


Centreville Road (Route 28)

STARS SAFETY AND OPERATIONAL IMPROVEMENTS STUDY

Prince William County, Virginia

FINAL REPORT

May 2020

Centreville Road/Route 28

Corridor Improvement Study

From Fairfax/Prince William Co Line

To Prince William Co/Manassas Park Line

Final Report

March 2020
(Rev May 2020)

Prepared for

VDOT Virginia Department of Transportation

Prepared by

ATCS®
4470 Cox Road, Suite 105
Glen Allen, VA 23060

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1.0 INTRODUCTION

1.1 Purpose / Background

The Virginia Department of Transportation Traffic & Mobility Planning Division (VDOT TMPD) initiated a study for State Route 28 in Prince William County due to significant safety and congestion issues that have been ongoing throughout the corridor. This study is entitled the Centreville Road (Route 28) STARS Safety and Operational Improvements Study and hereafter will be referred to as the Study. A project website for the Study was developed for information and outreach and is found at the follow web address: http://www.virginiadot.org/projects/northernvirginia/centreville_rd_study.asp

The purpose of the Study was to identify safety and operational deficiencies in the Route 28 corridor and develop potential projects and solutions that would improve both traffic flow and operations as well as improve safety and reduce collisions within the study area. The overall goal of the study is to develop projects and solutions that could be eligible for funding from any sources that may be applicable in the Northern Virginia Region including SMART SCALE, NVTA, or other Local programs.

A study stakeholder working group was developed to solicit input and feedback as the study progressed from initial existing conditions, traffic and safety analysis, and subsequently potential solutions along the corridor. The working group scoped a framework for the study, reviewed key assumptions and methodology approaches, and provided comments and pivotal concerns surrounding concepts and details of proposed solutions. The stakeholders group included representatives from several local jurisdictions as well as VDOT and consultant staff personnel:

- Delegate Danica Roem (D-13th), Virginia House of Delegates
- Prince William County
- City of Manassas Park
- VDOT Northern Virginia District and Central Office
- ATCS Team (consultants to VDOT TMPD for the Study)

1.2 Study Area

The study area for the Centreville Road corridor is approximately 2.1 miles in length, located in Prince William County in the area between Fairfax County and the City of Manassas Park, and is oriented in the north-south direction. The limits of the study include the Prince William/Fairfax County Line on the northern end and Blooms Quarry Road/Old Centreville Road on the southern end which corresponds with the Prince William County/City of Manassas Park line. **Figure 1** shows the limits of the corridor which does not include any extensions onto adjacent routes, however, additional modeling was conducted on intersections to the north and south to assess impacts of improvements to traffic operations outside of the corridor area.

The study area includes five major signalized intersections from South to North which are shown in **Figure 2**:

1) Centreville Road at Browns Lane/Maplewood Shopping Center
2) Centreville Road at Maplewood Rive
3) Centreville Road at Leland Drive
4) Centreville Road at Yorkshire Lane
5) Centreville Road at Orchard Bridge Drive

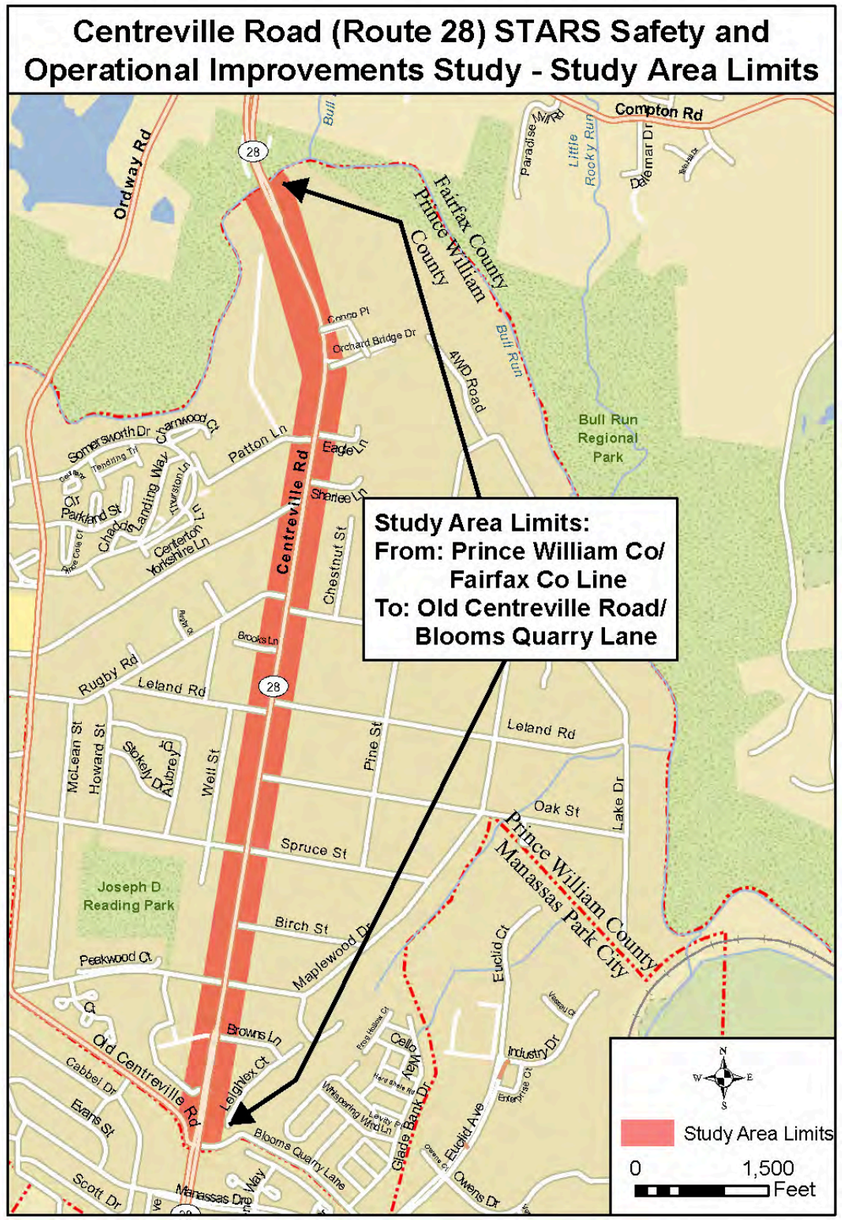

Figure 1: Centreville Road (Route 28) Corridor Study Area

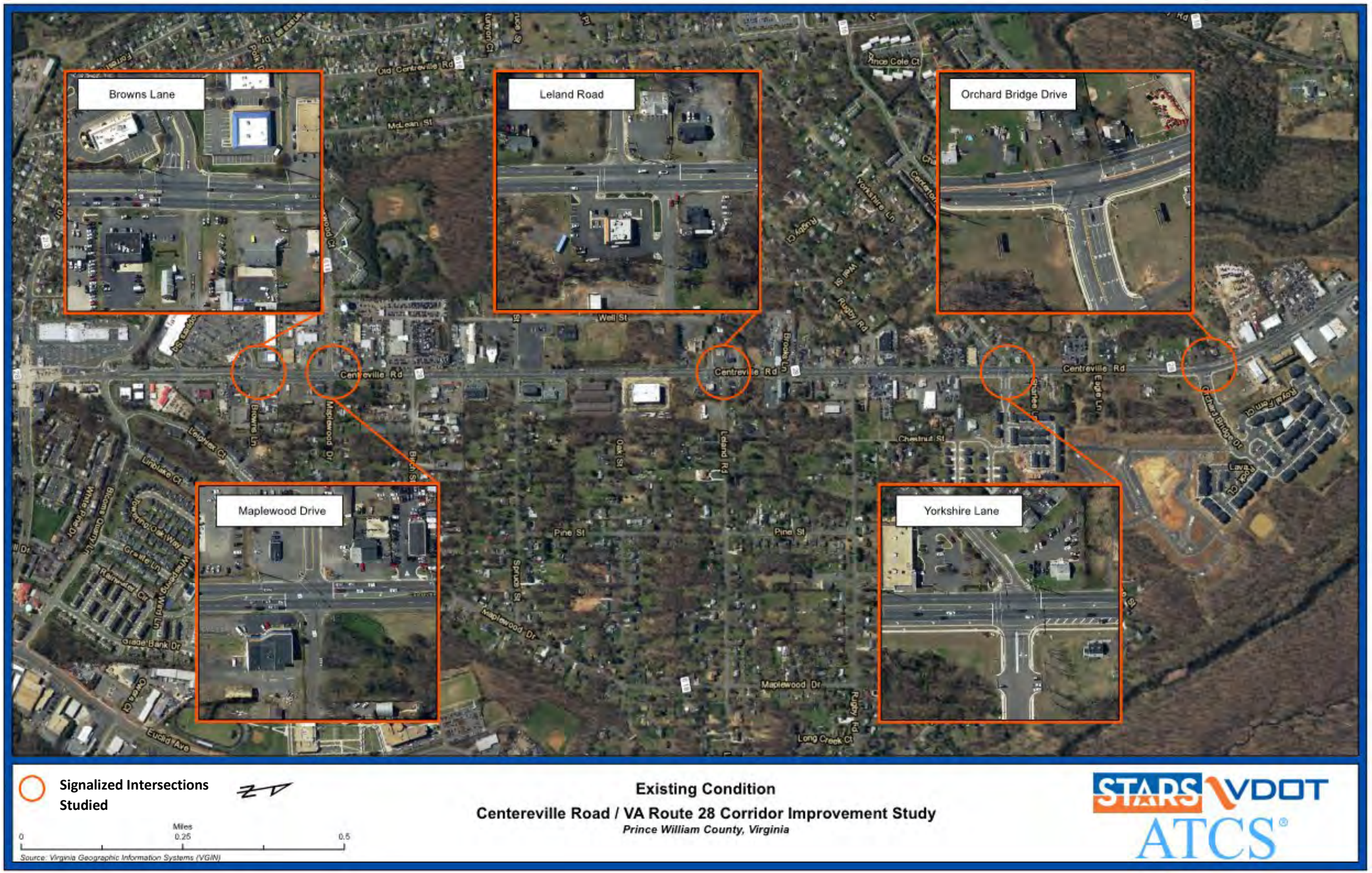

Figure 2: Study Area Map

1.3 Discussion of Existing Conditions and Data

As part of the initial review of the corridor, extensive data was gathered to assess congestion, traffic operations and safety concerns. Based on INRIX data extracted from RITIS depicting current operating conditions, travel times and congestion levels in the corridor are extremely high in the northbound direction during the AM Peak Hour and in the southbound direction in the PM Peak hour. **Figure 3 and Figure 5** summarize the travel time ranges across a 24-hour period on Route 28 for typical Tuesdays through Thursdays between September 3, 2018 and August 30, 2019 from Compton Road in the North to Sudley Road to the South. **Figure 4 and Figure 6** demonstrate that travel times in the corridor have been progressively increasing over the last several years. The AM Peak Hour travel time is particularly high and exhibits significant variations in terms of travel time reliability.

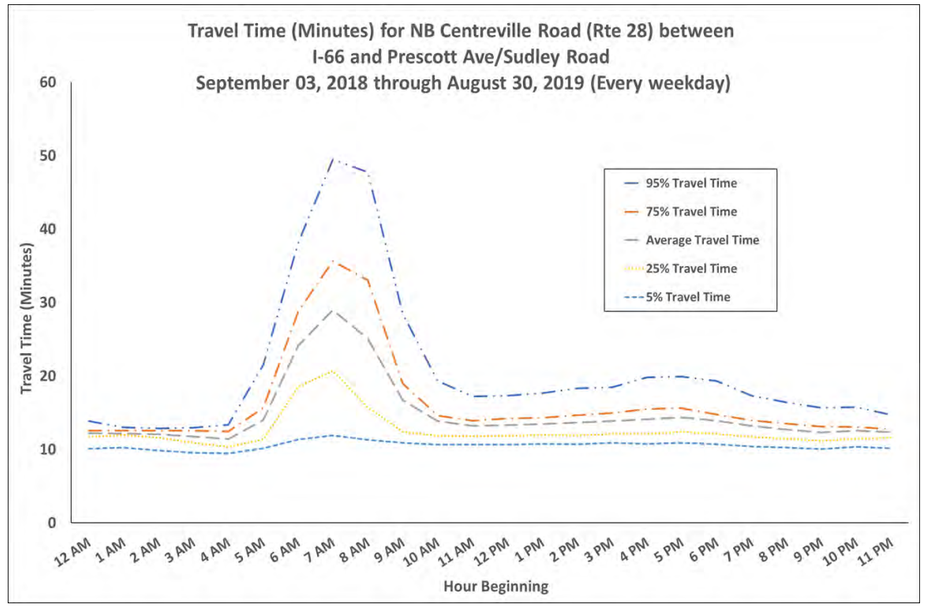

Figure 3: Centreville Road (Route 28) Northbound Travel Times

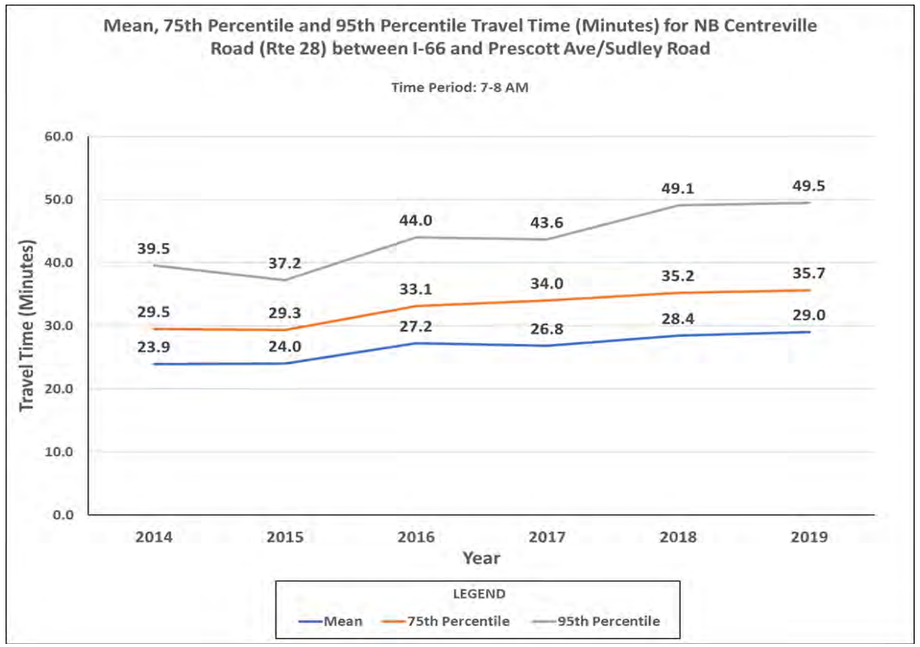

Figure 4: Centreville Road (Route 28) Northbound Travel Times from 2014-2019

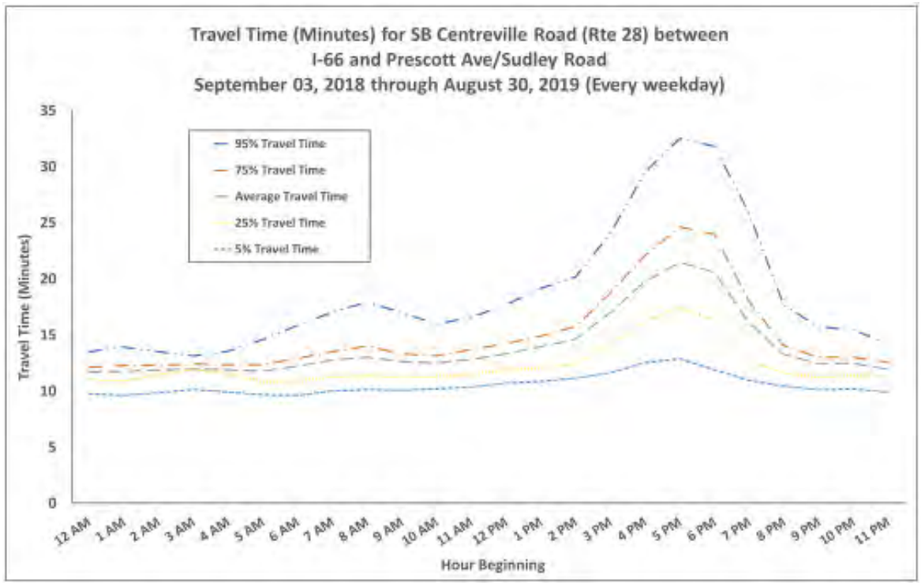

Figure 5: Centreville Road (Route 28) Southbound Travel Times

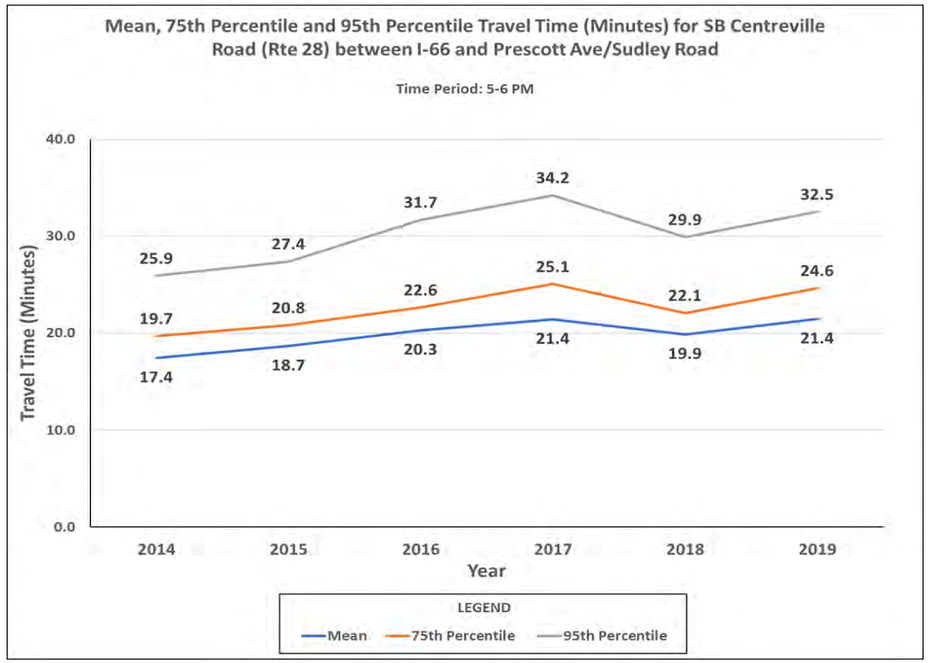

Figure 6: Centreville Road (Route 28) Southbound Travel Times from 2014-2019

For Safety Analysis, the primary tool utilized was the VDOT Crash Database Tableau Tool. At the time of study initiation, crash data from January 2013 to April 2019 was comprehensively available and used in the study. The study team gathered all available data to determine specific trends and "hot spot" areas for consideration in developing option improvement concepts. As part of the crash data review, all crashes were mapped by crash type and severity and wherever appropriate further details such as driver distraction, driving under influence, vehicle maneuvers, daylight conditions, pavement condition, etc. were considered. FR-300 reports were also requested and obtained from VDOT Northern Virginia District for additional review of crashes and to verify the correct coding of crash types (based on the notes associated with the crashes).

Table 1 shows the distribution of crash severity by year in the Study Area. Of the reported crashes, 187, or approximately 36% involved some level of injury: 2 Fatal Crashes, 16 Ambulatory or A Injury Crashes, 130 Visible or B Injury Crashes, and 39 Non-Visible or C Crashes. The crash history has been relatively consistent over the last several complete years available (2013-2019) as demonstrated in **Figure 7**. The Average Annual Crash (AAC) rates between 2013 and 2018 ranged from 193 to 242 crashes per 100 million vehicle miles. These AAC rates are 50% to 78% higher than AAC rates for Primary Highways in VDOT NOVA District and 50% to 88% higher than statewide average rates for Virginia.

