



PROJECT PIPELINE

NV04: Prince William County VA Route 294 – Prince William Parkway Final Report

From Smoketown Road to Crossing Place



VA Route 294 (Prince William Parkway) from Smoketown Road to Crossing Place

Final Report
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Prepared for



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Chapter 1:

Needs Evaluation and Diagnosis

Introduction:








Project Pipeline is a performance-based planning program to identify cost-effective solutions to multimodal transportation needs in Virginia. Through this planning process, projects and solutions may be considered for funding through programs including SMART SCALE, revenue sharing, interstate funding, and others. Visit the Project Pipeline webpage for additional information vapipeline.org.

This study focuses on concepts targeting identified needs including congestion mitigation, safety improvement, pedestrian and bicycle infrastructure along the corridor, and transit access. The objectives of Project Pipeline are shown below in **Figure 1**.

Background

The Office of Intermodal Planning and Investment (OIPI) prepared the VTrans Virginia's statewide transportation plan for the Commonwealth Transportation Board (CTB) in which mid-term needs (0 - 10 years) were identified for different categories listed in **Table 1**. This study focuses on addressing needs identified in VTrans, and those previously identified by the localities.

Table 1: List of VTrans Needs

VTrans Needs			
	Transportation Demand Management		Capacity Preservation
	Congestion Mitigation		Bicycle Access
	Safety Improvement		Pedestrian Safety Improvement
	Transit Access		

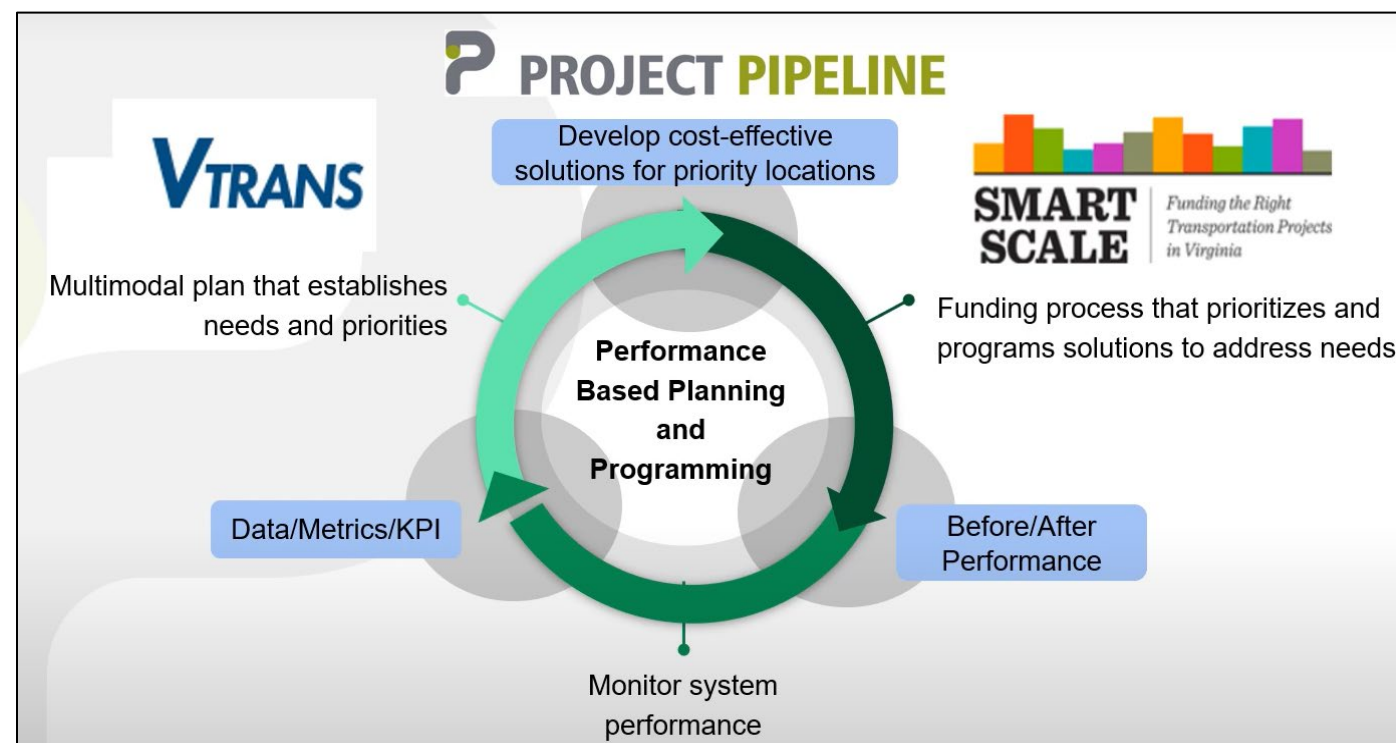


Figure 1: Project Pipeline Objectives

Methodology

The study is broken down into three phases. Phase I consists of the problem diagnosis and brainstorming of alternatives, Phase II includes the alternative evaluation and sketch level analysis, and Phase III is the investment strategy and cost estimates. Details on methods and solutions for each study phase are outlined below in **Figure 2**.

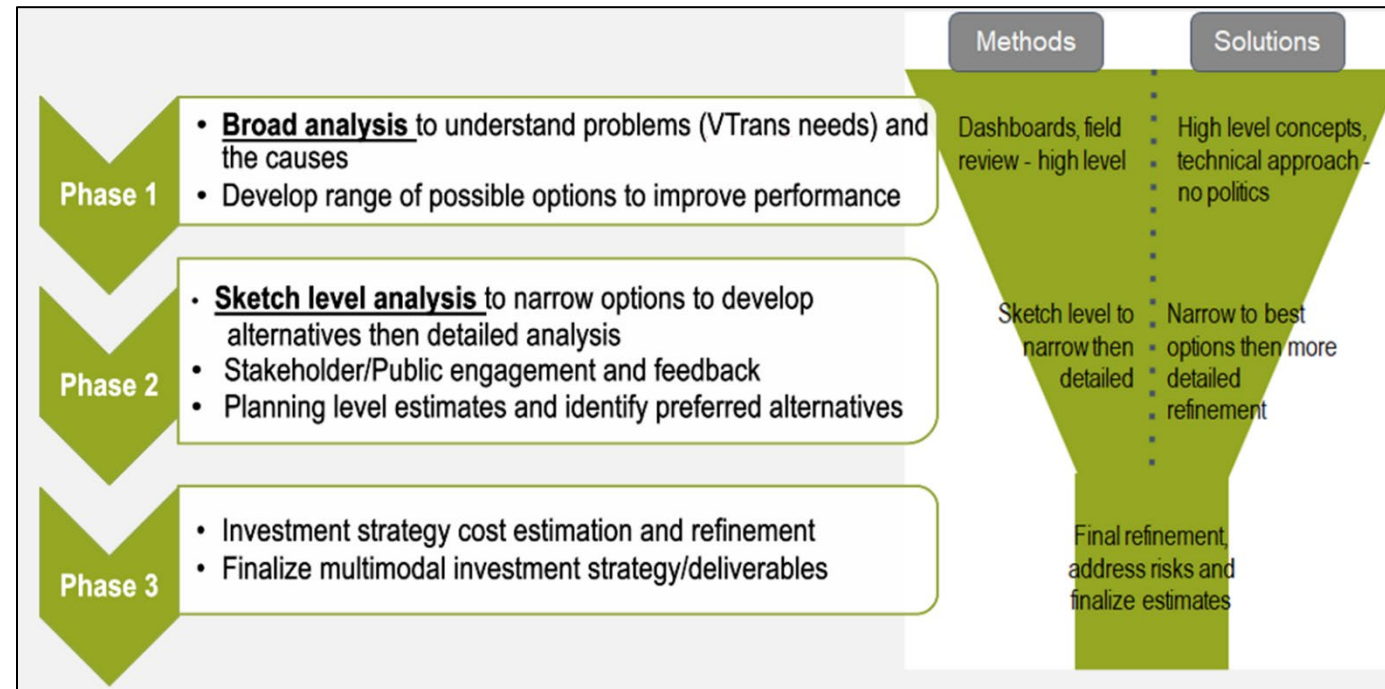


Figure 2: Study Phase Methods and Solutions

The study team is also broken down into three teams, with each team simultaneously working on different areas of the study. Team 1 focuses on Traffic Operations, Capacity, and Access, Team 2 focuses on Road Reliability and Safety, while Team 3 focuses on Rail, Transit, and Transportation Demand Management (TDM). As shown in **Figure 3**, Team 1 and Team 2 are led by ATCS, with support from KLS on the effort with respect to pedestrian and bicycle needs. Team 3 is led by Mead & Hunt, with support from Michael Baker under the Department of Rail and Public Transportation (DRPT) Program. The following details the focus areas of study for each team:

- Team 1 – Identify operation and access needs by conducting future traffic demand volume forecasts and performing operational analysis of future conditions using Synchro/SimTraffic. Evaluate operational mitigations such as geometric modifications, access management improvements, and installation of facilities for pedestrians and bicycles.
- Team 2 – Identify safety needs with respect to vehicles, pedestrians, and cyclists by evaluating existing roadway conditions as well as crash patterns and crash hot spot locations based on the most recent five-year crash history obtained from the Virginia Department of Transportation (VDOT) Crash Database Tableau Tool. Recommend safety improvement options through geometric modifications, access management improvements, and installation of facilities for pedestrians and bicycles.
- Team 3 – Identify needs with respect to rail, transit, and TDM by reviewing existing rail and transit routes and future traffic demand volume forecasts. Consider improvements recommended through public transit route extensions and the addition of Park and Ride lots.



Figure 3: Study Team and Focus Area of Study

Study Area

The VA Route 294 (Prince William Parkway) study corridor from Smoketown Road to Crossing Place is located in Prince William County, Virginia, and runs for approximately 0.9 miles. The Route 294 corridor is classified as an other principal arterial road within the study area, with a posted speed limit of 45 MPH. The corridor provides access for residential and business areas to the west to I-95, which is directly connected to Route 294 via an interchange to the east of the study area. Route 294 within the study area is a six-lane divided roadway, with a raised median and all unsignalized driveways limited to right-in/right-out movements. Left and right turn lanes are present at all signalized intersections. The area immediately surrounding the study corridor is a mix of general businesses, office space, light industrial uses, and planned business districts. A map detailing the study intersections along Route 294 is shown below in **Figure 4**.



Figure 4: Route 294 Study Area Map

VTrans and Related Project Background Information

VTrans is Virginia's statewide transportation plan. It identifies and prioritizes locations with transportation needs using data-informed transparent processes. The policy for identifying VTrans mid-term needs establishes multimodal need categories that correspond to the Commonwealth Transportation Board-adopted VTrans visions, goals, and objectives.¹ Each need category has one or more performance measures and thresholds to identify one or more needs. Visit the Vtrans policy guide for additional information: https://vtrans.org/resources/VTrans_Policy_Guide_v6.pdf.

The mid-term needs, as identified in VTrans for the Route 294 study corridor, were identified as 'Very High' for Transportation Demand Management, 'High' for Bicycle Access, Capacity Preservation, Congestion Mitigation, and Safety Improvement, 'Medium' for Pedestrian Safety Improvement, and 'Low' for Transit Access needs, as presented in **Table 2**.

Table 2: VTrans Needs in Study Area

VTRANS IDENTIFIED NEEDS	PRIORITIES
Bicycle Access	High
Capacity Preservation	High
Congestion Mitigation	High
IEDA (UDA) Access	None
Pedestrian Access	None
Safety Improvement	High
Pedestrian Safety Improvement	Medium
Reliability	None
Rail On-time Performance	None
Transit Access	Low
Transit Access for Equity Emphasis Areas	None
Transportation Demand Management	Very High

These mid-term needs, identified in VTrans, are prioritized on a tier from 1 to 4, with 1 being the most critical and 4 being the least critical. The segments ranked as "Priority 1" represent those with multiple categories identified as high in need. **Figure 5** presents a map of the study area with 2019 VTrans mid-term needs prioritized for district construction.

¹ Commonwealth Transportation Board, Actions to Approve the 2019 VTrans Vision, Goals, Objectives, Guiding Principles and the 2019 Mid-term Needs Identification Methodology and Accept the 2019 Mid-term Needs, January 15, 2020

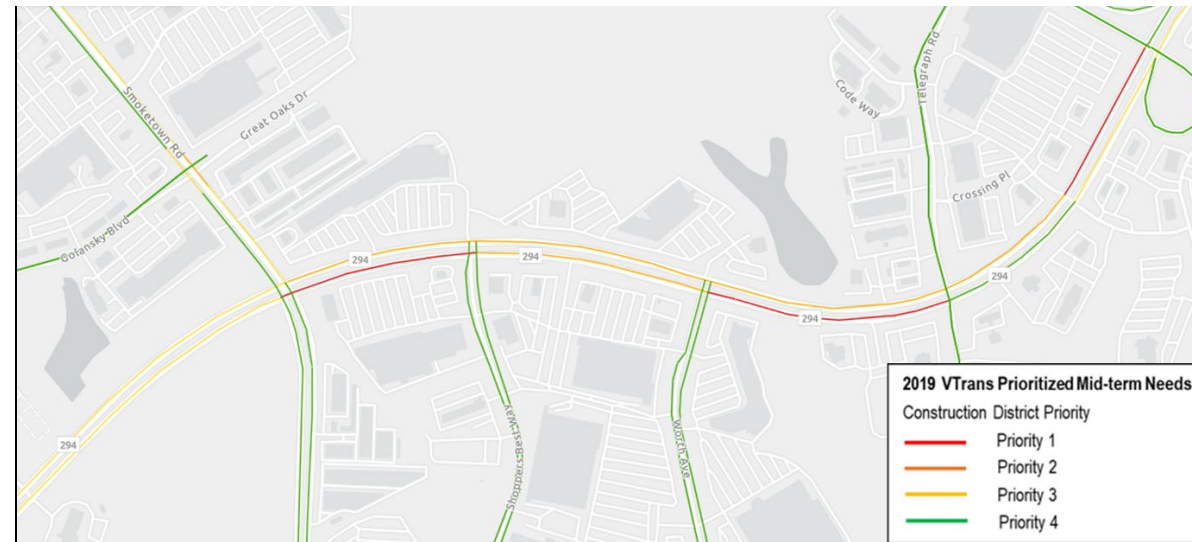


Figure 5: 2019 VTrans Prioritized Mid-term Needs in the Study Area

There is an in-progress project that will impact geometric and traffic conditions in the study area, which is discussed in greater detail in the following subsection.

Telegraph Road Improvements

Final engineering is underway for the Prince William County planned improvements along Telegraph Road with an anticipated construction completion of Winter 2023. These improvements include widening Telegraph Road to two lanes in each direction and adding dedicated turn lanes at the Route 294 and Caton Hill Road intersections. The design plan for the intersection of Route 294 and Telegraph Road is presented in **Figure 6**.

The Telegraph Road improvements rollplot obtained from the Prince William County website² is provided in **Appendix A**

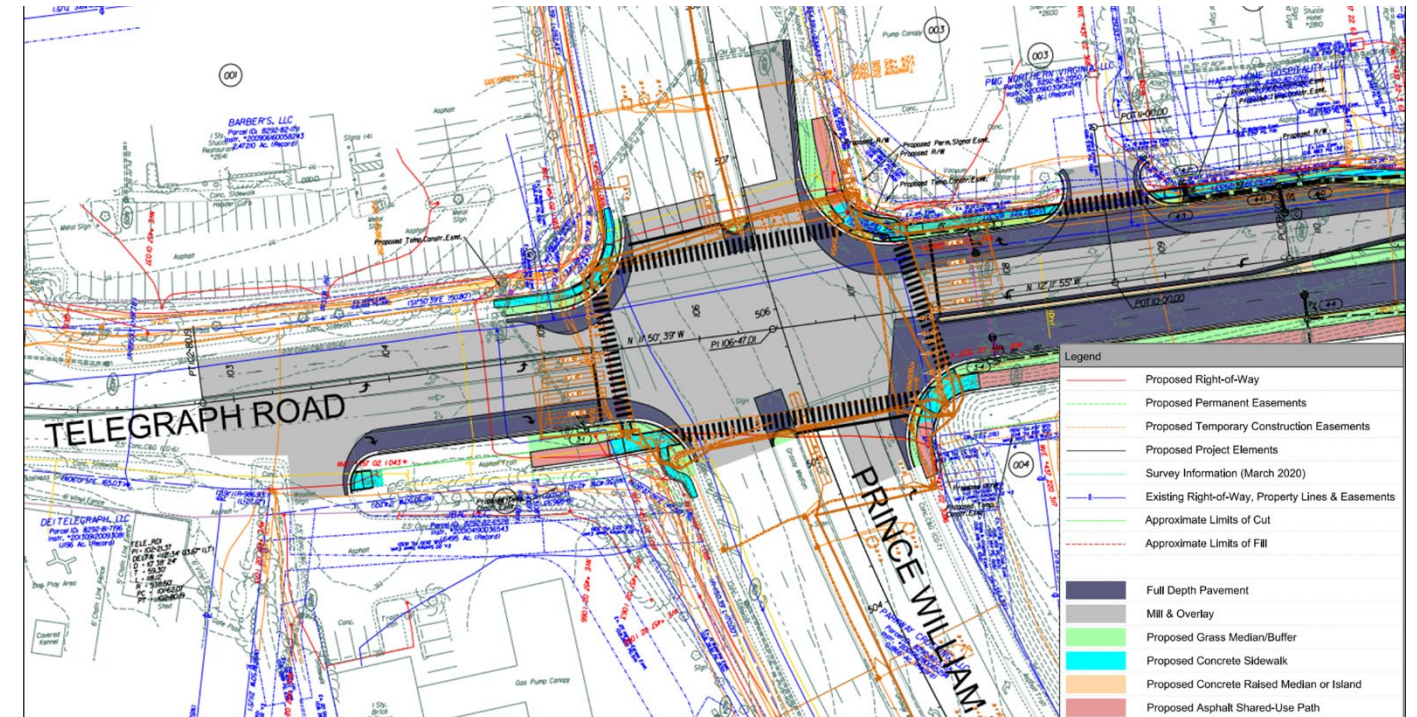


Figure 6: Telegraph Road Improvements

The main focus of this study is on concepts targeting known needs, including congestion mitigation, and bicycle and pedestrian infrastructure along the corridor.

