

INTERSECTION SAFETY STUDY

MAD US 42 14.00

US 42 (N London-Delaware Road) and
SR 29 (Urbana-West Jefferson Road)
Study PID #119698
Jefferson Township, Madison County
ODOT District 6

2021 ODOT SA – Rural Intersection Rank #69

Prepared for:

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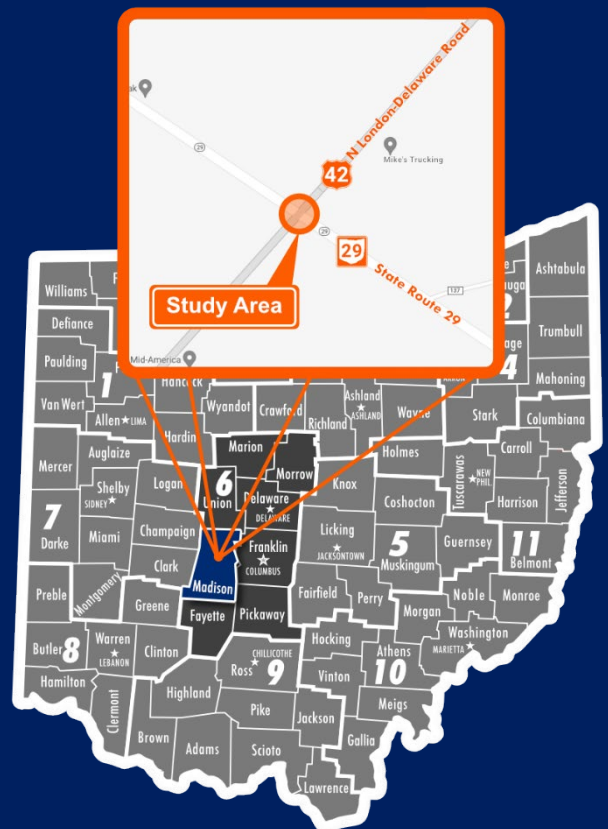
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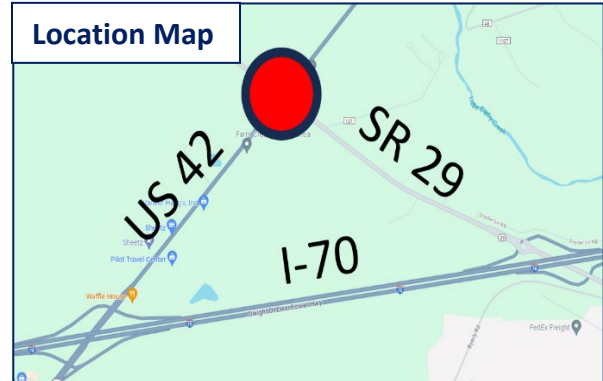
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2.0 One Page Project Summary

MAD US 42 14.00: US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road), Jefferson Township, Madison County, ODOT District 6.



Roundabout Cost Summary

Description	Cost
Construction Cost	\$2,121,380
Right of Way	\$312,000
Utility Relocation Allowance	\$200,000
Contingency (30%)	\$790,014
Design, Environment, and Construction Engineering Costs (30%)	\$790,014
Inflation (24.18%)	\$636,750
TOTAL COST	\$4,850,158



Crash Summary		
Crash Type	Crashes	%
Rear End	17	53.13%
Angle	8	25.00%
Left Turn	4	12.50%
Fixed Object	1	3.13%
Sideswipe - Opposite	1	3.13%
Sideswipe - Passing	1	3.13%
Grand Total	32	100.00%

Crash Severity	Crashes	%
(1) Fatal	1	3.13%
(2) Serious Injury Suspected	2	6.25%
(3) Minor Injury Suspected	10	31.25%
(4) Injury Possible	2	6.25%
(5) PDO/No Injury	17	53.13%
Grand Total	32	100.00%

Project Priority

This is the #69 statewide ranked rural intersection in the 2021 HSIP Priority Locations list.

Key Proposed Countermeasure

- **Roundabout.** Construct a single lane roundabout that will accommodate the large number of heavy vehicles and agricultural equipment at the intersection.

3.0 Executive Summary

The purpose of this study is to evaluate the existing safety performance and to identify potential countermeasures to reduce injury and overall traffic crashes at the intersection of US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road). The intersection is in Jefferson Township, Madison County, Ohio, located 7-miles northeast of the City of London, 11-miles southwest of the Village of Plain City, and 19-miles west of downtown Columbus. US 42 (N London-Delaware Road) provides a direct connection between London and Plain City. The US 42 (N London-Delaware Road) corridor between London and Plain City is experiencing an increase in traffic due to several planned developments along the corridor and has been identified as a major development site in Central Ohio region in the ongoing statewide Strategic Transportation & Development Analysis (STDA) study. This is the #69 statewide ranked rural intersection in the 2021 HSIP Priority Locations list.

There was one fatal and two serious injury crashes reported within the five-year study period. Rear End (17, 53.13%), Angle (8, 25.00%), and Left Turn (4, 12.50%) were the top three crash types. These three crash types account for 90.63% (29 of 32) of all crashes at the study intersection. The following crash types and/or conditions were determined to be over-represented compared to statewide averages (shown in parenthesis).

- Fatal Crash: 3.13% (0.33%)
- Serious Injury Crash: 6.25% (2.84%)
- Minor Injury Crash: 31.25% (11.13%)
- Rear End Crash: 54.84% (33.94%)
- Angle Crashes: 25.81% (14.91%)
- Dark – Roadway Not Lighted Crashes 34.38% (7.93%)

The following countermeasures are proposed to improve safety performance while balancing project costs:

1. **Roundabout.** Construct a single lane roundabout accommodating the large number of heavy vehicles and agricultural equipment at the intersection to mitigate the high percentage of angle crashes (25%), most of which resulted in injuries. An angle crash that occurred on November 14, 2022, was the crash type that resulted in a fatal crash at this intersection.
2. **Traffic Signal Improvements.** Install a near right side signal on the traffic signal pole on all approaches to the intersection. Consider extending all-red clearance intervals to better accommodate lower left-turning speeds.
3. **Signage Improvements.** Install “Signal Ahead” (W3-3) signs on the SR 29 (Urbana-West Jefferson Road) approaches to this intersection.
4. **Lighting Improvements.** Install LED roadway lighting at the intersection to improve intersection visibility during low light conditions.

An alternative long-term countermeasure that retains traffic signal operation with auxiliary left-turn lanes on all approaches was considered. However, this countermeasure would not be as effective in reducing the red light running and resulting angle crashes as a roundabout and is not recommended. Concept plans showing the proposed long-term roundabout countermeasure and the traffic signal alternative can be found in Appendix G.

4.0 Purpose and Need Statement

The purpose of this study is to evaluate the existing safety performance and to identify potential countermeasures to reduce injury and overall traffic crashes at the intersection of US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road). The intersection is in Jefferson Township, Madison County, Ohio, located 7-miles northeast of the City of London, 11-miles southwest of the Village of Plain City, and 19-miles west of downtown Columbus. The intersection is approximately one mile from two interchanges with I-70: US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road). This is the #69 statewide ranked rural intersection in the 2021 HSIP Priority Locations list.

US 42 (N London-Delaware Road) provides a direct connection between London and Plain City. The US 42 (N London-Delaware Road) corridor between London and Plain City is experiencing an increase in traffic due to several planned developments along the corridor and has been identified as a major development site in the Central Ohio region in the ongoing statewide Strategic Transportation & Development Analysis (STDA) study. Figure 1 shows the study intersection's regional location. Figure 2 shows new driveway access to the development on the southwest quadrant near the study intersection on US 42 and SR 29.

FIGURE 1 - LOCATION MAP

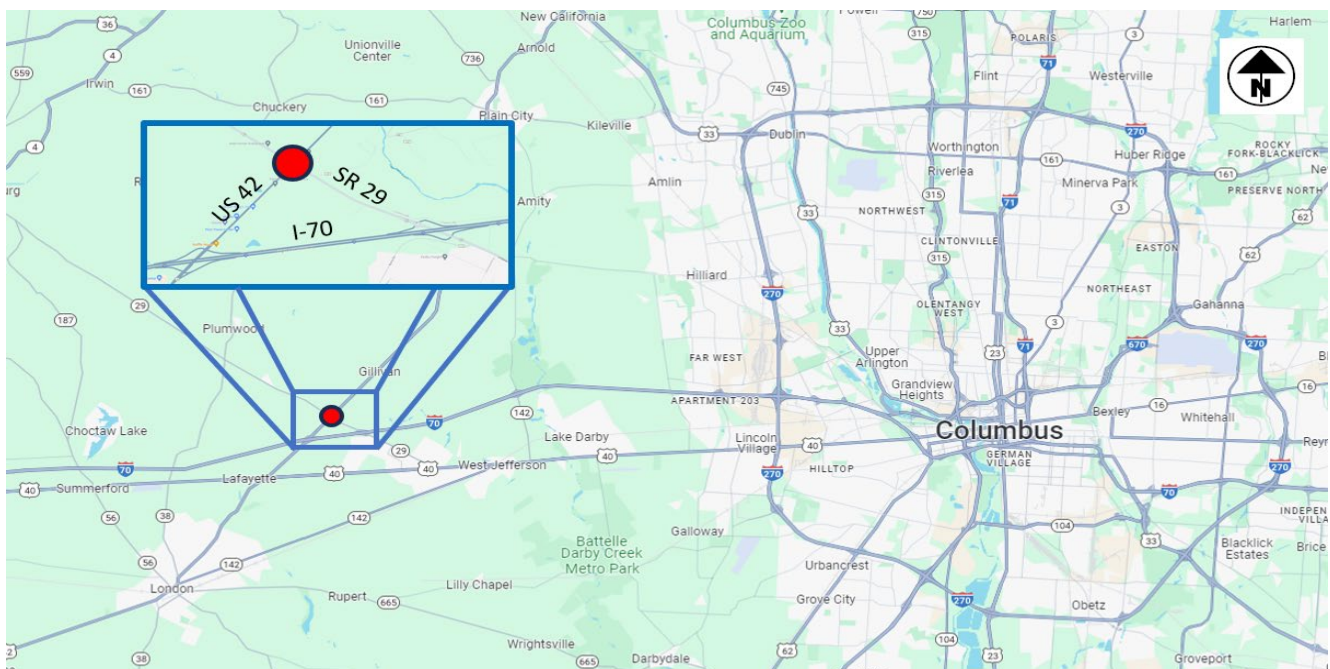
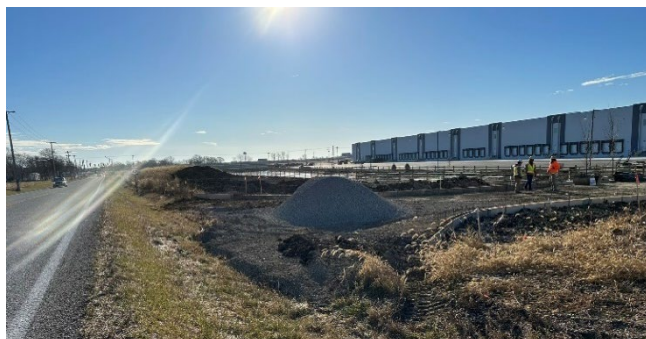


FIGURE 2 - DRIVEWAY ACCESS TO DEVELOPMENT IN SW QUADRANT



5.0 Existing Conditions

Existing conditions of the study intersection are shown in Figure 3. Field reviews were conducted on August 22, 2023, and December 20, 2023, to observe traffic operations and document field conditions. US 42 (N London-Delaware Road) is oriented in the northeast-southwest direction and SR 29 (Urbana-West Jefferson Road) is oriented in the northwest-southeast direction. For purposes of this study, the US 42 (N London-Delaware Road) approaches to the intersection will assume the cardinal direction to be north/south to match the current roadway signing. US 42 (N London-Delaware Road) is classified as a Principal Arterial while SR 29 (Urbana-West Jefferson Road) is classified as a Major Collector. The posted speed limit is 55 miles per hour on all approaches to the intersection. The study area included approximately a 500-foot radius from the center of the intersection and was used to capture the crash events for the 5-year period (2018-2022), which included 32 crashes.

FIGURE 3 - STUDY AREA



5.1 Intersection Conditions

All approaches to the intersection are a single lane with shared left, through, and right movements. All cross-sections approaching the intersection are two (2) lanes with a single lane in each direction.

The existing traffic signal is a traditional span wire configuration with 2-phase operation. Each approach has two (2) signal heads mounted on the far side span wire. All signal heads have reflective backplates. There are post-mounted "Signal Ahead" (W3-3) signs on the US 42 (N London-Delaware Road) approaches. There is a crest vertical curve on the westbound approach of SR 29 (Urbana-West Jefferson Road) about 400-feet east of the intersection having an approximate three (3) percent grade. This curve limits vertical sight distance of the traffic signal on SR 29 (Urbana-West Jefferson Road) when approaching from Byerly Mill Road (TR 137).

5.2 Heavy Vehicles and Agricultural Equipment

The intersection is utilized by several heavy vehicles along with agricultural equipment. All approaches have a heavy vehicle percentage of at least 7.9 percent during the peak hours; the westbound SR 29 (Urbana-West Jefferson Road) approach has a heavy vehicle percentage of 32.6% in the AM peak hour.

FIGURE 4 - HEAVY VEHICLES APPROACHING INTERSECTION



5.3 High Speed Approaches

All approaches have a posted speed limit of 55 miles per hour. The speed of vehicles approaching the intersection is a contributing factor to the severity of crashes at this intersection. See Figure 5 below for a windshield survey photo showing the posted 55 mph speed limit on US 42 (N London-Delaware Road).

FIGURE 5 - US 42 NORTHBOUND APPROACH



5.4 Isolated Signalized Intersection

The closest signalized intersection south of the study intersection is located 1 mile away at the US 42 at I-70 westbound ramps intersection. Driver expectation of a signalized intersection with a stop condition may be low due to the rural area.

5.5 Roundabout Installations in the Vicinity of the Study Intersection

There are several roundabouts that have been recently constructed, are under construction, or are proposed to be constructed in the vicinity of the study intersection. This will increase drivers' familiarity with navigating roundabouts. Like the study intersection, these roundabouts have high speed approaches with 55 mph speed limits. Below is a summary of roundabout intersections in the vicinity of the study intersection:

Existing Roundabouts

- SR 29 (Urbana-West Jefferson Road) at IR 70 (Interstate 70) Westbound Ramps (Figure 6).
- SR 29 (Urbana-West Jefferson Road) at SR 38 (Marysville-London Road) (Figure 6).

Roundabouts under Construction

- SR 29 (Urbana-West Jefferson Road) at IR 70 (Interstate 70) Eastbound Ramps.

Proposed Roundabouts

- US 42 (N London-Delaware Road) at CR 32 (Price Hilliards Road).

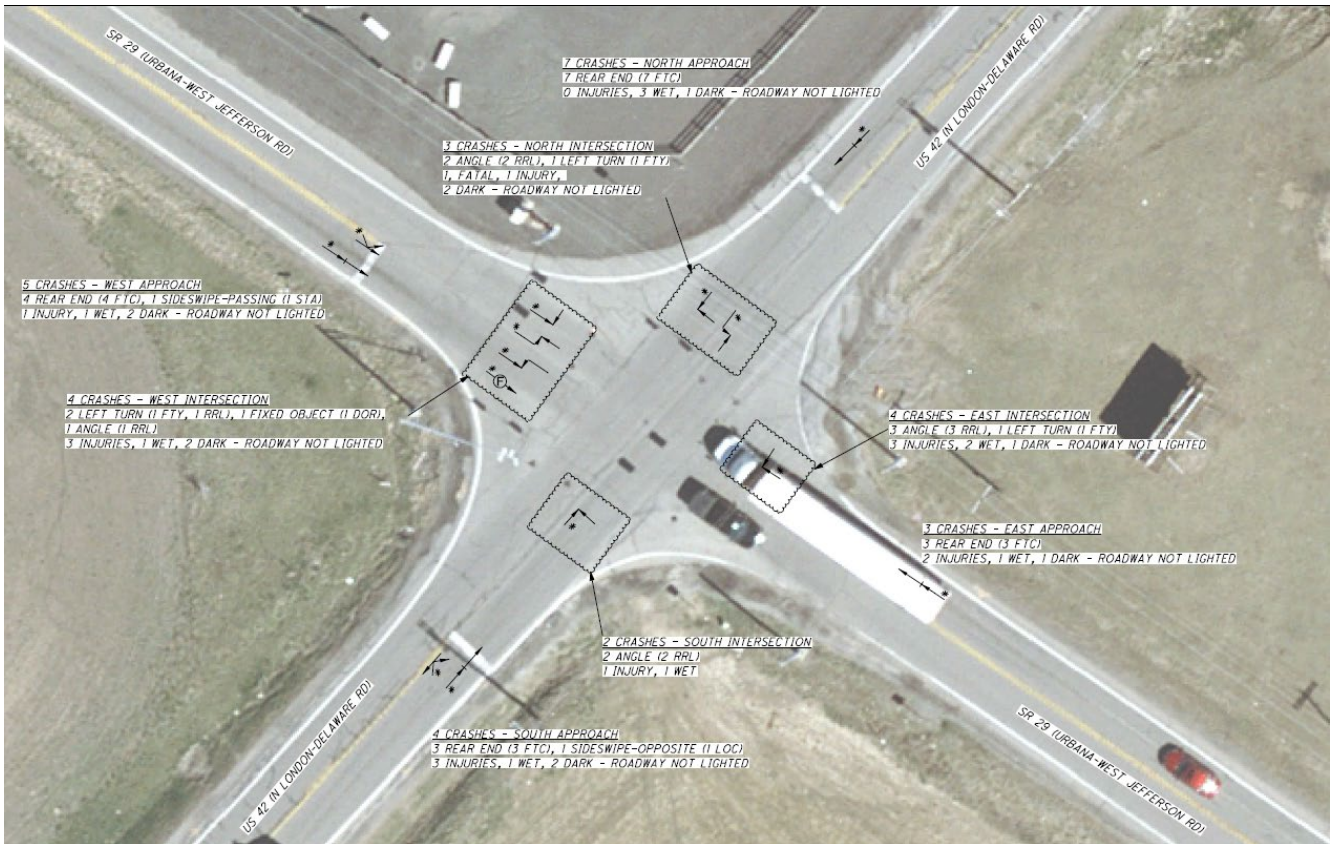
FIGURE 6 - SR 29 @ I-70 WESTBOUND RAMPS & SR 29 @ SR 38 ROUNDABOUTS



6.0 Crash Data and Analysis

Crash data was obtained using ODOT’s GIS Crash Analysis Tool (GCAT), housed within the ODOT Transportation Information Mapping System (TIMS) tool. A total of 32 crashes were reported over a five-year period between 2018 and 2022. Each crash report documented within the study limits was reviewed to confirm the accuracy and location of the crash. An excerpt of the intersection crash diagram is included as Figure 7 with the complete crash diagram included in Appendix D.

FIGURE 7 - CRASH DIAGRAM

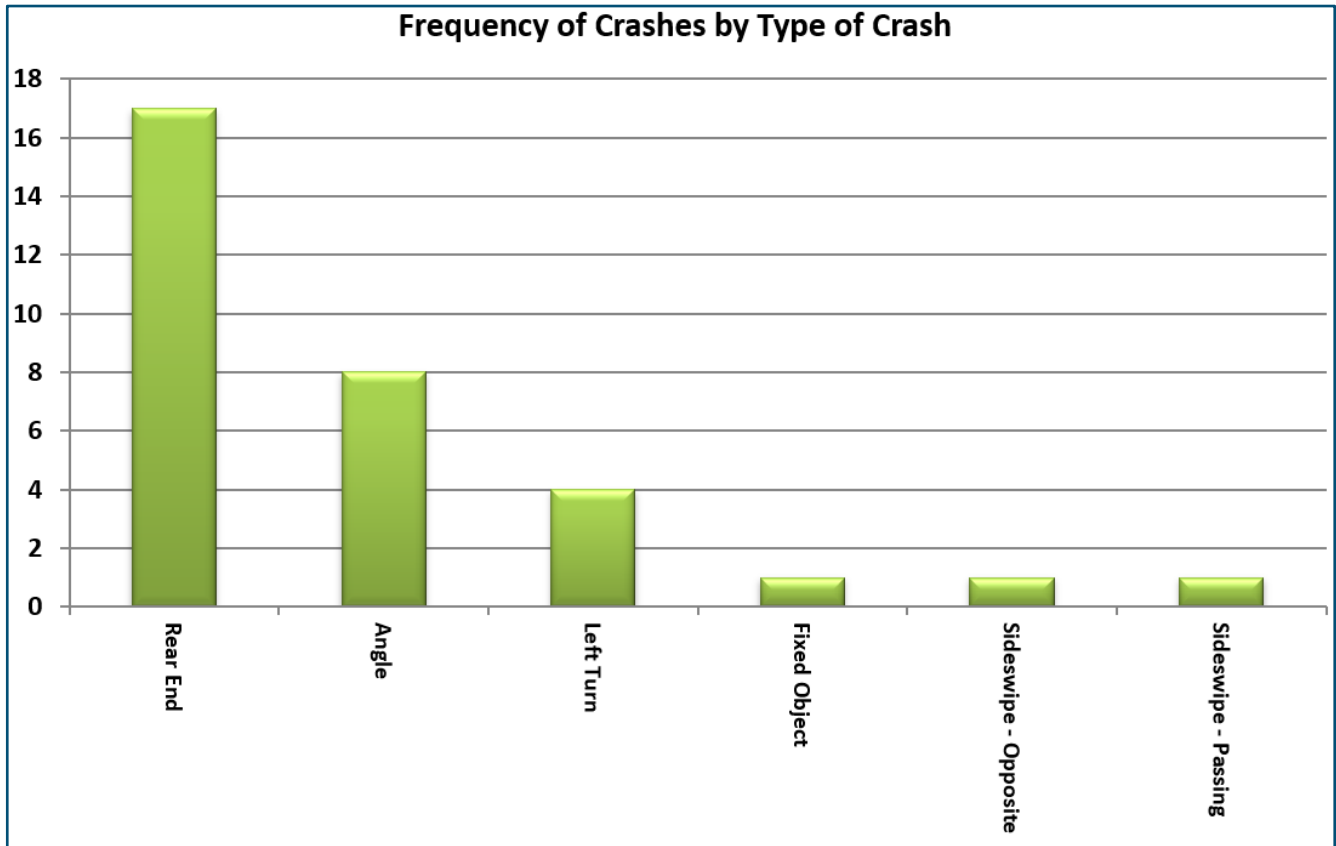


ODOT utilizes AASHTOWare’s Safety Analyst to prioritize safety locations within the State of Ohio and the subject intersection was the #69 statewide ranked rural intersection in the 2021 Safety Analyst Rural Intersection priority list. The following crash types and/or conditions were determined to be over-represented compared to statewide averages (shown in parenthesis).

- Fatal Crash: 3.13% (0.33%)
- Serious Injury Crash: 6.25% (2.84%)
- Minor Injury Crash: 31.25% (11.13%)
- Rear End Crash: 54.84% (33.94%)
- Angle Crashes: 25.81% (14.91%)
- Dark – Roadway Not Lighted Crashes 34.38% (7.93%)

There was one fatal and two serious injury crashes reported within the five-year study period. Rear End (17, 53.13%), Angle (8, 25.00%), and Left Turn (4, 12.50%) were the top three crash types. These three crash types account for 90.63% (29 of 32) of all crashes at the study intersection. Figure 8 shows frequency by crash type at the intersection over the five-year period.

FIGURE 8 - FREQUENCY OF CRASHES BY TYPE OF CRASH



The rear end and angle crashes are indicative of drivers not expecting a stop condition at this signalized intersection or signal head visibility. This issue is compounded by additional stop conditions created during green intervals by left turn vehicles waiting for gaps in opposing traffic. All the angle crashes, which included the fatal crash, were a result of a vehicle running a red light.

Red-light running crashes comprise 28.13% of crashes over the 5-year period. Heavy vehicles can pose issues for signal visibility for passenger vehicles following behind them.

6.1 *Benefit Cost Analysis*

A benefit cost analysis for the proposed countermeasures was prepared using the ODOT Economic Crash Analysis Tool (ECAT). The financial benefits of the recommended safety countermeasures were determined by comparing the net present value of the project construction costs to the safety benefits provided by the long-term countermeasures. Details of the benefit cost analysis are included in Appendix I.

The conversion of the intersection of US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road) from a signalized intersection to a 1x1 single-lane roundabout configuration means that the basic safety performance functions were modified between existing and proposed conditions. ECAT analysis using the updated version (Jan 2024) of the ECAT Tool includes the roundabout as a specific site type in lieu of applying Part D CMFs to this project.

Construction costs were estimated for the proposed safety countermeasures shown in Appendix G. Cost estimates are included in Appendix H. A summary of project costs for the Roundabout alternative and the Left-Turn Lanes Traffic Signal alternative are shown in Tables 1 and 2, respectively. Tables 3 and 4 summarize the benefit cost analysis results for the Roundabout alternative and Left-Turn Lanes Traffic Signal alternative.

Table 1 - Cost Summary for Roundabout Alternative

Description	Cost
*Construction Cost	\$ 2,121,380
Right of Way	\$ 312,000
Utility Relocation Allowance	\$ 200,000
Contingency (30%)	\$ 790,014
Design, Environment, and Construction Engineering Costs (30%)	\$ 790,014
TOTAL ESTIMATED CURRENT PROJECT COST	\$ 4,213,408
Inflation (24.18%)	\$ 636,750
TOTAL ESTIMATED PROJECT COST	\$ 4,850,158

*Based upon 2023 Construction Costs

Table 2 - Cost Summary for Left-Turn Lanes Traffic Signal Alternative

Description	Cost
*Construction Cost	\$ 4,132,625
Right of Way	\$ 510,000
Contingency (30%)	\$ 1,392,788
Design, Environment, and Construction Engineering Costs (30%)	\$ 1,392,788
TOTAL ESTIMATED CURRENT PROJECT COST	\$ 7,428,201
Inflation (22.0%)	\$ 1,021,378
TOTAL ESTIMATED PROJECT COST	\$ 8,449,579

*Based upon 2023 Construction Costs

Table 3 - Benefit Cost Results for Roundabout Alternative

Description	Value
Expected annual crash adjustment	-10.908 crashes/year
Net present value of project	\$4,213,408
Net present value of safety benefit	\$5,213,592
BENEFIT/COST RATIO	1.24

Table 4 - Benefit Cost Results for Left-Turn Lanes Traffic Signal Alternative

Description	Value
Expected annual crash adjustment	-5.284 crashes/year
Net present value of project	\$7,428,200
Net present value of safety benefit	\$2,909,542
BENEFIT/COST RATIO	0.39

7.0 Recommendations and Prioritization

Countermeasures have been developed that will improve the safety performance of the study area by focusing on crash types with the greatest potential for mitigation. The focus of the countermeasures is identifying factors that contribute to these crash types and providing measures that will mitigate these factors.

7.1 Short-Term Countermeasures

1. **Signage Improvements.** Adding advance warning signs on the SR 29 (Urbana-West Jefferson Road) approaches to match the existing “Signal Ahead” (W3-3) signs on the US 42 (N London-Delaware Road) approaches can help alert drivers on this route to the upcoming signalized intersection and give them enough time to slow down or stop if necessary. Recommend the following:
 - a. Install “Signal Ahead” (W3-3) signs on the SR 29 (Urbana-West Jefferson Road) approaches to the intersection in advance of the route marker signs.

7.2 Medium-Term Countermeasures

1. **Lighting Improvements.** Install LED roadway lighting at the intersection to improve intersection visibility during low light conditions.
2. **Traffic Signal Improvements.** The following traffic signal improvements can be performed to address the signal visibility and red-light running issues at this intersection.
 - a. Install a near right side signal on the traffic signal pole on all approaches to the intersection. An example of this type of installation at the US 42/SR 257 intersection is provided below.



- b. Consider extending all-red clearance intervals to better accommodate lower left-turning speeds.

7.3 Long-Term Countermeasures

- 1. Roundabout.** A single lane roundabout is proposed as an effective, long-term countermeasure to mitigate the high percentage of angle crashes (25.81%), most of which resulted in injury, including the fatal crash that occurred on November 14, 2022. Per FHWA's Roundabouts & Rural Highways resource, roundabouts constructed at intersections along high-speed, two-lane rural highways reduced overall crashes by up to 68 percent, reduced injury crashes by up to 88 percent, and eliminated 83 percent of angle-type crashes. Furthermore, driver expectation of roundabouts is present in this area due to the two current and two planned roundabouts around this intersection.

The proposed roundabout design will need to take into consideration the large number of heavy vehicles and agricultural equipment that utilized this intersection. There are established roundabout design features that have been used to accommodate these vehicles including inside truck aprons, mountable outside curb with truck aprons, and mountable splitter islands. Several different types of vehicles should be analyzed during the design including WB-67 trucks, lowboy trucks, tractor/trailer agricultural vehicles, and combine agricultural vehicles to determine which roundabout design feature is best to accommodate these vehicles. Consideration should also be given to sign placement to avoid placing signs directly across from each vehicle and being struck by oversized agricultural vehicles.

A Concept plan showing a proposed long-term roundabout countermeasure is included in Appendix G.

- 2. Left-Turn Lanes Traffic Signal Reconstruction.** An alternative long-term countermeasure that retains traffic signal operation with auxiliary left-turn lanes on all approaches was considered. However, this countermeasure would not be as effective in reducing the red light running and resulting angle crashes as a roundabout. Additionally, construction costs for a signalized intersection based on the following criteria is like a roundabout option:

- Left turn lane lengths of 500 +/- feet. Note the deceleration length for 55 MPH is equal to 285-ft per ODOT L&D Figure 401-9.
- Graded shoulder widths of 12 feet per ODOT L&D Figure 301-3.
- Protected/permissive signal phasing.
- Mast arm signal design with backplates.

This alternative was removed from further study due to its ability to mitigate the serious crash pattern and comparable construction costs.

8.0 Summary of Supplemental Traffic Studies

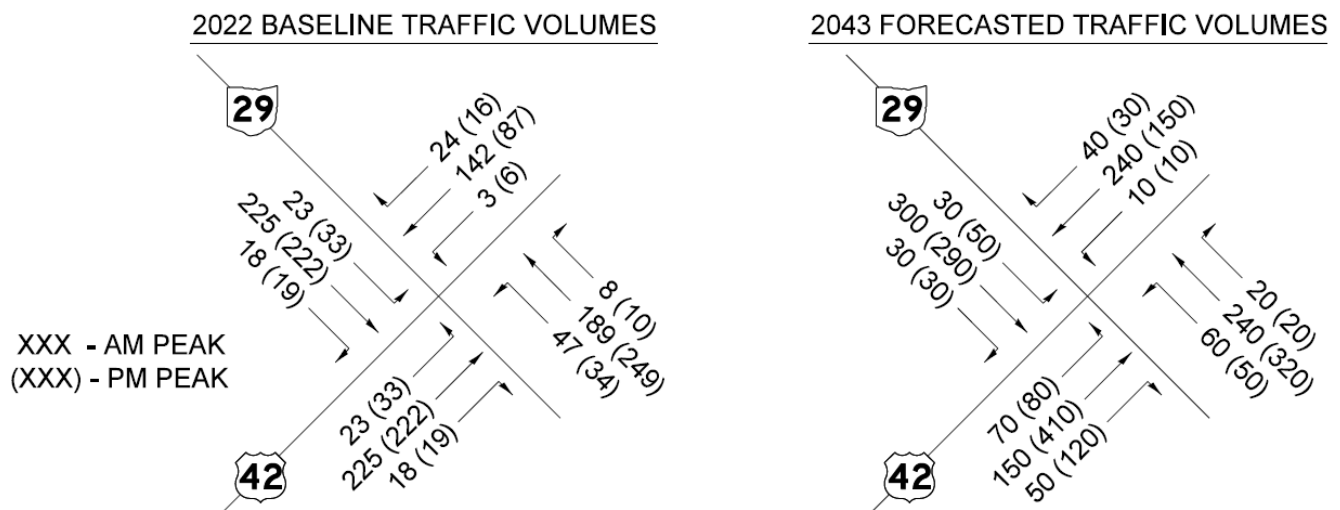
8.1 Data Collection

Turning movement counts (TMC) were collected at the study intersection on December 13, 2022, as part of the US 42 Warehouse & Altec Developments Traffic Access Studies (TAS) performed by Civil & Environmental Consultants, Inc., for two 4-hour periods from 6:00 AM to 10:00 AM and 3:00 PM to 7:00 PM. Traffic count data is included in Appendix B and a summary of the existing morning and afternoon peak hour traffic volumes is shown in Figure 9 below. The morning peak hour at the study intersection was identified from 7:45-8:45 AM and the afternoon peak hour was identified from 4:00-5:00 PM. The 2023 ADT on US 42 (N London-Delaware Road) was 6,188 vehicles per day (vpd) west of SR 29 (Urbana-West Jefferson Road) according to the ODOT Traffic Monitoring Management System (TMMS) traffic count maps (Location ID 4149). The 2023 ADT on SR 29 (Urbana-West Jefferson Road) was 4,965 vpd east of US 42 (N London-Delaware Road) according to the same ODOT TMMS traffic count maps (Location ID 449).

8.2 Baseline and Forecasted Traffic Volumes

A 2022 baseline condition was established by adding the proposed site generated volumes from the US 42 Warehouse and Altec developments to the existing traffic volumes. These base line volumes were then projected for Design Year (2043) using TFMS growth rates, with forecasted volumes shown in Figure 9. Refer to Appendix C for Future Traffic Volume Calculations.

FIGURE 9 - 2022 BASELINE AND 2043 FORECASTED TRAFFIC VOLUMES



8.3 Intersection Control Evaluation (ICE)

The Intersection Control Evaluation (ICE) methodology is a process through which ODOT and ODOT’s partners can evaluate combinations of geometric and traffic-control strategies at intersections using quantitative and qualitative analyses. The goal of ICE is to aid the decision making of the roadway agency in identifying and selecting an intersection alternative that meets the project purpose and reflects the overall best value using performance-based criteria. The ICE process is applicable when planning new intersections or upgrading existing intersections.

ODOT provides tools to assist with the two phases of the ICE program. In Phase 1, ICE is a screening process used to identify all feasible and reasonable control strategies. The FHWA CAP-X software is used during Phase 1. The CAP-X analysis takes traffic volume and roadway geometric information into consideration. In most scenarios, multiple intersection controls may be considered reasonable for analysis.

This safety study was scoped to integrate the ICE Phase 1 process into the study framework to aid in identifying a preferred alternative for the US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road) intersection. The first step in the Phase 1 process is use of the ODOT customized versions of the CAP-X and ICE spreadsheet-based tools to rank various intersection alternatives that were identified as feasible for this location. The following alternatives were selected to be compared to the existing signalized condition that exists at the intersection: **1 X 1 Roundabout** and **Traffic Signal**.

Restricted crossing options such as a signalized or unsignalized R-CUT treatment were eliminated from consideration since both US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road) are undivided 2-lane sections and therefore not favorable to median construction for U-turn movements inherent in the RCUT design.

The CAP-X software was run using opening year traffic volumes and again with design year traffic volumes assuming the addition of traffic generated by nearby developments analyzed in 2022. Results of the CAP-X runs for Design Year AM and PM peak hours are shown in Figure 10 with detailed output provided in Appendix J.

FIGURE 10 - CAP-X ANALYSIS FOR US 42 AND SR 29 INTERSECTION

DESIGN YEAR - AM PEAK HOUR

TYPE OF INTERSECTION	Overall V/C Ratio	V/C Ranking	Pedestrian Accommodations	Bicycle Accommodations
1 X 1 Roundabout	0.48	1	4.16	4.37
Traffic Signal	0.58	2	2.50	4.33

DESIGN YEAR - PM PEAK HOUR

TYPE OF INTERSECTION	Overall V/C Ratio	V/C Ranking	Pedestrian Accommodations	Bicycle Accommodations
Traffic Signal	0.68	1	2.50	4.33
1 X 1 Roundabout	0.74	2	4.12	4.33

Due to crash frequency and above average injury and fatality rate, retaining the Traffic Signal option does not satisfy the objective of this project to improve safety of the US 42 (N London-Delaware Road) and SR 29 (Urbana-West Jefferson Road) intersection. The single lane roundabout provides the passing v/c values in the design year and provides acceptable pedestrian and bicycle accommodation metrics. While the traffic signal alternative ranks well with respect to the V/C ratio, this alternative provides worse pedestrian accommodation metrics to the roundabout option.

