

ATCS[®]

Route 17 (Winchester Road) and
Route 245 (Old Tavern Road)/Route 703 Enon
Church Road
Intersection Safety & Design Study
Technical Report

Prepared for Virginia Department of Transportation

1601 Orange Road
Culpeper, Virginia

March 30, 2022



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Introduction and Background

This study seeks to screen, assess, and provide low-cost systemic and long-term safety improvements to the intersection of US 17 (Winchester Road) and Route 245 (Old Tavern Road)/Route 703 (Enon Church Road) in Fauquier County, Virginia within the Virginia Department of Transportation (VDOT)'s Culpeper District. This intersection has a history of crashes, often of high severity, that merited detailed review for further countermeasures.

FR-300 reports were utilized to analyze the crash history at the study intersection, with crash data from the VDOT PowerBI Database serving as a supplement. Crash data was analyzed for the period from January 1, 2014, to November 10, 2021.

Following the field review, short-term recommendations were developed and included as part of pavement marking and signing plans for the study intersection. These improvements were submitted to and accepted by VDOT as part of a memorandum dated January 10, 2022.

This report details the background of the study intersection, summarizes the previously recommended short-term improvements, and outlines medium and long-term recommendations as a follow-up to the referenced memorandum.

The evaluation of these long-term improvements includes safety analysis, operational analysis, and an overall comparison of the costs and benefits. Additional evaluation was performed at the adjacent intersections of US 17 and Old Winchester Road and Route 245 and Old Winchester Road for potential inclusion in improvement alternatives. Medium and long-term recommendations are not considered systemic and are based on the crash history for expanded improvements. Medium and long-term recommendations may or may not be eligible for HSIP funding. All recommendations meet minimum standards outlined in the Manual on Uniform Traffic Control Devices (MUTCD), the Virginia Supplement to the MUTCD, and the 2016 VDOT Road and Bridge Standards.

Executive Summary

Improvements at multiple cost levels and scale were considered to ensure that all angles of conventional and innovative concepts were considered. All concepts were carefully developed to address the current safety concerns of the intersection. All alternatives were thoroughly evaluated based on safety benefit, operational characteristics, impact to travel patterns, cost to implement, and other important factors to the surrounding community and environment.

A Split Intersection concept is considered the most viable concept for a shorter term, lower cost improvement due to potential to implement quickly and reduce left turn conflicts on an alternate alignment. An R-CUT Intersection concept is considered the most viable long-term concept due to significant benefit to cost comparisons based on similar implementations nationwide and feasibility of construction.

Existing Conditions

Intersection Route Information

Basic route information at the intersection is shown below in **Table 1**. Annual average daily traffic (AADT) was taken from the VDOT 2019 Traffic Data Publications. Posted speed was taken from the VDOT Speed Limits Map.

US 17 and Route 245/Route 703 Route Information			
Road Name	Route #	Posted Speed (MPH)	AADT (Vehicles/Day)
Winchester Road (north of intersection)	US 17	55	21,000
Winchester Road (south of intersection)	US 17	55	19,000
Old Tavern Road	Route 245	45	3,100
Enon Church Road	Route 703	Not Posted	120

Table 1: Route Information

US 17 (Winchester Road) in Fauquier County is considered a principal arterial. It is a Virginia Corridor of Statewide Significance, providing access between I-66 and Warrenton, with further access outside the county to Fredericksburg and Norfolk to the southeast. Per VTrans2035, long-term planning for the corridor revolves around increased capacity for both vehicles and transit for local users and freight traveling to and from the ports on the eastern coast of Virginia. Expected solutions include widening, intersection improvements, implementation of interchanges at strategic locations, traffic management, access management, improvement of parallel routes, fixed-route transit improvements, and freight rail improvements.

Route 245 (Old Tavern Road) is considered a major collector and Route 703 (Enon Church Road) is considered a local road.

Existing Geometric, Signing, and Marking Conditions

A field review was conducted at the study intersection on December 1st, 2021, to assess existing conditions and determine potential contributing factors to the crash history such as sight distance limitations, vertical and horizontal curves, fixed objects, and the presence and conditions of existing traffic control devices.

Observations were conducted during the field review to confirm intersection geometry and assess existing signs, pavement markings, and sight distance. An aerial of the existing intersection geometry is shown below in **Figure 1**. An aerial of the intersection with a view of the full Route 245 approach is shown in **Figure 2**.



Figure 1: Existing Intersection Geometry



Figure 2: Route 245 Approach Aerial

US 17 is a four-lane divided highway with left and right turn lanes on the approaches to the intersection. Through lane widths in the vicinity of the intersection were found to fluctuate between 11' and 12'. Both the northbound and southbound approaches include W1-10L Intersection/Curve Warning signs with W13-01P 50 Miles Per Hour (MPH) Advisory Speed plaques on the right shoulder and in the median.

Route 245 and Route 703 are both two-lane approaches. There are R1-1 Stop Signs and stop bars present on both approaches. The R1-1 Stop Signs are supplemented by R6-03 Divided Highway plaques. There are W3-1 Stop Ahead signs on both approaches.

Sight distance at the intersection is generally considered adequate from the stop bar locations, though there are sight obstructions present. Driver sight distance on westbound Route 245 is slightly obstructed due to the presence of sign assemblies in the channelization island for the US 17 northbound right turn. Driver sight distance is also temporarily blocked on approach to the intersection by the presence of trees in the southeast quadrant of the intersection, though the trees do not obstruct sight distance at the stop bar. An image of the trees in the southwest quadrant is shown below in **Figure 3**. Sight distance for drivers on eastbound Route 703 is obstructed due to the presence of a horizontal curve on US 17 southbound. A summary of the existing sight distance conditions at the intersection is found in **Table 2**.



Figure 3: Tree Sight Obstruction on Westbound Route 245

Table 2: Sight Distance Conditions Summary

US 17 and Route 245/Route 703 Sight Distance			
Approach	Looking	Condition	Reference Figure
US 17 Northbound	North	Unobstructed to intersection	Figure 4
US 17 Southbound	South	Unobstructed to intersection	Figure 5
Route 245 Westbound	North	Unobstructed at stop bar	Figure 6
Route 245 Westbound	South	Unobstructed at stop bar	Figure 7
Median Refuge Westbound	North	Unobstructed at yield point	Figure 8
Route 703 Eastbound	North	Obstructed at stop bar by horizontal curve	Figure 9
Route 703 Eastbound	South	Unobstructed at stop bar	Figure 10
Median Refuge Eastbound	South	Unobstructed at yield point	Figure 11

An additional aerial view of US 17 south of the intersection is shown in **Figure 12** to provide additional sight distance context for the US 17 northbound approach.



Figure 4: Looking Towards Intersection from US 17 Northbound



Figure 5: Looking Towards Intersection from US 17 Southbound



Figure 6: Looking North from Westbound Route 245



Figure 7: Looking South from Westbound Route 245



Figure 8: Looking North from Median Refuge Westbound



Figure 9: Looking North from Route 703 Eastbound



Figure 10: Looking South from Route 703 Eastbound



Figure 11: Looking South from Median Refuge Eastbound



Figure 12: Aerial Image of US 17 South of the Intersection

Historical Crash Data

Crash data was collected from VDOT’s PowerBI crash tool for the period from January 1, 2014, to November 10, 2021. FR-300 reports for the collected data was requested from VDOT and analyzed. The crash data is summarized by year, including the partial 2021 year, and type in **Table 3** and **Table 4**, respectively. A map of the crash data is shown in **Figure 13**.

Table 3: Site Crash Summary by Year

Route 17 and Route 245/Route 703 2014-2021 Crash Data by Year						
Crash Type and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
2014	0	0	0	1	2	3
2015	1	0	1	0	3	5
2016	0	0	0	0	2	2
2017	1	0	1	0	4	6
2018	0	0	1	0	1	2
2019	0	2	0	1	4	7
2020	0	0	0	1	2	3
2021	1	0	0	0	1	2
Total	3	2	3	3	19	30

Table 4: Site Crash Summary by Type

Route 17 and Route 245/Route 703 2014-2021 Crash Data by Type						
Crash Type and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
Rear End	0	0	0	0	6	6
Angle	3	2	2	3	9	19
Swideswipe - Same Direction	0	0	0	0	1	1
Fixed Object - Off Road	0	0	1	0	0	1
Deer	0	0	0	0	2	2
Other	0	0	0	0	1	1
Total	3	2	3	3	19	30

A total of 30 crashes were reported at the intersection during the studied period. Key takeaways from the crash data include:

- 63% of the reported crashes were recorded as angle crashes.
- 37% of the crashes were recorded as an injury or fatal crash, with a total of three fatal crashes at the intersection during the study period.
- 53% of the crashes involved a vehicle traveling westbound on Route 245 striking or being struck by a vehicle traveling northbound on US 17, including all three fatal crashes and six additional injury crashes.
- An additional four crashes involved vehicles traveling westbound on Route 245 striking or being struck by a vehicle traveling southbound on US 17.

While a majority of the crashes at the intersection are associated with the westbound left turn movement from Route 245 across US 17 northbound, sight distance for the movement is approximately 1,200 feet looking to the right and 1,300 feet looking to the left. From crash reports and field observations, it is evident that drivers may feel the need to cross the intersection quickly in one movement and often, due to advance sight distance, may misjudge gaps. The horizontal curvature of the road may also lead to driver perception error.

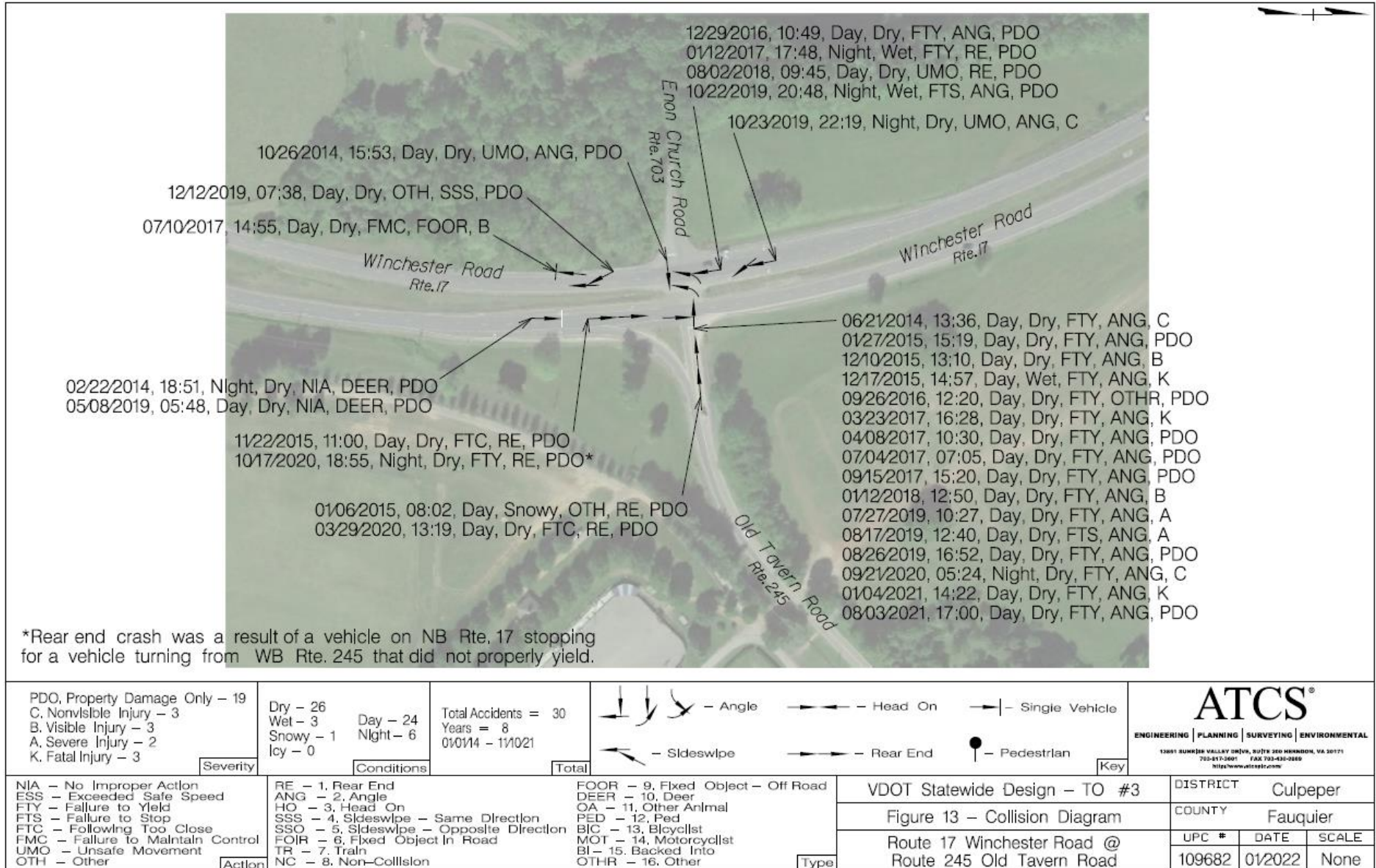


Figure 13: Historical Crash Map

Traffic Data (2021)

As part of the study, 12-hour turning movement counts at the intersection of US 17 and Route 245/Route 703 and US 17 and Old Winchester Road were collected in December 2021. Turning movement counts were also collected in January 2021 as part of a previous study completed by VDOT in July 2021. **Figure 14** shows the hourly volume comparison between the January 2021 and December 2021 volumes. Overall, the December hourly volumes are consistent with the January hourly volumes. Due to the relative consistency of the volumes, the higher December 2021 volumes were used for the traffic analysis at the intersections of US 17 and Route 245/Route 703 and US 17 and Old Winchester Road. The network peak hours for the collected volumes were determined to be 7:45-8:45 AM and 3:00-4:00 PM. Turning movement counts at the intersection of Route 245 and Old Winchester Road were extrapolated by balancing collected volumes at the two adjacent intersections.

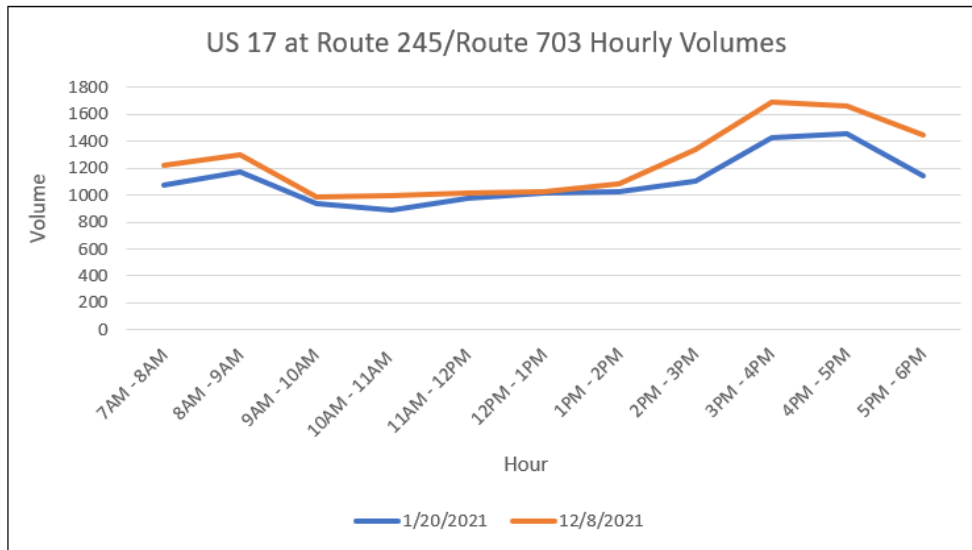


Figure 14: Collected Volume Comparison

Existing Conditions Operational Analysis

Existing conditions analysis was performed in Synchro using HCM 2000 methodologies. The results are shown in **Table 5** for the AM and PM peak hours.

Table 5: Existing Operational Analysis

Intersection	Existing AM Peak Hour Analysis Results				Existing PM Peak Hour Analysis Results			
	Intersection Delay (s/veh)*	LOS	WBL Delay (s/veh)*	LOS	Intersection Delay (s/veh)*	LOS	WBL Delay (s/veh)*	LOS
US 17 at Enon Church Road/Old Tavern Road	0.9	LOS A	18.8	LOS B	5.9	LOS A	48.4	LOS D
US 17 at Old Winchester Road	0.1	LOS A	-	-	0.3	LOS A	-	-
Old Tavern Road at Old Winchester Road	0.3	LOS A	-	-	0.2	LOS A	-	-

All three intersections evaluated operate at LOS A overall. The westbound left turn from Route 245 onto US 17 operates at LOS B in the AM peak hour and LOS D in the PM peak hour.

The queue for the westbound left turn was observed during a field visit in February 2022 and is shown in **Figure 15**. Queuing was noted as non-excessive, with a maximum observed stationary queue of seven vehicles. Delay for the left turning movement was also noted to be minimal.



Figure 15: Aerial View of Route 245 Westbound Left Turn PM Peak Hour Queue onto Southbound US 17

Short-Term Improvements

A brief summary of the short-term improvements proposed in the previously submitted memorandum are summarized in **Table 6** and **Table 7** for signs and pavement markings, respectively. Sketches of these improvements can be found in **Appendix A**.

Table 6: Proposed Short-Term Signing Improvements

US 17 and Route 245/Route 703 - Signing Improvements Summary	
Recommended Action	Purpose
Removal of existing No Parking signs and extraneous Route Shield signs on US 17.	Reduce sign clutter to more clearly provide drivers with important information.
Removal of existing Curve Warning signs and Advisory Speed plaques on US 17 and replacement with Intersection Warning signs, Watch for Turning Vehicles signs, Distance plaques, and warning flashers.	Re-focus warning signs on the presence of the intersection and its associated conflicting movements as opposed to the curvature of the roadway.
Removal of existing Divided Highway plaques and replacement with Cross Traffic Does Not Stop plaques on side street approaches.	Provide a more clear indication to drivers on the presence of conflicting movements.

Table 7: Proposed Short-Term Pavement Marking Improvements

US 17 and Route 245/Route 703 - Pavement Marking Improvements Summary	
Recommended Action	Purpose
Shift Route 245 and Route 703 stop bars closer to the US 17 travel way.	Improve sight distance and provide a shorter crossing distance to the median.
Delineate US 17 travel way with mini-skips across the side streets and median openings.	Improve the ability of drivers to judge the path of conflicting vehicles on US 17.
Install optical speed bars on US 17 northbound.	Slow vehicles approaching the intersection.
Provide gore area markings adjacent to the US 17 northbound right turn channelization island.	Improve delineation of the travel way.
Provide "STOP AHEAD" message markings and transverse rumble strips on Route 245 westbound.	Enhance advanced warning of the downstream stop condition.

Medium-Term Improvements

As previously discussed, there is a sight distance obstruction on the westbound 245 approach due to the presence of trees within the sightline looking south. To prevent drivers approaching the stop bar from losing sight of conflicting vehicles on US 17 northbound, it is recommended that the trees in the southeast corner of the intersection be removed. The trees recommended for removal are highlighted in **Figure 16**.



Figure 16: Proposed Tree Removal in Southeast Quadrant

Long-Term Improvements

Proposed Long-Term Improvements

In developing alternative intersection concepts, a thorough review of existing safety, traffic, and geometric data was performed. While the intersection of US 17 and Route 245/Route 703 is considered the focus of the study, the adjacent intersections at US 17 and Old Winchester Road and Route 245 and Old Winchester Road were considered as part of alternative solutions.

As the previous study completed by VDOT in July 2021 determined that signalization of the intersection is neither warranted nor appropriate, alternative concepts were developed around unsignalized alternative intersections. Signalization has not been further evaluated as part of this study. Alternative intersection solutions were focused on improvements to safety while minimizing impacts to vehicle travel time and delay. An emphasis was placed on elimination of critical crossing conflicts. A breakdown of conflict points at a standard four-leg intersection is shown in **Figure 17**. Alternatives analyzed as part of this study include:

1. Unsignalized Green-T Intersection
2. Median U-Turn
3. Split Intersection
 - a. Split Intersection with Unsignalized Green-T
4. Restricted Crossing U-Turn
5. Widened Median
6. Roundabout
7. Grade Separation

These alternatives are discussed in greater detail in the sections that follow. Note that costs are planning level only and have not been calculated in great detail. These values are based on other recent projects and would require further analysis for funding/investment submission.

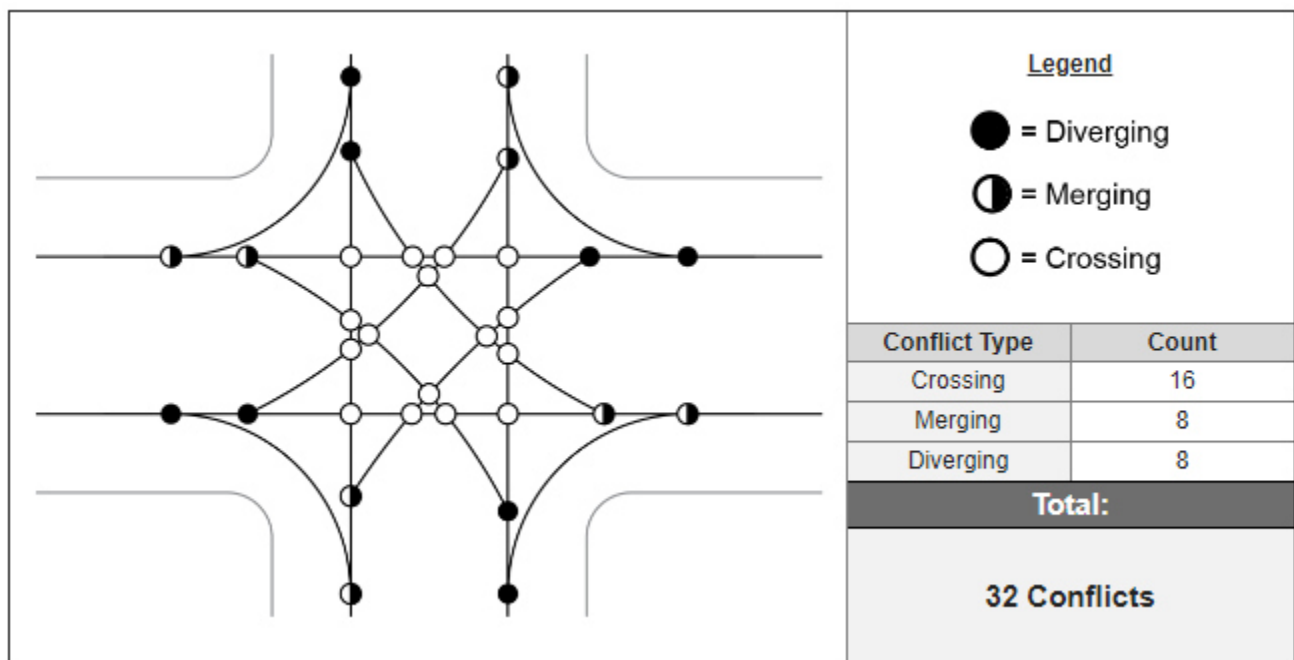


Figure 17: Standard Four-Leg Intersection Conflict Points

Crash Modification Factors are based on published Virginia Specific values where available and FHWA Clearinghouse values where more appropriate.

