US-22 & SR-753

Intersection Safety Study

Draft Report

June 27, 2025

6612 Singletree Drive
Columbus, OH 43229
614.656.2424
www.cmtran.com

Prepared for:
Ohio Valley Regional Development Commission &
Fayette County Engineer

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I. Executive Summary

A. Purpose

The purpose of this study is to analyze crash trends, determine countermeasures to mitigate crashes, and prioritize/recommend countermeasures for implementation. The study limits include the intersection of US-22 & SR-753 and extend approximately 500' on each intersection approach. The intersection is located in Fayette County, just east of the City of Washington Court House. The study location has been identified as a priority intersection by the Fayette County Engineer's Office.

B. Overview of Existing Conditions and Analysis

US-22 & SR-753 is a four-leg, all-way stop-controlled (AWSC) intersection. All approaches have a single approach lane with dual stop signs and sign post reflectors. The stop signs on the right side of each approach have solar powered LED blinkers. The capacity analysis of existing conditions shows that all approaches are expected to have acceptable delays and queues through 2045. The requirements for ASWC per the OMUTCD methodologies are satisfied. The signal warrant analysis results show a traffic signal is not warranted per ODOT standards with current traffic volumes. Furthermore, the signal is not anticipated to meet warrants in 2045.

C. Overview of Safety Issues

A total of 38 crashes occurred between 2018-2025 (data obtained on June 2, 2025). Angle crashes were the most prevalent crash type at the study intersection. A total of 27 angle crashes were reported with seven resulting in minor injuries and six with possible injury. Angle crashes represent 71.1% of the total crashes, higher than the statewide average of 31.42%. Vehicles at fault and involved in the angle crashes are evenly spread across all legs of the intersection. The frequency of this crash type is likely caused by driver confusion as to who has the right-of-way and not expecting an AWSC intersection at this location. Rear end crashes are the second most prevalent crash type at the study intersection. A total of eight rear end crashes were reported with two resulting in minor injuries. Rear end crashes represent 21.1% of the total crashes, higher than the statewide average of 14.31%. These crashes are likely due to drivers not expecting to stop.

D. Countermeasures

The intersection already has many short-term improvements implemented, including the dual stop signs, stop signs with LED blinkers, and advanced warning signage on all approaches. Based on the continued crash trends, a long-term improvement is needed to address the prevalent crash type. A roundabout should be considered for implementation at this intersection. The capacity analysis results show that a single-lane circulating roundabout with single-lane approaches is expected to operate with acceptable LOS/delay through 2045.

E. Benefit-Cost Analysis

The proposed roundabout is estimated to cost $2,811,300. This intersection is on the border between the areas specified as urban and rural. Therefore, it was analyzed as both a rural and urban intersection to provide the most comprehensive results. An AWSC urban intersection has a dedicated site type in ECAT. However, an AWSC rural intersection does not have a dedicated site type, and it is analyzed the same as a two-way stop-controlled intersection. The proposed roundabout has a dedicated site type in ECAT for both urban and rural intersections. The benefit-cost ratio for the roundabout is 1.30 analyzed as rural, but is 0.01 analyzed as an urban site type.

F. Recommendations

The roundabout alternative should be considered for implementation. A roundabout would more clearly delineate the vehicle with right-of-way, slow vehicles as they enter the intersection, and decrease the severity of crashes that occur. Even though the proposed roundabout is costly and has a benefit-cost ratio with varied results, it is still recommended a roundabout be further considered for implementation. If desired, formal safety funding could be pursued for this improvement through ODOT or CEAO.

II. Purpose

The purpose of this study is to analyze crash trends, determine countermeasures to mitigate crashes, and prioritize/recommend countermeasures for implementation. The study limits include the intersection of US-22 & SR-753 and extend approximately 500' on each intersection approach. The intersection is located in Fayette County, just east of the City of Washington Court House.

The study location has been identified as a priority intersection by the Fayette County Engineer's Office. A project location map is provided in **Figure 1.** A study area map is provided in **Figure 2**.

Figure 1 - Project Location Map (Fayette County outlined in red)

Figure 2 – Study Area Map

III. Existing Conditions

A. Land Use and Development

The study area is located in Fayette County, just east of the City of Washington Court House, on the border between the areas specified as urban and rural. The area surrounding the study intersection includes a self-storage development to the west and undeveloped agricultural land.

