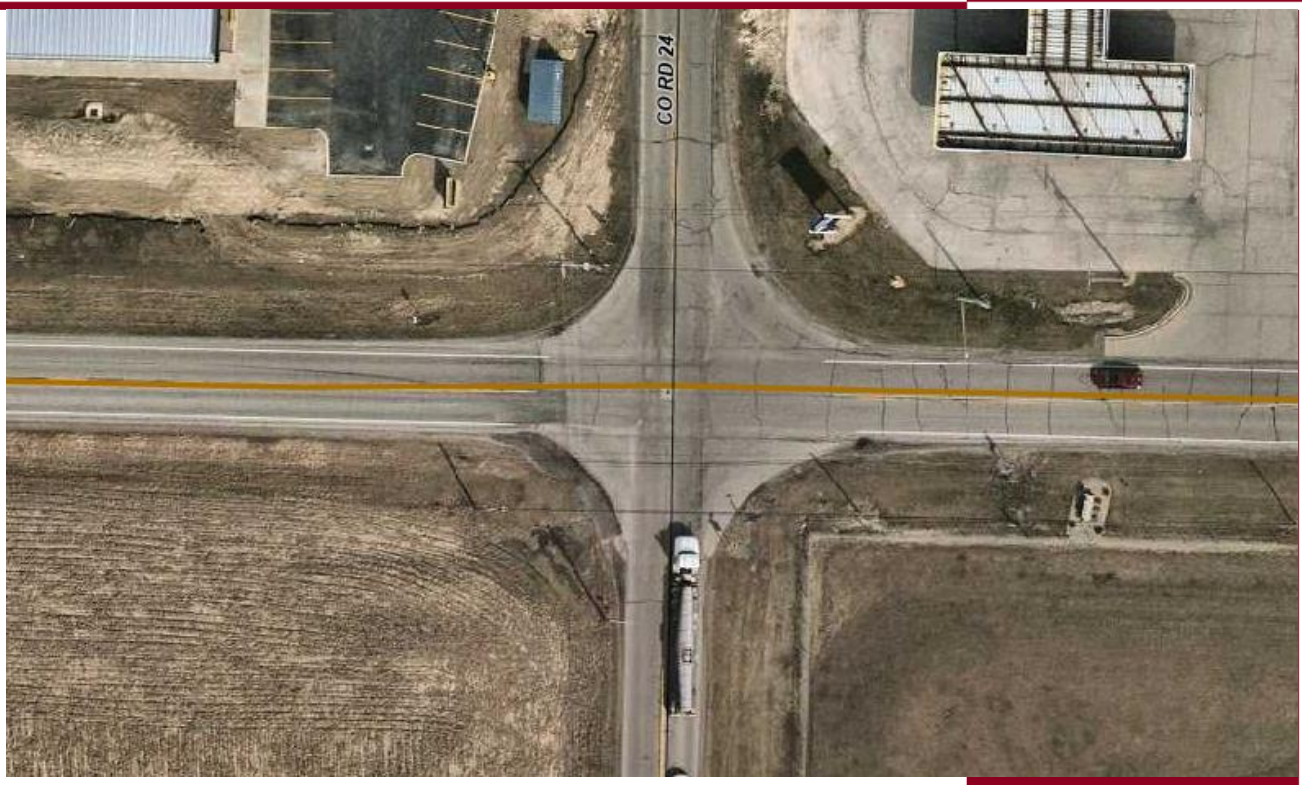

FUL-02-2.858
Safety Study

Stryker Street/SR-2 at Frey Road/TR-24
Village of Archbold
2021 HSIP Intersection Rank #233

March 27, 2024

Prepared for:
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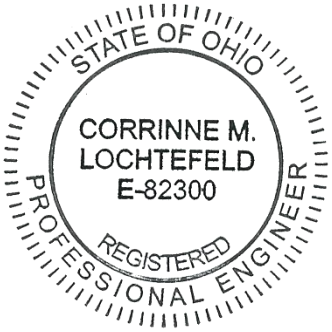
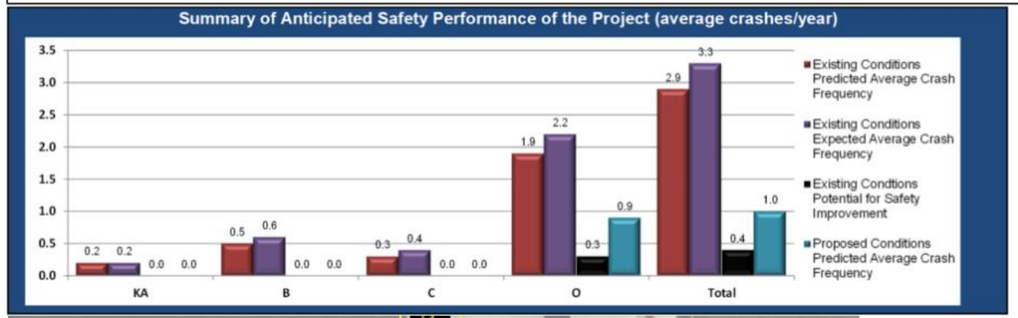
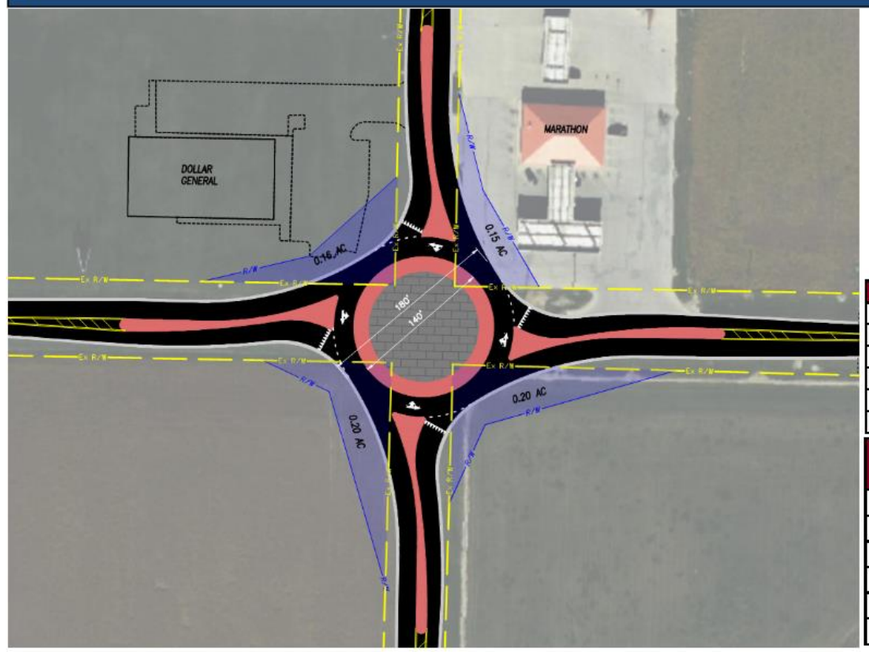


