



ROS-50-19.45

ROS-50 & Veteran's Parkway Safety Study

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I. Executive Summary

A. Purpose and Need

The purpose of this study is to analyze existing conditions and identify potential countermeasures to reduce crash frequency and severity at the intersection of US 50 and Veteran's Parkway. The study limits include the intersection of US 50, Veteran's Parkway and approximately 1000 feet on each intersection approach.

ODOT Safety maintains a list of HSIP priority locations and ranks each location based on crash criteria. This intersection is ranked #224 on the 2021 suburban intersections list. It is important to note that a new ranking system has been implemented to the HSIP list the last two iterations. This intersection was ranked #95 on the 2018 suburban intersection list, the last HSIP priority list before the new ranking system was implemented. In addition to the HSIP Priority List, ODOT TSMO maintains a TOAST list. On the 2022 TOAST list, this intersection is located within the 5th and 6th top ranked TOAST segments in District 9.

B. Overview of Safety Issues

Crash data was pulled from 2018 through 2022 from ODOT's crash database inside TIMS. There were 34 crashes within that 5-year period.

Of the 34 crashes, 12 crashes (35.3%) resulted in injuries. Of the 12 injury crashes, 6 were minor injury crashes and 6 were injury possible crashes. 16 of the 34 crashes (47.1%) were left turn/angle crashes. There were an additional 2 head on collision crashes that are attributed to left turning traffic. There is a significant trend of eastbound traffic on US 50 failing to yield to oncoming traffic when making a left turn. It is believed that the congestion is causing drivers to become impatient and attempt the left turns without an appropriate gap in traffic.

C. Recommended Countermeasures

Based on the crash report investigation resulting in an angle/left turn crash pattern being identified, a turboroundabout is being proposed at this intersection. The turboroundabout is expected to mitigate the primary crash pattern identified at the intersection. The estimated cost of the turboroundabout is \$3,419,386. ECAT analysis shows a benefit-cost ratio of 0.92. It is recommended that the turboroundabout be considered for future implementation.

II. Purpose and Need

The purpose of this study is to analyze existing conditions and identify potential countermeasures to reduce crash frequency and severity at the intersection of US 50 and Veteran's Parkway. The study limits include the intersection of US 50, Veteran's Parkway and approximately 1000 feet on each intersection approach.

ODOT Safety maintains a list of HSIP priority locations and ranks each location based on crash criteria. This intersection is ranked #224 on the 2021 suburban intersections list. It is important to note that a new ranking system has been implemented to the HSIP list the last two iterations. This intersection was ranked #95 on the 2018 suburban intersection list. In addition to the HSIP Priority List, ODOT TSMO maintains a TOAST list. On the 2022 TOAST list, this intersection is located within the 5th and 6th top ranked TOAST segments in District 9. The location is also listed as a Safety Integrated Project (SIP) location. The ranking on the HSIP Priority List and marked SIP location indicates possible safety improvement at the intersection. A study location map is provided in **Figure 1**. A study area aerial is provided in **Figure 2**.



Figure 1: Project Location Map (Ross County outlined in red)