The ODOT ICE Tool provides life cycle cost comparisons between different intersection treatments. The comparisons are made between safety, vehicular delay, operations and maintenance, design and construction, and right of way costs. Results of the ICE Tool analysis are included in Figure 11 and detailed outputs are included in Appendix J.

FIGURE 11 - ICE ANALYSIS FOR US 42 AND SR 29 INTERSECTION

Cost Categories	Net Present Value of Costs	
	Traffic Signal	Roundabout
Planning, Construction & Right of Way Costs	\$ 8,550,119	\$ 4,709,272
Post-Opening Costs	\$ 95,545	\$ 72,952
Auto Passenger Delay	\$ 824,480	\$ 724,525
Truck Delay	\$ 556,495	\$ 489,029
Safety	\$ 1,821,133	\$ 998,756
Total cost	\$11,847,772	\$6,994,533

If the initial cost of the roundabout and traffic signal alternatives are removed from the table presented in Figure 11, the annual operating, delay, and safety costs for the roundabout option amount to a net present value of \$2,285,262 which is approximately a million dollars less than the traffic signal alternative. In other words, if constructed, a roundabout is estimated to start providing savings after 4 years compared to maintaining the existing traffic signal condition.

8.4 Capacity Analysis

Capacity analyses were performed to determine operational impacts of the proposed recommended countermeasures and traffic signal improvements. Analyses were prepared for the AM and PM peak periods for the 2022 base line, 2043 No Build, and 2043 build condition with proposed safety countermeasures. Results summarized in Table 5 and Table 6 indicate that LOS D or better is maintained for the intersection and all approaches with the proposed safety countermeasures. Details of the capacity analysis procedures and results are included in Appendix F.

Table 5 - Capacity Analysis Summary (Roundabout Alternative)

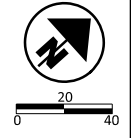
Intersection/ Approach	AM Peak Hour			PM Peak Hour		
	2022 Baseline	2043 No Build	2043 Build (Roundabout)	2022 Baseline	2043 No Build	2043 Build (Roundabout)
	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)
US 42 & SR 29	B (12.8)	B (13.5)	A (9.6)	B (13.0)	B (19.1)	C (19.0)
EB Approach	B (16.2)	B (16.2)	B (10.4)	B (15.8)	C (22.0)	A (8.9)
WB Approach	B (15.9)	B (15.7)	A (8.3)	B (16.2)	C (22.9)	C (19.4)
NB Approach	A (7.4)	B (10.5)	A (9.2)	A (9.7)	B (17.6)	D (27.8)
SB Approach	A (7.6)	B (10.6)	A (10.4)	A (7.7)	B (10.3)	A (9.6)

Table 6 – Capacity Analysis Summary (Left-Turn Lanes Traffic Signal Alternative)

Intersection/ Approach	AM Peak Hour			PM Peak Hour		
	2022 Baseline	2043 No Build	2043 Build (Left Turn Lanes)	2022 Baseline	2043 No Build	2043 Build (Left Turn Lanes)
	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)	LOS (Delay/sec)
US 42 & SR 29	B (12.8)	B (13.5)	C (29.4)	B (13.0)	B (19.1)	B (16.1)
EB Approach	B (16.2)	B (16.2)	C (33.4)	B (15.8)	C (22.0)	B (17.5)
WB Approach	B (15.9)	B (15.7)	C (33.3)	B (16.2)	C (22.9)	B (17.8)
NB Approach	A (7.4)	B (10.5)	C (24.7)	A (9.7)	B (17.6)	B (15.9)
SB Approach	A (7.6)	B (10.6)	C (24.6)	A (7.7)	B (10.3)	B (10.8)

APPENDIX A

Existing Conditions Diagram



N LONDON-DELAWARE ROAD (US 42) & URBANA-WEST JEFFERSON ROAD (SR 29)
EXISTING CONDITIONS DIAGRAM

DESIGN AGENCY



DESIGNER
LM 11-29-23

REVIEWER
AW 01-13-24

PROJECT ID
119698

SUBSET	TOTAL
1	1

APPENDIX B

Existing Traffic Data

QUALITY COUNTS REPORT

=====

Intersection: N London-Delaw Urbana-West Jefferson Rd
 City/State: West Jefferson OH
 QJobNo: 16040801
 ClientID:
 Date: 12/13/2022
 Comments:
 Latitude/Longitude: 39.96653677 -83.3626
 PEAK HOUR STAR: 7:45 AM
 PEAK HOUR END: 8:45 AM

PHF 0.96

PEAK-HOUR VOLUMES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
Total	14	83	25	3	141	24	23	221	15	35	181	8
Heavy Vehicles	3	8	10	2	11	2	1	58	5	14	58	1
Passenger Vehicle	11	75	15	1	130	22	22	163	10	21	123	7

PERCENT HEAVY VEHICLES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
HEAVY VEHICLES	21.4	9.6	40	66.7	7.8	8.3	4.3	26.2	33.3	40	32	12.5
BUSES												

ALL-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	NB U-Turn	NB RTOR	SB Left	SB Thru	SB Right	SB U-Turn	SB RTOR	EB Left	EB Thru	EB Right	EB U-Turn	EB RTOR	WB Left	WB Thru	WB Right	WB U-Turn	WB RTOR	Total
6:00 AM	1	9	1	0	0	1	24	2	0	0	0	23	0	0	0	3	20	0	0	0	84
6:15 AM	0	11	2	0	0	1	27	3	0	0	0	26	0	0	0	4	24	0	0	0	98
6:30 AM	2	12	0	0	0	0	20	5	0	0	1	26	1	0	0	3	19	1	0	0	90
6:45 AM	0	8	4	0	0	1	30	3	0	0	1	34	1	0	0	6	25	1	0	0	114
7:00 AM	3	9	10	0	0	4	35	7	0	0	2	57	2	0	0	16	32	1	0	0	178
7:15 AM	5	18	11	0	0	1	46	10	0	0	5	34	3	0	0	8	36	2	0	0	179
7:30 AM	1	8	6	0	0	3	46	7	0	0	6	46	4	0	0	11	44	3	0	0	185
7:45 AM	5	18	8	0	0	0	35	7	0	0	5	58	4	0	0	6	42	1	0	0	189
8:00 AM	3	20	6	0	0	1	40	4	0	0	3	56	3	0	0	9	40	1	0	0	186
8:15 AM	4	18	4	0	0	0	36	7	0	0	7	61	3	0	0	11	48	2	0	0	201
8:30 AM	2	27	7	0	0	2	30	6	0	0	8	46	5	0	0	9	51	4	0	0	197
8:45 AM	7	18	5	0	0	5	24	10	0	0	6	46	8	0	0	4	49	0	0	0	182
9:00 AM	5	17	5	0	0	1	25	9	0	0	5	45	7	0	0	3	50	0	0	0	172
9:15 AM	5	15	3	0	0	2	20	9	0	0	5	41	6	0	0	2	41	2	0	0	151
9:30 AM	3	11	2	0	0	1	19	7	0	0	3	35	4	0	0	3	43	1	0	0	132
9:45 AM	3	9	3	0	0	1	21	5	0	0	2	30	2	0	0	4	35	1	0	0	116

HEAVY-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
6:00 AM	2	0	1	0	1	0	0	4	0	1	3	0	12
6:15 AM	1	0	2	0	0	0	0	4	1	1	4	0	13
6:30 AM	1	1	1	0	1	0	0	6	2	2	4	0	18
6:45 AM	2	0	1	0	0	0	0	7	1	1	5	0	17
7:00 AM	1	0	5	1	3	0	0	14	0	3	7	0	34
7:15 AM	2	1	6	0	4	0	1	12	2	1	10	0	39
7:30 AM	0	1	1	0	1	1	1	6	1	3	8	0	23
7:45 AM	1	1	3	0	3	1	0	7	3	2	9	0	30
8:00 AM	0	1	3	1	5	0	0	18	1	4	13	0	46
8:15 AM	2	2	1	0	2	0	1	15	0	4	22	1	50
8:30 AM	0	4	3	1	1	1	0	18	1	4	14	0	47
8:45 AM	1	4	2	0	1	0	0	14	1	2	13	0	38
9:00 AM	0	4	0	0	1	0	0	11	0	1	9	0	26
9:15 AM	1	2	2	0	1	0	0	8	1	1	8	0	24
9:30 AM	1	3	1	1	1	1	1	3	1	0	5	1	19
9:45 AM	0	2	1	0	0	0	0	3	0	0	2	0	8

QUALITY COUNTS REPORT

=====

Intersectio N London-Del Urbana-West Jefferson Rd

City/State: West Jefferson OH

QCJobNo: 16040802

ClientID:

Date: 12/13/2022

Comments:

Latitude/Lc 39.9665368 -83.3626

PEAK HOUJ 4:00 PM

PEAK HOUJ 5:00 PM

PHF 0.96

PEAK-HOUR VOLUMES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
Total	32	237	60	6	87	16	32	208	18	28	246	10
Heavy Veh	5	10	11	0	7	3	6	26	5	17	40	0
Passenger	27	227	49	6	80	13	26	182	13	11	206	10

PERCENT HEAVY VEHICLES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
HEAVY VEH	15.6	4.2	18.3	0	8	18.8	18.8	12.5	27.8	60.7	16.3	0

BUSES

PEAK-HOUR VOLUMES - PEDESTRIANS

Leg/Crossv South	North	West	East
	0	0	0

ALL-VEHICLE VOLUMES

Time Perio	NB Left	NB Thru	NB Right	NB U-Turn	NB RTOR	SB Left	SB Thru	SB Right	SB U-Turn	SB RTOR	EB Left	EB Thru	EB Right	EB U-Turn	EB RTOR	WB Left	WB Thru	WB Right	WB U-Turn	WB RTOR	Total	Hourly Totals
3:00 PM	3	40	11	0	0	1	11	3	0	0	7	29	1	0	0	3	33	1	0	0	143	
3:15 PM	2	44	12	0	0	1	12	1	0	0	6	33	1	0	0	2	36	1	0	0	151	
3:30 PM	1	39	15	0	0	2	9	1	0	0	3	36	0	0	0	2	45	0	0	0	153	
3:45 PM	3	41	13	0	0	0	15	1	0	0	5	35	2	0	0	6	41	0	0	0	162	609
4:00 PM	10	61	19	0	0	3	19	6	0	0	9	44	2	0	0	11	57	3	0	0	244	710
4:15 PM	3	68	17	0	0	1	27	5	0	0	10	53	8	0	0	7	56	1	0	0	256	815
4:30 PM	14	68	12	0	0	2	16	3	0	0	6	45	5	0	0	4	68	3	0	0	246	908
4:45 PM	5	40	12	0	0	0	25	2	0	0	7	66	3	0	0	6	65	3	0	0	234	980
5:00 PM	2	43	15	0	0	5	20	5	0	0	12	45	5	0	0	12	63	1	0	0	228	964
5:15 PM	4	45	8	0	0	1	18	3	0	0	5	48	3	0	0	10	53	3	0	0	201	909
5:30 PM	1	37	15	0	0	0	37	3	0	0	7	43	5	0	0	2	41	2	0	0	193	856
5:45 PM	2	36	10	0	0	0	26	6	0	0	3	49	3	0	0	10	47	5	0	0	197	819
6:00 PM	1	33	11	0	0	0	25	5	0	0	2	45	2	0	0	8	41	3	0	0	176	767
6:15 PM	1	29	9	0	0	0	26	4	0	0	2	41	3	0	0	4	39	2	0	0	160	726
6:30 PM	0	31	8	0	0	1	19	3	0	0	1	42	2	0	0	3	35	2	0	0	147	680
6:45 PM	1	28	9	0	0	0	21	3	0	0	0	37	1	0	0	4	35	1	0	0	140	623

HEAVY-VEHICLE VOLUMES

Time Perio	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total	Hourly Totals
3:00 PM	0	2	1	0	0	0	0	2	0	1	8	1	15	
3:15 PM	0	1	2	0	0	1	1	2	1	1	7	0	16	
3:30 PM	1	0	2	0	1	0	0	3	2	4	5	0	18	
3:45 PM	1	0	1	0	1	0	0	2	0	2	8	0	15	64
4:00 PM	2	3	6	0	3	2	0	5	0	5	15	0	41	90
4:15 PM	0	5	3	0	3	0	3	7	4	5	11	0	41	115
4:30 PM	1	1	0	0	0	0	0	3	1	2	8	0	16	113
4:45 PM	2	1	2	0	1	1	3	11	0	5	6	0	32	130
5:00 PM	1	8	5	0	4	0	1	12	1	6	8	0	46	135
5:15 PM	3	2	3	0	3	0	0	5	1	2	5	0	24	118
5:30 PM	0	2	2	0	5	1	0	4	2	1	5	0	22	124
5:45 PM	1	0	0	0	2	1	0	5	1	3	5	1	19	111
6:00 PM	0	0	1	0	2	1	0	4	0	1	4	0	13	78
6:15 PM	1	1	0	0	3	1	0	3	1	1	4	0	15	69
6:30 PM	0	2	1	0	2	0	1	1	2	0	2	0	11	58
6:45 PM	1	1	0	0	1	0	1	2	1	1	3	0	11	50

APPENDIX C

Future Traffic Volumes

Future Traffic Volumes

TFMS Output

Traffic Volume Calculations US-42 at SR-29 Safety Study

2022 Traffic Counts
AM Peak Hour (7:45-8:45 AM)

0.96		20.0%			8	RT				
		RT	TH	LT	181	TH	15.0%			
		24	141	3	35	LT	SR-29			
					23	14	83	25		
14.0%					TH	221	LT	TH	RT	
					RT	15	18.0%			
LEGEND:										
Int PHF										
App Heavy-%										
					US-42					

2022 Traffic Counts
PM Peak Hour (4:00 - 5:00 PM)

0.96		20.0%			10	RT				
		RT	TH	LT	246	TH	15.0%			
		16	87	6	28	LT	SR-29			
					32	32	237	60		
14.0%					TH	208	LT	TH	RT	
					RT	18	18.0%			
LEGEND:										
Int PHF										
App Heavy-%										
					US-42					

Count Info:

Tuesday

12/13/2022, 6-10AM and 3-7PM

Source: Traffic Access Study for the Proposed US 42 Warehouse Development, CEC, 06/07/2023

Factors:

	US-42	SR-29
2022 Pk-to-DHV Factor:	1.24	1.19

Growth Factors

2043

TFMS Growth Rates	EB	0.4 %/yr	1.08
	WB	0.3 %/yr	1.06
	NB	1.8 %/yr	1.38
	SB	1.5 %/yr	1.32

2022 Traffic Counts with Future Development Trips
AM DHV

0.96		20.0%			8	RT				
		RT	TH	LT	189	TH	15.0%			
		24	142	3	47	LT	SR-29			
					23	37	83	27		
14.0%					TH	225	LT	TH	RT	
					RT	18	18.0%			
LEGEND:										
Int PHF										
App Heavy-%										
					US-42					

2022 Traffic Counts with Future Development Trips
PM DHV

0.96		20.0%			10	RT				
		RT	TH	LT	249	TH	15.0%			
		16	87	6	34	LT	SR-29			
					33	44	237	65		
14.0%					TH	222	LT	TH	RT	
					RT	19	18.0%			
LEGEND:										
Int PHF										
App Heavy-%										
					US-42					

Notes:

1. DHV rounded to nearest 10
2. TFMS Growth Rates used
3. No COVID adjustment factor applied
4. Heavy Truck-% Obtained from TFMS TD-% Output in lieu of the Traffic Access Study

2043 Design Hour Volumes
AM DHV

0.96		20.0%			20	RT				
		RT	TH	LT	240	TH	15.0%			
		40	240	10	60	LT	SR-29			
					30	70	150	50		
14.0%					TH	300	LT	TH	RT	
					RT	30	18.0%			
LEGEND:										
Int PHF										
App Heavy-%										
					US-42					

2043 Design Hour Volumes
PM DHV

0.96		20.0%			20	RT				
		RT	TH	LT	320	TH	15.0%			
		30	150	10	50	LT	SR-29			
					50	80	410	120		
14.0%					TH	290	LT	TH	RT	
					RT	30	18.0%			
LEGEND:										
Int PHF										
App Heavy-%										
					US-42					

TFMS - Segment Forecast Report

Username	Email	Script Import Date	Script Version	Model Version
Ghansel	ghansel@cmtengr.com	4/14/2020 5:30:19 PM	2020.001	2023.1900

Forecast Summary

Project ID	Project Name	Opening Year	Design Year
	US-42 at SR-29 Safety Study	2023	2043

Project Description

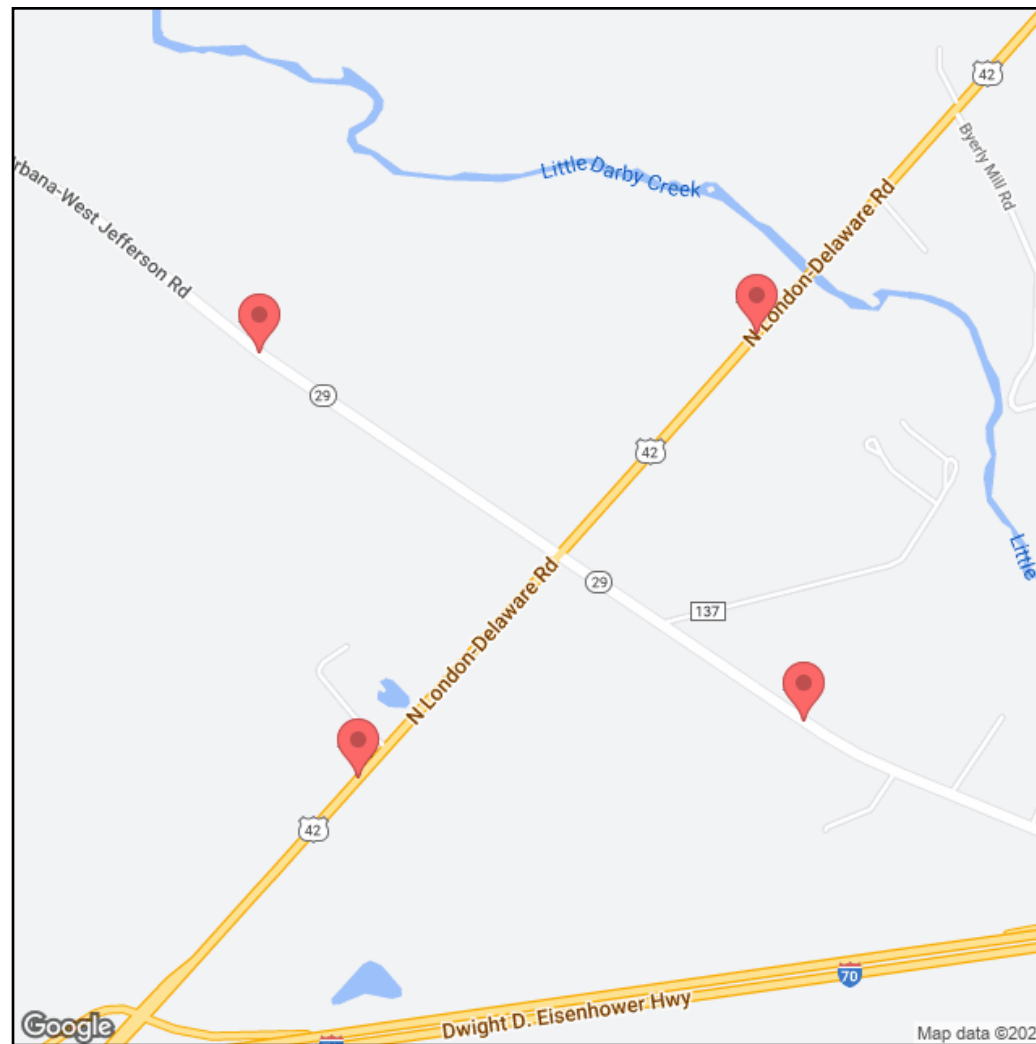
*Users of this data need to be aware that there are limitations to the forecasts generated by this product that make it suitable only for roadway design projects which are low risk.

Segment Information

Segment ID	LRS ID	BMP	EMP	Length	Latitude	Longitude
1850450	SMADSR00029**C	8.570	9.589	1.019	-83.3704992864957	39.9706541780601
1850452	SMADSR00029**C	9.589	10.418	0.829	-83.3560490331477	39.9631788285228
1850749	SMADUS00042**C	13.155	13.998	0.843	-83.3678506417906	39.9620060315064
1850755	SMADUS00042**C	13.998	14.831	0.833	-83.3573006438278	39.9710356454198

Forecast Information

Segment ID	2023 AADT	2043 AADT	DHV-30	K%	D%	T24%	TD%
1850450	5,100	5,700	700	11.9	61.4	19	14
1850452	5,100	5,600	650	11.9	61.4	20	15
1850749	6,500	9,300	1,100	12.0	50.9	21	18
1850755	6,900	9,500	1,000	11.0	51.6	23	20



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
1850450	SMADSR00029**C	8.570	9.589

Forecast

Year	K%	T24 % (Existing)	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2050	◆ 11.9	17	4,800	Average	0.400	0.400
AACT	D%	TD % (Existing)	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
6,000	◆ 61.4	12	1,200	Model	1.400	1.400

◆ K/D factors from TCDS were used.

Regression

Method Number	PA AADT	BC AADT	AACT
2	5,322	1,645	6,967

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
4131	6256	467	2133	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	0.86	2.92	0	0	5,244	1,528	5,289	1,544
2	0.89	3.34	4	2	5,308	1,631	5,322	1,645
3	1.00	1.52	0	0	5,428	1,147	5,449	1,212
4	0.99	0.02	4	6	5,442	681	5,441	855
5	1.04	1.97	0	0	5,479	1,266	5,496	1,320
6	0.93	2.32	4	5	5,369	1,384	5,372	1,403

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	-4,238	5,488	10	1,181	0.04	1.39
2	RAT	0.55	5,316	1.01	1,185	-0.11	1.41
3	MRAT	1.04	5,322	1.39	1,184	-0.10	1.40
4	RAF		5,405		1,183	-0.03	1.40

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Average	0.000	1.400

Method 1 - 4 Volume

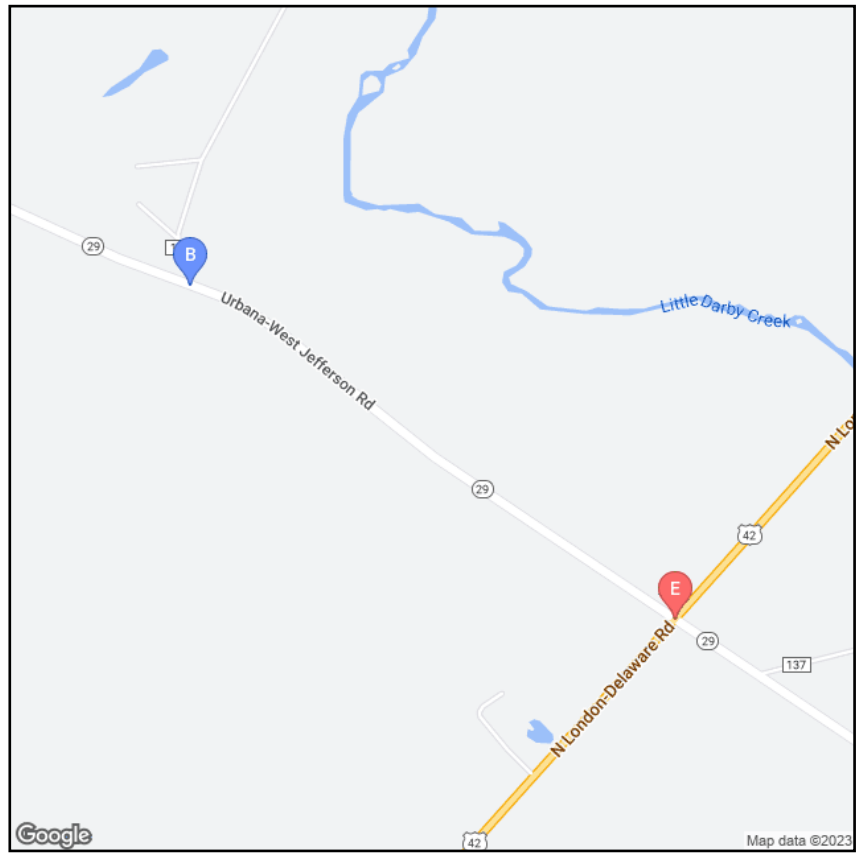
PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
4131	4307	1181	1185	5312	5492

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

Historical Count

Year	All	Cars	Trucks
2007	4,070	3,710	360
2011	4,450	3,780	670
2013	4,589	3,898	691
2016	4,542	3,884	657
2019	4,814	4,130	684
* 2022	5,108	4,258	850

* Pivot Point



Segment ID	LRS ID	BMP	EMP	Length	Yr 2023 AADT	Yr 2043 AADT	DHV30	K %	D %	T24 %	TD %
1850450	SMADSR00029**C	8.570	9.589	1.019	5,100	5,700	700	11.9	61.4	19	14

Forecast Segment ID	Route	BMP	EMP
1850452	SMADSR00029**C	9.589	10.418

Forecast

Year	K%	T24 % (Existing)	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2050	◆ 11.9	17	4,600	Average	0.300	0.300
AADT	D%	TD % (Existing)	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
5,800	◆ 61.4	12	1,200	Model	1.400	1.400

◆ K/D factors from TCDS were used.

Regression

Method Number	PA AADT	BC AADT	AADT
2	5,322	1,645	6,967

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
3780	6256	467	2133	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	0.86	2.92	0	0	5,244	1,528	5,289	1,544
2	0.89	3.34	4	2	5,308	1,631	5,322	1,645
3	1.00	1.52	0	0	5,428	1,147	5,449	1,212
4	0.99	0.02	4	6	5,442	681	5,441	855
5	1.04	1.97	0	0	5,479	1,266	5,496	1,320
6	0.93	2.32	4	5	5,369	1,384	5,372	1,403

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	-3,347	4,971	-21	1,191	-0.40	1.43
2	RAT	0.60	5,025	0.98	1,182	-0.35	1.39
3	MRAT	0.98	5,025	1.39	1,185	-0.35	1.41
4	RAF		4,998		1,188	-0.38	1.42

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Ratio	Average	-0.400	1.400

Method 1 - 4 Volume

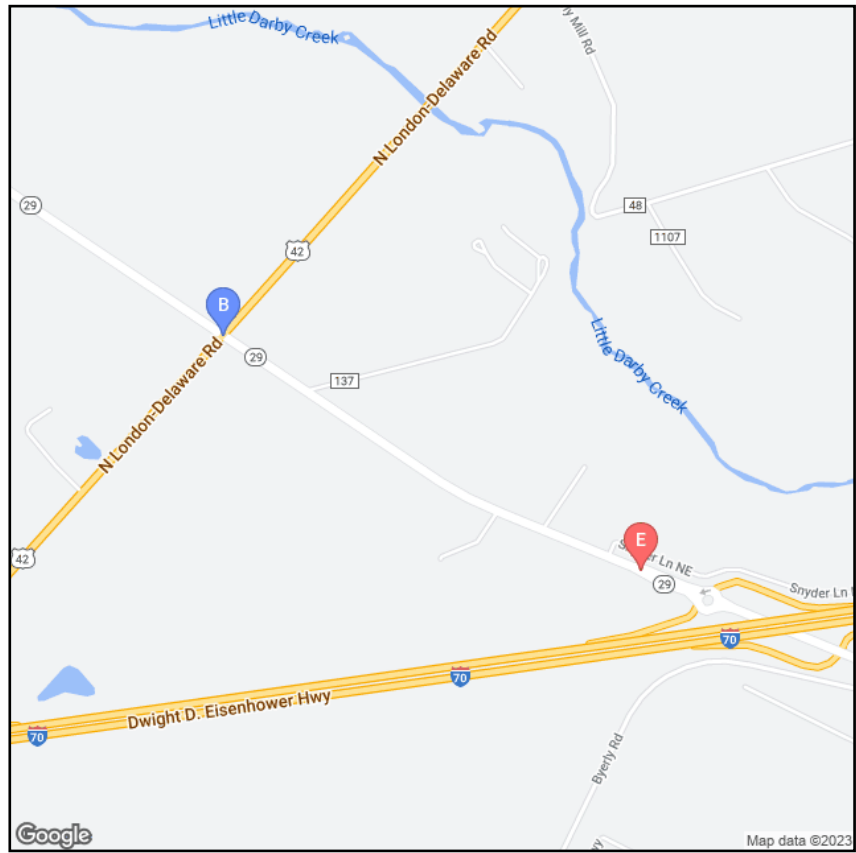
PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
3780	3843	1182	1191	4962	5034

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

Historical Count

Year	All	Cars	Trucks
2007	4,070	3,710	360
2011	4,450	3,780	670
2013	4,589	3,898	691
2016	4,542	3,884	657
2019	4,814	4,130	684
* 2022	5,108	4,258	850

* Pivot Point



Segment ID	LRS ID	BMP	EMP	Length	Yr 2023 AADT	Yr 2043 AADT	DHV30	K %	D %	T24 %	TD %
1850452	SMADSR00029**C	9.589	10.418	0.829	5,100	5,600	650	11.9	61.4	20	15

Forecast Segment ID	Route	BMP	EMP
1850749	SMADUS00042**C	13.155	13.998

Forecast

Year	K%	T24 % (Existing)	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2050	◆ 12.0	17	8,000	Model	1.800	1.800
AADT	D%	TD % (Existing)	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
10,300	◆ 50.9	14	2,300	Average	■ 5.800	4.000

■ Warning: The truck growth rate was exceeded the maximum and was capped at 5.800%

◆ K/D factors from TCDS were used.

Regression

Method Number	PA AADT	BC AADT	AADT
2	9,927	2,002	11,929

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
3320	12082	563	4799	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	2.05	2.44	0	0	8,748	1,762	8,348	1,820
2	3.12	3.04	6	2	10,307	1,949	9,927	2,002
3	1.93	1.74	0	0	8,541	1,521	8,167	1,609
4	3.74	3.96	6	2	11,330	2,264	10,861	2,283
5	1.03	3.96	0	0	7,062	2,264	6,826	2,283
6	0.70	4.07	5	5	6,385	2,310	6,347	2,315

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	-301	11,709	-2,042	4,799	1.08	12.27
2	RAT	0.95	11,469	0.35	2,369	2.56	4.25
3	MRAT	1.80	11,575	2.19	3,689	1.74	8.61
4	RAF		11,642		4,244	1.41	10.44

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Model Ratio	1.800	8.600

Method 1 - 4 Volume

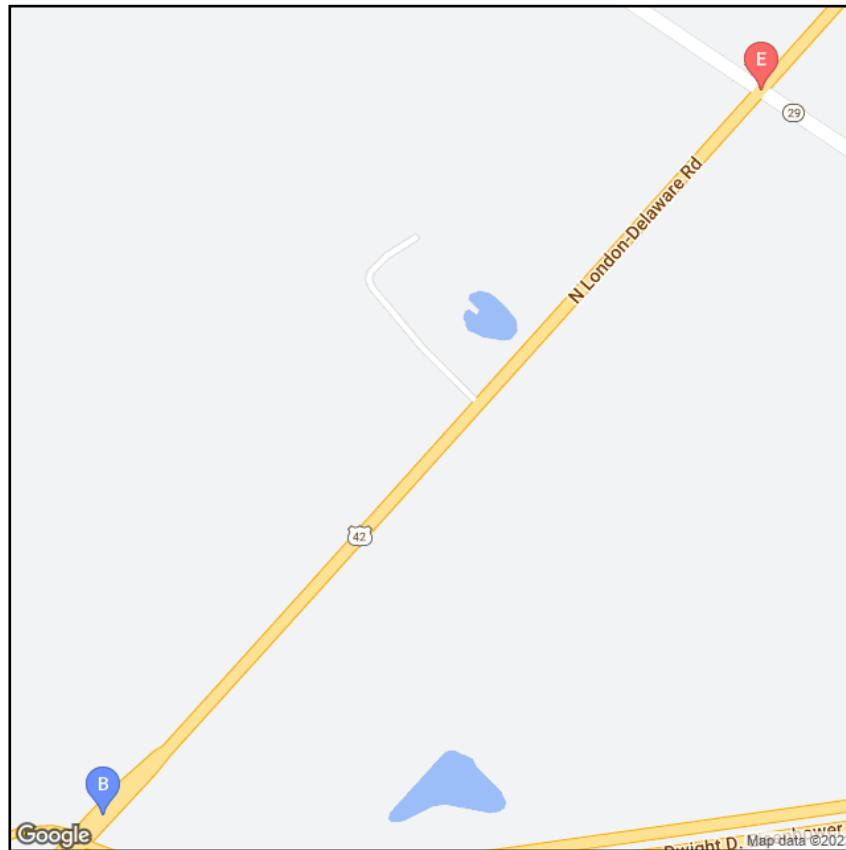
PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
6910	9100	2369	4799	9279	13899

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

Historical Count

Year	All	Cars	Trucks
2007	4,590	4,020	570
2011	5,207	4,290	917
2014	5,669	4,928	740
2016	6,058	5,266	791
2019	6,640	5,730	910
* 2022	6,384	5,302	1,082

* Pivot Point



Segment ID	LRS ID	BMP	EMP	Length	Yr 2023 AADT	Yr 2043 AADT	DHV30	K %	D %	T24 %	TD %
1850749	SMADUS00042**C	13.155	13.998	0.843	6,500	9,300	1100	12.0	50.9	21	18

Forecast Segment ID	Route	BMP	EMP
1850755	SMADUS00042**C	13.998	14.831

Forecast

Year	K%	T24 % (Existing)	PA AADT	PA Method	PA Growth Rate %	PA Calculated Rate %
2050	◆ 11.0	17	8,000	Model	1.500	1.500
AADT	D%	TD % (Existing)	BC AADT	BC Method	BC Growth Rate %	BC Calculated Rate %
10,500	◆ 51.6	15	2,500	Average	■ 4.300	4.000

■ Warning: The truck growth rate was exceeded the maximum and was capped at 4.300%

◆ K/D factors from TCDS were used.