1 ONE PAGE PROJECT SUMMARY

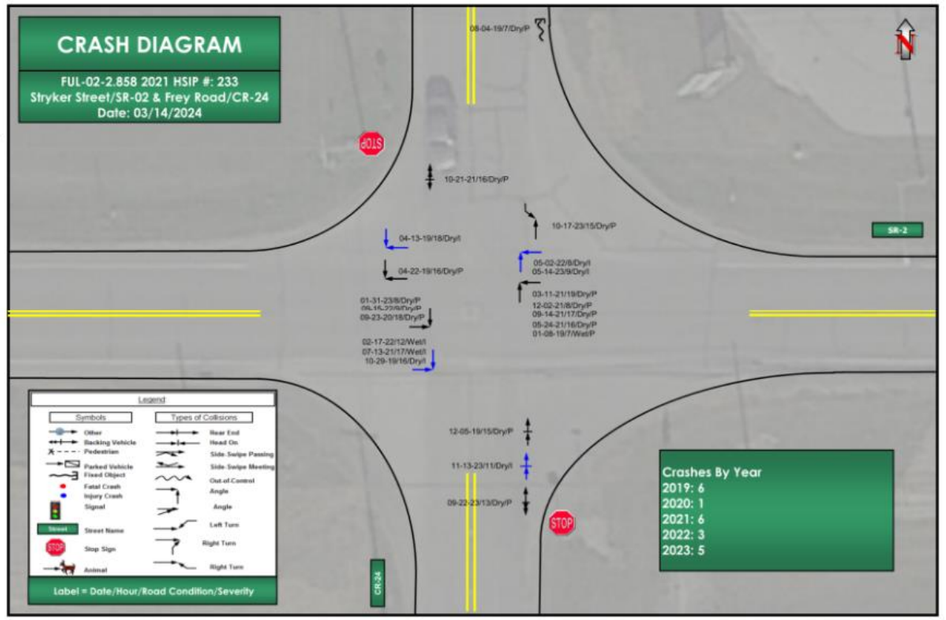
Safety Application Summary
FUL – SR 2 – 2.858
SR 2 & TR 24
Village of Archbold, Fulton County
March 2024

Description
Convert existing TWSC intersection to a high-speed single-lane roundabout. Short term countermeasures include converting the intersection to AWSC with advanced warning signs.





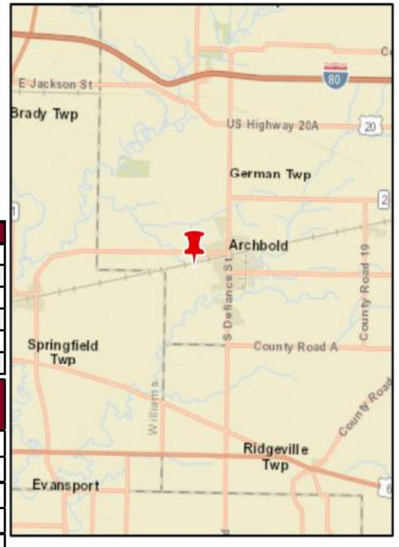
Project Priority
Intersection of SR 2 & TR 24 ranked #233 in the 2021 HSIP Priority Locations



2018-2022 Crash Analysis						
Crash Type	# of Crashes	%		Severity	# of Crashes	%
Angle	15	71%		Inj. Crash	7	33%
Rear End	2	9.5%		PDO Crash	14	67%
Backing	2	9.5%				
Left Turn	1	5%				
Other Object	1	5%				
Grand Total	**21**					

Application Scoring	Score	Possible Points
Ratio of Observed Fatal and Serious Injuries to Observed Total Crashes	30	30
Percentage of the Potential for Safety Improvement to Total Expected Crashes	8	20
Relative Severity Index	20	20
Equivalent Property Damage Only Index	18	20
Location Equity Measure	0	10
Total	**76**	**100**

Project Phase	Fiscal Year	Other Funding	Previous Safety	New Safety	Total
Safety Study	2023	$ 26,500.00			**$ 26,500.00**
Environmental/PE	2024	$ 6,668.00		$ 60,017.80	**$ 66,685.80**
Detailed Design	2025	$ 15,560.00		$ 140,040.20	**$ 155,600.20**
ROW/Utilities	2026	$ 40,000.00		$ 360,000.00	**$ 400,000.00**
Construction	2028	$ 326,063.00		$ 2,934,565.00	**$ 3,260,628.00**
	Total	**$ 414,791.00**	**$ -**	**$ 3,494,623.00**	**$ 3,909,414.00**



2 EXECUTIVE SUMMARY

2a Background

The intersection of Stryker Street/SR-2 and Frey Road/TR-24 is a priority safety location for the Village of Archbold and ODOT as it is ranked #233 in the 2021 HSIP Priority Locations. The intersection is stop-controlled on Frey Road/TR-24, the minor road approach. The intersection was evaluated for its safety performance in 2020 but did not meet thresholds for safety funding through ODOT's HSIP. The intersection is being reevaluated due to an increase in injury crashes since 2020.

2b Purpose & Need

Since the intersection was last evaluated in 2020, serious injury crashes have increased with four occurring in the years 2021-2023 while the years 2019-2020 had zero serious injury crashes. Also, traffic patterns have likely changed since 2020 due to the construction of a Dollar General on the northwest corner of the intersection and the expansion of the Conagra Brands facility on the southeast corner of the intersection. The inclusion of these two trip generators may contribute to longer queues on the stop-controlled approaches of Frey Road/TR-24.

2c Overview of Possible Causes

Based on the review of site conditions, traffic counts, and crash data, the following are possible causes to the crashes that occurred from 2019 through 2023:

- Over one-third of the reported crashes occurred during the PM peak hour, suggesting traffic volumes and/or congestion could be an issue.
- Speed limits vary along Stryker Street/SR-2 at the intersection being studied. With traffic accelerating on one of the free-flow approaches to the intersection and traffic decelerating on the other free-flow approach, it may be difficult for traffic on the stop-controlled approaches to judge oncoming traffic speeds.
- Stop signs on the northbound and southbound approaches are approximately 37 feet and 30 feet from the edge of the intersecting roadway with no stop bars present. This could contribute to vehicles creeping into Stryker Street/SR 2 to get a better view of oncoming traffic.
- Signage, fencing and utility poles around the intersection can create sight obstructions for drivers and make it difficult to determine adequate gaps in traffic.
- Agricultural land on the southwest corner of the intersection is approximately 20 feet from the edge of the roadway for Stryker Street/SR-2. This could create a visual obstruction for drivers trying to see oncoming traffic, depending on what is planted and the time of year.
- With the combination of traffic congestion and the difficulty of drivers to determine adequate gaps in traffic, drivers on the stop-controlled approaches may confuse or incorrectly assume which driver has the right of way to travel through the intersection which can contribute to near misses and failure to yield crashes.
- Sun glare may contribute to visibility issues for northbound and southbound traffic with 4 out of 9 crashes involving westbound traffic occurring in the morning and 3 out of 7 crashes involving eastbound traffic occurring in the evening.

2d Recommended Countermeasures & Related Costs

Through conversations with the Village of Archbold and German Township short and long-term countermeasures were identified to improve the safety performance of the intersection.

- *Short-Term Countermeasures:*
    - Convert existing intersection to a multi-way stop with advanced warning signs until the long-term countermeasure can be built.
- *Long-Term Countermeasure:*
    - Convert existing TWSC intersection into a single-lane roundabout capable of facilitating truck traffic and farm equipment.

The total costs for the stated improvements are estimated to be $3,882,914. This includes an 11% design fee, a 12% construction inspection & testing, a 30% contingency, a 19.5% inflation rate and $400,000 for ROW acquisition.

3 PURPOSE & NEED STATEMENT

The purpose of this study is to evaluate the existing safety conditions and to identify potential countermeasures at the intersection of Stryker Street/SR-2 (log point 2.858) and Frey Road/TR-24 in Fulton County. This intersection is a priority location for the Village of Archbold and is listed in ODOT's 2021 HSIP Priority Locations, ranked #233. Since the last safety analysis in 2020, there has been an increase in injury crashes from two injury crashes from 2018 to 2020 to four injury crashes each in the years 2021 and 2023. A Conagra Brands facility is located on the southeastern corner of the study intersection with access points on Stryker Street/SR-2 as well as Frey Road/TR-24. Because of the close proximity to the intersection, the facility can contribute to longer queues on the south leg of the intersection during shift changes.

