Department of Transportation

Safety Study

MUS-146 Northpointe Dr. to Dillon School Dr.

Project PID 119788

Muskingum County, OH

Prepared for:
ODOT District 5

Prepared By:
WSP

August 2024

Contents

Purpose and Need

The Ohio Department of Transportation (ODOT) District 5 is conducting a safety study along State Route 146 (SR 146) (Newark Road) from the Northpointe Drive intersection to the Dillon School Drive intersection in the City of Zanesville, Muskingum County, Ohio. As part of this safety study the following were performed: Crash data analyses, crash collision diagrams, capacity analyses, alternatives analyses and crash prediction analyses for the various alternatives. This memo summarizes the findings of each of these analyses.

Existing Conditions

SR 146 is a 2-lane roadway minor arterial with a posted speed limit of 45 miles per hour (mph). The segment of interest is about 0.56 miles in length with 4 business drives and 4 intersecting roadways. The intersecting roadways include Northpointe Drive, Arrow Point Drive, and Dillon School Drive. As seen in Figure 1, Dillon School Drive intersects SR 146 twice. For discussion purposes in this memo, the Dillon school Drive intersection closest to the Northpointe Drive intersection is considered the north entrance and the Dillon School Drive intersection furthest from the Northpointe Drive intersection is considered the south entrance.

Figure 1. Study Area SR 146 - Northpointe Drive to Dillon School Drive

The Northpointe Drive is classified as a major collector and connects to the east of SR 146, with a roadway width of approximately 60 feet. Northpointe Drive contains a right turn lane, a through lane, and a left turn lane. Northpointe Drive does not continue west of the intersection. North of the intersection, SR 146 is approximately 36 feet wide and contains a left turn lane and a through lane. South of the intersection, SR 146 is approximately 50 feet wide and contains a left turn lane, a through lane, and a right turn lane (Figure 2).

Figure 2. Intersection of SR 146 & Northpointe Drive

At the Arrow Point Drive intersection, Arrow Point Drive is classified as a local road which connects west of SR 146. Arrow Point Drive serves as the only entrance point for approximately 23 residences. It is a 2-lane roadway measuring approximately 16 feet wide. At this intersection, traffic is controlled only on Arrow Point Drive with a stop sign. About 160 feet south of the Arrow Point intersection, the north entrance of the Dillon School Drive connects to SR 146 to form a signalized T-intersection. Dillon School Drive is a 2-lane roadway, approximately 20 feet wide, classified a major collector, and connects to the west of SR 146 with a single lane for all turning movements. At this intersection, SR 146 remains a 2-lane roadway where one lane serves all turning movements (Figure 3).

Figure 3. SR 146 (Intersections with Arrow Point Drive and Dillon School Drive

The south entrance of Dillon School Drive is less than half a mile south of the north entrance. The south entrance is a 2-lane roadway, approximately 20 feet wide, classified a major collector, and connects to the west of SR 146 to form a T intersection. The eastbound approach has a single lane for all turning movements. The southbound approach on SR 146 is approximately 35 feet wide with a single lane for all turning movements and a flush median separating opposing traffic. The northbound approach on SR 146 is approximately 35 feet wide which contains a through lane and a left turn lane (Figure 4).

Figure 4. Intersection of SR 146 and Dillon School Drive

Crash Data Overview

Crash data was obtained from ODOT's GIS Crash Analysis Tool (GCAT) site from 2021 to 2023 along SR 146 from the Northpointe Dr intersection to the Dillon School Drive intersection. For the purposes of this study, animal crashes (5 crashes) were omitted, and a non-collision crashes was reclassified as Fixed Object crashes (1 crash). These revisions resulted in a total of 30 crashes which occurred from 2021 to 2023 where the yearly crash rates were similar: 9 crashes in 2021 (30.00%), 11 crashes in 2022 (36.67%), and 10 crashes in 2023 (33.33%). The predominant crash type observed along this segment were rear end crashes (66.67%) followed by sideswipe-passing crashes (13.33%), and fixed object crashes (10.00%) as seen in Figure 5. From 2021 to 2023, the crash severity included minor injury suspected (1 crash, 3.33%), possible injury crashes (4 crashes; 13.33%), and the most reported, property damage only (PDO)/No injury crashes (25 crashes; 83.33%). No fatal and serious injury (FSI) crashes were reported within the study area. Overall, 16.7% of crashes resulted in an injury.

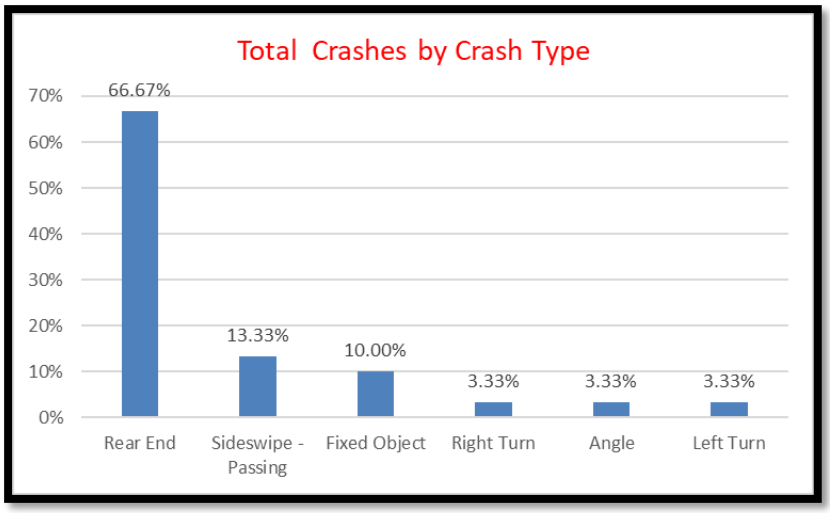


Figure 5 Total Crashes by Crash Type

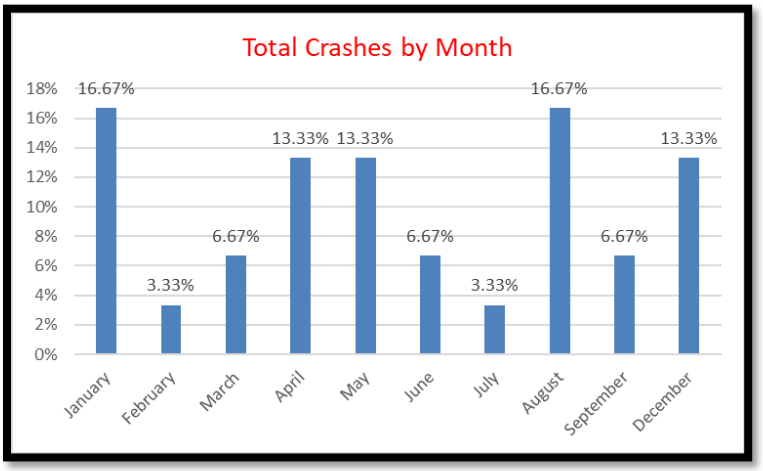


Figure 6 Total Crashes by Month

Throughout the year, from January to December, the crash rates varied monthly as seen in Figure 6. The months of January and August observed the most crashes (16.67%), followed by April, May, and December (13.33%). The months of February and July observed the lowest crash rates at 3.33%.

Looking at the daily crash rates in Figure 7, from Sunday through Thursday, crash rates steadily inclined with the lowest observed on Sunday (3.33%) and the peak occurring on Thursday (23.33%). After Thursday, on Friday and Saturday, crashes decline to 13.33%.

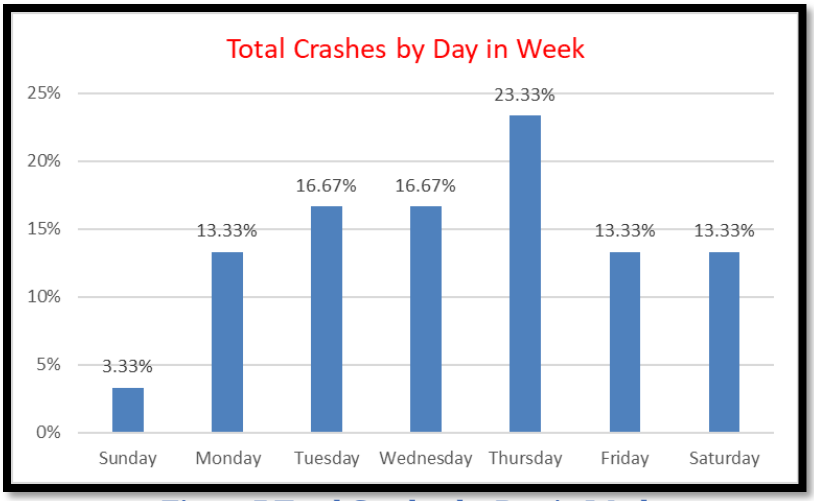


Figure 7 Total Crashes by Day in Week

In a 24-hour period, from 0:00 to 13:00, crash rates were at its lowest (3.33%), but increased for a short period of time at 8:00 (6.67%). From 14:00 to 17:00, crash rates gradually increased to 13.33%, declined at 16:00 to 10.00%, and rapidly increased to peak at 17:00 (26.67%). Then after, a gradual decline in crash rates were observed from 18:00 to 21:00, to mimic early morning hours (3.33%) (Figure 8).

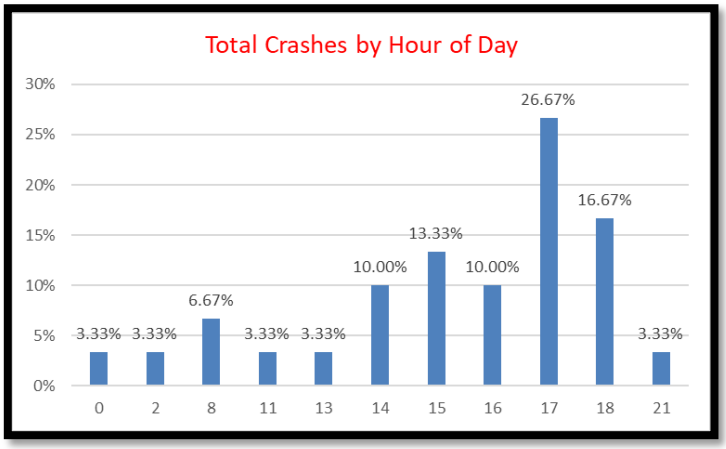


Figure 8 Total Crashes by Hour of Day

Data on the environmental conditions during the crashes were also investigated, these include pavement and weather conditions. Looking at the pavement conditions, of the 30 crashes that occurred in the study area, majority occurred on dry pavement (25 crashes) and 5 crashes occurred on wet pavement. The data on weather conditions showed that majority occurred during clear conditions (18 crashes), followed by cloudy conditions (9 crashes), and rainy conditions (3 crashes).

Crash Collision Diagram

A crash collision diagram visually depicts the crash types occurring at a specific location along a roadway and/or an intersection. For this study, a crash collision diagram was generated for SR 146 from the Northpointe Drive intersection to the Dillon School Drive intersections which can be found in Appendix A. Looking at the collision diagram, majority of the crashes occurred along the roadway segment (19 crashes) and are relatively spread out, with the most frequent crash type being rear-ended crashes (14 crashes). Majority of the rear end crashes are seen to occur between the Northpointe Drive and the Arrow Point Drive intersections and to have the most injury related crashes (3 crashes). Focusing on the intersections in the collision diagram, the Northpointe intersection observed the most crashes: 3 rear-end, 2 angle, 1 fixed-object, and 1 sideswipe-passing crash, followed by the north entrance of the Dillon School Drive with 3 rear-end crashes.

Alternatives Considered

For this study, five alternatives were analyzed to determine ways to better improve roadway safety along SR 146 from Northpointe Dr to Dillon School Drive, specifically focused on alleviating congestion cause by heavy turn movements at SR 146 and Dillon School Drive North. Plan view layouts of these alternatives were created and can be found in Appendix B. Each alternative can be seen listed below with a follow up discussion on identified impacts.

- **No Build:** current configuration as described in Existing Conditions
- **Alternative 1:** Installation of a protected southbound right turn lane at the intersection of SR 146 and Dillon School Dr (North).
- **Alternative 2:** Realigning Dillon School Dr (North) to a near 90^0 angle with SR 146 including the installation of a protected southbound right turn lane at the intersection of SR 146 and Dillon School Dr (North).
- **Alternative 3:** Slip movement for right turning traffic at the intersection of SR 146 and Dillon School Dr (South)
- **Alternative 4:** Placement of a cul-de-sac on Dillon School Dr (South); No entry or exit to and from Dillon School Dr (South).
- **Alternative 5:** Installation a roundabout at the intersection of SR 146 and Dillon School Dr (North)

Design Criteria

As part of alternatives 1 and 2, it was determined a 275-foot storage length, 12 feet wide, with an 8-foot shoulder would be sufficient for the southbound right turn movement. This determination was made using ODOT's Location and Design Manual (L&D) which are detailed below.

Storage Length

- Maximum southbound left turn volumes (PM Peak) = 407 vehs
- From ODOT L&D Volume 1 Figure 401-10
  - 2 phase signal = 60 cycles/hr
  - Average veh/cycle = 407/60 = 6.78 ~ 7
  - Required length = **275 feet**

Lane Width Determination

- Using Figure 301-2 of the ODOT L&D
  - SR 146 Functional classification: Arterial (from TIMS)
  - Design Year ADT: 9907 (from TIMS)
  - Design Speed: 45-50 mph
  - Minimum Lane width = 12 ft

Shoulder Determination

- Using Figure 301-3 of the ODOT L&D
  - SR 146 Functional classification: Arterial (from TIMS)
  - Design Year ADT: 9907 (from TIMS)

- Graded Width; Without Barrier 6:1 or Flatter Foreslope = 8 ft

Alternative 1 proposes the installation of a southbound right turn lane at the intersection of SR 146 and Dillon School Dr (North). With this alternative, a dedicated southbound right turn lane with an accompanying shoulder will impact the adjacent parking lots, Arrow Point Dr, and potentially a homeowner's land. The estimated cost for this alternative is $541,477.20.

Alternative 2 proposes the realignment of Dillon School Dr to a near 90^0 angle. From this modification, three major impacts were identified which include the business drive southwest of the intersection, the two residential homes northwest of the intersection, and grading impacts. (1) Currently there are two access drives serving the business and to limit potential safety issues, this study proposes to close the access drive closest to the intersection. Business traffic shall utilize the access drive further southwest. (2) Residential homes closest to the intersection will be impacted from this alternative, and to remediate this, this study proposes two options; Option 1 shall provide access to the drive from SR 146 and option 2 provides access to the drives from Dillon School Drive. (3) Currently Dillon School Sd (North) intersects with SR 146 at a steep grade and this alternative presents grade impacts for which lowering SR146 at Dillon School Dr (North) might be an option to explore for a smoother grade transition at the intersection.

In addition, truck turning templates were performed for alternative 2 to determine if trucks can safely perform a turn movement. WB-62 truck templates were utilized considering SR 146 is a state route and trucking companies were noticed in the surrounding area. Truck turning templates were created for the eastbound left, southbound right, and eastbound right turn movements. To accommodate the truck turns, the intersection radius had to be increased and the pavement marking on the north and south leg moved back at least 9 feet. The estimated cost for this alternative is $1,632,958.80.

Alternative 3 proposes a slip movement for the eastbound right traffic at the intersection SR 146 and Dillon School Dr (South) thus prohibiting left turns in and out of Dillon School Dr (South). To do this, alongside the slip movement on the west leg of the intersection, the already existing centerline chevrons on the north and south leg of the intersection shall be connected, with the installation of no left turn signage to further prohibit left turn movements at this intersection. The estimated cost for this alternative is $56,212.20.

Alternative 4 proposes the installation of a cul-de-sac at Dillon School Dr (South) to close access to Dillon School Dr (South) from SR 146. This study proposes a 50-foot cul-de-sac radius in accordance with the Muskingum County planning commission revised subdivision regulations. Similar to alternative 3, the already existing centerline chevrons on the north and south leg of the intersection shall be connected and a solid edge line placed at the entrance of Dillon School Dr (South) to keep the through movements past the drive. The estimated cost for this alternative is $471,648.00.

Alternative 5 proposes a roundabout at the intersection of SR146 and Dillon School Dr (North) designed to ODOT standards. With this alternative, the business access drive closest to the intersection shall be closed. Business traffic will still be able to utilize the southwest entrance. Similar to alternative 2, to address the steep grade at SR 146 and Dillon School Dr (North) for alternative 5, lowering SR146 at Dillon School Dr (North) might be an option to explore for a smoother grade transition at the intersection. It should also be noted that there is an existing culvert which runs parallel to Dillon School Drive (North) through the proposed roundabout layout. The estimated cost for this alternative is $3,221,568.00.

Capacity Analysis

The capacity analysis for the existing conditions as well as each alternative were evaluated using the Highway Capacity Software (HCS) version 8.3. This study utilized this software to understand how the capacity of the existing intersections are impacted from the various alternatives, for which the results are discussed below and can be seen in Table 1 and Table 2.

No Build

The existing conditions for the SR 146 & Northpointe Drive intersection experience intersection delays of 27.6 seconds/vehicle (LOS C) and 28.0 seconds/vehicle (LOS C) for the AM peak and PM peak respectively. SR 146 and Dillon School Drive North intersection experience intersection delays of 32.7 seconds/vehicle (LOS C) and 33.3 seconds/vehicle (LOS C) for the AM peak and PM peak respectively. SR 146 and Dillon School Drive South is a stop-controlled intersection for eastbound traffic and does not experience intersection delays.

Alternatives 1 and 2

Alternatives 1 and 2 provided a minor improvement to the intersection delay at SR 146 and Dillon School Drive North. The AM peak delay changed from 32.7 seconds/vehicle to 26.0 seconds/vehicle which kept the level of service at a LOS C. The PM peak delay also had a minor change from 33.3 seconds/vehicle to 26.6 seconds/vehicle which kept the level of service at a LOS C.

Alternative 3

Alternative 3 results in a higher intersection delay at SR 146 and Dillon School Drive North,. The AM peak delay changed from 32.7 seconds/vehicle to 37.1 seconds/vehicle which changed the level of service from a LOS C to a LOS D. The PM peak delay changed from 33.3 seconds/vehicle to 91.8 seconds/vehicle which changed the level of service from a LOS C to a LOS F.

Alternative 4

Alternative 4 results in higher intersection delays at SR 146 and Dillon School Drive North. The AM peak delay changed from 32.7 seconds/vehicle to 42.2 seconds/vehicle which changed the level of service from a LOS C to an LOS D. The PM peak delay changed from 33.3 seconds/vehicle to 91.8 seconds/vehicle which changed the level of service from a LOS C to a LOS F.

Alternative 5

Alternative 5 provided improvements to the intersection delays at SR 146 and Dillon School Drive North. The AM peak delay changed from 32.7 seconds/vehicle to 8.5 seconds/vehicle which changed the level of service from a LOS C to a LOS A. The PM peak delay had a minor change from 33.3 seconds/vehicle to 10.7 seconds/vehicle which changed the level of service from a LOS C to a LOS B.

Table 1. Overall Intersection Delay

Intersection	Existing				Alternative 1 & 2				Alternative 3				Alternative 4				Alternative 5			
	AM		PM		AM		PM		AM		PM		AM		PM		AM		PM	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
SR 146 & Northpointe Dr	27.6	C	28.0	C	27.6	C	28.0	C	27.6	C	28.0	C	27.6	C	28.0	C	27.6	C	28.0	C
SR 146 & Dillon School Dr (North)	32.7	C	33.3	C	26.0	C	26.6	C	37.1	D	41.1	D	42.2	D	41.1	D	8.5	A	10.7	B
SR 146 & Dillon School Dr (South)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Note: Delay in seconds/vehicle

Table 2. Approach Delay

Condition	Intersection	Eastbound				Westbound				Northbound				Southbound			
		AM		PM		AM		PM		AM		PM		AM		PM	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Existing	SR 146 & Northpointe Dr	29.4	C	31.6	C	28.1	C	26.5	C	26.0	C	30.3	C	29.0	C	26.0	C
	SR 146 & Dillon School Dr (North)	36.7	D	38.7	D	-	-	-	-	16.1	B	18.8	B	36.6	D	39.4	D
	SR 146 & Dillon School Dr (South)	17.3	C	26.7	D	-	-	-	-	1.0	A	1.0	A	-	-	-	-
Alternative 1 & 2	SR 146 & Northpointe Dr	29.4	C	31.6	C	28.1	C	26.5	C	26.0	C	30.3	C	29.0	C	26.0	C
	SR 146 & Dillon School Dr (North)	24.5	C	27.5	C	-	-	-	-	24.1	C	27.0	C	27.5	C	25.9	C
	SR 146 & Dillon School Dr (South)	11.6	B	26.7	D	-	-	-	-	1.0	A	1.0	A	-	-	-	-
Alternative 3	SR 146 & Northpointe Dr	29.4	C	31.6	C	28.1	C	26.5	C	26.0	C	30.3	C	29.0	C	26.0	C
	SR 146 & Dillon School Dr (North)	36.7	D	53.7	D	-	-	-	-	38.1	D	52.6	D	36.9	D	26.3	C
	SR 146 & Dillon School Dr (South)	11.5	B	10.8	B	-	-	-	-	0.0	A	0.0	A	-	-	-	-
Alternative 4	SR 146 & Northpointe Dr	29.4	C	31.6	C	28.1	C	26.5	C	26.0	C	30.3	C	29.0	C	26.0	C
	SR 146 & Dillon School Dr (North)	45.4	D	53.7	D	-	-	-	-	44.0	D	52.6	D	39.2	D	26.3	C
	SR 146 & Dillon School Dr (South)	-	-	-	-	-	-	-	-	0.0	A	0.0	A	-	-	-	-
Alternative 5	SR 146 & Northpointe Dr	29.4	C	31.6	C	28.1	C	26.5	C	26.0	C	30.3	C	29.0	C	26.0	C
	SR 146 & Dillon School Dr (North)	9.7	A	9.9	A	-	-	-	-	7.1	A	13.0	B	8.4	A	9.7	A
	SR 146 & Dillon School Dr (South)	11.6	B	26.7	D	-	-	-	-	1.0	A	1.0	A	-	-	-	-

Note: Delay in seconds/vehicle

Safety Analysis

To understand how the crash occurrences along this project site compares to similar sites and how much of an impact each proposed alternatives may have on reducing crashes, this study utilized the economic crash analysis tool (ECAT). The ECAT analyses were performed for the existing and all five proposed alternatives for which the results are summarized in Table 3 with a follow up discussion.

Table 3. ECAT Analysis Summary

Condition		Severity Category				Total
		KA	B	C	O	
Existing	Npredicted	0.5856	2.2512	2.3921	15.0058	20.2347
	Nexpected	0.4806	1.8464	1.8974	11.1133	15.3377
	Npotential for improvement	-0.105	-0.4048	-0.4947	-3.8925	-4.897
Alternative 1 - Turn Lane at Dillon School Dr (North)		0.5719	2.1923	2.3174	14.5605	19.6421
Alternative 2 - Realignment of Dillon School Dr (North)		0.5719	2.1923	2.3174	14.5605	19.6421
Alternative 3 - Slip movement at Dillon School Dr (South)		0.5471	2.147	2.326	14.7742	19.7943
Alternative 4 - Cul-de-sac at Dillon School Dr (South)		0.4698	1.9158	2.1479	13.5563	18.0898
Alternative 5 - Roundabout at Dillon School Dr (North)		0.2432	0.8118	0.5714	4.5659	6.1923

Note: KA: Fatality resulting from crash and serious injuries, B: Minor injuries, C: Possible injuries, O: No injuries/Property damage only

Existing Conditions

From Figure 9, overall, along the study segment, the average crash frequency predicted was 20.23 ($N_{predicted}$) and the average crash frequency expected was 15.33 ($N_{expected}$). This indicates that there have been 4 to 5 fewer crashes occurring at the study site compared to similar sites in the state of Ohio. Intuitively, this may not be a call for concern as the project site is performing better compared to similar sites in Ohio, but crashes are still occurring. There is potential for this site to observe fewer crashes as proven by at least one of the alternatives.