Safety improvements are another focus of the study. The entire length of the study area is on the statewide Potential for Safety Improvement (PSI) ranking which is based on highway Safety Performance Function (SPF) developed by VDOT using the latest Highway Safety Manual (HSM) methods. Below is a breakdown of the PSI ranking for the corridor segments:

- Route 294 from Smoketown Road to Shoppers Best Way - PSI Segment #25
- Route 294 from Shoppers Best Way to Worth Avenue - PSI Segment #179
- Route 294 from Worth Avenue to Telegraph Road - PSI Segment #51
- Route 294 from Telegraph Road to Crossing Place - PSI Segment #102
- Route 294 from Crossing Place to Caton Hill Road - PSI Segment #19

² Telegraph Road Rollplot 3/3/2022. Obtained from: <https://www.pwcva.gov/assets/2022-03/Telegraph%20Road%20Rollplot%203%203%2022.pdf>

Traffic Operations and Accessibility:

Traffic operational analysis was performed using Synchro 10 software for all study intersections along the Route 294 corridor. Inputs and analysis methodologies are consistent with the VDOT Traffic Operations and Safety Analysis Manual (TOSAM) guidelines. Both AM and PM peak hour analyses were performed for the existing year 2021.

Traffic Data

Average Daily Traffic (ADT) volumes and intersection turning movement counts were collected in June 2021 and were compared to the 2019 pre-COVID traffic counts. It was determined that the AM volumes for the eastbound direction and the PM volumes for the westbound direction had decreased since pre-COVID conditions. Therefore, an adjustment factor was used to mitigate the impact of COVID on traffic volumes. The impact of COVID on traffic volumes and the adjustments factors are shown in **Figure 7**. It should be noted that the 2021 AM volumes for the westbound direction and the PM volumes for the eastbound direction that were higher compared to pre-COVID, were not adjusted (the 0.85 and 0.96 adjustment factors were not used).

The raw ADTs and intersection turning movement counts are provided in **Appendix B**.

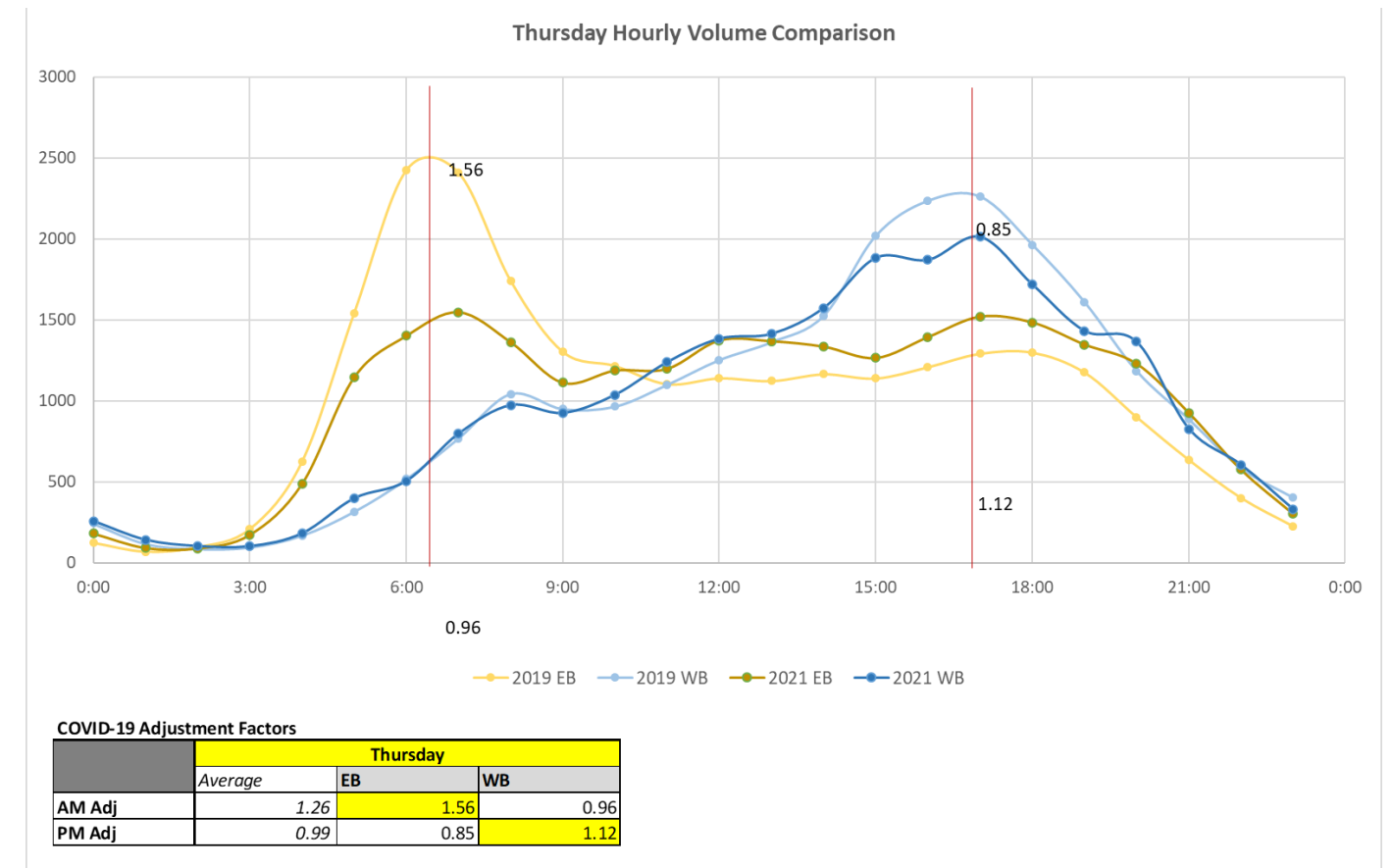


Figure 7: Traffic Volume Adjustment Factors

In the volume settings in Synchro, an overall Peak Hour Factor (PHF) was used per intersection as recommended by the Highway Capacity Manual. If PHFs for each individual approach or movement are used, they are likely to create demand volumes from one 15-minute period that are in apparent conflict with demand volumes from another 15-minute period, but in reality these peak volumes do not occur at the same time. Truck percentages for each movement were calculated and used in the models. Synchro roadway speeds were assumed to be the posted speed limit.

Measures of Effectiveness

There are many measures of effectiveness (MOE) in traffic operations analysis to quantify operational and safety objectives and provide a basis for evaluating the performance of a transportation network. Several MOEs for intersection analyses can be reported from Synchro/SimTraffic, VJuST, and SIDRA.

For the purposes of this study, guidance for reporting MOEs for signalized and unsignalized intersections was obtained from Chapter 4 of the VDOT TOSAM. A summary of the MOEs evaluated for the study intersections is presented below:

- Control Delay (measured in seconds per vehicle – sec/veh)
- Level of service (LOS)
- 95th Percentile Queue Length via Synchro (measured in feet – ft)
- Volume-to-Capacity (v/c) Ratio

Traffic Operations Analysis Results

In an effort to identify operational and accessibility needs along the study corridor, Synchro analysis was performed for the existing year 2021. Due to the focus of Project Pipeline on addressing existing issues and fast moving study schedule, modeling focus was on existing and near term issues. Study technical teams agreed to this approach and that future modeling would be completed during later efforts as needed.

The operational analysis shows that all study intersections operate at a Level of Service (LOS) D or better during both AM and PM peak hours in 2021, except for the intersection of Smoketown Road during the PM peak hour, which operates at LOS E. Overall, the side streets along Route 294 operate at LOS E or worse with queues for some of the movements extending beyond the existing turn storage lanes.

The analysis shows that at the intersection of Route 294 and Smoketown Road, the eastbound approach experiences congestion and queueing during the PM peak hour. The eastbound right turn lane spills over the available storage and the eastbound and westbound left turns operate with excessive delays.

For the intersections of Route 294 and Shoppers Best Way and Route 294 and Worth Avenue, the analysis results show excessive delays for the eastbound and westbound left turn lanes.

At the intersection of Route 294 and Telegraph Road, the eastbound and westbound left turns operate with excessive delays and the westbound left turn lane spills over during the PM peak hour.

The intersection of Route 294 and Crossing Place operates with excessive delays for the eastbound and westbound left turn lanes. Also, the westbound traffic experiences excessive delays and queues that present safety concerns for this approach such as a higher risk of rear end crashes.

Table 3 presents the AM and PM peak hour Synchro analysis results summary for 2021 existing conditions. The 95th percentile queues highlighted in pink represent those exceeding the available storage facility. The Synchro reports are included in **Appendix C**. The traffic operations and accessibility needs are summarized in **Figure 8** to **Figure 11**.

Table 3: 2021 Existing Synchro Analysis Results Summary

Traffic Control	Intersection	Approach	Movement	Existing AM				Existing PM			
				LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)	
						95% Queues ³	Available Storage			95% Queues	Available Storage
Signalized	Prince William Pkwy & Smoketown Rd	EB	L	F	90.2	20	400	F	96.8	60	400
			T	D	35.7	975	-	D	44.8	515	-
			R	B	18.5	540	375	C	32.7	905	375
			Overall	C	31.7	-	-	D	41.3	-	-
		WB	L	F	96.8	#160	385	F	118.0	175	385
			T	C	29.7	255	-	C	29.8	750	-
			R	C	32.5	25	-	A	5.9	150	-
			Overall	D	40.6	-	-	C	33.0	-	-
		NB	L	F	85.6	250	465	F	157.4	#700	465
			T	E	80.0	195	-	E	76.4	360	-
			R	E	63.6	60	300	E	55.3	140	300
			Overall	F	80.6	-	-	F	111.5	-	-
		SB	L	F	85.2	200	370	F	98.6	370	370
			T	E	79.7	135	-	F	86.6	345	-
			R	E	72.1	0	190	E	65.0	0	190
			Overall	F	82.4	-	-	F	90.8	-	-
		Intersection Overall		D	45.2	-	-	E	61.9	-	-
Stop-Controlled	Prince William Pkwy & Parking Ent ⁴	SB	R (Overall)	A	8.8	0	-	A	9.7	5	-
		Intersection Overall		A	8.8	-	-	A	9.7	-	-
Signalized	Prince William Pkwy & Shoppers Best Way	EB	L	F	117.2	40	380	F	102.9	#210	380
			T	A	1.4	35	-	B	19.7	265	-
			R	A	0.2	0	410	D	44.4	85	410
			Overall	A	2.3	-	-	C	29.8	-	-
		WB	L	F	81.5	50	355	F	125.0	160	355
			T	A	6.0	60	-	B	13.7	435	-
			R	A	5.1	0	400	A	1.1	0	400
			Overall	A	9.1	-	-	C	21.5	-	-
		NB	L	F	84.3	80	175	F	93.2	325	175
			T	E	75.8	10	-	E	77.8	80	-
			R	E	70.3	35	-	E	67.2	125	-
			Overall	E	78.7	-	-	F	86.5	-	-
		SB	L	F	103.7	20	150	F	104.4	150	150
			T	F	85.0	25	-	F	95.6	85	-
			R	F	84.0	0	175	F	91.6	0	175
			Overall	F	88.8	-	-	F	97.7	-	-
		Intersection Overall		A	7.2	-	-	D	35.2	-	-
Stop-Controlled	Prince William Pkwy & Smoketown Station ⁴	NB	R (Overall)	B	10.2	10	-	A	9.0	5	-
		Intersection Overall		B	10.2	-	-	A	9.0	-	-
Signalized	Prince William Pkwy & Worth Ave	EB	L	F	108.3	5	365	F	93.4	90	365
			T	A	6.3	140	-	C	32.9	530	-
			R	A	0.2	0	-	A	0.9	5	-
			Overall	A	6.1	-	-	C	28.3	-	-
		WB	L	E	75.4	155	520	F	105.9	460	520
			T	A	5.3	105	-	A	3.7	85	-
			R	A	4.8	0	400	A	0.0	0	400
			Overall	B	17.0	-	-	C	30.6	-	-
		NB	L	F	86.4	50	195	F	90.3	255	195
			TR	E	78.7	75	-	E	79.9	140	-
			R	E	65.7	60	-	D	47.6	245	-
			Overall	E	74.7	-	-	E	72.6	-	-
		SB	L	F	110.5	20	100	F	98.5	125	100
			T	F	84.1	25	-	F	90.0	60	-
			R	F	82.0	0	100	F	82.2	0	100
			Overall	F	93.1	-	-	F	90.7	-	-
		Intersection Overall		B	14.0	-	-	D	38.5	-	-

Table 3 (Cont.): 2021 Existing Synchro Analysis Results Summary

Traffic Control	Intersection	Approach	Movement	Existing AM				Existing PM			
				LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)	
						95% Queues ³	Available Storage			95% Queues	Available Storage
Signalized	Prince William Pkwy & Telegraph Rd	EB	L	F	113.9	185	375	F	115.9	#440	375
			T	B	10.9	760	-	D	43.8	580	-
			R	A	6.1	5	550	F	292.9	40	550
			Overall	B	15.0	-	-	E	66.2	-	-
		WB	L	F	121.5	220	425	F	128.6	510	425
			T	B	11.3	85	-	B	17.5	650	-
			R	B	15.9	0	430	A	0.1	0	430
			Overall	C	23.0	-	-	C	30.6	-	-
		NB	L	E	79.0	85	290	F	99.8	195	290
			T	F	84.7	150	-	F	97.2	190	-
			R	E	77.3	90	310	F	85.9	105	310
			Overall	F	80.5	-	-	F	92.3	-	-
		SB	L	F	89.2	135	250	F	86.2	145	250
			T	F	81.1	95	-	F	94.9	220	-
			R	E	77.9	0	-	F	82.8	95	-
			Overall	F	82.6	-	-	F	88.8	-	-
		Intersection Overall		C	27.0	-	-	D	53.6	-	-
Signalized	Prince William Pkwy & Crossing Pl	EB	L	F	103.0	55	410	F	110.9	#330	410
			T	A	2.8	85	-	B	15.5	255	-
			R	A	0.1	0	315	B	16.8	30	315
			Overall	A	4.0	-	-	C	22.6	-	-
		WB	L	F	83.9	95	355	F	97.8	175	355
			T	B	10.6	240	-	D	38.2	995	-
			R	A	8.3	0	675	C	20.2	0	675
			Overall	B	17.2	-	-	D	42.5	-	-
		NB	L	F	88.3	70	-	F	103.2	235	-
			LT	F	87.0	70	-	F	96.4	235	-
			R	E	73.1	15	-	E	69.2	45	-
			Overall	F	80.8	-	-	F	92.6	-	-
		SB	LT	F	92.2	115	-	F	110.9	#305	-
			R	E	73.2	0	175	E	68.5	185	175
			Overall	F	88.6	-	-	F	90.0	-	-
		Intersection Overall		B	11.0	-	-	D	41.5	-	-

¹ Level of Service (LOS) is obtained from Synchro per HCM 2000 criteria

² Delay is expressed as Seconds per Vehicle

³ Queues obtained from Synchro queueing output

⁴ Worst approach delay and LOS reported as the overall unsignalized intersection operation
95th percentile volume exceeds capacity, queue may be longer.

Safety and Reliability:

For the analysis of existing safety conditions, the VDOT Crash Database Tableau Tool was utilized to determine the crash history at the study intersections and along the study corridor on Route 294. Crash data was collected and analyzed for a five-year period spanning from January 2015 to December 2019. The study team reviewed the FR-300 crash reports provided by VDOT to determine specific trends and “hot spot” areas for consideration in developing alternative improvement concepts. For the purposes of this analysis, “injury crashes” is defined as the sum of type A (severe injury), B (visible injury), and C (non-visible injury) crashes. Raw crash data is provided in **Appendix D**.

Safety Analysis Results

The crash severity within the study area is summarized by year and type in **Table 4** and **Table 5**, respectively.

Table 4: Study Area Crash Severity by Year

Crash Year and Severity	K. Fatal Injury	A. Severe Injury	B. Visible Injury	C. Nonvisible Injury	PDO. Property Damage Only	Total
2015	0	1	27	7	37	72
2016	0	0	29	1	54	84
2017	0	1	10	3	55	69
2018	0	1	23	5	48	77
2019	0	0	13	1	44	58
Total	0	3	102	17	238	360

Table 5: Study Area Crash Severity 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	1	61	8	144	214
Deer	0	0	0	0	1	1
Ped	0	0	4	2	0	6
Other	0	0	6	0	8	14
Angle	0	1	28	3	56	88
Head On	0	0	1	0	2	3
Sideswipe - Same Direction	0	0	2	4	23	29
Sideswipe - Opposite Direction	0	0	0	0	1	1
Fixed Object in Road	0	0	0	0	1	1
Fixed Object - Off Road	0	1	0	0	2	3
Total	0	3	102	17	238	360

A total of 360 crashes were reported within the Route 294 study area during the five-year study period. Key takeaways from the crash data are as follows:

1. Year over year crash occurrence varies with the highest number of crashes (84) occurring in 2016, followed by 77 in 2018.
2. The approximate average number of reported crashes per year is 72.
3. The majority of reported crashes within the corridor are rear end and angle crashes. Combined, these constitute approximately 84% of the total crashes.
4. A total of 122 crashes were associated with injuries, which account for approximately 34% of the total reported crashes within the corridor. There were no crashes that led to a fatality.
5. A significant concentration of crashes was reported at the intersections, with few crashes occurring on the segments between intersections.
6. There was a night time pedestrian crash at the Smoketown Road intersection in 2015, which involved a pedestrian in the west leg crosswalk that was struck by a westbound travelling vehicle. A second night time pedestrian crash happened at the Smoketown Road intersection in 2018, which involved a pedestrian crossing the south leg that was struck by a southbound travelling vehicle. These two pedestrian crashes are shown in **Figure 9**.
7. At the Telegraph Road intersection, a pedestrian crash happened in 2016 during day time hours, which involved a pedestrian that was struck about 100 ft east of the intersection in the outside lane. Another Telegraph Road pedestrian crash happened in 2017 during day time

hours, when a pedestrian was in the south leg crosswalk and was struck by a vehicle in the northbound right turn lane. These two pedestrian crashes are shown in **Figure 11**.

The safety and reliability needs and diagnosis identified during the analysis are summarized in **Figure 8** to **Figure 11**. Detailed collision diagrams at the study intersections are provided in **Appendix E**.