B. Roadway Conditions

US-22

US-22 serves as an east-west connector, extending from Cincinnati to the eastern limits of Ohio and through West Virgina, Pennsylvania, and New Jersey. US-22 has a posted speed limit of 55 MPH within the study area. The roadway is classified as an Urban Minor Arterial and is generally a two-lane roadway.

The roadway has raised pavement markers (RPMs) east of the intersection, but no lighting, rumble strips/stripes, or sidewalk. The roadway has approximately 11' lanes with 0.5-1' paved shoulders along the length of the study area. At the study intersection, additional shoulder space is striped out on the north side of the road, tapering away from the intersection. The east leg of US-22 is located on the National Truck Network.

SR-753

SR-753 is a north-south connector running from US-62 to SR-41. SR-753 has a posted speed limit of 50 MPH within the study area. The roadway is classified as an Urban Minor Arterial and has a two-lane typical section. It has RPMs but no lighting, rumble strips/stripes, or sidewalk, has approximately 11-12' lanes, and 3-4' paved shoulders.

C. Intersection Conditions

US-22 & SR-753 is a four-leg, all-way stop-controlled (AWSC) intersection. All approaches have a single approach lane with dual stop signs and sign post reflectors. The stop signs on the right side of each approach have solar powered LED blinkers. Northbound and southbound approaches have 'All Way' signs mounted under both stop signs, while eastbound and westbound approach have them mounted under only the stop sign on the right side of the approach. Route signs with arrows are located in all four corners of the intersection. The intersection configuration can be seen in **Figure 2**.

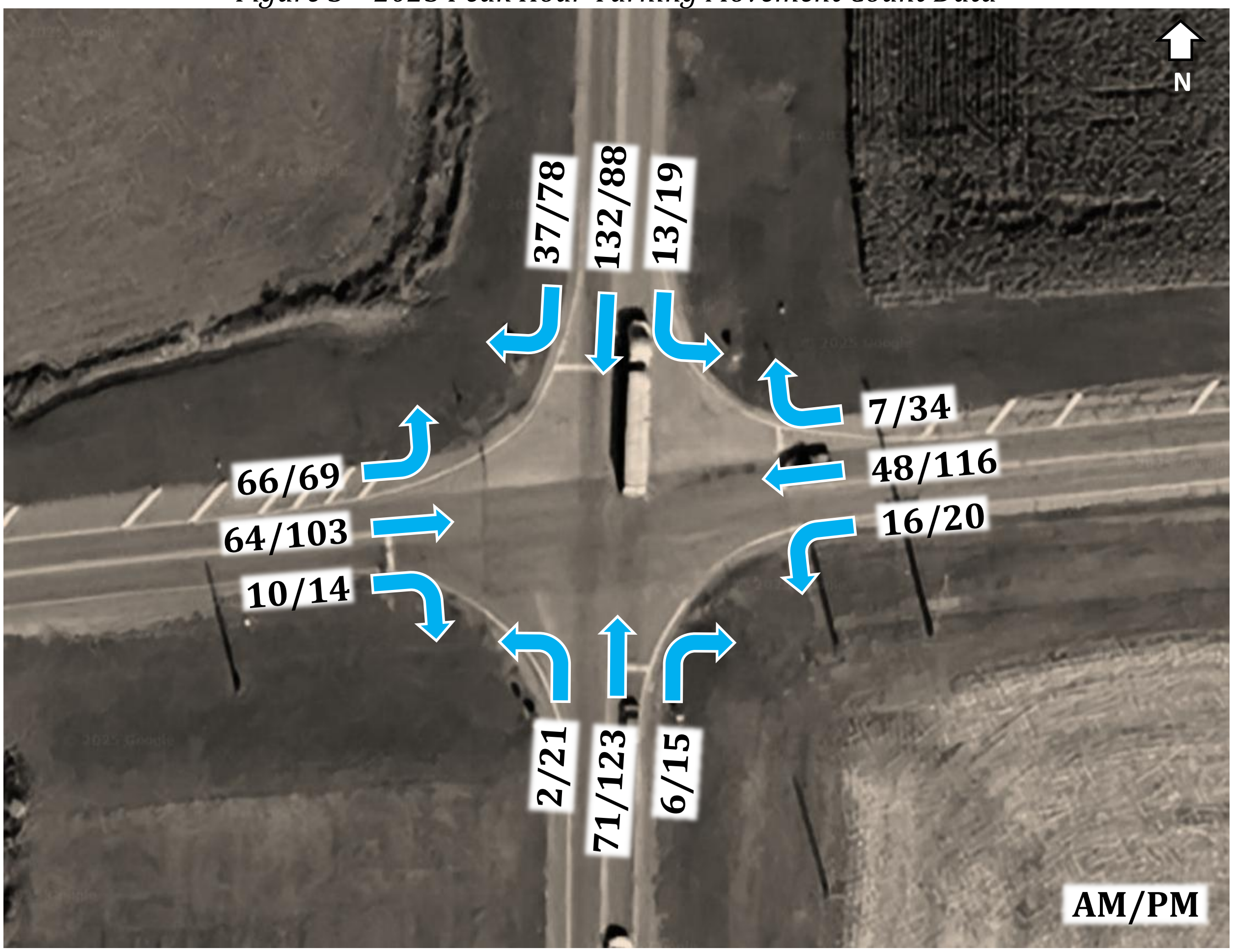
The eastbound approach has dual stop ahead warning signs located approximately 770 feet from the stop line and no parking signs along the south side of the roadway from approximately 140-260 feet prior to the stop line. The westbound approach also has dual stop ahead warning signs located approximately 850 feet from the stop line and 'No Driving on Marked Shoulder' signs located approximately 395 feet and 215 feet from the stop line. The northbound approach has dual stop ahead warning signs located approximately 670 feet from the stop line. The southbound approach has dual stop ahead warning signs located approximately 580 feet from the stop line.

