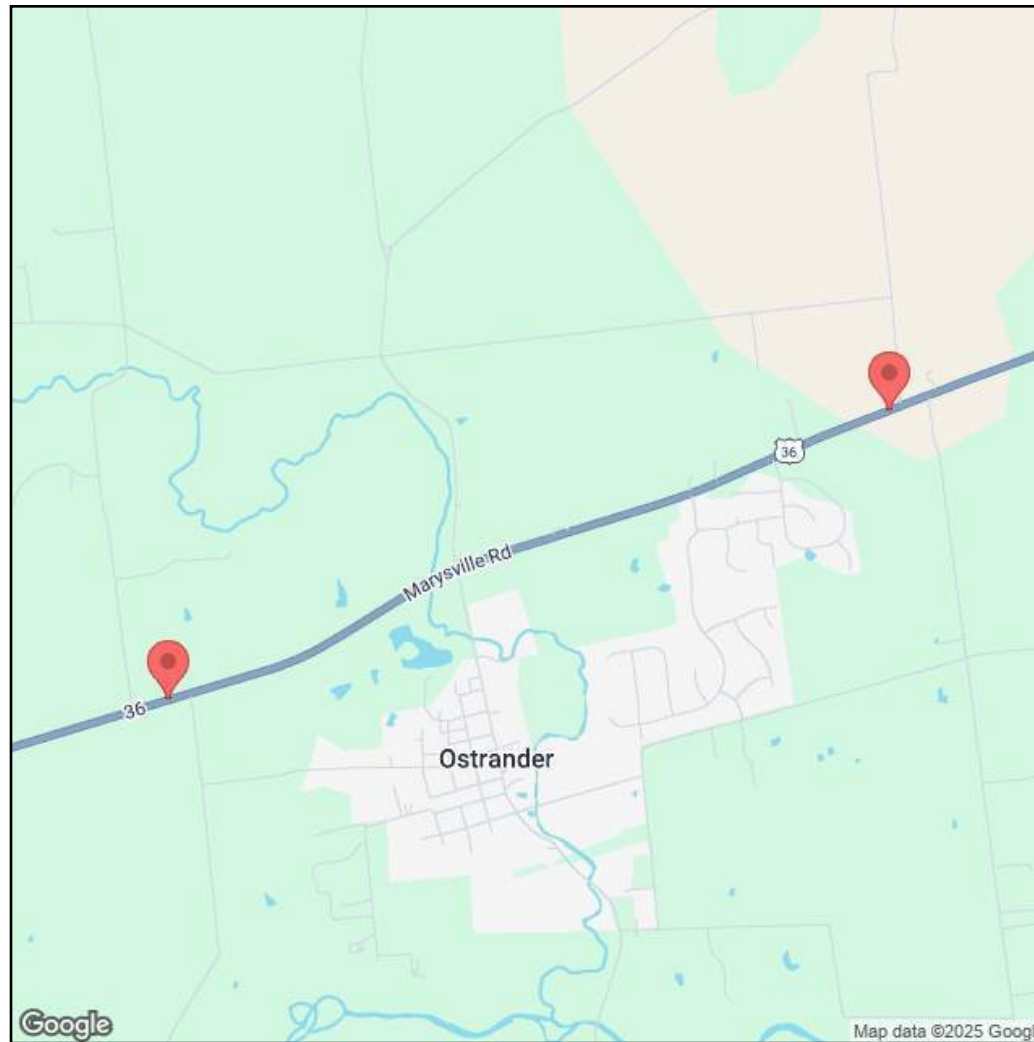
*Users of this data need to be aware that there are limitations to the forecasts generated by this product that make it suitable only for roadway design projects which are low risk.

Segment Information

Segment ID	LRS ID	BMP	EMP	Length	Latitude	Longitude
1922379	SDELUS00036**C	0.000	2.078	2.078	-83.230116185162	40.2685168830208
1922381	SDELUS00036**C	2.078	4.364	2.286	-83.1918927075537	40.2802101258834

Forecast Information

Segment ID	2025 AADT	2050 AADT	DHV-30	K%	D%	T24%	TD%
1922379	6,900	9,600	1,300	14.0	51.7	6	4
1922381	6,800	8,700	1,200	14.0	51.7	7	4



Definitions:

- o AADT – Annual Average Daily Traffic
- o DHV30 – Design Hour Volume for 30th highest hour of the year
- o $DHV30 = K * AADT$
- o K % – Design Hour Factor
- o D % – Peak Direction Factor
- o T24 % – Percent Daily Trucks
- o TD % – Percent Design Hour Trucks

Forecast Segment ID	Route	BMP	EMP
1922379	SDELUS00036**C	0.000	2.078

Forecast

Year	K%	T24 % (Existing)	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2050	◆ 14.0	8	9,000	Model	1.800	1.800
AADT	D%	TD % (Existing)	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
9,600	◆ 51.7	5	600	Model	0.300	0.300

◆ K/D factors from TCDS were used.

Regression

Method Number	PA AADT	BC AADT	AADT
2	7,543	252	7,795

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
2522	13198	-1794	3863	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	0.47	0.14	0	0	6,356	785	6,857	579
2	0.89	-2.03	5	2	7,380	438	7,543	252
3	0.77	1.89	0	0	6,923	1,088	7,351	843
4	1.28	10.23	5	6	8,121	2,559	8,181	2,100
5	1.19	-4.69	0	0	7,684	-13	8,036	-148
6	1.70	-6.21	5	5	8,882	-343	8,866	-377

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	1,080	9,370	-182	602	1.64	0.29
2	RAT	1.19	9,901	0.75	591	1.97	0.22
3	MRAT	1.49	9,726	1.06	592	1.86	0.23
4	RAF		9,548		597	1.75	0.26
Adjust Method AADT		Adjust Method BC		Selected PA Growth Rate %		Selected BC Growth Rate %	
Average		Average		1.800		0.300	

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
8768	9310	591	602	9359	9912

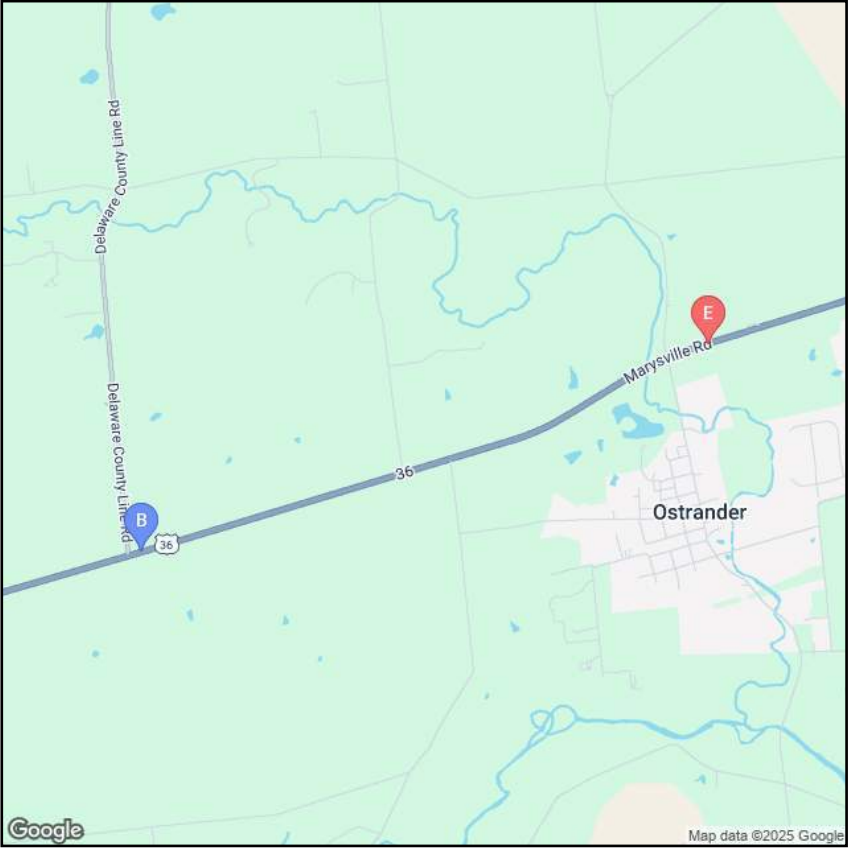
Process Flag: Adjusted model to counts with process per ODOT 255 spreadsheet

Comment: No Comment

Historical Count

Year	All	Cars	Trucks
2008	6,180	5,330	850
2011	5,697	5,239	456
2014	5,971	5,135	836
2017	6,427	5,527	900
2020	5,815	4,866	949
* 2023	6,638	6,080	558

* Pivot Point



Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2050 AADT	DHV30	K %	D %	T24 %	TD %
1922379	SDELUS00036**C	0.000	2.078	2.078	6,900	9,600	1300	14.0	51.7	6	4

Forecast Segment ID	Route	BMP	EMP
1922381	SDELUS00036**C	2.078	4.364

Forecast							
Year	K%	T24 % (Existing)	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %	
2050	◆ 14.0	8	8,100	Model	1.200	1.200	
AADT	D%	TD % (Existing)	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %	
8,690	◆ 51.7	5	590	Model	0.200	0.200	

◆ K/D factors from TCDS were used.

Regression			
Method Number	PA AADT	BC AADT	AADT
2	7,543	252	7,795

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
2522	13198	-1794	3863	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	0.47	0.14	0	0	6,356	785	6,857	579
2	0.89	-2.03	5	2	7,380	438	7,543	252
3	0.77	1.89	0	0	6,923	1,088	7,351	843
4	1.28	10.23	5	6	8,121	2,559	8,181	2,100
5	1.19	-4.69	0	0	7,684	-13	8,036	-148
6	1.70	-6.21	5	5	8,882	-343	8,866	-377

Adjustment Info

ID	Adjustment Methods Name	Model vs Count AADT	Adjusted AADT	Model vs Count BC	Adjusted BC	PA Growth Rate %	BC Growth Rate %
1	DIF	2,400	8,356	-163	598	1.02	0.27
2	RAT	1.57	9,329	0.77	589	1.62	0.21
3	MRAT	1.41	9,048	1.05	589	1.45	0.21
4	RAF		8,702		593	1.24	0.23
Adjust Method AADT		Adjust Method BC		Selected PA Growth Rate %		Selected BC Growth Rate %	
Average		Average		1.200		0.200	

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
7758	8740	589	598	8347	9338

Process Flag: Adjusted model to counts with process per ODOT 255 spreadsheet

Comment: No Comment

Historical Count

Year	All	Cars	Trucks
2008	6,180	5,330	850
2011	5,697	5,239	456
2014	5,971	5,135	836
2017	6,427	5,527	900
2020	5,815	4,866	949
* 2023	6,638	6,080	558

* Pivot Point



Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2050 AADT	DHV30	K %	D %	T24 %	TD %
1922381	SDELUS00036**C	2.078	4.364	2.286	6,800	8,700	1200	14.0	51.7	7	4

PEAK HOUR to DESIGN HOUR FACTORS
FUNCTIONAL CLASSIFICATION = 04r
(Rural Minor Arterial)

Day Month	Monthly Average by Day-of-Week							
	WEEKDAY MON- THUR	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
January	1.34	1.87	1.38	1.35	1.33	1.31	1.25	1.66
February	1.31	1.82	1.35	1.30	1.31	1.28	1.22	1.59
March	1.25	1.66	1.28	1.25	1.23	1.23	1.14	1.46
April	1.19	1.56	1.22	1.20	1.19	1.16	1.09	1.39
May	1.16	1.46	1.20	1.16	1.16	1.12	1.06	1.30
June	1.17	1.40	1.21	1.18	1.17	1.13	1.07	1.29
July	1.19	1.43	1.23	1.19	1.17	1.15	1.08	1.32
August	1.17	1.38	1.21	1.18	1.17	1.12	1.04	1.26
September	1.17	1.44	1.21	1.17	1.17	1.12	1.03	1.30
October	1.16	1.45	1.19	1.16	1.15	1.13	1.03	1.31
November	1.22	1.60	1.26	1.22	1.20	1.21	1.10	1.47
December	1.23	1.65	1.26	1.23	1.23	1.20	1.14	1.48

peak hour volume * factor = design hour volume

source: year 2018,2019,2021 Automatic Traffic Recorders (ATR) Data

ATR Stations:

2018: 10 Stations

2019: 11 Stations

2021: 10 Stations

Ohio Department of Transportation
Modeling & Forecasting Section
Nov 2022

NOTE: These are NOT seasonal adjustment factors!!!

PEAK HOUR to DESIGN HOUR FACTORS
FUNCTIONAL CLASSIFICATION = 05, 06r
(Rural Major Collector & Rural Minor Collector)

Day Month	Monthly Average by Day-of-Week							
	WEEKDAY MON- THUR	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
January	1.32	1.97	1.33	1.33	1.31	1.30	1.23	1.74
February	1.28	1.96	1.31	1.27	1.28	1.26	1.22	1.69
March	1.22	1.75	1.23	1.22	1.21	1.22	1.16	1.55
April	1.15	1.59	1.17	1.15	1.12	1.15	1.09	1.45
May	1.12	1.53	1.16	1.11	1.10	1.10	1.05	1.36
June	1.15	1.52	1.20	1.14	1.13	1.14	1.09	1.39
July	1.16	1.53	1.18	1.16	1.14	1.14	1.12	1.39
August	1.12	1.45	1.16	1.14	1.12	1.09	1.06	1.32
September	1.13	1.52	1.17	1.12	1.12	1.09	1.03	1.36
October	1.15	1.59	1.19	1.14	1.13	1.12	1.06	1.38
November	1.20	1.75	1.22	1.19	1.17	1.21	1.11	1.58
December	1.21	1.76	1.23	1.19	1.22	1.20	1.12	1.58

peak hour volume * factor = design hour volume

source: year 2018,2019,2021 Automatic Traffic Recorders (ATR) Data

ATR Stations:

2018: 8 Stations

2019: 8 Stations

2021: 8 Stations

Ohio Department of Transportation
Modeling & Forecasting Section
Nov 2022

NOTE: These are NOT seasonal adjustment factors!!!

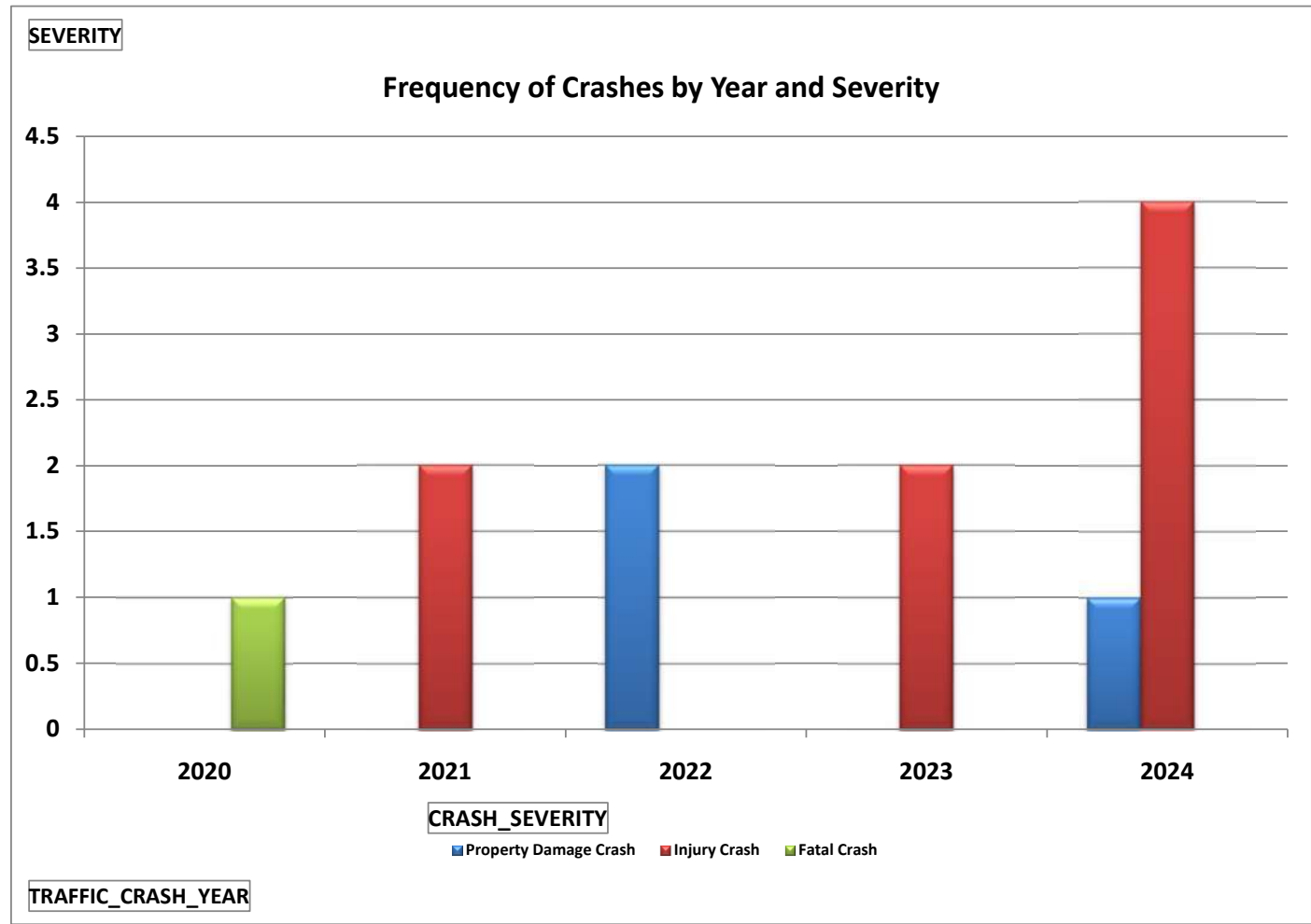
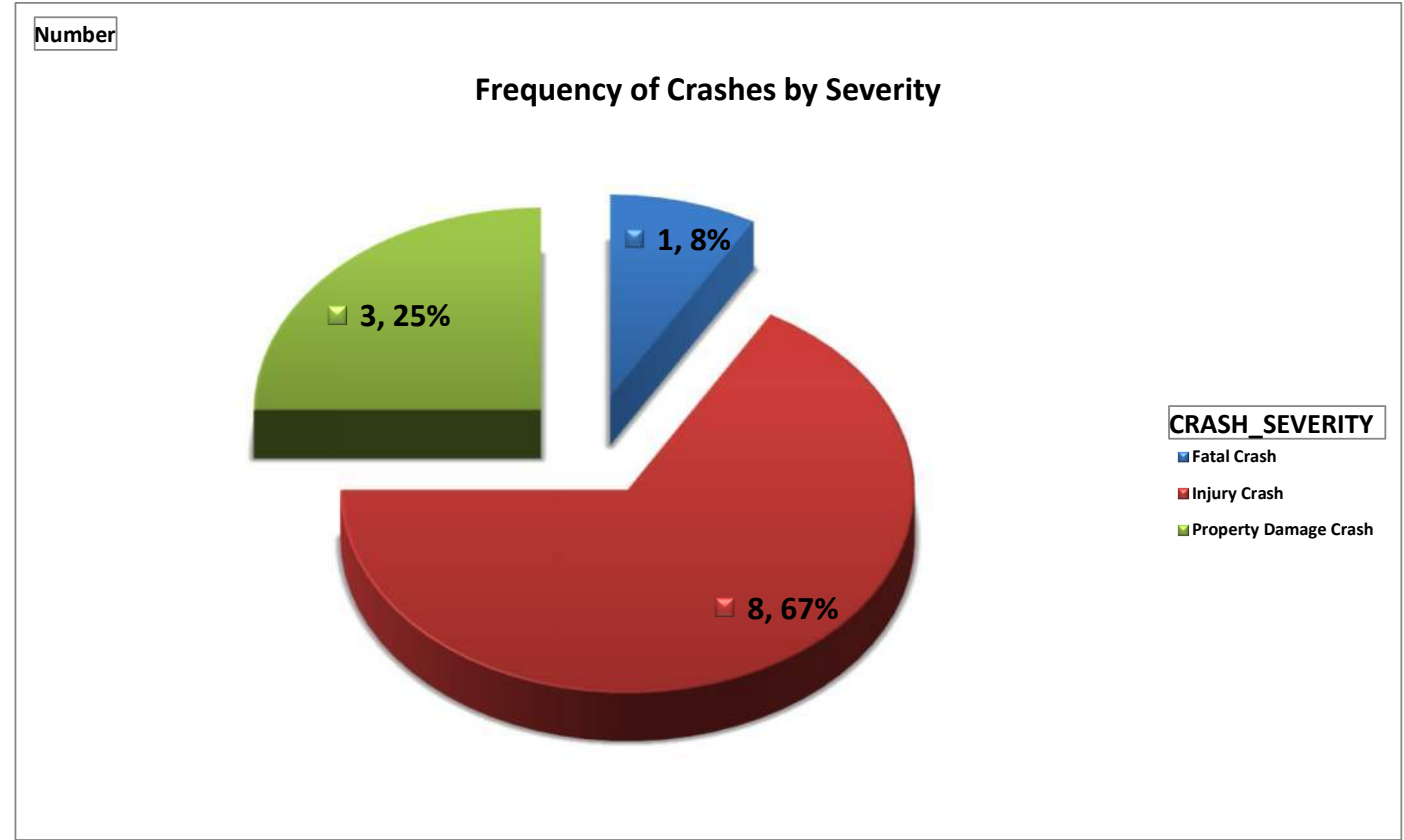
Note: Insufficient data exists to produce factors for functional class 07 Rural.