Pedestrian and Bicycle Access

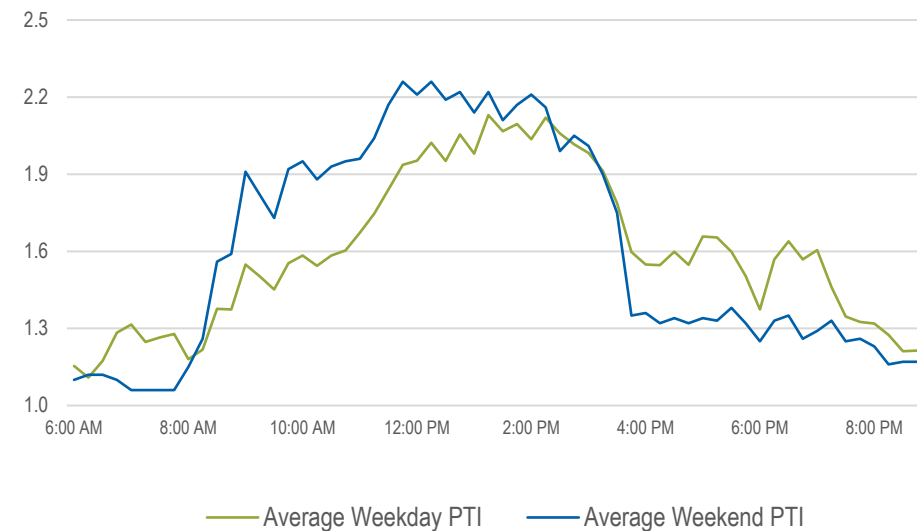
In an effort to identify the needs with respect to accessibility, the study team reviewed existing conditions for pedestrian and bicycle accommodations. There are sidewalks along both sides of the Route 294 study corridor, but the sidewalk along the south side does not meet minimum width requirements for American with Disabilities Act (ADA) compliance. Additionally, the pavement markings for crosswalks are mostly worn out, and most curb ramps and pedestrian push buttons are not ADA compliant due to the lack of an accessible route for wheelchairs and/or do not meet standard distances. Overall, the intersections within the study area have long crossing distances and high speed turning movements with poor yielding behavior. There are no existing bike lanes within the roadway.

Figure 8 to **Figure 11** summarizes these findings.

Corridor Operation and Safety Needs and Diagnosis Summary:

Traffic flow along the corridor

- Lower average travel speeds are experienced during PM peak period (4 pm – 6 pm) compared to the AM peak period.
- Travel reliability decreases as the variability in average travel speeds increases requiring travelers to plan additional time to reach their destinations on time.
- High variability in travel time along the corridor occurs during the mid-day rush hours (10 am – 2 pm) with weekend mid-day travel times more variable compared to the weekday mid-day travel times.



Planning Time Index

Per 2019 vehicle probe data from INRIX

Planning Time Index (PTI) is a travel time reliability measure. It is the ratio of the 95th percent travel time to the free flow travel time.



Average Speed by Time of Day

Per 2019 vehicle probe data from INRIX

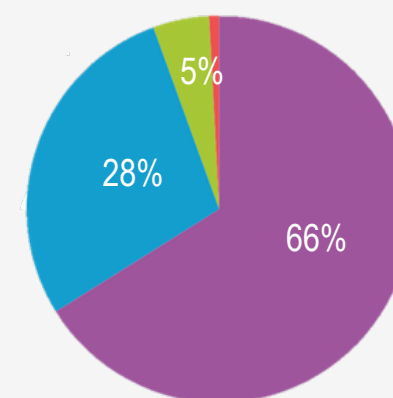
Crash severity along the corridor

- The corridor has 360 total crashes from 2015 to 2019.
- Few crashes occurred on the segments between intersections. Roadway is median divided; therefore, the need for access management is low.
- A breakdown of the crash severity per year and overall crash severity by type is shown below.

CRASH SEVERITY PER YEAR

Crash Severity	2015	2016	2017	2018	2019	Total
A. Severe Injury	1	0	1	1	0	3
B. Visible Injury	27	29	10	23	13	102
C. Nonvisible Injury	7	1	3	5	1	17
PDO. Property Damage Only	37	54	55	48	44	238
Total	72	84	69	77	58	360

OVERALL CRASH SEVERITY



- 66% Property Damage Only
- 28% Visible Injury
- 5% Nonvisible Injury
- 1% Severe Injury

Figure 8: Corridor Operations and Safety Needs and Diagnosis

Smoketown Road Operation and Safety Needs and Diagnosis Summary:



Eastbound congestion and queueing at Smoketown Road during afternoon rush hours.

Eastbound right turn lane queues spill over during PM peak.

Eastbound and westbound left turns operate with excessive delays during both peaks.



Angle and rear-end crashes at the intersections. Congestion is suspected to be a primary contributor.

One pedestrian crash was reported on the west leg and another one on the south leg.



The existing sidewalk along the south side does not meet the minimum width requirements for ADA compliance.

INTERSECTION CRASH TYPES (2015 – 2019):



Figure 9: Smoketown Road Operations and Safety Needs and Diagnosis

Shoppers Best Way and Worth Avenue Operation and Safety Needs and Diagnosis Summary:



Eastbound and westbound left turns operate with excessive delays during both peaks.

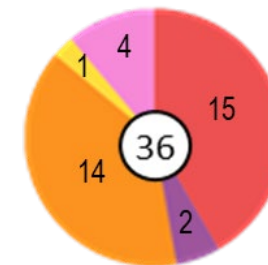


Angle and rear-end crashes at the intersections. Congestion is suspected to be a primary contributor.

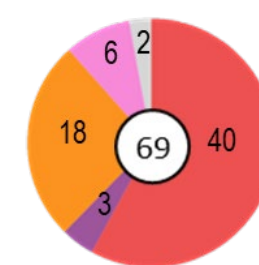


The existing sidewalk along the south side does not meet the minimum width requirements for ADA compliance.

CRASH TYPES (2015 – 2019):



Shoppers Best Way



Worth Avenue



Rear-end Crashes



Angle Crashes



Sideswipe



Deer



Head on



Fixed Object



Others



Number of Crashes

Figure 10: Shoppers Best Way and Worth Avenue Operations and Safety Needs and Diagnosis

Telegraph Road and Crossing Place Operation and Safety Needs and Diagnosis Summary:



Westbound congestion and queueing at Telegraph Road due to left turn lane spill over during PM peak, northbound and southbound congestion and queueing during both peaks.

Westbound congestion and queueing at Crossing Place during PM peak.

Eastbound and westbound left turns operate with excessive delays during both peaks.

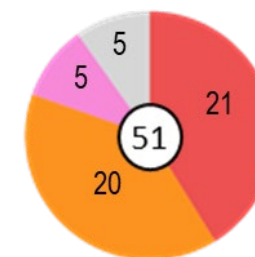


Angle and rear-end crashes at the intersections. Congestion is suspected to be a primary contributor. High number of crashes along westbound approach at Crossing Place. One pedestrian crash was reported in the Telegraph Road south leg crosswalk. One pedestrian crash was reported east of the Telegraph Road intersection.

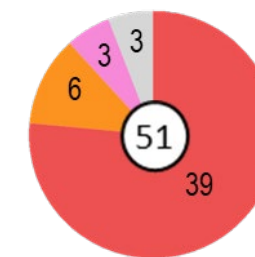


The existing sidewalk along the south side does not meet the minimum width requirements for ADA compliance.

CRASH TYPES (2015 – 2019):



Telegraph Road



Crossing Place



Rear-end Crashes



Angle Crashes



Sideswipe



Deer



Head on



Fixed Object



Others



Number of Crashes

Figure 11: Telegraph Road and Crossing Place Operations and Safety Needs and Diagnosis

Rail, Transit, and TDM:

With support from DRPT, the study team reviewed the existing rail infrastructure, Park and Ride locations, and public transit routes in the study area. Park and Ride locations within the study area range between 2.5 and 5.5 miles to the west and from 0.5 and 0.7 miles to the north of the project limits as shown in **Figure 12**.

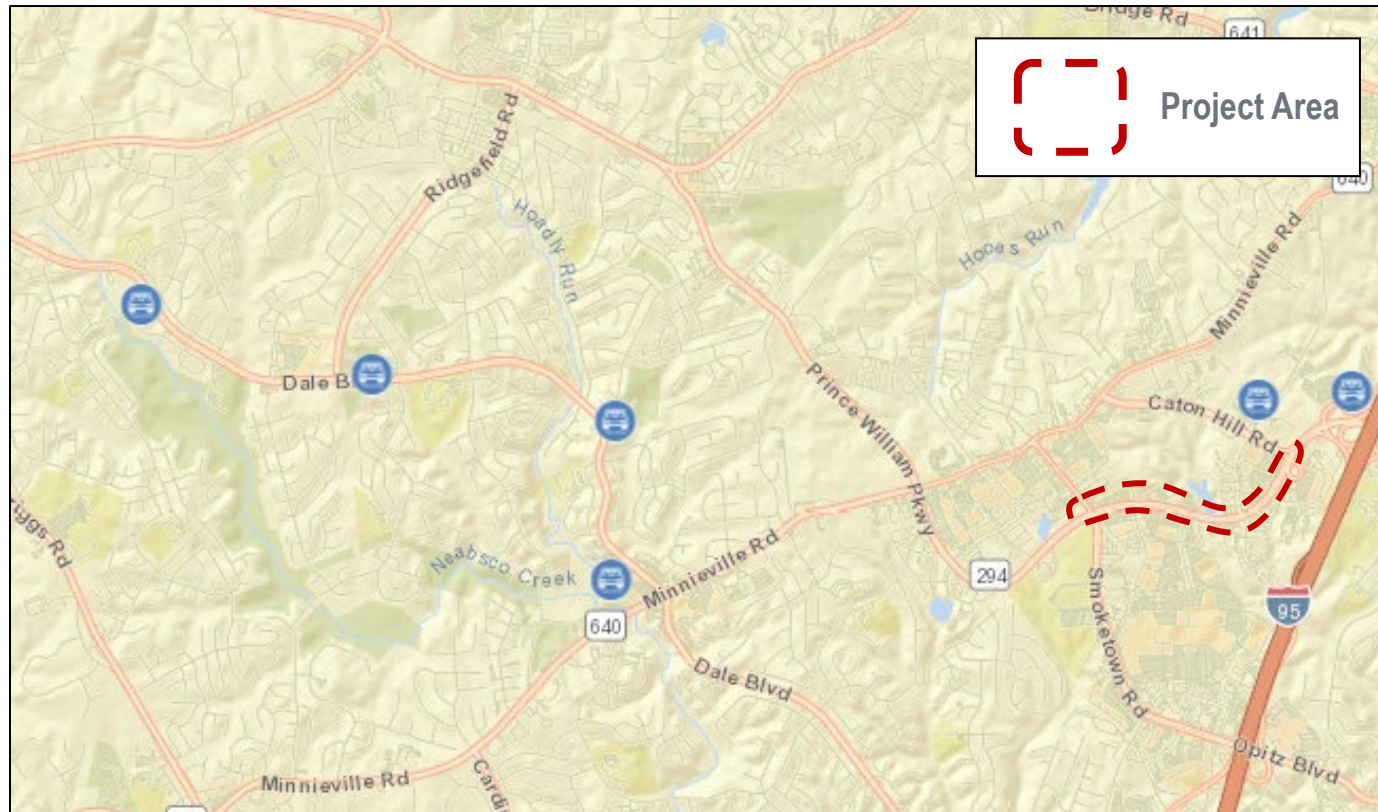


Figure 12: Existing Park and Ride Locations in the Study Area

Table 6 shows the existing Park and Ride characteristics, capacity and utilization rate.

Table 6: Existing Park and Ride Locations Data

Park and Ride Location	Characteristics	Capacity	Utilization
Princedale Park & Ride	Paved and partially lit	38 spaces (none marked as ADA)	30%
Lindendale Park & Ride	Lit and paved	216 spaces (10 marked as ADA)	1%
Hillendale Park & Ride	Lit and paved	248 spaces (8 marked as ADA)	12%
Dale City Park & Ride	Lit and paved	591 spaces (9 marked as ADA)	9%
Telegraph Park & Ride	Lit and paved	700 spaces (22 marked as ADA)	100%*
Horner Park & Ride	Lit and paved	2,363 spaces	85%*

* Per 2016 VDOT Survey

The rail, transit, and TDM needs identified by the study team are presented in **Figure 13**.

Rail, Transit, and TDM Needs and Diagnosis Summary:



Existing Conditions







-  No rail infrastructure
-  OmniRide, Commuter Connections, and DRPT Programs (vanpool, carpool, etc.)
-  Telegraph and Horner Road PNR lots are northeast of corridor and served by buses that use the corridor
-  None
-  OmniRide PWME, E-W Express, Dale City Express, Woodbridge/Lake Ridge Local use portions of corridor
-  No stops directly on corridor; stops on Telegraph Road and Worth Avenue are closest stops to corridor

Figure 13: Rail, Transit, and TDM Needs and Diagnosis

Chapter 2:

Alternative Development and Refinement

Alternative Development and Screening:

In order to develop alternative concepts to address the needs and incorporate the diagnosis identified in Chapter 1, a thorough review of the existing conditions data was conducted. A screening-level analysis was performed in Synchro on potential alternative options at the study intersections. For the intersections of Smoketown Road, Telegraph Road and Crossing Place, a VJuST analysis was completed prior to the Synchro analyses to consider alternative intersection designs and compare their potential operational and safety benefits to the conventional intersection. VJuST is a screening tool that helps in the decision-making process of identifying innovative intersection and interchange configurations that are most appropriate in reducing congestion and improving safety to advance to further study, analysis, and design. The inputs and analysis methodologies are consistent with the VDOT TOSAM guidelines. For the purposes of alternative testing and screening, the AM and PM peak hour Synchro analyses were performed for the existing year 2021. The analyses conducted are discussed in greater detail in the following section. As mentioned before, no future year analysis was performed based on the study framework/scoping document.

VJuST Analysis

In order to address operational and capacity needs, a VJuST analysis was completed for the subject intersections to consider alternative intersection designs and evaluate their potential benefits. VJuST analysis does not consider the influence of adjacent intersections on traffic patterns. Therefore, it was conducted for screening purposes only with detailed analyses performed using Synchro. VJuST analysis was performed for the intersections for Smoketown Road, Telegraph Road and Crossing Place. Some alternative design options were not feasible for the roadway type at the subject intersection; hence, only the ones deemed most feasible were considered. The analysis is explained in greater detail in the following sections. VJuST worksheets for the AM and PM peak hours are provided in **Appendix F**.

Route 294 and Smoketown Road VJuST Analysis

Table 7 presents the alternative designs considered at the Route 294 and Smoketown Road intersection and their results compared to the conventional intersection as it exists today. The VJuST analysis results show that during the PM peak hour, which is more critical than the AM peak hour for this intersection, the alternative designs do not provide significant benefits that would justify their cost and impact on the area.

Table 7: Route 294 and Smoketown Road VJuST Analysis Summary

Type	Congestion		Pedestrian	Safety
	Maximum V/C		Accommodation Compared to Conventional	Weighted Total Conflict Points
	AM	PM		
Conventional	0.75	0.76		48
Center Turn Overpass	0.61	0.69	+	32
Echelon	0.67	0.75	+	28
Full Displaced Left Turn	0.58	0.61	-	40
Partial Displaced Left Turn	0.62	0.72	-	44
Split Intersection	0.79	0.96		36

Route 294 and Telegraph Road VJuST Analysis

Table 8 presents the alternative designs considered at the Route 294 and Telegraph Road intersection and their results compared to the conventional intersection as it exists today. The VJuST analysis results show that the alternative designs do not provide significant benefits that would justify their cost and impact on the area.

Table 8: Route 294 and Telegraph Road VJuST Analysis Summary

Type	Dir	Congestion		Pedestrian	Safety
		Maximum V/C		Accommodation Compared to Conventional	Weighted Total Conflict Points
		AM	PM		
Conventional	-	0.70	0.78		48
Bowtie	-	0.68	0.84	+	24
Median U-Turn	-	0.70	0.80	+	20
Partial Median U-Turn	-	0.70	0.75	+	28
Quadrant Roadway	N-E	0.65	0.82		40

Route 294 and Crossing Place VJuST Analysis

Table 9 presents the alternative designs considered at the Route 294 and Crossing Place intersection and their results compared to the conventional intersection as it exists today. It should be noted that a thru-cut was considered at this location because of the low side street volumes and the operational and safety benefits that it provides. As explained later in this report, it was determined that a thru-cut would be the preferred alternative for this intersection.

Table 9: Route 294 and Crossing Place VJuST Analysis Summary

Type	Dir	Congestion		Pedestrian	Safety
		Maximum V/C		Accommodation Compared to Conventional	Weighted Total Conflict Points
		AM	PM		
Conventional	-	0.58	0.67		48
Bowtie	-	0.87	0.72	+	24
Echelon	-	0.55	0.58	+	28
Full Displaced Left Turn	-	0.56	0.62	-	40
Median U-Turn	-	0.93	0.79	+	20
Partial Median U-Turn	-	0.89	0.74	+	28
Quadrant Roadway	N-W	0.59	0.72		40
Thru-Cut	-	1.37	0.72		28

Alternative Analysis

Based on the findings from the existing conditions analyses performed for the study area, and the VJuST analysis completed for the intersections of Smoketown Road, Telegraph Road and Crossing Place, potential alternative options were developed and a screening-level Synchro analysis was performed at the study intersections for the 2021 AM and PM peak hours. Alternative development and screening results are discussed for each study intersection in the following sections.

Route 294 and Smoketown Road Synchro Analysis

As previously mentioned, the critical movements at the Route 294 and Smoketown Road intersection were identified as the eastbound through and right turn movements. Therefore, three different conventional options with improved traffic flow for the eastbound right turn movement were evaluated at the subject intersection. Option 1 would extend the eastbound right turn lane to contain the eastbound right turn queue and reduce the spill over to the main line. Option 2 would convert the eastbound right to a channelized free flow movement with a receiving lane along Smoketown Road in the southbound direction. Option 3 would convert the eastbound right to a dual right turn lane operating with a traffic signal. All these options include elements that would improve safety and accessibility at this intersection.

Table 10 presents the year 2021 AM and PM peak hour Synchro analysis results at this intersection. It should be noted that HCM 2000 reports from Synchro do not take the Option 1 extended right turn lane effect into their calculations. Therefore, no Synchro analysis results are shown for Option 1 as it would be identical to the existing condition with respect to operations. Based on the analysis results, Options 2 and 3 are anticipated to significantly improve delays and queues for the eastbound right movement. A summary of the proposed improvements is shown in **Figure 14**.