Historically, the intersection has been an AWSC intersection. Between August 2015 and June 2018, the intersection was updated to remove the old overhead flashing beacons installed on a span wire and replace it with the current LED blinker stop signs. It was also noted that the lights on the roof of a warehouse located approximately 0.75 miles south of the intersection are visible from the study intersection. These may cause some driver distraction, specifically for the southbound approach, when combined with the flashing stop signs present at the intersection.

D. Data Collection

Turning movement counts were collected at the study intersection from 6 AM to 7 PM on Tuesday, April 1, 2025. The AM peak hour is from 7:00-8:00 and the PM peak hour is from 3:45-4:45. Peak hour data is summarized in **Figure 3**. The count data is provided in **Appendix A**.

Figure 3 – 2025 Peak Hour Turning Movement Count Data



E. Traffic Volume Development

2022 peak hour to design hour volume (DHV) factors were applied to the 2025 turning movement count data to produce adjusted 2025 volumes. Background growth rates were obtained from the ODOT Transportation Forecasting Modeling System (TFMS) for the study intersection approaches.

The growth rates were applied to the adjusted 2025 count data to develop Design Year (2045) AM, PM, and average daily traffic (ADT) volumes. Volumes were also rounded to the nearest 10, with a minimum of 10 vehicles, for all allowable movements. The ODOT partial count factor form (PCFF) was used to extrapolate ADT data from the 13 hours of data collected. The DHV factor table, TFMS growth rate outputs, PCFF, relevant adjustment tables, and volume calculations are provided in **Appendix B**.

IV. Analysis

A. Signal Warrant Analysis

A signal warrant analysis was performed at the study intersection. Eight-hour, four-hour, and peak hour (Warrants 1, 2, and 3) signal warrant analyses were evaluated per the Ohio Manual of Uniform Traffic Control Devices (OMUTCD). Analyses were conducted for the raw 2025 count data with right turn reductions (RTR). The results show a traffic signal is not warranted per ODOT standards with current traffic volumes. Additional analysis was conducted with 2045 volumes to determine if the signal may meet warrants in the future. Results of this planning-level analysis show that the signal is not anticipated to meet warrants in the Design Year. The full signal warrant analysis can be seen in **Appendix C**.