4 EXISTING CONDITIONS

4a Background

The location under study is the intersection of Stryker Street/SR-2 and Frey Road/TR-24 located in the Village of Archbold, Fulton County (District 2). Stryker Street/SR-2 is a two-lane, undivided roadway classified by ODOT as a Major Collector with a posted speed limit of 50 MPH oriented in the east-west direction. Approximately 1,300 feet east of the intersection, the posted speed limit is reduced to 35 MPH as eastbound traffic moves toward the Village of Archbold. Frey Road/TR-24 is also a two-lane, undivided roadway classified as a Major Collector with a statutory speed limit of 55 MPH oriented in the north-south direction. Frey Road/TR-24 intersects Stryker Street/SR-2 as a two-way-stop-control (TWSC) with the stop control on the Frey Road/TR-24 approaches. There are no exclusive turn lanes at the intersection. Although Frey Road/TR 24 is treated as the minor street, ODOT traffic volume data show Frey Road/TR-24 has a higher ADT than either approach of Stryker Street/SR-2. According to ODOT's Transportation Information Mapping System (TIMS), the ADT for Stryker Street/SR-2 is 1,779 and 7% of traffic being trucks. Frey Road/TR-24 has an ADT of 3,687 and 2,724 for the north and south legs, respectively. Data to determine percent trucks was not available.

The land uses for the area surrounding the intersection include agricultural, industrial, and commercial. There is a gas station on the northeast corner of the intersection with two access points on the north leg of Frey Road/TR-24 and one access point on the east leg of Stryker

Street/SR-2. A Dollar General is also located at the intersection with access on the north leg of Frey Road/TR-24. A grain elevator is located on the south leg of Frey Road/TR-24, about 960 feet from the intersection. A farm machinery retailer and auction house are located approximately 800 feet north of Stryker Street/SR-2 on Frey Road/TR-24. Archbold High School and Elementary School are located about along Lafayette Street, about ¾ of a mile east of Frey Road/TR-24.

At the intersection there are several utilities including a high-powered gas line, transmission and distribution electric lines, as well as internet and communications utilities. An existing conditions diagram can be found in Section 4b.

Based on conversations with the Archbold Engineering Department, school traffic and other drivers use Frey Road/TR-24 as a bypass to avoid delays by driving through the village center on SR-66. Frey Road/TR-24 can also be used as an alternative route if a train is blocking through traffic on SR-66 at the center of the village.

The speed limits on Stryker Street/SR-2 and their spacing were also evaluated to determine if vehicles speeds were contributing to crashes at the intersection being studied. Stryker Street/SR-2 west of the intersection is 55 MPH until it goes through the Village of Stryker approximately 5 miles away. Traffic traveling eastbound through the intersection with Frey Road/TR-24 has their speed drop from 55 MPH to 50 MPH immediately after the intersection and then drops again to 35 MPH about 1,460 feet east of Frey Road/TR-24. Similarly, traffic traveling westbound on Stryker Street/SR-2 has their speed limit rise from 35 MPH to 50 MPH about 1,300 feet east of the intersection and then rises again to 55 MPH at the intersection with Frey Road/TR-24. The speed limits and their spacing can be seen in Figure 1.

Figure 1 Stryker Street/SR-2 Speed Limits

A site visit was conducted on October 11th, 2023 to verify the existing conditions of the study area and to conduct a speed study of Frey Road/TR-24. The speed study was conducted on Frey Road/TR-24 from CR-D as the northern terminus and Lafayette Street as the southern terminus. Traffic counts were collected on October 10th, 2023 for a 10-hour period. Peak hour turning movement counts are summarized in Figure 2 and the full traffic count data can be found in Appendix A. Heavy vehicles were classified in the collected traffic count, 4% trucks were located on Stryker Street/SR-2 and 8% were located on Frey Road/TR-24.

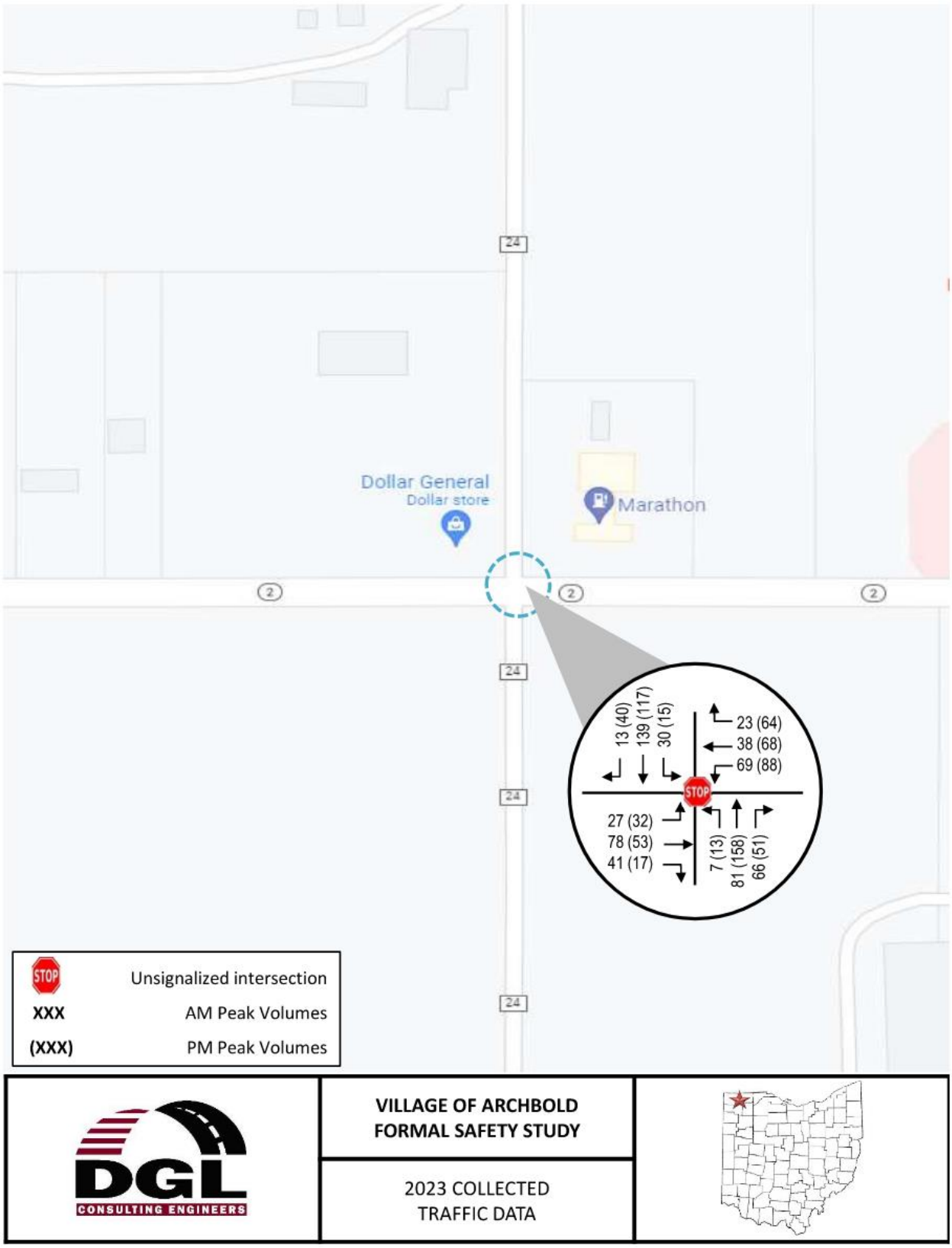


Figure 2 Stryker Street/SR-2 & Frey Road/TR-24 Peak Hour Counts

4b Conditions Diagram

Figure 3 Existing Conditions Diagram

4c Physical Condition Write-up

Based on field observations, the pavement at the intersection appears to be in good condition with very little cracking. Two sets of transverse rumble strips are present on Frey Road/TR-24 for each approach to Stryker Street/SR-2, creating a total of 4 sets of rumble strips. The rumble strips were installed to alert and slow traffic in advance of the two-way stop control for the intersection. The intersection has single stop signs on the controlled approaches and the stop signs are LED-lit along the border of the sign and signage underneath that cross traffic does not stop. The posts for the stop signs also have reflectors. The reflectors on the south leg are worn and should be reviewed for replacement. There was no signage on Frey Road/TR-24 to alert drivers that the intersection with Stryker Street/SR-2 is ahead.