Table 1: Crash Severity by year in the Study Area

Sr. No.	Crash Severity	2013	2014	2015	2016	2017	2018	2019	Total
1	K - Fatal Injury	0	0	1	0	1	0	0	**2**
2	A - Severe Injury	6	2	3	2	2	1	0	**16**
3	B - Visible Injury	9	22	24	28	21	23	3	**130**
4	C - Non-visible Injury	26	3	4	3	1	2	0	**39**
5	PDO - Property Damage Only	35	49	65	56	51	51	19	**326**
Total Crashes		76	76	97	89	76	77	22	**513**

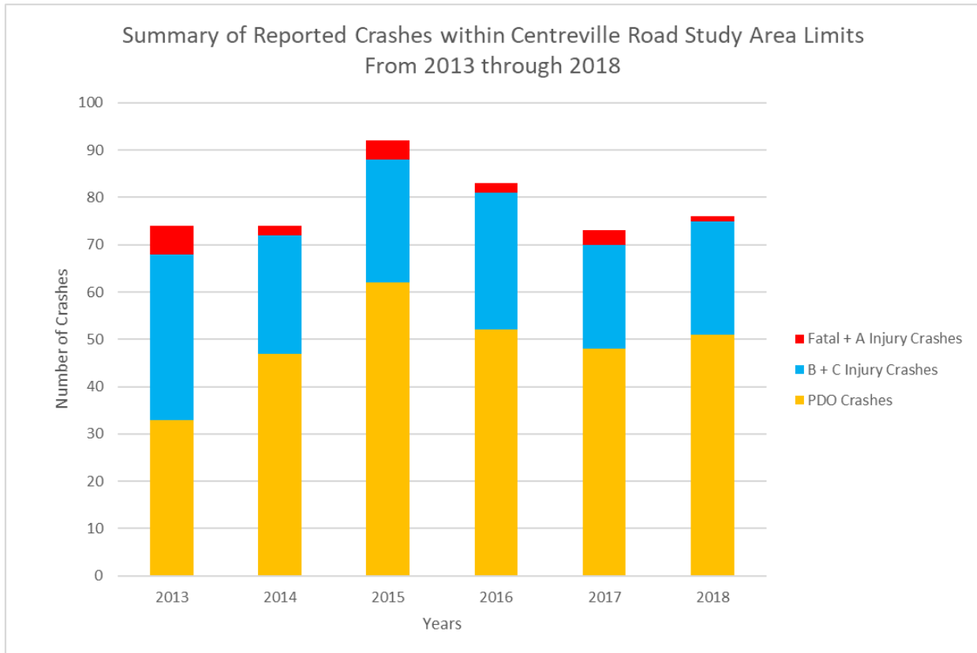

Figure 7: Historical Crash Volumes on Centreville Road within Study Area (Complete Years Only)

Figure 8 demonstrates a mapping of the crashes by severity along the Route 28 corridor. **Table 2** shows the breakdown of crash type by year in the Study Area. Rear-End and Angle crash types constituted 83% of the total crashes in the Study Area.

Table 2: Crash Type by year in the Study Area

Sr. No.	Crash Type	2013	2014	2015	2016	2017	2018	2019	Total
1	Rear End	46	42	46	41	47	32	9	**263**
2	Angle	21	17	33	36	18	29	11	**165**
3	Head On	0	3	4	0	3	4	0	**14**
4	Sideswipe - Same Direction	4	7	6	7	5	4	0	**33**
5	Sideswipe - Opposite Direction	1	0	0	1	0	1	0	**3**
6	Fixed Object in Road	0	0	0	0	0	1	1	**2**
7	Fixed Object - Off Road	2	6	6	4	3	6	0	**27**
8	Deer	0	1	1	0	0	0	1	**3**
9	Pedestrian	1	0	0	0	0	0	0	**1**
10	Other	1	0	1	0	0	0	0	**2**
Total Crashes		**76**	**76**	**97**	**89**	**76**	**77**	**22**	**513**

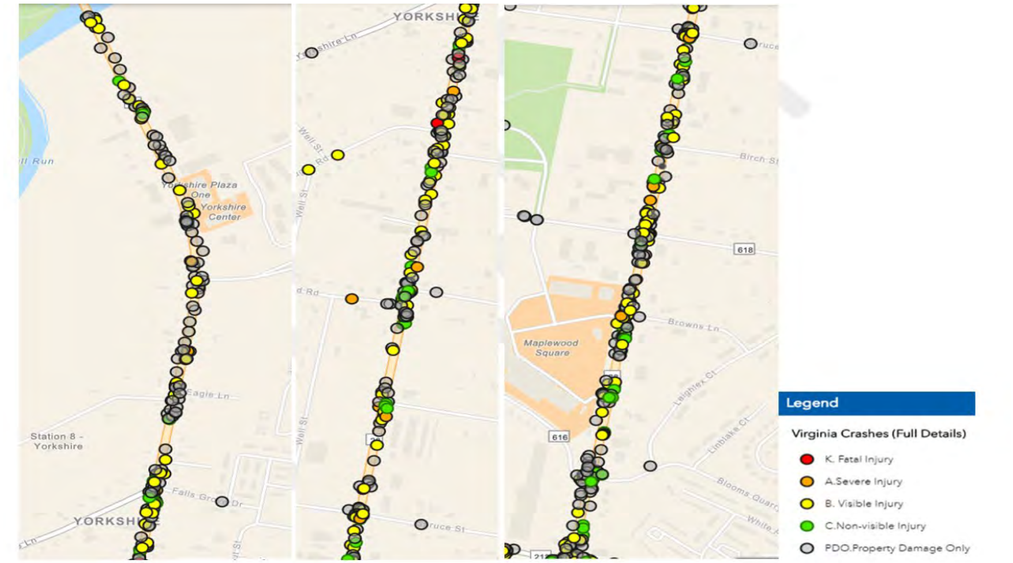

Figure 8: Historical Crash Activity by Severity

Further crash review was performed at the major signalized intersections along the corridor to determine those that had the highest crash activity to be focused on during the process of option development. Of the total crash activity in the Study Area, 202 crashes, or 42%, occurred within the 250-foot radii of the signalized intersections (typically identified as intersection-related). **Table 3** illustrates the distribution of these crashes by intersection and severity. As seen in **Table 3**, a majority of the signalized intersections on Route 28 within the Study Area, with the exception of Orchard Bridge Drive, have relatively high crash volumes. The primary patterns at intersections were comprised of Angle and Rear-End type crash activity.

Table 3: Crash Volumes at Signalized Intersections in the Study Area

	Fatal	Injury	PDO	Total
Orchard Bridge Drive	0	5	14	19
Yorkshire Lane	0	20	24	44
Leland Road	0	13	30	43
Maplewood Drive	0	20	35	55
Browns Lane	0	15	26	41
Total	***0***	***73***	***129***	***202***

1.4 Additional Route 28 Projects

A separate effort is currently underway by Prince William County to assess the location and feasibility of either a Bypass or Widening of Route 28, including widening within the Study Area. At the time of the Study public meetings, the County's preferred option has not been determined. Citizens of Prince William County voted in favor of authorizing the Board of Supervisors to take action on the Bond Referendum necessary to provide the additional funding.

Details of the project are as follows and mapping/concepts of the Bypass corridor are shown in **Figure 9**.

- **Description: 4-lane limited access road, extending from Flat Branch to Route 28 near the Fairfax/Prince William County Line and one bike/ped facility or widening of existing Route 28 to 6 lanes.**
- **Approximate Project Cost: $300,000,000**
- **Proposed Bond Authorization: $200,000,000**
- **Existing Funding: $95 million in NVTA funds.**
- **Project Duration: 5 to 7 years**

The surrounding efforts by both Fairfax and Prince William County highlight the need to consider the study area in relation to these ongoing projects as lack of improvements will cause increased bottle necks relative to those improvements.

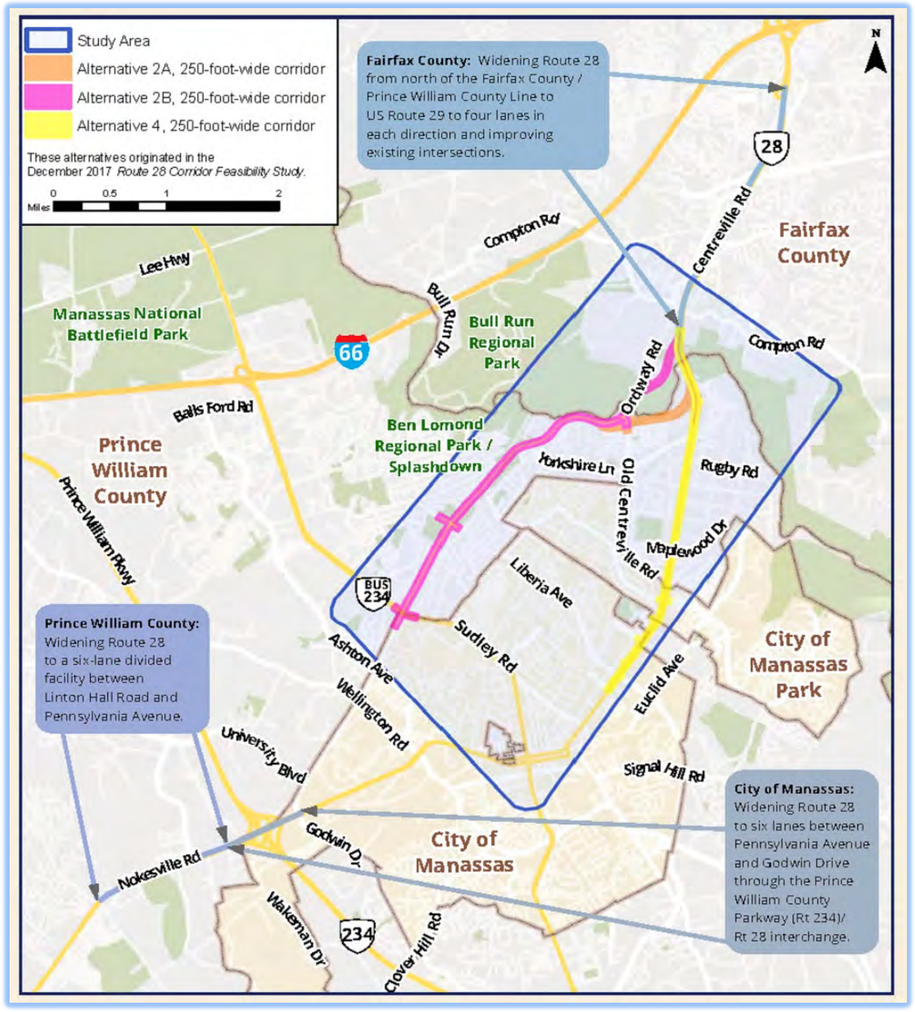

Figure 9: Prince William County Proposed Route 28 Bypass Information (Source Prince William Co)

Additionally, Fairfax County currently has a project funded and in Design-Build Procurement to widen Route 28 from four to six lanes from Route 29 to the Fairfax/Prince William County Line. The Design Public Hearing was held September 23, 2019. Details and project area for the Fairfax County Project are shown in **Figure 10**:

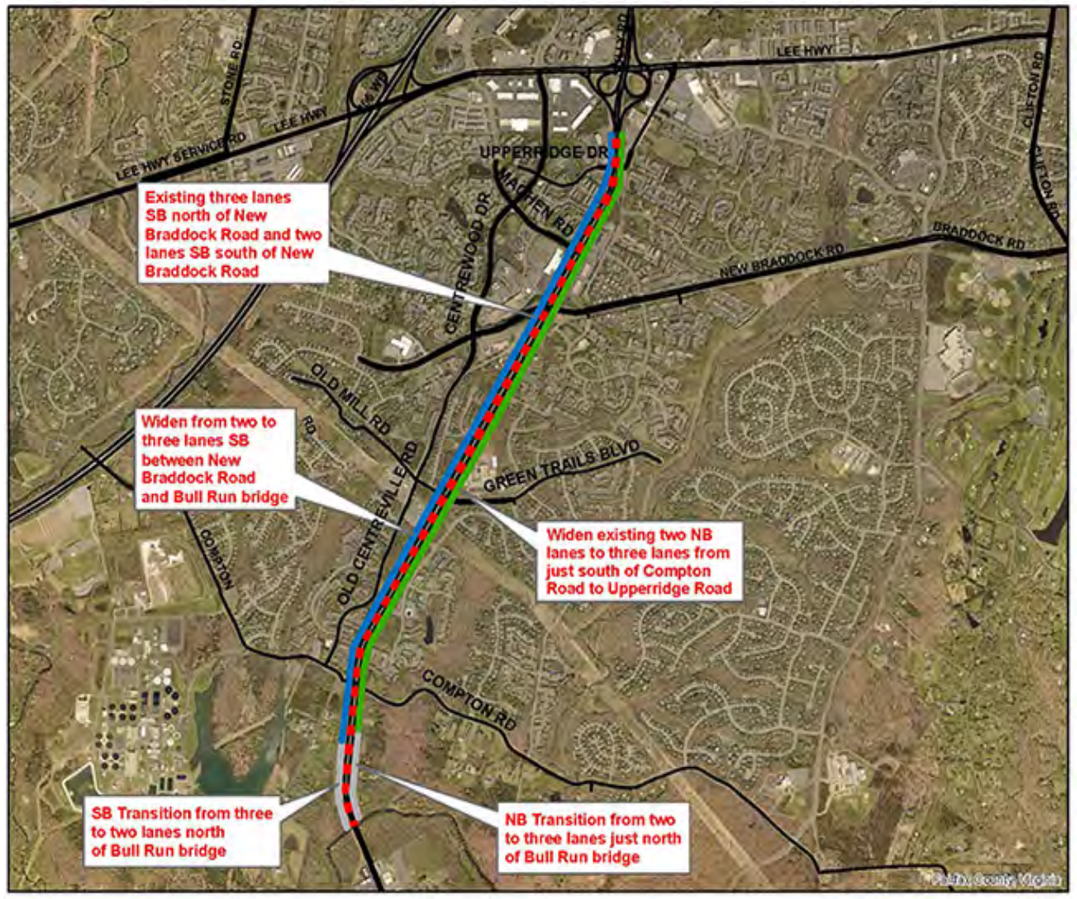

Figure 10: Fairfax County Proposed Widening (Source Fairfax Co)

1.5 Public Involvement Part 1 / Survey Results

Phase 1 of public involvement was conducted between September 20, 2019 and October 7, 2019. For the full duration of this time period, an online survey was open to allow for members of the public to provide feedback on the traffic operational and safety issues within the study area. A public information meeting was held on September 30, 2019. The meeting was attended by approximately 100 members of the public and the survey closed with 646 participants. Survey participants were asked to rank relevant issues based on importance to them. The results of the survey are summarized below in **Figure 11 and Table 4.**

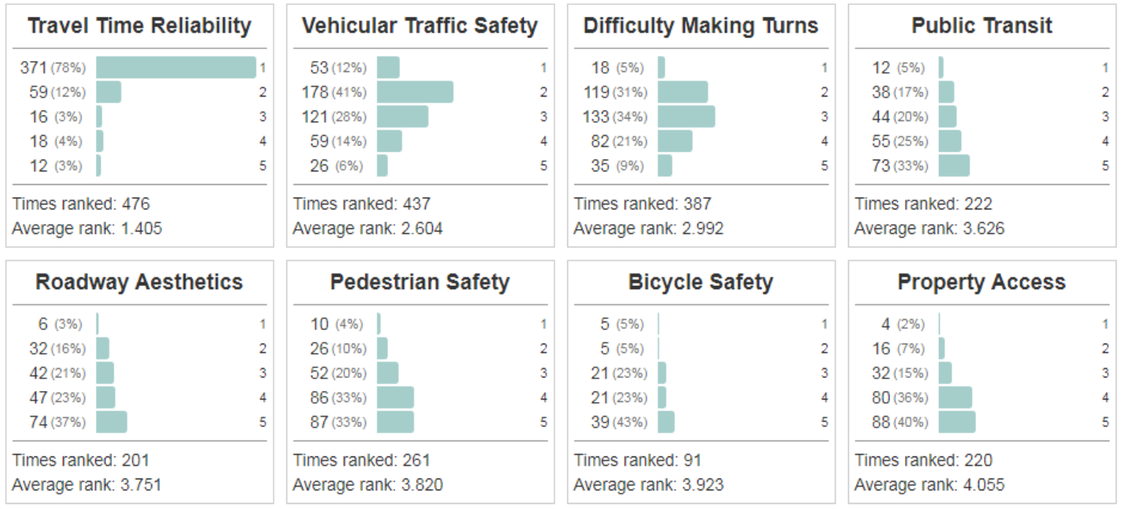

Figure 11: Public Involvement Phase 1 Ranking of Importance Survey Results

Table 4: Public Involvement Phase 1 - Overall Summary of Survey Results

Transportation Issue	Total Responses	Comments
Congestion	1,603	422
Safety	245	128
Access	132	63
Multimodal	42	16
Other Issues	75	68

Based on the data collected from the public's input, it is clear that vehicular travel time, congestion, and safety are the most important issues. There is also a high level of support for improvements to multimodal options within the study area. Additionally, many comment responses suggested that the respondents were in favor of access improvements to reduce conflicts and improve operations throughout the corridor. The survey results were used to develop the options outlined in Section 3 of this report.

2.0 Improvement Options

2.1 Summary and Development of Options

In developing option scenarios, a thorough review of the existing conditions data and results of the public input were considered. The goal of the study team was to develop multiple options that would address the highest priority concerns for further consideration and feedback by the public. Options were developed at different levels of impact to the traffic patterns and different levels of cost to construct and implement for each of the signalized intersection locations. The goal of each option was to find new or innovative ways to improve the efficiency of the signals and corridor through application of multiple approaches including:

- Simplification or reduction of signal phases
- Elimination of low volume movements
- Minor operational improvements or geometrics to expand capacity
- Innovative Intersections
- Access Management techniques such as raised median

As part of the initiation of the study, several options at specific locations were also requested for review such as Roundabouts and Flyovers. Based on Prince William County's current project and study to construct a Bypass or to consider widening of Route 28, those options were specifically deferred so as not to duplicate efforts. After a review of multiple potential options at each signalized intersection on the corridor, the study team formed several option scenarios for further analysis and subsequent concept development. These scenarios were carried forward to solicit public input. Those scenarios can be summarized as follows:

- Option 1 – Minor Improvements to redirect traffic movements and reduce signal phases as well as small capacity improvements to side street approaches
- Option 2 – Innovative Intersection implementation including Restricted Crossing U-Turns (RCUTs) and Median U-Turns (MUTs)
- Option 3 – Innovative Intersections with Continuous Median – inclusion of Innovative Intersections with raised median
- Option 4 – Flyover at Orchard Bridge Drive and Roundabout at Yorkshire Lane

Conceptual design graphics displaying corridor-wide improvement with specific intersection insets for Options 1 through 3 are shown in **Figures 14 through 18**. These figures appear on pages 10-15. Concepts for Option 4 are shown in **Figure 12** and **Figure 13**.

Detailed Intersection Improvements are listed as follows:

Option 1 – Minor Improvements

Orchard Bridge Drive

- Remove Northbound Left/U-Turn Lane

Yorkshire Lane

- Widen Yorkshire Lane approach
- Restrict through movements

Leland Road

- Restrict Eastbound to Right-In / Right-Out

- Widen Westbound approach to two lanes

Maplewood Drive

- Restrict Westbound to Ingress Only
- Widen Eastbound approach to two lanes

Browns Lane / Shopping Center

- Shift/Realign approaches
- Restrict through movements

Pedestrian Accommodations

- Connect bridge over Bull Run Bridge Trail to Orchard Bridge
- Connect Shopping Center to Maplewood
- Signal crossing improvements/upgrades where appropriate

Option 2 – Innovative Intersections

Orchard Bridge Drive

- Restricted Crossing U-Turn/J-Turn

Yorkshire Lane

- Median U-Turn

Leland Road

- Restricted Crossing U-Turn

Maplewood Drive

- Restricted Crossing U-Turn

Browns Lane / Shopping Center

- Restrict to Left-In / Utilize adjacent intersections for U-Turns

Pedestrian Accommodations

- Add 5-foot sidewalk full length of Northbound side from Blooms Quarry Road to Bull Run Bridge
- Provide pedestrian crossings at RCUT Left Turns through median islands

Option 3 – Innovative Intersections with Continuous Median

Option 3 provides similar intersection treatments as Option 2 (Innovative Intersections), but also applies access management throughout the corridor with a continuous median. Additionally, a 10-foot multi-use path along the northbound side of Route 28 is included in this concept.