B. AWSC Warrant Analysis

AWSC warrant analysis was performed at the study intersection per the OMUTCD methodologies. Five or more angle crashes occurred within a 12-month period (six crashes between 5/9/2020 and 11/27/2022), which are susceptible to correction by AWSC application. Since the 85th percentile approach speed of the major street traffic exceeds 40 MPH, 70% of the minimum volume thresholds can be utilized. Then the minimum volume thresholds are met using 2025 data. Therefore, the requirements for ASWC are satisfied. The AWSC warrant analysis can be seen in **Appendix C.**

C. Capacity Analysis

Highway Capacity Software (HCS) version 2024 was used to analyze capacity at the study intersection under existing conditions. AM and PM peak hour volumes were analyzed for 2025 (Existing Year) and 2045 (Design Year).

Existing conditions capacity analysis results for 2025 and 2045 are provided in **Tables 1 and 2.** In general, a minimum level of service (LOS) of D for each intersection approach and movement was considered acceptable. Volume to capacity (V/C) ratios less than one for all movements (0.93 or less preferred) were also considered acceptable. Full capacity analysis results are provided in **Appendix D.**

Table 1 – Existing Conditions AM Peak Capacity Analysis Results

Approach/ Movement	2025 AM				2045 AM			
	LOS	Delay (sec/veh)	v/c	95th % Queue	LOS	Delay (sec/veh)	v/c	95th % Queue
EBL/T/R	B	10.6	0.3	34	B	12.3	0.4	42
WBL/T/R	A	9.6	0.2	16	B	10.9	0.2	22
NBL/T/R	A	9.7	0.2	20	B	10.9	0.3	28
SBL/T/R	B	11.4	0.4	51	C	17.5	0.6	131
Intersection	**B**	**10.6**	**---**	**---**	**B**	**14.2**	**---**	**---**

Table 2 – Existing Conditions PM Peak Capacity Analysis Results

Approach/ Movement	2025 PM				2045 PM			
	LOS	Delay (sec/veh)	v/c	95th % Queue	LOS	Delay (sec/veh)	v/c	95th % Queue
EBL/T/R	B	11.7	0.4	44	C	15.4	0.5	65
WBL/T/R	B	11.0	0.3	34	C	15.1	0.5	65
NBL/T/R	B	11.2	0.3	35	C	15.1	0.5	65
SBL/T/R	B	11.2	0.3	40	C	18.8	0.6	115
Intersection	**B**	**11.3**	**---**	**---**	**C**	**16.4**	**---**	**---**

The results show that all approaches are expected to have acceptable delays and queues through 2045.

V. Crash Data

A. Crash Data Summary

Crash data was obtained from ODOT AASHTOWare Safety for seven complete years (2018-2024) and the available crash data for 2025 at the time of the data pull (June 2, 2025). A total of 38 crashes were obtained. The OH-1 report for each documented crash was reviewed to correct information, where necessary, and properly locate crashes within the study limits. The original crash data query included 39 crashes, which was adjusted to 38 crashes after reviewing and relocating crashes.

Table 3 shows a summary of the crash data. Crash data for the study area was plotted on an aerial map to identify crash patterns and probable causes. The crash diagram for the study intersection can be seen in **Figure 4**.

Table 3 – 2018-2025 Crash Statistics

Crash Year	Number	Percent
2018	6	15.8%
2019	4	10.5%
2020	5	13.2%
2021	7	18.4%
2022	5	13.2%
2023	4	10.5%
2024	5	13.2%
2025	2	5.3%

Crash Severity	Number	Percent
Property Damage Crash	22	57.9%
Injury Crash	16	42.1%

Crash Type	Number	Percent
Angle	27	71.1%
Rear End	8	21.1%
Fixed Object	1	2.6%
Backing	1	2.6%
Other Non-Collision	1	2.6%

Road Condition	Number	Percent
Dry	33	86.8%
Wet	5	13.2%

Hour of Day	Number	Percent
2:00 AM	1	2.6%
6:00 AM	1	2.6%
7:00 AM	1	2.6%
8:00 AM	2	5.3%
9:00 AM	2	5.3%
10:00 AM	1	2.6%
11:00 AM	2	5.3%
12:00 PM	1	2.6%
1:00 PM	4	10.5%
2:00 PM	2	5.3%
3:00 PM	5	13.2%
4:00 PM	5	13.2%
5:00 PM	6	15.8%
6:00 PM	1	2.6%
7:00 PM	1	2.6%
9:00 PM	1	2.6%
11:00 PM	2	5.3%

Day of Week	Number	Percent
Sunday	4	10.5%
Monday	6	15.8%
Tuesday	5	13.2%
Wednesday	6	15.8%
Thursday	5	13.2%
Friday	4	10.5%
Saturday	8	21.1%

