



HOL-39-28.99 Traffic Safety Study



ODOT – District 11 – Office of Planning and Engineering
August 2022

Introduction

The purpose of this traffic study is to study the overall safety and traffic operation of the intersection of State Route (SR) 39 and County Road (CR) 114 in Walnut Creek Township, Holmes County, Ohio.

SR 39 is the major east-west route through Holmes County. SR 39 provides access to Interstate 77 and United States Route 62 which are major routes that direct tourism and economic development into Holmes County. As one of the main arterials in Holmes County, SR 39 accommodates a variety of vehicles that mix local and non-local tourist passenger vehicles, tourist buses, local trucks, local and long-haul semi-tractor trailer trucks, motorcycles, bicycles, e-bicycles, Amish buggies, and farm equipment. With the increased use of vehicle GPS/mapping apps and the continued increase in traffic volumes on ODOT's maintained roadways, the local county and township roadway system are increasingly being used as alternate routes to many of the business and tourist destinations in Holmes County. CR 114 is a county road that provides an alternate route to the community of Charm which is home to a variety of businesses and tourist destinations such as Keim Lumber/Home Center, Chalet in The Valley restaurant, Guggisberg Cheese and Charm Harness & Boot (see Figure 1).

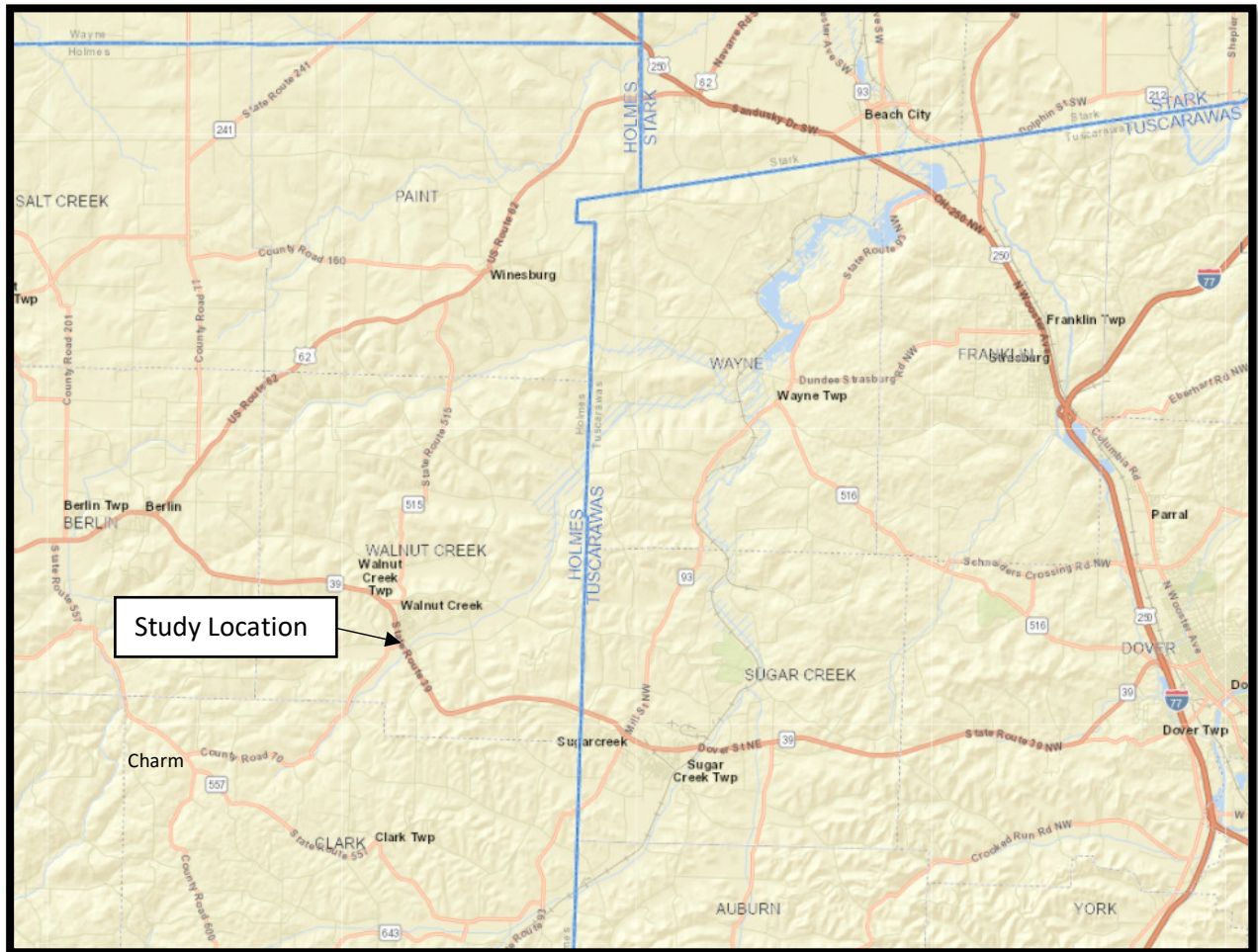


Figure 1. Study Location Map

In 2017, this location became a safety concern of the district when two fatal crashes occurred within six months of one another. The severity of those crashes prompted the district to review this location. After

a review of the fatal crash reports and of the existing traffic control elements of this intersection, the district decided to install LED stop signs, LED stop sign ahead warning signs, and stop bar pavement markings to help mitigate future crashes at this location. The signs and pavement markings were installed in October 2017. Since then, the intersection has not experienced any fatalities. The number of crashes has fluctuated over the last five years from six in 2017 and 2019, two in 2018 and 2020 to five in 2021.

Existing Conditions

This section of SR 39 is a national truck route and scenic byway (Amish Country Byway). It is an east-west minor arterial with a posted speed limit of 50 mph and an annual average daily traffic (AADT) volume of 9485 with approximately 12% truck volume. There is one 12-foot-wide lane in each direction, with 6-foot-wide paved shoulder adjacent to the travel lanes. According to the department's Transportation Information Mapping System (TIMS), the pavement condition rating (PCR) for SR 39 is 77. There are dual crossroad intersection warning signs with supplemental CR 114 name plaques both east & west bound on SR 39 prior to the intersection with CR 114 .

CR 114 is a north-south minor collector with a legal speed limit of 55 mph and an AADT volume of 1838. The intersection of SR 39 and CR 114 is a stop-controlled intersection with the stop control on the CR 114 approaches. There are stop bars, dual stop signs, and dual stop ahead warning signs on the CR 114 approaches. The stop signs and the northbound stop ahead warning signs are enhanced with LED lighting. The intersection is not illuminated with highway lighting.

Figure 2 below shows the intersection orientation view of CR 114 and SR 39.

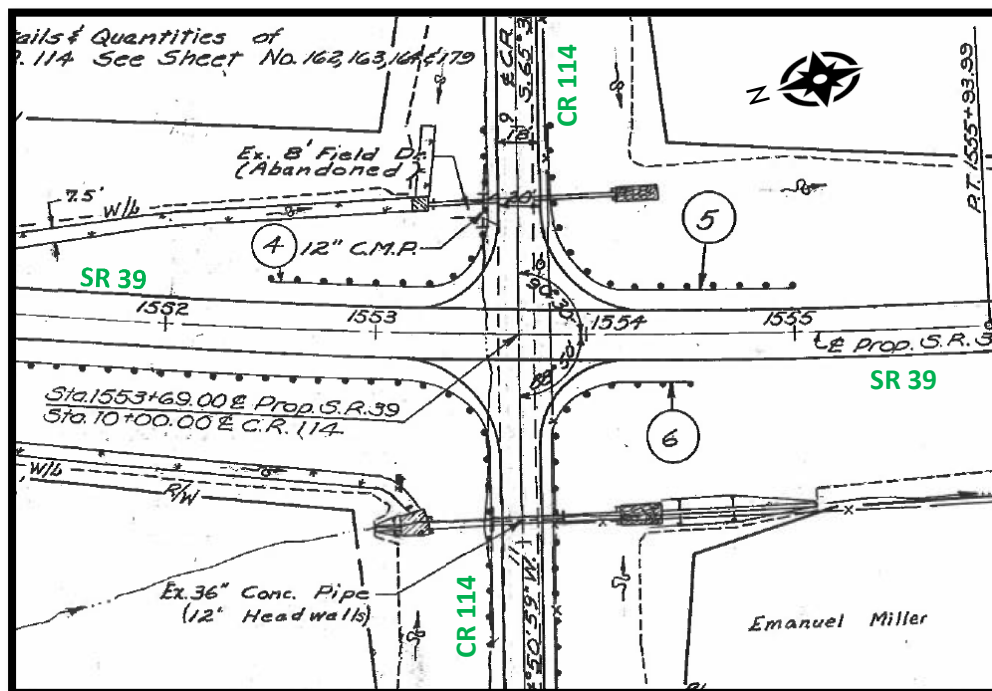


Figure 2. Intersection Geometrics of CR 114 & SR 39

No pedestrian facilities (sidewalk, curb ramps, and crosswalks) are within the study area.

Plan and profiles sheets of SR 39 and CR 114 can be found in Appendix B. The existing sign locations can also be found in Appendix B.

Crash Data

Crash data from 2017 to 2021 was obtained from the department’s Transportation Information Mapping System (TIMS). A total of 21 crashes occurred at this intersection during the five-year period.

The frequencies of crash types in the study area compared to the statewide average for rural roads on the state system are shown on Figure 3.

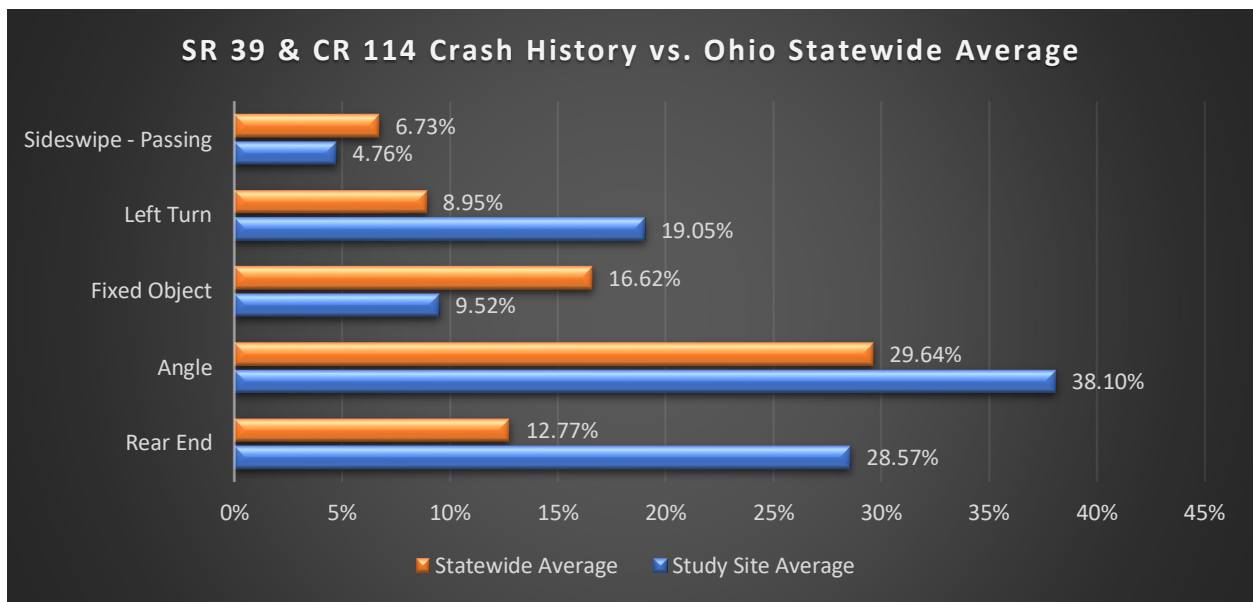


Figure 3. Crash History Compared to Statewide Averages

Additional crash statistics are summarized below. The most common crash types that occurred during the study period were angle, rear end, and left turning crashes. There were two fatal, six injury, and thirteen property damage only crashes.

Crash Type	Crashes	%
Angle	8	38.10%
Rear End	6	28.57%
Left Turn	4	19.05%
Fixed Object	2	9.52%
Sideswipe - Passing	1	4.76%
Grand Total	21	100.00%

Year	Crashes	%
2017	6	28.57%
2018	2	9.52%
2019	6	28.57%
2020	2	9.52%
2021	5	23.81%
Grand Total	21	100.00%

Crash Severity	Crashes	%
(1) Fatal	2	9.52%
(2) Serious Injury Suspected	2	9.52%
(3) Minor Injury Suspected	4	19.05%
(5) PDO/No Injury	13	61.90%
Grand Total	21	100.00%

Contributing Factor	Crashes	%
Failure to Yield	12	57.14%
Following Too Closely/ACDA	7	33.33%
Unsafe Speed	2	9.52%
Grand Total	21	100.00%

Narrative of the Angle, Left Turn, and Rear End Type Crashes

Angle Crashes

A total of eight angle type crashes occurred during the study period of 2017 to 2021. Three in 2017, one in 2018, two in 2019, and on each in 2020 and 2021. Both fatal crashes occurred in 2017 and were angle type crashes.

The first angle crash in 2017 was a fatal crash that occurred during daylight on January 17th that involved a passenger car and a horse drawn buggy. The passenger car driven by a 74-year-old was westbound on SR 39 and the horse drawn buggy driven by a 76-year-old was northbound on CR 114. The horse drawn buggy failed to yield from the stop sign when attempting to cross SR 39 and was struck by the westbound vehicle. The passenger car, after striking the buggy, traveled off the right side of the roadway into a ditch. The driver of the passenger car died of injuries sustained from the crash. The second fatal crash occurred during daylight on July 21st and involved an SUV and a recreational motor coach towing a small SUV. The SUV driven by a 79-year-old was northbound on CR 114 and the motor coach driven by a 63-year-old was westbound on SR 39. The SUV ran the stop sign when attempting to cross SR 39 and was struck by the westbound motor coach. The driver and a passenger in the motor coach both died of injuries sustained in the crash. The third angle crash in 2017 occurred at night on December 2nd involving a pickup truck and a horse drawn buggy. The pickup truck driven by a 52-year-old was northbound on CR 114 and the horse drawn buggy driven by a 66-year-old was eastbound on SR 39. The driver of the pickup truck the horse drawn buggy resulting in minor injuries to the driver of the buggy.

The angle crash in 2018 occurred during daylight on December 18th involving a passenger car and a bicyclist. The passenger car driven by a 64-year-old was exiting a private driveway and was struck by a 16-year-old riding a bicycle. The crash resulted in property damage only. No injuries were reported.

The first angle crash in 2019 occurred at night on August 3rd involving a passenger car driven by a 17-year-old and another passenger car driven by a 66-year-old. The 17-year-old was southbound on CR 114 and stopped at the stop sign. The 66-year-old was eastbound on SR 39 and was struck by the 17-year-old as he pulled out from the stop sign. Neither driver nor passengers sustained any injuries. The second angle crash occurred at night on October 17th involving a pickup truck driven by a 19-year-old heading northbound on CR 114 and a 16-year-old bicyclist heading eastbound on SR 39. The pickup driver failed to stop for the stop sign striking the bicyclist. The bicyclist sustained serious injuries.

The angle crash in 2020 occurred during daylight on October 29th involving a passenger car driven by an 18-year-old heading northbound on CR 114 and an SUV driven by a 57-year-old heading eastbound on SR 39. The CR 114 vehicle stopped at the stop sign then pulled out to cross SR 39 and was struck by the SUV on the driver side door. Both drivers and passengers sustained injuries.

The angle crash in 2021 occurred during daylight on November 4th involving a school bus driven by a 63-year-old heading southbound on CR 114 and a pickup truck driven by a 50-year-old heading eastbound on SR 39. The school bus stopped at the stop sign then pulled out to cross SR 39 and was struck by the pickup truck. Neither driver nor passengers sustained any injuries.

Left turn Crashes

A total of four left turn type crashes occurred during the study period of 2017 to 2021, two in 2019 and two in 2021.

The first left turn crash in 2019 occurred during daylight on March 18th involving a pickup truck driven by a 72-year-old attempting to turn left from eastbound SR 39 to head northbound onto CR 114 and a westbound passenger car driven by a 52-year-old. The pickup truck struck the passenger car. Neither driver nor passengers sustained any injuries. The other left turn crash in 2019 occurred at dawn on December 18th involving a pickup truck driven by a 20-year-old attempting to turn left from northbound CR 114 to head westbound onto SR 39 and an eastbound pickup driven by a 69-year-old. Neither driver nor passengers sustained any injuries.

The first left turn crash in 2021 occurred during daylight on June 2nd involving a passenger car driven by a 36-year-old attempting to turn left from southbound CR 114 to head eastbound onto SR 39 and a northbound motorized bicycle driven by a 67-year-old attempting to cross SR 39. The bicyclist sustained minor injuries. The second left turn crash in 2021 occurred during daylight on July 5th involving a pickup truck driven by a 45-year-old attempting to turn left from eastbound SR 39 to head northbound onto CR 114 and a westbound pickup driven by a 57-year-old. Both drivers and passengers sustained injuries.

Rear End Crashes

A total of six rear end crashes occurred during the study period of 2017 to 2021. Three in 2017, and one each in 2019, 2020, and 2021.

The first rear end crash in 2017 occurred when a westbound SR 39 vehicle came upon a vehicle stopped to turn left into CR 114. The approaching vehicle was unable to stop and rear ended the vehicle waiting to turn left onto CR 114. The second rear end crash in 2017 occurred when an eastbound SR 39 vehicle rear ended a vehicle stopped waiting to turn left into CR 114. The third rear end crash in 2017 occurred when a westbound SR 39 vehicle was slowing to turn right onto CR 114 and was struck in the rear by another westbound vehicle.

The rear end crash in 2019 occurred when an eastbound SR 39 vehicle was stopped for traffic and was struck in the rear by another eastbound vehicle.

The rear end crash in 2020 occurred when a northbound vehicle on CR 114 was stopped for traffic and was struck in the rear by another northbound vehicle.

The final rear end crash in the study period occurred in 2021. A westbound SR 39 vehicle came upon a vehicle stopped to turn left into CR 114. The vehicle was unable to stop, and rear ended the vehicle waiting to turn left onto CR 114.

All the rear end crashes occurred during daylight hours. A full printout from the CAM Tool and collision diagram for the study area is included in Appendix A.

Existing Conditions Capacity Analysis

Existing Conditions 2022 Capacity Analysis Results

The existing capacity analysis is presented in the table below. Outputs from HCS are included in Appendix E.

Intersection	Movement	2022 AM			2022 PM		
		LOS	Delay (seconds/veh.)	Average Queue Length (veh.)	LOS	Delay (seconds/veh.)	Average Queue Length (veh.)
SR 39/CR 114	Eastbound	A	8.1 for the Lt. turning vehicles	< 1	A	8.2 for the Lt. turning vehicles	< 1
	Westbound	A	8.0 for the Lt. turning vehicles	< 1	A	9.0 for the Lt. turning vehicles	< 1
	Northbound	C	16.8	< 1	E	39.1	3
	Southbound	B	13.6	< 1	E	35.1	2

As shown in the table above, SR 39 movements operate at a LOS A in the AM and PM peaks hours. There is some delay whenever a vehicle is attempting to turn left. On the CR 114 legs, the PM peak hour is at LOS E. However, the delay and queue length have been observed to be greater than what the HCS analysis indicates.

No-Build Conditions 2025/2045 Capacity Analysis Results

The no-build capacity analysis for Opening Year (2025) and Design Year (2045) are presented in the tables below. Outputs from HCS are included in Appendix E.

Intersection	Movement	2025 AM			2025 PM		
		LOS	Delay (seconds/veh.)	Average Queue Length (veh.)	LOS	Delay (seconds/veh.)	Average Queue Length (veh.)
SR 39/CR 114	Eastbound	A	8.2 for the Lt. turning vehicles	< 1	A	8.3 for the Lt. turning vehicles	< 1
	Westbound	A	7.9 for the Lt. turning vehicles	< 1	A	8.9 for the Lt. turning vehicles	< 1
	Northbound	C	16.6	< 1	D	32.0	2
	Southbound	C	17.1	< 1	D	28.4	1

Intersection	Movement	2045 AM			2045 PM		
		LOS	Delay (seconds/veh.)	Average Queue Length (veh.)	LOS	Delay (seconds/veh.)	Average Queue Length (veh.)
SR 39/CR 114	Eastbound	A	8.1 for the Lt. turning vehicles	< 1	A	8.3 for the Lt. turning vehicles	< 1
	Westbound	A	8.0 for the Lt. turning vehicles	< 1	A	8.9 for the Lt. turning vehicles	< 1
	Northbound	C	16.8	< 1	D	32.0	2
	Southbound	B	15.0	< 1	D	28.4	1

Turn Lane Warrants

Turn lane warrants on free-flow approaches were checked according to Figures 401-5b and 401-6b in ODOT’s Location and Design Manual (see Appendix G). The table below identifies the lanes that warrant left or right turn lanes on SR 39.

Intersection	Turn Lane	Turn Lane Warrant
SR 39 & CR 114	Eastbound Left Turn	Yes
	Westbound Left Turn	Yes
	Eastbound Right Turn	Yes
	Westbound Right Turn	No
	Northbound Left Turn	No
	Southbound Left Turn	No
	Northbound Right Turn	No
	Southbound Right Turn	No

Traffic Signal Warrant Analysis

A traffic signal warrant analysis was conducted using the Office of Traffic Operations signal Warrant spreadsheet following TEM section 402-3. The location did not meet the requirements for a traffic signal. However, the HCS analysis for a traffic signal will reduce the delay on the CR 114 from a LOS of E (2022 PM Peak traffic) for a two way stop controlled intersection (current condition) to a LOS B if the intersection was controlled by a traffic signal. SR 39 would have a LOS of A if the traffic signal were installed. See Appendix D for the traffic signal warrant analysis and Appendix E for the level of service analysis.

Crash Probable Causes

As indicated above, the angle, left turn, and rear end crashes account for most of the crashes that occurred in the study area between 2017 and 2021. Probable causes regarding these crash types are summarized below:

- *Angle & Lt. Turn Crashes* – Failure to yield was the contributing factor cited in OH-1 reports. Five of the eight angle type crashes and three of the four left turn crashes involved a vehicle traveling in the eastbound direction. Vehicles traveling in this direction are traversing a 4% downward grade (see plan & profile sheets in Appendix B). This downward grade may contribute to drivers driving faster than they realize resulting in drivers on CR 114 misjudging the speed of the eastbound vehicles when they began to enter the intersection area.
- *Rear End Crashes* – Five of the six rear end crashes occurred on SR 39. Assured clear distance or following too closely was the contributing factor in most of these crashes according to the OH-1 reports, indicating that inattentive driving may be a common contributing factor. There is no pattern to the rear end crashes. Two occurred in the eastbound direction, three in the westbound direction and one in the northbound direction. Only one rear end crash had injuries. That crash occurred in November 2021 involving persons aged 69 and 77.

Another contributing factor that may be causing crashes at this location are the long queues of traffic that the northbound leg of CR 114 experiences. The queuing occurs frequently during the summer and fall months of the year during tourist season. However, the queuing has been observed during the off-peak tourist season. These long queues may make drivers impatient which may lead them to act more aggressively when accessing a gap in SR 39 traffic to complete their maneuver onto SR 39.



Figure 4: Google Imagine from 2018 showing the traffic queuing on NB CR 114 & the various types of vehicles

Intersection Control Evaluation (ICE)

The ICE process is new to the department. The purpose of ICE is to foster thoughtful consideration of alternative intersection types through quantitative and qualitative analysis, as appropriate.

Capacity Analysis for Planning of Junctions (CAP-X) Summary

The Capacity Analysis for Planning of Junctions (CAP-X) Tool was developed to provide practitioners with a means of evaluating the anticipated operational performance of innovative intersection control strategies within a single tool. The CAP-X Tool uses a critical lane volume analysis to determine the volume to capacity ratio for a variety of intersection control strategies and also provides an assessment of the pedestrian and bicycle accommodations for the selected intersection types.¹

TYPE OF INTERSECTION	Overall v/c Ratio	V/C Ranking	Pedestrian Accommodations	Bicycle Accommodations
Two-Way Stop Control E-W	0.31	1	2.75	4.072676268
Traffic Signal	0.47	2	3.73	4.41627355
1 X 1 Roundabout	0.49	3	5.39	4.579921703
50 ICD	0.66	4	5.39	4.579921703
75 ICD	0.66	5	5.39	4.579921703
All-Way Stop Control	0.98	6	3.87	4.41627355

¹Capacity Analysis of Planning of Junctions (CAP-X) Tool User Manual, FHWA, October 2018

ECAT – ICE Safety Analysis Evaluation

Control Strategy	Opening Year		Design Year		Total Project Life Cycle	EPDO Index	Rank
	Total	Fatal & Injury	Total	Fatal & Injury			
Minor Road Stop	1.09	0.36	1.1088	0.3662	21.99	6.23	2
All-Way Stop	--	--	--	--	--	--	--
Traffic Signal	1.76	0.53	1.7903	0.5391	35.50	7.78	3
1-Lane Roundabout	1.65	0.15	1.6784	0.1526	33.28	2.89	1

ICE Results

The ICE process indicates a roundabout would perform better than a signalized intersection both in operation and safety than the current two way stop condition. See Appendix F for ICE and CAP-X work sheets.

Proposed Countermeasures

Angle and rear end type crashes were most of the crashes that occurred at this intersection. The proposed countermeasures will focus on reducing these types of crashes.

- Short Term – The goal of the short-term countermeasures is to improve the visibility of the intersection.
 - Provide flashing LED intersection-ahead warning signs on the SR 39 approaches.
 - Although over 80% of the crashes occurred during daylight hours, providing intersection highway lighting would help make the non-motorized vehicle traffic (especially the horse drawn vehicles) more visible to motorized traffic during low light conditions.
- Long Term – The goal of the long-term countermeasures is to improve the operation (improve the level of service on CR 114 legs (i.e., reduce the queuing of the CR 114 legs)) and visibility of the intersection.
 - Convert the intersection to a modern single-lane roundabout. This option will reduce the delay on CR 114 and reduce the number of angle crashes that have occurred.
 - Install a traffic signal with left turn lanes on the SR 39 approaches. The intersection did not meet the requirements for a traffic signal, however, installation of a traffic signal at the intersection will help reduce the CR 114 delay and make it easier for the CR 114 traffic to enter or cross SR 39. However, statistically, installation of traffic signal increases the frequency and severity of rear-end crashes which may negatively impact the safety of the intersection.

- Install left turn lanes on the SR 39 approaches. This will remove the left turning vehicles from the traffic stream on SR 39. Providing left turn lanes should reduce the number of rear end crashes on SR 39 approaches. But could increase angle crashes due to longer length a vehicle would need to traverse if going left onto SR 39.

ECAT Analysis

An ECAT analysis was performed for each countermeasure. ODOT’s ECAT was used to calculate predicted crash frequency ($N_{\text{predicted}}$) and expected crash frequency (N_{expected}). $N_{\text{predicted}}$ and N_{expected} are from AASHTO’s Highway Safety Manual (HSM) and are used to determine how a corridor, or intersection, is performing to similar locations.² They are also used to assess the safety benefits of proposed countermeasures. The difference between predicted and expected crash frequency is as follows:

$N_{\text{predicted}}$ is the anticipated (predicted) crash frequency, which describes how a location is expected to perform relative to similar sites. N_{expected} is the estimated expected average crash frequency at a site for a given period. The calculation of N_{expected} uses the Empirical Bayes method to combine actual crash frequency with $N_{\text{predicted}}$. The difference between $N_{\text{predicted}}$ and N_{expected} is the “expected excess crashes.” If N_{expected} is greater than $N_{\text{predicted}}$, the location may benefit from a safety improvement. If N_{expected} is less than $N_{\text{predicted}}$, the site is experiencing fewer crashes than similar sites.

The existing conditions (traffic control, presence of a median, number of lanes, intersection control, lighting, presence of driveways) of the study area were input into ECAT. CMFs were used in ECAT to calculate the reduction in crashes that can be expected if a particular improvement is implemented. ODOT’s ECAT was also used to perform a benefit-cost analysis for the recommended improvements.

Below are tables showing the ECAT and B/C ratios for each proposed countermeasure.

ECAT Analysis Results – LED Warning Signs

Crashes	KA	B	C	O	Total
$N_{\text{predicted}}$ (Existing Conditions)	0.3366	0.8157	0.5435	2.9199	4.6157
N_{expected} (Existing Conditions)	0.3311	0.8024	0.5343	2.7881	4.4559
$N_{\text{potential for improvement}}$ (Existing Conditions)	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
$N_{\text{expected}} - \text{Proposed Condition}$	0.3290	0.7926	0.5217	2.7355	4.3788

² AASHTO. 2010. Highway Safety Manual. First Edition

ECAT Analysis Results – Highway Lighting

Crashes	KA	B	C	O	Total
N _{predicted} (Existing Conditions)	0.3366	0.8157	0.5435	2.9199	4.6157
N _{expected} (Existing Conditions)	0.3311	0.8024	0.5343	2.7881	4.4559
N _{potential for improvement} (Existing Conditions)	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
N _{expected} – Proposed Condition	0.3311	0.8024	0.5343	2.7881	4.4559

ECAT Analysis Results – Roundabout

Crashes	KA	B	C	O	Total
N _{predicted} (Existing Conditions)	0.3366	0.8157	0.5435	2.9199	4.6157
N _{expected} (Existing Conditions)	0.3311	0.8024	0.5343	2.7881	4.4559
N _{potential for improvement} (Existing Conditions)	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
N _{expected} – Proposed Condition	0.0438	0.1060	0.0707	0.8468	1.0673

ECAT Analysis Results – Traffic Signal and Turn Lanes

Crashes	KA	B	C	O	Total
N _{predicted} (Existing Conditions)	0.3366	0.8157	0.5435	2.9199	4.6157
N _{expected} (Existing Conditions)	0.3311	0.8024	0.5343	2.7881	4.4559
N _{potential for improvement} (Existing Conditions)	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
N _{expected} – Proposed Condition	0.1373	0.5842	0.7386	4.4130	5.8731

Benefit/Cost Summary

Countermeasure	B/C Ratio
LED Signing	3.73
Highway Lighting	0.00
Roundabout	0.64
Traffic Signal & Turn Lanes	0.37

Conclusions and Recommendations

The long-term recommendation is to convert the two-way stop condition to a modern single-lane roundabout. The roundabout option improves both the level of service and safety of the intersection. In the short term it is recommended to provide flashing LED intersection-ahead warning signs on the SR 39 approaches.

Appendix A

Crash Data & Collision Diagram

HOL 39 28.99 - 2017 to 2021 - Int. SR 39 & CR 114

Crash Summary Sheet

Fatalities	3
Serious Injuries	3
Other Injuries	13

Crash Severity	Crashes	%
(1) Fatal	2	9.52%
(2) Serious Injury Suspected	2	9.52%
(3) Minor Injury Suspected	4	19.05%
(5) PDO/No Injury	13	61.90%
Grand Total	21	100.00%

Day of Week	Crashes	%
(1) Sunday	1	4.76%
(2) Monday	2	9.52%
(3) Tuesday	4	19.05%
(4) Wednesday	5	23.81%
(5) Thursday	3	14.29%
(6) Friday	4	19.05%
(7) Saturday	2	9.52%
Grand Total	21	100.00%

Hour of Day	Crashes	%
5	1	4.76%
11	2	9.52%
12	1	4.76%
13	1	4.76%
15	6	28.57%
16	3	14.29%
17	2	9.52%
18	2	9.52%
21	2	9.52%
23	1	4.76%
Grand Total	21	100.00%

Crashes Per Year	4.20
Fatal and All Injury Crashes	8
Percent Injury	38.1%
Equivalent PDO Index Value	11.86

Year	Crashes	%
2017	6	28.57%
2018	2	9.52%
2019	6	28.57%
2020	2	9.52%
2021	5	23.81%
Grand Total	21	100.00%

Crash Type	Crashes	%
Angle	8	38.10%
Rear End	6	28.57%
Left Turn	4	19.05%
Fixed Object	2	9.52%
Sideswipe - Passing	1	4.76%
Grand Total	21	100.00%

Month	Crashes	%
1	1	4.76%
3	2	9.52%
5	2	9.52%
6	2	9.52%
7	3	14.29%
8	3	14.29%
9	1	4.76%
10	2	9.52%
11	2	9.52%
12	3	14.29%
Grand Total	21	100.00%

HOL 39 28.99 - 2017 to 2021 - Int. SR 39 & CR 114

Crash Summary Sheet

Weather Condition	Crashes	%
Clear	16	76.19%
Rain	3	14.29%
Cloudy	2	9.52%
Grand Total	21	100.00%

Road Condition	Crashes	%
Dry	17	80.95%
Wet	4	19.05%
Grand Total	21	100.00%

Light Condition	Crashes	%
Daylight	17	80.95%
Dark - Roadway Not Lighted	3	14.29%
Dawn/Dusk	1	4.76%
Grand Total	21	100.00%

Number of Units	Crashes	%
2	17	80.95%
3	2	9.52%
1	2	9.52%
Grand Total	21	100.00%

ODOT Location	Crashes	%
Not An Intersection	13	61.90%
Four-Way Intersection	7	33.33%
Driveway/Alley Access	1	4.76%
Grand Total	21	100.00%

Work Zone Related	Crashes	%
No	21	100.00%
Grand Total	21	100.00%

Alcohol Related	Crashes	%
No	21	100.00%
Grand Total	21	100.00%

Drug Related (Inc. Marijuana)	Crashes	%
No	21	100.00%
Grand Total	21	100.00%

Contour	Crashes	%
Curve Grade	3	14.29%
Straight Grade	8	38.10%
Straight Level	10	47.62%
Grand Total	21	100.00%

Marijuana Related	Crashes	%
No	21	100.00%
Grand Total	21	100.00%

Roadway Departure	Crashes	%
No	16	76.19%
Yes	5	23.81%
Grand Total	21	100.00%

Older Driver (65+)	Crashes	%
No	11	52.38%
Yes	10	47.62%
Grand Total	21	100.00%

Intersection Related	Crashes	%
Yes	15	71.43%
No	6	28.57%
Grand Total	21	100.00%

Young Driver (15-25)	Crashes	%
No	12	57.14%
Yes	9	42.86%
Grand Total	21	100.00%

Speed Related	Crashes	%
No	19	90.48%
Yes	2	9.52%
Grand Total	21	100.00%

Motorcycle Involved	Crashes	%
No	21	100.00%
Grand Total	21	100.00%

Crash Summary Sheet

Unit 1 Summary

Unit 1 Pre-Crash Action	Crashes	%
Straight Ahead	13	61.90%
Making Left Turn	6	28.57%
Entering Traffic Lane	1	4.76%
Other / Unknown	1	4.76%
Grand Total	21	100.00%

Unit 1 Contributing Factor	Crashes	%
Failure to Yield	12	57.14%
Following Too Closely/ACDA	7	33.33%
Unsafe Speed	2	9.52%
Grand Total	21	100.00%

Unit 1 Object Struck	Crashes	%
Nothing Struck	19	90.48%
Ditch	1	4.76%
Guardrail Face	1	4.76%
Grand Total	21	100.00%

Unit 1 Traffic Control	Crashes	%
No Control	13	61.90%
Stop Sign	8	38.10%
Grand Total	21	100.00%

Unit 1 Posted Speed	Crashes	%
0	1	4.76%
45	1	4.76%
50	7	33.33%
55	12	57.14%
Grand Total	21	100.00%

Unit 1 Direction From	Crashes	%
East	6	28.57%
West	5	23.81%
Southwest	3	14.29%
South	3	14.29%
Northwest	2	9.52%
Northeast	1	4.76%
North	1	4.76%
Grand Total	21	100.00%

Unit 1 Direction To	Crashes	%
East	7	33.33%
West	7	33.33%
Northeast	3	14.29%
North	2	9.52%
Northwest	1	4.76%
Southeast	1	4.76%
Grand Total	21	100.00%

Crash Summary Sheet

Unit 1 Summary

Unit 1 Type	Crashes	%
Passenger Car	9	42.86%
Pick up	7	33.33%
Bus (16+ Passengers)	1	4.76%
Single Unit Truck	1	4.76%
Sport Utility Vehicle	1	4.76%
Animal with Rider or Animal Drawn Vehicle	1	4.76%
Passenger Van (minivan)	1	4.76%
Grand Total	21	100.00%

Unit 1 Special Function	Crashes	%
None	19	90.48%
School Transport	1	4.76%
Fire	1	4.76%
Grand Total	21	100.00%

HOL 39 28.99 - 2017 to 2021 - Int. SR 39 & CR 114
Crash Summary Sheet

Unit 2 Summary

Unit 2 Pre-Crash Action	Crashes	%
Straight Ahead	12	57.14%
Slowing or Stopped In Traffic	3	14.29%
	2	9.52%
Making Left Turn	2	9.52%
Walking, Running, Jogging, Playing	1	4.76%
Entering or Crossing Specified Location	1	4.76%
Grand Total	21	100.00%

Unit 2 Contributing Factor	Crashes	%
None	19	90.48%
	2	9.52%
Grand Total	21	100.00%

Unit 2 Direction From	Crashes	%
	2	9.52%
East	5	23.81%
North	1	4.76%
Northwest	2	9.52%
South	1	4.76%
Southeast	3	14.29%
Southwest	2	9.52%
West	5	23.81%
Grand Total	21	100.00%

Unit 2 Direction To	Crashes	%
	2	9.52%
East	4	19.05%
North	1	4.76%
Northeast	3	14.29%
Northwest	3	14.29%
South	2	9.52%
Southeast	2	9.52%
West	4	19.05%
Grand Total	21	100.00%

Unit 2 Type	Crashes	%
Passenger Car	7	33.33%
Sport Utility Vehicle	3	14.29%
Pick up	3	14.29%
	2	9.52%
Bicycle	2	9.52%
Moped or Motorized Bicycle	1	4.76%
Motorhome	1	4.76%
Passenger Van (minivan)	1	4.76%
Animal with Rider or Animal Drawn Vehicle	1	4.76%
Grand Total	21	100.00%

Unit 2 Special Function	Crashes	%
None	19	90.48%
	2	9.52%
Grand Total	21	100.00%

OHIO SHSP EMPHASIS AREAS (Fatalities)																						
Target Group	2021 Fatalities	2021 % of Total Fatalities	2020 Fatalities	2020 % of Total Fatalities	2019 Fatalities	2019 % of Total Fatalities	2018 Fatalities	2018 % of Total Fatalities	2017 Fatalities	2017 % of Total Fatalities	2016 Fatalities	2016 % of Total Fatalities	2015 Fatalities	2015 % of Total Fatalities	2014 Fatalities	2014 % of Total Fatalities	2013 Fatalities	2013 % of Total Fatalities	2012 Fatalities	2012 % of Total Fatalities	2011 Fatalities	2011 % of Total Fatalities
Total Fatalities by Year	0	0%	0	0%	0	0%	0	0%	3	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Roadway Departure	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Intersection	0	0%	0	0%	0	0%	0	0%	2	67%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Railroad Crossing	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Alcohol Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Restraints Not Used Driver/Occupants	0	0%	0	0%	0	0%	0	0%	3	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Speed Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Young Driver Involvement (15-25)	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Older Driver Involvement (65+)	0	0%	0	0%	0	0%	0	0%	3	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Distracted Drivers	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Motorcycle Driver/Passenger	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Pedestrian Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Bicycle Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Work Zone Related	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Drug Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Marijuana Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Rear End	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

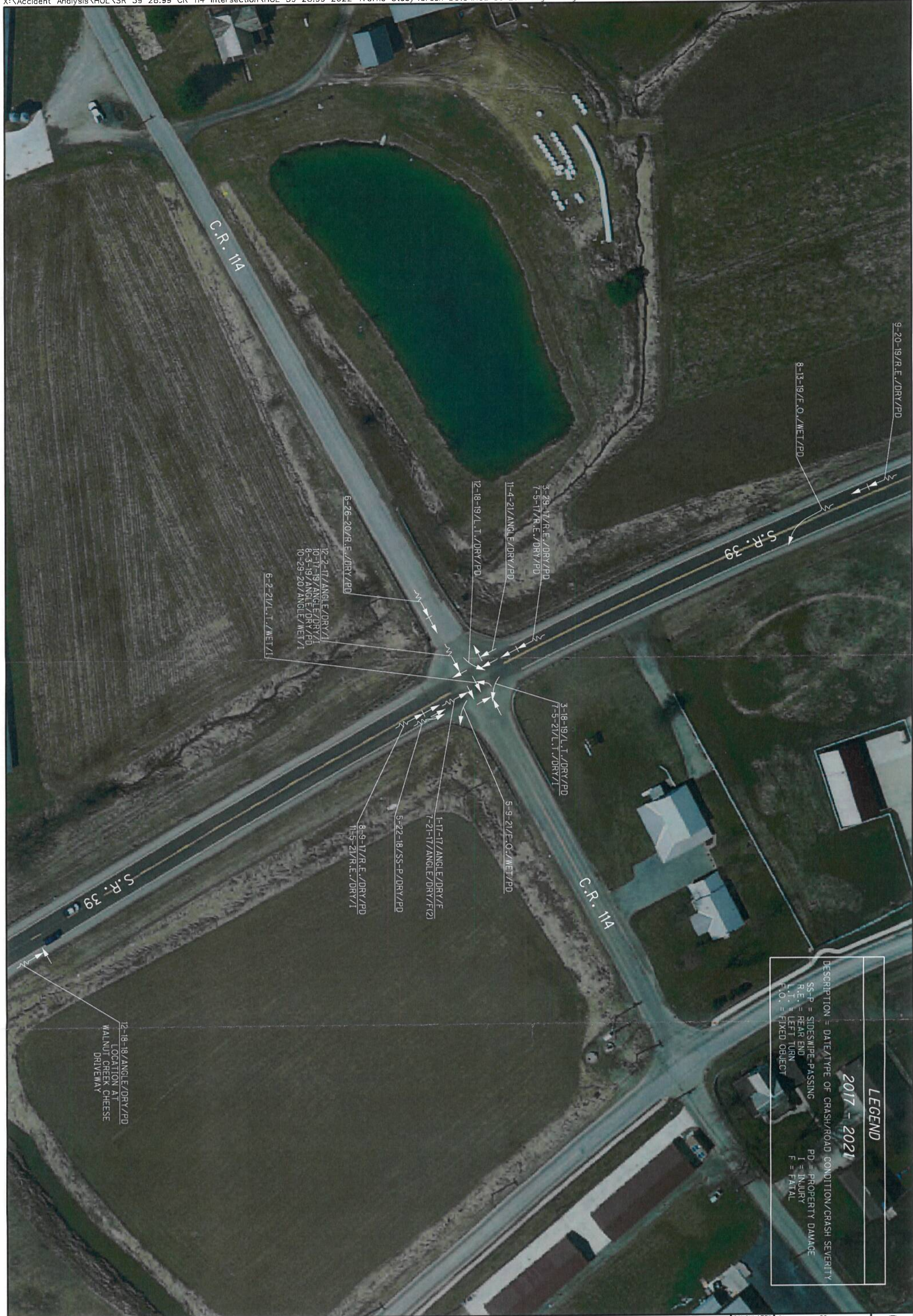
*2020 Data is Preliminary

OHIO SHSP EMPHASIS AREAS (Serious Injuries)																						
Target Group	2021 Serious Injuries	2021 % of Total Serious Injuries	2020 Serious Injuries	2020 % of Total Serious Injuries	2019 Serious Injuries	2019 % of Total Serious Injuries	2018 Serious Injuries	2018 % of Total Serious Injuries	2017 Serious Injuries	2017 % of Total Serious Injuries	2016 Serious Injuries	2016 % of Total Serious Injuries	2015 Serious Injuries	2015 % of Total Serious Injuries	2014 Serious Injuries	2014 % of Total Serious Injuries	2013 Serious Injuries	2013 % of Total Serious Injuries	2012 Serious Injuries	2012 % of Total Serious Injuries	2011 Serious Injuries	2011 % of Total Serious Injuries
Total Serious Injuries by Year	1	0%	0	0%	1	0%	0	0%	1	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Roadway Departure	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Intersection	0	0%	0	0%	1	100%	0	0%	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Railroad Crossing	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Alcohol Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Restraints Not Used Driver/Occupants	0	0%	0	0%	0	0%	0	0%	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Speed Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Young Driver Involvement (15-25)	0	0%	0	0%	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Older Driver Involvement (65+)	1	100%	0	0%	0	0%	0	0%	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Distracted Drivers	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Motorcycle Driver/Passenger	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Pedestrian Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Bicycle Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Work Zone Related	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Drug Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Marijuana Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Rear End	1	100%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

*2020 Data is Preliminary

OHIO SHSP EMPHASIS AREAS (Total Crashes)																						
Target Group	2021 Crashes	2021 % of Total Crashes	2020 Crashes	2020 % of Total Crashes	2019 Crashes	2019 % of Total Crashes	2018 Crashes	2018 % of Total Crashes	2017 Crashes	2017 % of Total Crashes	2016 Crashes	2016 % of Total Crashes	2015 Crashes	2015 % of Total Crashes	2014 Crashes	2014 % of Total Crashes	2013 Crashes	2013 % of Total Crashes	2012 Crashes	2012 % of Total Crashes	2011 Crashes	2011 % of Total Crashes
Total Crashes by Year	5	40%	1	0%	6	33%	2	50%	6	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Roadway Departure	2	40%	0	0%	2	33%	1	50%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Intersection	3	60%	1	100%	3	50%	2	100%	5	83%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Railroad Crossing	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Alcohol Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Restraints Not Used Driver/Occupants	0	0%	0	0%	0	0%	0	0%	3	50%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Speed Related Involvement	1	20%	0	0%	1	17%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Young Driver Involvement (15-25)	1	20%	0	0%	4	67%	1	50%	1	17%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Older Driver Involvement (65+)	2	40%	1	100%	5	83%	1	50%	3	50%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Distracted Drivers	1	20%	0	0%	1	17%	1	50%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Motorcycle Driver/Passenger	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Pedestrian Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Bicycle Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Work Zone Related	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Drug Related Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Marijuana Involvement	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%
Rear End	1	20%	0	0%	1	17%	0	0%	3	50%	0	0%	0	0%	0	0%	0	0%	0	0%	0	0%

*2020 Data is Preliminary



HOL-39-28.99

**S.R. 39 & C.R. 114 INTERSECTION
 COLLISION DIAGRAM**

CALCULATED
 RDA
 CHECKED
 CJV

0 20 40
 HORIZONTAL SCALE IN FEET



Appendix B

Existing Plan & Right of Way Sheets



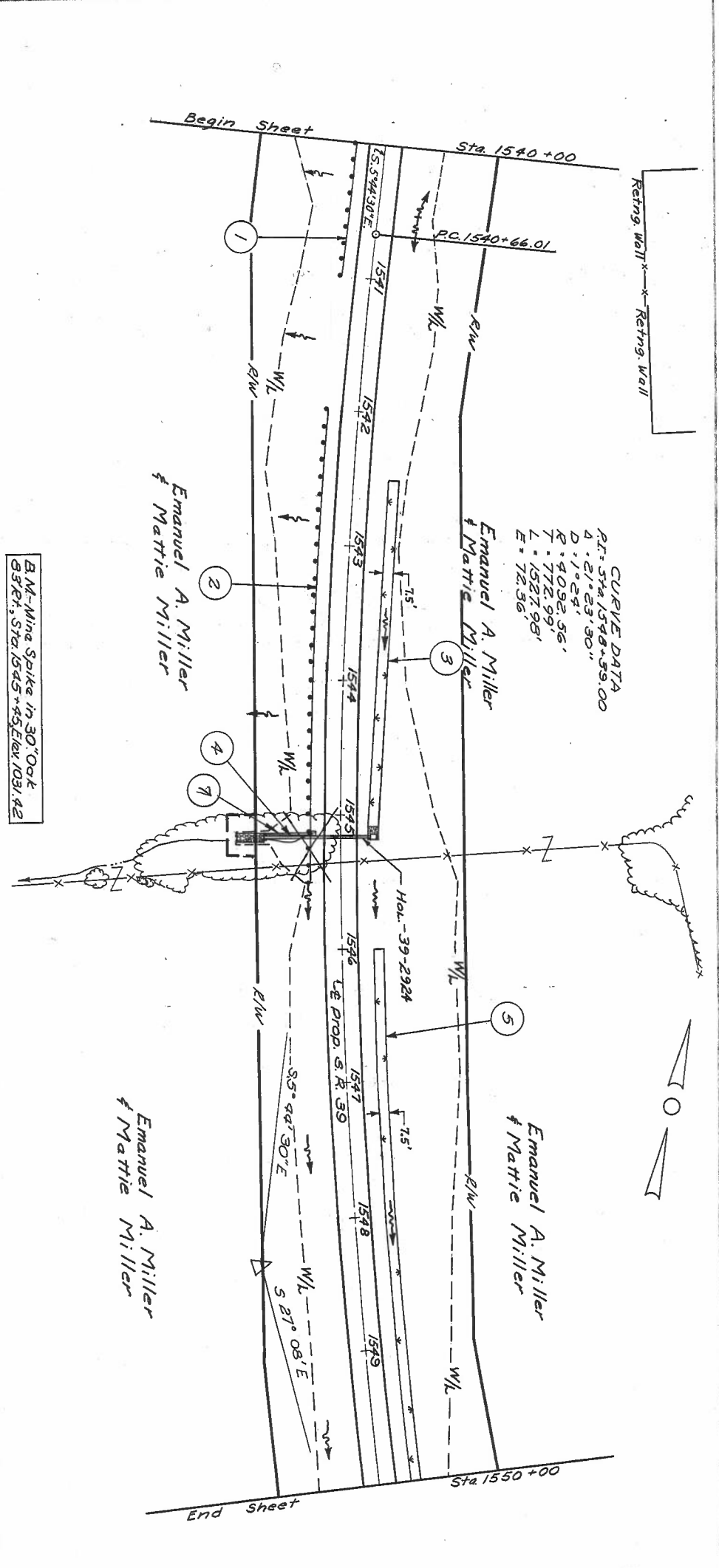
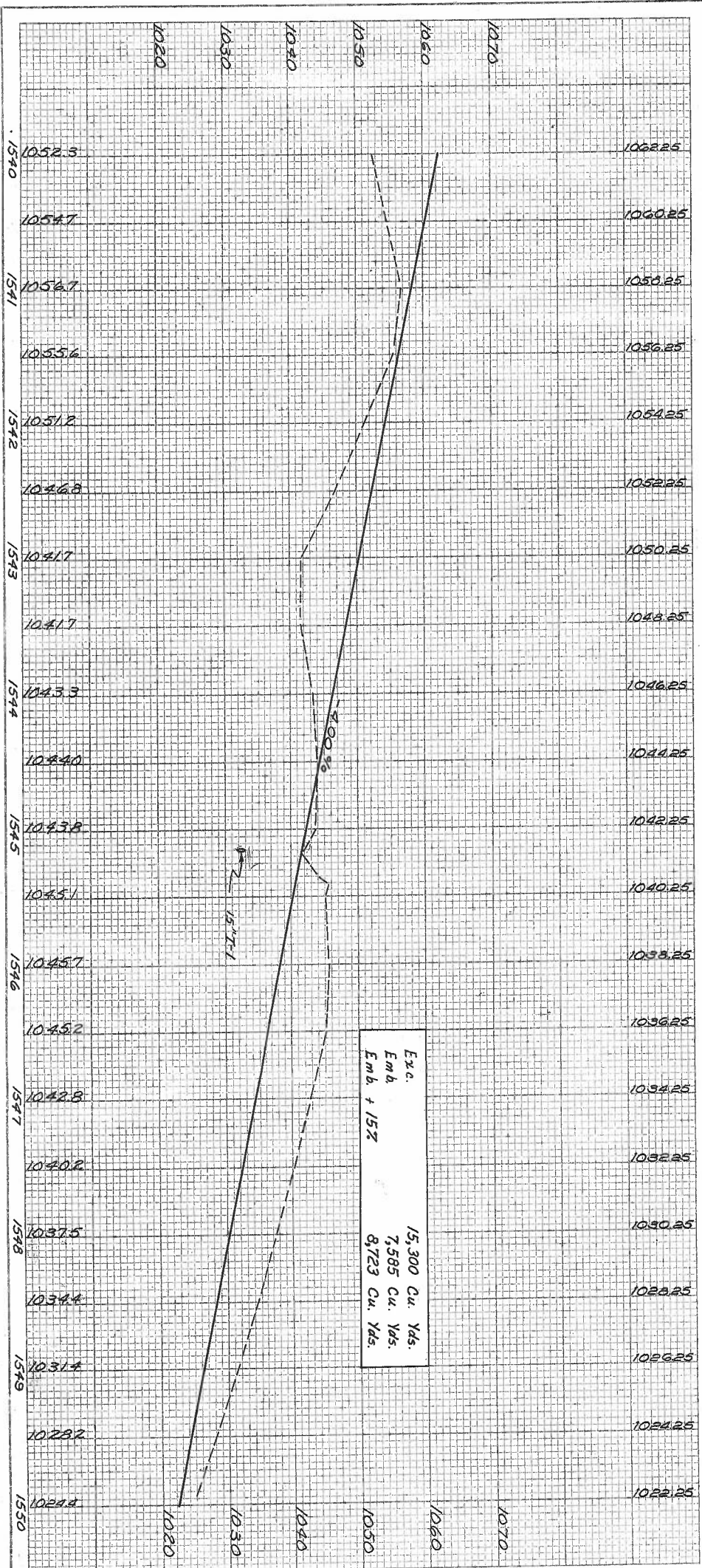
HOL - 39 - 28.99