Regression

Method Number	PA AADT	BC AADT	AADT
2	5,996	1,370	7,366

95% Confidence Min/Max

PA Min	PA Max	BC Min	BC Max	Year
3565	11760	763	4911	2050

Method Number	PA Growth %	BC Growth %	PA Drop Count	BC Drop Count	PA AADT	BC AADT	PA Adjustment	PA Adjustment
1	0.99	1.48	0	0	6,702	1,554	7,111	1,665
2	0.27	0.59	6	6	5,108	1,121	5,996	1,370
3	1.51	2.32	0	0	7,635	1,869	7,927	1,941
4	0.48	3.47	6	2	5,461	2,287	6,318	2,320
5	2.37	3.47	0	0	9,115	2,287	9,268	2,320
6	2.61	3.67	5	5	9,644	2,384	9,642	2,388

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	-309	11,844	-2,016	4,911	0.87	11.33
2	RAT	0.96	11,620	0.37	2,554	2.24	4.18
3	MRAT	1.72	11,714	2.17	3,825	1.49	8.03
4	RAF		11,779		4,368	1.18	9.68

Adjust Method AADT	Adjust Method BC	Selected PA Growth Rate %	Selected BC Growth Rate %
Average	Model Ratio	1.500	8.000

Method 1 - 4 Volume

PA Min Volume	PA Max Volume	BC Min Volume	BC Max Volume	Total Min Volume	Total MaxVolume
6933	9066	2554	4911	9487	13977

Process Flag:	Adjusted model to counts with process per ODOT 255 spreadsheet
Comment:	No Comment

Historical Count

Year	All	Cars	Trucks
2007	5,440	4,560	880
2011	5,491	4,612	879
2014	5,241	4,402	839
2016	5,601	4,704	897
2019	5,713	4,742	971
* 2022	6,746	5,569	1,177

* Pivot Point



Segment ID	LRS ID	BMP	EMP	Length	Yr 2023 AADT	Yr 2043 AADT	DHV30	K %	D %	T24 %	TD %
1850755	SMADUS00042**C	13.998	14.831	0.833	6,900	9,500	1000	11.0	51.6	23	20

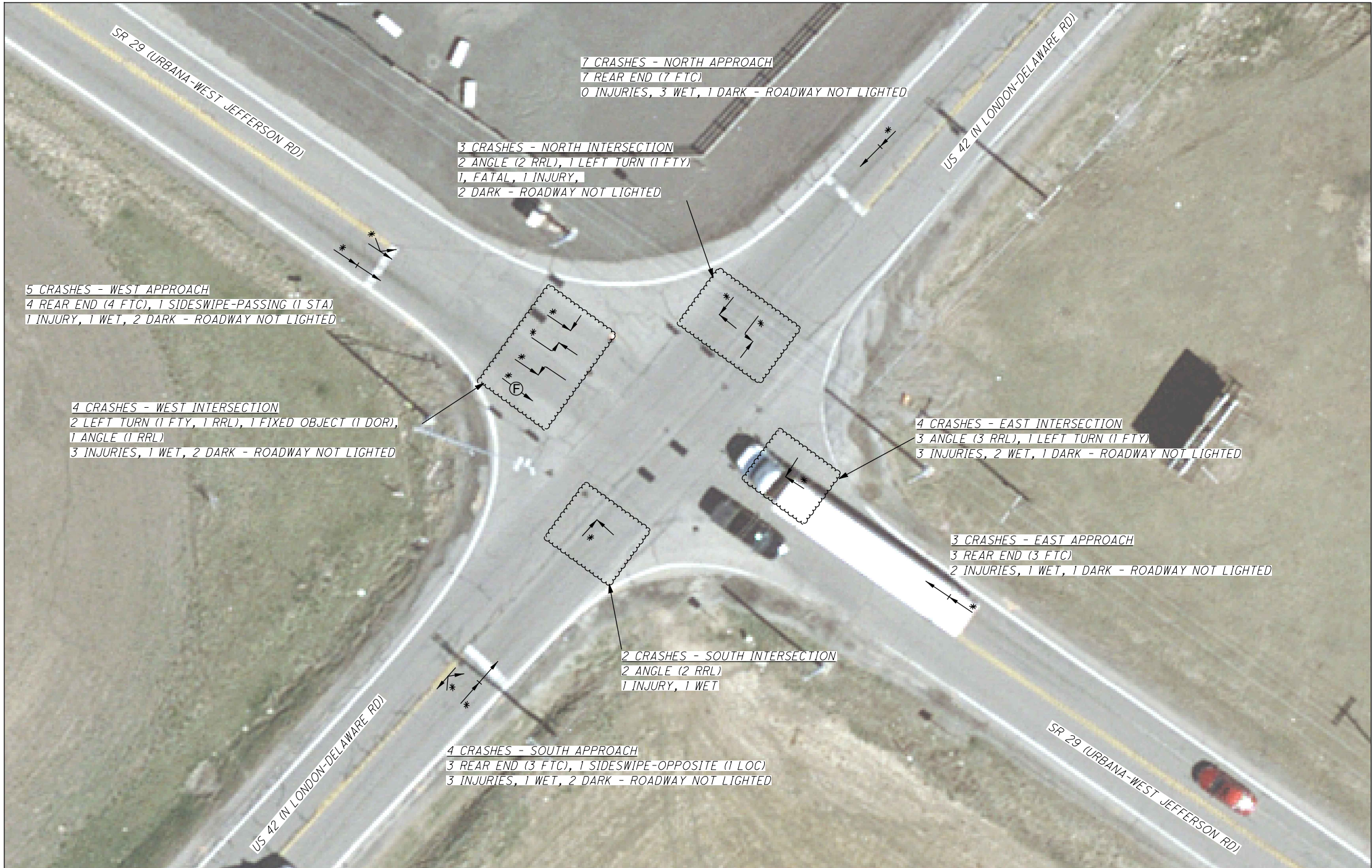
APPENDIX D

Crash Diagram



TYPE OF CRASHES	
17	- REAR END
8	- ANGLE
4	- LEFT TURN
1	- FIXED OBJECT
1	- SIDESWIPE - OPPOSITE
1	- SIDESWIPE - PASSING
TOTAL: 32	

CRASH SEVERITY	
17	- PDO CRASHES
14	- INJURY CRASHES
1	- FATAL



LEGEND	TYPES OF CRASHES		SYMBOLS		CONTRIBUTING FACTORS				
		Rear End		Fixed Object		FTY	Failure to Yield	ILC	Improper Lane Change
		Angle		Pedestrian		RRL	Ran Red Light	IP	Improper Passing
		Side Swipe		Left Turning		FTC	Following Too Closely	LOC	Left of Center
		Right Turning				IC	Improper Crossing	DOR	Drove off Road
		Backing Up				IT	Improper Turn	USS	Unsafe Speed
					OIA	Other Improper Action	STA	Swerving to Avoid	

CRASH DIAGRAM

LOG POINT _____

PERIOD 5 Years FROM 2018 TO 2022

JURISDICTION Jefferson Township, Madison County

ROUTE NAME / NUMBER State Route 29 at US Route 42

SINGH

SINGH + ASSOCIATES, INC.
CONSULTING ENGINEERS

SINGH + Associates, Inc. | Consulting Engineers
875 N. High Street, Suite 300 | Columbus, OH | 43215

DATE: Nov 21, 2023	PAGE: 1 of 1
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APPENDIX E

Crash Summary (CAM Tool Output)

MAD US 42 14.00

Crash Summary Sheet

Fatalities	1
Serious Injuries	3
Other Injuries	20

Crash Severity	Crashes	%
(1) Fatal	1	3.13%
(2) Serious Injury Suspected	2	6.25%
(3) Minor Injury Suspected	10	31.25%
(4) Injury Possible	2	6.25%
(5) PDO/No Injury	17	53.13%
Grand Total	32	100.00%

Day of Week	Crashes	%
(1) Sunday	3	9.38%
(2) Monday	7	21.88%
(3) Tuesday	5	15.63%
(4) Wednesday	4	12.50%
(5) Thursday	6	18.75%
(6) Friday	6	18.75%
(7) Saturday	1	3.13%
Grand Total	32	100.00%

Hour of Day	Crashes	%
2	1	3.13%
4	1	3.13%
5	1	3.13%
6	3	9.38%
7	2	6.25%
8	1	3.13%
10	1	3.13%
12	1	3.13%
14	3	9.38%
15	1	3.13%
16	7	21.88%
17	5	15.63%
18	1	3.13%
19	1	3.13%
21	2	6.25%
22	1	3.13%
Grand Total	32	100.00%

Crashes Per Year	6.40
Fatal and All Injury Crashes	15
Percent Injury	46.9%
Equivalent PDO Index Value	7.16

Year	Crashes	%
2018	15	46.88%
2019	8	25.00%
2020	4	12.50%
2021	1	3.13%
2022	4	12.50%
Grand Total	32	100.00%

Crash Type	Crashes	%
Rear End	17	53.13%
Angle	8	25.00%
Left Turn	4	12.50%
Fixed Object	1	3.13%
Sideswipe - Opposite	1	3.13%
Sideswipe - Passing	1	3.13%
Grand Total	32	100.00%

Month	Crashes	%
1	1	3.13%
2	1	3.13%
3	6	18.75%
4	3	9.38%
6	5	15.63%
7	5	15.63%
8	2	6.25%
9	2	6.25%
10	2	6.25%
11	2	6.25%
12	3	9.38%
Grand Total	32	100.00%

MAD US 42 14.00
Crash Summary Sheet

Weather Condition	Crashes	%
Clear	17	53.13%
Cloudy	10	31.25%
Rain	5	15.63%
Grand Total	32	100.00%

Road Condition	Crashes	%
Dry	22	68.75%
Wet	10	31.25%
Grand Total	32	100.00%

Light Condition	Crashes	%
Daylight	20	62.50%
Dark - Roadway Not Lighted	10	31.25%
Dark - Lighted Roadway	1	3.13%
Dawn/Dusk	1	3.13%
Grand Total	32	100.00%

Number of Units	Crashes	%
2	25	78.13%
3	4	12.50%
1	1	3.13%
5	1	3.13%
4	1	3.13%
Grand Total	32	100.00%

ODOT Location	Crashes	%
Four-Way Intersection	31	96.88%
Not An Intersection	1	3.13%
Grand Total	32	100.00%

Work Zone Related	Crashes	%
No	32	100.00%
Grand Total	32	100.00%

Alcohol Related	Crashes	%
No	31	96.88%
Yes	1	3.13%
Grand Total	32	100.00%

Contour	Crashes	%
Straight Level	32	100.00%
Grand Total	32	100.00%

Drug Related (Inc. Marijuana)	Crashes	%
No	31	96.88%
Yes	1	3.13%
Grand Total	32	100.00%

Marijuana Related	Crashes	%
No	32	100.00%
Grand Total	32	100.00%

Roadway Departure	Crashes	%
No	28	87.50%
Yes	4	12.50%
Grand Total	32	100.00%

Older Driver (65+)	Crashes	%
No	27	84.38%
Yes	5	15.63%
Grand Total	32	100.00%

Intersection Related	Crashes	%
Yes	31	96.88%
No	1	3.13%
Grand Total	32	100.00%

Young Driver (15-25)	Crashes	%
No	23	71.88%
Yes	9	28.13%
Grand Total	32	100.00%

Speed Related	Crashes	%
No	32	100.00%
Grand Total	32	100.00%

Motorcycle Involved	Crashes	%
No	32	100.00%
Grand Total	32	100.00%

MAD US 42 14.00
Crash Summary Sheet
Unit 1 Summary

Unit 1 Pre-Crash Action	Crashes	%
Straight Ahead	26	81.25%
Making Left Turn	4	12.50%
Slowing or Stopped In Traffic	1	3.13%
Making Right Turn	1	3.13%
Grand Total	32	100.00%

Unit 1 Contributing Factor	Crashes	%
Following Too Closely/ACDA	18	56.25%
Ran Red Light	7	21.88%
Failure to Yield	5	15.63%
Drove off Road	1	3.13%
Left of Center	1	3.13%
Grand Total	32	100.00%

Unit 1 Object Struck	Crashes	%
Nothing Struck	30	93.75%
Other Fixed Object	1	3.13%
Ditch	1	3.13%
Grand Total	32	100.00%

Unit 1 Traffic Control	Crashes	%
Signal	29	90.63%
No Control	3	9.38%
Grand Total	32	100.00%

Unit 1 Posted Speed	Crashes	%
55	32	100.00%
Grand Total	32	100.00%

Unit 1 Direction From	Crashes	%
North	9	28.13%
West	6	18.75%
East	6	18.75%
South	5	15.63%
Northeast	2	6.25%
Southeast	2	6.25%
Southwest	1	3.13%
Northwest	1	3.13%
Grand Total	32	100.00%

Unit 1 Direction To	Crashes	%
South	11	34.38%
North	6	18.75%
East	5	15.63%
West	4	12.50%
Southwest	2	6.25%
Northwest	2	6.25%
Southeast	1	3.13%
Northeast	1	3.13%
Grand Total	32	100.00%

MAD US 42 14.00
Crash Summary Sheet
Unit 1 Summary

Unit 1 Type	Crashes	%
Passenger Car	18	56.25%
Pick up	8	25.00%
Semi-Tractor	2	6.25%
Sport Utility Vehicle	2	6.25%
Cargo Van	1	3.13%
Passenger Van (minivan)	1	3.13%
Grand Total	32	100.00%

Unit 1 Special Function	Crashes	%
None	31	96.88%
Other / Unknown	1	3.13%
Grand Total	32	100.00%

MAD US 42 14.00
Crash Summary Sheet

Unit 2 Summary

Unit 2 Pre-Crash Action	Crashes	%
Slowing or Stopped In Traffic	16	50.00%
Straight Ahead	13	40.63%
	1	3.13%
Making Left Turn	1	3.13%
Making Right Turn	1	3.13%
Grand Total	32	100.00%

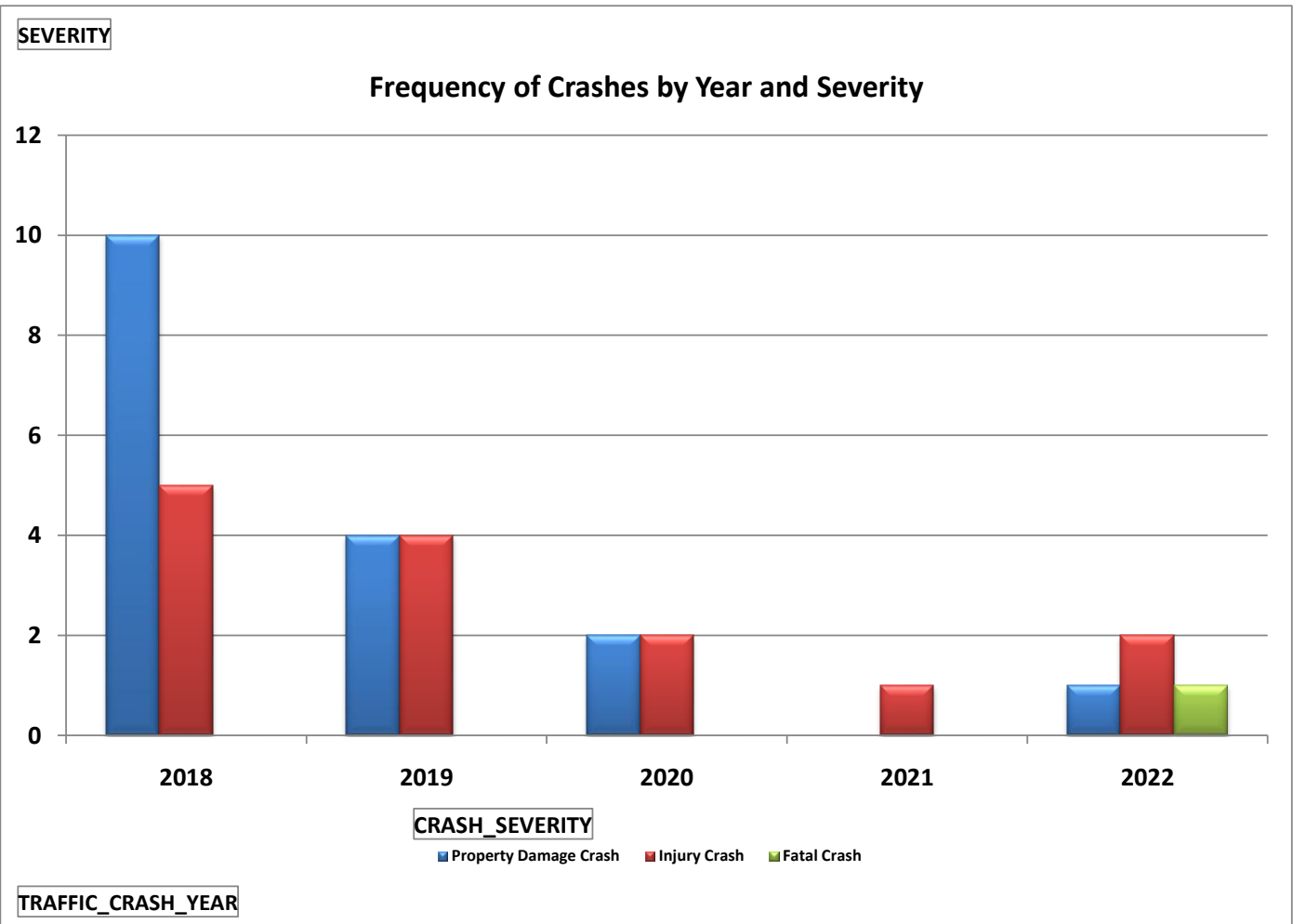
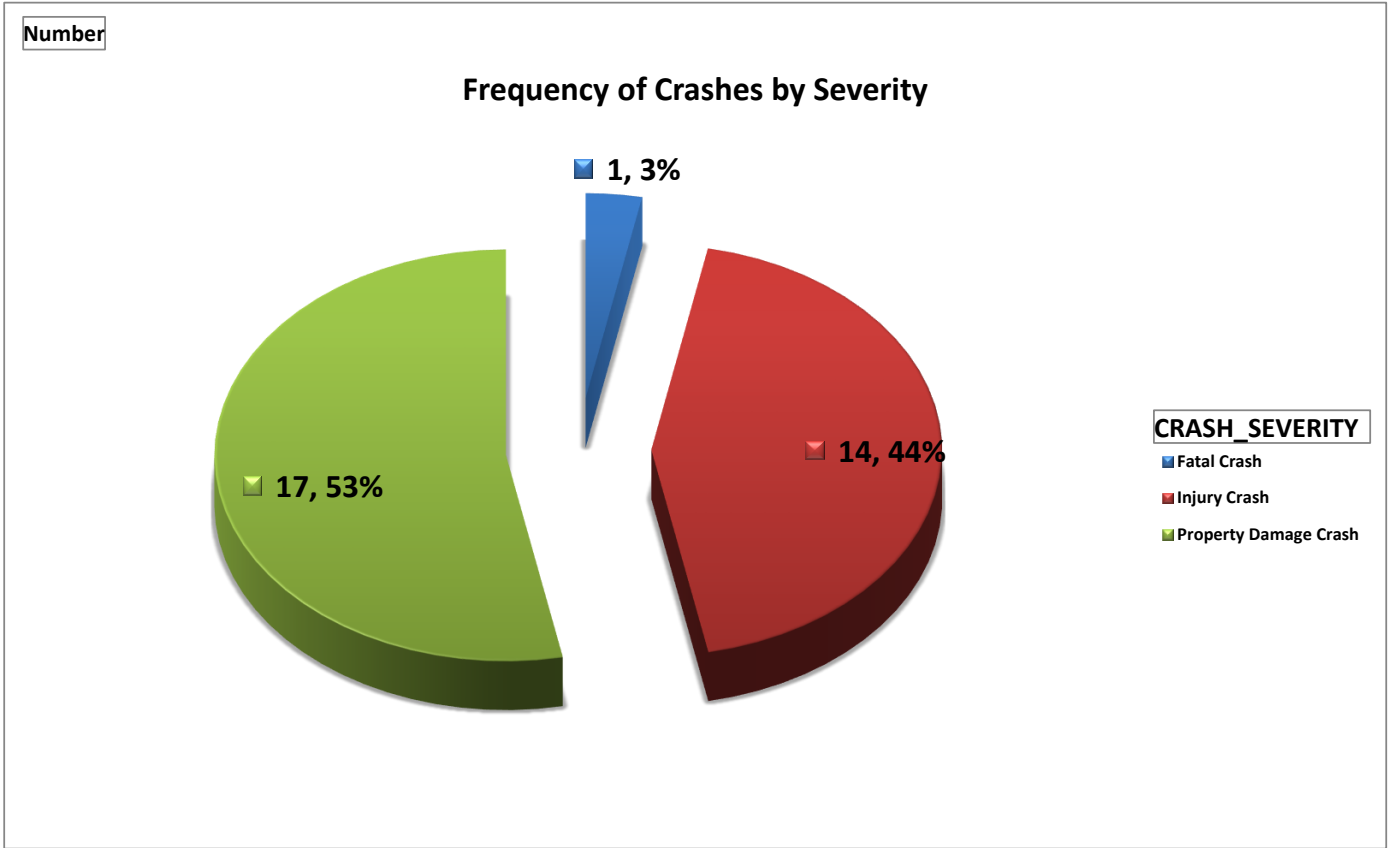
Unit 2 Contributing Factor	Crashes	%
None	31	96.88%
	1	3.13%
Grand Total	32	100.00%

Unit 2 Direction From	Crashes	%
	1	3.13%
East	3	9.38%
North	10	31.25%
Northwest	2	6.25%
South	6	18.75%
Southeast	4	12.50%
Southwest	1	3.13%
West	5	15.63%
Grand Total	32	100.00%

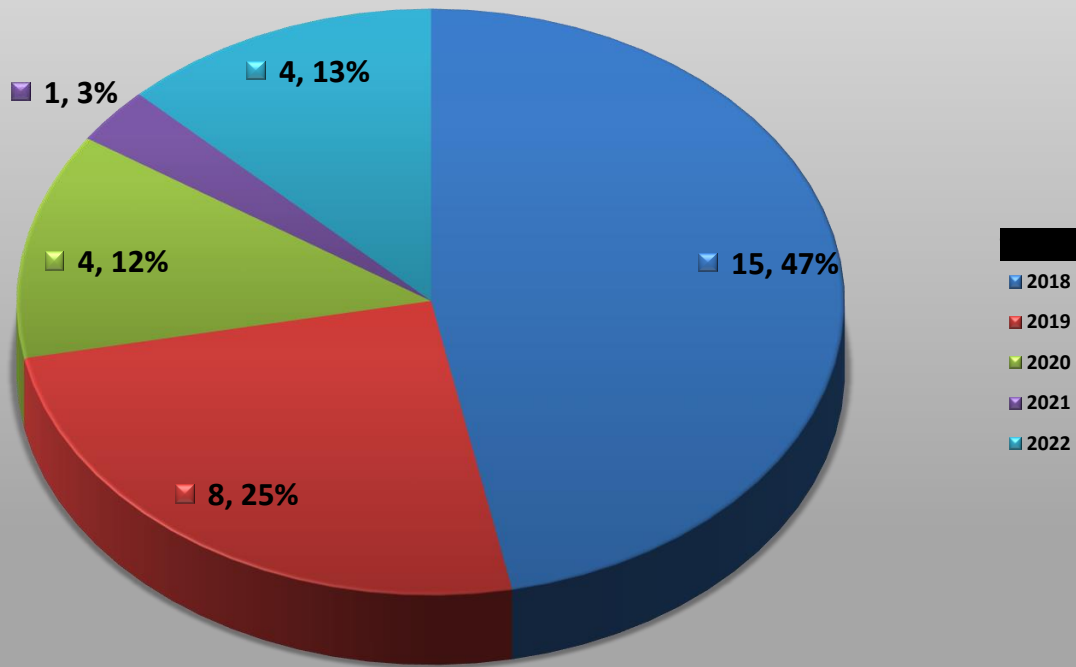
Unit 2 Direction To	Crashes	%
	1	3.13%
East	6	18.75%
North	5	15.63%
Northeast	2	6.25%
Northwest	4	12.50%
South	10	31.25%
Southeast	1	3.13%
West	3	9.38%
Grand Total	32	100.00%

Unit 2 Type	Crashes	%
Sport Utility Vehicle	10	31.25%
Passenger Car	10	31.25%
Semi-Tractor	5	15.63%
Pick up	4	12.50%
Passenger Van (minivan)	1	3.13%
	1	3.13%
Single Unit Truck	1	3.13%
Grand Total	32	100.00%

Unit 2 Special Function	Crashes	%
None	29	90.63%
Other / Unknown	1	3.13%
	1	3.13%
Farm	1	3.13%
Grand Total	32	100.00%



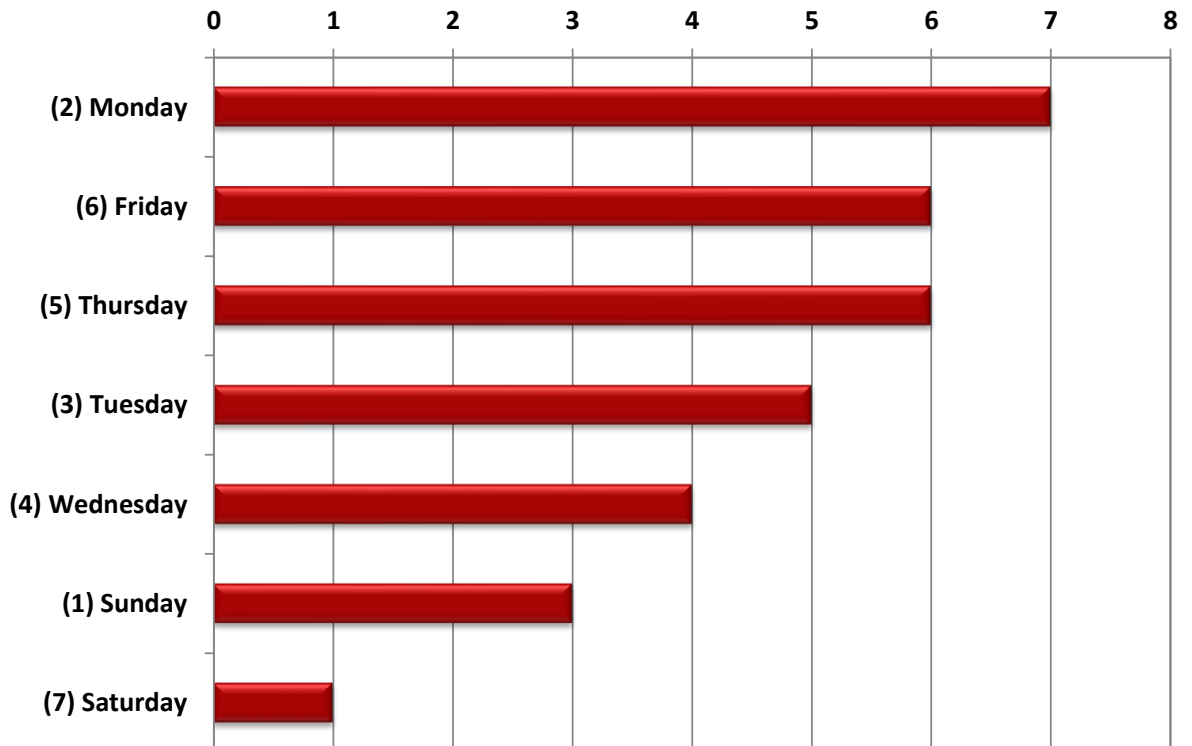
Frequency of Crashes by Year



Frequency of Crashes by Day of the Week

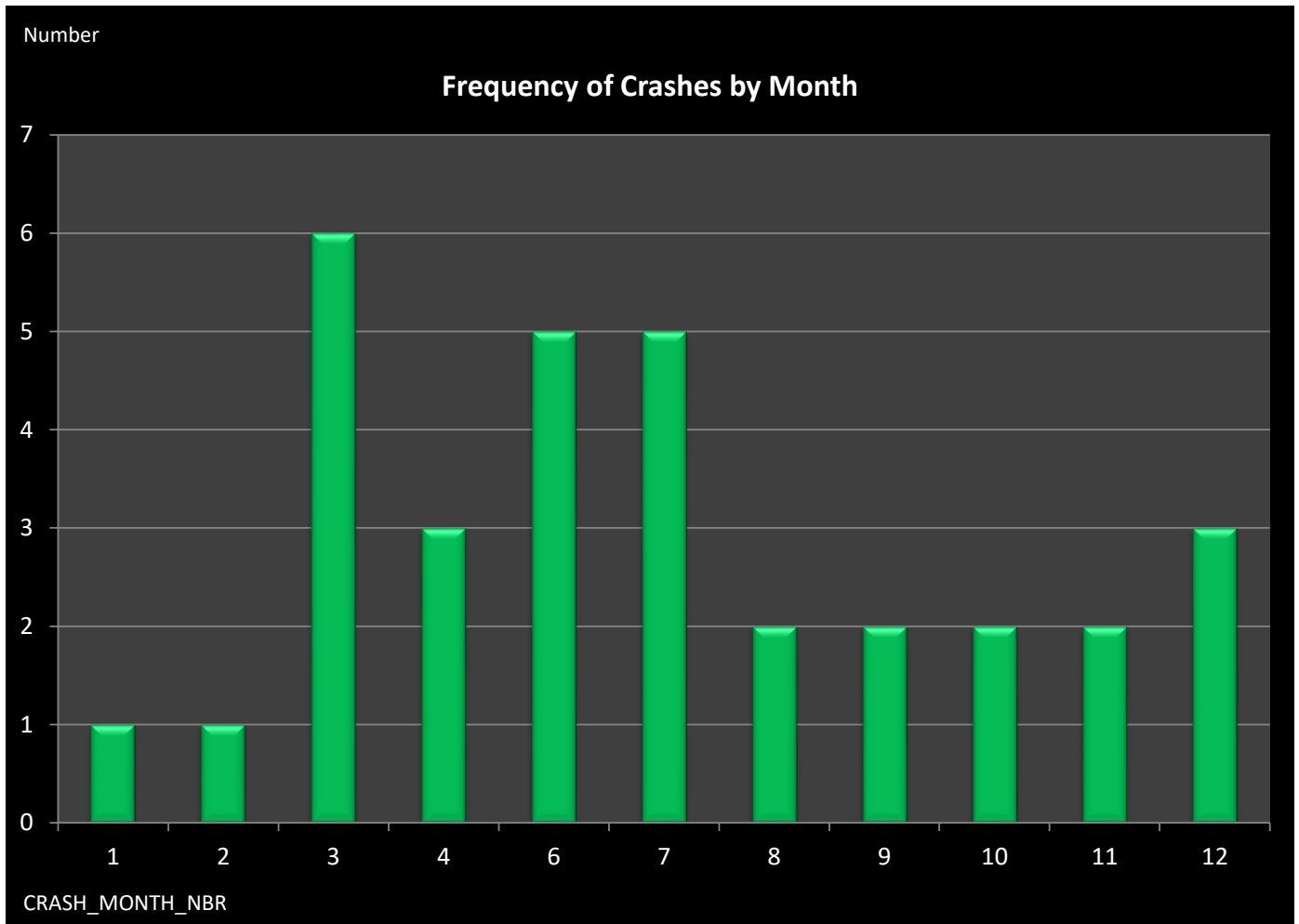
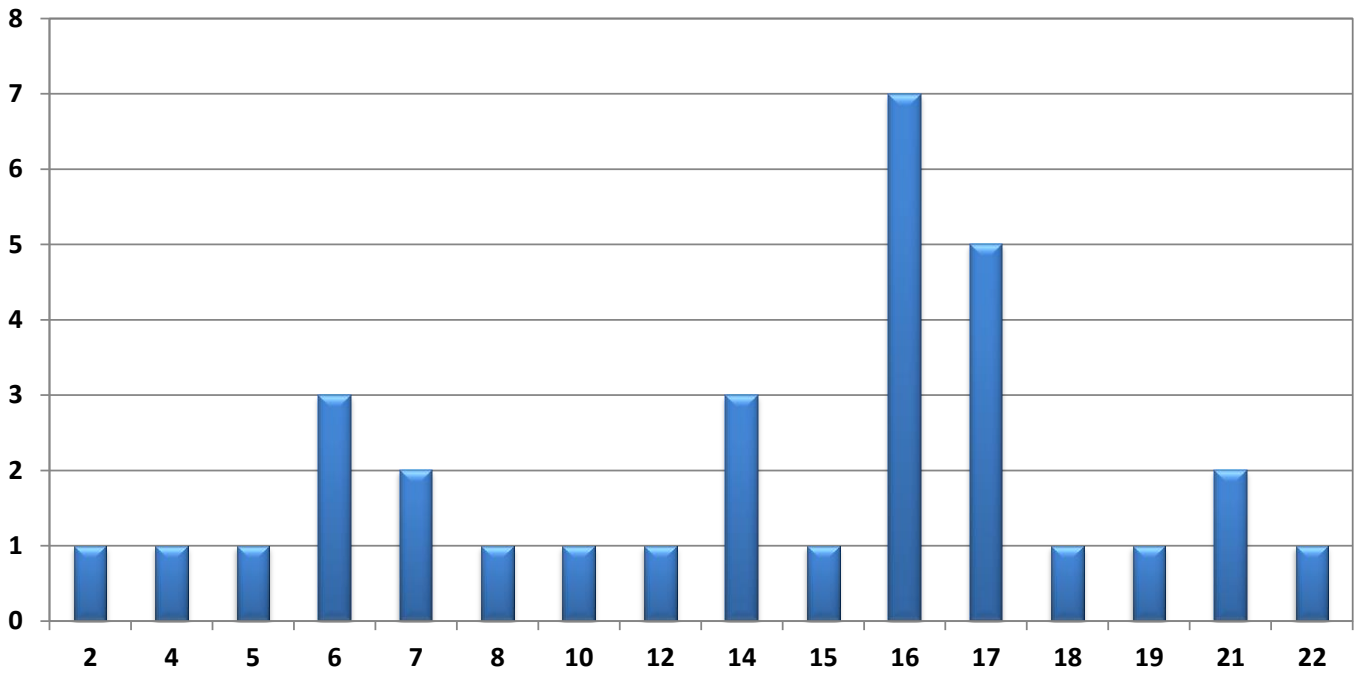
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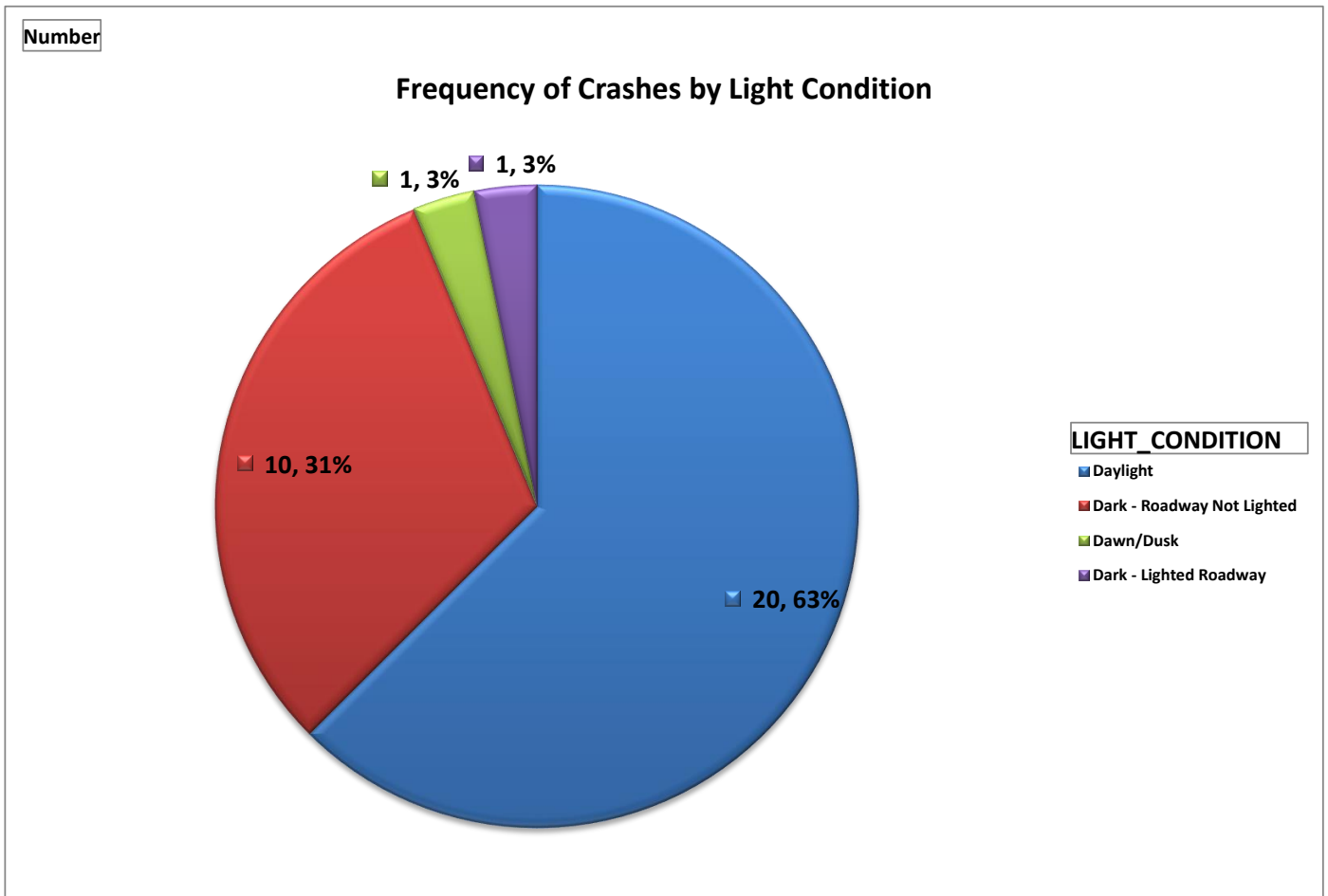
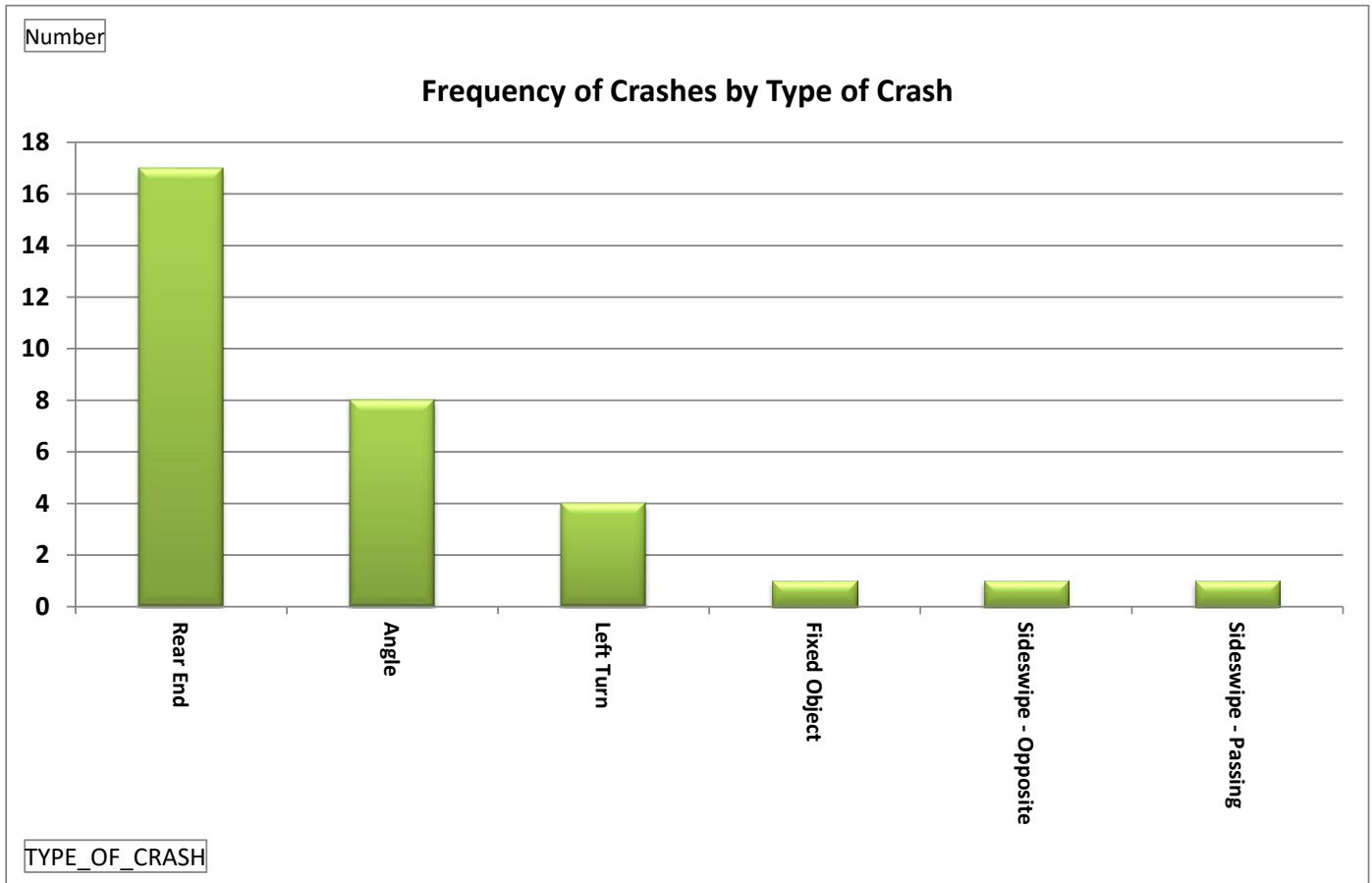
DAY_OF_WEEK