Unsignalized Green-T Intersection

Description of Alternative

The Unsignalized Green-T Intersection alternative involves the addition of a median separated acceleration lane on US 17 for vehicles turning left from westbound Route 245. This was developed to provide drivers with separate observation points for the crossing traffic on US 17 northbound and the merging traffic on US 17 southbound.

Vehicles on Route 703 would be restricted to right-out only turns, with an existing turnaround for vehicles available at the entrance to Great Meadow approximately 1,300' to the south of the intersection. Vehicles attempting to travel through from Route 245 to Route 703 or turn left from US 17 onto Route 703 may turn around at the intersection of US 17 and Old Winchester Road approximately 1,700' to the north. A concept sketch of the Unsignalized Green-T intersection alternative is shown in **Figure 19**. This alternative is expected to have no impacts on existing right-of-way (ROW) and cost between \$4,000,000 and \$5,000,000. A breakdown of the projected cost estimate for the Unsignalized Green-T is shown in **Table 8**.

Table 8: Unsignalized Green-T Projected Cost Estimate Breakdown

US 17 and Route 245 - Unsignalized Green-T Alternative Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 750,000.00	40%	\$ 1,050,000.00	8/4/2025
Right-of-Way/Utilities	\$ 100,000.00	40%	\$ 140,000.00	12/20/2026
Construction	\$ 2,000,000.00	40%	\$ 2,800,000.00	8/4/2027
CEI (20% of Construction Base Estimate)			\$ 400,000.00	CN End Date
Total			\$ 4,390,000.00	11/1/2028

Operational Analysis

The addition of the acceleration lane is expected to provide a slight improvement to operations for the westbound left turn movement, with a reduction in delay from approximately 48.4 seconds/vehicle to 46.5 seconds/vehicle. There is no additional travel distance for the Route 245 left turn movement with the implementation of this alternative.

Safety Benefits

While this alternative does provide for a significant reduction in the number of crossing conflict points for the westbound left turn, from eight to three, the proposed alignment does not remove the most critical crossing conflict point with the northbound through movement. A breakdown of the conflict points for a standard Green-T is shown in **Figure 18**. As such the safety improvement is expected to be minimal, with a 0.96 and 0.84 crash modification factor (CMF) for all crashes and fatal/injury crashes, respectively. These values correspond to a 4% and 16% reduction in relevant crashes. It may be possible that this solution would simplify driver decision making and have a higher safety benefit, however, this is based on qualitative assessment and not other researched reduction factors.

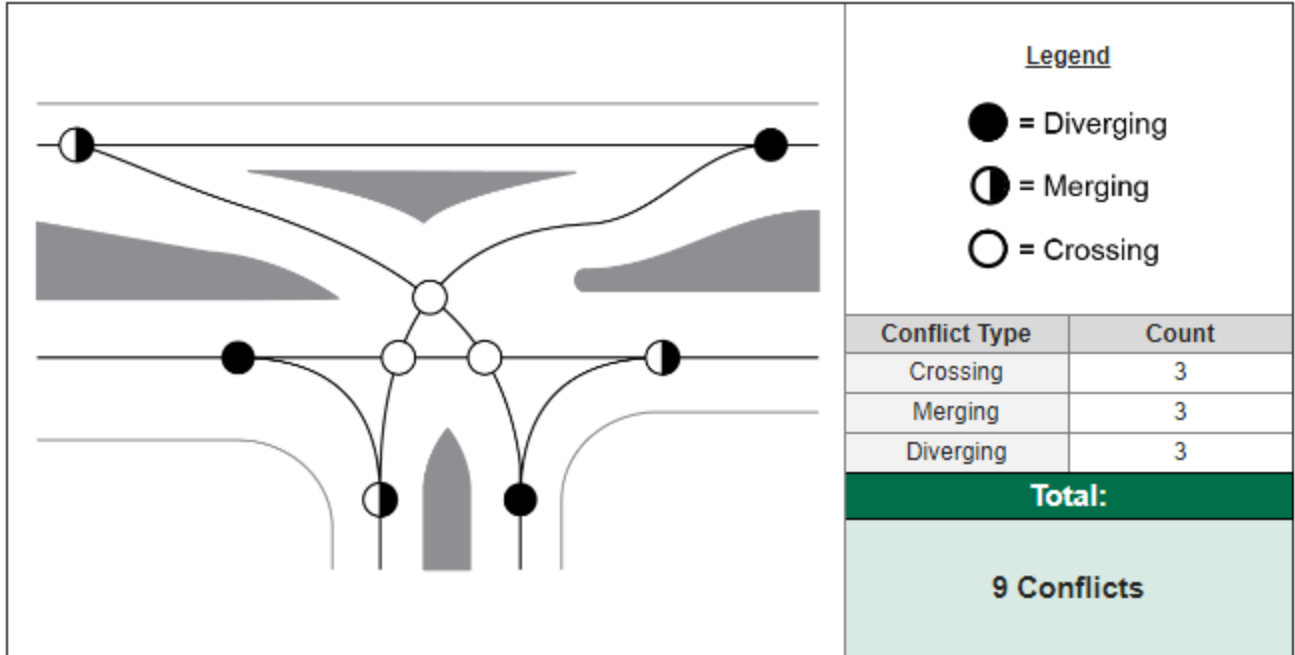
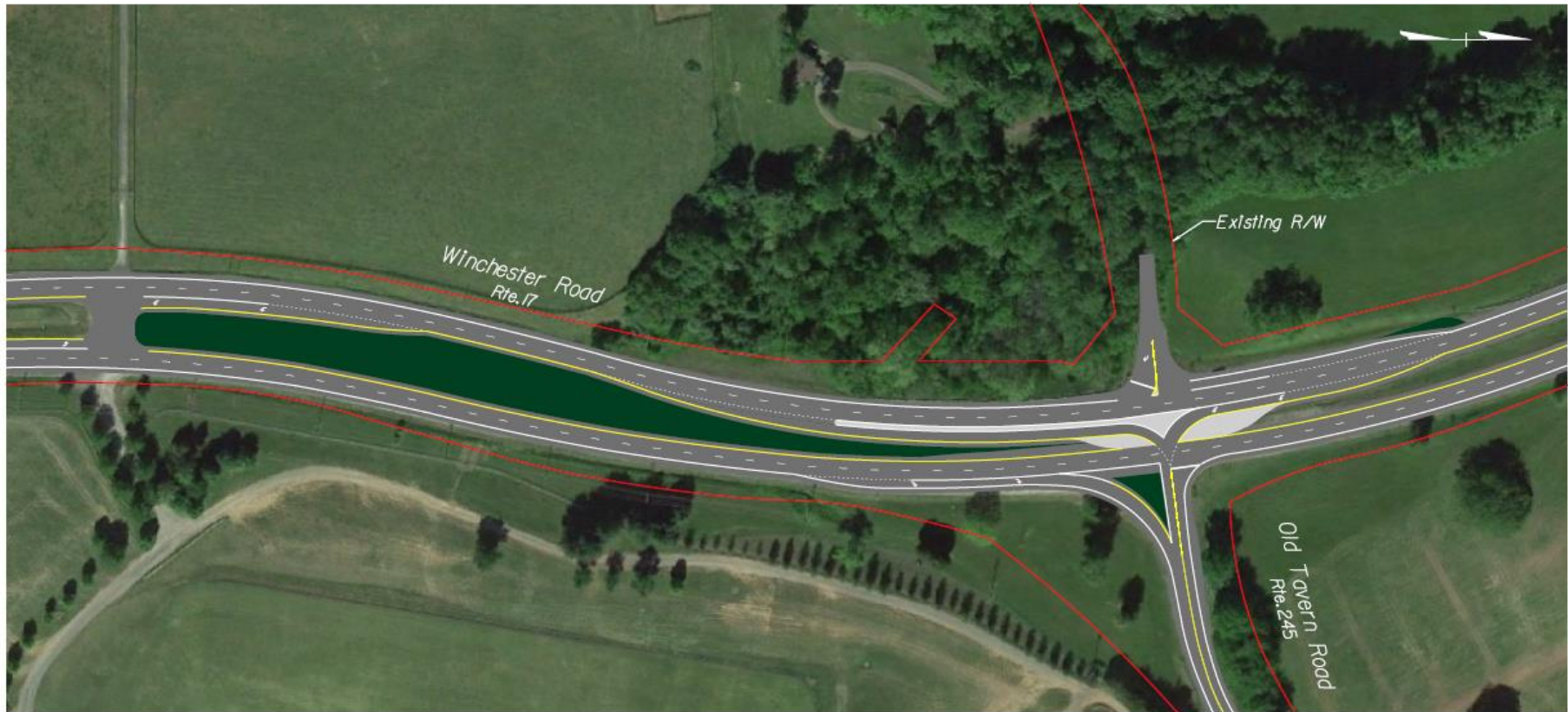


Figure 18: Standard Green-T Conflict Points



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	Figure 19 – Unsignalized Green-T		COUNTY Fauquier	
	Route 17 Winchester Road @ Route 245 Old Tavern Road		UPC *	DATE
		109682	01/2022	None

Figure 19: Green-T Alternative Concept Sketch

Median U-Turn

Description of Alternative

The Median U-Turn (MUT) alternative removes all side street left turn movements and redirects them through two turnarounds. Side street through movements would be similarly restricted. The northern turnaround would be provided approximately 375' to the north of the intersection, and a southern turnaround would be provided approximately 400' south of the intersection. Both turnarounds would tie directly into the existing right turn lanes on US 17. A concept sketch of the MUT alternative is shown in **Figure 21**. This alternative is expected to have minor impacts on the existing ROW and cost between \$4,000,000 and \$5,000,000. A breakdown of the projected cost estimate for the MUT is shown in **Table 9**.

Table 9: Median U-Turn Projected Cost Estimate Breakdown

US 17 and Route 245 - Median U-Turn Alternative Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 700,000.00	40%	\$ 980,000.00	8/4/2025
Right-of-Way/Utilities	\$ 100,000.00	40%	\$ 140,000.00	12/20/2026
Construction	\$ 2,000,000.00	40%	\$ 2,800,000.00	8/4/2027
CEI (20% of Construction Base Estimate)			\$ 400,000.00	CN End Date
Total			\$ 4,320,000.00	11/1/2028

Operational Analysis

The redirection of the westbound left turn movement to a right turn movement and a U-turn at a downstream turnaround is expected to reduce the westbound left turn delay from approximately 48.4 seconds/vehicle to 47.2 seconds/vehicle, including the travel time from the right turn through the turnaround and back to the intersection. The additional travel distance for the westbound left turn movement is approximately 800'. Operational performance for the MUT is expected to scale with growing volumes in future years due to the ability to signalize the turnarounds.

Safety Benefits

Due to the restriction of the left turning movements, conflict points for the westbound left turn reduce from eight in the existing configuration to zero. A breakdown of the conflict points for the proposed MUT is shown in **Figure 20**. The proposed MUT configuration removes the four crossing conflicts in the middle due to the further restriction of the side street through movements. CMFs for all crashes and fatal/injury crashes are expected to be 0.63 and 0.37, respectively, based on studies and FHWA published research. These values equate to a 37% and 63% reduction in crashes.

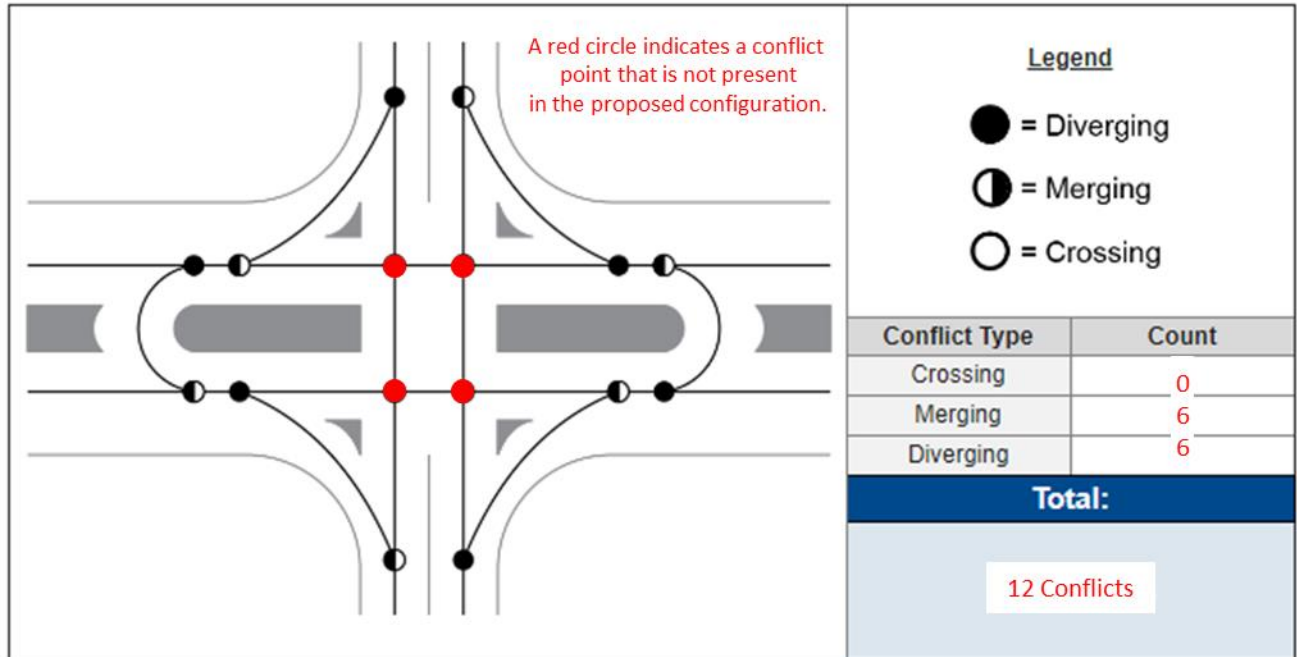
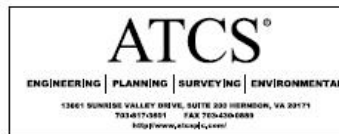


Figure 20: Modified Median U-Turn Conflict Points



VDOT Statewide Design – TO #3

Figure 21 – Median U–Turn

Route 17 Winchester Road @
Route 245 Old Tavern Road

DISTRICT		Culpeper	
COUNTY		Fauquier	
UPC	DATE	SCALE	
109682	01/2022	None	

Figure 21: Median U-Turn Alternative Concept Sketch

Split Intersection

Description of Alternative

The Split Intersection alternative reduces conflict points for the westbound left turn movement on Route 245 by restricting traffic on Route 245 and Old Winchester Road to one-way operations, with Route 245 acting as an ingress and Old Winchester Road acting as an egress. Traffic on Route 245 between US 17 and the Great Meadow entrance would be restricted to one-way operations eastbound, with two-way operations provided between the Great Meadow entrance and Old Winchester Road to minimize impacts to access. Similarly, traffic on Old Winchester Road would be limited to northbound traffic only, with the exception of two-way operations between the private residence driveways and Route 245. The existing extraneous pavement on Old Winchester Road would be repurposed as a non-separated pedestrian facility.

At the intersection of US 17 and Route 245, all ingress movements onto Route 245 would be maintained with no egress movements from Route 245 provided. Full egress movements would be provided at the intersection of US 17 and Route 245, with the existing southbound left turn and northbound right turn movements removed. Concept sketches of the Split Intersection alternative are shown in **Figure 23**, **Figure 24**, and **Figure 25**.

A modified version of the Split Intersection alternative was evaluated, which would further modify the intersection of US 17 and Old Winchester Road to include an Unsignalized Green-T intersection as previously described for the intersection of US 17 and Route 245. A concept sketch of this alternative has not been provided.

Both alternatives are expected to have no impacts on existing ROW. The expected cost for the standard Split Intersection is approximately \$300,000, while the Split Intersection with Green-T is expected to cost approximately \$5,000,000 to \$6,000,000. The increase assumes additional improvements and Preliminary Engineering costs such as upgrades to the Old Winchester and Route 245 Intersection. A breakdown of the projected cost estimate for the Split Intersection is shown in **Table 10**. A breakdown of the projected cost estimate for the Split Intersection with Green-T is shown in **Table 11**.

US 17 and Route 245 - Split Intersection Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 100,000.00	40%	\$ 140,000.00	8/4/2022
Right-of-Way/Utilities	\$ -	40%	\$ -	
Construction	\$ 100,000.00	40%	\$ 140,000.00	3/20/2023
CEI (20% of Construction Base Estimate)			\$ 20,000.00	CN End Date
Total			\$ 300,000.00	6/20/2023

Table 11: Split Intersection with Green-T Projected Cost Estimate Breakdown

US 17 and Route 245 - Split Intersection with Unsignalized Green-T Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 700,000.00	40%	\$ 980,000.00	8/4/2025
Right-of-Way/Utilities	\$ 100,000.00	40%	\$ 140,000.00	12/20/2026
Construction	\$ 2,500,000.00	40%	\$ 3,500,000.00	8/4/2027
CEI (20% of Construction Base Estimate)			\$ 500,000.00	CN End Date
Total			\$ 5,120,000.00	11/1/2028

Operational Analysis

Due to the redirection of outbound turning movements to a different intersection, vehicles turning left from Route 245 onto US 17 will be required to drive an additional 2,400 feet to the egress point on Old Winchester Road. Due to the additional

travel time, the Route 245 travel time delay is expected to increase from 48.4 seconds/vehicle to 64.4 seconds/vehicle for the standard Split Intersection and 64.8 seconds/vehicle for the Split Intersection with Green-T.

Safety Benefits

With the modification to a Split intersection configuration, the number of crossing conflict points for the westbound left turn movement reduce from eight to three. A breakdown of the conflict points for the proposed Split Intersection configuration is shown in **Figure 22**. It is noted that the Route 703 approach to US 17 will not be modified to one-way operations, and while no direct CMF exists for the Split Intersection concept, there is an expected safety benefit from the modification due to the decrease in conflict points for the westbound left turn from eight to three in both evaluated configurations. The Green-T portion of the secondary alternative is expected to provide a minimal additional reduction in crashes, with a 0.96 and 0.84 crash modification factor (CMF) for all crashes and fatal/injury crashes, respectively. These values correspond to 4% and 16% reductions in the relevant crash types. The safety benefits are based on simplified decision making for drivers and reduction in conflicts that would promote safer operations and reduce the likelihood of angle crashes.