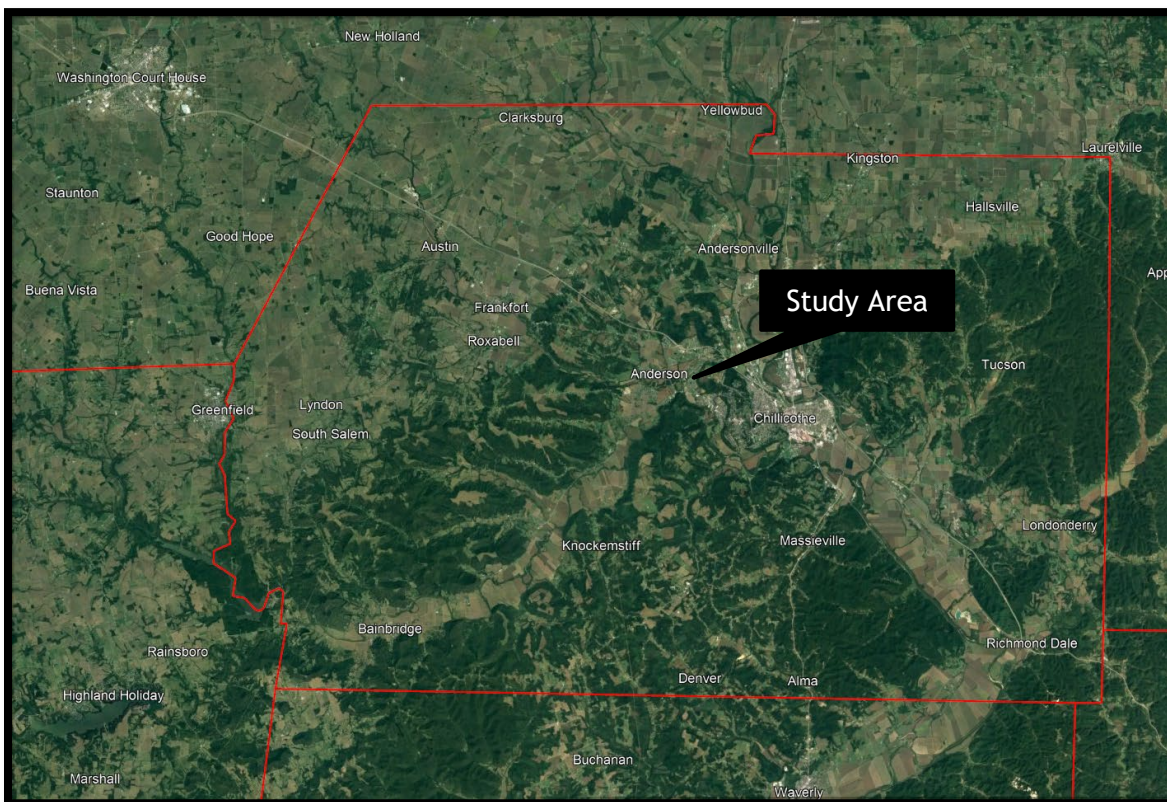


Figure 2: Study Area Aerial





III. Existing Conditions

A. Land Use

The study area is approximately 0.5 miles outside of the city of Chillicothe. The surrounding area of the study area includes undeveloped wooded and grassy space and commercial properties. One culvert exists in the study area. Culvert ID 91514252 is an 80' long, 18" span culvert with a current appraisal rating of 6. One bridge exists in the study area. Bridge ID 32617563 is an 80' (maximum span) bridge with a current general appraisal rating of 5.

B. Roadway Conditions

US 50 acts as an east-west connector throughout Ohio and is one of the higher AADT routes in District 9 with an AADT of as high as 15,827 in locations along this corridor. US 50 is classified as a Minor Arterial and has a posted speed limit of 45 MPH. This segment of US 50 is a two-lane, rural highway with 4-foot shoulders.

Veteran's Parkway is designated as CR-608 and is classified as a Major Collector. The roadway is a two-lane rural roadway with a 2-foot paved shoulder. Centerline and edge lines exist on the roadway. The posted speed limit on Veteran's Parkway is 45 MPH. The AADT on Veteran's Parkway is 12,317.

C. Intersection Conditions

The intersection of US 50 and Veteran's Parkway is a signalized 4-leg, rural intersection. Dedicated left turn lanes exist on US 50 in both directions. A dedicated left turn lane also exists on Veteran's Parkway. In addition to the dedicated left turn lane, a dedicated right turn lane exists on the east leg of US 50 at the intersection. The southern leg of the intersection is a business drive for a Dollar General.

D. Data Collection

Existing data for the routes and the intersection was obtained through TIMS.