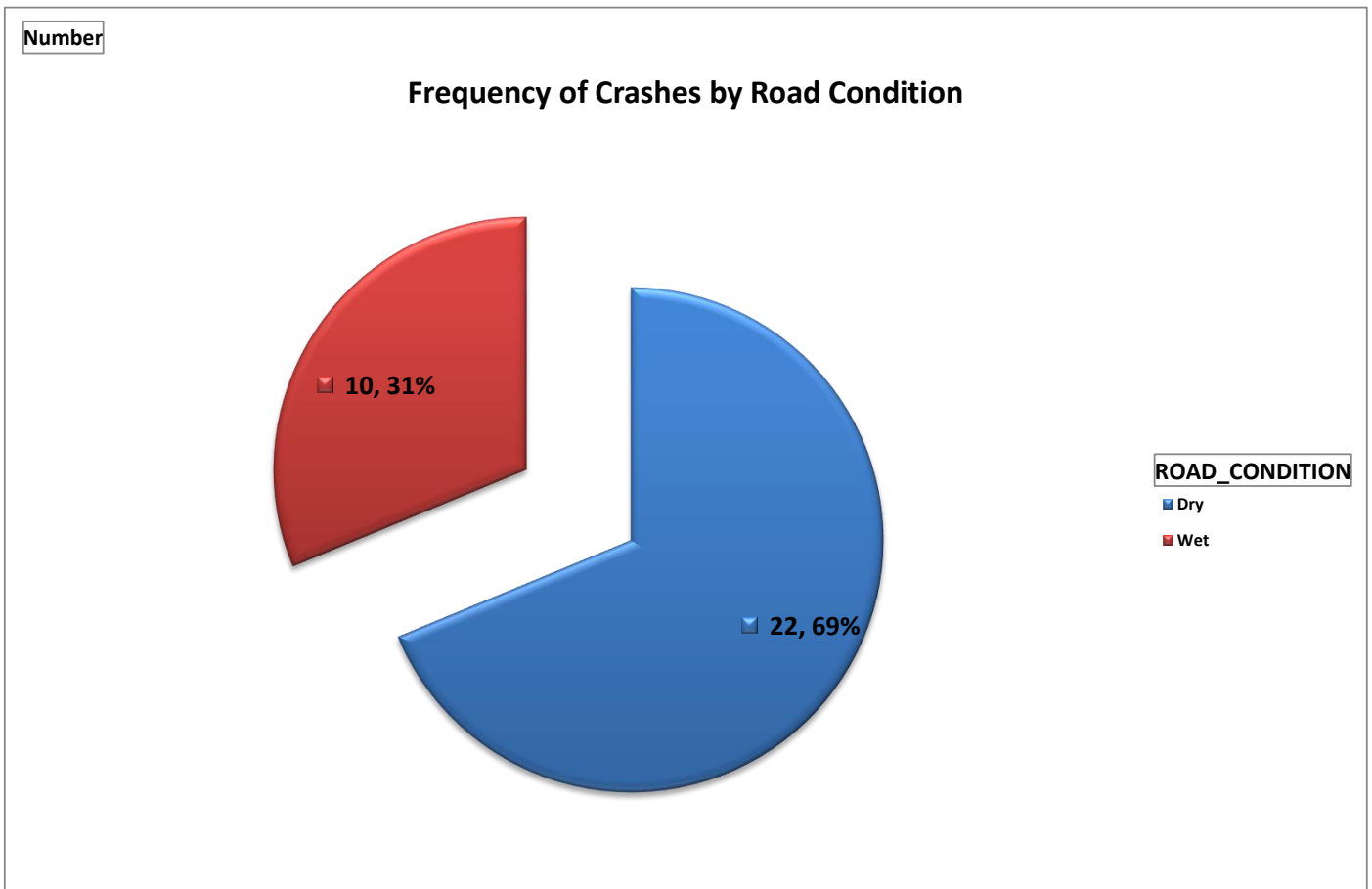
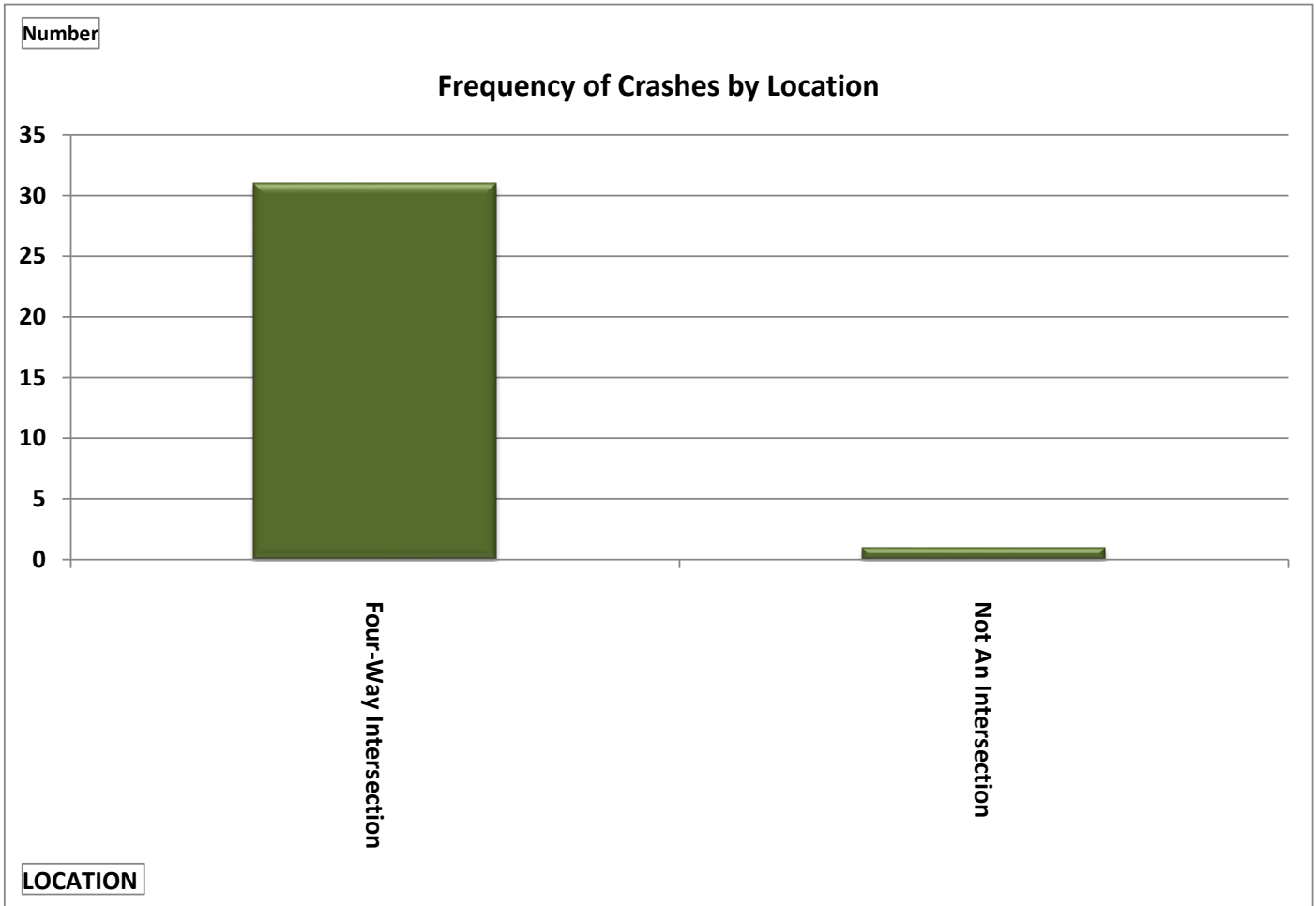


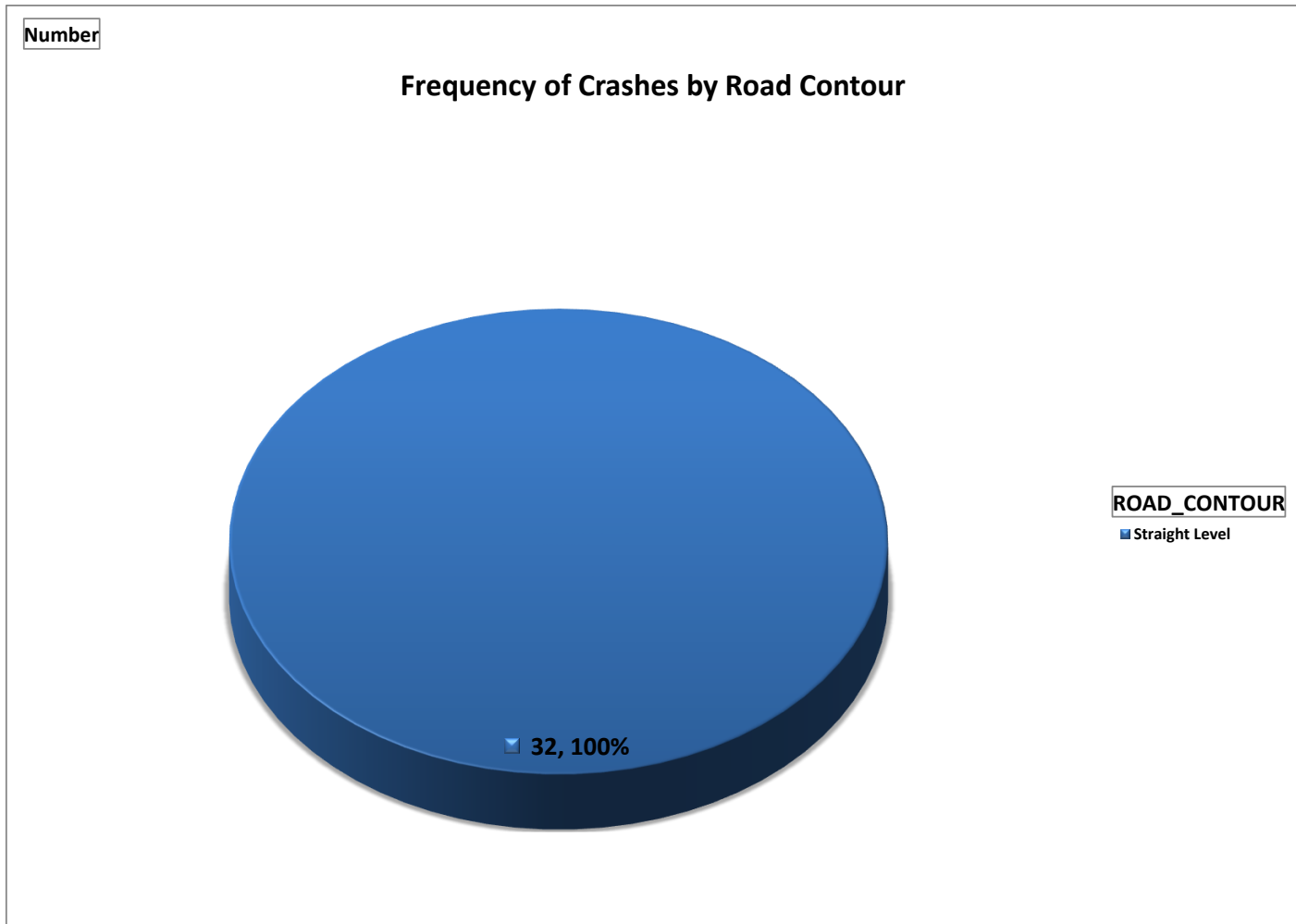
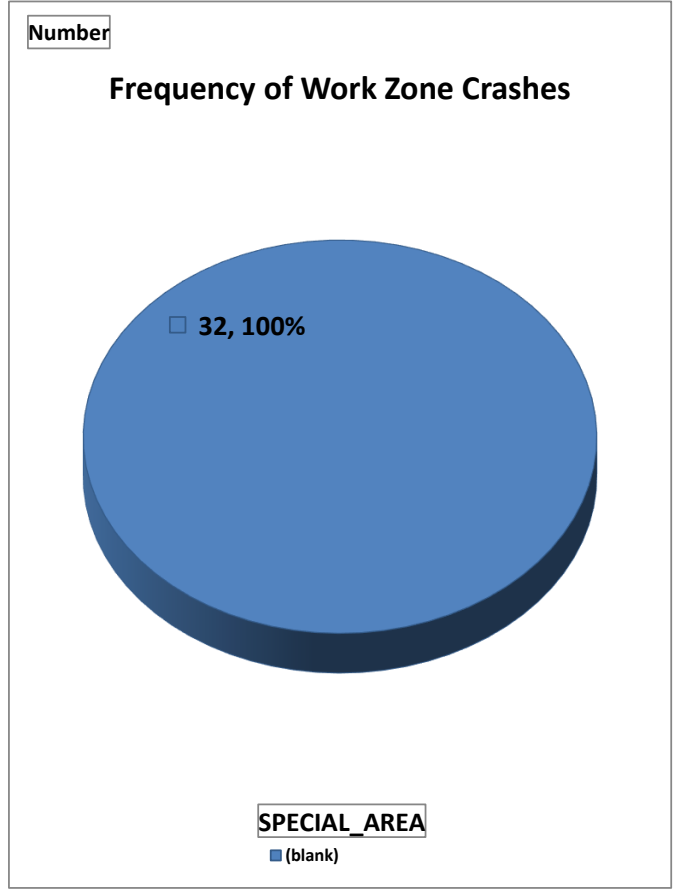
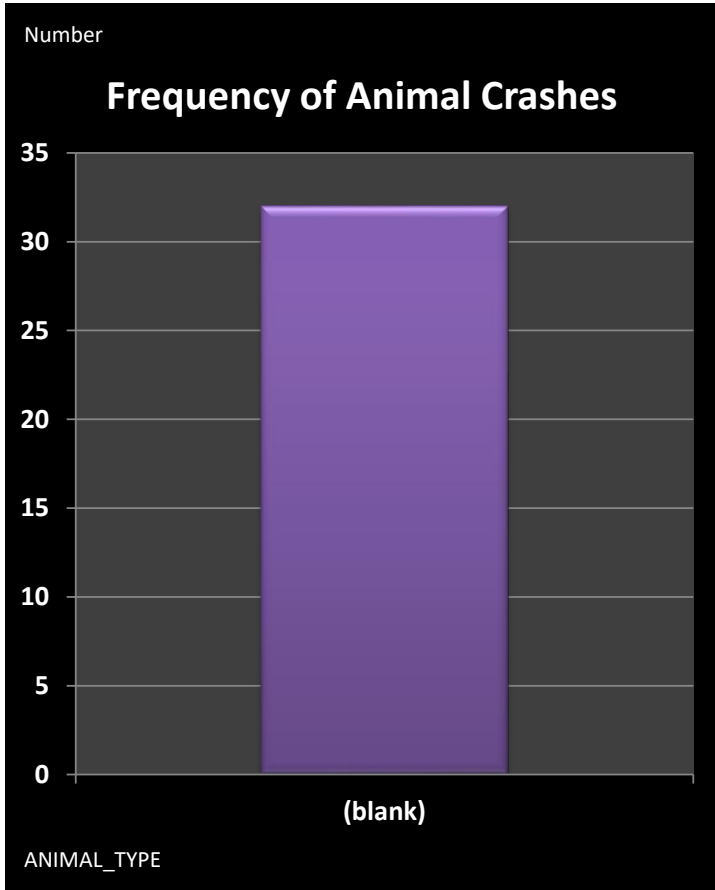


Frequency of Crashes by Hour



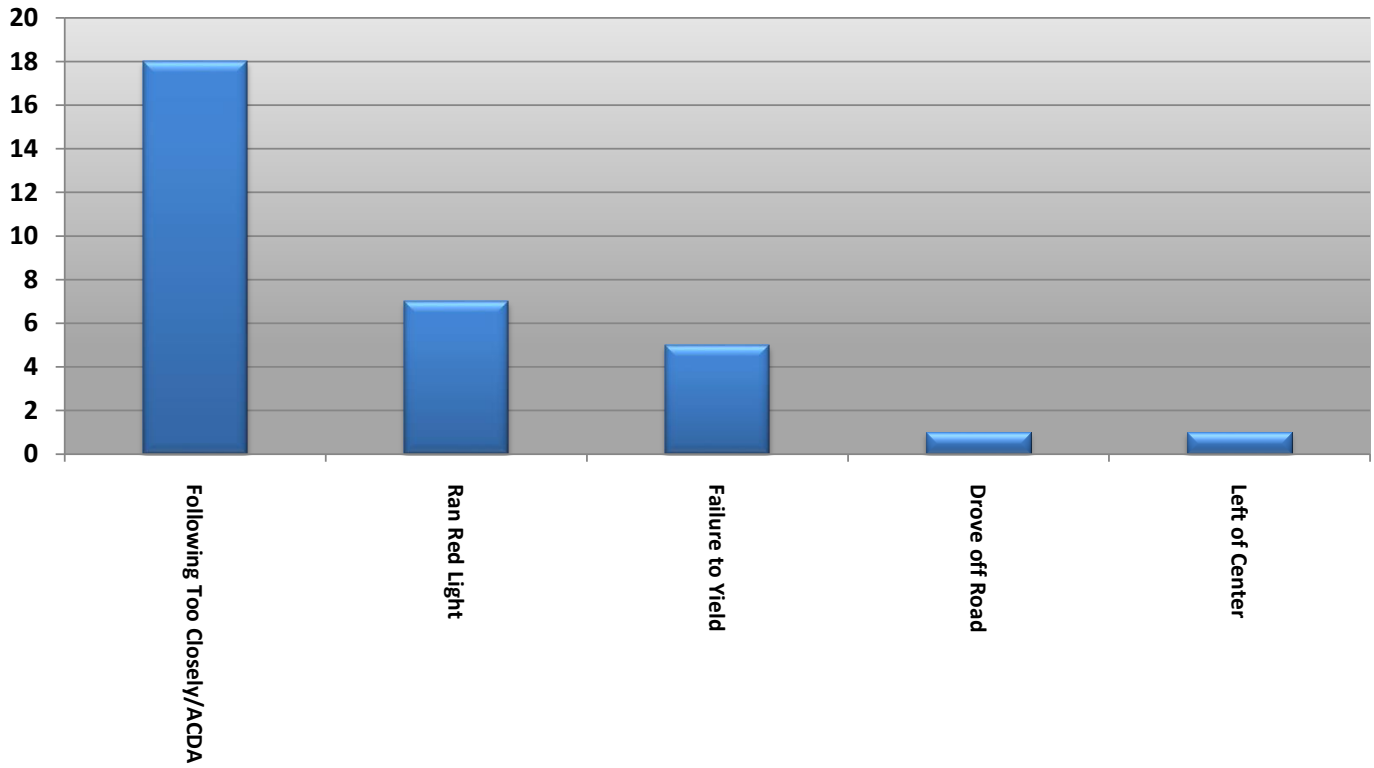






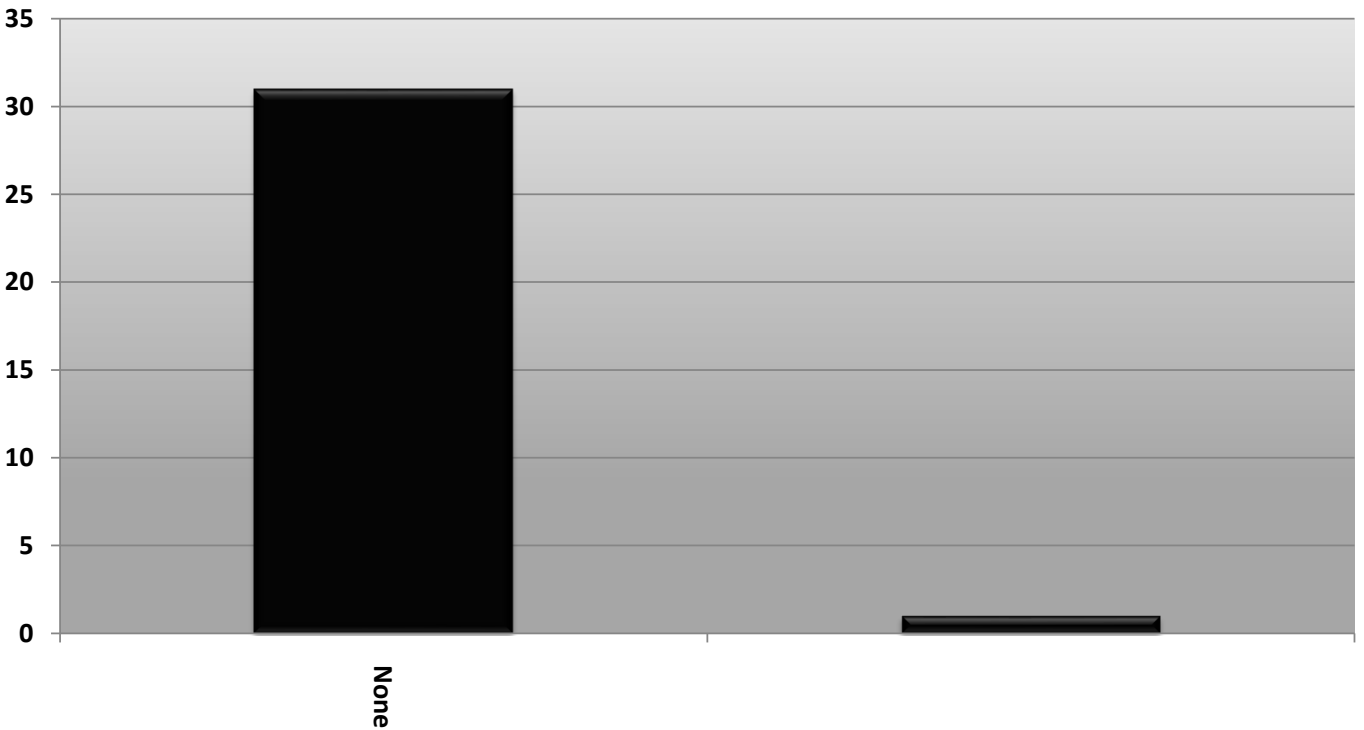


Frequency of Crashes by Contributing Factor 1

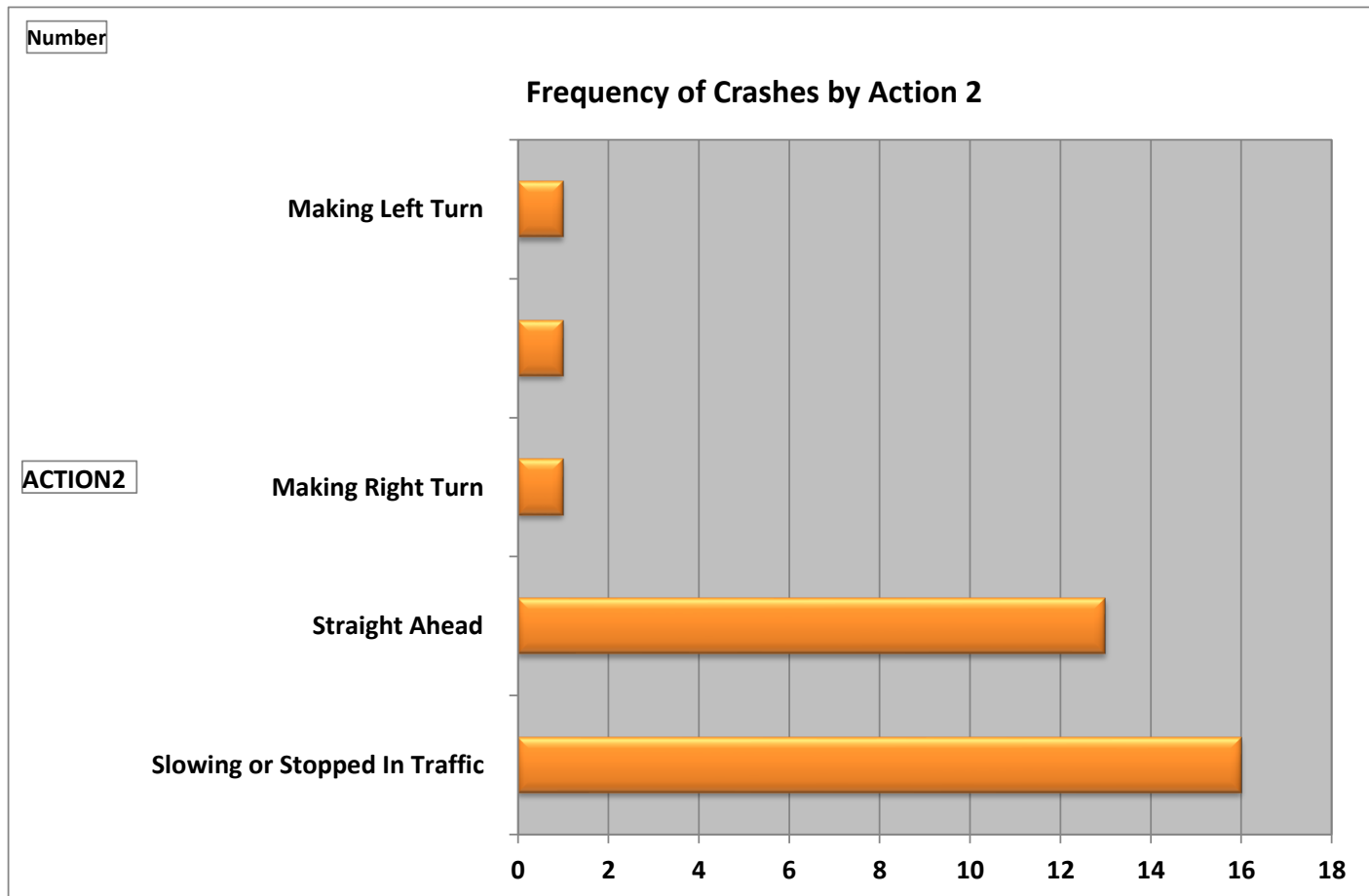
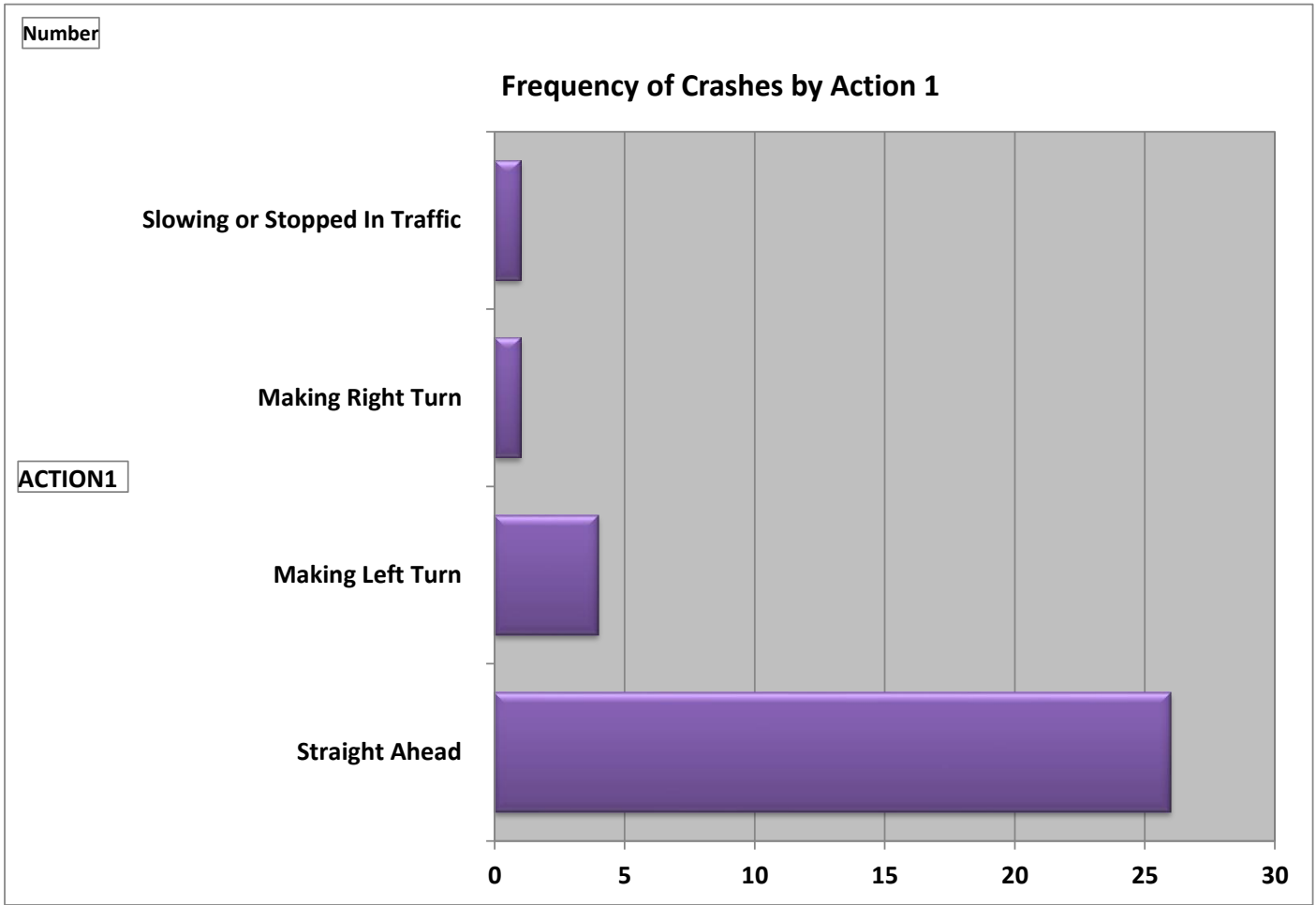