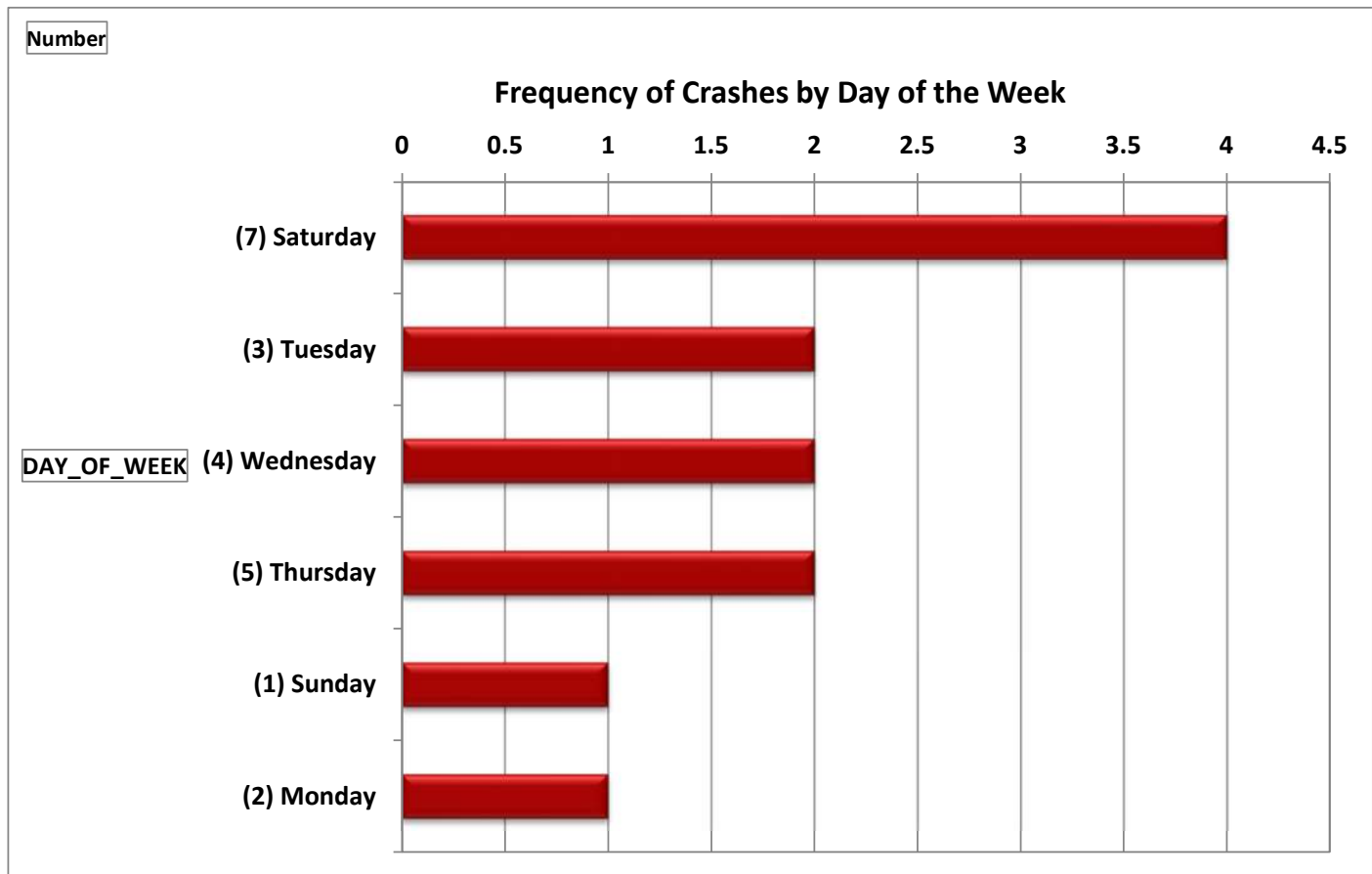
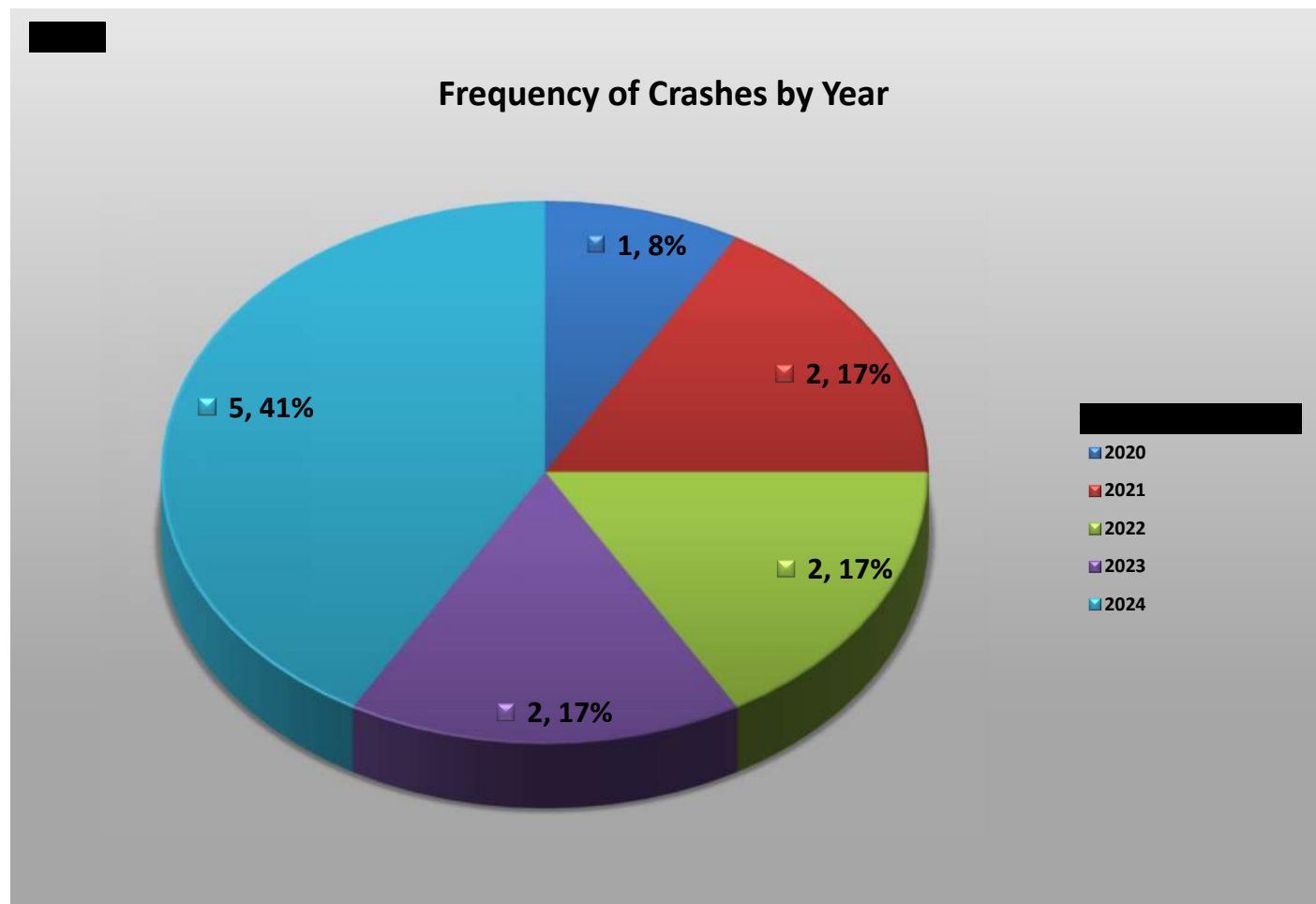
DEL-US36-1.93 SAFETY STUDY

APPENDIX B: SAFETY ANALYSIS



Ostrander Road at US36 (Marysville Rd)

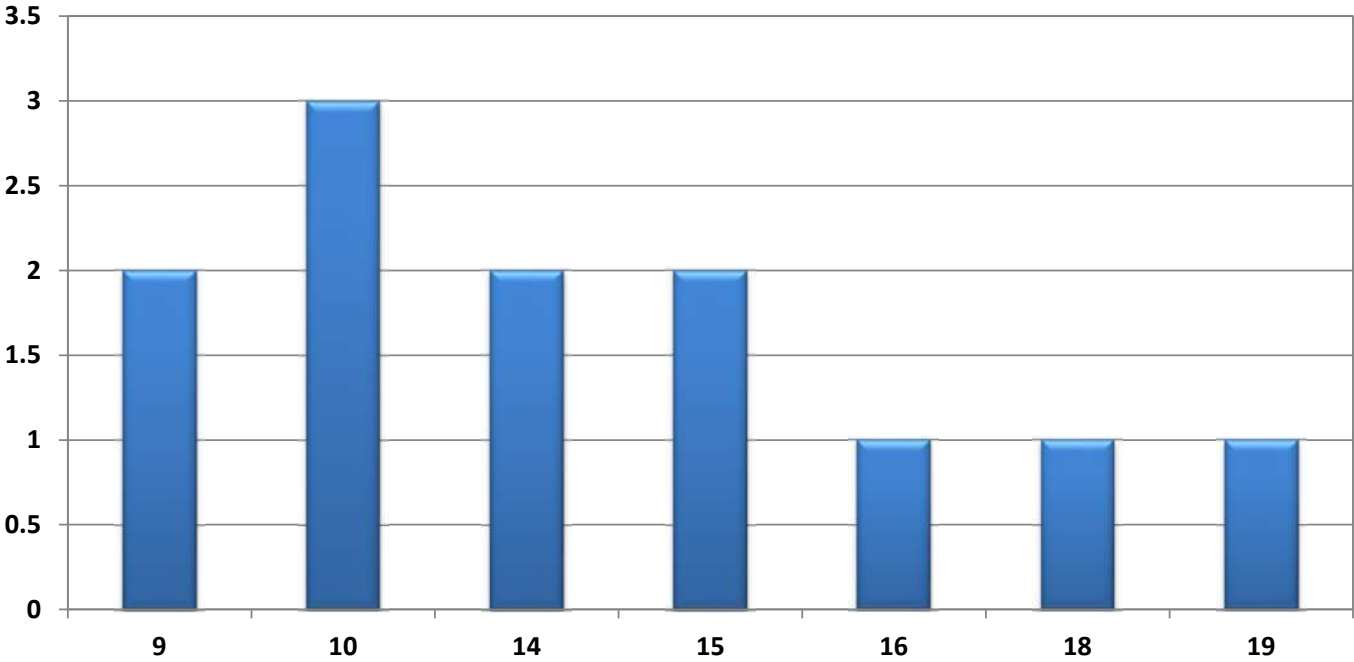




Ostrander Road at US36 (Marysville Rd)

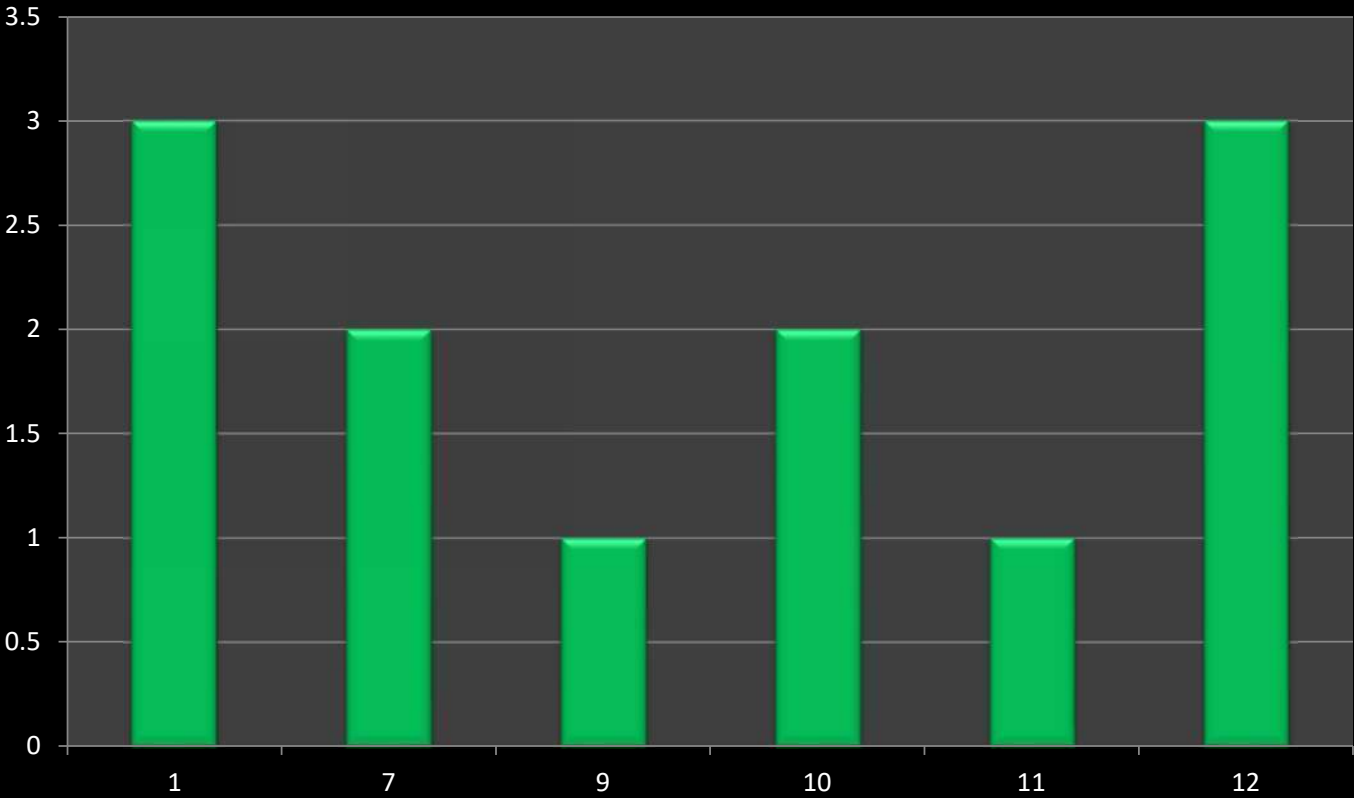


Frequency of Crashes by Hour



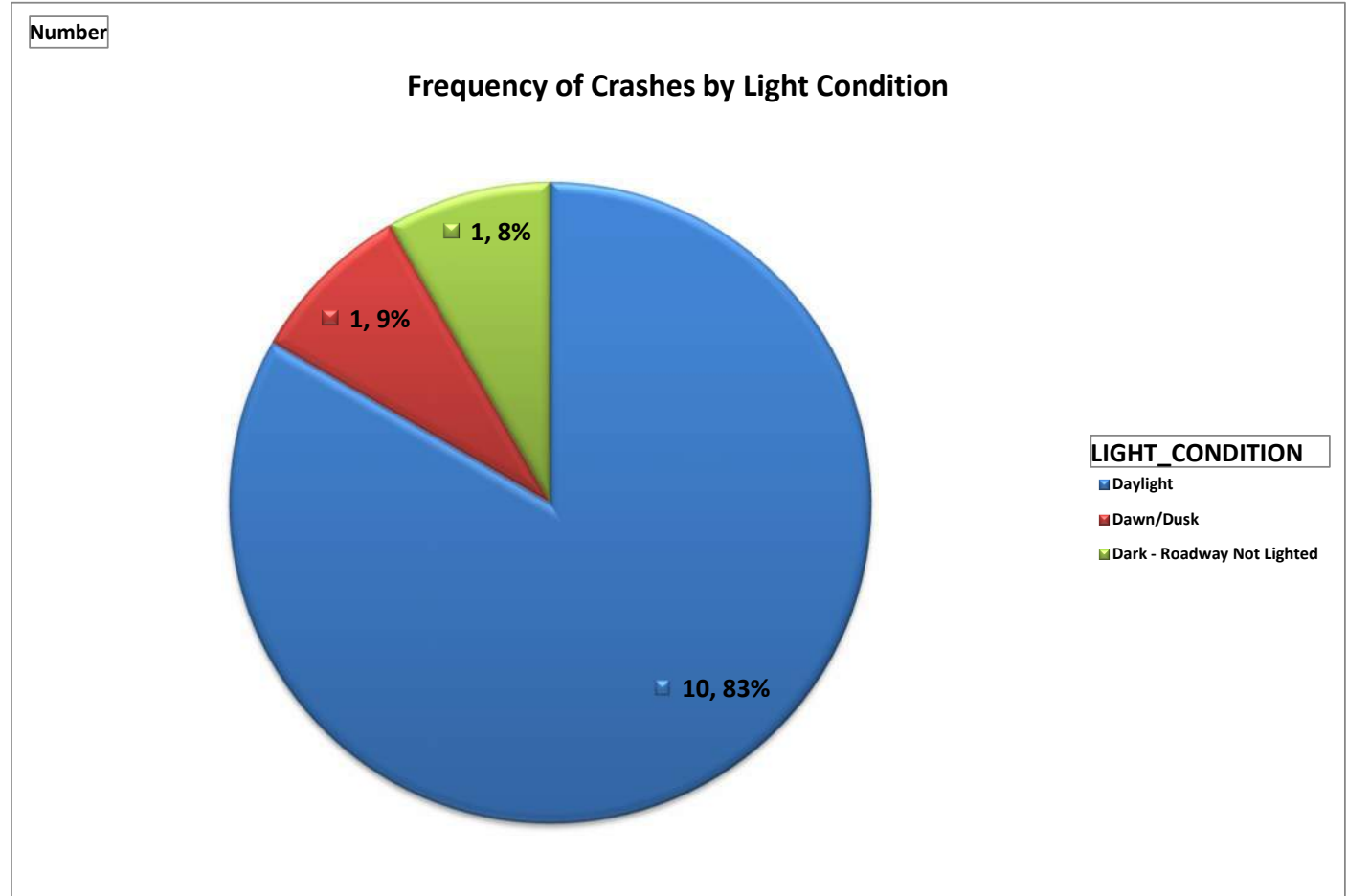
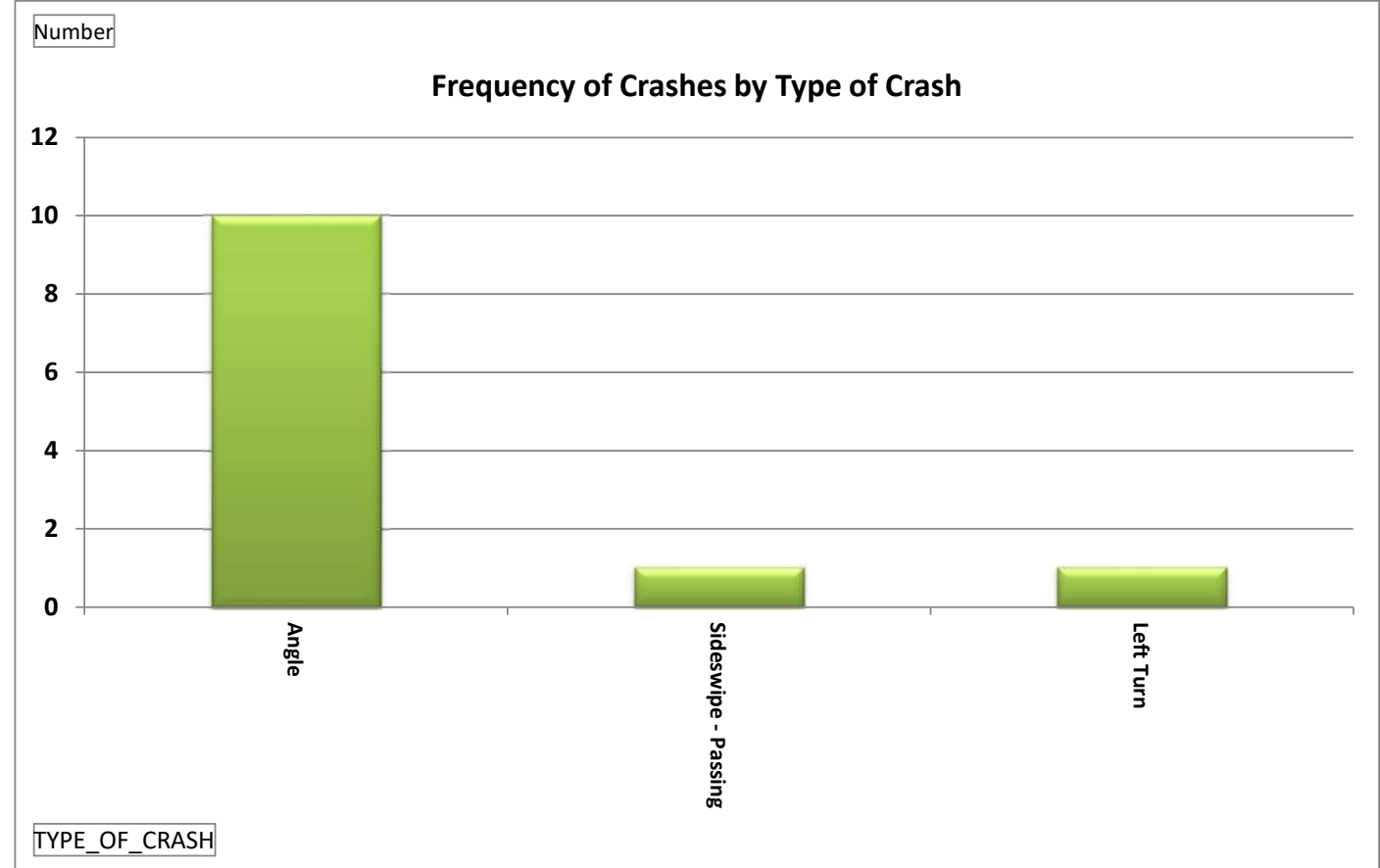
Number