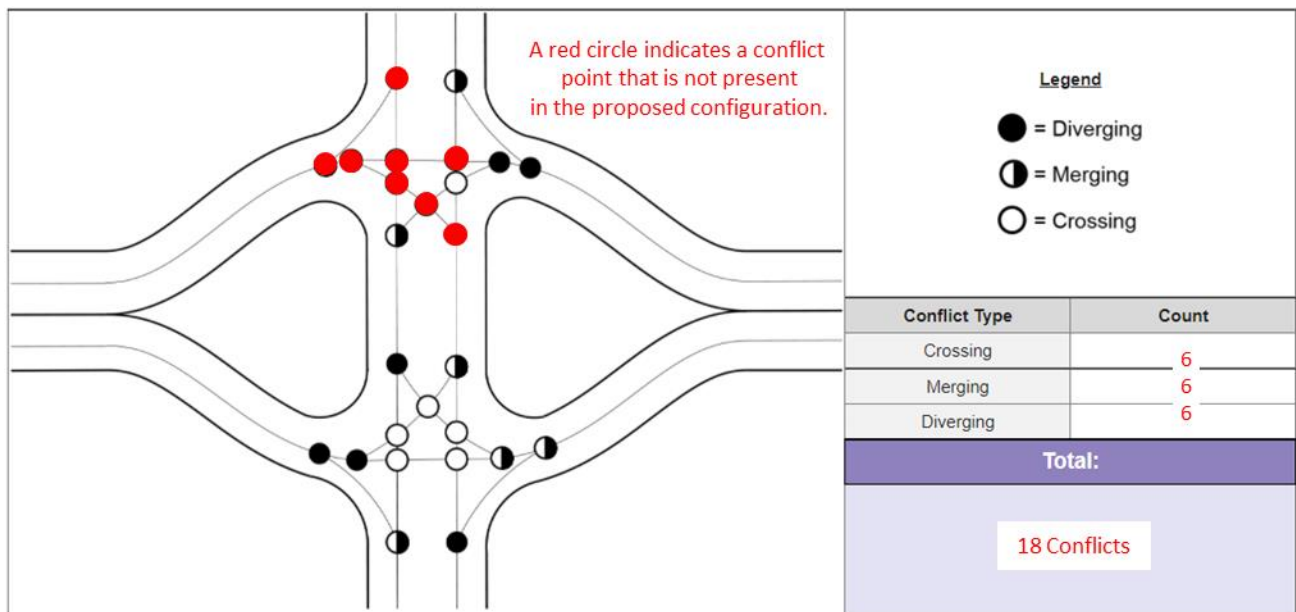


Figure 22: Modified Split Intersection Conflict Points



Figure 23: Split Intersection Alternative Concept Sketch – Full Concept

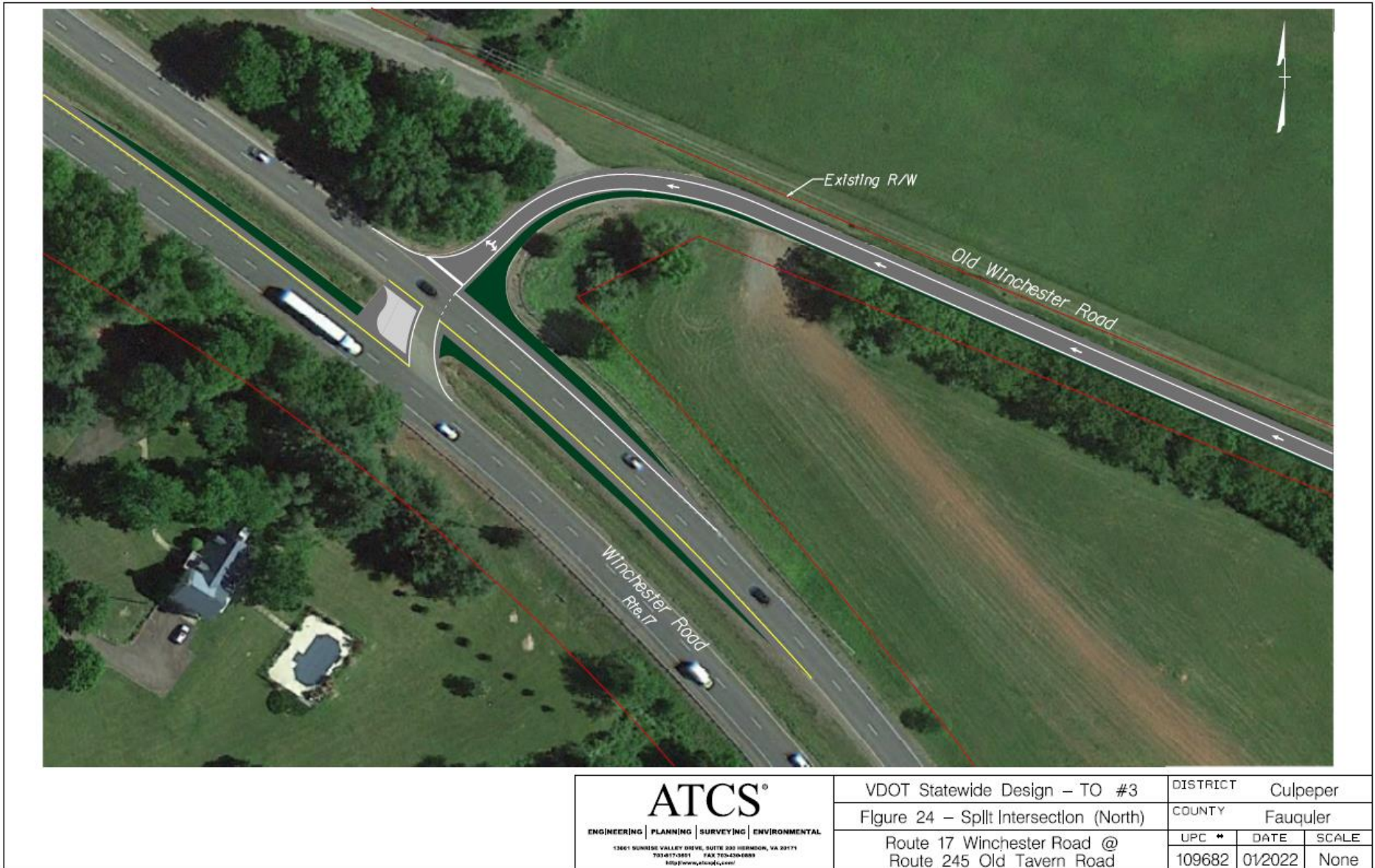


Figure 24: Split Intersection Alternative Concept Sketch – Northern Details

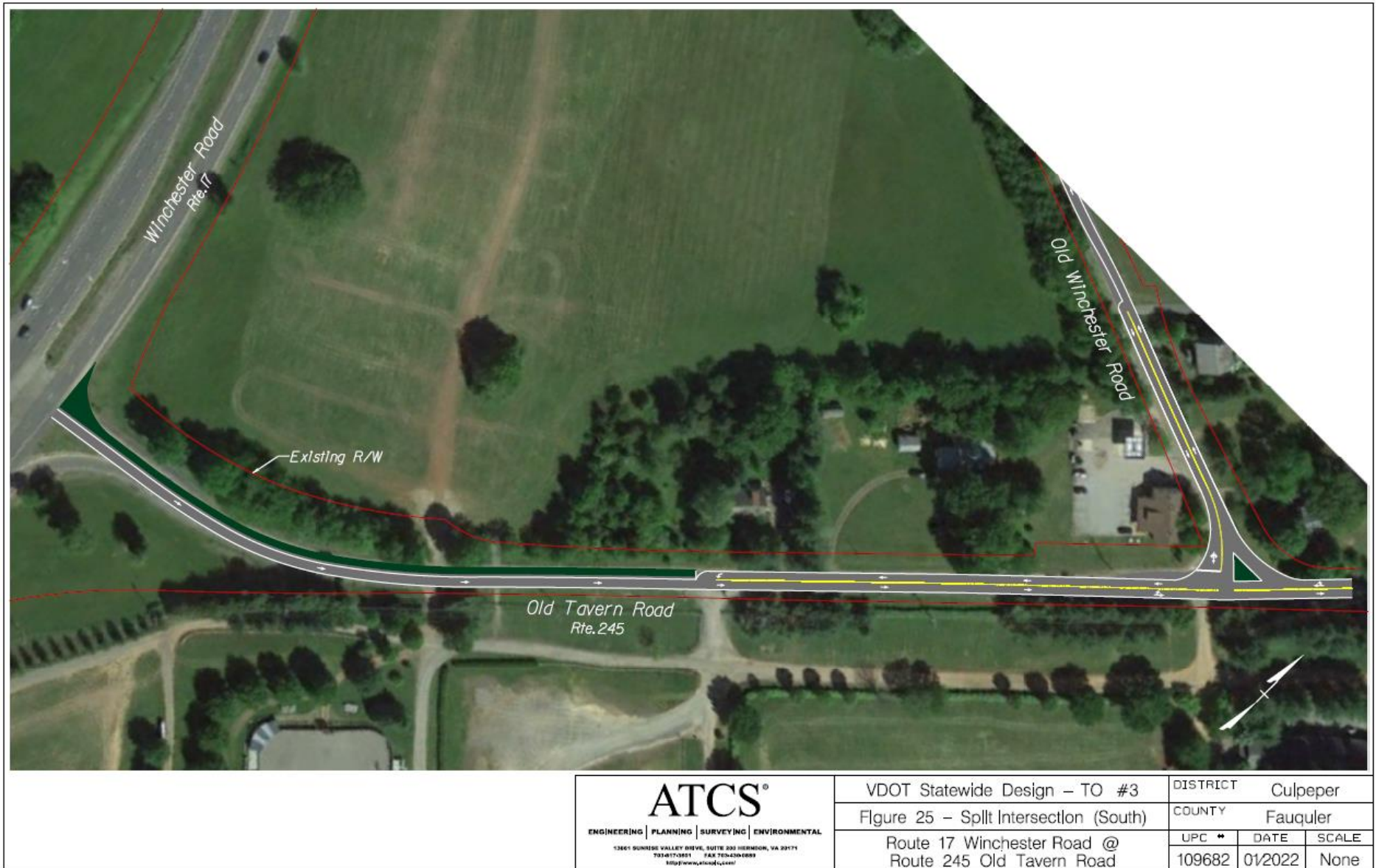


Figure 25: Split Intersection Alternative Concept Sketch – Southern Details

Restricted Crossing U-Turn

Description of Alternative

The Restricted Crossing U-Turn (R-CUT) alternative restricts the through and left turn movements from the side streets and redirects all traffic to the relevant right turn movements. Vehicles making the through or left turn movements out of Route 703 may utilize the existing turnaround at the entrance to Great Meadow approximately 1,300' to the south of the intersection. Vehicles making these movements from Route 245 would be provided a new turnaround location approximately 375' to the north of the intersection. This turnaround would tie directly into the existing right turn lane onto Route 703. However, left turns from mainline US-17 would still be allowed and not restricted compared to existing travel patterns. A concept sketch of the R-CUT is shown in **Figure 27**. This alternative is expected to have minor impacts on existing ROW and cost between \$4,000,000 and \$5,000,000. A breakdown of the projected cost estimate for the R-CUT is shown in **Table 12**.

Table 12: Restricted Crossing U-Turn Projected Cost Estimate Breakdown

US 17 and Route 245 - Restricted Crossing U-Turn Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 750,000.00	40%	\$ 1,050,000.00	8/4/2025
Right-of-Way/Utilities	\$ 100,000.00	40%	\$ 140,000.00	12/20/2026
Construction	\$ 1,800,000.00	40%	\$ 2,520,000.00	8/4/2027
CEI (20% of Construction Base Estimate)			\$ 360,000.00	CN End Date
Total			\$ 4,070,000.00	11/1/2028

Operational Analysis

Due to the redirection of the westbound left turn movement to the U-Turn north of the intersection, vehicles making that movement would be required to drive approximately 800 additional feet to complete their movement. The reduction in delay from the redirection of the left turn movement to a right turn and U-turn would modify the delay to approximately 47.2 seconds/vehicle, down from 48.4 seconds/vehicle in the existing geometric configuration. Operational performance for the MUT is expected to scale with growing volumes in future years due to the ability to signalize the turnarounds.

Safety Benefits

Due to the removal of all left turning movements at the intersection, there is a reduction in westbound left turn movement crossing conflicts from eight to zero. A breakdown of the conflict points for a standard R-CUT is shown in **Figure 26**. Expected crash reduction is high, with CMFs of 0.54 and 0.37 for all crashes and fatal/injury crashes, respectively. These CMF values correspond to 46% and 63% reductions in the relevant crash types.

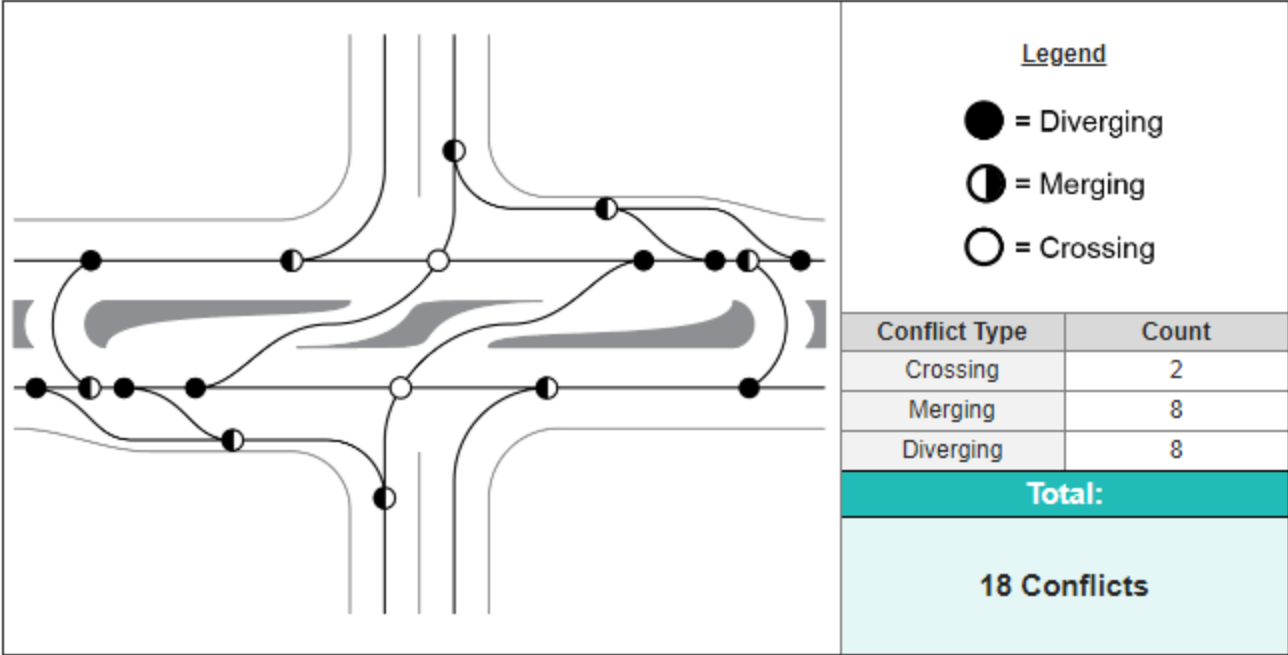
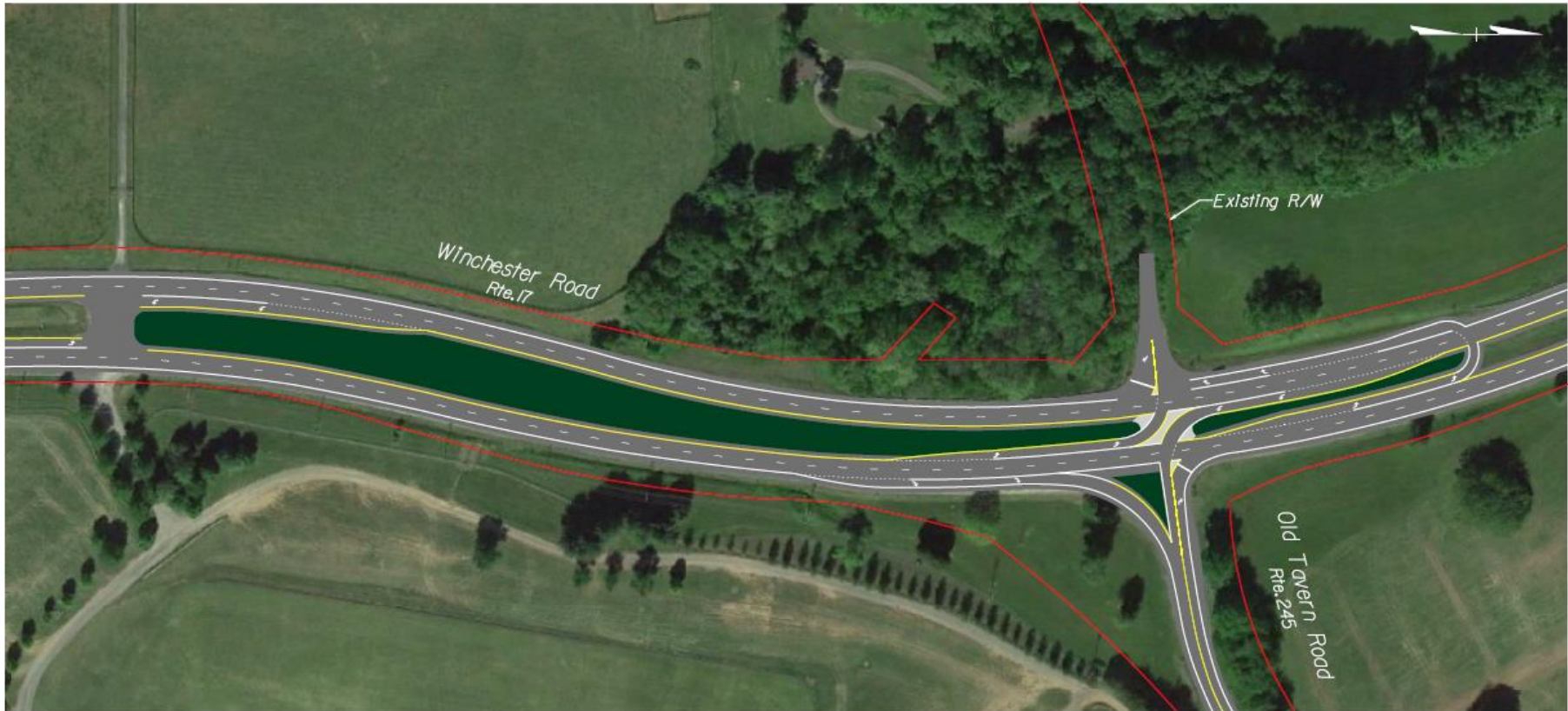


Figure 26: Standard R-Cut Conflict Points



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	Figure 27 – R-CUT		COUNTY Fauquier		
	Route 17 Winchester Road @ Route 245 Old Tavern Road		UPC **	DATE	SCALE
			109682	01/2022	None

Figure 27: Restricted Crossing U-Turn Alternative Concept Sketch

Widened Median

Description of Alternative

This alternative provides additional median refuge space for turning vehicles by shifting the alignment of US 17 southbound to the west. There is approximately 40' of storage between the US 17 travel lanes, including the mainline left turn lanes, and approximately 16' of storage between the turn lanes. This provides minimal area for vehicles to comfortably stage in crossing each direction of US-17, therefore leading to the potential feeling of drivers to cross in one movement. Shifting US 17 southbound while maintaining curve design standards would provide approximately 30' of storage between the turn lanes and 54' of storage between the US 17 travel lanes. A concept sketch of the Widened Median alternative is shown in **Figure 28**.

This alternative is expected to have significant impacts to the existing ROW and cost in excess of \$13,000,000 due to major reconstruction of the roadway. A breakdown of the projected cost estimate for the Widened Median is shown in **Table 13**.

Table 13: Widened Median Projected Cost Estimate Breakdown

US 17 and Route 245 - Widened Median Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 1,500,000.00	40%	\$ 2,100,000.00	8/4/2025
Right-of-Way/Utilities	\$ 1,000,000.00	40%	\$ 1,400,000.00	8/4/2027
Construction	\$ 6,000,000.00	40%	\$ 8,400,000.00	3/30/2029
CEI (20% of Construction Base Estimate)			\$ 1,200,000.00	CN End Date
Total			\$ 13,100,000.00	11/30/2030

Operational Analysis

As this alternative does not modify the turning movements at the intersection, no change to the delay for the westbound left turn is expected compared to existing conditions.

Safety Benefits

While this modification does not remove any of the crossing conflict points for the westbound left turning movement, the increased storage in the median provides passenger vehicles with a useable refuge to two-stage their turning movement. As such, the CMF for this alternative is expected to be 0.84 for all crash severities. This corresponds to a 16% reduction in all crash types. As all heavy vehicles may not find sufficient storage in the median even with the modification, the increased crossing distance may negatively impact their navigation.

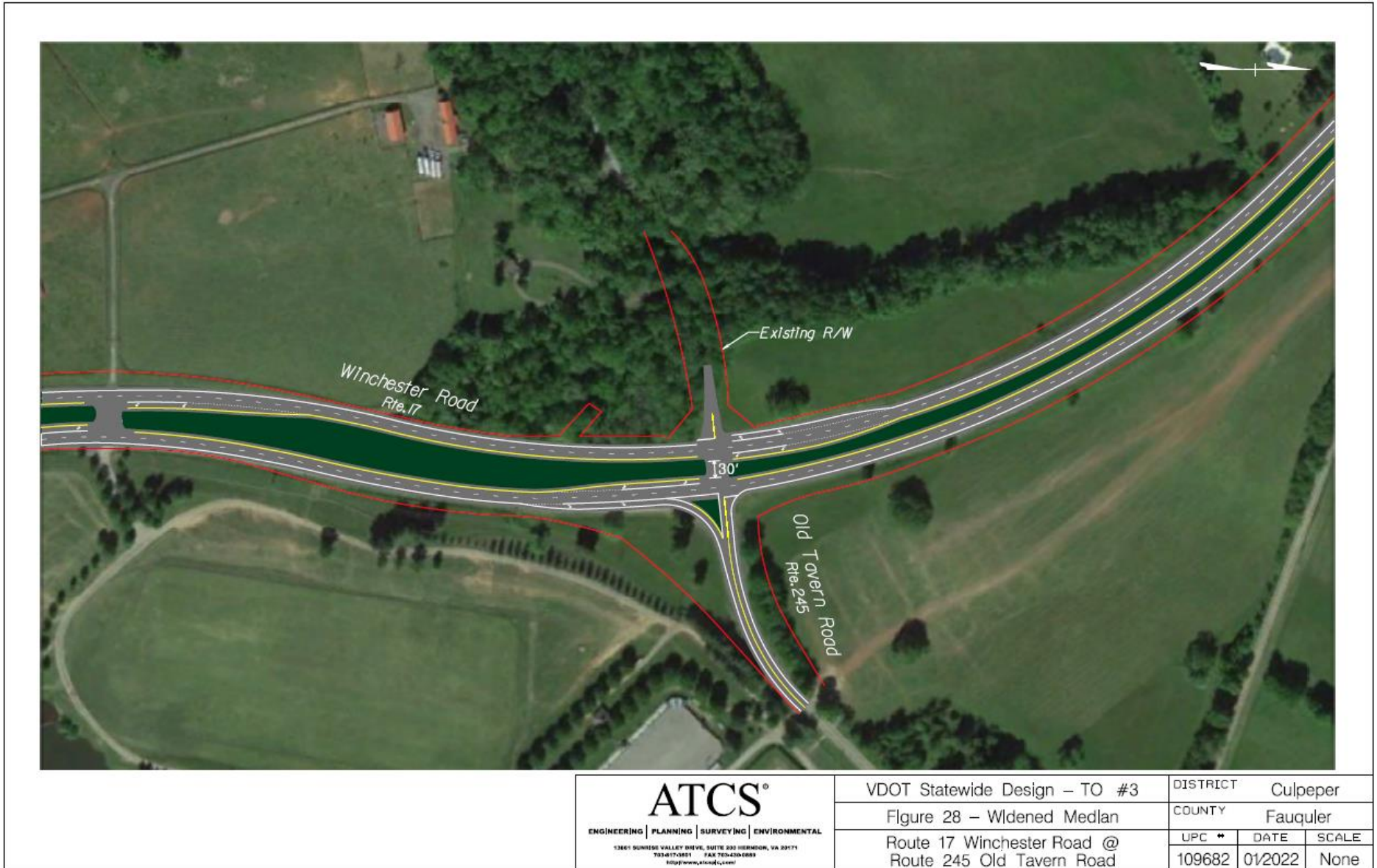


Figure 28: Widened Median Concept Sketch

Roundabout

Description of Alternative

A multilane roundabout was evaluated for feasibility and for comparison to the developed alternatives. A concept sketch for the roundabout has been provided in **Figure 30**. The roundabout was not selected as a reasonable alternative due to the isolated rural character of the corridor making a roundabout unexpected. Additionally, the curvature and other geometrics of the intersection and roadway would make construction difficult.

ROW impacts are expected to be significant for the roundabout. Expected cost for the roundabout is approximately \$12,000,000 - \$15,000,000. A breakdown of the projected cost estimate for the roundabout is shown in **Table 14**.

Table 14: Roundabout Projected Cost Estimate Breakdown

US 17 and Route 245 - Roundabout Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 1,500,000.00	40%	\$ 2,100,000.00	8/4/2025
Right-of-Way/Utilities	\$ 1,500,000.00	40%	\$ 2,100,000.00	8/4/2027
Construction	\$ 6,000,000.00	40%	\$ 8,400,000.00	3/30/2029
CEI (20% of Construction Base Estimate)			\$ 1,200,000.00	CN End Date
Total			\$ 13,800,000.00	11/30/2030

Operational Analysis

SIDRA analysis was performed for the roundabout and found that the delay for the westbound left turn is expected to reduce from 48.4 seconds/vehicle to 11.0 seconds/vehicle. Operational performance for the roundabout is not expected to scale with growing volumes in future years due to finite capacity unless completely reconstructed.

Safety Benefits

The roundabout would reduce the crossing conflict points for the westbound left turn from eight to zero. A breakdown of the conflict points for a single-lane roundabout is shown in **Figure 29**. It is noted that the proposed roundabout for this location is a multilane roundabout on mainline US 17, which increases the number of conflict points compared to a single-lane roundabout. CMFs for the roundabout are 1.062 and 0.37 for all crashes and fatal/injury crashes, respectively. These correspond to a 6.2% increase in all crash types but a 63% reduction in fatal/injury crashes. This is due to the geometry of a multilane roundabout typically increase the frequency of property damage only (PDO) crashes due to a higher occurrence of rear end and sideswipe incidents, but with reduced crash severity overall.