Option 4A – Left Turn Flyover at Orchard Bridge Lane

One improvement considered for Option 4 includes full removal of Southbound Left Turn lane and replacement with a grade-separated flyover and is shown in **Figure 12**.

Option 4B – Yorkshire Roundabout

An additional improvement for option 4 is the construction of a roundabout at the intersection of Route 28 with Yorkshire Lane, Leland Road, and Maplewood Drive. **Figure 13** displays a conceptual roundabout design at the northernmost intersection considered for a roundabout – Yorkshire Lane.

Figure 12: Option 4A Flyover at Orchard Bridge

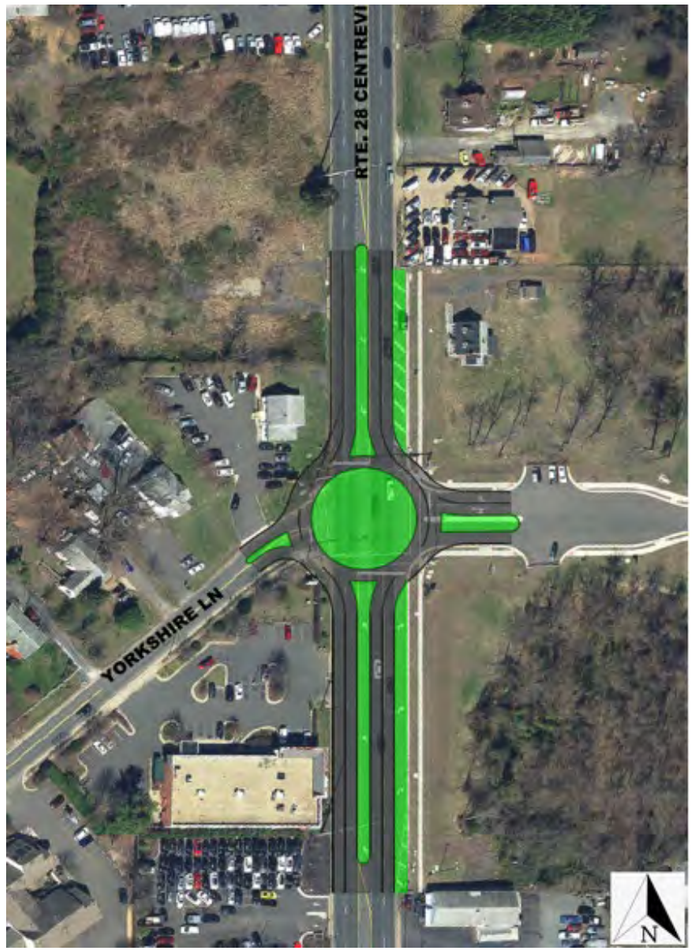

Figure 13: Yorkshire Roundabout

2.2 Pedestrian Accommodation Options

Pedestrian improvements scored highly in terms of importance on the online opinion survey from Public Involvement as noted in Part 1 and thus were considered as part of all the corridor-wide improvements. Several options of different levels of accommodations were developed and considered in tandem with the roadway improvements. A summary of the proposed improvements as a function of their overall impact on the corridor is shown in **Table 5**.

Table 5 – Pedestrian Improvement Summary

	Option 1 – Minor Improvements	Option 2 – Innovative Intersections	Option 3 – Innovative Intersections with Continuous Median
Enhancements for Pedestrians	High Visibility Crosswalk at 2 locations and sidewalk/trail along east side from Orchard Bridge Road to bridge over bull Run	Improved pedestrian crossings with enhanced safety and reduced delays at 5 locations	Improved pedestrian crossings with enhanced safety and reduced delays at 5 locations
Assessment	Enhanced pedestrian safety at 2 locations and 0.4-mile extension of trail/sidewalk	Significantly enhanced pedestrian safety, reduced pedestrian delays, improved refuges and enhanced mobility for the crosswalks across Route 28 and signalized side road approaches	Significantly enhanced pedestrian safety, reduced pedestrian delays, improved refuges and enhanced mobility for the crosswalks across Route 28 and signalized side road approaches
Rating	Slightly Better	Significantly Better	Significantly Better

Current conditions have a discontinuous sidewalk system that has been implemented as part of property redevelopment and makes the corridor difficult to traverse for pedestrians.

As part of inclusion in Option 1, due to low cost nature, only minor connectivity on the northern and southern ends of the corridor would be made but pedestrian crossings at signalized intersections would be added. These improvements would allow for safely crossing Route 28 from Residential Land Uses to Commercial Lane Uses to encourage pedestrian trips between those areas. It would improve the safety of crossing Route 28 but still present challenges for pedestrians that would have destinations along the corridor or need to travel from end to end.

For Option 2 and 3, a full-length pedestrian facility would be added to the corridor. Option 2 includes standard sidewalk, while Option 3 would go further and include a full Multi-Use Path. These would allow for save travel on the full corridor by pedestrians. Due to cost and right of way constraints, the improvements are only proposed for construction on one side of the road that would be determined further in the future based on a more detailed review of site conditions and desirability.

2.3 Graphics of Options

As described in **Section 2.1**, the following concept sketches and details of proposed options were developed and presented to the study team and were presented at the Public Information Meeting held on November 20th, 2019.

CENTREVILLE ROAD (Route 28)
OPTION 1 - MINOR IMPROVEMENTS

Section 1 of 2: Southern Section

Figure 14: Option 1 – Minor Improvements Part 1

CENTREVILLE ROAD (Route 28)
OPTION 1 - MINOR IMPROVEMENTS

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Section 2 of 2: Northern Section

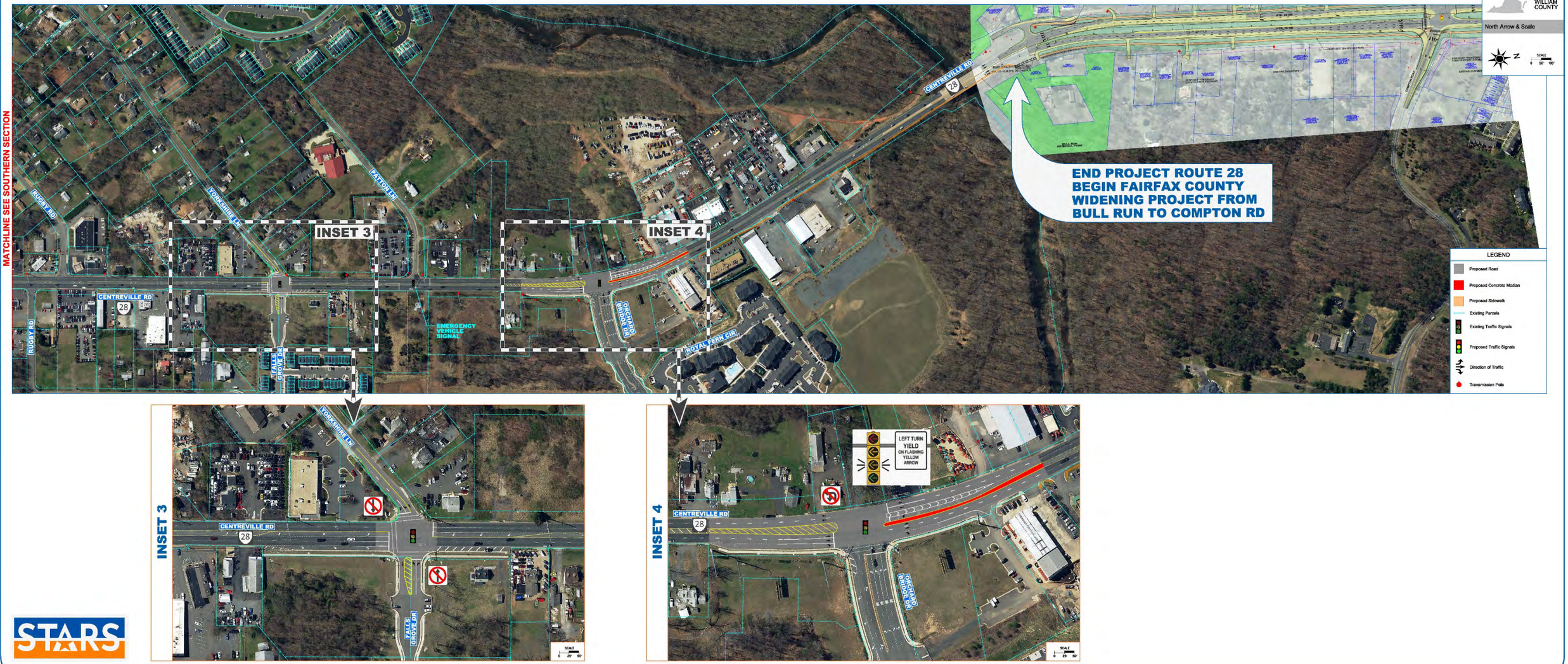

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Figure 15: Option 1 – Minor Improvements Part 2

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CENTREVILLE ROAD (Route 28)

OPTION 2 - INNOVATIVE INTERSECTIONS

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Section 1 of 2: Southern Section

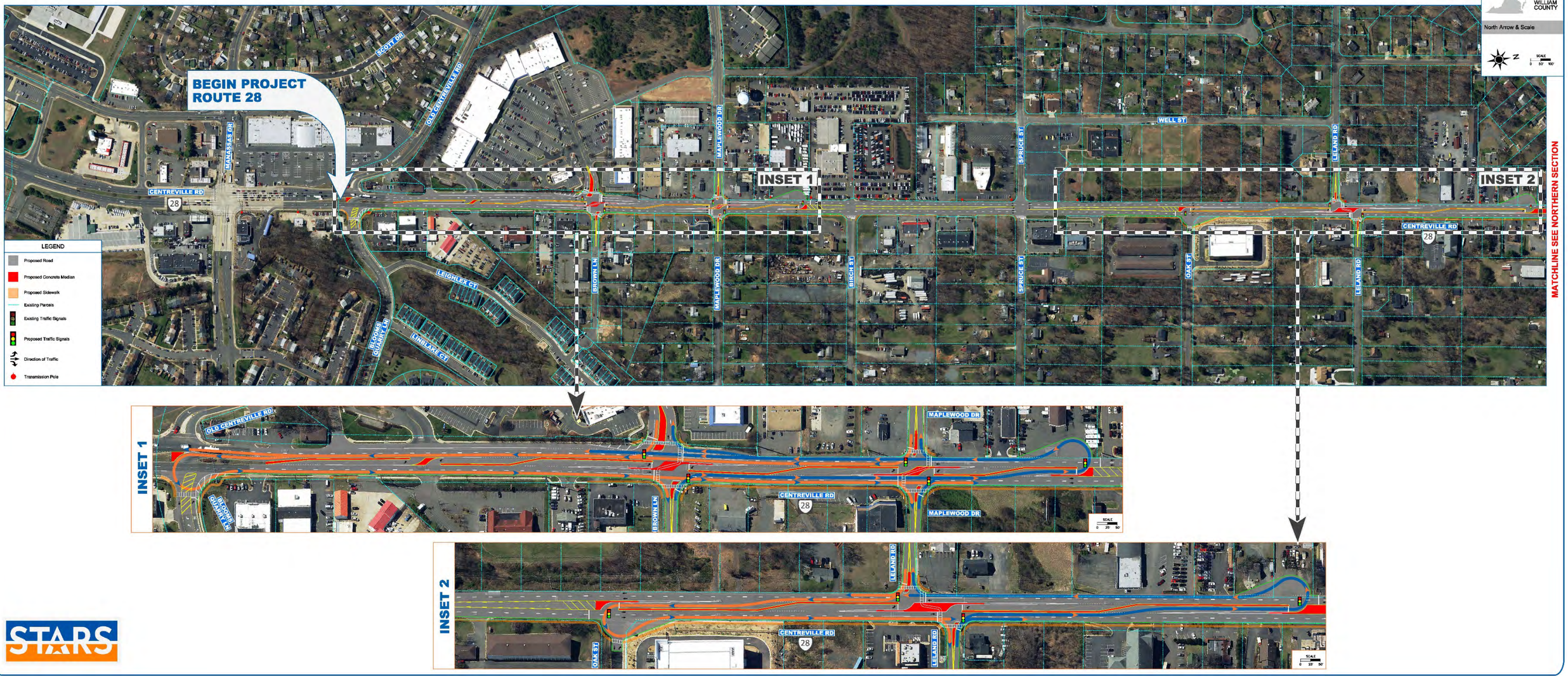

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Figure 16: Option 2 – Innovative Intersections Part 1

CENTREVILLE ROAD (Route 28)
OPTION 2 - INNOVATIVE INTERSECTIONS

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Section 2 of 2: Northern Section

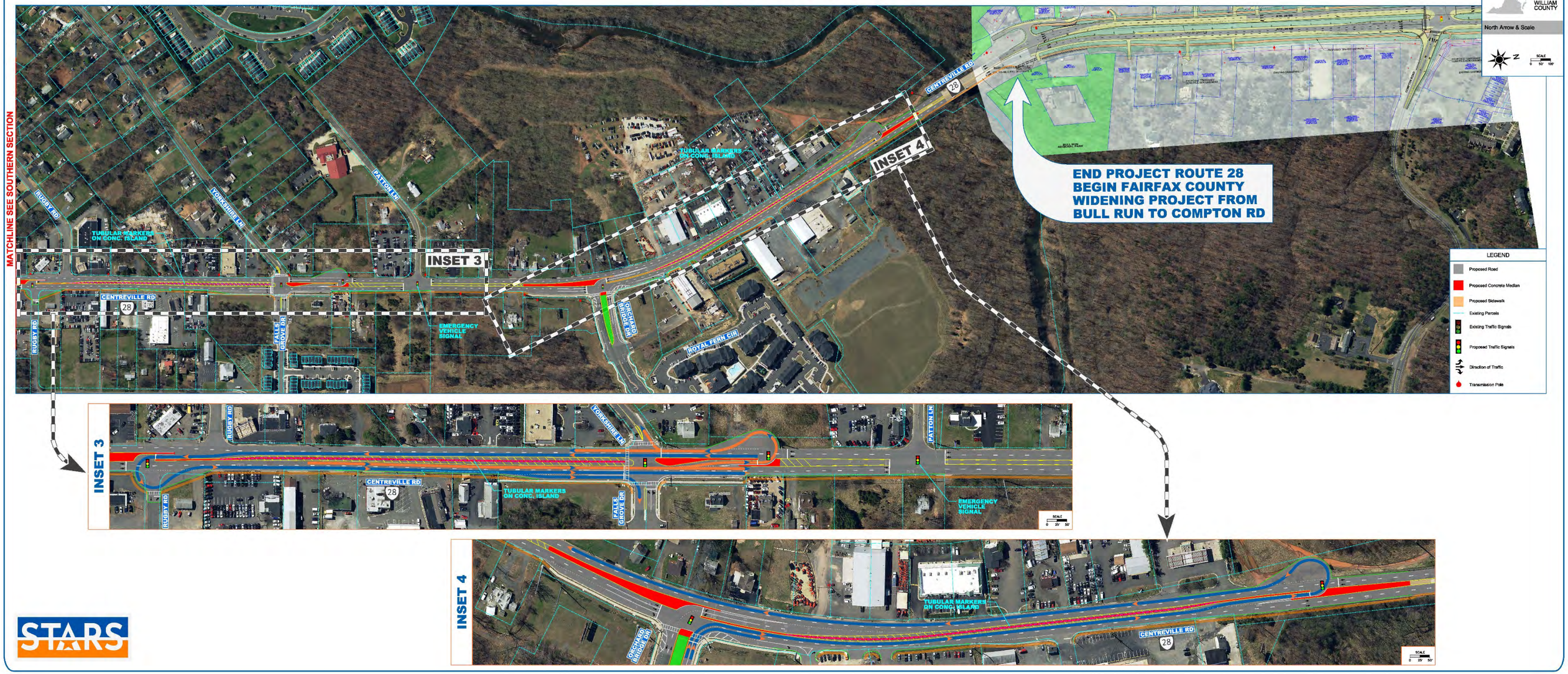

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Figure 17: Option 2 – Innovative Intersections Part 2

CENTREVILLE ROAD (Route 28)

OPTION 3 - INNOVATIVE INTERSECTIONS WITH CONTINUOUS MEDIAN

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Section 1 of 2: Southern Section

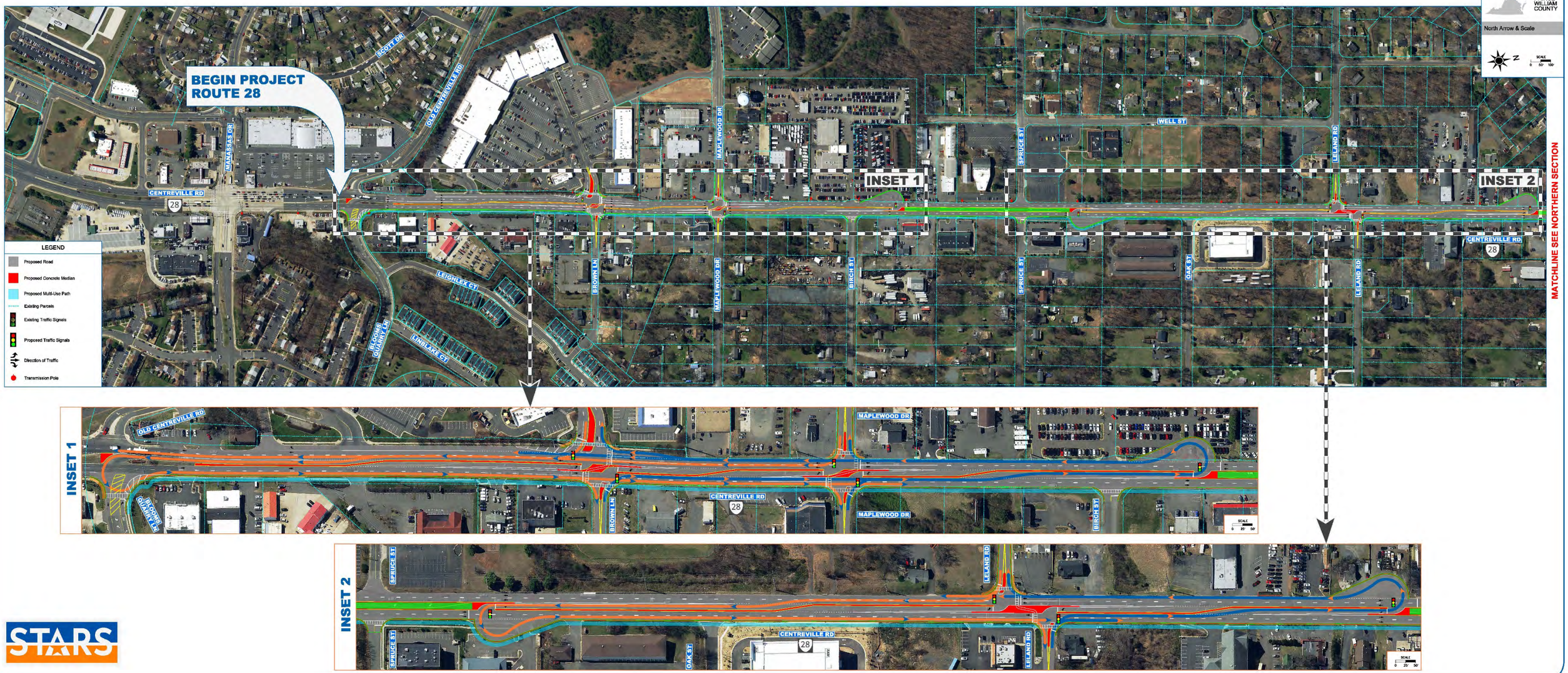

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Figure 18: Option 3 – Innovative Intersections with Continuous Median Part 1

CENTREVILLE ROAD (Route 28)