Table 10: 2021 Alternative Screening Synchro Analysis Results at Route 294 and Smoketown Road

Traffic Control	Intersection	Approach	Movement	COVID Adjusted 2021 (Estimated September 2019)								Option 2								Option 3							
				Existing AM				Existing PM				Existing AM				Existing PM				Existing AM				Existing PM			
				LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)		LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)		LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)	
						95% Queues ³	Available Storage			95% Queues	Available Storage			95% Queues ³	Available Storage			95% Queues	Available Storage			95% Queues ³	Available Storage			95% Queues	Available Storage
Signalized	Prince William Pkwy & Smoketown Rd	EB	L	F	90.2	20	400	F	96.8	60	400	F	90.2	20	400	F	96.8	60	400	F	90.2	20	400	F	96.8	60	400
			T	D	35.7	975	-	D	44.8	515	-	D	35.7	975	-	D	44.8	515	-	D	35.7	975	-	D	44.8	515	-
			R	B	18.5	540	375	C	32.7	905	375	A	1.1	0	375	A	1.1	0	375	A	9.9	230	375	B	18.6	375	375
			Overall	C	31.7	-	-	D	41.3	-	-	C	27.5	-	-	C	28.9	-	-	C	29.6	-	-	D	35.8	-	-
		WB	L	F	96.8	#160	385	F	118.0	175	385	F	96.8	#160	385	F	118.0	175	385	F	96.8	#160	385	F	118.0	175	385
			T	C	29.7	255	-	C	29.8	750	-	C	29.7	255	-	C	29.8	750	-	C	29.7	255	-	C	29.8	750	-
			R	C	32.5	25	-	A	5.9	150	-	C	32.5	25	-	A	5.9	150	-	C	32.5	25	-	A	5.9	150	-
			Overall	D	40.6	-	-	C	33.0	-	-	D	40.6	-	-	C	33.0	-	-	D	40.6	-	-	C	33.0	-	-
		NB	L	F	85.6	250	465	F	157.4	#700	465	F	85.6	250	465	F	157.4	#700	465	F	85.6	250	465	F	157.4	#700	465
			T	E	80.0	195	-	E	76.4	360	-	E	80.0	195	-	E	76.4	360	-	E	80.0	195	-	E	76.4	360	-
			R	E	63.6	60	300	E	55.3	140	300	E	63.6	60	300	E	55.3	140	300	E	63.6	60	300	E	55.3	140	300
			Overall	F	80.6	-	-	F	111.5	-	-	F	80.6	-	-	F	111.5	-	-	F	80.6	-	-	F	111.5	-	-
		SB	L	F	85.2	200	370	F	98.6	370	370	F	85.2	200	370	F	98.6	370	370	F	85.2	200	370	F	98.6	370	370
			T	E	79.7	135	-	F	86.6	345	-	E	79.7	135	-	F	86.6	345	-	E	79.7	135	-	F	86.6	345	-
			R	E	72.1	0	190	E	65.0	0	190	E	72.1	0	190	E	65.0	0	190	E	72.1	0	190	E	65.0	0	190
			Overall	F	82.4	-	-	F	90.8	-	-	F	82.4	-	-	F	90.8	-	-	F	82.4	-	-	F	90.8	-	-
		Intersection Overall		D	45.2	-	-	E	61.9	-	-	D	42.7	-	-	E	58.5	-	-	D	43.9	-	-	E	60.4	-	-

¹ Level of Service (LOS) is obtained from Synchro per HCM 2000 criteria

² Delay is expressed as Seconds per Vehicle

³ Queues obtained from Synchro queueing output

⁴ Worst approach delay and LOS reported as the overall unsignalized intersection operation

95th percentile volume exceeds capacity, queue may be longer

The 95th percentile queues highlighted in pink represent those exceeding the available storage facility



Vehicular Congestion Mitigation

- Extend the eastbound right turn lane to contain the eastbound right turn queue which will reduce eastbound congestion (Option 1).
- Free flow eastbound right turn lane with 4th receiving lane to largely remove eastbound right turn queue which will reduce eastbound congestion (Option 2).
- Dual right turn lane with no RTOR will mitigate eastbound congestion (Option 3).



Safety Improvements

- All options are expected to improve eastbound right turn crashes since they improve the operations for this movement.



Multimodal Accessibility

- High visibility and shorter crosswalks at Smoketown Road intersection to improve pedestrian visibility and safety.
- Pedestrians crossing the west and south legs of Smoketown Road intersection will be accommodated in two stages (Option 2 & 3).

Figure 14: Smoketown Road Eastbound Right Improvement Options

Route 294 and Shoppers Best Way Synchro Analysis

A thru-cut option was considered at the intersection of Route 294 and Shoppers Best Way, as the side street through movement volumes were lower than 35 during the AM and PM peak hours. Based on the Synchro analysis results, it was determined that the thru-cut intersection would provide a cost effective solution and improve safety and efficiency without having a significant adverse impact on the side street through movement operations. The diagonal mainline crossing included as part of this alternative allows for the removal of left turning vehicular conflicts with pedestrians during concurrent side street operations and improves visibility for pedestrians in conflict with right turning vehicles. Design considerations should be made to ensure sufficient offset between the center pedestrian refuge and traffic on Route 294 for the benefit of both pedestrians and drivers.

Table 11 presents the year 2021 AM and PM peak hour Synchro analysis results at this intersection. With the thru-cut option, it is expected that the overall intersection delay would improve slightly during the AM peak hour, with the PM peak hour LOS improving from LOS D to LOS C during the PM peak hour. A summary of the proposed improvements is shown in **Figure 15**.

Table 11: 2021 Alternative Screening Synchro Analysis Results at Route 294 and Shoppers Best Way

Traffic Control	Intersection	Approach	Movement	COVID Adjusted 2021 (Estimated September 2019)								Shoppers Best Way Through-cut							
				Existing AM				Existing PM				Existing AM				Existing PM			
				LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)		LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)	
						95% Queues ³	Available Storage			95% Queues	Available Storage			95% Queues ³	Available Storage			95% Queues	Available Storage
Signalized	Prince William Pkwy & Shoppers Best Way	EB	L	F	117.2	40	380	F	102.9	#210	380	F	105.7	40	380	F	91.9	#210	380
			T	A	1.4	35	-	B	19.7	265	-	A	0.8	20	-	B	14.2	250	-
			R	A	0.2	0	410	D	44.4	85	410	A	0.2	0	410	D	41.2	90	410
			Overall	A	2.3	-	-	C	29.8	-	-	A	1.7	-	-	C	24.8	-	-
		WB	L	F	81.5	50	355	F	125.0	160	355	E	74.8	50	355	F	111.3	160	355
			T	A	6.0	60	-	B	13.7	435	-	A	3.5	60	-	A	8.4	160	-
			R	A	5.1	0	400	A	1.1	0	400	A	1.3	0	400	A	0.0	0	400
			Overall	A	9.1	-	-	C	21.5	-	-	A	6.4	-	-	B	15.5	-	-
		NB	L	F	84.3	80	175	F	93.2	325	175	F	84.3	80	175	F	92.2	325	175
			T	E	75.8	10	-	E	77.8	80	-	-	-	-	-	-	-	-	-
			R	E	70.3	35	-	E	67.2	125	-	E	77.8	90	-	E	68.1	220	-
			Overall	E	78.7	-	-	F	86.5	-	-	F	81.6	-	-	F	85.4	-	-
		SB	L	F	103.7	20	150	F	104.4	150	150	F	80.6	20	150	E	76.7	135	150
			T	F	85.0	25	-	F	95.6	85	-	-	-	-	-	-	-	-	-
			R	F	84.0	0	175	F	91.6	0	175	F	80.3	0	175	E	73.9	45	175
			Overall	F	88.8	-	-	F	97.7	-	-	F	80.4	-	-	E	75.0	-	-
		Intersection Overall		A	7.2	-	-	D	35.2	-	-	A	6.1	-	-	C	29.4	-	-

¹ Level of Service (LOS) is obtained from Synchro per HCM 2000 criteria

² Delay is expressed as Seconds per Vehicle

³ Queues obtained from Synchro queueing output

⁴ Worst approach delay and LOS reported as the overall unsignalized intersection operation

95th percentile volume exceeds capacity, queue may be longer

The 95th percentile queues highlighted in pink represent those exceeding the available storage facility



Vehicular Congestion Mitigation

- Convert Shoppers Best Way intersection to a thru-cut intersection to reduce signal phases, which improves signal efficiency and reduces congestion and queueing.
- The through traffic volumes along Shoppers Best Way / Best Buy Entrance during the peak travel periods are less than 35 per hour.



Safety Improvements

- Converting the Shoppers Best Way intersection to a thru-cut reduces the number of intersection conflict points, improves mainline traffic flow and reduces potential for angle and rear-end crashes.



Multimodal Accessibility

- Provide high visibility diagonal crosswalk with refuge island across Shoppers Best Way intersection. Diagonal crosswalks improve pedestrian visibility.

Figure 15: Shoppers Best Way Thru-Cut

Route 294 and Telegraph Road Synchro Analysis

As previously mentioned, the westbound left turn at the Route 294 and Telegraph Road intersection operates with excessive queues that would spill over during the PM peak hour. An option was considered that converts the westbound left turn at Telegraph Road from one to two lanes to provide additional capacity and sufficient storage length. Geometric modifications to the existing curb and sidewalk in the southwestern quadrant would be required to allow for two sufficiently wide receiving lanes with appropriate turning paths from the dual turn lanes.

Table 12 presents the AM and PM peak hour Synchro analysis results at the Route 294 and Telegraph Road intersection, comparing 2021 existing conditions to the westbound dual left turn lane scenario. The analysis shows that this option is expected to address the westbound left turn queue spill over during the PM peak hour. It will also improve the eastbound through movement from LOS B to LOS A during the AM peak hour and LOS D to LOS C during the PM peak hour. The overall intersection operations are also expected to improve for both peak hours. A summary of the proposed improvements is shown in **Figure 16**.

Table 12: 2021 Alternative Screening Synchro Analysis Results at Route 294 and Telegraph Road

Traffic Control	Intersection	Approach	Movement	COVID Adjusted 2021 (Estimated September 2019)								Telegraph Rd Double WBL							
				Existing AM				Existing PM				Existing AM				Existing PM			
				LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)		LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)	
						95% Queues ³	Available Storage			95% Queues	Available Storage			95% Queues ³	Available Storage			95% Queues	Available Storage
Signalized	Prince William Pkwy & Telegraph Rd	EB	L	F	113.9	185	375	F	115.9	#440	375	F	113.9	185	375	F	115.9	#440	375
			T	B	10.9	760	-	D	43.8	580	-	A	6.7	420	-	C	33.6	555	-
			R	A	6.1	5	550	F	292.9	40	550	B	11.1	0	550	F	266.8	40	550
			Overall	B	15.0	-	-	E	66.2	-	-	A	3.1	-	-	E	56.1	-	-
		WB	L	F	121.5	220	425	F	128.6	510	425	F	105.6	115	365	F	120.0	300	365
			T	B	11.3	85	-	B	17.5	650	-	B	11.3	85	-	B	17.5	650	-
			R	B	15.9	0	430	A	0.1	0	430	B	15.9	0	430	A	0.1	0	430
			Overall	C	23.0	-	-	C	30.6	-	-	C	21.4	-	-	C	29.6	-	-
		NB	L	E	79.0	85	290	F	99.8	195	290	E	79.0	85	290	F	99.8	195	290
			T	F	84.7	150	-	F	97.2	190	-	F	84.7	150	-	F	97.2	190	-
			R	E	77.3	90	310	F	85.9	105	310	E	78.6	115	310	F	85.9	105	310
			Overall	F	80.5	-	-	F	92.3	-	-	F	81.2	-	-	F	92.3	-	-
		SB	L	F	89.2	135	250	F	86.2	145	250	F	89.2	135	250	F	86.2	145	250
			T	F	81.1	95	-	F	94.9	220	-	F	81.1	95	-	F	94.9	220	-
			R	E	77.9	0	-	F	82.8	95	-	E	77.9	0	-	F	82.8	95	-
			Overall	F	82.6	-	-	F	88.8	-	-	F	82.6	-	-	F	88.8	-	-
		Intersection Overall		C	27.0	-	-	D	53.6	-	-	C	24.3	-	-	D	49.9	-	-

¹ Level of Service (LOS) is obtained from Synchro per HCM 2000 criteria

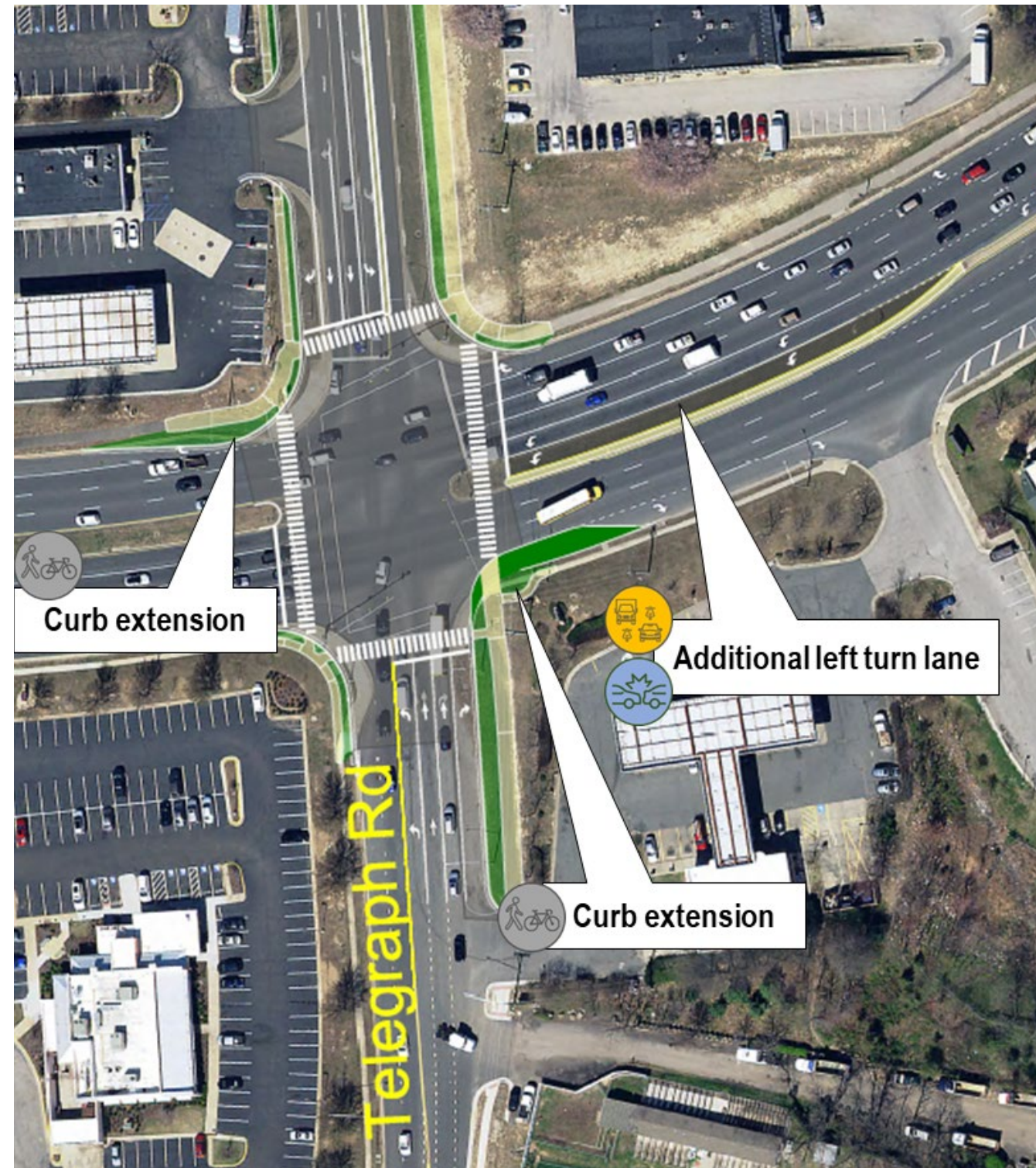
² Delay is expressed as Seconds per Vehicle

³ Queues obtained from Synchro queueing output

⁴ Worst approach delay and LOS reported as the overall unsignalized intersection operation

95th percentile volume exceeds capacity, queue may be longer

The 95th percentile queues highlighted in pink represent those exceeding the available storage facility



Vehicular Congestion Mitigation

- Westbound dual left turn lanes gives more capacity for the left turn which in turn gives more efficiency to the eastbound through movement.
- Final engineering is underway for the Prince William County planned improvements along Telegraph Road with an anticipated construction completion of Winter 2023. These improvements include widening Telegraph Road to two lanes in each direction and adding dedicated turn lanes at the Prince William Parkway and Caton Hill Road intersections.



Safety Improvements

- Reduced congestion and queueing will result in fewer rear end collisions.



Multimodal Accessibility

- High visibility and shorter crosswalks at Telegraph Road intersection to improve pedestrian visibility and safety.

Figure 16: Telegraph Road Double Westbound Left Turn Lanes

Route 294 and Telegraph Road Previously Considered Option

A Bowtie intersection was proposed at Telegraph Road where the northbound left and southbound left movements were closed and the left turning vehicles would use the roundabouts provided on the north and south legs to reach their destination. This option was ruled out since the required roundabout sizes were too impactful and did not justify the costs. Therefore, no Synchro analysis results are provided for this option. A concept sketch of this option is shown in **Figure 17**.



Figure 17: Telegraph Road Bowtie

Route 294 and Crossing Place Synchro Analysis

To improve the overall operations and safety at the intersection of Route 294 and Crossing Place two options were considered. This intersection currently runs with split phasing signal operations for the side streets. Option 1 would convert the signal operations at the intersection to eight-phase (concurrent phase for side streets) and restripe the middle lane for the northbound direction from left-through to through only. Option 2 would convert the intersection to a thru-cut as the side street through movement volumes were lower than 40 during the AM and PM peak hours. It was determined that the thru-cut intersection would provide a cost effective solution and improve safety and efficiency without having a significant adverse impact on the side street through volumes.

Due to the relatively low volume of side street through volumes, the impact on the adjacent signalized intersections is expected to be minimal. Route 294 and Telegraph Road was evaluated for impacts due to the rerouted traffic. An increase in the PM peak hour westbound left turn queue at Telegraph Road from 510' to 620' was noted in the Synchro results. While both the existing and alternative queue exceed the existing 425' storage for this movement, the proposed modification to a dual left turn lane at the intersection would mitigate these queues. Impacts on delay for both the left turn movement and overall intersection are expected to be negligible. No evaluation has been provided for the intersection of Route 294 and I-95 Southbound/Park and Ride Lot because it is outside of the study area.

Table 13 presents the year 2021 AM and PM peak hour Synchro analysis results at this intersection. Both options are expected to improve the operations while the thru-cut improvements are more significant. Option 2 is expected to improve the overall intersection delay from LOS B to LOS A during the AM peak hour and from LOS D to LOS C during the PM peak hour. A summary of the proposed improvements is shown in **Figure 18**.