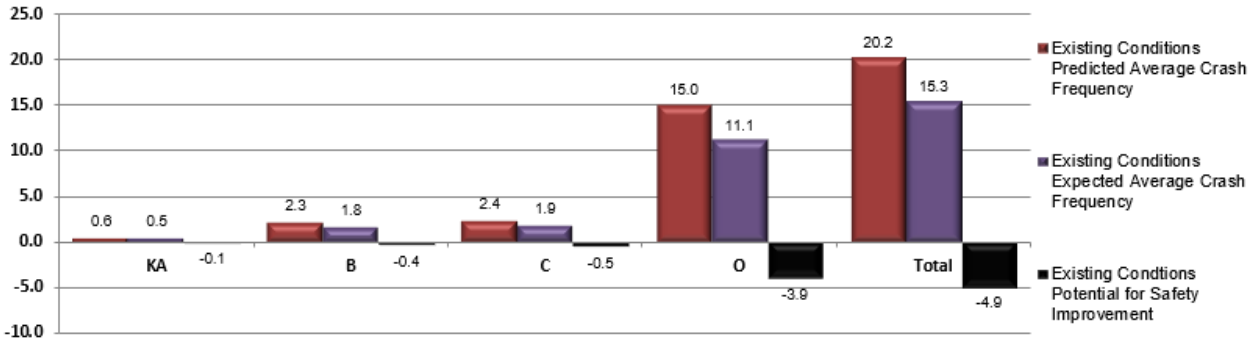


Figure 9. Existing Conditions Safety Performance for MUS-146 (average crashes/year)

Alternative 1 and 2

From Figure 10, installing a right turn lane at the intersection of SR 146 and Dillon School Dr (North) improves the overall safety conditions as the average number of crashes reduces to 19.64 ($N_{proposed}$) compared to similar sites (20.23). Though an improvement, this alternative does not improve crash rates

from the current conditions, as the average expected crash frequency is lower by 4 to 5 crashes. The numbers from Figure 10 are similar to alternative 2 as the only difference between the two alternatives is Dillon School Dr (North) intersecting SR 146 at a near 90-degree angle.

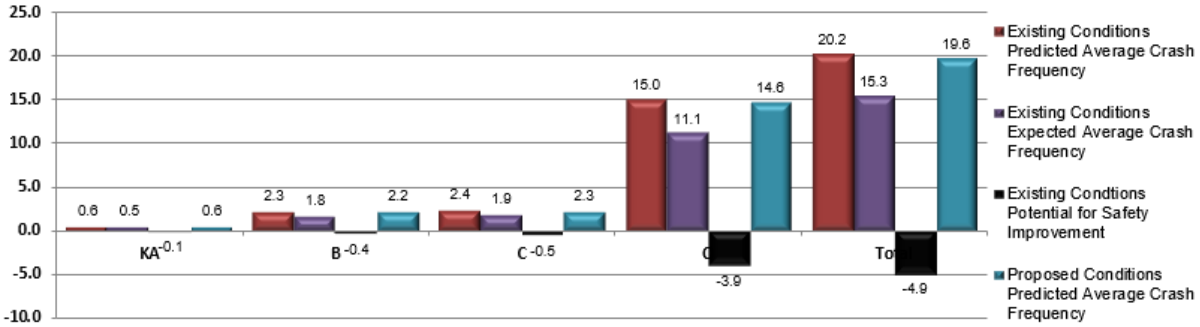


Figure 10. Alternative 1 & 2 Safety Performance for MUS-146 (average crashes/year)

Alternative 3

To create a scenario in the ECAT depicting a slip movement for the eastbound right turn traffic, the number of uncontrolled approaches with a left-turn lane was set to 0 lanes and the crash modification factor (CMF) for replacing direct left-turn with right-turn/U-turn was applied. This led to the proposed average crash frequency (21.13) being higher than both expected and predicted crashes, thus creating a more unsafe area.

Realistically, restricting left turning traffic to and from Dillon School Dr (South), it is expected to observe fewer crashes to occur at this location due to lesser conflict points. For this reason, the number of uncontrolled approaches with a left-turn lane was set to 1 and the CMF to replace direct left-turn with right-turn/U-turn was applied. This scenario in the ECAT resulted in lesser crashes observed compared to the predicted crashes but still higher than the expected crashes, as seen in Figure 11.

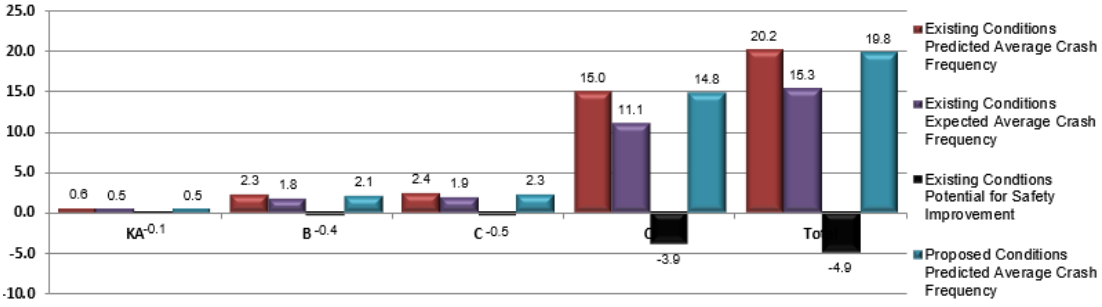


Figure 11. Alternative 3 Safety Performance for MUS-146 (average crashes/year)

Alternative 4

From Figure 12, terminating Dillon School Dr (South) with a cul-de-sac improves the overall safety conditions in the study area (18.1) compared to similar sites (20.2), but still is higher compared to existing conditions (15.3).

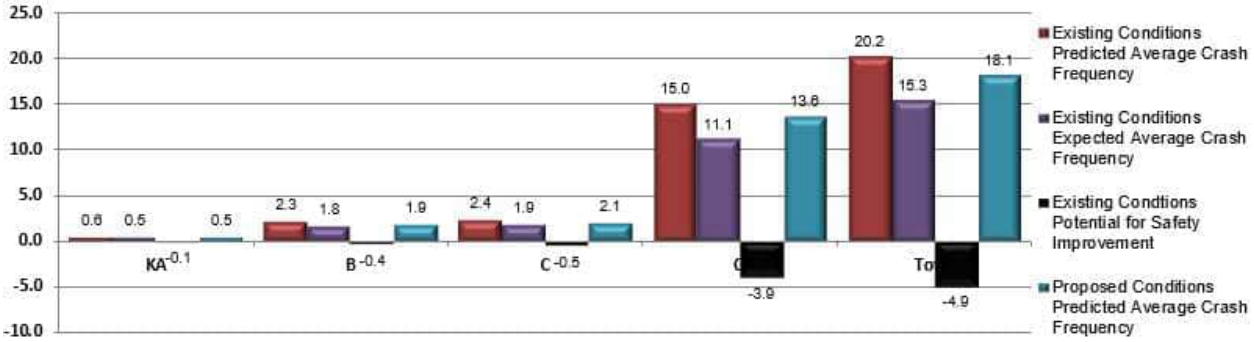


Figure 12. Alternative 4 Safety Performance for MUS-146 (average crashes/year)

Alternative 5

From Figure 13, installing a roundabout at the intersection of SR 146 and Dillon School Dr (North) significantly improves the overall safety conditions in the study area as the average number of crashes reduces to 6.19 compared to both the predicted (20.23) and expected crashes (15.33).

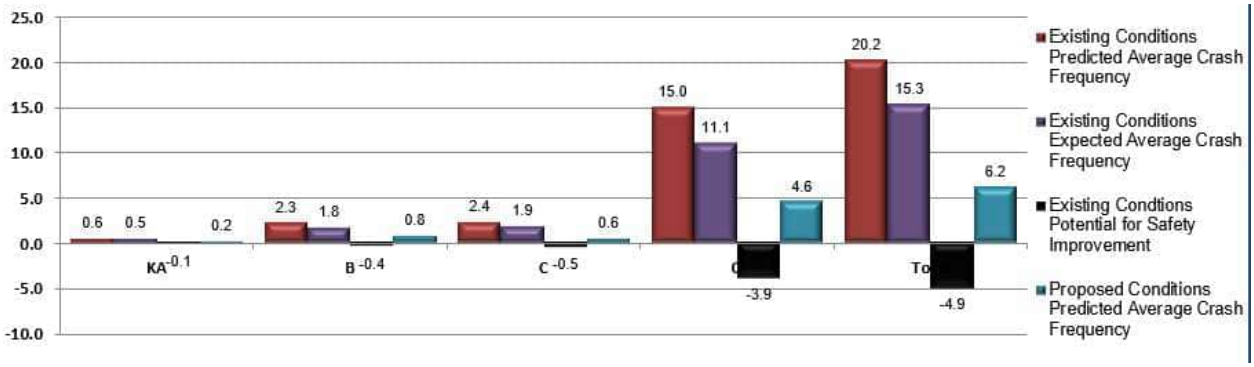


Figure 13 Alternative 5 Safety Performance for MUS-146 (average crashes/year)

Alternatives Summary

This section summarizes the results of the various analyses for each alternative and provides an alternative comparison matrix

Alternative 1 proposes a dedicated southbound right turn lane with an accompanying shoulder at the intersection of SR 146 and Dillon School Dr (North). With this alternative adjacent parking lots, private land, and Arrow Point Dr are seen to be impacted. Though some impacts to the surroundings, the HCS results show improvements in capacity with the LOS becoming better for the AM peak (LOS B to an LOS A) and minor improvements to the LOS during the PM peak (LOS D). The ECAT analysis shows this alternative to perform better compared to similar sites, but does not improve safety conditions compared to existing conditions ($N_{proposed}$ = 19.64; $N_{predicted}$ = 20.23; $N_{Expected}$ = 15.33). The benefit/cost ratio of this alternative 0.42.

Alternative 2 proposes the west leg at the intersection of SR 146 and Dillon School Dr (North) to be realigned at a near 90^0 angle with SR 146 with the inclusion of a southbound right turn lane. With this alternative, adjacent homes northwest of the intersection and the business drive southwest of the intersection shall be impacted. The HCS and ECAT results are similar to alternative 1, as the only

difference between the two alternatives is the skew which does not impact either of these analyses. The benefit/cost ratio of this alternative 0.14.

Alternative 3 proposes a slip movement for the eastbound right traffic at the intersection of SR 146 and Dillon School Dr (South). With this alternative, there are little to no major impacts to the surrounding environment, but impacts are observed in the intersection capacity of SR 146 and Dillon School Drive (North). Since left turns will be prohibited at Dillon School Dr (South), the left turning traffic will head towards Dillon School Dr (North) further increasing the delay at the intersection. The ECAT analysis shows this alternative to perform better compared to similar sites, but does not improve safety conditions compared to existing conditions ($N_{proposed}$ = 19.8; $N_{predicted}$ = 20.23; $N_{Expected}$ = 15.33). The benefit/cost ratio of this alternative 8.22.

Alternative 4 proposes the installation of a cul-de-sac at Dillon School Dr (South). Similar to Alternative 3, left turns will be prohibited at Dillon School Dr (South) resulting in this traffic heading towards the Dillon School Dr (North) intersection. For the Dillon School Dr (North) intersection, this results in the LOS of the AM peak reducing by one letter grade (B to C) and additional delay for the PM peak, but retaining an LOS of D. The ECAT analysis shows this alternative to perform better compared to similar sites, but does not improve safety conditions compared to existing conditions ($N_{proposed}$ = 18.08; $N_{predicted}$ = 20.23; $N_{Expected}$ = 15.33). The benefit/cost ratio of this alternative 3.07.

Alternative 5 proposes a roundabout at the intersection of SR146 and Dillon School Dr (North). HCS results show additional time being added to the delay with no changes to the LOS grade. Though no major improvements to the capacity, the ECAT showcases the reduction in average crash frequency due to the roundabout with significantly lower crashes compared to predicted and expected crashes ($N_{proposed}$ = 6.2; $N_{predicted}$ = 20.23; $N_{Expected}$ = 15.33). The benefit/cost ratio of this alternative 1.74.

Table 4 Alternative Comparison Matrix

Topic	Average predicted Crashes	Average Expected Crashes	Avg Crashes from proposed alternatives	Construction impacts	Property Impacts	AM Peak Congestion		PM Peak Congestion		Cost Estimate	Benefit Cost Ratio
						SR146 & Northpoint Dr	SR146 & Dillon School Dr-North	SR146 & Northpoint Dr	SR146 & Dillon School Dr-North		
No Build	20.234	15.377	N/A	None	None	LOS C	LOS C	LOS C	LOS C	N/A	N/A
Alternative 1 - Turn Lane at Dillon School Dr (North)	N/A	N/A	19.6421	Adjacent parking lots, Arrow Point Drive, potential R/W takes	Yes	LOS C	LOS C	LOS C	LOS C	$257,600	0.78
Alternative 2 - Realignment of Dillon School Dr (North)	N/A	N/A	19.6421	Business drive southwest of the intersection, residential home access drives northwest of the intersection	Yes					$1,235,400	0.16
Alternative 3 - Slip movement at Dillon School Dr (South)	N/A	N/A	19.7943	None	No	LOS C	LOS D	LOS C	LOS D	$30,100	11.57
Alternative 4 - Cul-de-sac at Dillon School Dr (South)	N/A	N/A	18.0898	Trees and shrubs, potential R/W takes	Yes	LOS C	LOS D	LOS C	LOS D	$412,400	3.13
Alternative 5 - Roundabout at Dillon School Dr (North)	N/A	N/A	6.1923	Trees and shrubs, potential R/W takes	Yes	LOS C	LOS A	LOS C	LOS B	$2,183,400	2.1

Table 5 Cost estimate and Safety Impact

Alternative	Cost Estimate	Safety Benefit	Benefit Cost Ratio
Alternative 1 - Turn Lane at Dillon School Dr (North)	$ 257,600.00	Improve eastbound flow of traffic at Dillon School Dr (North)	0.78
Alternative 2 - Realignment of Dillon School Dr (North)	$ 1,235,400.00	Provide northbound right turning vehicles with the ability to make smoother turn	0.16
Alternative 3 - Slip movement at Dillon School Dr (South)	$ 30,100.00	Reduce conflict points at the Dillon School Dr(South) intersection	11.57
Alternative 4 - Cul-de-sac at Dillon School Dr (South)	$ 412,400.00	Eliminate conflict points at the Dillon School Dr (South) intersection	3.13
Alternative 5 - Roundabout at Dillon School Dr (North)	$ 2,230,397.95	Improve overall capacity at the Dillon School North intersection	1.94

Conclusion

ODOT District 5 is conducting a safety study along SR 146 from the Northpointe Drive intersection to the Dillon School Drive intersection in the City of Zanesville, Muskingum County, Ohio. As part of this safety study, crashes were studied from the years of 2021 to 2023 and various alternatives were studied to discern the most appropriate countermeasure to improve safety conditions along this segment.

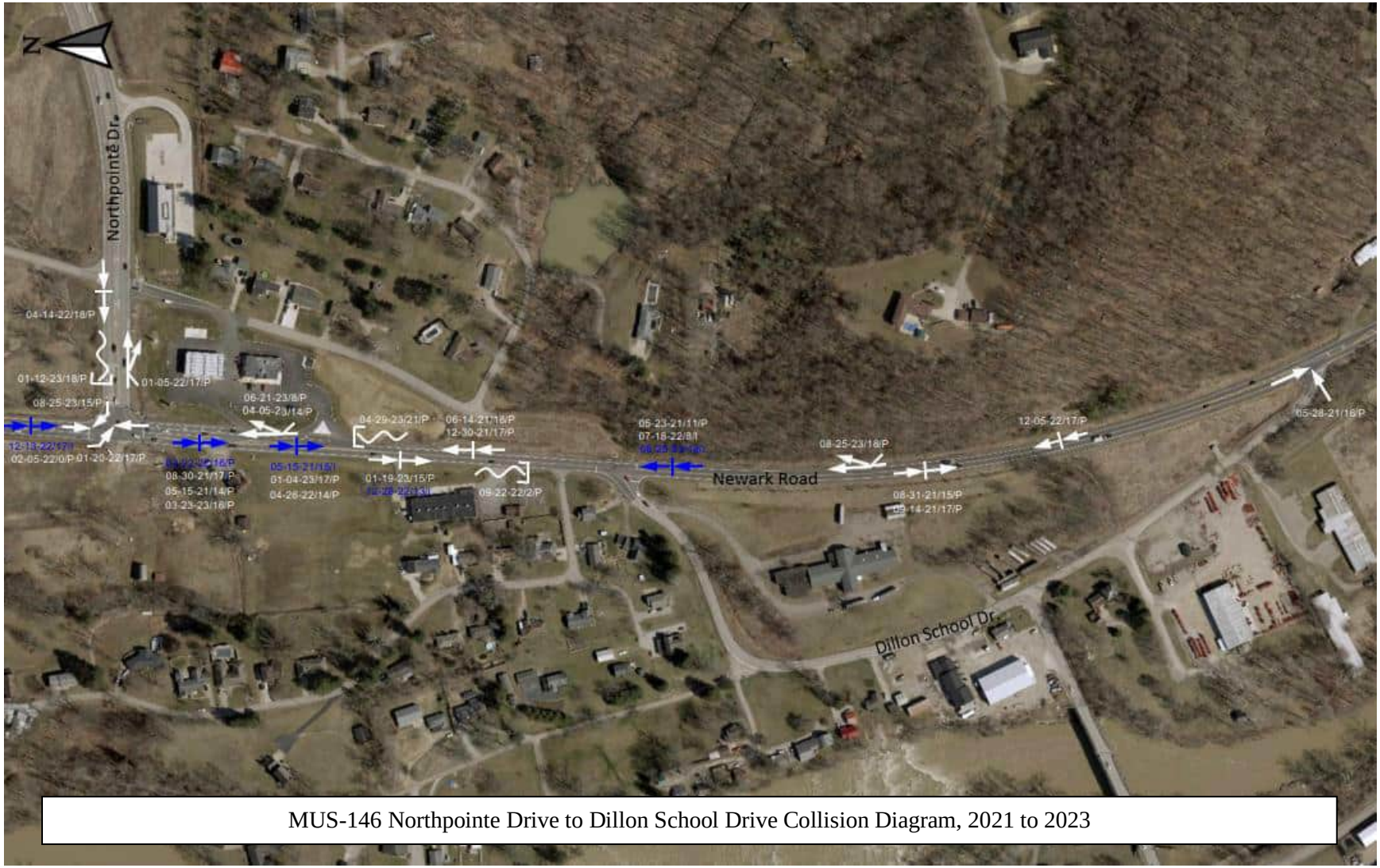
From 2021 to 2023, 30 crashes have occurred within the study area with 2022 recording the most crashes (36.67%) and 2021 recording the least number of crashes (30.00%). The most crash types observed at this intersection were rear end crashes (66.67%) followed by sideswipe-passing crashes (13.33%). Throughout the year, the months of January and August observed the most crashes (16.67%) while February and July observed the least crashes (3.33%). During the week, Thursday observed the most crashes (23.33%) while Sunday observed the least crashes (3.33%). On an hourly basis, the most crashes occurred at 17:00 (26.67%), while the least number of crashes were seen between the hours of 21:00 and 13:00 (3.33%). Majority of these crashes occurred during clear conditions (60.00%) on dry pavement (83.33%).

The crash collision diagram showed that majority of the total crashes occurred along SR 146 (19 crashes) where mostly rear end crashes were recorded (14 crashes). No FSI crashes were reported in the study area, but 5 injury related crashes were reported, where 3 occurred along the roadway and 2 occurred at intersections - all due to rear ended crashes. The Northpointe intersection observed more crashes than any other intersection in the study area with a total of 7 crashes.

Five alternatives were studied which included the installation of a right turn lane at the Dillon School Dr (North) intersection for the southbound direction (Alternative 1), the realignment of Dillon School Dr (North) (Alternative 2), a slip movement at Dillon School Dr (South) for the eastbound traffic (Alternative 3), the installation of a cul-de-sac at Dillon School Dr (South) (Alternative 4), and a roundabout at the Dillon School Dr (North) intersection (Alternative 5). Each of these alternatives have varied benefits for which HCS, ECAT, cost estimates, and benefit/cost analyses were performed to showcase these benefits.

APPENDIX A

Crash Collision Diagram

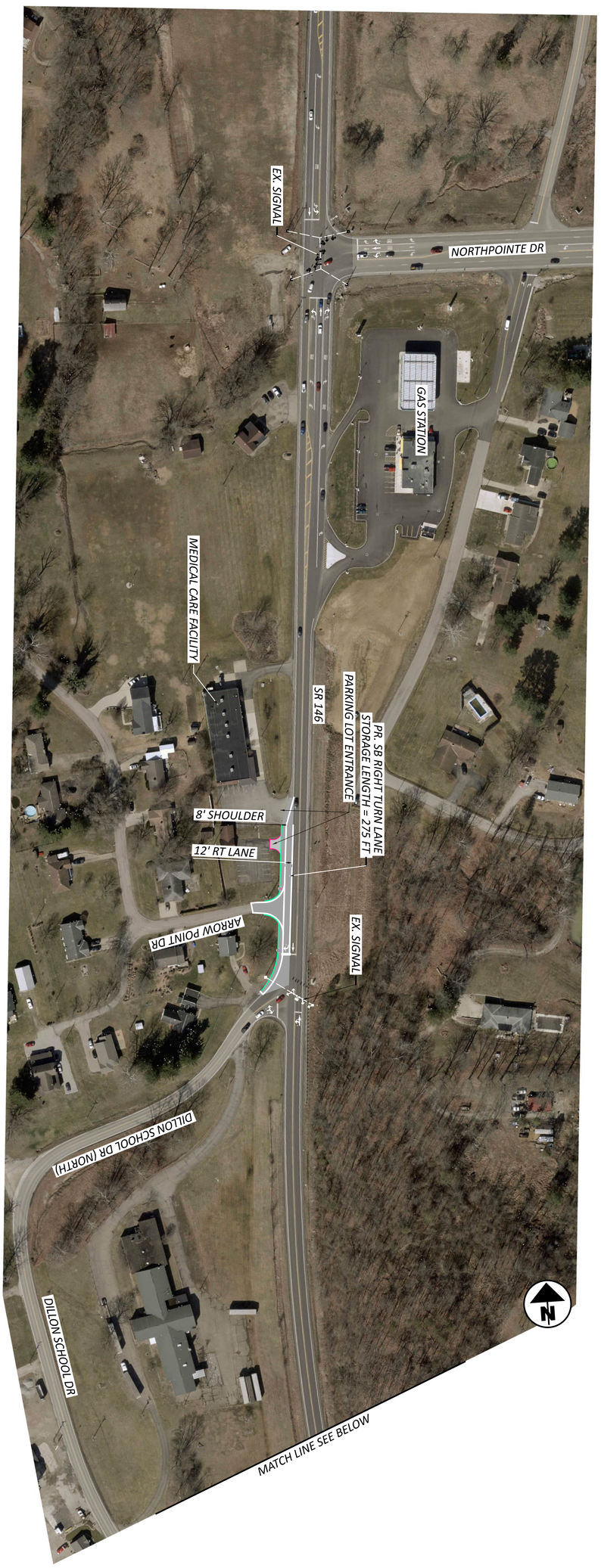


MUS-146 Northpointe Drive to Dillon School Drive Collision Diagram, 2021 to 2023

APPENDIX B

Preliminary Alternatives Plan Layouts

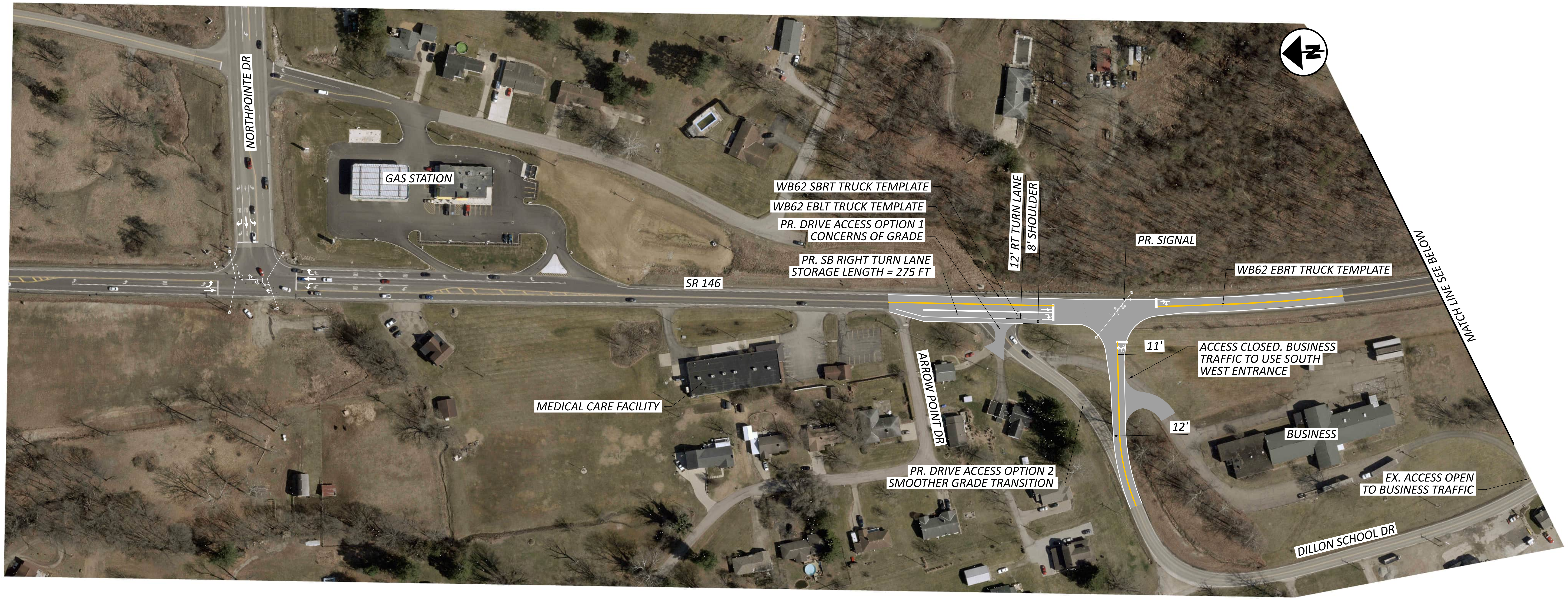
MODEL: CLP_4 - Plan 1 [Sheet] PAPERSIZE: 34x22 (in.) DATE: 8/22/2024 TIME: 12:05:43 PM USER: USNN125005
pw:\\wsp-us-pw.bentley.com:wsp-us-pw-02\Documents\OH - OHIO Projects\Traffic projects\400-Engineering\Traffic\Basemaps\MUS-146\39815_MUS-146_BT001.dgn