OPTION 3 - INNOVATIVE INTERSECTIONS WITH CONTINUOUS MEDIAN

Section 2 of 2: Northern Section

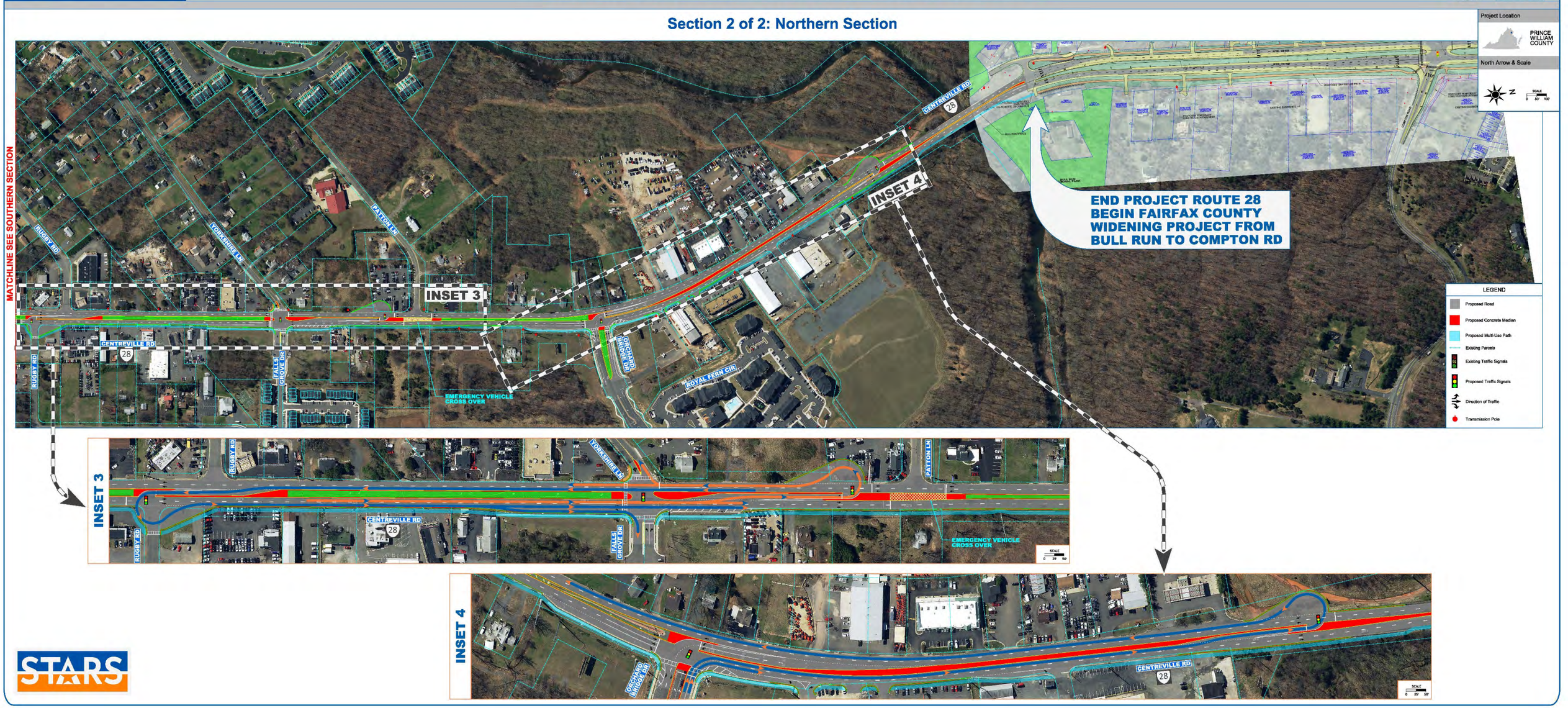


Figure 19: Option 3 – Innovative Intersections with Continuous Median Part 2

3.0 Options Analysis

3.1 Traffic Forecasting and Methodology

Due to the compressed schedule of the study and availability of other models from previous studies and efforts, models and traffic volumes were solicited from the Prince William County efforts mentioned in Section 1.4 as well as existing timings and Synchro Models from VDOT Northern Virginia Traffic Engineering.

The Study Existing (2019) traffic models were based on the VDOT provided models which contained the highest volumes and therefore presented the most conservative scenario compared to other available models. For future 2030 scenarios, the forecasting from the Prince William County 2040 Bypass Study was interpolated to determine volumes based on growth if Bypass or Widening is not built in 2030. In assessing the forecast scenarios of the study, it was determined that if the Bypass is built it will effectively accommodate future traffic growth in the study area. However, the remaining demand on the corridor would remain relatively consistent and still utilize the capacity available. To summarize:

- Existing (2019) volumes – Derived from VDOT models
- 2030 "With Bypass" scenario – Equal volumes to 2019 Existing volumes (demand/growth accommodated by newly constructed Bypass)
- 2030 "Without Bypass scenario - Interpolated forecast volumes from Prince William Co Bypass Study

3.2 Options Screening Comparison

Synchro 10 was used for screening-level analysis to provide a comparison between the existing conditions and multiple improvement options using 2019 volumes. A summary of the existing conditions operational analysis results are shown in **Appendix A Table 1** and **Appendix A Table 2**.

The 2019 volumes were grown to Year 2030 volumes as noted in Section 3.1 and applied to the Synchro network. A summary of the Future Year operational analysis are shown in **Appendix Table 3** and **Appendix Table 4** and represent a screening of the "Without Bypass" scenario that assumes traffic growth on the study corridor. This scenario was utilized to assess the effectiveness of the options under increased traffic demand.

3.3 VISSIM Analysis

VISSIM, a microscopic traffic simulation software, was used to understand the network level operational performance of No-Build and the proposed improvement options. It was seen that the operational performance of Option 1 was very similar to No-Build and the operational performance of Option 2 was very similar to Option 3. Hence, for sake of simplicity, **Table 6** below shows the comparison of network performance metrics between No-Build and Option 3. We see from **Table 6** that Option 3 typically has 7% to 11% additional capacity than No-Build for the different scenarios with and without Bypass. Additionally, for the AM peak hour Option 3 has 3% to 22% reduction in network delay and concomitant increase in network speeds. From the VISSIM analysis, Option 3 (and Option 2) have the ability to handle additional capacity at similar or better operational performance levels compared to No-Build (and Option 1). In addition to the improvements in operational performance, the expected improvements to safety conditions for the proposed improvement options is discussed in Section 3.4

Table 6: Network Performance Comparison – Option 3 with No-Build conditions

Network Performance Metrics - AM Peak Hour							
Performance Measure	2019 Existing	2030 Without Bypass			2030 With Bypass		
		No-Build	Option 3	Difference	No-Build	Option 3	Difference
Network Delay (min/veh)	7.4	5.6	5.5	-3%	2.5	2.0	-22%
Total Vehicles Serviced (veh)	9578	11190	12120	8%	9321	10297	10%
Average Network Speed (mi/hr)	11.0	13.3	13.4	1%	21.0	22.8	8%
Network Performance Metrics - PM Peak Hour							
Performance Measure	2019 Existing	2030 Without Bypass			2030 With Bypass		
		No-Build	Option 3	Difference	No-Build	Option 3	Difference
Network Delay (min/veh)	4.6	8.6	8.9	3%	5.9	6.0	2%
Total Vehicles Serviced (veh)	10428	12248	13633	11%	11884	12688	7%
Average Network Speed (mi/hr)	16.7	9.0	8.7	-3%	13.1	12.4	-5%

3.4 Expected Safety Performance

In considering impacts of the proposed options that were developed for public input, the primary methodology used was the application of VDOT SMART SCALE Crash Modification Factor (CMF) values to historical crash trends for Fatal & Injury Crashes. The appropriate CMF values were applied to the subject crash volumes at each location (that would benefit from the improvement) to determine expected crash reductions. For consideration of reduction in All crashes, FHWA CMFs were utilized and are noted in **Table 7.**

For Option 1, due to lower cost and focus on operational improvements, no defined CMFs were readily available. It is assumed that there would be potential safety benefits to Option 1 based on improved operations and if median or other access management techniques were applied. Based on engineering judgment, it is considered reasonable that 2-5% spot crash reductions could be realized upon implementation.

Based on the most up to date VDOT/SMART SCALE Value guidelines, the values found in **Table 7** were utilized.

Table 7: Applied Crash Modification Factors

Improvement	CMF - Fat/Inj*	CMF - All **
RCUT	0.65	0.85
MUT	0.70	0.84
Raised Median	0.4	0.39

*VDOT SMART Scale F+I CMF

**FHWA CMF IDs 9984, 3034

Based on the application of the appropriate CMFs, positive results were shown at Intersections in Option 2 resulting in expected reductions of 30%-35% improvements in Fatal & Injury crashes and 15%-16% expected reductions in all crashes. The greatest safety benefit is realized in Option 3 with the addition of a full corridor raised median coupled with Innovative Intersections at all signalized intersections. **Table 8** summarizes the expected crash reductions based on the analysis.

Table 8: Expected Crash Reductions for Option 2 and Option 3

	Fatal/Injury Crashes				Total Crashes			
	Historical	Avg/Year	Expected		Historical	Avg/Year	Expected	
Orchard Bridge Road	5	0.8	3.3	0.5	19	2.9	16	2.5
Yorkshire Lane	20	3.1	14	2.2	44	6.8	37	5.7
Leland Road	13	2.0	8.5	1.3	43	6.6	37	5.6
Maplewood Drive	20	3.1	13	2	55	8.5	47	7.2
Browns Lane	15	2.3	9.8	1.5	41	6.3	35	5.4
Option 2 Total	***73***	***12***	***48***	***7***	***202***	***31***	***171***	***26***
	CORRIDOR Reduction		-14% Fatal/Injury				-7% All Crashes	
Continuous Median	114	18	45.6	7.2	311	49.1	124.4	19.6
Option 3 Total	***187***	***30***	***94***	***14***	***513***	***73***	***277***	***43***
	CORRIDOR Reduction		-50% Fatal/Injury				-42% All Crashes	

3.5 Cost Comparison / Estimates

As part of initial study team and stakeholder review of options, general order of magnitude cost ranges were assigned to each option to approximate needed budget based on 2019 dollars and market conditions. **Table 9** summarizes the initial cost opinions of all options described in Section 2.1.

Table 9: Cost Ranges for Included Improvement Options

	Order of Magnitude Cost Comparison Ranges Preliminary Cost Ranges
Option 1 - Minor Improvements	$4,000,000 - $5,000,000
Option 2 - Innovative Intersections	$16,000,000 - $20,000,000
Option 3 - Continuous Median	$27,000,000 - $32,000,000
Option 4a - Orchard Bridge Flyover	$28,000,000 - $33,000,000
Option 4b - Yorkshire Roundabout	$9,000,000 - $11,000,000

3.6 Public Involvement Phase 2 - Survey Results

Phase 2 of public involvement was conducted between November 20, 2019 and December 2, 2019. The online survey was open for the duration of this time period to allow for the public to give their feedback on the developed design options. The second public information meeting was held on November 20, 2019. The meeting was attended by 58 members of the public and the survey had 698 participants. Participants in the survey were asked to give star ratings to the different options at each intersection. The survey results for the signalized intersections within the study area are shown in **Figure 20**.

Figure 2012: Public Involvement Phase 2 Ranking of Options Survey Results for the Signalized Intersections

The results of the second survey showed a significant amount of support for Option 3. The average rating for each intersection was just under four out of five stars and over 50% of respondents rated Option 3 as five stars. These results are consistent with the results of the survey from Phase 1, as Option 3 combines significant congestion and safety improvements while also providing for multimodal transportation improvements. The No-Build Option received minimal support, with approximately 70% of participants rating it as 1 star.

4.0 Conclusions and Recommendations

4.1 Transit Study Recommendation

Demographic information for residents in the region around the study area was collected from the U.S. Census Bureau Work Destination Report from 2017 in order to determine the need for and feasibility of additional mass-transit within the corridor. At present, only a single local bus stop for OmniRide exists within the study area. A map showing the workplace destinations for commuters originating around the study area is shown in **Figure 21**.

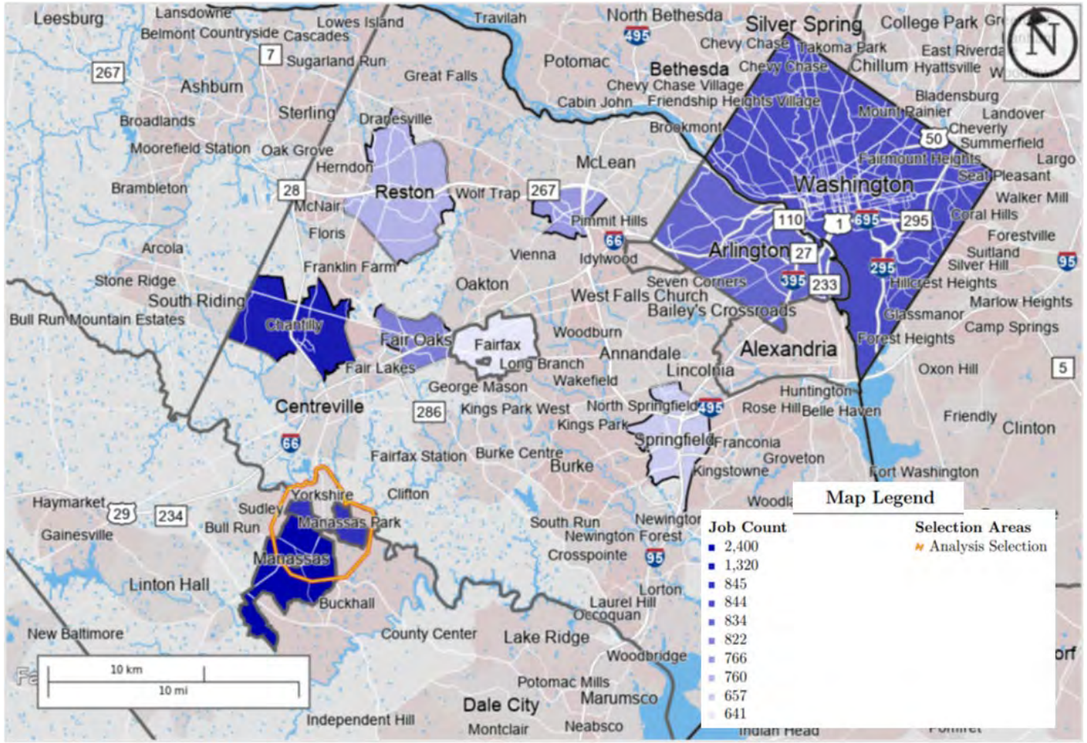


Figure 21: Workplace Destinations for Commuters Originating in the Vicinity of the Study Area

While many trips originating in and near the study area travel locally in the Manassas and Manassas Park areas, a significant number of commuters travel to destinations such as Chantilly, Arlington, and Washington D.C. for employment. A numerical breakdown of the commuter destinations is shown in **Table 10**.

Based on the results of this demographics report, it is recommended that a transit study be conducted for the corridor to determine the feasibility of providing a service to nearby destination centers outside of Prince William County, particularly the currently unserved areas such as Chantilly, Fair Oaks, and Reston areas.

Table 10: Study Area Workplace Commuter Destination Summary

Places (Cities, CDPs, etc.) as Work Destination Area	Count	Share
All Places (Cities, CDPs, etc.)	26,866	100.0
Manassas city, VA	2,400	8.9
Chantilly CDP, VA	1,320	4.9
Manassas Park city, VA	845	3.1
Washington city, DC	844	3.1
Arlington CDP, VA	834	3.1
Fair Oaks CDP, VA	822	3.1
Tysons CDP, VA	766	2.9
Reston CDP, VA	760	2.8
Springfield CDP, VA	657	2.4
Fairfax city, VA	641	2.4
All Other Locations	16,977	63.2

4.2 Short-Term Recommendations

Separate from the corridor and intersection improvements that were developed, several signal and intersection location upgrades could be systemically implemented to provide for operational and safety impact in advance of any significant project improvements to the corridor. Low cost, short term countermeasures include:

- Flashing Yellow Arrow Left Turn Phasing
- High Visibility Backplates
- Lead/Lag and Updated Signal Timing and Coordination
- Side-street approach re-striping to allow for additional lanes and expanded storage
- Pedestrian Signal Heads and Phasing implementation

As of the finalization of this report several Low-Cost Improvements were being moved to the implementation phase and will soon be installed on the corridor including:

- Systemic Signal Improvements under the Highway Safety Improvement Program (HSIP).
- Signal re-timing and updating
- Some of the Options identified in Option 1 of this report. Designs and information on these can also be found in **Appendix C** of this document:
    - Revision of Left Turn Phasing at Orchard Bridge Road
    - Re-striping of Eastbound Maplewood Drive to accommodate a two-lane approach

4.3 Preferred Option

Based on the positive operational analysis results, clear safety benefits, as well as being ranked the highest in the survey of the public, Option 3, as shown in **Figure 18** and **Figure 19** was determined by the study team to be the final Preferred Option for the project. It was further determined by the study team that, for the most cost-efficient scenario, the Option 3 roadway improvements would be combined with the sidewalk pedestrian option. As the preferred combination of improvements, significant cost estimating, and more detailed conceptual design was undertaken. This effort included extensive field review to consider all site conditions, optimization of sidewalk and loon locations to minimize right of way and utility impacts, documentation of design waivers or exceptions that may be necessary, and detailed quantity estimation and bid analysis.

Fully updated concepts are shown in **Figure 22 & Figure 23**. A summary of the final cost estimation analysis by phase is shown in **Table 11**, further detailed breakdown with quantities and pricing is located in **Appendix B**. These costs include contingencies but are rated in 2019/2020-dollar values to reflect the most recent VDOT Bid Tabs and Line Item Costs. As such, estimates do not reflect any potential escalation or inflation based on timing of funding. Additionally, design assumptions and recommendations are included in **Appendix B** that are documented in a thorough Design Technical Memorandum.

	Option 3 - Continuous Median
	Planning Level Cost Estimate
Preliminary Engineering	$2,800,000
Right of Way/Utilities	$12,050,563
Roadway Construction	$23,523,542
TOTAL*	***$38,374,105***

Table 11: Planning Level Cost Estimate in 2019 Dollar Values

**Additional Technical Appendices are available in separate documents with greater analysis detail and input that formed the basis of the operational analysis and cost estimating results included in this report.*

4.4 Final Conclusions

The study and analysis conducted under the Centreville Road STARS study highlighted the range of issues along the Route 28 corridor that were reinforced by public feedback and involvement. After a full evaluation of the study efforts, Option 3 provides the most safety benefit as well as significant operational improvements to the corridor to address the most prevalent issues and concerns of the traveling public for Route 28. Whether a Bypass or Widening of Route 28 is undertaken by Prince William County, the concepts and options developed under this STARS study could be considered to improve safety and operations along the corridor.

With thorough and expansive public involvement efforts of the study, the options put forth demonstrate broad support to pursue the concepts outlined towards implementation for funding and are recommended for further development and engineering.