Figure 4 – 2018-2025 Crash Diagram

Crash Totals

22	Property Damage Only
16	Injury
38	Total Crashes

Symbols

Rear End
Backing
Fixed Object
Angle
Other/Non-Collision
Injury

Crash Text

1. Time, day, date
2. Road condition
3. NITE – dark outside

Notes:
1. Crash text is positioned with the at fault vehicle

B. Probable Causes

Angle

Angle crashes are the most prevalent crash type at the study intersection. A total of 27 angle crashes were reported with seven resulting in minor injury and six with possible injury. Angle crashes represent 71.1% of the total crashes, higher than the statewide average of 31.42%. In general, the crashes are summarized as follows:

- Eight crashes involving a southbound vehicle and an eastbound vehicle
  - Five with the eastbound vehicle at fault, three with the southbound vehicle at fault
- Seven crashes involving a southbound vehicle and a westbound vehicle
  - Five with the southbound vehicle at fault, two with the westbound vehicle at fault
- Six crashes involving a northbound vehicle and a westbound vehicle
  - Five with the westbound vehicle at fault, one with the southbound vehicle at fault
- Four crashes involving a northbound vehicle and an eastbound vehicle
  - All with the northbound vehicle at fault

The frequency of this crash type is likely caused by driver confusion as to who has the right-of-way and not expecting an AWSC intersection at this location.

Rear End

Rear end crashes are the second most prevalent crash type at the study intersection. A total of eight rear end crashes were reported with two resulting in minor injuries. Rear end crashes represent 21.1% of the total crashes, higher than the statewide average of 14.31%. The crashes are summarized as follows:

- Three on the eastbound approach (all property damage only)
- Three on the westbound approach (one injury)
- Two on the northbound approach (one injury)

In general, these crashes are likely due to congestion and drivers' frustration, inattention, and not expecting to have to stop.

C. Safety Analysis

The Highway Safety Manual (HSM) predictive method was applied to the study area to determine the potential for safety improvement using the ODOT Economic Crash Analysis Tool (ECAT). The analysis included 2018-2025 crash data. Note, this intersection is on the border between the areas specified as urban and rural. Therefore, it was analyzed as both a rural and urban intersection to provide the most comprehensive results. An AWSC urban intersection has a dedicated site type in ECAT, which was utilized for analysis. However, an AWSC rural intersection does not have a dedicated site type, so it is analyzed the same as a two-way stop-controlled intersection.

The results presented in **Table 4** show the expected crash frequency calculated using HSM predictive method with cleaned crash data and existing conditions for the study intersection.

Table 4 - HSM Results for Existing Conditions for All Crashes (shown in crashes/year)

Site Type	Rural	Urban
Predicted Average Crash Frequency	3.4794	0.8265
Expected Average Crash Frequency – Existing Conditions	3.8384	1.4735
Expected Excess Crashes	0.3590	0.6470
Potential for Improvement	Yes	Yes

The results conclude that the expected crash frequency is greater than the predicted crash frequency for the study intersection analyzed as both a rural or urban intersection. This suggests the intersection experiences more average crashes per year than its peers and has a potential to reduce crashes based on HSM methodology. HSM output reports are provided in **Appendix H**.

VI. Countermeasures

The following section addresses possible countermeasures to mitigate the prevalent crash types at the study intersection. The intersection already has many short-term improvements implemented, including the dual stop signs, stop signs with LED blinkers, and advanced warning signage on all approaches. Based on the continued crash trends, a long-term improvement is needed to address the prevalent crash type.

A. Long-Term Countermeasure

Install a Roundabout

A roundabout should be considered for implementation at this intersection. The FHWA Office of Safety identified roundabouts as a Proven Safety Countermeasure because of their ability to greatly reduce the types of crashes that result in serious injury or fatality. By reducing the number and severity of conflict points at the intersection, and because of the lower speeds of vehicles moving through the intersection, roundabouts are proven to be a safer intersection type. Roundabouts are generally becoming more common throughout Ohio. It is anticipated that traffic driving through the area will be familiar with roundabouts.