SHEET 1 | TOTAL 5	PROJECT ID 120801	REVIEWER NWA 8/11/2024	DESIGNER NN	WSP USA Inc. 2 Miranova Pl, Suite 450 Columbus, OH 43215	DESIGN AGENCY

OH 146: NORTHPOINTE DR. TO DILLON SCHOOL DR. SAFETY STUDY
ALTERNATIVE 1: SOUTHBOUND RIGHT TURN LANE AT DILLON SCHOOL DR (NORTH)

HORIZONTAL SCALE IN FEET
0 100
50 200



HORIZONTAL SCALE IN FEET

0 50 100 200

OH 146: NORTHPOINTE DR. TO DILLON SCHOOL DR. SAFETY STUDY
ALTERNATIVE 2: REALIGNMENT OF DILLON SCHOOL DR (NORTH)

DESIGN AGENCY

WSP

WSP USA, Inc.
2 Miranova Pl,
Suite 450
Columbus, OH 43215

DESIGNER: NN

REVIEWER: NWA 8/11/2024

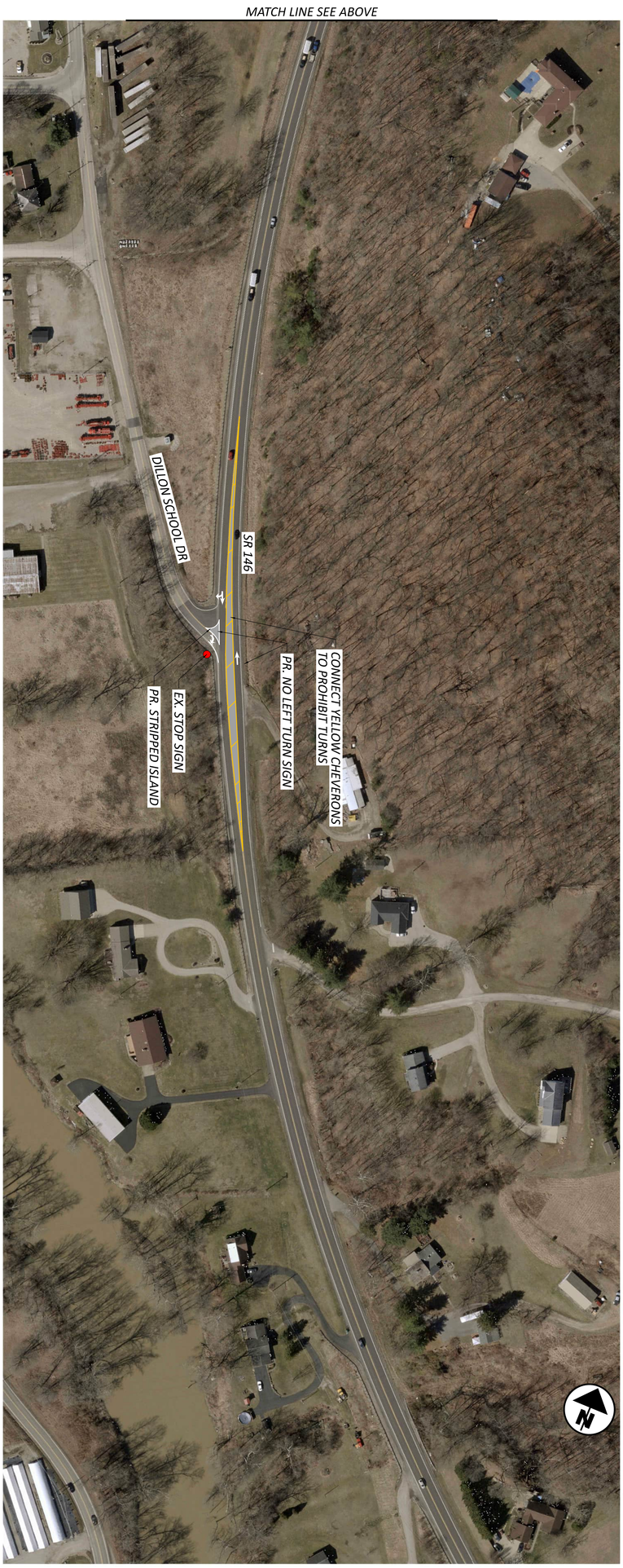
PROJECT ID: 120801

SHEET 2 | TOTAL 5

MUS-146

MODEL: CLP_4 - Plan 1 [Sheet] PAPERSIZE: 34x22 (in.) DATE: 8/11/2024 TIME: 5:06:11 PM USER: USNN125005
pw:\\wsp-us-pw.bentley.com:wsp-us-pw-02\Documents\OH - OHIO Projects\Traffic projects\400-Engineering\Traffic\Basemaps\MUS-146\39815_MUS-146_BT002.dgn

MODEL: CLP_4 - Plan 1 [Sheet] PAPERSIZE: 34x22 (in.) DATE: 8/11/2024 TIME: 5:18:31 PM USER: USNN125005
pw:\\wsp-us-pw.bentley.com:wsp-us-pw-02\Documents\OH - OHIO Projects\Traffic projects\400-Engineering\Traffic\Basemaps\MUS-146\39815_MUS-146_BT003.dgn

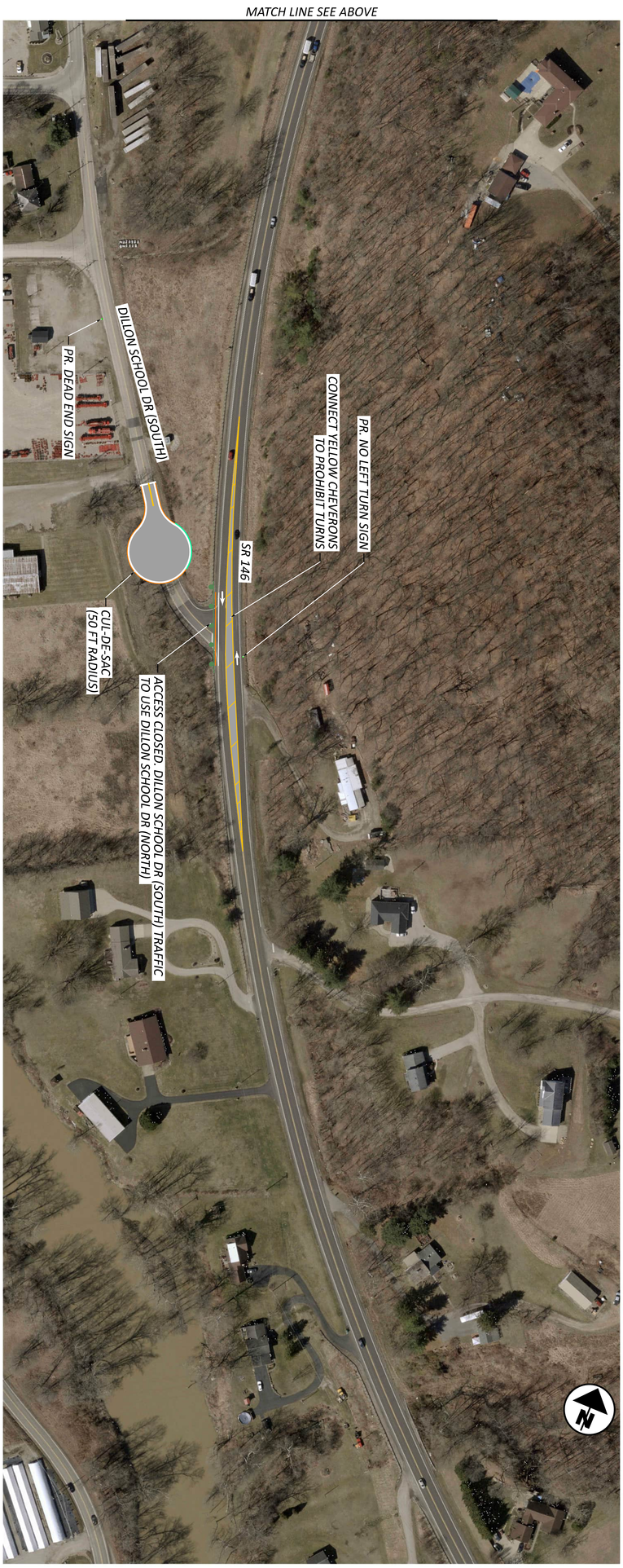


SHEET 3 | TOTAL 5	PROJECT ID 120801	REVIEWER NWA 8/11/2024	DESIGNER NN	WSP USA Inc. 2 Miranova Pl, Suite 450 Columbus, OH 43215	DESIGN AGENCY

OH 146: NORTHPOINTE DR. TO DILLON SCHOOL DR. SAFETY STUDY
ALTERNATIVE 3: SLIP MOVEMENT AT DILLON SCHOOL DR (SOUTH)

HORIZONTAL SCALE IN FEET
0 100
50 200

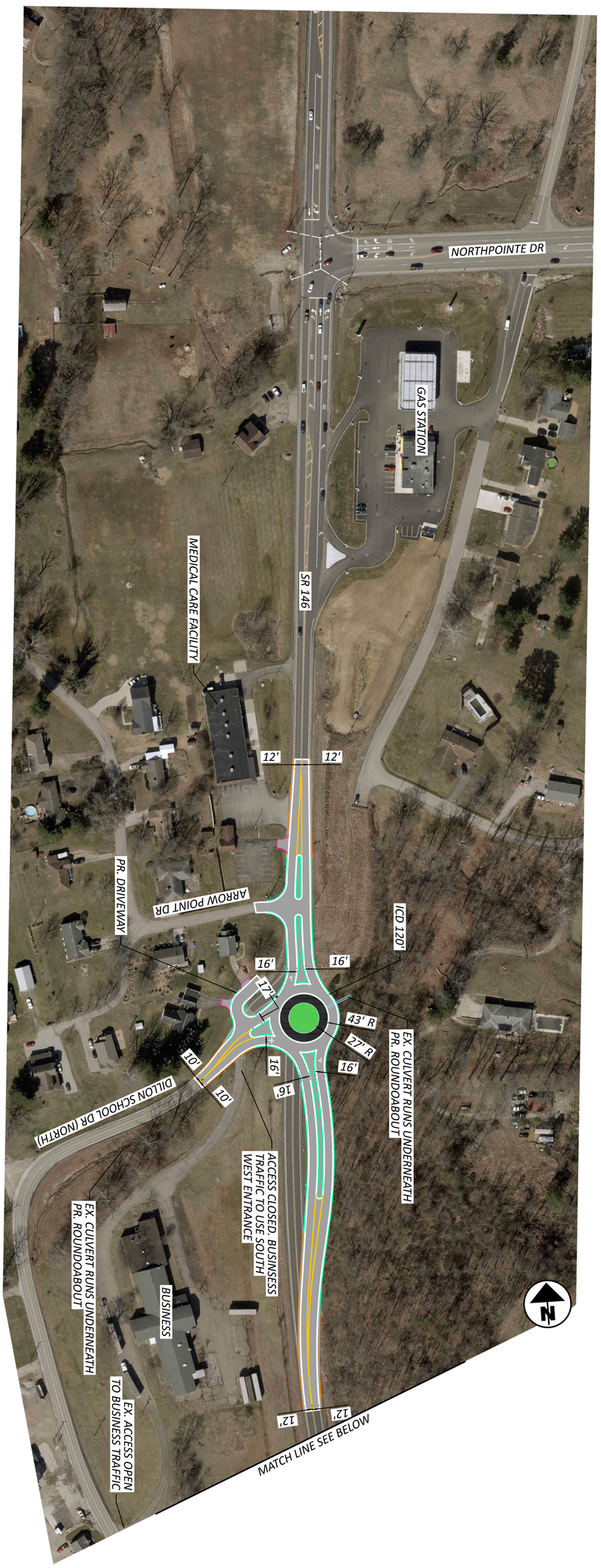
MODEL: CLP_4 - Plan 1 [Sheet] PAPERSIZE: 34x22 (in.) DATE: 8/11/2024 TIME: 5:44:11 PM USER: USNN125005
pw:\\wsp-us-pw.bentley.com:wsp-us-pw-02\Documents\OH - OHIO Projects\Traffic projects\400-Engineering\Traffic\Basemaps\MUS-146\39815_MUS-146_BT004.dgn



SHEET 4 | TOTAL 5	PROJECT ID 120801	REVIEWER NWA 8/11/2024	DESIGNER NN	DESIGN AGENCY WSP USA Inc. 2 Miranova Pl, Suite 450 Columbus, OH 43215	OH 146: NORTHPOINTE DR. TO DILLON SCHOOL DR. SAFETY STUDY ALTERNATIVE 4: CUL-DE-SAC AT DILLON SCHOOL DR (SOUTH)

HORIZONTAL SCALE IN FEET
0 100
50 200

MODEL: CLP_4 - Plan 1 [Sheet] PAPERSIZE: 34x22 (in.) DATE: 8/11/2024 TIME: 5:54:51 PM USER: USNN125005
pw:\\wsp-us-pw.bentley.com:wsp-us-pw-02\Documents\OH - OHIO Projects\Traffic projects\400-Engineering\Traffic\Basemaps\MUS-146\39815_MUS-146_BT005.dgn



SHEET 5 / TOTAL 5	PROJECT ID 120801	REVIEWER NWA 8/11/2024	DESIGNER NN	WSP USA Inc. 2 Miranova Pl, Suite 450 Columbus, OH 43215	DESIGN AGENCY

OH 146: NORTHPOINTE DR. TO DILLON SCHOOL DR. SAFETY STUDY
ALTERNATIVE 5: ROUNDABOUT AT DILLON SCHOOL DR (NORTH)

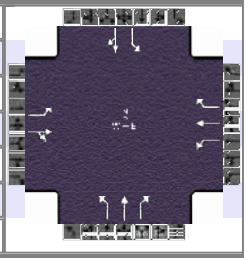
HORIZONTAL SCALE IN FEET
0 100
50 200

APPENDIX C

HCS Results

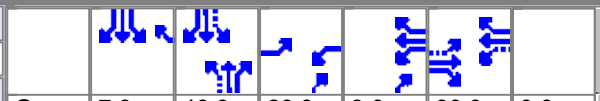
HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	Aug 8, 2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.88
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_AM Peak_Existing.xus		
Project Description	Existing AM Peak				

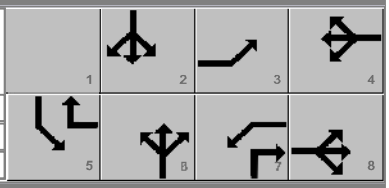


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	337	1	91	1	214	343	170	326	1

Signal Information			
Cycle, s	120.0	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	7.0	40.0	20.0	3.0	30.0	0.0
Yellow	3.5	3.5	3.5	0.0	3.5	0.0
Red	1.5	1.5	1.5	0.0	1.5	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		6	5	2
Case Number	1.1	4.0	1.1	3.0		5.3	1.0	4.0
Phase Duration, s	25.0	35.0	28.0	38.0		45.0	12.0	57.0
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.0	3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s	2.0	2.1	23.3	8.5		23.0	9.0	21.3
Green Extension Time (g_e), s	0.0	0.2	0.0	0.2		1.9	0.0	1.9
Phase Call Probability	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability	0.00	0.00	1.00	0.00		0.01	1.00	0.00

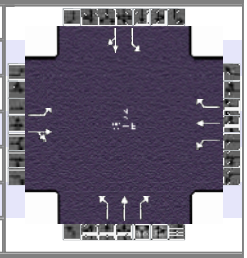
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		383	1	103	1	243	390	193	372	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1667	1606		1589	1750	1367	1027	1641	1448	1641	1681	
Queue Service Time (g_s), s	0.0	0.1		21.3	0.1	6.5	0.1	13.9	21.0	7.0	19.3	
Cycle Queue Clearance Time (g_c), s	0.0	0.1		21.3	0.1	6.5	7.4	13.9	21.0	7.0	19.3	
Green Ratio (*g/C*)	0.42	0.25		0.44	0.27	0.33	0.33	0.33	0.53	0.41	0.43	
Capacity (*c*), veh/h	697	401		705	481	456	340	547	760	403	728	
Volume-to-Capacity Ratio (*X*)	0.002	0.006		0.543	0.002	0.227	0.003	0.445	0.513	0.480	0.510	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		310	1	108	1	234	268	85	297	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		11.8	0.0	4.0	0.0	8.8	10.5	3.3	11.4	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.13	0.00	0.00	0.00	0.00	0.46	0.26	0.00	
Uniform Delay (d_1), s/veh	20.4	33.8		24.6	31.6	28.8	31.8	31.3	18.5	28.1	24.7	
Incremental Delay (d_2), s/veh	0.0	0.0		3.0	0.0	1.2	0.0	2.6	2.5	4.1	2.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	20.4	33.8		27.6	31.6	30.0	31.8	33.9	21.0	32.2	27.3	
Level of Service (LOS)	C	C		C	C	C	C	C	C	C	C	
Approach Delay, s/veh / LOS	29.4	C		28.1	C		26.0	C		29.0	C	
Intersection Delay, s/veh / LOS	27.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.94	B	2.12	B	1.92	B
Bicycle LOS Score / LOS	0.49	A	1.29	A	1.53	B	1.42	A

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

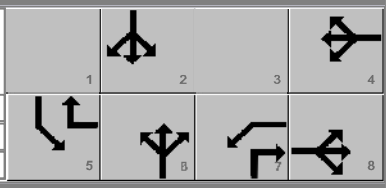
General Information				Intersection Information	
Agency	WSP			Duration, h	1.000
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	1.00
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_PM Peak_Existing.xus		
Project Description	Existing PM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	432	1	229	1	336	496	182	312	1

Signal Information			
Cycle, s	120.0	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	7.0	43.0	17.0	33.0	0.0	0.0
Yellow	3.5	3.5	3.5	3.5	0.0	0.0
Red	1.5	1.5	1.5	1.5	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8	7	4		6	5	2
Case Number		6.3	1.0	3.0		5.3	1.0	4.0
Phase Duration, s		38.0	22.0	60.0		48.0	12.0	60.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s		2.1	19.0	12.7		32.5	9.0	16.7
Green Extension Time (g_e), s		0.5	0.0	0.5		2.0	0.0	2.3
Phase Call Probability		1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability		0.00	1.00	0.00		0.11	1.00	0.00

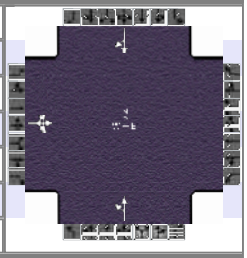
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		432	1	229	1	336	496	182	313	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1439	1606		1654	1750	1471	1083	1709	1471	1667	1694	
Queue Service Time (g_s), s	0.1	0.1		17.0	0.0	10.7	0.1	18.8	30.5	7.0	14.7	
Cycle Queue Clearance Time (g_c), s	0.1	0.1		17.0	0.0	10.7	2.8	18.8	30.5	7.0	14.7	
Green Ratio (*g/C*)	0.28	0.28		0.43	0.46	0.52	0.36	0.36	0.50	0.43	0.46	
Capacity (*c*), veh/h	456	442		685	802	760	423	612	736	371	777	
Volume-to-Capacity Ratio (*X*)	0.002	0.005		0.631	0.001	0.301	0.002	0.549	0.674	0.491	0.403	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		361	1	152	1	299	379	151	233	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		14.3	0.0	6.1	0.0	11.7	15.0	6.0	9.0	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.49	0.00	0.00	0.00	0.00	0.65	0.46	0.00	
Uniform Delay (d_1), s/veh	31.6	31.6		26.7	17.6	16.6	26.5	30.7	22.6	26.1	21.6	
Incremental Delay (d_2), s/veh	0.0	0.0		4.5	0.0	1.0	0.0	3.6	5.0	4.7	1.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	31.6	31.6		31.2	17.6	17.6	26.5	34.3	27.6	30.8	23.2	
Level of Service (LOS)	C	C		C	B	B	C	C	C	C	C	
Approach Delay, s/veh / LOS	31.6	C		26.5	C		30.3	C		26.0	C	
Intersection Delay, s/veh / LOS	28.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.91	B	2.12	B	1.91	B
Bicycle LOS Score / LOS	0.49	A	1.58	B	1.86	B	1.30	A

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

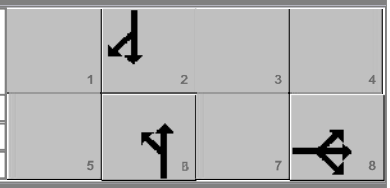
General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.89
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_AM Peak_Exi…		
Project Description	Existing AM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	355	0	0				0	240			384	273

Signal Information			
Cycle, s	120.0	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	65.0	45.0	0.0	0.0	0.0	0.0	
Yellow	3.5	3.5	0.0	0.0	0.0	0.0	
Red	1.5	1.5	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		8.0
Phase Duration, s		50.0				70.0		70.0
Change Period, ($Y+R_c$), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.0				3.0		3.0
Queue Clearance Time (g_s), s		26.6				13.1		51.9
Green Extension Time (g_e), s		0.7				2.1		1.9
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.00				0.00		0.03

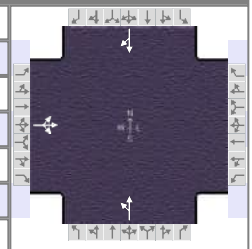
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		399						0			738	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1615						0			1552	
Queue Service Time (g_s), s		24.6						0.0			49.9	
Cycle Queue Clearance Time (g_c), s		24.6						0.0			49.9	
Green Ratio (*g/C*)		0.38									0.54	
Capacity (*c*), veh/h		606									841	
Volume-to-Capacity Ratio (*X*)		0.659						0.000			0.878	
Back of Queue (*Q*), ft/ln (95 th percentile)		394						0			698	
Back of Queue (*Q*), veh/ln (95 th percentile)		15.3						0.0			26.6	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	
Uniform Delay (d_1), s/veh		31.1									24.0	
Incremental Delay (d_2), s/veh		5.5						0.0			12.6	
Initial Queue Delay (d_3), s/veh		0.0						0.0			0.0	
Control Delay (*d*), s/veh		36.7									36.6	
Level of Service (LOS)		D									D	
Approach Delay, s/veh / LOS	36.7	D		0.0			16.1	B		36.6	D	
Intersection Delay, s/veh / LOS	32.7						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.74	B	1.38	A	1.38	A
Bicycle LOS Score / LOS	1.15	A			0.93	A	1.71	B

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

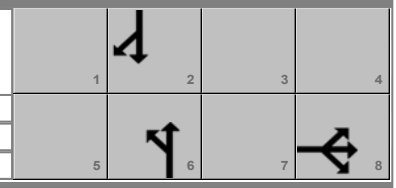
General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	0.95
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_PM Peak_Exi…		
Project Description	Existing PM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	399	0	1				0	458			337	407

Signal Information			
Cycle, s	120.0	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	66.0	44.0	0.0	0.0	0.0	0.0	
Yellow	3.5	3.5	0.0	0.0	0.0	0.0	
Red	1.5	1.5	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		8.0
Phase Duration, s		49.0				71.0		71.0
Change Period, ($Y+R_c$), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.0				3.1		3.1
Queue Clearance Time (g_s), s		28.0				23.0		55.9
Green Extension Time (g_e), s		0.7				2.8		2.3
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.00				0.00		0.16

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		421						0			783	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1653						0			1568	
Queue Service Time (g_s), s		26.0						0.0			53.9	
Cycle Queue Clearance Time (g_c), s		26.0						0.0			53.9	
Green Ratio (*g/C*)		0.37									0.55	
Capacity (*c*), veh/h		606									863	
Volume-to-Capacity Ratio (*X*)		0.695						0.000			0.908	
Back of Queue (*Q*), ft/ln (95 th percentile)		414						0			739	
Back of Queue (*Q*), veh/ln (95 th percentile)		16.4						0.0			29.1	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	
Uniform Delay (d_1), s/veh		32.3									24.3	
Incremental Delay (d_2), s/veh		6.5						0.0			15.1	
Initial Queue Delay (d_3), s/veh		0.0						0.0			0.0	
Control Delay (*d*), s/veh		38.7									39.4	
Level of Service (LOS)		D									D	
Approach Delay, s/veh / LOS	38.7	D		0.0			18.8	B		39.4	D	
Intersection Delay, s/veh / LOS	33.3						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.74	B	1.38	A	1.38	A
Bicycle LOS Score / LOS	1.18	A			1.28	A	1.78	B

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Two-Way Stop-Control Report

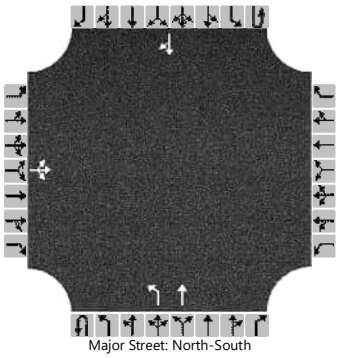
General Information

Analyst	JET
Agency/Co.	WSP
Date Performed	6/5/2024
Analysis Year	2024
Time Analyzed	Exisitng AM PEAK
Intersection Orientation	North-South
Project Description	SR 146 Intersections

Site Information

Intersection	SR 146 & Dillon School Dr (South)
Jurisdiction	ODOT D5
East/West Street	Dillon School Dr (South)
North/South Street	SR 146
Peak Hour Factor	0.91
Analysis Time Period (hrs)	1.00

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		1	26	0						34	243				370	2
Percent Heavy Vehicles (%)		0	7	0						3						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.57	6.20						4.13						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.06	3.30						2.23						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			30							37						
Capacity, c (veh/h)			323							1145						
v/c Ratio			0.09							0.03						
95% Queue Length, Q_{95} (veh)			0.3							0.1						
95% Queue Length, Q_{95} (ft)			7.9							2.6						
Control Delay (s/veh)			17.3							8.2						
Level of Service (LOS)			C							A						
Approach Delay (s/veh)		17.3								1.0						
Approach LOS		C								A						

Copyright © 2024 University of Florida. All Rights Reserved.