Frequency of Crashes by Month

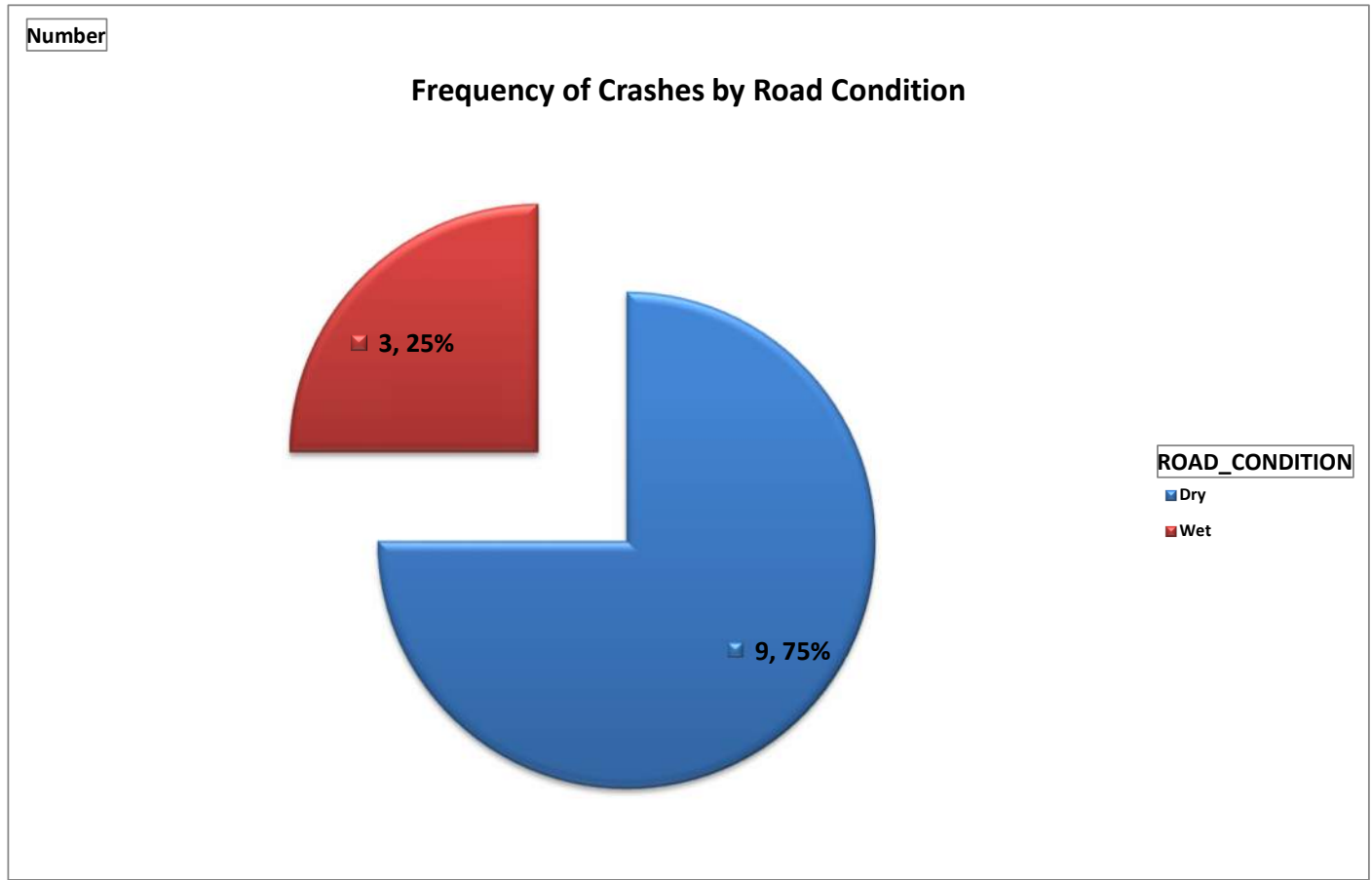
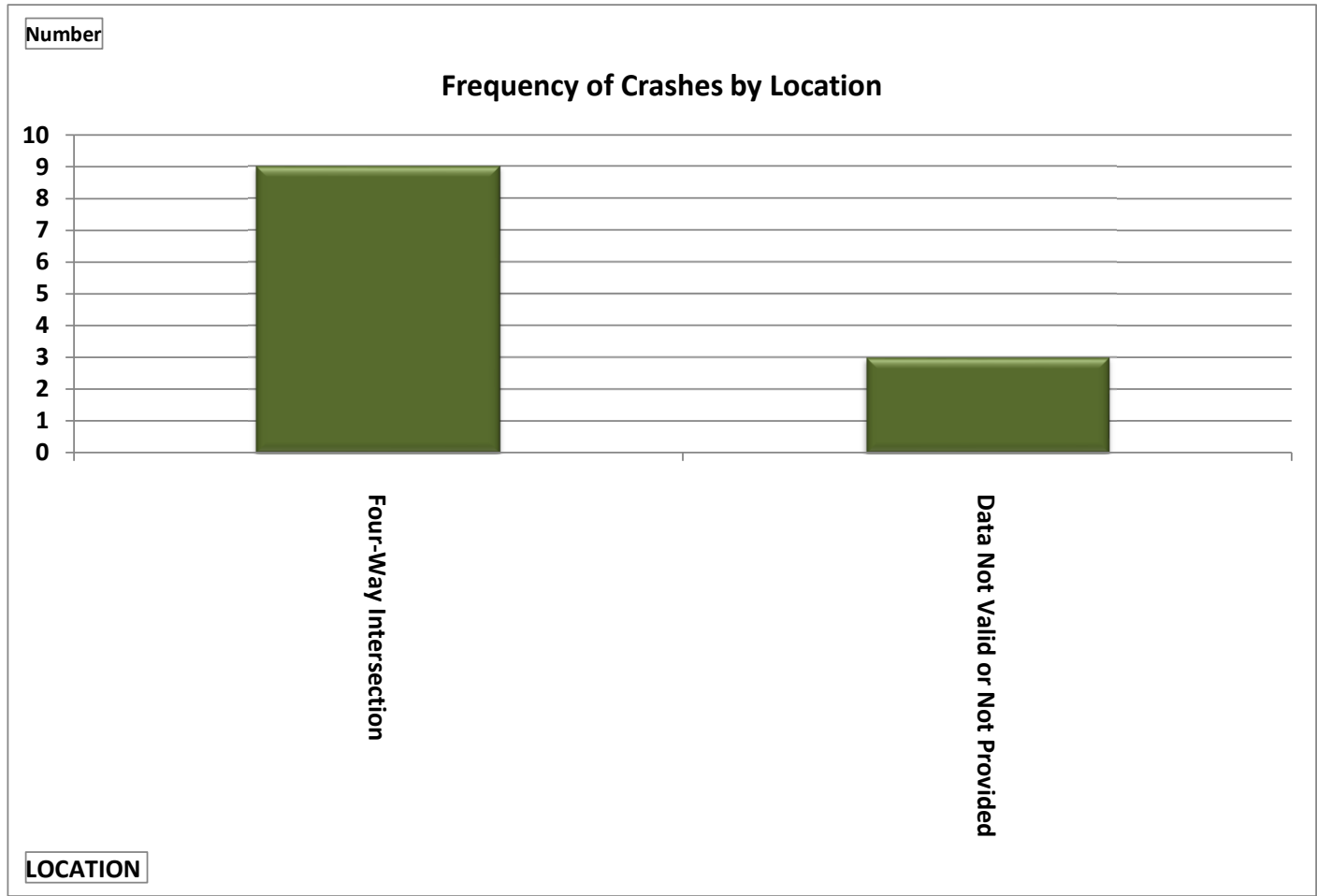


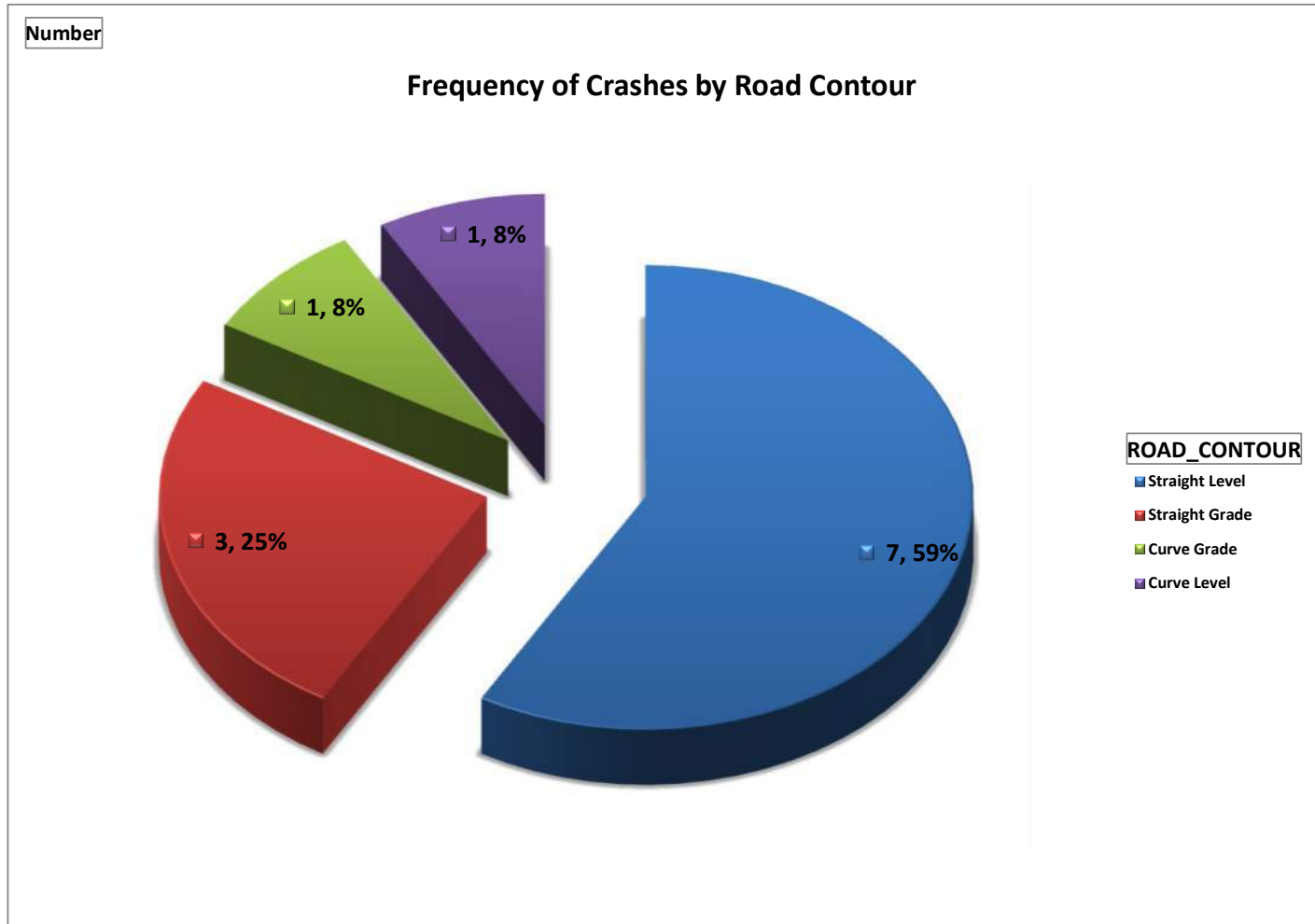
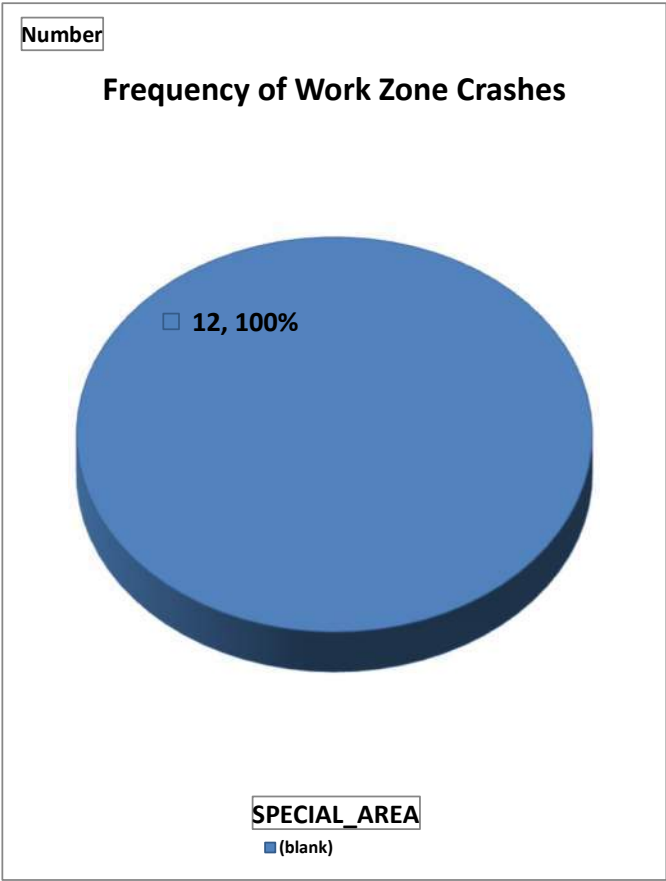
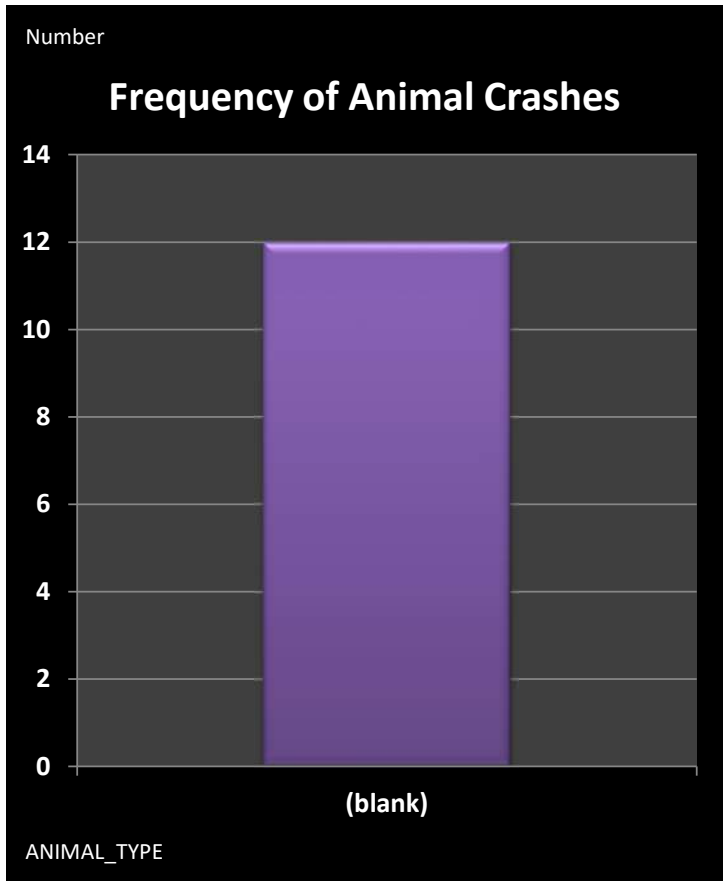
CRASH_MONTH_NBR

Ostrander Road at US36 (Marysville Rd)



Ostrander Road at US36 (Marysville Rd)

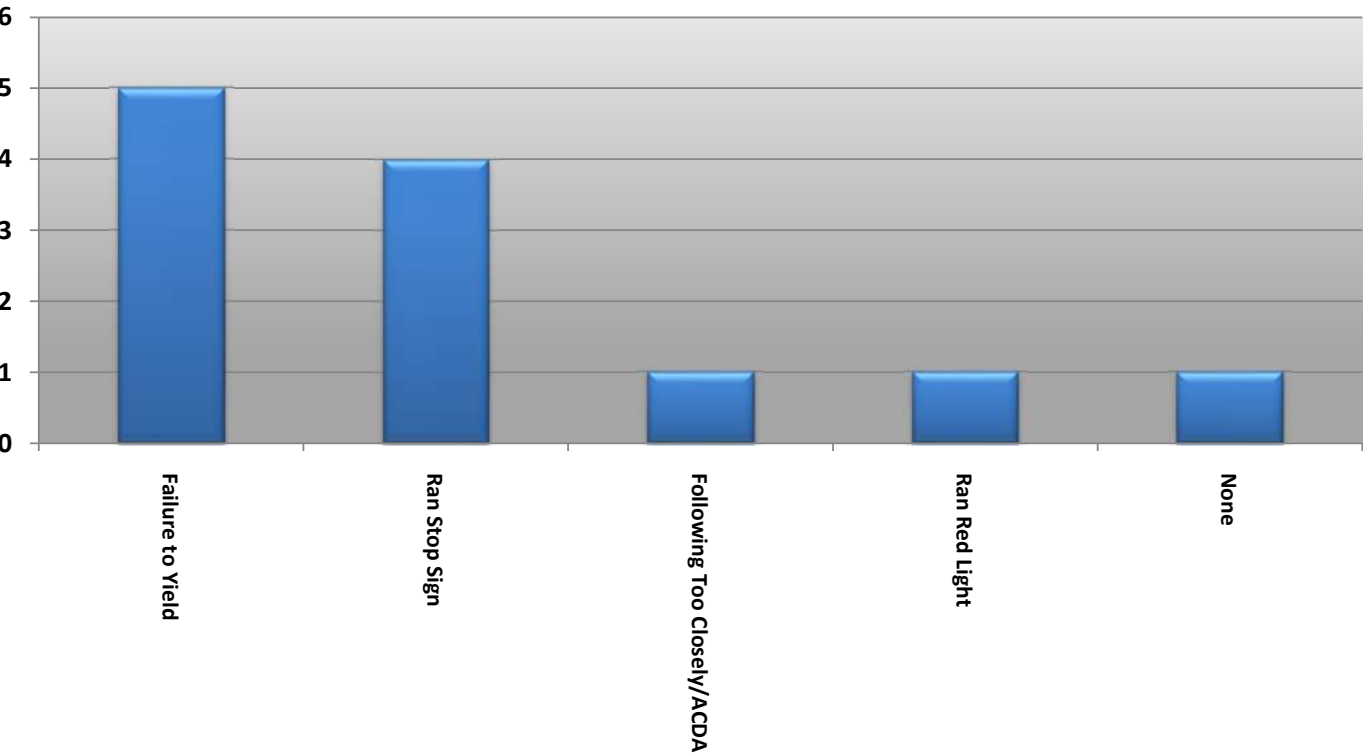




Ostrander Road at US36 (Marysville Rd)

[Redacted]