PLAN
SIGNS

CALCULATED
RDA
CHECKED
CJV

0 120 240
60
HORIZONTAL
SCALE IN FEET





CURVE DATA
 P.T. Sta. 1548+59.00
 A. 21° 23' 30"
 D. 110.24'
 R. 4092.56'
 T. 772.99'
 L. 1527.98'
 E. 72.36'

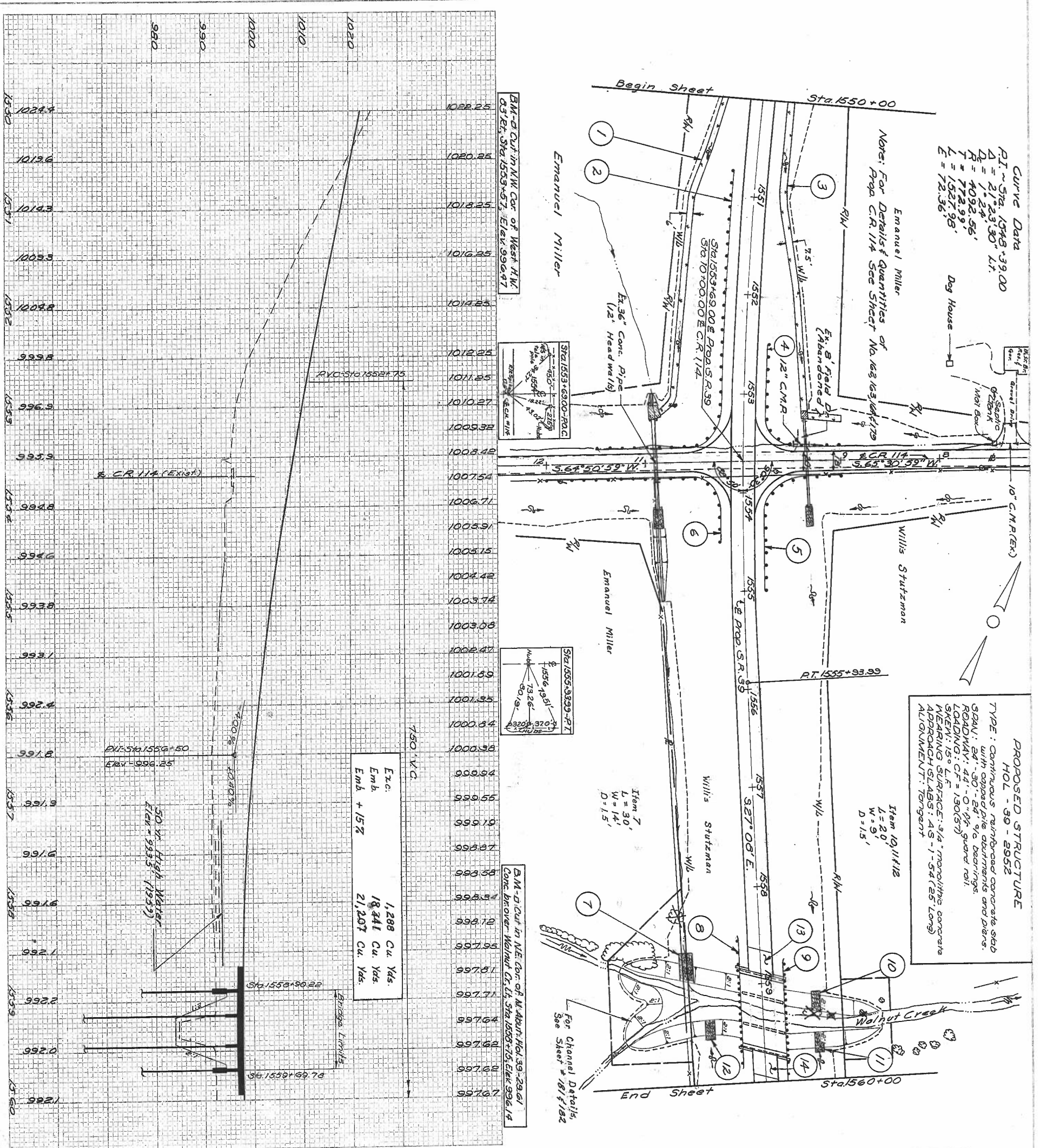
B.N. - Mine Spike in 30' 00'
 83' Rt. Sta. 1545+45 Elev. 1031.42

Exc. 15,300 Cu. Yds.
 Emb. 7,585 Cu. Yds.
 Emb. + 15% 8,723 Cu. Yds.

* Sec. M-6.4(d) ESTIMATED QUANTITIES ** Sec. M-6.4(h) As per Plan. *** Sec. M-6.4(e)

REF. NO.	STATION TO STATION	SIDE	* Sec. M-6.4(d)				** Sec. M-6.4(h) As per Plan.			SEE SHEET NO.	
			I-1 15" Class A-1	I-2 Class "C"	I-8 Stal. No. B C. B.	I-10 Dumped Rock C. P.	L-10 Sq. Yds.	I-15 Std.	I-1 Class I-3 Lin. Ft.		I-2 No. 1 As Per Plan Lin. Ft.
1	1540+00 1541+00	Rt.									
2	1542+00 1545+50	Rt.									
3	1542+50 1545+09	Lt.									60
4	1545+16	R.	85	0.3	1	11					
5	1546+00 1550+00	Lt.									183
7	1545+15	Rt.						26	10	3	

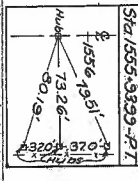
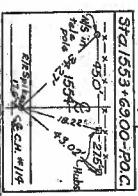
Sta. 1540+00 to Sta. 1550+00



Curve Data
 PI - Sta. 1548+39.00
 Δ = 21°23'30" Lt.
 Δ₂ = 14°24'56"
 R = 4092.56'
 T = 772.99'
 L = 1527.98'
 E = 72.36'

PROPOSED STRUCTURE
 HOL - 39 - 2952
 TYPE: Continuous reinforced concrete slab with opposed pile abutments and piers.
 SPAN: 24' - 30' - 24' 1/2 bearings.
 ROADWAY: 41' - 0" 9% guard rail.
 LOADING: CF = 130(S-7)
 SKEW: 15° L.F.
 WEARING SURFACE: 3/4" monolithic concrete
 APPROACH SLABS: 45' - 1' - 54" (25' Long)
 ALIGNMENT: Tangent

B.M. - D. Cut in NW Cor. of West H.W.
 03 Ft. Sta. 1553+57, Elev. 994.97



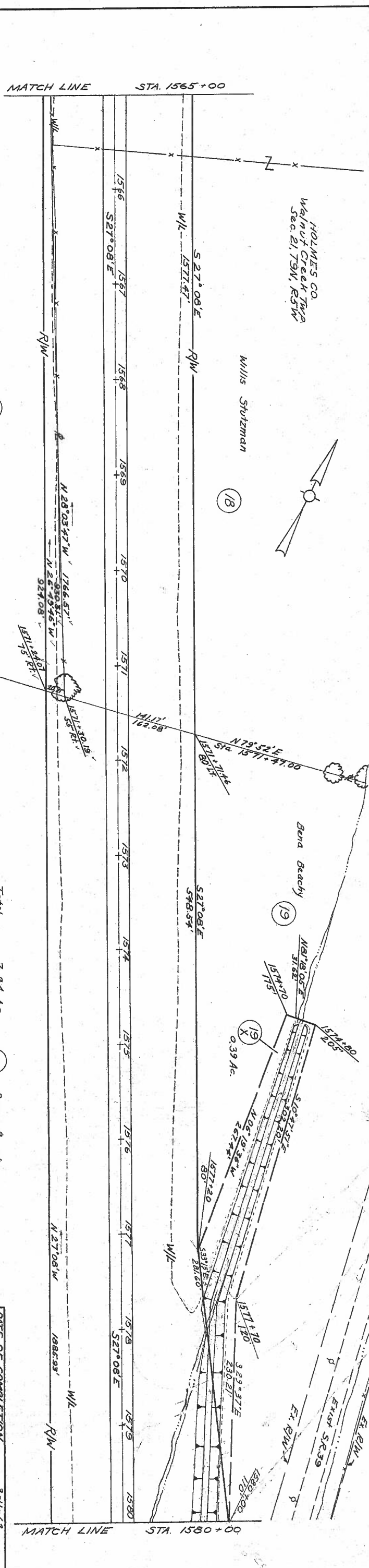
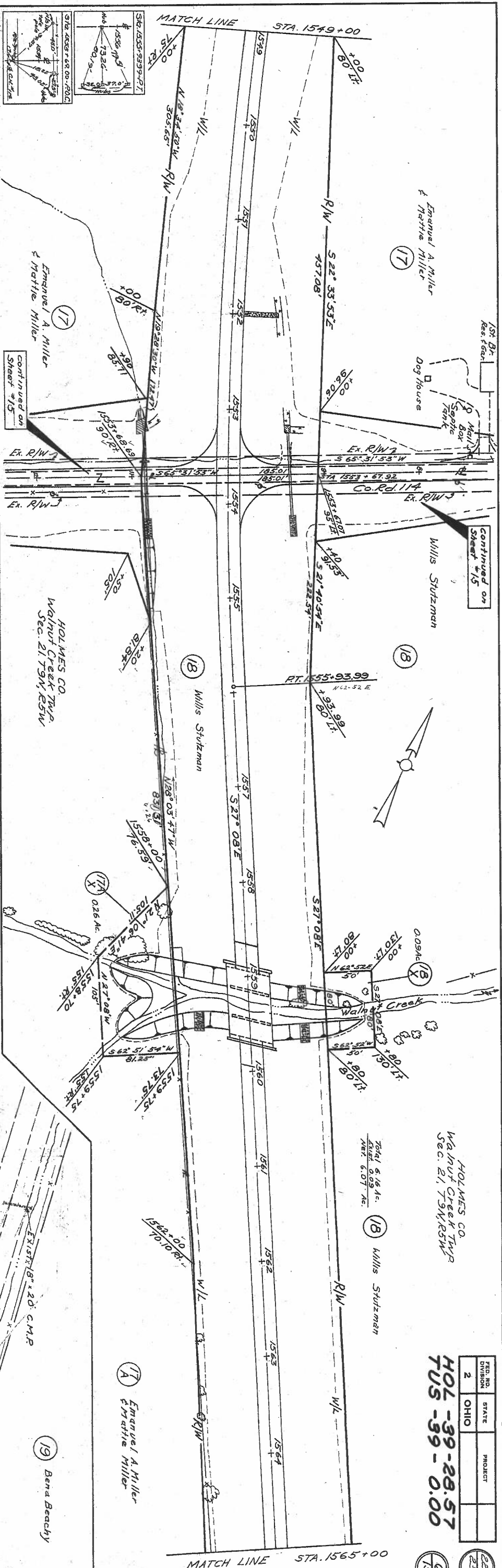
B.M. - D. Cut in NE Cor. of N. Abut. Hol. 39 - 2961
 Conc. Broyer - Walnut Cr. Lt. Sta. 1558+55, Elev. 996.14

Exc. 1,288 Cu. Yds.
 Emb. 1841 Cu. Yds.
 Emb. + 15% 21,207 Cu. Yds.

ESTIMATED QUANTITIES

STATION TO STATION	SIDE	* Bridge Limits Deducted				Lip. Ft.
		I-10	I-15	L-10	I-7	
1 1550+00 ~ 1553+20	Rt.					300
2 1550+75 ~ 10+60	Rt.					
3 1550+00 ~ 1553+16	Lt.			263		
4 1552+50 ~ 9+40	Lt.					12.5
5 9+36 ~ 1553+00	Lt.					137.5
6 10+62 ~ 1554+50	Rt.					87.5
7 1558+66 ~ 1558+96	Rt.	23				
8 1558+55.21 ~ 1559+00.21	Rt.					
9 1558+79.79 ~ 1560+00.79	Lt.					
10 1559+10 ~ 1559+30	Lt.	10				
11 1559+52 ~ 1559+72	Lt.	10				
12 1559+34 ~ 1559+54	Rt.	10				
13 1558+65.22 ~ 1558+90.22	Rt.				67	
14 1559+69.78 ~ 1559+94.78	Rt.				67	

Sta. 1550+00 to Sta. 1560+00



Total	3.94 Ac.
Ex. R/W	1.46
Net	6.43 Ac.

HOLMES CO.
Walnut Creek TWP.
Sec. 21, 79N, R5W

DATE OF COMPLETION	3-11-62
REVISIONS	Description
3-12-63	Parcel 19 changed - Approach moved
3-12-63	Parcel 19 changed - Approach moved from 1579+00 to 1582+75

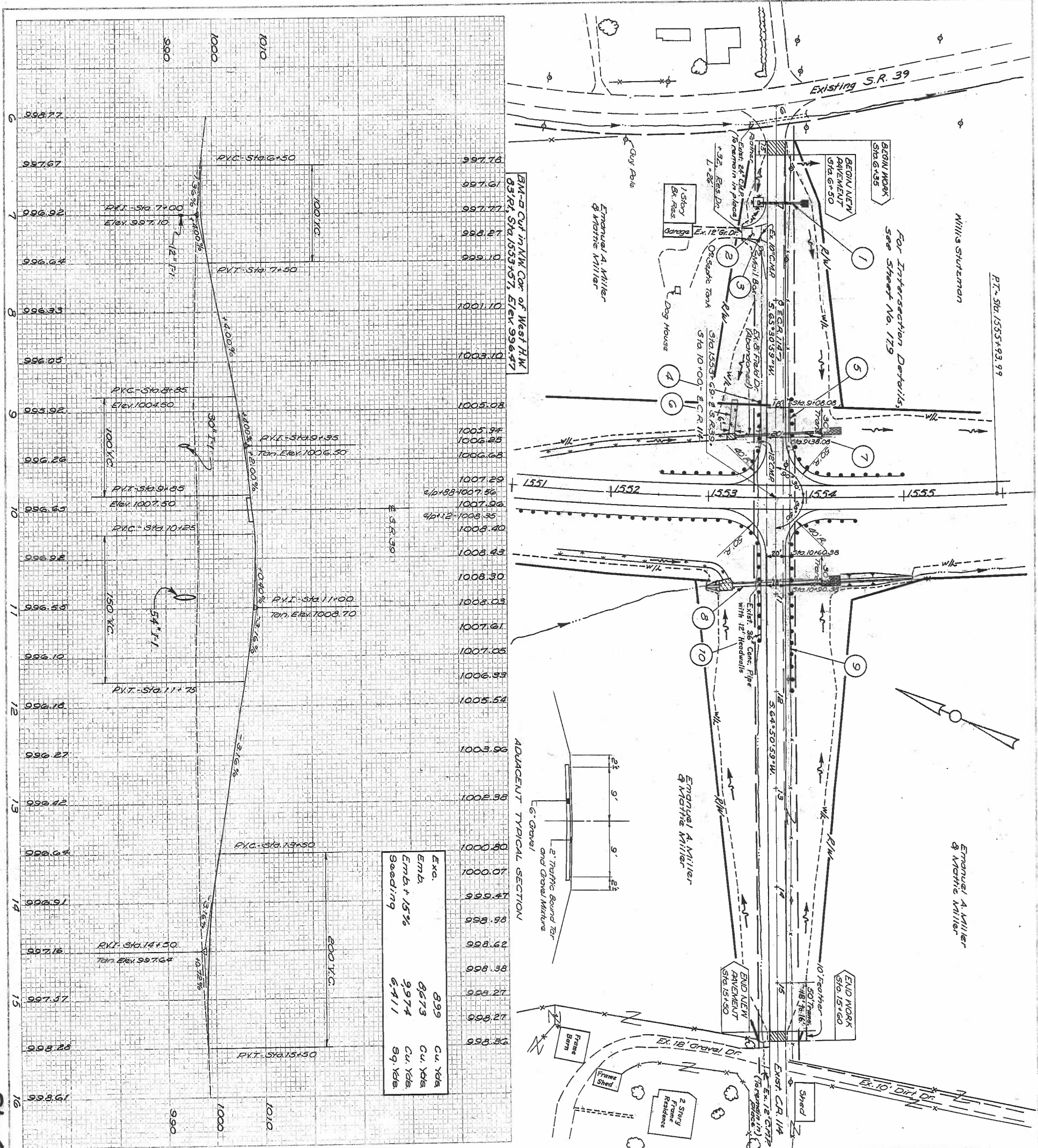
Scale: 1" = 50'

Sta. 1549+00 to Sta. 1580+00

FED. RD. DIVISION	STATE	PROJECT
2	OHIO	

HOL-39-28.57
TUS-39-0.00

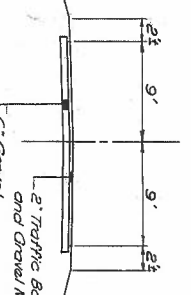
19-18



BM - 2 Cut in NW Cor of West HW
 83124, Sta. 1533+157, Elev. 996.47

Exc.	839	Cu. Yds
Emb.	8673	Cu. Yds
Emb. + 15%	9974	Cu. Yds
Seeding	6,411	Sq. Yds

ADJACENT TYPICAL SECTION



ESTIMATED QUANTITIES

* 900 M-G.6(b), M-G.8(b) or Sec. M-6.4(d)*** Sec. M-6.6(b)

REF. NO.	STATION TO STATION	TYPE	E-3	E-12	E-12	T-35	I-1	I-1*	I-1**	I-2	I-3	I-10	I-10	I-15	I-18	L-10	STATION
			Cu. Yds	Lin. Ft.	Lin. Ft.	Cu. Yds	Lin. Ft.	Lin. Ft.	Lin. Ft.	Class	Std. Pumped	Rip. C.P.	Rip. C.P.	Std. 5'	Std. 5'		
1	7+00 - 7+32	Rt				4	43			0.2	1	2				11	163
2	7+32 - 7+24	Rt		16													
3	7+24 - 7+40	Rt															
4	9+02.5 - 9+40	Lt												375			
5	8+58.5 - 9+36	Lt												375			
6	9+00 - 9+33	Rt														23	190
7	9+34 - 10+38	Rt	14	15	29			88		1.0		11	5			11	191
8	10+38 - 11+99.5	Rt							92	1.9		20	18			1375	
9	10+62 - 11+47.5	Rt														875	
10	10+60 - 11+47.5	Rt															

Sta 6+35 to Sta 15+60 ~ CO. RD. # 114

101-39-2857
 108-39-000

162
 231

14 31 29 4 43 88 92 3.1 1 33 23 300 10 61

Appendix C

TFMS Traffic Forecast Reports



TFMS - Segment Forecast Report

Username	Email	Script Import Date	Script Version	Model Version
Chris.Varcolla	Chris.Varcolla@dot.ohio.gov	4/14/2020 5:30:19 PM	2020.001	2022.1900

Forecast Summary

Project ID	Project Name	Opening Year	Design Year
	HOL 39 28.99	2022	2042

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.

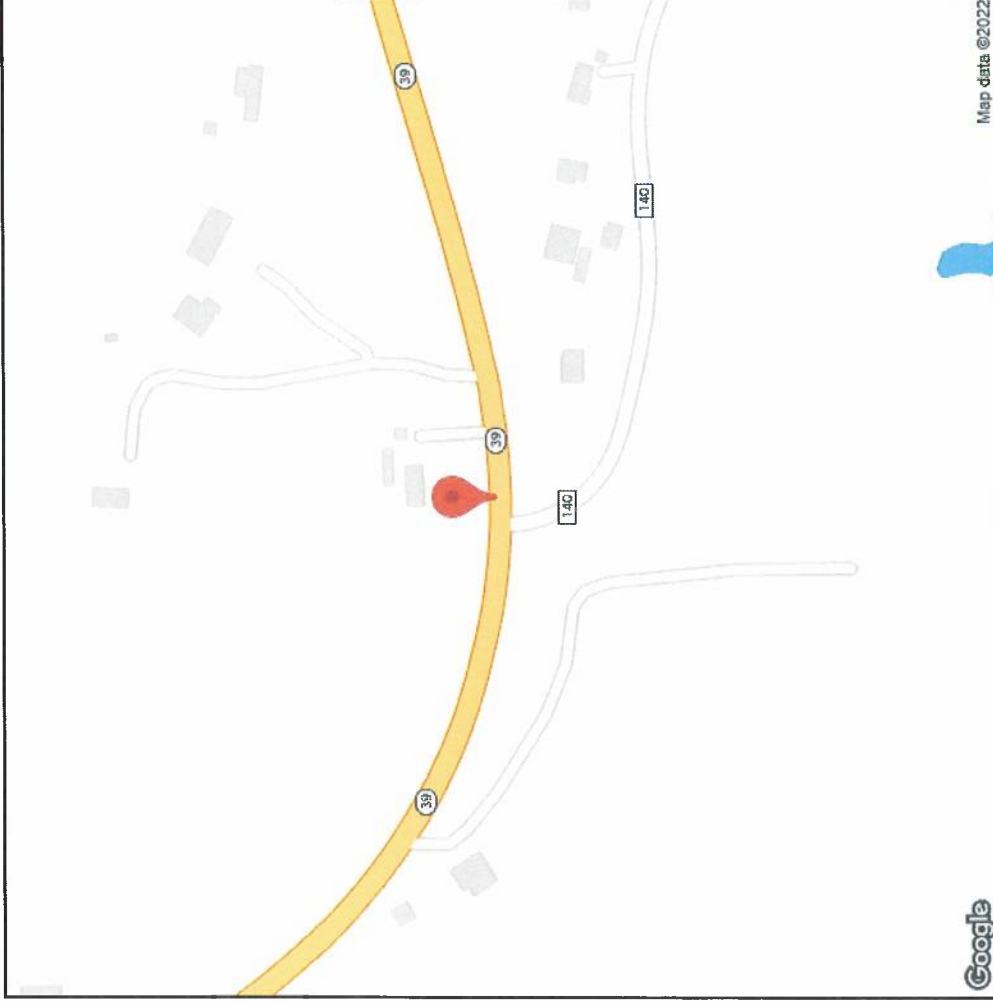
Segment Information

Segment ID	LRS ID	BMP	EMP	Length	Latitude	Longitude
1521016	SHOLSR00039**C	28.254	32.489	4.235	-81.7058762044281	40.5161127662579

Forecast Information

Segment ID	2022 AADT	2042 AADT	DHV-30	K%	D%	T24%	TD%
1521016	8,600	8,600	850	10.0	65.7	8	5






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
1521016	SHOLSR00039**C	28.254	32.489

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2050	10.0	8	7,900	Model	-0.400	0.000
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
8,610	65.7	5	710	Model	-0.200	0.000

 Warning: The growth rate was negative and was capped.

Regression

Method Number	PA AADT	BC AADT	AADT
2	10,869	1,248	12,117

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
2000	23284	-1422	4312	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	1.18	4.46	0	0	10,533	1,804	10,608	1,627
2	1.29	2.62	4	5	11,104	1,272	10,869	1,248
3	1.59	3.05	0	0	11,599	1,475	11,552	1,336
4	1.41	0.86	4	5	11,412	859	11,146	886
5	2.04	3.23	0	0	12,712	1,516	12,572	1,374
6	1.08	1.26	4	5	10,607	950	10,392	969

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	-2,586	7,428	-790	622	-0.48	-0.42
2	RAT	0.77	7,702	0.47	668	-0.38	-0.20
3	MRAT	0.89	7,702	0.94	668	-0.38	-0.20
4	RAF		7,565		645	-0.43	-0.31
Adjust Method AADT		Adjust Method BC		Selected PA Growth Rate %		Selected BC Growth Rate %	
Ratio		Ratio		-0.400		-0.200	

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total Max Volume
6806	7034	622	668	7428	7702

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

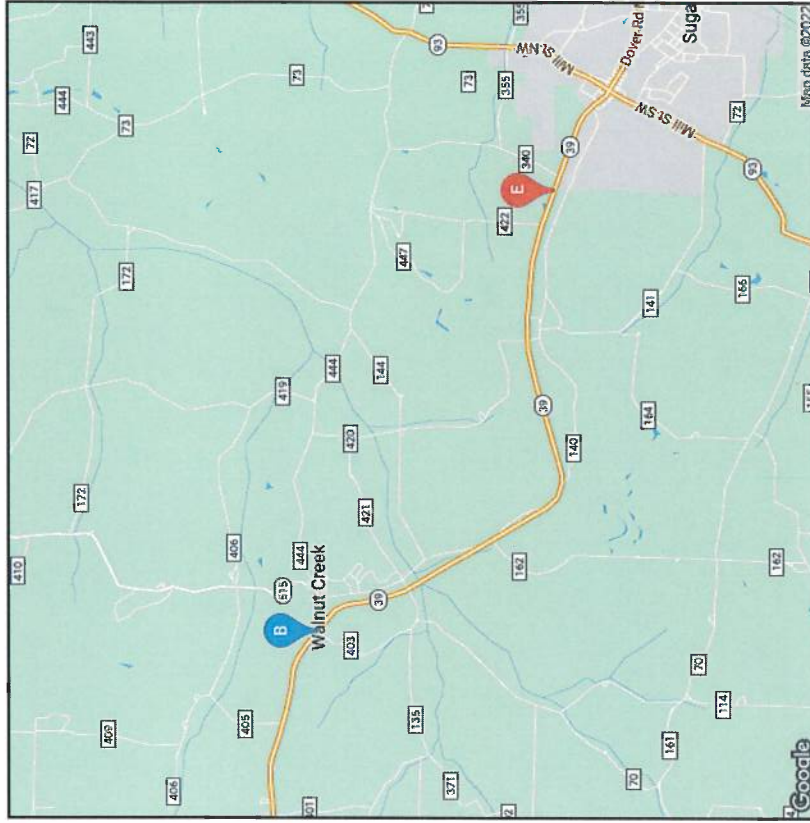
Comment:

No Comment

Historical Count

Year	All	Cars	Trucks
2008	7,280	6,890	390
2011	7,560	6,920	640
2013	7,982	7,306	676
2015	6,586	6,028	558
2018	9,281	8,208	1,073
* 2021	8,615	7,906	709

* Pivot Point



Segment ID	LRS ID	BMP	EMP	Length	Yr 2022 AADT	Yr 2042 AADT	DHV30	K %	D %	T24 %	TD %
1521016	SHOLSR00039**C	28.254	32.489	4.235	8,600	8,600	850	10.0	65.7	8	5



TFMS - Segment Forecast Report

Username	Email	Script Import Date	Script Version	Model Version
Chris.Varcolla	Chris.Varcolla@dot.ohio.gov	4/14/2020 5:30:19 PM	2020.001	2022.1900

Forecast Summary

Project ID	Project Name	Opening Year	Design Year
	HOL 39 28.99	2025	2045

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

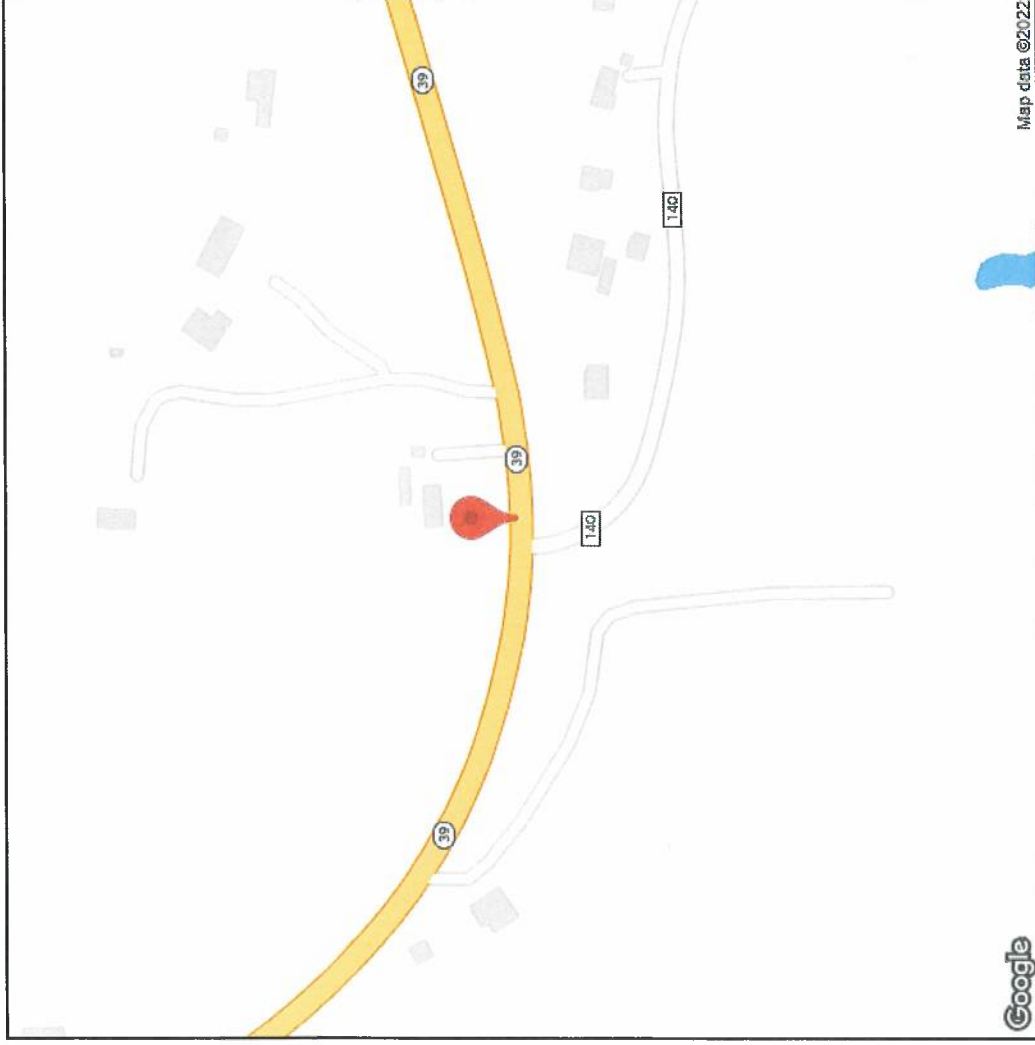
Segment ID	LRS ID	BMP	EMP	Length	Latitude	Longitude
1521016	SHOLSR00039**C	28.254	32.489	4.235	-81.7058762044281	40.5161127662579

Forecast Information

Segment ID	2025 AADT	2045 AADT	DHV-30	K%	D%	T24%	TD%
1521016	9,300	9,300	950	10.0	65.7	12	7

The values in parenthesis are numbers that have been overridden.






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
1521016	SHOLSR00039**C	28.254	32.489

Forecast

Year	K %	T24 %	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2050	10.0	8	7,900	Model	-0.400	0.000
AADT	D %	TD %	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
8,610	65.7	5	710	Model	-0.200	0.000

 Warning: The growth rate was negative and was capped.

Regression

Method Number	PA AADT	BC AADT	AADT
2	10,869	1,248	12,117

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
2000	23284	-1422	4312	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	1.18	4.46	0	0	10,533	1,804	10,608	1,627
2	1.29	2.62	4	5	11,104	1,272	10,869	1,248
3	1.59	3.05	0	0	11,599	1,475	11,552	1,336
4	1.41	0.86	4	5	11,412	859	11,146	886
5	2.04	3.23	0	0	12,712	1,516	12,572	1,374
6	1.08	1.26	4	5	10,607	950	10,392	969

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	-2,586	7,428	-790	622	-0.48	-0.42
2	RAT	0.77	7,702	0.47	668	-0.38	-0.20
3	MRAT	0.89	7,702	0.94	668	-0.38	-0.20
4	RAF		7,565		645	-0.43	-0.31

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Ratio	Ratio	-0.400	-0.200

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total Max Volume
6806	7034	622	668	7428	7702

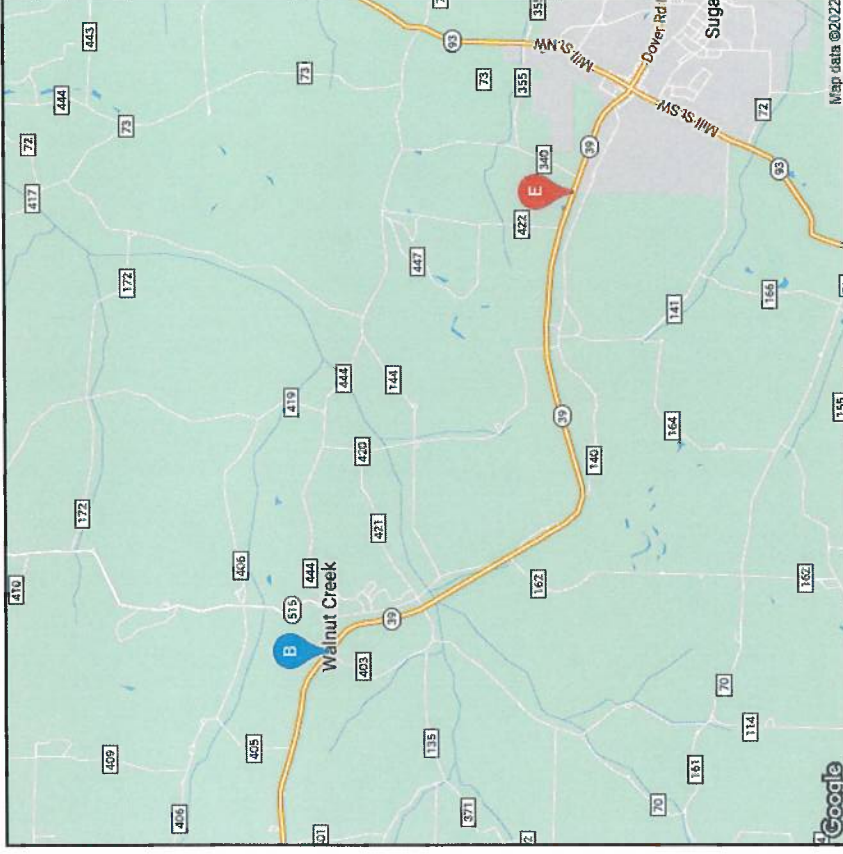
Process Flag: Adjusted model to counts with process per ODOT 255 spreadsheet

Comment:

Historical Count

Year	All	Cars	Trucks
2008	7,280	6,890	390
2011	7,560	6,920	640
2013	7,982	7,306	676
2015	6,586	6,028	558
2021	8,615	7,906	709
* 2018	9,281	8,208	1,073

* Pivot Point

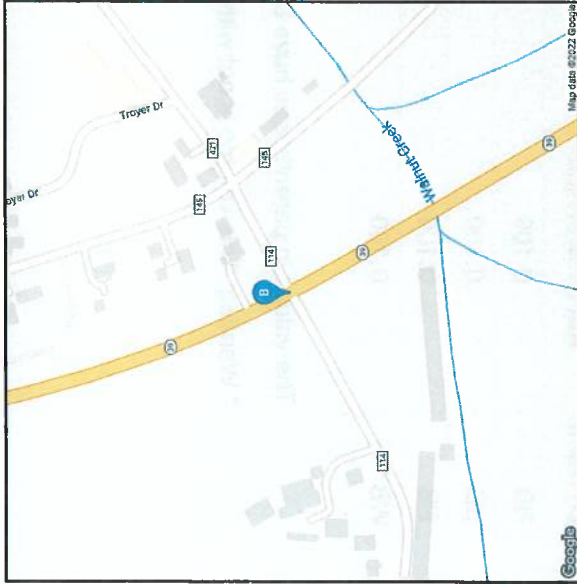


Segment ID	LRS ID	BMP	EMP	Length	Yr 2025 AADT	Yr 2045 AADT	DHV30	K %	D %	T24 %	TD %
1521016	SHOLSR00039**C	28.254	32.489	4.235	9,300	9,300	950	10.0	65.7	12	7



TFMS - Intersection Forecast Report

Forecast Summary



Project Id	Project Name
Project Description	

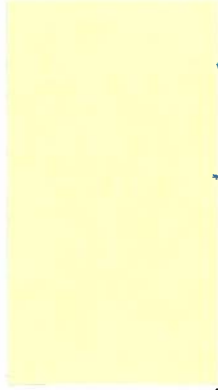
Model Version	Script Date	Script Version
2022.1900	4/14/2020 5:30:19 PM	2020.001
Username	Email Address	
Chris.Varcolla	Chris.Varcolla@dot.ohio.gov	

*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.

Road Name	2025 AADT	2045 AADT	K%	DHV30	D%	T24%	TD%
SR 39	9,750	9,950	10.0	1000	66	8.2	5.2
SR 39	9,800	10,000	10.0	1000	66	8.2	5.2
CR 114	1,850	1,850	(10.0)	(190)	(56)	6.2	6.6
CR 114	1,200	1,200	(10.0)	(120)	(56)	3.3	3.6

The values in parentheses have been overridden.

Pivot Count Date: 04/26/2022





TFMS - Intersection Forecast Report

Segment Information

Approach Name	Segment ID	LRS ID	BMP	Midpoint	EMP	Length	Latitude	Longitude
NB	1727	SHOLSR00039**C	28.254	30.3715	32.489	4.235	40.5161127662579	-81.7058762044281
SB	1728	SHOLSR00039**C	28.254	30.3715	32.489	4.235	40.5161127662579	-81.7058762044281
EB	1729							
WB	1730							

Target Value Summary

Approach Name	Adt Growth Rate	Adt Growth	2025 AADT	2045 AADT	2025 AM	2045 AM	2025 PM	2045 PM
NB	0.100	10,000	9,750	9,950	640	650	980	1,000
SB	0.100	10,000	9,800	10,000	640	660	980	1,000
EB	0.100	2,000	* 1,850	* 1,850	120	120	180	190
WB	0.100	1,000	* 1,200	* 1,200	80	80	120	120

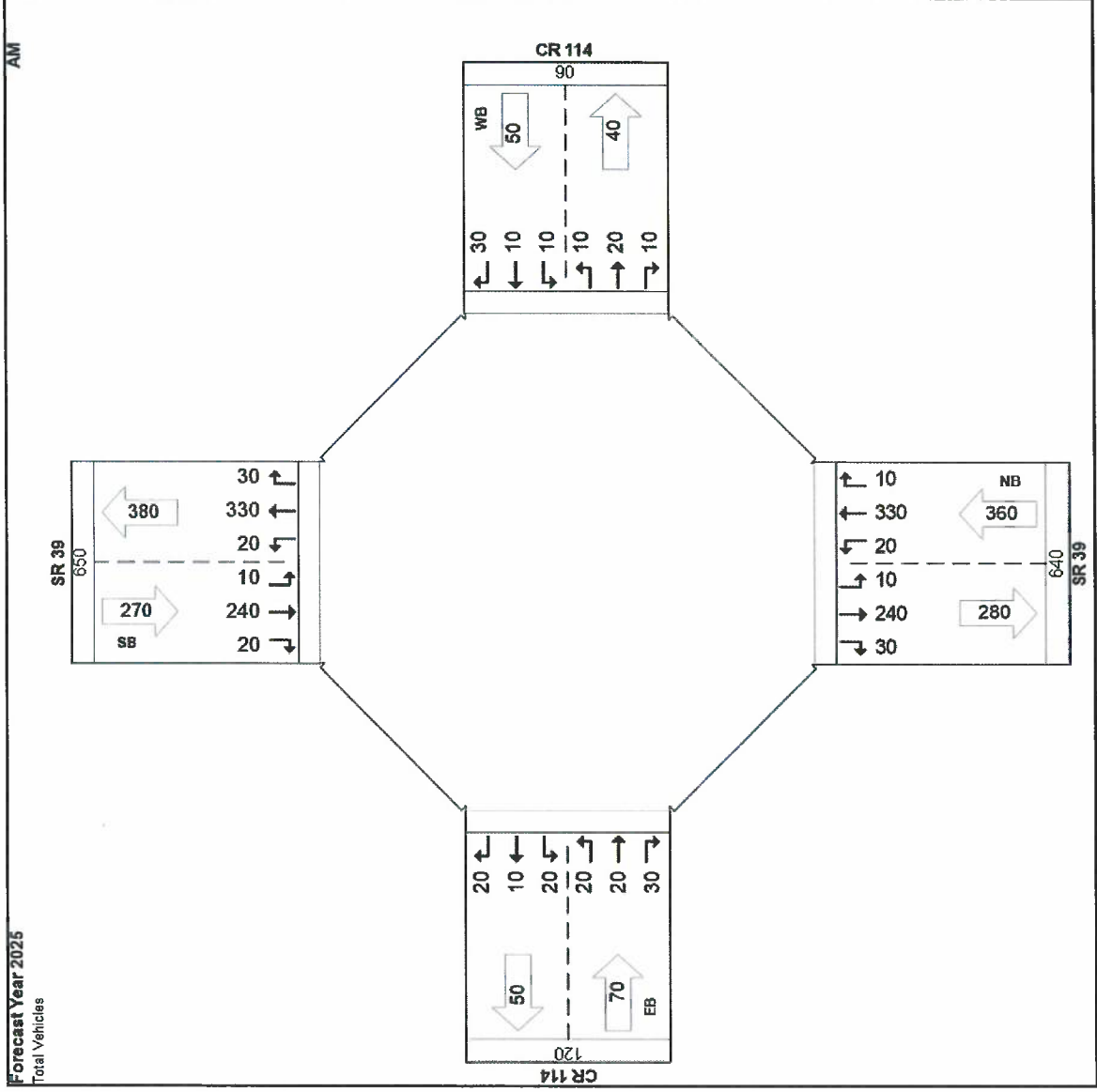
The values in parentheses have been overridden.