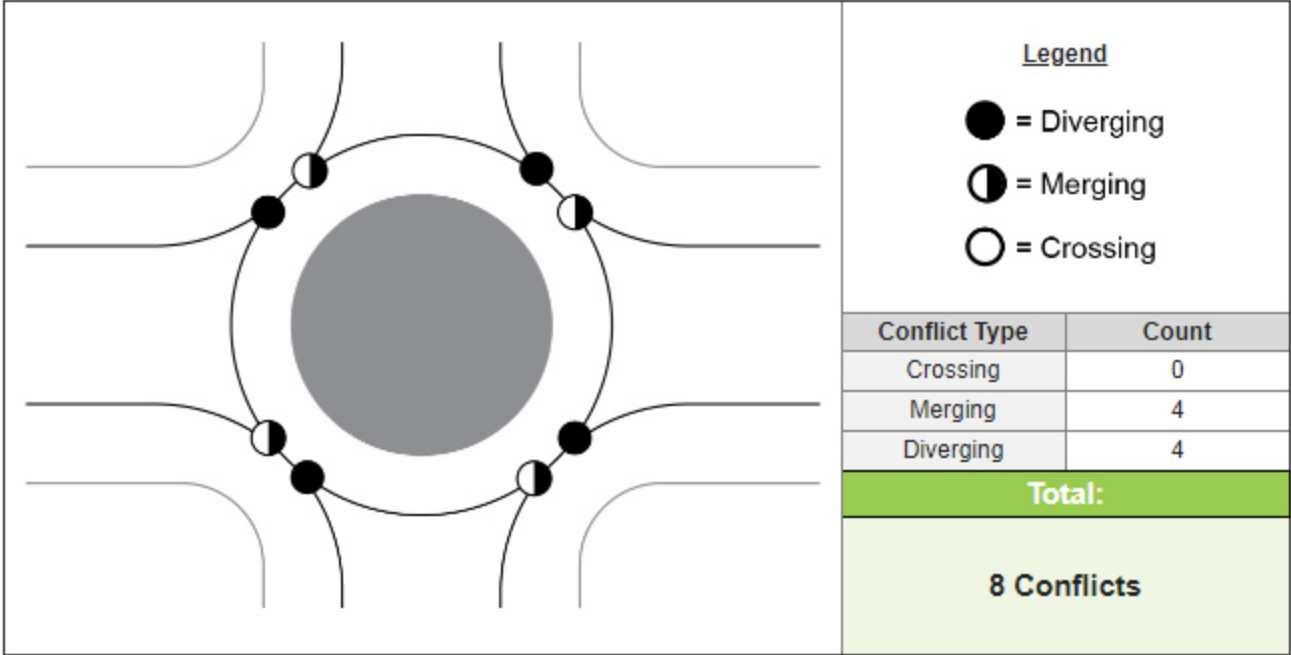


Figure 29: Standard Single-Lane Roundabout Conflict Points



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Figure 30 – Roundabout

Route 17 Winchester Road @
 Route 245 Old Tavern Road

DISTRICT		Culpeper	
COUNTY		Fauquier	
UPC #	DATE	SCALE	
109682	03/2022	None	

Figure 30: Roundabout Concept Sketch

Grade Separation

Description of Alternative

Grade separation was evaluated for feasibility and for comparison to the developed alternatives. A concept sketch for grade separation has not been provided. ROW impacts are expected to be extremely high for grade separation. Expected cost for grade separation is expected to be in excess of \$30,000,000. A breakdown of the projected cost estimate for grade separation is shown in **Table 15**.

Table 15: Grade Separation Projected Cost Estimate Breakdown

US 17 and Route 245 - Grade Separation Cost Evaluation				
Phase	Base Estimate (2021 Value)	Percent Contingency	Minimum Total Estimate (2021 Value)	Phase Start Date
Preliminary Engineering	\$ 3,000,000.00	40%	\$ 4,200,000.00	8/4/2025
Right-of-Way/Utilities	\$ 3,000,000.00	40%	\$ 4,200,000.00	3/30/2028
Construction	\$ 15,000,000.00	40%	\$ 21,000,000.00	3/30/2030
CEI (20% of Construction Base Estimate)			\$ 3,000,000.00	CN End Date
Total			\$ 32,400,000.00	11/30/2033

Operational Analysis

No analysis has been performed for grade separation due to the variability of potential configurations.

Safety Benefits

Grade separation would reduce the crossing conflict points for the westbound left turn from eight to zero. CMFs for grade separation are 0.64 for all crashes, 0.58 for fatal crashes, and 0.43 for injury crashes. These CMFs correspond to a 36% reduction in all crashes, a 42% reduction in fatal crashes, and a 57% reduction in injury crashes.

Alternative Operational Analysis Comparison

Alternatives were evaluated using HCM 2000 methodologies in Synchro, with the exception of the roundabout which was evaluated using SIDRA. Only PM peak hour results are provided due overall higher volumes compared to the AM peak hour. As shown in **Table 16**, all intersections operate at an overall level of service (LOS) of A. The westbound left turn from Route 245 operates at LOS D in all alternatives except for the split intersection and roundabout. Due to the increased travel time down Old Winchester Road, the westbound left turn movement is expected to see an increase in delay to LOS E, with approximately 16 seconds of additional delay per vehicle. The roundabout is expected to reduce delay for the movement to 11.0 seconds/vehicle and operate at LOS B.

Table 16: Alternatives Operational Analysis

Alternative	PM Peak Hour Analysis Results							
	US 17 at Route 245/Route 703				US 17 at Old Winchester Road		Route 245 at Old Winchester	
	Intersection Delay (s/veh)*	LOS	WBL Delay (s/veh)*	LOS	Intersection Delay (s/veh)*	LOS	Intersection Delay (s/veh)*	LOS
Existing	5.9	LOS A	48.4	LOS D	0.3	LOS A	0.2	LOS A
Green-T	5.6	LOS A	46.5	LOS D	0.3	LOS A	0.2	LOS A
Median U-Turn	1.5	LOS A	47.2	LOS D	0.3	LOS A	0.2	LOS A
Split Intersection	0.1	LOS A	64.4	LOS E	5.7	LOS A	0.0	LOS A
Split Intersection with Green-T	0.1	LOS A	64.8	LOS E	5.7	LOS A	0.0	LOS A
RCUT	1.5	LOS A	47.2	LOS D	0.3	LOS A	0.2	LOS A
Widened Median	5.9	LOS A	48.4	LOS D	0.3	LOS A	0.2	LOS A
Roundabout	9.2	LOS A	11.0	LOS B	-	-	-	-

Alternative Comparison Matrix

A matrix comparing the costs, safety benefits, operational analysis, and other evaluated metrics is shown in **Table 17**.

Goal/Need	Metric	Existing	Green-T	Median U-Turn	Split Intersection		RCUT	Widened Median	Roundabout	Grade Separation
					Without Green T	With Green-T				
Overall Safety ¹	Reduction in All/O Crashes		4%	37%	*	4%	46%	16%	↑6%**	36%
Severity ¹	Reduction in KABC Crashes		16%	63%	*	16%	63%	16%	63%	42-57%
Left Turn Conflict Safety	Westbound Left Turn Conflicts	8	3	0	3	3	0	8	0	0 (on US-17)
Property Access Impacts	Impacts to Driveways/Direct Access To Roadways				One Way Operations	One Way Operations				Ramps & Footprint Impacts
Right of Way Impacts	Physical Impacts to Property			Minor			Minor	Significant	Significant	Extremely High
Intersection Operations	Overall PM Peak Hour Operations	A	A	A	A	A	A	A	A	
Route 245 Left Turn Delay	PM Peak Hour Average Delay (s/veh) + Travel Time	48.4	46.5	47.2	64.4	64.8	47.2	48.4	11.0	***
Route 245 Additional Travel Distance	Additional Distance Traveled (ft)		0	800	2400	2400	800	0	0	0
Heavy Vehicle Accomodations	Navigation for Oversized Vehicles				Similar			Longer Crossing		
Cost ²	Preliminary Cost Estimate, Could Vary based on details/funding		\$\$\$	\$\$\$	\$	\$\$\$\$	\$\$\$****	\$\$\$\$\$	\$\$\$\$\$	\$\$\$\$\$\$\$\$
			\$4-5m	\$4-5m	<\$500k	\$5-7m	\$4-5m	\$13m+	\$12-15m	\$30m+

	Very Improved/Beneficial
	Somewhat Improved/Beneficial
	Minimally Improved/Minor Benefit
	Not Applicable/No Impact
	Neutral/No Impact
	Somewhat Negative/Impacted
	Very Negative/Impacted
	Significantly Negative/Impacted

*No Direct CMF Available - Based on qualitative improvements to geometrics & conflicts

**Multilane Roundabouts generally increase PDO crashes but reduce severity

***Variability based on configuration

****Assumes RCUT for 245 approach only

Notes:

1) CMFs utilize Virginia Specific Values where available, FHWA Clearinghouse where VA specific unavailable

2) Costs based on similar projects, are planning level only, and in 2022 dollars

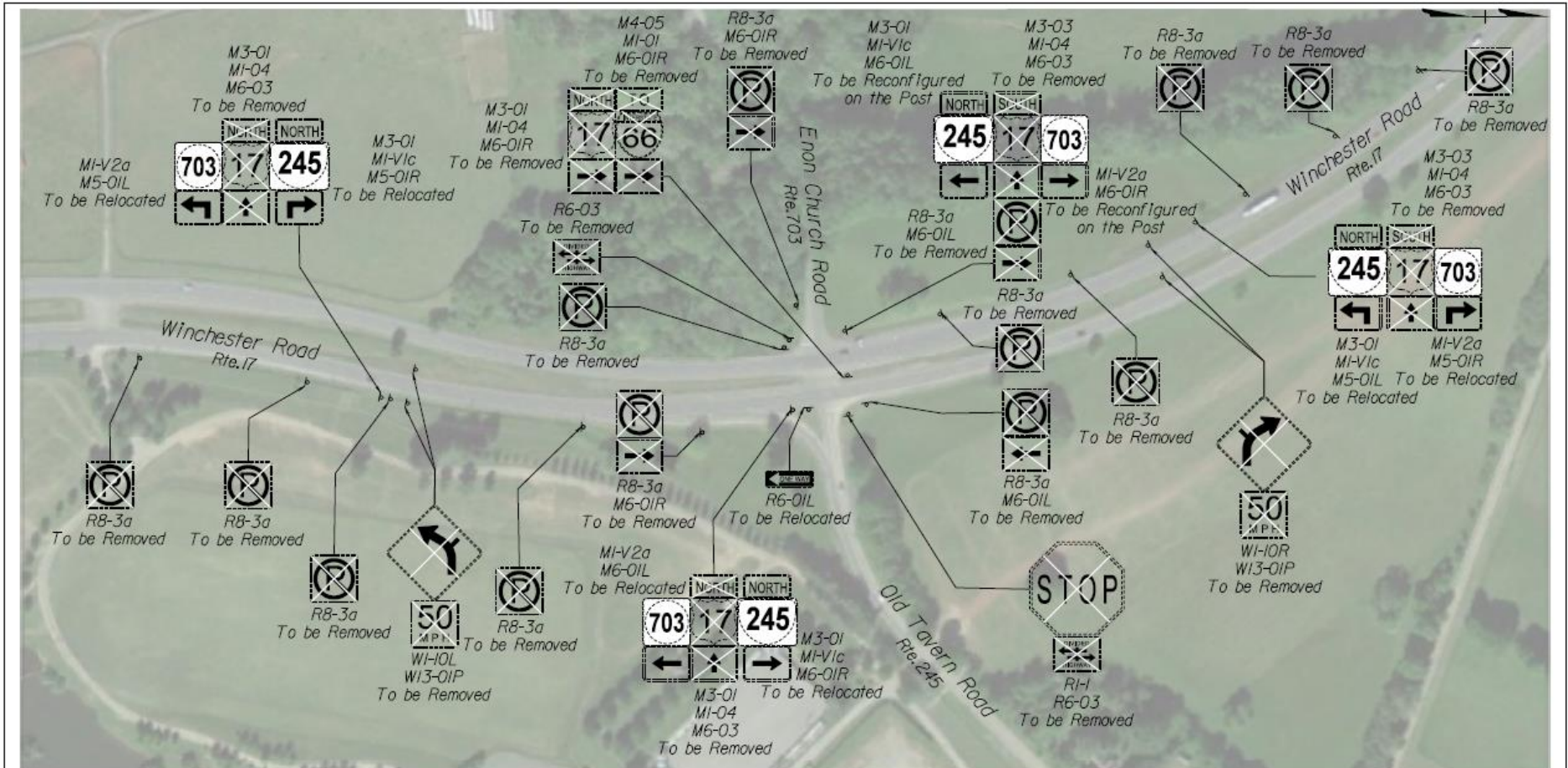
Recommendation and Conclusions

Based on the comprehensive analysis of several feasible alternatives, the most viable options that are recommended for further consideration are as follows:

- The ***Split Intersection*** concept provides an option that is of relatively low cost if implemented through modification of existing roadways only. If pursued, this concept could be implemented relatively quickly and provide for potential safety improvements in less time, possibly within 12-24 months. While there are some impacts to property in terms of access, redirection could be minimized through consideration of short two-way operation segments and crossover modifications on US-17. While left turn conflicts remain, those conflicts would be under conditions that would have strong potential to improve driver decisions and reduce crashes.
- The ***R-CUT Intersection*** concept provides the likelihood for the greatest reduction in crashes by removing the current left turn conflicts that are the cause of the highest crash pattern at the intersection while maintaining other movements that have not caused safety issues. Though at higher cost, this option would likely provide the best long-term benefit to cost ratio and lower the overall impact to traffic patterns that would make it the most likely to achieve funding. This option would be desirable if the Split Intersection safety benefits did not materialize. Additionally, if redirection of traffic were not desirable over a longer time frame for the local area and a more permanent solution were needed to maintain current access the RCUT would retain existing Route 245 and Old Winchester Road travel patterns. In the current funding environment, investment and implementation could be completed in 4-8 years.

Both options could be pursued with the Split Intersection as a medium-term option while the RCUT or higher cost options were pursued for funding and subsequent implementation.

Appendix A – Signing and Marking Plans



Description	Item #	Units	Quantity
Sign Panel	50106	SF	193
Remove Existing 1 Post Sign Panel	50320	EA	47
Relocate Existing 1 Post Ground Mounted Sign Panel	50340	EA	21
Sign Post STP-1, 2 1/2", 12 Gauge	50436	LF	165
Concrete Sign Foundation STP-1, Type A	50485	EA	12
Flashing Beacon FB-2	5162	EA	2
Type B Class 1 Pavt Line Mktg 4"	54032	LF	225
Type B Class 1 Pavt Line Marking 12"	54039	LF	100
Type B Class 1 Pavt Line Marking 24"	54041	LF	200
Eradicate Exis. Linear Pavt Marking	54105	LF	125
Pvnt Message, 6, Character, Ty. B, CL, II	54257	EA	9
Transverse Rubble Strips (One Set)	N/A	EA	1

PLAN ITEM	PLAN SYMBOL	
	PROPOSED	EXISTING
Single Post Sign Support		
Double Post Sign Support		
Flashing Beacon		

SIGN CALL-OUTS	
Existing Sign to Remain or to be Relocated	
Existing Sign to be Removed	
Proposed Sign Panel	

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VDOT Statewide Design – TO #3		DISTRICT	Culpeper
Figure 30 – Relocate & Remove Plan		COUNTY	Fauquier
Route 17 Winchester Road @ Route 245 Old Tavern Road		UPC #	DATE
		109682	01/2022
		SCALE	None