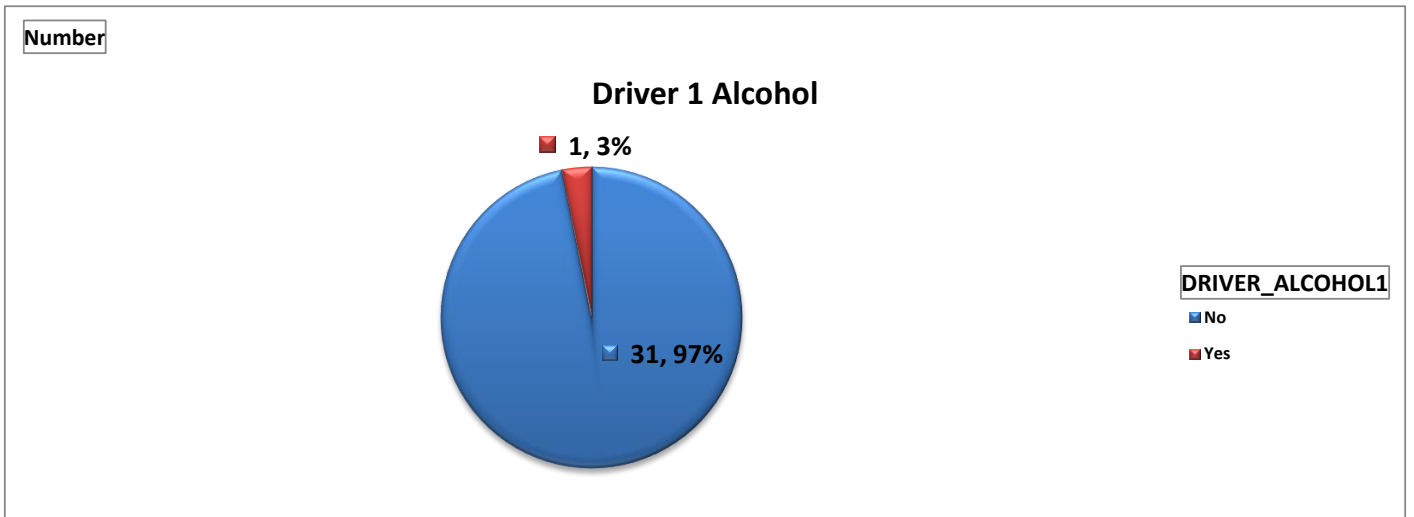
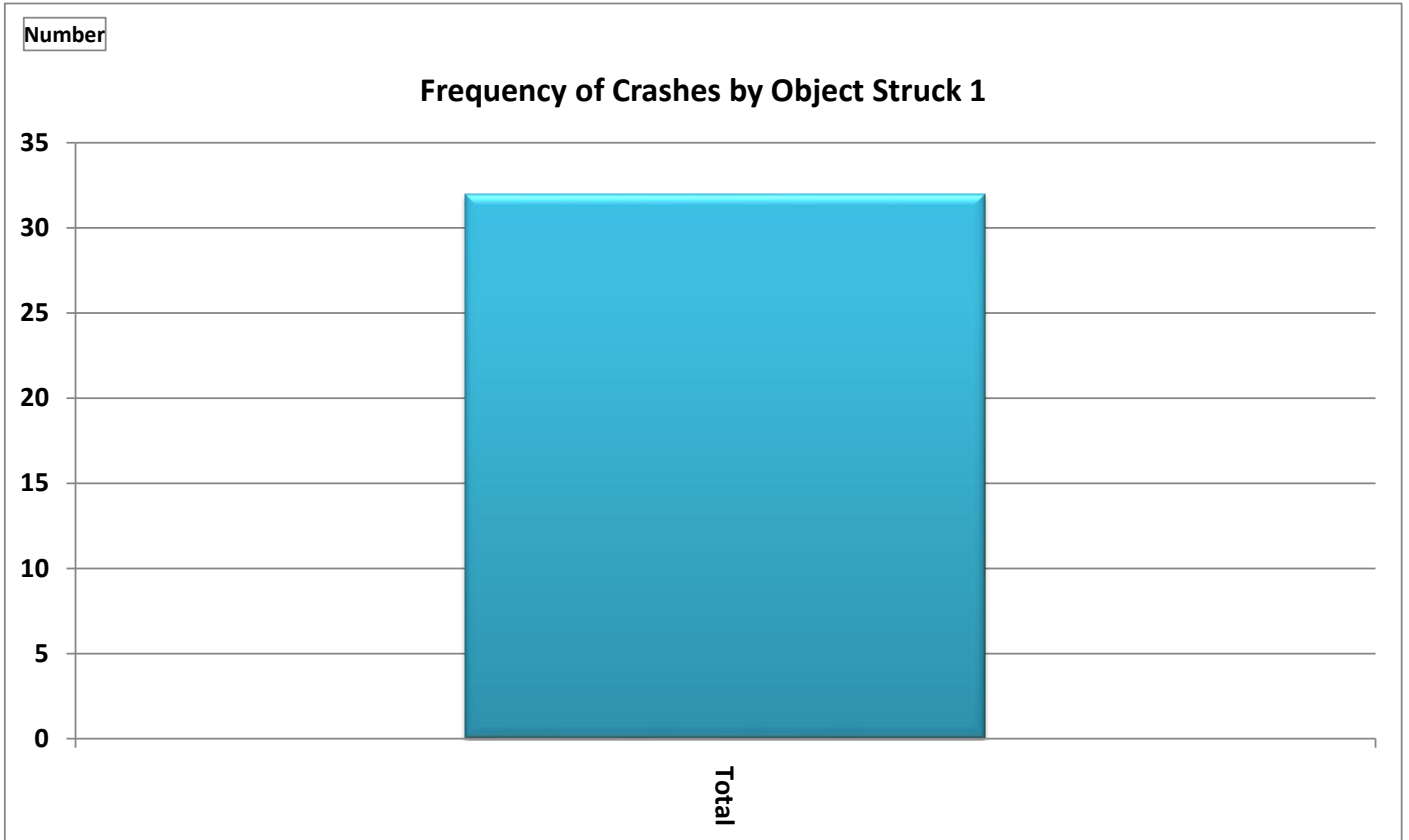
Number

Frequency of Crashes by Contributing Factor 2



CONTRIBUTING_FACTOR2





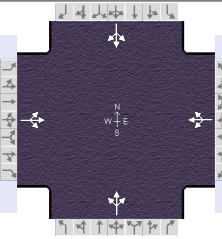
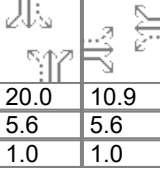
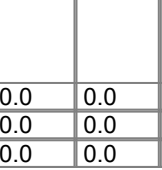
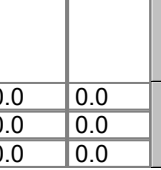
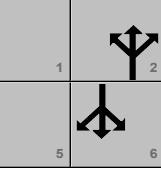
APPENDIX F

Capacity Analyses

Roundabout

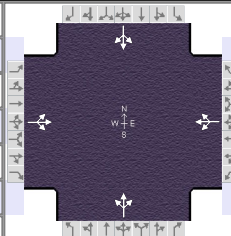
Left-Turn Lanes Traffic Signal Alternative

HCS Signalized Intersection Input Data

General Information					Intersection Information										
Agency	SINGH + Associates				Duration, h	0.250									
Analyst	Greg Gedemer	Analysis Date	12/19/2023		Area Type	Other									
Jurisdiction	ODOT	Time Period	AM Peak		PHF	0.96									
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line		Analysis Period	1 > 7:00									
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2022 Baseline.xus												
Project Description	US 42 Safety Study														
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				23	225	18	47	189	8	37	83	27	3	142	24
Signal Information															
Cycle, s	44.1	Reference Phase	2	Green	20.0	10.9	0.0	0.0	0.0	0.0	0.0	1	2	3	4
Offset, s	0	Reference Point	End	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	0.0	5	6	7	8
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	0.0	0.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On												
Traffic Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				23	225	18	47	189	8	37	83	27	3	142	24
Initial Queue (Q _b), veh/h				0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s ₀), veh/h				1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N _m), man/h				None			None			None			None		
Heavy Vehicles (P _{HV}), %				14			15			18			20		
Ped / Bike / RTOR, /h				0	0	0	0	0	0	0	0	0	0	0	0
Buses (N _b), buses/h				0	0	0	0	0	0	0	0	0	0	0	
Arrival Type (AT)				3	3	3	3	3	3	3	3	3	3	3	
Upstream Filtering (I)				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Lane Width (W), ft				12.0			12.0			12.0			12.0		
Turn Bay Length, ft				0			0			0			0		
Grade (Pg), %				0			0			0			0		
Speed Limit, mi/h				55	55	55	55	55	55	55	55	55	55	55	55
Phase Information				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Maximum Green (G _{max}) or Phase Split, s					30.0		30.0		60.0		60.0				
Yellow Change Interval (Y), s					5.6		5.6		5.6		5.6				
Red Clearance Interval (R _c), s					1.0		1.0		1.0		1.0				
Minimum Green (G _{min}), s					10		10		20		20				
Start-Up Lost Time (lt), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Extension of Effective Green (e), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Passage (PT), s					3.5		3.5		3.5		3.5				
Recall Mode					Off		Off		Min		Min				
Dual Entry					Yes		Yes		Yes		Yes				
Walk (Walk), s					0.0		0.0		0.0		0.0				
Pedestrian Clearance Time (PC), s					0.0		0.0		0.0		0.0				
Multimodal Information				EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius				0.0	No	25.0	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0
Walkway / Crosswalk Width / Length, ft				9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0
Street Width / Island / Curb, ft				0.0	0	No	0.0	0	No	0.0	0	No	0.0	0	No
Width Outside / Bike Lane / Shoulder, ft				12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0
Pedestrian Signal / Occupied Parking				No	0.50	No	0.50	No	0.50	No	0.50	No	0.50		

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2022 Baseline.xus				
Project Description	US 42 Safety Study						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	23	225	18	47	189	8	37	83	27	3	142	24

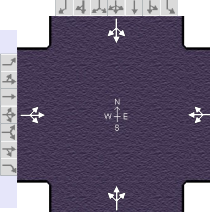
Signal Information															
Cycle, s	44.1	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	10.9	0.0	0.0	0.0	0.0	1		2	3	4
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	5		6	7	8
				Red	1.0	1.0	0.0	0.0	0.0	0.0					

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		17.5		17.5		26.6		26.6
Change Period, (Y+R _c), s		6.6		6.6		6.6		6.6
Max Allow Headway (MAH), s		4.4		4.4		4.4		4.4
Queue Clearance Time (g _s), s		8.7		8.3		4.6		5.1
Green Extension Time (g _e), s		2.2		2.2		1.4		1.4
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.00		0.00		0.00		0.00

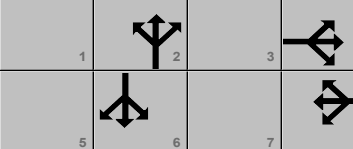
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	277			254			153			176		
Adjusted Saturation Flow Rate (s), veh/h/ln	1633			1549			1448			1561		
Queue Service Time (g _s), s	0.4			0.0			0.0			0.0		
Cycle Queue Clearance Time (g _c), s	6.7			6.3			2.6			3.1		
Green Ratio (g/C)	0.25			0.25			0.45			0.45		
Capacity (c), veh/h	492			480			759			791		
Volume-to-Capacity Ratio (X)	0.563			0.530			0.202			0.222		
Back of Queue (Q), ft/ln (95 th percentile)	95			86			24.9			29.5		
Back of Queue (Q), veh/ln (95 th percentile)	3.4			3.1			0.9			1.0		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d ₁), s/veh	15.0			14.8			7.3			7.4		
Incremental Delay (d ₂), s/veh	1.2			1.1			0.2			0.2		
Initial Queue Delay (d ₃), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	16.2			15.9			7.4			7.6		
Level of Service (LOS)	B			B			A			A		
Approach Delay, s/veh / LOS	16.2	B		15.9	B		7.4	A		7.6	A	
Intersection Delay, s/veh / LOS	12.8						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.67	B	1.67	B	1.65	B	1.65	B
Bicycle LOS Score / LOS	0.94	A	0.91	A	0.74	A	0.78	A

HCS Signalized Intersection Intermediate Values

General Information				Intersection Information		
Agency	SINGH + Associates			Duration, h	0.250	
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other	
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96	
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line	Analysis Period	1 > 7:00	
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2022 Baseline.xus			
Project Description	US 42 Safety Study					

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	23	225	18	47	189	8	37	83	27	3	142	24

Signal Information															
Cycle, s	44.1	Reference Phase	2	Green	20.0	10.9	0.0	0.0	0.0	0.0					
Offset, s	0	Reference Point	End	Yellow	5.6	5.6	0.0	0.0	0.0	0.0					
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	0.0	0.0	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On												

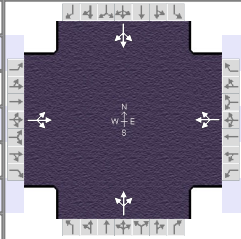
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.891	1.000	1.000	0.883	1.000	1.000	0.860	1.000	1.000	0.844	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.975	0.965		0.927	0.923		0.913	0.887		0.998	0.973	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.965		0.000	0.923		0.000	0.887		0.000	0.973
Left-Turn Pedestrian Adjustment Factor (f_{LPb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Prot. CAV Adj. Factor ($f_{CAV,prot}$)												
Left-Turn Perm. CAV Adj. Factor ($f_{CAV,perm}$)	1.00			1.00			1.00			1.00		
Movement Saturation Flow Rate (s), veh/h	141	1381	110	298	1200	51	364	818	266	28	1312	222
Proportion of Vehicles Arriving on Green (P)	0.25	0.25	0.25	0.25	0.25	0.25	0.45	0.45	0.45	0.45	0.45	0.45
Incremental Delay Factor (k)		0.13			0.13			0.13			0.13	

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.6		6.6		6.6		6.6
Green Ratio (g/C)		0.25		0.25		0.45		0.45
Permitted Saturation Flow Rate (s_p), veh/h/ln		1195		1144		1231		1298
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1610		1488		1437		1591
Permitted Effective Green Time (g_p), s		10.9		10.9		20.0		20.0
Permitted Service Time (g_u), s		4.6		4.2		17.0		17.4
Permitted Queue Service Time (g_{ps}), s		0.4		0.0		0.0		0.0
Time to First Blockage (g_t), s		5.3		3.8		5.6		15.9
Queue Service Time Before Blockage (g_{ts}), s		5.3		3.8		1.9		2.4
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	0.972	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.101	0.000	0.101	0.000	0.076	0.000	0.076
Pedestrian M_{corner} / M_{cw}	0.00		0.00		0.00		0.00	
Bicycle c_b / d_b	493.60	12.50	493.60	12.50	907.49	6.58	907.49	6.58
Bicycle F_w / F_v	-3.64	0.46	-3.64	0.42	-3.64	0.25	-3.64	0.29

HCS Signalized Intersection Results Graphical Summary

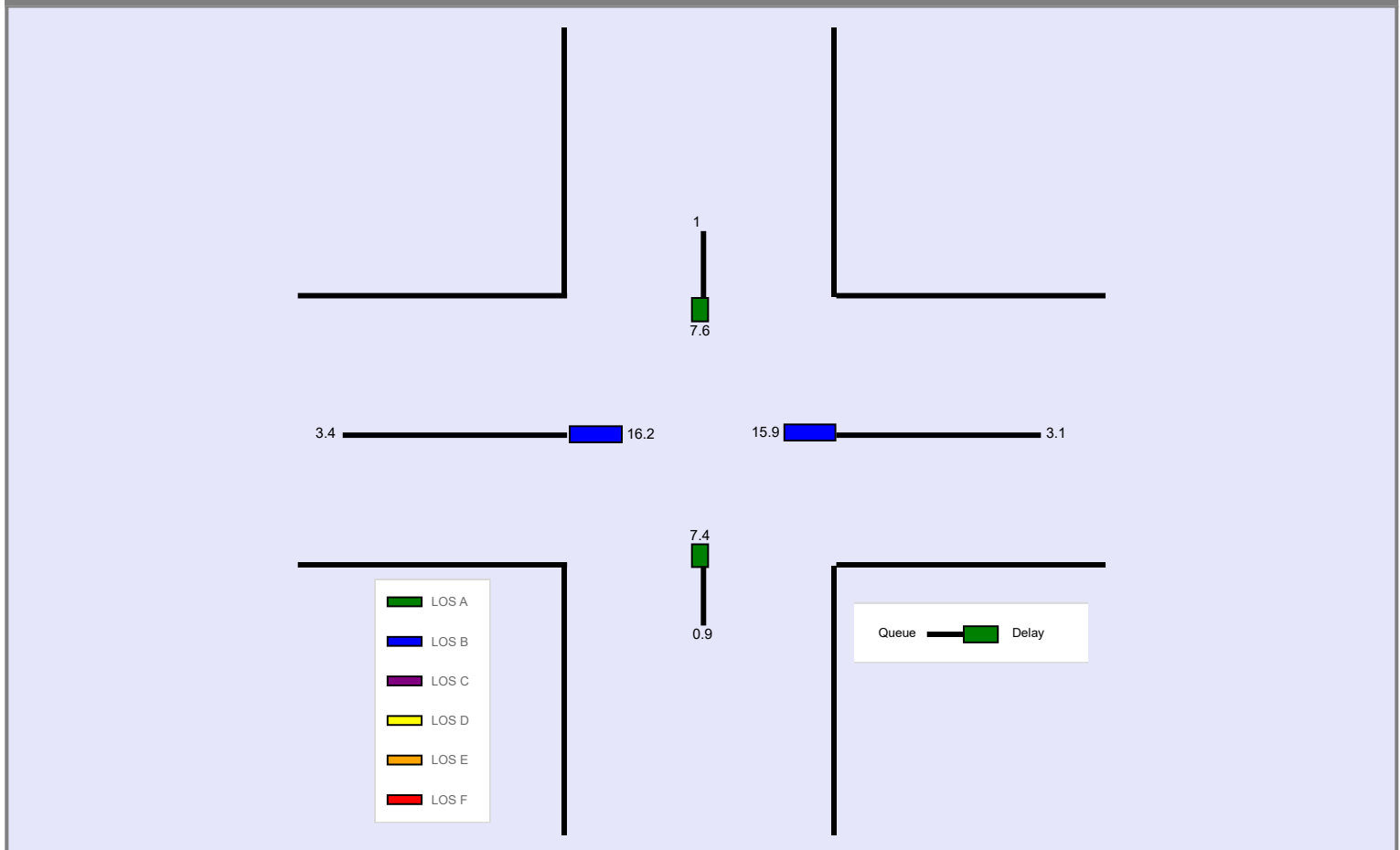
General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2022 Baseline.xus				
Project Description	US 42 Safety Study						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	23	225	18	47	189	8	37	83	27	3	142	24

Signal Information																
Cycle, s	44.1	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	20.0	10.9	0.0	0.0	0.0	0.0			1	2	3	4
				Yellow	5.6	5.6	0.0	0.0	0.0	0.0			5	6	7	8
				Red	1.0	1.0	0.0	0.0	0.0	0.0						

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Back of Queue (Q), ft/ln (95 th percentile)		95			86			24.9			29.5	
Back of Queue (Q), veh/ln (95 th percentile)		3.4			3.1			0.9			1.0	
Queue Storage Ratio (RQ) (95 th percentile)		0.00			0.00			0.00			0.00	
Control Delay (d), s/veh		16.2			15.9			7.4			7.6	
Level of Service (LOS)		B			B			A			A	
Approach Delay, s/veh / LOS	16.2		B	15.9		B	7.4		A	7.6		A
Intersection Delay, s/veh / LOS	12.8						B					



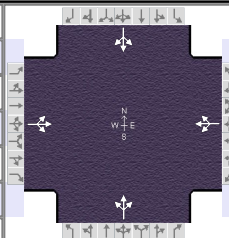
--- Messages ---

No errors or warnings exist.

--- Comments ---

HCS Signalized Intersection Input Data

General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2022 Baseline.xus				
Project Description	US 42 Safety Study						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (<i>v</i>), veh/h	33	222	19	34	249	10	44	237	65	6	87	16

Signal Information													
Cycle, s	45.3	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	12.1	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

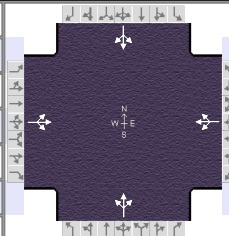
Traffic Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (<i>v</i>), veh/h	33	222	19	34	249	10	44	237	65	6	87	16
Initial Queue (<i>Q_b</i>), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (<i>s₀</i>), veh/h	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (<i>N_m</i>), man/h		None			None			None			None	
Heavy Vehicles (<i>P_{HV}</i>), %		14			15			18			20	
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (<i>N_b</i>), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (<i>AT</i>)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (<i>I</i>)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (<i>W</i>), ft		12.0			12.0			12.0			12.0	
Turn Bay Length, ft		0			0			0			0	
Grade (<i>P_g</i>), %		0			0			0			0	
Speed Limit, mi/h	55	55	55	55	55	55	55	55	55	55	55	55

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (<i>G_{max}</i>) or Phase Split, s		30.0		30.0		60.0		60.0
Yellow Change Interval (<i>Y</i>), s		5.6		5.6		5.6		5.6
Red Clearance Interval (<i>R_c</i>), s		1.0		1.0		1.0		1.0
Minimum Green (<i>G_{min}</i>), s		10		10		20		20
Start-Up Lost Time (<i>l_t</i>), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (<i>e</i>), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (<i>P_T</i>), s		3.5		3.5		3.5		3.5
Recall Mode		Off		Off		Min		Min
Dual Entry		Yes		Yes		Yes		Yes
Walk (<i>Walk</i>), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (<i>PC</i>), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0
Walkway / Crosswalk Width / Length, ft	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0
Street Width / Island / Curb, ft	0.0	0	No	0.0	0	No	0.0	0	No	0.0	0	No
Width Outside / Bike Lane / Shoulder, ft	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0
Pedestrian Signal / Occupied Parking	No		0.50	No		0.50	No		0.50	No		0.50

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2022 Baseline.xus				
Project Description	US 42 Safety Study						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	33	222	19	34	249	10	44	237	65	6	87	16

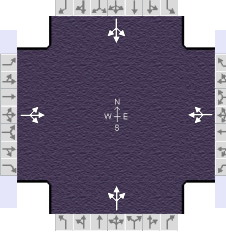
Signal Information													
Cycle, s	45.3	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	12.1	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		18.7		18.7		26.6		26.6
Change Period, (Y+R _c), s		6.6		6.6		6.6		6.6
Max Allow Headway (MAH), s		4.4		4.4		4.4		4.4
Queue Clearance Time (g _s), s		9.0		9.6		9.5		4.0
Green Extension Time (g _e), s		2.5		2.5		2.2		2.2
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.01		0.01		0.00		0.00

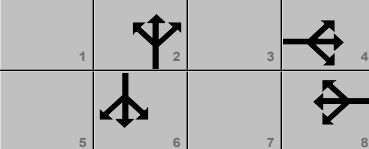
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	285			305			360			114		
Adjusted Saturation Flow Rate (s), veh/h/ln	1604			1602			1533			1547		
Queue Service Time (g _s), s	0.0			0.7			0.0			0.0		
Cycle Queue Clearance Time (g _c), s	7.0			7.6			7.5			2.0		
Green Ratio (g/C)	0.27			0.27			0.44			0.44		
Capacity (c), veh/h	518			517			766			766		
Volume-to-Capacity Ratio (X)	0.551			0.590			0.470			0.148		
Back of Queue (Q), ft/ln (95 th percentile)	97.6			107.7			78.6			20.4		
Back of Queue (Q), veh/ln (95 th percentile)	3.5			3.8			2.7			0.7		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d ₁), s/veh	14.7			14.9			9.2			7.6		
Incremental Delay (d ₂), s/veh	1.1			1.3			0.5			0.1		
Initial Queue Delay (d ₃), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	15.8			16.2			9.7			7.7		
Level of Service (LOS)	B			B			A			A		
Approach Delay, s/veh / LOS	15.8	B		16.2	B		9.7	A		7.7	A	
Intersection Delay, s/veh / LOS	13.0						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.67	B	1.67	B	1.65	B	1.65	B
Bicycle LOS Score / LOS	0.96	A	0.99	A	1.08	A	0.67	A

HCS Signalized Intersection Intermediate Values

General Information				Intersection Information		
Agency	SINGH + Associates			Duration, h	0.250	
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other	
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96	
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line	Analysis Period	1 > 7:00	
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2022 Baseline.xus			
Project Description	US 42 Safety Study					

Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	33	222	19	34	249	10	44	237	65	6	87	16

Signal Information															
Cycle, s	45.3	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	12.1	0.0	0.0	0.0	0.0					
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0					
				Red	1.0	1.0	0.0	0.0	0.0	0.0					

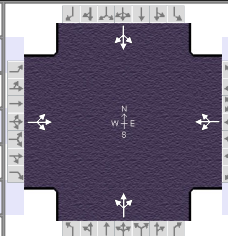
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.891	1.000	1.000	0.883	1.000	1.000	0.860	1.000	1.000	0.844	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.957	0.948		0.960	0.955		0.970	0.939		0.990	0.964	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.948		0.000	0.955		0.000	0.939		0.000	0.964
Left-Turn Pedestrian Adjustment Factor (f_{LPb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Prot. CAV Adj. Factor ($f_{CAV,prot}$)												
Left-Turn Perm. CAV Adj. Factor ($f_{CAV,perm}$)	1.00			1.00			1.00			1.00		
Movement Saturation Flow Rate (s), veh/h	193	1300	111	186	1361	55	195	1050	288	85	1234	227
Proportion of Vehicles Arriving on Green (P)	0.27	0.27	0.27	0.27	0.27	0.27	0.44	0.44	0.44	0.44	0.44	0.44
Incremental Delay Factor (k)		0.13			0.13			0.13			0.13	

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.6		6.6		6.6		6.6
Green Ratio (g/C)		0.27		0.27		0.44		0.44
Permitted Saturation Flow Rate (s_p), veh/h/ln		1127		1147		1307		1082
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1563		1559		1544		1540
Permitted Effective Green Time (g_p), s		12.1		12.1		20.0		20.0
Permitted Service Time (g_u), s		4.5		5.2		18.0		12.5
Permitted Queue Service Time (g_{ps}), s		0.0		0.7		0.0		0.0
Time to First Blockage (g_t), s		5.3		5.2		8.9		14.8
Queue Service Time Before Blockage (g_{ts}), s		5.3		5.2		5.3		1.6
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	0.972	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.100	0.000	0.100	0.000	0.078	0.000	0.078
Pedestrian M_{corner} / M_{cw}	0.00		0.00		0.00		0.00	
Bicycle c_b / d_b	535.07	12.16	535.07	12.16	882.51	7.08	882.51	7.08
Bicycle F_w / F_v	-3.64	0.47	-3.64	0.50	-3.64	0.59	-3.64	0.19

HCS Signalized Intersection Results Graphical Summary

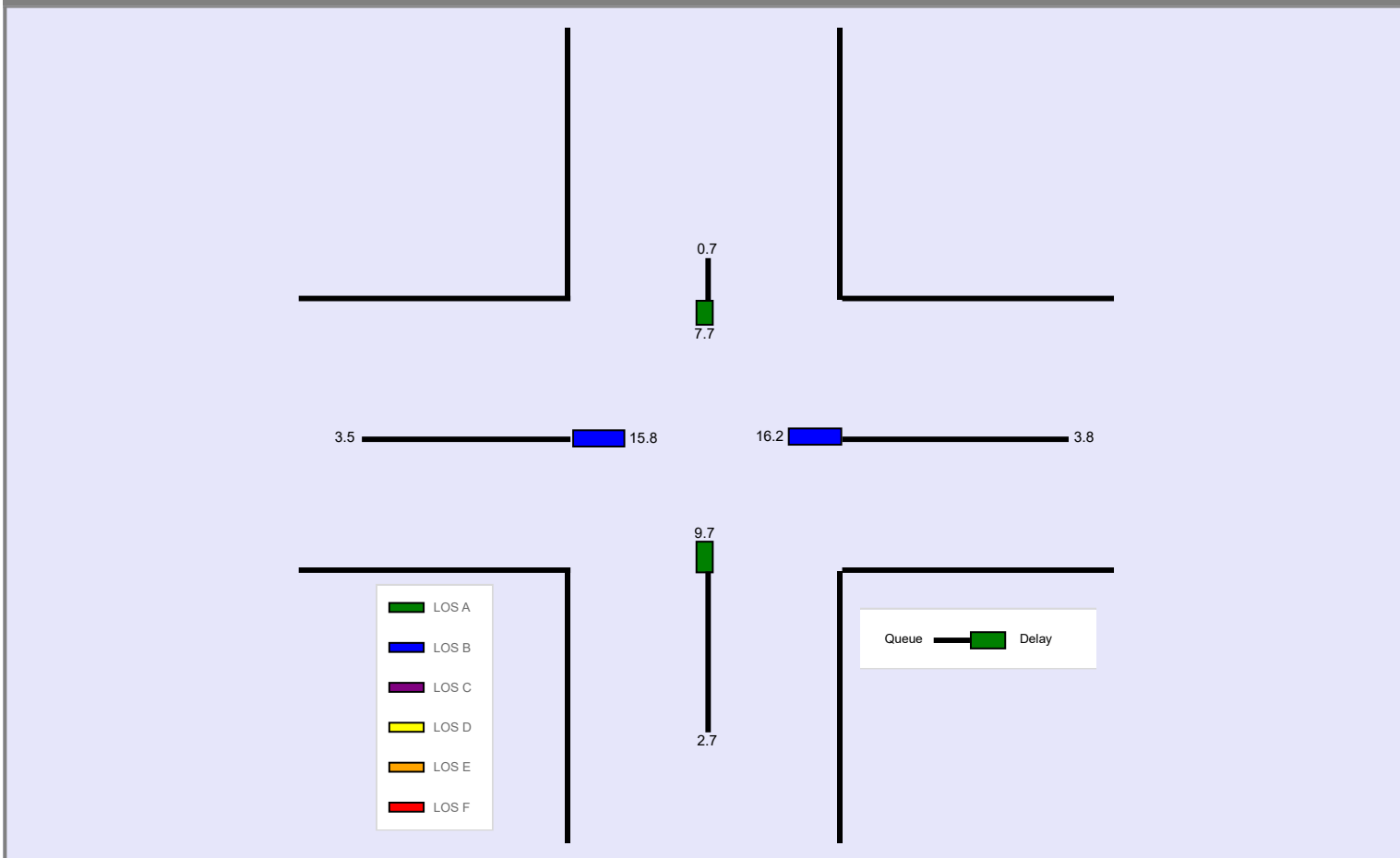
General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2022 Base Line	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2022 Baseline.xus				
Project Description	US 42 Safety Study						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	33	222	19	34	249	10	44	237	65	6	87	16

Signal Information															
Cycle, s	45.3	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	12.1	0.0	0.0	0.0	0.0	1		2	3	4
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	5		6	7	8
				Red	1.0	1.0	0.0	0.0	0.0	0.0					

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Back of Queue (Q), ft/ln (95 th percentile)		97.6			107.7			78.6			20.4	
Back of Queue (Q), veh/ln (95 th percentile)		3.5			3.8			2.7			0.7	
Queue Storage Ratio (RQ) (95 th percentile)		0.00			0.00			0.00			0.00	
Control Delay (d), s/veh		15.8			16.2			9.7			7.7	
Level of Service (LOS)		B			B			A			A	
Approach Delay, s/veh / LOS	15.8		B	16.2		B	9.7		A	7.7		A
Intersection Delay, s/veh / LOS	13.0						B					



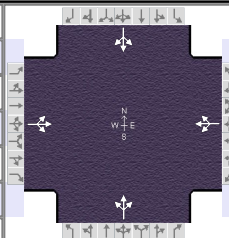
--- Messages ---

No errors or warnings exist.

--- Comments ---

HCS Signalized Intersection Input Data

General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2043 No-Build	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 No-Build.xus				
Project Description	US 42 Safety Study						



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	300	30	60	240	20	70	150	50	10	240	40

Signal Information													
Cycle, s	48.1	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	14.9	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

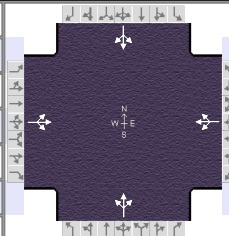
Traffic Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	30	300	30	60	240	20	70	150	50	10	240	40
Initial Queue (Q _b), veh/h	0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s ₀), veh/h	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N _m), man/h		None			None			None			None	
Heavy Vehicles (P _{HV}), %		14			15			18			20	
Ped / Bike / RTOR, /h	0	0	0	0	0	0	0	0	0	0	0	0
Buses (N _b), buses/h	0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (AT)	3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (I)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (W), ft		12.0			12.0			12.0			12.0	
Turn Bay Length, ft		0			0			0			0	
Grade (Pg), %		0			0			0			0	
Speed Limit, mi/h	55	55	55	55	55	55	55	55	55	55	55	55

Phase Information	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Maximum Green (G _{max}) or Phase Split, s		30.0		30.0		60.0		60.0
Yellow Change Interval (Y), s		5.6		5.6		5.6		5.6
Red Clearance Interval (R _c), s		1.0		1.0		1.0		1.0
Minimum Green (G _{min}), s		10		10		20		20
Start-Up Lost Time (lt), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Extension of Effective Green (e), s	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Passage (PT), s		3.5		3.5		3.5		3.5
Recall Mode		Off		Off		Min		Min
Dual Entry		Yes		Yes		Yes		Yes
Walk (Walk), s		0.0		0.0		0.0		0.0
Pedestrian Clearance Time (PC), s		0.0		0.0		0.0		0.0

Multimodal Information	EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0
Walkway / Crosswalk Width / Length, ft	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0
Street Width / Island / Curb, ft	0.0	0	No	0.0	0	No	0.0	0	No	0.0	0	No
Width Outside / Bike Lane / Shoulder, ft	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0
Pedestrian Signal / Occupied Parking	No	0.50		No	0.50		No	0.50		No	0.50	

HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 No-Build	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 No-Build.xus		
Project Description	US 42 Safety Study				



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	300	30	60	240	20	70	150	50	10	240	40

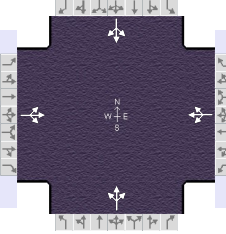
Signal Information												
Cycle, s	48.1	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	14.9	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0		
				Red	1.0	1.0	0.0	0.0	0.0	0.0		

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		21.5		21.5		26.6		26.6
Change Period, ($Y+R_c$), s		6.6		6.6		6.6		6.6
Max Allow Headway (MAH), s		4.5		4.5		4.5		4.5
Queue Clearance Time (g_s), s		11.8		11.0		8.2		8.7
Green Extension Time (g_e), s		3.1		3.1		2.8		2.8
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.04		0.03		0.00		0.00

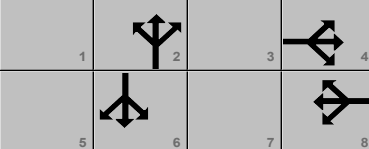
Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Assigned Movement	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	375			333			281			302		
Adjusted Saturation Flow Rate (s), veh/h/ln	1624			1519			1407			1555		
Queue Service Time (g_s), s	0.8			0.0			0.0			0.0		
Cycle Queue Clearance Time (g_c), s	9.8			9.0			6.2			6.7		
Green Ratio (g/C)	0.31			0.31			0.42			0.42		
Capacity (c), veh/h	583			559			680			725		
Volume-to-Capacity Ratio (X)	0.643			0.597			0.414			0.417		
Back of Queue (Q), ft/ln (95 th percentile)	137.8			119.3			71.1			78.4		
Back of Queue (Q), veh/ln (95 th percentile)	5.0			4.3			2.5			2.7		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d_1), s/veh	14.8			14.4			10.0			10.2		
Incremental Delay (d_2), s/veh	1.4			1.2			0.5			0.5		
Initial Queue Delay (d_3), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	16.2			15.7			10.5			10.6		
Level of Service (LOS)	B			B			B			B		
Approach Delay, s/veh / LOS	16.2	B		15.7	B		10.5	B		10.6	B	
Intersection Delay, s/veh / LOS	13.5						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.67	B	1.67	B	1.66	B	1.66	B
Bicycle LOS Score / LOS	1.11	A	1.04	A	0.95	A	0.99	A

HCS Signalized Intersection Intermediate Values

General Information				Intersection Information		
Agency	SINGH + Associates			Duration, h	0.250	
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other	
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96	
Urban Street	MAD US 42 14.00	Analysis Year	2043 No-Build	Analysis Period	1 > 7:00	
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 No-Build.xus			
Project Description	US 42 Safety Study					

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	300	30	60	240	20	70	150	50	10	240	40

Signal Information																	
Cycle, s	48.1	Reference Phase	2	Green	20.0	14.9	0.0	0.0	0.0	0.0							
Offset, s	0	Reference Point	End	Yellow	5.6	5.6	0.0	0.0	0.0	0.0							
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	0.0	0.0	0.0	0.0							
Force Mode	Fixed	Simult. Gap N/S	On														

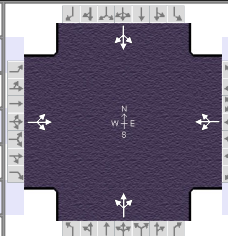
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.891	1.000	1.000	0.883	1.000	1.000	0.860	1.000	1.000	0.844	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.972	0.959		0.912	0.906		0.885	0.861		0.994	0.970	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.959		0.000	0.906		0.000	0.861		0.000	0.970
Left-Turn Pedestrian Adjustment Factor (f_{LPb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{RPb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Prot. CAV Adj. Factor ($f_{CAV,prot}$)												
Left-Turn Perm. CAV Adj. Factor ($f_{CAV,perm}$)	1.00			1.00			1.00			1.00		
Movement Saturation Flow Rate (s), veh/h	135	1353	135	285	1140	95	365	782	261	54	1287	214
Proportion of Vehicles Arriving on Green (P)	0.31	0.31	0.31	0.31	0.31	0.31	0.42	0.42	0.42	0.42	0.42	0.42
Incremental Delay Factor (k)		0.13			0.13			0.13			0.13	

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.6		6.6		6.6		6.6
Green Ratio (g/C)		0.31		0.31		0.42		0.42
Permitted Saturation Flow Rate (s_p), veh/h/ln		1126		1053		1105		1192
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1601		1458		1376		1571
Permitted Effective Green Time (g_p), s		14.9		14.9		20.0		20.0
Permitted Service Time (g_u), s		5.9		5.1		13.3		13.8
Permitted Queue Service Time (g_{ps}), s		0.8		0.0		0.0		0.0
Time to First Blockage (g_t), s		7.0		4.9		5.4		13.6
Queue Service Time Before Blockage (g_{ts}), s		7.0		4.9		4.4		5.3
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	0.972	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.098	0.000	0.098	0.000	0.084	0.000	0.084
Pedestrian M_{corner} / M_{cw}	0.00		0.00		0.00		0.00	
Bicycle c_b / d_b	618.35	11.47	618.35	11.47	832.34	8.19	832.34	8.19
Bicycle F_w / F_v	-3.64	0.62	-3.64	0.55	-3.64	0.46	-3.64	0.50

HCS Signalized Intersection Results Graphical Summary

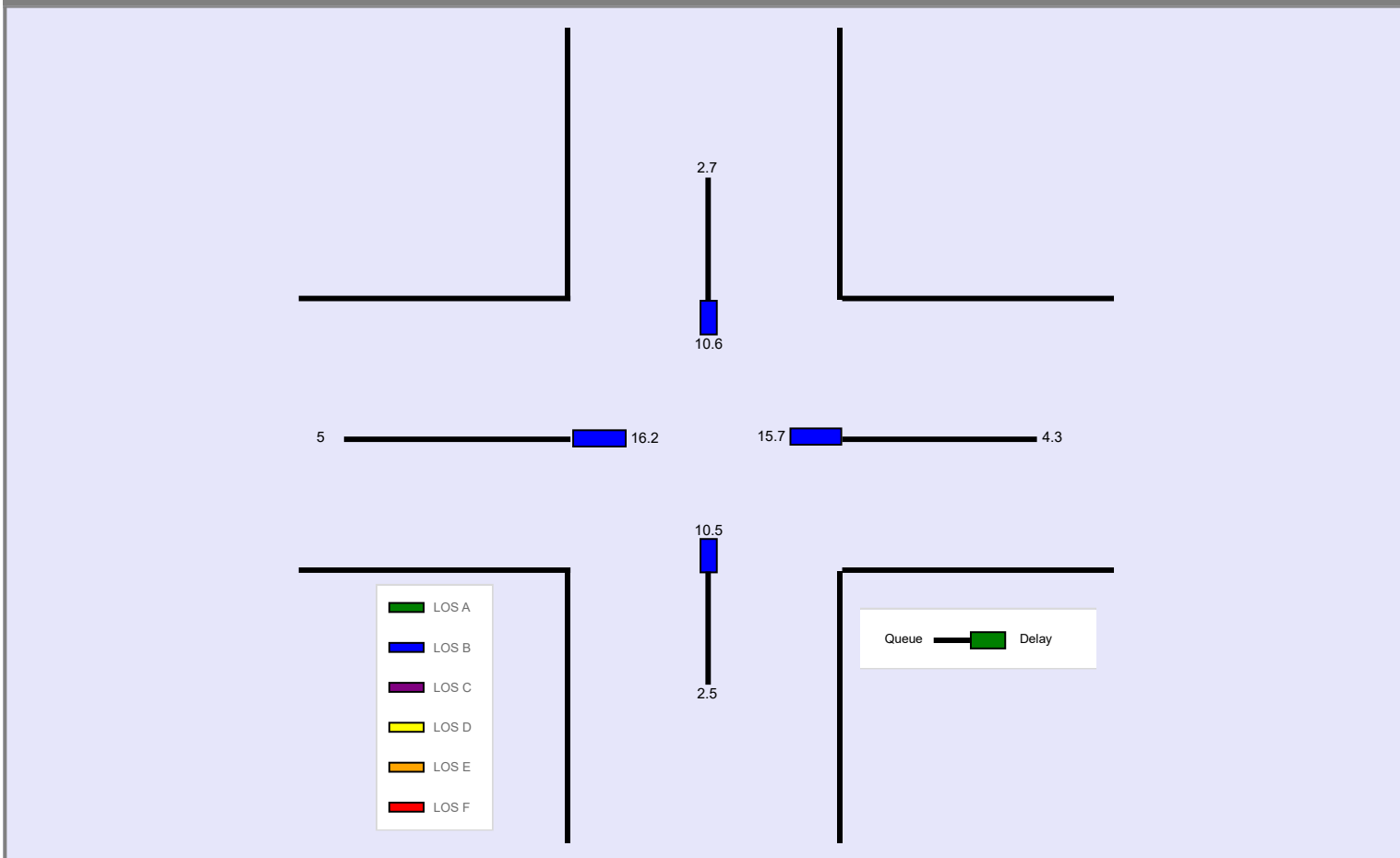
General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 No-Build	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 No-Build.xus		
Project Description	US 42 Safety Study				



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	300	30	60	240	20	70	150	50	10	240	40

Signal Information													
Cycle, s	48.1	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	20.0	14.9	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Back of Queue (Q), ft/ln (95 th percentile)		137.8			119.3			71.1			78.4	
Back of Queue (Q), veh/ln (95 th percentile)		5.0			4.3			2.5			2.7	
Queue Storage Ratio (RQ) (95 th percentile)		0.00			0.00			0.00			0.00	
Control Delay (d), s/veh		16.2			15.7			10.5			10.6	
Level of Service (LOS)		B			B			B			B	
Approach Delay, s/veh / LOS	16.2		B	15.7		B	10.5		B	10.6		B
Intersection Delay, s/veh / LOS	13.5						B					



--- Messages ---

No errors or warnings exist.