IV. Existing Conditions Analysis

Numerous studies have been performed at the intersection, dating back to 2004. The most recent study was completed in 2022. This 2022 study resulted in an abbreviated safety application being submitted for improvements at the intersection. The improvements included adding Wavetronix and a supplemental signal head at the intersection. The turboroundabout alternative was developed along with the 2022 study but was not chosen due to the lack of funding availability at the time. There is a significant trend of eastbound traffic on US 50 failing to yield to oncoming traffic when making a left turn. It is believed that the congestion is causing drivers to become impatient and attempt the left turns without an appropriate gap in traffic. **Table 1** shows 2022 TOAST data for the segment of roadway in which the intersection is located.



Table 1: 2022 TOAST Data

ID	Score	Statewide Rankings				District Rankings			
		Overall		Category		Overall		Category	
		Rank	Total	Rank	Total	Rank	Total	Rank	Total
SROSUS00050**C_16.850_26.740_F	47.8%	285	11112	79	3954	6	674	6	184
SROSUS00050**C_16.850_26.740_R	44.8%	222	11112	55	3954	5	674	5	184

V. Crash Data

Crash data was pulled from 2018 through 2022 from ODOT’s crash database inside TIMS. There were 34 crashes within that 5-year period.

Of the 34 crashes, 12 crashes (35.3%) resulted in injuries. Of the 12 injury crashes, 6 were minor injury crashes and 6 were injury possible crashes. 16 of the 34 crashes (47.1%) were left turn/angle crashes. There were an additional 2 head on collision crashes that are attributed to left turning traffic. The trend of left turn and rear end crashes, along with the 2022 TOAST score, suggests that these crashes may be related to roadway congestion at the intersection. Table 2 shows a breakdown of crash statistics over the 5-year period.

Table 2: Crash Statistics

TRAFFIC_CRASH_YEAR	Number	%
2018	8	23.5%
2019	5	14.7%
2020	8	23.5%
2021	6	17.6%
2022	7	20.6%
Grand Total	34	100.0%

CRASH_SEVERITY	Number	%
Injury Crash	12	35.3%
Property Damage Crash	22	64.7%
Grand Total	34	100.0%

TYPE_OF_CRASH	Number	%
Left Turn	15	44.1%
Rear End	14	41.2%
Head On	2	5.9%
Angle	1	2.9%
Fixed Object	1	2.9%
Right Turn	1	2.9%
Grand Total	34	100.0%

HOUR_OF_DAY	Number	%
5	3	8.8%
7	3	8.8%
9	4	11.8%
10	1	2.9%
12	1	2.9%
13	3	8.8%
15	3	8.8%
17	4	11.8%
18	6	17.6%
19	2	5.9%
21	2	5.9%
22	2	5.9%
Grand Total	34	100.0%

CONTRIBUTING_FACTOR1	Number	%
Failure to Yield	19	55.9%
Following Too Closely/ACDA	14	41.2%
Unsafe Speed	1	2.9%
Grand Total	34	100.0%



VI. Recommended Countermeasures

A. Recommended Alternative

Based on the crash report investigation resulting in an 52.9% left turn/angle crash pattern being identified, a turboroundabout configuration is being proposed at this intersection. Roundabouts have been shown to reduce serious injury and fatal crashes from 78% to 82%. Given the serious injury and fatal angle crashes observed at the intersection, it is believed that a turboroundabout is the best solution to the crash pattern observed. While a single lane roundabout is often preferred to multi-lane roundabout types, traffic analysis showed the single lane roundabout having failing levels-of-service in 2032.

A traditional 2-lane highway intersection has 32 total conflict points, including 16 crossing points, 8 merge points, and 8 diverge points. The turboroundabout configuration proposed reduces those conflict points down to 13. Those 13 conflict points include 2 crossing points, 7 merge points, and 4 diverge points. **Figure 3** shows the proposed layout of the Turbo Lane configuration. **Figure 4** shows the comparison of conflict points of a traditional intersection vs a roundabout. **Figure 5** shows the comparison of conflict points between different roundabout types. **Figure 6** shows the conflict points for the proposed turboroundabout. **Table 3** shows the traffic analysis results of the proposed turboroundabout. **Table 4** shows the traffic analysis results of a no-build scenario.