Figure 31: Proposed Short-Term Sign Removal

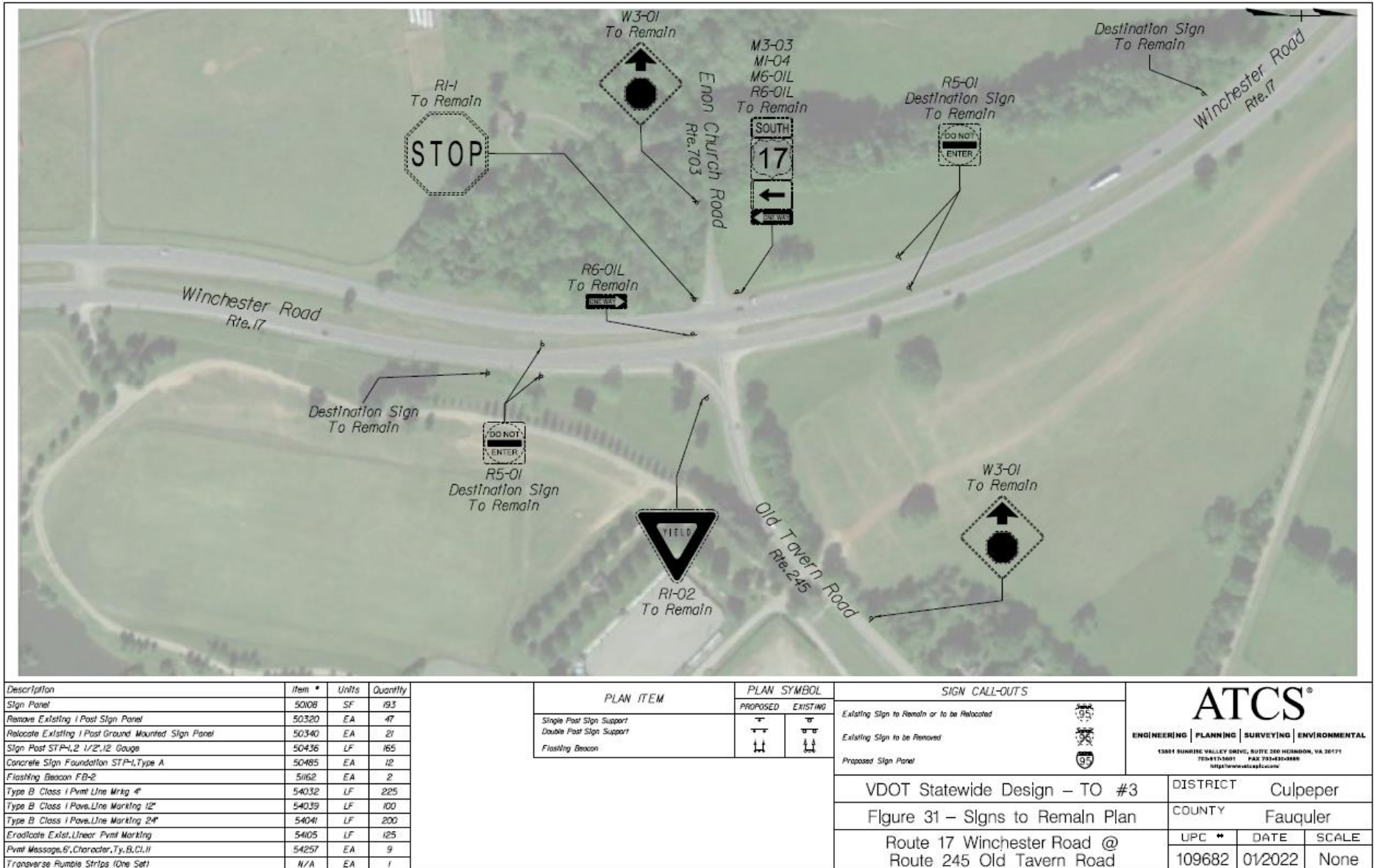


Figure 32: Existing Signs to Remain

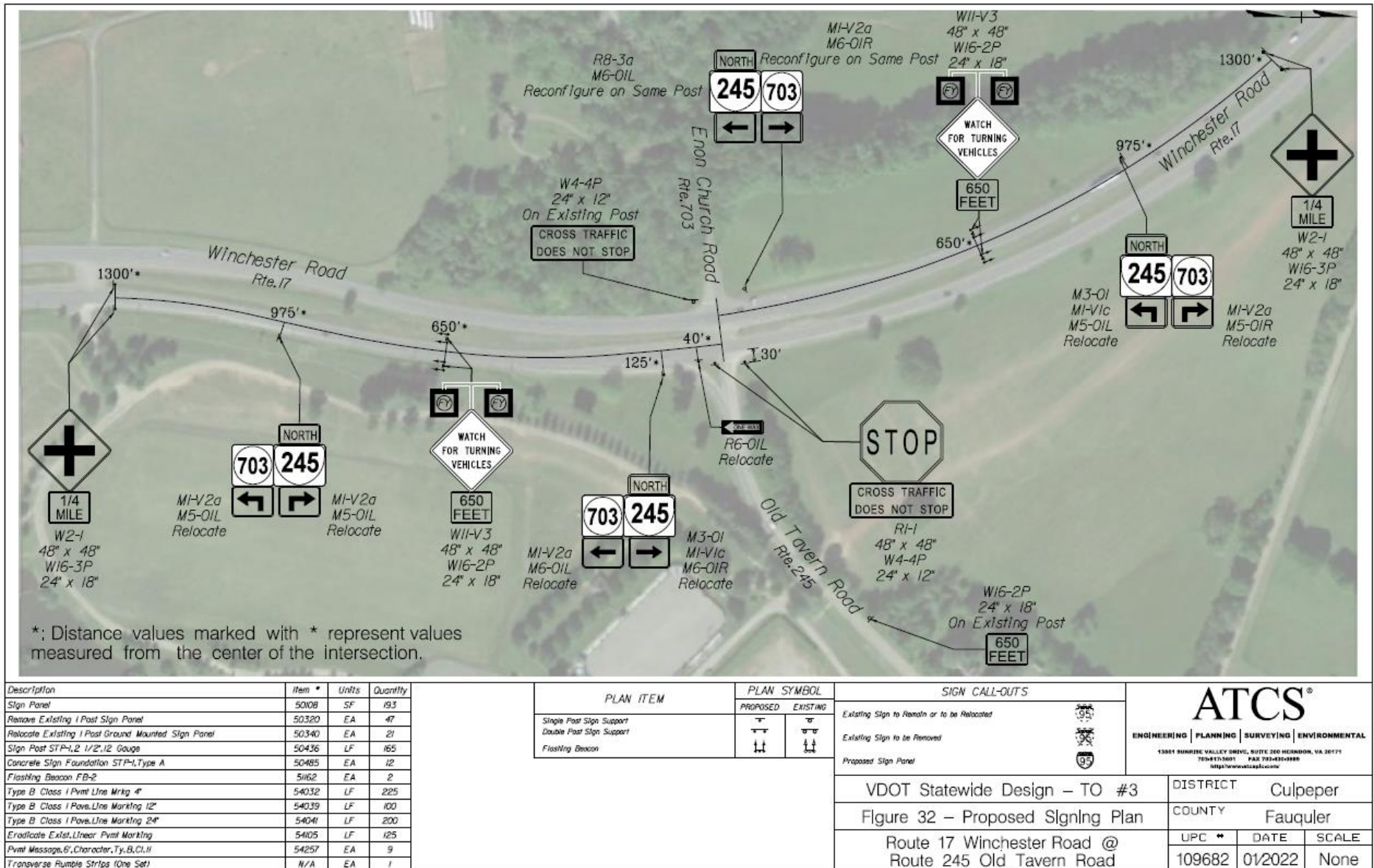


Figure 33: Proposed Short-Term Sign Improvements

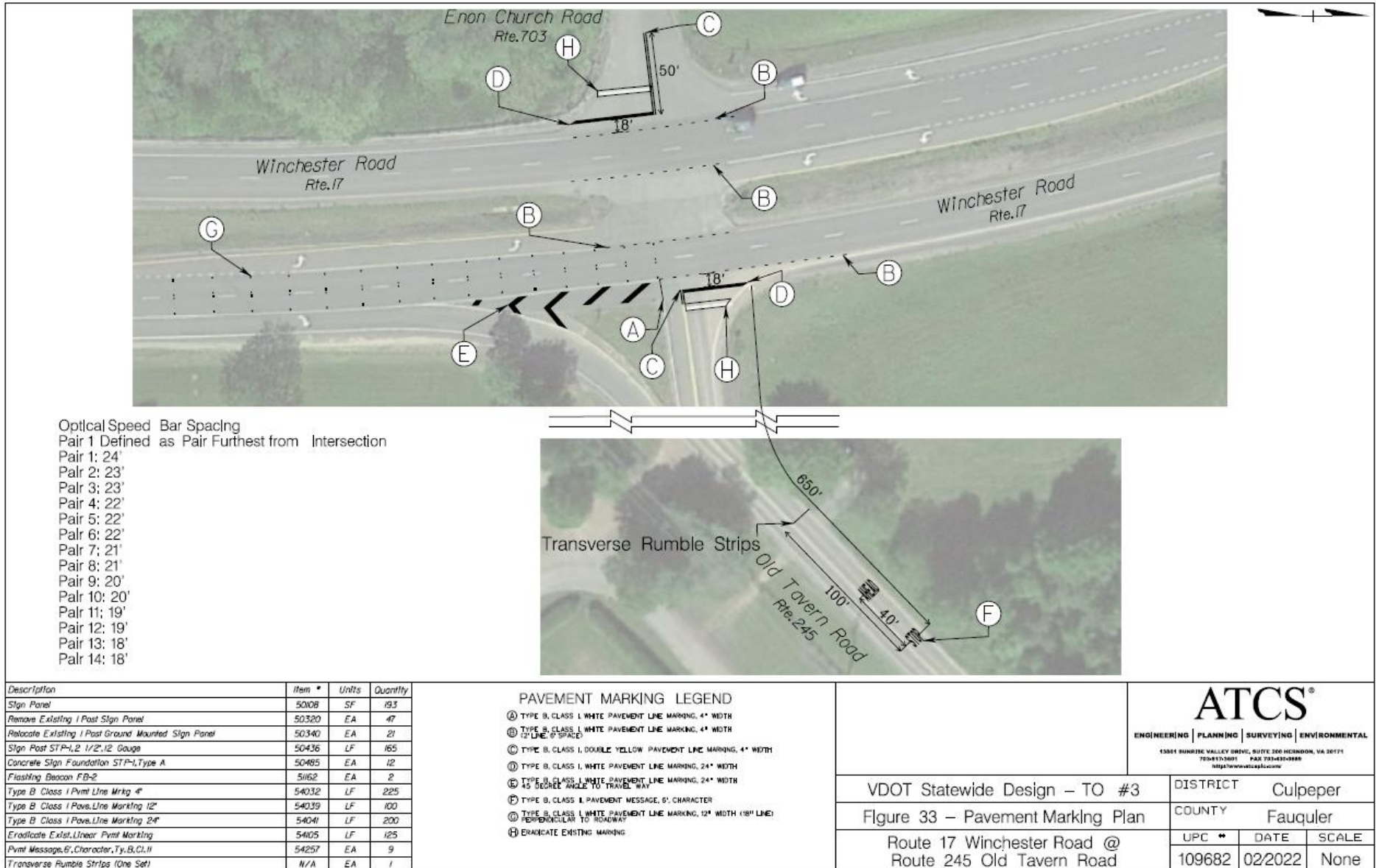


Figure 34: Proposed Short-Term Pavement Marking Improvements

Appendix B – Synchro Results

HCM Unsignalized Intersection Capacity Analysis

3: Old Tavern Rd & Old Winchester Rd





















02/15/2022



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Future Volume (Veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	103	0	0	208	24	0	0	0	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	208			103			323	311	103	323	323	220
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	208			103			323	311	103	323	323	220
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.3	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.7	4.0	3.3
p0 queue free %	100			100			100	100	100	99	100	100
cM capacity (veh/h)	1375			1502			634	607	957	597	598	825
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	103	232	0	6								
Volume Left	0	0	0	6								
Volume Right	0	24	0	0								
cSH	1375	1502	1700	597								
Volume to Capacity	0.00	0.00	0.00	0.01								
Queue Length 95th (ft)	0	0	0	1								
Control Delay (s)	0.0	0.0	0.0	11.1								
Lane LOS			A	B								
Approach Delay (s)	0.0	0.0	0.0	11.1								
Approach LOS			A	B								
Intersection Summary												
Average Delay			0.2									
Intersection Capacity Utilization			22.0%	ICU Level of Service	A							
Analysis Period (min)			15									














HCM Unsignalized Intersection Capacity Analysis
 6: US 17 & Enon Church Rd/Old Tavern Rd

02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	5	200	2	0	3	738	96	4	641	2
Future Volume (Veh/h)	1	0	5	200	2	0	3	738	96	4	641	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	1	0	5	204	2	0	3	753	98	4	654	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1046	1421	327	1099	1423	376	656			753		
vC1, stage 1 conf vol	662	662		759	759							
vC2, stage 2 conf vol	384	759		340	664							
vCu, unblocked vol	1046	1421	327	1099	1423	376	656			753		
tC, single (s)	7.5	6.5	7.3	7.6	6.5	6.9	4.8			4.6		
tC, 2 stage (s)	6.5	5.5		6.6	5.5							
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.5		
p0 queue free %	100	100	99	26	99	100	100			99		
cM capacity (veh/h)	306	260	619	276	260	627	746			717		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	6	206	3	376	376	98	4	327	327	2		
Volume Left	1	204	3	0	0	0	4	0	0	0		
Volume Right	5	0	0	0	0	98	0	0	0	2		
cSH	529	276	746	1700	1700	1700	717	1700	1700	1700		
Volume to Capacity	0.01	0.75	0.00	0.22	0.22	0.06	0.01	0.19	0.19	0.00		
Queue Length 95th (ft)	1	136	0	0	0	0	0	0	0	0		
Control Delay (s)	11.9	48.4	9.8	0.0	0.0	0.0	10.0	0.0	0.0	0.0		
Lane LOS	B	E	A				B					
Approach Delay (s)	11.9	48.4	0.0				0.1					
Approach LOS	B	E										
Intersection Summary												
Average Delay			5.9									
Intersection Capacity Utilization			44.9%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 7: US 17 & Old Winchester Rd

02/15/2022

								
Movement	WBL	WBR	NBU	NBT	NBR	SBL	SBT	
Lane Configurations								
Traffic Volume (veh/h)	20	3	0	738	1	5	627	
Future Volume (Veh/h)	20	3	0	738	1	5	627	
Sign Control	Stop			Free		Free		
Grade	0%			0%		0%		
Peak Hour Factor	0.90	0.90	0.92	0.90	0.90	0.90	0.90	
Hourly flow rate (vph)	22	3	0	820	1	6	697	
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type				Raised		Raised		
Median storage (veh)				1		1		
Upstream signal (ft)								
pX, platoon unblocked			0.00					
vC, conflicting volume	1180	410	0	821				
vC1, stage 1 conf vol	820							
vC2, stage 2 conf vol	360							
vCu, unblocked vol	1180	410	0	821				
tC, single (s)	6.8	6.9	0.0	4.6				
tC, 2 stage (s)	5.8							
tF (s)	3.5	3.3	0.0	2.5				
p0 queue free %	93	99	0	99				
cM capacity (veh/h)	304	596	0	672				
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	25	410	410	1	0	6	348	348
Volume Left	22	0	0	0	0	6	0	0
Volume Right	3	0	0	1	0	0	0	0
cSH	323	1700	1700	1700	1700	672	1700	1700
Volume to Capacity	0.08	0.24	0.24	0.00	0.00	0.01	0.20	0.20
Queue Length 95th (ft)	6	0	0	0	0	1	0	0
Control Delay (s)	17.1	0.0	0.0	0.0	0.0	10.4	0.0	0.0
Lane LOS	C					B		
Approach Delay (s)	17.1	0.0	0.1					
Approach LOS	C							
Intersection Summary								
Average Delay	0.3							
Intersection Capacity Utilization	30.4%			ICU Level of Service			A	
Analysis Period (min)	15							

HCM Unsignalized Intersection Capacity Analysis

3: Old Tavern Rd & Old Winchester Rd




















02/15/2022



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Future Volume (Veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	103	0	0	208	24	0	0	0	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	208			103			323	311	103	323	323	220
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	208			103			323	311	103	323	323	220
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.3	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.7	4.0	3.3
p0 queue free %	100			100			100	100	100	99	100	100
cM capacity (veh/h)	1375			1502			634	607	957	597	598	825
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	103	232	0	6								
Volume Left	0	0	0	6								
Volume Right	0	24	0	0								
cSH	1375	1502	1700	597								
Volume to Capacity	0.00	0.00	0.00	0.01								
Queue Length 95th (ft)	0	0	0	1								
Control Delay (s)	0.0	0.0	0.0	11.1								
Lane LOS			A	B								
Approach Delay (s)	0.0	0.0	0.0	11.1								
Approach LOS			A	B								
Intersection Summary												
Average Delay			0.2									
Intersection Capacity Utilization			22.0%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 6: US 17 & Enon Church Rd/Old Tavern Rd














02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	6	200	0	2	0	741	96	4	641	7
Future Volume (Veh/h)	0	0	6	200	0	2	0	741	96	4	641	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	0	0	6	204	0	2	0	756	98	4	654	7
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			Raised	
Median storage veh											1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1042	1418	327	1091	1425	378	661			756		
vC1, stage 1 conf vol	662	662		756	756							
vC2, stage 2 conf vol	380	756		335	669							
vCu, unblocked vol	1042	1418	327	1091	1425	378	661			756		
tC, single (s)	7.5	6.5	7.3	7.6	6.5	6.9	4.8			4.6		
tC, 2 stage (s)	6.5	5.5		6.6	5.5							
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.5		
p0 queue free %	100	100	99	27	100	100	100			99		
cM capacity (veh/h)	307	262	619	279	261	625	742			715		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4			
Volume Total	6	206	378	378	98	4	327	327	7			
Volume Left	0	204	0	0	0	4	0	0	0			
Volume Right	6	2	0	0	98	0	0	0	7			
cSH	619	280	1700	1700	1700	715	1700	1700	1700			
Volume to Capacity	0.01	0.73	0.22	0.22	0.06	0.01	0.19	0.19	0.00			
Queue Length 95th (ft)	1	132	0	0	0	0	0	0	0			
Control Delay (s)	10.9	46.5	0.0	0.0	0.0	10.1	0.0	0.0	0.0			
Lane LOS	B	E				B						
Approach Delay (s)	10.9	46.5	0.0			0.1						
Approach LOS	B	E										
Intersection Summary												
Average Delay			5.6									
Intersection Capacity Utilization			42.3%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

7: US 17 & Old Winchester Rd
















02/15/2022

								
Movement	WBL	WBR	NBU	NBT	NBR	SBL	SBT	
Lane Configurations								
Traffic Volume (veh/h)	20	3	5	737	1	5	627	
Future Volume (Veh/h)	20	3	5	737	1	5	627	
Sign Control	Stop			Free		Free		
Grade	0%			0%		0%		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
Hourly flow rate (vph)	21	3	0	768	1	5	653	
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type				Raised		Raised		
Median storage (veh)				1		1		
Upstream signal (ft)								
pX, platoon unblocked	0.00							
vC, conflicting volume	1104	384	0					769
vC1, stage 1 conf vol	768							
vC2, stage 2 conf vol	336							
vCu, unblocked vol	1104	384	0					769
tC, single (s)	6.8	6.9	0.0					4.5
tC, 2 stage (s)	5.8							
tF (s)	3.5	3.3	0.0					2.4
p0 queue free %	94	100	0					99
cM capacity (veh/h)	326	620	0					733
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	24	384	384	1	0	5	326	326
Volume Left	21	0	0	0	0	5	0	0
Volume Right	3	0	0	1	0	0	0	0
cSH	347	1700	1700	1700	1700	733	1700	1700
Volume to Capacity	0.07	0.23	0.23	0.00	0.00	0.01	0.19	0.19
Queue Length 95th (ft)	6	0	0	0	0	1	0	0
Control Delay (s)	16.2	0.0	0.0	0.0	0.0	9.9	0.0	0.0
Lane LOS	C			A				
Approach Delay (s)	16.2	0.0					0.1	
Approach LOS	C							
Intersection Summary								
Average Delay	0.3							
Intersection Capacity Utilization	30.4%			ICU Level of Service			A	
Analysis Period (min)	15							

HCM Unsignalized Intersection Capacity Analysis

2: North Median & US 17

















02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											 	
Traffic Volume (veh/h)	0	0	0	202	0	0	0	0	0	0	647	0
Future Volume (Veh/h)	0	0	0	202	0	0	0	0	0	0	647	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	220	0	0	0	0	0	0	703	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	703	703	352	352	703	0	703			0		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	703	703	352	352	703	0	703			0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	62	100	100	100			100		
cM capacity (veh/h)	324	360	645	579	360	1084	890			1622		
Direction, Lane #												
	WB 1	SB 1	SB 2									
Volume Total	220	352	352									
Volume Left	220	0	0									
Volume Right	0	0	0									
cSH	579	1700	1700									
Volume to Capacity	0.38	0.21	0.21									
Queue Length 95th (ft)	44	0	0									
Control Delay (s)	15.0	0.0	0.0									
Lane LOS	B											
Approach Delay (s)	15.0	0.0										
Approach LOS	B											
Intersection Summary												
Average Delay			3.6									
Intersection Capacity Utilization		45.0%		ICU Level of Service		A						
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Old Tavern Rd & Old Winchester Rd
















02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Future Volume (Veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	103	0	0	208	24	0	0	0	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	208		103		323		311		103		220	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	208		103		323		311		103		220	
tC, single (s)	4.1		4.1		7.1		6.5		6.2		6.2	
tC, 2 stage (s)												
tF (s)	2.2		2.2		3.5		4.0		3.3		3.3	
p0 queue free %	100		100		100		100		100		100	
cM capacity (veh/h)	1375		1502		634		607		957		825	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	103	232	0	6								
Volume Left	0	0	0	6								
Volume Right	0	24	0	0								
cSH	1375	1502	1700	597								
Volume to Capacity	0.00	0.00	0.00	0.01								
Queue Length 95th (ft)	0	0	0	1								
Control Delay (s)	0.0	0.0	0.0	11.1								
Lane LOS			A	B								
Approach Delay (s)	0.0	0.0	0.0	11.1								
Approach LOS			A	B								
Intersection Summary												
Average Delay			0.2									
Intersection Capacity Utilization			22.0%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

5: North Median














02/15/2022

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations								 					
Traffic Volume (veh/h)	0	0	0	0	0	0	202	739	0	0	0	0	
Future Volume (Veh/h)	0	0	0	0	0	0	202	739	0	0	0	0	
Sign Control		Stop			Stop			Free			Free		
Grade		0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	0	0	0	220	803	0	0	0	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type							None			None			
Median storage veh													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	842	1243	0	1243	1243	402	0			803			
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	842	1243	0	1243	1243	402	0			803			
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1			
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2			
p0 queue free %	100	100	100	100	100	100	86			100			
cM capacity (veh/h)	231	150	1084	117	150	598	1622			817			
Direction, Lane #	NB 1	NB 2	NB 3										
Volume Total	220	402	402										
Volume Left	220	0	0										
Volume Right	0	0	0										
cSH	1622	1700	1700										
Volume to Capacity	0.14	0.24	0.24										
Queue Length 95th (ft)	12	0	0										
Control Delay (s)	7.6	0.0	0.0										
Lane LOS	A												
Approach Delay (s)	1.6												
Approach LOS													
Intersection Summary													
Average Delay			1.6										
Intersection Capacity Utilization			45.0%	ICU Level of Service									A
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis

7: US 17 & Old Winchester Rd

02/15/2022

								
Movement	WBL	WBR	NBU	NBT	NBR	SBL	SBT	
Lane Configurations								
Traffic Volume (veh/h)	20	3	0	738	1	5	627	
Future Volume (Veh/h)	20	3	0	738	1	5	627	
Sign Control	Stop			Free		Free		
Grade	0%			0%		0%		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
Hourly flow rate (vph)	21	3	0	769	1	5	653	
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type				Raised		Raised		
Median storage (veh)				1		1		
Upstream signal (ft)								
pX, platoon unblocked			0.00					
vC, conflicting volume	1106	384	0	770				
vC1, stage 1 conf vol	769							
vC2, stage 2 conf vol	336							
vCu, unblocked vol	1106	384	0	770				
tC, single (s)	6.8	6.9	0.0	4.5				
tC, 2 stage (s)	5.8							
tF (s)	3.5	3.3	0.0	2.4				
p0 queue free %	94	100	0	99				
cM capacity (veh/h)	326	619	0	732				
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	24	384	384	1	0	5	326	326
Volume Left	21	0	0	0	0	5	0	0
Volume Right	3	0	0	1	0	0	0	0
cSH	346	1700	1700	1700	1700	732	1700	1700
Volume to Capacity	0.07	0.23	0.23	0.00	0.00	0.01	0.19	0.19
Queue Length 95th (ft)	6	0	0	0	0	1	0	0
Control Delay (s)	16.2	0.0	0.0	0.0	0.0	9.9	0.0	0.0
Lane LOS	C					A		
Approach Delay (s)	16.2	0.0	0.1					
Approach LOS	C							
Intersection Summary								
Average Delay	0.3							
Intersection Capacity Utilization	30.4%			ICU Level of Service			A	
Analysis Period (min)	15							



















Intersection Sign configuration not allowed in HCM analysis.

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis

12: US 17 & Enon Church Rd/Old Tavern Rd

02/15/2022
















												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	6	0	0	202	0	742	100	0	845	4
Future Volume (Veh/h)	0	0	6	0	0	202	0	742	100	0	845	4
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	0	0	6	0	0	206	0	757	102	0	862	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1240	1619	431	1188	1623	378	866			757		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1240	1619	431	1188	1623	378	866			757		
tC, single (s)	7.5	6.5	7.3	7.5	6.5	7.0	4.8			4.6		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.5		
p0 queue free %	100	100	99	100	100	67	100			100		
cM capacity (veh/h)	89	104	525	144	104	616	604			715		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3				
Volume Total	6	206	378	378	102	431	431	4				
Volume Left	0	0	0	0	0	0	0	0				
Volume Right	6	206	0	0	102	0	0	4				
cSH	525	616	1700	1700	1700	1700	1700	1700				
Volume to Capacity	0.01	0.33	0.22	0.22	0.06	0.25	0.25	0.00				
Queue Length 95th (ft)	1	37	0	0	0	0	0	0				
Control Delay (s)	11.9	13.7	0.0	0.0	0.0	0.0	0.0	0.0				
Lane LOS	B	B										
Approach Delay (s)	11.9	13.7	0.0			0.0						
Approach LOS	B	B										
Intersection Summary												
Average Delay			1.5									
Intersection Capacity Utilization			39.7%			ICU Level of Service				A		
Analysis Period (min)			15									

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis
















17: South Median

02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											 	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	0	0	5	846	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	0	0	5	846	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	5	920	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	930	930	460	470	930	0	920				0	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	930	930	460	470	930	0	920				0	
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	100	100	100	100	100	100	100				100	
cM capacity (veh/h)	222	265	548	476	265	1084	738				1622	
Direction, Lane #	SB 1	SB 2	SB 3									
Volume Total	5	460	460									
Volume Left	5	0	0									
Volume Right	0	0	0									
cSH	1622	1700	1700									
Volume to Capacity	0.00	0.27	0.27									
Queue Length 95th (ft)	0	0	0									
Control Delay (s)	7.2	0.0	0.0									
Lane LOS	A											
Approach Delay (s)	0.0											
Approach LOS												
Intersection Summary												
Average Delay			0.0									
Intersection Capacity Utilization			26.9%	ICU Level of Service								A
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 18: US 17 & South Median

















02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	5	0	0	0	0	0	0	837	0	0	0	0
Future Volume (Veh/h)	5	0	0	0	0	0	0	837	0	0	0	0
Sign Control		Yield			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	5	0	0	0	0	0	0	910	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	455	910	0	910	910	455	0			910		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	455	910	0	910	910	455	0			910		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	100	100	100	100	100			100		
cM capacity (veh/h)	489	273	1084	230	273	552	1622			744		
Direction, Lane #												
	EB 1	NB 1	NB 2									
Volume Total	5	455	455									
Volume Left	5	0	0									
Volume Right	0	0	0									
cSH	489	1700	1700									
Volume to Capacity	0.01	0.27	0.27									
Queue Length 95th (ft)	1	0	0									
Control Delay (s)	12.4	0.0	0.0									
Lane LOS	B											
Approach Delay (s)	12.4	0.0										
Approach LOS	B											
Intersection Summary												
Average Delay			0.1									
Intersection Capacity Utilization			33.1%	ICU Level of Service		A						
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Old Tavern Rd & Old Winchester Rd




















02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	106	0	0	0	225	0	0	0	0	0	0
Future Volume (Veh/h)	0	106	0	0	0	225	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	109	0	0	0	232	0	0	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0			109			225	109	109	225	225	116
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			109			225	109	109	225	225	116
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.3	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.7	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1636			1494			735	785	950	694	678	942
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	109	232	0	0								
Volume Left	0	0	0	0								
Volume Right	0	232	0	0								
cSH	1636	1494	1700	1700								
Volume to Capacity	0.00	0.00	0.00	0.00								
Queue Length 95th (ft)	0	0	0	0								
Control Delay (s)	0.0	0.0	0.0	0.0								
Lane LOS			A	A								
Approach Delay (s)	0.0	0.0	0.0	0.0								
Approach LOS			A	A								
Intersection Summary												
Average Delay			0.0									
Intersection Capacity Utilization			17.3%		ICU Level of Service				A			
Analysis Period (min)			15									