HCS Two-Way Stop-Control Report

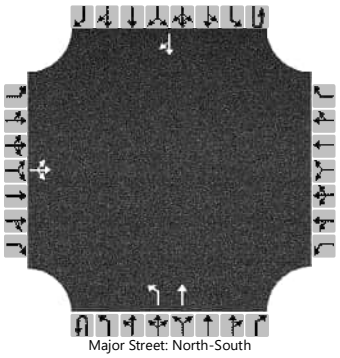
General Information

Analyst	JET
Agency/Co.	WSP
Date Performed	6/5/2024
Analysis Year	2024
Time Analyzed	Existing PM PEAK
Intersection Orientation	North-South
Project Description	SR 146 Intersections

Site Information

Intersection	SR 146 & Dillon School Dr (South)
Jurisdiction	ODOT D5
East/West Street	Dillon School Dr (South)
North/South Street	SR 146
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		5	57	0						59	449				340	0
Percent Heavy Vehicles (%)		0	2	0						2						
Proportion Time Blocked																
Percent Grade (%)		0														
Right Turn Channelized																
Median Type | Storage		Undivided														

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.52	6.20						4.12						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.02	3.30						2.22						

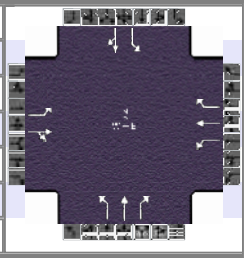
Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			67							64						
Capacity, c (veh/h)			233							1191						
v/c Ratio			0.29							0.05						
95% Queue Length, Q_{95} (veh)			1.2							0.2						
95% Queue Length, Q_{95} (ft)			30.4							5.1						
Control Delay (s/veh)			26.7							8.2						
Level of Service (LOS)			D							A						
Approach Delay (s/veh)		26.7								1.0						
Approach LOS		D								A						

Copyright © 2024 University of Florida. All Rights Reserved.

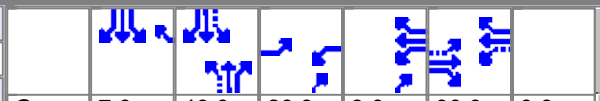
HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.88
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_AM Peak_Alternative 1....		
Project Description	Alternative 1 AM Peak				

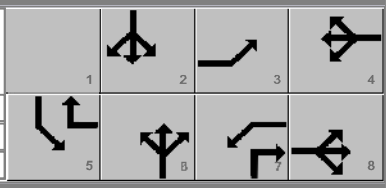


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	337	1	91	1	214	343	170	326	1

Signal Information			
Cycle, s	120.0	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	7.0	40.0	20.0	3.0	30.0	0.0
Yellow	3.5	3.5	3.5	0.0	3.5	0.0
Red	1.5	1.5	1.5	0.0	1.5	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		6	5	2
Case Number	1.1	4.0	1.1	3.0		5.3	1.0	4.0
Phase Duration, s	25.0	35.0	28.0	38.0		45.0	12.0	57.0
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.0	3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s	2.0	2.1	23.3	8.5		23.0	9.0	21.3
Green Extension Time (g_e), s	0.0	0.2	0.0	0.2		1.9	0.0	1.9
Phase Call Probability	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability	0.00	0.00	1.00	0.00		0.01	1.00	0.00

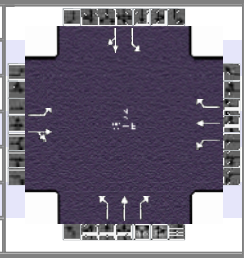
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		383	1	103	1	243	390	193	372	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1667	1606		1589	1750	1367	1027	1641	1448	1641	1681	
Queue Service Time (g_s), s	0.0	0.1		21.3	0.1	6.5	0.1	13.9	21.0	7.0	19.3	
Cycle Queue Clearance Time (g_c), s	0.0	0.1		21.3	0.1	6.5	7.4	13.9	21.0	7.0	19.3	
Green Ratio (*g/C*)	0.42	0.25		0.44	0.27	0.33	0.33	0.33	0.53	0.41	0.43	
Capacity (*c*), veh/h	697	401		705	481	456	340	547	760	403	728	
Volume-to-Capacity Ratio (*X*)	0.002	0.006		0.543	0.002	0.227	0.003	0.445	0.513	0.480	0.510	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		310	1	108	1	234	268	85	297	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		11.8	0.0	4.0	0.0	8.8	10.5	3.3	11.4	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.13	0.00	0.00	0.00	0.00	0.46	0.26	0.00	
Uniform Delay (d_1), s/veh	20.4	33.8		24.6	31.6	28.8	31.8	31.3	18.5	28.1	24.7	
Incremental Delay (d_2), s/veh	0.0	0.0		3.0	0.0	1.2	0.0	2.6	2.5	4.1	2.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	20.4	33.8		27.6	31.6	30.0	31.8	33.9	21.0	32.2	27.3	
Level of Service (LOS)	C	C		C	C	C	C	C	C	C	C	
Approach Delay, s/veh / LOS	29.4	C		28.1	C		26.0	C		29.0	C	
Intersection Delay, s/veh / LOS	27.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.94	B	2.12	B	1.92	B
Bicycle LOS Score / LOS	0.49	A	1.29	A	1.53	B	1.42	A

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

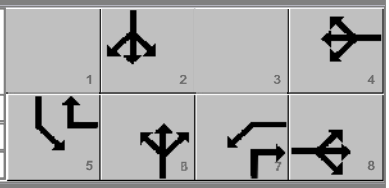
General Information				Intersection Information	
Agency	WSP			Duration, h	1.000
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	1.00
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_PM Peak_Alternative 1....		
Project Description	Alternative 1 PM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	432	1	229	1	336	496	182	312	1

Signal Information			
Cycle, s	120.0	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	7.0	43.0	17.0	33.0	0.0	0.0
Yellow	3.5	3.5	3.5	3.5	0.0	0.0
Red	1.5	1.5	1.5	1.5	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8	7	4		6	5	2
Case Number		6.3	1.0	3.0		5.3	1.0	4.0
Phase Duration, s		38.0	22.0	60.0		48.0	12.0	60.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s		2.1	19.0	12.7		32.5	9.0	16.7
Green Extension Time (g_e), s		0.5	0.0	0.5		2.0	0.0	2.3
Phase Call Probability		1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability		0.00	1.00	0.00		0.11	1.00	0.00

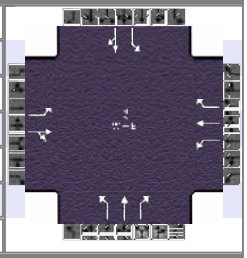
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		432	1	229	1	336	496	182	313	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1439	1606		1654	1750	1471	1083	1709	1471	1667	1694	
Queue Service Time (g_s), s	0.1	0.1		17.0	0.0	10.7	0.1	18.8	30.5	7.0	14.7	
Cycle Queue Clearance Time (g_c), s	0.1	0.1		17.0	0.0	10.7	2.8	18.8	30.5	7.0	14.7	
Green Ratio (*g/C*)	0.28	0.28		0.43	0.46	0.52	0.36	0.36	0.50	0.43	0.46	
Capacity (*c*), veh/h	456	442		685	802	760	423	612	736	371	777	
Volume-to-Capacity Ratio (*X*)	0.002	0.005		0.631	0.001	0.301	0.002	0.549	0.674	0.491	0.403	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		361	1	152	1	299	379	151	233	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		14.3	0.0	6.1	0.0	11.7	15.0	6.0	9.0	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.49	0.00	0.00	0.00	0.00	0.65	0.46	0.00	
Uniform Delay (d_1), s/veh	31.6	31.6		26.7	17.6	16.6	26.5	30.7	22.6	26.1	21.6	
Incremental Delay (d_2), s/veh	0.0	0.0		4.5	0.0	1.0	0.0	3.6	5.0	4.7	1.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	31.6	31.6		31.2	17.6	17.6	26.5	34.3	27.6	30.8	23.2	
Level of Service (LOS)	C	C		C	B	B	C	C	C	C	C	
Approach Delay, s/veh / LOS	31.6	C		26.5	C		30.3	C		26.0	C	
Intersection Delay, s/veh / LOS	28.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.91	B	2.12	B	1.91	B
Bicycle LOS Score / LOS	0.49	A	1.58	B	1.86	B	1.30	A

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

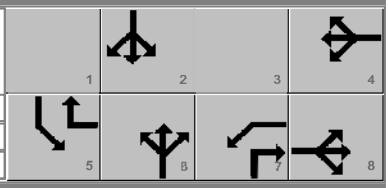
General Information				Intersection Information	
Agency	WSP			Duration, h	1.000
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	1.00
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_PM Peak_Alternative 3....		
Project Description	Alternative 3 PM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	432	1	229	1	336	496	182	312	1

Signal Information			
Cycle, s	120.0	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	7.0	43.0	17.0	33.0	0.0	0.0
Yellow	3.5	3.5	3.5	3.5	0.0	0.0
Red	1.5	1.5	1.5	1.5	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8	7	4		6	5	2
Case Number		6.3	1.0	3.0		5.3	1.0	4.0
Phase Duration, s		38.0	22.0	60.0		48.0	12.0	60.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s		2.1	19.0	12.7		32.5	9.0	16.7
Green Extension Time (g_e), s		0.5	0.0	0.5		2.0	0.0	2.3
Phase Call Probability		1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability		0.00	1.00	0.00		0.11	1.00	0.00

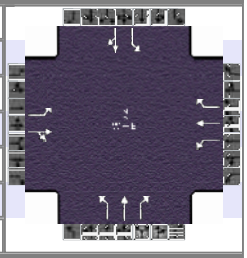
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		432	1	229	1	336	496	182	313	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1439	1606		1654	1750	1471	1083	1709	1471	1667	1694	
Queue Service Time (g_s), s	0.1	0.1		17.0	0.0	10.7	0.1	18.8	30.5	7.0	14.7	
Cycle Queue Clearance Time (g_c), s	0.1	0.1		17.0	0.0	10.7	2.8	18.8	30.5	7.0	14.7	
Green Ratio (*g/C*)	0.28	0.28		0.43	0.46	0.52	0.36	0.36	0.50	0.43	0.46	
Capacity (*c*), veh/h	456	442		685	802	760	423	612	736	371	777	
Volume-to-Capacity Ratio (*X*)	0.002	0.005		0.631	0.001	0.301	0.002	0.549	0.674	0.491	0.403	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		361	1	152	1	299	379	151	233	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		14.3	0.0	6.1	0.0	11.7	15.0	6.0	9.0	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.49	0.00	0.00	0.00	0.00	0.65	0.46	0.00	
Uniform Delay (d_1), s/veh	31.6	31.6		26.7	17.6	16.6	26.5	30.7	22.6	26.1	21.6	
Incremental Delay (d_2), s/veh	0.0	0.0		4.5	0.0	1.0	0.0	3.6	5.0	4.7	1.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	31.6	31.6		31.2	17.6	17.6	26.5	34.3	27.6	30.8	23.2	
Level of Service (LOS)	C	C		C	B	B	C	C	C	C	C	
Approach Delay, s/veh / LOS	31.6	C		26.5	C		30.3	C		26.0	C	
Intersection Delay, s/veh / LOS	28.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.91	B	2.12	B	1.91	B
Bicycle LOS Score / LOS	0.49	A	1.58	B	1.86	B	1.30	A

Copyright © 2024 University of Florida, All Rights Reserved.

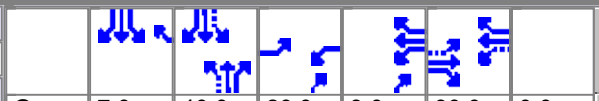
HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.88
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_AM Peak_Alternative 3....		
Project Description	Alternative 3 AM Peak				

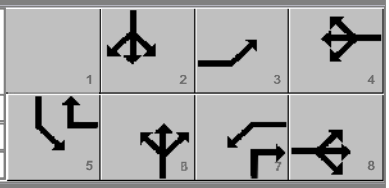


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	337	1	91	1	214	343	170	326	1

Signal Information			
Cycle, s	120.0	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	7.0	40.0	20.0	3.0	30.0	0.0
Yellow	3.5	3.5	3.5	0.0	3.5	0.0
Red	1.5	1.5	1.5	0.0	1.5	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		6	5	2
Case Number	1.1	4.0	1.1	3.0		5.3	1.0	4.0
Phase Duration, s	25.0	35.0	28.0	38.0		45.0	12.0	57.0
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.0	3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s	2.0	2.1	23.3	8.5		23.0	9.0	21.3
Green Extension Time (g_e), s	0.0	0.2	0.0	0.2		1.9	0.0	1.9
Phase Call Probability	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability	0.00	0.00	1.00	0.00		0.01	1.00	0.00

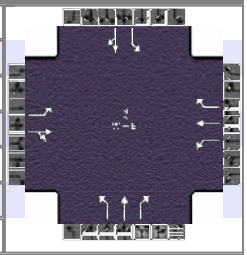
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		383	1	103	1	243	390	193	372	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1667	1606		1589	1750	1367	1027	1641	1448	1641	1681	
Queue Service Time (g_s), s	0.0	0.1		21.3	0.1	6.5	0.1	13.9	21.0	7.0	19.3	
Cycle Queue Clearance Time (g_c), s	0.0	0.1		21.3	0.1	6.5	7.4	13.9	21.0	7.0	19.3	
Green Ratio (*g/C*)	0.42	0.25		0.44	0.27	0.33	0.33	0.33	0.53	0.41	0.43	
Capacity (*c*), veh/h	697	401		705	481	456	340	547	760	403	728	
Volume-to-Capacity Ratio (*X*)	0.002	0.006		0.543	0.002	0.227	0.003	0.445	0.513	0.480	0.510	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		310	1	108	1	234	268	85	297	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		11.8	0.0	4.0	0.0	8.8	10.5	3.3	11.4	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.13	0.00	0.00	0.00	0.00	0.46	0.26	0.00	
Uniform Delay (d_1), s/veh	20.4	33.8		24.6	31.6	28.8	31.8	31.3	18.5	28.1	24.7	
Incremental Delay (d_2), s/veh	0.0	0.0		3.0	0.0	1.2	0.0	2.6	2.5	4.1	2.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	20.4	33.8		27.6	31.6	30.0	31.8	33.9	21.0	32.2	27.3	
Level of Service (LOS)	C	C		C	C	C	C	C	C	C	C	
Approach Delay, s/veh / LOS	29.4	C		28.1	C		26.0	C		29.0	C	
Intersection Delay, s/veh / LOS	27.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.94	B	2.12	B	1.92	B
Bicycle LOS Score / LOS	0.49	A	1.29	A	1.53	B	1.42	A

Copyright © 2024 University of Florida, All Rights Reserved.

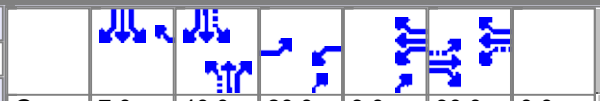
HCS Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.88
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_AM Peak_Alternative 4....		
Project Description	Alternative 4 AM Peak				

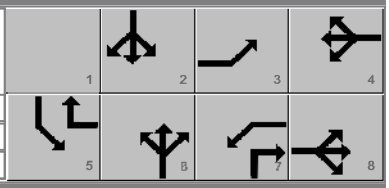


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	337	1	91	1	214	343	170	326	1

Signal Information			
Cycle, s	120.0	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	7.0	40.0	20.0	3.0	30.0	0.0
Yellow	3.5	3.5	3.5	0.0	3.5	0.0
Red	1.5	1.5	1.5	0.0	1.5	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase	3	8	7	4		6	5	2
Case Number	1.1	4.0	1.1	3.0		5.3	1.0	4.0
Phase Duration, s	25.0	35.0	28.0	38.0		45.0	12.0	57.0
Change Period, ($Y+R_c$), s	5.0	5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s	3.0	3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s	2.0	2.1	23.3	8.5		23.0	9.0	21.3
Green Extension Time (g_e), s	0.0	0.2	0.0	0.2		1.9	0.0	1.9
Phase Call Probability	1.00	1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability	0.00	0.00	1.00	0.00		0.01	1.00	0.00

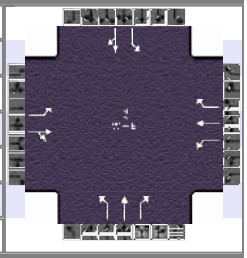
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		383	1	103	1	243	390	193	372	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1667	1606		1589	1750	1367	1027	1641	1448	1641	1681	
Queue Service Time (g_s), s	0.0	0.1		21.3	0.1	6.5	0.1	13.9	21.0	7.0	19.3	
Cycle Queue Clearance Time (g_c), s	0.0	0.1		21.3	0.1	6.5	7.4	13.9	21.0	7.0	19.3	
Green Ratio (*g/C*)	0.42	0.25		0.44	0.27	0.33	0.33	0.33	0.53	0.41	0.43	
Capacity (*c*), veh/h	697	401		705	481	456	340	547	760	403	728	
Volume-to-Capacity Ratio (*X*)	0.002	0.006		0.543	0.002	0.227	0.003	0.445	0.513	0.480	0.510	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		310	1	108	1	234	268	85	297	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		11.8	0.0	4.0	0.0	8.8	10.5	3.3	11.4	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.13	0.00	0.00	0.00	0.00	0.46	0.26	0.00	
Uniform Delay (d_1), s/veh	20.4	33.8		24.6	31.6	28.8	31.8	31.3	18.5	28.1	24.7	
Incremental Delay (d_2), s/veh	0.0	0.0		3.0	0.0	1.2	0.0	2.6	2.5	4.1	2.5	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	20.4	33.8		27.6	31.6	30.0	31.8	33.9	21.0	32.2	27.3	
Level of Service (LOS)	C	C		C	C	C	C	C	C	C	C	
Approach Delay, s/veh / LOS	29.4	C		28.1	C		26.0	C		29.0	C	
Intersection Delay, s/veh / LOS	27.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.94	B	2.12	B	1.92	B
Bicycle LOS Score / LOS	0.49	A	1.29	A	1.53	B	1.42	A

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

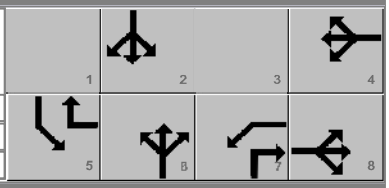
General Information				Intersection Information	
Agency	WSP			Duration, h	1.000
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	1.00
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Northpointe Dr	File Name	SR 146 & Northpointe Dr_PM Peak_Alternative 4....		
Project Description	Alternative 4 PM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	1	1	1	432	1	229	1	336	496	182	312	1

Signal Information			
Cycle, s	120.0	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	7.0	43.0	17.0	33.0	0.0	0.0
Yellow	3.5	3.5	3.5	3.5	0.0	0.0
Red	1.5	1.5	1.5	1.5	0.0	0.0



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8	7	4		6	5	2
Case Number		6.3	1.0	3.0		5.3	1.0	4.0
Phase Duration, s		38.0	22.0	60.0		48.0	12.0	60.0
Change Period, ($Y+R_c$), s		5.0	5.0	5.0		5.0	5.0	5.0
Max Allow Headway (*MAH*), s		3.3	3.0	3.3		3.1	3.0	3.1
Queue Clearance Time (g_s), s		2.1	19.0	12.7		32.5	9.0	16.7
Green Extension Time (g_e), s		0.5	0.0	0.5		2.0	0.0	2.3
Phase Call Probability		1.00	1.00	1.00		1.00	1.00	1.00
Max Out Probability		0.00	1.00	0.00		0.11	1.00	0.00

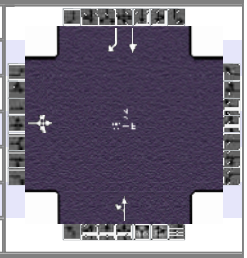
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18	7	4	14	1	6	16	5	2	12
Adjusted Flow Rate (*v*), veh/h	1	2		432	1	229	1	336	496	182	313	
Adjusted Saturation Flow Rate (*s*), veh/h/ln	1439	1606		1654	1750	1471	1083	1709	1471	1667	1694	
Queue Service Time (g_s), s	0.1	0.1		17.0	0.0	10.7	0.1	18.8	30.5	7.0	14.7	
Cycle Queue Clearance Time (g_c), s	0.1	0.1		17.0	0.0	10.7	2.8	18.8	30.5	7.0	14.7	
Green Ratio (*g/C*)	0.28	0.28		0.43	0.46	0.52	0.36	0.36	0.50	0.43	0.46	
Capacity (*c*), veh/h	456	442		685	802	760	423	612	736	371	777	
Volume-to-Capacity Ratio (*X*)	0.002	0.005		0.631	0.001	0.301	0.002	0.549	0.674	0.491	0.403	
Back of Queue (*Q*), ft/ln (90 th percentile)	1	2		361	1	152	1	299	379	151	233	
Back of Queue (*Q*), veh/ln (90 th percentile)	0.0	0.1		14.3	0.0	6.1	0.0	11.7	15.0	6.0	9.0	
Queue Storage Ratio (*RQ*) (90 th percentile)	0.00	0.00		2.49	0.00	0.00	0.00	0.00	0.65	0.46	0.00	
Uniform Delay (d_1), s/veh	31.6	31.6		26.7	17.6	16.6	26.5	30.7	22.6	26.1	21.6	
Incremental Delay (d_2), s/veh	0.0	0.0		4.5	0.0	1.0	0.0	3.6	5.0	4.7	1.6	
Initial Queue Delay (d_3), s/veh	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Control Delay (*d*), s/veh	31.6	31.6		31.2	17.6	17.6	26.5	34.3	27.6	30.8	23.2	
Level of Service (LOS)	C	C		C	B	B	C	C	C	C	C	
Approach Delay, s/veh / LOS	31.6	C		26.5	C		30.3	C		26.0	C	
Intersection Delay, s/veh / LOS	28.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	2.13	B	1.91	B	2.12	B	1.91	B
Bicycle LOS Score / LOS	0.49	A	1.58	B	1.86	B	1.30	A

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

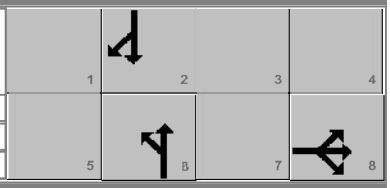
General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.89
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_AM Peak_Alte…		
Project Description	Alternative 1 AM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	355	0	0				0	240			384	273

Signal Information			
Cycle, s	120.0	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	54.0	57.0	0.0	0.0	0.0	0.0	
Yellow	4.0	3.5	0.0	0.0	0.0	0.0	
Red	0.0	1.5	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		7.0
Phase Duration, s		62.0				58.0		58.0
Change Period, ($Y+R_c$), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.0				3.0		3.0
Queue Clearance Time (g_s), s		22.7				15.6		25.4
Green Extension Time (g_e), s		0.7				1.9		1.9
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.00				0.00		0.00

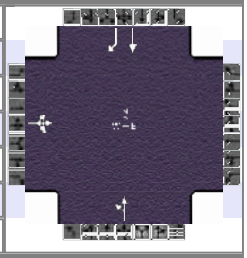
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		399						0			431	307
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1615						0			1668	1483
Queue Service Time (g_s), s		20.7						0.0			23.4	17.5
Cycle Queue Clearance Time (g_c), s		20.7						0.0			23.4	17.5
Green Ratio (*g/C*)		0.48									0.44	0.44
Capacity (*c*), veh/h		767									737	655
Volume-to-Capacity Ratio (*X*)		0.520						0.000			0.586	0.468
Back of Queue (*Q*), ft/ln (95 th percentile)		323						0			380	259
Back of Queue (*Q*), veh/ln (95 th percentile)		12.5						0.0			14.5	10.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	0.00
Uniform Delay (d_1), s/veh		22.0									25.2	23.6
Incremental Delay (d_2), s/veh		2.5						0.0			3.4	2.4
Initial Queue Delay (d_3), s/veh		0.0						0.0			0.0	0.0
Control Delay (*d*), s/veh		24.5									28.6	26.0
Level of Service (LOS)		C									C	C
Approach Delay, s/veh / LOS	24.5	C		0.0			24.1	C		27.5	C	
Intersection Delay, s/veh / LOS	26.0						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.96	B	1.40	A	1.69	B
Bicycle LOS Score / LOS	1.15	A			0.93	A	1.71	B