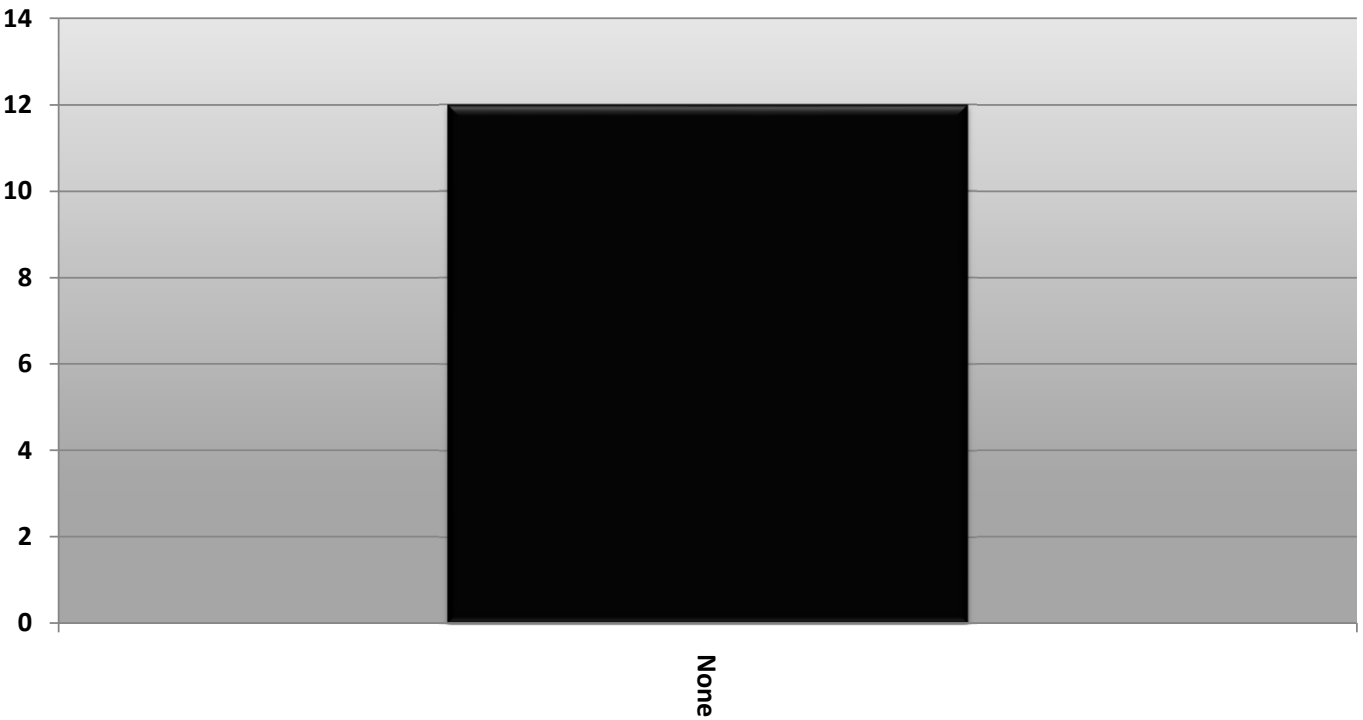
Frequency of Crashes by Contributing Factor 1



[Redacted]

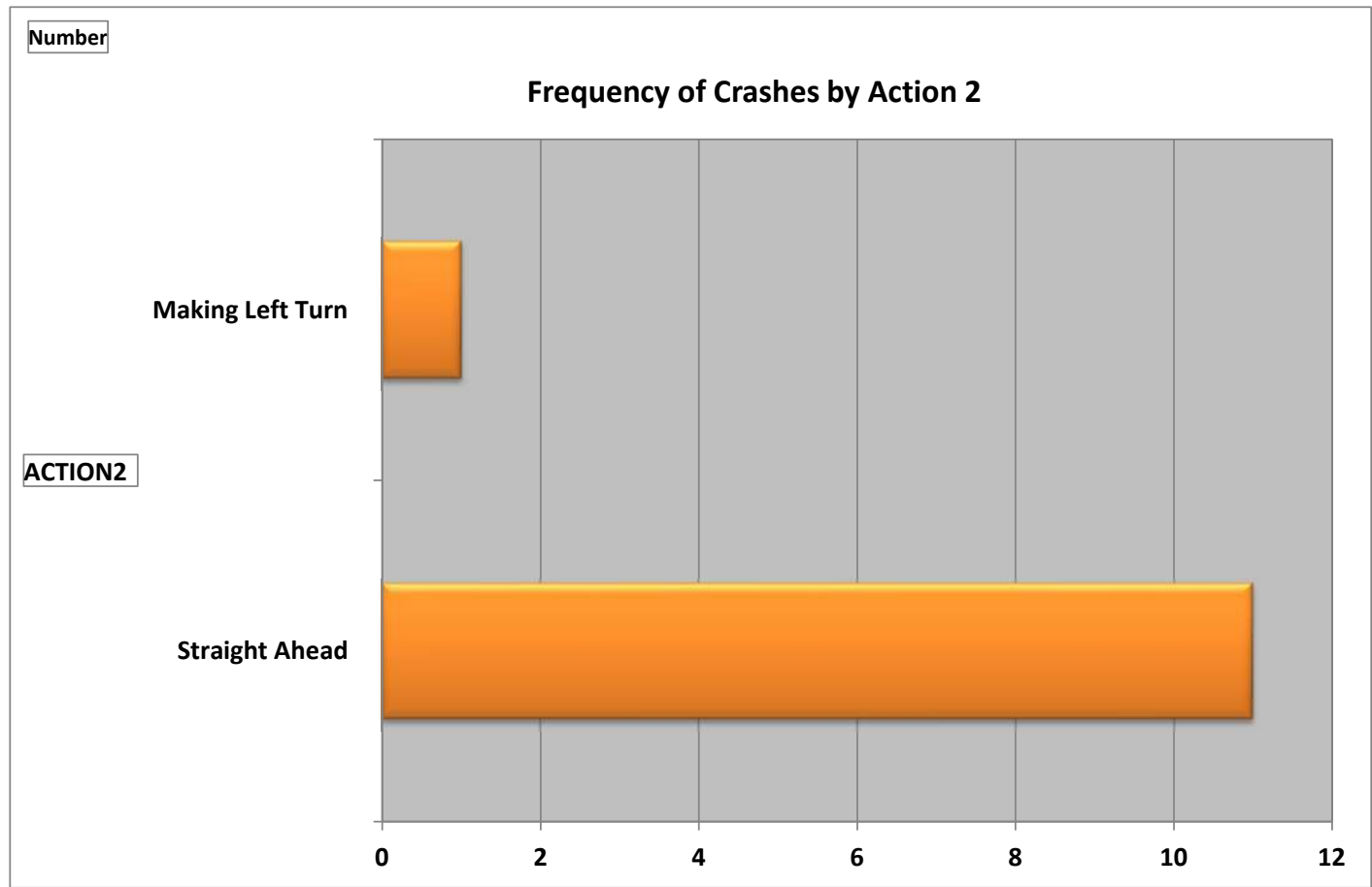
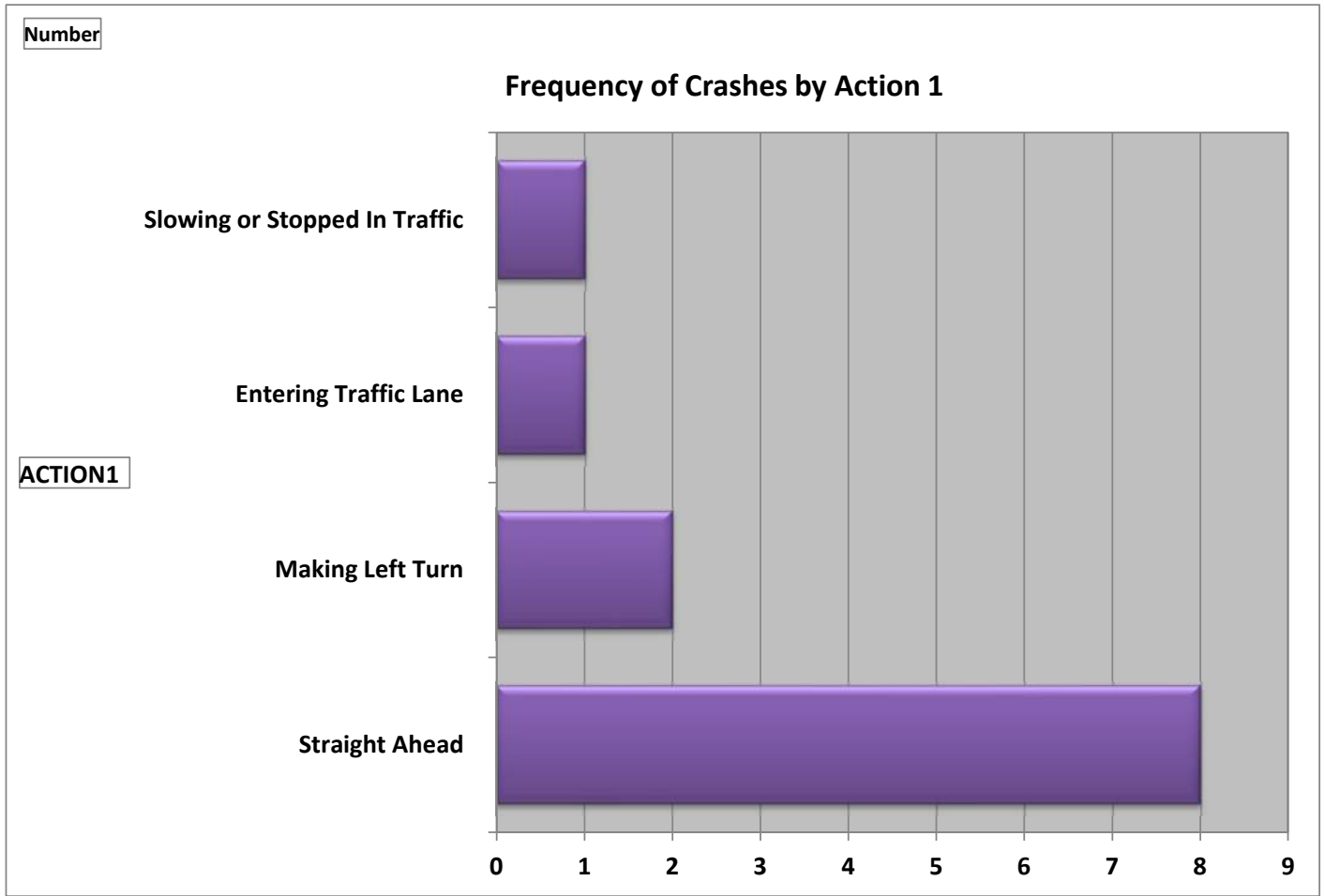
Number

Frequency of Crashes by Contributing Factor 2



CONTRIBUTING_FACTOR2

Ostrander Road at US36 (Marysville Rd)

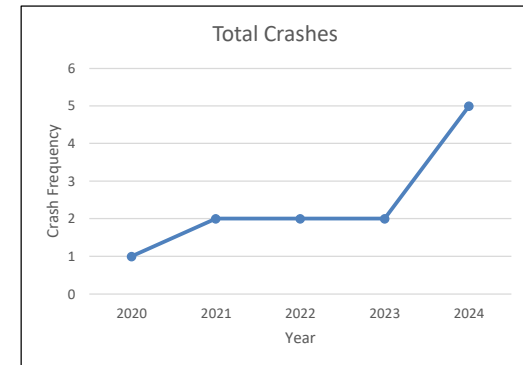
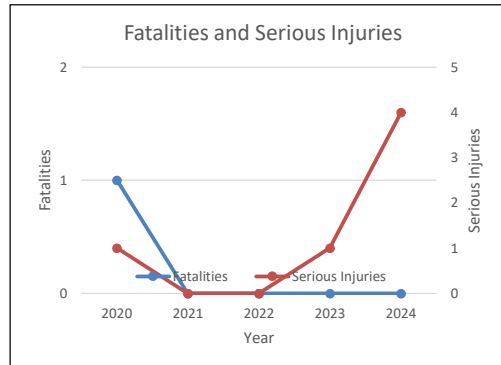


Ostrander Road at US36 (Marysville Rd)

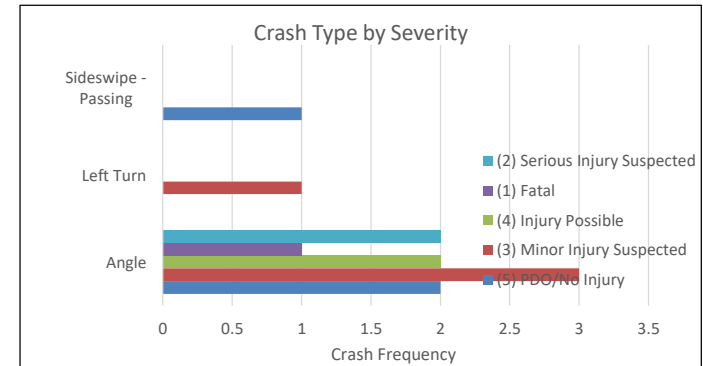
Crash Summary Sheet

Crashes Per Year	2.40	Percent Injury	75.0%	EPDO	14.59
------------------	------	----------------	-------	------	-------

Year	Total Crashes	Fatalities	Serious Injuries
2020	1	1	1
2021	2	0	0
2022	2	0	0
2023	2	0	1
2024	5	0	4
Grand Total	12	1	6



Total Crashes	Injury Level					Grand Total
Crash Type	(1) Fatal	(2) Serious Inju	(3) Minor Injury	(4) Injury Possil	(5) PDO/No Inj	
Angle	1	2	3	2	2	10
Sideswipe - Passing	0	0	0	0	1	1
Left Turn	0	0	1	0	0	1
Grand Total	1	2	4	2	3	12



Ostrander Road at US36 (Marysville Rd)

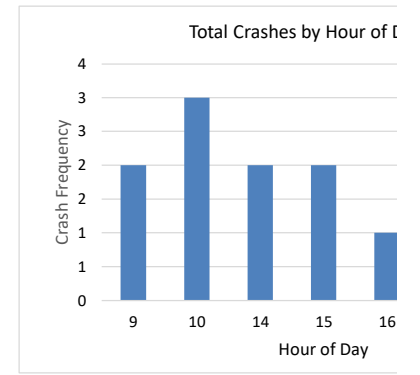
Crash Summary Sheet

Crashes Per Year	2.40	Percent Injury	75.0%	EPDO	14.59
------------------	------	----------------	-------	------	-------

Road Condition	Total Crashes	Fatalities	Serious Injuries
Dry	9	1	6
Wet	3	0	0
Grand Total	12	1	6

Hour of Day	Total Crashes
9	2
10	3
14	2
15	2
16	1
18	1
19	1
Grand Total	12

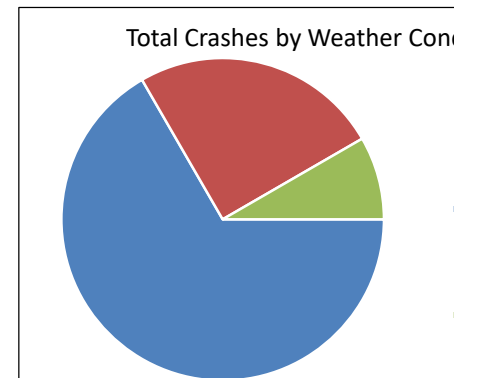
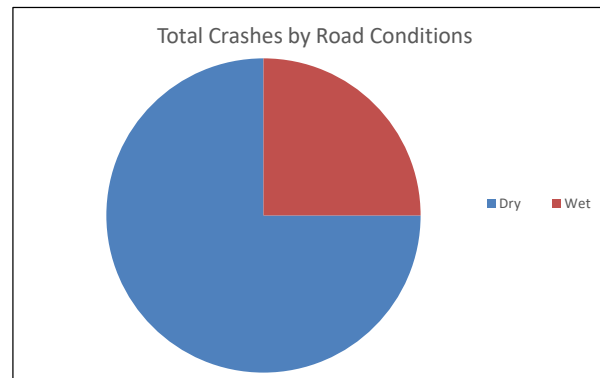
Month	Total Crashes
January	3
July	2
September	1
October	2
November	1
December	3
Grand Total	12



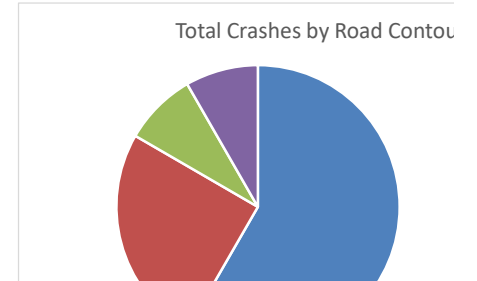
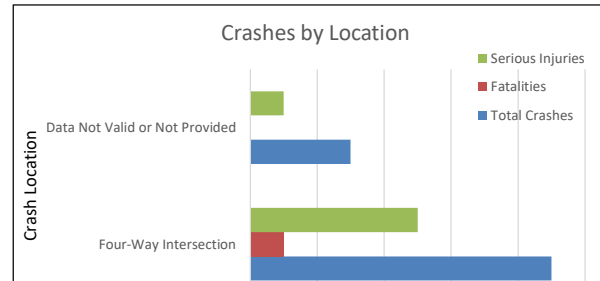
Weather	Total Crashes	Fatalities	Serious Injuries
Clear	8	1	6
Cloudy	3	0	0
Snow	1	0	0
Grand Total	12	1	6

Day in Week	Total Crashes
(1) Sunday	1
(2) Monday	1
(3) Tuesday	2
(4) Wednesday	2
(5) Thursday	2
(7) Saturday	4
Grand Total	12

Crash Location	Total Crashes	Fatalities	Serious Injuries
Four-Way Intersection	9	1	5
Data Not Valid or Not Provided	3	0	1
Grand Total	12	1	6



Roadway Contour	Total Crashes	Fatalities	Serious Injuries
Straight Level	7	0	1
Straight Grade	3	1	1
Curve Grade	1	0	4
Curve Level	1	0	0
Grand Total	12	1	6



DEL-US36-1.93 SAFETY STUDY

APPENDIX C: SIGNAL AND AWSC WARRANTS



SIGNAL WARRANT ANALYSIS

Signal warrant analyses were performed at the US Route 36 (Marysville Road) and Ostrander Road intersection to evaluate the feasibility of options related to intersection traffic control.

The signal warrant analysis follows the guidance established in the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) when evaluating the need for traffic signal control. Nine warrants have been defined in the OMUTCD to determine if a traffic signal should be installed at a particular location. These warrants have been established to prevent the overuse of traffic signals as a traffic control device. Unwarranted traffic signals can adversely affect the safety and efficiency of vehicular, pedestrian, and bicycle traffic.

The OMUTCD states that a traffic signal shall not be installed unless one or more of the 9 warrants are met. Signal warrants were limited to the primary volume-based warrants: Warrant #1 (8-Hour), Warrant #2 (4-Hour) and Warrant #3 (Peak Hour). Right Turn Lane Reduction factors were not applied due to the right turn movements are from shared lanes.

The warrant analysis was performed using the Ohio Department of Transportation (ODOT) Traffic Signal Warrant Spreadsheet. The raw, unadjusted, traffic volume data were used to evaluate signal warrants. Some warrants allow the minimum traffic volume thresholds to be reduced if the 85th percentile speed of traffic is equal to or exceeds 40 MPH and if the area is located in a population less than 10,000 – **the speeds on the US-36 are above the 40 MPH threshold therefore reduced thresholds are applicable.**

The following criteria from the Ohio Manual of Uniform Traffic Control Devices (OMUTCD), latest edition, was used to evaluate the following signal warrants.

Table C1: OMUTCD Table 4C-1 Warrant 1, Eight-Hr Volume

Condition A—Minimum Vehicular Volume									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% ^a	80% ^b	70% ^c	56% ^d	100% ^a	80% ^b	70% ^c	56% ^d
1	1	500	400	350	280	150	120	105	84
2 or more	1	600	480	420	336	150	120	105	84
2 or more	2 or more	600	480	420	336	200	160	140	112
1	2 or more	500	400	350	280	200	160	140	112

Warrant #1 – Eight-hour Vehicular Volume

The eight highest pairs of hourly volume on the higher-volume minor street approach and its corresponding total hourly volume from both major street approaches were

Condition B—Interruption of Continuous Traffic									
Number of lanes for moving traffic on each approach		Vehicles per hour on major street (total of both approaches)				Vehicles per hour on higher-volume minor-street approach (one direction only)			
Major Street	Minor Street	100% ^a	80% ^b	70% ^c	56% ^d	100% ^a	80% ^b	70% ^c	56% ^d
1	1	750	600	525	420	75	60	53	42
2 or more	1	900	720	630	504	75	60	53	42
2 or more	2 or more	900	720	630	504	100	80	70	56
1	2 or more	750	600	525	420	100	80	70	56

^a Basic minimum hourly volume.