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis
 6: US 17 & Enon Church Rd/Old Tavern Rd

02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	5	0	0	0	3	737	97	9	841	4
Future Volume (Veh/h)	1	0	5	0	0	0	3	737	97	9	841	4
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	1	0	5	0	0	0	3	752	99	9	858	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage veh												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1258	1634	429	1210	1638	376	862			752		
vC1, stage 1 conf vol	876	876		758	758							
vC2, stage 2 conf vol	382	758		452	880							
vCu, unblocked vol	1258	1634	429	1210	1638	376	862			752		
tC, single (s)	7.5	6.5	7.3	7.6	6.5	6.9	4.8			4.6		
tC, 2 stage (s)	6.5	5.5		6.6	5.5							
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.5		
p0 queue free %	100	100	99	100	100	100	100			99		
cM capacity (veh/h)	237	221	527	255	221	627	607			718		
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	6	3	376	376	99	9	429	429	4			
Volume Left	1	3	0	0	0	9	0	0	0			
Volume Right	5	0	0	0	99	0	0	0	4			
cSH	438	607	1700	1700	1700	718	1700	1700	1700			
Volume to Capacity	0.01	0.00	0.22	0.22	0.06	0.01	0.25	0.25	0.00			
Queue Length 95th (ft)	1	0	0	0	0	1	0	0	0			
Control Delay (s)	13.3	11.0	0.0	0.0	0.0	10.1	0.0	0.0	0.0			
Lane LOS	B	B				B						
Approach Delay (s)	13.3	0.0				0.1						
Approach LOS	B											
Intersection Summary												
Average Delay			0.1									
Intersection Capacity Utilization			33.2%			ICU Level of Service			A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

7: US 17 & Old Winchester Rd

02/15/2022



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations	↔		↕↕			↕↕
Traffic Volume (veh/h)	222	3	738	0	0	632
Future Volume (Veh/h)	222	3	738	0	0	632
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	231	3	769	0	0	658
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage (veh)			1			1
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1098	384			769	
vC1, stage 1 conf vol	769					
vC2, stage 2 conf vol	329					
vCu, unblocked vol	1098	384			769	
tC, single (s)	6.9	6.9			4.5	
tC, 2 stage (s)	5.9					
tF (s)	3.5	3.3			2.4	
p0 queue free %	28	100			100	
cM capacity (veh/h)	322	619			733	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	234	384	384	329	329	
Volume Left	231	0	0	0	0	
Volume Right	3	0	0	0	0	
cSH	324	1700	1700	1700	1700	
Volume to Capacity	0.72	0.23	0.23	0.19	0.19	
Queue Length 95th (ft)	133	0	0	0	0	
Control Delay (s)	40.3	0.0	0.0	0.0	0.0	
Lane LOS	E					
Approach Delay (s)	40.3	0.0		0.0		
Approach LOS	E					
Intersection Summary						
Average Delay			5.7			
Intersection Capacity Utilization			39.5%		ICU Level of Service	A
Analysis Period (min)			15			

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis

3: Old Tavern Rd & Old Winchester Rd

02/15/2022





















Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	0	106	0	0	0	225	0	0	0	0	0	0
Future Volume (Veh/h)	0	106	0	0	0	225	0	0	0	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	109	0	0	0	232	0	0	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	0			109			225	109	109	225	225	116
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	0			109			225	109	109	225	225	116
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.3	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.7	4.0	3.3
p0 queue free %	100			100			100	100	100	100	100	100
cM capacity (veh/h)	1636			1494			735	785	950	694	678	942
Direction, Lane #												
	EB 1	WB 1	NB 1	SB 1								
Volume Total	109	232	0	0								
Volume Left	0	0	0	0								
Volume Right	0	232	0	0								
cSH	1636	1494	1700	1700								
Volume to Capacity	0.00	0.00	0.00	0.00								
Queue Length 95th (ft)	0	0	0	0								
Control Delay (s)	0.0	0.0	0.0	0.0								
Lane LOS			A	A								
Approach Delay (s)	0.0	0.0	0.0	0.0								
Approach LOS			A	A								
Intersection Summary												
Average Delay			0.0									
Intersection Capacity Utilization			17.3%	ICU Level of Service		A						
Analysis Period (min)			15									

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis
 6: US 17 & Enon Church Rd/Old Tavern Rd












02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	6	0	0	0	0	741	97	9	841	4
Future Volume (Veh/h)	0	0	6	0	0	0	0	741	97	9	841	4
Sign Control	Stop			Stop				Free			Free	
Grade	0%			0%				0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	0	0	6	0	0	0	0	756	99	9	858	4
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type												
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1254	1632	429	1203	1636	378	862			756		
vC1, stage 1 conf vol	876	876		756	756							
vC2, stage 2 conf vol	378	756		447	880							
vCu, unblocked vol	1254	1632	429	1203	1636	378	862			756		
tC, single (s)	7.5	6.5	7.3	7.6	6.5	6.9	4.8			4.6		
tC, 2 stage (s)	6.5	5.5		6.6	5.5							
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.5		
p0 queue free %	100	100	99	100	100	100	100			99		
cM capacity (veh/h)	238	222	527	258	223	625	607			715		
Direction, Lane #	EB 1	NB 1	NB 2	NB 3	SB 1	SB 2	SB 3	SB 4				
Volume Total	6	378	378	99	9	429	429	4				
Volume Left	0	0	0	0	9	0	0	0				
Volume Right	6	0	0	99	0	0	0	4				
cSH	527	1700	1700	1700	715	1700	1700	1700				
Volume to Capacity	0.01	0.22	0.22	0.06	0.01	0.25	0.25	0.00				
Queue Length 95th (ft)	1	0	0	0	1	0	0	0				
Control Delay (s)	11.9	0.0	0.0	0.0	10.1	0.0	0.0	0.0				
Lane LOS	B				B							
Approach Delay (s)	11.9	0.0			0.1							
Approach LOS	B											
Intersection Summary												
Average Delay			0.1									
Intersection Capacity Utilization			33.2%	ICU Level of Service		A						
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

7: US 17 & Old Winchester Rd

02/15/2022
















						
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations			 			 
Traffic Volume (veh/h)	222	3	741	0	0	632
Future Volume (Veh/h)	222	3	741	0	0	632
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96
Hourly flow rate (vph)	231	3	772	0	0	658
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			Raised			Raised
Median storage veh			1			1
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	1101	386			772	
vC1, stage 1 conf vol	772					
vC2, stage 2 conf vol	329					
vCu, unblocked vol	1101	386			772	
tC, single (s)	6.9	6.9			4.5	
tC, 2 stage (s)	5.9					
tF (s)	3.5	3.3			2.4	
p0 queue free %	28	100			100	
cM capacity (veh/h)	321	618			731	
Direction, Lane #	WB 1	NB 1	NB 2	SB 1	SB 2	
Volume Total	234	386	386	329	329	
Volume Left	231	0	0	0	0	
Volume Right	3	0	0	0	0	
cSH	323	1700	1700	1700	1700	
Volume to Capacity	0.72	0.23	0.23	0.19	0.19	
Queue Length 95th (ft)	133	0	0	0	0	
Control Delay (s)	40.7	0.0	0.0	0.0	0.0	
Lane LOS	E					
Approach Delay (s)	40.7	0.0		0.0		
Approach LOS	E					
Intersection Summary						
Average Delay			5.7			
Intersection Capacity Utilization			39.6%	ICU Level of Service	A	
Analysis Period (min)			15			

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis

2: North Median & US 17

















02/15/2022

													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations											 		
Traffic Volume (veh/h)	0	0	0	202	0	0	0	0	0	0	647	0	
Future Volume (Veh/h)	0	0	0	202	0	0	0	0	0	0	647	0	
Sign Control		Stop				Stop				Free		Free	
Grade		0%				0%				0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	0	0	220	0	0	0	0	0	0	703	0	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type													
Median storage veh													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	703	703	352	352	703	0	703				0		
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	703	703	352	352	703	0	703				0		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1		
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2		
p0 queue free %	100	100	100	62	100	100	100				100		
cM capacity (veh/h)	324	360	645	579	360	1084	890				1622		
Direction, Lane #													
	WB 1	SB 1	SB 2										
Volume Total	220	352	352										
Volume Left	220	0	0										
Volume Right	0	0	0										
cSH	579	1700	1700										
Volume to Capacity	0.38	0.21	0.21										
Queue Length 95th (ft)	44	0	0										
Control Delay (s)	15.0	0.0	0.0										
Lane LOS	B												
Approach Delay (s)	15.0	0.0											
Approach LOS	B												
Intersection Summary													
Average Delay			3.6										
Intersection Capacity Utilization		45.0%		ICU Level of Service							A		
Analysis Period (min)			15										

HCM Unsignalized Intersection Capacity Analysis

3: Old Tavern Rd & Old Winchester Rd
















02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Future Volume (Veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	103	0	0	208	24	0	0	0	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	208			103			323	311	103	323	323	220
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	208			103			323	311	103	323	323	220
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.3	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.7	4.0	3.3
p0 queue free %	100			100			100	100	100	99	100	100
cM capacity (veh/h)	1375			1502			634	607	957	597	598	825
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	103	232	0	6								
Volume Left	0	0	0	6								
Volume Right	0	24	0	0								
cSH	1375	1502	1700	597								
Volume to Capacity	0.00	0.00	0.00	0.01								
Queue Length 95th (ft)	0	0	0	1								
Control Delay (s)	0.0	0.0	0.0	11.1								
Lane LOS			A	B								
Approach Delay (s)	0.0	0.0	0.0	11.1								
Approach LOS			A	B								
Intersection Summary												
Average Delay			0.2									
Intersection Capacity Utilization			22.0%	ICU Level of Service	A							
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

5: North Median














02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	0	0	0	0	0	0	202	739	0	0	0	0
Future Volume (Veh/h)	0	0	0	0	0	0	202	739	0	0	0	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	220	803	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	842	1243	0	1243	1243	402	0			803		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	842	1243	0	1243	1243	402	0			803		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	86			100		
cM capacity (veh/h)	231	150	1084	117	150	598	1622			817		
Direction, Lane #	NB 1	NB 2	NB 3									
Volume Total	220	402	402									
Volume Left	220	0	0									
Volume Right	0	0	0									
cSH	1622	1700	1700									
Volume to Capacity	0.14	0.24	0.24									
Queue Length 95th (ft)	12	0	0									
Control Delay (s)	7.6	0.0	0.0									
Lane LOS	A											
Approach Delay (s)	1.6											
Approach LOS												
Intersection Summary												
Average Delay			1.6									
Intersection Capacity Utilization			45.0%			ICU Level of Service				A		
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

7: US 17 & Old Winchester Rd

02/15/2022

								
Movement	WBL	WBR	NBU	NBT	NBR	SBL	SBT	
Lane Configurations								
Traffic Volume (veh/h)	20	3	0	738	1	5	627	
Future Volume (Veh/h)	20	3	0	738	1	5	627	
Sign Control	Stop			Free		Free		
Grade	0%			0%		0%		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
Hourly flow rate (vph)	21	3	0	769	1	5	653	
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type				Raised		Raised		
Median storage (veh)				1		1		
Upstream signal (ft)								
pX, platoon unblocked	0.00							
vC, conflicting volume	1106	384	0					770
vC1, stage 1 conf vol	769							
vC2, stage 2 conf vol	336							
vCu, unblocked vol	1106	384	0					770
tC, single (s)	6.8	6.9	0.0					4.5
tC, 2 stage (s)	5.8							
tF (s)	3.5	3.3	0.0					2.4
p0 queue free %	94	100	0					99
cM capacity (veh/h)	326	619	0					732
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	24	384	384	1	0	5	326	326
Volume Left	21	0	0	0	0	5	0	0
Volume Right	3	0	0	1	0	0	0	0
cSH	346	1700	1700	1700	1700	732	1700	1700
Volume to Capacity	0.07	0.23	0.23	0.00	0.00	0.01	0.19	0.19
Queue Length 95th (ft)	6	0	0	0	0	1	0	0
Control Delay (s)	16.2	0.0	0.0	0.0	0.0	9.9	0.0	0.0
Lane LOS	C					A		
Approach Delay (s)	16.2	0.0						0.1
Approach LOS	C							
Intersection Summary								
Average Delay	0.3							
Intersection Capacity Utilization	30.4%			ICU Level of Service			A	
Analysis Period (min)	15							





















Intersection Sign configuration not allowed in HCM analysis.

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis

12: US 17 & Enon Church Rd/Old Tavern Rd

02/15/2022
















													
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Lane Configurations													
Traffic Volume (veh/h)	0	0	6	0	0	202	3	739	96	4	841	4	
Future Volume (Veh/h)	0	0	6	0	0	202	3	739	96	4	841	4	
Sign Control	Stop			Stop				Free			Free		
Grade	0%			0%				0%			0%		
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	
Hourly flow rate (vph)	0	0	6	0	0	206	3	754	98	4	858	4	
Pedestrians													
Lane Width (ft)													
Walking Speed (ft/s)													
Percent Blockage													
Right turn flare (veh)													
Median type													
Median storage veh													
Upstream signal (ft)													
pX, platoon unblocked													
vC, conflicting volume	1249	1626	429	1197	1630	377	862			754			
vC1, stage 1 conf vol													
vC2, stage 2 conf vol													
vCu, unblocked vol	1249	1626	429	1197	1630	377	862			754			
tC, single (s)	7.5	6.5	7.3	7.5	6.5	7.0	4.8			4.6			
tC, 2 stage (s)													
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.5			
p0 queue free %	100	100	99	100	100	67	100			99			
cM capacity (veh/h)	87	102	527	141	102	618	607			717			
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4			
Volume Total	6	206	3	377	377	98	4	429	429	4			
Volume Left	0	0	3	0	0	0	4	0	0	0			
Volume Right	6	206	0	0	0	98	0	0	0	4			
cSH	527	618	607	1700	1700	1700	717	1700	1700	1700			
Volume to Capacity	0.01	0.33	0.00	0.22	0.22	0.06	0.01	0.25	0.25	0.00			
Queue Length 95th (ft)	1	36	0	0	0	0	0	0	0	0			
Control Delay (s)	11.9	13.7	11.0	0.0	0.0	0.0	10.1	0.0	0.0	0.0			
Lane LOS	B	B	B				B						
Approach Delay (s)	11.9	13.7	0.0				0.0						
Approach LOS	B	B											
Intersection Summary													
Average Delay			1.5										
Intersection Capacity Utilization			39.6%	ICU Level of Service						A			
Analysis Period (min)			15										

Intersection Sign configuration not allowed in HCM analysis.

HCM Unsignalized Intersection Capacity Analysis
















17: South Median

02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations											 	
Traffic Volume (veh/h)	0	0	0	0	0	0	0	0	0	1	846	0
Future Volume (Veh/h)	0	0	0	0	0	0	0	0	0	1	846	0
Sign Control	Stop			Stop			Free			Free		
Grade	0%			0%			0%			0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	0	0	0	0	0	0	1	920	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type							None			None		
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	922	922	460	462	922	0	920				0	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	922	922	460	462	922	0	920				0	
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1				4.1	
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2				2.2	
p0 queue free %	100	100	100	100	100	100	100				100	
cM capacity (veh/h)	225	268	548	483	268	1084	738				1622	
Direction, Lane #	SB 1	SB 2	SB 3									
Volume Total	1	460	460									
Volume Left	1	0	0									
Volume Right	0	0	0									
cSH	1622	1700	1700									
Volume to Capacity	0.00	0.27	0.27									
Queue Length 95th (ft)	0	0	0									
Control Delay (s)	7.2	0.0	0.0									
Lane LOS	A											
Approach Delay (s)	0.0											
Approach LOS												
Intersection Summary												
Average Delay			0.0									
Intersection Capacity Utilization			32.6%	ICU Level of Service								A
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis
 18: US 17 & South Median

02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations								 				
Traffic Volume (veh/h)	1	0	0	0	0	0	0	837	0	0	0	0
Future Volume (Veh/h)	1	0	0	0	0	0	0	837	0	0	0	0
Sign Control		Yield			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	0	0	0	0	0	0	910	0	0	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	455	910	0	910	910	455	0			910		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	455	910	0	910	910	455	0			910		
tC, single (s)	7.5	6.5	6.9	7.5	6.5	6.9	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	100	100			100		
cM capacity (veh/h)	489	273	1084	230	273	552	1622			744		
Direction, Lane #	EB 1	NB 1	NB 2									
Volume Total	1	455	455									
Volume Left	1	0	0									
Volume Right	0	0	0									
cSH	489	1700	1700									
Volume to Capacity	0.00	0.27	0.27									
Queue Length 95th (ft)	0	0	0									
Control Delay (s)	12.4	0.0	0.0									
Lane LOS	B											
Approach Delay (s)	12.4	0.0										
Approach LOS	B											
Intersection Summary												
Average Delay			0.0									
Intersection Capacity Utilization			33.1%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

3: Old Tavern Rd & Old Winchester Rd

02/15/2022























Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Volume (veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Future Volume (Veh/h)	0	100	0	0	202	23	0	0	0	6	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Hourly flow rate (vph)	0	103	0	0	208	24	0	0	0	6	0	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type	None				None							
Median storage (veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	208		103		323		311		103		220	
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	208		103		323		311		103		220	
tC, single (s)	4.1		4.1		7.1		6.5		6.2		6.2	
tC, 2 stage (s)												
tF (s)	2.2		2.2		3.5		4.0		3.3		3.3	
p0 queue free %	100		100		100		100		99		100	
cM capacity (veh/h)	1375		1502		634		607		957		825	
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	103	232	0	6								
Volume Left	0	0	0	6								
Volume Right	0	24	0	0								
cSH	1375	1502	1700	597								
Volume to Capacity	0.00	0.00	0.00	0.01								
Queue Length 95th (ft)	0	0	0	1								
Control Delay (s)	0.0	0.0	0.0	11.1								
Lane LOS			A	B								
Approach Delay (s)	0.0	0.0	0.0	11.1								
Approach LOS			A	B								
Intersection Summary												
Average Delay			0.2									
Intersection Capacity Utilization			22.0%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

6: US 17 & Enon Church Rd/Old Tavern Rd














02/15/2022

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	0	5	200	2	0	3	738	96	4	641	2
Future Volume (Veh/h)	1	0	5	200	2	0	3	738	96	4	641	2
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Hourly flow rate (vph)	1	0	5	204	2	0	3	753	98	4	654	2
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								Raised			Raised	
Median storage (veh)								1			1	
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	1046	1421	327	1099	1423	376	656			753		
vC1, stage 1 conf vol	662	662		759	759							
vC2, stage 2 conf vol	384	759		340	664							
vCu, unblocked vol	1046	1421	327	1099	1423	376	656			753		
tC, single (s)	7.5	6.5	7.3	7.6	6.5	6.9	4.8			4.6		
tC, 2 stage (s)	6.5	5.5		6.6	5.5							
tF (s)	3.5	4.0	3.5	3.5	4.0	3.3	2.5			2.5		
p0 queue free %	100	100	99	26	99	100	100			99		
cM capacity (veh/h)	306	260	619	276	260	627	746			717		
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3	SB 4		
Volume Total	6	206	3	376	376	98	4	327	327	2		
Volume Left	1	204	3	0	0	0	4	0	0	0		
Volume Right	5	0	0	0	0	98	0	0	0	2		
cSH	529	276	746	1700	1700	1700	717	1700	1700	1700		
Volume to Capacity	0.01	0.75	0.00	0.22	0.22	0.06	0.01	0.19	0.19	0.00		
Queue Length 95th (ft)	1	136	0	0	0	0	0	0	0	0		
Control Delay (s)	11.9	48.4	9.8	0.0	0.0	0.0	10.0	0.0	0.0	0.0		
Lane LOS	B	E	A				B					
Approach Delay (s)	11.9	48.4	0.0				0.1					
Approach LOS	B	E										
Intersection Summary												
Average Delay			5.9									
Intersection Capacity Utilization			44.9%		ICU Level of Service				A			
Analysis Period (min)			15									

HCM Unsignalized Intersection Capacity Analysis

7: US 17 & Old Winchester Rd

02/15/2022

								
Movement	WBL	WBR	NBU	NBT	NBR	SBL	SBT	
Lane Configurations								
Traffic Volume (veh/h)	20	3	0	738	1	5	627	
Future Volume (Veh/h)	20	3	0	738	1	5	627	
Sign Control	Stop			Free		Free		
Grade	0%			0%		0%		
Peak Hour Factor	0.96	0.96	0.96	0.96	0.96	0.96	0.96	
Hourly flow rate (vph)	21	3	0	769	1	5	653	
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type				Raised		Raised		
Median storage (veh)				1		1		
Upstream signal (ft)								
pX, platoon unblocked			0.00					
vC, conflicting volume	1106	384	0	770				
vC1, stage 1 conf vol	769							
vC2, stage 2 conf vol	336							
vCu, unblocked vol	1106	384	0	770				
tC, single (s)	6.8	6.9	0.0	4.5				
tC, 2 stage (s)	5.8							
tF (s)	3.5	3.3	0.0	2.4				
p0 queue free %	94	100	0	99				
cM capacity (veh/h)	326	619	0	732				
Direction, Lane #	WB 1	NB 1	NB 2	NB 3	NB 4	SB 1	SB 2	SB 3
Volume Total	24	384	384	1	0	5	326	326
Volume Left	21	0	0	0	0	5	0	0
Volume Right	3	0	0	1	0	0	0	0
cSH	346	1700	1700	1700	1700	732	1700	1700
Volume to Capacity	0.07	0.23	0.23	0.00	0.00	0.01	0.19	0.19
Queue Length 95th (ft)	6	0	0	0	0	1	0	0
Control Delay (s)	16.2	0.0	0.0	0.0	0.0	9.9	0.0	0.0
Lane LOS	C					A		
Approach Delay (s)	16.2	0.0	0.1					
Approach LOS	C							
Intersection Summary								
Average Delay	0.3							
Intersection Capacity Utilization	30.4%			ICU Level of Service			A	
Analysis Period (min)	15							

MOVEMENT SUMMARY

 Site: US 17 at Enon Church Rd/Old Tavern Rd (PM) - No slip lanes

US 17 at Enon Church Rd/Old Tavern Rd (PM)
Roundabout

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Average Speed
		Total	HV %	v/c	sec		Vehicles	Distance		per veh	mph
		veh/h	%				veh	ft			
South: US 17											
3	L2	3	33.0	0.435	8.7	LOS A	1.5	42.7	0.05	0.01	33.9
8	T1	753	16.0	0.435	8.7	LOS A	1.5	42.7	0.05	0.01	38.5
18	R2	98	3.0	0.435	8.6	LOS A	1.5	40.7	0.05	0.01	36.9
Approach		854	14.6	0.435	8.6	LOS A	1.5	42.7	0.05	0.01	38.3
East: Old Tavern Rd											
1	L2	204	3.0	0.349	11.0	LOS B	1.1	27.6	0.56	0.58	33.4
6	T1	2	0.0	0.349	11.0	LOS B	1.1	27.6	0.56	0.58	32.4
16	R2	1	0.0	0.349	11.0	LOS B	1.1	27.6	0.56	0.58	32.8
Approach		207	3.0	0.349	11.0	LOS B	1.1	27.6	0.56	0.58	33.4
North: US 17											
7	L2	4	25.0	0.404	9.4	LOS A	1.2	35.3	0.33	0.26	34.7
4	T1	654	18.0	0.404	9.4	LOS A	1.2	35.3	0.32	0.25	37.8
14	R2	2	50.0	0.404	9.3	LOS A	1.2	33.2	0.31	0.24	30.8
Approach		660	18.1	0.404	9.4	LOS A	1.2	35.3	0.32	0.25	37.8
West: Enon Church Rd											
5	L2	1	0.0	0.014	7.4	LOS A	0.0	0.9	0.50	0.46	38.6
2	T1	1	0.0	0.014	7.4	LOS A	0.0	0.9	0.50	0.46	36.9
12	R2	5	20.0	0.014	7.4	LOS A	0.0	0.9	0.50	0.46	34.9
Approach		7	14.3	0.014	7.4	LOS A	0.0	0.9	0.50	0.46	35.6
All Vehicles		1729	14.5	0.435	9.2	LOS A	1.5	42.7	0.22	0.17	37.4

Level of Service (LOS) Method: Delay & v/c (HCM 2010).