Table 13: 2021 Alternative Screening Synchro Analysis Results at Route 294 and Crossing Place

Traffic Control	Intersection	Approach	Movement	COVID Adjusted 2021 (Estimated September 2019)								Option 1 (Crossing PI Eight-Phase)								Option 2 (Crossing PI Through-cut))							
				Existing AM				Existing PM				Existing AM				Existing PM				Existing AM				Existing PM			
				LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)		LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)		LOS ¹	Delay ²	Queues (ft)		LOS	Delay	Queues (ft)	
						95% Queues ³	Available Storage			95% Queues	Available Storage			95% Queues ³	Available Storage			95% Queues	Available Storage			95% Queues ³	Available Storage			95% Queues	Available Storage
Signalized	Prince William Pkwy & Crossing PI	EB	L	F	103.0	55	410	F	110.9	#330	410	F	96.3	55	410	F	98.2	265	410	F	86.7	55	410	F	112.5	#330	410
			T	A	2.8	85	-	B	15.5	255	-	A	2.4	80	-	B	13.8	255	-	A	1.7	80	-	A	3.9	265	-
			R	A	0.1	0	315	B	16.8	30	315	A	0.1	0	315	B	15.9	30	315	A	0.1	0	315	A	0.3	80	315
			Overall	A	4.0	-	-	C	22.6	-	-	A	3.5	-	-	C	20.2	-	-	A	2.7	-	-	B	11.5	-	-
		WB	L	F	83.9	95	355	F	97.8	175	355	F	83.9	95	355	F	95.5	175	355	F	83.9	95	355	F	95.5	175	355
			T	B	10.6	240	-	D	38.2	995	-	A	9.0	210	-	C	33.2	995	-	A	5.8	165	-	C	24.4	875	-
			R	A	8.3	0	675	C	20.2	0	675	A	7.0	0	675	B	17.7	0	675	A	4.6	0	675	B	13.4	25	675
			Overall	B	17.2	-	-	D	42.5	-	-	B	15.7	-	-	D	37.7	-	-	B	12.8	-	-	C	29.4	-	-
		NB	L	F	88.3	70	-	F	103.2	235	-	E	76.3	85	-	F	86.1	305	-	F	84.1	90	-	F	100.4	340	-
			LT	F	87.0	70	-	F	96.4	235	-	F	84.4	35	-	F	86.6	90	-	-	-	-	-	-	-	-	-
			R	E	73.1	15	-	E	69.2	45	-	E	73.3	25	-	E	70.5	50	-	E	72.5	85	-	E	65.0	145	-
			Overall	F	80.8	-	-	F	92.6	-	-	E	75.8	-	-	F	82.5	-	-	E	77.4	-	-	F	87.7	-	-
		SB	LT	F	92.2	115	-	F	110.9	#305	-	F	81.6	105	-	F	82.8	225	-	F	86.4	110	-	F	82.3	245	-
			R	E	73.2	0	175	E	68.5	185	175	F	86.8	35	175	F	94.8	120	175	E	72.5	20	175	E	62.7	225	175
			Overall	F	88.6	-	-	F	90.0	-	-	F	82.8	-	-	F	89.5	-	-	F	83.2	-	-	E	71.4	-	-
		Intersection Overall		B	11.0	-	-	D	41.5	-	-	B	10.1	-	-	D	37.5	-	-	A	8.8	-	-	C	29.2	-	-

¹ Level of Service (LOS) is obtained from Synchro per HCM 2000 criteria

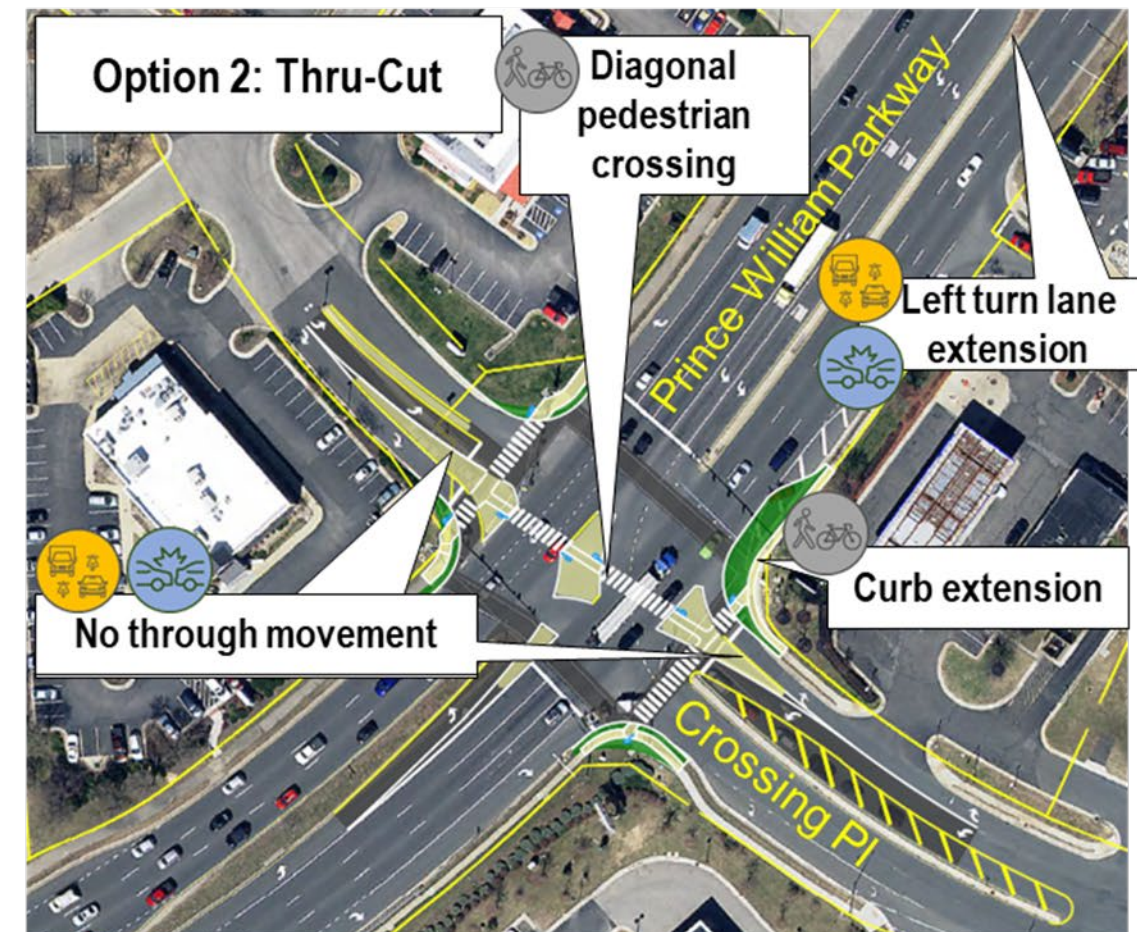
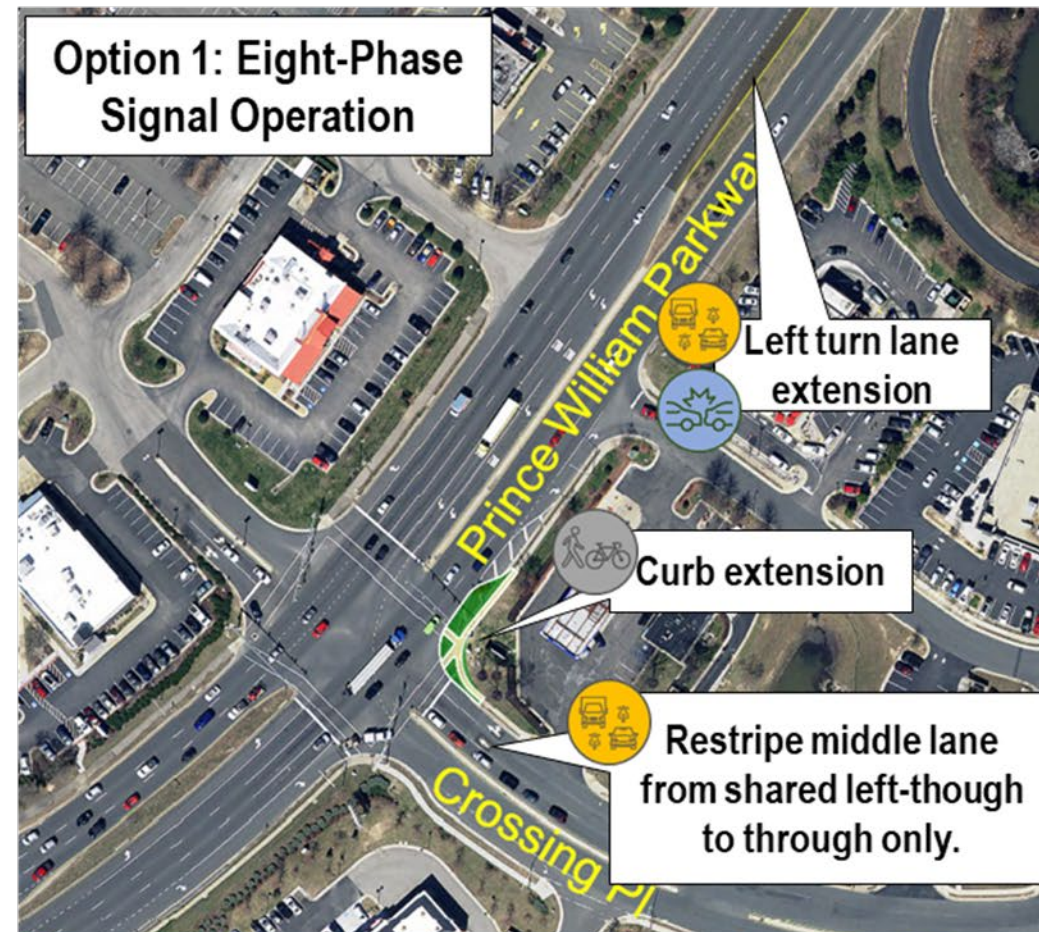
² Delay is expressed as Seconds per Vehicle

³ Queues obtained from Synchro queueing output

⁴ Worst approach delay and LOS reported as the overall unsignalized intersection operation

95th percentile volume exceeds capacity, queue may be longer

The 95th percentile queues highlighted in pink represent those exceeding the available storage facility



Vehicular Congestion Mitigation

- Convert Crossing Place intersection to 8-phase signal operations to mitigate delays and queues along westbound Prince William Pkwy (Option 1).
- Convert Crossing PI intersection to a thru-cut intersection to reduce the signal phases which improves efficiency, gives westbound movements more green time, and reduce congestion (Option 2).
- The through traffic volumes along Crossing PI during the peak hours are less than 40 per hour.



Safety Improvements

- Extend westbound left turn lane at Crossing PI intersection to mitigate westbound rear end collisions.
- Reduced westbound congestion and queuing mitigates rear end collisions (Options 1 & 2).
- Removing side street through movements reduces conflict points and will reduce angle collisions (Option 2).



Multimodal Accessibility

- Crosswalk improvements across north and south legs of Crossing Place intersection to improve pedestrian visibility.
- Provide high visibility diagonal crosswalk with refuge island across Crossing Place intersection.

Figure 18: Crossing Place Improvement Options

Route 294 and Crossing Place Previously Considered Option

Instead of a diagonal crosswalk, four crosswalks were provided along the intersection approaches at Crossing Place. There were some safety concerns with this configuration since the crosswalks on Route 294 operate concurrently with the side streets which no longer provides pedestrians with protection from side street left turning vehicles. When compared to a diagonal crosswalk, there is no conflict between the pedestrians and left turning vehicles from the side streets. Therefore, no Synchro analysis results are provided for this option. A concept sketch of this option is shown in **Figure 19**.



Figure 19: Crossing Place Thru-Cut with Four Leg Crosswalk

Chapter 3:

Public and Stakeholder Outreach and Feedback

Public Involvement:

Following the development and analysis of the alternative designs for the study intersections, a public involvement survey was developed to determine the public's response to the recommended improvements and what they perceived as the relevant issues within the study area. This survey was available online for 14 days spanning from February 2 to February 16, 2022.

Survey Design

Public involvement for this study took place in the form of an online survey developed in MetroQuest, which is an online engagement platform that is designed to educate the public while gathering informed output. The goals of this public outreach effort were to present relevant issues, educate the public on the recommended improvement concepts outlined in Chapter 2, and to receive the public's feedback on the proposed improvements.

Overall, the survey is divided into five sections, which include the following:

1. Welcome/introduction with overview of the project and study area
2. Smoketown Road Improvements
3. Shoppers Best Way and Telegraph Road Improvements
4. Crossing Place Improvements
5. Wrap up with demographic questions

The first section provides an overview of the study area and the project initiative. In the second section through fourth section, a summary of the recommended improvements and benefits was presented to the participants, as shown in **Figure 20**. For these recommended improvement concepts, participants were asked to rate them based on their opinion from one to five, one being very unfavorable, three being neutral, and five being strongly in favor. They were also provided with an option to input comments or concerns. At the end of the survey, the participants were asked a few demographic questions such as; "How do you normally travel in this area?" and "What other modes of travel would you prefer?". A total of 549 people participated in the survey and 160 comments were submitted.

Figure 20: Public Survey Layout

Survey Questions and Results

The survey results on the participants' trip purpose, current and preferred modes of travel are presented in **Figure 21** to **Figure 23**. Overall, the majority of participants live and drive their personal vehicle within the study area. Approximately 39% of participants responded that they preferred active transportation (walking/biking/transit).

What is your usual trip purpose to/from area?

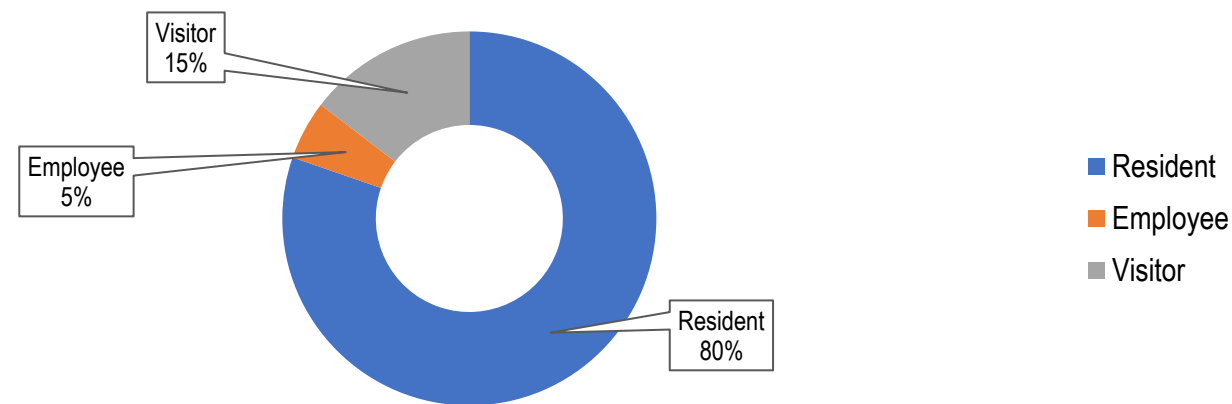


Figure 21: Participants' Trip Purpose

How do you normally travel in this area?

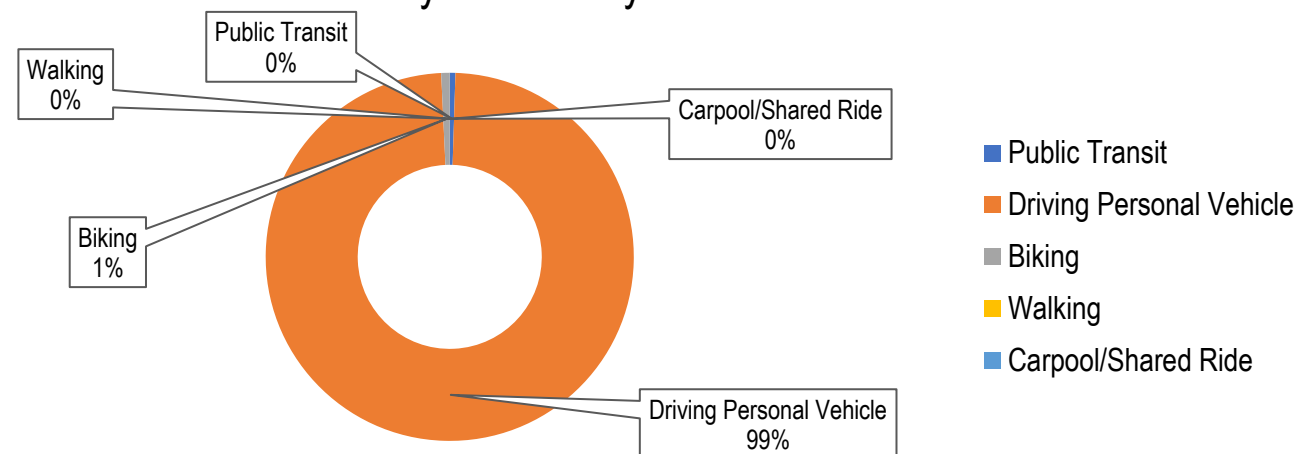


Figure 22: Participants' Current Mode of Travel

What other modes of travel would you prefer?

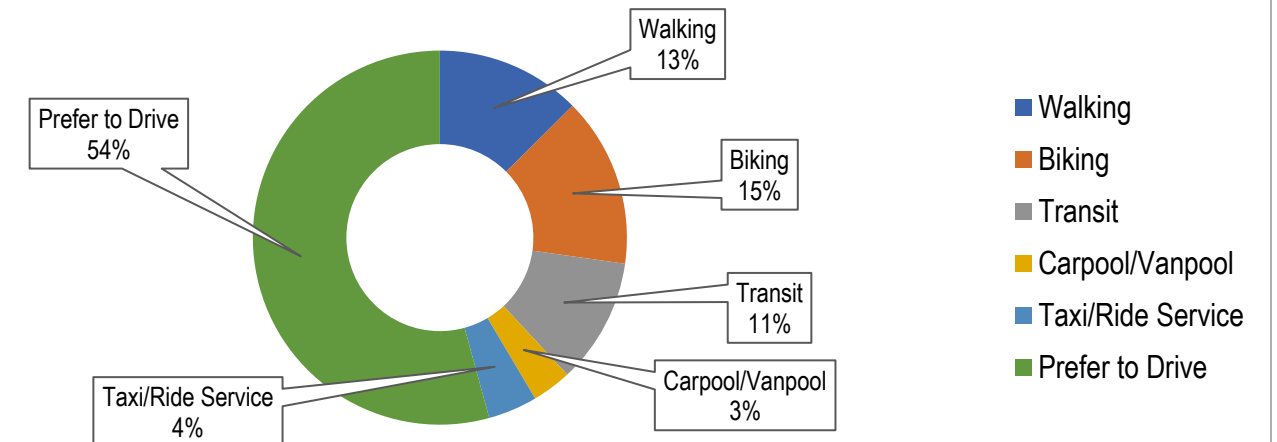


Figure 23: Participants' Preferred Mode of Travel

Next, participants were presented with the design concepts for the intersections of Smoketown Road, Shoppers Best Way, Telegraph Road and Crossing Place to rate each improvement on a scale from one to five stars. The three eastbound right turn lane alternatives at Smoketown Road along with the ratings for each alternative are presented in **Figure 24**. The thru-cut alternative at the Shoppers Best Way intersection with the participants rating for this alternative are shown in **Figure 25**. The Telegraph Road dual westbound left turn lanes with the participants rating for this alternative are shown in **Figure 26**. Finally, the eight-phase signal alternative and the thru-cut alternative at Crossing Place, along with the ratings for each alternative, are presented in **Figure 27**.