^b Used for combination of Conditions A and B after adequate trial of other remedial measures.

^c May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.

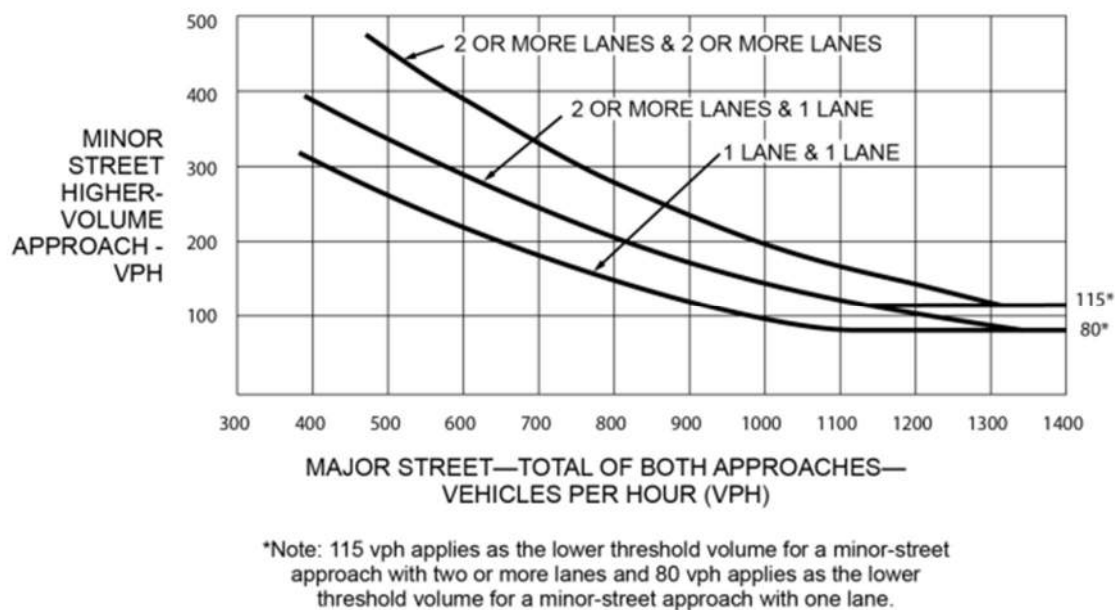
^d May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000.

used in analyzing warrant #1. The signal warrant spreadsheet then compares these volumes with the signal warrant #1 thresholds presented in Table 4C-1 of the OMUTCD (see **Table C1**) and determines whether the signal is warranted under Condition A (Minimum Vehicular Volume), Condition B (Interruption of Continuous Traffic), or a combination of both conditions evaluated at 80% threshold.

Warrant #2 – Four-hour Vehicular Volume

The four highest pairs of hourly volume on the higher-volume minor street approach and its corresponding total hourly volume from both major street approaches were used in analyzing Warrant #2. The signal warrant spreadsheet then plots and compares these volumes with the signal warrant #2 thresholds presented in Figure 4C-1 of the OMUTCD (see **Figure C1**) and determines whether the signal is warranted.

FIGURE C1: OMUTCD FIGURE 4C-1 WARRANT 2, FOUR-HR VOLUME

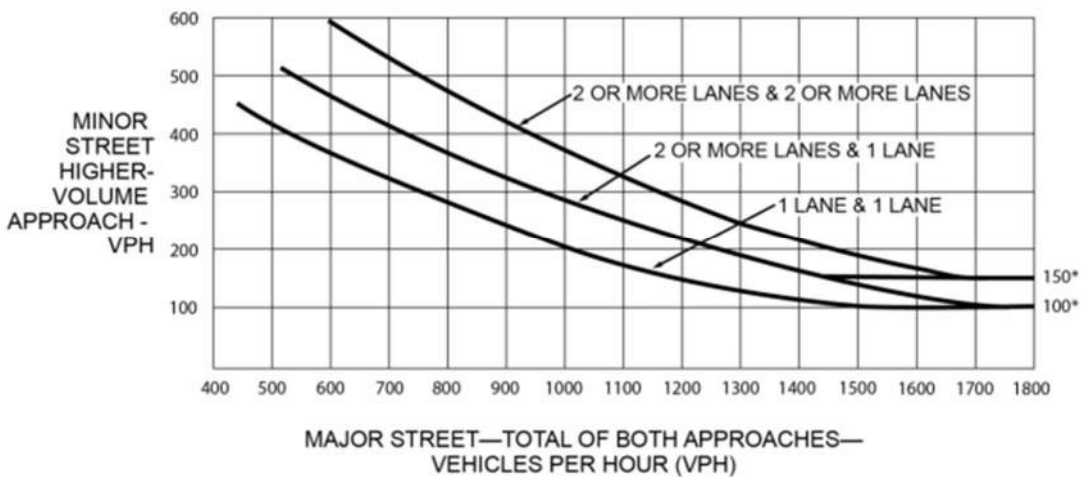


Warrant #3 – Peak Hour

The OMUTCD states that this peak-hour volume-based warrant is applied to office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities (e.g., bus stations) that attract or discharge large numbers of vehicles over a short time. If a traffic signal is justified by an engineering study and is warranted only by Warrant #3, the signal should be traffic-actuated and may be operated in flashing mode during hours that the volume criteria of warrant #3 are met.

The highest pair of hourly volume on the higher-volume minor street approach and its corresponding total hourly volume from both major street approaches were used in analyzing warrant #3 -- see **Figure C2**.

FIGURE C2: OMUTCD FIGURE 4C-3 WARRANT 3 (PEAK HOUR)



US-36 AT OSTRANDER ROAD SIGNAL WARRANT

This 4-legged intersection is analyzed assuming one (1) approach lane on the major street approach (US36) and one (1) through lane on the minor street approach (Ostrander Road), resulting in the following:

- **Warrant #1.** The minimum threshold for vehicles per hour on the higher volume, minor side street approach is 42 vehicles when evaluating the combo Warrant #1 at Condition B. Only four out of the required eight hours required exceeds the minimum volume threshold of 60 vehicles (and main street volume of 420 vehicles) if the approach is evaluated as a single lane. *Warrant #1 is NOT satisfied.*
- **Warrant #2.** Plotting the four highest volume-pairs of OMUTCD Figure 4C-2 (**Figure C3**) results in none of the four highest volume-pairs exceeding the thresholds of warrant #2. *Warrant #2 is NOT satisfied.*
- **Warrant #3.** Plotting the highest volume-pair of OMUTCD Figure 4C-4 (**Figure C4**) results in *Warrant #3 NOT being satisfied.*

A traffic signal at the US-36 and Ostrander Road intersection is **NOT** warranted.

FIGURE C3: OSTRANDER ROAD WARRANT #2

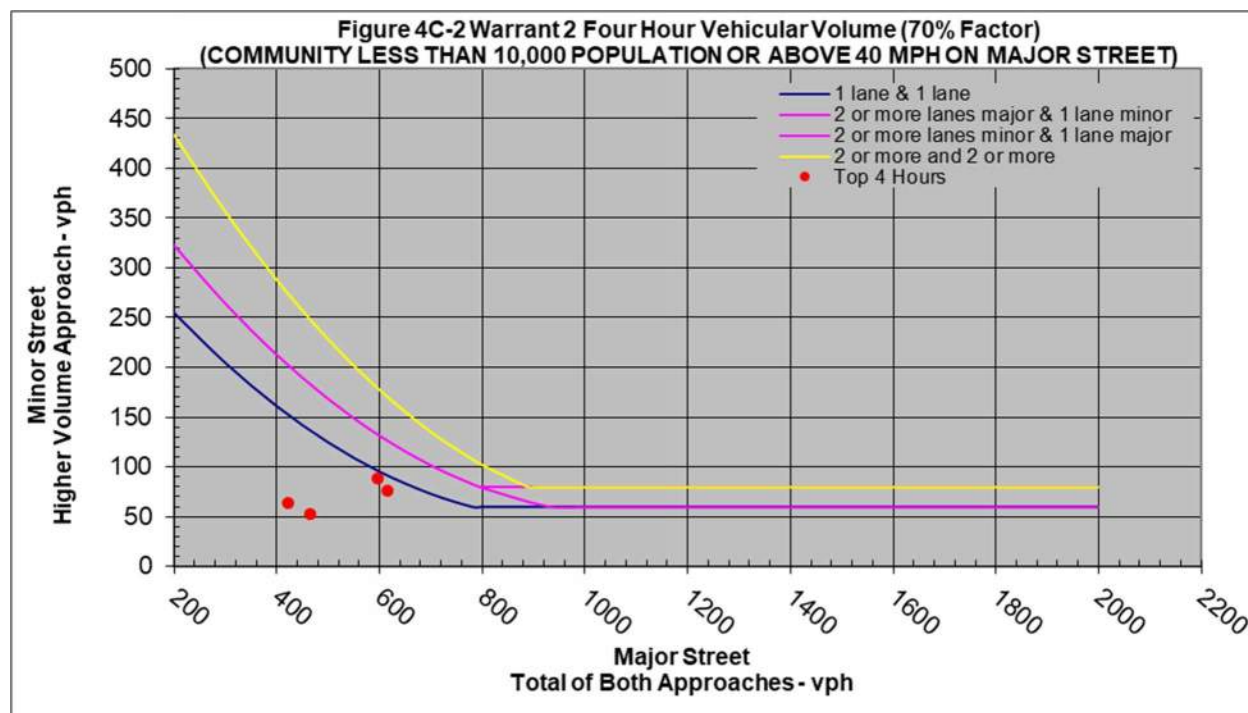
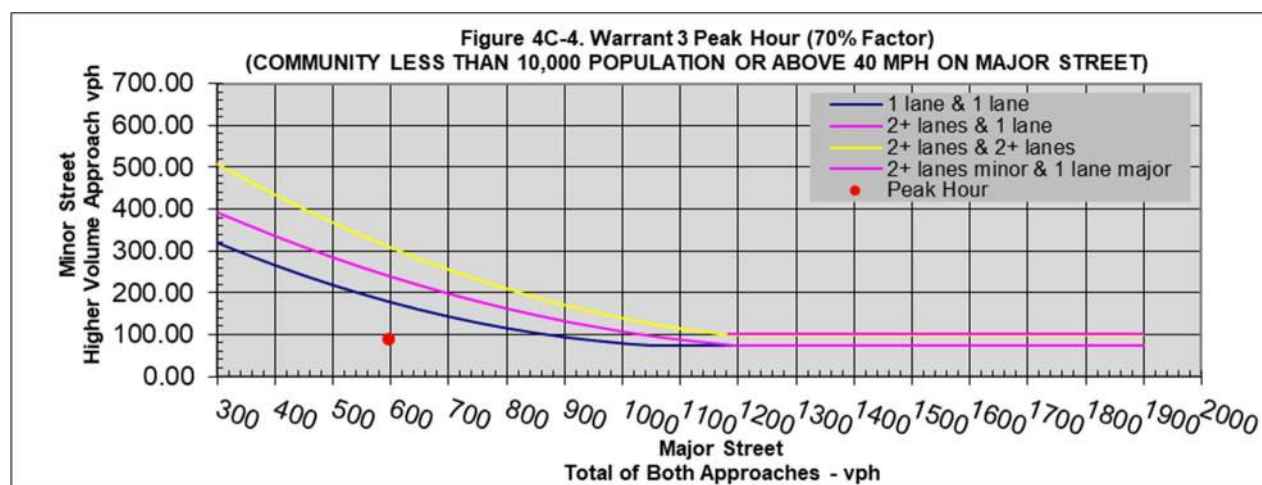


FIGURE C4: OSTRANDER ROAD WARRANT #3



OSTRANDER AWSC WARRANT

OMUTCD Section 4C.01 states the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal. Therefore, the US-36 at Ostrander Road intersection was evaluated if converted to an all-way stop control (AWSC) intersection instead of the existing signalized control.

The following criteria from the Ohio Manual of Uniform Traffic Control Devices (OMUTCD), latest edition, was used to evaluate the subject intersection for a multi-way STOP sign installation. The justification for 4-way stop control at the subject intersection warrant includes the following volume-based criteria:

- ***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.*** The existing volumes on the major street approaches (US-36) exceeds 300 vehicles from during 9 hours between 6:00AM to 6:00PM. The minimum volume threshold of 300 vehicles per hour for an 8-hour period is met.
- ***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 hours with an average delay to minor street vehicular traffic of at least 30 seconds per vehicle during the highest hour.*** The vehicular volumes on the minor street approaches do not exceed 90 vehicles per hour, which is less than the 70% reduction threshold (140 vehicles) if speeds exceed 40 MPH. Pedestrian and bicycle traffic do not increase volumes that meet a minimum volume threshold of 200 units per hour for an 8-hour period.

The US-36 at Ostrander Road intersection DOES NOT meet criteria for a 4-way stop sign in accordance with minimum volume thresholds defined in the OMUTCD.

The justification for 4-way stop control at the subject intersection warrant also includes the following accident-based criteria:

- ***Five or more reported crashes in a 12-month period that are susceptible to correction by a multiway stop installation (angle crashes).*** While 5 angle crashes were recorded between December 2023 and November 2024, three of these crashes involve vehicles running through the existing STOP sign.

The US-36 at Ostrander Road intersection DOES NOT meet criteria for a 4-way stop sign in accordance with minimum crashes due to 3 out of the 5 recorded relevant crashes involved stop-sign running vehicles.

STUDY AND ANALYSIS INFORMATION

Municipality:	Columbus	Traffic Volumes Obtained By:	CMT
County:	Delaware	Analysis Date:	2/18/2025
ODOT Engineering District:	6	Agency/ Company Name Performing Warrant Analysis:	CMT
Google map link:	Map		

Analysis Information

Data Collection Date: 11/21/2024
 Day of the Week: Thursday

Is the intersection in a built-up area of an isolated community of <10,000 population? Yes

Existing Traffic Signal at intersection: No

Total Number of Approaches at Intersection: 4

Major Street Information

Major Street Name and Route Number: US 36

Major Street Approach Direction: E-Bound
W-Bound

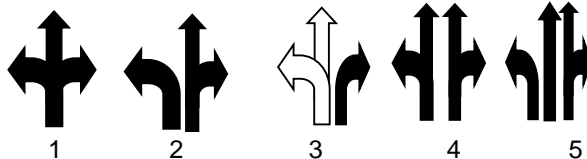
Number of Thru Lanes on Each Major Street Approach: 1 LANE(S)

Speed Limit or 85th Percentile Speed on the Major Street*: 60+ MPH
*Unknown assumes below 45 mph

Minor Street Information

Minor Street Name and Route Number: Ostrander Road

Minor Street Approach Configuration: 1 N-Bound
1 S-Bound



Number of Thru Lanes on Each Minor Street Approach: 1 LANE(S)

Apply Right Turn Lane Reduction*: No

*Right Turn Lane Reduction Shall be used for Warrants 1, 2, & 3 for New ODOT Signals. Please refer to TEM 402-3.2 for clarification and criteria under which Right Turn Reduction is not required.

TRAFFIC SIGNAL WARRANT ANALYSIS FINDINGS

	Warrant Applicable?	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	<div> <div>Signals installed under Warrant 3 should be traffic actuated.</div> <div> <div>Peak Hour</div> <div>4:15 PM</div> <div>5:15 PM</div> </div> </div>
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)			
Warrant 4, Pedestrian Volume	No		<div> <div>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.</div> <div> <div>Peak Hour</div> <div>3:00 PM</div> <div>4:00 PM</div> </div> </div>
Warrant 5, School Crossing	No		N/A
Warrant 6, Coordinated Signal System	No		(Shall not be used as the sole warrant in the analysis)
Warrant 7, Crash Experience	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	No		(Shall not be used as the sole warrant in the analysis)
Warrant 9, Intersection Near a Grade Crossing	No		Figure 4C-9
Multi-Way Stop Warrant	No		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.

Notes: Conclusion:

OMUTCD WARRANT 1, EIGHT-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic
on Each Approach

Major Street: 1 Lane

Minor Street: 1 Lane

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

**Only applicable after an adequate trial of other alternatives (See section 4C.02.06 of the 2012 OMUTCD)*

Lanes Major/ Minor	Adjusted Volumes		Condition A				Condition B				Combination A/B*							
			100%		70%		100%		70%		Cond. A		Cond. B		Cond. A		Cond. B	
	Major	Minor	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.	Maj.	Min.
1 / 1	X		500	150	350	105	750	75	525	53	400	120	600	60	280	84	420	42
2+ / 1			600	150	420	105	900	75	630	53	480	120	720	60	336	84	504	42
2+ / 2+			600	200	420	140	900	100	630	70	480	160	720	80	336	112	504	56
1 / 2+			500	200	350	140	750	100	525	70	400	160	600	80	280	112	420	56
12:00 AM	0	0																
12:15 AM	0	0																
12:30 AM	0	0																
12:45 AM	0	0																
1:00 AM	0	0																
1:15 AM	0	0																
1:30 AM	0	0																
1:45 AM	0	0																
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5:00 AM	0	0																
5:15 AM	50	11																
5:30 AM	135	23																
5:45 AM	237	33																
6:00 AM	334	45													1			
6:15 AM	384	44			1													
6:30 AM	393	40																
6:45 AM	399	46																
7:00 AM	401	51									1				1			
7:15 AM	419	58			1													
7:30 AM	423	63															1	1
7:45 AM	399	59																
8:00 AM	390	58													1			
8:15 AM	342	45																
8:30 AM	321	44																
8:45 AM	306	36																
9:00 AM	294	39													1			
9:15 AM	290	38																
9:30 AM	287	33																

Ostrander-US36 SigWarrant

9:45 AM	282	34																
10:00 AM	276	29																
10:15 AM	288	33											1					
10:30 AM	297	35																
10:45 AM	294	42																
11:00 AM	298	50																
11:15 AM	296	57											1					
11:30 AM	303	66																
11:45 AM	319	63																
12:00 PM	336	58																
12:15 PM	342	51											1					
12:30 PM	337	43																
12:45 PM	337	40																
1:00 PM	318	41																
1:15 PM	328	35											1					
1:30 PM	347	38																
1:45 PM	354	45			1													
2:00 PM	398	45																
2:15 PM	467	52							1					1		1	1	
2:30 PM	525	54	1						1	1								
2:45 PM	609	56			1							1						
3:00 PM	633	64																
3:15 PM	617	76									1			1		1	1	
3:30 PM	608	78	1						1	1								
3:45 PM	592	85			1													
4:00 PM	594	85																
4:15 PM	597	88									1			1	1	1	1	
4:30 PM	582	90	1						1	1								
4:45 PM	546	81			1													
5:00 PM	523	77																
5:15 PM	375	51											1					
5:30 PM	237	32																
5:45 PM	121	16																
6:00 PM	0	0																
6:15 PM	0	0																
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8:45 PM	0	0																
9:00 PM	0	0																
9:15 PM	0	0																
9:30 PM	0	0																
9:45 PM	0	0																
HOURS MET			3	0	6	0	0	0	3	3	4	0	1	0	12	1	4	4
WARRANT SATISFIED?			NO		NO		NO		NO		NO		NO		NO		NO	

Warrant Met: **No**

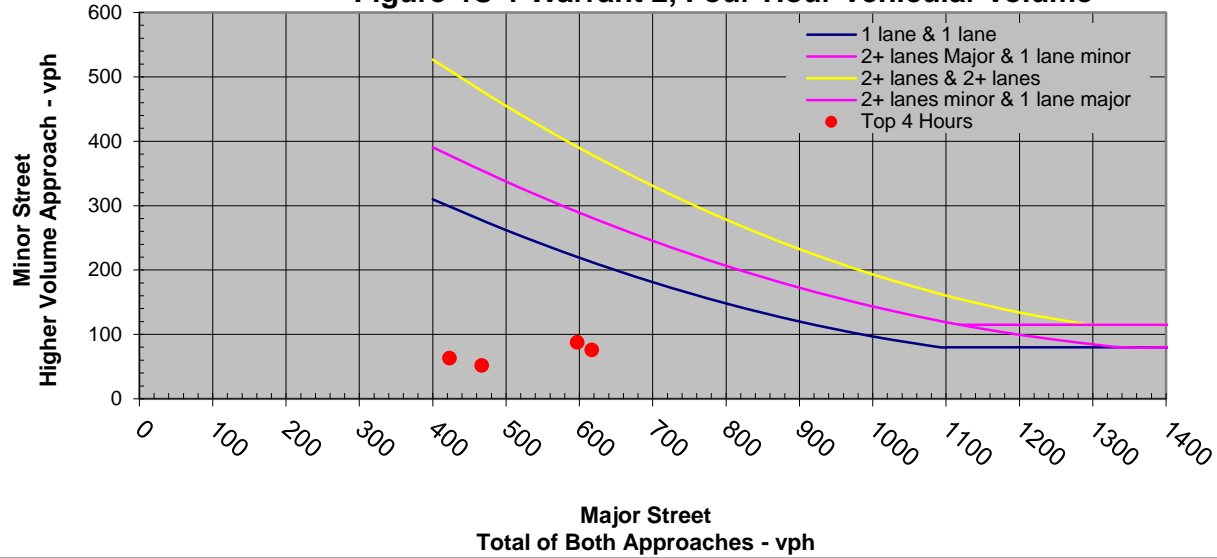
Notes:

OMUTCD WARRANT 2, FOUR-HOUR VEHICULAR VOLUME

Number of Lanes for Moving Traffic on Each Approach		Total Number of Unique Hours Met on Figure 4C-1	0
Major street:	1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	0
Minor Street:	1 Lane		

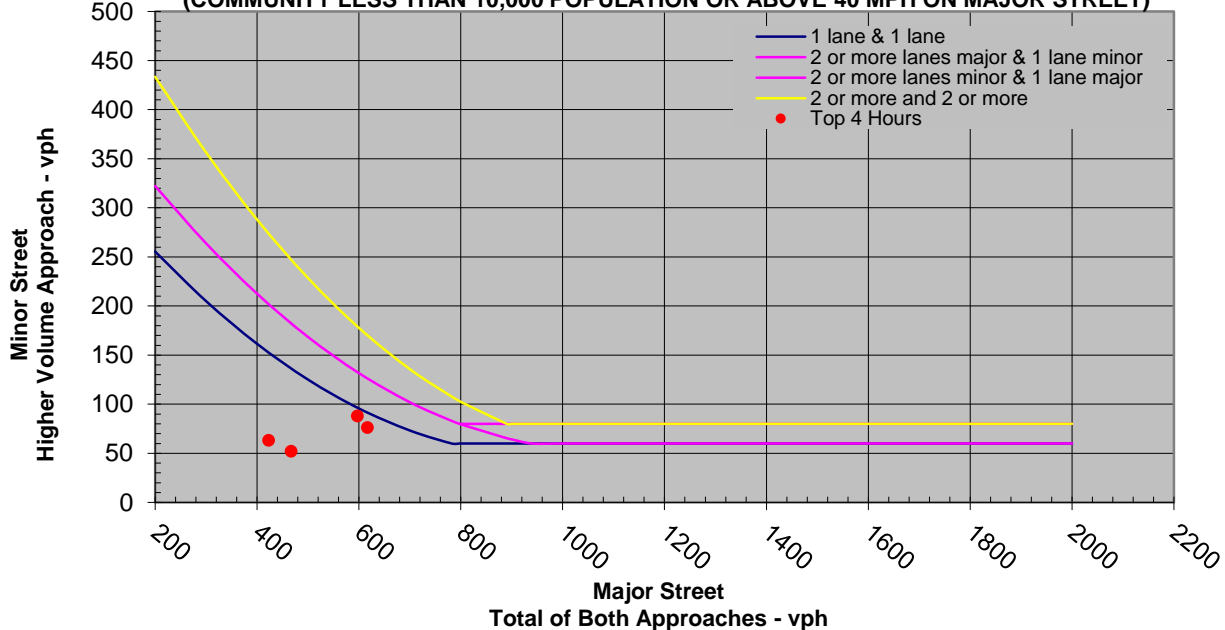
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?	Yes
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Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Minor - Ostrander Road		Major - US 36					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	18	45	202	132	334	45		
6:15 AM	30	44	234	150	384	44		
6:30 AM	32	40	239	154	393	40		
6:45 AM	40	46	226	173	399	46		
7:00 AM	48	51	231	170	401	51		
7:15 AM	43	58	234	185	419	58		
7:30 AM	44	63	244	179	423	63		
7:45 AM	43	59	237	162	399	59		
8:00 AM	39	58	218	172	390	58		
8:15 AM	37	45	191	151	342	45		
8:30 AM	40	44	160	161	321	44		
8:45 AM	36	35	141	165	306	36		
9:00 AM	39	24	139	155	294	39		
9:15 AM	38	27	143	147	290	38		
9:30 AM	33	23	148	139	287	33		
9:45 AM	34	24	145	137	282	34		
10:00 AM	29	22	137	139	276	29		
10:15 AM	33	24	144	144	288	33		
10:30 AM	35	22	148	149	297	35		
10:45 AM	42	31	151	143	294	42		
11:00 AM	50	31	162	136	298	50		
11:15 AM	57	28	159	137	296	57		
11:30 AM	66	28	168	135	303	66		
11:45 AM	63	19	173	146	319	63		
12:00 PM	58	24	175	161	336	58		
12:15 PM	51	25	185	157	342	51		
12:30 PM	43	26	177	160	337	43		
12:45 PM	40	27	173	164	337	40		
1:00 PM	41	27	164	154	318	41		
1:15 PM	35	24	160	168	328	35		
1:30 PM	38	21	171	176	347	38		
1:45 PM	45	24	182	172	354	45		
2:00 PM	45	23	198	200	398	45		
2:15 PM	52	25	227	240	467	52		
2:30 PM	54	32	248	277	525	54		
2:45 PM	56	28	288	321	609	56		
3:00 PM	64	35	335	298	633	64		
3:15 PM	76	36	335	282	617	76		
3:30 PM	78	32	337	271	608	78		
3:45 PM	85	40	324	268	592	85		
4:00 PM	85	36	295	299	594	85		
4:15 PM	88	38	291	306	597	88		
4:30 PM	90	37	284	298	582	90		
4:45 PM	81	34	272	274	546	81		
5:00 PM	77	31	267	256	523	77		
5:15 PM	51	22	193	182	375	51		
5:30 PM	32	16	122	115	237	32		
5:45 PM	16	7	63	58	121	16		
6:00 PM	0	0	0	0	0	0		
6:15 PM	0	0	0	0	0	0		
6:30 PM	0	0	0	0	0	0		
6:45 PM	0	0	0	0	0	0		
7:00 PM	0	0	0	0	0	0		
7:15 PM	0	0	0	0	0	0		
7:30 PM	0	0	0	0	0	0		
7:45 PM	0	0	0	0	0	0		
8:00 PM	0	0	0	0	0	0		

Figure 4C-1 Warrant 2, Four-Hour Vehicular Volume

Top Hours for Figure 4C-1	Start Time	End Time	Major Street	Minor Street
Top Hour	4:15 PM	5:15 PM	597	88
2nd Highest Hour	3:15 PM	4:15 PM	617	76
3rd Highest Hour	2:15 PM	3:15 PM	467	52
4th Highest Hour	7:30 AM	8:30 AM	423	63

Top Hours for Figure 4C-2	Start Time	End Time	Major Street	Minor Street
Top Hour	4:15 PM	5:15 PM	597	88
2nd Highest Hour	3:15 PM	4:15 PM	617	76
3rd Highest Hour	2:15 PM	3:15 PM	467	52
4th Highest Hour	7:30 AM	8:30 AM	423	63

**Figure 4C-2 Warrant 2 Four Hour Vehicular Volume (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)**

Are the requirements for Warrant 2 met?: **No**

OMUTCD WARRANT 3, PEAK HOUR

Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time	4:15 PM
Major Street:	1 Lane	Peak Hour End Time	5:15 PM
Minor Street:	1 Lane		

Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street?

Yes

Is this signal warrant being applied for an unusual case, such as office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time?

No

Indicate whether all three of the following conditions for the same 1 hour (any four consecutive 15-minute periods) of an average day are present*

Does the total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceed 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach?

Does the volume on the same minor-street approach (one direction only) equal or exceed 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes?

No

Does the total entering volume serviced during the hour equal or exceed 650 vehicles per hour for intersection with three approaches or 800 vehicles per hour for intersections with four or more approaches?

No

*If applicable, attach all supporting calculations and documentation.

Are the requirements for Warrant 3 met?:

No

Figure 4C-3. Warrant 3 Peak Hour

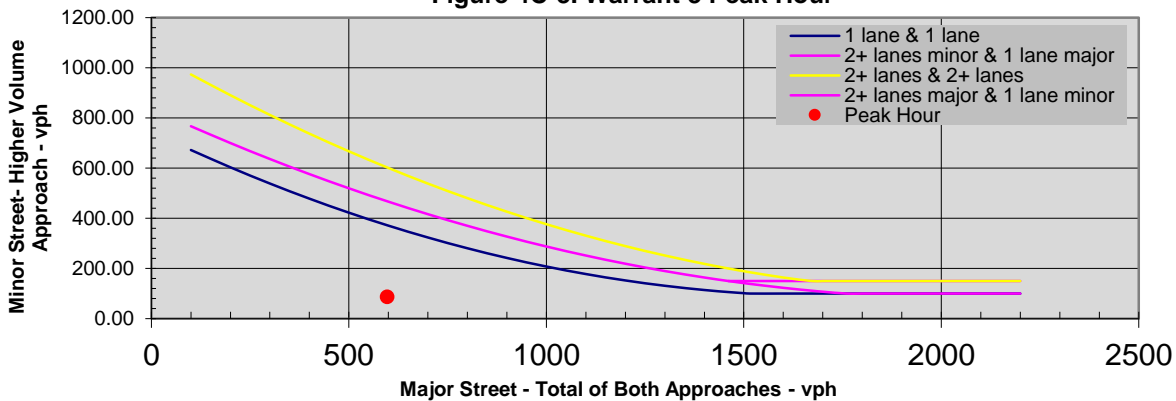
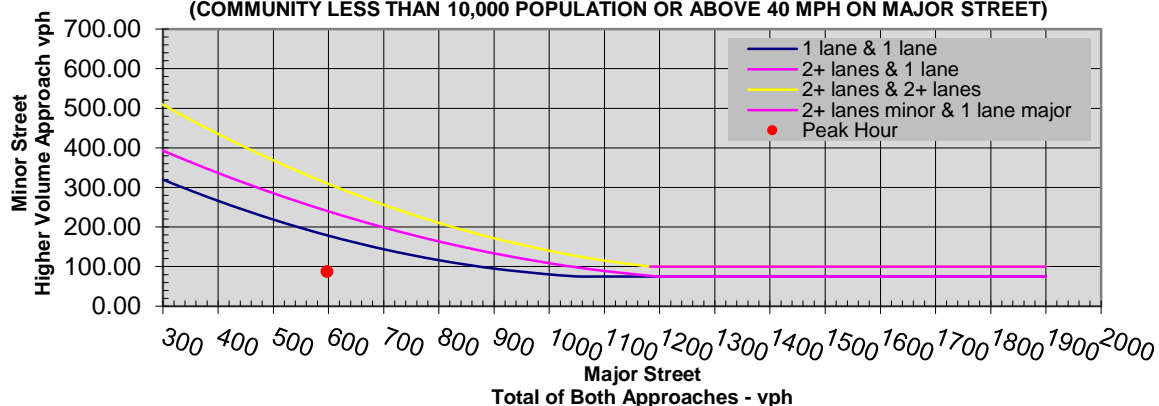


Figure 4C-4. Warrant 3 Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



Hour Vehicular Volume				
Hour Interval Beginning At	Major Street Combined Vehicles Per Hour (VPH)	Highest Minor Street Approach Vehicles Per Hour (VPH)	Sum of Major Street and Highest Minor Street	Sum of Major Street and Combined Minor Street
6:00 AM	334	45	379	397
6:15 AM	384	44	428	458
6:30 AM	393	40	433	465
6:45 AM	399	46	445	485
7:00 AM	401	51	452	500
7:15 AM	419	58	477	520
7:30 AM	423	63	486	530
7:45 AM	399	59	458	501
8:00 AM	390	58	448	487
8:15 AM	342	45	387	424
8:30 AM	321	44	365	405
8:45 AM	306	36	342	377
9:00 AM	294	39	333	357
9:15 AM	290	38	328	355
9:30 AM	287	33	320	343
9:45 AM	282	34	316	340
10:00 AM	276	29	305	327
10:15 AM	288	33	321	345
10:30 AM	297	35	332	354
10:45 AM	294	42	336	367
11:00 AM	298	50	348	379
11:15 AM	296	57	353	381
11:30 AM	303	66	369	397
11:45 AM	319	63	382	401
12:00 PM	336	58	394	418
12:15 PM	342	51	393	418
12:30 PM	337	43	380	406
12:45 PM	337	40	377	404
1:00 PM	318	41	359	386
1:15 PM	328	35	363	387
1:30 PM	347	38	385	406
1:45 PM	354	45	399	423
2:00 PM	398	45	443	466
2:15 PM	467	52	519	544
2:30 PM	525	54	579	611
2:45 PM	609	56	665	693
3:00 PM	633	64	697	732
3:15 PM	617	76	693	729
3:30 PM	608	78	686	718
3:45 PM	592	85	677	717
4:00 PM	594	85	679	715
4:15 PM	597	88	685	723
4:30 PM	582	90	672	709
4:45 PM	546	81	627	661
5:00 PM	523	77	600	631
5:15 PM	375	51	426	448
5:30 PM	237	32	269	285
5:45 PM	121	16	137	144
6:00 PM	0	0	0	0
6:15 PM	0	0	0	0
6:30 PM	0	0	0	0
6:45 PM	0	0	0	0
7:00 PM	0	0	0	0
7:15 PM	0	0	0	0
7:30 PM	0	0	0	0
7:45 PM	0	0	0	0
8:00 PM	0	0	0	0

Actual Peak Hour Major Traffic Volume	Actual Peak Hour Minor Traffic Volume	Required Peak Hour Minor Traffic Volume for Fig. 4C-3	Required Peak Hour Minor Traffic Volume for Fig. 4C-4
597	88	372	179

Multi-Way Stop Application

OMUTCD Section 2B.07

- | | |
|--|---|
| <p>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.</p> | <div style="background-color: #808080; color: white; padding: 2px; border: 1px solid black; font-weight: bold;">Warranted ?</div> <div style="background-color: #FFFF00; padding: 5px; border: 1px solid black; font-weight: bold; margin-top: 5px;">No</div> |
| <p>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.</p> | <div style="background-color: #FFFF00; padding: 5px; border: 1px solid black; font-weight: bold;">No</div> |
| <p>C. Minimum Volumes:</p> <p style="margin-left: 20px;">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.</p> | <div style="background-color: #90EE90; padding: 5px; border: 1px solid black; font-weight: bold;">Yes</div> |
| <p style="margin-left: 20px;">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.*</p> <p style="margin-left: 20px;">*If this condition is satisfied, there must also be an average delay of at least 30 seconds per vehicle during the peak hour.</p> | <div style="background-color: #90EE90; padding: 5px; border: 1px solid black; font-weight: bold;">No</div> |
| <p style="margin-left: 20px;">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.</p> | <div style="background-color: #90EE90; padding: 5px; border: 1px solid black; font-weight: bold;">Yes</div> |
| <p>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</p> | <div style="background-color: #90EE90; padding: 5px; border: 1px solid black; font-weight: bold;">No</div> |
| <p>Other criteria that may be considered in an engineering study include:</p> | |
| <p style="margin-left: 20px;">A. The need to control left-turn conflicts;</p> | <div style="background-color: #FFFF00; height: 20px; border: 1px solid black;"></div> |
| <p style="margin-left: 20px;">B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;</p> | <div style="background-color: #FFFF00; height: 20px; border: 1px solid black;"></div> |
| <p style="margin-left: 20px;">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</p> | <div style="background-color: #FFFF00; height: 20px; border: 1px solid black;"></div> |
| <p style="margin-left: 20px;">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.</p> | <div style="background-color: #FFFF00; height: 20px; border: 1px solid black;"></div> |

Are the requirements for Multi-Way Stop Satisfied?: No

AUTOCALC table								
Each hour is individually checked and tallied if "met"								
Lanes	ADJUSTED VOLUMES		Condition C.1		Condition C.2		Condition D	
Major/ Minor			100%		70%		80%	
	MAJOR	MINOR	MAJ.	MIN.	MAJ.	MIN.	MAJ.	MIN.
Required Volumes			300	200	210	140	240	160
6:00 AM	334	45	1				1	
6:15 AM	384	44						
6:30 AM	393	40						
6:45 AM	399	46			1			
7:00 AM	401	51	1				1	
7:15 AM	419	58						
7:30 AM	423	63						
7:45 AM	399	59			1			
8:00 AM	390	58	1				1	
8:15 AM	342	45						
8:30 AM	321	44						
8:45 AM	306	36			1			
9:00 AM	294	39					1	
9:15 AM	290	38						
9:30 AM	287	33						
9:45 AM	282	34			1			
10:00 AM	276	29					1	
10:15 AM	288	33						
10:30 AM	297	35						
10:45 AM	294	42			1			
11:00 AM	298	50					1	
11:15 AM	296	57						
11:30 AM	303	66	1					
11:45 AM	319	63			1			
12:00 PM	336	58					1	
12:15 PM	342	51						
12:30 PM	337	43	1					
12:45 PM	337	40			1			
1:00 PM	318	41					1	
1:15 PM	328	35						
1:30 PM	347	38	1					
1:45 PM	354	45			1			
2:00 PM	398	45					1	
2:15 PM	467	52						
2:30 PM	525	54	1					
2:45 PM	609	56			1			
3:00 PM	633	64					1	
3:15 PM	617	76						
3:30 PM	608	78	1					
3:45 PM	592	85			1			
4:00 PM	594	85					1	
4:15 PM	597	88						
4:30 PM	582	90	1					
4:45 PM	546	81			1			
5:00 PM	523	77					1	
5:15 PM	375	51						

Ostrander-US36 AWSC Warrant

5:30 PM	237	32						
5:45 PM	121	16						
6:00 PM	0	0						
6:15 PM	0	0						
6:30 PM	0	0						
6:45 PM	0	0						
7:00 PM	0	0						
7:15 PM	0	0						
7:30 PM	0	0						
7:45 PM	0	0						
8:00 PM	0	0						
8:15 PM	0	0						
8:30 PM	0	0						
8:45 PM	0	0						
9:00 PM	0	0						
9:15 PM	0	0						
9:30 PM	0	0						
9:45 PM	0	0						
10:00 PM	0	0						
10:15 PM	0	0						
10:30 PM	0	0						
10:45 PM	0	0						
11:00 PM	0	0						
11:15 PM	0	0						
11:30 PM	0	0						
11:45 PM	0	0						
HOURS MET			9	0	12	1	12	0
CONDITION SATISFIED?			NO		NO		NO	

DEL-US36-1.93 SAFETY STUDY

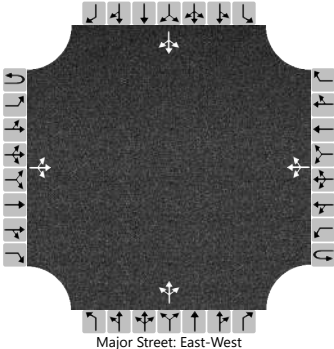
APPENDIX D: CAPACITY ANALYSES



HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	GSH	Intersection	US-36 at Ostrander Rd
Agency/Co.	CMT	Jurisdiction	Delaware County
Date Performed	2/19/2025	East/West Street	US-36
Analysis Year	2050	North/South Street	Ostrander Rd
Time Analyzed	AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	US-36 at Ostrander Safety Study		

Lanes



Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		10	290	20		40	360	20		20	20	50		60	50	20
Percent Heavy Vehicles (%)		11				8				9	9	9		3	3	3
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways																
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.21				4.18				7.19	6.59	6.29		7.13	6.53	6.23
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.30				2.27				3.58	4.08	3.38		3.53	4.03	3.33

Delay, Queue Length, and Level of Service																
Flow Rate, v (veh/h)		11				43					98				141	
Capacity, c (veh/h)		1099				1189					364				266	
v/c Ratio		0.01				0.04					0.27				0.53	
95% Queue Length, Q ₉₅ (veh)		0.0				0.1					1.1				2.9	
95% Queue Length, Q ₉₅ (ft)		0.0				2.5					29.5				74.2	
Control Delay (s/veh)		8.3	0.1	0.1		8.1	0.4	0.4			18.5				32.8	
Level of Service (LOS)		A	A	A		A	A	A			C				D	
Approach Delay (s/veh)	0.4				1.1				18.5				32.8			
Approach LOS	A				A				C				D			

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	GSH	Intersection	US-36 at Ostrander Rd
Agency/Co.	CMT	Jurisdiction	Delaware County
Date Performed	2/19/2025	East/West Street	US-36
Analysis Year	2050	North/South Street	Ostrander Rd
Time Analyzed	PM Peak	Peak Hour Factor	0.96
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	US-36 at Ostrander Safety Study		