Roundabout LOS Method: Same as Sign Control.

Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement

LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).

Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).

Roundabout Capacity Model: US HCM 2010.

HCM Delay Formula option is used. Control Delay does not include Geometric Delay since Exclude Geometric Delay option applies.

Gap-Acceptance Capacity: Traditional M1.

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: ATCS, PLC | Processed: Tuesday, February 15, 2022 7:40:41 PM

Project: S:\Projects\007081_VDOT Statewide Design_L&D\03. Task Orders\03 - US-17 at VA-245 Intersection & Design Study, Fauquier Co\Traffic Analysis

\Sidra\US 17 at Enon Church Rd_Old Tavern Rd.sip6

Appendix C – Previous VDOT Report

Technical Memorandum

To: D. Mark Nesbit
Resident Engineer
Warrenton Residency

From: Md Atiquzzaman
Traffic Engineer
Culpeper District Traffic Engineering

Date: July 28, 2021

Re: Safety Review for the intersection of Rte. 17 (Winchester Rd./James Madison Hwy.) and Rte. 245 (Old Tavern Rd.)/Rte. 703 (Enon Church Rd.)

Background

Culpeper District Traffic Engineering section received the request from Warrenton Residency to conduct a safety review at the intersection of Rte. 17 (Winchester Rd./James Madison Hwy.) and Rte. 245 (Old Tavern Rd.)/Rte. 703 (Enon Church Rd.). This intersection is #66 in the list of top potential safety improvement (PSI) intersections in Culpeper District.

Existing Conditions

The study intersection is a traditional four-legged, two-way stop controlled intersection. The major road (i.e., Rte. 17) approaches are free-flow movements and runs north to south. On the other hand, the minor road (i.e., Rte. 245/Rte. 703) approaches are stop controlled and runs east to west.

Both approaches of Rte. 17 have one left-turn lane, two through lanes, and one right-turn lane. The existing lane widths are approximately 12 ft. with 4-6 ft. shoulder on the outside edge and 2-3 ft. shoulder on the median side. The average daily traffic (ADT) on Rte. 17 is approximately 21,000 vehicles per day (vpd). The posted speed limit is 55 mph.

Both Rte. 245 and Rte. 703 approaches have only one shared left-through-right lane approaching the intersection. The existing travel lane on Rte. 245 is approximately 10 ft. with 1-2 ft. paved shoulders. Rte. 703 has no centerline marking currently. The available pavement width is approximately 22 ft. on this approach. The ADT on Rte. 245 and Rte. 703 are 3,100 vpd and 120 vpd, respectively. Rte. 245 is currently posted at 45 mph and Rte. 703 is unposted.

Crash Summary

Crash data was collected from VDOT's PowerBi database for a period of five years from February 1, 2016 to January 31, 2021. There was a total of 21 crashes during this period within a 500 ft. radius of the study intersection. A summary of the crash data is shown in Table 1. Approximately 67% (14 out of 21) of the crashes were found to be angle collisions. There were two fatal crashes during the study period. Both of them occurred from angle collisions.

Table 1. Summary of five years crash data (February 1, 2016 to January 31, 2021)

Collision Type	Total	Total (%)	Crash Severity			Lighting Condition		Road Surface Condition		Alcohol/Drug Related?		Speeding Related?	
			Fatal	Injury	PDO	Daylight	Darkness	Dry	Wet	Yes	No	Yes	No
Rear End	4	19%	0	0	4	2	2	3	1	0	4	2	2
Angle	14	67%	2	5	7	11	3	13	1	0	14	2	12
Sideswipe - Same Direction	1	5%	0	0	1	1	0	1	0	0	1	0	1
Fixed Object - Off Road	1	5%	0	1	0	1	0	1	0	0	1	0	1
Deer/Other Animal	1	5%	0	0	1	0	1	1	0	0	1	0	1
Total	21		2	6	13	15	6	19	2	0	21	4	17
Total (%)	100%	100%	9.5%	28.6%	61.9%	71.4%	28.6%	90.5%	9.5%	0.0%	100.0%	19.0%	81.0%

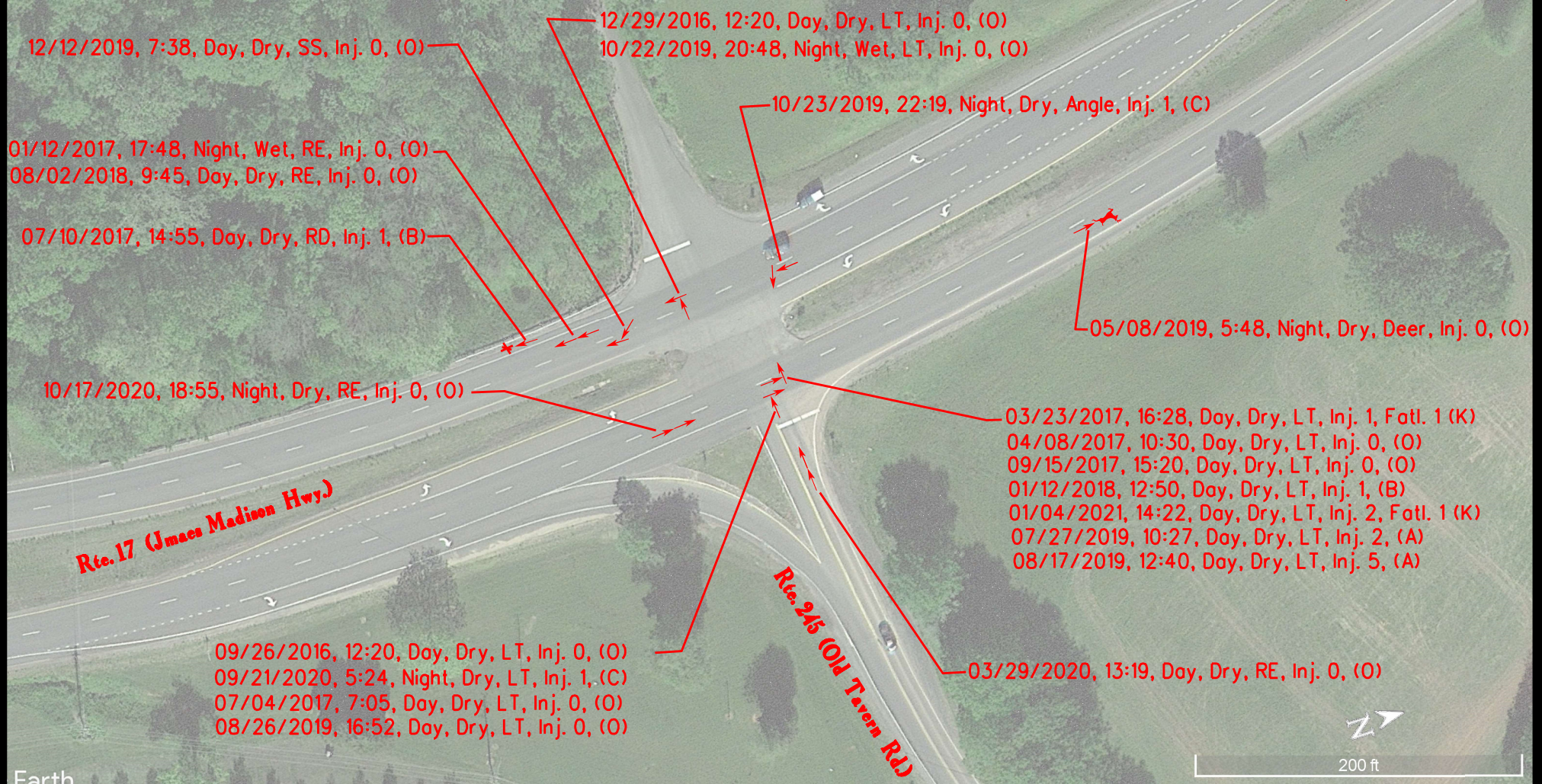
To further investigate the nature of the crashes, collision diagram has been prepared for the study intersection as shown in Figure 1. The collision diagram shows that a majority of the angle crashes (i.e. 11 out of 14) occurred between left-turning movements from Rte. 245 and through movements on Rte. 17 northbound. Additionally, two angle crashes occurred between left-turning movements from Rte. 245 and through movements on Rte. 17 southbound. Therefore, the left-turning movement from Rte. 245 contributed to approximately 93% (13 out of 14) of the angle crashes or 62% of the total crashes. Additionally, both of the fatal crashes during the study period occurred between left-turning movements from Rte. 245 and through movements on Rte. 17 northbound.

Based on the available crash data and collision diagram, no other recognizable crash pattern was observed at the study intersection during the five years period from February 1, 2016 to January 31, 2021.

FIGURE 1. COLLISION DIAGRAM

Rte. 17 (Jmaes Madison Hwy.) and Rte. 245 (Old Tavern Rd.)

Fauquier County



**CULPEPER DISTRIC
TRAFFIC ENGINEERING**
1601 ORANGE ROAD
CULPEPER, VA 22701

NOT TO SCALE

YR	2016	2017	2018	2019	2020	2021	TOTAL	SEVERITY	2016	2017	2018	2019	2020	2021	TOTAL
ANGLE	0	0	0	1	0	0	1	K	0	1	0	0	0	1	2
RT	0	0	0	0	0	0	0	A	0	0	0	2	0	0	2
LT	2	4	1	4	1	1	13	B	0	1	1	0	0	0	2
SS	0	0	0	1	0	0	1	C	0	0	0	1	1	0	2
RD	0	1	0	0	0	0	1	O	2	4	1	4	2	0	13
RE	0	1	1	0	2	0	4								
TOTAL	2	6	2	6	3	1	20								
	Day - 15			Dry - 19				*Five years of Crash Data from May 1st, 2016 thru April 30, 2021 was examined for this report.							
	Night - 6			Wet/Icy/Snowy - 2											

LEGEND	
Angle	Through
RT	Right Turn
LT	Left Turn
SS	Side Swipe
RD	Road Departure
RE	Rear End
→	Vehicle
🦌	Deer

June 22, 2021

Signal Warrant Analysis

A traffic signal warrant analysis was conducted for the study intersection using 12-hours turning movement counts collected on January 20, 2021 from 6:00 AM – 6:00 PM. Based on the collected data, the study intersection does not meet the volume criteria stated in Warrants 1-3 of the 2009 Manual on Uniform Traffic Control Devices (MUTCD) and Virginia Supplement to the 2009 MUTCD.

In addition to the turning movement counts, crash history at the study intersection was obtained to evaluate Warrant 7 – Crash Experience. There were four crashes of a type susceptible to correction by signalization occurred at this intersection during a 12-months period from February 1, 2020 to January 31, 2021. Section 4C.08 of the 2009 MUTCD states that a traffic control signal shall be considered if *“Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash.”* Therefore, a traffic signal is not warranted at the study intersection based on the crash experience.

A site visit was conducted at the study intersection on June 23, 2021 during the afternoon peak hour. No significant congestion or delay was observed during the site visit.

Field Review

A field review was conducted for the study intersection on June 23, 2021. Following characteristics were observed during the field visit:

- The intersection is conspicuous for both directions of traffic on the major road (Rte. 17).
- For Rte. 245 approach, the available intersection sight distance to right (SDR) is more than the minimum requirement of 750 ft. Additionally, the available intersection sight distance to left (SDL) is also more than the minimum requirement of 650 ft.
- For Rte. 703 approach, the available SDR and SDL are slightly less than the minimum requirements.
- The intersection has limited visibility for traffic approaching from both Rte. 245 and Rte. 703 approaches. There are existing stop ahead warning signs on these approaches to compensate for the limited visibility and warn approaching vehicles.
- Damaged pavement in the median opening area.

A list of images exhibiting the existing field conditions of the study intersections are shown in Appendix A.

Conclusions and Recommendations

Based on the collected turning movement counts and the crash experience, a traffic signal is not warranted at the study intersection. The crash analysis revealed that the left-turning traffic from Rte. 245 was involved in the majority of the crashes at the study intersection. However, the available intersection sight distance is more than the minimum required and these crashes are unlikely to be mitigated by any low cost countermeasures such as signing and pavement markings. A preliminary screening for alternative intersections using VJuST tool suggested that the modification of this intersection to Median U-Turns is likely to provide better safety and operational benefits over other intersection types.

To improve the overall safety at the study intersection, the damaged pavement on the median opening area, as shown in Figure 2, is recommended to be repaired. Additionally, trees are recommended to be trimmed/removed within the marked areas shown in Figure 3.



Figure 2. Damaged pavement to be repaired

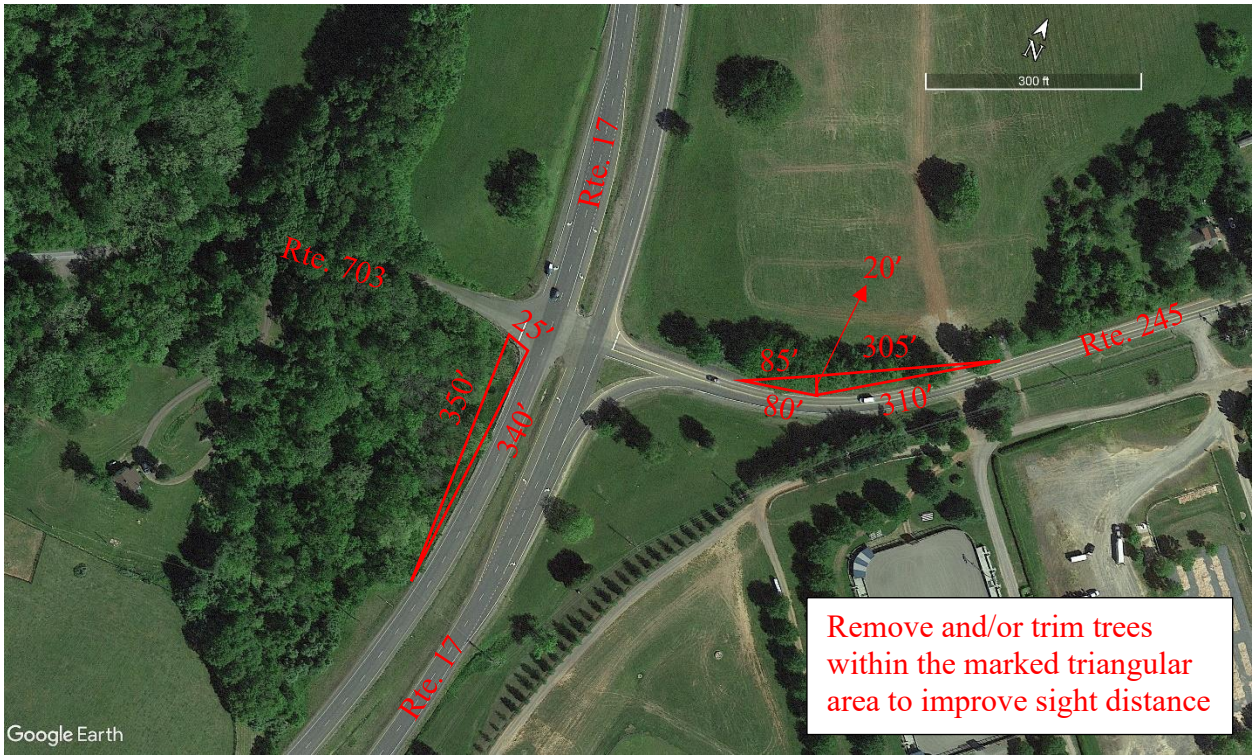


Figure 3. Recommendations for tree trimming/removal

Study Name: Rte. 17 and 245 Signal Warrant Study
Study Date : 7/23/2021

Signal Warrants - Summary

Major Street Approaches

Northbound: Rte. 17
Number of Lanes : 2+

Total Approach Volume: 5,733

Southbound: Rte. 17
Number of Lanes :2+

Total Approach Volume: 6,339

Minor Street Approaches

Eastbound: Rte. 703
Number of Lanes :1

Total Approach Volume: 53

Westbound: Rte. 245
Number of Lanes :1

Total Approach Volume: 824

Warrant Summary (Urban Values Apply)

Warrant 1 - Eight Hour Vehicular Volumes.....Not Satisfied

Warrant 1A - Minimum Vehicular Volume.....Not Satisfied
Required volumes reached for 1 hours, 8 are needed

Warrant 1B - Interruption of Continuous Traffic.....Not Satisfied
Required volumes reached for 5 hours, 8 are needed

Warrant 1C - Combination of Warrants.....Not Satisfied
Required 1A volumes reached for 2 hours, 8 are needed
Required 1B volumes reached for 7 hours, 8 are needed

Warrant 2 - Four Hour Volumes.....Not Satisfied
Number of hours (3) volumes exceed minimum < minimum required (4).

Warrant 3 - Peak Hour.....Satisfied

Warrant 3A - Peak Hour Delay.....Satisfied
Number of one hour periods (10) volumes exceed minimum >= required (1). Delay data not evaluated.

Warrant 3B - Peak Hour Volumes.....Not Satisfied
Volumes do not exceed minimums for any one hour period.

Warrant 4 - Pedestrian Volumes.....Not Evaluated

Warrant 5 - School Crossing.....Not Evaluated

Warrant 6 - Coordinated Signal System.....Not Evaluated

Warrant 7 - Crash Experience.....Not Satisfied
Number of accidents (4) is less than minimum (5). Volume minimums are not met.

Warrant 8 - Roadway Network.....Not Evaluated

Warrant 9 - Intersection Near a Grade Crossing.....Not Evaluated

Study Name: Rte. 17 and 245 Signal Warrant Study

Study Date : 7/23/2021

Warrant 1A - Minimum Volumes

Description

Intended for sites where the volume of intersecting traffic is the principal reason for consideration of a signal installation.

Summary

Only 1 one hour periods meet minimums.
Warrant is NOT met.

Site Data Required

Rural Settings Apply = **False**
 Number of Major Lanes = **2 or more**
 Number of Minor Lanes = **1**

Volume Requirements

Veh/Hr Major = **600**

Veh/Hr Minor = **150**

Time	Major Road Rte. 17				Total	Minor Road Rte. 703		Met?
	Major NB	+	Major SB	=		Minor EB	Minor WB	
15:15 - 16:15	587	+	693	=	1280	3	151	Yes
16:15 - 17:15	548	+	738	=	1286	3	136	No
15:00 - 16:00	572	+	704	=	1276	6	145	No
14:45 - 15:45	563	+	694	=	1257	4	134	No
16:30 - 17:30	526	+	699	=	1225	5	111	No
16:45 - 17:45	517	+	661	=	1178	5	103	No
14:30 - 15:30	516	+	646	=	1162	6	108	No
07:30 - 08:30	549	+	597	=	1146	4	76	No
07:45 - 08:45	551	+	585	=	1136	6	71	No
08:00 - 09:00	520	+	579	=	1099	7	64	No
07:15 - 08:15	523	+	566	=	1089	3	59	No
14:15 - 15:15	503	+	578	=	1081	7	98	No
17:00 - 18:00	466	+	587	=	1053	6	87	No
08:15 - 09:15	532	+	518	=	1050	6	48	No
13:30 - 14:30	486	+	536	=	1022	3	72	No
07:00 - 08:00	555	+	466	=	1021	2	48	No
14:00 - 15:00	469	+	542	=	1011	5	92	No
13:45 - 14:45	465	+	532	=	997	5	80	No
11:45 - 12:45	456	+	525	=	981	7	53	No
08:30 - 09:30	484	+	495	=	979	5	30	No
06:45 - 07:45	521	+	448	=	969	2	36	No
13:00 - 14:00	455	+	510	=	965	2	62	No
13:15 - 14:15	459	+	505	=	964	2	66	No
12:15 - 13:15	427	+	536	=	963	7	60	No
11:30 - 12:30	457		499		956	6	40	No

Study Name: Rte. 17 and 245 Signal Warrant Study

Study Date : 7/23/2021

Warrant 1B - Interruption of Continuous Traffic

Description

Intended for sites where the volume of the major street is so heavy that traffic on the minor street suffers excessive delay or hazard.

Summary

Only 5 one hour periods meet minimums.
Warrant is NOT met.