* Warning: This volume is not within 10% of the target volume, growth rate or DHV factors may be incompatible between segments



TFMS - Intersection Forecast Report

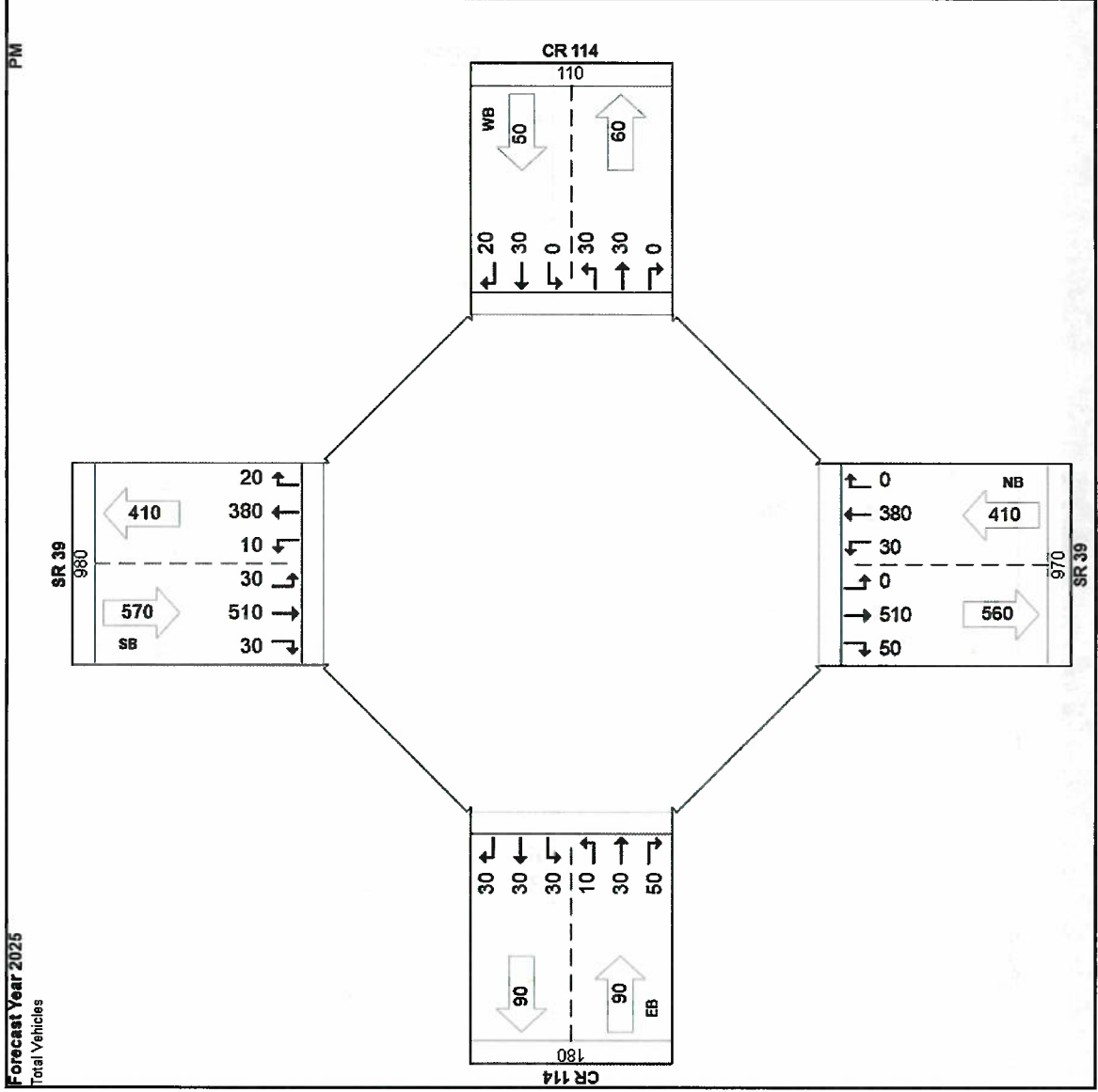
Opening Year AM





TFMS - Intersection Forecast Report

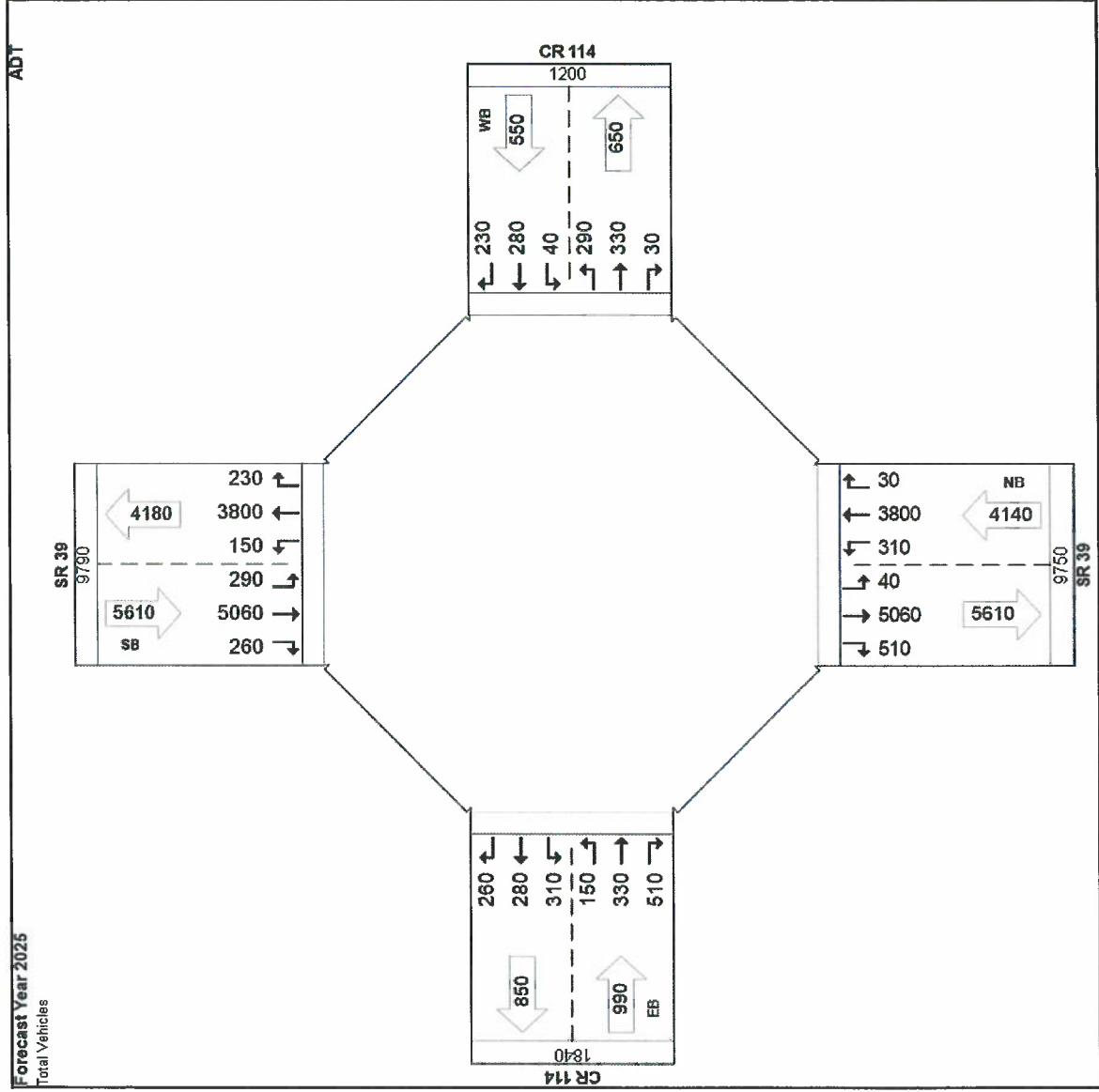
Opening Year PM





TFMS - Intersection Forecast Report

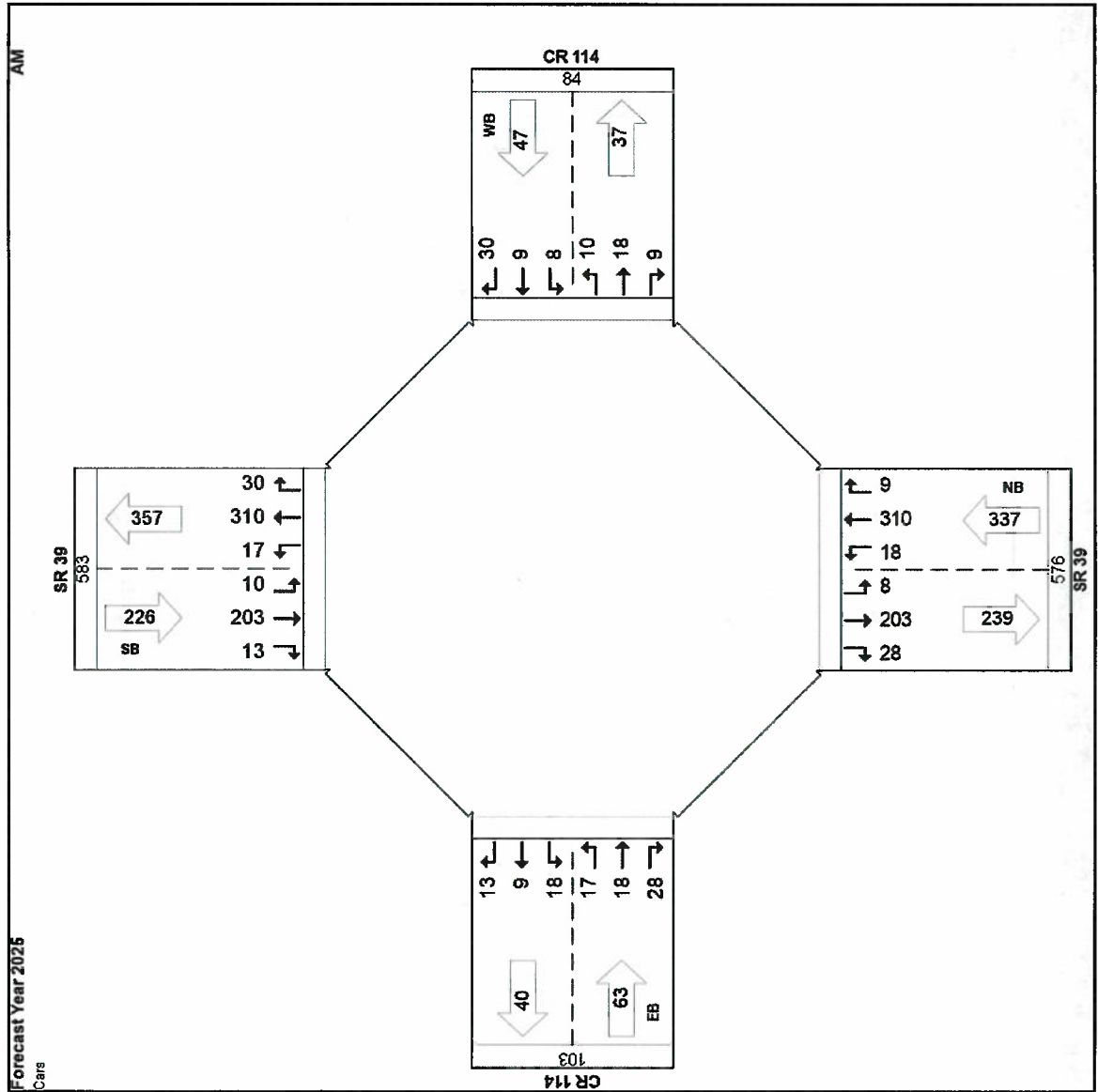
Opening Year ADT





TFMS - Intersection Forecast Report

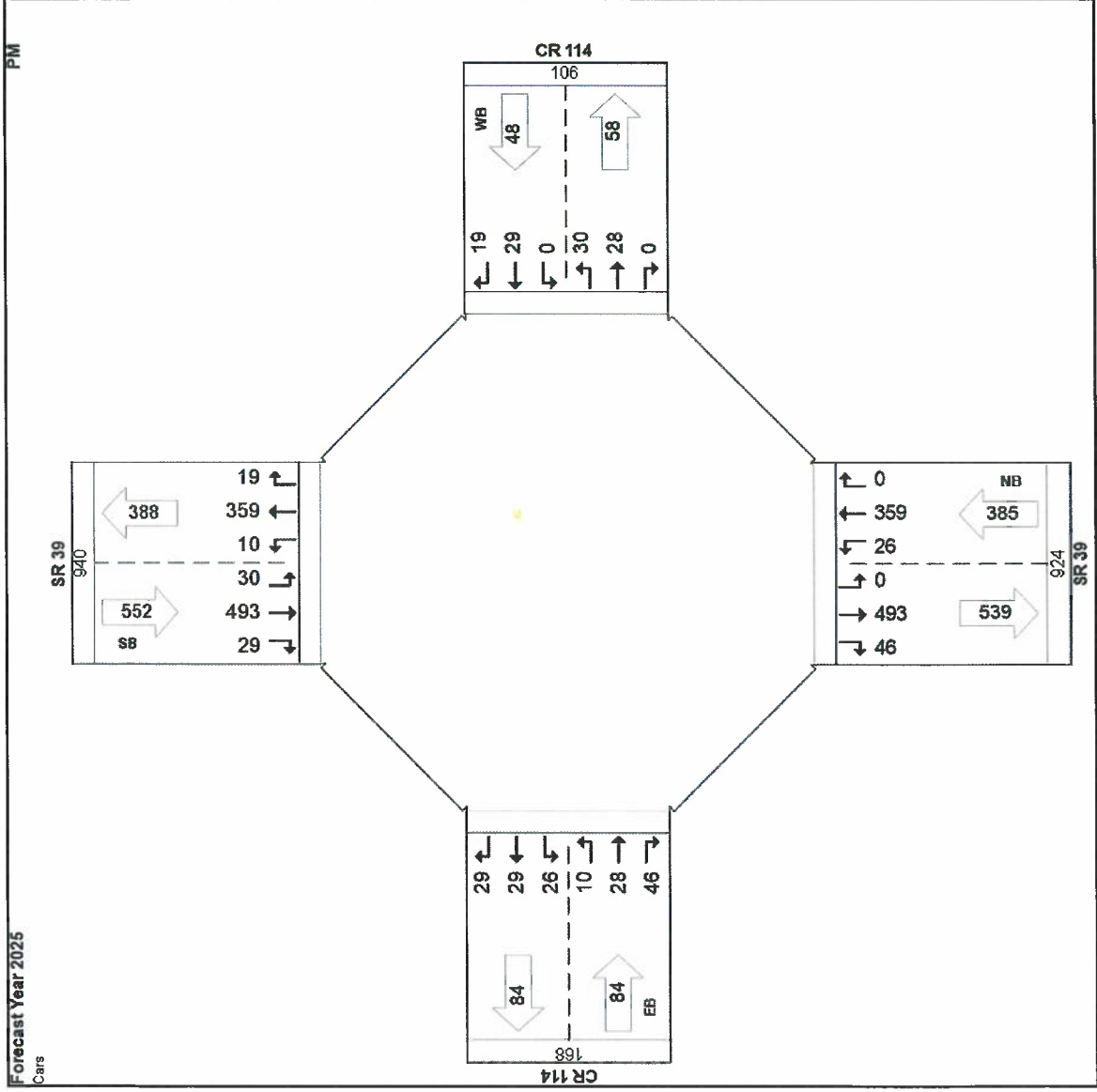
Opening Year Cars AM





TFMS - Intersection Forecast Report

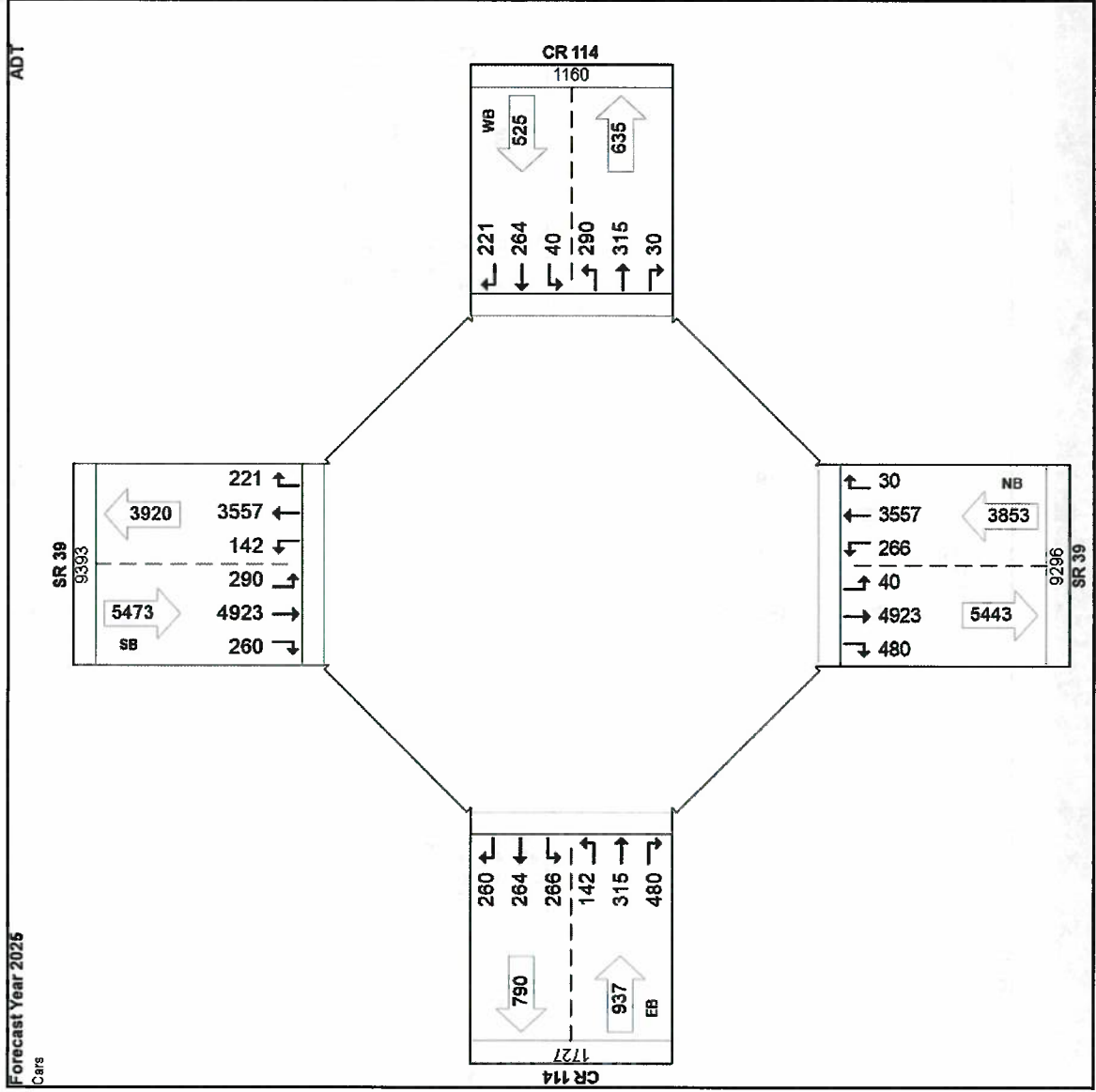
Opening Year Cars PM





TFMS - Intersection Forecast Report

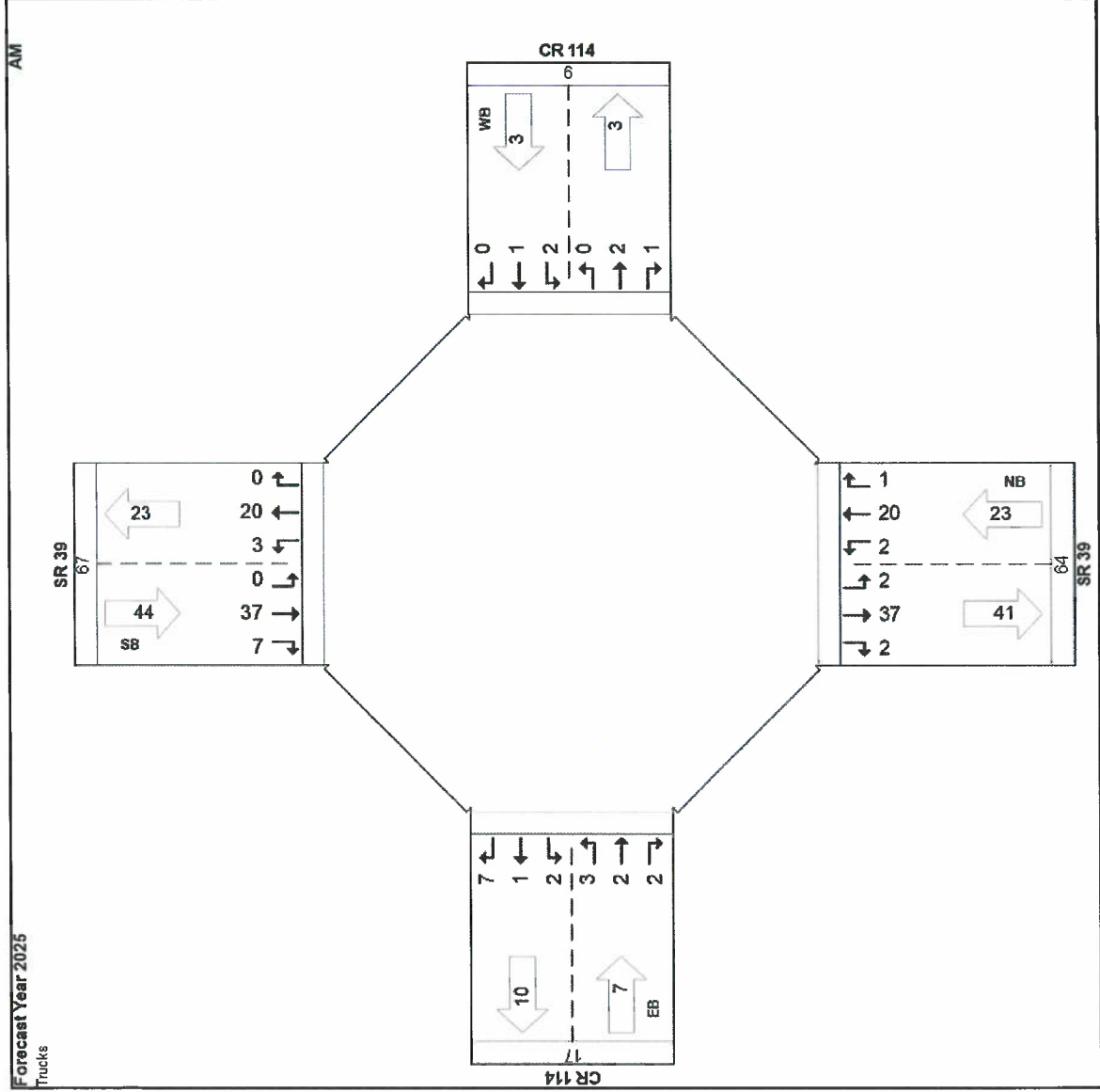
Opening Year Cars ADT





TFMS - Intersection Forecast Report

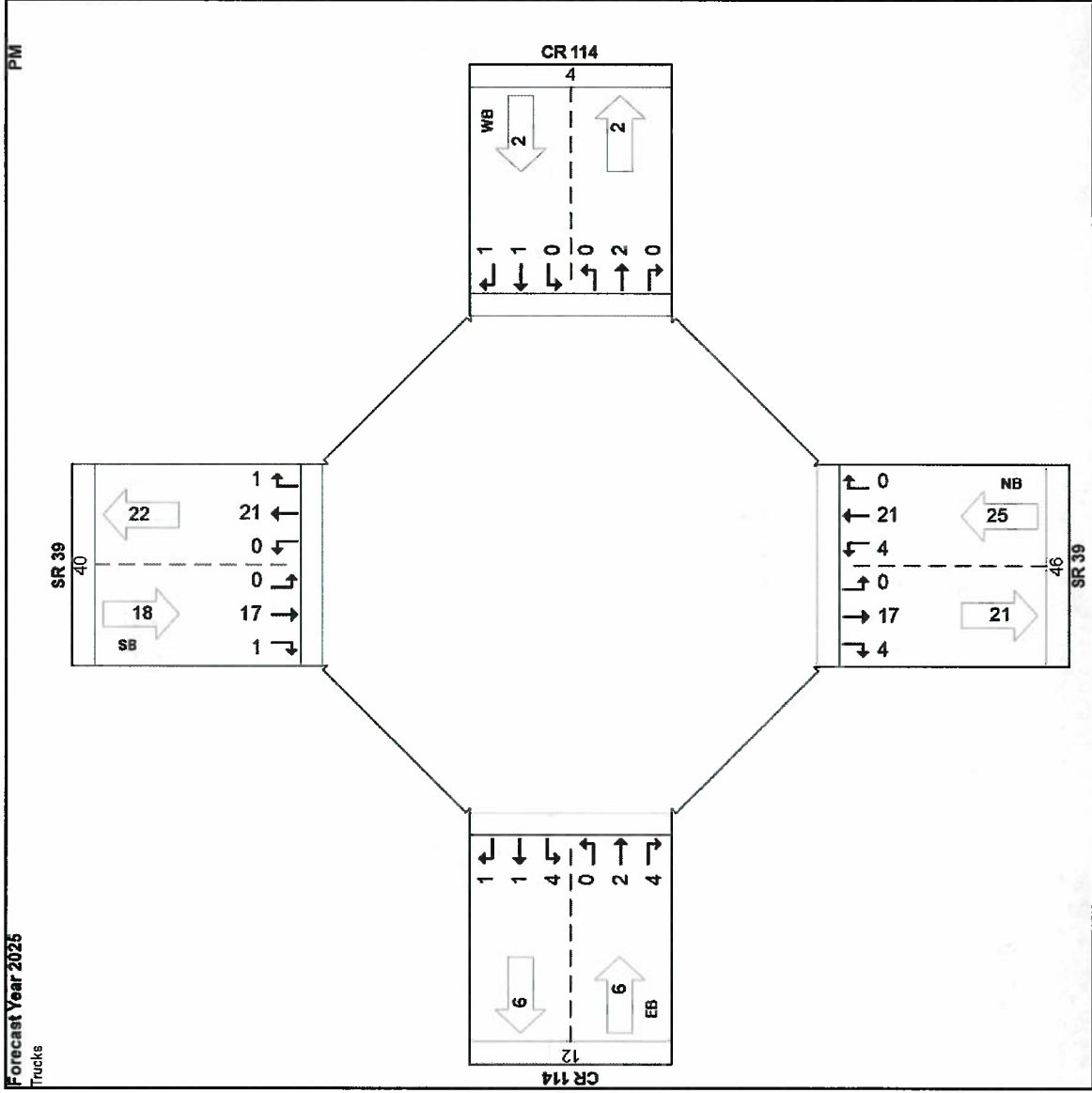
Opening Year Trucks AM





TFMS - Intersection Forecast Report

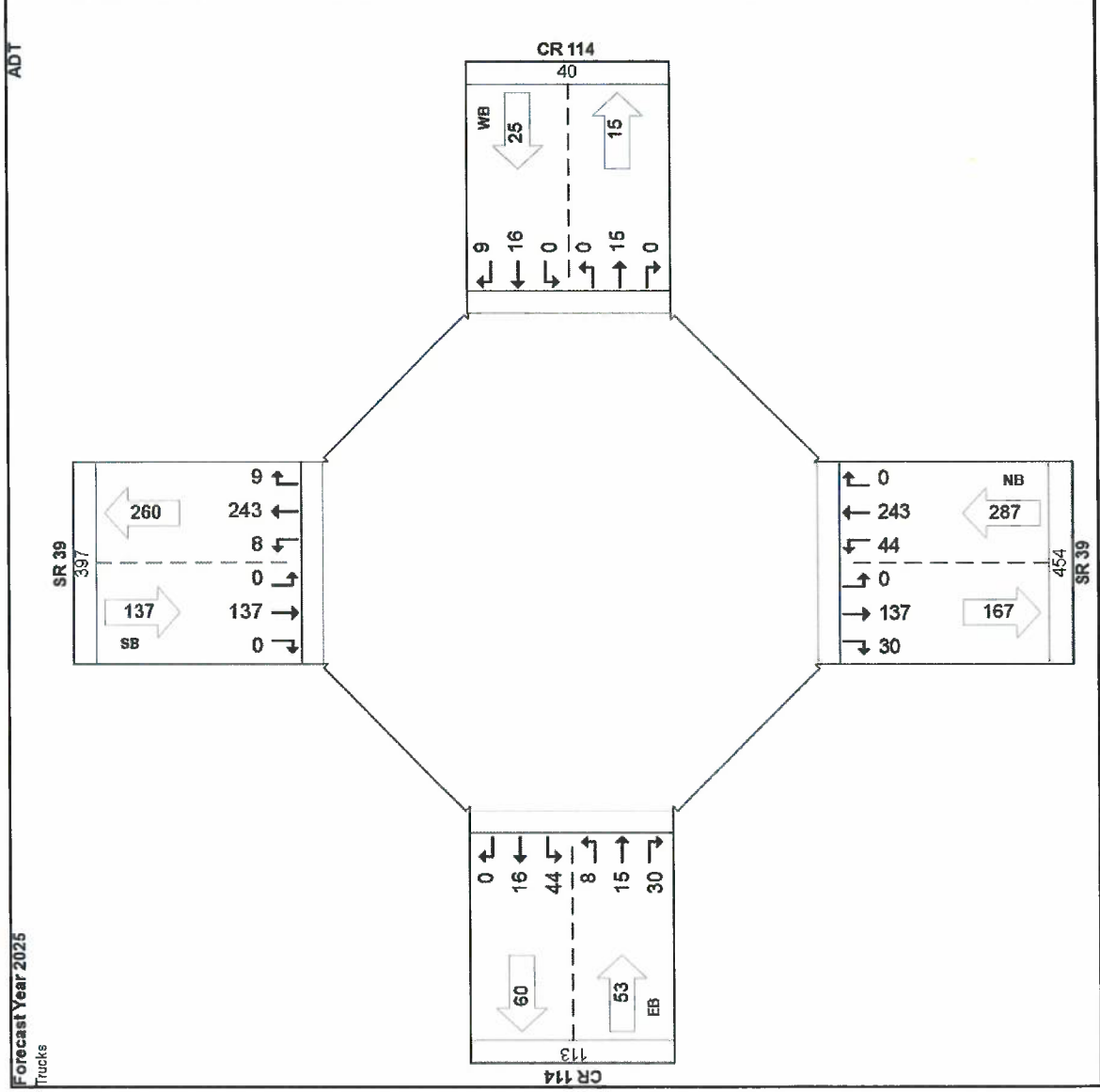
Opening Year Trucks PM





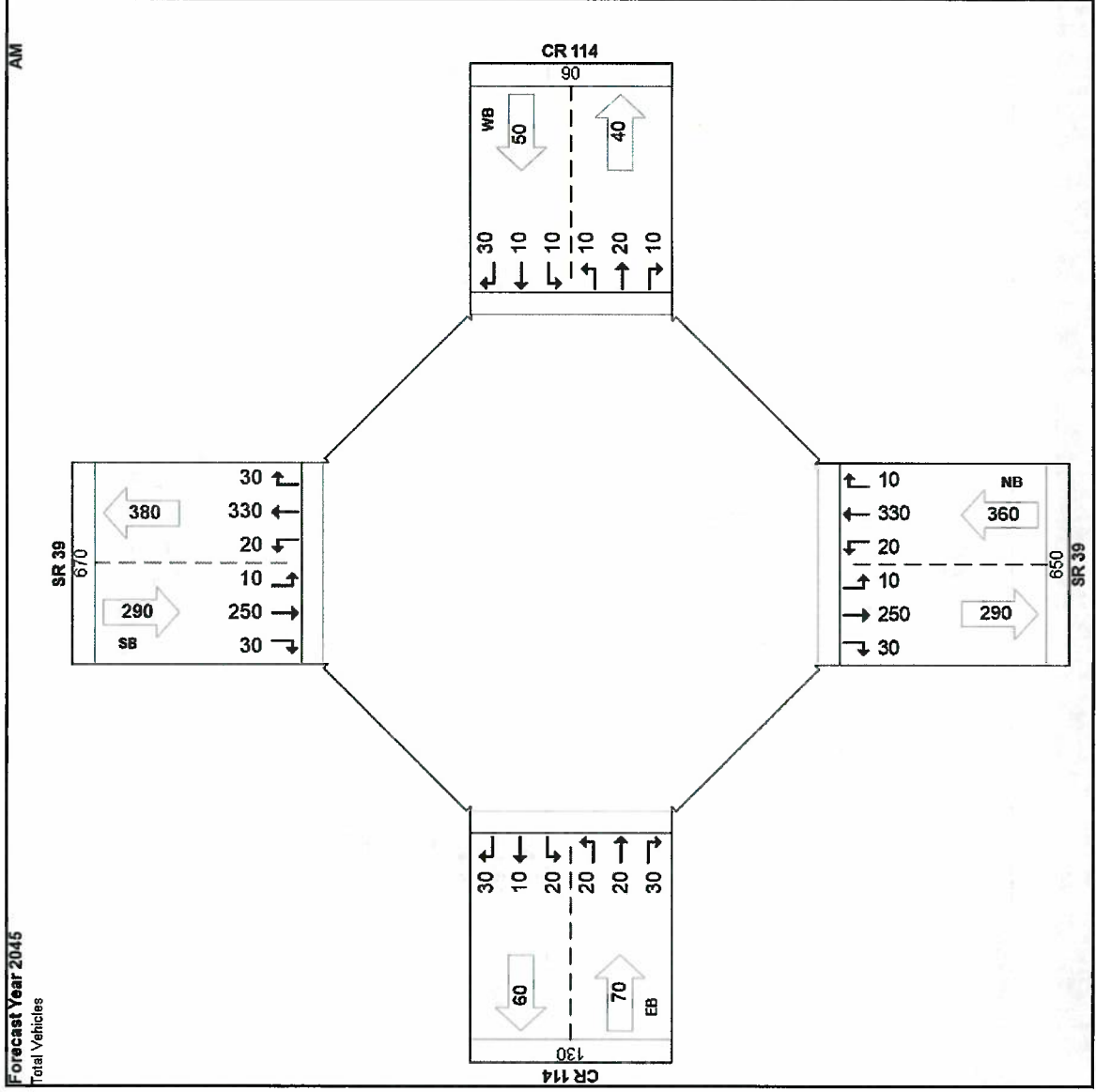
TFMS - Intersection Forecast Report

Opening Year Trucks ADT





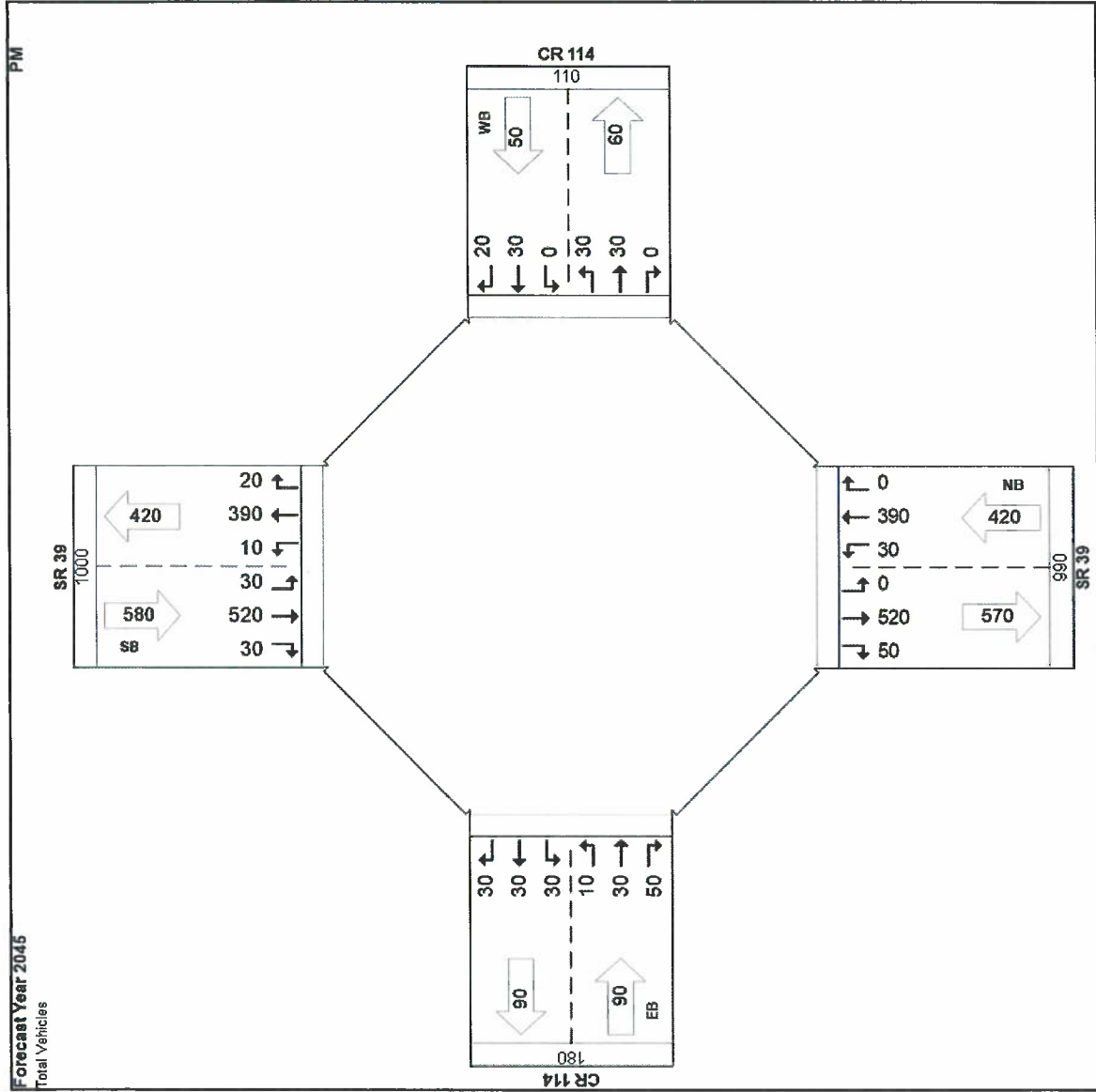
Design Year AM





TFMS - Intersection Forecast Report

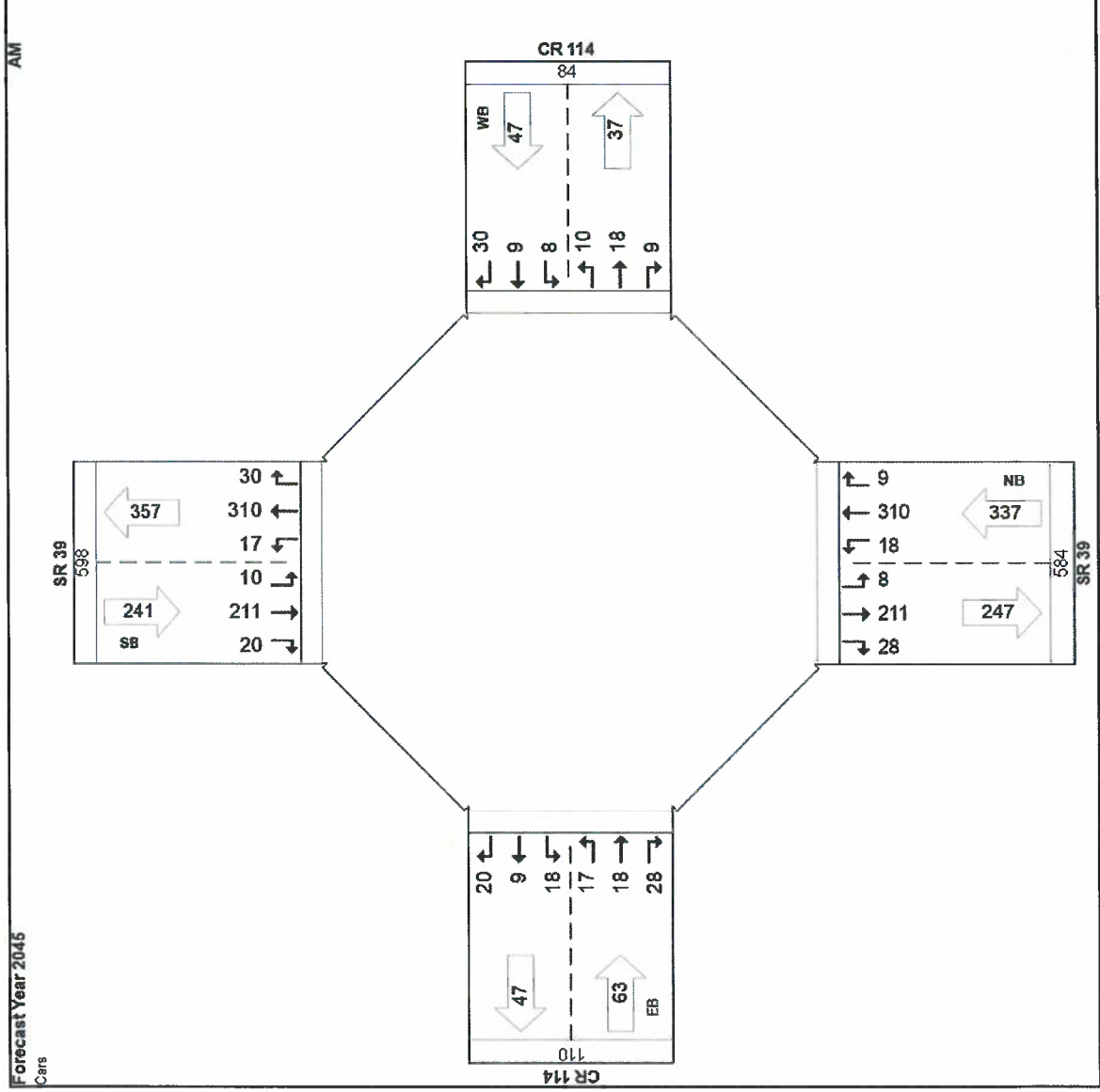
Design Year PM





TFMS - Intersection Forecast Report

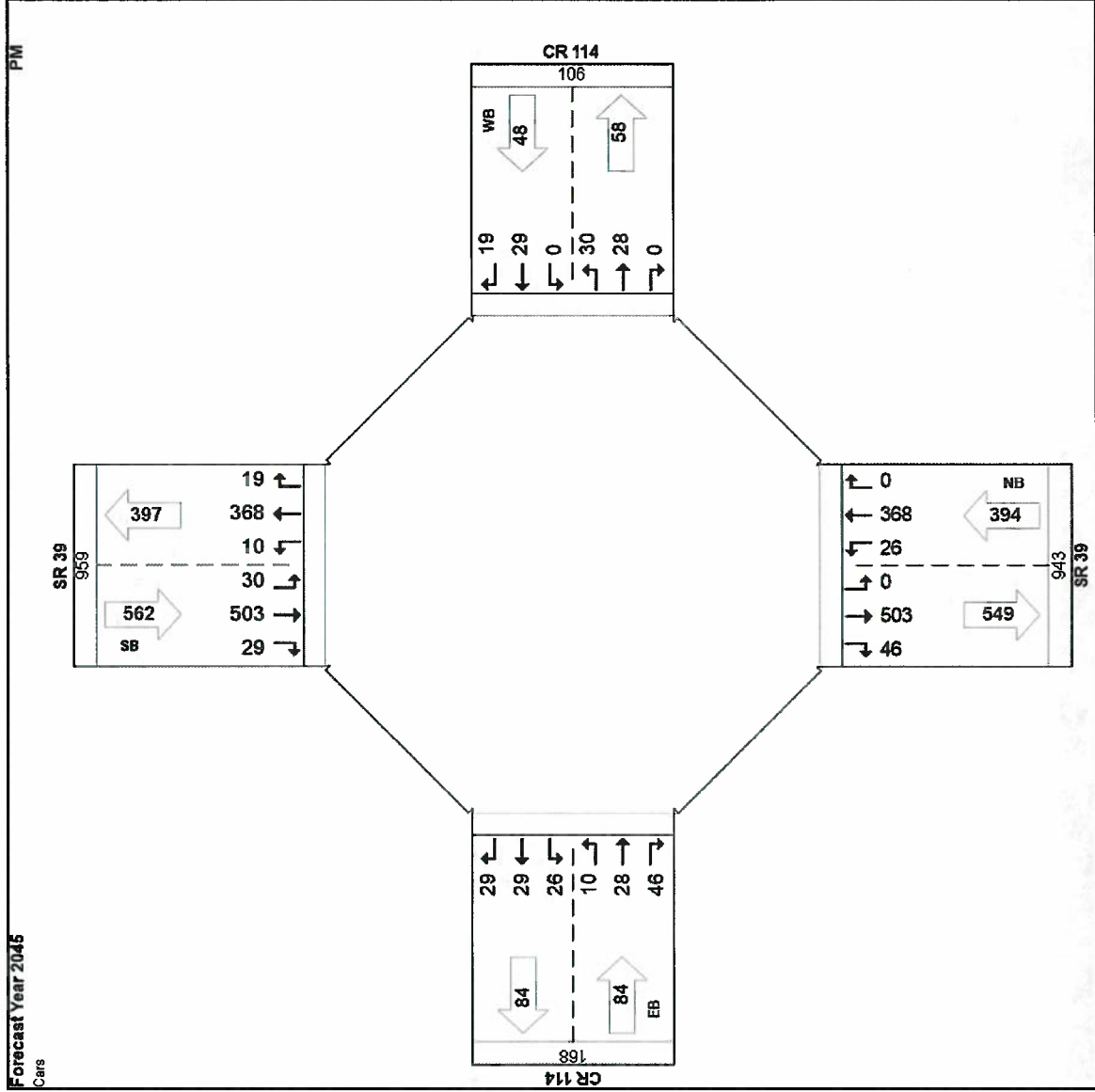
Design Year Cars AM





TFMS - Intersection Forecast Report

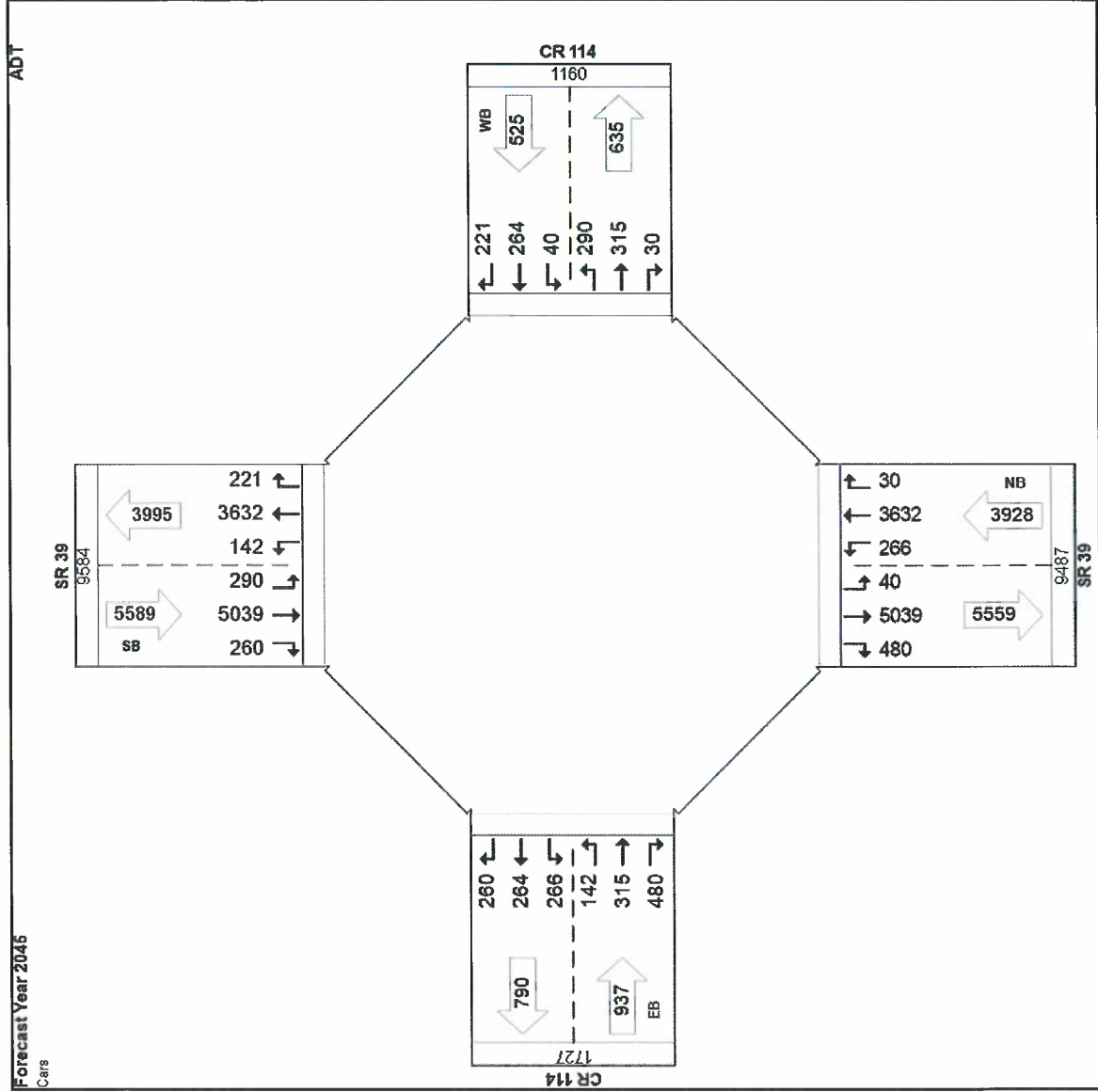
Design Year Cars PM





TFMS - Intersection Forecast Report

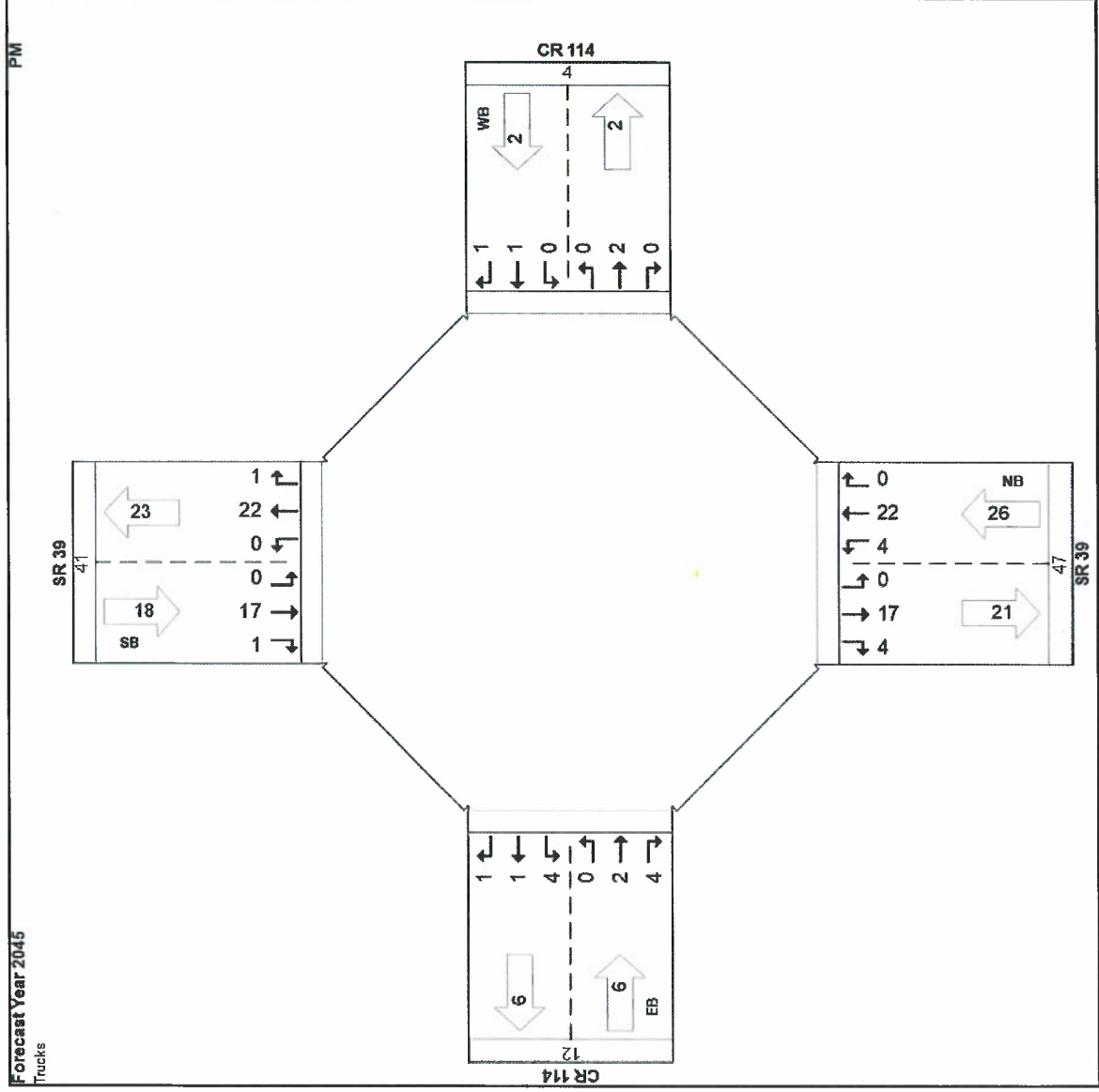
Design Year Cars ADT





TFMS - Intersection Forecast Report

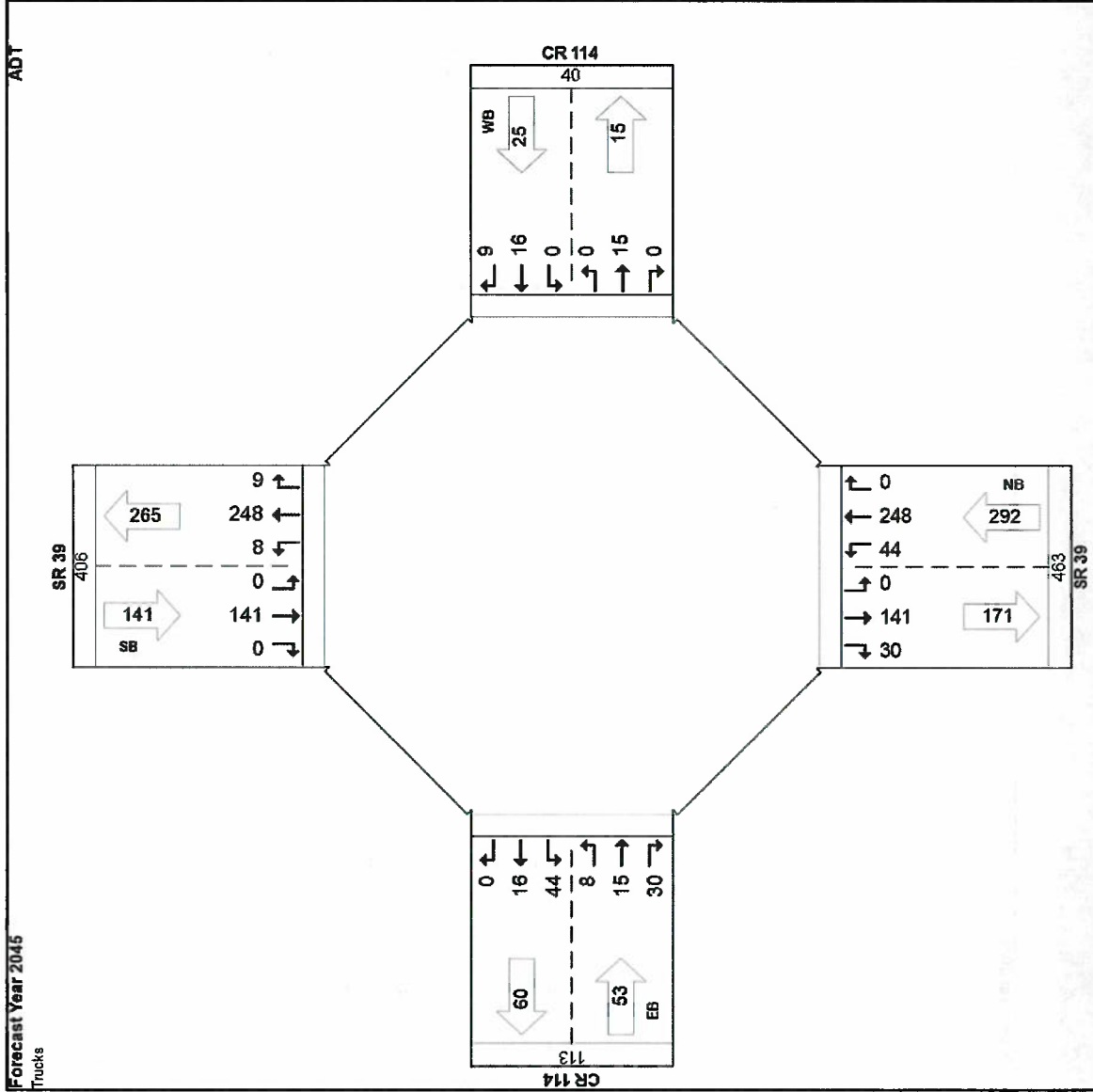
Design Year Trucks PM





TFMS - Intersection Forecast Report

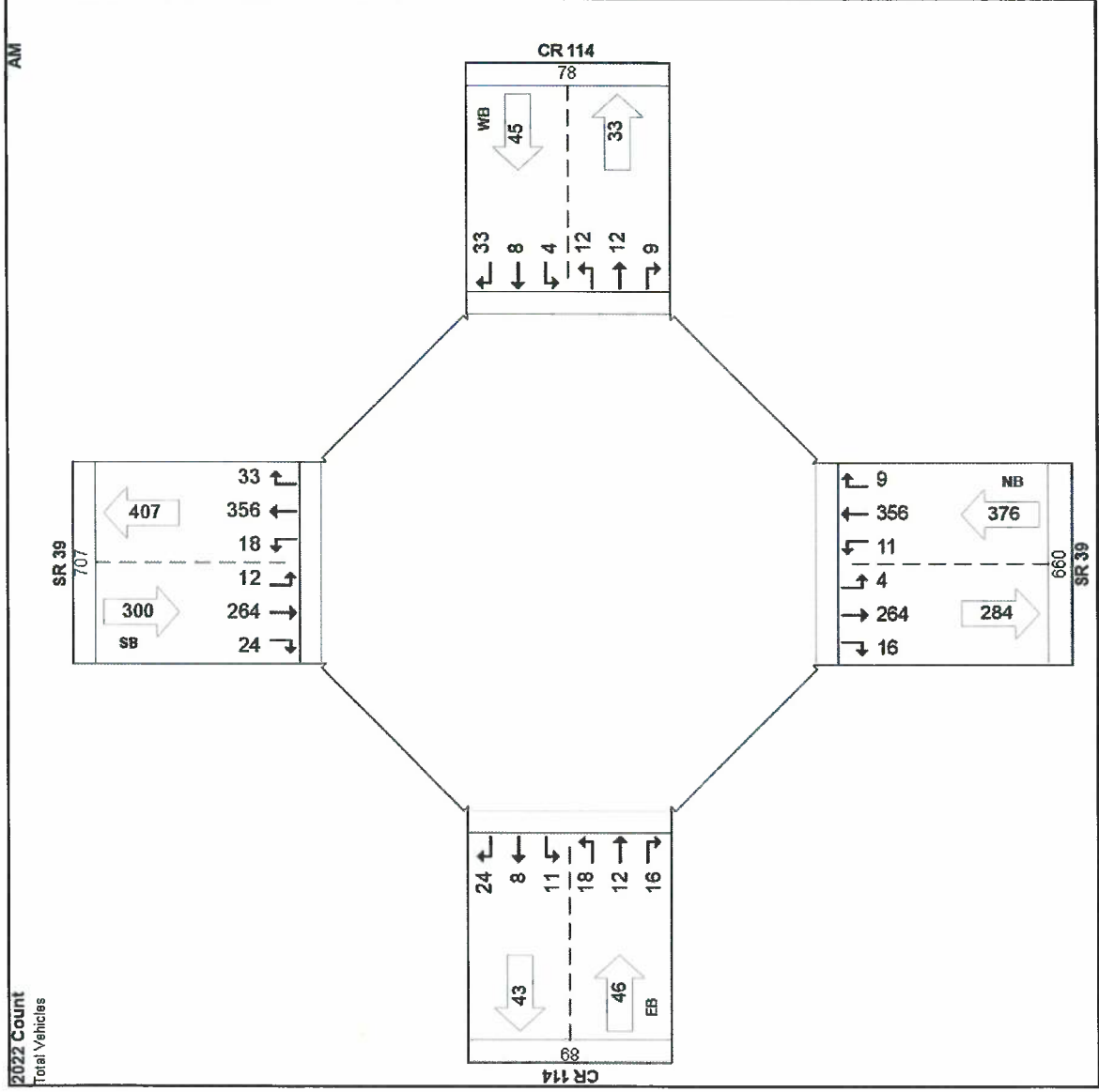
Design Year Trucks ADT





TFMS - Intersection Forecast Report

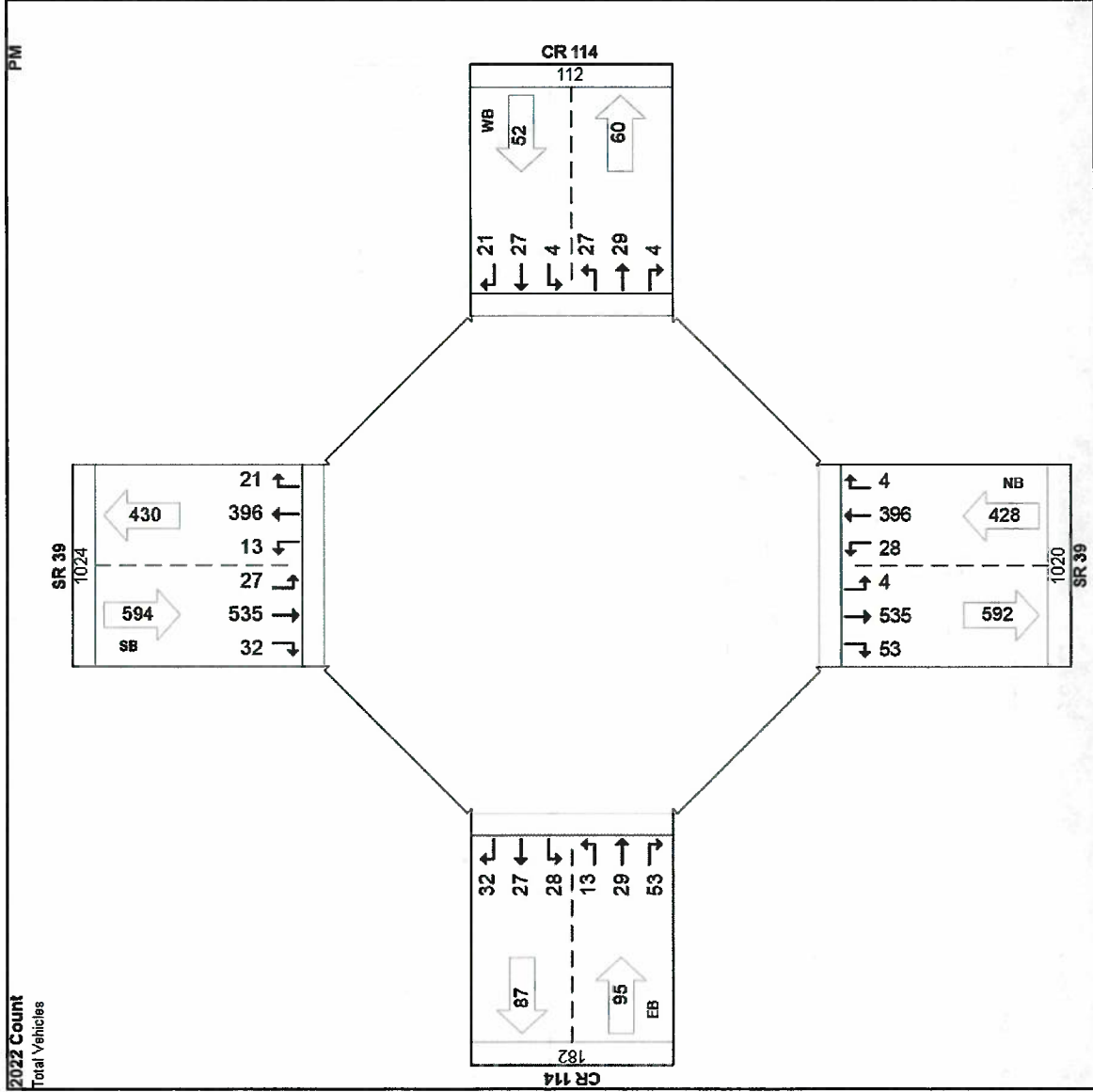
Pivot Point AM





TFMS - Intersection Forecast Report

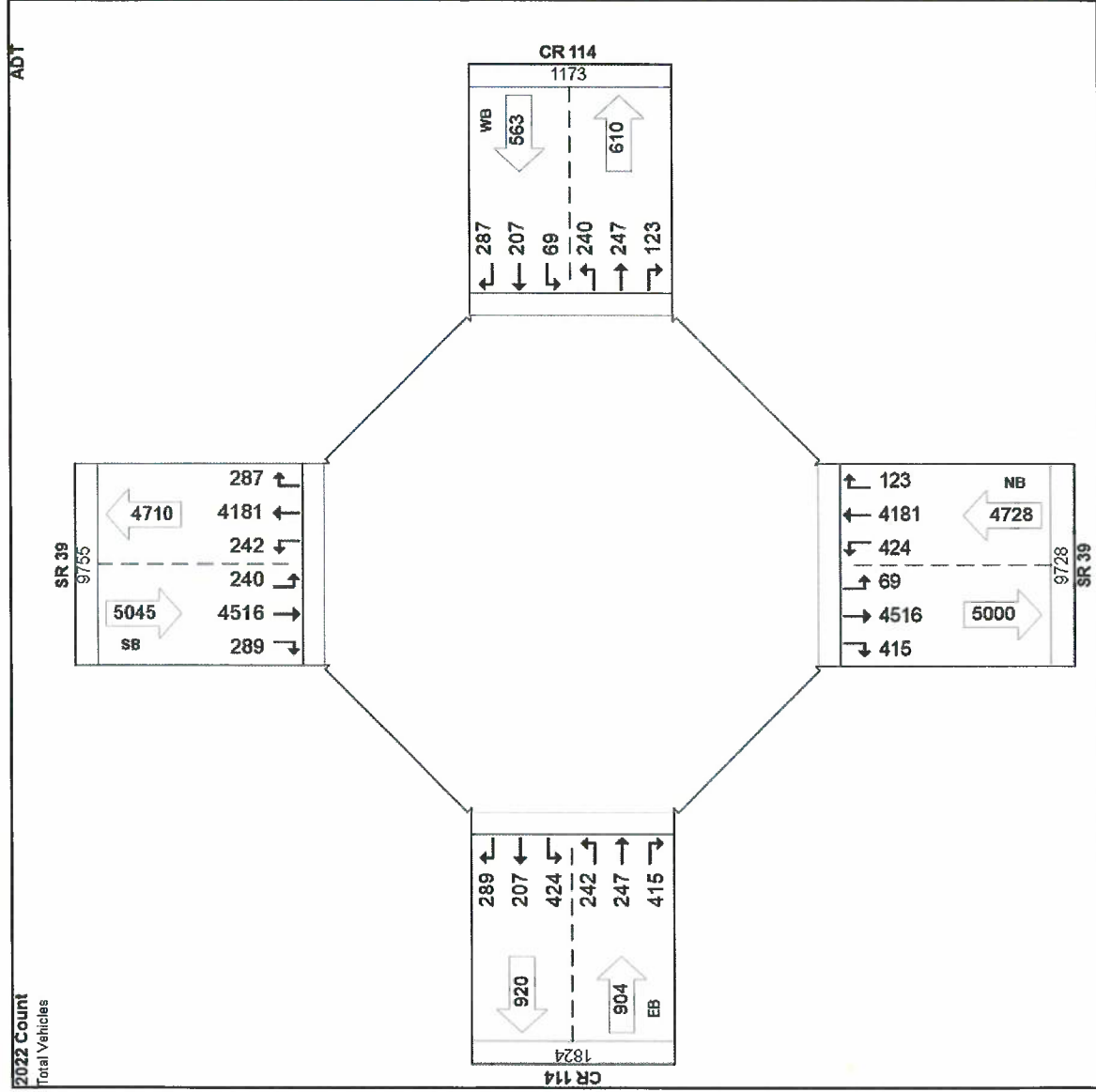
Pivot Point PM





TFMS - Intersection Forecast Report

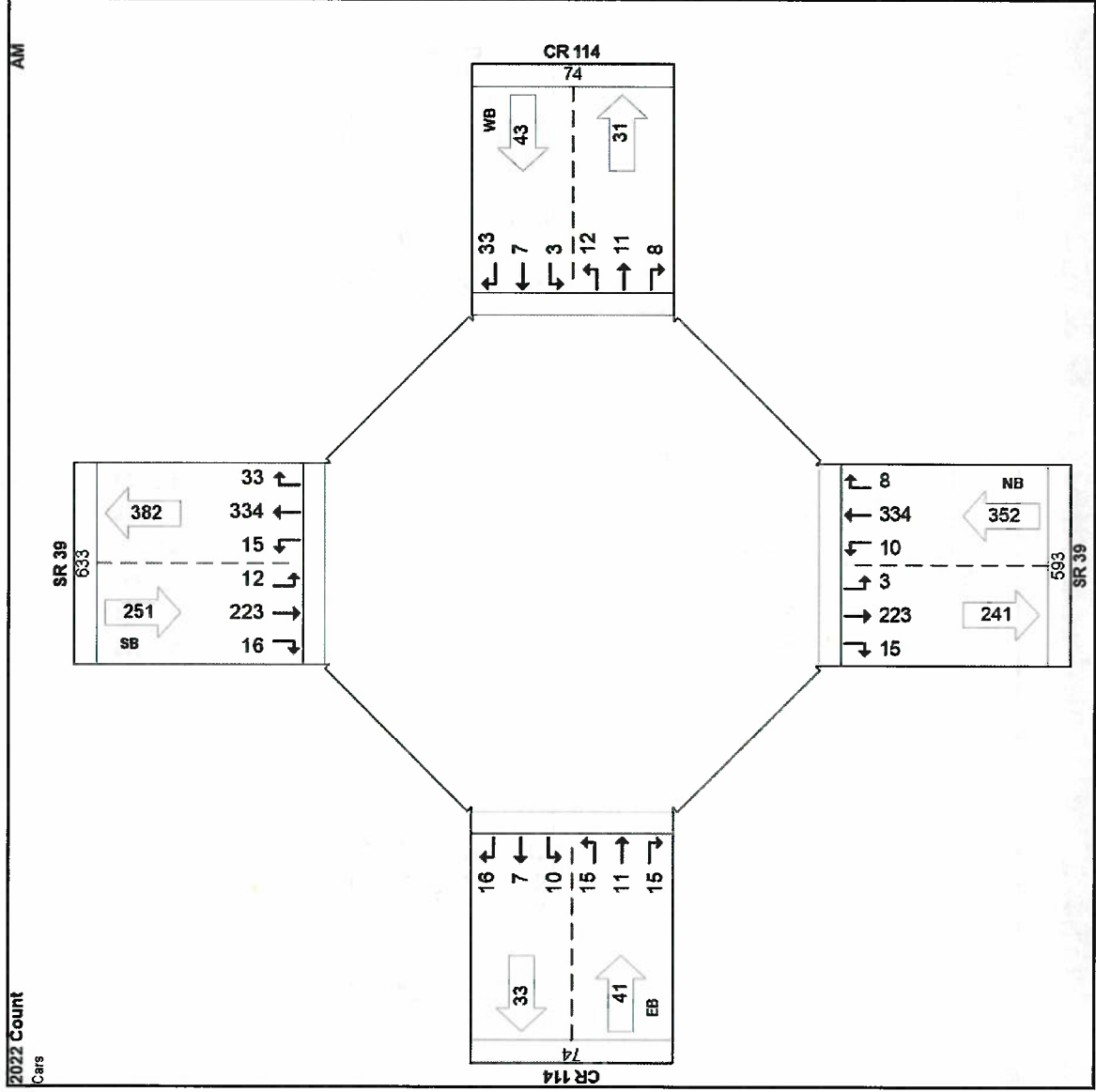
Pivot Point ADT





TFMS - Intersection Forecast Report

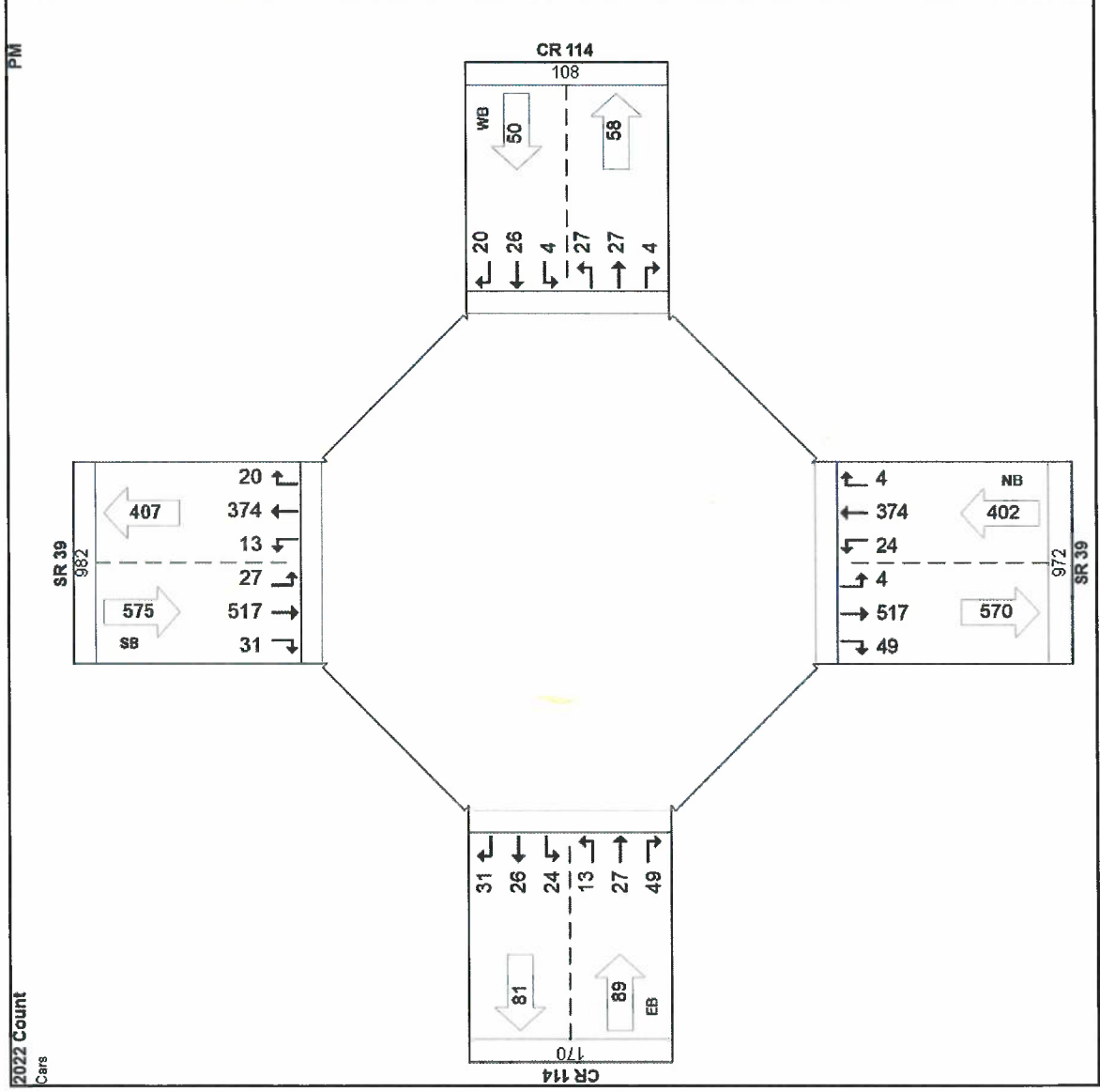
Pivot Point Cars AM





TFMS - Intersection Forecast Report

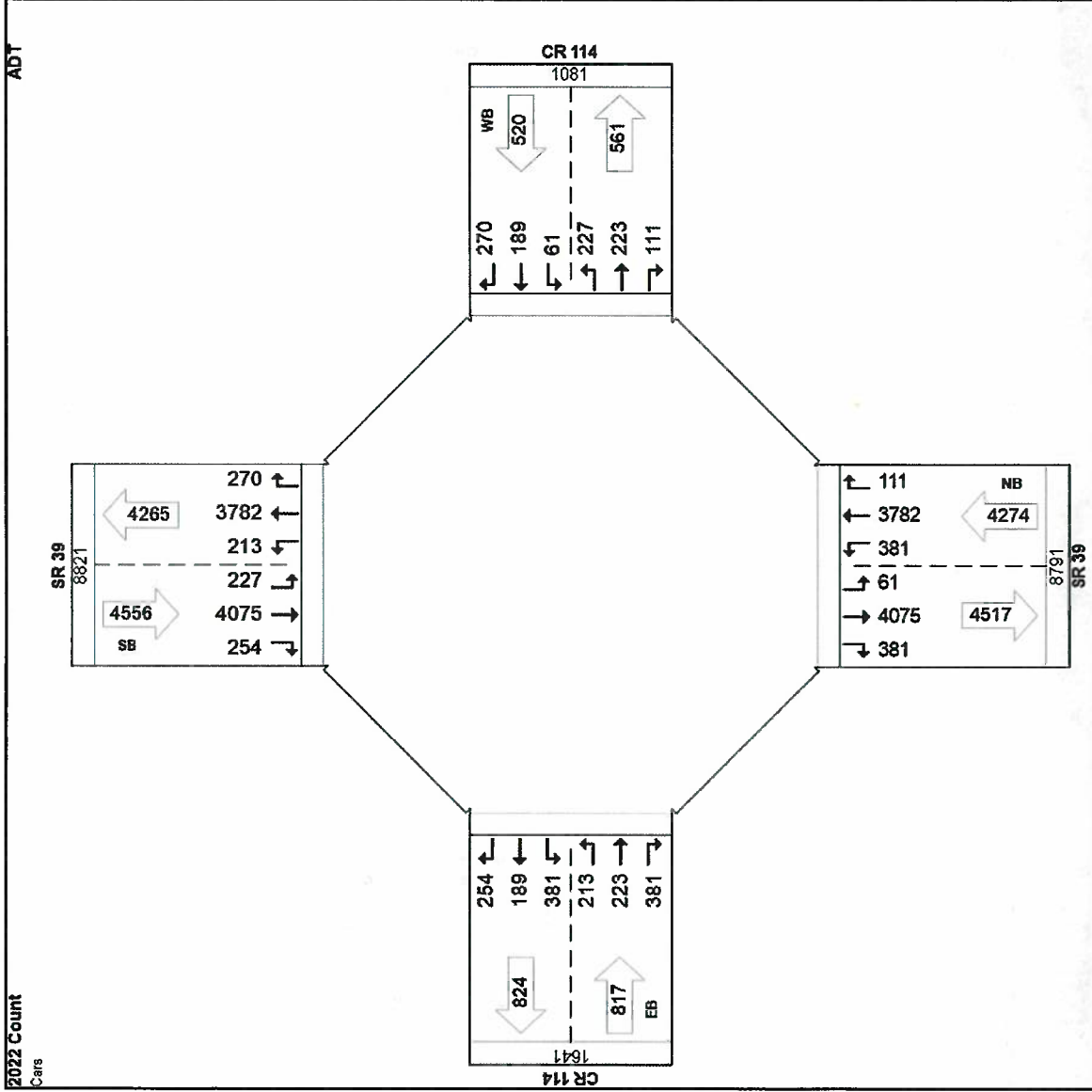
Pivot Point Cars PM





TFMS - Intersection Forecast Report

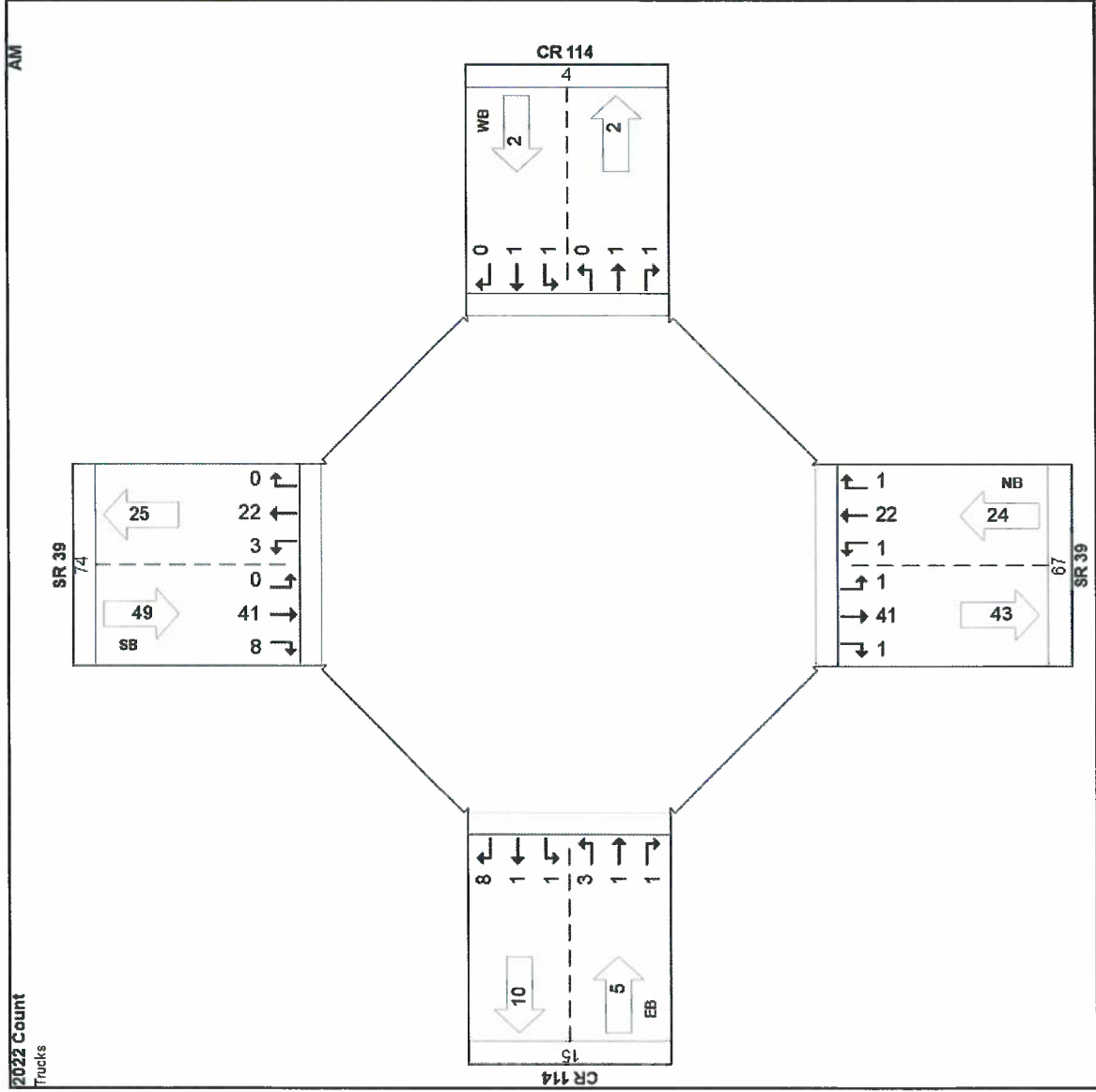
Pivot Point Cars ADT





TFMS - Intersection Forecast Report

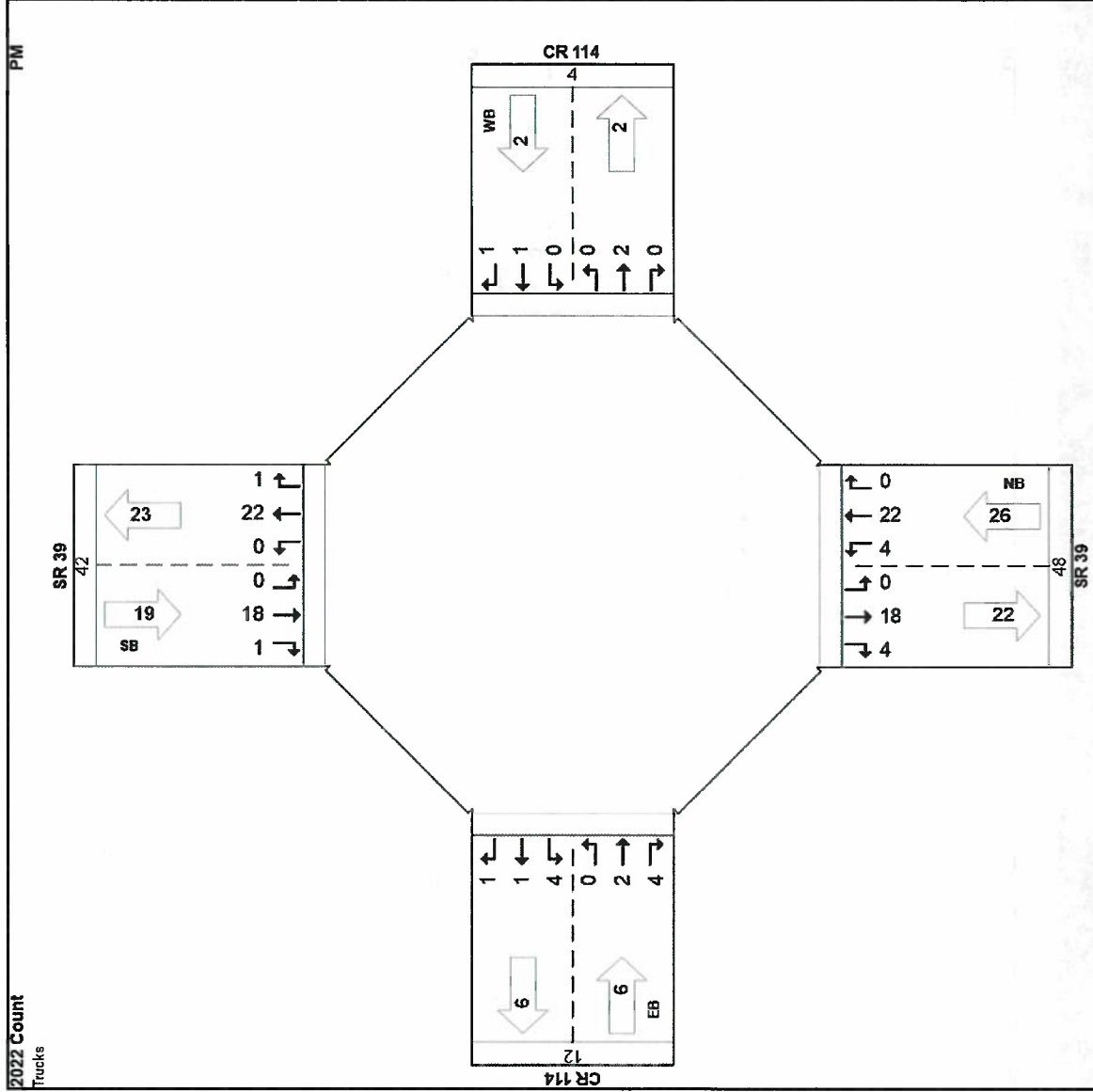
Pivot Point Trucks AM





TFMS - Intersection Forecast Report

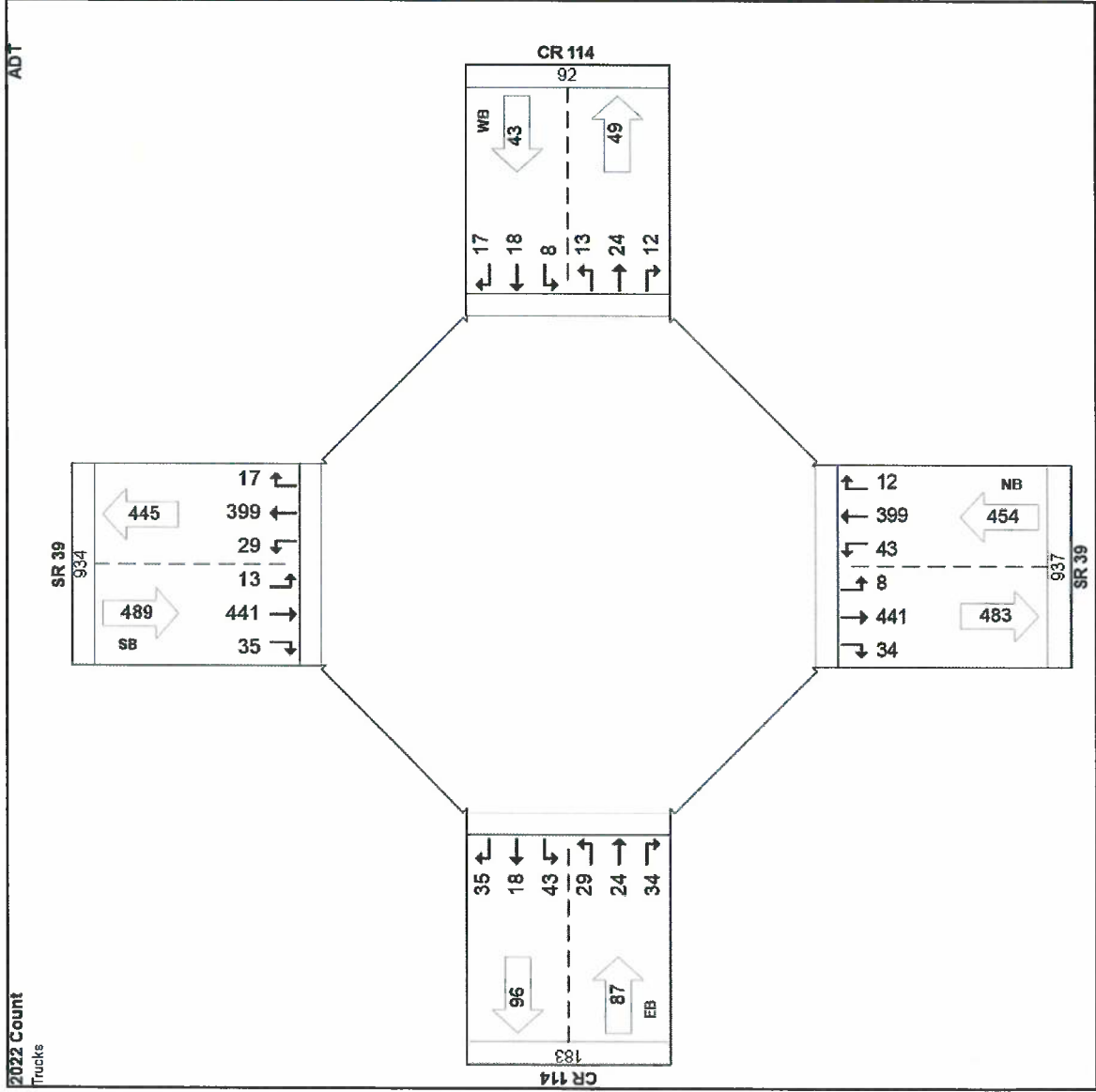
Pivot Point Trucks PM





TFMS - Intersection Forecast Report

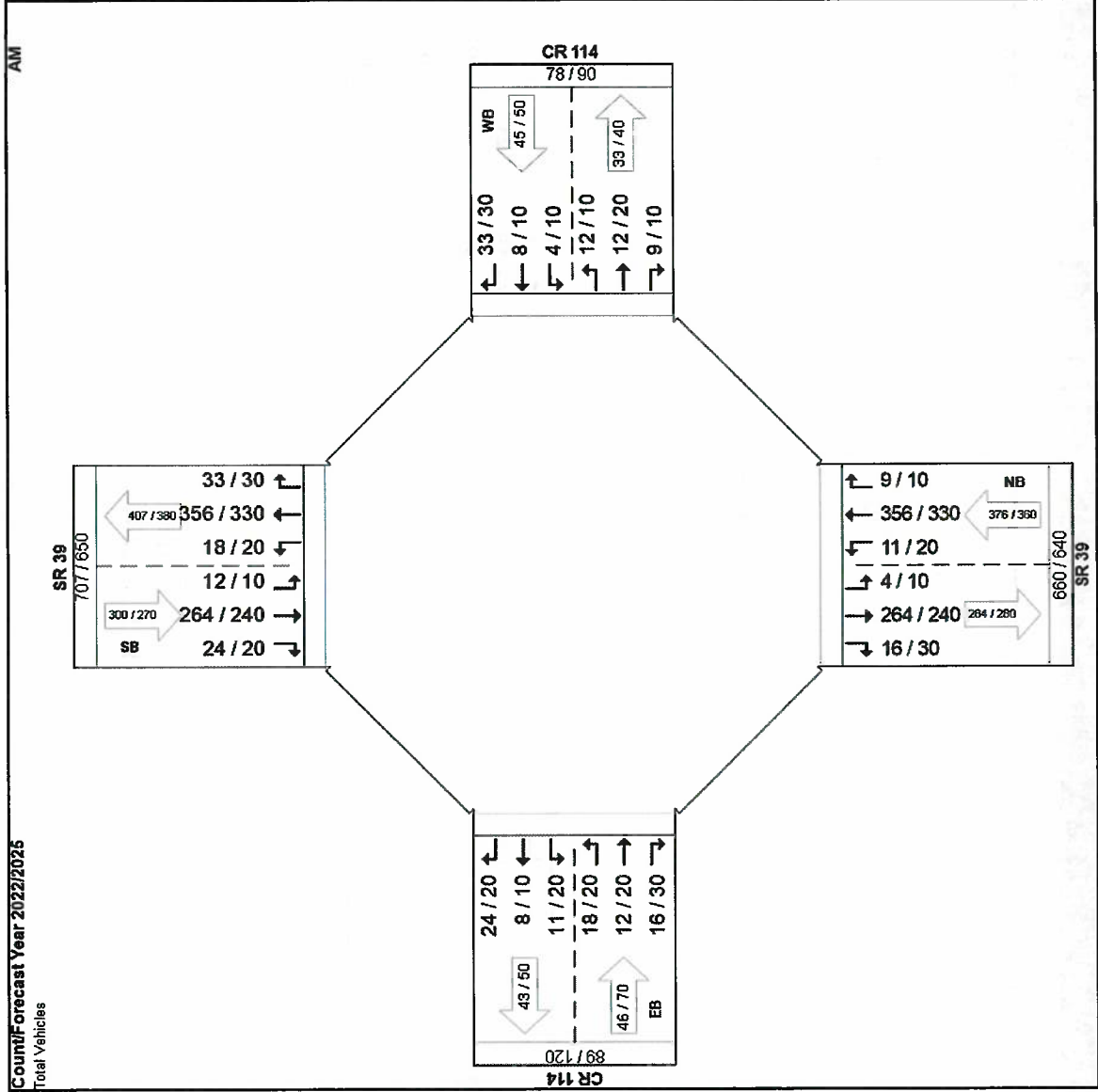
Pivot Point Trucks ADT





TFMS - Intersection Forecast Report

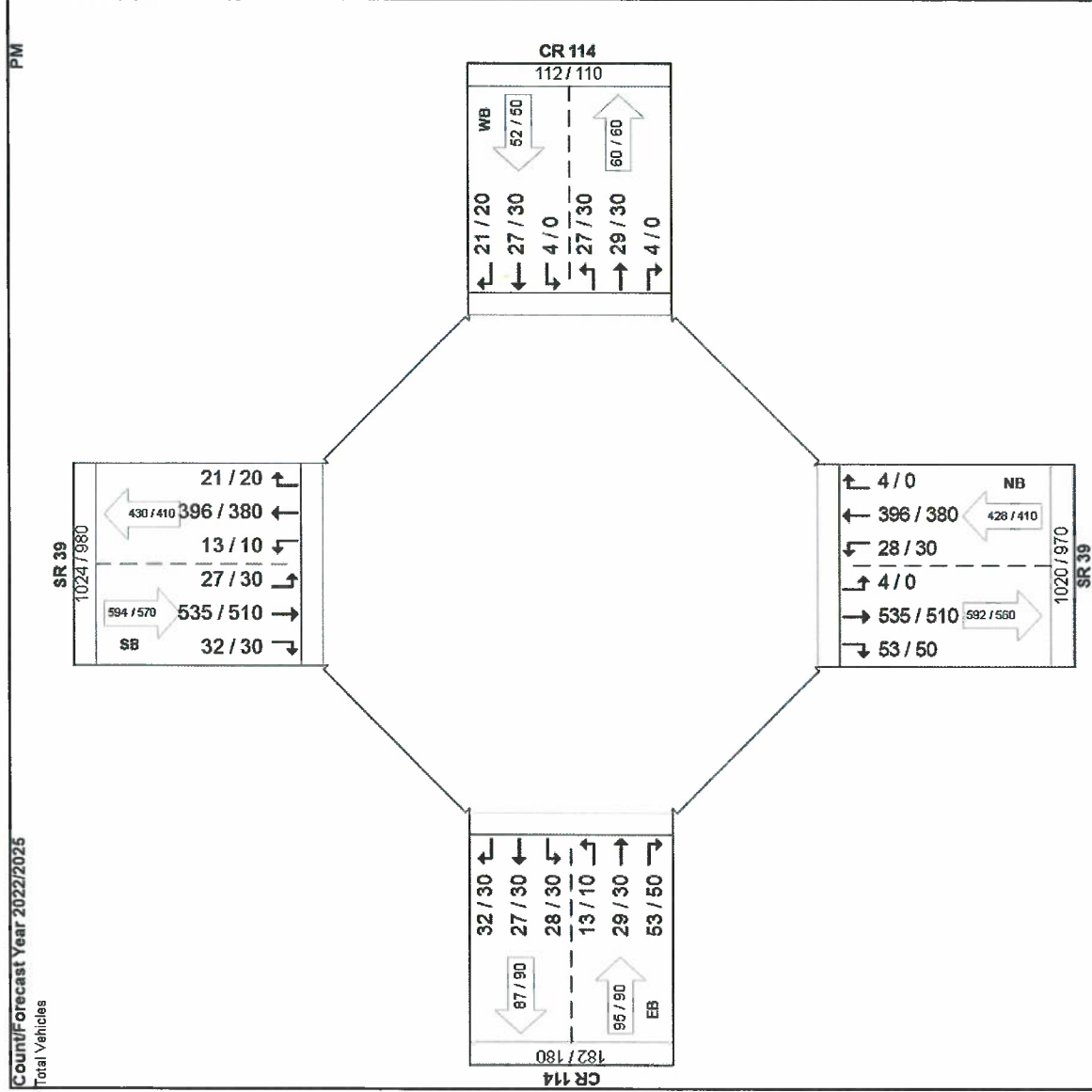
Count VS Opening Year AM





TFMS - Intersection Forecast Report

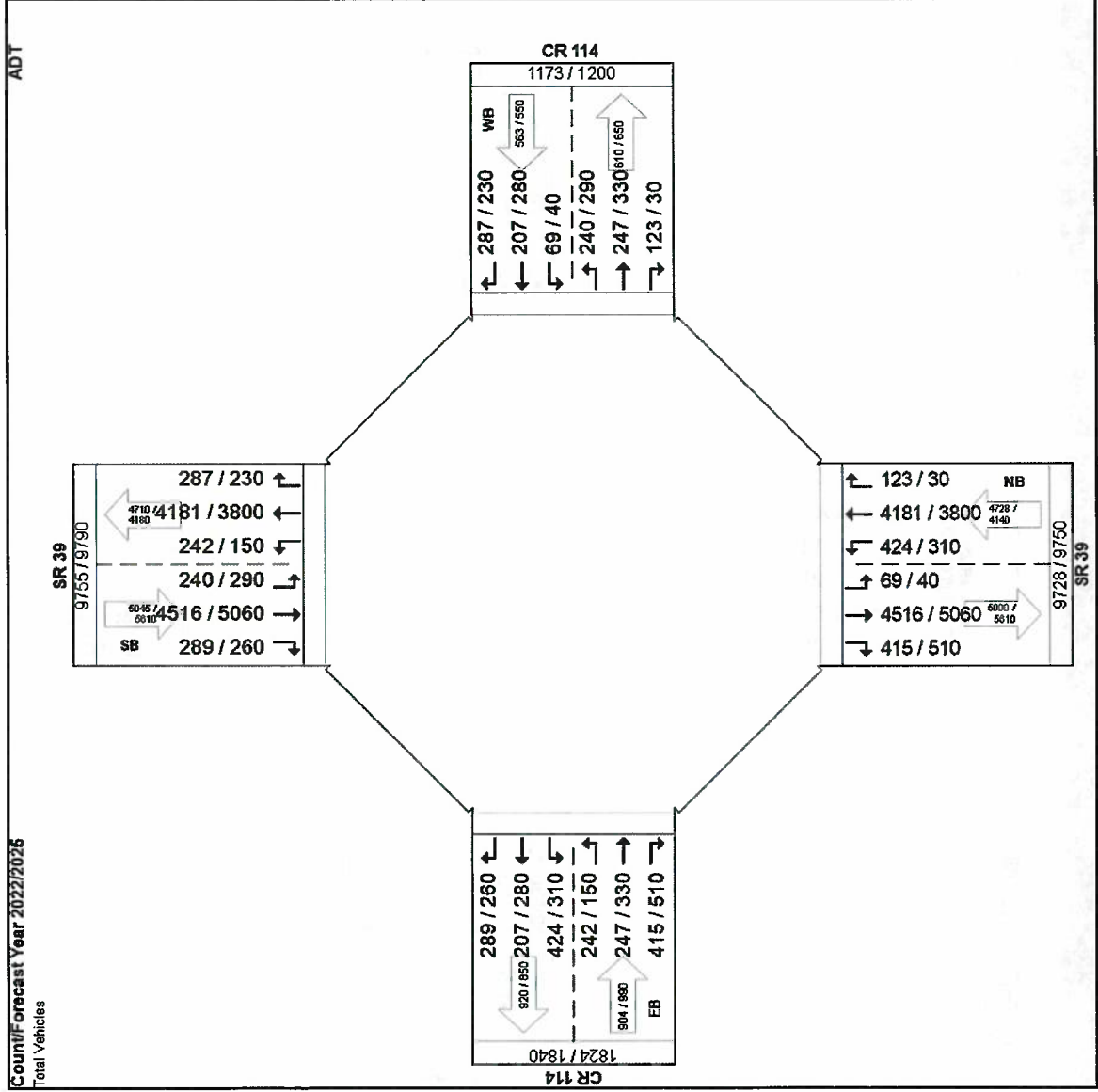
Count VS Opening Year PM





TFMS - Intersection Forecast Report

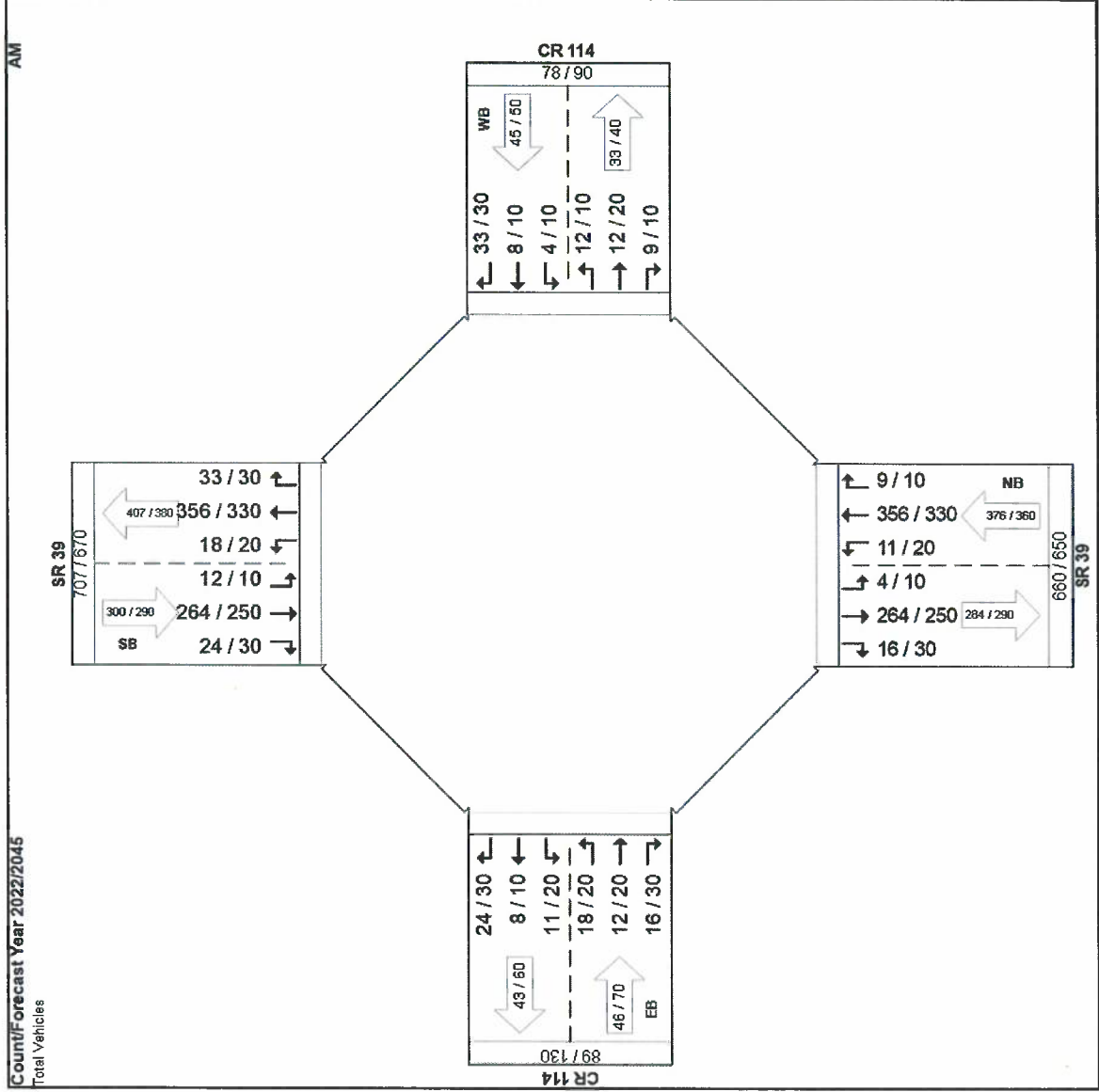
Count VS Opening Year ADT





TFMS - Intersection Forecast Report

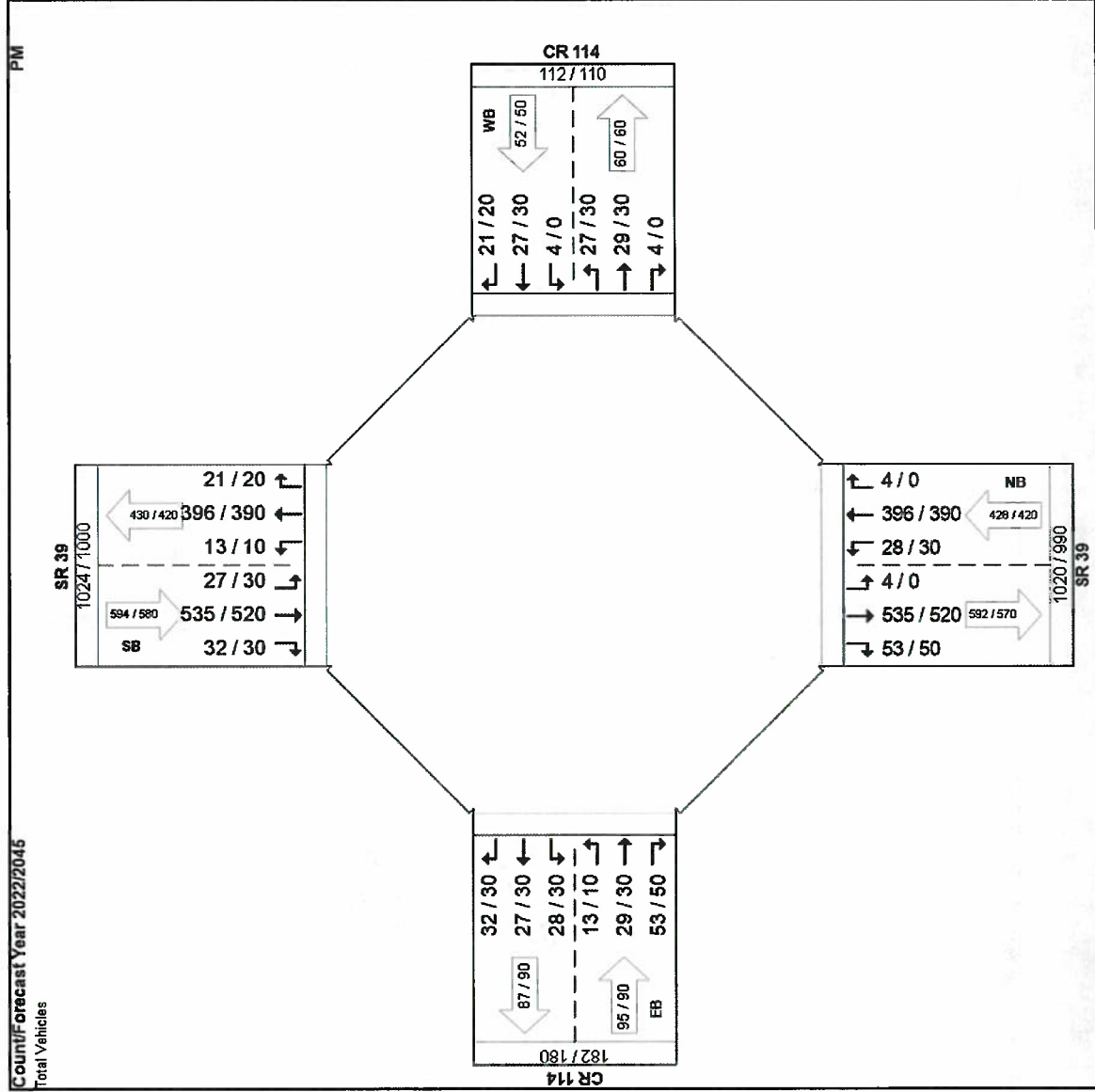
Count VS Design Year AM





TFMS - Intersection Forecast Report

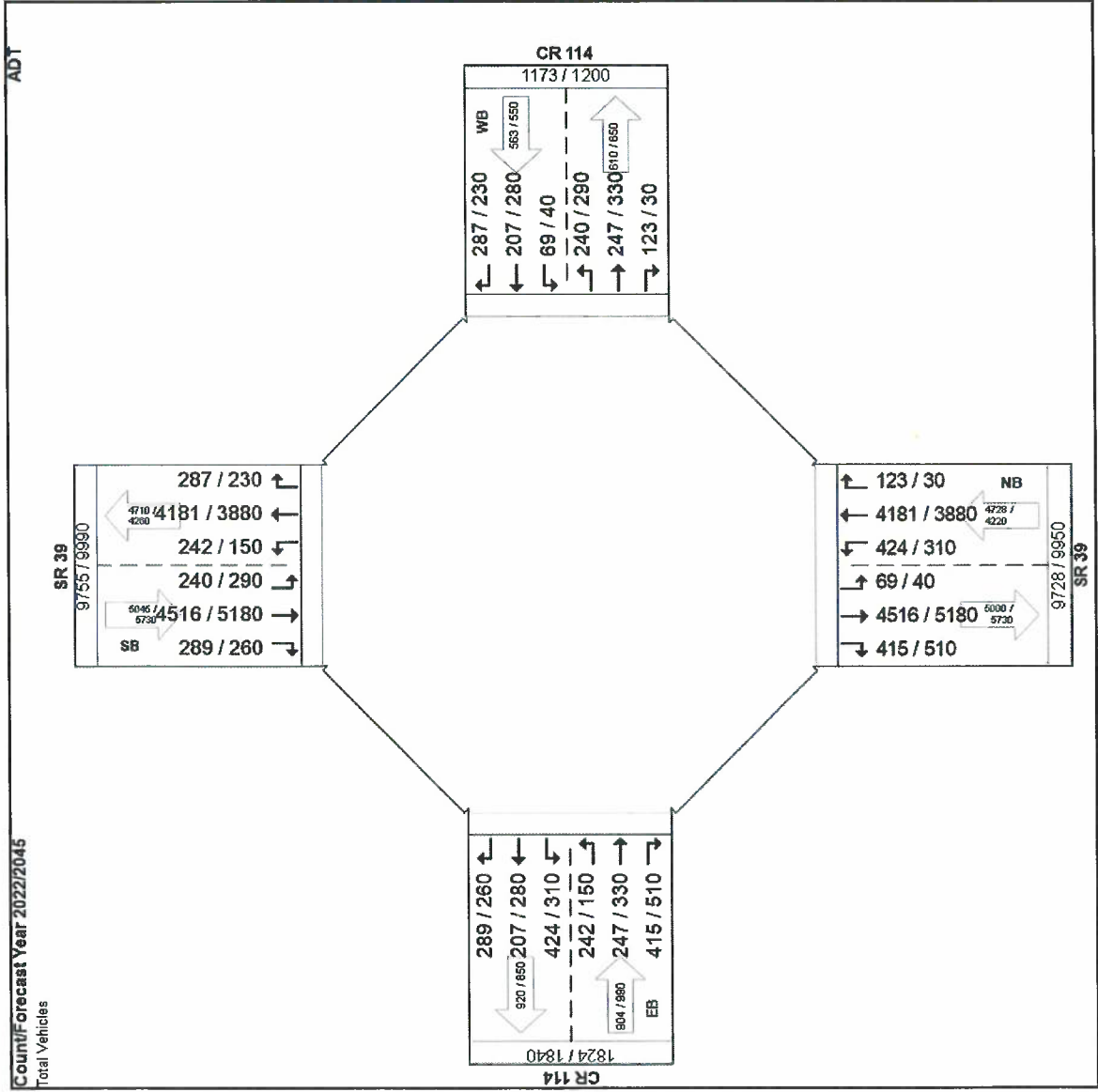
Count VS Design Year PM





TFMS - Intersection Forecast Report

Count VS Design Year ADT



Appendix D

Traffic Signal Warrant Analysis

STUDY AND ANALYSIS INFORMATION

Municipality:	Near the community of Walnut Creek	Traffic Volumes Obtained By:	MioVison
County:	Holmes	Analysis Date:	5/17/2022
ODOT Engineering District:	11	Agency/ Company Name Performing Warrant Analysis:	ODOT District 11
Google map link:	Map		

Analysis Information

Data Collection Date:

Day of the Week:

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

Existing Traffic Signal at intersection:

Total Number of Approaches at Intersection:

Major Street Information

Major Street Name and Route Number:

Major Street Approach Direction:

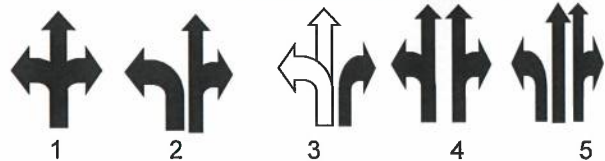
Number of Thru Lanes on Each Major Street Approach: LANE(S)

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

Minor Street Information

Minor Street Name and Route Number:

Minor Street Approach Configuration:



Number of Thru Lanes on Each Minor Street Approach: LANE(S)
 Apply Right Turn Lane Reduction*:

*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		Notes and Comments:			
	Applicable?	Satisfied?				
Warrant 1, Eight-Hour Vehicular Volume	Yes	No				
Warrant 2, Four-Hour Vehicular Volume	Yes	No				
Warrant 3, Peak Hour	Yes	No	Signals installed under Warrant 3 should be traffic actuated. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">4:00 PM</td></tr> <tr><td style="text-align: center;">5:00 PM</td></tr> </table>	Peak Hour	4:00 PM	5:00 PM
Peak Hour						
4:00 PM						
5:00 PM						
For Warrants 1-3, new ODOT signals must be based off of 100% volume thresholds (TEM 402-3.2)						
Warrant 4, Pedestrian Volume	No	No	If this warrant is met, and a traffic control signal is justified by an engineering study, the traffic control signal shall be equipped with pedestrian signal heads complying with the provisions set forth in Chapter 4E of the OMUTCD. <table border="1" style="float: right; margin-top: 5px;"> <tr><td style="text-align: center;">Peak Hour</td></tr> <tr><td style="text-align: center;">3:45 PM</td></tr> <tr><td style="text-align: center;">4:45 PM</td></tr> </table>	Peak Hour	3:45 PM	4:45 PM
Peak Hour						
3:45 PM						
4:45 PM						
Warrant 5, School Crossing	No	No	N/A			
Warrant 6, Coordinated Signal System	N/A	No	(Shall not be used as the sole warrant in the analysis)			
Warrant 7, Crash Experience	No	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	No	(Shall not be used as the sole warrant in the analysis)			
Warrant 9, Intersection Near a Grade Crossing	N/A	No	Figure 4C-9			
Multi-Way Stop Warrant	Yes	Yes	May be used as an interim measure if traffic signal warrants are satisfied.			

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

<p>If no warrants are satisfied, additional options may be considered:</p> <ol style="list-style-type: none"> 1. An engineering study, performed by a firm prequalified by ODOT for signal design, if approved by the ODOT district, may be used to justify a new signal installation or retention of an existing signal that otherwise does not meet the published warrants. An example of such an instance is a traffic signal in proximity to a railroad crossing that serves to reduce queuing across the tracks. 2. According to TEM 402-2, If the actual turning movement counts fail to satisfy a signal warrant, it may be acceptable to use traffic volumes projected to the second year after project completion. The Modeling and Forecasting Section should provide the projected traffic volumes. 3. A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a location that does not meet traffic signal warrants (see Chapter 4C of TEM) or at a location that meets traffic signal warrants under Sections 4C.05 and/or 4C.06 but a decision is made to not install a traffic control signal. Please fill inputs on PHB Score Sheet and submit to ODOT.
--

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

Conclusion:

Notes:

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%		80%		80%		56%		56%	
	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																
2:00 AM	0	0																
2:15 AM	0	0																
2:30 AM	0	0																
2:45 AM	0	0																
3:00 AM	0	0																
3:15 AM	0	0																
3:30 AM	0	0																
3:45 AM	0	0																
4:00 AM	0	0																
4:15 AM	0	0																
4:30 AM	0	0																
4:45 AM	0	0																
5:00 AM	0	0																
5:15 AM	0	0																
5:30 AM	0	0																
5:45 AM	0	0																
6:00 AM	0	0																
6:15 AM	138	15																
6:30 AM	346	24												1				
6:45 AM	515	32	1		1					1		1					1	
7:00 AM	666	42							1			1						
7:15 AM	678	42																
7:30 AM	604	45												1				
7:45 AM	572	54	1		1					1							1	1
8:00 AM	562	56							1	1								
8:15 AM	518	59																
8:30 AM	500	52												1				
8:45 AM	492	43			1						1					1	1	
9:00 AM	480	38																
9:15 AM	505	36	1															
9:30 AM	518	40												1				
9:45 AM	548	44			1				1		1						1	1

10:00 AM	578	46																
10:15 AM	594	50	1															
10:30 AM	646	45								1		1						
10:45 AM	677	47		1				1		1						1		1
11:00 AM	678	53																
11:15 AM	694	52	1															
11:30 AM	694	57								1		1						
11:45 AM	679	52		1				1		1						1		1
12:00 PM	692	59																
12:15 PM	705	58	1															
12:30 PM	694	56								1		1						
12:45 PM	674	64		1				1	1	1						1		1
1:00 PM	690	57																
1:15 PM	708	56	1															
1:30 PM	760	53				1				1		1						
1:45 PM	781	49		1				1		1						1		1
2:00 PM	793	56																
2:15 PM	832	61	1															
2:30 PM	798	63				1					1	1	1					
2:45 PM	846	67		1				1	1	1						1		1
3:00 PM	907	74																
3:15 PM	967	79	1															
3:30 PM	1023	86				1	1				1	1	1	1				
3:45 PM	1051	87		1				1	1	1						1		1
4:00 PM	1029	100																
4:15 PM	951	94	1															
4:30 PM	904	92				1	1				1	1	1	1				
4:45 PM	823	88		1				1	1	1						1		1
5:00 PM	724	69																
5:15 PM	655	76	1															
5:30 PM	580	68											1					
5:45 PM	510	59		1						1						1		1
6:00 PM	466	52																
6:15 PM	320	30																
6:30 PM	198	23																
6:45 PM	97	14																
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																
HOURS MET			11	0	12	0	4	2	10	5	12	0	8	3	12	2	12	11
WARRANT SATISFIED?			NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

Warrant Met: **No**

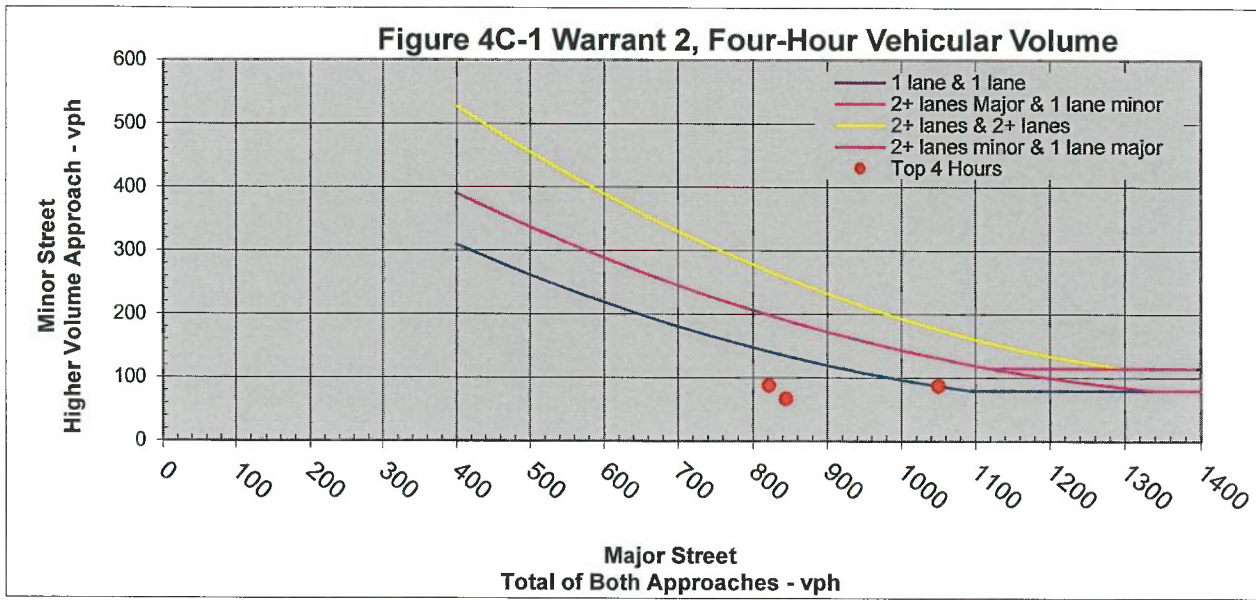
Notes:

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	1
Major street: 1 Lane Minor Street: 1 Lane	Total Number of Unique Hours Met on Figure 4C-2 (70% Factor)	3

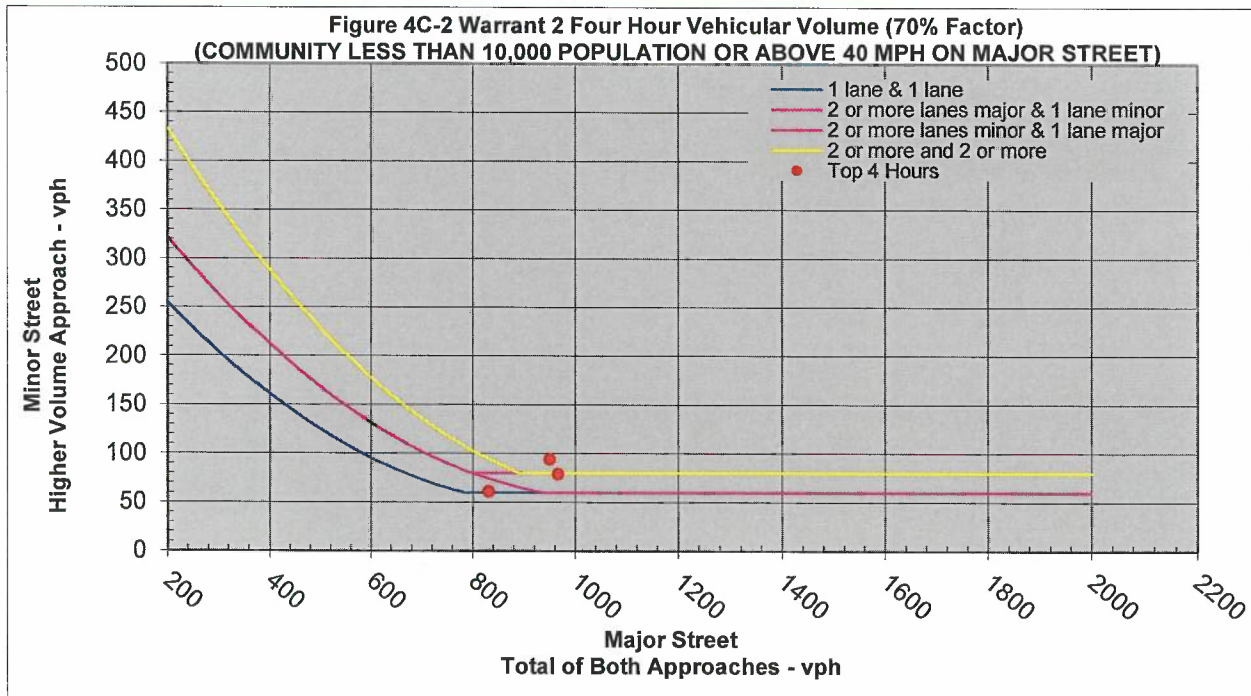
Built up Isolated Community with Less Than 10,000 Population or Above 40 MPH on Major Street? **Yes**

Hour Interval Beginning At	Raw Traffic Counts				Total Major Approach Volumes	Highest Actual Minor Street Approach Volumes	Hour Met?	Hour Met? (70% Factor)