Lanes

Vehicle Volumes and Adjustments																
Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Number of Lanes	0	0	1	0	0	0	1	0		0	1	0		0	1	0
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		30	470	20		70	480	30		20	40	60		20	40	20
Percent Heavy Vehicles (%)		4				4				8	8	8		11	11	11
Proportion Time Blocked																
Percent Grade (%)									0				0			
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways																
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.14				4.14				7.18	6.58	6.28		7.21	6.61	6.31
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.24				2.24				3.57	4.07	3.37		3.60	4.10	3.40

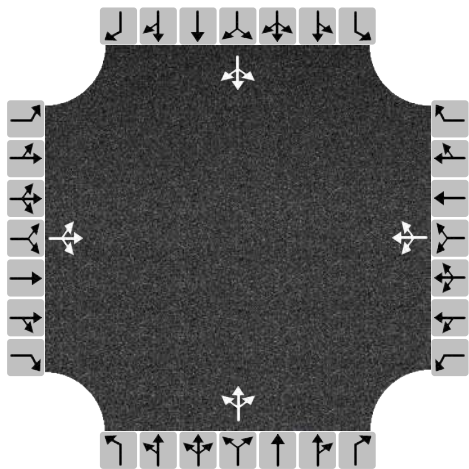
Delay, Queue Length, and Level of Service																
Flow Rate, v (veh/h)		31				73					125				83	
Capacity, c (veh/h)		1026				1045					199				142	
v/c Ratio		0.03				0.07					0.63				0.59	
95% Queue Length, Q ₉₅ (veh)		0.1				0.2					3.6				3.0	
95% Queue Length, Q ₉₅ (ft)		2.5				5.0					95.8				81.6	
Control Delay (s/veh)		8.6	0.4	0.4		8.7	0.9	0.9			49.7				61.6	
Level of Service (LOS)		A	A	A		A	A	A			E				F	
Approach Delay (s/veh)	0.8				1.8				49.7				61.6			
Approach LOS	A				A				E				F			

HCS All-Way Stop Control Report

General and Site Information

Analyst	GSH
Agency/Co.	CMT
Date Performed	2/19/2025
Analysis Year	2050
Analysis Time Period (hrs)	0.25
Time Analyzed	AM Peak
Project Description	US-36 at Ostrander Safety Study
Intersection	US-36 at Ostrander Rd
Jurisdiction	Delaware County
East/West Street	US-36
North/South Street	Ostrander Rd
Peak Hour Factor	0.92

Lanes



Turning Movement Demand Volumes

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume (veh/h)	10	290	20	40	360	20	20	20	50	60	50	20
% Thrus in Shared Lane												

Lane Flow Rate and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	348			457			98			141		
Percent Heavy Vehicles	11			8			9			3		
Initial Departure Headway, h_d (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.309			0.406			0.087			0.126		
Final Departure Headway, h_d (s)	5.54			5.36			6.28			6.34		
Final Degree of Utilization, x	0.536			0.680			0.171			0.249		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, t_s (s)	3.54			3.36			4.28			4.34		

Capacity, Delay and Level of Service

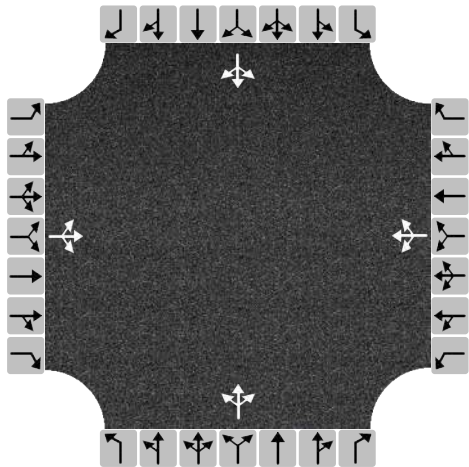
Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	348			457			98			141		
Capacity (veh/h)	649			671			573			568		
95% Queue Length, Q ₉₅ (veh)	3.2			5.3			0.6			1.0		
95% Queue Length, Q ₉₅ (ft)	87.0			141.0			16.1			25.6		
Control Delay (s/veh)	14.8			19.0			10.6			11.4		
Level of Service, LOS	B			C			B			B		
Approach Delay (s/veh) LOS	14.8		B	19.0		C	10.6		B	11.4		B
Intersection Delay (s/veh) LOS	15.8						C					

HCS All-Way Stop Control Report

General and Site Information

Analyst	GSH
Agency/Co.	CMT
Date Performed	2/19/2025
Analysis Year	2050
Analysis Time Period (hrs)	0.25
Time Analyzed	PM Peak
Project Description	US-36 at Ostrander Safety Study
Intersection	US-36 at Ostrander Rd
Jurisdiction	Delaware County
East/West Street	US-36
North/South Street	Ostrander Rd
Peak Hour Factor	0.96

Lanes



Turning Movement Demand Volumes

Approach	Eastbound			Westbound			Northbound			Southbound		
Movement	L	T	R	L	T	R	L	T	R	L	T	R
Volume (veh/h)	30	470	20	70	480	30	20	40	60	20	40	20
% Thrus in Shared Lane												

Lane Flow Rate and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	542			604			125			83		
Percent Heavy Vehicles	4			4			8			11		
Initial Departure Headway, h_d (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.481			0.537			0.111			0.074		
Final Departure Headway, h_d (s)	5.73			5.64			7.10			7.50		
Final Degree of Utilization, x	0.861			0.947			0.247			0.174		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, t_s (s)	3.73			3.64			5.10			5.50		

Capacity, Delay and Level of Service

Approach	Eastbound			Westbound			Northbound			Southbound		
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	542			604			125			83		
Capacity (veh/h)	629			638			507			480		
95% Queue Length, Q ₉₅ (veh)	9.8			13.1			1.0			0.6		
95% Queue Length, Q ₉₅ (ft)	252.8			338.0			26.6			16.3		
Control Delay (s/veh)	34.0			47.1			12.4			12.1		
Level of Service, LOS	D			E			B			B		
Approach Delay (s/veh) LOS	34.0		D	47.1		E	12.4		B	12.1		B
Intersection Delay (s/veh) LOS	36.5						E					

HCS Roundabouts Report

General Information	Site Information
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Analyst	GSH		Intersection	US-36 at Ostrander Rd
Agency or Co.	CMT		E/W Street Name	US-36
Date Performed	2/19/2025		N/S Street Name	Ostrander Rd
Analysis Year	2050		Analysis Time Period, hrs	0.25
Time Analyzed	AM Peak		Peak Hour Factor	0.92
Project Description	US-36 at Ostrander Rd Safety Study		Jurisdiction	Delaware County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	290	20	0	40	360	20	0	20	20	50	0	60	50	20
Percent Heavy Vehicles, %	0	11	11	11	0	8	8	8	0	9	9	9	0	3	3	3
Flow Rate (v _{PCE}), pc/h	0	12	350	24	0	47	423	23	0	24	24	59	0	67	56	22
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
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		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway, s		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		386			493			107			145	
Entry Volume, veh/h		348			456			98			141	
Circulating Flow (v_c), pc/h	170			60			429			494		
Exiting Flow (v_{ex}), pc/h	476			469			59			127		
Capacity (C_{pce}), pc/h		1160			1298			891			834	
Capacity (c), veh/h		1045			1202			817			809	
v/c Ratio (x)		0.33			0.38			0.12			0.17	

Delay and Level of Service	
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Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.8			6.7			5.6			6.3	
Lane LOS		A			A			A			A	
95% Queue Length, Q ₉₅ (veh)		1.5			1.8			0.4			0.6	
95% Queue Length, Q ₉₅ (ft)		40.8			47.9			10.7			15.4	
Approach Delay, s/veh LOS	6.8	A		6.7	A		5.6	A		6.3	A	
Intersection Delay, s/veh LOS	6.6						A					

HCS Roundabouts Report

General Information	Site Information
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Analyst	GSH		Intersection	US-36 at Ostrander Rd
Agency or Co.	CMT		E/W Street Name	US-36
Date Performed	2/19/2025		N/S Street Name	Ostrander Rd
Analysis Year	2050		Analysis Time Period, hrs	0.25
Time Analyzed	PM Peak		Peak Hour Factor	0.96
Project Description	US-36 at Ostrander Rd Safety Study		Jurisdiction	Delaware County

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	30	470	20	0	70	480	30	0	20	40	60	0	20	40	20
Percent Heavy Vehicles, %	0	4	4	4	0	4	4	4	0	8	8	8	0	11	11	11
Flow Rate (v _{PCE}), pc/h	0	32	509	22	0	76	520	32	0	23	45	68	0	23	46	23
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
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		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway, s		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		563			628			136			92	
Entry Volume, veh/h		541			604			126			83	
Circulating Flow (v_c), pc/h	145			100			564			619		
Exiting Flow (v_{ex}), pc/h	600			566			109			144		
Capacity (C_{pce}), pc/h		1190			1246			776			734	
Capacity (c), veh/h		1144			1198			719			661	
v/c Ratio (x)		0.47			0.50			0.18			0.13	

Delay and Level of Service	
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Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		8.3			8.5			6.9			6.8	
Lane LOS		A			A			A			A	
95% Queue Length, Q ₉₅ (veh)		2.6			2.9			0.6			0.4	
95% Queue Length, Q ₉₅ (ft)		67.1			74.8			16.0			10.9	
Approach Delay, s/veh LOS	8.3	A		8.5	A		6.9	A		6.8	A	
Intersection Delay, s/veh LOS	8.2						A					

DEL-US36-1.93 SAFETY STUDY

APPENDIX E: COST ESTIMATE



ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
OSTRANDER - US36 - Roundabout Alternate

PID: 120561
Client name: ODOT

Date: February 21, 2025

Ref. No.	Item No.	Description	Total Estimated Quantity	Unit	Estimated Unit Cost	Total Estimated Cost
1	202	CLEARING AND GRUBBING	1	LUMP	\$ 50,000.00	\$ 50,000
2	202	PAVEMENT REMOVED	4500	SQ YD	\$ 15.00	\$ 67,500
3	202	GUARDRAIL REMOVED	1750	FEET	\$ 3.00	\$ 5,250
4	203	EXCAVATION	1100	CU YD	\$ 23.00	\$ 25,300
5	203	EMBANKMENT	9531.25	CU YD	\$ 25.00	\$ 238,281
6	204	SUBGRADE COMPACTION	3800	SQ YD	\$ 1.25	\$ 4,750
7	204	EXCAVATION OF SUBGRADE	1250	CU YD	\$ 33.00	\$ 41,250
8	204	PROOF ROLLING	4	HOUR	\$ 250.00	\$ 1,000
9	204	GRANULAR MATERIAL, TYPE D	1250	CU YD	\$ 75.00	\$ 93,750
10	204	GEOTEXTILE FABRIC	3800	SQ YD	\$ 3.50	\$ 13,300
11	254	PAVEMENT PLANING, ASPHALT CONCRETE	3275	SQ YD	\$ 4.00	\$ 13,100
12	301	ASPHALT CONCRETE BASE	630	CU YD	\$ 170.00	\$ 107,100
13	304	AGGREGATE BASE	810	CU YD	\$ 75.00	\$ 60,750
14	441	ASPHALT CONCRETE SURFACE COURSE	160	CU YD	\$ 300.00	\$ 48,000
15	441	ASPHALT CONCRETE INTERMEDIATE COURSE	160	CU YD	\$ 300.00	\$ 48,000
16	452	9" NON-REINFORCED CONCRETE PAVEMENT, CLASS QC 1P	1140	SQ YD	\$ 120.00	\$ 136,800
17	606	GUARDRAIL, TYPE MGS	1325	FEET	\$ 25.00	\$ 33,125
18	606	ANCHOR ASSEMBLY TYPE E	6	EACH	\$ 1,000.00	\$ 6,000
19	606	BRIDGE TERMINAL ASSEMBLY, TYPE 1	2	EACH	\$ 1,250.00	\$ 2,500
20	609	COMBINATION CURB AND GUTTER, TYPE 9	2950	FEET	\$ 35.00	\$ 103,250
21	611	DRAINAGE	1	LUMP	\$ 120,000.00	\$ 120,000
22	625	LIGHTING	1	LUMP	\$ 150,000.00	\$ 150,000
23	630	SIGNAGE AND PAVEMENT MARKINGS	1	LUMP	\$ 60,000.00	\$ 60,000
24	659	TOPSOIL	525	CU YD	\$ 120.00	\$ 63,000
25	659	SEEDING AND MULCHING	4700	SQ YD	\$ 10.00	\$ 47,000
26	832	EROSION CONTROL	60000	EACH	\$ 1.00	\$ 60,000
						\$ 1,599,006
27	614	MAINTENANCE OF TRAFFIC	1	LUMP	\$ 100,000.00	\$ 100,000
28	619	FIELD OFFICE, TYPE B	8	MONTH	\$ 1,800.00	\$ 14,400
29	623	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LUMP	\$ 35,000.00	\$ 35,000
30	624	MOBILIZATION	1	LUMP	\$ 100,000.00	\$ 100,000
SUBTOTAL ESTIMATED CONSTRUCTION COST						\$ 1,850,000
SUBTOTAL ESTIMATED RIGHT OF WAY COST						\$ 75,000
						\$ 1,925,000
CONSTRUCTION CONTINGENCY					25%	\$ 481,000
ENGINEERING, DESIGN & CONSTRUCTION ADMINISTRATION					30%	\$ 580,000
						\$ 2,986,000
INFLATION CONTINGENCY (2028 CONSTRUCTION)					18.0%	\$ 540,000
TOTAL ESTIMATED PROJECT COST						\$ 3,530,000

DEL-US36-1.93 SAFETY STUDY

APPENDIX F: ECAT ANALYSIS





Project Information

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		
Perform Benefit Cost Analysis?	Yes		

Do the proposed improvements fundamentally change the conditions of the base safety performance function (SPF),
Or is crash data unavailable for the analysis condition,
Or is only predicted (and not expected) analysis needed for the existing or proposed condition?

Yes

(Examples: unsignalized to signalized, undivided to divided, increase or decrease in the number of lanes, change the number of approaches to an intersection, significant realignment of the roadway)

If Yes, are you analyzing the existing or proposed conditions?

Existing

Project Elements Description Table

Project Element ID (Must be Unique)	Site Type	Intersection Control Type	Location Information					
			NLFID	Begin Logpoint/ Intersection Midpoint	End Logpoint (Leave blank for Intersection)	Length (mi) OR Intersection Radius Buffer (mi)	Cross Route NLFID(s)	Common Name
US36; 1.88	Rural Two-Lane Two Way Intersection	Unsignalized	SDELUS00036**C	1.88		0.05	CDELCR0016	US36 at Ostrander Rd

Traffic Volume Growth Rate Calculation For Benefit Cost Analysis

	Year	AADT	
Present ADT (PADT)	2025	7,200	veh / day
Future ADT (FADT)	2050	9,900	veh / day
Annual Linear Growth Rate		0.0150	

Existing Conditions: General Information and Data for Rural Two-Lane Two-Way Intersection							
General Information				Location Information			
Analyst	GSH			Route	US36		
Agency or Company	CMT			Logpoint	1.88		
Date Performed	02/21/25			Common Name	US36 at Ostrander Rd		
Intersection	US36; 1.88			Analysis Year	2050		
Signalized/Unsignalized	Unsignalized						
Input Data				Existing Conditions		HSM Base Conditions	
Intersection type (3ST, 4ST, 4SG)				4ST		--	
AADT _{major} (veh/day)		AADT _{MAX} = 14,700 (veh/day)		8,250		--	
AADT _{minor} (veh/day)		AADT _{MAX} = 3,500 (veh/day)		1,650		--	
Intersection skew angle (degrees) <div> <div>Skew Angle Help</div> <div>Does skew differ for minor legs? Else, No.</div> <div>No</div> </div>				Skew for Leg 1 (All):	10	Skew for Leg 2 (4ST only):	10
						0	
Number of uncontrolled approaches with a left-turn lane (0, 1, 2, 3, 4)				0		0	
Number of uncontrolled approaches with a right-turn lane (0, 1, 2, 3, 4)				0		0	
Intersection lighting (present/not present)				Not Present		Not Present	
Calibration Factor, C _i				1.01		1.00	
Locality:				State System			

Existing Conditions: Crash Modification Factors (CMFs) for Rural Two-Lane Two-Way Intersection				
(1) CMF for Intersection Skew Angle CMF _{1i} from Equations 10-22 or 10-23	(2) CMF for Left-Turn Lanes CMF _{2i} from Table 10-13	(3) CMF for Right-Turn Lanes CMF _{3i} from Table 10-14	(4) CMF for Lighting CMF _{4i} from Equation 10-24	(5) Combined CMF CMF _{comb} (1)*(2)*(3)*(4)
1.0555	1.0000	1.0000	1.0000	1.0555

Existing Conditions: Predicted Crash Summary for Rural Two-Lane Two-Way Intersection							
(1) Crash Severity Level	(2) N _{spf 3ST, 4ST or 4SG} from Equations 10-8, 10-9, or 10-10	(3) Overdispersion Parameter, k from Section 10.6.2	(4) Crash Severity Distribution from Table 10-5	(5) N _{spf 3ST, 4ST or 4SG by Severity Distribution} (2) _{TOTAL} * (4)	(6) Combined CMFs from (5) of Worksheet 2B	(7) Calibration Factor, C _i	(8) Predicted average crash frequency, N _{predicted int} (5)*(6)*(7)
Total	3.935	0.24	1.000	3.935	1.06	1.01	4.195
Fatal and Injury (FI)	--	--	0.367	1.446	1.06	1.01	1.541
Property Damage Only (PDO)	--	--	0.633	2.489	1.06	1.01	2.654



Project Information

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		
Perform Benefit Cost Analysis?	Yes		

Do the proposed improvements fundamentally change the conditions of the base safety performance function (SPF),
Or is crash data unavailable for the analysis condition,
Or is only predicted (and not expected) analysis needed for the existing or proposed condition?

Yes

(Examples: unsignalized to signalized, undivided to divided, increase or decrease in the number of lanes, change the number of approaches to an intersection, significant realignment of the roadway)

If Yes, are you analyzing the existing or proposed conditions?