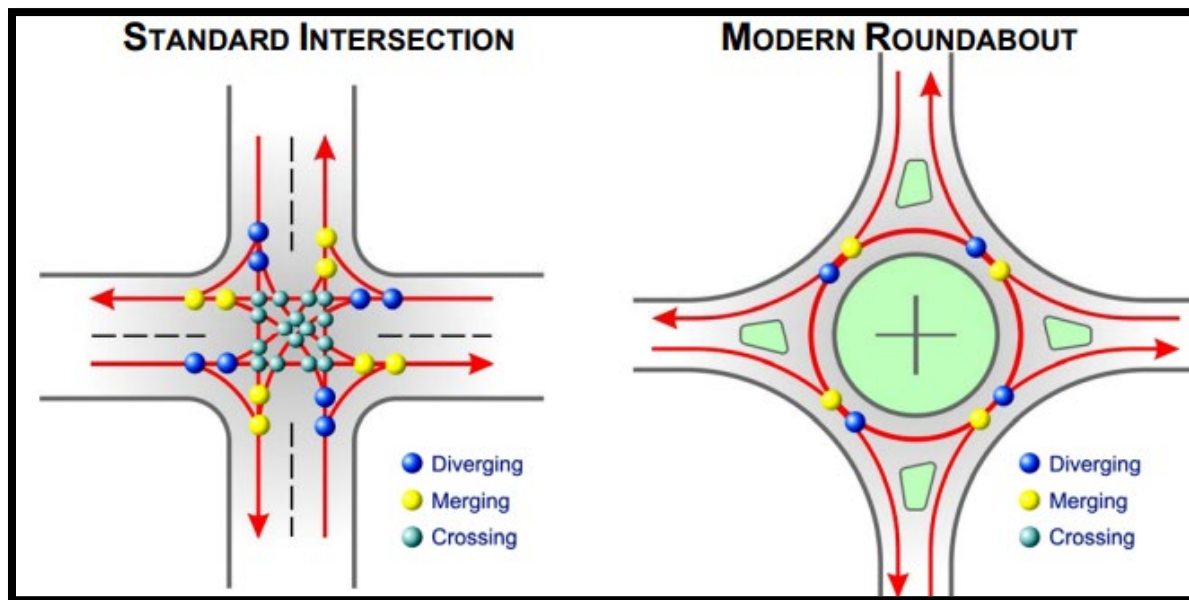


Figure 3: Proposed Turboroundabout Layout





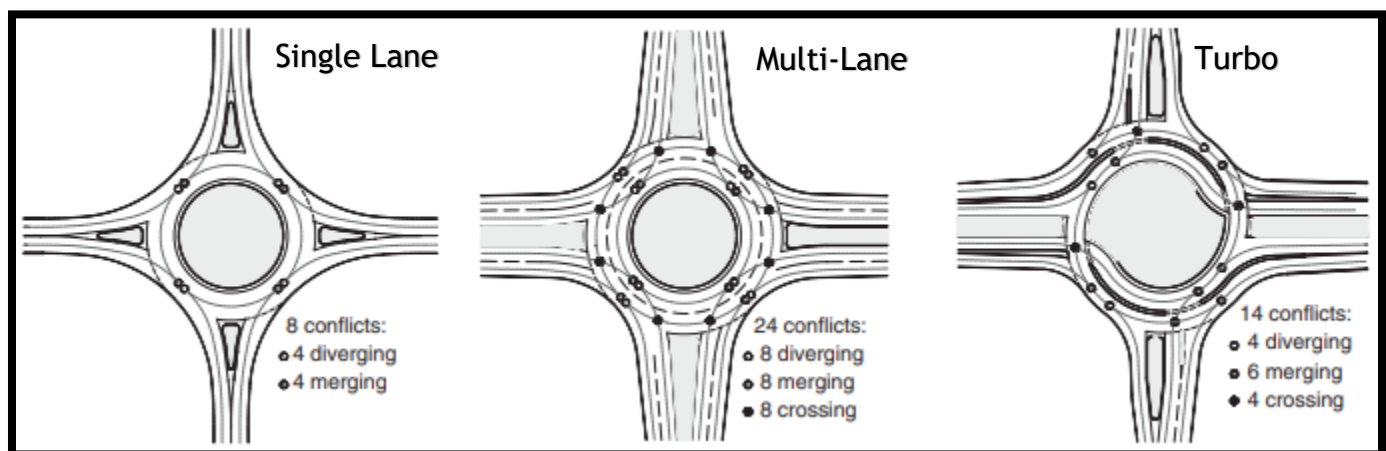
Figure 4: Traditional Intersection Conflict Points vs Roundabout Conflict Points