Capacity analysis was conducted using HCS to determine the roundabout configuration required for acceptable LOS/delay. The results show that a single-lane circulating roundabout with single-lane approaches is expected to operate with acceptable LOS/delay through 2045. Capacity analysis results are summarized in **Tables 5 and 6**. Detailed capacity analysis results for this alternative are provided in **Appendix F**.

Table 5 – Roundabout Alternative AM Peak Capacity Analysis Results

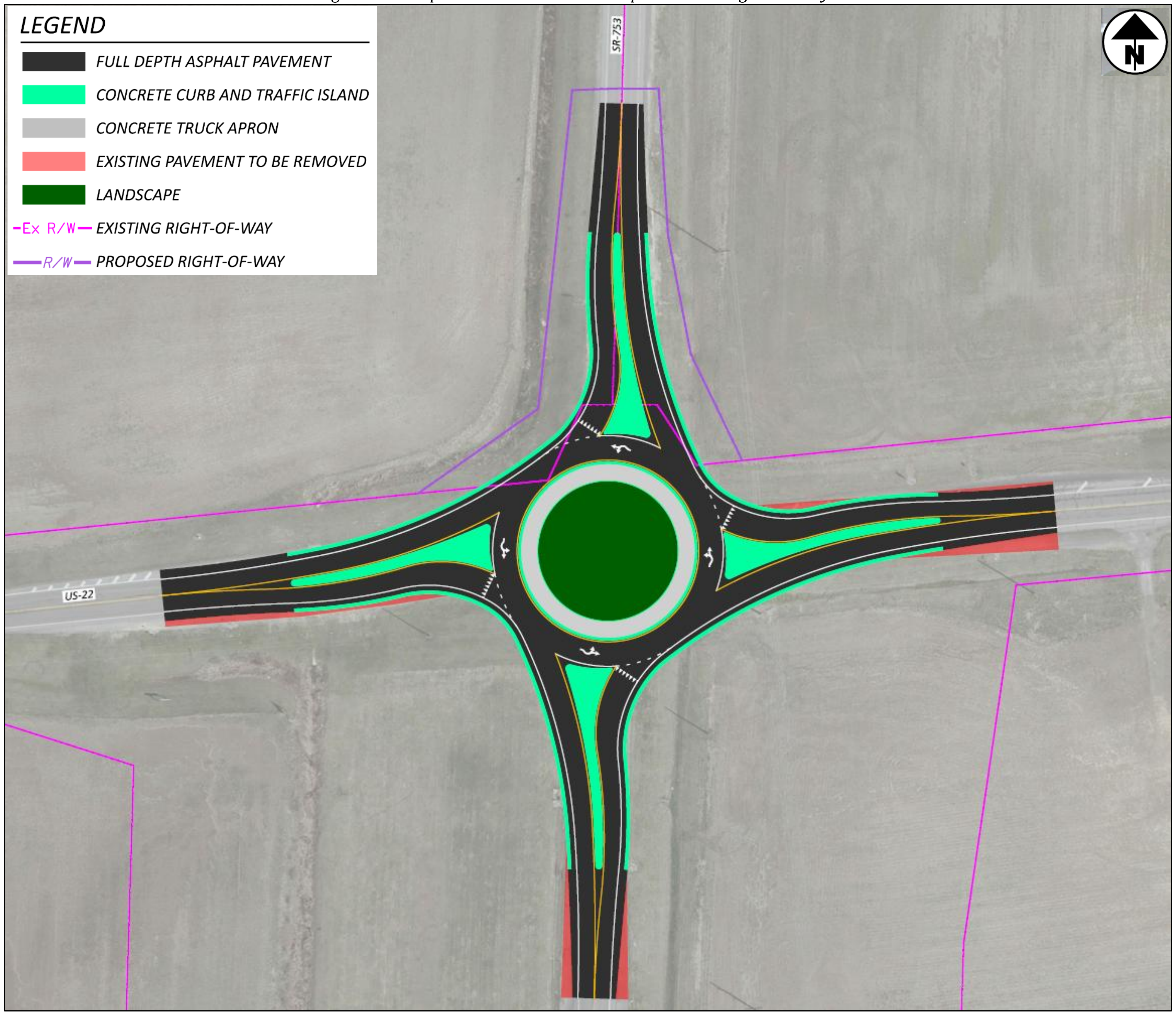
Approach/ Movement	2045 AM – Existing Conditions				2045 AM – Roundabout			
	LOS	Delay (sec/veh)	v/c	95th % Queue	LOS	Delay (sec/veh)	v/c	95th % Queue
EBL/T/R	B	12.3	0.4	42	A	6.9	0.25	26
WBL/T/R	B	10.9	0.2	22	A	5.1	0.14	14
NBL/T/R	B	10.9	0.3	28	A	5.4	0.16	17
SBL/T/R	C	17.5	0.6	131	A	8.1	0.42	60
Intersection	**B**	**14.2**	**---**	**---**	**A**	**6.9**	**---**	**---**