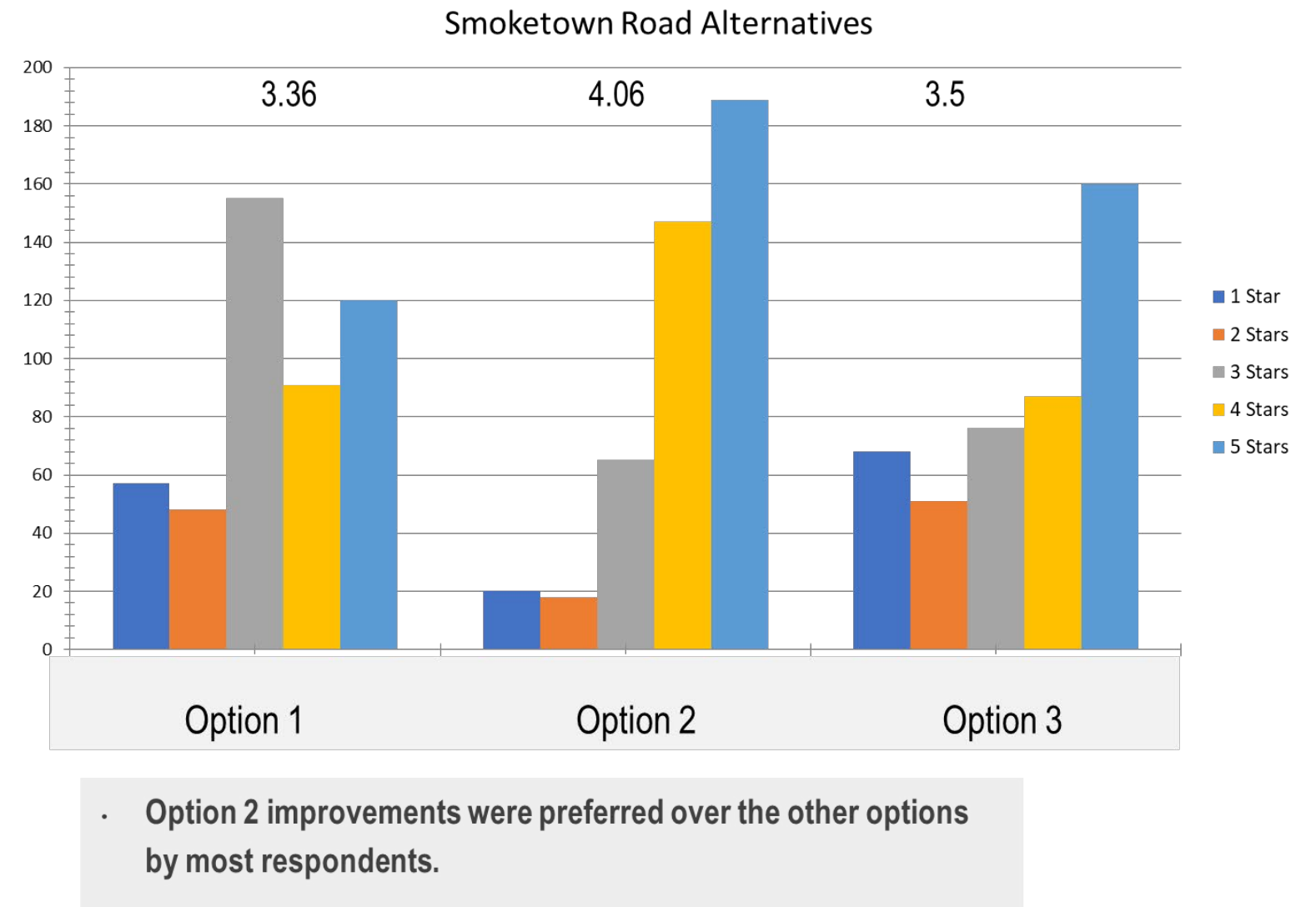


Figure 24: Smoketown Road Survey Results

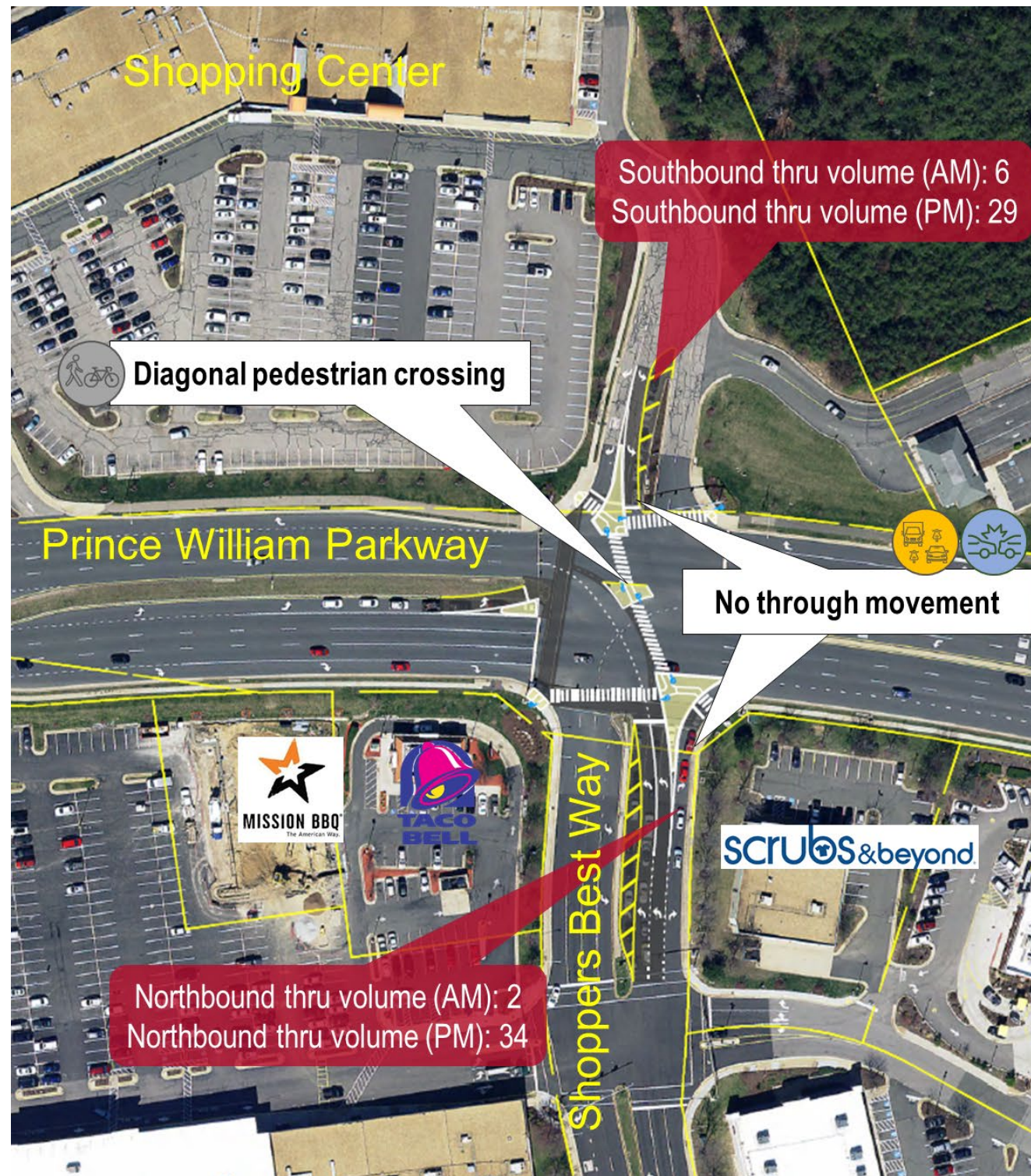


Figure 25: Shoppers Best Way Survey Results

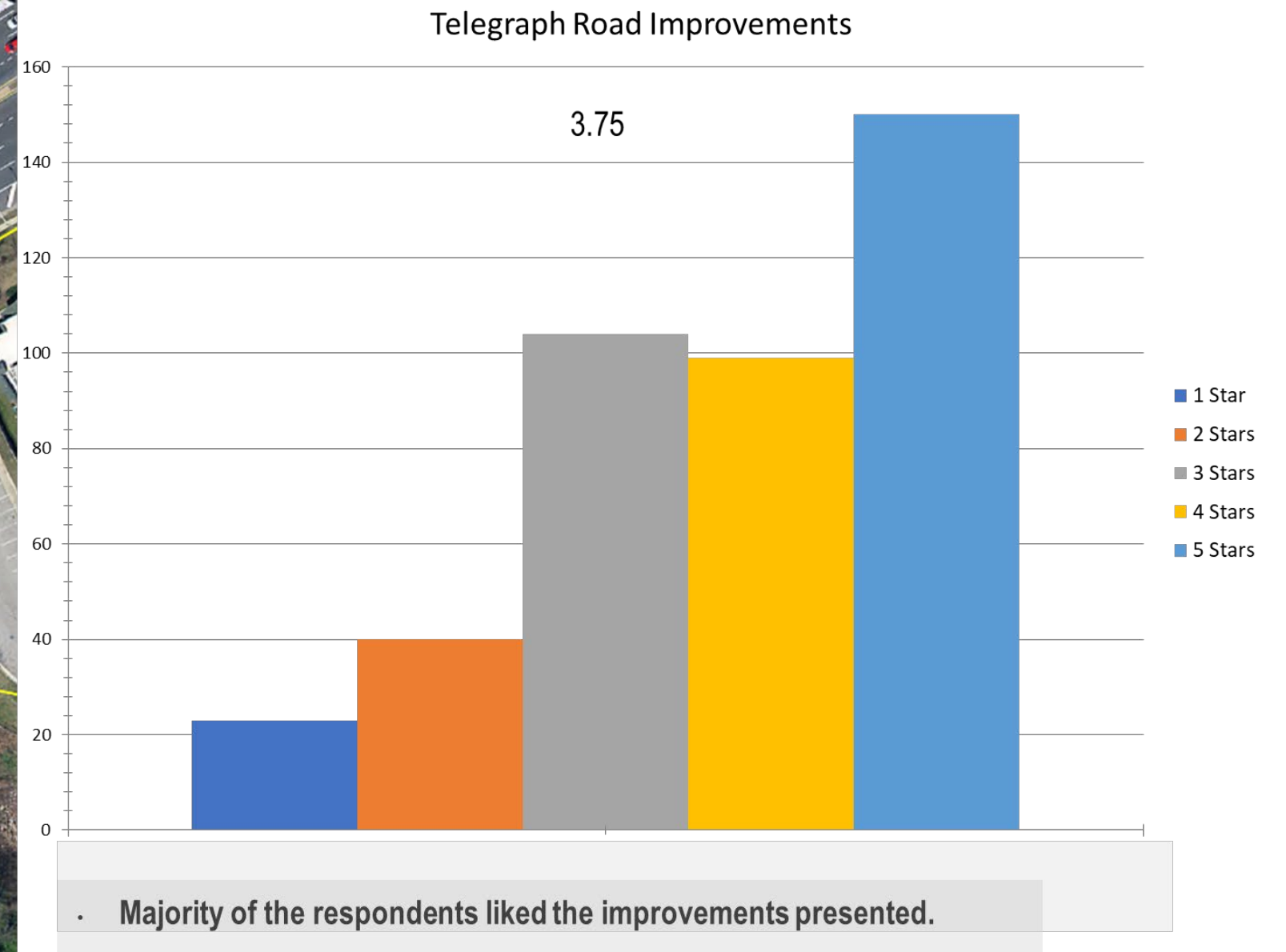
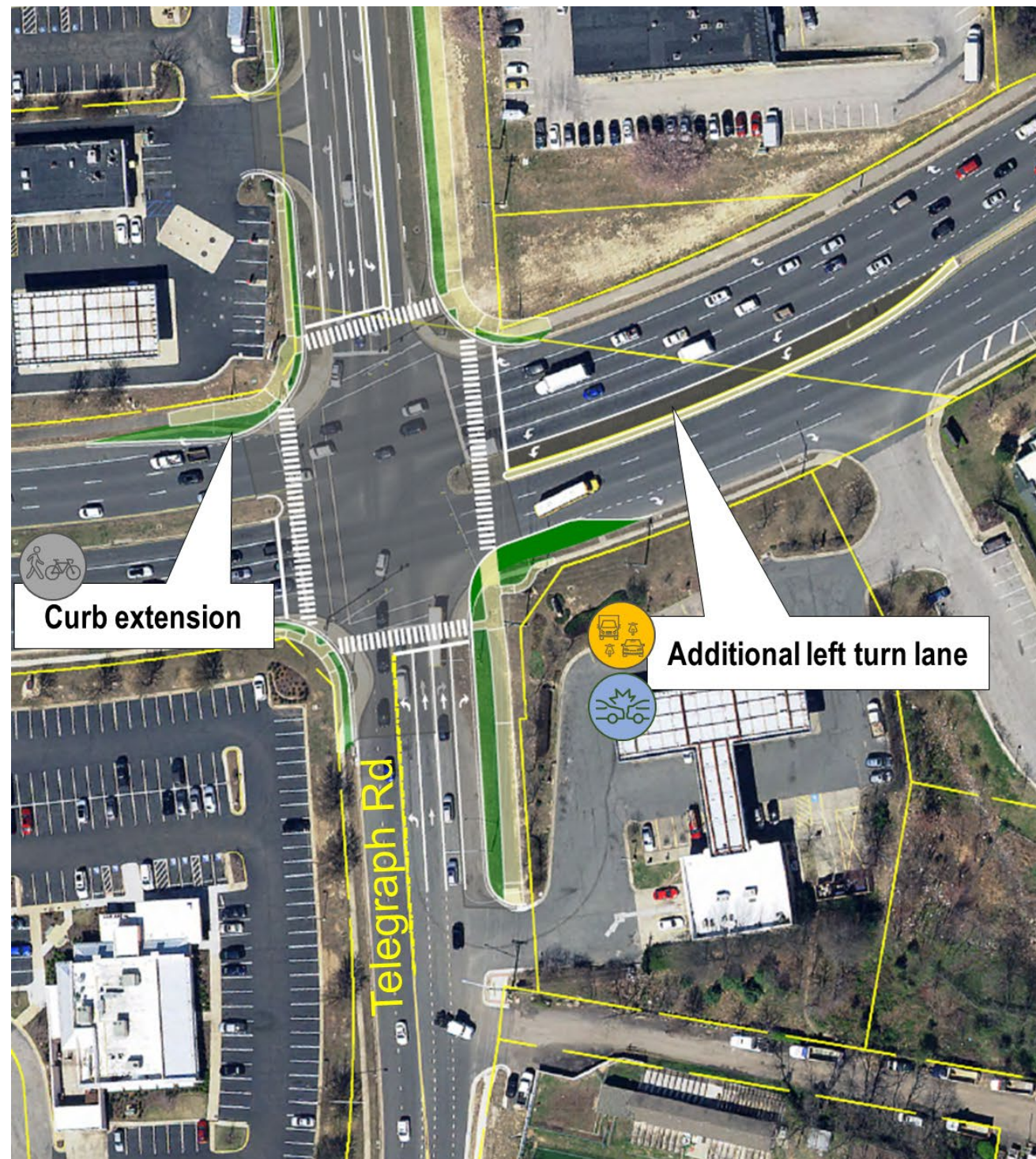
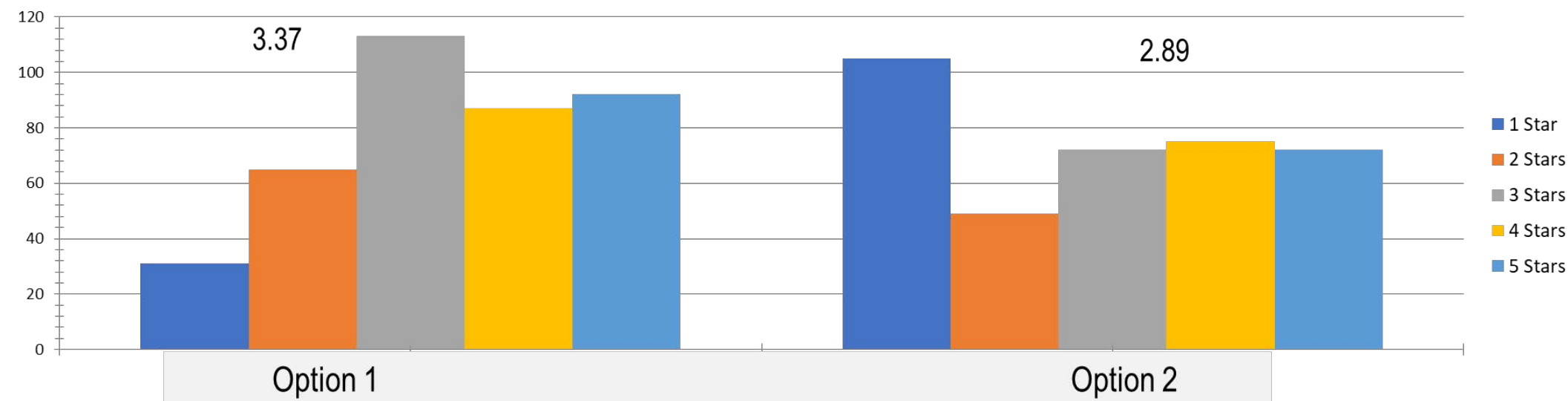
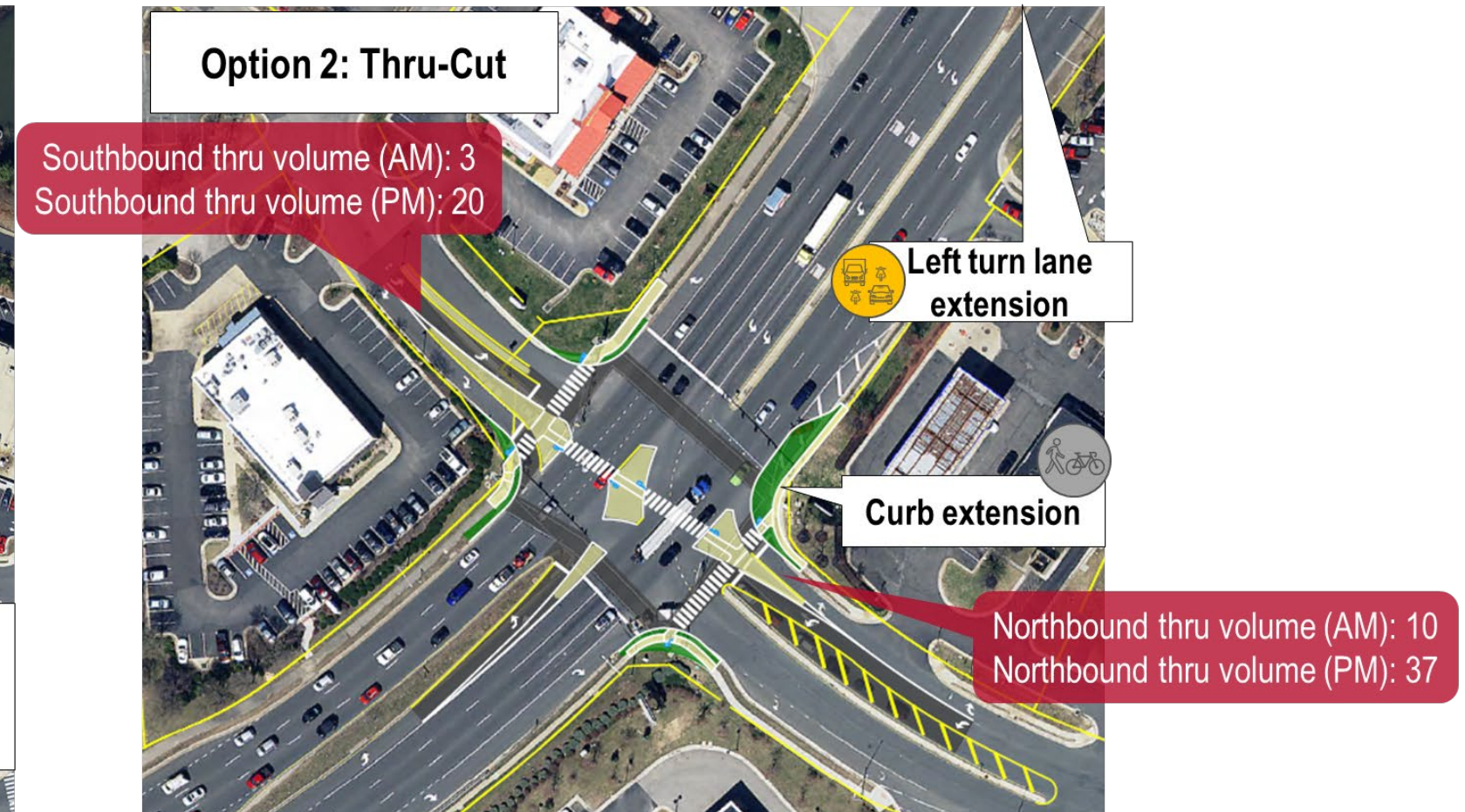
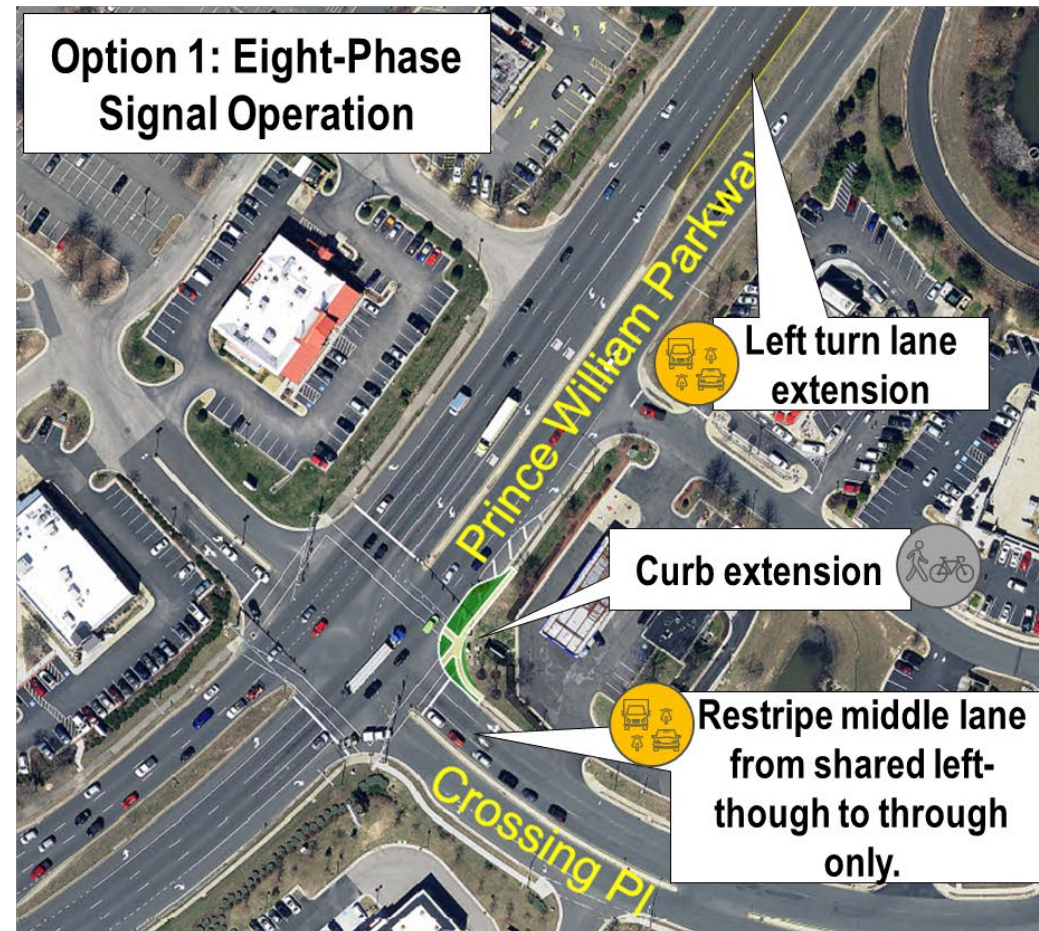