Kentucky Transportation Cabinet (KYTC)

<https://transportation.ky.gov/Congestion-Toolbox/Documents/Modern%20Roundabouts%20101.pdf>

Figure 5: Roundabout Type Conflict Points



Transportation Research Record Journal of the Transportation Research Board.

https://www.researchgate.net/publication/266852241_Turboroundabouts_Multicriterion_Assessment_of_Intersection_Capacity_Safety_and_Emissions



Figure 6: Proposed Turboroundabout Conflict Points

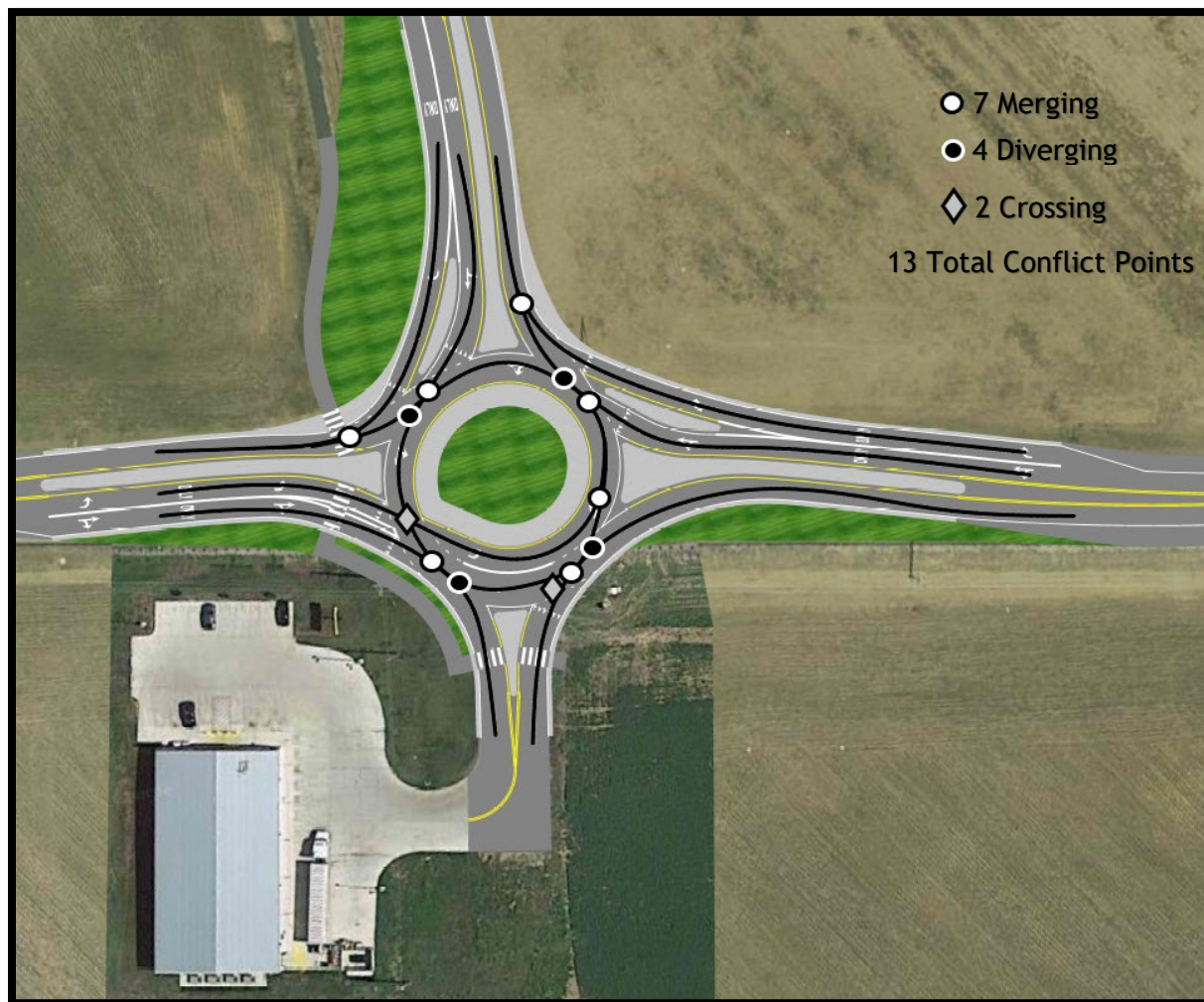




Table 3: 2042 Turboroundabout Traffic Analysis

2042 AM Full Build- HCS Roundabout Results (PHF=0.88)					
US50/Veterans Pkwy	LOS	Delay (sec/veh)	v/c	95th % Queued (Veh)	95% Queue Length (ft)
EB Left	B	11.1	0.55	3.4	85.0
EB TR	A	8.3	0.39	1.9	47.5
EB Approach	A	9.9			
WB LT	A	7.4	0.19	0.7	17.5
WB Right (Yield Bypass)	B	12.9	0.17	3.3	82.5
WB Approach	B	11.6			
NB LTR	B	11.7	0.10	0.3	7.5
NB Approach	B	11.7			
SB L/T	A	6.7	0.35	1.6	40.0
SB Right (Bypass)	A	4.8	0.17	0.6	15.0
SB Approach	A	6.1			
Overall RAB	A	9.3			

2042 PM Full Build- HCS Roundabout Results (PHF=0.92)**					
US50/Veterans Pkwy	LOS	Delay (sec/veh)	v/c	95th % Queued (Veh)	95% Queue Length (ft)
EB Left	A	8.3	0.34	1.5	37.5
EB TR	A	8.8	0.37	1.7	42.5
EB Approach	A	8.6			
WB LT	A	9.4	0.47	2.5	62.5
WB Right (Yield Bypass)	A	9.6	0.48	2.7	67.5
WB Approach	A	9.5			
NB LTR	A	8.3	0.14	0.5	12.5
NB Approach	A	8.3			
SB L/T	B	14.4	0.63	4.5	112.5