Table 6 – Roundabout Alternative PM Peak Capacity Analysis Results

Approach/ Movement	2045 PM – Existing Conditions				2045 PM – Roundabout			
	LOS	Delay (sec/veh)	v/c	95th % Queue	LOS	Delay (sec/veh)	v/c	95th % Queue
EBL/T/R	C	15.4	0.5	65	A	6.1	0.26	26
WBL/T/R	C	15.1	0.5	65	A	6.9	0.28	31
NBL/T/R	C	15.1	0.5	65	A	6.7	0.27	30
SBL/T/R	C	18.8	0.6	115	A	7.7	0.37	46
Intersection	**C**	**16.4**	**---**	**---**	**A**	**6.9**	**---**	**---**

The capacity analysis shows that a roundabout would improve the overall operations at the study intersection. The roundabout would also mitigate the primary crash type of angle crashes. A conceptual, planning-level layout of the proposed alternative is provided in **Figure 5**.

Figure 5 – Proposed Roundabout Conceptual Planning-Level Layout



VII. Benefit-Cost Analysis

Benefit-cost analysis is a tool used to determine the financial benefits of a project by comparing the net present value (NPV) of a project to the NPV of the safety benefit provided by the project. Benefit-cost values greater than one indicate a positive return on the original investment. Preferred countermeasures are those having the highest NPV of safety benefits. A benefit-cost analysis for the roundabout alternative was prepared using ODOT ECAT.

A cost estimate was prepared for the alternative. The construction cost estimate assumes the following:

- 15% engineering design
- 30% contingency
- 10% environmental, geotechnical, federal requirements
- 9.1% inflation rate for an estimated 2027 construction year[1]
- Right-of-way impacts
- Utility relocation costs are not included

The estimated cost for the roundabout alternative was $2,811,300. The detailed cost estimate is included in **Appendix G.**

The proposed improvements fundamentally change the conditions of the base safety performance function. For this reason, a separate HSM analysis was conducted of the proposed conditions and compared to the existing conditions. The proposed roundabout has a dedicated site type in ECAT for both urban and rural intersections, which was utilized for the analysis.

Table 7 summarizes the benefit-cost analysis results. Detailed benefit-cost analysis reports from ECAT are included in **Appendix H**.

Table 7 - Benefit-Cost Analysis

Countermeasure	Roundabout	
Site Type	Rural	Urban
Expected Annual Crash Adjustment	-2.411	+0.340
NPV of Project	$2,576,810.68	
NPV of Safety Benefit	$3,346,120.40	$27,665.66
Benefit-Cost Ratio	1.30	0.01

In general, a benefit-cost ratio greater than 1.0 is preferred, showing the implementation of the countermeasure is expected to have a positive return on the original investment. Unfortunately, the benefit-cost analysis shows varied results for the implementation of the roundabout analyzed as rural and urban site types. This is likely due to the fact that this

[1] Note, inflation rates have been irregularly high recently. If the proposed project is not immediately moved forward, this cost estimate will likely need revised as time passes.

intersection is on the border of the two site types and is not easily comparable to other intersections. Due to the varied results, engineering judgement must be relied upon.

VIII. Recommendations

The intersection already has many short-term improvements implemented. However, based on the continued crash trends, a long-term improvement is needed to address the prevalent crash type. The roundabout alternative should be considered for implementation. The primary crash type is angle crashes, with vehicles at fault and involved evenly spread across all legs. A roundabout would more clearly delineate the vehicle with right-of-way, slow vehicles as they enter the intersection, and decrease the severity of crashes that occur. Even though the proposed roundabout is costly and has a benefit-cost ratio with varied results, it is still recommended a roundabout be further considered for implementation. If desired, formal safety funding could be pursued for this improvement through ODOT or CEAO.