Centerline markings are clear and visible along Frey Road/TR-24 and Stryker Street/SR-2. As the stopped condition, Frey Road/TR-24 does not have visible stop bars at the intersection with Stryker Street/SR-2. Edge lines are not visible along Frey Road/TR-24 which has a gravel shoulder of approximately 1 foot. In contrast, Stryker Street/SR-2 does have clear and visible edge lines and has a paved shoulder of approximately 2 feet. There were no pedestrians present or pedestrian facilities when field observations were conducted.

The vertical approach on Frey Road/TR-24 has a slight upslope approaching Stryker Street/SR-2 so the intersection can drain water effectively since no storm infrastructure is present. Intersection geometry does not seem to be adequate for truck turning movements onto Frey Road/TR-24 as the trucks turning left have to enter the other lane to make their turn. Figure 4 shows a truck crossing the centerline in order to make their left turn onto southbound Frey Road/TR-24. It should be noted that signage is present that prohibits through truck traffic on the southern leg of Frey Road/TR-24 going southbound. While some trucks do use the south leg of Frey Road/TR-24 to access the grain elevator by the railroad, other trucks do proceed over the railroad tracks, thereby violating the prohibited through truck traffic signage present. The sign is not installed to the standard sign height and is about 4 feet off the ground and could be missed by trucks since it is not located where a driver expects signs to be located.

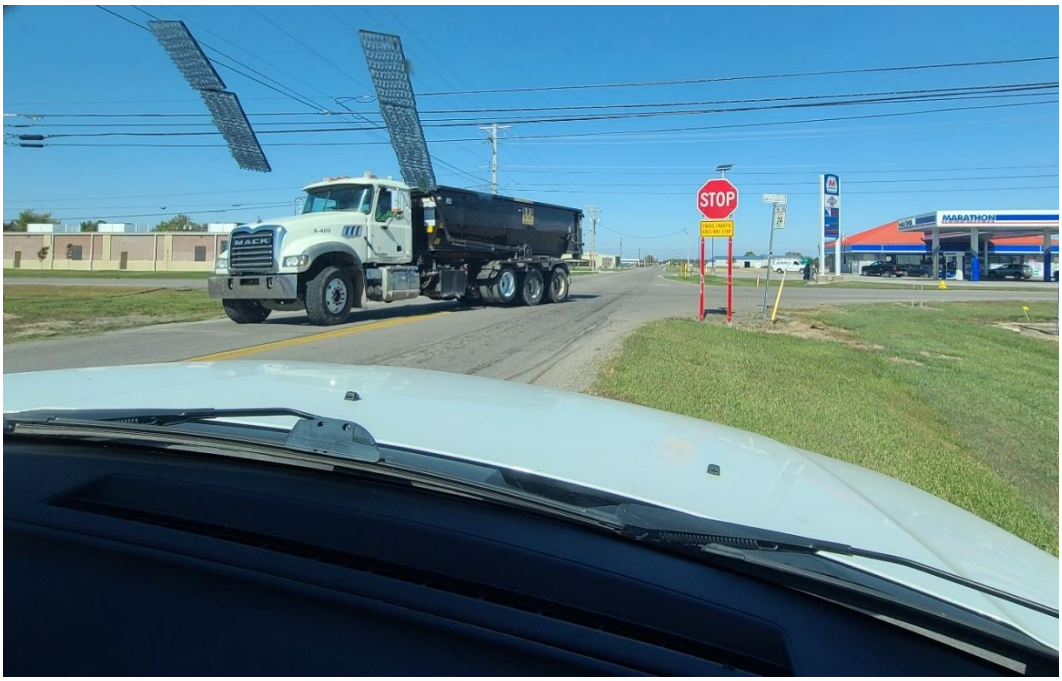


Figure 4 Truck encroaching on lane to make left turn

Sight distances were evaluated for the stop-controlled approaches of Frey Road/TR-24 at Stryker Street/SR-2 and found obstructions that could make it difficult for drivers to determine adequate gaps to proceed through the intersection. Most notably, vehicles entering the intersection on the south leg of Frey Road/TR-24 have a lot of visual clutter when looking east. Figure 5 and Figure 6 show these limited sight distances at the stop sign on the south leg as well as in front of the stop sign as many vehicles were observed creeping further into the intersection for better sight distances. The fence and the village welcome sign seem to be the obstructions contributing most to the sight distance issues along the southeastern quadrant of the intersection. The sight distance looking west did not have significant sight obstructions during the site visit but could be an issue if the farm field on the southwest corner of the intersection was growing tall crops such as corn.

Figure 5 Northbound looking east at the stop sign

Figure 6 Northbound looking east, past the stop sign

The north leg also has sight obstructions to the east and west due to commercial signage as well as utility poles that create a screen to make the judgement of gaps in traffic more difficult. The access point on Stryker Street/SR-2 for the Marathon gas station on the northeast corner of the intersection can also create sight obstructions if there are vehicles waiting to exit onto Stryker Street/SR-2. Figures 7 through Figure 10 show the varying sight obstructions for stopped southbound traffic.

Figure 7 Southbound looking east, at the stop sign

Figure 8 Southbound looking west, at the stop sign

Figure 9 Southbound looking east, past the stop sign

Figure 10 Southbound looking west, past the stop sign

4d Speed Study

A speed study was conducted during the site visit for Frey Road/TR-24 from CR-D to the north and Lafayette Street to the south. Locations to evaluate vehicle speeds attempted to be halfway between the two termini and Stryker Street/SR-2. Because the railroad tracks intersect Frey Road/TR-24 about halfway between Stryker Street/SR-2 and Lafayette Street, the location to evaluate vehicle speeds was chosen to determine the speeds entering and exiting the intersection with Stryker Street/SR-2. Given the physical constraints of the area it was determined to be the best spot to determine traffic speeds approaching the intersection being studied. Figure 11 shows the locations of each location where vehicle speed data was collected.