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

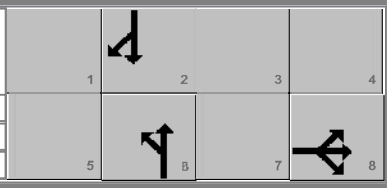
General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	0.95
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_PM Peak_Alte…		
Project Description	Alternative 1 PM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	399	0	1				0	458			337	407

Signal Information			
Cycle, s	120.0	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	56.0	54.0	0.0	0.0	0.0	0.0	
Yellow	3.5	3.5	0.0	0.0	0.0	0.0	
Red	1.5	1.5	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		7.0
Phase Duration, s		59.0				61.0		61.0
Change Period, (*Y+R c*), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.0				3.0		3.0
Queue Clearance Time (*g s*), s		24.6				26.9		28.0
Green Extension Time (*g e*), s		0.8				2.5		2.5
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.00				0.00		0.00

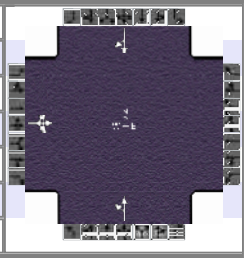
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		421						0			355	428
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1653						0			1723	1483
Queue Service Time (*g s*), s		22.6						0.0			16.6	26.0
Cycle Queue Clearance Time (*g c*), s		22.6						0.0			16.6	26.0
Green Ratio (*g/C*)		0.45									0.47	0.47
Capacity (*c*), veh/h		744									804	692
Volume-to-Capacity Ratio (*X*)		0.566						0.000			0.441	0.619
Back of Queue (*Q*), ft/ln (95 th percentile)		350						0			279	359
Back of Queue (*Q*), veh/ln (95 th percentile)		13.9						0.0			11.0	14.4
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	0.00
Uniform Delay (*d 1*), s/veh		24.4									21.5	24.0
Incremental Delay (*d 2*), s/veh		3.1						0.0			1.8	4.1
Initial Queue Delay (*d 3*), s/veh		0.0						0.0			0.0	0.0
Control Delay (*d*), s/veh		27.5									23.2	28.1
Level of Service (LOS)		C									C	C
Approach Delay, s/veh / LOS	27.5	C		0.0			27.0	C		25.9	C	
Intersection Delay, s/veh / LOS	26.6						C					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.96	B	1.39	A	1.69	B
Bicycle LOS Score / LOS	1.18	A			1.28	A	1.78	B

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

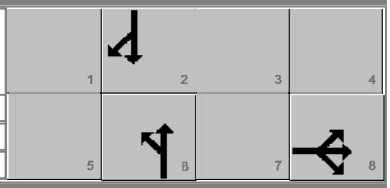
General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.89
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_AM Peak_Alte…		
Project Description	Alternative 3 AM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	356	0	0				34	240			384	275

Signal Information			
Cycle, s	120.0	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	65.0	45.0	0.0	0.0	0.0	0.0	
Yellow	3.5	3.5	0.0	0.0	0.0	0.0	
Red	1.5	1.5	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		8.0
Phase Duration, s		50.0				70.0		70.0
Change Period, (*Y+R c*), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.0				3.1		3.1
Queue Clearance Time (*g s*), s		26.7				62.8		52.2
Green Extension Time (*g e*), s		0.7				0.7		2.1
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.00				1.00		0.05

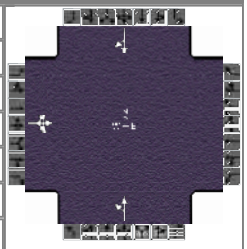
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		400						308			740	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1615						653			1552	
Queue Service Time (*g s*), s		24.7						10.6			50.2	
Cycle Queue Clearance Time (*g c*), s		24.7						60.8			50.2	
Green Ratio (*g/C*)		0.38						0.54			0.54	
Capacity (*c*), veh/h		606						387			840	
Volume-to-Capacity Ratio (*X*)		0.661						0.795			0.881	
Back of Queue (*Q*), ft/ln (95 th percentile)		395						277			703	
Back of Queue (*Q*), veh/ln (95 th percentile)		15.3						10.2			26.8	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	
Uniform Delay (*d 1*), s/veh		31.2						22.7			24.1	
Incremental Delay (*d 2*), s/veh		5.6						15.4			12.8	
Initial Queue Delay (*d 3*), s/veh		0.0						0.0			0.0	
Control Delay (*d*), s/veh		36.7						38.1			36.9	
Level of Service (LOS)		D						D			D	
Approach Delay, s/veh / LOS	36.7	D		0.0			38.1	D		36.9	D	
Intersection Delay, s/veh / LOS	37.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.74	B	1.38	A	1.38	A
Bicycle LOS Score / LOS	1.15	A			1.00	A	1.71	B

Copyright © 2024 University of Florida, All Rights Reserved.

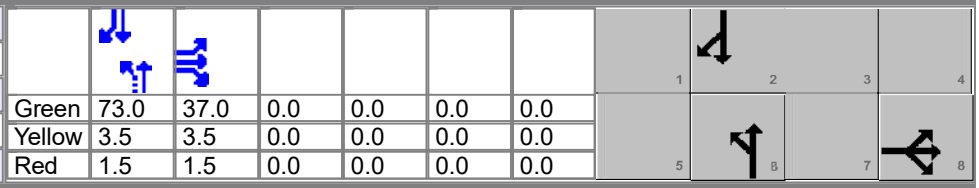
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	Aug 8, 2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	0.95
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_PM Peak_Alte…		
Project Description	Alternative 3 PM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	404	0	1				59	458			337	407

Signal Information			
Cycle, s	120.0	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	73.0	37.0	0.0	0.0	0.0	0.0						
Yellow	3.5	3.5	0.0	0.0	0.0	0.0						
Red	1.5	1.5	0.0	0.0	0.0	0.0						

Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		8.0
Phase Duration, s		42.0				78.0		78.0
Change Period, ($Y+R_c$), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.0				3.2		3.2
Queue Clearance Time (g_s), s		30.8				75.0		48.9
Green Extension Time (g_e), s		0.5				0.0		3.3
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.12				1.00		0.01

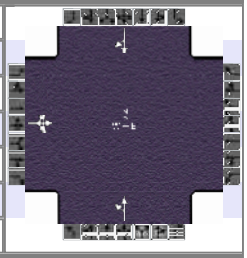
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		426						544			783	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1653						889			1568	
Queue Service Time (g_s), s		28.8						26.1			46.9	
Cycle Queue Clearance Time (g_c), s		28.8						73.0			46.9	
Green Ratio (*g/C*)		0.31						0.61			0.61	
Capacity (*c*), veh/h		510						574			954	
Volume-to-Capacity Ratio (*X*)		0.836						0.948			0.821	
Back of Queue (*Q*), ft/ln (95 th percentile)		486.3						676.1			601.9	
Back of Queue (*Q*), veh/ln (95 th percentile)		19.3						26.6			23.7	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	
Uniform Delay (d_1), s/veh		38.7						25.9			18.4	
Incremental Delay (d_2), s/veh		15.0						26.7			7.9	
Initial Queue Delay (d_3), s/veh		0.0						0.0			0.0	
Control Delay (*d*), s/veh		53.7						52.6			26.3	
Level of Service (LOS)		D						D			C	
Approach Delay, s/veh / LOS	53.7	D		0.0			52.6	D		26.3	C	
Intersection Delay, s/veh / LOS	41.1						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.74	B	1.37	A	1.37	A
Bicycle LOS Score / LOS	1.19	A			1.39	A	1.78	B

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Signalized Intersection Results Summary

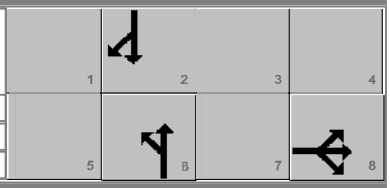
General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	AM Peak	PHF	0.89
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_AM Peak_Alte…		
Project Description	Alternative 4 AM Peak				



Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	356	0	87				34	240			384	275

Signal Information			
Cycle, s	120.0	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	64.0	46.0	0.0	0.0	0.0	0.0	
Yellow	3.5	3.5	0.0	0.0	0.0	0.0	
Red	1.5	1.5	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		8.0
Phase Duration, s		51.0				69.0		69.0
Change Period, ($Y+R_c$), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.1				3.1		3.1
Queue Clearance Time (g_s), s		36.2				64.0		53.1
Green Extension Time (g_e), s		0.8				0.0		2.0
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.02				1.00		0.09

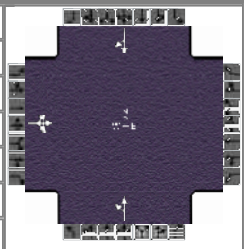
Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		498						308			740	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1576						622			1552	
Queue Service Time (g_s), s		34.2						10.9			51.1	
Cycle Queue Clearance Time (g_c), s		34.2						62.0			51.1	
Green Ratio (*g/C*)		0.38						0.53			0.53	
Capacity (*c*), veh/h		604						366			828	
Volume-to-Capacity Ratio (*X*)		0.824						0.842			0.895	
Back of Queue (*Q*), ft/ln (95 th percentile)		532						296			724	
Back of Queue (*Q*), veh/ln (95 th percentile)		20.6						10.9			27.6	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	
Uniform Delay (d_1), s/veh		33.3						23.6			25.0	
Incremental Delay (d_2), s/veh		12.1						20.4			14.2	
Initial Queue Delay (d_3), s/veh		0.0						0.0			0.0	
Control Delay (*d*), s/veh		45.4						44.0			39.2	
Level of Service (LOS)		D						D			D	
Approach Delay, s/veh / LOS	45.4	D		0.0			44.0	D		39.2	D	
Intersection Delay, s/veh / LOS	42.2						D					

Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.74	B	1.38	A	1.38	A
Bicycle LOS Score / LOS	1.31	A			1.00	A	1.71	B

Copyright © 2024 University of Florida, All Rights Reserved.

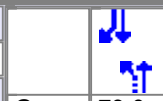
HCS7 Signalized Intersection Results Summary

General Information				Intersection Information	
Agency	WSP			Duration, h	0.250
Analyst	JET	Analysis Date	6/5/2024	Area Type	Other
Jurisdiction	ODOT District 5	Time Period	PM Peak	PHF	0.95
Urban Street	SR 146	Analysis Year	2024	Analysis Period	1> 7:00
Intersection	SR 146 & Dillon School…	File Name	SR 146 & Dillon School Dr (North)_PM Peak_Alte…		
Project Description	Alternative 4 PM Peak				

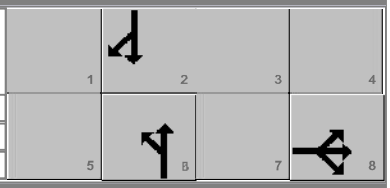


Demand Information	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Demand (*v*), veh/h	404	0	1				59	458			337	407

Signal Information			
Cycle, s	120.0	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	73.0	37.0	0.0	0.0	0.0	0.0	
Yellow	3.5	3.5	0.0	0.0	0.0	0.0	
Red	1.5	1.5	0.0	0.0	0.0	0.0	



Timer Results	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Assigned Phase		8				6		2
Case Number		12.0				8.0		8.0
Phase Duration, s		42.0				78.0		78.0
Change Period, ($Y+R_c$), s		5.0				5.0		5.0
Max Allow Headway (*MAH*), s		3.0				3.2		3.2
Queue Clearance Time (g_s), s		30.8				75.0		48.9
Green Extension Time (g_e), s		0.5				0.0		3.3
Phase Call Probability		1.00				1.00		1.00
Max Out Probability		0.12				1.00		0.01

Movement Group Results	EB			WB			NB			SB		
Approach Movement	L	T	R	L	T	R	L	T	R	L	T	R
Assigned Movement	3	8	18				1	6			2	12
Adjusted Flow Rate (*v*), veh/h		426						544			783	
Adjusted Saturation Flow Rate (*s*), veh/h/ln		1653						889			1568	
Queue Service Time (g_s), s		28.8						26.1			46.9	
Cycle Queue Clearance Time (g_c), s		28.8						73.0			46.9	
Green Ratio (*g/C*)		0.31						0.61			0.61	
Capacity (*c*), veh/h		510						574			954	
Volume-to-Capacity Ratio (*X*)		0.836						0.948			0.821	
Back of Queue (*Q*), ft/ln (95 th percentile)		486.3						676.1			601.9	
Back of Queue (*Q*), veh/ln (95 th percentile)		19.3						26.6			23.7	
Queue Storage Ratio (*RQ*) (95 th percentile)		0.00						0.00			0.00	
Uniform Delay (d_1), s/veh		38.7						25.9			18.4	
Incremental Delay (d_2), s/veh		15.0						26.7			7.9	
Initial Queue Delay (d_3), s/veh		0.0						0.0			0.0	
Control Delay (*d*), s/veh		53.7						52.6			26.3	
Level of Service (LOS)		D						D			C	
Approach Delay, s/veh / LOS	53.7	D		0.0			52.6	D		26.3	C	
Intersection Delay, s/veh / LOS	41.1						D					

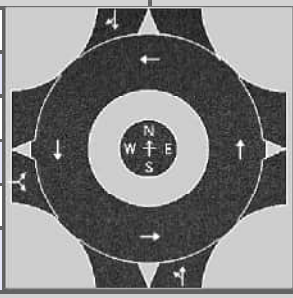
Multimodal Results	EB		WB		NB		SB	
Pedestrian LOS Score / LOS	1.74	B	1.74	B	1.37	A	1.37	A
Bicycle LOS Score / LOS	1.19	A			1.39	A	1.78	B

Copyright © 2024 University of Florida, All Rights Reserved.

HCS Roundabouts Report

General Information

Analyst	JET
Agency or Co.	WSP
Date Performed	8/1/2024
Analysis Year	2024
Time Analyzed	Alternative 5 AM Peak
Project Description	SR 146 Intersections



Site Information

Intersection	SR 146 & Dillon School Dr (...
E/W Street Name	Dillon School Dr (North)
N/S Street Name	SR 146
Analysis Time Period, hrs	0.25
Peak Hour Factor	0.92
Jurisdiction	ODOT D5

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0
Lane Assignment			LR								LT				TR	
Volume (V), veh/h	0	355		0					0	0	240		0		384	273
Percent Heavy Vehicles, %	3	3		3					3	3	3		3		3	3
Flow Rate (v_{PCE}), pc/h	0	397		0					0	0	269		0		430	306
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1								1				1			
Pedestrians Crossing, p/h	0								0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.9763						4.9763			4.9763	
Follow-Up Headway, s		2.6087						2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		397						269			736	
Entry Volume, veh/h		385						261			715	
Circulating Flow (v_c), pc/h	430			666			397			0		
Exiting Flow (v_{ex}), pc/h	0			306			666			430		
Capacity (c_{pce}), pc/h		890						920			1380	
Capacity (c), veh/h		864						894			1340	
v/c Ratio (x)		0.45						0.29			0.53	

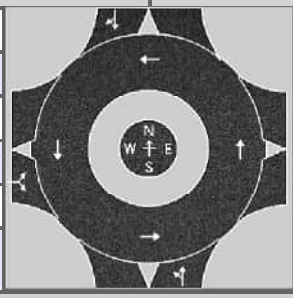
Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		9.7						7.1			8.4	
Lane LOS		A						A			A	
95% Queue Length, Q_{95} (veh)		2.3						1.2			3.3	
95% Queue Length, Q_{95} (ft)		58.9						30.0			84.5	
Approach Delay, s/veh | LOS	9.7	A					7.1	A		8.4	A	
Intersection Delay, s/veh | LOS	8.5						A					

HCS Roundabouts Report

General Information

Analyst	JET
Agency or Co.	WSP
Date Performed	8/1/2024
Analysis Year	2024
Time Analyzed	Alternative 5 PM Peak
Project Description	SR 146 Intersections



Site Information

Intersection	SR 146 & Dillon School Dr (...
E/W Street Name	Dillon School Dr (North)
N/S Street Name	SR 146
Analysis Time Period, hrs	0.25
Peak Hour Factor	0.92
Jurisdiction	ODOT D5

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	0	0	0	0	1	0	0	0	1	0
Lane Assignment			LR								LT				TR	
Volume (V), veh/h	0	399		1					0	0	458		0		337	407
Percent Heavy Vehicles, %	3	3		3					3	3	3		3		3	3
Flow Rate (v_{PCE}), pc/h	0	447		1					0	0	513		0		377	456
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1								1				1			
Pedestrians Crossing, p/h	0								0				0			
Proportion of CAVs, %	0															

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway, s		4.9763						4.9763			4.9763	
Follow-Up Headway, s		2.6087						2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		448						513			833	
Entry Volume, veh/h		435						498			809	
Circulating Flow (v_c), pc/h	377			960			447			0		
Exiting Flow (v_{ex}), pc/h	0			456			960			378		
Capacity (c_{pce}), pc/h		939						875			1380	
Capacity (c), veh/h		912						849			1340	
v/c Ratio (x)		0.48						0.59			0.60	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		9.9						13.0			9.7	
Lane LOS		A						B			A	
95% Queue Length, Q_{95} (veh)		2.6						3.9			4.3	
95% Queue Length, Q_{95} (ft)		66.6						97.5			110.1	
Approach Delay, s/veh | LOS	9.9	A					13.0	B		9.7	A	
Intersection Delay, s/veh | LOS	10.7						B					

HCS Two-Way Stop-Control Report

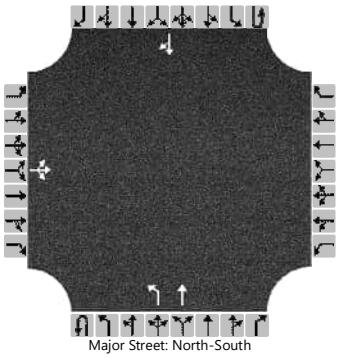
General Information

Analyst	JET
Agency/Co.	WSP
Date Performed	6/5/2024
Analysis Year	2024
Time Analyzed	Alternative 1 AM PEAK
Intersection Orientation	North-South
Project Description	SR 146 Intersections

Site Information

Intersection	SR 146 & Dillon School Dr (South)
Jurisdiction	ODOT D5
East/West Street	Dillon School Dr (South)
North/South Street	SR 146
Peak Hour Factor	0.91
Analysis Time Period (hrs)	1.00

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		1	0	87						34	243				370	2
Percent Heavy Vehicles (%)		0	7	0						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.57	6.20						4.13						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.06	3.30						2.23						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			97							37						
Capacity, c (veh/h)			640							1145						
v/c Ratio			0.15							0.03						
95% Queue Length, Q_{95} (veh)			0.5							0.1						
95% Queue Length, Q_{95} (ft)			12.5							2.6						
Control Delay (s/veh)			11.6							8.2						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	11.6								1.0							
Approach LOS	B								A							

Copyright © 2024 University of Florida. All Rights Reserved.

HCS Two-Way Stop-Control Report

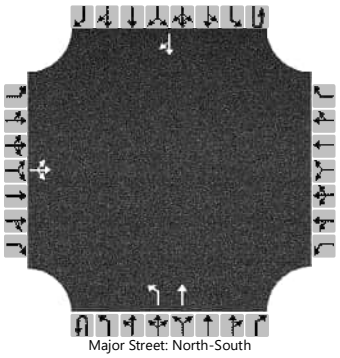
General Information

Analyst	JET
Agency/Co.	WSP
Date Performed	6/5/2024
Analysis Year	2024
Time Analyzed	Alternative 1 PM PEAK
Intersection Orientation	North-South
Project Description	SR 146 Intersections

Site Information

Intersection	SR 146 & Dillon School Dr (South)
Jurisdiction	ODOT D5
East/West Street	Dillon School Dr (South)
North/South Street	SR 146
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		5	57	0						59	449				340	0
Percent Heavy Vehicles (%)		0	2	0						2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.52	6.20						4.12						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.02	3.30						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			67							64						
Capacity, c (veh/h)			233							1191						
v/c Ratio			0.29							0.05						
95% Queue Length, Q_{95} (veh)			1.2							0.2						
95% Queue Length, Q_{95} (ft)			30.4							5.1						
Control Delay (s/veh)			26.7							8.2						
Level of Service (LOS)			D							A						
Approach Delay (s/veh)	26.7								1.0							
Approach LOS	D								A							

Copyright © 2024 University of Florida. All Rights Reserved.

HCS Two-Way Stop-Control Report

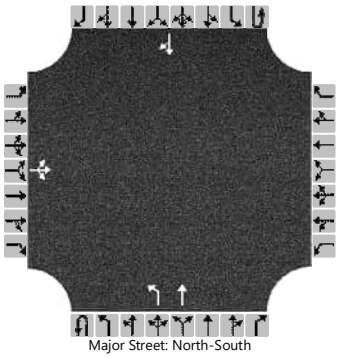
General Information

Analyst	JET
Agency/Co.	WSP
Date Performed	6/5/2024
Analysis Year	2024
Time Analyzed	Alternative 3 AM PEAK
Intersection Orientation	North-South
Project Description	SR 146 Intersections

Site Information

Intersection	SR 146 & Dillon School Dr (South)
Jurisdiction	ODOT D5
East/West Street	Dillon School Dr (South)
North/South Street	SR 146
Peak Hour Factor	0.91
Analysis Time Period (hrs)	1.00

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		0	0	87						0	243				370	0
Percent Heavy Vehicles (%)		0	7	0						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.57	6.20						4.13						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.06	3.30						2.23						

Delay, Queue Length, and Level of Service

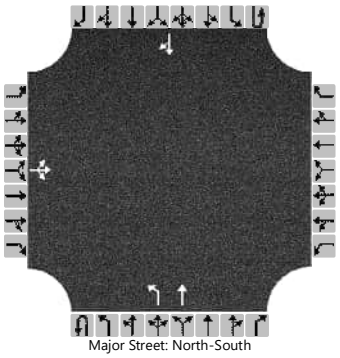
Flow Rate, v (veh/h)			96							0						
Capacity, c (veh/h)			649							1147						
v/c Ratio			0.15							0.00						
95% Queue Length, Q_{95} (veh)			0.5							0.0						
95% Queue Length, Q_{95} (ft)			12.5													
Control Delay (s/veh)			11.5							8.1						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	11.5								0.0							
Approach LOS	B								A							

Copyright © 2024 University of Florida. All Rights Reserved.

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	JET	Intersection	SR 146 & Dillon School Dr (South)
Agency/Co.	WSP	Jurisdiction	ODOT D5
Date Performed	6/5/2024	East/West Street	Dillon School Dr (South)
Analysis Year	2024	North/South Street	SR 146
Time Analyzed	Alternative 3 PM PEAK	Peak Hour Factor	0.92
Intersection Orientation	North-South	Analysis Time Period (hrs)	1.00
Project Description	SR 146 Intersections		

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		0	0	57						0	449				340	0
Percent Heavy Vehicles (%)		0	2	0						2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.52	6.20						4.12						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.02	3.30						2.22						

Delay, Queue Length, and Level of Service

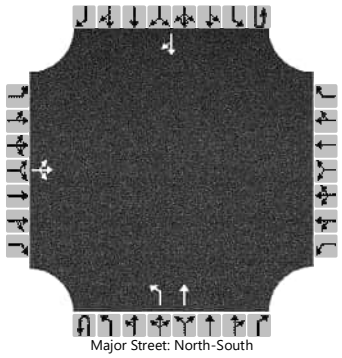
Flow Rate, v (veh/h)			62							0						
Capacity, c (veh/h)			681							1191						
v/c Ratio			0.09							0.00						
95% Queue Length, Q_{95} (veh)			0.3							0.0						
95% Queue Length, Q_{95} (ft)			7.5													
Control Delay (s/veh)			10.8							8.0						
Level of Service (LOS)			B							A						
Approach Delay (s/veh)	10.8								0.0							
Approach LOS	B								A							

Copyright © 2024 University of Florida. All Rights Reserved.

HCS Two-Way Stop-Control Report

General Information		Site Information	
Analyst	JET	Intersection	SR 146 & Dillon School Dr (South)
Agency/Co.	WSP	Jurisdiction	ODOT D5
Date Performed	6/5/2024	East/West Street	Dillon School Dr (South)
Analysis Year	2024	North/South Street	SR 146
Time Analyzed	Alternative 4 AM PEAK	Peak Hour Factor	0.91
Intersection Orientation	North-South	Analysis Time Period (hrs)	1.00
Project Description	SR 146 Intersections		

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		0	0	0						0	243				370	0
Percent Heavy Vehicles (%)		0	7	0						3						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.57	6.20						4.13						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.06	3.30						2.23						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			0							0						
Capacity, c (veh/h)			0							1147						
v/c Ratio										0.00						
95% Queue Length, Q_{95} (veh)										0.0						
95% Queue Length, Q_{95} (ft)																
Control Delay (s/veh)										8.1						
Level of Service (LOS)										A						
Approach Delay (s/veh)									0.0							
Approach LOS									A							

Copyright © 2024 University of Florida. All Rights Reserved.