SB Right (Yield Bypass)	B	11.8	0.54	3.3	82.5
SB Approach	B	13.2			
Overall RAB	B	10.7			

Table 4: 2042 No-Build Traffic Analysis

US50 & Veterans Pkwy (84 sec cycle + PHF=0.88)	LOS	Delay (sec/veh)	v/c	95% QSR	95% Queue Length (ft)
EB L	C	30.5	0.829	0.73	145.1
EB T/R	C	20.2	0.516	0	221.8
EB Approach	C	26.2			
WB L	C	24.3	0.081	0.05	13.4
WB T	C	26.3	0.272	0	84.9
*WB R	A	0	0	0	0
WB Approach	A	6.1			
NB L/ T	D	37.6	0.191	0	19.2
NB R	D	37.2	0.11	0.1	9.6
NB Approach	D	37.5			
SB L	C	33.1	0.887	0	291.5
SB T/R	C	28.1	0.542	0	155.3
SB Approach	C	31.3			
Overall Roundabout	C	22.5			

US50 & Veterans Pkwy (122 sec cycle & PHF=.92)	LOS	Delay (sec/veh)	v/c	95% QSR	95% Queue Length (ft)
EB L	C	31.6	0.829	1.22	244.9
EB T/R	C	30.1	0.467	0	281.4
EB Approach	C	30.8			
WB L	C	30.7	0.075	0.1	24.6
WB T	E	56.5	0.86	0	498.1
*WB R	A	0	0	0	0
WB Approach	C	26.9			
NBL/T	D	54.2	0.383	0	69.4
NB R	D	53	0.19	0.29	29.2
NB Approach	D	53.8			
SB L	D	38.4	0.821	0	467.9
SB T/R	D	42.6	0.932	0	506.4
SB Approach	D	40.5			
Overall Intersection	C	33.8			



The estimated cost of the turboroundabout is \$3,419,386. Despite the high cost, ECAT analysis shows a benefit-cost ratio of 0.92. Design and construct issues driving the high cost are the need for dedicated right turn bypass lanes to accommodate traffic in later years. This impacts the footprint of the roundabout, requiring a larger roundabout.