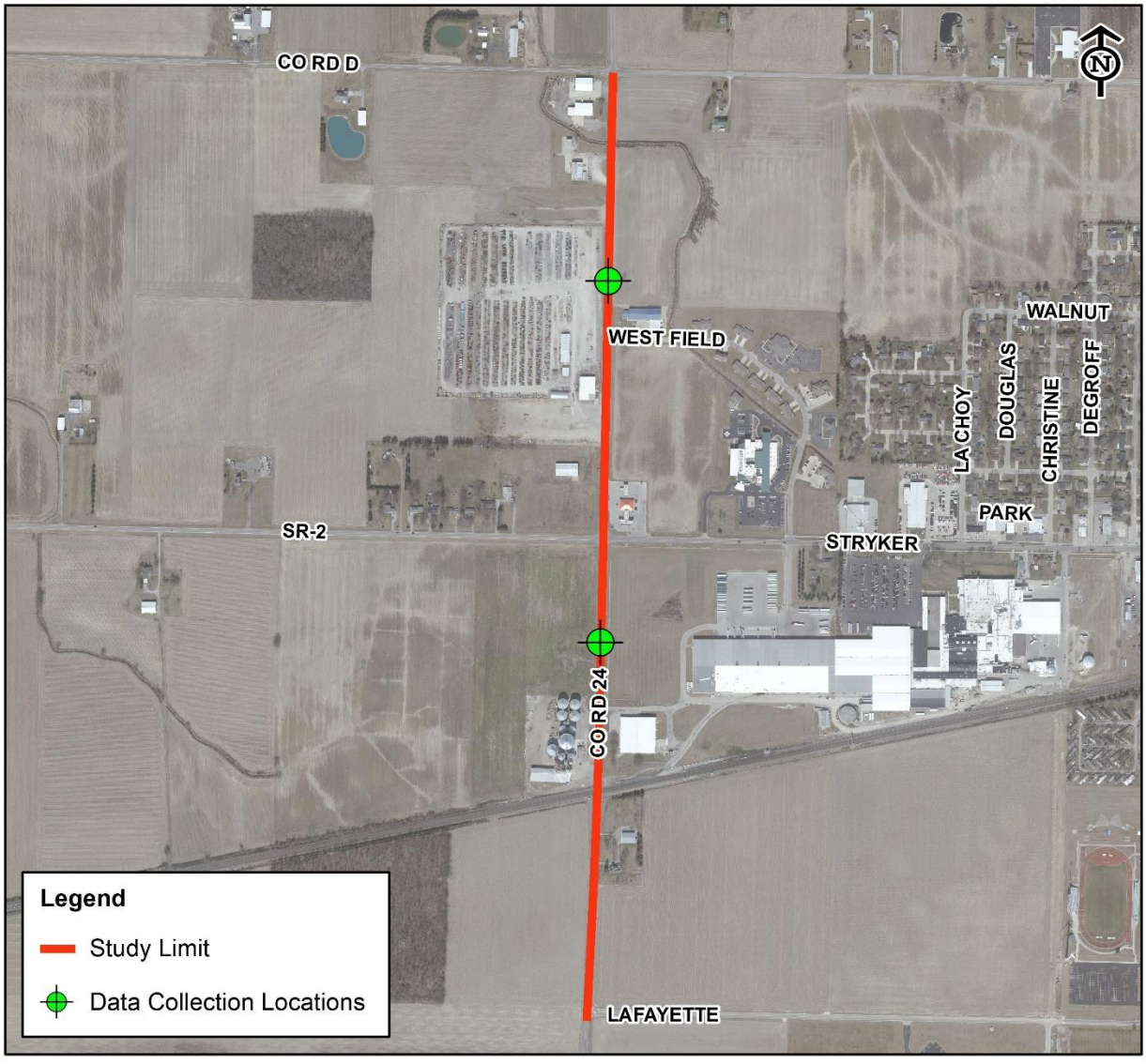


Figure 11 Speed Study Data Collection Locations

Traffic speeds for each leg were gathered over an hour time period. The results of the collected traffic speeds are shown below.

Table 1 Speed Analysis			
Segment	# of Observations	50th Percentile Speed	85th Percentile Speed
North Leg	204	43 MPH	48 MPH
South Leg	234	37 MPH	43 MPH
Full Segment	**438**	**39 MPH**	**46 MPH**

This data was then used to fill out the FHWA's USLIMITS2 spreadsheet and the ODOT Speed Evaluation Sheet, TEM Form 1296-2 to determine if the speed limit of Frey Road/TR-24 should be changed. The results of both analyses are aligned and find that the existing speed limit of 50 MPH should be reduced to 45 MPH based on roadway characteristics and the calculated speed. However, it is stated in the USLIMITS2 Crash section that, "The speed limit should only be reduced as a last measure after all other treatments have either been tried or ruled out" in terms of reducing the crash/injury rate in the section of roadway being studied. The applicability of other treatments will be determined in Section 5 of this study. The results of the USLIMITS2 and TEM Form 1296-2 can be found in Appendix C.

5 CRASH DATA & ANALYSIS

5a Crash Data Summaries, Graphs and Tables

A review of crash data provided by ODOT database, in conjunction with the Archbold Police Department, yielded a total of 21 reported crashes within the intersection influence area (500 feet on each approach) during a 5-year period between 2019 and 2023. Out of these 21 reported crashes, 7 of the crashes (33.3%) resulted in some type of injury. From 2019 to 2020, the intersection went from having zero serious injury crashes to having 4 serious injury crashes from 2021 to 2023. The most prominent crash type was angle crashes, accounting for 15 total crashes (71%) as well as 6 out of the 7 injury crashes that occurred at the intersection. The distribution of angle crashes is even, with 8 crashes resulting from crashes with southbound traffic and 8 crashes resulting from northbound traffic. Contrastingly, 7 of the angle crashes involved eastbound traffic while 9 crashes involved westbound traffic.

8 total crashes (38%) occurred during the period from 16:00 to 18:00, representing the period with the most crashes at the intersection. The next highest 3-hour period occurred from 07:00 to 09:00 with 7 total crashes (33.3%).

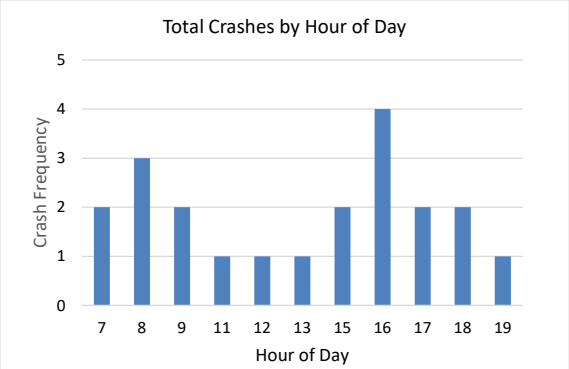
Tuesdays and Thursdays saw the most total crashes (6 each) over the study period. Monday (4 total crashes) was the day of the week with the next highest number of crashes.

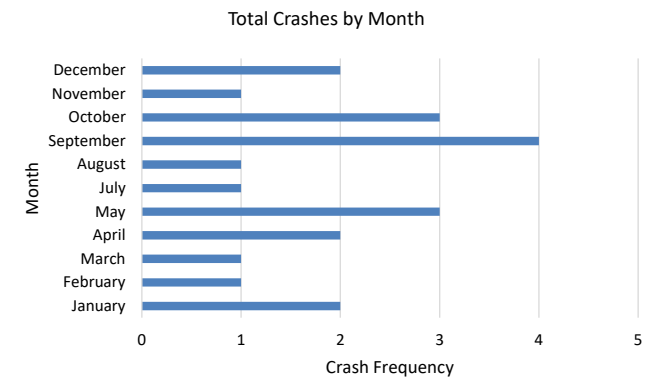
Failure to yield, running the stop sign, improper backing and following too closely were the predominant contributing factors to the crashes that occurred over the study period. Failure to yield and running the stop sign contributed to the 4 serious injury crashes that occurred over the study period.

Table 2 Crash Data Tables & Graphs

Year	Total Crashes	Fatalities	Serious Injuries
2019	6	0	0
2020	1	0	0
2021	6	0	1
2022	3	0	1
2023	5	0	2
Grand Total	21	0	4

Total Crashes Crash Type	Injury Level (2) Serious Inju	(3) Minor Injury	(4) Injury Possil	(5) PDO/No Inju	Grand Total
Angle	3	3	0	9	15
Rear End	0	0	1	1	2
Backing	0	0	0	2	2
Left Turn	0	0	0	1	1
Fixed Object	0	0	0	1	1
Grand Total	3	3	1	14	21





Contributing Circumstances	Total Crashes	Fatalities	Serious Injuries
Failure to Yield	12	0	3
Ran Stop Sign	4	0	1
Improper Backing	2	0	0
Following Too Closely/ACDA	2	0	0
Drove off Road	1	0	0
Grand Total	21	0	4

Based on the crash analysis, an overview of the possible causes is listed below:

- Over one-third of the reported crashes occurred during the 3-hour period, which includes the PM Peak Hour, from 15:00-17:00, suggesting traffic volumes and/or congestion could be an issue. Discussion with the Village staff indicated that the queue lengths on Frey Road/TR-24 at the intersection are typically present after school dismissal. Long queues were also observed in video counts on Frey Road/TR-24, with a backup of 400 feet from 3:17 PM to 3:35 PM.
- Westbound traffic coming from the Village of Archbold has the posted speed limit increased from 35 MPH to 50 MPH about 1,300 feet from the intersection. The posted speed limit increases again at the intersection with a posted speed limit of 55 MPH starting at the northwest corner of the intersection being studied. Likewise, eastbound traffic has their posted speed limit decrease from 55 MPH to 50 MPH about 110 feet east of the

intersection. With traffic accelerating on one of the free-flow approaches to the intersection and traffic decelerating on the other free-flow approach, it may be difficult for traffic on the stop-controlled approaches to judge oncoming traffic speeds.