HCS Two-Way Stop-Control Report

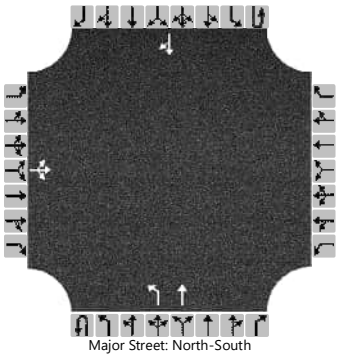
General Information

Analyst	JET
Agency/Co.	WSP
Date Performed	6/5/2024
Analysis Year	2024
Time Analyzed	Alternative 4 PM PEAK
Intersection Orientation	North-South
Project Description	SR 146 Intersections

Site Information

Intersection	SR 146 & Dillon School Dr (South)
Jurisdiction	ODOT D5
East/West Street	Dillon School Dr (South)
North/South Street	SR 146
Peak Hour Factor	0.92
Analysis Time Period (hrs)	1.00

Lanes


Major Street: North-South

Vehicle Volumes and Adjustments

Approach	Eastbound				Westbound				Northbound				Southbound			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Priority		10	11	12		7	8	9	1U	1	2	3	4U	4	5	6
Number of Lanes		0	1	0		0	0	0	0	1	1	0	0	0	1	0
Configuration			LTR							L	T					TR
Volume (veh/h)		0	0	0						0	449				340	0
Percent Heavy Vehicles (%)		0	2	0						2						
Proportion Time Blocked																
Percent Grade (%)	0															
Right Turn Channelized																
Median Type | Storage	Undivided															

Critical and Follow-up Headways

Base Critical Headway (sec)		7.1	6.5	6.2						4.1						
Critical Headway (sec)		7.10	6.52	6.20						4.12						
Base Follow-Up Headway (sec)		3.5	4.0	3.3						2.2						
Follow-Up Headway (sec)		3.50	4.02	3.30						2.22						

Delay, Queue Length, and Level of Service

Flow Rate, v (veh/h)			0							0						
Capacity, c (veh/h)			0							1191						
v/c Ratio										0.00						
95% Queue Length, Q_{95} (veh)										0.0						
95% Queue Length, Q_{95} (ft)																
Control Delay (s/veh)										8.0						
Level of Service (LOS)										A						
Approach Delay (s/veh)									0.0							
Approach LOS									A							

Copyright © 2024 University of Florida. All Rights Reserved.

APPENDIX D

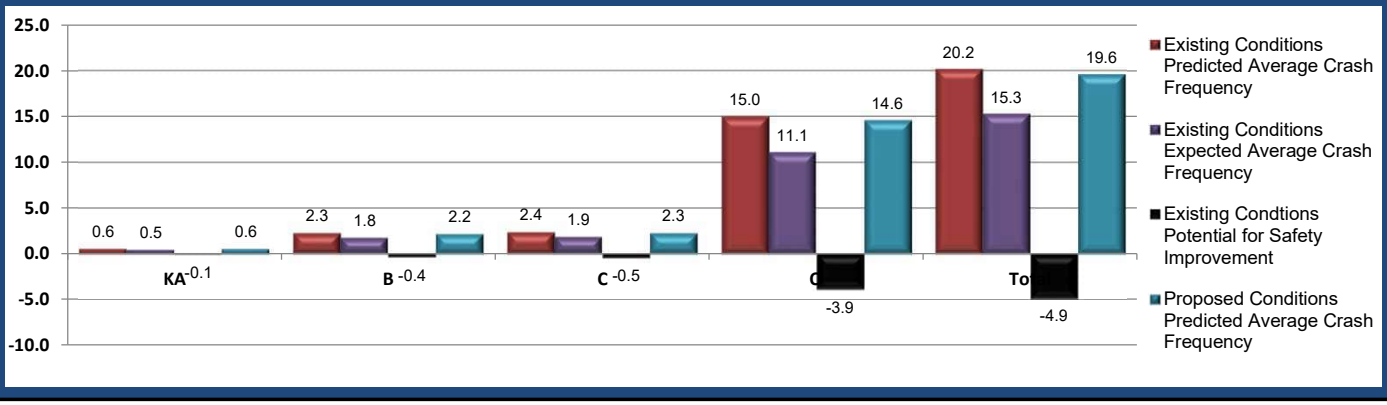
ECAT Results

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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	0.5856	2.2512	2.3921	15.0058	20.2347
$N_{expected}$ - Existing Conditions	0.4806	1.8464	1.8974	11.1133	15.3377
$N_{potential\ for\ improvement}$ - Existing Conditions	-0.1050	-0.4048	-0.4947	-3.8925	-4.8970
$N_{predicted}$ - Proposed Conditions	0.5719	2.1923	2.3174	14.5605	19.6421

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3464	1.4736	1.8632	11.1327	14.8159

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0849	0.2224	0.1049	0.881	1.2932
SR146; 10.467	SR146 & Northpointe Dr	0.0407	0.249	0.2085	3.9388	4.437
SR146; 10.679	SR146 & Dillon School Dr (S)	0.0994	0.2879	0.2096	1.1057	1.7026
SR146; 10.695	SR146 & Dillon School Dr (N)	0.2556	1.0871	1.3744	5.1878	7.9049

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	-0.0044	-0.0112	-0.0053	**0.2311**	**0.2102**
SR146; 10.467	SR146 & Northpointe Dr	**0.0066**	**0.0404**	**0.034**	**2.1651**	**2.2461**
SR146; 10.679	SR146 & Dillon School Dr (S)	-0.0164	-0.0475	-0.0346	-0.3438	-0.4423
SR146; 10.695	SR146 & Dillon School Dr (N)	-0.0908	-0.3865	-0.4888	-5.9449	-6.911

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3327	1.4147	1.7885	10.6874	14.2233

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Expected Crash Frequency
Unknown	0.0322	0.0241	-0.0081	
Head On	0.1729	0.1468	-0.0261	
Rear End	8.3064	6.0794	-2.2270	
Backing	0.8649	0.5644	-0.3005	
Sideswipe - Meeting	0.4771	0.3291	-0.1480	
Sideswipe - Passing	1.3909	1.1321	-0.2588	
Angle	3.6527	2.5491	-1.1036	
Parked Vehicle	0.6592	0.3811	-0.2781	
Pedestrian	0.1553	0.1117	-0.0436	
Animal	0.7469	0.9993	**0.2524**	
Train	0.0005	0.0006	**0.0001**	
Pedalcycles	0.1208	0.1063	-0.0145	
Other Non-Vehicle	0.0005	0.0004	-0.0001	
Fixed Object	2.3886	2.1884	-0.2002	
Other Object	0.0912	0.0962	**0.0050**	
Overturning	0.1614	0.1545	-0.0069	
Other Non-Collision	0.2114	0.2440	**0.0326**	
Left Turn	1.4843	1.0909	-0.3934	
Right Turn	0.0644	0.1386	**0.0742**	

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

All Sites

Comments:

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
Added Right Turn Lane	20	$530,860.00			$530,860.00	$530,860.00	-0.593	$222,411
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00	0.000	$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
		$0.00			$0.00	$0.00	0.000	$0
Totals		**$530,860.00**	**$0.00**	**$0.00**	**$530,860.00**	**$530,860.00**	**-0.593**	**$222,411**

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Benefit - Cost Calculator

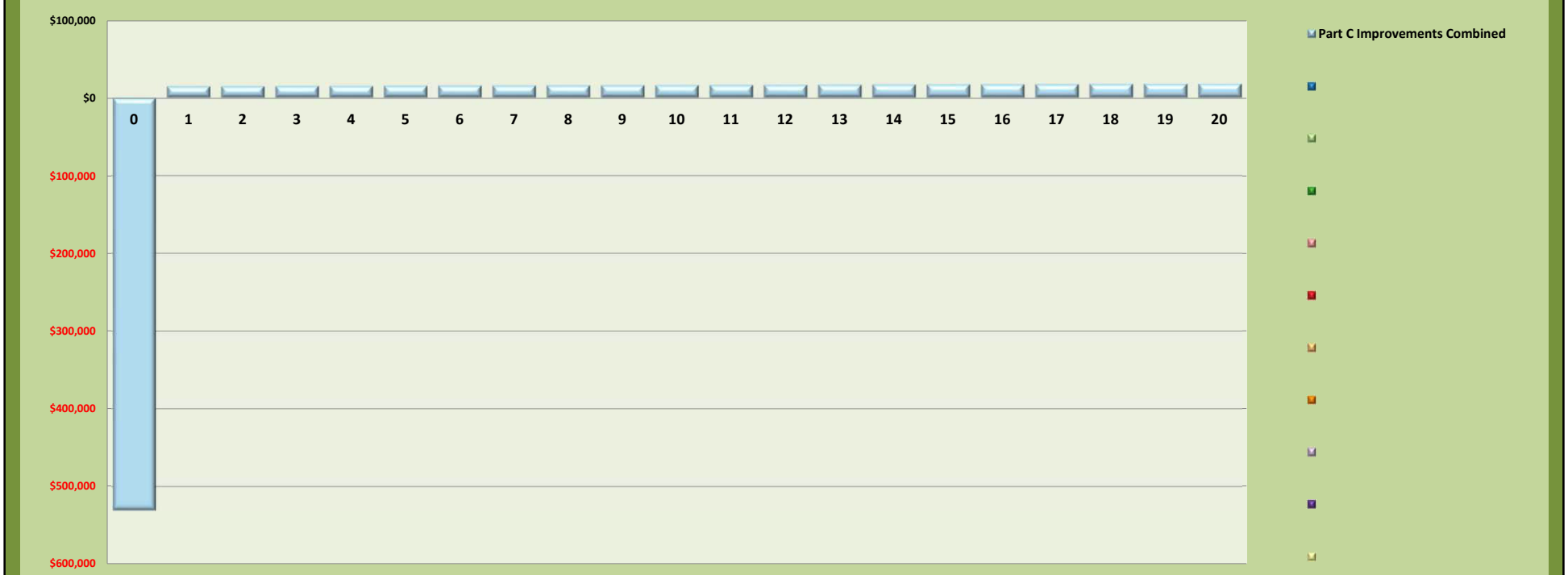
Net Present Value of Project	$530,860.00
Net Present Value of Safety Benefits	$222,410.69
Net Benefit	($308,449.31)
Benefit / Cost Ratio	0.42

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.014
Number of Injury Crashes	-0.147
Number of Total Crashes	-0.593

Comments:

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



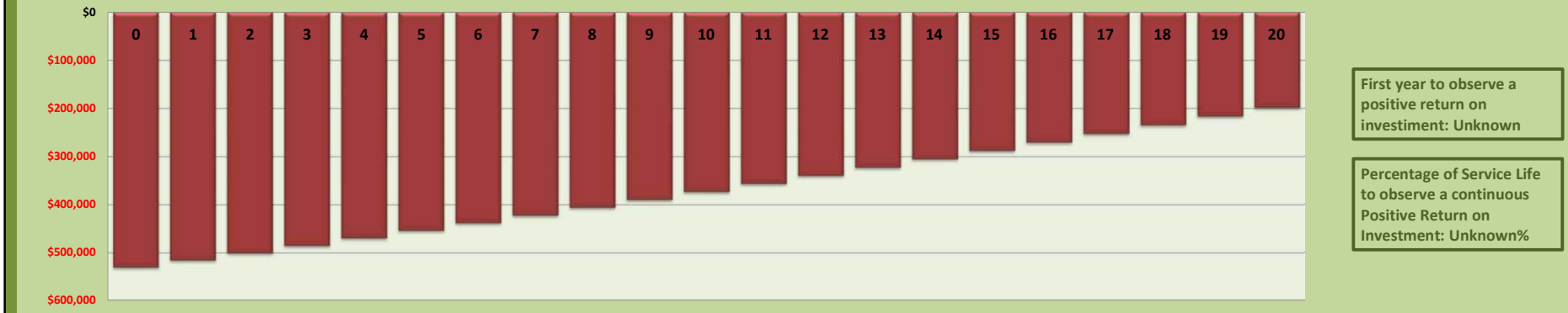
Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 1: SBRT Lane at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/7/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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 investiment: Unknown

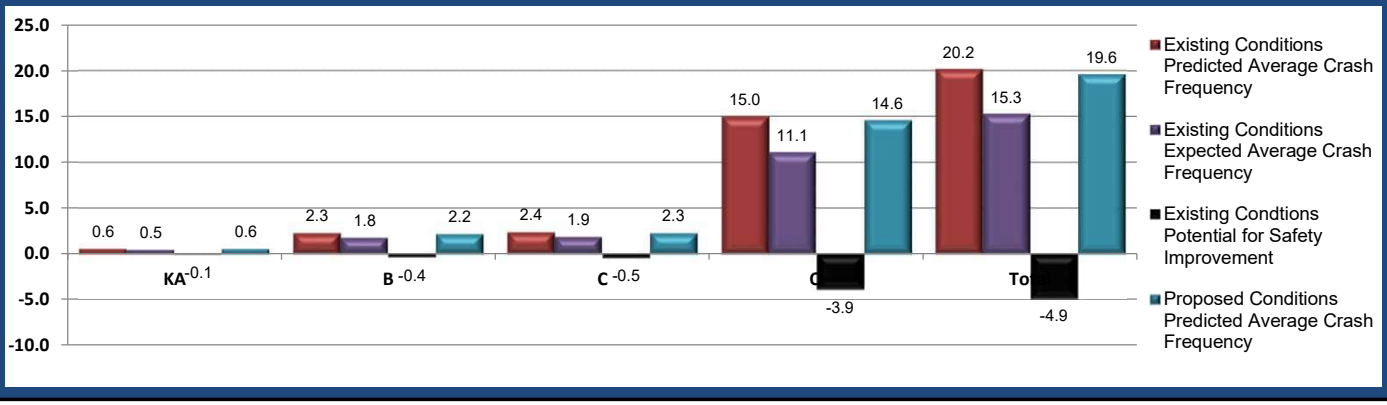
Percentage of Service Life to observe a continuous Positive Return on Investment: Unknown%

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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	0.5856	2.2512	2.3921	15.0058	20.2347
$N_{expected}$ - Existing Conditions	0.4806	1.8464	1.8974	11.1133	15.3377
$N_{potential\ for\ improvement}$ - Existing Conditions	-0.1050	-0.4048	-0.4947	-3.8925	-4.8970
$N_{predicted}$ - Proposed Conditions	0.5719	2.1923	2.3174	14.5605	19.6421

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3464	1.4736	1.8632	11.1327	14.8159

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0849	0.2224	0.1049	0.881	1.2932
SR146; 10.467	SR146 & Northpointe Dr	0.0407	0.249	0.2085	3.9388	4.437
SR146; 10.679	SR146 & Dillon School Dr (S)	0.0994	0.2879	0.2096	1.1057	1.7026
SR146; 10.695	SR146 & Dillon School Dr (N)	0.2556	1.0871	1.3744	5.1878	7.9049

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	-0.0044	-0.0112	-0.0053	**0.2311**	**0.2102**
SR146; 10.467	SR146 & Northpointe Dr	**0.0066**	**0.0404**	**0.034**	**2.1651**	**2.2461**
SR146; 10.679	SR146 & Dillon School Dr (S)	-0.0164	-0.0475	-0.0346	-0.3438	-0.4423
SR146; 10.695	SR146 & Dillon School Dr (N)	-0.0908	-0.3865	-0.4888	-5.9449	-6.911

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3327	1.4147	1.7885	10.6874	14.2233

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Expected Crash Frequency
Unknown	0.0322	0.0241	-0.0081	
Head On	0.1729	0.1468	-0.0261	
Rear End	8.3064	6.0794	-2.2270	
Backing	0.8649	0.5644	-0.3005	
Sideswipe - Meeting	0.4771	0.3291	-0.1480	
Sideswipe - Passing	1.3909	1.1321	-0.2588	
Angle	3.6527	2.5491	-1.1036	
Parked Vehicle	0.6592	0.3811	-0.2781	
Pedestrian	0.1553	0.1117	-0.0436	
Animal	0.7469	0.9993	**0.2524**	
Train	0.0005	0.0006	**0.0001**	
Pedalcycles	0.1208	0.1063	-0.0145	
Other Non-Vehicle	0.0005	0.0004	-0.0001	
Fixed Object	2.3886	2.1884	-0.2002	
Other Object	0.0912	0.0962	**0.0050**	
Overturning	0.1614	0.1545	-0.0069	
Other Non-Collision	0.2114	0.2440	**0.0326**	
Left Turn	1.4843	1.0909	-0.3934	
Right Turn	0.0644	0.1386	**0.0742**	

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

All Sites

Comments:

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
Realignment + Right Turn Lane	20	$1,600,940.00			$1,600,940.00	$1,600,940.00	-0.593	$222,411
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00	0.000	$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
		$0.00			$0.00	$0.00	0.000	$0
Totals		**$1,600,940.00**	**$0.00**	**$0.00**	**$1,600,940.00**	**$1,600,940.00**	**-0.593**	**$222,411**

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Benefit - Cost Calculator

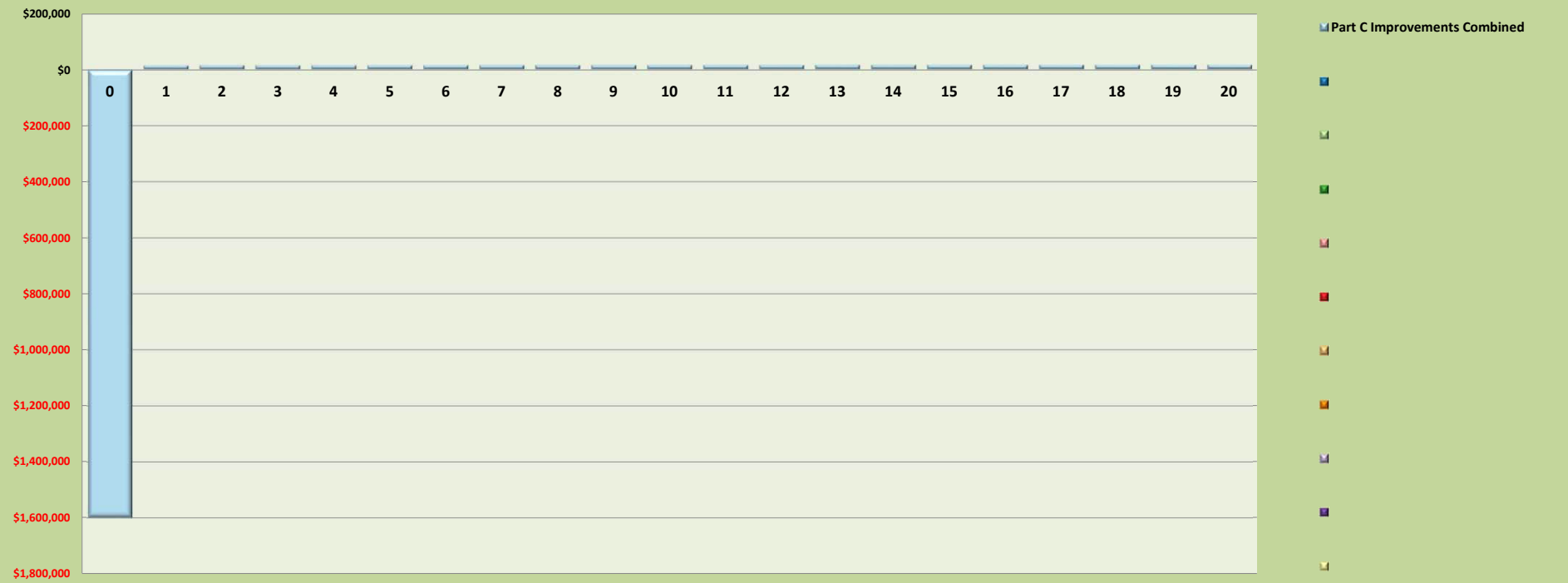
Net Present Value of Project	$1,600,940.00
Net Present Value of Safety Benefits	$222,410.69
Net Benefit	($1,378,529.31)
Benefit / Cost Ratio	0.14

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.014
Number of Injury Crashes	-0.147
Number of Total Crashes	-0.593

Comments:

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

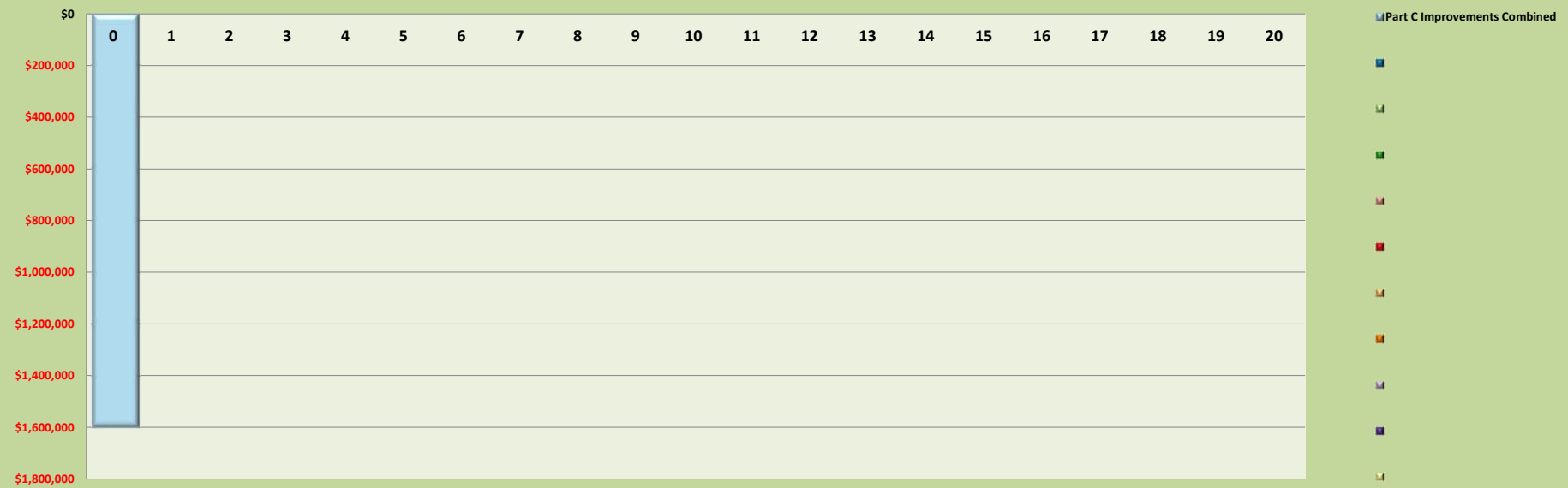


Safety Benefit - Cost Analysis

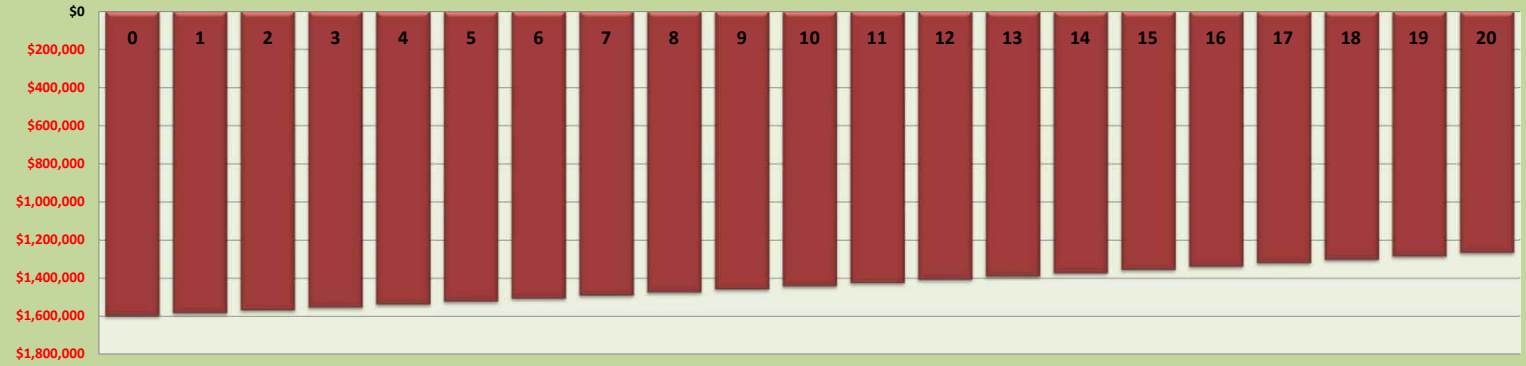
General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 2: Dillon School Dr (North) Realigned	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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 investiment: Unknown