Proposed

Project Elements Description Table

Project Element ID (Must be Unique)	Site Type	Intersection Control Type	Location Information					
			NLFID	Begin Logpoint/ Intersection Midpoint	End Logpoint (Leave blank for Intersection)	Length (mi) OR Intersection Radius Buffer (mi)	Cross Route NLFID(s)	Common Name
US36; 1.88	Roundabout	Unsignalized	SDELUS00036**C	1.88		0.05	CDELCR0016	US36 at Ostrander Rd

Traffic Volume Growth Rate Calculation For Benefit Cost Analysis

	Year	AADT	
Present ADT (PADT)	2025	7,200	veh / day
Future ADT (FADT)	2050	9,900	veh / day
Annual Linear Growth Rate		0.0150	

Proposed Conditions: General Information and Data for Roundabout Intersection						
General Information				Location Information		
Analyst	GSH		Route		US36	
Agency or Company	CMT		Logpoint		1.88	
Date Performed	02/21/25		Common Name		US36 at Ostrander Rd	
Intersection	US36; 1.88		Analysis Year		2050	
Signalized/Unsignalized	Unsignalized					
Input Data			Proposed Conditions		HSM Base Conditions	
Area Type (Rural, Urban)			Rural		--	
Number of Legs (3 or 4)			4		--	
Single-Lane or Multi-lane Roundabout			Single-Lane		--	
Total Entering AADT (veh/day)			9,900		--	
					0	
Presence of Outbound Only Leg (present/not present)			Not Present		Not Present	
Calibration Factor, C _i			Varies, See Below		1.00	
Locality:			State System		--	
Leg 1	Leg 1 Entering AADT (veh/day)	AADT _{MAX} = 19,733 (veh/day)	690		--	
	Bypass lane (present/not present) - Leg 1		Not Present		--	
	Number of driveways or unsignalized access points - Leg 1		1		--	
	Entry width (feet) - Leg 1		17		16-25 ft	
	Number of entering lanes (1 lane, 2 lanes) - Leg 1		1		--	
Leg 2	Leg 2 Entering AADT (veh/day)	AADT _{MAX} = 19,733 (veh/day)	4,310		--	
	Bypass lane (present/not present) - Leg 2		Not Present		--	
	Number of driveways or unsignalized access points - Leg 2		0		--	
	Entry width (feet) - Leg 2		17		16-25 ft	
	Number of entering lanes (1 lane, 2 lanes) - Leg 2		1		--	
Leg 3	Leg 3 Entering AADT (veh/day)	AADT _{MAX} = 19,733 (veh/day)	1,010		--	
	Bypass lane (present/not present) - Leg 3		Not Present		--	
	Number of driveways or unsignalized access points - Leg 3		2		--	
	Entry width (feet) - Leg 3		17		16-25 ft	
	Number of entering lanes (1 lane, 2 lanes) - Leg 3		1		--	
Leg 4	Leg 4 Entering AADT (veh/day)	AADT _{MAX} = 19,733 (veh/day)	3,890		--	
	Bypass lane (present/not present) - Leg 4		Not Present		--	
	Number of driveways or unsignalized access points - Leg 4		0		--	
	Entry width (feet) - Leg 4		17		16-25 ft	
	Number of entering lanes (1 lane, 2 lanes) - Leg 4		1		--	

Proposed Conditions: Crash Modification Factors (CMFs) for Roundabout Intersection								
Crash Severity Level	Inscribed Circle CMF	Outbound Only Leg CMF	Leg CMFs					Combined CMF
			Leg 1 CMF	Leg 2 CMF	Leg 3 CMF	Leg 4 CMF	Total CMF Legs	
Fatal and Injury (FI)	1.00	0.43	1.07	1.00	1.14	1.00	1.02	0.43
Property Damage Only (PDO)	1.00	1.00	1.09	1.00	1.19	1.00	1.03	1.03

Proposed Conditions: Predicted Crash Summary for Roundabout Intersection								
--	--	--	--	--	--	--	--	--

(1)	(2)			(3)	(4)	(5)	(6)	(7)
Crash Severity Level	SPF Coefficients			N _{spf int}	Overdispersion Parameter, k	Combined CMFs	Calibration Factor, C _i	Predicted average crash frequency, N _{predicted int}
	from Table 11-7 or 11-8					from (6) of Worksheet 2B		
	a	b	c	from Equation 11-11 or 11-12	from Table 11-7 or 11-8			(3)*(5)*(6)
Total	--	--	--	--	--	--	--	1.518
Fatal and Injury (FI)	-3.503	0.915	0.206	0.301	0.33	0.43	1.00	0.131
Property Damage Only (PDO)	-1.475	0.702	0.168	1.35	0.80	1.03	1.00	1.387

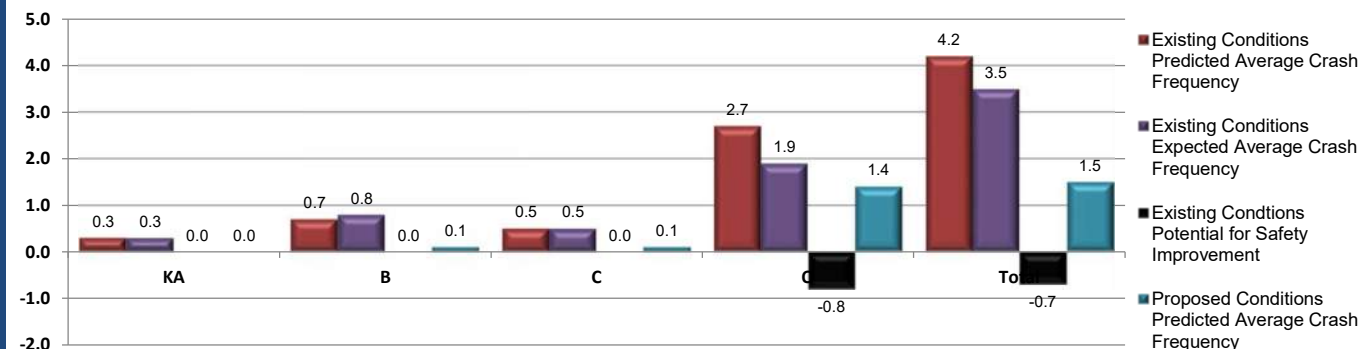


Project Safety Performance Report

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Summary of Anticipated Safety Performance of the Project (average crashes/year)



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
N_{predicted} - Existing Conditions	0.3059	0.7416	0.4938	2.6539	4.1952
N_{expected} - Existing Conditions	0.3199	0.7752	0.5162	1.8546	3.4659
N_{potential for improvement} - Existing Conditions	0.0140	0.0336	0.0224	-0.7993	-0.7293
N_{expected} - Proposed Conditions	0.0065	0.0549	0.0680	1.3733	1.5027



Project Safety Performance Report

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Existing Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US36: 1.88	US36 at Ostrander Rd	0.3059	0.7416	0.4938	2.6539	4.1952



Project Safety Performance Report

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Existing Conditions Project Element Expected Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US36: 1.88	US36 at Ostrander Rd	0.3199	0.7752	0.5162	1.8546	3.4659



Project Safety Performance Report

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Existing Conditions Project Element Potential for Safety Improvement Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
US36: 1.88	US36 at Ostrander Rd	0.014	0.0336	0.0224	-0.7993	-0.7293



Project Safety Performance Report

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Proposed Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
US36: 1.88	US36 at Ostrander Rd	0.0065	0.0549	0.068	1.3733	1.5027



Project Safety Performance Report

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.0164	0.0131	-0.0033	0.0430
Head On	0.0362	0.0334	-0.0028	0.0013
Rear End	0.8966	0.7233	-0.1733	0.2295
Backing	0.1687	0.1209	-0.0478	0.0139
Sideswipe - Meeting	0.1219	0.1022	-0.0197	0.0000
Sideswipe - Passing	0.1897	0.1476	-0.0421	0.4714
Angle	1.6007	1.3878	-0.2129	0.4238
Parked Vehicle	0.1493	0.1099	-0.0394	0.0000
Pedestrian	0.0204	0.0202	-0.0002	0.0013
Animal	0.0000	0.0000	0.0000	0.0152
Train	0.0008	0.0007	-0.0001	0.0000
Pedalcycles	0.0153	0.0148	-0.0005	0.0013
Other Non-Vehicle	0.0003	0.0003	0.0000	0.0000
Fixed Object	0.7037	0.5614	-0.1423	0.1517
Other Object	0.0246	0.0181	-0.0065	0.0000
Overturning	0.0424	0.0388	-0.0036	0.0013
Other Non-Collision	0.0557	0.0420	-0.0137	0.0290
Left Turn	0.1525	0.1314	-0.0211	0.0329
Right Turn	0.0000	0.0000	0.0000	0.1023

Project Cost Estimate			
Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Engineering Design %	30%
Contingency %	25%

Countermeasures	Construction Costs	Right of Way Costs	Engineering Design Costs	Contingency Amount	Total Cost of Countermeasure	Annual Maintenance & Energy Costs	Salvage Value
Site Characteristic Improvements (i.e. Lane widening)	\$1,850,000.00	\$75,000.00	\$580,000.00	\$481,000.00	\$2,986,000.00		
Site Characteristic Improvements (i.e. Lighting)			\$0.00	\$0.00	\$0.00		
Site Characteristic Improvements (i.e. Signal Phasing)			\$0.00	\$0.00	\$0.00		
Site Characteristic Improvements (i.e. Added Right Turn Lane)			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
			\$0.00	\$0.00	\$0.00		
Totals	\$1,850,000.00	\$75,000.00	\$580,000.00	\$481,000.00	\$2,986,000.00	\$0.00	\$0.00

Inflation %	18%
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Final Construction Cost:	\$3,530,000.00
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*Final construction cost should match the Project Cost Estimate



Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Comments:

Countermeasure Service Lives, Costs, and Safety Benefits

Created by the Office of Systems Planning and Program Management



Safety Benefit - Cost Analysis

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Benefit - Cost Calculator

Net Present Value of Project **\$2,986,000.00**

Net Present Value of Safety Benefits **\$4,085,894.24**

Net Benefit **\$1,099,894.24**

Benefit / Cost Ratio **1.37**

Expected Annual Crash Adjustment

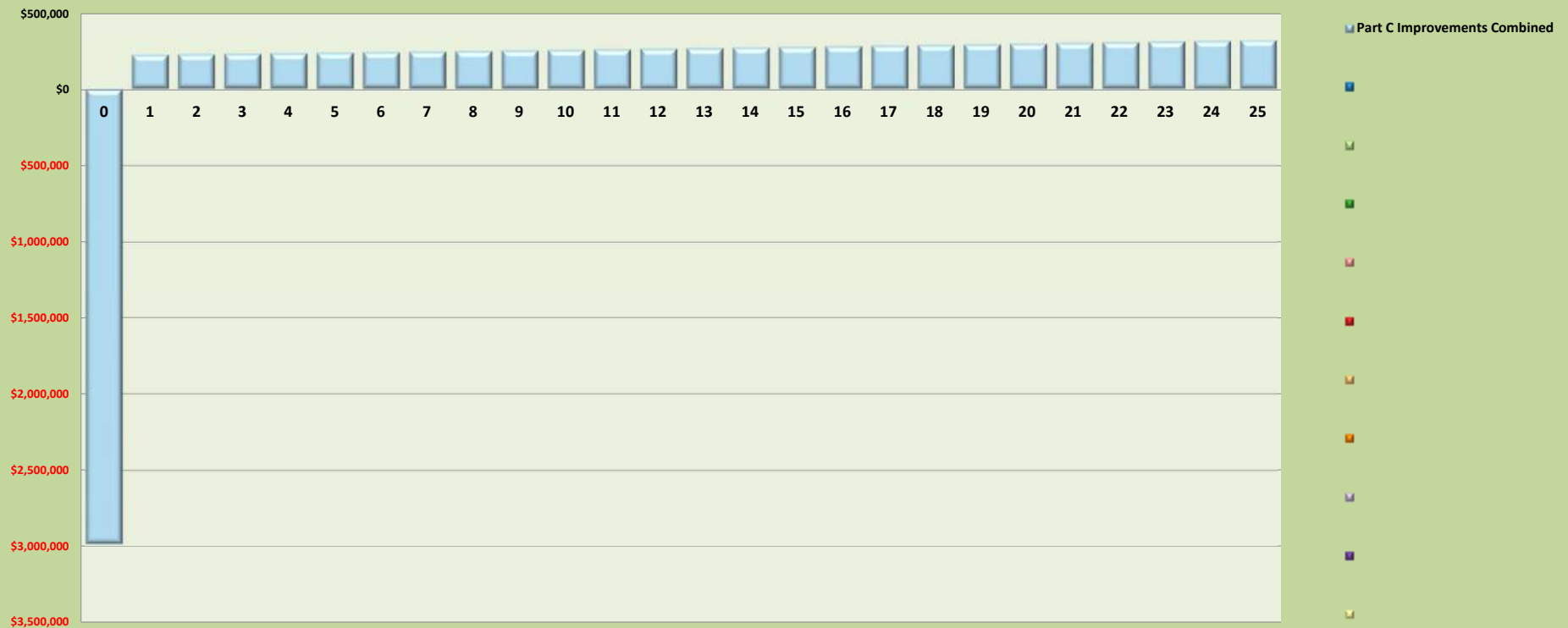
Number of Fatal & Incapacitating Injury Crashes **-0.299**

Number of Injury Crashes **-1.412**

Number of Total Crashes **-2.693**

Comments:

Safety Benefits and Project Costs Combined Cash Flows By Countermeasure Per Year



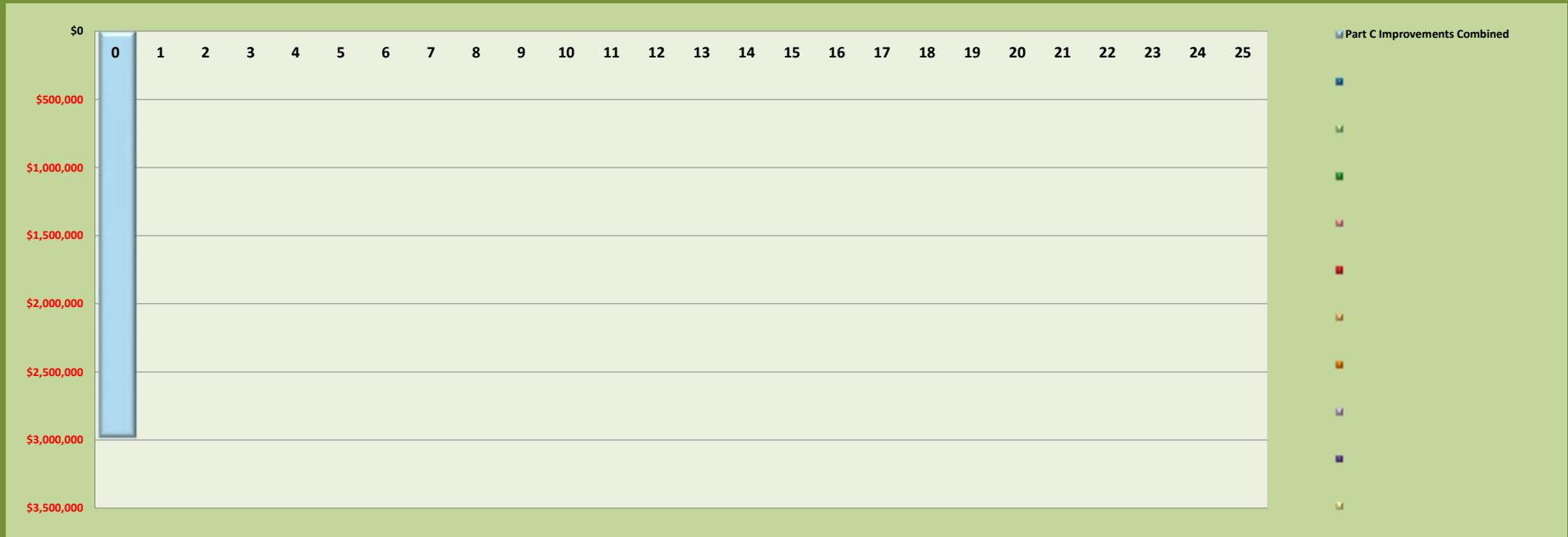


Safety Benefit - Cost Analysis

General Information

Project Name	US-36 at Ostrander Rd Safety Study	Contact Email	ghansel@cmtengr.com
Project Description	US-36 at Ostrander Rd Safety Study	Contact Phone	(614) 468-1213
Reference Number	2436	Date Performed	2/21/2025
Analyst	GSH	Analysis Year	2050
Agency/Company	CMT		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



DEL-US36-1.93 SAFETY STUDY

APPENDIX G: SAFETY APPLICATION



Highway Safety Improvement Program

Formal Funding Application

General Project Information	
Project Sponsoring Agency	Delaware County
Project Name	Ostrander Rd (CR 163) and US36/Marysville Road
PID	NA
Applicant Name	Robert Riley, PE, PS
Contact Phone	(740) 833-2431
Contact Email	rriley@co.delaware.oh.us

Location Information			
ODOT District	6	County	DEL - Delaware
Route Number	US36/ Ostrander (CR 163)	Road Name	US Route 36
Begin Logpoint	1.930	End Logpoint	1.930
Begin Latitude	40.274	Begin Longitude	-83.215
End Latitude	40.274	End Longitude	-83.215

Project Description

Summary of Crash Patterns
<p>A total of 11 crashes occurred at the 2-way stop controlled intersection over a 4-year period (2021-2024). The overall injury rate is 72.7%. 82% of all crashes are angle crashes (9) whereas an additional 9% are rear end (1) and 9% are left turn (1); no other crash types were documented contributing to the severity of crashes. The distribution of crashes are across many hours of the day and increased crashes around mid-day are noted and may be attributed to free flow speeds/ weekend trips. Factors contributing to the ability of side street traffic to safely navigate the intersection include the following:</p> <ol style="list-style-type: none"> 1. High operating speeds on US36 approaches 2. Guardrail combined with side street profile constrains intersection sight distance. 3. Increased driver workload for older (65+) and young drivers (15-25) <p>Crash frequency and severity is expected to trend higher due to projected growth in Delaware County. The frequency of crashes is increasing by year over the 4-year timeline showing a consistent trend of injury crashes.</p>

Summary of Recommended Countermeasures
<p>A roundabout is proposed to mitigate the high percentage angle crashes resulting in angle injuries with vehicles not yielding on the County Line Road approaches. Speed reduction and long-term capacity of a roundabout are desirable to improve safety performance. Vacant parcels enable the roundabout to be constructed while minimizing impacts to adjacent residential parcels. The proposed single lane roundabout alternative is projected to operate at LOS A (9.9 sec/vehicle) for the AM Peak hour and LOS E (38.2 sec/vehicle) during the PM peak hour in the 2050 design year. The NB approach during the PM peak hour of operation is the critical movement projected to operate at LOS F (53.2 sec/delay) at year 2048. The overall roundabout is projected to operate at LOS D in the 2048 design year. A NB_LT and NB-Thru-RT lane (2 entry lanes) would be required to operate at LOS C in the design year 2050. DECO would include provisions as part of preliminary design to accommodate a flair on the south leg of the intersection and two circulating lanes.</p>

Project Priority Information
<p>The existing segment of US36 appears on an ODOT roadway departure priority list (low). The location does not appear on the MORPC high crash location list or the CEAO priority list. The absence of the DEL-US36-1.93 intersection on a local, regional or statewide priority listing is attributed to the gradual increase of crash frequency. The average number of crashes per year is 2.75 crashes/ year (11 crashes) over a 4-year period (2021-2024). The dataset does not include a fatal crash that occurred in 2020 (angle crash). Continued growth in Delaware County is anticipated which is expected to contribute to an increase in crash frequency/ severity. See the Safety Analysis section for additional information</p>

Highway Safety Improvement Program

Formal Funding Application

Crash Data					
Crash Totals (average per year)					
	Fatal & Serious Injury (KA)	Visible Injury (B)	Non-Visible (C)	Property Damage Only (O)	Total
Existing Conditions: Predicted Crash Frequency	0.3059	0.7416	0.4938	2.6539	4.20
Existing Conditions: Expected Crash Frequency	0.3199	0.7752	0.5162	1.8546	3.47
Potential for Safety Improvement	0.0140	0.0336	0.0224	-0.7993	-0.73
Proposed Conditions: Expected Crash Frequency	0.0065	0.0549	0.0680	1.3733	1.50
Observed Crashes	0.6000	0.8000	0.4000	0.6000	2.40
Observed People Injury Totals					
	Fatal Injury (K)	Serious Injury (A)	Visible Injury (B)	Non-Visible (C)	Total
Observed People Injury Totals	0.2000	1.2000	1.6000	1.2000	4.20

Application Scoring

Category	Scoring Value	Points Awarded	Points Possible
Ratio of Observed Fatal and Serious Injuries to Observed Total Crashes	0.58	30	30
Percentage of the Potential for Safety Improvement to Total Expected Crashes	0.00%	0	20
Relative Severity Index	56,622.32	20	20
Equivalent Property Damage Only Index	6.83	20	20
Location Equity Measure	4.00%	0	10
Total		70	100

Safety Key Metrics

Functional Class	4 - Minor Arterial Roadway	Active Transportation Need	1
Major Route AADT	6,832	Active Transportation Demand	1
Maximum Posted Speed Limit	55	Bicycle Level of traffic stress (if available)	
		TOAST Score (if available)	0.71

Strategic Highway Safety Plan

Ohio Emphasis Area	Serious Crash Types
Ohio Emphasis Area Subcategory	Intersection
FHWA Emphasis Area	Improving the design and operation of highway intersections
FHWA Improvement Category	Intersection Geometry
FHWA Improvement Subcategory	Splitter island - install on one or more approaches

Work Locations

NLFID	Begin Logpoint	End Logpoint	Begin Latitude	Begin Longitude	Location Termini (i.e. from Street 1 to Street 2)
CDELCR00051**C	4.383	0.000	40.189	-82.7570	CR 51 and SR 37/Johnstown-Alexandria Road

Highway Safety Improvement Program

Formal Funding Application

Project Funding							
Project Phase	Safety Study	Interchange Mod. Study	PE - Environmental	PE - Detailed Design	Right of Way /Utilities	Construction	Total
Fiscal Year	2025		2026	2027	2028	2029	
Project Phase Completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	N/A	
Previous Safety							\$0.00
New Safety						\$2,875,000.00	\$2,875,000.00
Sponsor Funding	\$24,954.00		\$410,000.00	\$170,000.00	\$75,000.00		\$679,954.00
Total	\$24,954.00	\$0.00	\$410,000.00	\$170,000.00	\$75,000.00	\$2,875,000.00	\$3,554,954.00

Additional Funding Detail
Delaware County open to Local Let or ODOT let options.

Safety Economic Analysis Results			
Net Present Value of Project	\$2,986,000.00	Net Benefit	\$1,099,894.24
Net Present Value of Safety Benefits	\$4,085,894.24	Benefit / Total Project Cost Ratio	1.37
		Benefit / Safety Funding Request Ratio	1.42

Applicant Information		
Name	Title	Phone Number
Robert Riley, PE, PS	Chief Deputy Engineer	(740) 833-2431
Signature		Date
		February 21, 2025

Version: 20221028

The following information should be included in submission of the safety project application:

1. An electronic copy of the Safety Engineering Study
2. All Excel Analysis Files
 - May include Crash Analysis Module (CAM) Tool, Economic Crash Analysis Tool (ECAT), HSIP Application and Scoring Tool.
3. Benefit-Cost Results (Economic Analysis)
4. DSRT approval signatures