Figure 26: Telegraph Road Survey Results



Option 1 improvements were preferred over Option 2 by most respondents.

Figure 27: Crossing Place Survey Results

A summary of public comments and concerns on the Preferred Alternative improvements is shown in **Table 14**.

Table 14: Summary of Public Comments and Concerns

Public Comments and Concerns	
Smoketown Road free flow right turn lane	"This seems like the most cost-effective solution. Not as expensive as 2 right-turn lanes and keeps more traffic flowing than the first option."
Telegraph Road improvements	"Gets more traffic flowing onto Telegraph quicker which shortens delays on eastbound PWP traffic. Also not the most expensive option."
Thru-cut diagonal crossing	<p>"This looks terrifying to me. A walker would have to monitor an enormous amount of lanes for red light runners. Diagonal crossing is better for low-speed areas. Someone would get killed here."</p> <p>"The pedestrian crossing is longer and less direct. The vehicle-turning restriction would be an improvement."</p>
Thru-cut through movement restriction	"HORRIBLE! I don't care how much it seems to save traffic flow, it makes 0 sense that I can't go straight at an intersection and instead have to make 3 lefts."
Speed limits	"Diagonal crosswalks are underused but please lower the speed limit on the way up to the intersection."

Chapter 4:

Preferred Alternative Design Refinement & Investment Strategy

Preferred Alternative:

The Preferred Alternative option was developed for the study area based on the results of the analysis as discussed in the previous *Alternative Development and Screening* section (Chapter 2), and *Public and Stakeholders Feedback* (Chapter 3). A summary of all the options, including the proposed alternatives and the previously considered options, is explained in **Table 15**. An overview of the Preferred Build Alternative and the explanations on expected operation and safety benefits are presented in **Figure 28** and **Figure 29**. The recommended considerations developed by Team 3 with respect to rail, transit, and TDM are shown in **Figure 30** and **Figure 31**.

Table 15: List of Preferred Alternative Improvements

Improvement	Description	Action	Reason if “Not Proceed”	Improvement Categories
Smoketown Road Option 1	Extend eastbound right turn lane	Not Proceed	Option 2 was preferred in the public survey and by the County.	Traffic Flow, Traffic Safety
Smoketown Road Option 2	Free-flow Eastbound right turn lane	Proceed	-	Traffic Flow, Traffic Safety
Smoketown Road Option 3	Double eastbound right turn lane with a traffic signal	Not Proceed	Option 2 was preferred in the public survey and by the County.	Traffic Flow, Traffic Safety
Shoppers Best Way Thru-Cut	Convert Shoppers Best Way to a thru-cut intersection	Under Consideration	-	Traffic Flow, Traffic Safety
Telegraph Road Westbound Left	Increase the westbound left turn lanes at Telegraph Road from one to two lanes	Proceed	-	Traffic Flow, Traffic Safety
Crossing Place 8-Phase Signal	Convert Crossing Place from split phase to 8-phase	Proceed	-	Traffic Flow, Traffic Safety
Crossing Place Thru-Cut with Diagonal Crossing	Convert Crossing Place to a thru-cut intersection with diagonal pedestrian crossing	Under Consideration	-	Traffic Flow, Traffic Safety
Crossing Place Thru-Cut with Four-Leg Crossing	Convert Crossing Place to a thru-cut intersection with typical crosswalks that are across each leg	Under Consideration	-	Traffic Flow, Traffic Safety
Telegraph Road Bowtie	Close the northbound left and southbound left movements and the traffic would use the roundabouts provided on the north and south legs to reach their destination	Not Proceed	Required roundabout sizes too impactful, costs did not justify the benefits.	Traffic Flow, Traffic Safety
Queue Jump for Buses	Queue jump for buses at feasible intersections.	Under Consideration	-	Transit, Traffic Flow
Transit Signal Priority	Transit signal priority at feasible intersections.	Under Consideration	-	Transit, Traffic Flow
Park and Ride Improvements	Add capacity, connectivity and mobility hub elements to the existing Park and Ride Lot.	Under Consideration	-	Transportation Demand Management

Preferred Alternative Summary:

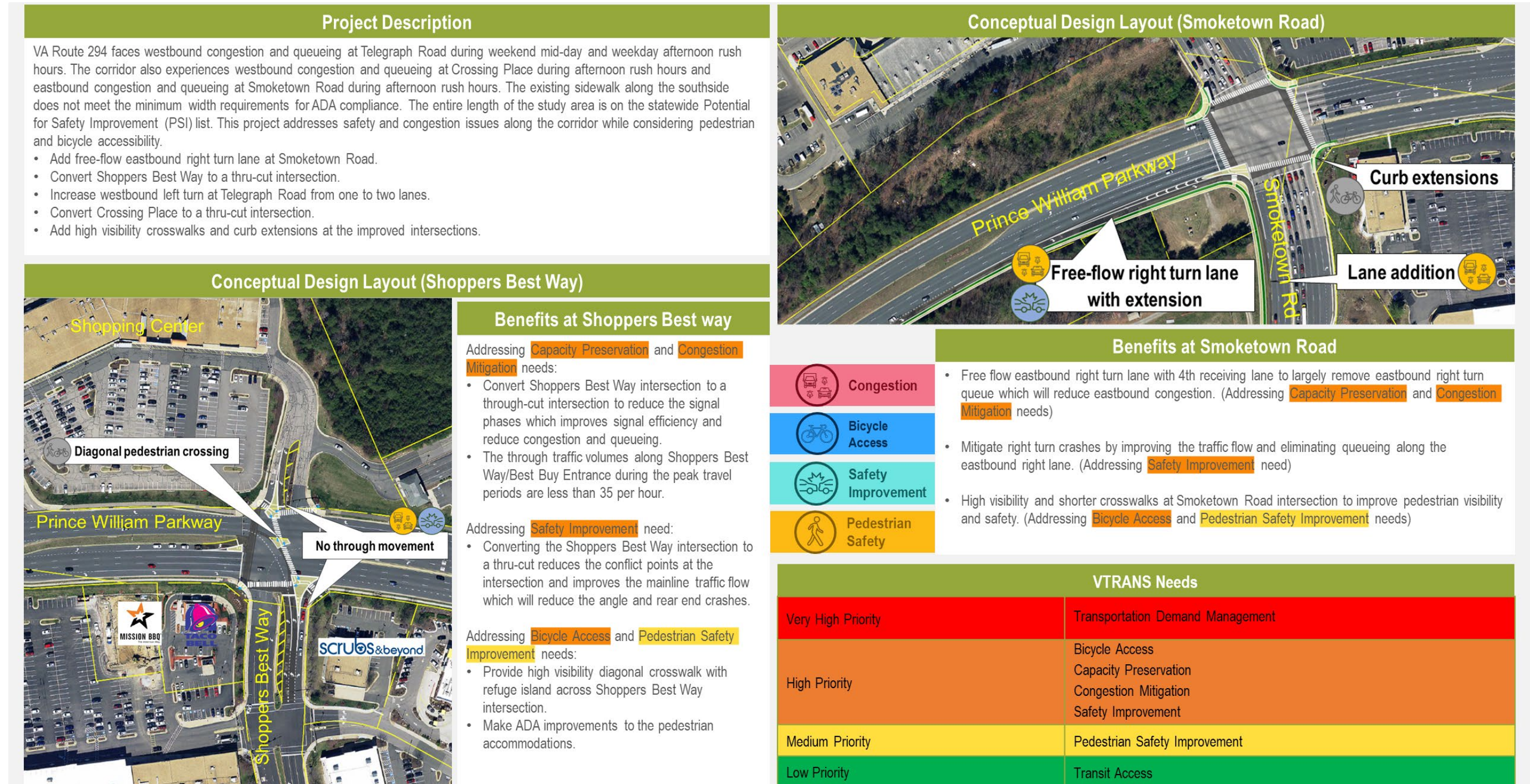


Figure 28: Route 294 Preferred Alternative Summary

Preferred Alternative Summary – Cont'd:

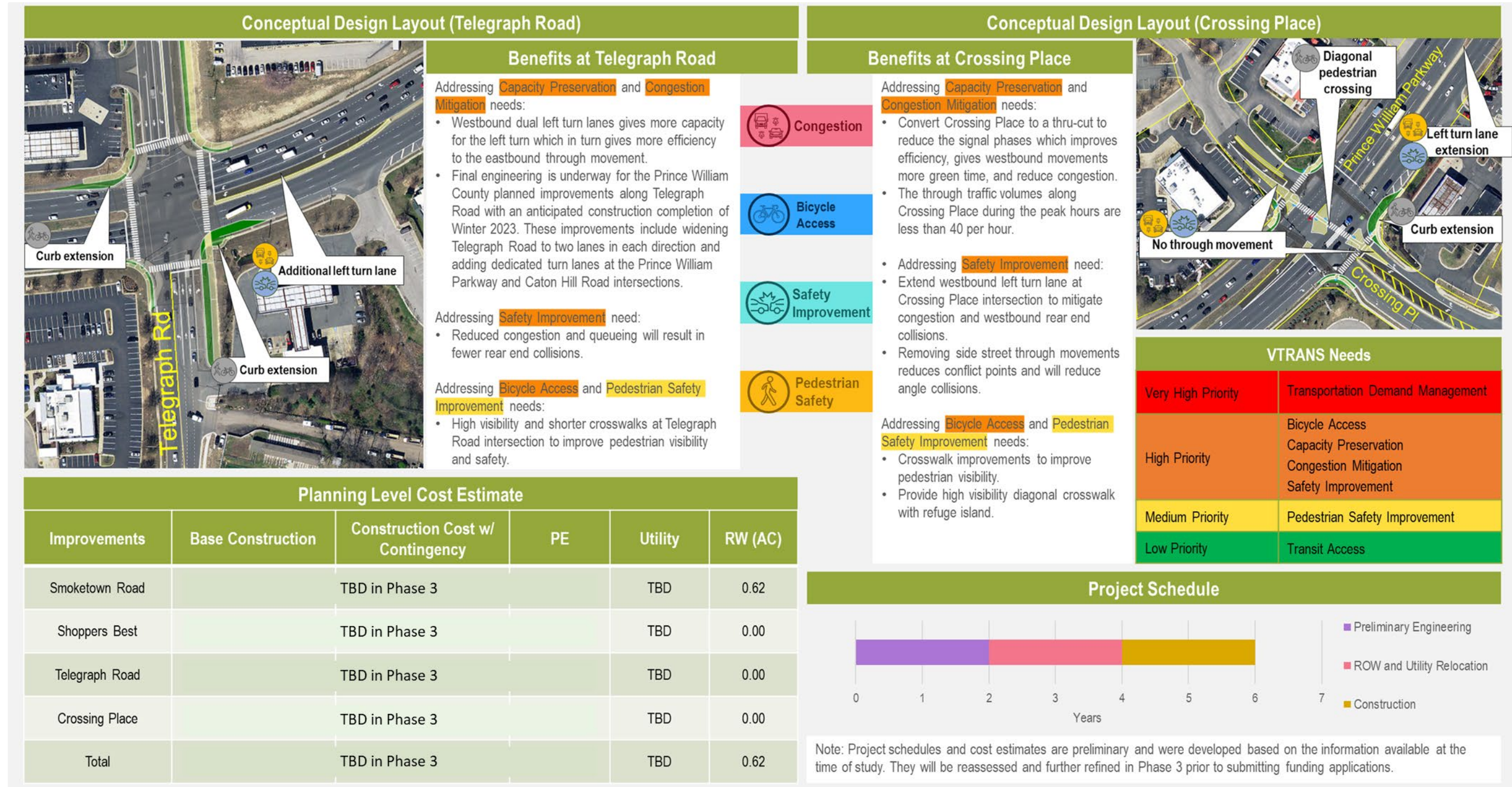
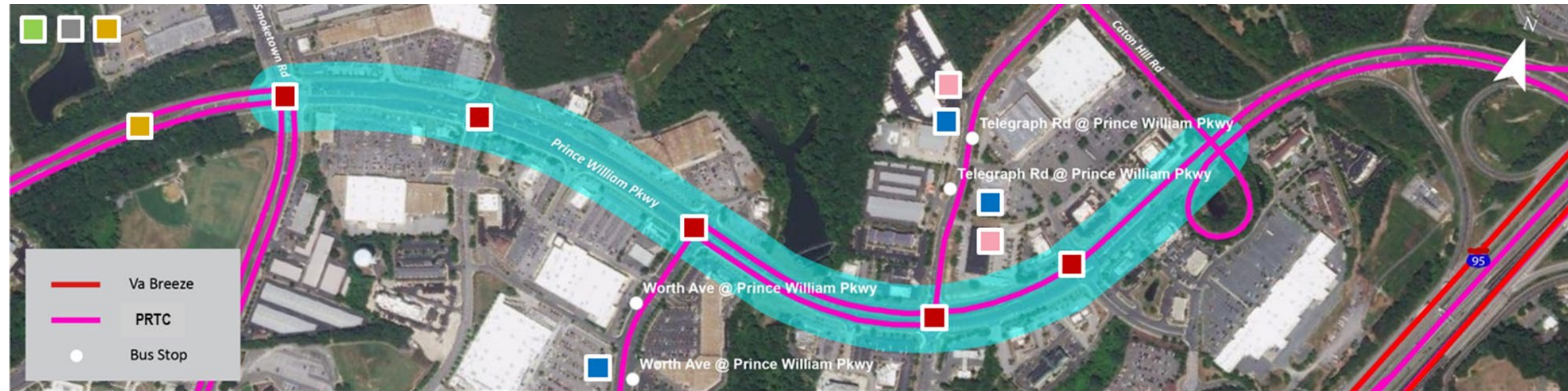