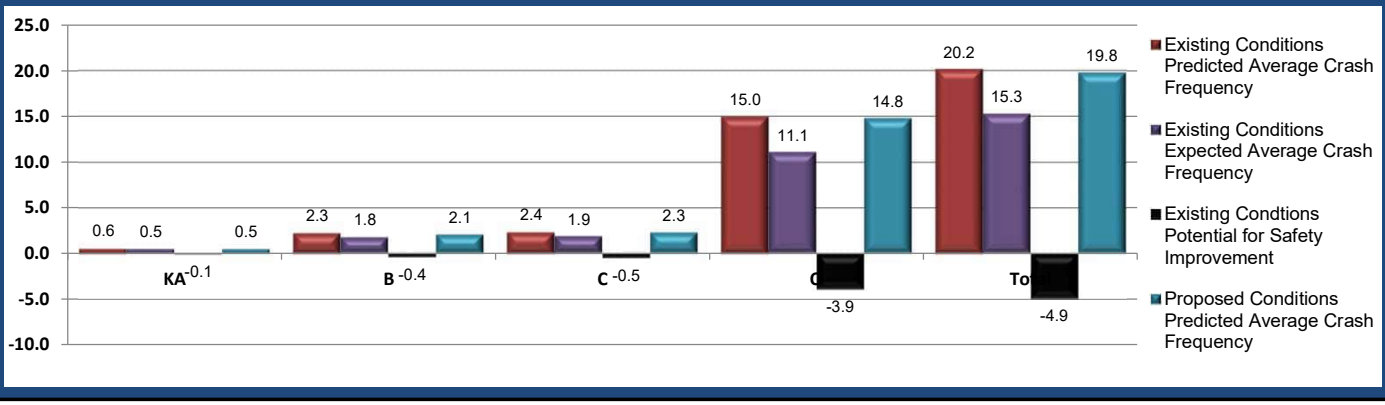
Percentage of Service Life to observe a continuous Positive Return on Investment: Unknown%

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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	0.5856	2.2512	2.3921	15.0058	20.2347
$N_{expected}$ - Existing Conditions	0.4806	1.8464	1.8974	11.1133	15.3377
$N_{potential\ for\ improvement}$ - Existing Conditions	-0.1050	-0.4048	-0.4947	-3.8925	-4.8970
$N_{predicted}$ - Proposed Conditions	0.5471	2.1470	2.3260	14.7742	19.7943

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3464	1.4736	1.8632	11.1327	14.8159

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0849	0.2224	0.1049	0.881	1.2932
SR146; 10.467	SR146 & Northpointe Dr	0.0407	0.249	0.2085	3.9388	4.437
SR146; 10.679	SR146 & Dillon School Dr (S)	0.0994	0.2879	0.2096	1.1057	1.7026
SR146; 10.695	SR146 & Dillon School Dr (N)	0.2556	1.0871	1.3744	5.1878	7.9049

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	-0.0044	-0.0112	-0.0053	**0.2311**	**0.2102**
SR146; 10.467	SR146 & Northpointe Dr	**0.0066**	**0.0404**	**0.034**	**2.1651**	**2.2461**
SR146; 10.679	SR146 & Dillon School Dr (S)	-0.0164	-0.0475	-0.0346	-0.3438	-0.4423
SR146; 10.695	SR146 & Dillon School Dr (N)	-0.0908	-0.3865	-0.4888	-5.9449	-6.911

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.0773	0.2312	0.1781	1.2179	1.7045
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3464	1.4736	1.8632	11.1327	14.8159

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.0322	0.0241	-0.0081	0.0387
Head On	0.1729	0.1468	-0.0261	0.1910
Rear End	8.3064	6.0794	-2.2270	8.8137
Backing	0.8649	0.5644	-0.3005	0.9208
Sideswipe - Meeting	0.4771	0.3291	-0.1480	0.5569
Sideswipe - Passing	1.3909	1.1321	-0.2588	1.4639
Angle	3.6527	2.5491	-1.1036	3.8860
Parked Vehicle	0.6592	0.3811	-0.2781	0.7216
Pedestrian	0.1553	0.1117	-0.0436	0.1657
Animal	0.7469	0.9993	**0.2524**	0.7469
Train	0.0005	0.0006	**0.0001**	0.0007
Pedalcycles	0.1208	0.1063	-0.0145	0.1303
Other Non-Vehicle	0.0005	0.0004	-0.0001	0.0007
Fixed Object	2.3886	2.1884	-0.2002	2.8941
Other Object	0.0912	0.0962	**0.0050**	0.1097
Overturning	0.1614	0.1545	-0.0069	0.1947
Other Non-Collision	0.2114	0.2440	**0.0326**	0.2414
Left Turn	1.4843	1.0909	-0.3934	1.5258
Right Turn	0.0644	0.1386	**0.0742**	0.0644

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

All Sites

Comments:

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
Right Turn Slip Lane	20	$55,110.00			$55,110.00	$55,110.00	0.000	$0
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
CMF 1 - Replace direct left-turn with right-turn/U-turn	20	$0.00			$0.00	$0.00	-0.440	$452,826
		$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		**$55,110.00**	**$0.00**	**$0.00**	**$55,110.00**	**$55,110.00**	**-0.440**	**$452,826**

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Benefit - Cost Calculator

Net Present Value of Project	$55,110.00
Net Present Value of Safety Benefits	$452,826.00
Net Benefit	$397,716.00
Benefit / Cost Ratio	8.22

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.039
Number of Injury Crashes	-0.209
Number of Total Crashes	-0.440

Comments:

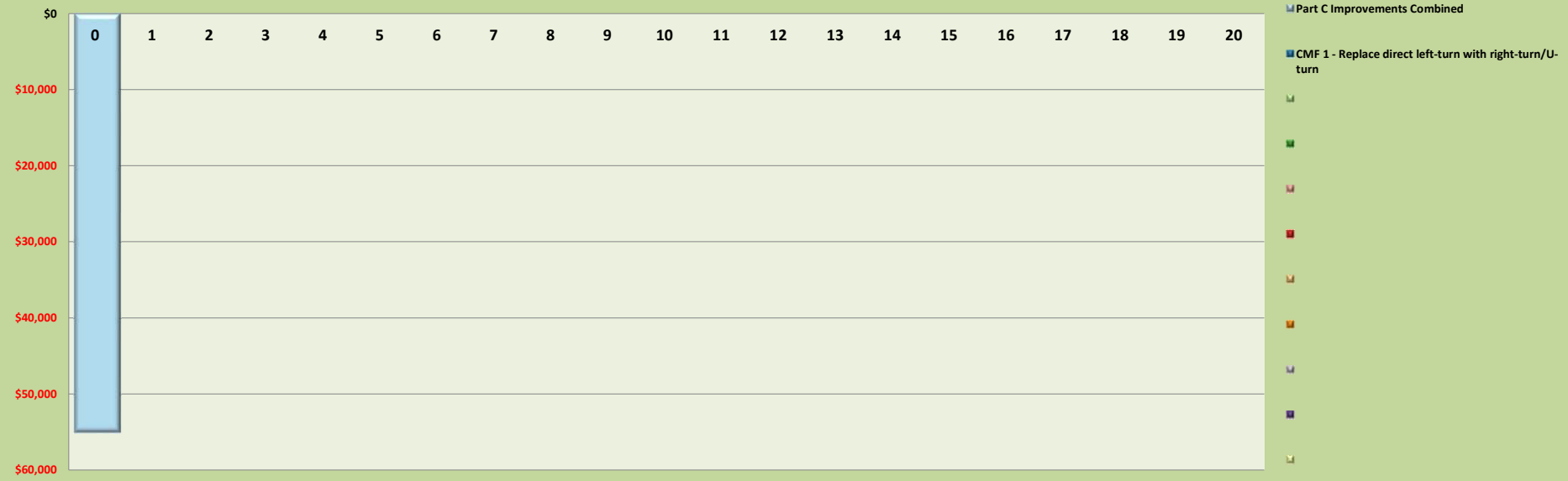
Safety Benefits and Project Costs Combined Cash Flows By Countermeasure Per Year

Safety Benefit - Cost Analysis

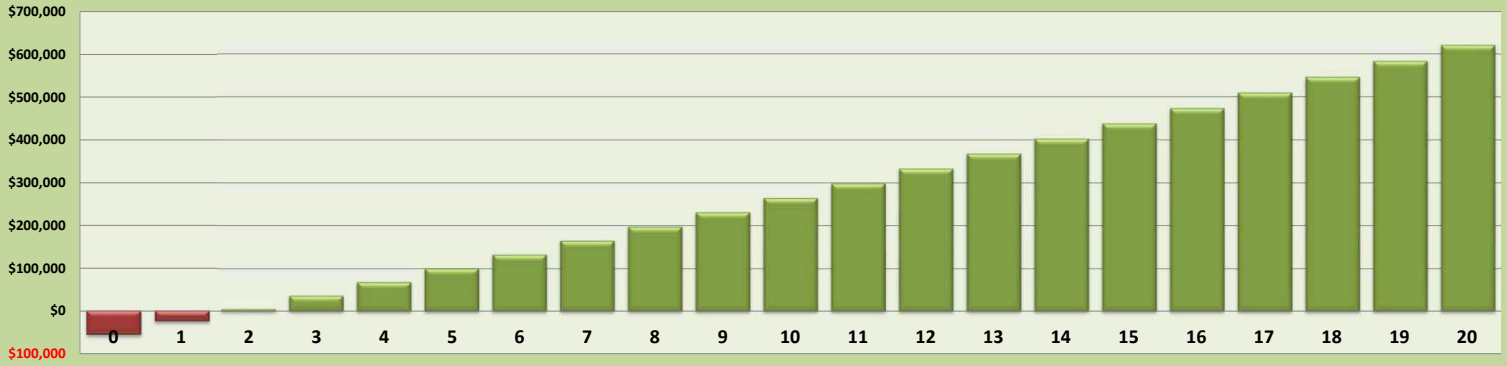
General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 3: Slip Movement at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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 investiment: 2026 (2 years)

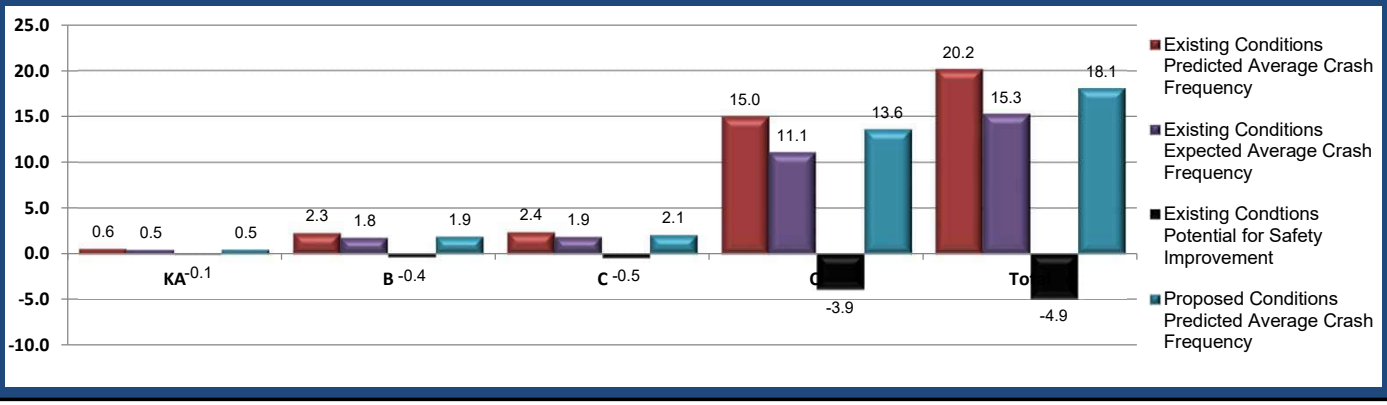
Percentage of Service Life to observe a continuous Positive Return on Investment: 95.00%

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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	0.5856	2.2512	2.3921	15.0058	20.2347
$N_{expected}$ - Existing Conditions	0.4806	1.8464	1.8974	11.1133	15.3377
$N_{potential\ for\ improvement}$ - Existing Conditions	-0.1050	-0.4048	-0.4947	-3.8925	-4.8970
$N_{expected}$ - Proposed Conditions	0.4698	1.9158	2.1479	13.5563	18.0898

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3464	1.4736	1.8632	11.1327	14.8159

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0849	0.2224	0.1049	0.881	1.2932
SR146; 10.467	SR146 & Northpointe Dr	0.0407	0.249	0.2085	3.9388	4.437
SR146; 10.679	SR146 & Dillon School Dr (S)	0.0994	0.2879	0.2096	1.1057	1.7026
SR146; 10.695	SR146 & Dillon School Dr (N)	0.2556	1.0871	1.3744	5.1878	7.9049

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	-0.0044	-0.0112	-0.0053	**0.2311**	**0.2102**
SR146; 10.467	SR146 & Northpointe Dr	**0.0066**	**0.0404**	**0.034**	**2.1651**	**2.2461**
SR146; 10.679	SR146 & Dillon School Dr (S)	-0.0164	-0.0475	-0.0346	-0.3438	-0.4423
SR146; 10.695	SR146 & Dillon School Dr (N)	-0.0908	-0.3865	-0.4888	-5.9449	-6.911

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3464	1.4736	1.8632	11.1327	14.8159

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.0322	0.0241	-0.0081	0.0233
Head On	0.1729	0.1468	-0.0261	0.1498
Rear End	8.3064	6.0794	-2.2270	7.6608
Backing	0.8649	0.5644	-0.3005	0.7938
Sideswipe - Meeting	0.4771	0.3291	-0.1480	0.3754
Sideswipe - Passing	1.3909	1.1321	-0.2588	1.2980
Angle	3.6527	2.5491	-1.1036	3.3557
Parked Vehicle	0.6592	0.3811	-0.2781	0.5801
Pedestrian	0.1553	0.1117	-0.0436	0.1422
Animal	0.7469	0.9993	**0.2524**	0.7469
Train	0.0005	0.0006	**0.0001**	0.0002
Pedalcycles	0.1208	0.1063	-0.0145	0.1090
Other Non-Vehicle	0.0005	0.0004	-0.0001	0.0001
Fixed Object	2.3886	2.1884	-0.2002	1.7451
Other Object	0.0912	0.0962	**0.0050**	0.0680
Overturning	0.1614	0.1545	-0.0069	0.1192
Other Non-Collision	0.2114	0.2440	**0.0326**	0.1732
Left Turn	1.4843	1.0909	-0.3934	1.4315
Right Turn	0.0644	0.1386	**0.0742**	0.0644

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

All Sites

Comments:

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
Cul-de-sac	20	$462,400.00			$462,400.00	$462,400.00	-2.145	$1,419,205
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00	0.000	$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
		$0.00			$0.00	$0.00	0.000	$0
Totals		**$462,400.00**	**$0.00**	**$0.00**	**$462,400.00**	**$462,400.00**	**-2.145**	**$1,419,205**

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Benefit - Cost Calculator

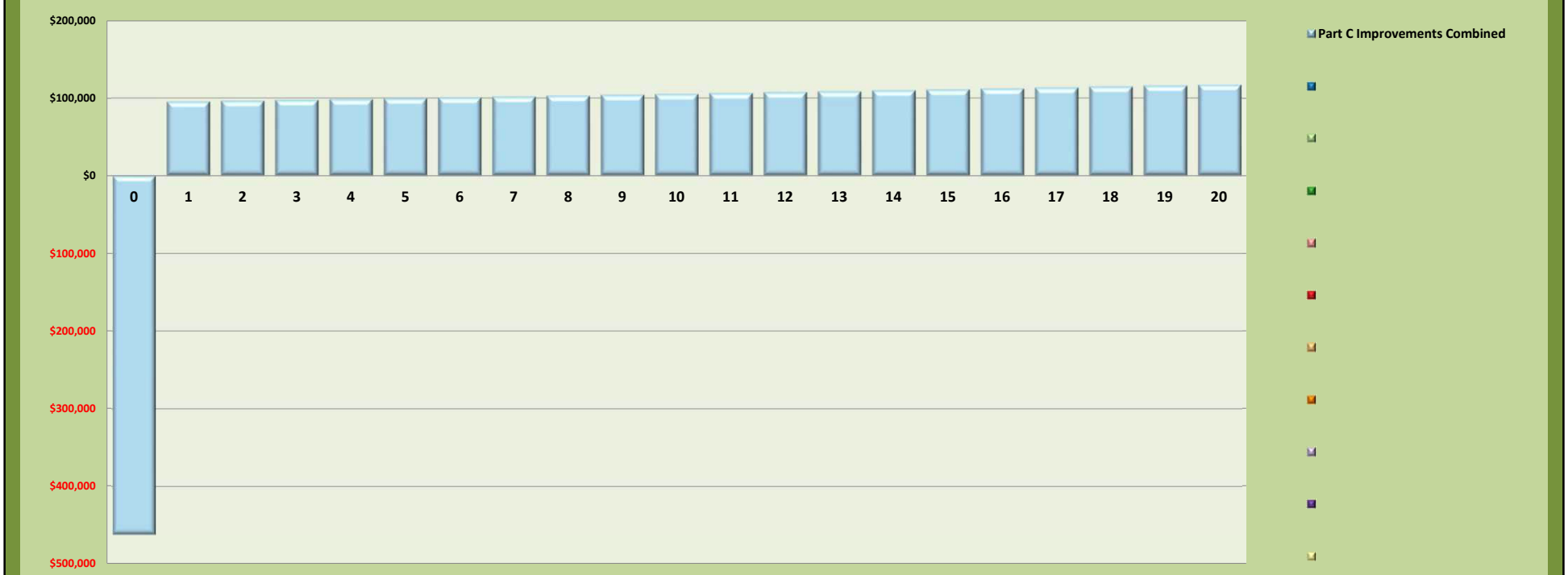
Net Present Value of Project	$462,400.00
Net Present Value of Safety Benefits	$1,419,204.64
Net Benefit	$956,804.64
Benefit / Cost Ratio	3.07

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.116
Number of Injury Crashes	-0.695
Number of Total Crashes	-2.145

Comments:

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

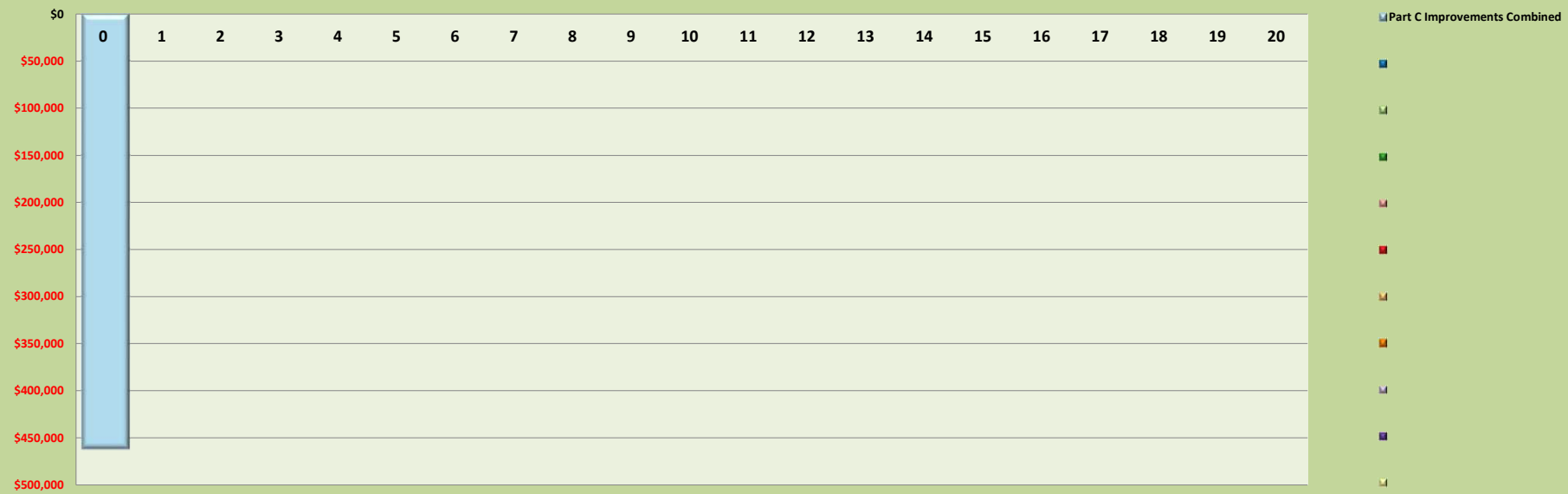


Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative 4: Cul-de-sac at Dillon School Dr (South)	Contact Phone	
Reference Number		Date Performed	7/30/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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 investiment: 2029 (5 years)

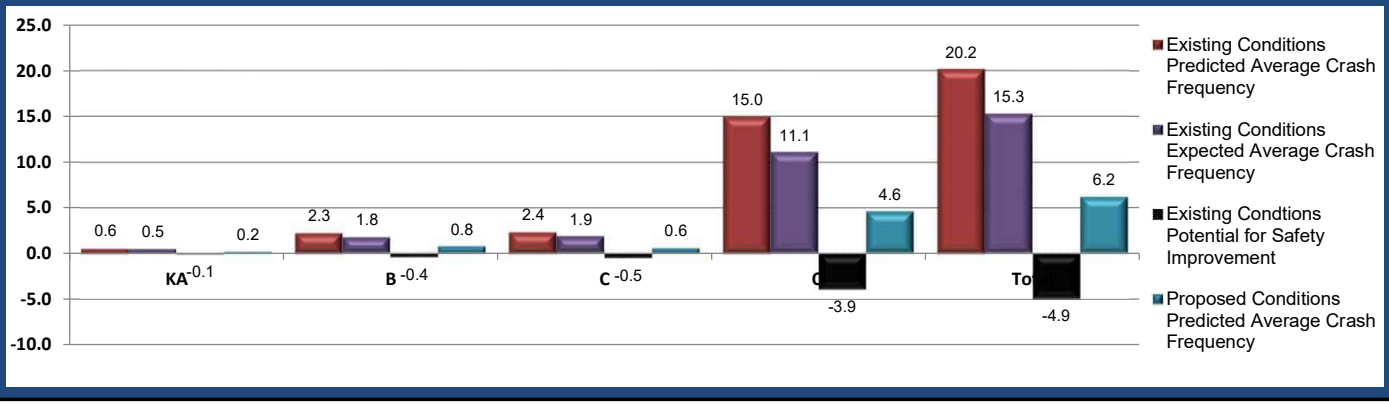
Percentage of Service Life to observe a continuous Positive Return on Investment: 80.00%

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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	0.5856	2.2512	2.3921	15.0058	20.2347
$N_{expected}$ - Existing Conditions	0.4806	1.8464	1.8974	11.1133	15.3377
$N_{potential\ for\ improvement}$ - Existing Conditions	-0.1050	-0.4048	-0.4947	-3.8925	-4.8970
$N_{expected}$ - Proposed Conditions	0.2432	0.8118	0.5714	4.5659	6.1923

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.3464	1.4736	1.8632	11.1327	14.8159

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0849	0.2224	0.1049	0.881	1.2932
SR146; 10.467	SR146 & Northpointe Dr	0.0407	0.249	0.2085	3.9388	4.437
SR146; 10.679	SR146 & Dillon School Dr (S)	0.0994	0.2879	0.2096	1.1057	1.7026
SR146; 10.695	SR146 & Dillon School Dr (N)	0.2556	1.0871	1.3744	5.1878	7.9049

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	-0.0044	-0.0112	-0.0053	**0.2311**	**0.2102**
SR146; 10.467	SR146 & Northpointe Dr	**0.0066**	**0.0404**	**0.034**	**2.1651**	**2.2461**
SR146; 10.679	SR146 & Dillon School Dr (S)	-0.0164	-0.0475	-0.0346	-0.3438	-0.4423
SR146; 10.695	SR146 & Dillon School Dr (N)	-0.0908	-0.3865	-0.4888	-5.9449	-6.911

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
SR146; 10.467-11.01	SR146	0.0893	0.2336	0.1102	0.6499	1.083
SR146; 10.467	SR146 & Northpointe Dr	0.0341	0.2086	0.1745	1.7737	2.1909
SR146; 10.679	SR146 & Dillon School Dr (S)	0.1158	0.3354	0.2442	1.4495	2.1449
SR146; 10.695	SR146 & Dillon School Dr (N)	0.004	0.0342	0.0425	0.6928	0.7735

Project Safety Performance Report

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.0368	0.0324	-0.0044	0.0368
Head On	0.0653	0.0802	**0.0149**	0.0653
Rear End	1.9000	2.5771	**0.6771**	1.9000
Backing	0.1662	0.2212	**0.0550**	0.1662
Sideswipe - Meeting	0.1775	0.1589	-0.0186	0.1775
Sideswipe - Passing	0.6111	0.7917	**0.1806**	0.6111
Angle	0.8735	1.0390	**0.1655**	0.8735
Parked Vehicle	0.1066	0.1051	-0.0015	0.1066
Pedestrian	0.0186	0.0164	-0.0022	0.0186
Animal	0.7547	0.8114	**0.0567**	0.7547
Train	0.0005	0.0005	0.0000	0.0005
Pedalcycles	0.0304	0.0442	**0.0138**	0.0304
Other Non-Vehicle	0.0005	0.0004	-0.0001	0.0005
Fixed Object	1.5244	1.6273	**0.1029**	1.5244
Other Object	0.0612	0.0734	**0.0122**	0.0612
Overturning	0.1031	0.1117	**0.0086**	0.1031
Other Non-Collision	0.1418	0.1962	**0.0544**	0.1418
Left Turn	0.2582	0.3753	**0.1171**	0.2582
Right Turn	0.1166	0.1737	**0.0571**	0.1166