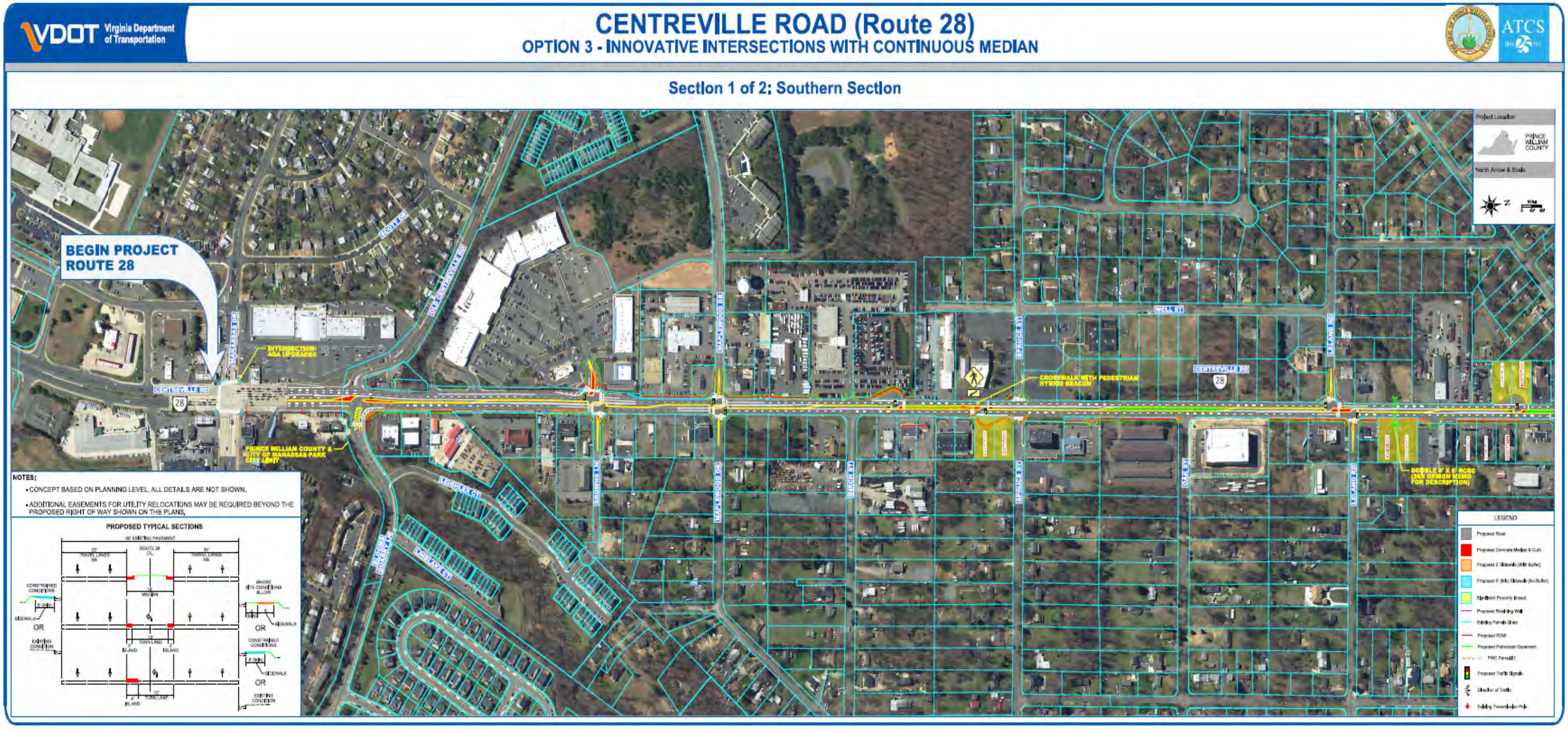


Figure 22: Optimized and Detailed Option 3/Preferred Option – Part 1

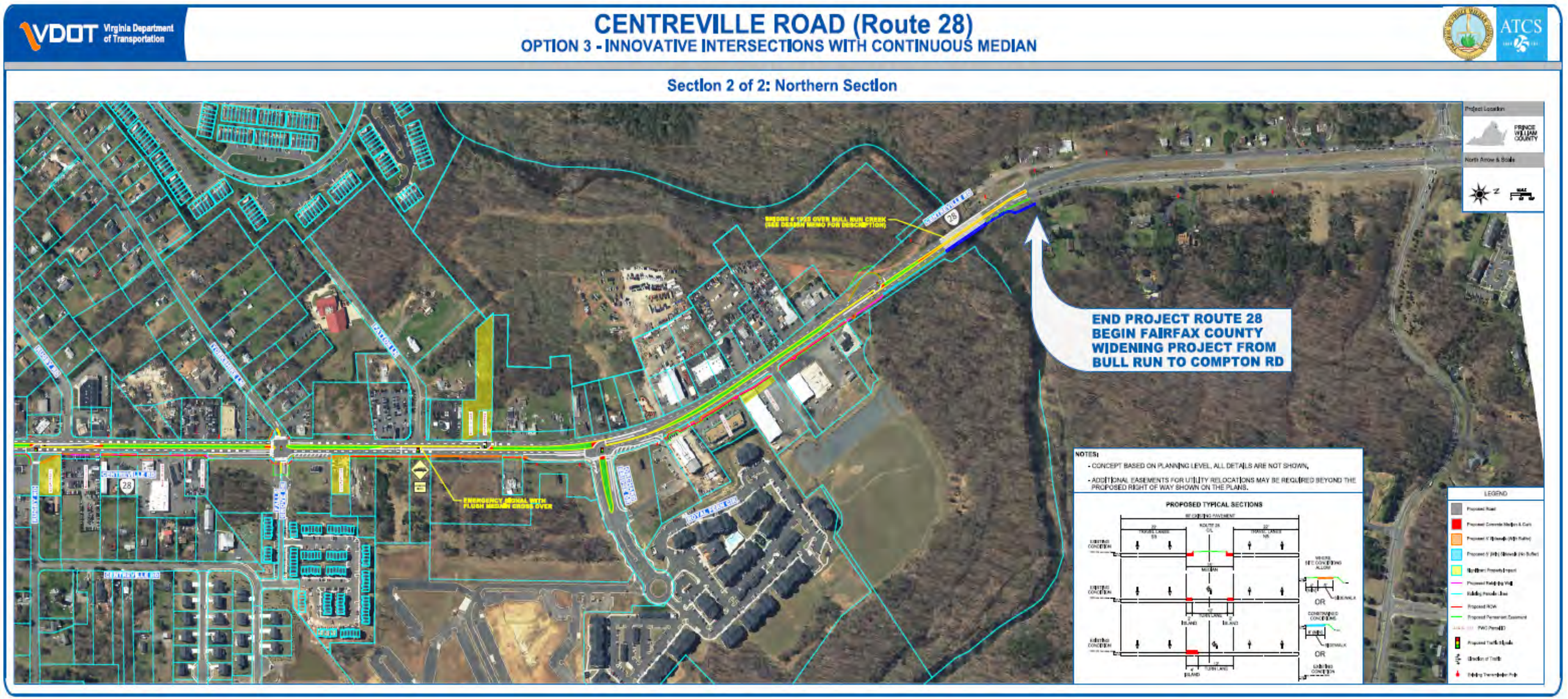


Figure 23: Optimized and Detailed Option 3/Preferred Option – Part 2

APPENDIX A – TECHNICAL APPENDIX

SYNCHRO TABLES

SYNCHRO, as an analytical tool, is useful in cases where the traffic congestion is under-saturated. In over-saturated conditions, as is the case in the current study, SYNCHRO does not repot the interactions among multiple intersections; rather analyzes intersection performance in isolation. Therefore, the SYNCHRO results are primarily used to ascertain the relative differences among potential Options. In addition, the number of operational challenges with the two-way center left-turn lane and multiple access points on the corridor are not captured realistically in SYNCHRO. The proposed Options 2 and 3 improve the safety and operations with the introduction of medians and the improved operational and safety performance are documented in Section 3 of the main report.

Table 1 Arterial Results Comparison – Options with Existing Conditions

Route 28 Arterial Results								
	Travel Time (NB) (s)	Travel Time (SB) (s)	Arterial Speed (NB) (mph)	Arterial Speed (SB) (mph)	Peak Direction Delay (hr)*	Peak Direction Delay (% reduction)	Total Delay (hr.)	Total Delay (% reduction from existing)
AM Peak								
Existing (2019)	246.2	270.9	27.4	31.0	56	-	87	-
Option 1	223.2	227	30.2	37.1	39	30.4%	52	40.2%
Option 2/3	215.1	238.9	31.4	35.2	35	37.5%	54	37.9%
Option 4 (Flyover)	242.9	268.6	27.8	31.3	53	5.4%	83	4.6%
PM Peak								
Existing (2019)	217.2	252.4	31.1	33.3	36	-	60	-
Option 1	194.2	231.2	34.8	36.4	25	30.6%	40	33.3%
Option 2/3	191.4	233.8	35.3	36	24	33.3%	37	38.3%
Option 4 (Flyover)	214.5	251.3	31.5	33.5	34	5.6%	57	5.0%

*Peak Direction Delay represents the northbound direction in the AM Peak and southbound direction in the PM Peak

Note: Arterial results are only reflective of the network within the study area. The entire Synchro network provided by VDOT extends Route 28 to the north to Route 29 (Lee Highway).

Table 2 Average Intersection Delay Comparison – Options with Existing Conditions

Intersection Performance Summary			
Intersection with RT 28	**Alternative**	**AM Peak Hour**	**PM Peak Hour**
		Delay (Sec/Veh)	**Delay (Sec/Veh)**
Orchard Bridge Dr	Existing (2019)	7.9	7.9
	Option 1	9.6	4.9
	Option 2/3	5.7	5.8
	Option 4 (Flyover)	5.2	5.2
Yorkshire Ln	Existing (2019)	24.9	15.6
	Option 1	17.3	13.7
	Option 2/3	15.3	7.9
	Option 4 (Roundabout)	376.5	360.2
Leland Rd	Existing (2019)	25.0	21.6
	Option 1	19.9	8.7
	Option 2/3	10.0	8.6
	Option 4 (Roundabout)	264.2	224.8
Maplewood Dr	Existing (2019)	17.6	13.9
	Option 1	10.3	13.8
	Option 2/3	8.0	9.4
	Option 4 (Roundabout)	311.0	227.3
Browns Ln	Existing (2019)	30.8	13.4
	Option 1	16.4	15.8
	Option 2/3	16.1	7.5

Table 3 Arterial Results Comparison – Options with No-Build Conditions

Route 28 Arterial Results								
	Travel Time (NB) (s)	Travel Time (SB) (s)	Arterial Speed (NB) (mph)	Arterial Speed (SB) (mph)	Peak Direction Delay (hr)*	Peak Direction Delay (% reduction)	Total Delay (hr.)	Total Delay (% reduction from existing)
AM Peak								
2030 No Build	469.6	276.9	14.4	30.4	269	-	309	-
2030 Option 1	328.7	229.4	20.5	36.7	144	46.5%	161	47.9%
2030 Option 2/3	281.6	251.1	24.0	33.5	103	61.7%	131	57.6%
PM Peak								
2030 No Build	199.1	293.4	33.9	28.7	81	-	103	-
2030 Option 1	195.2	266.5	34.6	31.6	64	21.0%	89	13.6%
2030 Option 2/3	195.2	263.3	34.6	32.0	56	30.9%	75	27.2%

Table 4 Average Intersection Delay Comparison – Options with No-Build conditions

Intersection Performance Summary			
Intersection with Route 28	**Alternative**	**AM Peak Hour**	**PM Peak Hour**
		Delay (Sec/Veh)	**Delay (Sec/Veh)**
Orchard Bridge Dr	2030 No Build	48.0	12.0
	2030 Option 1	28.8	8.7
	2030 Option 2	31.2	10.6
Yorkshire Ln	2030 No Build	57.2	40.3
	2030 Option 1	25.7	21.2
	2030 Option 2	23.6	15.5
Leland Rd	2030 No Build	37.5	14.3
	2030 Option 1	18.1	6.1
	2030 Option 2	13.3	19.1
Maplewood Dr	2030 No Build	72.4	39.9
	2030 Option 1	24.1	22.1
	2030 Option 2	30.1	28.3
Browns Ln	2030 No Build	47.2	15.6
	2030 Option 1	42.5	23.9
	2030 Option 2	36.4	11.9

APPENDIX B – DESIGN & ESTIMATING INFORMATION

TECHNICAL MEMORANDUM

DATE: May 14, 2020

TO: Terrell Hughes, PE
Gary Wilmouth, PE
Clint Smith, PE
VDOT TMPD STARS Program

FROM: Nathan Umberger, PE, PTOE
Jason Breda, PE
ATCS, PLC

SUBJECT: **VDOT STARS Route 28 Centreville Road - Prince William County**
Design Study

INTRODUCTION

The purpose of the Route 28 Centerville Road Stars Study in Prince William County, VA is to improve traffic operations and safety in the Route 28 corridor between the intersection of Old Centreville Road/Blooms Quarry Lane to slightly north of the Bull Run Creek Bridge while minimizing impacts to private property and utilities. These improvements will consist of installing innovative intersections at key locations and the addition of a continuous raised median along Route 28.

The purpose of this memorandum is to document the design assumptions and considerations that are included as part of development of the preferred project concept and in support of the estimate for this phase of design. Note that a field survey and utility designation has not been conducted at the time of this memorandum and the preliminary design is based solely on aerial imagery, GIS information, and field observations.

CURRENT CORRIDOR CONDITIONS

Current Conditions on the corridor are as follows:

Route 28 (Centreville Road)	
Functional Classification	Urban Principal Arterial
Average Annual Daily Traffic (AADT)	54,000
Posted Speed Limit	45 MPH
Lane Width	12 Feet

Table 1: Current Corridor Conditions

Design Speed

Typically, the posted speed limit is 5 MPH below the design speed. The posted speed limit within this segment of Route 28 is currently posted at 45 MPH. Per the VDOT Road Design Manual (Appendix A, Section A-1, page 4), low speed roadways (posted 45 MPH or less) may use a design speed equal to or higher than the posted speed. If the design speed were greater than 45 MPH, this segment of roadway would require minimum 12' lane widths. Constructing 12' travel lanes would have severe impacts to adjacent properties and utilities due to the requirement to widen a minimum of 4' laterally and fully reconstruct at least one outside curb line. For the purpose of the design study it is assumed that the design speed will be 45 MPH or less, allowing the use of 11' travel lanes. A Design Waiver is for design speed is not anticipated.

Typical Sections

The existing 60' wide, 5-lane curb and gutter section, consists of the following:

- Two 12' NB travel lanes
- Two 12' SB travel lanes
- One 12' center two-way left turn lane

The concept in this study proposes to reconfigure the existing section with a continuous raised median. With a design speed of 45 MPH, travel lane widths may be reduced to 11'. This will allow the existing center two-way left turn lane to be converted to a 16' wide continuous raised median within the existing outside curb lines (see TS 1 below). Since many buildings, utilities, and parking facilities are currently located adjacent to the existing roadway, maintaining the existing outside curb lines in their current location is imperative to minimize impacts. Left turn lanes at innovative intersections and loon locations include installation of dual 2' wide concrete MS-1 median islands with a 12' turn lane (TS 2). At conventional intersections where left turns are permitted, a single 4' wide concrete MS-1 median island (TS 3) can be provided with a 12' turn lane. Per RDM Page 2E-10, raised medians shall be offset 1' from the through lane edge. Due to limited room between existing curb lines and the necessity to keep them in their current locations, a Design Waiver will be needed.

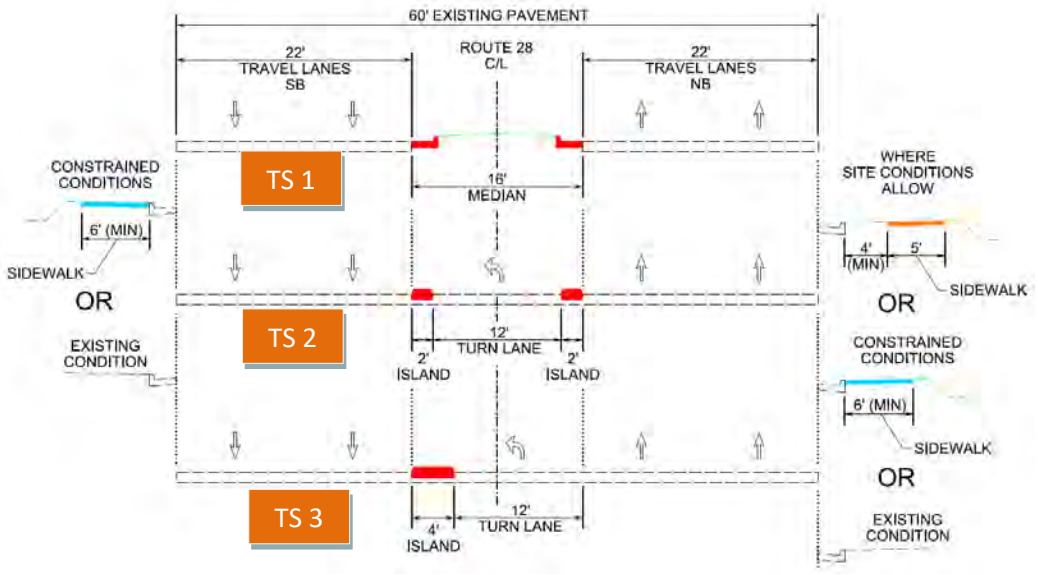


Figure 1: Proposed Typical Sections

SIDEWALK DESIGN

A new 5’ sidewalk is also proposed to be installed within the study area. The proposed sidewalk will utilize portions of the east and west sides of Route 28 to provide one pedestrian facility for the entire project length such that most pedestrian destinations can be accommodated. Pedestrian crossings will be provided at signalized locations only. The VDOT standard buffer width between the sidewalk and the back of curb is 4’. A design waiver is anticipated for constrained areas where providing this buffer is not feasible due to limited right-of-way and probable impacts to buildings, utilities, and parking facilities (See photos below of typical constrained areas). Where the buffer cannot be provided, a 6’ sidewalk abutting the back of curb is proposed. Short retaining walls are also anticipated behind the sidewalk to avoid excessive slope tie impacts (see concepts for anticipated locations of reduced/eliminated buffer and retaining walls). Utility poles are expected to remain in their current locations for sidewalk installation, and the full width of sidewalk will meander around the poles when possible. If a pole must remain within a sidewalk, at least 4’ of sidewalk width adjacent to the utility pole will be provided to be ADA compliant. A design waiver is anticipated for horizontal clearance from the back of sidewalk to utility poles (1’ clearance required) in these constrained areas. Although not shown on the concepts, all private driveways will need to be reconstructed where sidewalk is installed. Driveway slope ties will require additional temporary easements to construct without intruding on private property.

Figure 2: Examples of Constrained Conditions

INNOVATIVE INTERSECTIONS

The study proposal includes installing innovative intersections along Route 28 at the following locations:

Restricted Crossing U-Turn (RCUT) Intersection

- Browns Lane/Mall Entrance
- Maplewood Drive
- Leeland Road
- Orchard Bridge Drive

Median U-Turn (MUT) Intersection

- Yorkshire Lane/Falls Grove Drive

Minor widening for sideroad channelization islands will be required at most of these locations. Plus, widening at U-turn loons will be required at various locations along Route 28. Also, some minor utility relocation will be necessary; however, the large electric transmission poles are expected to be unaffected. In order to minimize impacts associated with the loon widening, a S-BUS-36 (65 Passenger Conventional School Bus) design vehicle will accommodate the turning vehicle demands. This design vehicle was used to establish all loon sizes, except for the northernmost loon. This loon will accommodate a WB-67 (Interstate Semi-Trailer). The intersection at Blooms Quarry Lane/Old Centreville Road will function as it currently does; however, widening is also proposed on the northeast quadrant to accommodate SB to NB WB-67 U-turn movements.

All other minor sideroads and driveways along this segment of Route 28 will become right-in and right-out only.

EMERGENCY SIGNALS

The emergency signal at Patton Lane will be maintained to allow for continued Emergency Vehicle access from the County Fire Station. However, the intersection will be modified to allow left turns for emergency vehicles only. This signal will need to be interconnected with the loon signal just north of Patton Lane. The concrete median along Route 28 at this location will require a modified flush/mountable design for a short section to accommodate turning emergency vehicles (e.g., fire trucks, ambulances).