Figure 29: Route 294 Preferred Alternative Summary – cont'd

Rail, Transit, and TDM Recommended Considerations Summary:



Potential Projects



Provide ADA loading pads at Telegraph Rd stops and the Worth Ave southbound stop



Connect Telegraph Rd stops into the existing pedestrian network on Prince William Parkway



Add striped crosswalks at all crossings at the intersection of Prince William Pkwy with Crossing Pl, Telegraph Rd, Worth Ave, Shoppers Best Way, and Smoketown Rd



Implement transit signal priority infrastructure at Smoketown Rd and peak period bus-only lane on Prince William Parkway west of Smoketown Rd (see 2020 *Prince William Peak Hour Express Bus Study*); consider “alternative service scenarios (e.g., microtransit) per PRTC TDP in Dale City and Woodbridge areas



Consider bike sharing program in and around Potomac Mills and neighboring multi-family residential areas

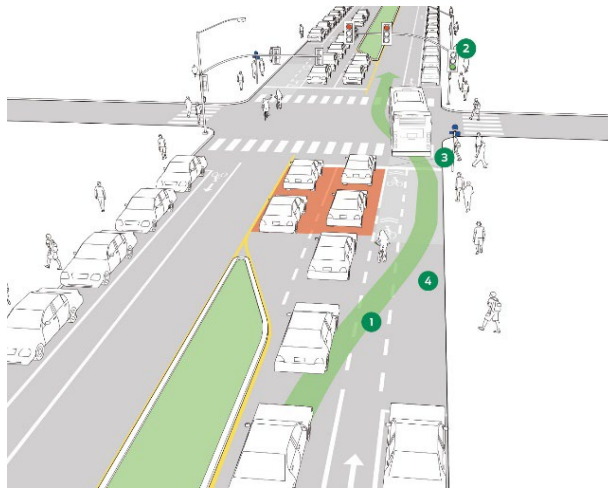


Leverage the existing OmniRide commuter assistance programs to promote the use of transit, carpool and vanpool, and to provide ridematching and commute options information to residents, employers and employees.



Expand Horner Road Park & Ride lot and add mobility hub elements. Enhance connectivity to Woodbridge VRE station with potential shuttle. Future BRT connections.

Figure 30: Recommended Considerations for Rail, Transit, and TDM



Feasible Queue Jump Locations

- Golansky Boulevard and Sonora Street in the westbound direction.
- Noble Pond Way in the westbound direction.
- Shoppers Best Way in the eastbound direction.
- Telegraph Road in the eastbound direction.
- Crossing Place in the eastbound direction.

* Queue jumps can be designed with no special signal timing when the bus station is on the far side or with actuation by an approaching bus to give it a green signal before the adjacent through lanes when the bus station is on the near side.



Figure 31: Feasible Queue Jump Locations

Intent of Phase 3

Phase 3 of the Pipeline Effort is intended to develop detailed concepts of the Phase 2 Preferred Alternative that will carry through to funding applications and project validation. The goal is to ensure that projects are defined to the maximum extent possible and to identify and mitigate potential risks. Utilizing technical resources of both VDOT and consultant teams, a multidisciplinary design approach is part of the overall effort that provides the needed input and problem-solving to ensure funding applications are thoroughly vetted and taken past a planning level sketch and estimate.

The goal is to develop more detailed, quantity based, deterministic estimates and designs paired with thoughtful risk assessment and mitigation. The team will use practical design and common-sense engineering methods to document the assumptions and approaches that lead to the most efficient and effective project scopes. The effort maintains focus on the purpose and needs identified through Phase 1 and 2 that address the VTRANS priorities.

Technical resources utilize Phase 3 for thorough communication and collaboration with District, Central Office, FHWA, or other key partners and stakeholders that may have decision making authority or input on final designs if projects are selected for funding. An intended outcome is that projects, if funded, will have the documentation and support for innovation and flexibility that may be necessary to achieve success.

The Phase 3 Technical Team developed the analysis, design, deliverables, and documentation that will serve as the basis for future Preliminary Engineering work on the projects. At the conclusion of Phase 3, projects should achieve a solid foundation of understanding from a planning and preliminary engineering focus that will ensure applications are well validated, reasonably scoped, meet the needs originally established in studies, and have a high probability of success.

Assumptions

The following are key design assumptions that informed the concept development and cost estimate preparation:

- Roadway geometry – The design assumes keeping much of the existing roads pavement and sidewalks. A WB-62 design vehicle was used to set edge geometrics at intersections. Note the design assumes using a mountable truck apron at the southwest quadrant of Route 294 and Smoketown Road. This is used to facilitate turning by larger vehicles while slowing turn speeds for smaller vehicles at this pedestrian crossing.
- Hydraulics and stormwater management – The majority of the existing drainage system will be unaffected, except for the drainage system at the intersection of Route 294 and Smoketown Road. With the added right turn lane and acceleration lane on Route 294 and Smoketown proposed drainage structures will be placed along the new curb line and be connected to the existing system, which will avoid relocating and realigning the existing storm sewer pipes.
- Utility impacts – The edge limit of the existing sidewalks at curb ramp locations will be held to avoid impact to existing traffic signals.
- Right of Way – The proposed improvements will involve acquiring right of way and easements on several parcels. This is primarily due to the proposed added right turn lane and acceleration lane at the intersection of Route 294 and Smoketown Road. Refer to the concept design exhibits and Right of Way Data Sheet for more details.
- Schedule – Following is the anticipated project development schedule:
 - PE 8/2023 Start 8/2025 End
 - RW/Utility 2/2025 Start 8/2026 End
 - CN 8/2026 Start 8/2028 End

Risk Assessment/Contingency

As part of the risk assessment process, a risk register was developed to identify major/high impact project risk elements. The guidance provided in VDOT's Cost Estimating Manual (Chapter 5) and IIM PMO-15.0 was followed and identified after assessing collected data, field visits, stakeholder input, and concept development. Risks were organized by broad categories including Maintenance of Traffic,

Roadway Design, Right-of-Way, Utilities, Mobilization/Construction Survey, Hydraulics, Traffic, Structures/Bridge Design, Geotechnical, and Environmental. The major risks identified in this project include:

- Significant public and stakeholder involvement is anticipated which could have schedule/time impacts.

The project is considered Moderately Complex. However, the level of concept design development is relatively detailed (between Pre-Scoping and PFI level of design), therefore the Most Likely Estimate (MLE) contingency would be more accurately in the 40% to 45% range. Each individual risk was “scored” based on probability, cost impacts, and time impacts. Scoring was used to assign contingencies per risk line item. These line-item risk contingencies were then aggregated to determine a contingency amount per category to include preliminary engineering, right-of-way and utilities, mobilization/construction survey, maintenance of traffic (MOT), roadway design, hydraulics, traffic, and earthwork/geotechnical.

Cost Estimate

The project cost estimate was developed using the following methodology:

- Understanding the goals of the project and scope of improvements to be implemented.
- Gathering and reviewing as much information about the project as possible including site visits and stakeholder input.
- Establishing design criteria and developing a detailed design concept.
- Performing quantity take offs and identifying unit prices based on Bid Express to develop “defined costs”.
- Developing “allowance costs” for some elements based on potential impacts and complexity. Allowances add costs for elements based on percentage of the base construction cost.
 - Maintenance of Traffic 15% Allowance
 - Erosion and Sediment Control 3% Allowance
 - Utility Relocations 10% Allowance
 - Traffic Items 5% Allowance
 - Seeding 1% Allowance
 - Landscape 1% Allowance

- Lighting 8% Allowance

- Identifying proposed property impacts, developing a Right of Way Data Sheet and coordinating with VDOT to develop Right-of-Way costs. Note, only 7 parcels are anticipated to be impacted (5 with Fee Taking and easements, and an additional 2 with just easements).
- Performing a risk assessment as outlined above and identifying appropriate contingency percentages by category.
- Developing Preliminary Engineering costs by category based on a percentage of the Construction cost (See the Cost Estimate for more details).

Concept Revisions & Final Estimate

Based on VDOT and Stakeholder input from Phase 2 and the site visit performed at the commencement of Phase 3, the concept was advanced, refining key elements of the preferred alternative, as shown in **Figure 32** and **Figure 33**. As the design progressed, several elements were altered from the concept that resulted from Phase 2 to include:

- Removing the grass area on the east side of NB Telegraph Road at Route 294; and
- Re-aligning the diagonal crosswalk at the intersection of Route 294/Crossing PI to begin and end at the refuge islands within the north and south crosswalks.

Cost Estimate Breakdown

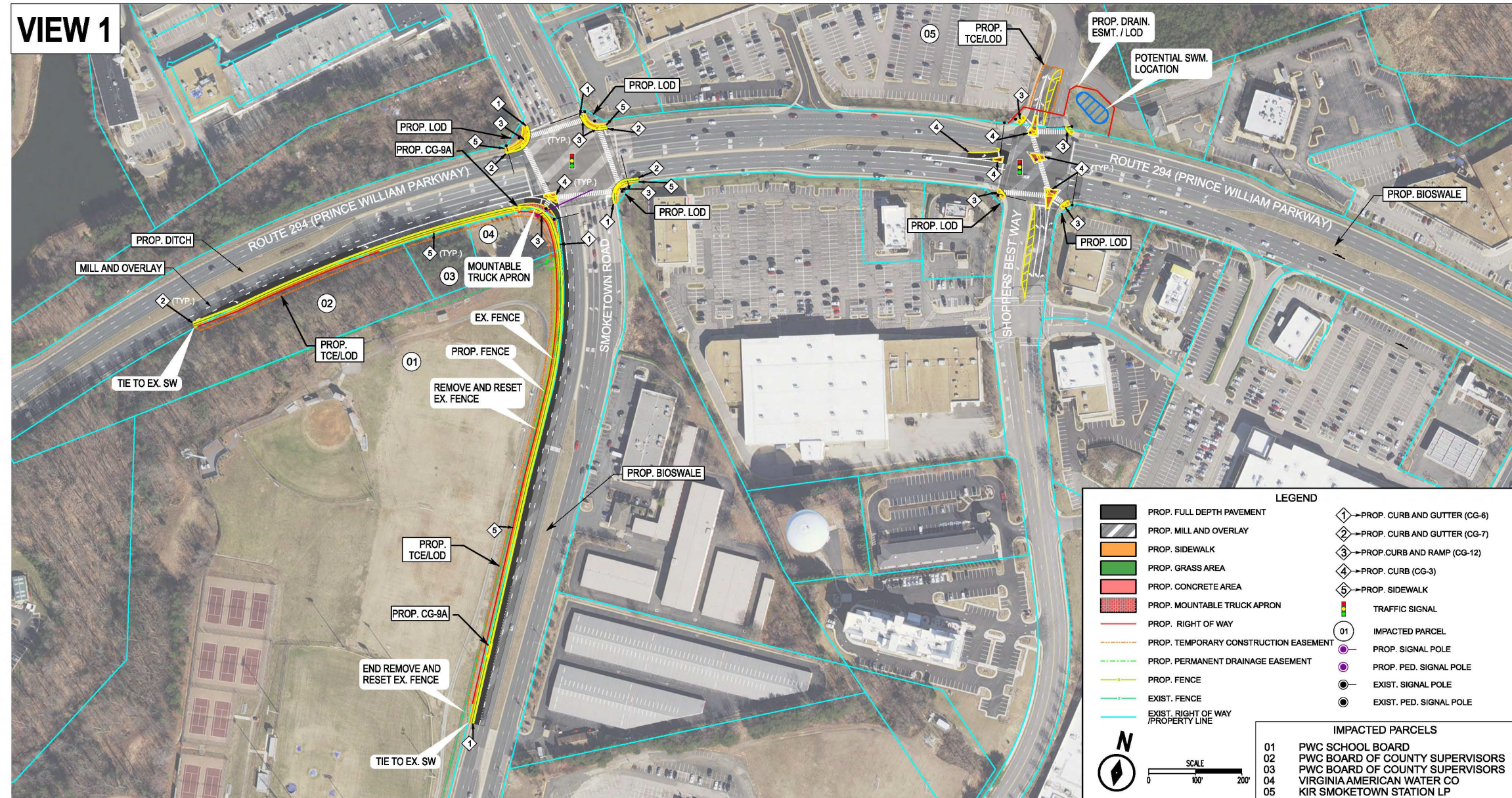
The total project cost is estimated to be \$11,085,805 and broken down by Phase/Major area as shown in **Table 16** below. This cost includes contingencies and represents uninflated July 2022 dollars.

Table 16. Cost Estimate Breakdown

Phase	Total
Preliminary Engineering Phase	\$1,755,000
Right-of-Way and Utilities Phase	\$7,215,000
Construction Phase (without CEI)	\$8,093,332.80
Construction Phase (with CEI)	\$9,263,975.58
Total	\$18,233,975.58

UPC 119905 | ROUTE 294 FROM SMOKETOWN ROAD TO CATON HILL ROAD ROADWAY EXHIBIT
SHEET 1 OF 2

JUNE 2022

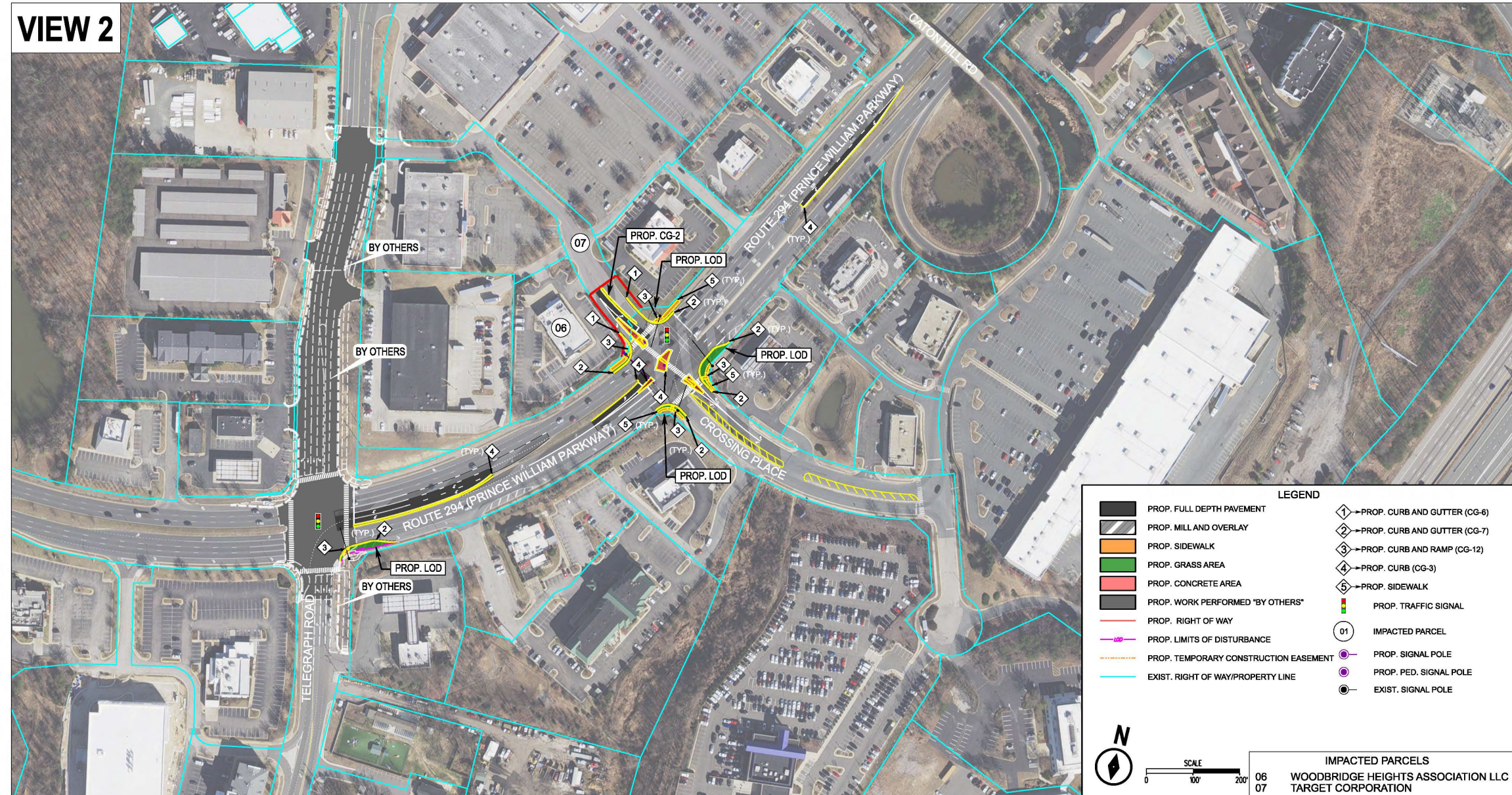


PROJECT PIPELINE NV04 | PRINCE WILLIAM COUNTY, VA

Figure 32: Route 294 Improvements

UPC 119905 | ROUTE 294 FROM SMOKETOWN ROAD TO CATON HILL ROAD ROADWAY EXHIBIT
SHEET 2 OF 2

JUNE 2022



PROJECT PIPELINE NV04 | PRINCE WILLIAM COUNTY, VA

Figure 33: Route 294 Improvements (Continued)

Appendix A: Telegraph Road Rollplot

Appendix B: ADT and Turning Movement Counts

Appendix C: Synchro Reports

Appendix D: Raw Crash Data 2015 – 2019

Appendix E: Collision Diagrams

Appendix F: VJuST Worksheets

Appendix G: Phase 3 Basis of Design Memo