	Major - SR 39		Minor - CR 114					
	N-Bound	S-Bound	W-Bound	E-Bound				
6:00 AM	0	0	0	0	0	0		
6:15 AM	87	51	15	10	138	15		
6:30 AM	204	142	24	22	346	24		
6:45 AM	308	207	32	31	515	32		
7:00 AM	382	284	42	42	666	42		
7:15 AM	376	302	28	42	678	42		
7:30 AM	339	265	24	45	604	45		
7:45 AM	317	255	32	54	572	54		
8:00 AM	321	241	33	56	562	56		
8:15 AM	299	219	34	59	518	59		
8:30 AM	278	222	36	52	500	52		
8:45 AM	267	225	36	43	492	43		
9:00 AM	258	222	33	38	480	38		
9:15 AM	267	238	28	36	505	36		
9:30 AM	270	248	31	40	518	40		
9:45 AM	279	269	27	44	548	44		
10:00 AM	300	278	29	46	578	46		
10:15 AM	309	285	37	50	594	50		
10:30 AM	339	307	34	45	646	45		
10:45 AM	348	329	33	47	677	47		
11:00 AM	339	339	27	53	678	53		
11:15 AM	349	345	21	52	694	52		
11:30 AM	349	345	29	57	694	57		
11:45 AM	348	331	28	52	679	52		
12:00 PM	359	333	33	59	692	59		
12:15 PM	369	336	39	58	705	58		
12:30 PM	360	334	33	56	694	56		
12:45 PM	343	331	39	64	674	64		
1:00 PM	346	344	38	57	690	57		
1:15 PM	352	356	38	56	708	56		
1:30 PM	378	382	32	53	760	53		
1:45 PM	388	393	35	49	781	49		
2:00 PM	394	399	41	56	793	56		
2:15 PM	392	440	38	61	832	61	Met	
2:30 PM	374	424	48	63	798	63		
2:45 PM	394	452	44	67	846	67		
3:00 PM	402	505	44	74	907	74		
3:15 PM	416	551	54	79	967	79	Met	
3:30 PM	438	585	52	86	1023	86		
3:45 PM	448	603	55	87	1051	87	Met	
4:00 PM	444	585	64	100	1029	100		
4:15 PM	405	546	55	94	951	94	Met	
4:30 PM	360	544	52	92	904	92		
4:45 PM	330	493	53	88	823	88		
5:00 PM	291	433	43	69	724	69		
5:15 PM	277	378	44	76	655	76		
5:30 PM	258	322	37	68	580	68		
5:45 PM	220	290	30	59	510	59		
6:00 PM	184	282	31	52	466	52		
6:15 PM	122	198	18	30	320	30		
6:30 PM	73	125	13	23	198	23		
6:45 PM	30	67	7	14	97	14		
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		



Top Hours for Figure 4C-1				
	Start Time	End Time	Major Street	Minor Street
Top Hour	3:45 PM	4:45 PM	1051	87
2nd Highest Hour	3:45 PM	4:45 PM	1051	87
3rd Highest Hour	4:45 PM	5:45 PM	823	88
4th Highest Hour	2:45 PM	3:45 PM	846	67

Top Hours for Figure 4C-2				
	Start Time	End Time	Major Street	Minor Street
Top Hour	4:15 PM	5:15 PM	951	94
2nd Highest Hour	3:15 PM	4:15 PM	967	79
3rd Highest Hour	2:15 PM	3:15 PM	832	61
4th Highest Hour	12:00 AM	1:00 AM	0	76



Are the requirements for Warrant 2 met?:

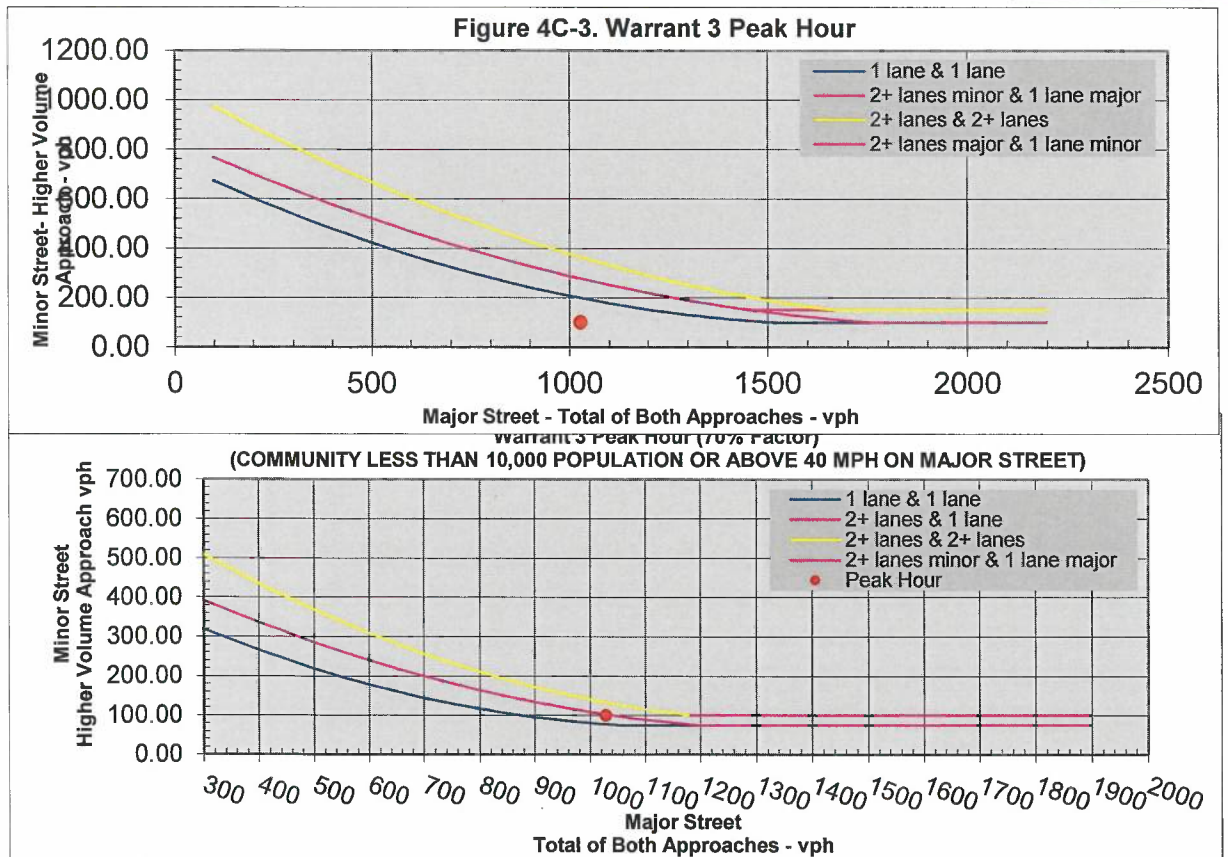
OMUTCD WARRANT 3, PEAK HOUR			
Number of Lanes for Moving Traffic on Each Approach		Peak Hour Start time	4:00 PM
Major Street:	1 Lane	Peak Hour End Time	5:00 PM
Minor Street:	1 Lane		

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?	Yes
<i>*If applicable, attach all supporting calculations and documentation.</i>	
Are the requirements for Warrant 3 met?:	No

Figure 4C-3. Warrant 3 Peak Hour



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	0	0	0	0
6:15 AM	138	15	153	163
6:30 AM	346	24	370	392
6:45 AM	515	32	547	578
7:00 AM	666	42	708	750
7:15 AM	678	42	720	748
7:30 AM	604	45	649	673
7:45 AM	572	54	626	658
8:00 AM	562	56	618	651
8:15 AM	518	59	577	611
8:30 AM	500	52	552	588
8:45 AM	492	43	535	571
9:00 AM	480	38	518	551
9:15 AM	505	36	541	569
9:30 AM	518	40	558	589
9:45 AM	548	44	592	619
10:00 AM	578	46	624	653
10:15 AM	594	50	644	681
10:30 AM	646	45	691	725
10:45 AM	677	47	724	757
11:00 AM	678	53	731	758
11:15 AM	694	52	746	767
11:30 AM	694	57	751	780
11:45 AM	679	52	731	759
12:00 PM	692	59	751	784
12:15 PM	705	58	763	802
12:30 PM	694	56	750	783
12:45 PM	674	64	738	777
1:00 PM	690	57	747	785
1:15 PM	708	56	764	802
1:30 PM	760	53	813	845
1:45 PM	781	49	830	865
2:00 PM	793	56	849	890
2:15 PM	832	61	893	931
2:30 PM	798	63	861	909
2:45 PM	846	67	913	957
3:00 PM	907	74	981	1025
3:15 PM	967	79	1046	1100
3:30 PM	1023	86	1109	1161
3:45 PM	1051	87	1138	1193
4:00 PM	1029	100	1129	1193
4:15 PM	951	94	1045	1100
4:30 PM	904	92	996	1048
4:45 PM	823	88	911	964
5:00 PM	724	69	793	836
5:15 PM	655	76	731	775
5:30 PM	580	68	648	685
5:45 PM	510	59	569	599
6:00 PM	466	52	518	549
6:15 PM	320	30	350	368
6:30 PM	198	23	221	234
6:45 PM	97	14	111	118
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
1029	100	199	77

402 TRAFFIC CONTROL SIGNAL NEEDS STUDIES**402-1 General**

All new or reconstructed signalized intersections shall be warranted based on **OMUTCD Chapter 4C**; however, for roadway projects that have a minor impact on the existing signals, signal warrants may not be necessary. An example is a pavement planning and resurfacing project which will destroy and replace loop detectors.

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

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.

Considerations such as geometrics and lack of sight distance can occasionally, with a documented engineering study, be accepted in lieu of satisfying signal warrants. These considerations may allow an otherwise unwarranted traffic signal to be retained at 100 percent local cost.

402-2 Traffic Volumes

In addition to proper signal warrant analysis, good signal design requires recent volume data. Therefore, for existing intersections, actual turning movement counts should be used for signal warranting purposes. The traffic counts shall not be over three years old and should, at a minimum, include the 8 hours that contain the greatest percentage of daily traffic. **Form 496-18** provides an example of a chart used to display vehicular and pedestrian volumes.

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. Twenty-year design ADT or DHV (Design Hourly Volumes) shall not be used for signal warrants, rather the ADT volume 2 years after opening shall be interpolated between the opening year and design year forecasts provided by the **Modeling and Forecasting Section**, and the percentage of traffic occurring in the 8th highest hour, as obtained from the traffic count, shall be applied to ADT to obtain the forecast hourly volume for warrant analysis.

When actual side street volumes do not exist, such as at a proposed development or new road, an eighth highest hour factor may be used with the projected ADT for warrant purposes. This factor is obtained from the **Modeling and Forecasting Section** along with the ADT traffic projection, and usually ranges from 0.054 to 0.058 of the ADT. This request should be accompanied by a 24-hour machine count at the proposed intersection location, as well as any TIS or other studies conducted for proposed developments. Hourly distribution factors should not be used to develop 8 hours of warrant data from the ADT as hourly distribution factors vary greatly depending on the type of development surrounding an intersection.

If high truck volumes (20% or greater) are present at an approach, a Passenger Car Equivalent (PCE) may be used for warrant analysis. For vehicle classes 4-7, a PCE of 1.5 may be used. For vehicle classes of 8-13 or higher, a PCE of 2.0 may be used.

Consideration should be given to operating a signal, which was warranted based on projected traffic, as a flasher until actual traffic volumes satisfy signal warrants and make signalization appropriate.

402-3 Signal Warrant Practices and Procedures

402-3.1 General

As noted above, the warrants used to evaluate the need for a traffic control signal at a particular location are described in **OMUTCD Chapter 4C**. ODOT Traffic Signal Warrant Spreadsheet should be used for all ODOT Signal Warrant analysis and can be used for All-Way Stop, and Pedestrian Hybrid Beacon (PHB) installations.

402-3.2 Warrants 1, 2 and 3 (Volumes)

For determining the number of approach lanes, a short left-turn lane is not usually considered an approach lane (**OMUTCD Chapter 4C**). Usually, the number of approach lanes refers to through lanes. An exception might be where a through lane develops into an exclusive turn lane or high-turning volumes require double turning lanes.

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

For retention of existing ODOT Signals, Warrants 1, 2 and 3 can be based on the 70 percent values (**OMUTCD Chapter 4C**) and engineering judgment, regardless of the speed on the major street and regardless of proximity to an isolated community with a population of less than 10,000.

Signal warrants for Local Agencies using State or Federal funding shall be included in the above criteria.

All ODOT-maintained signals warranted based on the 70 percent values (**OMUTCD Chapter 4**) shall require the approval of OTO.

Signals installed under Warrant 3 should be traffic-actuated.

402-3.3 Warrant 4 (Pedestrian Volume)

Intersections approved under this warrant shall utilize pedestrian signal heads. Signals based only on Warrant 4 or Warrant 5 should also control the minor street or driveway.

If installed at a non-intersection crossing the traffic control signal shall be pedestrian-actuated.

402-3.4 Warrant 5 (School Crossings)

Intersections approved under this warrant shall utilize pedestrian signal heads. Signals based only on Warrant 4 or Warrant 5 should also control the minor street or driveway.

The designer shall show that the intersection is used as a school crossing. This may include:

1. School route plan developed by the school system.
2. Count of pedestrians during the study period. **OMUTCD Section 4C.06** requires a minimum of 20 students during the highest crossing hour.
3. Presence of school crossing guards.
4. Map showing the location of the school relative to the intersection.

In order to show that there is less than one acceptable gap per minute, the designer shall present the following:

1. Street crossing time based on width and crossing speed.

- The number of gaps in the traffic stream that exceed the minimum crossing time during the study period. These gaps may be measured in the field or approximated using two different equations to find the probability of a gap greater than the crossing time.

The expected number of gaps per T which are equal to or greater than t will be:

$$V * e^{\left(\frac{-Vt}{T}\right)}$$

The expected number of t-second intervals per T which are free of cars will be:

$$\left(\frac{T}{t}\right) * e^{\left(\frac{-Vt}{T}\right)}$$

t = required gap time (seconds) where,