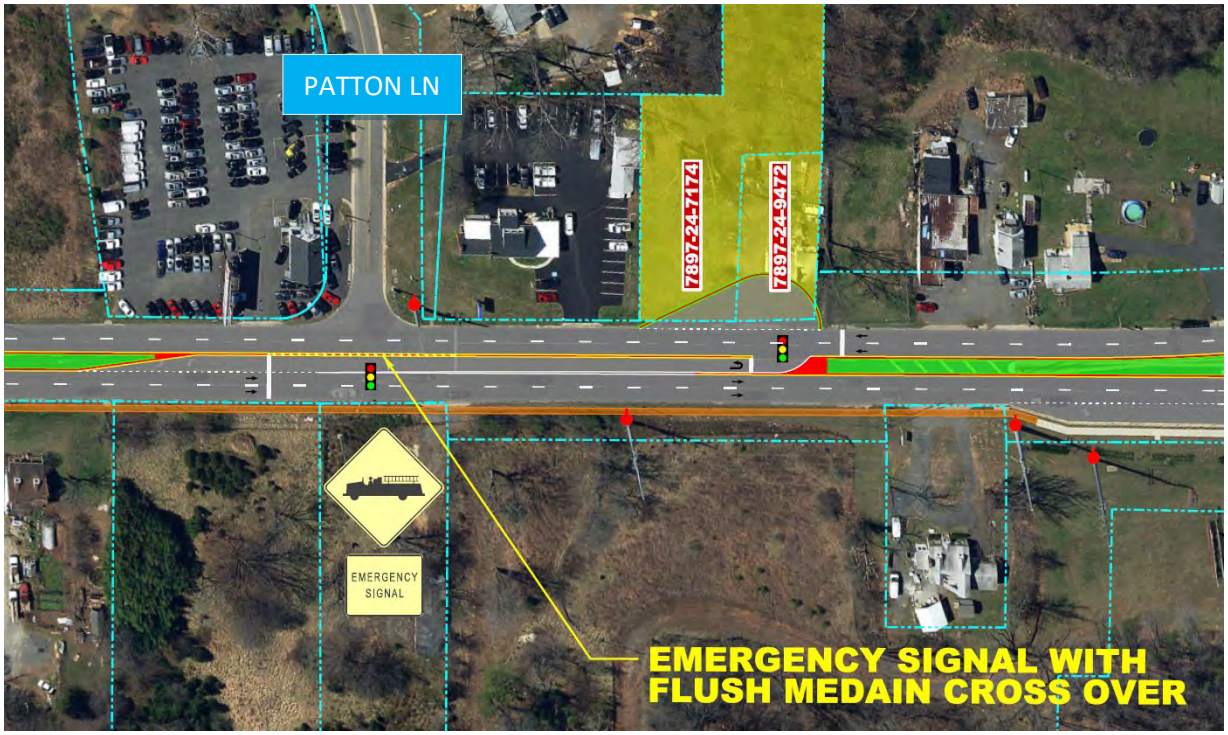


Figure 3: Proposed Emergency Signal at Patton Lane

MAJOR STRUCTURES

Double 8' x 6' RCBC - Just north of Leland Road Crossing under Route 28

This box culvert will likely require extension on the east side of Route 28 due to the addition of sidewalk on that side. For the purpose of this study, construction costs are included for its extension. However, during the design phase of the project, it may be possible to reconstruct the headwalls and wing walls to provide a taller height, which may reduce costs.

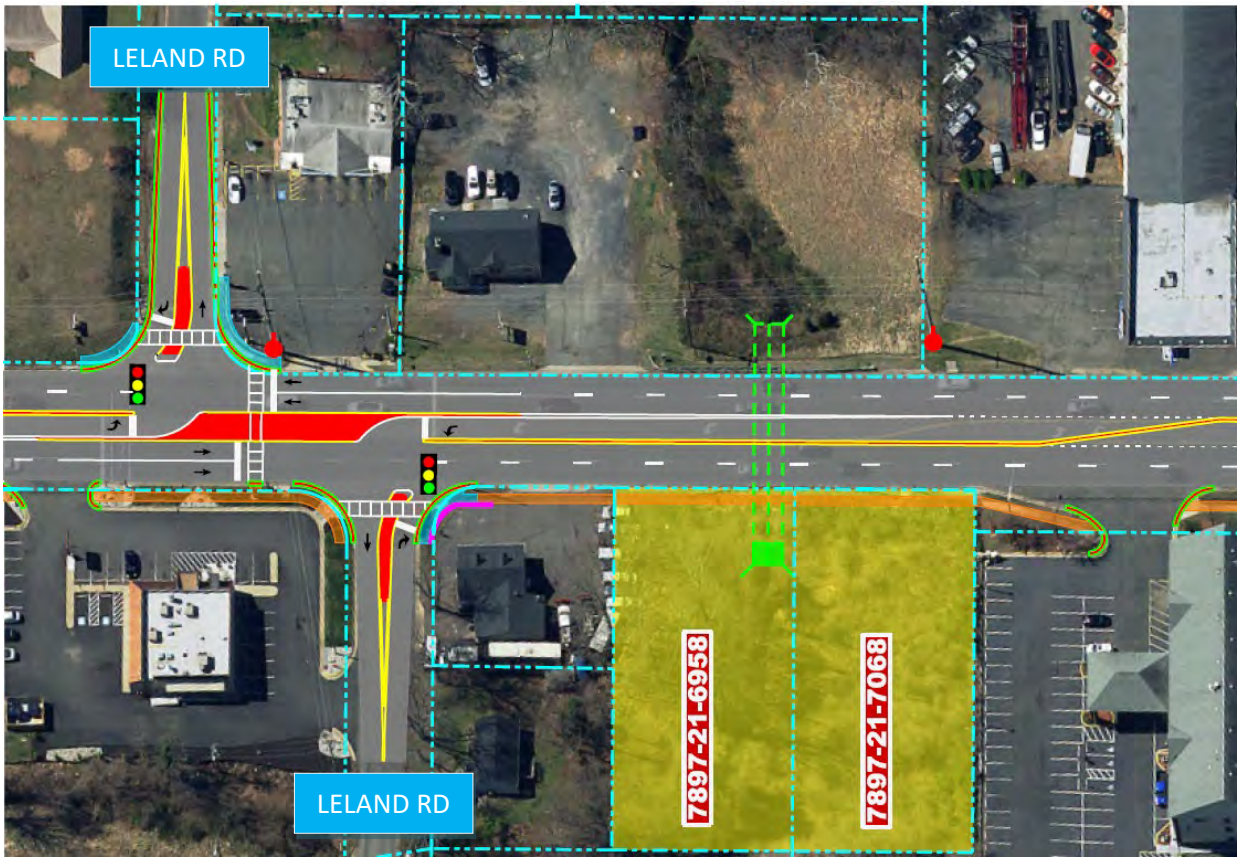


Figure 4: Proposed RCBC Extension - North of Leland Road

Bridge # 1925 over Bull Run Creek (+/- 242' L x 76' W)

This bridge is currently in the design stages for rehab and repairs (UPC 111318). It is reasonably considered that the northbound side of the bridge could be reconfigured or widened such that a barrier separated pedestrian facility could be accommodated as part of that project (or another funded project). This would provide a pedestrian connection to the proposed shared-use-path on the Fairfax County Project (2G10-100-00) on the north side of the bridge. That project is currently funded and nearing construction. Costs for these modifications are expected to be included in a separate project, therefore these costs are not included in the estimate for this study.

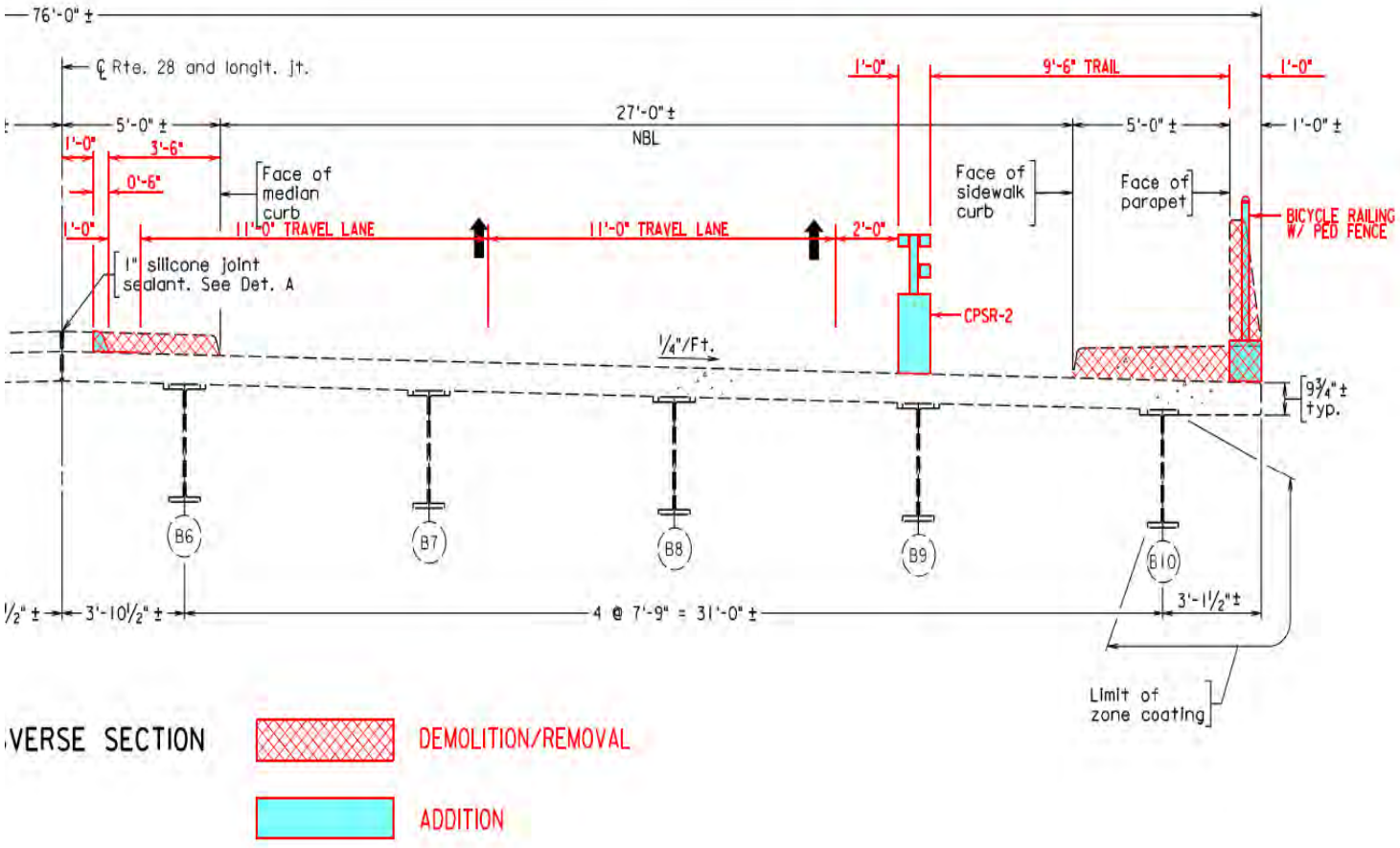


Figure 5: Possible Barrier Separated Pedestrian Facility on Bull Run Creek Bridge

Design Waivers

This study assumes that the existing horizontal and vertical roadway geometry will not need to be altered. At this point in the study, there is no information suggesting a horizontal and/or vertical deficiency exists. However, a design survey is not available in order to confirm the geometry. If in design it is found that the geometry does not meet current design standards, it is further assumed that Design Waivers for any deficient elements will be allowed. Based on the items discussed and other design assumptions considered, the anticipated Design Waivers that would be required for the project are as follows:

- Minimum concrete island width (4' required)
- Raised median offset (1' required)
- VDOT standard buffer width (4' required)
- Minimum horizontal clearance between edge of sidewalk and utility poles (1' required)
  Note: As design is further refined, it may be possible to provide a 2' buffer between the edge of sidewalk and utility poles in some areas. However, since a survey has not been completed, it is predicted in the preliminary design that the sidewalk will need to be curb abutted in some areas to minimize impacting slopes and existing features on private property.

These waivers are critical to the budget and footprint of the project, any case where a waiver was not allowed would jeopardize the ability of the project to stay within the current roadway footprint and have extreme cost escalation, likely doubling the cost of the project.

Anticipated Right-of-Way Requirements

Due to minor widening (at U-turn loons and intersections) and the addition of sidewalk, the following right-of-way requirements are anticipated:

- 8 total acquisition parcels with 5 business relocations
- 70,000 SF of proposed fee right-of-way
- 66,000 SF of temporary construction easement
- Minimal utility easements needed (only minor utility relocations expected)
- 53 parcels impacted

The total of these impacts is expected to cost approximately $12,050,563. For assumptions used to make this cost determination, see **Page 9**.

Cost Estimate

The probable cost of the project is estimated at **$38.374 million** and is broken down in Table 2 below. This estimate assumes the crown of the roadway does not need to be modified and major utility relocation will not be required. It also assumes the existing drainage and stormwater management system is sufficient and few if any drainage structures will be needed in the proposed median. Note that no drainage analysis has been performed as part of this preliminary design. The current cost estimate assumes that the existing pavement will be milled and resurfaced. See **Page 10** for construction cost breakdown and assumptions.

Cost Estimate	
Construction (Includes CEI)	$23,523,542
Right-of-Way	$12,050,563
Preliminary Engineering	$2,800,000
Total	**$38,374,105**

Table 2: Cost Estimate Breakdown

RIGHT-OF-WAY COSTS AND ASSUMPTIONS

Route 28 Alternative 3 Right-of-Way Cost Estimate

This estimate was prepared utilizing aerial imagery, GIS information, and field observations. Note that no field survey nor utility designation has been conducted at the time of this estimate. R/W and easement areas were computed by CAD drawings using general assumptions on the existing terrain.

The Right-of-Way Cost Estimate is: $12,050,563

Assumptions:

1. Proposed Fee R/W is 2 feet behind the sidewalk. Total Fee R/W is estimated to be approximately 70,000SF @ $20/SF = **$1,400,000**
2. Proposed Temporary Construction Easement (TCE) is 8 feet behind the Fee R/W. Total TCE is estimated to be approximately 66,000 SF @ $18/SF = **$1,188,000**
3. Proposed Utility Easement is expected to be minor, as overhead utilities and poles do not appear to be significantly impacted
4. The following parcels are anticipated as total acquisitions:

PIN	Owner	Acreage	2020 Market Value
7896-29-3056	Humphrey	0.4614	$ 185,700
7896-29-3366	Humphrey	0.4546	$ 183,000
7897-21-6958	Hossein	0.4614	$ 126,600
7897-21-7068	Hossein	0.4614	$ 126,600
7897-22-8449	Rissa	0.4544	$ 357,200
7897-33-0893	Saturnino	0.4362	$ 339,600
7897-24-7174	Tilley	1.2503	$ 392,100
7897-24-9472	Moon	0.2414	$ 130,200
7897-22-5528	Jang	0.4362	$ 261,200
7897-22-5219	Jang	0.4362	$ 304,100
7897-22-5219	Mathai LLC	1.6296	$ 1,063,600
		Total	**$ 3,469,900**

5. Total acquisition is estimated to cost 2020 Market Value Total + 25% inflation = **$4,337,375**
6. Contingency at 50% of Fee, TCE and total acquisitions = **$3,462,688**
7. Condemnation court costs are estimated at approximately = **$500,000**
8. Estimated 53+/- parcels impacted @ $12,500/parcel admin fees = **$662,500**
9. Assuming there are 5 relocations (costs included in contingency amount)
10. Costs for damages and impact of improvements included in contingency amount
11. The anticipated R/W NTP is 2023
12. Beginning of project is at the southeast intersection of Blooms Quarry Lane and Centreville Road and ends at Fairfax County Line and Bull Run River
13. Access will be provided to ALL parcels except the ones shown as total acquisitions above
14. Hazardous Material remediation is NOT included in this estimate.
15. Utility Estimate – No significant above ground utilities are anticipated to be impacted, to provide additional contingency and allow for minor underground relocations at signals or loons **$500,000** is included in the Phase estimate.
16. An in-depth market research analysis of property values was not performed

CONSTRUCTION COSTS AND ASSUMPTIONS

Route 28 Study
Prince William County, VA

5/14/2020

Prepared by: ATCS

Code	Description	Unit	Qty	Unit Price	Total
	Grading Items				
00120	Regular Excavation	CY	1,720	$ 30	$ 51,600
00140	Borrow Excavation	CY	9,320	$ 35	$ 326,200
	Box Culvert Extension				
00212	Minor Str. Excavation Box Culvert	CY	187	$ 36	$ 6,732
00507	Bedding Material No. 57	TON	11	$ 50	$ 550
00522	Concrete Class A4 Box Culvert	CY	25	$ 2,500	$ 62,500
00540	Reinf. Steel	LBS	400	$ 2.5	$ 1,000
	Pavement Items				
10128	Aggr. Base Material Ty. 1 No.21B	TON	7,214	$ 50	$ 360,700
10610	Asphalt Concrete Ty. IM-19.0A	TON	740	$ 100	$ 74,000
10628	Flexible Pavement Planing 0"-2"	SY	80,263	$ 5	$ 401,315
10635	Asphalt Concrete Ty. SM-9.5A	TON	9,021	$ 120	$ 1,082,520
10636	Asphalt Concrete Ty. SM-9.5D	TON	774	$ 120	$ 92,880
10642	Asphalt Concrete Ty. BM-25.A	TON	2,462	$ 120	$ 295,440
	Incidental Items				
00587	Underdrain UD-3	LF	9,000	$ 20	$ 180,000
00588	Underdrain UD-4	LF	4,930	$ 20	$ 98,600
12030	Std. Curb CG-3	LF	8,780	$ 20	$ 175,600
12600	Std. Comb. Curb & Gutter CG-6	LF	4,930	$ 32	$ 157,760
13102	Rad. Comb. Curb & Gutter CG-11	LF	1,680	$ 102	$ 171,360
13220	Hydr. Cement Concrete Sidewalk 4"	SY	5,835	$ 65	$ 379,275
13530	Retaining Wall RW-3	CY	1,081	$ 1,250	$ 1,351,250
13565	Retaining Wall Excavation	CY	1,436	$ 40	$ 57,440
21020	Median Strip MS-1	SY	3,672	$ 150	$ 550,800
21215	Median Strip MS-2	LF	4,380	$ 65	$ 284,700
24420	Demo. Of Pavement (Rigid)	SY	6,782	$ 20	$ 135,640
24430	Demo. Of Pavement (Flexible)	SY	11,234	$ 20	$ 224,680
NS	Traffic Signal	EA	5	$ 600,000	$ 3,000,000
	Subtotal				$ 9,522,542
	Drainage Items	10%			$ 953,000
	Maintenance of Traffic (MOT)	15%			$ 1,429,000
	Erosion and Sediment Control	10%			$ 953,000
	Landscaping	5%			$ 477,000
	Traffic Items	3%			$ 286,000
	Pavement Marking and Signing Items	7%			$ 667,000
	Construction Cost				$ 14,287,542
	Mobilization	LS	1	$ 745,000	$ 745,000
	Construction Surveying	LS	1	$ 143,000	$ 143,000
	Subtotal				$ 888,000
	Pre-Contingency Construction Cost				$ 15,175,542
	C.E.I	15%			$ 2,277,000
	Contingency	40%			$ 6,071,000
	Total				**$ 23,523,542**

Notes:
1. Unit Prices Taken from VDOT District Averages December 1, 2019 thru November 1, 2017 and VDOT Two Year Historical Bid History December 1, 2019 though November 1, 2017.
2. Mobilization and Construction Surveying calculated using VDOT Equations.
3. Utility Relocation cost is excluded.
4. Right of Way and Construction Easement Costs are excluded.

APPENDIX C – LOW COST IMPROVEMENT DESIGNS

OVERHEAD UTIL DETAIL

LOCATION ⚠ (MAST ARM @ OVH LINE)

SECONDARY
COMM
COMM
COMM
COMM

27'0" | 25'8" | (POLE & ARM UNDER 21') | 25'1" | 24'6" | 23'6"

FLASHING YELLOW ARROW RETROFIT

1. THIS MODIFICATION IS FOR THE FLASHING YELLOW ARROW RETROFIT OF THE MAINLINE LEFT TURN SIGNAL HEADS 1 AND 5 FOR THE SB AND NB APPROACHES. RESPECTIVELY.

2. PROPOSED SIGNAL HEAD 1A SHOULD BE APPROXIMATELY LANE CENTERED WITHOUT IMPACTING EXISTING EQUIPMENT ON THE MAST ARM.

3. DURING FLASH MODE. THE DISPLAY OF A FLASHING LEFT-TURN YELLOW ARROW INDICATION SHALL BE ONLY FROM THE SIGNAL SECTION THAT DISPLAYS A STEADY LEFT-TURN ARROW INDICATION DURING STEADY MODE (STOP AND GO) OPERATION.