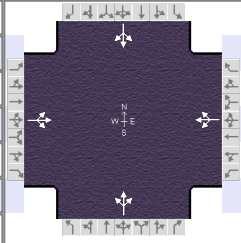
--- Comments ---

HCS Signalized Intersection Input Data

General Information					Intersection Information										
Agency	SINGH + Associates				Duration, h	0.250									
Analyst	Greg Gedemer	Analysis Date	12/19/2023		Area Type	Other									
Jurisdiction	ODOT	Time Period	PM Peak		PHF	0.96									
Urban Street	MAD US 42 14.00		Analysis Year	2043 No-Build		Analysis Period	1 > 7:00								
Intersection	US 42 at SR 29		File Name	US 42-SR 29 PM Peak - 2043 No-Build.xus											
Project Description	US 42 Safety Study														
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				50	290	30	50	320	20	80	410	120	10	150	30
Signal Information															
Cycle, s	65.2	Reference Phase	2	Green	31.3	20.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Offset, s	0	Reference Point	End	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Force Mode	Fixed	Simult. Gap N/S	On												
Traffic Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				50	290	30	50	320	20	80	410	120	10	150	30
Initial Queue (Q _b), veh/h				0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s ₀), veh/h				1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N _m), man/h				None			None			None			None		
Heavy Vehicles (P _{HV}), %				14			15			18			20		
Ped / Bike / RTOR, /h				0	0	0	0	0	0	0	0	0	0	0	0
Buses (N _b), buses/h				0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (AT)				3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (I)				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (W), ft				12.0			12.0			12.0			12.0		
Turn Bay Length, ft				0			0			0			0		
Grade (P _g), %				0			0			0			0		
Speed Limit, mi/h				55	55	55	55	55	55	55	55	55	55	55	55
Phase Information				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Maximum Green (G _{max}) or Phase Split, s					30.0		30.0		60.0		60.0				
Yellow Change Interval (Y), s					5.6		5.6		5.6		5.6				
Red Clearance Interval (R _c), s					1.0		1.0		1.0		1.0				
Minimum Green (G _{min}), s					10		10		20		20				
Start-Up Lost Time (l _t), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Extension of Effective Green (e), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Passage (P _T), s					3.5		3.5		3.5		3.5				
Recall Mode					Off		Off		Min		Min				
Dual Entry					Yes		Yes		Yes		Yes				
Walk (Walk), s					0.0		0.0		0.0		0.0				
Pedestrian Clearance Time (P _C), s					0.0		0.0		0.0		0.0				
Multimodal Information				EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius				0.0	No	25.0	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0
Walkway / Crosswalk Width / Length, ft				9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0
Street Width / Island / Curb, ft				0.0	0	No	0.0	0	No	0.0	0	No	0.0	0	No
Width Outside / Bike Lane / Shoulder, ft				12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0
Pedestrian Signal / Occupied Parking				No	0.50	No	0.50	No	0.50	No	0.50	No	0.50		

HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 No-Build	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2043 No-Build.xus		
Project Description	US 42 Safety Study				



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	50	290	30	50	320	20	80	410	120	10	150	30

Signal Information															
Cycle, s	65.2	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	31.3	20.7	0.0	0.0	0.0	0.0	1		2	3	4
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	5		6	7	8
				Red	1.0	1.0	0.0	0.0	0.0	0.0					

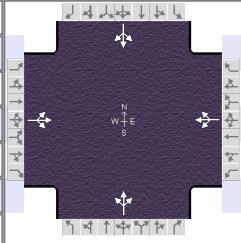
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		8.0		8.0		8.0		8.0
Phase Duration, s		27.3		27.3		37.9		37.9
Change Period, (Y+R _c), s		6.6		6.6		6.6		6.6
Max Allow Headway (MAH), s		4.5		4.5		4.5		4.5
Queue Clearance Time (g _s), s		16.6		17.6		26.8		6.9
Green Extension Time (g _e), s		3.1		3.0		4.4		4.5
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.15		0.18		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	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	385			406			635			198		
Adjusted Saturation Flow Rate (s), veh/h/ln	1542			1557			1500			1534		
Queue Service Time (g _s), s	0.0			0.9			16.5			0.0		
Cycle Queue Clearance Time (g _c), s	14.6			15.6			24.8			4.9		
Green Ratio (g/C)	0.32			0.32			0.48			0.48		
Capacity (c), veh/h	552			557			783			795		
Volume-to-Capacity Ratio (X)	0.698			0.730			0.811			0.249		
Back of Queue (Q), ft/ln (95 th percentile)	223.5			241.1			300.6			66.3		
Back of Queue (Q), veh/ln (95 th percentile)	8.0			8.6			10.5			2.3		
Queue Storage Ratio (RQ) (95 th percentile)	0.00			0.00			0.00			0.00		
Uniform Delay (d ₁), s/veh	20.0			20.4			15.1			10.1		
Incremental Delay (d ₂), s/veh	2.0			2.6			2.5			0.2		
Initial Queue Delay (d ₃), s/veh	0.0			0.0			0.0			0.0		
Control Delay (d), s/veh	22.0			22.9			17.6			10.3		
Level of Service (LOS)	C			C			B			B		
Approach Delay, s/veh / LOS	22.0	C		22.9	C		17.6	B		10.3	B	
Intersection Delay, s/veh / LOS	19.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.68	B	1.68	B	1.66	B	1.66	B
Bicycle LOS Score / LOS	1.12	A	1.16	A	1.54	B	0.81	A

HCS Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 No-Build	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2043 No-Build.xus		
Project Description	US 42 Safety Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	50	290	30	50	320	20	80	410	120	10	150	30

Signal Information												
Cycle, s	65.2	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On	Green	31.3	20.7	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0		
				Red	1.0	1.0	0.0	0.0	0.0	0.0		

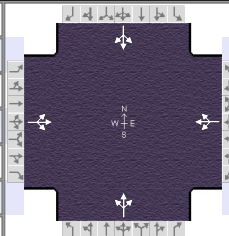
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.891	1.000	1.000	0.883	1.000	1.000	0.860	1.000	1.000	0.844	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.919	0.911		0.933	0.928		0.949	0.918		0.980	0.956	
Right-Turn Adjustment Factor (f_{RT})		0.000	0.911		0.000	0.928		0.000	0.918		0.000	0.956
Left-Turn Pedestrian Adjustment Factor (f_{LPb})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{Rpb})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Prot. CAV Adj. Factor ($f_{CAV,prot}$)												
Left-Turn Perm. CAV Adj. Factor ($f_{CAV,perm}$)	1.00			1.00			1.00			1.00		
Movement Saturation Flow Rate (s), veh/h	208	1209	125	200	1277	80	197	1008	295	81	1211	242
Proportion of Vehicles Arriving on Green (P)	0.32	0.32	0.32	0.32	0.32	0.32	0.48	0.48	0.48	0.48	0.48	0.48
Incremental Delay Factor (k)		0.13			0.15			0.13			0.13	

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.6		6.6		6.6		6.6
Green Ratio (g/C)		0.32		0.32		0.48		0.48
Permitted Saturation Flow Rate (s_p), veh/h/ln		1043		1063		1215		869
Shared Saturation Flow Rate (s_{sh}), veh/h/ln		1462		1495		1521		1509
Permitted Effective Green Time (g_p), s		20.8		20.8		31.4		31.4
Permitted Service Time (g_u), s		5.2		6.1		26.7		6.7
Permitted Queue Service Time (g_{ps}), s		0.0		0.9		16.5		0.0
Time to First Blockage (g_t), s		7.1		7.1		8.3		20.6
Queue Service Time Before Blockage (g_{ts}), s		7.1		7.1		8.3		3.8
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	0.972	0.000	0.972	0.000	0.972	0.000	0.972	0.000
Pedestrian F_s / F_{delay}	0.000	0.109	0.000	0.109	0.000	0.087	0.000	0.087
Pedestrian M_{corner} / M_{cw}	0.00		0.00		0.00		0.00	
Bicycle c_b / d_b	634.74	15.20	634.74	15.20	960.48	8.81	960.48	8.81
Bicycle F_w / F_v	-3.64	0.64	-3.64	0.67	-3.64	1.05	-3.64	0.33

HCS Signalized Intersection Results Graphical Summary

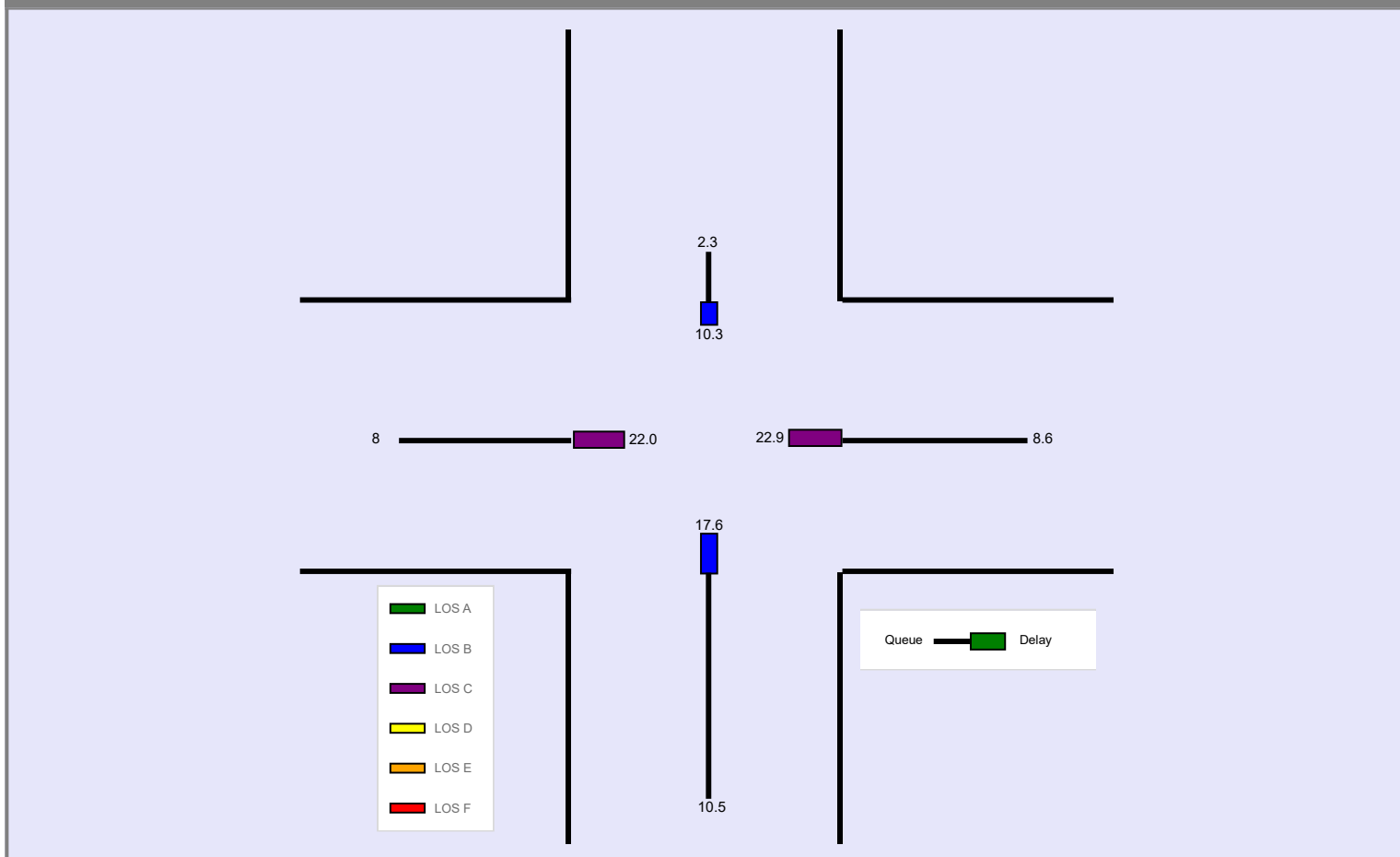
General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 No-Build	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2043 No-Build.xus		
Project Description	US 42 Safety Study				



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	50	290	30	50	320	20	80	410	120	10	150	30

Signal Information															
Cycle, s	65.2	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	31.3	20.7	0.0	0.0	0.0	0.0	1		2	3	4
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	5		6	7	8
				Red	1.0	1.0	0.0	0.0	0.0	0.0					

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Back of Queue (Q), ft/ln (95 th percentile)		223.5			241.1			300.6			66.3	
Back of Queue (Q), veh/ln (95 th percentile)		8.0			8.6			10.5			2.3	
Queue Storage Ratio (RQ) (95 th percentile)		0.00			0.00			0.00			0.00	
Control Delay (d), s/veh		22.0			22.9			17.6			10.3	
Level of Service (LOS)		C			C			B			B	
Approach Delay, s/veh / LOS	22.0		C	22.9		C	17.6		B	10.3		B
Intersection Delay, s/veh / LOS	19.1						B					



--- Messages ---

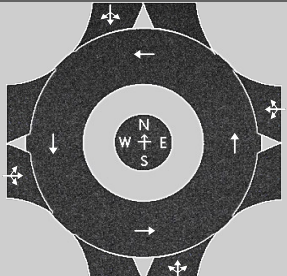
No errors or warnings exist.

--- Comments ---

HCS Roundabouts Report

General Information

Site Information

Analyst	Greg Gedemer		Intersection	US 42 at SR 29
Agency or Co.	SINGH + Associates		E/W Street Name	SR 29
Date Performed	2/16/2024		N/S Street Name	US 42
Analysis Year	2023		Analysis Time Period, hrs	0.25
Time Analyzed	AM Peak Hour - 2043 Build		Peak Hour Factor	0.96
Project Description	US 42 Safety Study		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	300	30	0	60	240	20	0	70	150	50	0	10	240	40
Percent Heavy Vehicles, %	3	2	15	19	3	18	15	6	3	21	10	40	3	67	18	18
Flow Rate (v _{PCE}), pc/h	0	32	359	37	0	74	287	22	0	88	172	73	0	17	295	49
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		428			383			333			361	
Entry Volume, veh/h		375			333			281			302	
Circulating Flow (v _c), pc/h	386			292			408			449		
Exiting Flow (v _{ex}), pc/h	449			424			226			406		
Capacity (c _{PCE}), pc/h		931			1025			910			873	
Capacity (c), veh/h		815			891			769			730	
v/c Ratio (x)		0.46			0.37			0.37			0.41	

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		10.4			8.3			9.2			10.4	
Lane LOS		B			A			A			B	
95% Queue, veh		2.4			1.7			1.7			2.0	
Approach Delay, s/veh LOS	10.4		B	8.3		A	9.2		A	10.4		B
Intersection Delay, s/veh LOS	9.6						A					

HCS Roundabouts Report

General Information

Site Information

Analyst	Greg Gedemer		Intersection	US 42 at SR 29
Agency or Co.	SINGH + Associates		E/W Street Name	SR 29
Date Performed	2/16/2024		N/S Street Name	US 42
Analysis Year	2023		Analysis Time Period, hrs	0.25
Time Analyzed	PM Peak Hour - 2043 Build		Peak Hour Factor	0.96
Project Description	US 42 Safety Study		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	50	290	30	0	50	320	20	0	80	410	120	0	10	150	30
Percent Heavy Vehicles, %	3	19	13	29	3	46	12	0	3	36	9	41	3	0	18	42
Flow Rate (v _{PCE}), pc/h	0	62	341	40	0	76	373	21	0	113	466	176	0	10	184	44
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	

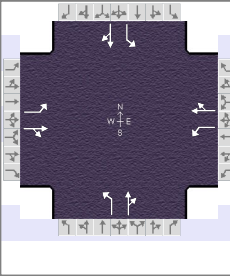
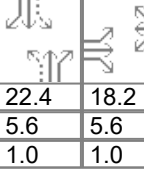
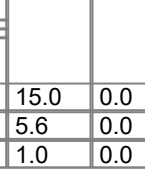
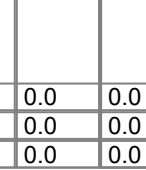
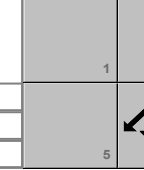
Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v _e), pc/h		443			470			755			238	
Entry Volume, veh/h		385			406			635			197	
Circulating Flow (v _c), pc/h	270			641			413			562		
Exiting Flow (v _{ex}), pc/h	527			530			549			300		
Capacity (c _{PCE}), pc/h		1048			718			906			778	
Capacity (c), veh/h		910			620			762			644	
v/c Ratio (x)		0.42			0.65			0.83			0.31	

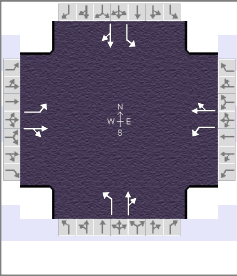
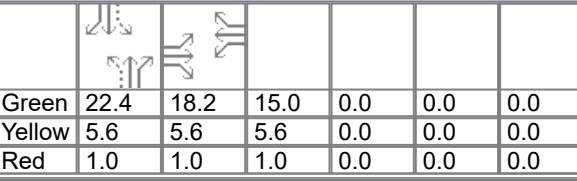
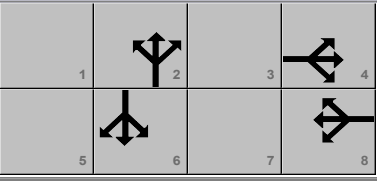
Delay and Level of Service

Approach	EB			WB			NB			SB		
	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		8.9			19.4			27.8			9.6	
Lane LOS		A			C			D			A	
95% Queue, veh		2.1			4.8			9.4			1.3	
Approach Delay, s/veh LOS	8.9	A		19.4	C		27.8	D		9.6	A	
Intersection Delay, s/veh LOS	19.0						C					

HCS Signalized Intersection Input Data

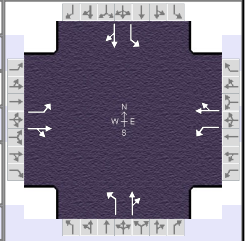
General Information					Intersection Information										
Agency	SINGH + Associates				Duration, h	0.250									
Analyst	Greg Gedemer	Analysis Date	12/19/2023		Area Type	Other									
Jurisdiction	ODOT	Time Period	AM Peak		PHF	0.96									
Urban Street	MAD US 42 14.00	Analysis Year	2043 Left Turn Lanes		Analysis Period	1 > 7:00									
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 Left Turn.xus												
Project Description	US 42 Safety Study														
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	300	30	60	240	20	70	150	50	10	240	40
Signal Information															
Cycle, s	75.5	Reference Phase	2	Green	22.4	18.2	15.0	0.0	0.0	0.0	0.0	1	2	3	4
Offset, s	0	Reference Point	End	Yellow	5.6	5.6	5.6	0.0	0.0	0.0	0.0	5	6	7	8
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On												
Traffic Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				30	300	30	60	240	20	70	150	50	10	240	40
Initial Queue (Q _b), veh/h				0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s ₀), veh/h				1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N _m), man/h				None			None			None			None		
Heavy Vehicles (P _{HV}), %				14	14		15	15		18	18		20	20	
Ped / Bike / RTOR, /h				0	0	0	0	0	0	0	0	0	0	0	0
Buses (N _b), buses/h				0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (AT)				3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (I)				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (W), ft				12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Turn Bay Length, ft				0	0		0	0		0	0		0	0	
Grade (P _g), %				0			0			0			0		
Speed Limit, mi/h				55	55	55	55	55	55	55	55	55	55	55	55
Phase Information				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Maximum Green (G _{max}) or Phase Split, s					30.0		30.0		60.0		60.0				
Yellow Change Interval (Y), s					5.6		5.6		5.6		5.6				
Red Clearance Interval (R _c), s					1.0		1.0		1.0		1.0				
Minimum Green (G _{min}), s					10		10		20		20				
Start-Up Lost Time (I _t), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Extension of Effective Green (e), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Passage (P _T), s					3.5		3.5		3.5		3.5				
Recall Mode					Off		Off		Min		Min				
Dual Entry					Yes		Yes		Yes		Yes				
Walk (Walk), s					0.0		0.0		0.0		0.0				
Pedestrian Clearance Time (P _C), s					0.0		0.0		0.0		0.0				
Multimodal Information				EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius				0.0	No	25.0	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0
Walkway / Crosswalk Width / Length, ft				9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0
Street Width / Island / Curb, ft				0.0	0	No	0.0	0	No	0.0	0	No	0.0	0	No
Width Outside / Bike Lane / Shoulder, ft				12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0
Pedestrian Signal / Occupied Parking				No	0.50	No	0.50	No	0.50	No	0.50	No	0.50		

HCS Signalized Intersection Results Summary

General Information					Intersection Information										
Agency	SINGH + Associates				Duration, h	0.250									
Analyst	Greg Gedemer	Analysis Date	12/19/2023		Area Type	Other									
Jurisdiction	ODOT	Time Period	AM Peak		PHF	0.96									
Urban Street	MAD US 42 14.00	Analysis Year	2043 Left Turn Lanes		Analysis Period	1 > 7:00									
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 Left Turn.xus												
Project Description	US 42 Safety Study														
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	300	30	60	240	20	70	150	50	10	240	40
Signal Information															
Cycle, s	75.5	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	22.4	18.2	15.0	0.0	0.0	0.0	0.0	1	2	3	4
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	5.6	0.0	0.0	0.0	0.0	5	6	7	8
				Red	1.0	1.0	1.0	0.0	0.0	0.0	0.0				
Timer Results				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Assigned Phase					4		8		2		6				
Case Number					10.0		10.0		6.0		6.0				
Phase Duration, s					24.8		21.6		29.0		29.0				
Change Period, (Y+R c), s					6.6		6.6		6.6		6.6				
Max Allow Headway (MAH), s					4.4		4.4		4.6		4.6				
Queue Clearance Time (g s), s					16.9		13.8		19.5		14.2				
Green Extension Time (g e), s					1.3		1.2		2.8		2.8				
Phase Call Probability					1.00		1.00		1.00		1.00				
Max Out Probability					0.02		0.00		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				7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h				31	344		63	271		73	208		10	292	
Adjusted Saturation Flow Rate (s), veh/h/ln				1612	1665		1598	1655		950	1563		1006	1563	
Queue Service Time (g s), s				1.1	14.9		2.5	11.8		5.4	8.2		0.6	12.2	
Cycle Queue Clearance Time (g c), s				1.1	14.9		2.5	11.8		17.5	8.2		8.7	12.2	
Green Ratio (g/C)				0.24	0.24		0.20	0.20		0.30	0.30		0.30	0.30	
Capacity (c), veh/h				389	402		318	330		226	465		287	465	
Volume-to-Capacity Ratio (X)				0.080	0.855		0.196	0.821		0.323	0.448		0.036	0.627	
Back of Queue (Q), ft/ln (95 th percentile)				19.6	276		43.5	231.2		60.5	138.3		7.4	212.2	
Back of Queue (Q), veh/ln (95 th percentile)				0.7	9.9		1.6	8.3		2.1	4.8		0.3	7.3	
Queue Storage Ratio (RQ) (95 th percentile)				0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Uniform Delay (d 1), s/veh				22.2	27.4		25.2	29.0		30.5	21.5		25.0	22.9	
Incremental Delay (d 2), s/veh				0.1	6.9		0.4	6.1		1.0	0.8		0.1	1.7	
Initial Queue Delay (d 3), s/veh				0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (d), s/veh				22.3	34.4		25.6	35.1		31.5	22.3		25.1	24.6	
Level of Service (LOS)				C	C		C	D		C	C		C	C	
Approach Delay, s/veh / LOS				33.4	C		33.3	C		24.7	C		24.6	C	
Intersection Delay, s/veh / LOS				29.4					C						
Multimodal Results				EB			WB			NB			SB		
Pedestrian LOS Score / LOS				1.93	B		1.94	B		1.91	B		1.91	B	
Bicycle LOS Score / LOS				1.11	A		1.04	A		0.95	A		0.99	A	

HCS Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 Left Turn Lanes	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 Left Turn.xus		
Project Description	US 42 Safety Study				



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	300	30	60	240	20	70	150	50	10	240	40

Signal Information												
Cycle, s	75.5	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On	Green	22.4	18.2	15.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	5.6	0.0	0.0	0.0		
				Red	1.0	1.0	1.0	0.0	0.0	0.0		

Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	0.891	0.891	1.000	0.883	0.883	1.000	0.860	0.860	1.000	0.844	0.844	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.952	0.000		0.952	0.000		0.500	0.000		0.530	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.984	0.984		0.986	0.986		0.957	0.957		0.975	0.975
Left-Turn Pedestrian Adjustment Factor (f_{LPB})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{RPB})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Prot. CAV Adj. Factor ($f_{CAV,prot}$)												
Left-Turn Perm. CAV Adj. Factor ($f_{CAV,perm}$)							1.00			1.00		
Movement Saturation Flow Rate (s), veh/h	1612	1514	151	1598	1527	127	950	1172	391	1006	1340	223
Proportion of Vehicles Arriving on Green (P)	0.24	0.24	0.24	0.20	0.20	0.20	0.30	0.30	0.30	0.30	0.30	0.30
Incremental Delay Factor (k)	0.13	0.15		0.13	0.13		0.13	0.13		0.13	0.13	

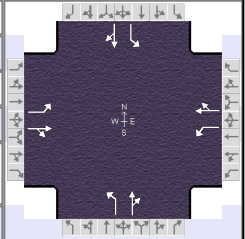
Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (tL)		4.0		6.6		6.6		6.6
Green Ratio (g/C)		0.24		0.20		0.30		0.30
Permitted Saturation Flow Rate (s _p), veh/h/ln		1612		1598		950		1006
Shared Saturation Flow Rate (s _{sh}), veh/h/ln								
Permitted Effective Green Time (g _p), s		0.0		0.0		22.5		22.5
Permitted Service Time (g _u), s		0.0		0.0		10.4		14.4
Permitted Queue Service Time (g _{ps}), s						5.4		0.6
Time to First Blockage (g _t), s		0.0		0.0		0.0		0.0
Queue Service Time Before Blockage (g _{fs}), s								
Protected Right Saturation Flow (s _R), veh/h/ln								
Protected Right Effective Green Time (g _R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	1.198	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.128	0.000	0.146	0.000	0.117	0.000	0.117
Pedestrian M_{corner} / M_{cw}	0.00		0.00		0.00		0.00	
Bicycle c_b / d_b	398.64	24.20	-201.32	45.73	594.09	18.65	594.09	18.65

Bicycle F_w / F_v	-3.64	0.62	-3.64	0.55	-3.64	0.46	-3.64	0.50
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HCS Signalized Intersection Results Graphical Summary

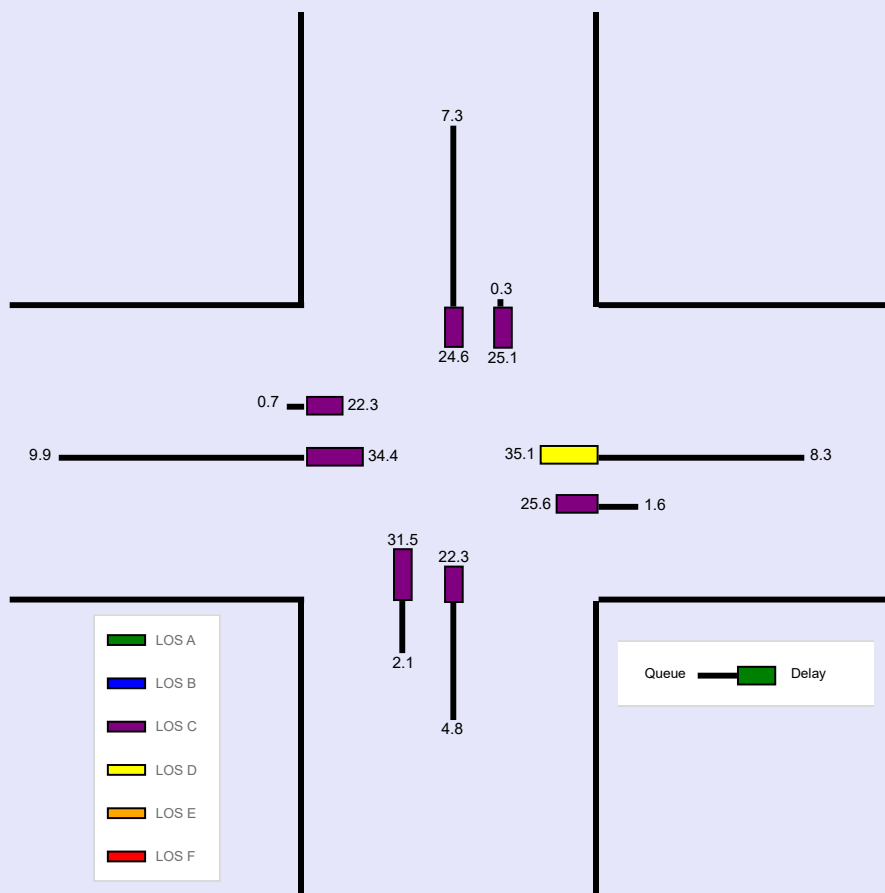
General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	AM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 Left Turn Lanes	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 AM Peak - 2043 Left Turn.xus		
Project Description	US 42 Safety Study				



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	300	30	60	240	20	70	150	50	10	240	40

Signal Information				Signal Phases									
Cycle, s	75.5	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		22.4	18.2	15.0	0.0	0.0	0.0				
		Yellow		5.6	5.6	5.6	0.0	0.0	0.0				
		Red		1.0	1.0	1.0	0.0	0.0	0.0				

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Back of Queue (Q), ft/ln (95 th percentile)	19.6	276		43.5	231.2		60.5	138.3		7.4	212.2	
Back of Queue (Q), veh/ln (95 th percentile)	0.7	9.9		1.6	8.3		2.1	4.8		0.3	7.3	
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Control Delay (d), s/veh	22.3	34.4		25.6	35.1		31.5	22.3		25.1	24.6	
Level of Service (LOS)	C	C		C	D		C	C		C	C	
Approach Delay, s/veh / LOS	33.4	C		33.3	C		24.7	C		24.6	C	
Intersection Delay, s/veh / LOS	29.4						C					



--- Messages ---

No errors or warnings exist.