$$t = 3 \text{ seconds} + \left[\frac{\text{width of crossing (ft)}}{3.5 \text{ ft/sec}} \right]$$

T = length of time for which the volume V applies (seconds)

V = two-way vehicular volume, through the crossing path, during time period T

e = base of the natural system of logarithms, having an approximate value of 2.718

402-3.5 Warrant 6 (Coordinated Signal System)

Warrant 6 shall not be used as the sole warrant in an ODOT signal warrant analysis.

402-3.6 Warrant 7 (Crash Experience)

Warrant 7 should only be used to warrant a signal if the 70 percent volume warrants are met.

Any traffic signal installed solely on this warrant should be semi-traffic-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.

The following types of accidents are susceptible to correction by traffic signal control:

- Those involving substantially right-angle collisions or conflicts, such as occur between vehicles on intersecting streets.
- Those involving conflicts between straight-moving vehicles and crossing pedestrians.
- Those between straight-moving and left-turning vehicles approaching from opposite directions, if an independent time interval is allowed during the signal cycle for the left-turn movement.
- Those involving excessive speed, in cases where signal coordination will restrict speed to a reasonable rate.

Traffic control signals cannot be expected to reduce the following types of accidents:

- Rear-end collisions, which often increase after signalization.
- Accidents involving pedestrians and turning vehicles when both move during the same interval.

3. Other types of pedestrian accidents, if pedestrians or drivers do not obey the signals.
4. Collisions between vehicles proceeding in the same or opposite directions, one of which makes a turn across the path of the other. This is particularly true if no independent signal interval is provided for these turn movements.

402-3.7 Warrant 8 (Roadway Network)

Warrant 8 shall not be used as the sole warrant in an ODOT signal warrant analysis.

402-3.8 Warrant 9 (Intersection Near Highway-Rail Grade Crossing)

The purpose of Warrant 9 is to provide a warrant for a traffic signal where a highway-rail grade crossing is in close proximity to an intersection and a traffic signal is not warranted under any of the other traffic signal warrants. This is especially beneficial where the clear storage distance (see **Part 8**) is less than a design vehicle length and gaps are infrequent on the road parallel to the track(s).

Signals installed based on Warrant 9 shall have minor street actuation, train preemption, and flashing-light grade crossing signals, and should also have automatic gates.

402-4 Unwarranted Existing Signalized Intersections

Every effort should be made to encourage removal of an existing unwarranted signal installation. The designer should realize that all existing unwarranted signals cannot always be removed, most often because of public or political pressures on the maintaining agency. If the removal of signals and the placement of STOP signs is agreed to, the work should be at normal project participation.

If the local agency insists that a large number of unwarranted signals be retained, the **State** should reevaluate if the project should continue. Reasons for retention of existing unwarranted signals shall be documented.

If an existing unwarranted signalized intersection is retained, the following applies:

1. All work and equipment at the intersection shall be at 100 percent local cost. Written confirmation is required from the local agency.
2. If within a system, signal control equipment shall be upgraded to be compatible with the system (same manufacturer for all controller software).
3. If within an area approved for special design considerations (such as mast arms, aesthetically designed poles, etc.), the unwarranted intersection shall be upgraded to these standards.
4. If it is not necessary to upgrade equipment except for the controller, the existing intersection signals, signs and pavement markings shall be in conformance with the **OMUTCD**. Deficiencies may be corrected by the project (at 100 percent local cost) or by the local maintaining agency. The intersection shall conform to the **OMUTCD** by the final inspection of the construction project.

402-5 Removing Right-Turn Vehicles from Signal Warrant Analysis

At intersections under ODOT's jurisdiction, the following procedure should be used to determine how much, if any, right-turning traffic from the minor street to remove from the signal warrant analysis.

From the "Minor Street Analysis Parameters" (see **Tables 497-7 and 497-8**) select the closest minor-leg lane configuration. Enter the configuration number under the MINOR STREET column

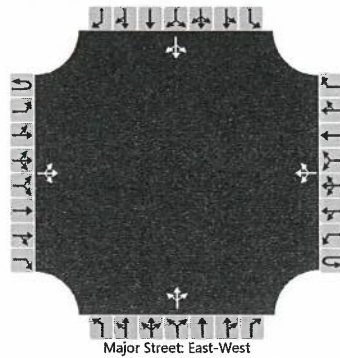
Appendix E

HCS Level of Service Analysis

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	CJV	Intersection	SR 39/ CR 114
Agency/Co.	ODOT - District 11	Jurisdiction	ODOT - D11
Date Performed	5/10/2022	East/West Street	SR 39
Analysis Year	2022	North/South Street	CR 114
Time Analyzed	2022 AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	HOL 39 28.99		

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
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)		12	265	25		10	334	8		19	12	17		4	10	33
Percent Heavy Vehicles (%)		3				6				6	6	6		3	3	3
Proportion Time Blocked																
Percent Grade (%)										3				4		
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)		4.13				4.16				7.76	7.16	6.56		7.93	7.33	6.63
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)		2.23				2.25				3.55	4.05	3.35		3.53	4.03	3.33

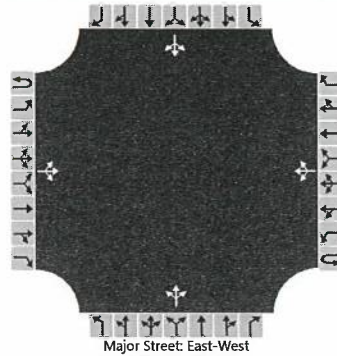
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		13				11					52				51	
Capacity, c (veh/h)		1180				1223					356				468	
v/c Ratio		0.01				0.01					0.15				0.11	
95% Queue Length, Q ₉₅ (veh)		0.0				0.0					0.5				0.4	
Control Delay (s/veh)		8.1	0.1	0.1		8.0	0.1	0.1			16.8				13.6	
Level of Service (LOS)		A	A	A		A	A	A			C				B	
Approach Delay (s/veh)		0.4				0.3				16.8				13.6		
Approach LOS		A				A				C				B		

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	CJV			Intersection	SR 39/ CR 114		
Agency/Co.	ODOT - District 11			Jurisdiction	ODOT - D11		
Date Performed	5/10/2022			East/West Street	SR 39		
Analysis Year	2022			North/South Street	CR 114		
Time Analyzed	2022 PM Peak			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	HOL 39 28.99						

Lanes



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
Number of Lanes	0	0	1	0	0	0	1	0	0	1	0	0	0	1	0	
Configuration			LTR				LTR				LTR				LTR	
Volume (veh/h)		27	542	34		24	373	4		13	35	55		4	36	22
Percent Heavy Vehicles (%)		3				6				6	6	6		3	3	3
Proportion Time Blocked																
Percent Grade (%)										3				4		
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

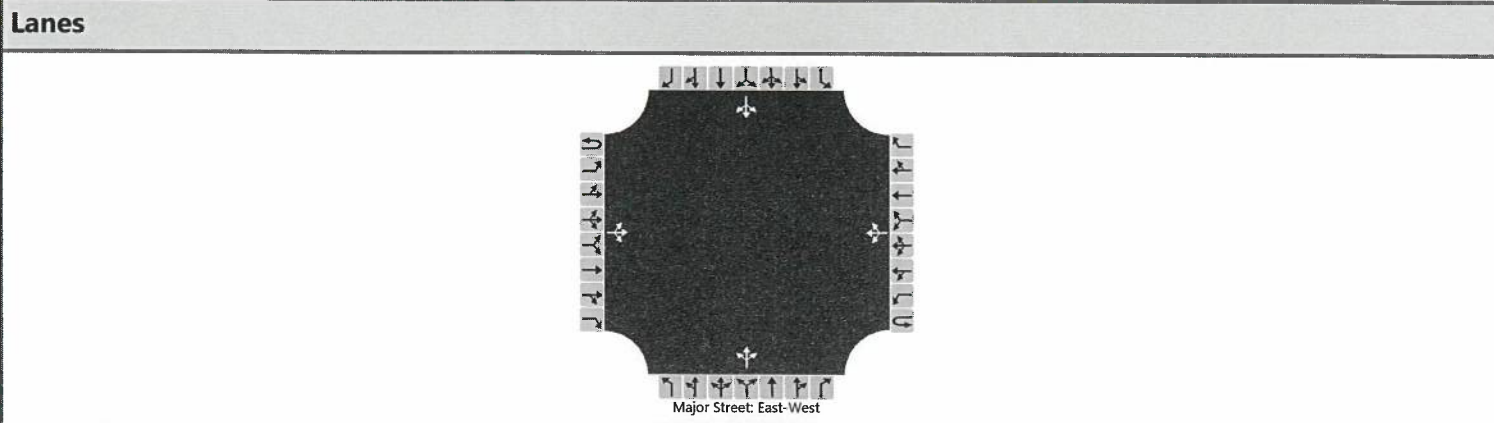
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.13				4.16				7.76	7.16	6.56		7.93	7.33	6.63
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.23				2.25				3.55	4.05	3.35		3.53	4.03	3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		29				26					112					67
Capacity, c (veh/h)		1143				936					213					186
v/c Ratio		0.03				0.03					0.52					0.36
95% Queue Length, Q ₉₅ (veh)		0.1				0.1					2.7					1.5
Control Delay (s/veh)		8.2	0.3	0.3		9.0	0.3	0.3			39.1					35.1
Level of Service (LOS)		A	A	A		A	A	A			E					E
Approach Delay (s/veh)		0.7				0.8				39.1				35.1		
Approach LOS		A				A				E				E		

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	CJV	Intersection	SR 39/ CR 114
Agency/Co.	ODOT - District 11	Jurisdiction	ODOT - D11
Date Performed	5/26/22	East/West Street	SR 39
Analysis Year	2025	North/South Street	CR 114
Time Analyzed	2025 AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	HOL 39 28.99		



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
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)		20	240	10		20	330	10		20	20	30		10	10	10
Percent Heavy Vehicles (%)		8				8				6	6	6		3	3	3
Proportion Time Blocked																
Percent Grade (%)										3				4		
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

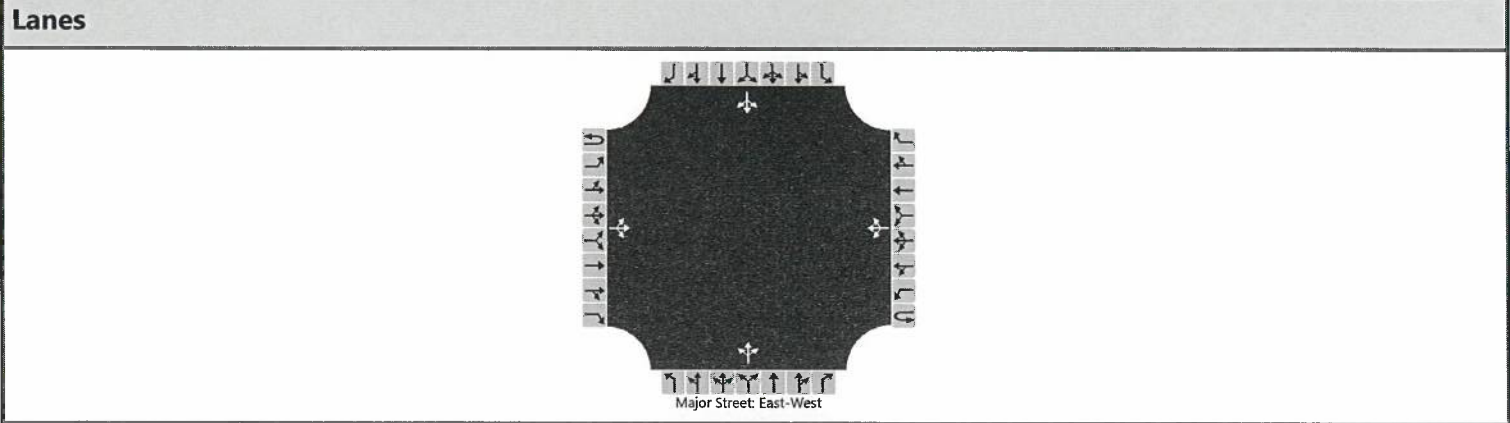
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.18				7.76	7.16	6.56		7.93	7.33	6.63
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.27				3.55	4.05	3.35		3.53	4.03	3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		22				22					76					33	
Capacity, c (veh/h)		1157				1258					386					330	
v/c Ratio		0.02				0.02					0.20					0.10	
95% Queue Length, Q ₉₅ (veh)		0.1				0.1					0.7					0.3	
Control Delay (s/veh)		8.2	0.2	0.2		7.9	0.2	0.2			16.6					17.1	
Level of Service (LOS)		A	A	A		A	A	A			C					C	
Approach Delay (s/veh)		0.8				0.6					16.6					17.1	
Approach LOS		A				A					C					C	

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	CJV			Intersection	SR 39/ CR 114		
Agency/Co.	ODOT - District 11			Jurisdiction	ODOT - D11		
Date Performed	5/26/22			East/West Street	SR 39		
Analysis Year	2025			North/South Street	CR 114		
Time Analyzed	2025 PM Peak			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	HOL 39 28.99						



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	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	510	30		30	380	0		10	30	50		0	30	20
Percent Heavy Vehicles (%)		8				8				6	6	6		3	3	3
Proportion Time Blocked																
Percent Grade (%)										3			4			
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

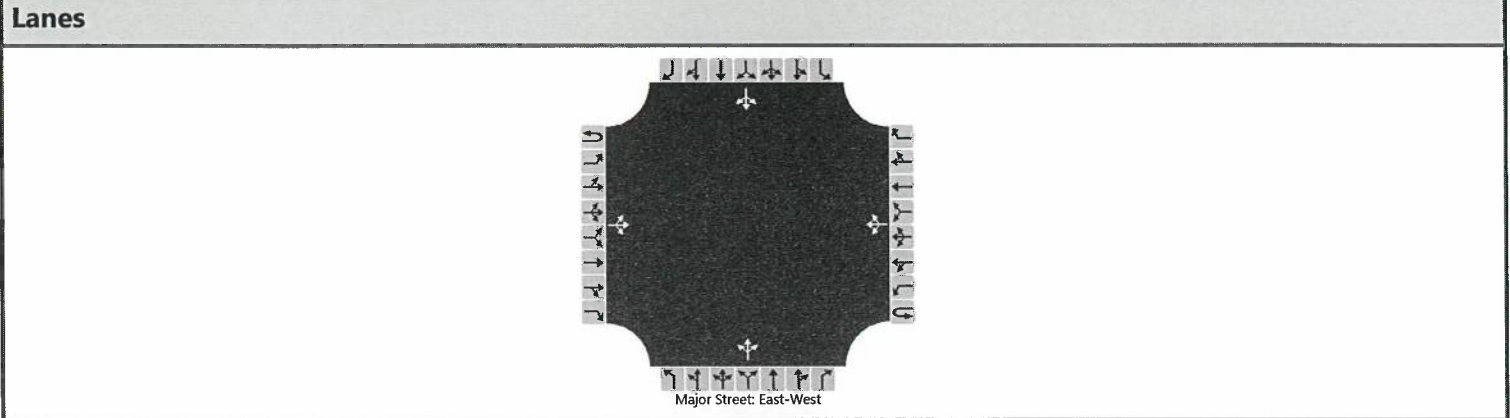
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.18				7.76	7.16	6.56		7.93	7.33	6.63
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.27				3.55	4.05	3.35		3.53	4.03	3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		33				33					98					54
Capacity, c (veh/h)		1114				959					229					207
v/c Ratio		0.03				0.03					0.43					0.26
95% Queue Length, Q ₉₅ (veh)		0.1				0.1					2.0					1.0
Control Delay (s/veh)		8.3	0.4	0.4		8.9	0.4	0.4			32.0					28.4
Level of Service (LOS)		A	A	A		A	A	A			D					D
Approach Delay (s/veh)		0.8				1.0				32.0				28.4		
Approach LOS		A				A				D				D		