- Stop signs on the northbound and southbound approaches are approximately 37 feet and 30 feet from the edge of the intersecting roadway with no stop bars present. This could contribute to vehicles creeping into the right of way to get a better view of oncoming traffic.
- Signage and utility poles around the intersection can create sight obstructions for drivers and make it difficult to determine adequate gaps in traffic.
- Agricultural land on the southwest corner of the intersection is approximately 20 feet from the edge of the roadway for Stryker Street/SR-2. This could create a visual obstruction for drivers trying to see oncoming traffic, depending on what is planted and the time of year.
- With the combination of traffic congestion and the difficulty of drivers to determine adequate gaps in traffic, drivers on the stop-controlled approaches may confuse or incorrectly assume which driver has the right of way to travel through the intersection which can contribute to near misses and failure to yield crashes.
- Sun glare may contribute to visibility issues for northbound and southbound traffic with 4 out of 9 crashes involving westbound traffic occurring in the morning and 3 out of 7 crashes involving eastbound traffic occurring in the evening.

5b Collision Diagram

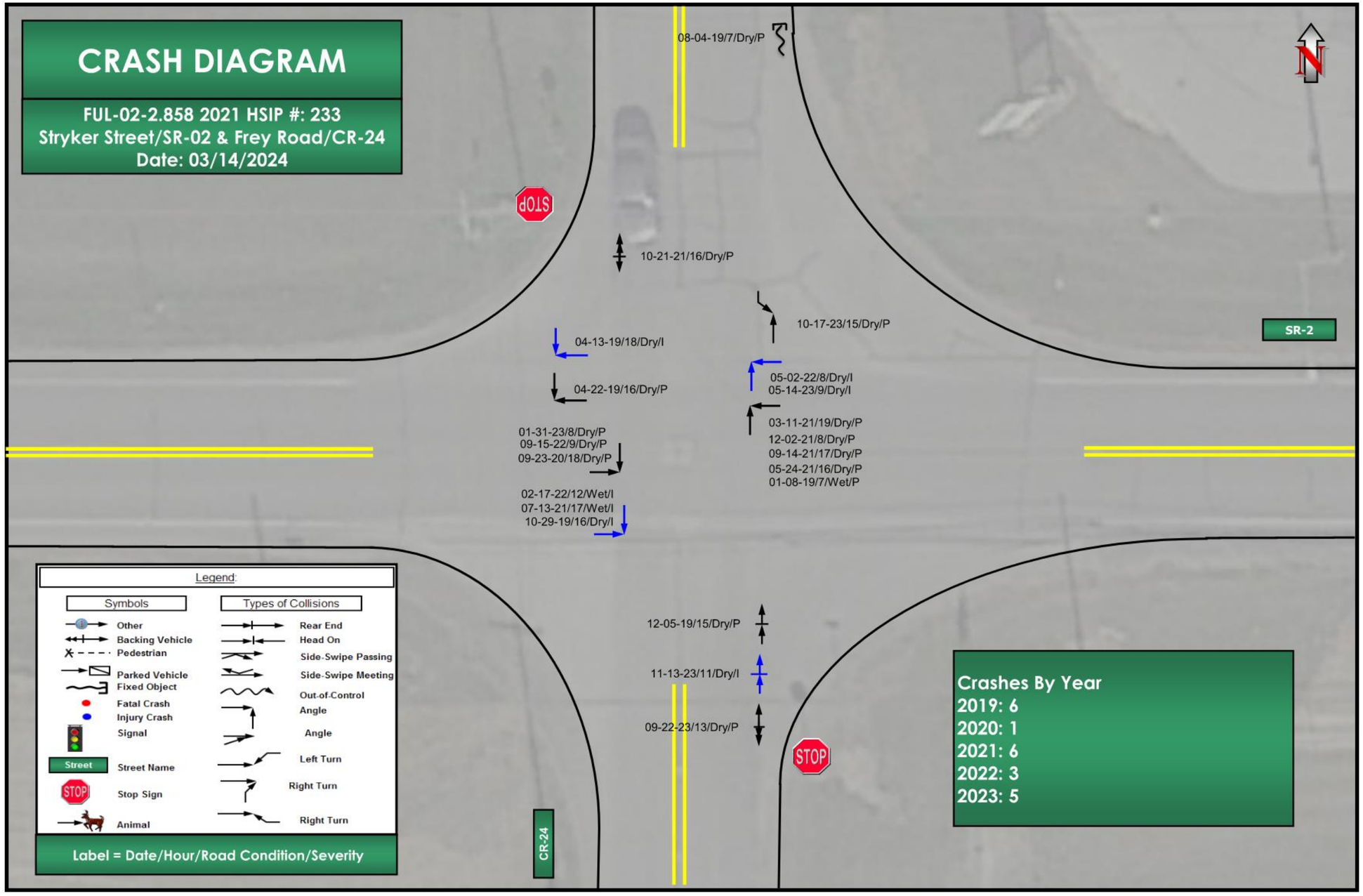


Figure 12 Stryker Street/SR-2 & Frey Road/TR-24 Collision Diagram, 2019-2023

5c Crash Summary Narrative

Based on a comparison of the site being studied to statewide crash statistics of similar sites, angle crashes seem to be the priority crash type to be addressed by any potential countermeasure. Analysis using ODOT's Economic Crash Analysis Tool (ECAT) shows the existing site has a potential for safety improvement of 0.4 crashes per year, which suggests safety improvements can be made to the intersection. The full ECAT summary for the existing conditions can be found in Appendix D. Contributing factors for the priority crash type include more traffic on the stop-controlled approaches when compared to the free-flow approaches, difficulty of traffic on the stop-controlled approaches to judge gaps in traffic, and sight distance issues.

i. Site Diagnosis

The results of the existing conditions crash analysis indicate a potential for site safety improvement of 0.4 crashes per year and over one-third of the expected crashes (3.3 crashes/year) are expected to be angle. According to the Crash Analysis Module (CAM) tool, the site is experiencing a higher overall frequency of crashes than would be expected for similar sites and suggests that the priority crash type to address and mitigate should be angle crashes. Based on the crash data obtained, the site average of angle crashes is 71.4% whereas the statewide average of similar sites is 29.6%. The site (71.4%) is also above the state average (47.3%) for fatal and injury angle crashes. Similarly, the site has an average of 14.29% of crashes resulting in serious injury while the statewide average is 6.4%. Based on this information and information obtained in a field review of the site several observations were made about the operation of the intersection:

- The stop-controlled approaches have more traffic than the free-flow approaches.
- Traffic on the stop-controlled approaches have difficulty judging gaps in traffic on Stryker Street/SR-2.
- Visual obstructions east of the intersection and farmland on the southwest corner of the intersection could contribute to sight distance issues.