REVISIONS (4/16/15)

#	DESCRIPTION	NAME
1	Shift the two (2) three-section Phase 6 signal head assemblies on mast arm #2 to the east approximately 6 foot each.	MC
2	Squeeze signs S-2 and S-3 closer to the Phase 4A signal head assembly. Replace the red right arrow with a red ball on Phase 4A signal head assembly.	MC
3	Replace exclusive left turn three-section assembly with four-section FYA assembly. Add sign for FYA signal.	CJP
4	Remove inside SB left turn lane. Replace exclusive left turn three-section assembly with four-section FYA assembly. Add sign for FYA signal.	CJP

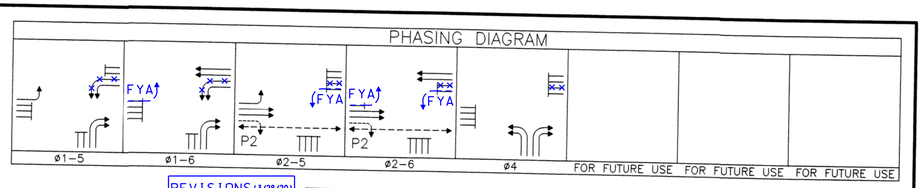
REVISIONS (4/16/15)

COMMONWEALTH OF VIRGINIA
THOMAS KENNETH FOLSE
Lic. No. 024381
PROFESSIONAL ENGINEER

Thomas K Folse
2015.04.27 08:47:31 -04'00'

VDOT Traffic Engineering
Fairfax, Virginia
TRAFFIC ENGINEER

PHASING DIAGRAM

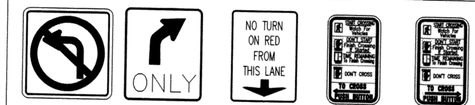


REVISIONS (3/28/20)

COMMONWEALTH OF VIRGINIA
CHRISTOPHER J. PEDUTO
Lic.No.044599
PROFESSIONAL ENGINEER

ATCS. PLC
HERNDON. VA
TRAFFIC ENGINEER

SIGNS



S-1 R3-2 36" X 36"
S-2 R3-5(R) 30" X 36"
S-3 R10-11d 30" X 42"
S-4 R10-3e(L) 9" X 15"
S-5 R10-3e(R) 9" X 15"

Orchard Bridge Rd S-6 192" X 24"

Centreville Rd S-7 162" X 24"

NOTE: MOUNTING DETAILS FOR S-6 AND S-7 WILL BE DETERMINED BY THE CONTRACTOR AND SUBMITTED TO VDOT PRIOR TO CONSTRUCTION. SIGN DETAILS ARE SHOWN ON SHEET 2 OF THIS PLAN SET.

NEW SIGNS

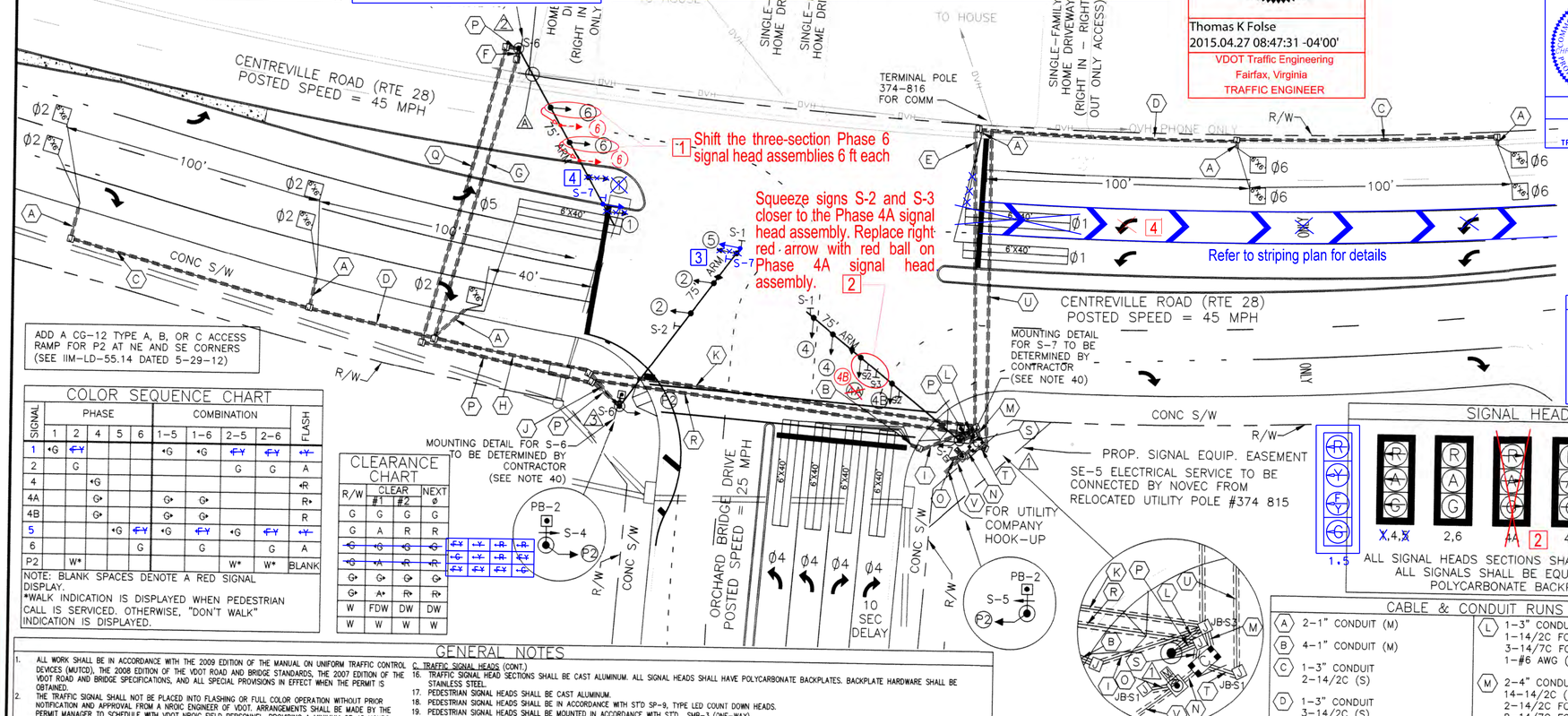
LEFT TURN YIELD ON FLASHING

S-7 R10-V1(MOD) 36" X 36"

NEW SIGNALS

ALL NEW TRAFFIC SIGNAL HEADS SHALL BE LEDs

PROPOSED VEHICULAR TRAFFIC SIGNAL HEADS SHALL BE EQUIPPED WITH HIGH VISIBILITY SIGNAL BACKPLATES



COLOR SEQUENCE CHART

SIGNAL	PHASE 1	2	4	5	6	COMBINATION 1–5	1–6	2–5	2–6	FLASH
1	•G	~~•Y~~				•G	•G	~~•Y~~	~~•Y~~	~~•Y~~
2	G							G	G	A
4			•G							•R
4A			G•			G•	G•			R•
4B			G•			G•	G•			R
5				•G	~~•Y~~	•G	~~•Y~~	•G	~~•Y~~	~~•Y~~
6					G		G		G	A
P2	W*							W*	W*	BLANK

NOTE: BLANK SPACES DENOTE A RED SIGNAL DISPLAY.
*WALK INDICATION IS DISPLAYED WHEN PEDESTRIAN CALL IS SERVICED. OTHERWISE, "DON'T WALK" INDICATION IS DISPLAYED.

CLEARANCE CHART

R/W	CLEAR #1	CLEAR #2	NEXT Ø
G	G	G	G
G	A	R	R
~~G~~	~~G~~	~~G~~	~~G~~
~~G~~	~~A~~	~~R~~	~~R~~
G•	G•	G•	G•
G•	A•	R•	R•
W	FDW	DW	DW
W	W	W	W

~~•Y~~	~~•Y~~	~~•R~~	~~•R~~
~~•G~~	~~•Y~~	~~•R~~	~~•Y~~
~~•Y~~	~~•Y~~	~~•Y~~	~~•Y~~
~~•Y~~	~~•Y~~	~~•Y~~	~~•G~~

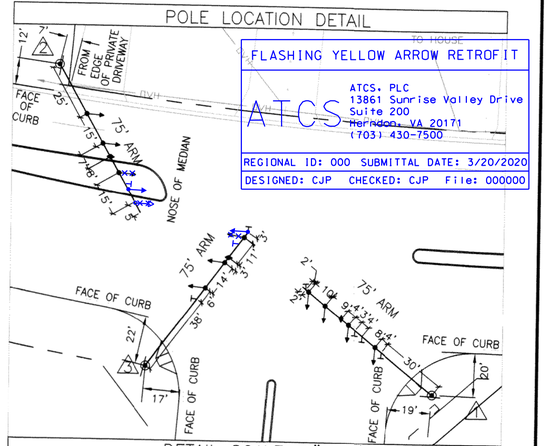
SIGNAL HEADS

ALL SIGNAL HEADS SECTIONS SHALL BE 12" LED. ALL SIGNALS SHALL BE EQUIPPED WITH POLYCARBONATE BACKPLATES.

CABLE & CONDUIT RUNS

A	2–1" CONDUIT (M)	L	1–3" CONDUIT 1–14/2C FOR PUSHBUTTON 3–14/7C FOR HEADS 4,4A,P2 1–#6 AWG (EGC)
B	4–1" CONDUIT (M)	M	2–4" CONDUIT 14–14/2C (S) 2–14/2C FOR PUSHBUTTONS 8–14/7C FOR HEADS 1,2,4,4A,4B, 5,6,P2 2–#6 AWG (EGC) 1–3" CONDUIT (SPARE) 1–#6 AWG (EGC) FOR SPARE
C	1–3" CONDUIT 2–14/2C (S)	N	1–1 1/4" CONDUIT (M) 3–#6 CABLES FOR ELEC SERVICE
D	1–3" CONDUIT 3–14/2C (S)	O	1–1" CONDUIT 1–#6 AWG (EGC) FOR SYSTEM GROUNDING
E	1–4" BORED CONDUIT 5–14/2C (S)	P	1–2" CONDUIT 1–GTT 138 DETECTOR CABLE 1–#6 AWG (EGC)
F	1–3" CONDUIT 2–14/7C FOR HEADS 1,6 1–#6 AWG (EGC)	Q	1–2" BORED CONDUIT 1–GTT 138 DETECTOR CABLE 1–#6 AWG (EGC)
G	1–4" BORED CONDUIT 2–14/7C FOR HEADS 1,6 1–#6 AWG (EGC)	R	1–2" BORED CONDUIT 2–GTT 138 DETECTOR CABLE 1–#6 AWG (EGC)
H	1–3" CONDUIT 5–14/2C (S) 2–14/7C FOR HEADS 1,6 1–#6 AWG (EGC)	S	1–2" CONDUIT 3–GTT 138 DETECTOR CABLE 1–#6 AWG (EGC)
I	1–3" CONDUIT 4–14/2C (S)	T	1–1" (M) CONDUIT WITH PULL STRING FOR COMMUNICATION
J	1–3" CONDUIT 1–14/2C FOR PUSHBUTTON 3–14/7C FOR HEADS 2,5,P2 1–#6 AWG (EGC)	U	1–2" BORED CONDUIT WITH PULL STRING FOR COMMUNICATION
K	1–4" BORED CONDUIT 5–14/2C (S) 1–14/2C FOR PUSHBUTTON 5–14/7C FOR HEADS 1,2,5,6,P2 1–#6 AWG (EGC)	V	1–2" CONDUIT FOR SE–5 CONNECT.

POLE LOCATION DETAIL



FLASHING YELLOW ARROW RETROFIT

ATCS. PLC
13861 Sunrise Valley Drive
Suite 200
Herndon, VA 20171
(703) 430-7500

REGIONAL ID: 000 SUBMITTAL DATE: 3/20/2020
DESIGNED: CJP CHECKED: CJP File: 000000

Legend

X = TO BE REMOVED

INITIAL TIMING CHART (FREE OP.)

PHASE	1	2	3	4	5	6	7	8
MOVEMENT	SBL CENTERVILLE RD	NBT+R CENTERVILLE RD		WBL+R ORCHARD BRIDGE DR	NBL CENTERVILLE RD	SB T CENTERVILLE RD		
PHASE ON								
PHASE OFF								
INTERVAL	PHASE TIMING							
MIN GREEN	7.0	15.0		7.0	7.0	15.0		
PASSAGE	2.0	2.0		2.0	2.0	2.0		
YELLOW	4.0	5.5		3.0	4.5	5.5		
RED	5.0	1.0		5.0	3.5	1.0		
MAX 1	30.0	60.0		30.0	10.0	60.0		
MAX 2		0.0				0.0		
MIN GAP	2.0	2.0		2.0	2.0	2.0		
TIME BEFORE REDUCTION	0.0	0.0		0.0	0.0	0.0		
TO REDUCE	0.0	0.0		0.0	0.0	0.0		
PED WALK	0.0	7.0		0.0	0.0	0.0		
PED FLASH DON'T WALK	0.0	26.0		0.0	0.0	0.0		
MODE	NON–LOCK	MIN RECALL		NON–LOCK	NON–LOCK	MIN RECALL		

GENERAL NOTES

1. ALL WORK SHALL BE IN ACCORDANCE WITH THE 2009 EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), THE 2008 EDITION OF THE VDOT ROAD AND BRIDGE STANDARDS, THE 2007 EDITION OF THE VDOT ROAD AND BRIDGE SPECIFICATIONS, AND ALL SPECIAL PROVISIONS IN EFFECT WHEN THE PERMIT IS OBTAINED.
2. THE TRAFFIC SIGNAL SHALL NOT BE PLACED INTO FLASHING OR FULL COLOR OPERATION WITHOUT PRIOR NOTIFICATION AND APPROVAL FROM A NROIC ENGINEER OF VDOT. ARRANGEMENTS SHALL BE MADE BY THE PERMIT MANAGER TO SCHEDULE WITH VDOT NROIC FIELD PERSONNEL, PROVIDING A MINIMUM OF 48 HOURS ADVANCE NOTICE. CONTRACTOR SHALL HAVE HIS QUALIFIED REPRESENTATIVE PRESENT TO MONITOR TRAFFIC FLOW AND ADJUST TIMINGS AS NECESSARY THROUGH A MINIMUM OF TWO (2) CONSECUTIVE MORNING AND EVENING RUSH HOUR PERIODS OR AS DIRECTED BY THE NROIC ENGINEER WITH VDOT.
3. FIVE (5) WORKING DAYS PRIOR TO COMMENCING TRAFFIC SIGNAL WORK AT ANY LOCATION IN NORTHERN VIRGINIA, THE SIGNAL CONTRACTOR MUST NOTIFY THE APPROPRIATE PERMITS SECTION (PRINCE WILLIAM) IN WRITING, WITH THE NAME, DAYTIME PHONE NUMBERS, AND EMERGENCY PHONE NUMBERS FOR THE CONTRACTOR GIVING THE LOCATION OF THE WORKSITE INCLUDING STREET NAMES, ROUTE NUMBERS, PERMIT NUMBER, TYPE AND DETAILS OF CONSTRUCTION, AND WORK SCHEDULE.
4. THE VDOT ENGINEER, PRIOR TO CONSTRUCTION, SHALL VERIFY LOCATIONS OF POLE(S) AND CONTROLLER CABINET.
5. NEW TRAFFIC SIGNAL INSTALLATIONS SHALL NOT BE PLACED INTO COLOR OPERATION ON MONDAYS, FRIDAYS OR DAYS PRECEDING OR FOLLOWING HOLIDAYS, UNLESS DIRECTED BY THE DISTRICT TRAFFIC ENGINEER.
6. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING A 2070–CONTROLLER AND CABINET THROUGH THE VDOT NORTHERN REGIONAL OPERATIONAL INSTALLATION & CONSTRUCTION (NROIC) SECTION OF THE NORTHERN DISTRICT. PAYMENT(S) FOR THE CONTROLLER AND CABINET IS REQUIRED PRIOR TO THE CONTRACTOR RECEIVING THE EQUIPMENT. IN ORDER TO AVOID DELAYS IN OBTAINING CONTROLLER AND CABINET, NROIC REQUIRES NOTIFICATION AND PAYMENT TWO (2) MONTHS PRIOR TO THE START OF ANY CONSTRUCTION. THE CONTRACTOR SHALL CONTACT NROIC (GREG WAYLAND @ (703) 334–0364) TO ARRANGE FOR PURCHASE AND PICK–UP OF THE CONTROLLER AND CABINET. TWO (2) WEEKS PRIOR TO THE AGREED UPON PICK UP DATE, THE CONTRACTOR SHALL CONTACT NROIC TO VERIFY EQUIPMENT AVAILABALITY. THE CONTRACTOR SHALL PICK–UP THE CONTROLLER AND CABINET AT NROIC'S TFO FACILITY AT 8010 MASON KING COURT, MANASSAS VA 20109. UPON RECEIPT OF THE 2070–CONTROLLER AND CABINET FROM VDOT, THE CONTRACTOR'S QUALIFIED REPRESENTATIVE SHALL WIRE THE CABINET, PROGRAM, AND TEST THE PHASING OF THE INTERSECTION AS SHOWN ON THE PLAN. THE CONTRACTOR SHALL PROVIDE A CERTIFICATION LETTER TO VDOT INDICATING THAT THE WORK IS IN COMPLIANCE WITH VDOT STANDARDS, AND IS CONSISTENT WITH THE PHASING AS PER THE SIGNAL PLAN. AS PART OF THE INSTALLATION, THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING THE CONCRETE FOUNDATION SPECIFIED AS A STD CF–3 AND THE PHONE COMPANY ACCESS COMPARTMENT SHOWN AS CC–2.
7. PLAN APPROVAL IS VALID FOR ONE YEAR FROM THE DATE OF THE APPROVAL STAMP. ALL PLANS WITH EXPIRED APPROVAL DATES SHALL BE RE–SUBMITTED FOR APPROVAL.

A. POLES AND FOUNDATIONS

8. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING COMMUNICATION TO THE CONTROLLER AT ALL TIMES. THE CONTRACTOR IS RESPONSIBLE FOR ANY COSTS ASSOCIATED WITH PROVIDING COMMUNICATION TO THE TRAFFIC SIGNAL. TWO–2 INCH COMMUNICATION ROAD BORES SHALL BE INSTALLED BY THE CONTRACTOR (ONE PRIMARY CROSSING, ONE SECONDARY CROSSING FROM THE CONTROLLER CABINET QUADRANT) IN ADDITION TO THE ROAD BORES FOR THE TRAFFIC SIGNAL INSTALLATION. THE CONTRACTOR SHALL CONTACT VDOT'S NORTHERN VIRGINIA REGION OPERATIONS INSTALLATION & OPERATIONS COMMUNICATIONS GROUP (GIDGET RAY 703–334–0882 GIDGET.RAY@VDOT.VIRGINIA.GOV OR TIM TERRY 703–334–0362 TIM.TERRY@VDOT.VIRGINIA.GOV) ONE HUNDRED TWENTY (120) DAYS PRIOR TO THE START OF TRAFFIC SIGNAL CONSTRUCTION TO COORDINATE ALL COMMUNICATION ACTIVITIES.
9. SIGNAL POLE, ARM AND FOUNDATION SHALL BE DESIGNED TO ACCOMMODATE AN ADDITIONAL 5–SECTION SIGNAL HEAD FOUR FEET FROM THE TIP (FREE END) OF THE ARM AND AN ADDITIONAL MUTCD R10–12 (30" X 36") SIGN ONE FOOT FROM THE TIP OF THE ARM.
10. PEDESTAL POLE (PF–2) SHALL BE 12 FT. IN HEIGHT.
11. ALL BREAKAWAY POLES SHALL HAVE BREAKAWAY FUSES.

B. CONTROLLER AND FOUNDATION

12. THE CONTROLLER CABINET FOUNDATION SHALL BE STD. CF–3 TO INCLUDE TWO 4" CONDUITS, ONE SPARE 3" CONDUIT TIED INTO THE JB–S3. THE CONTROLLER CABINET FOUNDATION SHALL HAVE A SEPARATE 1 ¼" CONDUIT TIED INTO THE SERVICE METER EQUIPMENT. THE 2008 VDOT R&B STANDARD (6–15–2009 REVISION) FOR THE CF–3 SHALL BE USED FOR ALL CONTROLLER CABINET FOUNDATIONS.THE CONTRACTOR SHALL PROVIDE, INSTALL AND ADJUST CONTROLLER TIMINGS TO PROVIDE AN ORDERLY FLOW OF TRAFFIC OR AS DIRECTED BY THE VDOT NROIC ENGINEER.
13. ALL RIGHT TURN OVERLAPS SHALL BE WIRED TO THE OVERLAP LOAD–SWITCH POSITION.