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	CJV	Intersection	SR 39/ CR 114
Agency/Co.	ODOT - District 11	Jurisdiction	ODOT - D11
Date Performed	5/26/22	East/West Street	SR 39
Analysis Year	2045	North/South Street	CR 114
Time Analyzed	2045 AM Peak	Peak Hour Factor	0.92
Intersection Orientation	East-West	Analysis Time Period (hrs)	0.25
Project Description	HOL 39 28.99		



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12
Priority																
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	250	30		20	330	10		20	20	30		10	10	30
Percent Heavy Vehicles (%)		8				8				6	6	6		3	3	3
Proportion Time Blocked																
Percent Grade (%)										3				4		
Right Turn Channelized																
Median Type Storage	Undivided															

Critical and Follow-up Headways

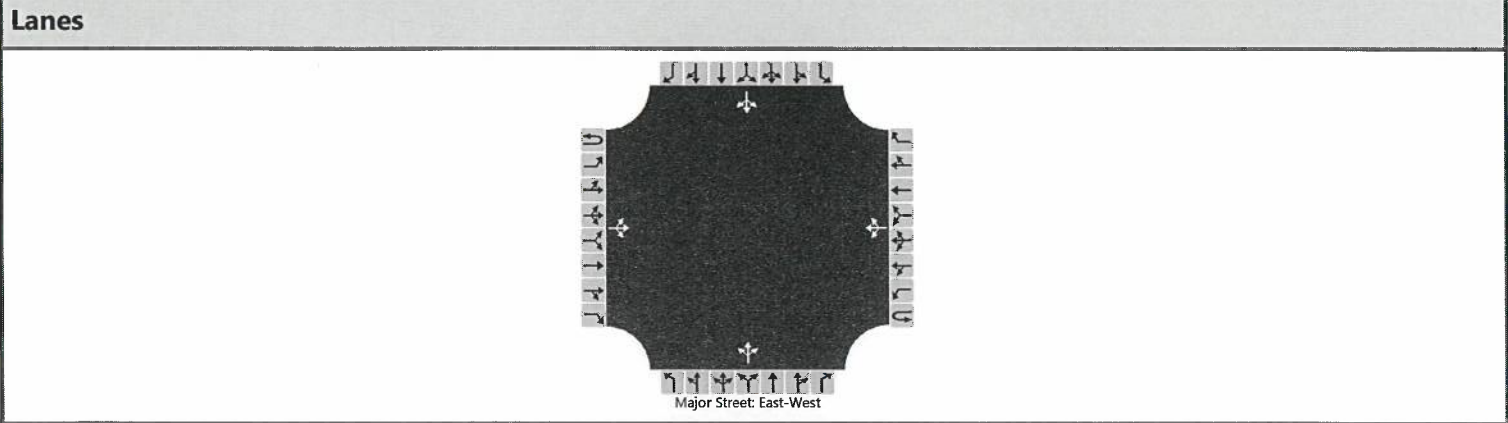
Base Critical Headway (sec)		4.1				4.1				7.1	6.5	6.2		7.1	6.5	6.2
Critical Headway (sec)		4.18				4.18				7.76	7.16	6.56		7.93	7.33	6.63
Base Follow-Up Headway (sec)		2.2				2.2				3.5	4.0	3.3		3.5	4.0	3.3
Follow-Up Headway (sec)		2.27				2.27				3.55	4.05	3.35		3.53	4.03	3.33

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		11				22					76					54
Capacity, c (veh/h)		1157				1223					381					414
v/c Ratio		0.01				0.02					0.20					0.13
95% Queue Length, Q ₉₅ (veh)		0.0				0.1					0.7					0.4
Control Delay (s/veh)		8.1	0.1	0.1		8.0	0.2	0.2			16.8					15.0
Level of Service (LOS)		A	A	A		A	A	A			C					B
Approach Delay (s/veh)		0.4			0.6					16.8			15.0			
Approach LOS		A			A					C			B			

HCS Two-Way Stop-Control Report

General Information				Site Information			
Analyst	CJV			Intersection	SR 39/ CR 114		
Agency/Co.	ODOT - District 11			Jurisdiction	ODOT - D11		
Date Performed	5/26/22			East/West Street	SR 39		
Analysis Year	2045			North/South Street	CR 114		
Time Analyzed	2045 PM Peak			Peak Hour Factor	0.92		
Intersection Orientation	East-West			Analysis Time Period (hrs)	0.25		
Project Description	HOL 39 28.99						



Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound				
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R	
Movement	1U	1	2	3	4U	4	5	6		7	8	9		10	11	12	
Priority																	
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	520	30		30	390	0		10	30	50		0	30	20	
Percent Heavy Vehicles (%)		8				8				6	6	6		3	3	3	
Proportion Time Blocked																	
Percent Grade (%)										3				4			
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)		4.18				4.18				7.76	7.16	6.56		7.93	7.33	6.63
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)		2.27				2.27				3.55	4.05	3.35		3.53	4.03	3.33

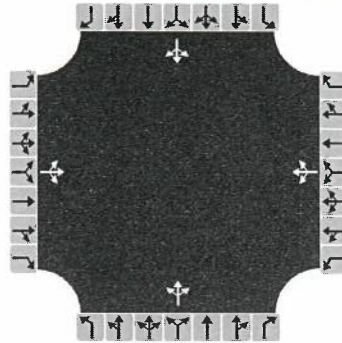
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)		33				33					98					54		
Capacity, c (veh/h)		1104				950					221					201		
v/c Ratio		0.03				0.03					0.44					0.27		
95% Queue Length, Q ₉₅ (veh)		0.1				0.1					2.1					1.1		
Control Delay (s/veh)		8.4	0.4	0.4		8.9	0.4	0.4			33.5					29.5		
Level of Service (LOS)		A	A	A		A	A	A			D					D		
Approach Delay (s/veh)		0.8				1.0					33.5				29.5			
Approach LOS		A				A					D				D			

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	CJV	Intersection	SR 39 & CR 114
Agency/Co.	ODOT - District 11	Jurisdiction	ODOT
Date Performed	5/19/2022	East/West Street	SR 39
Analysis Year	2022	North/South Street	CR 114
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	2022 AM Peak		
Project Description	HOL 39 28.99		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	12	265	25	10	334	8	19	12	17	4	10	33
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	328			383			52			51		
Percent Heavy Vehicles	3			6			6			3		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.292			0.340			0.046			0.045		
Final Departure Headway, hd (s)	4.65			4.67			5.60			5.29		
Final Degree of Utilization, x	0.424			0.496			0.081			0.075		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	2.65			2.67			3.60			3.29		

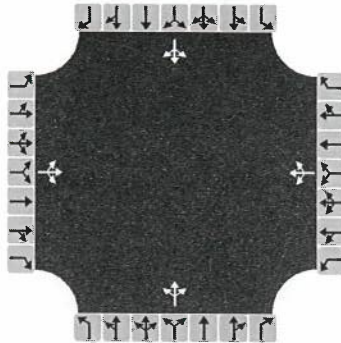
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	328			383			52			51		
Capacity	775			772			643			681		
95% Queue Length, Q ₉₅ (veh)	2.1			2.8			0.3			0.2		
Control Delay (s/veh)	11.0			12.2			9.1			8.7		
Level of Service, LOS	B			B			A			A		
Approach Delay (s/veh)	11.0			12.2			9.1			8.7		
Approach LOS	B			B			A			A		
Intersection Delay, s/veh LOS	11.3						B					

HCS All-Way Stop Control Report

General Information		Site Information	
Analyst	CJV	Intersection	SR 39 & CR 114
Agency/Co.	ODOT - District 11	Jurisdiction	ODOT
Date Performed	5/19/2022	East/West Street	SR 39
Analysis Year	2022	North/South Street	CR 114
Analysis Time Period (hrs)	0.25	Peak Hour Factor	0.92
Time Analyzed	2022 PM Peak		
Project Description	HOL 39 28.99		

Lanes



Vehicle Volume and Adjustments

Approach	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Movement												
Volume	27	542	34	24	373	4	13	35	55	4	36	22
% Thrus in Shared Lane												
Lane	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
Configuration	LTR			LTR			LTR			LTR		
Flow Rate, v (veh/h)	655			436			112			67		
Percent Heavy Vehicles	3			6			6			3		

Departure Headway and Service Time

Initial Departure Headway, hd (s)	3.20			3.20			3.20			3.20		
Initial Degree of Utilization, x	0.583			0.387			0.100			0.060		
Final Departure Headway, hd (s)	5.22			5.58			6.68			6.90		
Final Degree of Utilization, x	0.951			0.675			0.208			0.129		
Move-Up Time, m (s)	2.0			2.0			2.0			2.0		
Service Time, ts (s)	3.22			3.58			4.68			4.90		

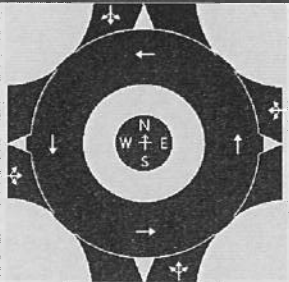
Capacity, Delay and Level of Service

Flow Rate, v (veh/h)	655			436			112			67		
Capacity	689			645			539			522		
95% Queue Length, Q ₉₅ (veh)	13.7			5.2			0.8			0.4		
Control Delay (s/veh)	45.7			19.4			11.4			10.9		
Level of Service, LOS	E			C			B			B		
Approach Delay (s/veh)	45.7			19.4			11.4			10.9		
Approach LOS	E			C			B			B		
Intersection Delay, s/veh LOS	31.8						D					

HCS Roundabouts Report

General Information

Site Information

Analyst	CJV		Intersection	SR 39 & CR 114 In Holmes C...
Agency or Co.	ODOT - District 11		E/W Street Name	SR 39
Date Performed	5/18/2022		N/S Street Name	CR 114
Analysis Year	2025		Analysis Time Period, hrs	0.25
Time Analyzed	2025 AM Peak		Peak Hour Factor	0.92
Project Description	Safety Study Intersection of...		Jurisdiction	ODOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
	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	240	20	0	20	330	10	0	20	20	30	0	10	10	30
Percent Heavy Vehicles, %	6	6	6	6	8	8	8	8	8	8	8	8	3	3	3	3
Flow Rate (v _{pc}), pc/h	0	12	277	23	0	23	387	12	0	23	23	35	0	11	11	34
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		
	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	

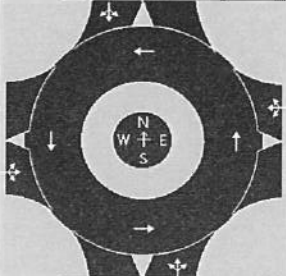
Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v _e), pc/h		312			422			81			56	
Entry Volume, veh/h		294			391			75			54	
Circulating Flow (v _c), pc/h		45			58			300			433	
Exiting Flow (v _{ex}), pc/h		323			444			47			57	
Capacity (C _{pc}), pc/h		1318			1301			1016			887	
Capacity (c), veh/h		1243			1204			941			861	
v/c Ratio (x)		0.24			0.32			0.08			0.06	

Delay and Level of Service

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.0			6.0			4.6			4.8	
Lane LOS		A			A			A			A	
95% Queue, veh		0.9			1.4			0.3			0.2	
Approach Delay, s/veh		5.0			6.0			4.6			4.8	
Approach LOS		A			A			A			A	
Intersection Delay, s/veh LOS	5.4						A					

HCS Roundabouts Report

General Information				Site Information				
Analyst	CJV				Intersection	SR 39 & CR 114 In Holmes C...		
Agency or Co.	ODOT - District 11				E/W Street Name	SR 39		
Date Performed	5/18/2022				N/S Street Name	CR 114		
Analysis Year	2025				Analysis Time Period, hrs	0.25		
Time Analyzed	2025 PM Peak				Peak Hour Factor	0.92		
Project Description	Safety Study Intersection of...				Jurisdiction	ODOT		

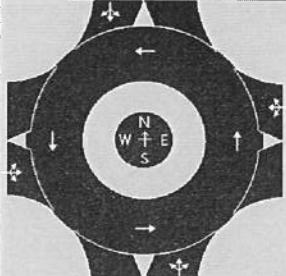
Volume Adjustments and Site Characteristics																
Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Movement																
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment	LTR				LTR				LTR				LTR			
Volume (V), veh/h	0	30	510	30	0	30	380	0	0	10	30	50	0	0	30	20
Percent Heavy Vehicles, %	6	6	6	6	8	8	8	8	8	8	8	8	3	3	3	3
Flow Rate (V _{PCE}), pc/h	0	35	588	35	0	35	446	0	0	12	35	59	0	0	34	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			
	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			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Entry Flow (v _e), pc/h		658			481			106			56		
Entry Volume, veh/h		621			445			98			54		
Circulating Flow (v _c), pc/h	69			82			623			493			
Exiting Flow (v _{ex}), pc/h	647			480			70			104			
Capacity (C _{PCE}), pc/h		1286			1269			731			835		
Capacity (c), veh/h		1213			1175			677			810		
v/c Ratio (x)		0.51			0.38			0.15			0.07		

Delay and Level of Service													
Approach	EB			WB			NB			SB			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Lane Control Delay (d), s/veh		8.6			6.8			6.9			5.1		
Lane LOS		A			A			A			A		
95% Queue, veh		3.0			1.8			0.5			0.2		
Approach Delay, s/veh	8.6			6.8			6.9			5.1			
Approach LOS	A			A			A			A			
Intersection Delay, s/veh LOS	7.7						A						

HCS Roundabouts Report

General Information				Site Information			
Analyst	CJV		Intersection	SR 39 & CR 114 In Holmes C...			
Agency or Co.	ODOT - District 11		E/W Street Name	SR 39			
Date Performed	5/18/2022		N/S Street Name	CR 114			
Analysis Year	2045		Analysis Time Period, hrs	0.25			
Time Analyzed	2045 AM Peak		Peak Hour Factor	0.92			
Project Description	Safety Study Intersection of...		Jurisdiction	ODOT			

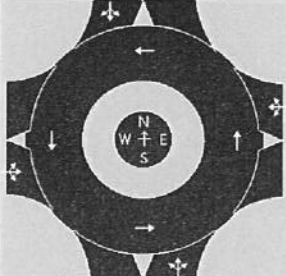
Volume Adjustments and Site Characteristics																
Approach	EB				WB				NB				SB			
	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment	LTR				LTR				LTR				LTR			
Volume (V), veh/h	0	10	250	30	0	20	330	10	0	20	20	30	0	10	10	30
Percent Heavy Vehicles, %	6	6	6	6	8	8	8	8	8	8	8	8	3	3	3	3
Flow Rate (V _{PCE}), pc/h	0	12	288	35	0	23	387	12	0	23	23	35	0	11	11	34
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			
	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		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v _e), pc/h		335			422			81			56	
Entry Volume, veh/h		316			391			75			54	
Circulating Flow (v _c), pc/h		45			58			311			433	
Exiting Flow (v _{ex}), pc/h		334			444			47			69	
Capacity (C _{PCE}), pc/h		1318			1301			1005			887	
Capacity (c), veh/h		1243			1204			930			861	
v/c Ratio (x)		0.25			0.32			0.08			0.06	

Delay and Level of Service												
Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.1			6.0			4.6			4.8	
Lane LOS		A			A			A			A	
95% Queue, veh		1.0			1.4			0.3			0.2	
Approach Delay, s/veh		5.1			6.0			4.6			4.8	
Approach LOS		A			A			A			A	
Intersection Delay, s/veh LOS	5.5						A					

HCS Roundabouts Report

General Information				Site Information			
Analyst	CJV				Intersection		SR 39 & CR 114 In Holmes C...
Agency or Co.	ODOT - District 11				E/W Street Name		SR 39
Date Performed	5/18/2022				N/S Street Name		CR 114
Analysis Year	2045				Analysis Time Period, hrs		0.25
Time Analyzed	2045 PM Peak				Peak Hour Factor		0.92
Project Description	Safety Study Intersection of...				Jurisdiction		ODOT

Volume Adjustments and Site Characteristics																	
Approach	EB				WB				NB				SB				
	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	520	30	0	30	390	0	0	10	30	50	0	0	30	20	
Percent Heavy Vehicles, %	6	6	6	6	8	8	8	8	8	8	8	8	3	3	3	3	
Flow Rate (v _{pc}), pc/h	0	35	599	35	0	35	458	0	0	12	35	59	0	0	34	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			
	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			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Entry Flow (v _e), pc/h		669			493			106			56		
Entry Volume, veh/h		631			456			98			54		
Circulating Flow (v _c), pc/h	69			82			634			505			
Exiting Flow (v _{ex}), pc/h	658			492			70			104			
Capacity (C _{pc}), pc/h		1286			1269			723			824		
Capacity (c), veh/h		1213			1175			669			800		
v/c Ratio (x)		0.52			0.39			0.15			0.07		

Delay and Level of Service													
Approach	EB			WB			NB			SB			
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	
Lane Control Delay (d), s/veh		8.7			6.9			7.0			5.2		
Lane LOS		A			A			A			A		
95% Queue, veh		3.1			1.9			0.5			0.2		
Approach Delay, s/veh	8.7			6.9			7.0			5.2			
Approach LOS	A			A			A			A			
Intersection Delay, s/veh LOS	7.8						A						

Lanes, Volumes, Timings

HOL 39 28.99 Synchro with Lt. Turn Lanes AM Peak Volumes.syn

05/19/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↗	↘		↗	↘	
Traffic Volume (vph)	19	12	17	4	10	33	10	334	8	12	265	25
Future Volume (vph)	19	12	17	4	10	33	10	334	8	12	265	25
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Grade (%)		0%			0%			0%			-4%	
Storage Length (ft)	0		0	0		0	100		0	100		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	50			50			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.953			0.905			0.996			0.987	
Flt Protected		0.980			0.996		0.950			0.950		
Satd. Flow (prot)	0	1648	0	0	1591	0	1676	1758	0	1710	1777	0
Flt Permitted		0.906			0.966		0.569			0.540		
Satd. Flow (perm)	0	1524	0	0	1543	0	1004	1758	0	972	1777	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		18			36			3			13	
Link Speed (mph)		50			50			50			50	
Link Distance (ft)		574			409			702			1111	
Travel Time (s)		7.8			5.6			9.6			15.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	21	13	18	4	11	36	11	363	9	13	288	27
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	52	0	0	51	0	11	372	0	13	315	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.05	1.05	1.05
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1	1		1	0		1	0	
Detector Template	Left			Left								
Leading Detector (ft)	30	0		30	0		30	0		30	0	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	30	30		30	30		30	30		30	30	
Detector 1 Type	Cl+Ex	Call		Cl+Ex	Call		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	

Lanes, Volumes, Timings

HOL 39 28.99 Synchro with Lt. Turn Lanes AM Peak Volumes.syn

05/19/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (s)	21.0	21.0		21.0	21.0		24.0	24.0		24.0	24.0	
Total Split (%)	46.7%	46.7%		46.7%	46.7%		53.3%	53.3%		53.3%	53.3%	
Maximum Green (s)	16.0	16.0		16.0	16.0		19.0	19.0		19.0	19.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		7.3			7.3		31.9	31.9		31.9	31.9	
Actuated g/C Ratio		0.19			0.19		0.82	0.82		0.82	0.82	
v/c Ratio		0.17			0.16		0.01	0.26		0.02	0.22	
Control Delay		11.3			8.5		3.8	3.8		3.8	3.5	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		11.3			8.5		3.8	3.8		3.8	3.5	
LOS		B			A		A	A		A	A	
Approach Delay		11.3			8.5			3.8			3.6	
Approach LOS		B			A			A			A	

Intersection Summary

Area Type: Other

Cycle Length: 45

Actuated Cycle Length: 39

Natural Cycle: 45

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.26

Intersection Signal Delay: 4.5

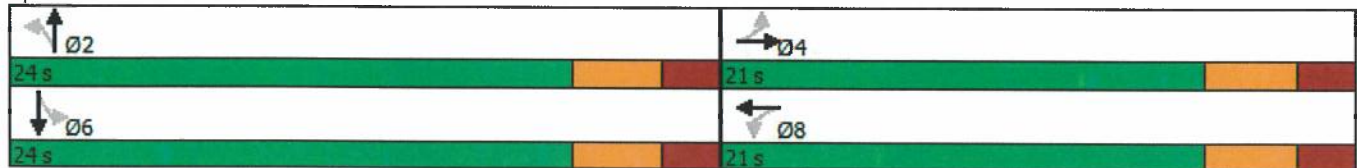
Intersection LOS: A

Intersection Capacity Utilization 35.8%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 3: SR 39 & CR 114



Lanes, Volumes, Timings

HOL 39 28.99 Synchro with Lt. Turn Lanes PM Peak Volumes.syn

05/19/2022



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔			↔		↗	↘		↗	↘	
Traffic Volume (vph)	13	35	55	4	36	22	24	373	4	27	542	34
Future Volume (vph)	13	35	55	4	36	22	24	373	4	27	542	34
Ideal Flow (vphpl)	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800	1800
Storage Length (ft)	0		0	0		0	100		0	100		0
Storage Lanes	0		0	0		0	1		0	1		0
Taper Length (ft)	50			50			50			50		
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.928			0.952			0.999			0.991	
Flt Protected		0.994			0.997		0.950			0.950		
Satd. Flow (prot)	0	1628	0	0	1675	0	1676	1763	0	1676	1749	0
Flt Permitted		0.944			0.978		0.381			0.522		
Satd. Flow (perm)	0	1546	0	0	1643	0	672	1763	0	921	1749	0
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		60			24			1			9	
Link Speed (mph)		50			50			50			50	
Link Distance (ft)		574			409			702			1085	
Travel Time (s)		7.8			5.6			9.6			14.8	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	14	38	60	4	39	24	26	405	4	29	589	37
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	112	0	0	67	0	26	409	0	29	626	0
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12			12	
Link Offset(ft)		0			0			0			0	
Crosswalk Width(ft)		16			16			16			16	
Two way Left Turn Lane												
Headway Factor	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07	1.07
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	1		1	1		1	0		1	0	
Detector Template	Left			Left						Left		
Leading Detector (ft)	30	0		30	0		30	0		30	0	
Trailing Detector (ft)	0	0		0	0		0	0		0	0	
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	
Detector 1 Size(ft)	30	30		30	30		30	30		30	30	
Detector 1 Type	Cl+Ex	Call		Cl+Ex	Call		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Detector Phase	4	4		8	8		2	2		6	6	
Switch Phase												
Minimum Initial (s)	7.0	7.0		7.0	7.0		7.0	7.0		7.0	7.0	
Minimum Split (s)	21.0	21.0		21.0	21.0		21.0	21.0		21.0	21.0	
Total Split (s)	21.0	21.0		21.0	21.0		34.0	34.0		34.0	34.0	



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Total Split (%)	38.2%	38.2%		38.2%	38.2%		61.8%	61.8%		61.8%	61.8%	
Maximum Green (s)	16.0	16.0		16.0	16.0		29.0	29.0		29.0	29.0	
Yellow Time (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
All-Red Time (s)	2.0	2.0		2.0	2.0		2.0	2.0		2.0	2.0	
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0	0.0	
Total Lost Time (s)		5.0			5.0		5.0	5.0		5.0	5.0	
Lead/Lag												
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Recall Mode	None	None		None	None		Max	Max		Max	Max	
Walk Time (s)	5.0	5.0		5.0	5.0		5.0	5.0		5.0	5.0	
Flash Dont Walk (s)	11.0	11.0		11.0	11.0		11.0	11.0		11.0	11.0	
Pedestrian Calls (#/hr)	0	0		0	0		0	0		0	0	
Act Effct Green (s)		8.1			8.1		36.7	36.7		36.7	36.7	
Actuated g/C Ratio		0.16			0.16		0.72	0.72		0.72	0.72	
v/c Ratio		0.38			0.24		0.05	0.32		0.04	0.50	
Control Delay		14.0			14.8		4.4	5.1		4.1	6.7	
Queue Delay		0.0			0.0		0.0	0.0		0.0	0.0	
Total Delay		14.0			14.8		4.4	5.1		4.1	6.7	
LOS		B			B		A	A		A	A	
Approach Delay		14.0			14.8			5.1			6.6	
Approach LOS		B			B			A			A	

Intersection Summary

Area Type: Other

Cycle Length: 55

Actuated Cycle Length: 51.3

Natural Cycle: 55

Control Type: Actuated-Uncoordinated

Maximum v/c Ratio: 0.50

Intersection Signal Delay: 7.2

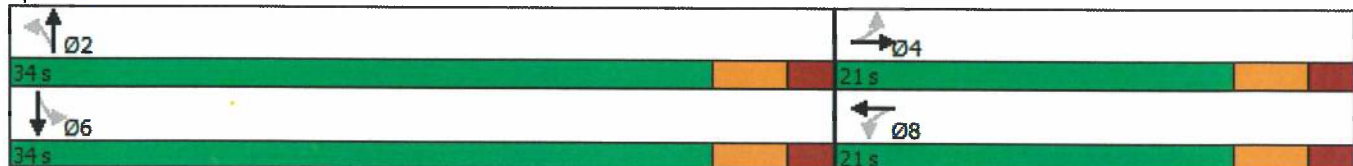
Intersection LOS: A

Intersection Capacity Utilization 50.7%

ICU Level of Service A

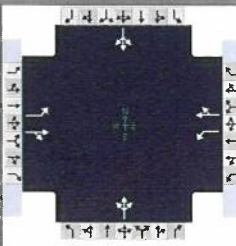
Analysis Period (min) 15

Splits and Phases: 3: SR 39 & CR 114



HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	ODOT - D 11			Duration, h	0.250		
Analyst	CJV		Analysis Date	May 18, 2022		Area Type	Other
Jurisdiction	ODOT		Time Period	PM Peak		PHF	0.92
Urban Street	SR 39		Analysis Year	2025		Analysis Period	1> 15:45
Intersection	SR 39 & CR 114		File Name	HOL 39 28.99 HCS Signal Analysis 2045 AM Pea...			
Project Description	2045 AM Peak						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	10	250	30	20	330	10	20	20	30	10	10	30

Signal Information				Signal Timing (s)									
Cycle, s	25.9	Reference Phase	2	Green	8.1	4.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Offset, s	0	Reference Point	End	Yellow	6.0	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Force Mode	Fixed	Simult. Gap N/S	On										

NB & SB = CR 114
 EB & WB = SR 39

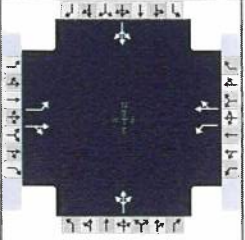
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT
Assigned Phase		2		6		7
Case Number		6.0		6.0		8.0
Phase Duration, s		15.1		15.1		10.8
Change Period, (Y+R _c), s		7.0		7.0		6.5
Max Allow Headway (MAH), s		2.9		2.9		3.1
Queue Clearance Time (g _s), s		7.0		6.7		3.1
Green Extension Time (g _e), s		1.1		1.2		0.2
Phase Call Probability		1.00		1.00		0.61
Max Out Probability		0.00		0.00		0.00

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	11	304		22	370			76			54	
Adjusted Saturation Flow Rate (s), veh/h/ln	964	1901		1024	1772			1529			1525	
Queue Service Time (g _s), s	0.3	3.4		0.5	4.7			0.0				
Cycle Queue Clearance Time (g _c), s	5.0	3.4		3.9	4.7			1.1				
Green Ratio (g/C)	0.31	0.31		0.31	0.31			0.16				
Capacity (c), veh/h	405	595		464	554			431				
Volume-to-Capacity Ratio (X)	0.027	0.512		0.047	0.667			0.177				
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	0.1	0.8		0.1	1.1			0.3				
Queue Storage Ratio (RQ) (95 th percentile)	0.01	0.00		0.02	0.00			0.00				
Uniform Delay (d ₁), s/veh	9.9	7.3		8.9	7.7			9.5				
Incremental Delay (d ₂), s/veh	0.0	0.3		0.0	0.5			0.1				
Initial Queue Delay (d ₃), s/veh	0.0	0.0		0.0	0.0			0.0				
Control Delay (d), s/veh	9.9	7.5		8.9	8.2			9.5			9.4	
Level of Service (LOS)	A	A		A	A			A			A	
Approach Delay, s/veh / LOS	7.6	A		8.3	A			9.5	A		9.4	A
Intersection Delay, s/veh / LOS	8.2						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.64	B	1.64	B	1.89	B	1.89	B
Bicycle LOS Score / LOS	1.01	A	1.13	A	0.61	A	0.58	A

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	ODOT - D 11			Duration, h	0.250		
Analyst	CJV	Analysis Date	May 18, 2022	Area Type	Other		
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.92		
Urban Street	SR 39	Analysis Year	2025	Analysis Period	1> 15:45		
Intersection	SR 39 & CR 114	File Name	HOL 39 28.99 HCS Signal Analysis 2045 PM Pea...				
Project Description	2045 PM Peak						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	30	520	30	30	390	10	10	30	50	10	30	20

Signal Information																		
Cycle, s	32.6	Reference Phase	2															
Offset, s	0	Reference Point	End															
Uncoordinated	Yes	Simult. Gap E/W	On	Green	13.7	5.4	0.0	0.0	0.0	0.0	1		2		3		4	
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	6.0	5.0	0.0	0.0	0.0	0.0	5		6		7		8	
				Red	1.0	1.5	0.0	0.0	0.0	0.0								

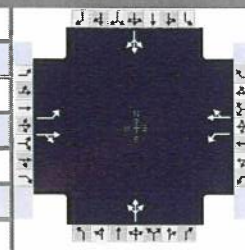
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		8.0		8.0
Phase Duration, s		20.7		20.7		11.9		11.9
Change Period, (Y+R _c), s		7.0		7.0		6.5		6.5
Max Allow Headway (MAH), s		3.0		3.0		3.1		3.1
Queue Clearance Time (g _s), s		10.6		11.8		3.8		3.1
Green Extension Time (g _e), s		1.9		1.9		0.2		0.2
Phase Call Probability		1.00		1.00		0.77		0.77
Max Out Probability		0.03		0.05		0.00		0.00

Movement Group Results	EB			WB			NB			SB			
	L	T	R	L	T	R	L	T	R	L	T	R	
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14	
Adjusted Flow Rate (v), veh/h	33	598		33	435			98				65	
Adjusted Saturation Flow Rate (s), veh/h/ln	908	1918		781	1773			1565				1604	
Queue Service Time (g _s), s	0.9	8.6		1.2	6.1			0.0				0.0	
Cycle Queue Clearance Time (g _c), s	7.1	8.6		9.8	6.1			1.8				1.1	
Green Ratio (g/C)	0.42	0.42		0.42	0.42			0.17				0.17	
Capacity (c), veh/h	430	805		342	744			382				395	
Volume-to-Capacity Ratio (X)	0.076	0.743		0.095	0.584			0.256				0.165	
Back of Queue (Q), ft/ln (95 th percentile)													
Back of Queue (Q), veh/ln (95 th percentile)	0.2	2.4		0.2	1.6			0.7				0.5	
Queue Storage Ratio (RQ) (95 th percentile)	0.04	0.00		0.04	0.00			0.00				0.00	
Uniform Delay (d ₁), s/veh	10.0	8.0		12.1	7.3			12.1				11.8	
Incremental Delay (d ₂), s/veh	0.0	0.5		0.0	0.3			0.1				0.1	
Initial Queue Delay (d ₃), s/veh	0.0	0.0		0.0	0.0			0.0				0.0	
Control Delay (d), s/veh	10.1	8.5		12.2	7.5			12.2				11.9	
Level of Service (LOS)	B	A		B	A			B				B	
Approach Delay, s/veh / LOS	8.6	A		7.9	A			12.2	B			11.9	B
Intersection Delay, s/veh / LOS	8.8			8.8			A			A			

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.64	B	1.64	B	1.89	B	1.89	B
Bicycle LOS Score / LOS	1.53	B	1.26	A	0.65	A	0.60	A

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	ODOT - D 11			Duration, h	0.250		
Analyst	CJV	Analysis Date	May 18, 2022	Area Type	Other		
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.92		
Urban Street	SR 39	Analysis Year	2025	Analysis Period	1> 15:45		
Intersection	SR 39 & CR 114	File Name	HOL 39 28.99 HCS Signal Analysis.xus				
Project Description	2025 PM Peak						



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	30	510	30	30	380	10	10	30	50	10	30	20

Signal Information												
Cycle, s	32.3	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On									
Force Mode	Fixed	Simult. Gap N/S	On									
		Green	13.4	5.4	0.0	0.0	0.0	0.0				
		Yellow	6.0	5.0	0.0	0.0	0.0	0.0				
		Red	1.0	1.5	0.0	0.0	0.0	0.0				

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		2		6		8		4
Case Number		6.0		6.0		8.0		8.0
Phase Duration, s		20.4		20.4		11.9		11.9
Change Period, (Y+R _c), s		7.0		7.0		6.5		6.5
Max Allow Headway (MAH), s		3.0		3.0		3.1		3.1
Queue Clearance Time (g _s), s		10.3		11.6		3.8		3.1
Green Extension Time (g _e), s		1.9		1.9		0.2		0.2
Phase Call Probability		1.00		1.00		0.77		0.77
Max Out Probability		0.03		0.04		0.00		0.00



















Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	5	2	12	1	6	16	3	8	18	7	4	14
Adjusted Flow Rate (v), veh/h	33	587		33	424			98			65	
Adjusted Saturation Flow Rate (s), veh/h/ln	918	1918		789	1773			1565			1604	
Queue Service Time (g _s), s	0.9	8.3		1.2	5.9			0.0			0.0	
Cycle Queue Clearance Time (g _c), s	6.9	8.3		9.6	5.9			1.8			1.1	
Green Ratio (g/C)	0.41	0.41		0.41	0.41			0.17			0.17	
Capacity (c), veh/h	434	795		345	735			385			398	
Volume-to-Capacity Ratio (X)	0.075	0.738		0.094	0.577			0.254			0.164	
Back of Queue (Q), ft/ln (95 th percentile)												
Back of Queue (Q), veh/ln (95 th percentile)	0.2	2.4		0.2	1.5			0.7			0.5	
Queue Storage Ratio (RQ) (95 th percentile)	0.03	0.00		0.04	0.00			0.00			0.00	
Uniform Delay (d ₁), s/veh	9.9	8.0		12.0	7.3			11.9			11.7	
Incremental Delay (d ₂), s/veh	0.0	0.5		0.0	0.3			0.1			0.1	
Initial Queue Delay (d ₃), s/veh	0.0	0.0		0.0	0.0			0.0			0.0	
Control Delay (d), s/veh	10.0	8.5		12.1	7.5			12.1			11.7	
Level of Service (LOS)	A	A		B	A			B			B	
Approach Delay, s/veh / LOS	8.5	A		7.9	A		12.1	B		11.7	B	
Intersection Delay, s/veh / LOS	8.7						A					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.64	B	1.64	B	1.89	B	1.89	B
Bicycle LOS Score / LOS	1.51	B	1.24	A	0.65	A	0.60	A

HCM 2010 Signalized Intersection Summary

HOL 39 28.99 Synchro with Lt. Turn Lanes 2025 AM Peak Volumes.syn

05/31/2022



















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	20	30	10	10	30	20	330	10	10	240	20
Future Volume (veh/h)	20	20	30	10	10	30	20	330	10	10	240	20
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1773	1673	1773	1764	1713	1764	1667	1667	1800	1700	1700	1836
Adj Flow Rate, veh/h	22	22	33	11	11	33	22	359	11	11	261	22
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	6	6	6	3	3	3	8	8	8	8	8	8
Cap, veh/h	334	3	5	311	2	7	925	804	25	860	773	65
Arrive On Green	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.50	0.50
Sat Flow, veh/h	471	471	707	339	339	1017	1031	1609	49	971	1547	130
Grp Volume(v), veh/h	77	0	0	55	0	0	22	0	370	11	0	283
Grp Sat Flow(s), veh/h/ln	1649	0	0	1696	0	0	1031	0	1658	971	0	1677
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	2.0	0.1	0.0	1.4
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.1	0.0	0.0	1.6	0.0	2.0	2.1	0.0	1.4
Prop In Lane	0.29		0.43	0.20		0.60	1.00		0.03	1.00		0.08
Lane Grp Cap(c), veh/h	342	0	0	321	0	0	925	0	829	860	0	838
V/C Ratio(X)	0.22	0.00	0.00	0.17	0.00	0.00	0.02	0.00	0.45	0.01	0.00	0.34
Avail Cap(c_a), veh/h	2708	0	0	2728	0	0	1662	0	2013	1554	0	2036
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.0	0.0	0.0	7.0	0.0	0.0	2.6	0.0	2.3	2.9	0.0	2.1
Incr Delay (d2), s/veh	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.9	0.0	0.0	0.7
LnGrp Delay(d),s/veh	7.4	0.0	0.0	7.3	0.0	0.0	2.6	0.0	2.6	2.9	0.0	2.3
LnGrp LOS	A			A			A		A	A		A
Approach Vol, veh/h		77			55			392			294	
Approach Delay, s/veh		7.4			7.3			2.6			2.4	
Approach LOS		A			A			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		14.0		0.0		14.0		0.0				
Change Period (Y+Rc), s		7.0		6.5		7.0		6.5				
Max Green Setting (Gmax), s		17.0		16.5		17.0		16.5				
Max Q Clear Time (g_c+11), s		4.0		0.0		4.1		0.0				
Green Ext Time (p_c), s		1.0		0.0		0.7		0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			3.3									
HCM 2010 LOS			A									

NB $\frac{1}{2}$ SB = SR 39
 EB $\frac{1}{2}$ WB = CR 114

HCM 2010 Signalized Intersection Summary

HOL 39 28.99 Synchro with Lt. Turn Lanes 2025 PM Peak Volumes.syn



















05/31/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	30	50	0	30	20	30	380	0	30	510	30
Future Volume (veh/h)	10	30	50	0	30	20	30	380	0	30	510	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1773	1673	1773	1764	1713	1764	1667	1667	1800	1700	1700	1836
Adj Flow Rate, veh/h	11	33	54	0	33	22	33	413	0	33	554	33
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	6	6	6	3	3	3	8	8	8	8	8	8
Cap, veh/h	272	0	0	0	37	25	700	875	0	833	834	50
Arrive On Green	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.52	0.00	0.52	0.52	0.52
Sat Flow, veh/h	0	0	0	0	5431	3621	779	1667	0	934	1589	95
Grp Volume(v), veh/h	98	0	0	0	0	55	33	413	0	33	0	587
Grp Sat Flow(s),veh/h/ln	0	0	0	0	0	9052	779	1667	0	934	0	1683
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.1	0.5	2.3	0.0	0.3	0.0	3.7
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.0	0.0	0.1	4.2	2.3	0.0	2.6	0.0	3.7
Prop In Lane	0.11		0.55	0.00		0.40	1.00		0.00	1.00		0.06
Lane Grp Cap(c), veh/h	272	0	0	0	0	61	700	875	0	833	0	884
V/C Ratio(X)	0.36	0.00	0.00	0.00	0.00	0.90	0.05	0.47	0.00	0.04	0.00	0.66
Avail Cap(c_a), veh/h	2577	0	0	0	0	10136	1454	2488	0	1736	0	2513
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.4	0.0	0.0	0.0	0.0	7.4	4.1	2.2	0.0	3.0	0.0	2.6
Incr Delay (d2), s/veh	0.8	0.0	0.0	0.0	0.0	32.2	0.0	0.4	0.0	0.0	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.7	0.1	1.0	0.0	0.1	0.0	1.8
LnGrp Delay(d),s/veh	8.2	0.0	0.0	0.0	0.0	39.5	4.1	2.6	0.0	3.1	0.0	3.4
LnGrp LOS	A					D	A	A		A		A
Approach Vol, veh/h		98			55			446			620	
Approach Delay, s/veh		8.2			39.5			2.7			3.4	
Approach LOS		A			D			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		14.7		0.0		14.7		0.0				
Change Period (Y+Rc), s		7.0		6.5		7.0		6.5				
Max Green Setting (Gmax), s		22.0		16.5		22.0		16.5				
Max Q Clear Time (g_c+I1), s		6.2		0.0		5.7		0.0				
Green Ext Time (p_c), s		1.3		0.0		2.0		0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			5.2									
HCM 2010 LOS			A									

HCM 2010 Signalized Intersection Summary

HOL 39 28.99 Synchro with Lt. Turn Lanes 2045 AM Peak Volumes.syn



















05/31/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	20	20	30	10	10	30	20	330	10	10	250	30
Future Volume (veh/h)	20	20	30	10	10	30	20	330	10	10	250	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1698	1800	1800	1748	1800	1667	1667	1800	1667	1667	1800
Adj Flow Rate, veh/h	22	22	33	11	11	33	22	359	11	11	272	33
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	6	6	6	3	3	3	8	8	8	8	8	8
Cap, veh/h	334	3	5	311	2	7	904	804	25	854	729	88
Arrive On Green	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.50	0.50
Sat Flow, veh/h	478	478	718	346	346	1038	1011	1609	49	952	1458	177
Grp Volume(v), veh/h	77	0	0	55	0	0	22	0	370	11	0	305
Grp Sat Flow(s),veh/h/ln	1674	0	0	1730	0	0	1011	0	1658	952	0	1635
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	2.0	0.1	0.0	1.6
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.1	0.0	0.0	1.8	0.0	2.0	2.1	0.0	1.6
Prop In Lane	0.29		0.43	0.20		0.60	1.00		0.03	1.00		0.11
Lane Grp Cap(c), veh/h	343	0	0	321	0	0	904	0	829	854	0	818
V/C Ratio(X)	0.22	0.00	0.00	0.17	0.00	0.00	0.02	0.00	0.45	0.01	0.00	0.37
Avail Cap(c_a), veh/h	2744	0	0	2778	0	0	1626	0	2013	1534	0	1986
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	1.00	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.0	0.0	0.0	7.0	0.0	0.0	2.7	0.0	2.3	2.9	0.0	2.2
Incr Delay (d2), s/veh	0.3	0.0	0.0	0.3	0.0	0.0	0.0	0.0	0.4	0.0	0.0	0.3
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.3	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.9	0.0	0.0	0.7
LnGrp Delay(d),s/veh	7.4	0.0	0.0	7.3	0.0	0.0	2.7	0.0	2.6	2.9	0.0	2.4
LnGrp LOS	A			A			A		A	A		A
Approach Vol, veh/h		77			55			392				316
Approach Delay, s/veh		7.4			7.3			2.6				2.5
Approach LOS		A			A			A				A
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		14.0		0.0		14.0		0.0				
Change Period (Y+Rc), s		7.0		6.5		7.0		6.5				
Max Green Setting (Gmax), s		17.0		16.5		17.0		16.5				
Max Q Clear Time (g_c+l1), s		4.0		0.0		4.1		0.0				
Green Ext Time (p_c), s		1.0		0.0		0.8		0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			3.3									
HCM 2010 LOS			A									

HCM 2010 Signalized Intersection Summary

HOL 39 28.99 Synchro with Lt. Turn Lanes 2045 PM Peak Volumes.syn

05/31/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	10	30	50	0	30	20	30	390	0	30	520	30
Future Volume (veh/h)	10	30	50	0	30	20	30	390	0	30	520	30
Number	7	4	14	3	8	18	5	2	12	1	6	16
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Adj Sat Flow, veh/h/ln	1800	1698	1800	1800	1748	1800	1667	1667	1800	1667	1667	1800
Adj Flow Rate, veh/h	11	33	54	0	33	22	33	424	0	33	565	33
Adj No. of Lanes	0	1	0	0	1	0	1	1	0	1	1	0
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Percent Heavy Veh, %	6	6	6	3	3	3	8	8	8	8	8	8
Cap, veh/h	264	0	0	0	37	24	688	896	0	820	838	49
Arrive On Green	0.00	0.00	0.00	0.00	0.00	0.00	0.54	0.54	0.00	0.54	0.54	0.54
Sat Flow, veh/h	0	0	0	0	5542	3695	772	1667	0	906	1560	91
Grp Volume(v), veh/h	98	0	0	0	0	55	33	424	0	33	0	598
Grp Sat Flow(s), veh/h/ln	0	0	0	0	0	9237	772	1667	0	906	0	1651
Q Serve(g_s), s	0.0	0.0	0.0	0.0	0.0	0.1	0.5	2.4	0.0	0.4	0.0	4.0
Cycle Q Clear(g_c), s	0.1	0.0	0.0	0.0	0.0	0.1	4.5	2.4	0.0	2.7	0.0	4.0
Prop In Lane	0.11		0.55	0.00		0.40	1.00		0.00	1.00		0.06
Lane Grp Cap(c), veh/h	264	0	0	0	0	61	688	896	0	820	0	887
V/C Ratio(X)	0.37	0.00	0.00	0.00	0.00	0.90	0.05	0.47	0.00	0.04	0.00	0.67
Avail Cap(c_a), veh/h	2543	0	0	0	0	10068	1649	2973	0	1949	0	2944
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Upstream Filter(I)	1.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00
Uniform Delay (d), s/veh	7.6	0.0	0.0	0.0	0.0	7.6	4.2	2.2	0.0	3.0	0.0	2.5
Incr Delay (d2), s/veh	0.9	0.0	0.0	0.0	0.0	33.3	0.0	0.4	0.0	0.0	0.0	0.9
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	0.4	0.0	0.0	0.0	0.0	0.8	0.1	1.2	0.0	0.1	0.0	1.9
LnGrp Delay(d),s/veh	8.5	0.0	0.0	0.0	0.0	40.8	4.2	2.6	0.0	3.0	0.0	3.4
LnGrp LOS	A					D	A	A		A		A
Approach Vol, veh/h		98			55			457			631	
Approach Delay, s/veh		8.5			40.8			2.7			3.4	
Approach LOS		A			D			A			A	
Timer	1	2	3	4	5	6	7	8				
Assigned Phs		2		4		6		8				
Phs Duration (G+Y+Rc), s		15.1		0.0		15.1		0.0				
Change Period (Y+Rc), s		7.0		6.5		7.0		6.5				
Max Green Setting (Gmax), s		27.0		16.5		27.0		16.5				
Max Q Clear Time (g_c+1), s		6.5		0.0		6.0		0.0				
Green Ext Time (p_c), s		1.5		0.0		2.2		0.0				
Intersection Summary												
HCM 2010 Ctrl Delay			5.2									
HCM 2010 LOS			A									

ASSOCIATED PHASE		DIRECTION	MOVEMENT	TRAFFIC SIGNAL										PEDESTRIAN													
				FACTORS (TEM 403-2)					CALCULATED (TEM 403-2)			FINAL CLEARANCE		PED MOVEMENT		ASSOCIATED PHASE		PUSHBUTTON PROVIDED		WALK INTERVAL (4-7s TYP)		CALCULATED PED CLEARANCE		PED CHANGE INTERVAL (FDW)		3 fps CHECKS (OMUTCD 4E.06, 01-14)	
MPH	SEC	V _y	V _r	a	W	L	g	Y	R	TOTAL	Y (3-6s TYP)	R (1-6s TYP)	TOTAL	L	P	SEC	SEC	SEC	SEC	X	Y	IS Y>=X?	SEC	SEC			
1	SB	THROUGH/RT	50	1	57	57	10	65	20	-4	5.8	0.0	5.8	6	1	7.0	-	-	-	-	-	-	-	-	-	-	-
2	NB	THROUGH/RT	50	1	57	57	10	65	20	0	5.2	0.0	5.2	5.5	1	6.5	-	-	-	-	-	-	-	-	-	-	-
3	EB	THROUGH/RT	50	1	57	57	10	65	20	3	4.8	0.0	4.8	5	1	6.0	-	-	-	-	-	-	-	-	-	-	-
4	WB	THROUGH/RT	50	1	57	57	10	65	20	4	4.7	0.0	4.7	5	1	6.0	-	-	-	-	-	-	-	-	-	-	-
5	SB LT	LEFT TURN	50	1	45	25	10	70	20	-4	4.8	1.4	6.2	5	1.5	6.5	-	-	-	-	-	-	-	-	-	-	-
6	NB LT	LEFT TURN	50	1	45	25	10	70	20	0	4.3	1.4	5.7	4.5	1.5	6.0	-	-	-	-	-	-	-	-	-	-	-
7	EB LT	LEFT TURN	50	1	45	25	10	70	20	3	4.0	1.4	5.4	4	1.5	5.5	-	-	-	-	-	-	-	-	-	-	-
8	WB LT	LEFT TURN	50	1	45	25	10	70	20	4	3.9	1.4	5.3	4	1.5	5.5	-	-	-	-	-	-	-	-	-	-	-





Appendix F

CAP-X & ICE-ECAT Analysis & Results

Capacity Analysis for Planning of Junctions

Summary Report

Project Name:	HOL-39-28.99
Project Number:	CAP-X Analysis
Location:	SR 39 & CR 114 Intersection
Date:	May 16, 2022
Number of Intersection Legs:	4
Major Street Direction:	East-West

Traffic Volume Demand						
	Volume (Veh/hr)				Percent (%)	
	U-Turn 	Left 	Thru 	Right 	Heavy Vehicles	Volume Growth
Eastbound	0	27	542	34	3.20%	0.00%
Westbound	0	24	373	4	5.80%	0.00%
Southbound	0	4	36	22	3.20%	0.00%
Northbound	0	13	35	55	5.80%	0.00%
Adjustment Factor	0.80	0.95		0.85		
Suggested	0.80	0.95		0.85		
Truck to PCE Factor				Suggested = 2.00	2.00	
Multimodal Activity Level			0			
Critical Lane Volume Threshold	2-phase signal	Suggested = 1800 (Urban), 1650 (Rural)			1650	
	3-phase signal	Suggested = 1750 (Urban), 1600 (Rural)			1600	
	4-phase signal	Suggested = 1700 (Urban), 1550 (Rural)			1550	

Capacity Analysis for Planning of Junctions

Summary Report

#####

TYPE OF INTERSECTION	Overall v/c Ratio	V/C Ranking	Pedestrian Accommodations	Bicycle Accommodations
Two-Way Stop Control E-W	0.31	1	2.75	4.072676268
Traffic Signal	0.47	2	3.73	4.41627355
1 X 1 Roundabout	0.49	3	5.39	4.579921703
50 ICD	0.66	4	4.49	4.579921703
75 ICD	0.66	5	4.49	4.579921703
All-Way Stop Control	0.98	6	3.87	4.41627355
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--
--	--	--	--	--