Site Data Required

Rural Settings Apply = **False**
 Number of Major Lanes = **2 or more**
 Number of Minor Lanes = **1**

Volume Requirements

Veh/Hr Major = **900**

Veh/Hr Minor = **75**

Time	Major Road				Total	Minor Road		Met?
	Major NB	+	Major SB	=		Minor EB	Minor WB	
	Rte. 17					Rte. 703		
14:45 - 15:45	563	+	694	=	1257	4	134	Yes
15:45 - 16:45	574	+	682	=	1256	4	154	Yes
16:45 - 17:45	517	+	661	=	1178	5	103	Yes
07:30 - 08:30	549	+	597	=	1146	4	76	Yes
13:45 - 14:45	465	+	532	=	997	5	80	Yes
07:15 - 08:15	523	+	566	=	1089	3	59	No
13:30 - 14:30	486	+	536	=	1022	3	72	No
07:00 - 08:00	555	+	466	=	1021	2	48	No
11:45 - 12:45	456	+	525	=	981	7	53	No
08:30 - 09:30	484	+	495	=	979	5	30	No
06:45 - 07:45	521	+	448	=	969	2	36	No
13:00 - 14:00	455	+	510	=	965	2	62	No
13:15 - 14:15	459	+	505	=	964	2	66	No
12:15 - 13:15	427	+	536	=	963	7	60	No
11:30 - 12:30	457	+	499	=	956	6	40	No
12:00 - 13:00	420	+	532	=	952	6	62	No
08:45 - 09:45	466	+	483	=	949	3	24	No
12:45 - 13:45	428	+	516	=	944	5	59	No
12:30 - 13:30	412	+	526	=	938	7	60	No
11:15 - 12:15	438	+	488	=	926	6	42	No
11:00 - 12:00	451	+	474	=	925	7	41	No
09:00 - 10:00	431	+	477	=	908	3	23	No
10:45 - 11:45	446	+	448	=	894	3	48	No
09:15 - 10:15	427	+	458	=	885	5	28	No
06:30 - 07:30	497		387		884	3	24	No

Study Name: Rte. 17 and 245 Signal Warrant Study

Study Date : 7/23/2021

Warrant 1C Combination of Warrants

Description

Intended for sites where the traffic volumes don't meet individual warrants but where Warrants 1A and 1B are both met to 80% of their stated values.

Summary

Only 2 hours meet 1A minimums.
 Only 7 hours meet 1B minimums.
 Warrant is NOT met.

Site Data Required

Rural Settings Apply = **False**
 Number of Major Lanes = **2 or more**
 Number of Minor Lanes = **1**

Volume Requirements

Warrant 1A 1B
 Veh/Hr Major = **480 720**
 Veh/Hr Minor = **120 60**

Major Road Rte. 17

Minor Road Rte. 703

Time	Major NB	+	Major SB	=	Total	Minor EB	Minor WB	Met1A?
14:45 - 15:45	563	+	694	=	1257	4	134	Yes
15:45 - 16:45	574	+	682	=	1256	4	154	Yes
16:45 - 17:45	517	+	661	=	1178	5	103	No
14:30 - 15:30	516	+	646	=	1162	6	108	No
07:30 - 08:30	549	+	597	=	1146	4	76	No
07:45 - 08:45	551	+	585	=	1136	6	71	No
08:00 - 09:00	520	+	579	=	1099	7	64	No
07:15 - 08:15	523	+	566	=	1089	3	59	No
14:15 - 15:15	503	+	578	=	1081	7	98	No
17:00 - 18:00	466	+	587	=	1053	6	87	No
08:15 - 09:15	532	+	518	=	1050	6	48	No
13:30 - 14:30	486	+	536	=	1022	3	72	No

Time	Major NB	+	Major SB	=	Total	Minor EB	Minor WB	Met1B?
16:00 - 17:00	579	+	731	=	1310	2	141	Yes
15:00 - 16:00	572	+	704	=	1276	6	145	Yes
07:30 - 08:30	549	+	597	=	1146	4	76	Yes
17:00 - 18:00	466	+	587	=	1053	6	87	Yes
14:00 - 15:00	469	+	542	=	1011	5	92	Yes
13:00 - 14:00	455	+	510	=	965	2	62	Yes
12:00 - 13:00	420	+	532	=	952	6	62	Yes
07:15 - 08:15	523	+	566	=	1089	3	59	No
07:00 - 08:00	555	+	466	=	1021	2	48	No
11:45 - 12:45	456	+	525	=	981	7	53	No
08:30 - 09:30	484	+	495	=	979	5	30	No
06:45 - 07:45	521	+	448	=	969	2	36	No

Study Name: Rte. 17 and 245 Signal Warrant Study

Study Date : 7/23/2021

Warrant 2 - Four Hour Volumes

Description

Intended for sites where the volume of intersecting traffic during any four hours of the day is the principal reason for consideration of a signal installation.

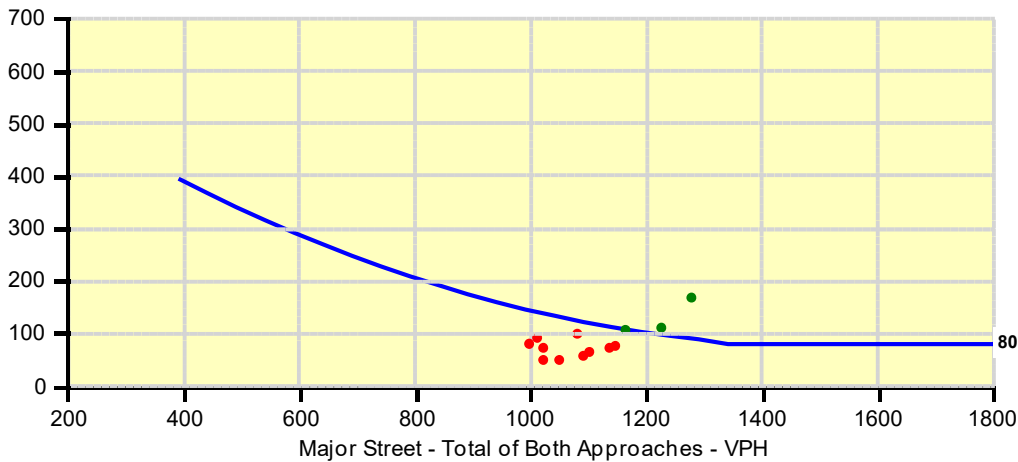
Summary

Only 3 one hour periods meet minimums.
Warrant is NOT met.

Site Data Required

Rural Settings Apply = **False**
 Number of Major Lanes = **2 or more**
 Number of Minor Lanes = **1**

Time	Major Road Rte. 17				Total	Minor Road Rte. 703		Met?
	Major NB	+	Major SB	=		Minor EB	Minor WB	
15:30 - 16:30	605	+	672	=	1277	3	169	Yes
16:30 - 17:30	526	+	699	=	1225	5	111	Yes
14:30 - 15:30	516	+	646	=	1162	6	108	Yes
07:30 - 08:30	549	+	597	=	1146	4	76	No
07:45 - 08:45	551	+	585	=	1136	6	71	No
08:00 - 09:00	520	+	579	=	1099	7	64	No
07:15 - 08:15	523	+	566	=	1089	3	59	No
14:15 - 15:15	503	+	578	=	1081	7	98	No
08:15 - 09:15	532	+	518	=	1050	6	48	No
13:30 - 14:30	486	+	536	=	1022	3	72	No
07:00 - 08:00	555	+	466	=	1021	2	48	No
							92	No



Study Name: Rte. 17 and 245 Signal Warrant Study

Study Date : 7/23/2021

Warrant 3A - Peak Hour Delay

Description

Intended for sites where for one hour of the day minor street traffic suffers undue traffic delay entering or crossing the major street.

Summary

45 one hour periods meet minimums.
Warrant IS met.

Site Data Required

Number of Minor Lanes =1

Volume and Delay Requirements

Veh/Hr All Approaches = **800**
Veh/Hr Minor = **100**
Total Delay (Veh-Hrs) = **4**

Time	Major Road Rte. 17			Minor Road Rte. 703			Warrant Met?		
	Total of All Approaches	Met?	Minor EB	Delay EB	Met?	Minor WB		Delay WB	Met?
16:00 - 17:00	1453	Yes	2	-	---	141	-	Yes	Yes
15:30 - 16:30	1449	Yes	3	-	---	169	-	Yes	Yes
15:15 - 16:15	1434	Yes	3	-	---	151	-	Yes	Yes
15:00 - 16:00	1427	Yes	6	-	---	145	-	Yes	Yes
16:15 - 17:15	1425	Yes	3	-	---	136	-	Yes	Yes
15:45 - 16:45	1414	Yes	4	-	---	154	-	Yes	Yes
14:45 - 15:45	1395	Yes	4	-	---	134	-	Yes	Yes
16:30 - 17:30	1341	Yes	5	-	---	111	-	Yes	Yes
16:45 - 17:45	1286	Yes	5	-	---	103	-	Yes	Yes
14:30 - 15:30	1276	Yes	6	-	---	108	-	Yes	Yes
07:30 - 08:30	1226	Yes	4	-	---	76	-	No	No
07:45 - 08:45	1213	Yes	6	-	---	71	-	No	No
14:15 - 15:15	1186	Yes	7	-	---	98	-	No	No
08:00 - 09:00	1170	Yes	7	-	---	64	-	No	No
07:15 - 08:15	1151	Yes	3	-	---	59	-	No	No
17:00 - 18:00	1146	Yes	6	-	---	87	-	No	No
14:00 - 15:00	1108	Yes	5	-	---	92	-	No	No
08:15 - 09:15	1104	Yes	6	-	---	48	-	No	No
13:30 - 14:30	1097	Yes	3	-	---	72	-	No	No
13:45 - 14:45	1082	Yes	5	-	---	80	-	No	No
07:00 - 08:00	1071	Yes	2	-	---	48	-	No	No
11:45 - 12:45	1041	Yes	7	-	---	53	-	No	No
13:15 - 14:15	1032	Yes	2	-	---	66	-	No	No
12:15 - 13:15	1030	Yes	7	-	---	60	-	No	No
13:00 - 14:00	1029	Yes	2	-	---	62	-	No	No

Study Name: Rte. 17 and 245 Signal Warrant Study

Study Date : 7/23/2021

Warrant 3B - Peak Hour Volumes

Description

Intended for sites where the volume of intersecting traffic during one hour of the day is the principal reason for consideration of a signal installation.

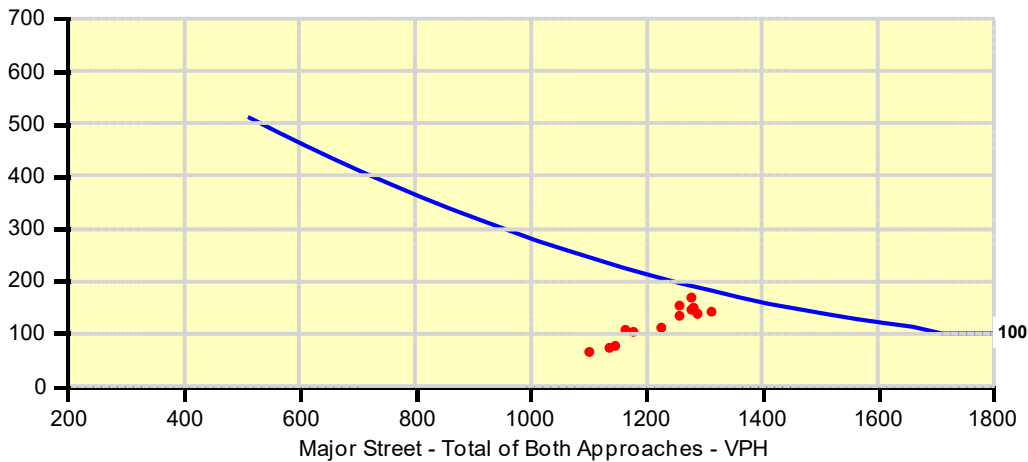
Summary

Only 0 one hour periods meet minimums.
Warrant is NOT met.

Site Data Required

Rural Settings Apply = **False**
 Number of Major Lanes = **2 or more**
 Number of Minor Lanes = **1**

Time	Major Road Rte. 17				Total	Minor Road Rte. 703		Met?
	Major NB	+	Major SB	=		Minor EB	Minor WB	
16:00 - 17:00	579	+	731	=	1310	2	141	No
16:15 - 17:15	548	+	738	=	1286	3	136	No
15:15 - 16:15	587	+	693	=	1280	3	151	No
15:30 - 16:30	605	+	672	=	1277	3	169	No
15:00 - 16:00	572	+	704	=	1276	6	145	No
14:45 - 15:45	563	+	694	=	1257	4	134	No
15:45 - 16:45	574	+	682	=	1256	4	154	No
16:30 - 17:30	526	+	699	=	1225	5	111	No
16:45 - 17:45	517	+	661	=	1178	5	103	No
14:30 - 15:30	516	+	646	=	1162	6	108	No
07:30 - 08:30	549	+	597	=	1146	4	76	No
							71	No



Study Name: Rte. 17 and 245 Signal Warrant Study

Study Date : 7/23/2021

Warrant 7 - Crash Experience

Description

Intended for sites where the frequency of correctible crashes in the past 12 months is the primary motivation for installing a traffic signal.

Summary

Number of crashes does not meet minimum.
 Pedestrian volumes do not meet the 80% criteria.
 War 1A or 1B volumes do not meet the 80% criteria.
 Warrant is NOT met.

Site Data Required

Number of crashes in last 12 months = **4**

Rural Settings Apply = **False**
 Number of Major Lanes = **2 or more**
 Number of Minor Lanes = **1**

Crash and Volume Requirements

Minimum number of crashes = **5**

Veh/Hr Major: War 1A = **480** War 1B = **720**

Veh/Hr Minor: War 1A = **120** War 1B = **60**

Volume and Pedestrian Data

Hours data meets 80% requirements of Warrant 1A (8 needed)**2** Met? **No**

Hours data meets 80% requirements of Warrant 1B (8 needed)**7** Met? **No**

Hours data meets 80% requirements of Warrant 4 (4,1 needed)**0** Met? **No**

Major Road
Rte. 17

Minor Road
Rte. 703

Warrant 1A Details

Time	Major NB	+	Major SB	=	Total	Minor EB	Minor WB	Met1A?
14:45 - 15:45	563	+	694	=	1257	4	134	Yes
15:45 - 16:45	574	+	682	=	1256	4	154	Yes
16:45 - 17:45	517	+	661	=	1178	5	103	No
14:30 - 15:30	516	+	646	=	1162	6	108	No
07:30 - 08:30	549	+	597	=	1146	4	76	No
07:45 - 08:45	551	+	585	=	1136	6	71	No
08:00 - 09:00	520	+	579	=	1099	7	64	No
07:15 - 08:15	523	+	566	=	1089	3	59	No
14:15 - 15:15	503	+	578	=	1081	7	98	No
17:00 - 18:00	466	+	587	=	1053	6	87	No
08:15 - 09:15	532	+	518	=	1050	6	48	No
13:30 - 14:30	486	+	536	=	1022	3	72	No

Warrant 1B Details

Time	Major NB	+	Major SB	=	Total	Minor EB	Minor WB	Met1B?
16:00 - 17:00	579	+	731	=	1310	2	141	Yes
15:00 - 16:00	572	+	704	=	1276	6	145	Yes
07:30 - 08:30	549	+	597	=	1146	4	76	Yes
17:00 - 18:00	466	+	587	=	1053	6	87	Yes
14:00 - 15:00	469	+	542	=	1011	5	92	Yes
13:00 - 14:00	455	+	510	=	965	2	62	Yes
12:00 - 13:00	420	+	532	=	952	6	62	Yes
07:15 - 08:15	523	+	566	=	1089	3	59	No
07:00 - 08:00	555	+	466	=	1021	2	48	No
11:45 - 12:45	456	+	525	=	981	7	53	No
08:30 - 09:30	484	+	495	=	979	5	30	No
06:45 - 07:45	521	+	448	=	969	2	36	No

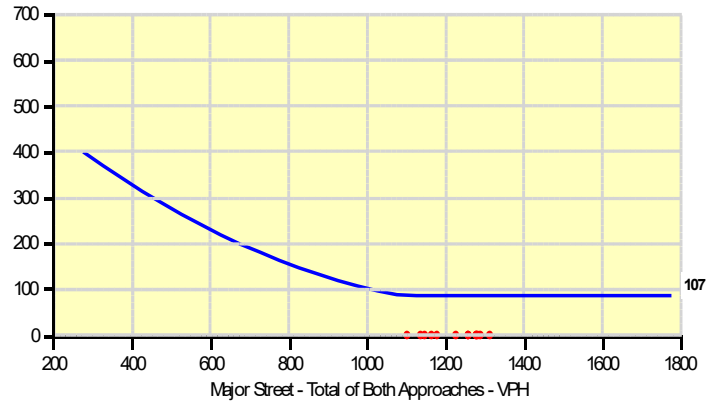
Warrant 7 - Crash Experience

Major Road

Rte. 17

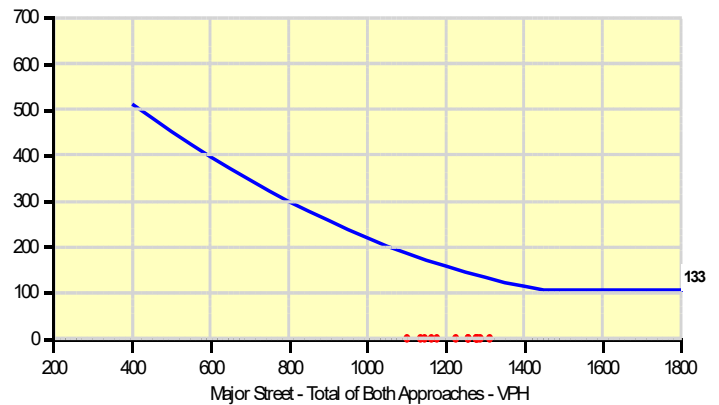
80% of Warrant 4 - 4 Hr Pedestrian Data

Time	NB Vehs	+	SB Vehs	=	Total Vehs	NB Peds	+	SB Peds	=	Ped Total	Met?
16:00 - 17:00	579	+	731	=	1310	0	+	0	=	0	No
16:15 - 17:15	548	+	738	=	1286	0	+	0	=	0	No
15:15 - 16:15	587	+	693	=	1280	0	+	0	=	0	No
15:30 - 16:30	605	+	672	=	1277	0	+	0	=	0	No
15:00 - 16:00	572	+	704	=	1276	0	+	0	=	0	No
14:45 - 15:45	563	+	694	=	1257	0	+	0	=	0	No
15:45 - 16:45	574	+	682	=	1256	0	+	0	=	0	No
16:30 - 17:30	526	+	699	=	1225	0	+	0	=	0	No
16:45 - 17:45	517	+	661	=	1178	0	+	0	=	0	No
14:30 - 15:30	516	+	646	=	1162	0	+	0	=	0	No
07:30 - 08:30	549	+	597	=	1146	0	+	0	=	0	No
07:45 - 08:45	551	+	585	=	1136	0	+	0	=	0	No



80% of Warrant 4 - 1 Hr Pedestrian Data

Time	NB Vehs	+	SB Vehs	=	Total Vehs	NB Peds	+	SB Peds	=	Ped Total	Met?
16:00 - 17:00	579	+	731	=	1310	0	+	0	=	0	No
16:15 - 17:15	548	+	738	=	1286	0	+	0	=	0	No
15:15 - 16:15	587	+	693	=	1280	0	+	0	=	0	No
15:30 - 16:30	605	+	672	=	1277	0	+	0	=	0	No
15:00 - 16:00	572	+	704	=	1276	0	+	0	=	0	No
14:45 - 15:45	563	+	694	=	1257	0	+	0	=	0	No
15:45 - 16:45	574	+	682	=	1256	0	+	0	=	0	No
16:30 - 17:30	526	+	699	=	1225	0	+	0	=	0	No
16:45 - 17:45	517	+	661	=	1178	0	+	0	=	0	No
14:30 - 15:30	516	+	646	=	1162	0	+	0	=	0	No
07:30 - 08:30	549	+	597	=	1146	0	+	0	=	0	No
07:45 - 08:45	551	+	585	=	1136	0	+	0	=	0	No



VDOT Junction Screening Tool

Results Worksheet



General Information	
Project Title:	Intersection of Rte. 17 and Rte. 245/Rte. 703
EW Facility:	Rte. 245/Rte. 703
NS Facility:	Rte. 17
Date:	July 28, 2021

Volumes (veh/hr)	U-Turn / Left	Through	Right
Eastbound	2	0	0
Westbound	3	2	136
Northbound	2	571	6
Southbound	67	661	3

General Instructions: All intersection and interchange configurations have a default assumption of one exclusive lane per movement. No results shall be interpreted until the user has verified the lane configurations on each worksheet.

Intersection Results

Type	Dir	Maximum V/C	Congestion		Pedestrian		Safety		Notes
			Accommodation Compared to Conventional	Weighted Total Conflict Points	Accommodation Compared to Conventional	Weighted Total Conflict Points	Accommodation Compared to Conventional	Weighted Total Conflict Points	
Bowtie	-	0.34	+	24					
Center Turn Overpass	-	0.34	+	32					
Echelon	-	0.51	+	28					
Full Displaced Left Turn	-	0.30	-	40					
Median U-Turn	-	0.34	+	20					
Partial Displaced Left Turn	-	0.57	-	44					
Partial Median U-Turn	-	0.31	+	28					
Quadrant Roadway	N-W	0.34		40					
	N-E	0.31		40					
	S-E	0.36		40					
	S-W	0.36		40					
Restricted Crossing U-Turn	-	0.52		20					
Single Loop	-	0.24	-	28					
Split Intersection	-	0.36		36					
Thru-Cut	-	0.54		28					
50 Mini Roundabout	-	0.83		8					
75 Mini Roundabout	-	0.82		8					
Roundabout	-	0.60		8					

*The continuous green-T is the only three-legged innovative intersection in this tool. To compare the continuous green-T to other innovative intersections, conflicts corresponding with the fourth leg must be removed. This has been done for the conventional intersection. Conflict point diagrams for three-legged and four-legged conventional intersections have been provided on the conventional intersection worksheet for reference.

Interchange Results					
Type	Dir	Maximum V/C	Accommodation Compared to Traditional Diamond	Weighted Total Conflict Points	Notes

Information	
Congestion	The maximum v/c ratio represents the worst v/c of all zones that make up an intersection.
Pedestrian	Compares the potential of each design to accommodate pedestrians based on safety, wayfinding, and delay. Potential is qualitatively defined as better (+), similar (blank cell), or worse (-) than a conventional intersection or traditional diamond interchange.
Safety	Weighted Total = (2 x Crossing Conflicts) + Merging Conflicts + Diverging Conflicts

Appendix A. Field Photos



Figure A.1 SDL for Rte. 245 approach



Figure A.2 SDR for Rte. 245 approach



Figure A.3 Sight distance obstruction for traffic approaching from Rte. 245



Figure A.4 Stop ahead warning for traffic approaching from Rte. 245



Figure A.5 SDL for Rte. 703 approach



Figure A.6 SDR for Rte. 703 approach



Figure A.7 Stop ahead warning for traffic approaching from Rte. 703



Figure A.8 View of intersection to traffic approaching from northbound on Rte. 17



Figure A.9 View of intersection to traffic approaching from southbound on Rte. 17



Figure A.10 Damaged pavement on the median opening area