ii. Potential Intersection Countermeasures Considered

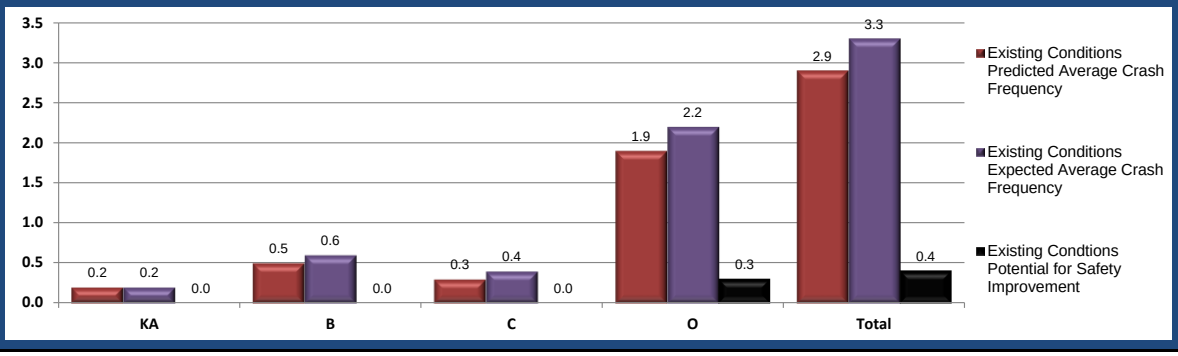
- *Countermeasure 1 – Turn Lane(s):* Turn lanes can reduce congestion while making the intersection safer by moving turning vehicles out of the through traveling traffic. Warrants need to be met in order to implement turn lanes for specific movements.
- *Countermeasure 2 – Single-lane Roundabout:* A roundabout at this location would address the priority crash type of angle crashes by slowing down traffic as vehicles approach and circulate through the intersection as well as reducing the number of conflict points from 32 at a typical four-leg intersection to 8 at a roundabout. By reducing the speed of traffic at the intersection, the severity of crashes should also be reduced since vehicle speed is a major contributor to the severity of crashes on a roadway.
- *Countermeasure 3 – Traffic Signal:* A traffic signal would also address angle crashes by providing intervals of time for traffic on the minor road approaches to travel through the intersection which addresses the predominant contributing circumstance of failure to yield for the observed crash history. Warrants must be met in order to implement a traffic signal.
- *Countermeasure 4 – All-Way-Stop-Control (AWSC):* Converting the existing TWSC to AWSC can be used as a preliminary measure before implementing a traffic signal or roundabout and improves the intersection by stopping traffic on all approaches and limiting the number of vehicles going through the intersection at one time.

Project Safety Performance Report

General Information

Project Name	FUL-02-2.858 Safety Study	Contact Email	tjones@dgl-ltd.com
Project Description	Determine Potential for Safety Improvement	Contact Phone	419-535-1015
Reference Number	23260	Date Performed	3/8/2024
Analyst	tsj	Analysis Year	2023
Agency/Company	DGL		

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	0.2146	0.5200	0.3462	1.8610	2.9418
$N_{expected}$ - Existing Conditions	0.2274	0.5514	0.3673	2.1509	3.2970
$N_{potential\ for\ improvement}$ - Existing Conditions	0.0128	0.0314	0.0211	0.2899	0.3552

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR2; 2.858	STRYKER ST & FREY RD	0.2146	0.52	0.3462	1.861	2.9418

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR2; 2.858	STRYKER ST & FREY RD	0.2274	0.5514	0.3673	2.1509	3.297

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
SR2; 2.858	STRYKER ST & FREY RD	0.0128	0.0314	0.0211	0.2899	0.3552

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Expected Crash Frequency
Unknown	0.0115	0.0131	0.0016	
Head On	0.0252	0.0276	0.0024	
Rear End	0.6286	0.7080	0.0794	
Backing	0.1184	0.1362	0.0178	
Sideswipe - Meeting	0.0854	0.0955	0.0101	
Sideswipe - Passing	0.1330	0.1508	0.0178	
Angle	1.1225	1.2457	0.1232	
Parked Vehicle	0.1047	0.1198	0.0151	
Pedestrian	0.0144	0.0154	0.0010	
Animal	0.0000	0.0000	0.0000	
Train	0.0005	0.0005	0.0000	
Pedalcycles	0.0109	0.0117	0.0008	
Other Non-Vehicle	0.0002	0.0002	0.0000	
Fixed Object	0.4934	0.5569	0.0635	
Other Object	0.0172	0.0196	0.0024	
Overturning	0.0298	0.0326	0.0028	
Other Non-Collision	0.0391	0.0446	0.0055	
Left Turn	0.1070	0.1188	0.0118	
Right Turn	0.0000	0.0000	0.0000	

5d Design Evaluation (if applicable)

While right-of-way impacts could vary depending on which countermeasure is pursued, the utilities at the intersection could also impact the design of the preferred alternative. Many of the existing utilities are located on the eastern half of the intersection with some being located within the roadway. In conversations with the Village of Archbold, they have expressed future plans that may extend utilities to residential parcels on Stryker Street/SR-2, west of the intersection. Depending on which countermeasure is selected, there may be a desire to at least extend utilities far enough west to prevent future disturbances of any intersection improvements pursued.

5e Proposed Countermeasure Evaluation

To determine the desired countermeasure, each alternative is assessed based on its projected effect on the study site. Traffic was projected, using the traffic counts conducted by DGL, for the opening and design years of 2027 and 2047, respectively. After reviewing the ODOT SHIFT growth rates, DGL reached out to ODOT District 2 to determine an acceptable growth rate for the area. ODOT recommended using a 0% growth rate for counted traffic. A factor was applied to the counted traffic to determine the Design Hourly Volumes (DHV) for the No-Build and Build conditions. Below is the analysis to evaluate the impacts of each countermeasure.

i. Turn Lane Warrant Analysis

Turn lane warrant analysis was conducted for the Stryker Street/SR-2 approaches at the intersection with Frey Road/TR-24. Turn lanes can reduce congestion while making the intersection safer by moving turning vehicles out of the through traveling traffic. The analyses were conducted using ODOT's Turn Lane Warrant Calculation Sheet for the free-flow condition using the 2027/2047 AM and PM Peak Hour Build scenario volumes. Turn lanes for the stopped condition are based on the level of service and delay. The results of the analyses reveal the following:

- Stryker Street/SR-2 & Frey Road/TR-24 – warrant requirements were met for a westbound left turn lane for the PM Peak Hour.

ii. All-Way Stop Warrant Analysis

All Way Stop Control warrant analysis was conducted using the ODOT's Signal Warrant Spreadsheet which is consistent with Ohio Manual of Uniform Traffic Control Devices (OMUTCD) and the ODOT Traffic Engineering Manual (TEM). The intersection met warrant requirements based on Warrant B, crash volumes. The installation of an all-way stop would reduce the number of right turn, left turn, and right angle collisions. The results of the analysis determined the following:

- Stryker Street/SR-2 & Frey Road/TR-24 – warrant requirements were met based on crash history. Install an all way stop as an interim countermeasure.

Signal Warrant Analysis

Signal Warrant Analysis was conducted using ODOT's Signal Warrant Spreadsheet. Turning movement counts collected by DGL were used to determine if the intersection meets any of the warrant requirements. Currently, the intersection does not meet signal warrants. The results are summarized in the table below. While the crash threshold for Warrant 7 were met, the TEM states that, "Warrant 7 should only be used to warrant a signal if the 70 percent volume warrants are met." The 70% volume warrant was not met for Warrant 1, and therefore, the signal cannot be

warranted based on the crash experience at the intersection. A full summary of the warrant analysis can be found in Appendix C.