Intersection Control Evaluation (ICE) Safety Analysis

General Information		Location Information			
Analyst	CJV	Route	HOL 39 28 99		
Agency or Company	ODOT - District 11	Logpoint	28.99		
Date Performed	05/17/22	Common Name			
Intersection	SR 39 & CR 114	Date	5/17/2022		
Intersection Site Conditions					
Input Data		Existing Conditions		HSM Base Conditions	
Locality:		State System			
System Type:		Rural Two-Lane Two Way Intersection			
Intersection type:		4ST		--	
Opening AADT _{major} (veh/day)	AADT _{MAX} = 14,700 (veh/day)	Opening Year	2025	AADT _{Major} = 9,800	--
Opening AADT _{minor} (veh/day)	AADT _{MAX} = 3,500 (veh/day)			AADT _{Minor} = 1,850	--
Design AADT _{major} (veh/day)	AADT _{MAX} = 14,700 (veh/day)	Design Year	2045	AADT _{Major} = 10,000	--
Design AADT _{minor} (veh/day)	AADT _{MAX} = 3,500 (veh/day)			AADT _{Minor} = 1,850	--
Intersection skew angle (degrees)		Skew for Leg 1:	0	Skew for Leg 2 (4ST only):	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	Not Present
Include Roundabout Alternative?		Yes			
Number of Legs (3 or 4)		4			--
Single-Lane or Multi-lane Roundabout		Single-Lane			--
Total Entering AADT (veh/day)		11,650			--
Presence of Outbound Only Leg (present/not present)		Not Present			Not Present
Leg 1	Leg 1 AADT (veh/day) Opening Year	AADT _{MAX} = 19,733 (veh/day)		4,900	--
	Bypass lane (present/not present) - Leg 1			Not Present	--
	Number of driveways or unsignalized access points - Leg 1			0	--
	Entry width (feet) - Leg 1			16	16-25 ft
Leg 2	Leg 2 AADT (veh/day) Opening Year	AADT _{MAX} = 19,733 (veh/day)		4,900	--
	Bypass lane (present/not present) - Leg 2			Not Present	--
	Number of driveways or unsignalized access points - Leg 2			0	--
	Entry width (feet) - Leg 2			16	16-25 ft
Leg 3	Leg 3 AADT (veh/day) Opening Year	AADT _{MAX} = 19,733 (veh/day)		925	--
	Bypass lane (present/not present) - Leg 3			Not Present	--
	Number of driveways or unsignalized access points - Leg 3			0	--
	Entry width (feet) - Leg 3			16	16-25 ft
Leg 4	Leg 4 AADT (veh/day) Opening Year	AADT _{MAX} = 19,733 (veh/day)		925	--
	Bypass lane (present/not present) - Leg 4			Not Present	--
	Number of driveways or unsignalized access points - Leg 4			0	--
	Entry width (feet) - Leg 4			16	16-25 ft
Include Signal Alternative Configuration?		Yes			
Number of approaches with left-turn lanes				2	0
Number of approaches with right-turn lanes				0	0
Number of approaches with left-turn signal phasing				2	--
Type of left-turn signal phasing for Leg #1				Permissive	Permissive
Type of left-turn signal phasing for Leg #2				Permissive	--
Type of left-turn signal phasing for Leg #3				Permissive	--
Type of left-turn signal phasing for Leg #4				Permissive	--





Project and Site Conditions Information



Capacity Analysis for Planning of Junctions

Detailed Report - Page 1 of 4

Project Name:	HOL-39-28.99
Project Number:	CAP-X Analysis
Location:	SR 39 & CR 114 Intersection
Date:	May 16, 2022
Number of Intersection Legs:	4
Major Street Direction:	East-West

Traffic Volume Demand						
	Volume (Veh/hr)				Percent (%)	
	U-Turn 	Left 	Thru 	Right 	Heavy Vehicles	Volume Growth
Eastbound	0	27	542	34	3.20%	0.00%
Westbound	0	24	373	4	5.80%	0.00%
Southbound	0	4	36	22	3.20%	0.00%
Northbound	0	13	35	55	5.80%	0.00%
Adjustment Factor	0.80	0.95		0.85		
Suggested	0.80	0.95		0.85		
Truck to PCE Factor				Suggested = 2.00		2.00
Multimodal Activity Level			0			
Critical Lane Volume Threshold	2-phase signal	Suggested = 1800 (Urban), 1650 (Rural)			1650	
	3-phase signal	Suggested = 1750 (Urban), 1600 (Rural)			1600	
	4-phase signal	Suggested = 1700 (Urban), 1550 (Rural)			1550	

Capacity Analysis for Planning of Junctions

Detailed Report - Page 2 of 4

Number of Lanes for Non-roundabout Intersections																	
TYPE OF INTERSECTION	Sheet	Northbound				Southbound				Eastbound				Westbound			
		U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Traffic Signal	FULL	/	0	1	0	/	0	1	0	/	0	1	0	/	0	1	0
Two-Way Stop Control	E-W	/	0	1	0	/	0	1	0	/	1	1	0	/	1	1	0
All-Way Stop Control	FULL	/	0	1	0	/	0	1	0	/	0	1	0	/	0	1	0

Number of Lanes for Grade Separated Intersections																	
TYPE OF INTERCHANGE	Sheet	Northbound				Southbound				Eastbound				Westbound			
		U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R

Number of Lanes for Interchanges																	
TYPE OF INTERCHANGE	Sheet	Northbound				Southbound				Eastbound				Westbound			
		U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R

Appendix G

Turn Lane Warrant Analysis



Ohio DOT - Traffic Operations
1606 West Broad Street

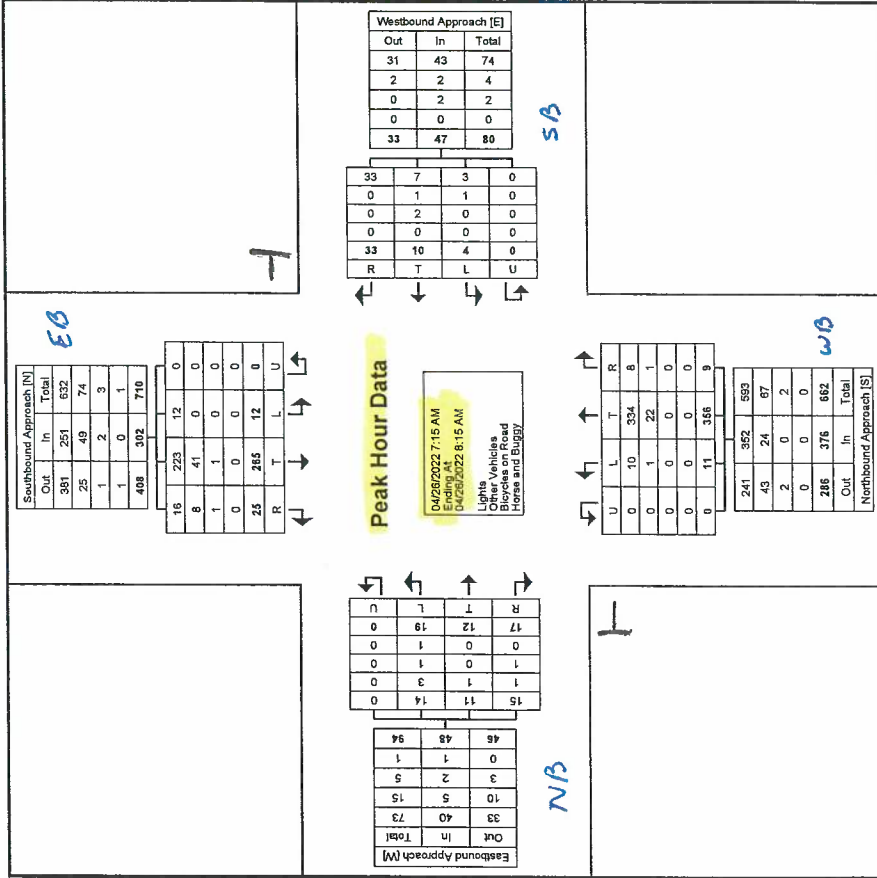
Columbus, Ohio, United States 43223
+16144667170 D11trafficcounts@dot.ohio.gov

Count Name: HOL-39-28.99
Site Code:
Start Date: 04/26/2022
Page No: 5

AM PEAK

SR 39

EO



CR 114

F Stop Sign Control
CR 114

Turning Movement Peak Hour Data Plot (7:15 AM)

SR 39





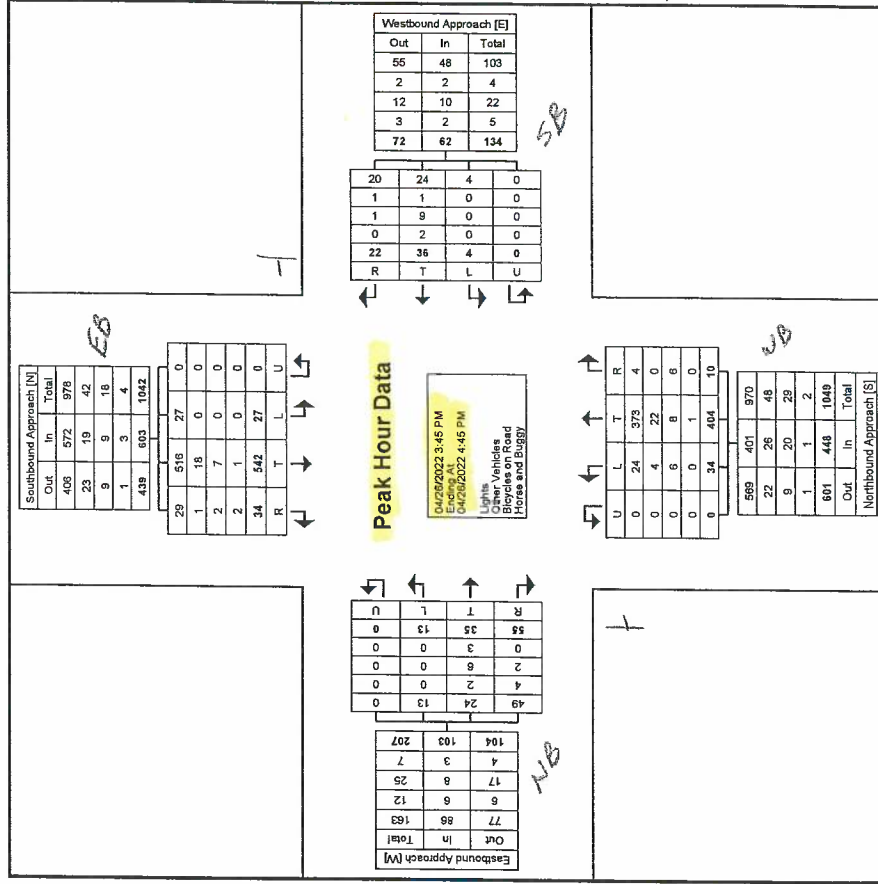
Ohio DOT - Traffic Operations
1606 West Broad Street

Columbus, Ohio, United States 43223
+16144667170 D11traffaccounis@dot.ohio.gov

Count Name: HOL-39-28.99
Site Code:
Start Date: 04/26/2022
Page No. 7

PM PEAK

SK 39



CR 114

SIGN
STOP CONTROL
CR 114

Turning Movement Peak Hour Data Plot (3:45 PM)

SK 39

CR 114

EB Lt. TURN LANE

PM PEAK HOUR

$$\text{Advancing Traffic} = (542 + 34 + 27) = 603$$

$$\text{Lt. TURN Traffic} = 27$$

$$\text{Opposing Traffic} = (373 + 24 + 4) = 401$$

$$\text{Lt. TURN \%} = 4.5\% = 27/603$$

AM PEAK HOUR

$$\text{Advancing Traffic} = (25 + 265 + 12) = 302$$

$$\text{Lt. TURN Traffic} = 12$$

$$\text{Opposing Traffic} = (10 + 334 + 8) = 352$$

$$\text{Lt. TURN Traffic} : 12/302 \approx 4.0\%$$

WB Lt. TURN LANE

PM PEAK

$$\text{Advancing Traffic} : (373 + 24 + 4) = 401$$

$$\text{Lt. TURN Traffic} : 24$$

$$\text{Opposing Traffic} : (542 + 34 + 27) = 603$$

$$\text{Lt. TURN \%} = 24/401 \approx 6.0\%$$

AM PEAK

$$\text{Advancing Traffic} : (10 + 334 + 8) = 352$$

$$\text{Lt. TURN Traffic} : 10$$

$$\text{Opposing Traffic} : (25 + 265 + 12) = 302$$

$$\text{Lt. TURN \%} : 10/352 : 2.8\%$$

NB : SB TURN LANES

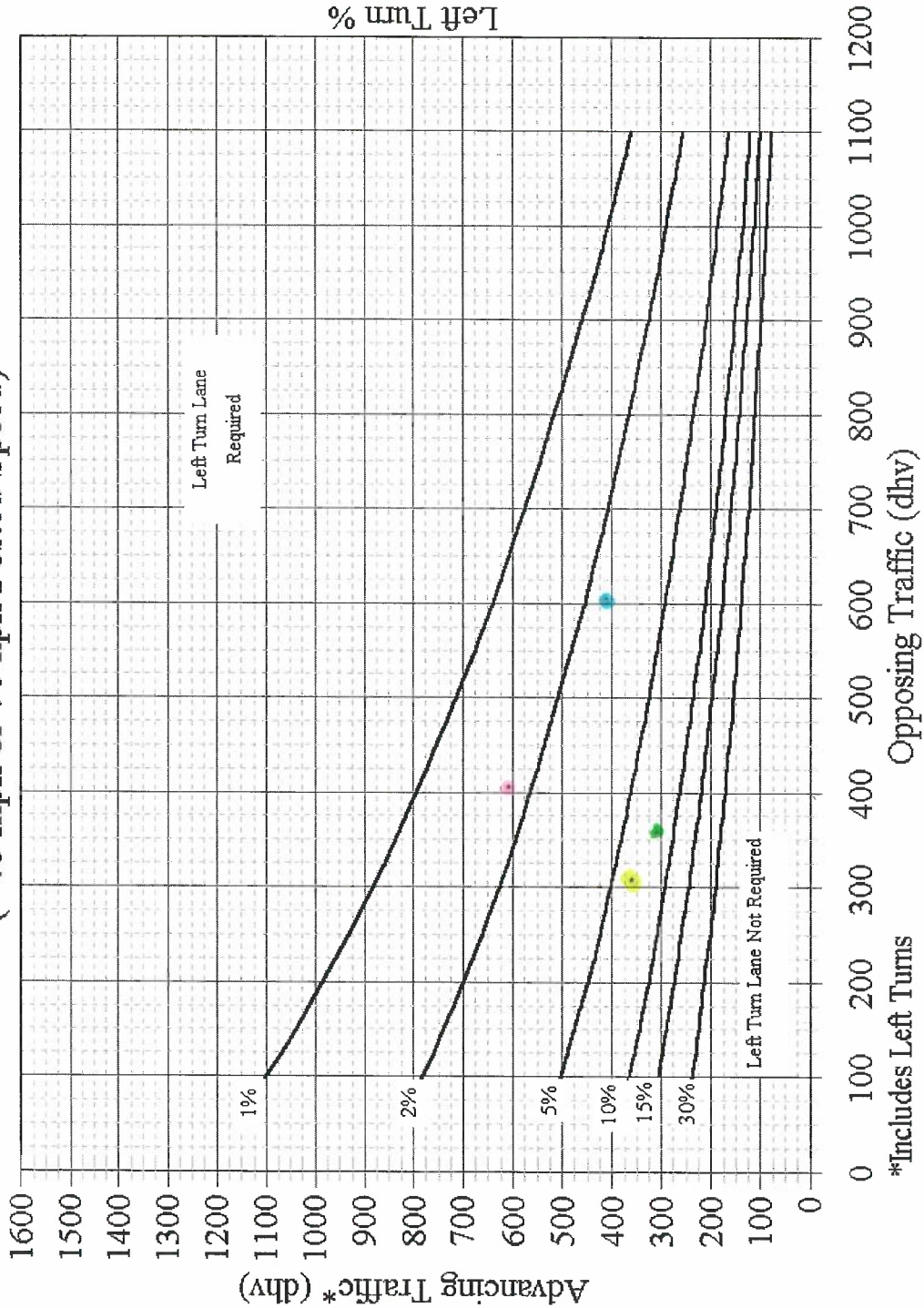
The volumes are too low for charts that they are off of the Charts.

2-LANE LEFT TURN LANE WARRANT (HIGH SPEED)

401-5b

REFERENCE SECTION
401.6.1

2-Lane Highway Left Turn Lane Warrant (>40 mph or 70 kph Posted Speed)



ED - PM PEAK
Opposing: 401
Advancing: 603
LT, Turn %: 4.58
MEETS

EB - AM PEAK
Opposing: 352
Advancing: 302
LT, Turn %: 4.0%
NOT Required

WB - PM PEAK
Opposing: 603
Advancing: 401
LT, Turn %: 6.0%
MEETS

WB - AM PEAK
Opposing: 302
Advancing: 352
LT, Turn %: 2.87%
NOT Required

*Includes Left Turns

2-LANE RIGHT TURN LANE WARRANT (HIGH SPEED)

401-6b

REFERENCE SECTION
401.6.3

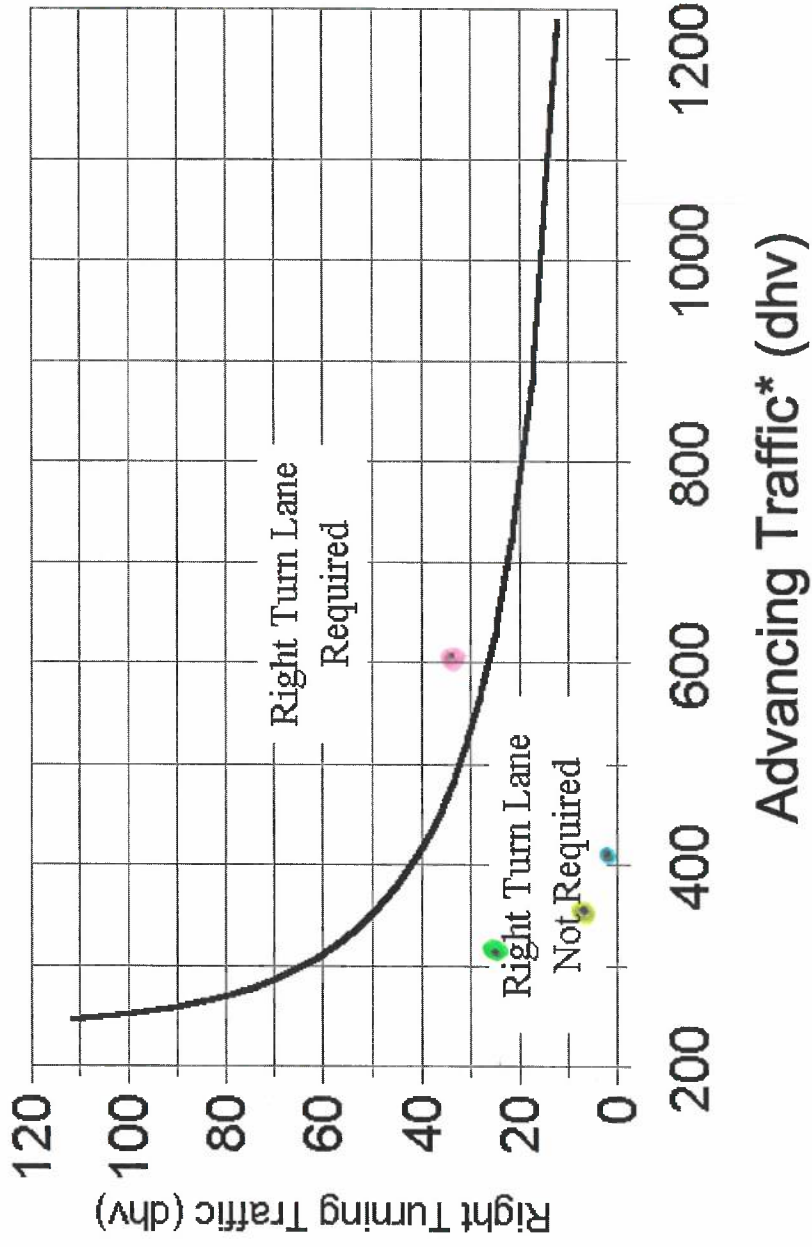
WB - PM PEAK
 ADVANCING TRAFFIC: 401 Not Required
 RT. TURNING: 4

WB - AM PEAK
 ADVANCING TRAFFIC: 352 Not Required
 RT. TURNING: 8

EB - PM PEAK
 ADVANCING TRAFFIC: 603 MEETS
 RT. TURNING: 34

EB - AM PEAK
 ADVANCING TRAFFIC: 302 Not Required
 RT. TURNING: 25

2-Lane Highway Right Turn Lane Warrant > 40 mph or 70 kph Posted Speed



*Includes Right Turns

Appendix H

Rodel Roundabout Analysis

Scheme Summary

Control Data

Control Data and Model Parameters

Cosgry/SR 161	2025 PHF Flow Profile (veh)
Scheme-1	7.5 min Time Slice
Rodel-Win1	Queuing Delays (sec)
Right Hand Drive	Daylight conditions
AM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Available Data

Entry Capacity Calibrated	No
Entry Capacity Modified	No
Crosswalks	No
Flows Factored	No
Approach/Exit Road Capacity Calibrated	No
Accidents	No
Accident Costs	No
Bypass Model	No
Bypass Calibration	No
Global Results	Yes

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	SB - SR 39	0	0	12.00	1	14.00	1	165.00	66.00	30.00
2	EB - CR 114	90	0	12.00	1	14.00	1	150.00	66.00	30.00
3	NB - SR 39	180	0	12.00	1	14.00	1	150.00	66.00	30.00
4	WB - CR 114	270	0	12.00	1	14.00	1	164.00	66.00	30.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	SB - SR 39	150.00	15.00	1	15.00	1	12.00	1
2	EB - CR 114	150.00	15.00	1	15.00	1	12.00	1
3	NB - SR 39	150.00	15.00	1	15.00	1	12.00	1
4	WB - CR 114	150.00	15.00	1	15.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	SB - SR 39	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	EB - CR 114	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	NB - SR 39	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	WB - CR 114	0	1.000	0	1.000	36.00	1792	0	12.00	1792	0

Traffic Flow Data (veh/hr)

2025 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	SB - SR 39	0	10	240	20	0	5.0	1.00	0.900
2	EB - CR 114	0	20	20	30	0	5.0	1.00	0.900
3	NB - SR 39	0	20	330	10	0	5.0	1.00	0.900
4	WB - CR 114	0	10	10	30	0	5.0	1.00	0.900

Operational Results

2025 AM Peak - 15 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	SB - SR 39	None	300		44		422	1075		0.2790	
2	EB - CR 114	None	78		289		56	952		0.0817	
3	NB - SR 39	None	400		56		311	1069		0.3740	
4	WB - CR 114	None	56		411		44	890		0.0624	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	SB - SR 39	None	4.11		4.11	0.94		A		A
2	EB - CR 114	None	3.72		3.72	0.22		A		A
3	NB - SR 39	None	4.68		4.68	1.43		A		A
4	WB - CR 114	None	3.90		3.90	0.17		A		A

Approach Flow Profile

2025 AM Peak - Approach Flows (Veh / Hour)

Time Slice	SB - SR 39	EB - CR 114	NB - SR 39	WB - CR 114
0.0 - 7.5	32.50	8.43	43.33	6.02
7.5 - 15.0	32.50	8.43	43.33	6.02
15.0 - 22.5	32.50	8.43	43.33	6.02
22.5 - 30.0	37.50	9.72	50.00	6.94
30.0 - 37.5	37.50	9.72	50.00	6.94
37.5 - 45.0	32.50	8.43	43.33	6.02
45.0 - 52.5	32.50	8.43	43.33	6.02
52.5 - 60.0	32.50	8.43	43.33	6.02
Peak 15 min	37.50	9.72	50.00	6.94
Peak 60 min	33.75	8.75	45.00	6.25

Exit Flow Profile

2025 AM Peak - Exit Flows (Veh / Hour)

Time Slice	SB - SR 39	EB - CR 114	NB - SR 39	WB - CR 114
0.0 - 7.5	45.70	6.01	33.68	4.81
7.5 - 15.0	45.74	6.02	33.70	4.81
15.0 - 22.5	45.74	6.02	33.70	4.81
22.5 - 30.0	52.73	6.94	38.86	5.55
30.0 - 37.5	52.78	6.94	38.89	5.56
37.5 - 45.0	45.79	6.02	33.73	4.82
45.0 - 52.5	45.74	6.02	33.70	4.81
52.5 - 60.0	45.74	6.02	33.70	4.81
0-60	380	50	280	40
%Trucks	5.00	5.00	5.00	5.00

Scheme Summary

Control Data

Control Data and Model Parameters

Cosgry/SR 161	2025 PHF Flow Profile (veh)
Scheme-1	7.5 min Time Slice
Rodel-Win1	Queuing Delays (sec)
Right Hand Drive	Daylight conditions
PM Peak Hour	Peak 60/15 min Results
Full Geometry	Output flows: Vehicles
English Units (ft)	50% Confidence Level

Available Data

Entry Capacity Calibrated	No
Entry Capacity Modified	No
Crosswalks	No
Flows Factored	No
Approach/Exit Road Capacity Calibrated	No
Accidents	No
Accident Costs	No
Bypass Model	No
Bypass Calibration	No
Global Results	Yes

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	SB - SR 39	0	0	12.00	1	14.00	1	165.00	66.00	30.00
2	EB - CR 114	90	0	12.00	1	14.00	1	150.00	66.00	30.00
3	NB - SR 39	180	0	12.00	1	14.00	1	150.00	66.00	30.00
4	WB - CR 114	270	0	12.00	1	14.00	1	164.00	66.00	30.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	SB - SR 39	150.00	15.00	1	15.00	1	12.00	1
2	EB - CR 114	150.00	15.00	1	15.00	1	12.00	1
3	NB - SR 39	150.00	15.00	1	15.00	1	12.00	1
4	WB - CR 114	150.00	15.00	1	15.00	1	12.00	1

Capacity Modifiers and Capacity Calibration (veh/hr)

Leg	Leg Names	Entry Capacity		Entry Calibration		Approach Road			Exit Road		
		Capacity + or -	XWalk Factor	Intercept + or -	Slope Factor	V (ft)	Default Capacity	Calib Capacity	V (ft)	Default Capacity	Calib Capacity
1	SB - SR 39	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
2	EB - CR 114	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
3	NB - SR 39	0	1.000	0	1.000	20.00	1792	0	12.00	1792	0
4	WB - CR 114	0	1.000	0	1.000	36.00	1792	0	12.00	1792	0

Traffic Flow Data (veh/hr)

2025 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	SB - SR 39	0	30	510	30	0	5.0	1.00	0.900
2	EB - CR 114	0	10	30	50	0	5.0	1.00	0.900
3	NB - SR 39	0	30	380	10	0	5.0	1.00	0.900
4	WB - CR 114	0	10	30	20	0	5.0	1.00	0.900

Operational Results

2025 PM Peak - 15 minutes

Flows and Capacity

Leg	Leg Names	Bypass Type	Flows (veh/hr)					Capacity (veh/hr)			
			Arrival Flow		Opposing Flow		Exit Flow	Capacity		Average VCR	
			Entry	Bypass	Entry	Bypass		Entry	Bypass	Entry	Bypass
1	SB - SR 39	None	633		78		455	1058		0.5984	
2	EB - CR 114	None	100		610		100	789		0.1267	
3	NB - SR 39	None	467		78		633	1058		0.4410	
4	WB - CR 114	None	67		466		78	862		0.0773	

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
			1	SB - SR 39	None	6.85		6.85	3.31	
2	EB - CR 114	None	4.66		4.66	0.36		A		A
3	NB - SR 39	None	5.21		5.21	1.86		A		A
4	WB - CR 114	None	4.08		4.08	0.21		A		A

Approach Flow Profile

2025 PM Peak - Approach Flows (Veh / Hour)

Time Slice	SB - SR 39	EB - CR 114	NB - SR 39	WB - CR 114
0.0 - 7.5	68.61	10.83	50.56	7.22
7.5 - 15.0	68.61	10.83	50.56	7.22
15.0 - 22.5	68.61	10.83	50.56	7.22
22.5 - 30.0	79.17	12.50	58.33	8.33
30.0 - 37.5	79.17	12.50	58.33	8.33
37.5 - 45.0	68.61	10.83	50.56	7.22
45.0 - 52.5	68.61	10.83	50.56	7.22
52.5 - 60.0	68.61	10.83	50.56	7.22
Peak 15 min	79.17	12.50	58.33	8.33
Peak 60 min	71.25	11.25	52.50	7.50

Exit Flow Profile

2025 PM Peak - Exit Flows (Veh / Hour)

Time Slice	SB - SR 39	EB - CR 114	NB - SR 39	WB - CR 114
0.0 - 7.5	49.30	10.82	68.51	8.42
7.5 - 15.0	49.35	10.83	68.61	8.43
15.0 - 22.5	49.35	10.83	68.61	8.43
22.5 - 30.0	56.88	12.48	79.01	9.71
30.0 - 37.5	56.94	12.50	79.16	9.72
37.5 - 45.0	49.42	10.85	68.76	8.44
45.0 - 52.5	49.35	10.83	68.62	8.43
52.5 - 60.0	49.35	10.83	68.61	8.43
0-60	410	90	570	70
%Trucks	5.00	5.00	5.00	5.00

Rodel Inputs



Appendix I

Countermeasures ECAT Analysis

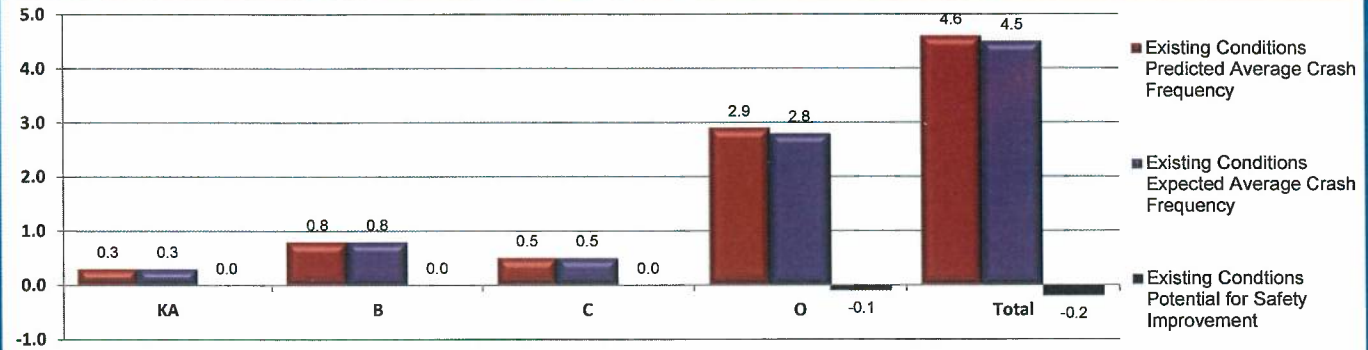


Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Existing Condition	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{\text{predicted}} - \text{Existing Conditions}$	0.3366	0.8157	0.5435	2.9199	4.6157
$N_{\text{expected}} - \text{Existing Conditions}$	0.3311	0.8024	0.5343	2.7881	4.4559
$N_{\text{potential for improvement}} - \text{Existing Conditions}$	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598

ECAT Ex. Condition



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Existing Condition	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39: 28.99		0.3366	0.8157	0.5435	2.9199	4.6157



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Existing Condition	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		0.3311	0.8024	0.5343	2.7881	4.4559



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Existing Condition	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		-0.0055	-0.0133	-0.0092	-0.1318	-0.1598



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Existing Condition	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Existing Condition	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Summary by Crash Type

Crash Type	Existing		PSI	Proposed
	Predicted Crash Frequency	Expected Crash Frequency		Expected Crash Frequency
Unknown	0.0184	0.0175	-0.0009	
Head On	0.0396	0.0386	-0.0010	
Rear End	0.9864	0.9508	-0.0356	
Backing	0.1857	0.1776	-0.0081	
Sideswipe - Meeting	0.1341	0.1296	-0.0045	
Sideswipe - Passing	0.2088	0.2006	-0.0082	
Angle	1.7612	1.7064	-0.0548	
Parked Vehicle	0.1642	0.1573	-0.0069	
Pedestrian	0.0225	0.0219	-0.0006	
Animal	0.0000	0.0000	0.0000	
Train	0.0008	0.0008	0.0000	
Pedalcycles	0.0170	0.0165	-0.0005	
Other Non-Vehicle	0.0003	0.0003	0.0000	
Fixed Object	0.7742	0.7456	-0.0286	
Other Object	0.0269	0.0259	-0.0010	
Overturning	0.0466	0.0453	-0.0013	
Other Non-Collision	0.0612	0.0588	-0.0024	
Left Turn	0.1678	0.1624	-0.0054	
Right Turn	0.0000	0.0000	0.0000	

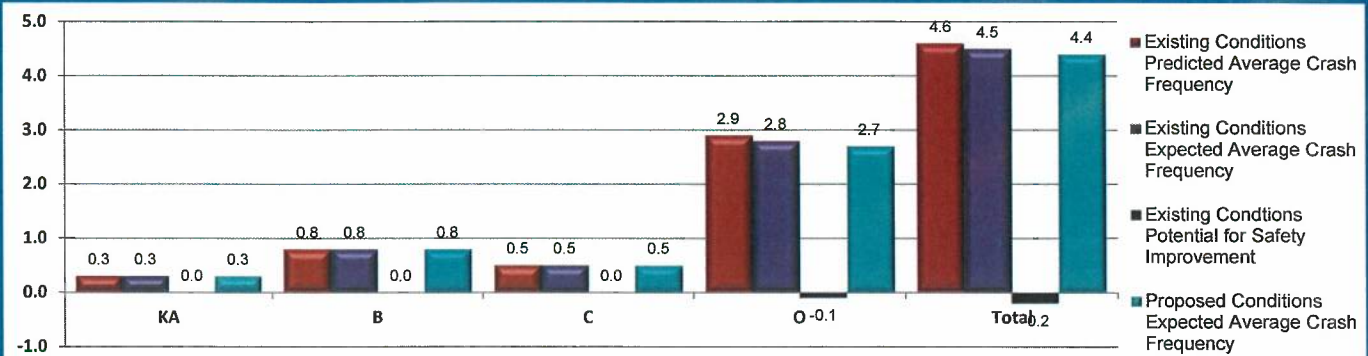


Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{\text{predicted}} - \text{Existing Conditions}$	0.3366	0.8157	0.5435	2.9199	4.6157
$N_{\text{expected}} - \text{Existing Conditions}$	0.3311	0.8024	0.5343	2.7881	4.4559
$N_{\text{potential for improvement}} - \text{Existing Conditions}$	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
$N_{\text{expected}} - \text{Proposed Conditions}$	0.3290	0.7926	0.5217	2.7355	4.3788

ECAT - LED SIGNS



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		0.3366	0.8157	0.5435	2.9199	4.6157



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		0.3311	0.8024	0.5343	2.7881	4.4559



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		-0.0055	-0.0133	-0.0092	-0.1318	-0.1598



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		0.329	0.7926	0.5217	2.7355	4.3788



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Summary by Crash Type

Crash Type	Existing		PSI	Proposed
	Predicted Crash Frequency	Expected Crash Frequency		Expected Crash Frequency
Unknown	0.0184	0.0175	-0.0009	0.0175
Head On	0.0396	0.0386	-0.0010	0.0386
Rear End	0.9864	0.9508	-0.0356	0.9508
Backing	0.1857	0.1776	-0.0081	0.1776
Sideswipe - Meeting	0.1341	0.1296	-0.0045	0.1296
Sideswipe - Passing	0.2088	0.2006	-0.0082	0.2006
Angle	1.7612	1.7064	-0.0548	1.7064
Parked Vehicle	0.1642	0.1573	-0.0069	0.1573
Pedestrian	0.0225	0.0219	-0.0006	0.0219
Animal	0.0000	0.0000	0.0000	0.0000
Train	0.0008	0.0008	0.0000	0.0008
Pedalcycles	0.0170	0.0165	-0.0005	0.0165
Other Non-Vehicle	0.0003	0.0003	0.0000	0.0003
Fixed Object	0.7742	0.7456	-0.0286	0.7456
Other Object	0.0269	0.0259	-0.0010	0.0259
Overturning	0.0466	0.0453	-0.0013	0.0453
Other Non-Collision	0.0612	0.0588	-0.0024	0.0588
Left Turn	0.1678	0.1624	-0.0054	0.1624
Right Turn	0.0000	0.0000	0.0000	0.0000



Safety Benefit - Cost Analysis

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Benefit - Cost Calculator

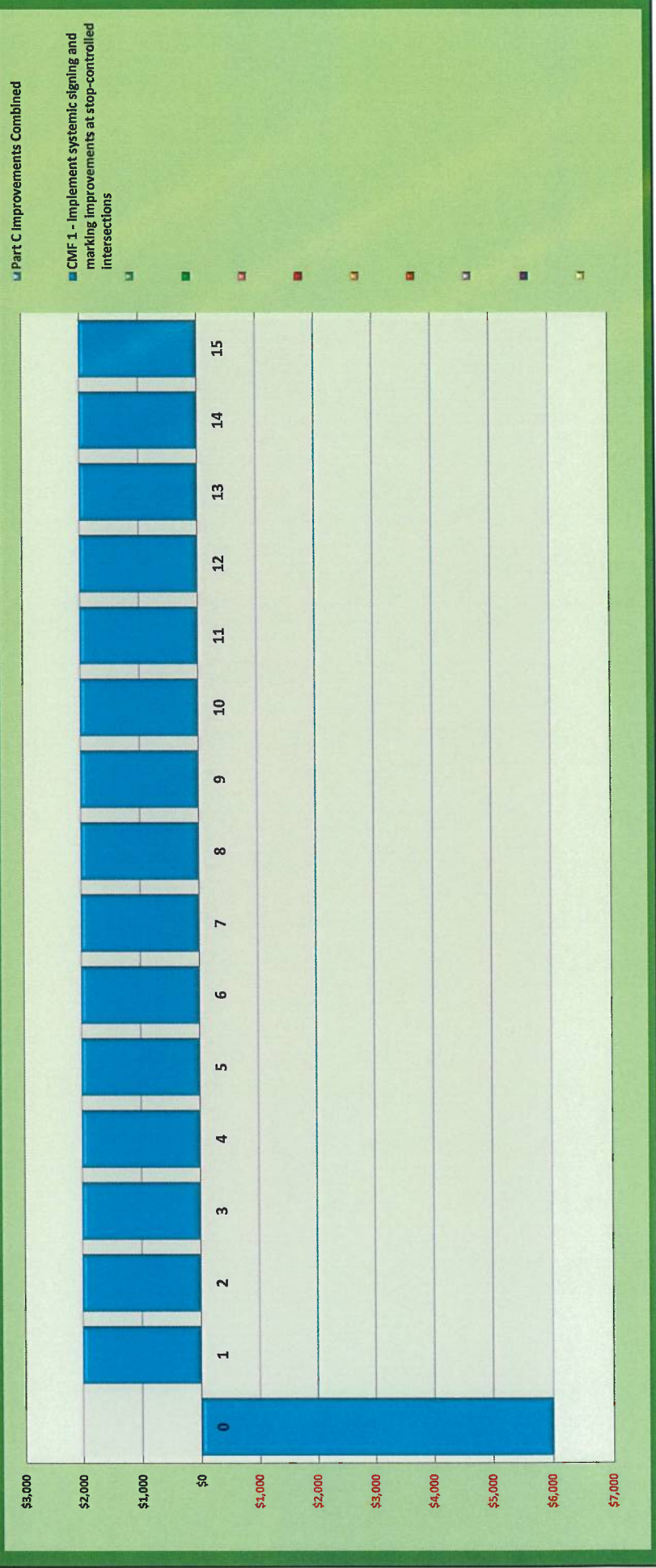
Net Present Value of Project	\$6,000.00
Net Present Value of Safety Benefits	\$22,398.88
Net Benefit	\$16,398.88
Benefit / Cost Ratio	3.73

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.002
Number of Injury Crashes	-0.025
Number of Total Crashes	-0.077

Comments:

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

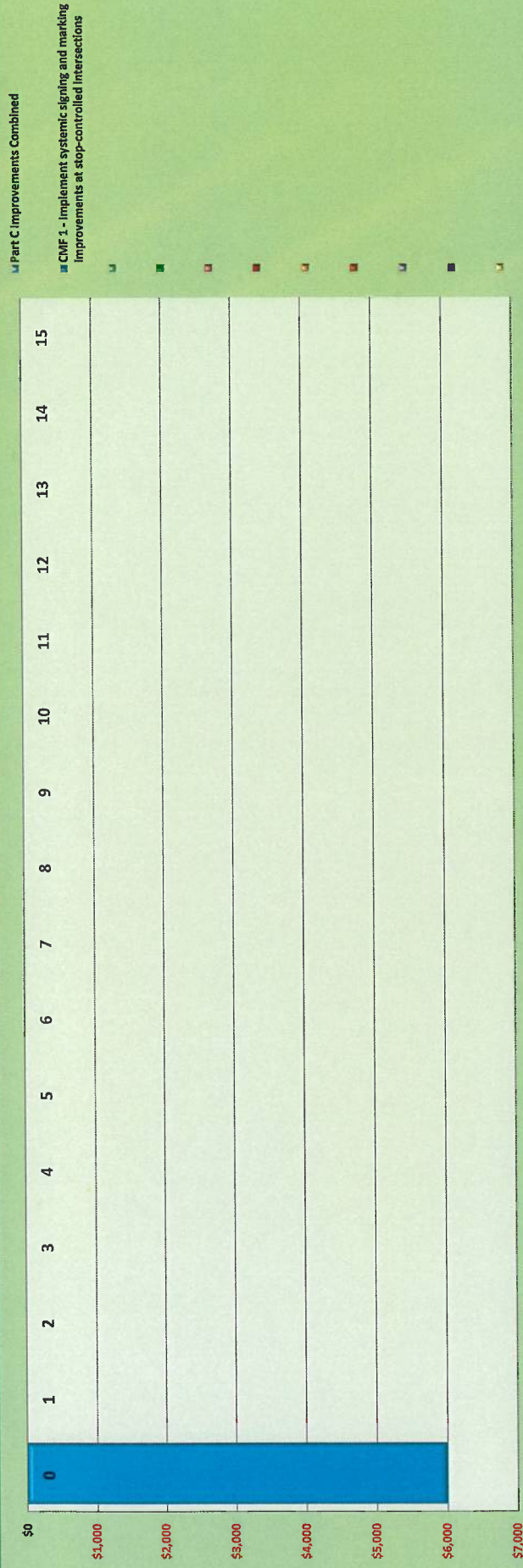


Safety Benefit - Cost Analysis

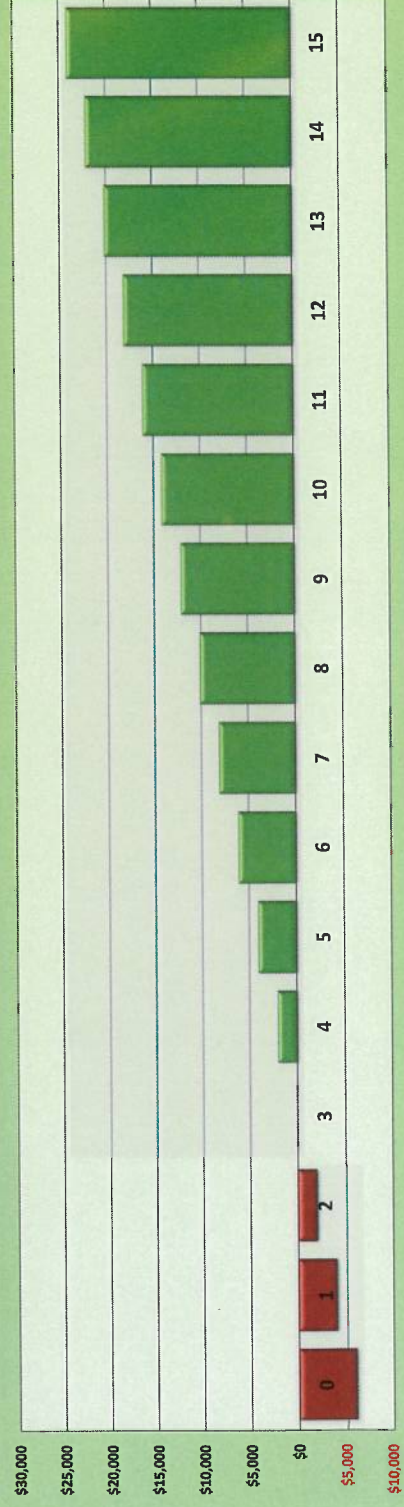
General Information

Project Name	HOL-39-28-99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	LED Advance Intersection Warning Signs	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



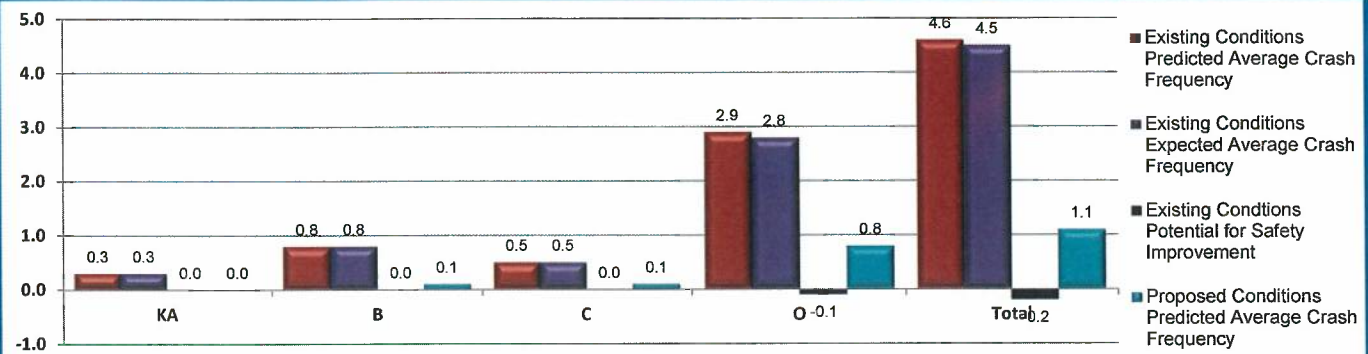


Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{\text{predicted}}$ - Existing Conditions	0.3366	0.8157	0.5435	2.9199	4.6157
N_{expected} - Existing Conditions	0.3311	0.8024	0.5343	2.7881	4.4559
$N_{\text{potential for improvement}}$ - Existing Conditions	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
N_{expected} - Proposed Conditions	0.0438	0.1060	0.0707	0.8468	1.0673

ECAT - ROUNDABOUT



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		0.3366	0.8157	0.5435	2.9199	4.6157



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39: 28.99		0.3311	0.8024	0.5343	2.7881	4.4559



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39: 28.99		-0.0055	-0.0133	-0.0092	-0.1318	-0.1598



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39: 28.99		0.0438	0.106	0.0707	0.8468	1.0673



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.0184	0.0175	-0.0009	0.0049
Head On	0.0396	0.0386	-0.0010	0.0078
Rear End	0.9864	0.9508	-0.0356	0.2528
Backing	0.1857	0.1776	-0.0081	0.0558
Sideswipe - Meeting	0.1341	0.1296	-0.0045	0.0322
Sideswipe - Passing	0.2088	0.2006	-0.0082	0.0564
Angle	1.7612	1.7064	-0.0548	0.3990
Parked Vehicle	0.1642	0.1573	-0.0069	0.0478
Pedestrian	0.0225	0.0219	-0.0006	0.0037
Animal	0.0000	0.0000	0.0000	0.0000
Train	0.0008	0.0008	0.0000	0.0002
Pedalcycles	0.0170	0.0165	-0.0005	0.0031
Other Non-Vehicle	0.0003	0.0003	0.0000	0.0001
Fixed Object	0.7742	0.7456	-0.0286	0.2017
Other Object	0.0269	0.0259	-0.0010	0.0078
Overturning	0.0466	0.0453	-0.0013	0.0095
Other Non-Collision	0.0612	0.0588	-0.0024	0.0172
Left Turn	0.1678	0.1624	-0.0054	0.0385
Right Turn	0.0000	0.0000	0.0000	0.0000