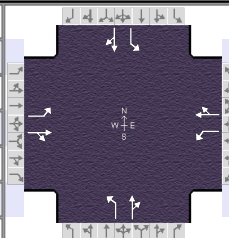
--- Comments ---

HCS Signalized Intersection Input Data

General Information					Intersection Information										
Agency	SINGH + Associates				Duration, h	0.250									
Analyst	Greg Gedemer	Analysis Date	12/19/2023		Area Type	Other									
Jurisdiction	ODOT	Time Period	PM Peak		PHF	0.96									
Urban Street	MAD US 42 14.00		Analysis Year	2043 Left Turn		Analysis Period	1 > 7:00								
Intersection	US 42 at SR 29		File Name	US 42-SR 29 PM Peak - 2043 Left Turn.xus											
Project Description	US 42 Safety Study														
Demand Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				50	290	30	50	320	20	80	410	120	10	150	30
Signal Information															
Cycle, s	54.5	Reference Phase	2	Green	23.6	17.7	0.0	0.0	0.0	0.0	0.0	1	2	3	4
Offset, s	0	Reference Point	End	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	0.0	5	6	7	8
Uncoordinated	Yes	Simult. Gap E/W	On	Red	1.0	1.0	0.0	0.0	0.0	0.0	0.0				
Force Mode	Fixed	Simult. Gap N/S	On												
Traffic Information				EB			WB			NB			SB		
Approach Movement				L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h				50	290	30	50	320	20	80	410	120	10	150	30
Initial Queue (Q _b), veh/h				0	0	0	0	0	0	0	0	0	0	0	0
Base Saturation Flow Rate (s ₀), veh/h				1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Parking (N _m), man/h				None			None			None			None		
Heavy Vehicles (P _{HV}), %				0	14		0	15		0	18		0	20	
Ped / Bike / RTOR, /h				0	0	0	0	0	0	0	0	0	0	0	0
Buses (N _b), buses/h				0	0	0	0	0	0	0	0	0	0	0	0
Arrival Type (AT)				3	3	3	3	3	3	3	3	3	3	3	3
Upstream Filtering (I)				1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Lane Width (W), ft				12.0	12.0		12.0	12.0		12.0	12.0		12.0	12.0	
Turn Bay Length, ft				0	0		0	0		0	0		0	0	
Grade (P _g), %					0			0			0			0	
Speed Limit, mi/h				55	55	55	55	55	55	55	55	55	55	55	55
Phase Information				EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT				
Maximum Green (G _{max}) or Phase Split, s					30.0		30.0		60.0		60.0				
Yellow Change Interval (Y), s					5.6		5.6		5.6		5.6				
Red Clearance Interval (R _c), s					1.0		1.0		1.0		1.0				
Minimum Green (G _{min}), s					10		10		20		20				
Start-Up Lost Time (l _t), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Extension of Effective Green (e), s				2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0				
Passage (P _T), s					3.5		3.5		3.5		3.5				
Recall Mode					Off		Off		Min		Min				
Dual Entry					Yes		Yes		Yes		Yes				
Walk (Walk), s					0.0		0.0		0.0		0.0				
Pedestrian Clearance Time (P _C), s					0.0		0.0		0.0		0.0				
Multimodal Information				EB			WB			NB			SB		
85th % Speed / Rest in Walk / Corner Radius				0.0	No	25.0	0.0	No	25.0	0.0	No	25.0	0.0	No	25.0
Walkway / Crosswalk Width / Length, ft				9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0	9.0	12.0	0.0
Street Width / Island / Curb, ft				0.0	0	No	0.0	0	No	0.0	0	No	0.0	0	No
Width Outside / Bike Lane / Shoulder, ft				12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0	12.0	5.0	2.0
Pedestrian Signal / Occupied Parking				No	0.50	No	0.50	No	0.50	No	0.50	No	0.50		

HCS Signalized Intersection Results Summary

General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2043 Left Turn	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2043 Left Turn.xus				
Project Description	US 42 Safety Study						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	50	290	30	50	320	20	80	410	120	10	150	30

Signal Information															
Cycle, s	54.5	Reference Phase	2												
Offset, s	0	Reference Point	End												
Uncoordinated	Yes	Simult. Gap E/W	On	Green	23.6	17.7	0.0	0.0	0.0	0.0	1		2	3	4
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0	5		6	7	8
				Red	1.0	1.0	0.0	0.0	0.0	0.0					

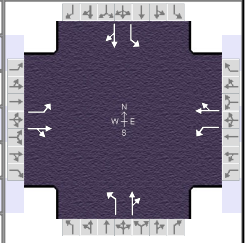
Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		4		8		2		6
Case Number		6.0		6.0		6.0		6.0
Phase Duration, s		24.3		24.3		30.2		30.2
Change Period, (Y+R _c), s		6.6		6.6		6.6		6.6
Max Allow Headway (MAH), s		4.5		4.5		4.5		4.5
Queue Clearance Time (g _s), s		14.5		13.6		18.8		19.3
Green Extension Time (g _e), s		3.2		3.3		4.3		4.3
Phase Call Probability		1.00		1.00		1.00		1.00
Max Out Probability		0.09		0.07		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	7	4	14	3	8	18	5	2	12	1	6	16
Adjusted Flow Rate (v), veh/h	52	333		52	354		83	552		10	188	
Adjusted Saturation Flow Rate (s), veh/h/ln	1043	1664		1063	1660		1215	1569		869	1557	
Queue Service Time (g _s), s	2.5	9.2		2.4	10.0		2.6	16.8		0.6	4.2	
Cycle Queue Clearance Time (g _c), s	12.5	9.2		11.6	10.0		6.7	16.8		17.3	4.2	
Green Ratio (g/C)	0.33	0.33		0.33	0.33		0.43	0.43		0.43	0.43	
Capacity (c), veh/h	280	542		298	540		566	679		242	673	
Volume-to-Capacity Ratio (X)	0.186	0.615		0.175	0.655		0.147	0.814		0.043	0.279	
Back of Queue (Q), ft/ln (95 th percentile)	23.5	139.6		22.8	152.7		24	226.6		4.6	53.5	
Back of Queue (Q), veh/ln (95 th percentile)	0.9	5.0		0.9	5.5		1.0	7.9		0.2	1.8	
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Uniform Delay (d ₁), s/veh	21.1	15.5		20.4	15.8		12.1	13.5		21.1	10.0	
Incremental Delay (d ₂), s/veh	0.4	1.4		0.3	1.6		0.1	2.9		0.1	0.3	
Initial Queue Delay (d ₃), s/veh	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	
Control Delay (d), s/veh	21.5	16.9		20.7	17.4		12.2	16.5		21.2	10.3	
Level of Service (LOS)	C	B		C	B		B	B		C	B	
Approach Delay, s/veh / LOS	17.5	B		17.8	B		15.9	B		10.8	B	
Intersection Delay, s/veh / LOS	16.1						B					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.90	B	1.90	B	1.88	B	1.88	B
Bicycle LOS Score / LOS	1.12	A	1.16	A	1.54	B	0.81	A

HCS Signalized Intersection Intermediate Values

General Information				Intersection Information	
Agency	SINGH + Associates			Duration, h	0.250
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96
Urban Street	MAD US 42 14.00	Analysis Year	2043 Left Turn	Analysis Period	1 > 7:00
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2043 Left Turn.xus		
Project Description	US 42 Safety Study				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (v), veh/h	50	290	30	50	320	20	80	410	120	10	150	30

Signal Information												
Cycle, s	54.5	Reference Phase	2									
Offset, s	0	Reference Point	End									
Uncoordinated	Yes	Simult. Gap E/W	On	Green	23.6	17.7	0.0	0.0	0.0	0.0		
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0		
				Red	1.0	1.0	0.0	0.0	0.0	0.0		

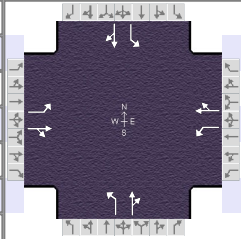
Saturation Flow / Delay	L	T	R	L	T	R	L	T	R	L	T	R
Lane Width Adjustment Factor (f_w)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Heavy Vehicles and Grade Factor (f_{HVg})	1.000	0.891	1.000	1.000	0.883	1.000	1.000	0.860	1.000	1.000	0.844	1.000
Parking Activity Adjustment Factor (f_p)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Bus Blockage Adjustment Factor (f_{bb})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Area Type Adjustment Factor (f_a)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Lane Utilization Adjustment Factor (f_{LU})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Adjustment Factor (f_{LT})	0.549	0.000		0.560	0.000		0.639	0.000		0.458	0.000	
Right-Turn Adjustment Factor (f_{RT})		0.983	0.983		0.990	0.990		0.961	0.961		0.971	0.971
Left-Turn Pedestrian Adjustment Factor (f_{LPB})	1.000			1.000			1.000			1.000		
Right-Turn Ped-Bike Adjustment Factor (f_{RPB})			1.000			1.000			1.000			1.000
Work Zone Adjustment Factor (f_{wz})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
DDI Factor (f_{DDI})	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
Left-Turn Prot. CAV Adj. Factor ($f_{CAV,prot}$)												
Left-Turn Perm. CAV Adj. Factor ($f_{CAV,perm}$)	1.00			1.00			1.00			1.00		
Movement Saturation Flow Rate (s), veh/h	1043	1508	156	1063	1562	98	1215	1214	355	869	1297	259
Proportion of Vehicles Arriving on Green (P)	0.33	0.33	0.33	0.33	0.33	0.33	0.43	0.43	0.43	0.43	0.43	0.43
Incremental Delay Factor (k)	0.13	0.13		0.13	0.13		0.13	0.13		0.13	0.13	

Signal Timing / Movement Groups	EBL	EBT/R	WBL	WBT/R	NBL	NBT/R	SBL	SBT/R
Lost Time (t_L)		6.6		6.6		6.6		6.6
Green Ratio (g/C)		0.33		0.33		0.43		0.43
Permitted Saturation Flow Rate (s_p), veh/h/ln		1043		1063		1215		869
Shared Saturation Flow Rate (s_{sh}), veh/h/ln								
Permitted Effective Green Time (g_p), s		17.7		17.7		23.6		23.6
Permitted Service Time (g_u), s		7.7		8.5		19.5		6.9
Permitted Queue Service Time (g_{ps}), s		2.5		2.4		2.6		0.6
Time to First Blockage (g_t), s		0.0		0.0		0.0		0.0
Queue Service Time Before Blockage (g_{fs}), s								
Protected Right Saturation Flow (s_R), veh/h/ln								
Protected Right Effective Green Time (g_R), s								

Multimodal	EB		WB		NB		SB	
Pedestrian F_w / F_v	1.198	0.000	1.198	0.000	1.198	0.000	1.198	0.000
Pedestrian F_s / F_{delay}	0.000	0.101	0.000	0.101	0.000	0.087	0.000	0.087
Pedestrian M_{corner} / M_{cw}	0.00		0.00		0.00		0.00	
Bicycle c_b / d_b	650.50	12.40	650.50	12.40	864.86	8.77	864.86	8.77
Bicycle F_w / F_v	-3.64	0.64	-3.64	0.67	-3.64	1.05	-3.64	0.33

HCS Signalized Intersection Results Graphical Summary

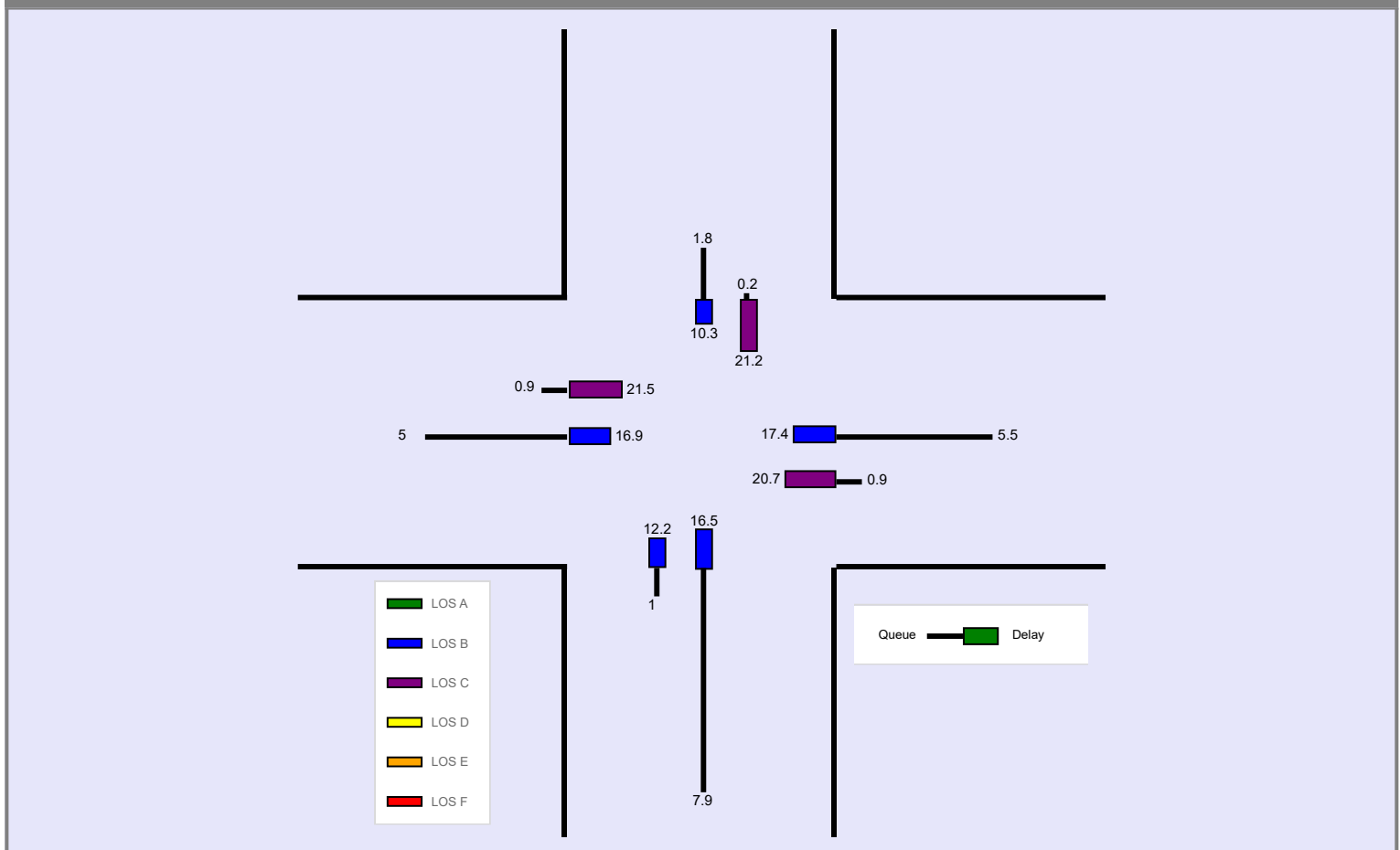
General Information				Intersection Information			
Agency	SINGH + Associates			Duration, h	0.250		
Analyst	Greg Gedemer	Analysis Date	12/19/2023	Area Type	Other		
Jurisdiction	ODOT	Time Period	PM Peak	PHF	0.96		
Urban Street	MAD US 42 14.00	Analysis Year	2043 Left Turn	Analysis Period	1 > 7:00		
Intersection	US 42 at SR 29	File Name	US 42-SR 29 PM Peak - 2043 Left Turn.xus				
Project Description	US 42 Safety Study						



Demand Information	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Demand (v), veh/h	50	290	30	50	320	20	80	410	120	10	150	30

Signal Information													
Cycle, s	54.5	Reference Phase	2										
Offset, s	0	Reference Point	End										
Uncoordinated	Yes	Simult. Gap E/W	On	Green	23.6	17.7	0.0	0.0	0.0	0.0			
Force Mode	Fixed	Simult. Gap N/S	On	Yellow	5.6	5.6	0.0	0.0	0.0	0.0			
				Red	1.0	1.0	0.0	0.0	0.0	0.0			

Movement Group Results	EB			WB			NB			SB		
	L	T	R	L	T	R	L	T	R	L	T	R
Approach Movement												
Back of Queue (Q), ft/ln (95 th percentile)	23.5	139.6		22.8	152.7		24	226.6		4.6	53.5	
Back of Queue (Q), veh/ln (95 th percentile)	0.9	5.0		0.9	5.5		1.0	7.9		0.2	1.8	
Queue Storage Ratio (RQ) (95 th percentile)	0.00	0.00		0.00	0.00		0.00	0.00		0.00	0.00	
Control Delay (d), s/veh	21.5	16.9		20.7	17.4		12.2	16.5		21.2	10.3	
Level of Service (LOS)	C	B		C	B		B	B		C	B	
Approach Delay, s/veh / LOS	17.5		B	17.8		B	15.9		B	10.8		B
Intersection Delay, s/veh / LOS	16.1						B					



--- Messages ---

No errors or warnings exist.

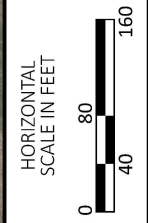
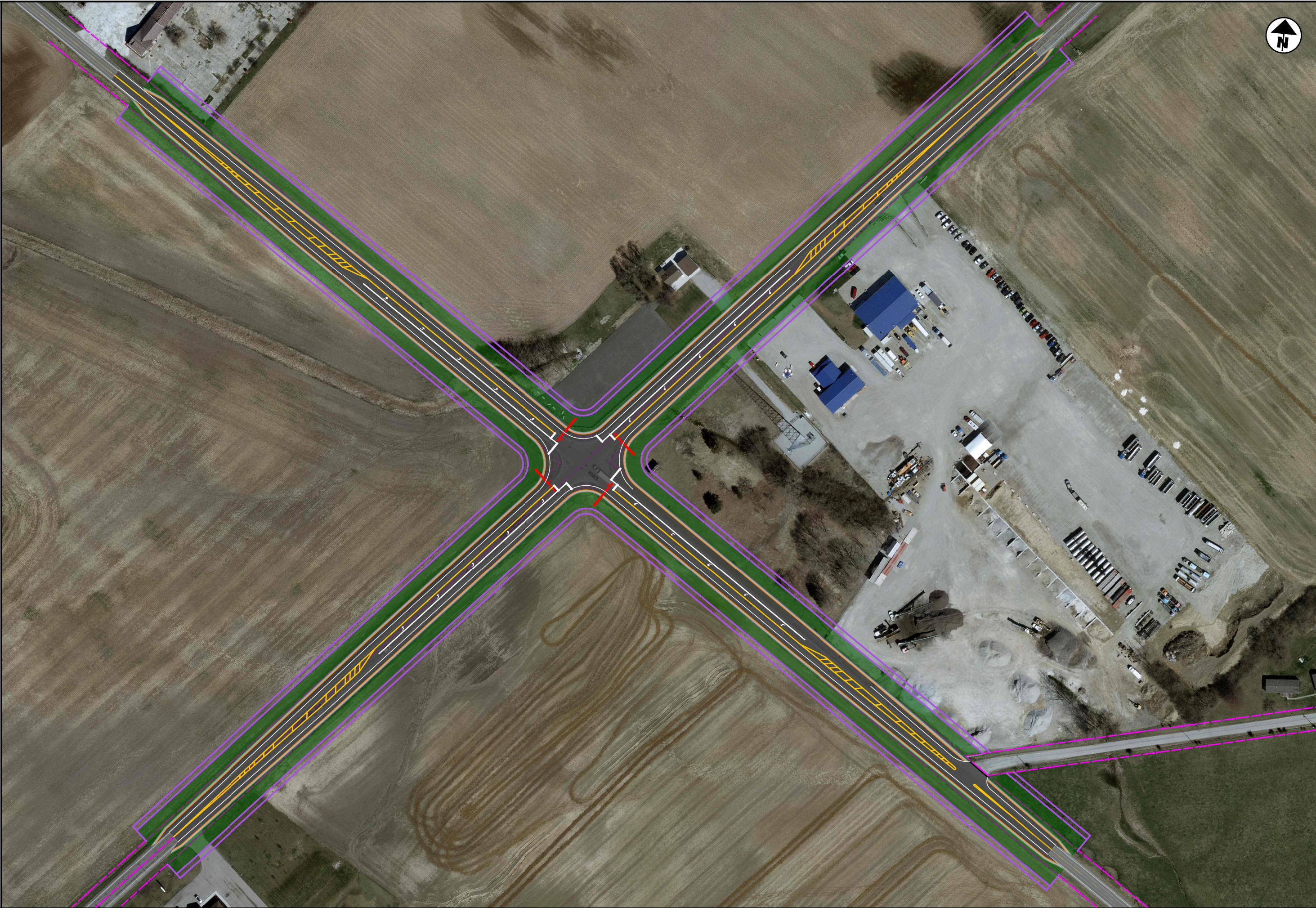
--- Comments ---

APPENDIX G

Concept Plans

Roundabout

Left-Turn Lanes Traffic Signal Alternative



PLAN VIEW
SIGNALIZED INTERSECTION LAYOUT EXHIBIT

DESIGN AGENCY
CMT
 CRAWFORD, MURPHY &
 WASHINGTON VILLAGER DR
 SAUTEER, OHIO 45689
 PH (631) 761-2100
 www.cmtinc.com

DESIGNER	GSH
REVIEWER	TJH
PROJECT ID	02-05-24
SHEET	570100
TOTAL	P.1
	1

APPENDIX H

Cost Estimates

Roundabout

Left-Turn Lanes Traffic Signal Alternative

**ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
MAD-US 42-14.00 - ROUNDABOUT ALTERNATIVE**

Project number: PID 119698

Date: March 19, 2024

Client name: ODOT District 6

(Based upon 2023 Construction Costs)

Ref. No.	Item No.	Description	Total Estimated Quantity	Unit	Estimated Unit Cost	Total Estimated Cost
ROADWAY						
1	201	CLEARING AND GRUBBING	1	LS	\$ 20,000.00	\$ 20,000.00
2	202	PAVEMENT REMOVED	3,400	SQ YD	\$ 20.00	\$ 68,000.00
3	202	FENCE REMOVED	250	FT	\$ 10.00	\$ 2,500.00
4	203	EXCAVATION	3,100	CU YD	\$ 40.00	\$ 124,000.00
5	204	EMBANKMENT	3,100	CU YD	\$ 25.00	\$ 77,500.00
6	204	SUBGRADE COMPACTION	7,500	SQ YD	\$ 3.00	\$ 22,500.00
7	204	PROOF ROLLING	3	HOUR	\$ 250.00	\$ 750.00
8	206	CEMENT STABILIZED SUBGRADE, 16 INCHES DEEP	7,500	SQ YD	\$ 4.00	\$ 30,000.00
9	206	LIME	275	TON	\$ 184.00	\$ 50,600.00
10	206	CURING COAT	7,500	SQ YD	\$ 1.20	\$ 9,000.00
11	206	TEST ROLLING	2	HOUR	\$ 250.00	\$ 500.00
12	206	MIXTURE DESIGN FOR CHEMICALLY STABILIZED SOILS	1	LS	\$ 25,000.00	\$ 25,000.00
EROSION CONTROL						
13	832	TOPSOIL, SEEDING AND MULCHING	13,700	SQ YD	\$ 8.00	\$ 109,600.00
14	832	CONSTRUCTION EROSION CONTROL	40,000	EACH	\$ 1.00	\$ 40,000.00
15	832	SWPPP	1	LS	\$ 5,000.00	\$ 5,000.00
16	832	SWPPP INSPECTIONS	1	LS	\$ 5,000.00	\$ 5,000.00
17	832	SWPPP SOFTWARE	1	LS	\$ 5,000.00	\$ 5,000.00
PAVEMENT						
18	252	FULL DEPTH PAVEMENT SAWING	4,725	FT	\$ 3.00	\$ 14,175.00
19	254	PAVEMENT PLANING, ASPHALT CONCRETE (VARIABLE DEPTH)	3,145	SQ YD	\$ 6.00	\$ 18,870.00
20	302	ASPHALT CONCRETE BASE, PG64-22, (449)	920	CU YD	\$ 250.00	\$ 230,000.00
21	304	AGGREGATE BASE 1160 CU YD \$ 85.00 \$ 98,600.00	1,160	CU YD	\$ 85.00	\$ 98,600.00
22	407	NON-TRACKING TACK COAT	790	GAL	\$ 4.00	\$ 3,160.00
23	441	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, (449)	385	CU YD	\$ 345.00	\$ 132,825.00
24	441	ASPHALT CONCRETE SURFACE COURSE, TYPE 1, PG64-22, (449)	330	CU YD	\$ 300.00	\$ 99,000.00
25	441	ASPHALT CONCRETE WEDGE COURSE, TYPE 2, (449)	82	CU YD	\$ 330.00	\$ 27,060.00
26	452	NON-REINFORCED CONCRETE PAVEMENT (ISLANDS)	810	SQ YD	\$ 80.00	\$ 64,800.00
27	452	NON-REINFORCED CONCRETE PAVEMENT (DRIVEWAYS)	110	SQ YD	\$ 110.00	\$ 12,100.00
28	452	NON-REINFORCED CONCRETE PAVEMENT (TRUCK APRON)	760	SQ YD	\$ 140.00	\$ 106,400.00
29	609	CURB TYPE 6	1,585	FT	\$ 35.00	\$ 55,475.00
30	609	COMBINATION CURB AND GUTTER, TYPE 2	1,400	FT	\$ 45.00	\$ 63,000.00
31	609	COMBINATION CURB AND GUTTER, TYPE 9	300	FT	\$ 40.00	\$ 12,000.00
DRAINAGE						
32	605	4" BASE PIPE UNDERDRAINS	1,695	FT	\$ 12.00	\$ 20,340.00
33	611	DRAINAGE (STORM SEWER AND STRUCTURES)	1	LS	\$ 120,000.00	\$ 120,000.00
34	611	30" CONDUIT, TYPE B	25	FT	\$ 265.00	\$ 6,625.00
35	611	STORM WATER BMP	1	LS	\$ 25,000.00	\$ 25,000.00

**ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
MAD-US 42-14.00 - ROUNDABOUT ALTERNATIVE**

Project number: PID 119698

Date: March 19, 2024

Client name: ODOT District 6

(Based upon 2023 Construction Costs)

TRAFFIC CONTROL, SIGNALS & LIGHTING						
36	625	LIGHTING	1	LS	\$ 120,000.00	\$ 120,000.00
37	630	GROUND MOUNTED SIGNAGE	1	LS	\$ 20,000.00	\$ 20,000.00
38	644	PAVEMENT MARKINGS	1	LS	\$ 12,000.00	\$ 12,000.00
MISCELLANEOUS						
39	614	MAINTAINING TRAFFIC	1	LS	\$ 149,000.00	\$ 149,000.00
40	619	FIELD OFFICE	8	MONTH	\$ 2,500.00	\$ 20,000.00
41	623	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LS	\$ 21,000.00	\$ 21,000.00
42	624	MOBILIZATION	1	LS	\$ 75,000.00	\$ 75,000.00
SUBTOTAL ESTIMATED CONSTRUCTION COST						\$ 2,121,380.00
SUBTOTAL ESTIMATED UTILITY RELOCATION ALLOWANCE						\$ 200,000.00
SUBTOTAL ESTIMATED RIGHT OF WAY COST						\$ 312,000.00
<i>subtotal</i>						\$ 2,633,380.00
CONSTRUCTION CONTINGENCY 30%						\$ 790,014.00
ENGINEERING, DESIGN & CONSTRUCTION ADMINISTRATION 30%						\$ 790,014.00
<i>subtotal</i>						\$ 4,213,408.00
INFLATION CONTINGENCY (CONSTRUCTION MIDPOINT ESTIMATED 7/1/2028) 24.2%						\$ 636,750.00
TOTAL ESTIMATED PROJECT COST						\$ 4,850,158.00

ASSUMPTIONS:

- (1) Partial Detour and Maintaining Traffic are the assumed MOT scheme.
- (2) Utility relocation costs are assumed to be non-reimbursable (inside existing right of way) to utility owners.
Allowance included above right of way costs for potential reimbursable utility relocations unknown at time of concept development.
- (3) Earthwork balanced site.

MAD-US-42-14.00 - ROUNDABOUT ALTERNATIVE

MADISON COUNTY, OHIO
RIGHT OF WAY ESTIMATE - updated 3/19/2024

Owner	CAD ID	Parcel ID	Address	Land Use	Land Value	Structure Value	Total	Area	(Land Value/Acre)*115%	Structure Impact	Area: Standard Highway	Area: Temporary	Acquisition Services Costs	Cost: Standard Highway	Cost: Temporary	Relocation	Sub-Total Cost	Cost to Cure	Comments
SR 29 WEST JEFF LLC	1	08-00902.005	1800 NE US 42	400-COMMERCIAL-VACANT LAND	\$1,385,470	\$0	\$1,385,470	24.670	\$ 64,590	NO	0.470	0.202	\$10,000	\$30,377	\$2,609		\$42,986		NO STRUCTURE ON PROPERTY
GREEN RICHARD L & ANITA S TRUSTEES OF THE RICHARD L & ANITA S GREEN REVOCABLE TRUST DATED JUNE 1, 2017	2	08-00429.003	US 42	400-COMMERCIAL-VACANT LAND	\$244,630	\$0	\$244,630	43.560	\$ 6,460	NO	0.453	0.190	\$10,000	\$2,928	\$300		\$13,228		NO STRUCTURE ON PROPERTY
COLBY CORNER LLC	3	08-00424.000	1870 US 42	400-COMMERCIAL-VACANT LAND	\$30,690	\$0	\$30,690	1.464	\$ 24,110	NO	0.147	0.083	\$10,000	\$3,551	\$401		\$13,952		NO STRUCTURE ON PROPERTY
COLBY HOLDINGS LLC	4	08-00228.003	1935 US 42	455-COMMERCIAL GARAGES	\$148,170	\$127,430	\$275,600	15.384	\$ 11,080	NO	0.162	0.124	\$10,000	\$1,797	\$300		\$12,097		
GREEN RICHARD L & ANITA S TRUSTEES OF THE RICHARD L & ANITA S GREEN REVOCABLE TRUST DATED JUNE 1, 2017	5	08-00228.001	1885 US 42	499-OTHER COMMERCIAL STRUCTURES	\$57,450	\$660	\$58,110	1.230	\$ 53,720	NO	0.029	0.029	\$10,000	\$1,542	\$308		\$11,850		
COLBY CORNER LLC	6	08-00937.000	1890 US 42	510-SINGLE FAMILY DWELLING	\$44,980	\$85,830	\$130,810	0.459	\$ 112,700	NO	0.030	0.030	\$10,000	\$3,370	\$674		\$14,044		
C PROPERTIES LLC	7	08-00228.002	1933 US 42	480-COMMERCIAL WAREHOUSES	\$41,140	\$167,830	\$208,970	1.465	\$ 32,300	NO	0.026	0.026	\$10,000	\$824	\$300		\$11,124		
PUTHIPREAK WATT KHMER	8	08-00469.555	3570 SR 29	111-CASH-GRAIN OR GENERAL FARM "QUALIFIED FOR CURRENT AGRICULTURAL USE VALUE"	\$610,790	\$50,520	\$661,310	52.890	\$ 13,290	NO	0.048	0.101	\$10,000	\$638	\$300		\$10,938		
	9																		
	10																		
	11																		
	12																		
	13																		
	14																		
	15																		
	16																		

\$2,563,320

141.122 \$ 20,890

Notes:

- All areas are in acres.
- Land and Structure Values estimated per county auditor records and/or Zillow estimates
- Acquisition costs estimated per ODOT Right of Way Manual
- An equal amount of additional temporary right of way is assumed for grading purposes

Sub-Totals \$45,026 \$5,192 \$0 \$130,218 \$0

Administrative Costs	[(sub-total)x0.15]x1.20	\$23,439
Jury trial Costs	[(sub-total)x0.10]x1.50	\$19,533
Incidental transfer Costs	[(sub-total)x0.90]x0.025	\$2,930
Contingency Costs	77%	\$135,613
Total Cost		\$312,000

*Acquisition Service Cost Includes the following:
(per ODOT Cost Estimating Procedures For Acquiring Rights of Way)

Titles & Detailed Appraisal	Detailed Appraisal Review	Negotiation & Relocation	Closings	Project Management	Subtotal	
\$4,900	\$2,000	\$1,100	\$400	\$550	\$10,000	No Relocation
\$4,900	\$2,000	\$6,700	\$400	\$550	\$14,550	With Relocation

**ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
MAD-US-42-14.00 - SIGNAL ALTERNATIVE**

Project number: 119698

Date: 2/15/2024

Client name: ODOT District 6

(Based upon 2022 Construction Costs)

Ref. No.	Item No.	Description	Total Estimated Quantity	Unit	Estimated Unit Cost	Total Estimated Cost
ROADWAY						
1	201	CLEARING AND GRUBBING	1	LS	\$ 20,000.00	\$ 20,000.00
2	202	PAVEMENT REMOVED	4000	SQ YD	\$ 20.00	\$ 80,000.00
3	202	FENCE REMOVED	1195	FT	\$ 10.00	\$ 11,950.00
4	203	EXCAVATION	8000	CU YD	\$ 40.00	\$ 320,000.00
5	204	EMBANKMENT	2000	CU YD	\$ 25.00	\$ 50,000.00
6	204	SUBGRADE COMPACTION	12675	SQ YD	\$ 3.00	\$ 38,025.00
7	204	PROOF ROLLING	5	HOUR	\$ 250.00	\$ 1,250.00
8	206	CEMENT STABILIZED SUBGRADE, 16 INCHES DEEP	12,700	SQ YD	\$ 4.00	\$ 50,800.00
9	206	LIME	450	TON	\$ 184.00	\$ 82,800.00
10	206	CURING COAT	12,700	SQ YD	\$ 1.20	\$ 15,240.00
11	206	TEST ROLLING	4	HOUR	\$ 250.00	\$ 1,000.00
12	206	MIXTURE DESIGN FOR CHEMICALLY STABILIZED SOILS	1	LS	\$ 25,000.00	\$ 25,000.00
EROSION CONTROL						
13	659	TOPSOIL, SEEDING AND MULCHING	38300	SQ YD	\$ 8.00	\$ 306,400.00
14	832	CONSTRUCTION EROSION CONTROL	40000	EACH	\$ 1.00	\$ 40,000.00
15	832	SWPPP	1	LS	\$ 5,000.00	\$ 5,000.00
16	832	SWPPP INSPECTIONS	1	LS	\$ 5,000.00	\$ 5,000.00
17	832	SWPPP SOFTWARE	1	LS	\$ 5,000.00	\$ 5,000.00
PAVEMENT						
18	252	FULL DEPTH PAVEMENT SAWING	12440	FT	\$ 3.00	\$ 37,320.00
19	254	PAVEMENT PLANING, ASPHALT CONCRETE (VARIABLE DEPTH)	11900	SQ YD	\$ 6.00	\$ 71,400.00
20	302	ASPHALT CONCRETE BASE, PG64-22, (449)	2420	CU YD	\$ 250.00	\$ 605,000.00
21	304	AGGREGATE BASE	2110	CU YD	\$ 85.00	\$ 179,350.00
22	407	NON-TRACKING TACK COAT	2380	GAL	\$ 4.00	\$ 9,520.00
23	441	ASPHALT CONCRETE INTERMEDIATE COURSE, TYPE 2, (449)	1185	CU YD	\$ 345.00	\$ 408,825.00
24	441	ASPHALT CONCRETE SURFACE COURSE, TYPE 1, PG64-22, (449)	1015	CU YD	\$ 300.00	\$ 304,500.00
25	441	ASPHALT CONCRETE WEDGE COURSE, TYPE 2, (449)	254	CU YD	\$ 330.00	\$ 83,820.00
26	452	8" NON-REINFORCED CONCRETE PAVEMENT (DRIVEWAYS)	220	SQ YD	\$ 110.00	\$ 24,200.00

**ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
MAD-US-42-14.00 - SIGNAL ALTERNATIVE**

Project number: 119698

Date: 2/15/2024

Client name: ODOT District 6

(Based upon 2022 Construction Costs)