Table 3 Signal Warrant Analysis				
Analysis Year	**Warrant 1 8-Hour Volume**	**Warrant 2 4-Hour Volume**	**Warrant 3 Peak Hour Volume**	**Warrant 7 Crash Experience**
2023	0 of 8 Hours Met	1 of 4 Hours Met	0 of 1 Hours Met	5 of 5 Crashes Met
2027/2047	0 of 8 Hours Met	1 of 4 Hours Met	0 of 1 Hours Met	5 of 5 Crashes Met

Since a traffic signal is not warranted at the intersection of Stryker Street/SR-2 & Frey Road/CR-24, it will no longer be considered as a potential countermeasure at this time.

iii. Intersection Capacity Analysis

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

Capacity Analysis was conducted for various geometric and traffic control alternatives for the intersection of Stryker Street/SR-2 and Frey Road/TR-24. HCS 2023 was used to determine the LOS for a signalized intersection, a stop-controlled intersection, and a roundabout. LOS is generally identified for each movement or approach. LOS C is considered acceptable in all conditions. For Two-Way Stop controlled intersections, the LOS is undefined for the overall intersection.

Table 4 Intersection Level Of Service And Delay (in seconds)											
Signalized Intersection				**Unsignalized Intersection**				**Roundabout Intersection**			
A	<=	10s		A	<=	10s		A	<=	10s	
B	>	10-20s		B	>	10-15s		B	>	10-15s	
C	>	20-35s		C	>	15-25s		C	>	15-25s	
D	**>**	**35-55s**		**D**	**>**	**25-35s**		**D**	**>**	**25-35s**	
E	**>**	**55-80s**		**E**	**>**	**35-50s**		**E**	**>**	**35-50s**	
F	**>**	**80s**		**F**	**>**	**50s**		**F**	**>**	**50s**	

iv. Existing Conditions

The 2023 counted traffic was analyzed to review how the intersection is currently functioning. The AM Peak for the intersection and the PM Peak were analyzed. Based on the counted traffic, the intersection is currently operating at acceptable levels for both peak hour scenarios.

Table 5 Existing Conditions				
	AM Peak		**PM Peak**	
	LOS	**Delay**	**LOS**	**Delay**
Stryker Street/SR-2 & Frey Road/TR-24				
Eastbound	A	(1.5)	A	(2.5)
Westbound	A	(4.3)	A	(3.3)
Northbound	C	(15.1)	C	(18.9)
Southbound	C	(22.6)	C	(17.0)
Overall	-		-	

v. Proposed Conditions

The traffic volumes collected in 2023 were projected for the year 2028/2048 to determine which countermeasure offers the best operational performance of the intersection. The existing traffic control is included to serve as a baseline if no improvements are made. Based on the analysis presented in Table 5, the existing traffic control is projected to operate at unacceptable levels for the southbound and northbound approaches for the AM and PM Peak Hours, respectively.

- The construction of the westbound left turn lane does not significantly impact the LOS of the intersection.
- Converting the existing TWSC to AWSC improves the LOS for the minor road approaches and the intersection overall is projected to operate at acceptable levels.
- The roundabout alternative provides the most efficient operation of the intersection out of the countermeasures evaluated.

Table 6 No-Build & Build Condition Comparison

		2028/2048 No-Build		2028/2048 Build – Turn Lane		2028/2048 Build – RAB		2028/2048 Build – AWSC + Turn Lane	
		LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay
Stryker Street/SR-2 & Frey Road/TR-24									
AM Peak	Eastbound	A (1.6)		A (1.6)		A (6.0)		B (11.6)	
	Westbound	A (4.4)		A (4.1)		A (4.8)		B (10.4)	
	Northbound	C (17.9)		C (17.8)		A (5.5)		B (11.9)	
	Southbound	**D (33.4)**		**D (33.1)**		A (5.6)		B (12.4)	
	Overall	**-**		**-**		**A (5.5)**		**B (11.7)**	
PM Peak	Eastbound	A (2.5)		A (2.5)		A (4.9)		B (10.4)	
	Westbound	A (3.4)		A (3.0)		A (6.1)		B (10.5)	
	Northbound	**D (25.0)**		C (24.7)		A (5.4)		B (11.5)	
	Southbound	C (21.4)		C (21.2)		A (5.3)		B (10.6)	
	Overall	**-**		**-**		**A (5.5)**		**B (10.8)**	

vi. Safety Improvement

Because a traffic signal is not warranted at the intersection being studied, the evaluation of the projected safety improvement of the considered alternatives will not include converting the existing intersection to a signalized intersection. A summary of the potential safety improvement by countermeasures is shown below. The complete detailed output for each ECAT can be found in Appendix D.

Table 7 Safety Improvement Comparison

Countermeasure	Predicted Crash Frequency
Two-Way-Stop-Control (baseline)	2.9
Westbound Left Turn Lane	2.1
Single-lane Roundabout	1.0
All-Way-Stop-Control w/ Left Turn Lane	0.4

5f Conclusions

Using the information presented in the analyses of Intersection Capacity and Safety Improvement, the following conclusions were made:

- The continued usage of the intersection is projected to operate at unacceptable levels for the southbound and northbound approaches in the AM and PM Peak Hours, respectively.
- A left turn lane does not significantly impact the future LOS for the intersection but is predicted to cut the number of annual crashes almost in half.
- Converting to an AWSC intersection and constructing a westbound left turn lane is anticipated to provide the highest safety improvement for the intersection while providing some improvements to LOS for the minor road approaches but extending the delay of traffic on the major road approaches.
- A single-lane roundabout would provide the greatest improvement for the intersection's LOS and is predicted to provide significant safety improvement.

6 SUMMARY OF SUPPLEMENTAL TRAFFIC STUDIES

In 2020, DGL was commissioned to conduct a safety review for the intersection of Stryker Street/SR-2 and Frey Road/TR-24 in the Village of Archbold after the Ohio Department of Transportation had previously analyzed the intersection. Both DGL and ODOT determined the intersection had no immediate safety concerns. The study evaluated turn lane warrants as well as signal warrants with neither meeting ODOT thresholds for implementation. Intersection Capacity analysis was also conducted and determined the intersection was functioning at acceptable levels of service.

In the same year, DGL also conducted a Traffic Impact Study (TIS) for an expansion of the existing Conagra Brands facility that included an additional truck drive accessing Stryker Street/SR-2 and an additional 125 employees. The proposed truck drive was determined to meet spacing requirements stated in the ODOT Access Management Manual. The study also evaluated turn warrants for no-build and build conditions and found that a westbound left turn lane on Stryker Street/SR-2 at Frey Road/TR-24 was warranted during the 2031 PM Build condition while the 2031 PM No-Build condition was close to warranting. The study also found that warrants for a signal or All-Way-Stop-Control (AWSC) were not met for the 2031 Build conditions. Intersection Capacity analysis was also conducted for the existing conditions, no-build, and build conditions and the intersection was found to operate at acceptable levels for all scenarios. Based on the capacity analysis comparing build conditions with or without the warranted westbound left turn lane at Frey Road/TR-24, the turn lane did not significantly improve the delay at the intersection. Because of this, there were no recommendations set forth by DGL.

7 RECOMMENDATIONS & PRIORITIZATION

A draft of this study and a list of the potential alternatives was presented to the Archbold Village Council, as well as representatives of German Township, in January to discuss which alternatives the village would like to pursue.

7a Countermeasure Recommendations and Implementation Plan

The following were determined to be the recommendations to improve safety at the intersection of Stryker Street/SR-2 and Frey Road/TR-24:

- Short-Term Countermeasure: Convert the intersection to All-Way-Stop Control until the long-term countermeasure can be built. Includes adding advanced warning signs on both SR-2 approaches.

- Long-Term Countermeasure: Convert existing TWSC intersection into a single-lane roundabout capable of facilitating truck traffic and farm equipment.

7b Public Involvement

The Village of Archbold has involved other stakeholders throughout the study and countermeasure selection process to ensure the recommended project is supported in the area. Resolutions and other letters supporting the recommended countermeasures from the Village of Archbold and German Township can be found in Appendix E.

7c Proposed Conditions Diagram

Proposed Conditions Diagram shows the worst-case scenario of having the roundabout centered on SR-2 & CR-24. Other roundabout layouts can be found in Appendix F.