Safety Benefit - Cost Analysis

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Benefit - Cost Calculator

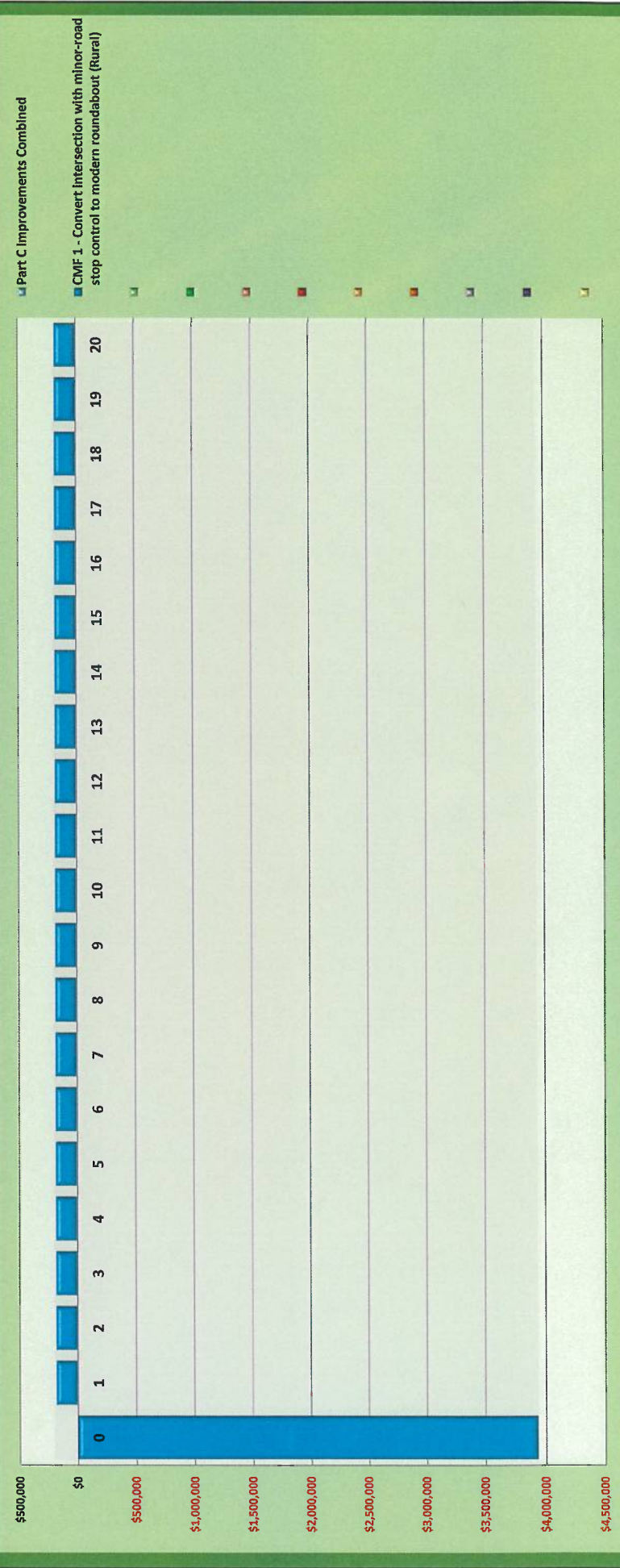
Net Present Value of Project	\$3,936,000.00
Net Present Value of Safety Benefits	\$2,508,388.12
Net Benefit	(\$1,427,611.88)
Benefit / Cost Ratio	0.64

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.293
Number of Injury Crashes	-1.475
Number of Total Crashes	-3.548

Comments:

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

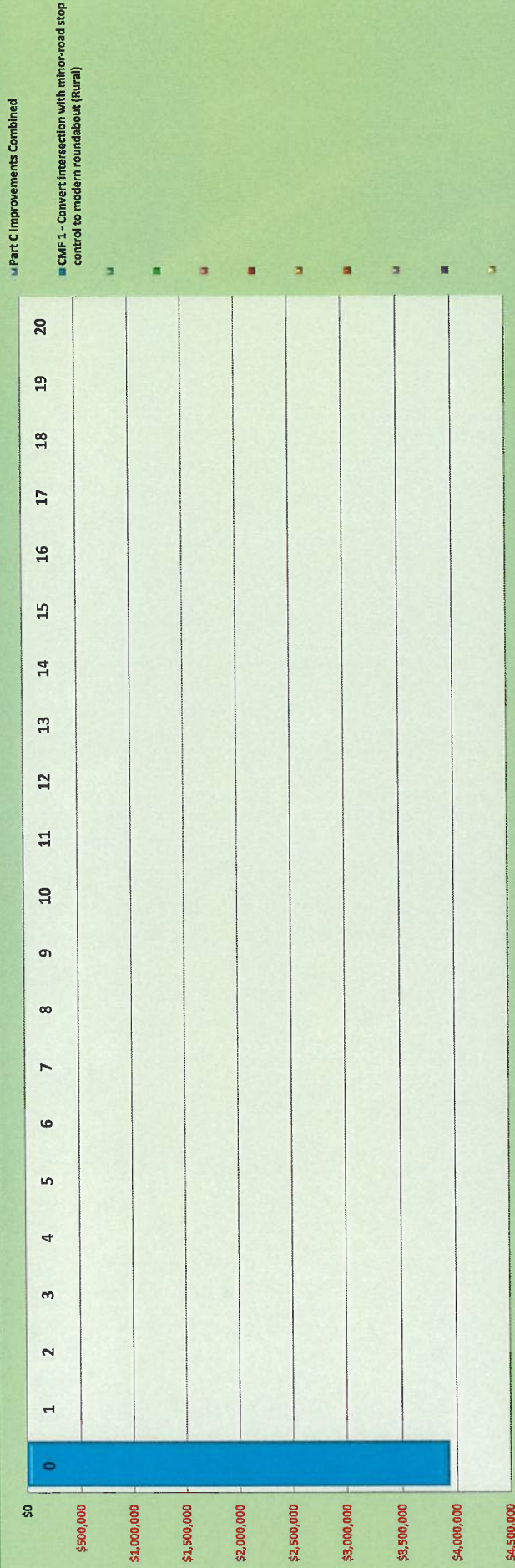


Safety Benefit - Cost Analysis

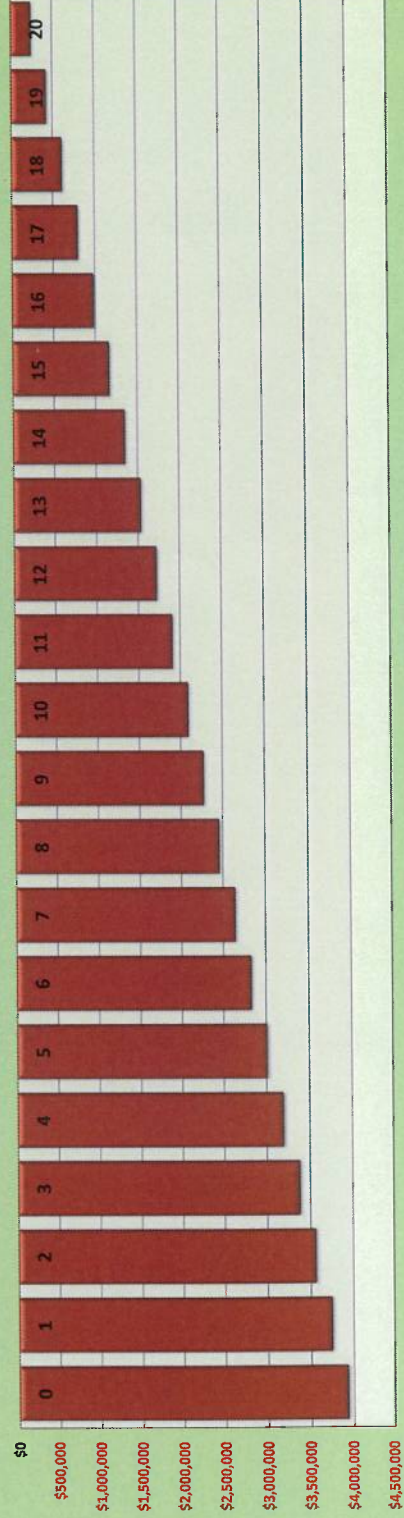
General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)

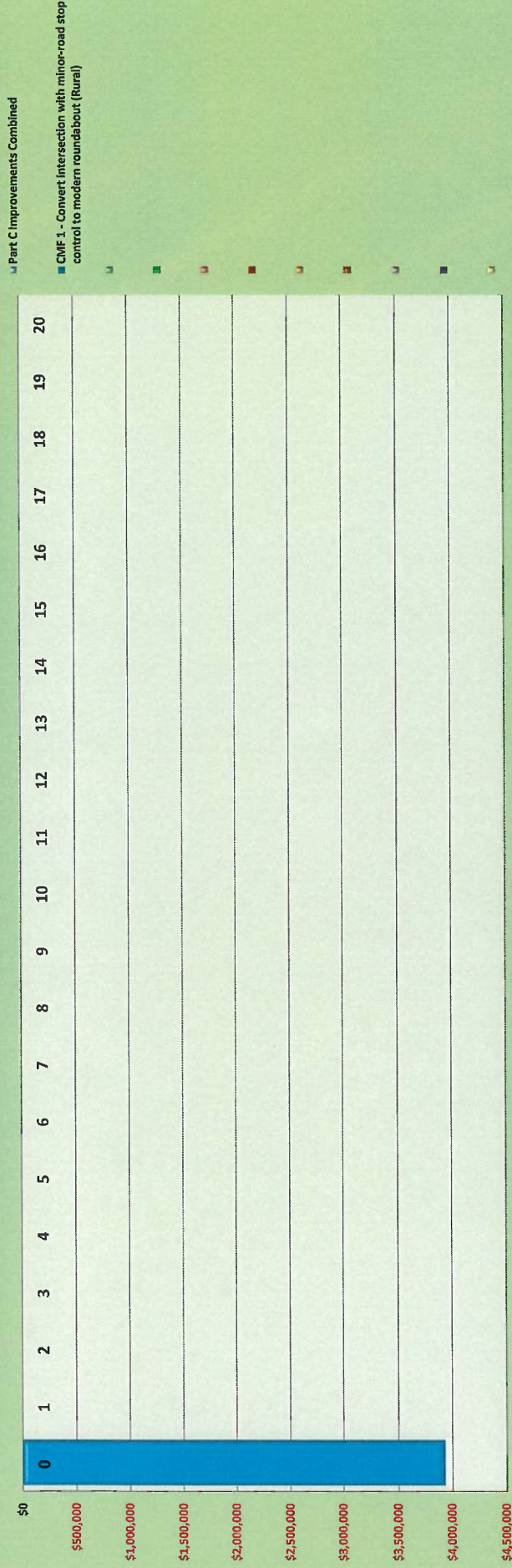


Safety Benefit - Cost Analysis

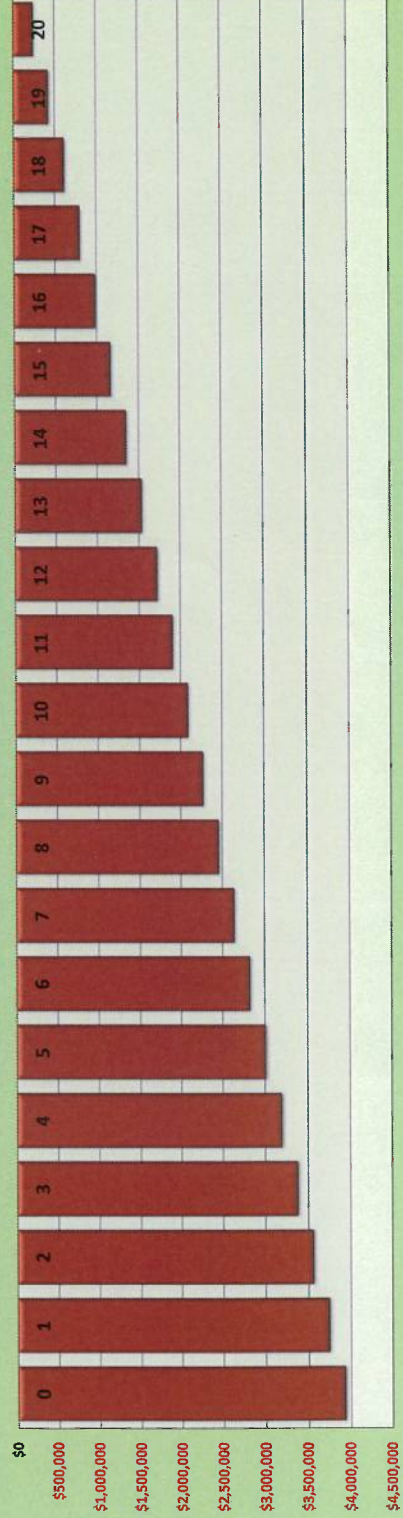
General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



First year to observe a positive return on investment: Unknown (Unknown years)

Percentage of Service Life to observe a continuous Positive Return on Investment: Unknown%

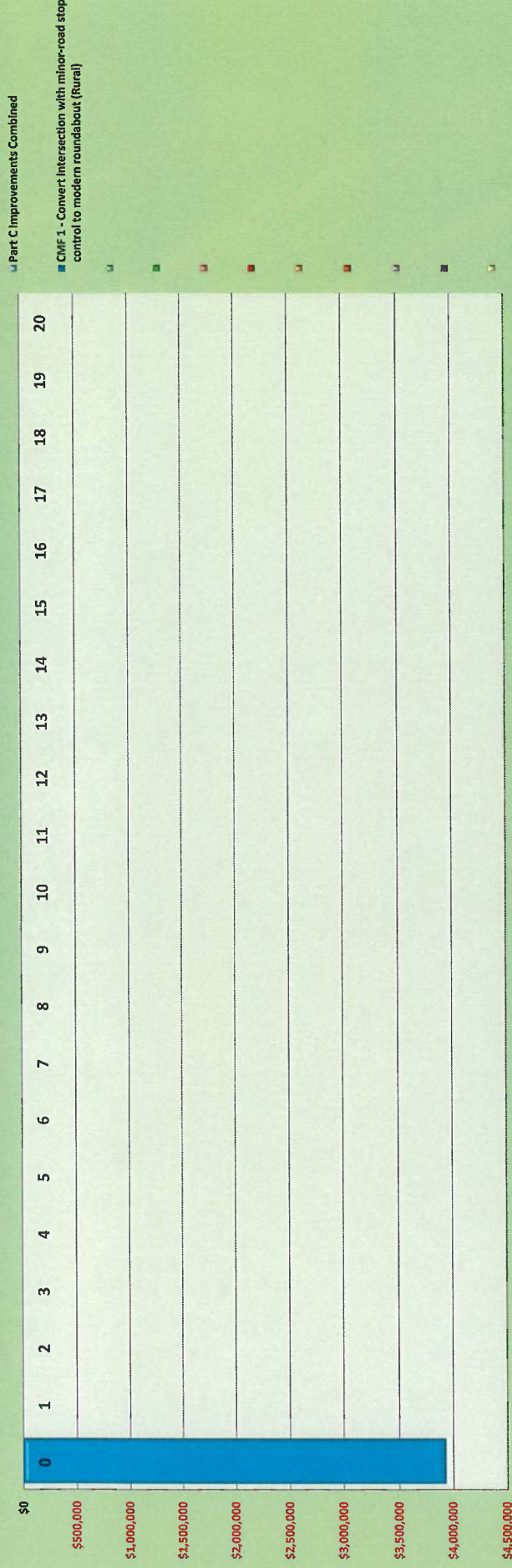


Safety Benefit - Cost Analysis

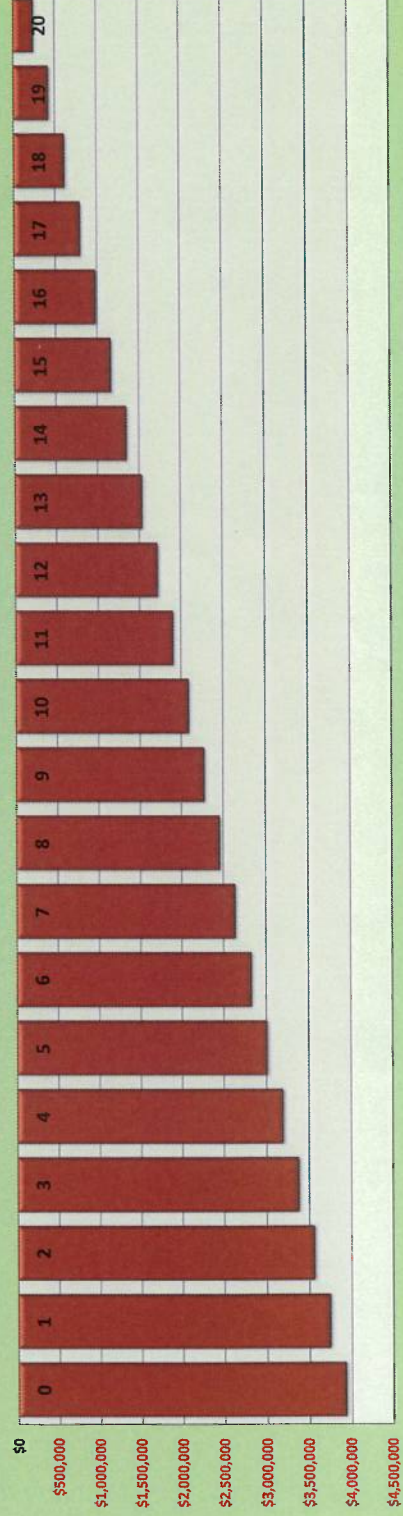
General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Roundabout ECAT	Date Performed	5/11/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



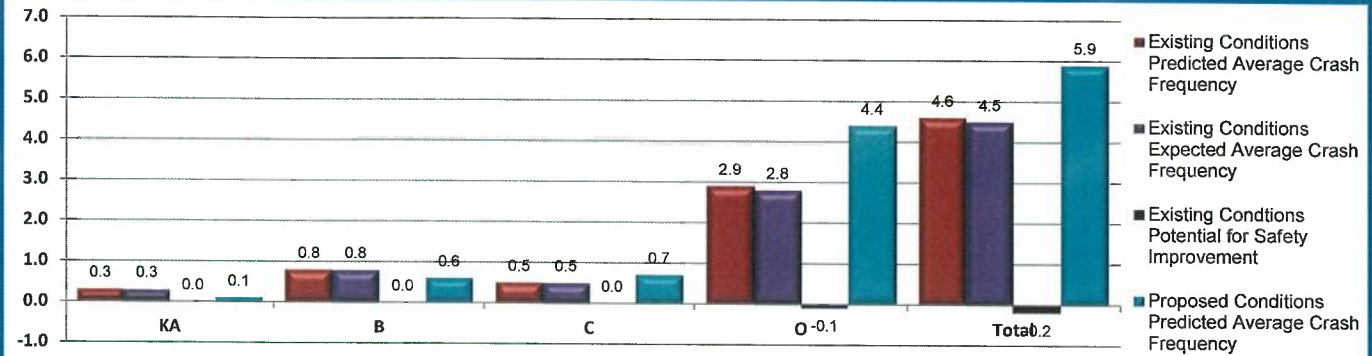


Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{\text{predicted}} - \text{Existing Conditions}$	0.3366	0.8157	0.5435	2.9199	4.6157
$N_{\text{expected}} - \text{Existing Conditions}$	0.3311	0.8024	0.5343	2.7881	4.4559
$N_{\text{potential for improvement}} - \text{Existing Conditions}$	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
$N_{\text{expected}} - \text{Proposed Conditions}$	0.1373	0.5842	0.7386	4.4130	5.8731



ECAT
Empirical Crash Analysis Tool

Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39: 28.99		0.3366	0.8157	0.5435	2.9199	4.6157



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		0.3311	0.8024	0.5343	2.7881	4.4559



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		-0.0055	-0.0133	-0.0092	-0.1318	-0.1598



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39, 28.99		0.1373	0.5842	0.7386	4.413	5.8731



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Summary by Crash Type

Crash Type	Existing		PSI	Proposed
	Predicted Crash Frequency	Expected Crash Frequency		Predicted Crash Frequency
Unknown	0.0184	0.0175	-0.0009	0.0184
Head On	0.0396	0.0386	-0.0010	0.0396
Rear End	0.9864	0.9508	-0.0356	0.9864
Backing	0.1857	0.1776	-0.0081	0.1857
Sideswipe - Meeting	0.1341	0.1296	-0.0045	0.1341
Sideswipe - Passing	0.2088	0.2006	-0.0082	0.2088
Angle	1.7612	1.7064	-0.0548	1.7612
Parked Vehicle	0.1642	0.1573	-0.0069	0.1642
Pedestrian	0.0225	0.0219	-0.0006	0.0225
Animal	0.0000	0.0000	0.0000	0.0000
Train	0.0008	0.0008	0.0000	0.0008
Pedalcycles	0.0170	0.0165	-0.0005	0.0170
Other Non-Vehicle	0.0003	0.0003	0.0000	0.0003
Fixed Object	0.7742	0.7456	-0.0286	0.7742
Other Object	0.0269	0.0259	-0.0010	0.0269
Overturning	0.0466	0.0453	-0.0013	0.0466
Other Non-Collision	0.0612	0.0588	-0.0024	0.0612
Left Turn	0.1678	0.1624	-0.0054	0.1678
Right Turn	0.0000	0.0000	0.0000	0.0000



Safety Benefit - Cost Analysis

General Information

Project Name	HOL-39-28.99	Contact Email	chris.vatcolia@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR 39	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Benefit - Cost Calculator

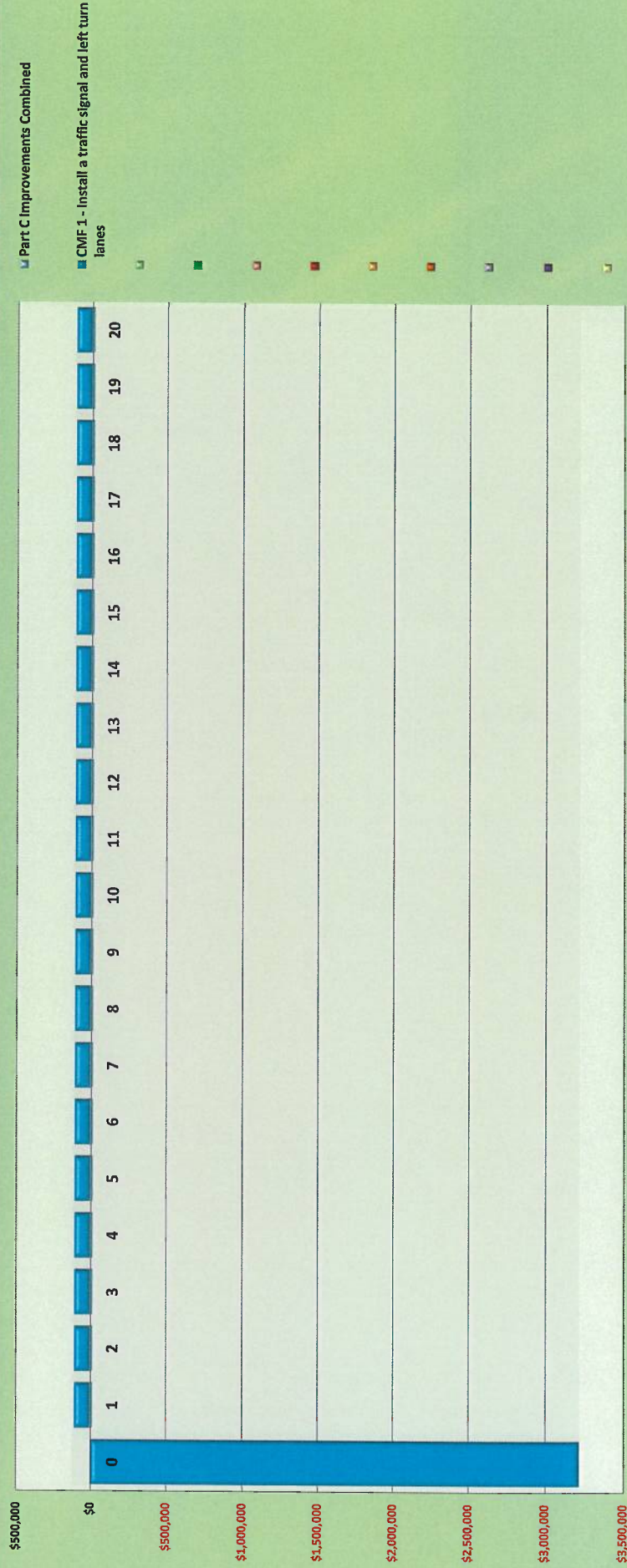
Net Present Value of Project	\$3,216,000.00
Net Present Value of Safety Benefits	\$1,189,821.70
Net Benefit	(\$2,026,178.30)
Benefit / Cost Ratio	0.37

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.199
Number of Injury Crashes	-0.236
Number of Total Crashes	1.257

Comments:

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



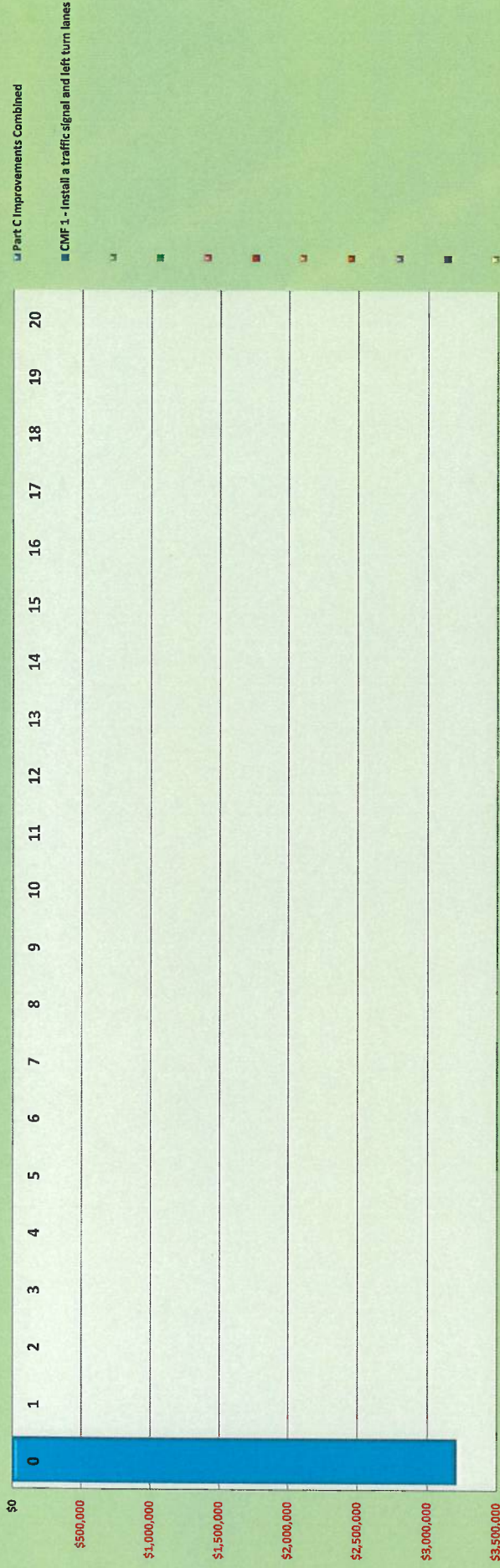


Safety Benefit - Cost Analysis

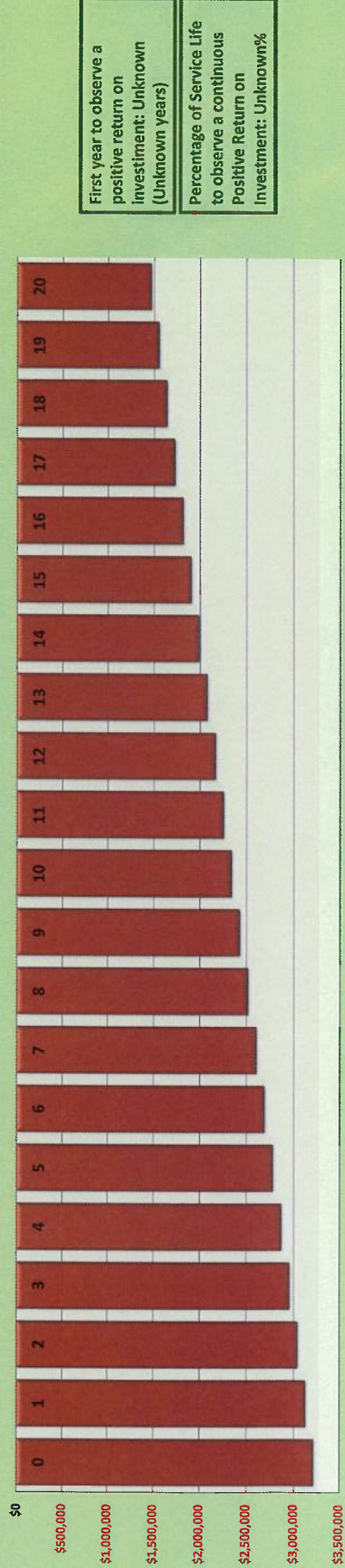
General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolia@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR 39	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



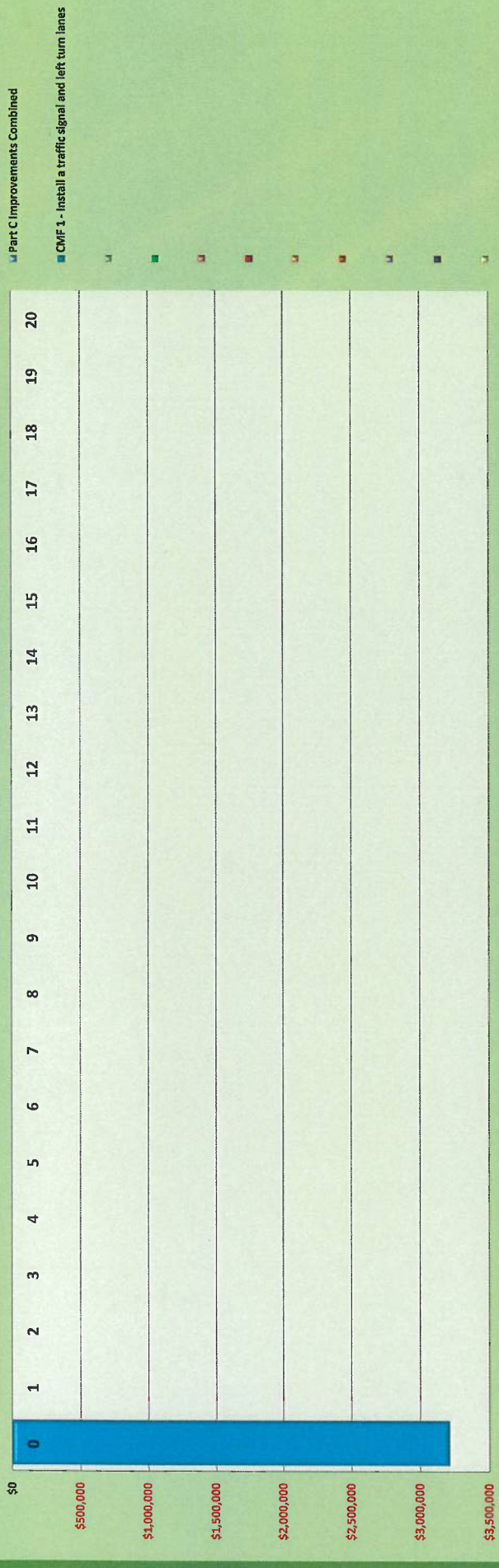


Safety Benefit - Cost Analysis

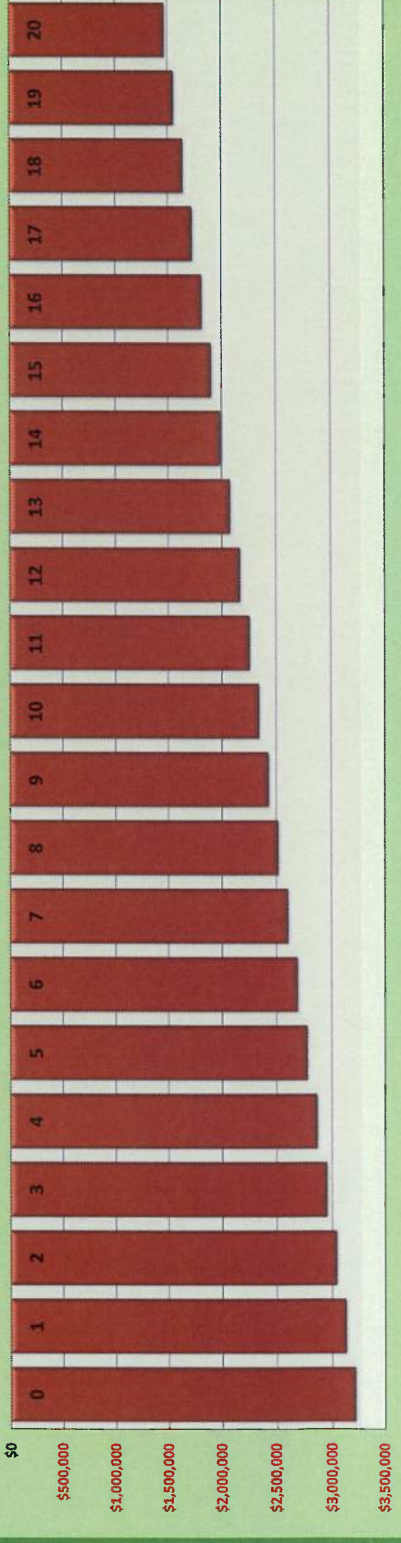
General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.us
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	New Traffic signal with Lt. Turn Lanes on SR 39	Date Performed	7/6/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



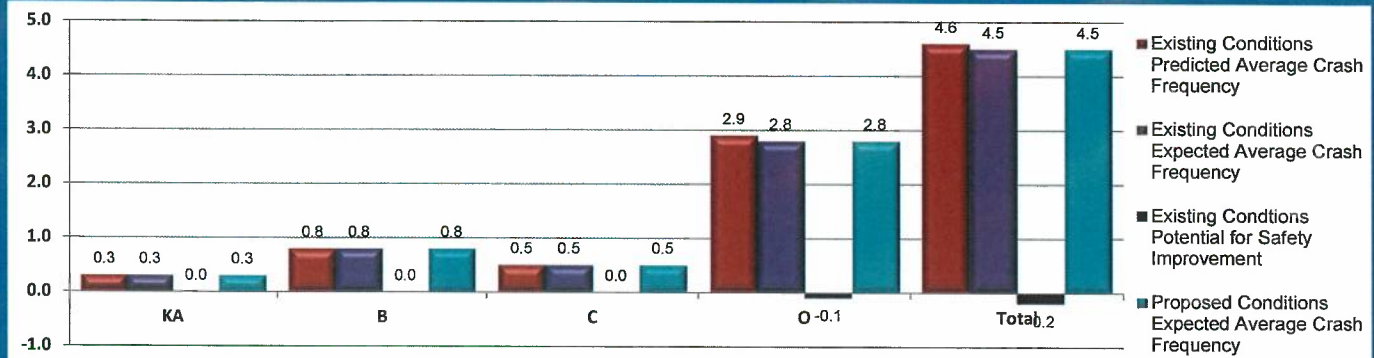


Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{\text{predicted}}$ - Existing Conditions	0.3366	0.8157	0.5435	2.9199	4.6157
N_{expected} - Existing Conditions	0.3311	0.8024	0.5343	2.7881	4.4559
$N_{\text{potential for improvement}}$ - Existing Conditions	-0.0055	-0.0133	-0.0092	-0.1318	-0.1598
N_{expected} - Proposed Conditions	0.3311	0.8024	0.5343	2.7881	4.4559



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39, 28.99		0.3366	0.8157	0.5435	2.9199	4.6157



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		0.3311	0.8024	0.5343	2.7881	4.4559



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39; 28.99		-0.0055	-0.0133	-0.0092	-0.1318	-0.1598



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
SR39: 28.99		0.3311	0.8024	0.5343	2.7881	4.4559



Project Safety Performance Report

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Expected Crash Frequency
Unknown	0.0184	0.0175	-0.0009	0.0175
Head On	0.0396	0.0386	-0.0010	0.0386
Rear End	0.9864	0.9508	-0.0356	0.9508
Backing	0.1857	0.1776	-0.0081	0.1776
Sideswipe - Meeting	0.1341	0.1296	-0.0045	0.1296
Sideswipe - Passing	0.2088	0.2006	-0.0082	0.2006
Angle	1.7612	1.7064	-0.0548	1.7064
Parked Vehicle	0.1642	0.1573	-0.0069	0.1573
Pedestrian	0.0225	0.0219	-0.0006	0.0219
Animal	0.0000	0.0000	0.0000	0.0000
Train	0.0008	0.0008	0.0000	0.0008
Pedalcycles	0.0170	0.0165	-0.0005	0.0165
Other Non-Vehicle	0.0003	0.0003	0.0000	0.0003
Fixed Object	0.7742	0.7456	-0.0286	0.7456
Other Object	0.0269	0.0259	-0.0010	0.0259
Overturning	0.0466	0.0453	-0.0013	0.0453
Other Non-Collision	0.0612	0.0588	-0.0024	0.0588
Left Turn	0.1678	0.1624	-0.0054	0.1624
Right Turn	0.0000	0.0000	0.0000	0.0000



Safety Benefit - Cost Analysis

General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3984
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

Benefit - Cost Calculator

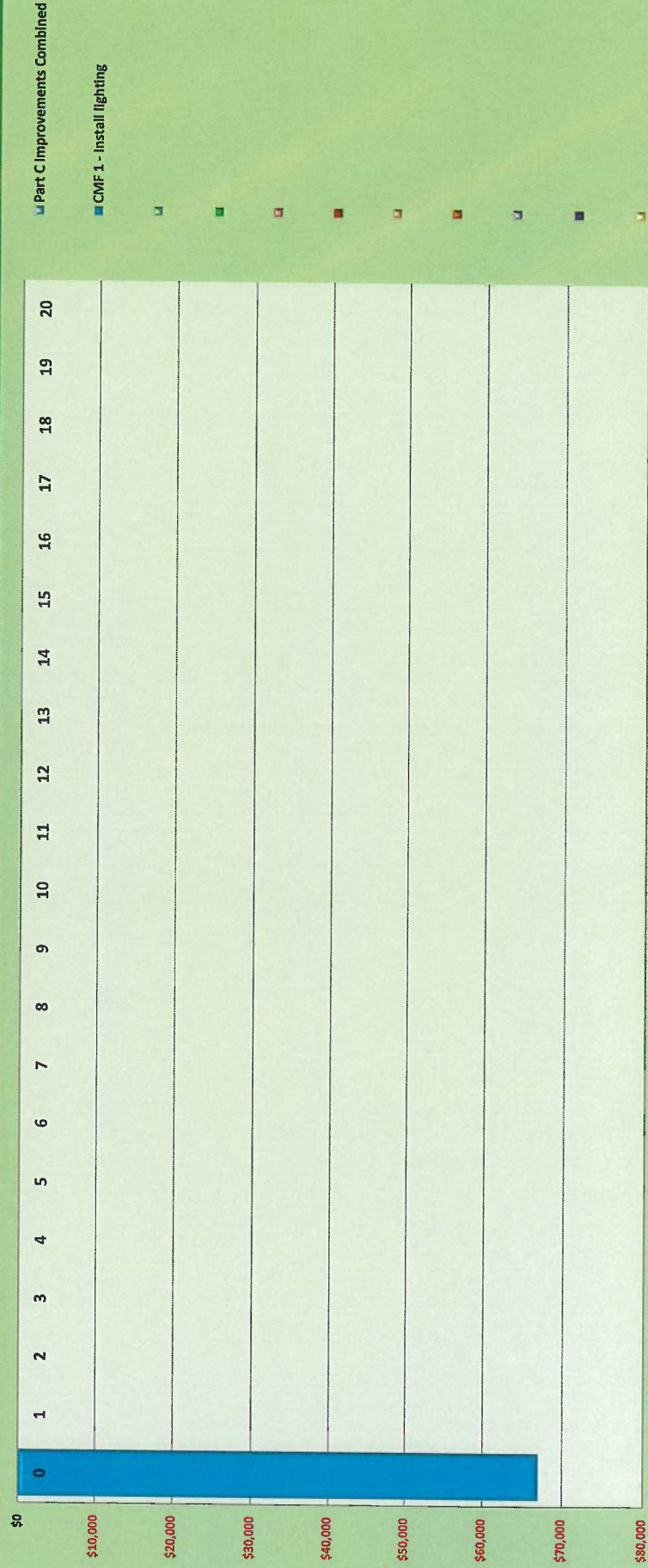
Net Present Value of Project	\$67,000.00
Net Present Value of Safety Benefits	\$0.00
Net Benefit	(\$67,000.00)
Benefit / Cost Ratio	0.00

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	0.000
Number of Injury Crashes	0.000
Number of Total Crashes	0.000

Comments:

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

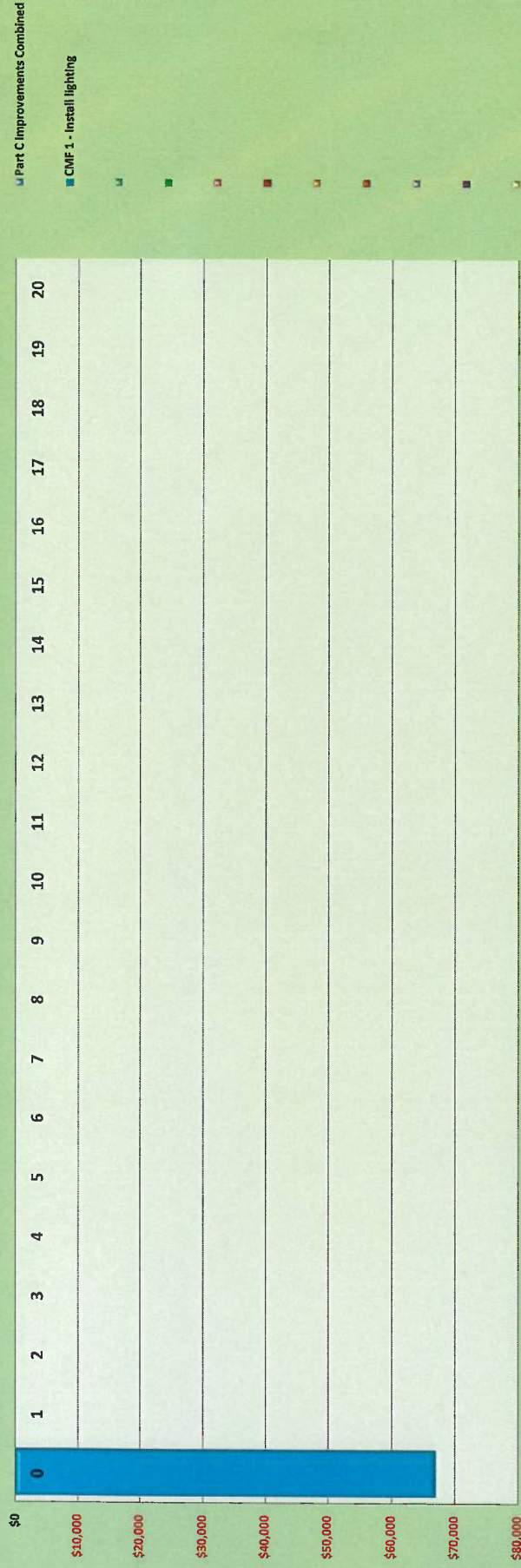


Safety Benefit - Cost Analysis

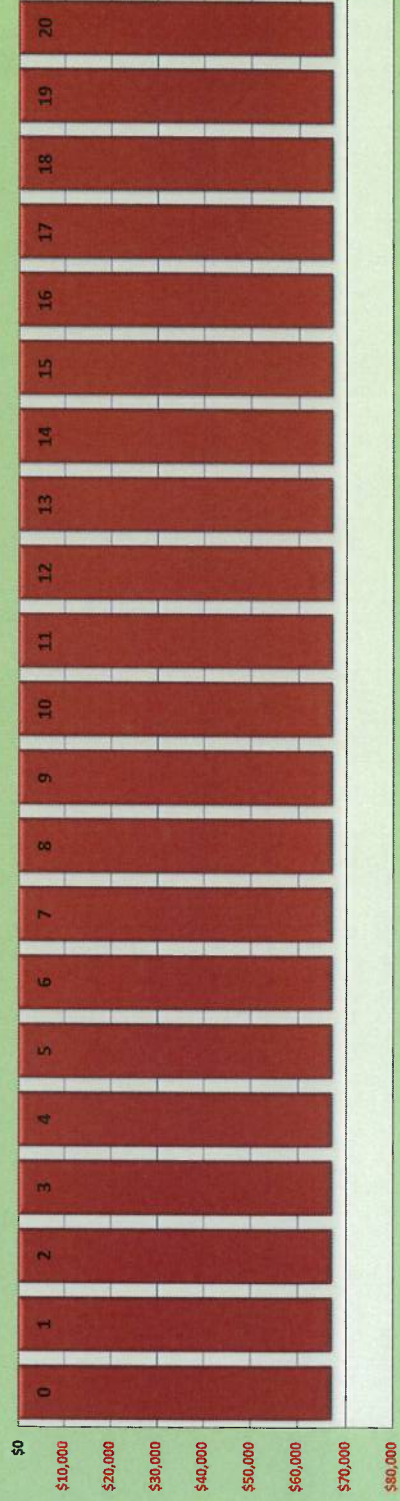
General Information

Project Name	HOL-39-28.99	Contact Email	chris.varcolla@dot.ohio.gov
Project Description	Traffic Safety Study at the Intersection of SR 39 and CR 114	Contact Phone	330-308-3994
Reference Number	Provide Highway Lighting at the Intersection	Date Performed	7/5/2022
Analyst	CJV	Analysis Year	2022
Agency/Company	ODOT - District 11		

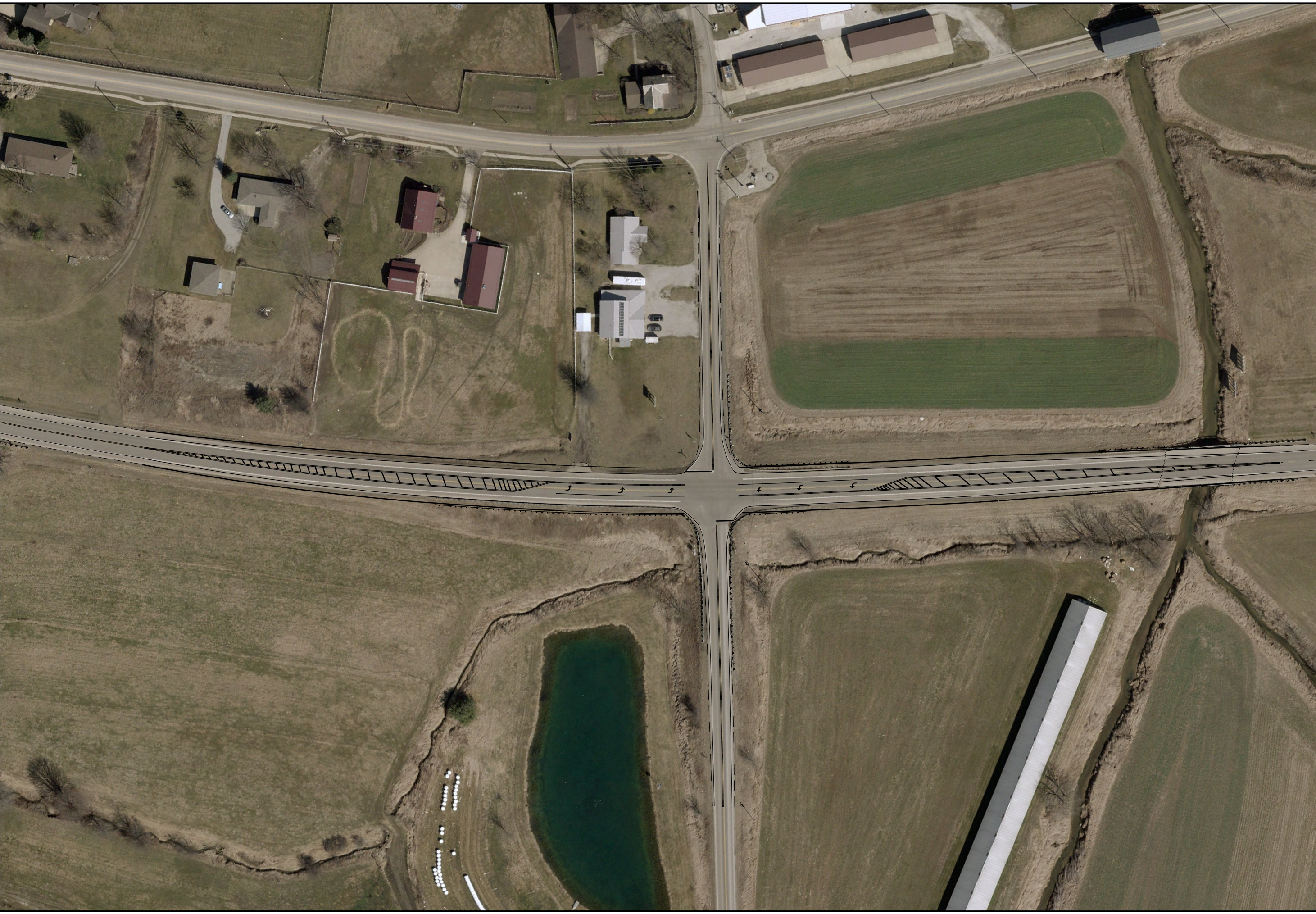
Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)



Appendix J
Long Term Countermeasures Layout
Turn Lanes
Roundabout





CALCULATED	LNW
CHECKED	DAH

0 20 40
HORIZONTAL
SCALE IN FEET

ROUNDABOUT OPTION ACCIDENT ANALYSIS

HOL - 39 - 28.99

Appendix K

Cost Estimates

Provide flashing LED intersection-ahead warning signs on the SR 39 approaches

ITEM	Description	Quantity	Unit	Cost/unit	Total
	LED Signs - 36" Cross Road Intersection Warning Sign	4	ea.	\$ 1,440.00	\$ 5,760.00

Description	Roundabout Option		Unit Cost	Total
	Quantity	Unit		
Pavement, Earthwork, Drainage	1	LS	\$ 2,400,000.00	\$ 2,400,000.00
Contingencies (30%)	1	LS	\$ 720,000.00	\$ 720,000.00
Construction Cost (CC)				\$ 3,120,000.00
Construction Engineering (7% of CC)				\$ 218,400.00
Design(30% of CC)				\$ 936,000.00
Right of Way Acquisition				\$ 60,000.00

Description	Quantity	Unit	Unit Cost	Total
Install Highway Lighting at the intersection	1	LS	\$ 40,000.00	\$ 40,000.00
Contingencies (30%)	1	LS	\$ 12,000.00	\$ 12,000.00
Construction Cost (CC)				\$ 52,000.00
Construction Engineering (10% of CC)				\$ 5,200.00
Design(30% of CC)				\$ 15,600.00
Right of Way Acquisition				\$ -

Traffic Signal & Turn Lane Option

Description	Quantity	Unit	Unit Cost	Total
Traffic Signal Hardware	1	LS	\$ 200,000.00	\$ 200,000.00
Pavement, Earthwork, Drainage	1	LS	\$ 1,300,000.00	\$ 1,300,000.00
Contingencies (30%)	1	LS	\$ 450,000.00	\$ 450,000.00
Construction Cost (CC)				\$ 1,950,000.00
Construction Engineering (7% of CC)				\$ 136,500.00
Design(30% of CC)				\$ 585,000.00
Right of Way Acquisition				\$ 60,000.00