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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

All Sites

Comments:

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
Roundabout	20	$3,158,400.00			$3,158,400.00	$3,158,400.00	-14.042	$5,489,224
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00		
		$0.00			$0.00	$0.00	0.000	$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
		$0.00			$0.00	$0.00	0.000	$0
Totals		**$3,158,400.00**	**$0.00**	**$0.00**	**$3,158,400.00**	**$3,158,400.00**	**-14.042**	**$5,489,224**

Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

Benefit - Cost Calculator

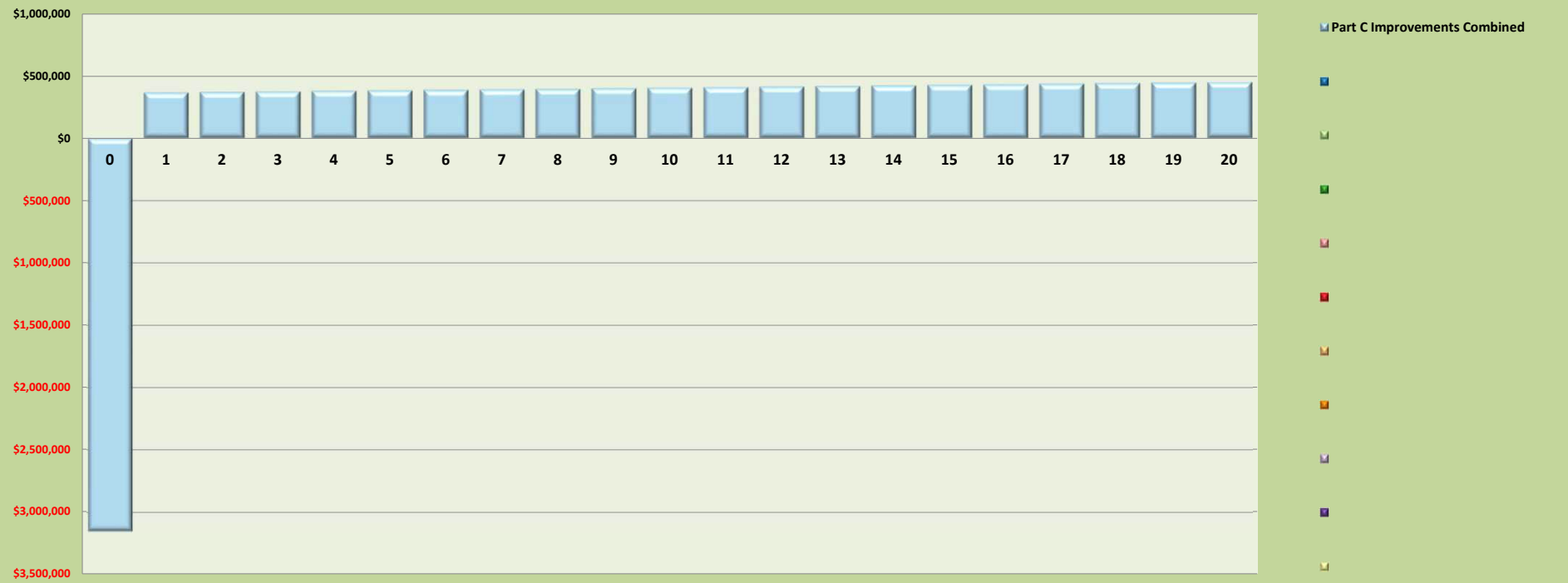
Net Present Value of Project	$3,158,400.00
Net Present Value of Safety Benefits	$5,489,223.65
Net Benefit	$2,330,823.65
Benefit / Cost Ratio	1.74

Expected Annual Crash Adjustment

Number of Fatal & Incapacitating Injury Crashes	-0.342
Number of Injury Crashes	-3.603
Number of Total Crashes	-14.042

Comments:

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

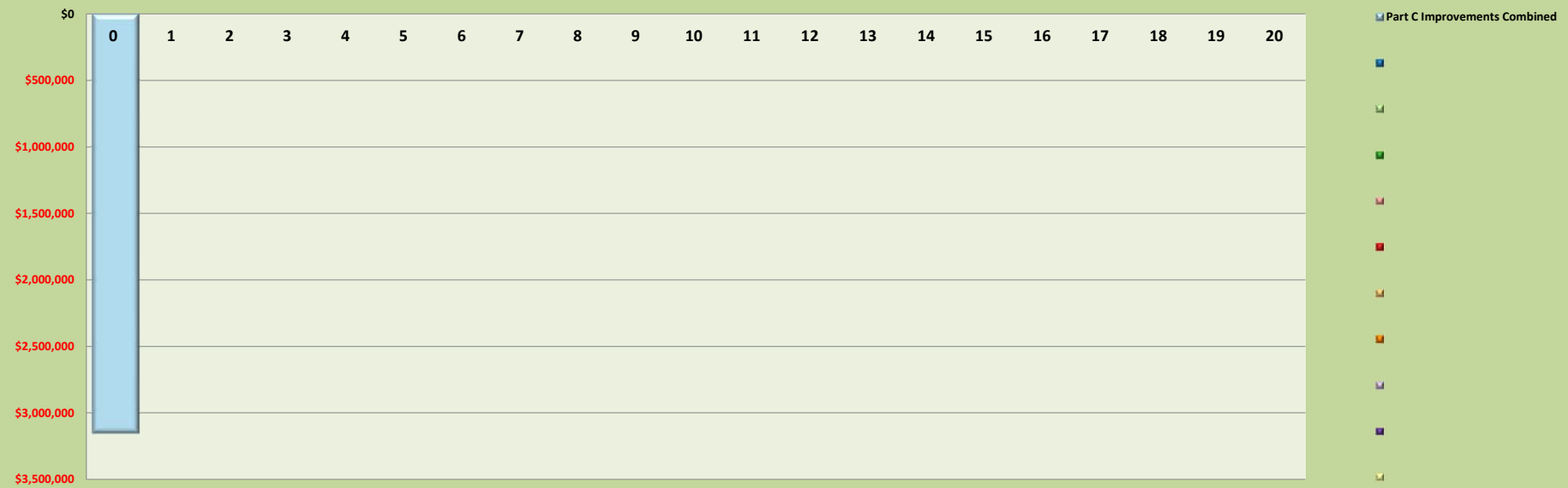


Safety Benefit - Cost Analysis

General Information

Project Name	MUS 146	Contact Email	
Project Description	Alternative: 5: Roundabout at Dillon School Dr (North)	Contact Phone	
Reference Number		Date Performed	8/2/2024
Analyst	NN	Analysis Year	2024
Agency/Company	WSP		

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 investiment: 2033 (9 years)

Percentage of Service Life to observe a continuous Positive Return on Investment: 60.00%

APPENDIX E

Cost Estimates

Prepared by: ABS
Date: 8/9/2024
Checked by:
Date:

PROJECT:	MUS 146 Safety Study
PID:	
PROJECT LIMITS:	North Zanesville, OH Alternative 1: Eastbound right turn (EBRT) lane at Dillon School Dr (North)

Item	Ext.	Pay Item Name	Qty	Unit	Unit Price	Total
		ROADWAY				
202	30800	TRAFFIC ISLAND REMOVED	0	SY	$ 40.00	$ -
202	32000	CURB REMOVED	0	FT	$ 12.00	$ -
202	23000	PAVEMENT REMOVED	514	SY	$ 15.00	$ 7,800.00
203	10000	EXCAVATION	489	CY	$ 36.00	$ 17,700.00
203	20000	EMBANKMENT	100	CY	$ 35.00	$ 3,500.00
609	26000	CURB, TYPE 6	310	FT	$ 45.00	$ 14,000.00
					SUBTOTAL	$ 43,000.00
		PAVEMENT				
301	56000	ASPHALT CONCRETE BASE (8")	218	CY	$ 320.00	$ 69,800.00
304	20000	AGGREGATE BASE (6")	163	CY	$ 100.00	$ 16,300.00
441	10000	ASPHALT CONCRETE SURFACE COURSE (1.25")	34	CY	$ 250.00	$ 8,500.00
441	70200	ASPHALT CONCRETE INTERMEDIATE COURSE (1.75")	48	CY	$ 240.00	$ 11,600.00
609	56000	6" CONCRETE TRAFFIC ISLAND	0	SY	$ 140.00	$ -
					SUBTOTAL	$ 106,200.00
		LIGHTING				
625	75400	LIGHT POLE REMOVED	0	EACH	$ 420.00	$ -
625		PROPOSED LIGHTING	0	LS	$ 750.00	$ -
					SUBTOTAL	$ -
		DRAINAGE				
611	05900	15" CONDUIT, TYPE B	150	FT	$ 140.00	$ 21,000.00
611	98150	CATCH BASIN, NO. 3	2	EACH	$ 5,000.00	$ 10,000.00
					SUBTOTAL	$ 31,000.00
		TRAFFIC CONTROL				
644	00300	CENTER LINE	0.00	MI	$ 8,400.00	$ -
644	00404	CHANNELIZING LINE, 12"	225	FT	$ 2.50	$ 600.00
644	00104	EDGE LINE, 6"	0.07	MI	$ 6,500.00	$ 500.00
644	00500	STOP LINE	12	FT	$ 2.50	$ 100.00
644	01300	LANE ARROW	4	EACH	$ 125.00	$ 500.00
644	30000	REMOVAL OF PAVEMENT MARKING	0	FT	$ 5.00	$ -
850	10000	GROOVING FOR 4" RECESSED PAVEMENT MARKING, (ASPHALT)	0	FT	$ 3,200.00	$ -
850	10130	GROOVING FOR 12" RECESSED PAVEMENT MARKING, (ASPHALT)	225	FT	$ 1.90	$ 500.00
					SUBTOTAL	$ 2,200.00
		INCIDENTALS				
614	11000	MAINTAINING TRAFFIC	1	LS	$ 11,500.00	$ 11,500.00
619	16000	FIELD OFFICE, TYPE A	1	MNTH	$ 1,200.00	$ 1,200.00
623	10000	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LS	$ 1,000.00	$ 1,000.00
624	15000	MOBILIZATION	1	LS	$ 2,000.00	$ 2,000.00
					SUBTOTAL	$ 15,700.00
					TOTAL	$ 198,100.00
			30%		CONTINGENCY	$ 59,430.00
					GRAND TOTAL	$ 257,600.00

Prepared by: KAB
Date: 8/9/2024
Checked by:
Date:

PROJECT:	MUS 146 Safety Study
PID:	
PROJECT LIMITS:	North Zanesville, OH Alternative 2: Dillon School Dr (N) Realigned and Southbound Right Turn Lane

Item	Ext.	Pay Item Name	Qty	Unit	Unit Price	Total
		ROADWAY				
202	30800	TRAFFIC ISLAND REMOVED	0	SY	$ 40.00	$ -
202	32000	CURB REMOVED	0	FT	$ 12.00	$ -
202	23000	PAVEMENT REMOVED	5159	SY	$ 15.00	$ 77,400.00
203	10000	EXCAVATION	978	CY	$ 36.00	$ 35,300.00
203	20000	EMBANKMENT	315	CY	$ 35.00	$ 11,100.00
609	26000	CURB, TYPE 6	0	FT	$ 45.00	$ -
					SUBTOTAL	$ 123,800.00
		PAVEMENT				
301	56000	ASPHALT CONCRETE BASE (8")	1044	CY	$ 320.00	$ 334,100.00
304	20000	AGGREGATE BASE (6")	783	CY	$ 100.00	$ 78,300.00
441	10000	ASPHALT CONCRETE SURFACE COURSE (1.25")	164	CY	$ 250.00	$ 41,000.00
441	70200	ASPHALT CONCRETE INTERMEDIATE COURSE (1.75")	229	CY	$ 240.00	$ 55,000.00
609	54000	6" CONCRETE TRAFFIC ISLAND	0	SY	$ 140.00	$ -
					SUBTOTAL	$ 508,400.00
		LIGHTING				
625	75400	LIGHT POLE REMOVED	0	EACH	$ 420.00	$ -
625		PROPOSED LIGHTING	0	LS	$ 750.00	$ -
					SUBTOTAL	$ -
		DRAINAGE				
611	05900	15" CONDUIT, TYPE B	150	FT	$ 140.00	$ 21,000.00
611	98150	CATCH BASIN, NO. 3	1	EACH	$ 5,000.00	$ 5,000.00
					SUBTOTAL	$ 26,000.00
		TRAFFIC CONTROL				
644	00300	CENTER LINE	0.17	MI	$ 8,400.00	$ 1,500.00
644	00204	CHANNELIZING LINE, 12"	225	FT	$ 2.50	$ 600.00
644	00104	EDGE LINE, 6"	0.50	MI	$ 6,500.00	$ 3,300.00
644	00500	STOP LINE	53	FT	$ 2.50	$ 200.00
644	01300	LANE ARROW	6	EACH	$ 125.00	$ 800.00
644	30000	REMOVAL OF PAVEMENT MARKING	0	FT	$ 5.00	$ -
850	10000	GROOVING FOR 4" RECESSED PAVEMENT MARKING, (ASPHALT)	0	MILE	$ 3,200.00	$ -
850	10130	GROOVING FOR 12" RECESSED PAVEMENT MARKING, (ASPHALT)	0	FT	$ 1.90	$ -
		SIGNAL	1	LS	$ 250,000.00	$ 250,000.00
					SUBTOTAL	$ 256,400.00
		INCIDENTALS				
614	11000	MAINTAINING TRAFFIC	1	LS	$ 31,500.00	$ 31,500.00
619	16000	FIELD OFFICE, TYPE A	1	MNTH	$ 1,200.00	$ 1,200.00
623	10000	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LS	$ 1,000.00	$ 1,000.00
624	15000	MOBILIZATION	1	LS	$ 2,000.00	$ 2,000.00
					SUBTOTAL	$ 35,700.00
					TOTAL	$ 950,300.00
			30%		CONTINGENCY	$ 285,090.00
					GRAND TOTAL	$ 1,235,400.00

Prepared by: KAB
Date: 8/9/2024
Checked by:
Date:

PROJECT:	MUS 146 Safety Study
PID:	
PROJECT LIMITS:	North Zanesville, OH Alternative 3: Slip Movement at Dillon School Dr (S)

Item	Ext.	Pay Item Name	Qty	Unit	Unit Price	Total
		ROADWAY				
202	30800	TRAFFIC ISLAND REMOVED	0	SY	$ 40.00	$ -
202	32000	CURB REMOVED	0	FT	$ 12.00	$ -
202	23000	PAVEMENT REMOVED	0	SY	$ 15.00	$ -
203	10000	EXCAVATION	0	CY	$ 36.00	$ -
203	20000	EMBANKMENT	0	CY	$ 35.00	$ -
609	26000	CURB, TYPE 6	0	FT	$ 45.00	$ -
					SUBTOTAL	$ -
		PAVEMENT				
301	56000	ASPHALT CONCRETE BASE (8")	0	CY	$ 320.00	$ -
304	20000	AGGREGATE BASE (6")	0	CY	$ 100.00	$ -
441	10000	ASPHALT CONCRETE SURFACE COURSE (1.25")	0	CY	$ 250.00	$ -
441	70200	ASPHALT CONCRETE INTERMEDIATE COURSE (1.75")	0	CY	$ 240.00	$ -
609	56000	6" CONCRETE TRAFFIC ISLAND	0	SY	$ 140.00	$ -
					SUBTOTAL	$ -
		LIGHTING				
625	75400	LIGHT POLE REMOVED	0	EACH	$ 420.00	$ -
625		PROPOSED LIGHTING	0	LS	$ 750.00	$ -
					SUBTOTAL	$ -
		DRAINAGE				
611	05900	15" CONDUIT, TYPE B	0	FT	$ 140.00	$ -
611	98150	CATCH BASIN, NO. 3	0	EACH	$ 5,000.00	$ -
					SUBTOTAL	$ -
		TRAFFIC CONTROL				
644	00300	CENTER LINE	0.00	MI	$ 8,400.00	$ -
644	00404	CHANNELIZING LINE, 12"	1685	FT	$ 2.50	$ 4,300.00
644	00104	EDGE LINE, 6"	0.00	MI	$ 6,500.00	$ -
644	00500	STOP LINE	0	FT	$ 2.50	$ -
644	01300	LANE ARROW	4	EACH	$ 125.00	$ 500.00
644	30000	REMOVAL OF PAVEMENT MARKING	1416	FT	$ 5.00	$ 7,100.00
850	10000	GROOVING FOR 4" RECESSED PAVEMENT MARKING, (ASPHALT)	0	MILE	$ 3,200.00	$ -
850	10130	GROOVING FOR 12" RECESSED PAVEMENT MARKING, (ASPHALT)	0	FT	$ 1.90	$ -
					SUBTOTAL	$ 11,900.00
		INCIDENTALS				
614	11000	MAINTAINING TRAFFIC	1	LS	$ 7,000.00	$ 7,000.00
619	16000	FIELD OFFICE, TYPE A	1	MNTH	$ 1,200.00	$ 1,200.00
623	10000	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LS	$ 1,000.00	$ 1,000.00
624	15000	MOBILIZATION	1	LS	$ 2,000.00	$ 2,000.00
					SUBTOTAL	$ 11,200.00
					TOTAL	$ 23,100.00
			30%		CONTINGENCY	$ 6,930.00
					GRAND TOTAL	$ 30,100.00

Prepared by: ABS
Date: 8/9/2024
Checked by:
Date:

PROJECT:	MUS 146 Safety Study
PID:	
PROJECT LIMITS:	North Zanesville, OH Alternative 4: Cul-de-sac at Dillon School Dr (South)

Item	Ext.	Pay Item Name	Qty	Unit	Unit Price	Total
		ROADWAY				
202	30800	TRAFFIC ISLAND REMOVED	0	SY	$ 40.00	$ -
202	32000	CURB REMOVED	0	FT	$ 12.00	$ -
202	23000	PAVEMENT REMOVED	789	SY	$ 15.00	$ 11,900.00
202	38000	GUARDRAIL REMOVED	250	FT	$ 4.00	$ 1,000.00
203	10000	EXCAVATION	200	CY	$ 36.00	$ 7,200.00
203	20000	EMBANKMENT	3300	CY	$ 35.00	$ 115,500.00
606	15050	GUARDRAIL, TYPE MGS	150	FT	$ 25.00	$ 3,800.00
609	26000	CURB, TYPE 6	87	FT	$ 45.00	$ 4,000.00
					SUBTOTAL	$ 143,400.00
		PAVEMENT				
301	56000	ASPHALT CONCRETE BASE (8")	252	CY	$ 320.00	$ 80,700.00
304	20000	AGGREGATE BASE (6")	189	CY	$ 100.00	$ 18,900.00
441	10000	ASPHALT CONCRETE SURFACE COURSE (1.25")	40	CY	$ 250.00	$ 10,000.00
441	70200	ASPHALT CONCRETE INTERMEDIATE COURSE (1.75")	56	CY	$ 240.00	$ 13,500.00
609	56000	6" CONCRETE TRAFFIC ISLAND	0	SY	$ 140.00	$ -
					SUBTOTAL	$ 123,100.00
		LIGHTING				
625	75400	LIGHT POLE REMOVED	0	EACH	$ 420.00	$ -
625		PROPOSED LIGHTING	0	LS	$ 750.00	$ -
					SUBTOTAL	$ -
		DRAINAGE				
611	05900	15" CONDUIT, TYPE B	150	FT	$ 140.00	$ 21,000.00
611	98150	CATCH BASIN, NO. 3	1	EACH	$ 5,000.00	$ 5,000.00
					SUBTOTAL	$ 26,000.00
		TRAFFIC CONTROL				
644	00300	CENTER LINE	0.34	MI	$ 8,400.00	$ 2,900.00
644	00404	CHANNELIZING LINE, 12"	0	FT	$ 2.50	$ -
644	00104	EDGE LINE, 6"	0.09	MI	$ 6,500.00	$ 600.00
644	00500	STOP LINE	0	FT	$ 2.50	$ -
644	00720	CHEVRON MARKING	168	FT	$ 8.50	$ 1,500.00
644	01300	LANE ARROW	0	EACH	$ 125.00	$ -
644	30000	REMOVAL OF PAVEMENT MARKING	0	FT	$ 5.00	$ -
850	10000	GROOVING FOR 4" RECESSED PAVEMENT MARKING, (ASPHALT)	0	FT	$ 3,200.00	$ -
850	10130	GROOVING FOR 12" RECESSED PAVEMENT MARKING, (ASPHALT)	0	FT	$ 1.90	$ -
					SUBTOTAL	$ 5,000.00
		INCIDENTALS				
614	11000	MAINTAINING TRAFFIC	1	LS	$ 15,500.00	$ 15,500.00
619	16000	FIELD OFFICE, TYPE A	1	MNTH	$ 1,200.00	$ 1,200.00
623	10000	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LS	$ 1,000.00	$ 1,000.00
624	15000	MOBILIZATION	1	LS	$ 2,000.00	$ 2,000.00
					SUBTOTAL	$ 19,700.00
					TOTAL	$ 317,200.00
			30%		CONTINGENCY	$ 95,160.00
					GRAND TOTAL	$ 412,400.00

Prepared by: ABS
Date: 8/9/2024
Checked by:
Date:

PROJECT:	MUS 146 Safety Study
PID:	
PROJECT LIMITS:	North Zanesville, OH Alternative 5: Roundabout

Item	Ext.	Pay Item Name	Qty	Unit	Unit Price	Total
		ROADWAY				
202	30800	TRAFFIC ISLAND REMOVED	0	SY	$ 40.00	$ -
202	32000	CURB REMOVED	0	FT	$ 12.00	$ -
202	23000	PAVEMENT REMOVED	5534	SY	$ 15.00	$ 83,100.00
203	10000	EXCAVATION	3336	CY	$ 36.00	$ 120,100.00
203	20000	EMBANKMENT	6699	CY	$ 35.00	$ 234,500.00
609	26000	CURB, TYPE 6	1658	FT	$ 45.00	$ 74,700.00
					SUBTOTAL	$ 512,400.00
		PAVEMENT				
301	56000	ASPHALT CONCRETE BASE (8")	1676	CY	$ 320.00	$ 536,400.00
304	20000	AGGREGATE BASE (6")	1257	CY	$ 100.00	$ 125,700.00
441	10000	ASPHALT CONCRETE SURFACE COURSE (1.25")	262	CY	$ 250.00	$ 65,500.00
441	70200	ASPHALT CONCRETE INTERMEDIATE COURSE (1.75")	367	CY	$ 240.00	$ 88,100.00
609	56000	CONCRETE MEDIAN	428	SY	$ 70.00	$ 30,000.00
					SUBTOTAL	$ 845,700.00
		LIGHTING				
625	75400	LIGHT POLE REMOVED	0	EACH	$ 420.00	$ -
625	10490	LIGHT POLE, CONVENTIONAL	8	EACH	$ 8,000.00	$ 64,000.00
					SUBTOTAL	$ 64,000.00
		DRAINAGE				
611	05900	15" CONDUIT, TYPE B	750	FT	$ 140.00	$ 105,000.00
611	16400	36" CONDUIT, TYPE B	60	FT	$ 330.00	$ 19,800.00
611	98150	CATCH BASIN, NO. 3	10	EACH	$ 5,000.00	$ 50,000.00
					SUBTOTAL	$ 174,800.00
		TRAFFIC CONTROL				
644	00300	CENTER LINE	0.23	MI	$ 8,400.00	$ 2,000.00
644	00404	CHANNELIZING LINE, 12"	1400	FT	$ 2.50	$ 3,500.00
644	00104	EDGE LINE, 6"	0.53	MI	$ 6,500.00	$ 3,500.00
644	00500	STOP LINE	30	FT	$ 2.50	$ 100.00
644	01300	LANE ARROW	6	EACH	$ 125.00	$ 800.00
644	30000	REMOVAL OF PAVEMENT MARKING	0	FT	$ 5.00	$ -
850	10000	GROOVING FOR 4" RECESSED PAVEMENT MARKING, (ASPHALT)	0	FT	$ 3,200.00	$ -
850	10130	GROOVING FOR 12" RECESSED PAVEMENT MARKING, (ASPHALT)	0	FT	$ 1.90	$ -
					SUBTOTAL	$ 9,900.00
		INCIDENTALS				
614	11000	MAINTAINING TRAFFIC	1	LS	$ 68,500.00	$ 68,500.00
619	16000	FIELD OFFICE, TYPE A	1	MNTH	$ 1,200.00	$ 1,200.00
623	10000	CONSTRUCTION LAYOUT STAKES AND SURVEYING	1	LS	$ 1,000.00	$ 1,000.00
624	15000	MOBILIZATION	1	LS	$ 2,000.00	$ 2,000.00
					SUBTOTAL	$ 72,700.00
					TOTAL	$ 1,679,500.00
			30%		CONTINGENCY	$ 503,850.00
					GRAND TOTAL	$ 2,183,400.00