C. TRAFFIC SIGNAL HEADS

14. TRAFFIC SIGNAL HEAD SECTIONS SHALL BE CAST ALUMINUM. ALL SIGNAL HEADS SHALL HAVE POLYCARBONATE BACKPLATES. BACKPLATE HARDWARE SHALL BE STAINLESS STEEL.
15. PEDESTRIAN SIGNAL HEADS SHALL BE CAST ALUMINUM.

C. TRAFFIC SIGNAL HEADS (CONT.)

16. TRAFFIC SIGNAL HEAD SECTIONS SHALL BE CAST ALUMINUM. ALL SIGNAL HEADS SHALL HAVE POLYCARBONATE BACKPLATES. BACKPLATE HARDWARE SHALL BE STAINLESS STEEL.
17. PEDESTRIAN SIGNAL HEADS SHALL BE CAST ALUMINUM.
18. PEDESTRIAN SIGNAL HEADS SHALL BE IN ACCORDANCE WITH ST'D SP–9, TYPE LED COUNT DOWN HEADS.
19. PEDESTRIAN SIGNAL HEADS SHALL BE MOUNTED IN ACCORDANCE WITH ST'D SMB–3 (ONE–WAY).
20. PEDESTAL POLE HEADS SHALL BE MOUNTED IN ACCORDANCE WITH STD SMB–2.
21. HANGER ASSEMBLY BRACKETS FOR ANGLED TRAFFIC SIGNAL HEADS SHALL BE SUCH THAT BACKPLATES CAN BE INSTALLED WITHOUT ALTERATION OR MODIFICATION.
22. ALL TRAFFIC SIGNAL HEAD SECTIONS SHALL BE LED PER VDOT'S SPECIFICATIONS.

D. DETECTORS

23. ALL 6' X 40' LOOP DETECTORS SHALL BE INSTALLED IN ACCORDANCE WITH ST'D TD–1C AND SHALL BE PLACED 5' IN FRONT OF THE STOP LINE.
24. ALL 6' X 6' LOOP DETECTORS SHALL BE INSTALLED IN ACCORDANCE WITH ST'D TD–1B. 14/1 ENCLOSED CONDUCTOR CABLE LEAD–IN REQUIRES 5/8" SAW CUT.
25. LOOP DETECTOR AMPLIFIERS SHALL BE ONE FOR EACH LOOP EXCEPT THAT, WHEN THERE ARE SETS OF 6' X 6' LOOPS, ONLY THE SET FARTHEST FROM THE STOP BAR SHALL HAVE SEPARATE DETECTOR UNITS, ALL OTHER SETS SHALL BE SPLICED IN SERIES.

E. CONDUIT, CONDUCTORS & ELECTRICAL

26. FOR INSTALLATION OF CONDUIT, NO OPEN CUT WILL BE ALLOWED IN ROADWAY SURFACE.
27. JUNCTION BOX COVERS SHALL HAVE THE LETTERS "TRAF" CAST IN THE TOP SURFACE DEPRESSION FOR ALL TRAFFIC SIGNAL RELATED JUNCTION BOXES CONTAINING CABLE WITH LESS THAN 50 VOLTS. ALL OTHER JUNCTION BOX COVERS SHALL HAVE THE LETTERS "ELEC" CAST IN THE TOP SURFACE DEPRESSION.
28. NO JB–S1, S2, OR S3 SHALL BE INSTALLED IN PAVED SHOULDER, SIDEWALK, OR MULTI–PURPOSE TRAIL.
29. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING ELECTRICAL SERVICE TO THE CONTROLLER AT ALL TIMES.
30. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATING THE LOCATION AND THE INSTALLATION OF THE ELECTRICAL SERVICE FOR THE TRAFFIC SIGNAL WITH THE LOCAL UTILITY COMPANY. THE CONTRACTOR IS RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH PROVIDING ELECTRICAL SERVICE TO THE TRAFFIC SIGNAL. THE ELECTRICAL SERVICE SHALL BE INSTALLED IN ACCORDANCE WITH NOVEC SPECIFICATIONS (D–MFS) WITH TWO CIRCUIT BREAKERS RATED AT 60 AMPS EACH AND SHALL BE AN EQUIVALENT TO VDOT'S SE–5 SPECIFICATION FOR AN UNDERGROUND SERVICE LATERAL. THE ELECTRICAL SERVICE SHALL BE METERED.
31. DIMENSIONS USED FOR LOCATING EQUIPMENT (SUCH AS SIGNAL HEAD ASSEMBLIES, SIGNS, PRE–EMPTOR, CAMERAS, ETC.) ON MAST ARMS ARE MEASURED TO THE CENTER OF THE SYMBOL USED TO INDICATE THE EQUIPMENT.
32. ALL JUNCTION BOXES SHALL BE INSTALLED IN ACCORDANCE WITH ST'D JB–S2 (UNLESS OTHERWISE SPECIFIED).
33. THE 1" METAL CONDUIT THAT IS INSTALLED AS PART OF THE COMMUNICATION CIRCUIT (ST'D CC–2 ON THE CONTROLLER CABINET) SHALL BE TERMINATED INTO A ST'D JB–S1 JUNCTION BOX LOCATED 12" TO 24" FROM THE CONTROLLER CABINET FOUNDATION. THE 2" CONDUIT FROM THE THE DESIGNATED COMMUNICATION PROVIDER CONNECTION POINT TO THE CONTROLLER CABINET SHALL BE TERMINATED INTO THIS JB–S1. THE REQUIRED GROUND ELECTRODE FOR THE COMMUNICATION CIRCUIT SHALL BE INSTALLED IN THIS JB–S1. THE COVER SHALL HAVE "COMM" CAST IN THE DEPRESSION ON TOP AS DETAILED IN THE ST'D JB–S1. PULL ROPE RATED AT 500 LBS. SHALL BE INSTALLED IN ALL COMMUNICATION CONDUITS.
34. (S) DENOTES SHIELDED CABLE.
(M) DENOTES METAL CONDUIT.
(EGC) DENOTES EQUIPMENT GROUNDING CONDUCTOR
35. THE 1 " METAL CONDUIT THAT IS INSTALLED AS PART OF THE COMMUNICATION CIRCUIT (ST'D CC–2 ON THE CONTROLLER CABINET) SHALL BE TERMINATED INTO A ST'D JB–S1 JUNCTION BOX LOCATED 12" TO 24" FROM THE CONTROLLER CABINET FOUNDATION. THE 2" CONDUIT FROM THE DESIGNATED COMMUNICATION PROVIDER CONNECTION POINT TO THE CONTROLLER CABINET SHALL BE TERMINATED INTO THIS JB–S1. THE REQUIRED GROUND ELECTRODE FOR THE COMMUNICATION CIRCUIT SHALL BE INSTALLED IN THIS JB–S1. THE COVER SHALL HAVE "COMM" CAST IN THE DEPRESSION ON TOP AS DETAILED IN THE ST'D JB–S1. PULL ROPE RATED AT 500 LBS. SHALL BE INSTALLED IN ALL COMMUNICATION CONDUITS.

F. SIGNS AND PAVEMENT MARKINGS

36. PAVEMENT MARKINGS SHALL BE MODIFIED TO REFLECT THE MARKINGS SHOWN ON THIS PLAN WHEN THE SIGNAL IS INSTALLED.
37. ANY EXISTING PAVEMENT MARKINGS WHICH CONFLICT WITH PROPOSED PAVEMENT MARKINGS SHALL BE COMPLETELY ERADICATED.
38. LIMITS SHOWN ON PROPOSED MARKINGS ARE APPROXIMATE AND SHALL BE MODIFIED IN THE FIELD TO ENSURE THAT PROPOSED PAVEMENT MARKINGS CONTINUE UNTIL EXISTING PAVEMENT MARKINGS CAN BE MATCHED.
39. PEDESTRIAN SIGNS SHALL BE MUTCD R10–3e (EDUCATIONAL PANEL WITH ARROWS).
40. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SIGN MOUNTING DETAIL TO INSTALL STREET NAME SIGNS ON SIGNAL POLES. DETAIL TO BE APPROVED BY VDOT.

G. PREEMPTION

41. ALL NEW TRAFFIC SIGNAL INSTALLATIONS AND MODIFICATIONS SHALL INCLUDE OPTICOM EMERGENCY VEHICLE PREEMPTION (EVP) EQUIPMENT.
42. THE CONTRACTOR SHALL INSTALL THE OPTICOM EVP SYSTEM AS SHOWN ON THE PLANS. THE OPTICOM EVP SYSTEM SHALL INCLUDE ALL OPTICAL DETECTORS, DETECTOR CABLES, PHASE SELECTORS AND DISCRIMINATORS FOR A FUNCTIONAL SYSTEMS.
43. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE PURCHASE AND INSTALLATION OF THE EVP EQUIPMENT PER CURRENT ADOPTED STATE AND COUNTY SPECIFICATIONS.
44. ALL INSTALLED OPTICOM EVP EQUIPMENT SHALL BE COMPATIBLE WITH EXISTING OR PROPOSED SIGNAL EQUIPMENT.
45. THE CONTRACTOR SHALL INSTALL THE OPTICOM EVP EQUIPMENT IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATION AND THE OPTICOM EVP CABLING SHALL BE INSTALLED IN SEPARATE CONDUITS AND JUNCTION BOXES BETWEEN FOUNDATIONS. THESE SEPARATE CONDUIT RUNS SHALL HOUSE THE GTT 138, 4 CONDUCTOR 16 GAUGE CABLE(S).
46. THE PROPOSED OPTICOM EVP SEQUENCE DIAGRAM AND TIMINGS SHALL BE SUBMITTED TO VDOT TE/NROIC FOR APPROVAL PRIOR TO INSTALLATION.
47. THE CONTRACTOR SHALL SECURE APPROVAL FROM THE DEPARTMENT OF FIRE AND RESCUE THAT SPECIFIES THE APPROACHES TO BE PRE–EMPTED. THE FIRE & RESCUE DEPARTMENT CONTACT IS CHIEF ROB CLEMONS 703–785–0434 OR E–MAIL @ RCLEMONS@PWCGOV.ORG.
48. PRINCE WILLIAM COUNTY SHALL BE RESPONSIBLE FOR THE INSTALLATION, OPERATION AND MAINTENANCE ASSOCIATED WITH THE OPTICOM EVP SYSTEM

QUANTITY SUMMARIES

DESCRIPTION	UNIT	QTY
MAST ARM POLE, 75' ARM	EA	3
SIGNAL POLE FOUNDATION	CF	33
TEST PITS	EA	3
TRAFFIC SIGNAL HEAD SECTION, 12" LED	EA	33
PEDESTRIAN COUNTDOWN SIGNAL HEAD	EA	2
PEDESTRIAN PUSHBUTTON	EA	2
HANGER ASSEMBLY SMD–2	EA	12
HANGER ASSEMBLY SM–3	EA	11
HANGER ASSEMBLY SMB–3	EA	2
JB–S1	EA	2
JB–S2	EA	13
JB–S3	EA	1
14/1 ENCLOSED CONDUCTOR	LF	3990
14/2 SHIELDED CABLE	LF	2540
14/2 CONDUCTOR CABLE	LF	215
14/7 CONDUCTOR CABLE	LF	1295
GTT 138 CONDUCTOR CABLE #6 CABLE	LF	450
1" METAL CONDUIT	LF	90
1 1/4" CONDUIT	LF	155
2" CONDUIT	LF	30
2 BORED" CONDUIT	LF	15
3" CONDUIT	LF	250
4" CONDUIT	LF	430
4" BORED CONDUIT	LF	10
SAW CUT	LF	400
TRENCH EXCAVATION	LF	1630
SIGN PANEL	LF	500
CONTROLLER CABINET	SF	107
CF–3 FOUNDATION	EA	1
UNINTERRUPTABLE POWER SUPPLY	EA	1
UPS CABINET	EA	1
UPS BATTERY	EA	6
GROUNDING ELECTRODE	EA	5

VIRGINIA DEPARTMENT OF TRANSPORTATION
REVIEW OF WORKING DRAWINGS

WORKING DRAWINGS HAVE BEEN REVIEWED IN ACCORDANCE WITH SECTION 105.02 OF THE VDOT ROAD & BRIDGE SPECIFICATIONS WITH THE FOLLOWING COMMENTS:

☐ REJECTED, CORRECT AND RESUBMIT
☐ APPROVED FOR DESIGN ONLY
☒ APPROVED FOR INSTALLATION Subject To:

1. Obtaining VDOT Land Use Permit Prior To Installation.
2. Review and Approval of All Catalog Cuts, Shop Drawings, Pole Calculations, Soil Tests, and Foundation Designs Prior to Construction.

REVIEWED BY: _____ DATE: 9/26/2013

Plan acceptance is valid for one year from date above.

REVISIONS

DATE	INITIAL

COMMONWEALTH OF VIRGINIA
AMY J. MORRIS
No. 041485
PROFESSIONAL ENGINEER

Digitally signed by Amy J Morris
PE SEAL Date: 2013.09.23 16:43:38 -04'00'

VETTRA COMPANY
11535 Gunner Court – Woodbridge, Virginia 22192
(703) 590–4932 – FAX (703) 590–1277
vettra@aol.com

- Traffic and Parking Studies
- Site Access & Circulation
- Traffic counts and Surveys
- Expert Testimony

13 design

FINAL TRAFFIC SIGNAL INSTALLATION PLAN
CENTREVILLE RD (RTE 28) &
ORCHARD BRIDGE DR
PRINCE WILLIAM COUNTY

DESIGNED	SJW
DRAWN	JMS
CHECKED	AJM
FILE NAME	13–0562
PLAN NO.	97–00108
SCALE	0 25' 50'
DATE	SEPT. 20, 2013
SHEET	1 OF 2

SURVEYED BY THOMAS FOLSE
APPROVED BY THOMAS FOLSE
REVIEWED BY MARC CIOFFI
CADD OPERATOR MARC CIOFFI
REVISED BY MARC CIOFFI

3/17/2020
8:39:57 PM

Striping Plans - 5 Intersections.dgn
Plotted By: cpeduzzi

PROJECT MANAGER
LOAD CHKED BY / DATE
DESIGN CHK
SUBSURFACE UTILITY BY / DATE

REVISED	STATE			SHEET NO
	STATE	ROUTE	PROJECT #	PLANS
	VA.			

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT.

PAVEMENT MARKING LEGEND

- (A) TY.B CL.I PAVE. LINE MARK. 4", YELLOW
- (B) TY.B CL.I PAVE. LINE MARK. 4", WHITE
- (C) TY.B CL.I PAVE. LINE MARK. 4", WHITE. 2' LONG. 4' SPACING
- (D) TY.B CL.I PAVE. LINE MARK. 4", WHITE. 10' LONG. 30' SPACING
- (E) TY.B CL.I PAVE. LINE MARK. 24", YELLOW. 45 DEGREE. 20' SPACING
- (F) TY.B CL.I PAVE. LINE MARK. 24", WHITE
- (G) TY.B CL.I PAVE. LINE MARK. 24", WHITE. 45 DEGREE. 20' SPACING
- (H) PAVEMENT MESSAGE MARK. ELONGATE ARROW SINGLE
- (I) PAVEMENT MARKING TO BE REMOVED

380'

CENTREVILLE ROAD

ORCHARD BRIDGE DRIVE

CENTREVILLE ROAD

Google Earth

PROJECT
SHEET NO
70 ft

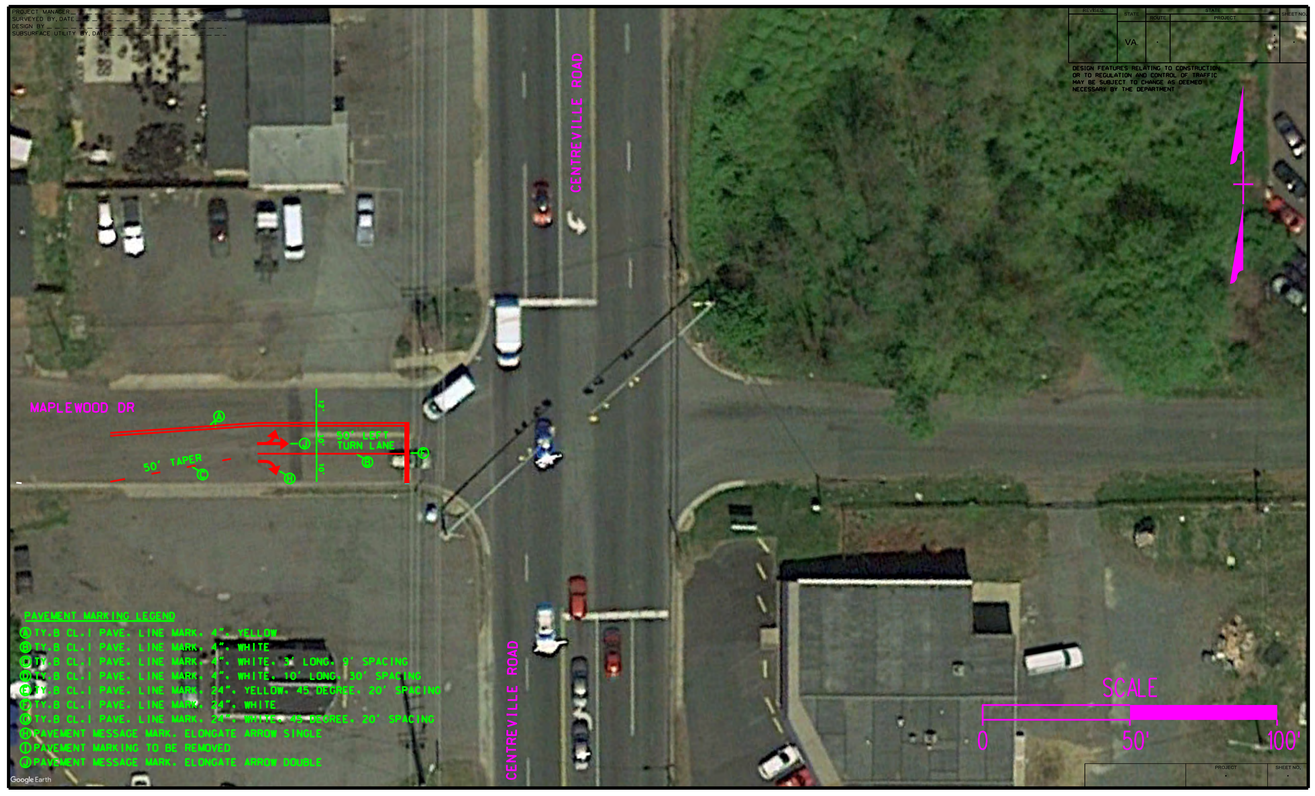
5/8/2020
9:47:16 AM

Striping Plans - 5 Intersections.dgn
Plotted By: cpeduzzi

PROJECT NUMBER:
SURVEYED BY: DATE:
DESIGN BY:
SUBSURFACE UTILITY BY/DATE:

FED. ROAD DIST. NO.	STATE	ROUTE	SECTION	SHEET NO.
	VA		PROJECT	

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED IT NECESSARY BY THE DEPARTMENT.



PAVEMENT MARKING LEGEND

① TY. B CL. I PAVE. LINE MARK., 4", YELLOW
② TY. B CL. I PAVE. LINE MARK., 4", WHITE
③ TY. B CL. I PAVE. LINE MARK., 4", WHITE, 3' LONG, 9' SPACING
④ TY. B CL. I PAVE. LINE MARK., 4", WHITE, 10' LONG, 30' SPACING
⑤ TY. B CL. I PAVE. LINE MARK., 24", YELLOW, 45 DEGREE, 20' SPACING
⑥ TY. B CL. I PAVE. LINE MARK., 24", WHITE
⑦ TY. B CL. I PAVE. LINE MARK., 24", WHITE, 45 DEGREE, 20' SPACING
⑧ PAVEMENT MESSAGE MARK. ELONGATE ARROW SINGLE
⑨ PAVEMENT MARKING TO BE REMOVED
⑩ PAVEMENT MESSAGE MARK. ELONGATE ARROW DOUBLE