B. Alternatives Considered

Given the crash trends and severity of the crashes at the intersection, a roundabout was the clear and obvious alternative choice. However, given the traffic analysis results, 2 roundabout layouts were investigated. These 2 roundabout layouts included: the selected turboroundabout layout and a single lane roundabout. Due to traffic analysis results showing failing levels-of-service for 2032, the single lane roundabout was ruled out. **Table 4** shows the traffic analysis results for the single lane (interim) roundabout. The proposed turboroundabout shows levels-of-service A and B for 2042 AM and 2042 PM, respectively.

Table 4: Single Lane (interim) Roundabout Traffic Analysis Results

2022 AM - Interim Build HCS Roundabout Results (PHF=0.88)						2032 AM - Interim Build HCS Roundabout Results (PHF=0.88)					
US50/Veterans Pkwy	LOS	Delay (sec/veh)	v/c	95th % Queued (Veh)	Queue Length (ft)	US50/Veterans Pkwy	LOS	Delay (sec/veh)	v/c	95th % Queued (Veh)	95% Queue Length (ft)
EB LTR	D	30.8	0.89	12.2	305.0	EB LTR	E	40.9	0.95	15.2	380.0
EB Approach	D	30.8				EB Approach	E	40.9			
WB LTR	C	16.1	0.65	4.9	122.5	WB LTR	C	18.4	0.69	5.7	142.5
WB Approach	C	16.1				WB Approach	C	18.4			
NB LTR	B	13.5	0.11	0.4	10.0	NB LTR	B	14.5	0.12	0.4	10.0
NB Approach	B	13.5				NB Approach	B	14.5			
SB LT	A	6.3	0.32	1.4	35.0	SB LT	A	6.5	0.34	1.5	37.5
SB Right (Yield Bypass)	A	4.5	0.16	0.6	15.0	SB Right (Yield Bypass)	A	4.7	0.17	0.6	15.0
SB Approach	A	5.7				SB Approach	A	5.9			
Overall RAB	C	19.3				Overall RAB	C	24.3			

2022 PM - Interim Build HCS Roundabout Results (PHF=0.92)**						2032 PM - Interim Build HCS Roundabout Results (PHF=0.92)**					
US50/Veterans Pkwy	LOS	Delay (sec/veh)	v/c	95th % Queued (Veh)	95% Queue Length (ft)	US50/Veterans Pkwy	LOS	Delay (sec/veh)	v/c	95th % Queued (Veh)	95% Queue Length (ft)
EB LTR	C	17.4	0.68	5.5	137.5	EB LTR	C	20.4	0.73	6.6	165.0
EB Approach	C	17.4				EB Approach	C	20.4			
WB LTR	D	31.1	0.90	12.7	317.5	WB LTR	E	41.4	0.96	15.8	395.0
WB Approach	D	31.1				WB Approach	E	41.4			
NB LTR	B	12.4	0.18	0.6	15.0	NB LTR	B	13.3	0.20	0.7	17.5
NB Approach	B	12.4				NB Approach	B	13.3			
SB LT	B	13.7	0.59	3.9	97.5	SB LT	C	15.4	0.63	4.6	115.0
SB Right (Yielded Bypass)	B	11.4	0.51	3.0	75.0	SB Right (Yield Bypass)	B	12.5	0.55	3.4	85.0
SB Approach	B	12.6				SB Approach	B	14.0			
Overall RAB	C	20.3				Overall RAB	D	25.2			