Ref. No.	Item No.	Description	Total Estimated Quantity	Unit	Estimated Unit Cost	Total Estimated Cost
DRAINAGE						
27	605	4" BASE PIPE UNDERDRAINS	9000	FT	\$ 12.00	\$ 108,000.00
28	611	DRAINAGE MISCELLANEOUS	1	LS	\$ 80,000.00	\$ 80,000.00
29	611	30" CONDUIT, TYPE B	60	LF	\$ 265.00	\$ 15,900.00
30	611	STORM WATER BMP	1	LS	\$ 50,000.00	\$ 50,000.00
TRAFFIC CONTROL & LIGHTING						
31	625	LIGHTING	1	LS	\$120,000.00	\$ 120,000.00
32	630	GROUND MOUNTED SIGNAGE	1	LS	\$20,000.00	\$ 20,000.00
33	644	PAVEMENT MARKINGS	1	LS	\$12,000.00	\$ 12,000.00
TRAFFIC SIGNAL						
34	625	CONNECTION, FUSED PULL APART	4	EACH	\$ 125.00	\$ 500.00
35	625	CONNECTION, UNFUSED PULL APART	4	EACH	\$ 125.00	\$ 500.00
36	625	BRACKET ARM, 30'	4	EACH	\$ 1,500.00	\$ 6,000.00
37	625	NO. 10 AWG 600 VOLT DISTRIBUTION CABLE	1300	FT	\$ 2.00	\$ 2,600.00
38	625	NO. 10 AWG POLE AND BRACKET CABLE	450	FT	\$ 2.50	\$ 1,125.00
39	625	LUMINAIRE, CONVENTIONAL, SOLID STATE (LED)	4	EACH	\$ 650.00	\$ 2,600.00
40	625	CONDUIT, 3", 725.04	150	FT	\$ 45.00	\$ 6,750.00
41	625	CONDUIT, JACKED OR DRILLED, 725.051, 4"	400	FT	\$ 46.00	\$ 18,400.00
42	625	TRENCH	150	FT	\$ 16.00	\$ 2,400.00
43	625	PULL BOX, 725.08, 24"	4	EACH	\$ 1,500.00	\$ 6,000.00
44	625	GROUND ROD	5	EACH	\$ 325.00	\$ 1,625.00
45	625	UNDERGROUND WARNING/MARKING TAPE	150	FT	\$ 1.50	\$ 225.00
46	630	SIGN HANGER ASSEMBLY, MAST ARM	4	EACH	\$ 450.00	\$ 1,800.00
47	630	SIGN, FLAT SHEET	30	SF	\$ 31.00	\$ 930.00
48	630	SIGN, STREET NAME	4	EACH	\$ 500.00	\$ 2,000.00
49	632	VEHICULAR SIGNAL HEAD, (LED), 3-SECTION, 12" LENS, 1-WAY, POLYCARBONATE, BLACK, WITH BACKPLATES	4	EACH	\$ 1,000.00	\$ 4,000.00
50	632	VEHICULAR SIGNAL HEAD, (LED), 5-SECTION, 12" LENS, 1-WAY, POLYCARBONATE, BLACK, WITH BACKPLATES	4	EACH	\$ 1,200.00	\$ 4,800.00
51	632	COVERING OF VEHICULAR SIGNAL HEAD	8	EACH	\$ 40.00	\$ 320.00
52	632	SIGNAL CABLE, 5 CONDUCTOR, NO. 14 AWG	1000	FT	\$ 2.50	\$ 2,500.00
53	632	SIGNAL CABLE, 7 CONDUCTOR, NO. 14 AWG	1000	FT	\$ 3.00	\$ 3,000.00
54	632	SIGNAL SUPPORT FOUNDATION	4	EACH	\$ 6,000.00	\$ 24,000.00
55	632	POWER CABLE, 3 CONDUCTOR, NO. 4 AWG	200	FT	\$ 4.00	\$ 800.00
56	632	SERVICE CABLE, 2 CONDUCTOR, NO. 6 AWG	100	FT	\$ 4.50	\$ 450.00
57	632	POWER SERVICE	1	EACH	\$ 6,500.00	\$ 6,500.00
58	632	COMBINATION SIGNAL SUPPORT, TYPE TC-81.22, DESIGN 13	4	EACH	\$ 21,000.00	\$ 84,000.00
59	632	REMOVAL OF TRAFFIC SIGNAL INSTALLATION	1	EACH	\$ 4,500.00	\$ 4,500.00

**ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST
MAD-US-42-14.00 - SIGNAL ALTERNATIVE**

Project number: 119698

Date: 2/15/2024

Client name: ODOT District 6

(Based upon 2022 Construction Costs)

Ref. No.	Item No.	Description	Total Estimated Quantity	Unit	Estimated Unit Cost	Total Estimated Cost
60	633	CABINET, TYPE TS-2	1	EACH	\$ 10,000.00	\$ 10,000.00
61	633	CABINET FOUNDATION	1	EACH	\$ 2,800.00	\$ 2,800.00
62	633	CONTROLLER WORK PAD	1	EACH	\$ 700.00	\$ 700.00
63	633	UNINTERRUPTIBLE POWER SUPPLY (UPS), 1000 WATT	1	EACH	\$ 8,500.00	\$ 8,500.00
64	809	ADVANCE RADAR DETECTION	4	EACH	\$ 8,000.00	\$ 32,000.00
65	809	STOP LINE RADAR DETECTION	4	EACH	\$ 8,000.00	\$ 32,000.00
66	809	ATC V6.24 CONTROLLER	1	EACH	\$ 9,000.00	\$ 9,000.00
MISCELLANEOUS						
67	614	MAINTAINING TRAFFIC	1	LS	\$ 278,000.00	\$ 278,000.00
68	619	FIELD OFFICE	8	MONTH	\$ 2,500.00	\$ 20,000.00
69	623	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LS	\$ 36,000.00	\$ 36,000.00
70	624	MOBILIZATION	1	LS	\$ 128,000.00	\$ 128,000.00
71	SPEC	UTILITY RELOCATION ALLOWANCE	1	LS	\$ 200,000.00	\$ 200,000.00
SUBTOTAL ESTIMATED CONSTRUCTION COST						\$ 4,132,625.00
SUBTOTAL ESTIMATED RIGHT OF WAY COST						\$ 510,000.00
						\$ 4,642,625.00
CONSTRUCTION CONTINGENCY					30%	\$ 1,392,788.00
ENGINEERING DESIGN, CONSTRUCTION INSPECTION & CONSTRUCTION ADMINISTRATION					30%	\$ 1,392,788.00
						\$ 7,428,201.00
INFLATION CONTINGENCY (CONSTRUCTION MIDPOINT ESTIMATED 7/1/2028)					22.0%	\$ 1,021,378.00
						\$ 8,449,579.00
TOTAL ESTIMATED PROJECT COST						\$ 8,449,579.00

ASSUMPTIONS:

- 1 Partial detour and maintaining traffic are assumed MOT scheme
- 2 Utility relocations are assumed to be non-reimbursable (inside existing right of way). Allowance included for potentially reimbursable utility relocations unknown at time of conceptual plan development.
- 3 Earthwork balanced site

APPENDIX I

Benefit-Cost (ECAT) Analysis

ECAT Summary & Safety Benefit-Cost Analysis

Roundabout

ECAT Summary & Safety Benefit-Cost Analysis

Left-Turn Lanes Traffic Signal Alternative



Project Information

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		
Perform Benefit Cost Analysis?	Yes		

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

Yes

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

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

Proposed

Project Elements Description Table

Project Element ID (Must be Unique)	Site Type	Intersection Control Type	Location Information					
			NLFID	Begin Logpoint/ Intersection Midpoint	End Logpoint (Leave blank for Intersection)	Length (mi) OR Intersection Radius Buffer (mi)	Cross Route NLFID(s)	Common Name
US42, 14.00	Roundabout	Unsignalized	SMADUS00042**C	14		0.05	SMADSR0002	US 42 & SR 29

Traffic Volume Growth Rate Calculation For Benefit Cost Analysis

	Year	AADT	
Present ADT (PADT)	2023	10,220	veh / day
Future ADT (FADT)	2043	15,600	veh / day
Annual Linear Growth Rate		0.0263	

Project Elements Description Table						
Project Element ID (Must be Unique)	Site Type	Intersection Control Type	Location Information			
			NLFID	Begin Logpoint/ Intersection Midpoint	End Logpoint (Leave blank for Intersection)	Length (mi) OR Intersection Radius Buffer (mi)

Select Other Non-Site Characteristic Based Countermeasures For Entire Project						
CMF Nbr	Countermeasure	CMF KA Value	CMF B Value	CMF C Value	CMF O Value	CMF Valid for the Following Site Types
CMF 1						
CMF 2						
CMF 3						
CMF 4						
CMF 5						
CMF 6						
CMF 7						
CMF 8						
CMF 9						
CMF 10						

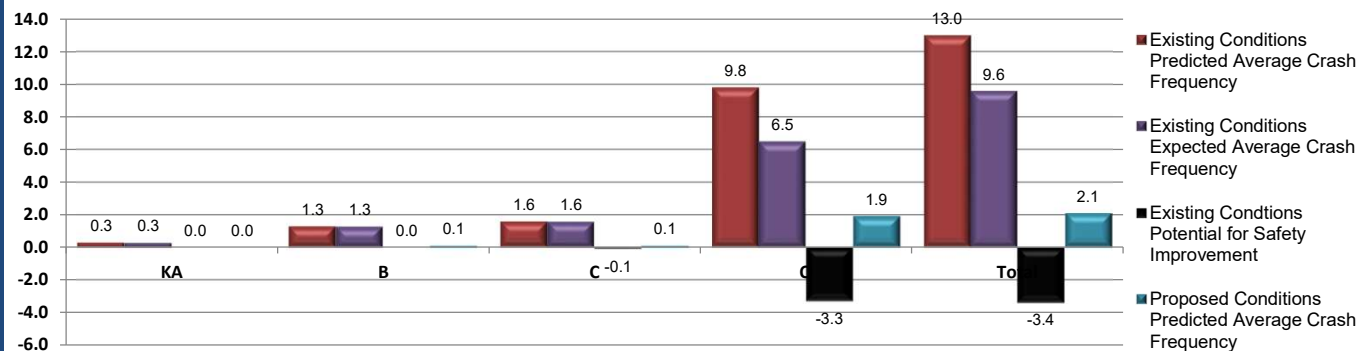


Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
N_{predicted} - Existing Conditions	0.3051	1.2973	1.6402	9.8009	13.0435
N_{expected} - Existing Conditions	0.2941	1.2509	1.5814	6.4801	9.6065
N_{potential for improvement} - Existing Conditions	-0.0110	-0.0464	-0.0588	-3.3208	-3.4370
N_{expected} - Proposed Conditions	0.0100	0.0848	0.1051	1.9358	2.1357



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghanse1@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US42_14.00	US 42 & SR 29	0.3051	1.2973	1.6402	9.8009	13.0435



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghanse1@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US42_14.00	US 42 & SR 29	0.2941	1.2509	1.5814	6.4801	9.6065



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghanse1@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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	
US42_14.00	US 42 & SR 29	-0.011	-0.0464	-0.0588	-3.3208	-3.437



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghanse1@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US42_14.00	US 42 & SR 29	0.01	0.0848	0.1051	1.9358	2.1357



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

Summary by Crash Type

Crash Type	Existing		PSI	Proposed
	Predicted Crash Frequency	Expected Crash Frequency		Predicted Crash Frequency
Unknown	0.0151	0.0112	-0.0039	0.0608
Head On	0.0955	0.0768	-0.0187	0.0020
Rear End	5.7457	4.2008	-1.5449	0.3291
Backing	0.6213	0.4156	-0.2057	0.0196
Sideswipe - Meeting	0.2639	0.1941	-0.0698	0.0000
Sideswipe - Passing	0.8988	0.6207	-0.2781	0.6696
Angle	2.6388	1.9965	-0.6423	0.6033
Parked Vehicle	0.4864	0.3348	-0.1516	0.0000
Pedestrian	0.1211	0.1114	-0.0097	0.0020
Animal	0.0000	0.0000	0.0000	0.0216
Train	0.0000	0.0000	0.0000	0.0000
Pedalcycles	0.0802	0.0706	-0.0096	0.0020
Other Non-Vehicle	0.0000	0.0000	0.0000	0.0000
Fixed Object	0.8296	0.6084	-0.2212	0.2162
Other Object	0.0264	0.0181	-0.0083	0.0000
Overturning	0.0520	0.0433	-0.0087	0.0020
Other Non-Collision	0.0743	0.0530	-0.0213	0.0412
Left Turn	1.0944	0.8512	-0.2432	0.0472
Right Turn	0.0000	0.0000	0.0000	0.1452



Safety Benefit - Cost Analysis

General Information

Project Name	MAD US 42 14.00	Contact Email	awalton@singhinc.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(312) 520-9276
Reference Number	119698	Date Performed	3/19/2024
Analyst	ADW	Analysis Year	2043
Agency/Company	Singh & Associates, Inc.		

Comments:

Select Site Types to be used in Benefit-Cost Analysis:

All Sites

Countermeasure Service Lives, Costs, and Safety Benefits

Countermeasures	Service Life (Years)	Initial Cost of Countermeasure	Annual Maintenance & Energy Costs	Salvage Value	Net Present Cost of Countermeasure	Total Cost of Countermeasures	Summary of Annual Crash Modifications	Net Present Value of Safety Benefits
Site Characteristic Improvements (i.e. Lane widening)		\$0.00			\$0.00	\$0.00	-10.908	\$5,213,592
Site Characteristic Improvements (i.e. Lighting)		\$0.00			\$0.00	\$0.00		
Site Characteristic Improvements (i.e. Signal Phasing)		\$0.00			\$0.00	\$0.00		
Site Characteristic Improvements (i.e. Added Right Turn Lane)		\$0.00			\$0.00	\$0.00		
Roundabout Cost	20	\$4,213,408.00			\$4,213,408.00	\$4,213,408.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
Totals		\$4,213,408.00	\$0.00	\$0.00	\$4,213,408.00	\$4,213,408.00	-10.908	\$5,213,592



Safety Benefit - Cost Analysis

General Information

Project Name	MAD US 42 14.00	Contact Email	awalton@singhinc.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(312) 520-9276
Reference Number	119698	Date Performed	3/19/2024
Analyst	ADW	Analysis Year	2043
Agency/Company	Singh & Associates, Inc.		

Benefit - Cost Calculator

Net Present Value of Project **\$4,213,408.00**

Net Present Value of Safety Benefits **\$5,213,591.97**

Net Benefit **\$1,000,183.97**

Benefit / Cost Ratio **1.24**

Expected Annual Crash Adjustment

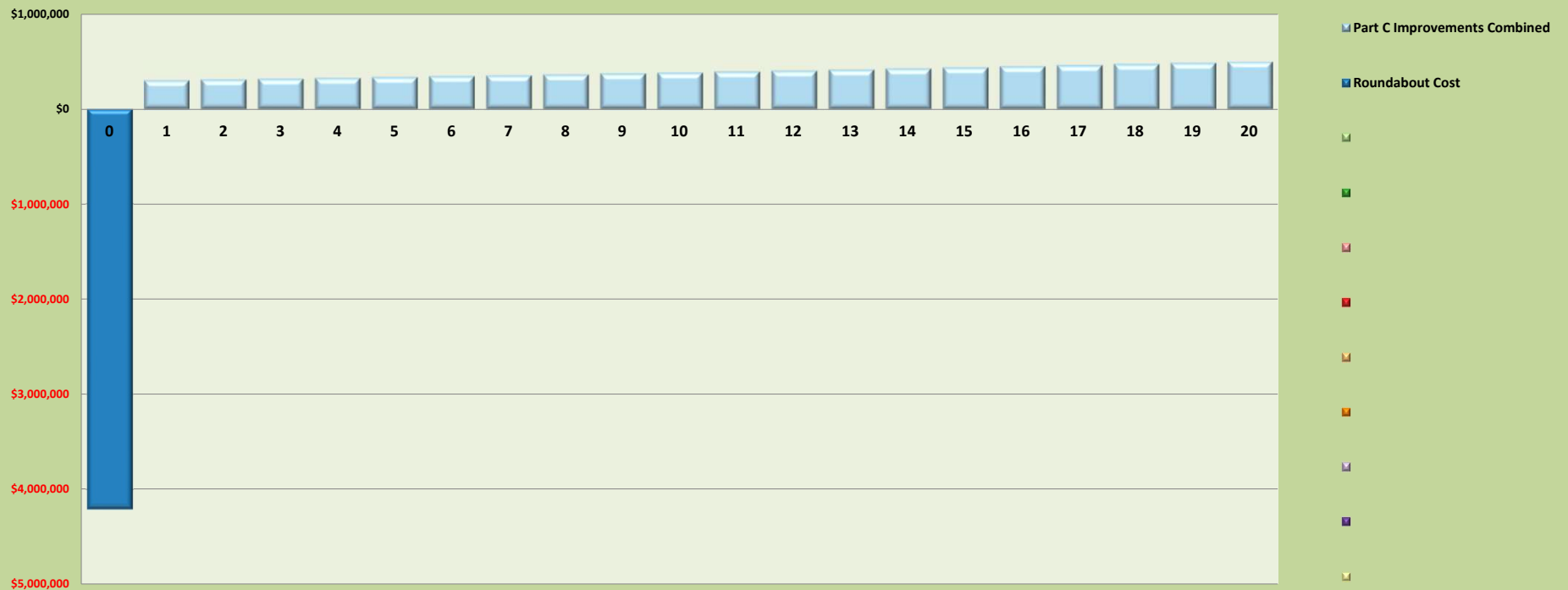
Number of Fatal & Incapacitating Injury Crashes **-0.295**

Number of Injury Crashes **-3.043**

Number of Total Crashes **-10.908**

Comments:

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



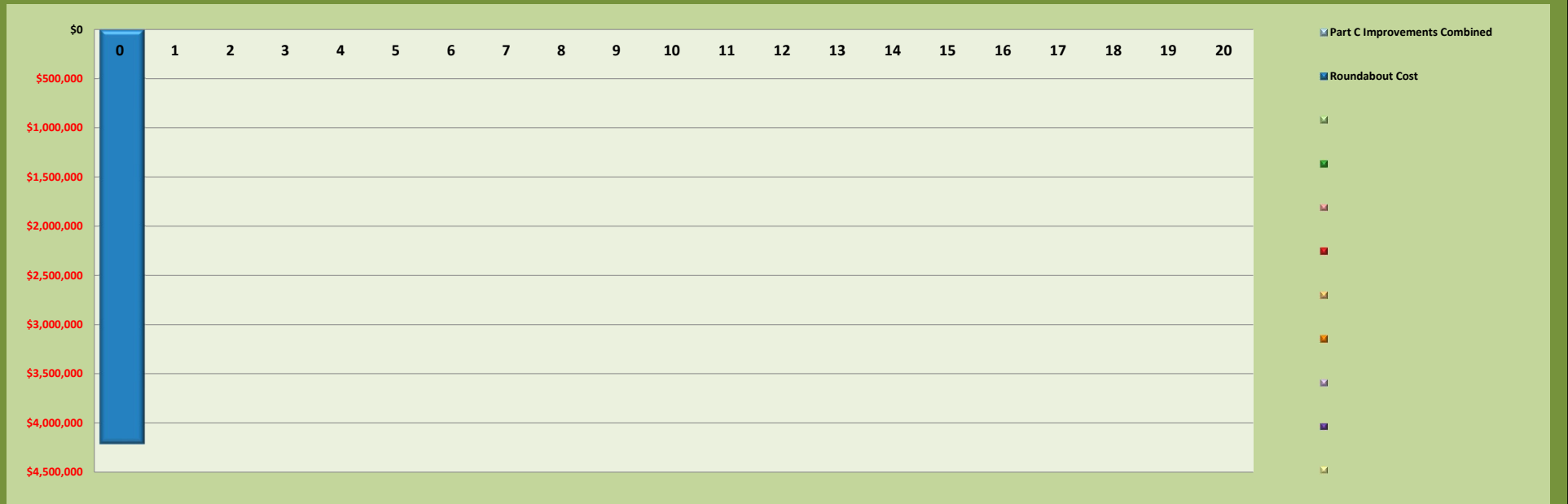


Safety Benefit - Cost Analysis

General Information

Project Name	MAD US 42 14.00	Contact Email	awalton@singhinc.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(312) 520-9276
Reference Number	119698	Date Performed	3/19/2024
Analyst	ADW	Analysis Year	2043
Agency/Company	Singh & Associates, Inc.		

Project Costs Only Cash Flows By Countermeasure Per Year



Return on Investment (Safety Benefits and Project Investments)





Project Information

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		
Perform Benefit Cost Analysis?	Yes		

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

No

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

Project Elements Description Table

Project Element ID (Must be Unique)	Site Type	Intersection Control Type	Location Information					
			NLFID	Begin Logpoint/ Intersection Midpoint	End Logpoint (Leave blank for Intersection)	Length (mi) OR Intersection Radius Buffer (mi)	Cross Route NLFID(s)	Common Name
US42, 14.00	Rural Two-Lane Two Way Intersection	Signalized	SMADUS00042**C	14		0.05	SMADSR0002	US 42 & SR 29

Traffic Volume Growth Rate Calculation For Benefit Cost Analysis

	Year	AADT	
Present ADT (PADT)	2023	10,220	veh / day
Future ADT (FADT)	2043	15,600	veh / day
Annual Linear Growth Rate		0.0263	

Project Elements Description Table						
Project Element ID (Must be Unique)	Site Type	Intersection Control Type	Location Information			
			NLFID	Begin Logpoint/ Intersection Midpoint	End Logpoint (Leave blank for Intersection)	Length (mi) OR Intersection Radius Buffer (mi)

Select Other Non-Site Characteristic Based Countermeasures For Entire Project						
CMF Nbr	Countermeasure	CMF KA Value	CMF B Value	CMF C Value	CMF O Value	CMF Valid for the Following Site Types
CMF 1						
CMF 2						
CMF 3						
CMF 4						
CMF 5						
CMF 6						
CMF 7						
CMF 8						
CMF 9						
CMF 10						

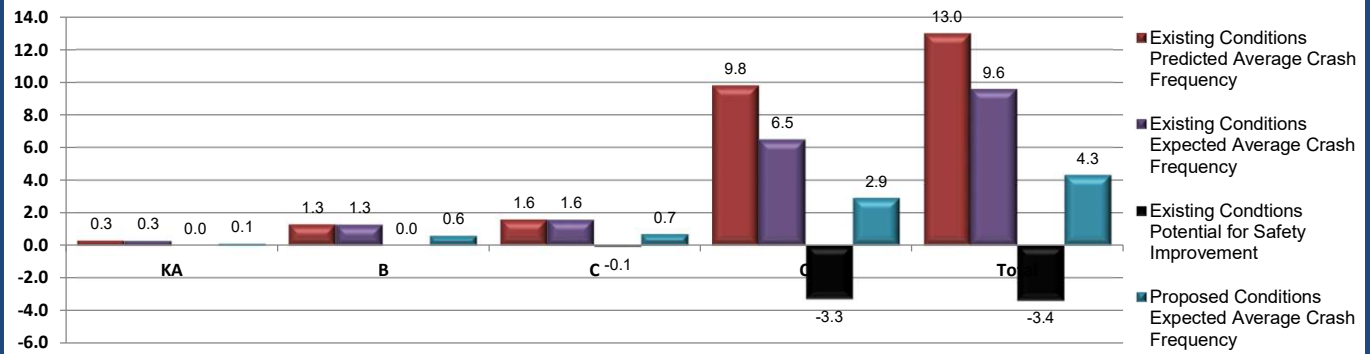


Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
N_{predicted} - Existing Conditions	0.3051	1.2973	1.6402	9.8009	13.0435
N_{expected} - Existing Conditions	0.2941	1.2509	1.5814	6.4801	9.6065
N_{potential for improvement} - Existing Conditions	-0.0110	-0.0464	-0.0588	-3.3208	-3.4370
N_{expected} - Proposed Conditions	0.1323	0.5629	0.7116	2.9160	4.3228



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghanse1@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US42_14.00	US 42 & SR 29	0.3051	1.2973	1.6402	9.8009	13.0435



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghanse1@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US42_14.00	US 42 & SR 29	0.2941	1.2509	1.5814	6.4801	9.6065



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghanse1@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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	
US42_14.00	US 42 & SR 29	-0.011	-0.0464	-0.0588	-3.3208	-3.437



Project Safety Performance Report

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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

Project Element ID	Common Name	Crash Severity Level				Total
		KA	B	C	O	
US42_14.00	US 42 & SR 29	0.1323	0.5629	0.7116	2.916	4.3228



Project Safety Performance Report

General Information

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Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Expected Crash Frequency
Unknown	0.0151	0.0112	-0.0039	0.0050
Head On	0.0955	0.0768	-0.0187	0.0346
Rear End	5.7457	4.2008	-1.5449	1.8904
Backing	0.6213	0.4156	-0.2057	0.1870
Sideswipe - Meeting	0.2639	0.1941	-0.0698	0.0873
Sideswipe - Passing	0.8988	0.6207	-0.2781	0.2793
Angle	2.6388	1.9965	-0.6423	0.8984
Parked Vehicle	0.4864	0.3348	-0.1516	0.1507
Pedestrian	0.1211	0.1114	-0.0097	0.0501
Animal	0.0000	0.0000	0.0000	0.0000
Train	0.0000	0.0000	0.0000	0.0000
Pedalcycles	0.0802	0.0706	-0.0096	0.0318
Other Non-Vehicle	0.0000	0.0000	0.0000	0.0000
Fixed Object	0.8296	0.6084	-0.2212	0.2738
Other Object	0.0264	0.0181	-0.0083	0.0081
Overturning	0.0520	0.0433	-0.0087	0.0195
Other Non-Collision	0.0743	0.0530	-0.0213	0.0239
Left Turn	1.0944	0.8512	-0.2432	0.3830
Right Turn	0.0000	0.0000	0.0000	0.0000



Safety Benefit - Cost Analysis

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

Comments:

Select Site Types to be used in Benefit-Cost Analysis:

All Sites

Countermeasure Service Lives, Costs, and Safety Benefits

Countermeasures	Service Life (Years)	Initial Cost of Countermeasure	Annual Maintenance & Energy Costs	Salvage Value	Net Present Cost of Countermeasure	Total Cost of Countermeasures	Summary of Annual Crash Modifications	Net Present Value of Safety Benefits
Site Characteristic Improvements (i.e. Lane widening)		\$0.00			\$0.00	\$0.00	-5.284	\$2,909,542
Site Characteristic Improvements (i.e. Lighting)		\$0.00			\$0.00	\$0.00		
Site Characteristic Improvements (i.e. Signal Phasing)		\$0.00			\$0.00	\$0.00		
Signal Reconstruction and Added Left Turn Lane	20	\$7,428,200.00			\$7,428,200.00	\$7,428,200.00		
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
		\$0.00			\$0.00	\$0.00	0.000	\$0
Totals		\$7,428,200.00	\$0.00	\$0.00	\$7,428,200.00	\$7,428,200.00	-5.284	\$2,909,542



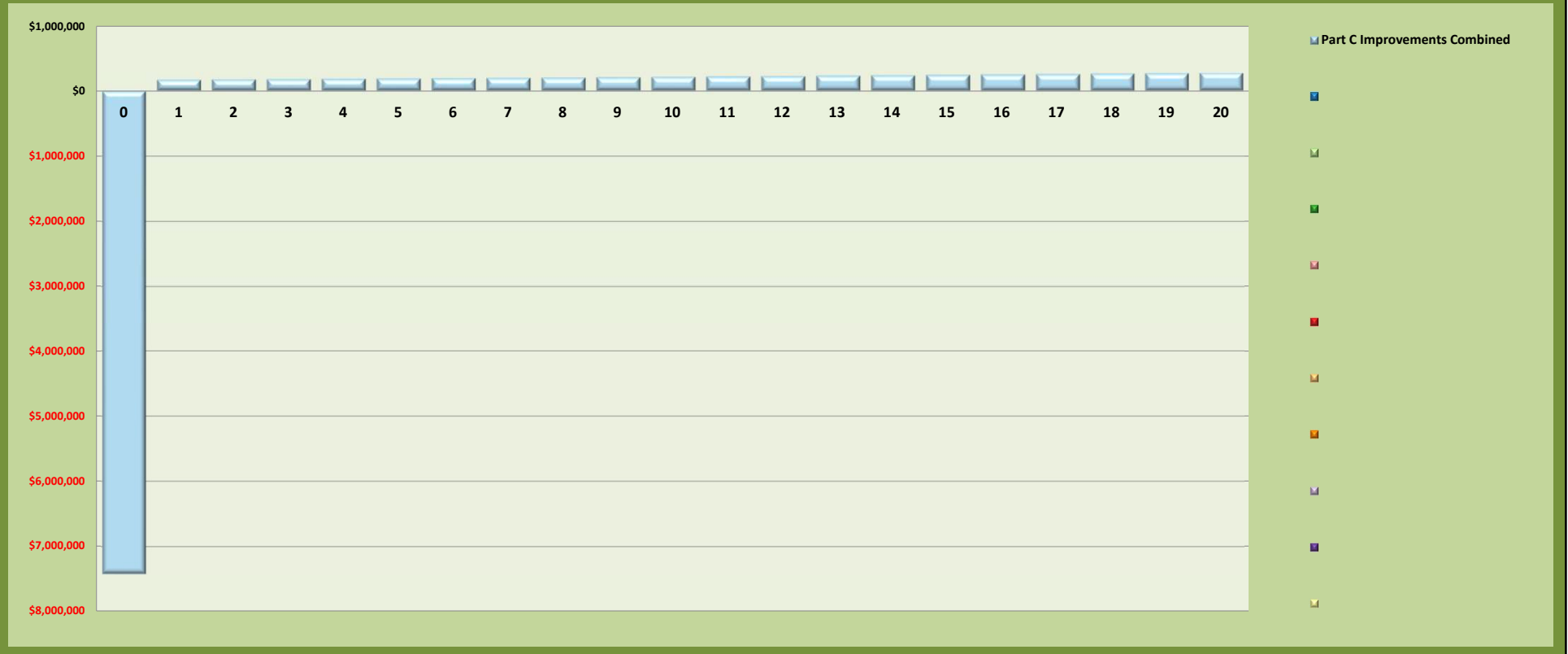
Safety Benefit - Cost Analysis

General Information

Project Name	MAD US 42 14.00	Contact Email	ghansel@cmtengr.com
Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
Reference Number	117886	Date Performed	2/13/2024
Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

Benefit - Cost Calculator		Expected Annual Crash Adjustment		Comments:
Net Present Value of Project	\$7,428,200.00	Number of Fatal & Incapacitating Injury Crashes	-0.162	
Net Present Value of Safety Benefits	\$2,909,541.70	Number of Injury Crashes	-1.720	
Net Benefit	(\$4,518,658.30)	Number of Total Crashes	-5.284	
Benefit / Cost Ratio	0.39			

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





Safety Benefit - Cost Analysis

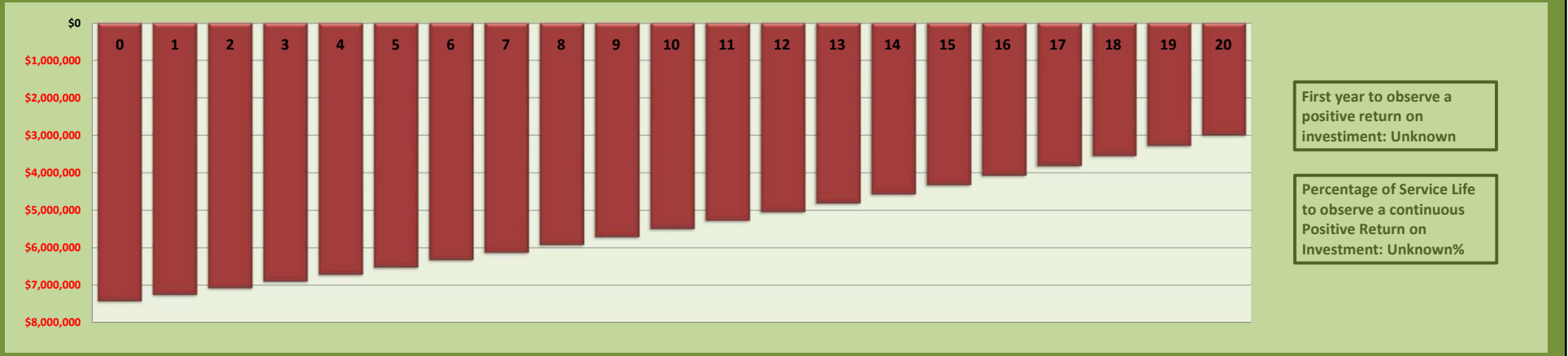
General Information

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Project Description	VAR-Statewide Safety Studies No. 2023-4 District 6 Task 3C	Contact Phone	(614) 468-1213
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Analyst	GSH	Analysis Year	2043
Agency/Company	CMT		

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

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

APPENDIX J

CAP-X Analysis and ICE Summary

Capacity Analysis for Planning of Junctions

Detailed Results Worksheet

Project Name:	MAD US 42-14.00	Estimated Volume-to-Capacity Ratio			
Project Number:	117886	Number of Configurations			
Location	Madison County	< 0.750	0.750 - 0.875	0.875 - 1.00	≥ 1.00
Date	2043 AM Peak	2	0	0	0

Results for Non-roundabout Intersections

TYPE OF INTERSECTION	Sheet	Zone 1 (North)		Zone 2 (South)		Zone 3 (East)		Zone 4 (West)		Zone 5 (Center)		Overall v/c Ratio	Pedestrian Accommodations	Bicycle Accommodations
		CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C			
Traffic Signal	<u>FULL</u>	/	/	/	/	/	/	/	/	896	<u>0.58</u>	0.58	2.50	4.33

Results for Grade Separated Intersections

TYPE OF INTERSECTION	Sheet	Zone 1 (North)		Zone 2 (South)		Zone 3 (East)		Zone 4 (West)		Zone 5 (Center)		Zone 6 (Raised)		Overall v/c Ratio	Ped	Bike
		CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C			

Capacity Analysis for Planning of Junctions

Detailed Results Worksheet

Project Name:	MAD US 42-14.00	Estimated Volume-to-Capacity Ratio			
Project Number:	117886	Number of Configurations			
Location:	Madison County	< 0.750	0.750 - 0.875	0.875 - 1.00	≥ 1.00
Date:	2043 PM Peak	2	0	0	0

Results for Non-roundabout Intersections

TYPE OF INTERSECTION	Sheet	Zone 1 (North)		Zone 2 (South)		Zone 3 (East)		Zone 4 (West)		Zone 5 (Center)		Overall v/c Ratio	Pedestrian Accommodations	Bicycle Accommodations
		CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C			
Traffic Signal	FULL	/	/	/	/	/	/	/	/	1061	<u>0.68</u>	0.68	2.50	4.33

Results for Grade Separated Intersections

TYPE OF INTERSECTION	Sheet	Zone 1 (North)		Zone 2 (South)		Zone 3 (East)		Zone 4 (West)		Zone 5 (Center)		Zone 6 (Raised)		Overall v/c Ratio	Ped	Bike
		CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C	CLV	V/C			

Outputs	This sheet compiles the data from summary tables in individual alternatives sheets. To populate the output sheet press the "Setup Worksheets" button in the Volumes tab.
Analyst:	TJH
Agency/Company:	CMT
Intersection:	US 42 & SR 29
Route:	MAD 42
Logpoint:	14
Common Name:	N London-Delaware Rd & Urbana-West Jefferson Rd
Date Performed:	2/16/2024
Analysis Type	At-Grade Intersection

Analysis Summary

Cost Categories	Net Present Value of Costs	
	Traffic Signal	Roundabout
Planning, Construction & Right of Way Costs	\$ 8,550,119	\$ 4,709,272
Post-Opening Costs	\$ 95,545	\$ 72,952
Auto Passenger Delay	\$ 824,480	\$ 724,525
Truck Delay	\$ 556,495	\$ 489,029
Safety	\$ 1,821,133	\$ 998,756
Total cost	\$11,847,772	\$6,994,533

Select Base Case for Benefit-Cost Comparison: (Choose from list)	Traffic Signal	
Benefit Categories	Net Present Value of Benefits Relative to Base Case	
	Traffic Signal	Roundabout
Auto Passenger Delay		\$ 99,955
Truck Delay		\$ 67,466
Safety		\$ 822,377
Net Present Value of Benefits		\$ 989,798
Net Present Value of Costs		\$ (3,863,440)
Net Present Value of Improvement		\$ 4,853,238
Benefit-Cost (B/C) Ratio		Control strategy preferred. Benefits are greater than base case and cost is less than base case.
Delay B/C		Control strategy preferred. Benefits are greater than base case and cost is less than base case.
Safety B/C		case and cost is less than base case.

Net Present Value of Total Costs

