4 No-Build Conditions Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study corridors under future (2030 and 2045) No-Build AM and PM peak hour conditions. The intent of the No-Build conditions analyses was to provide a general understanding of the baseline future traffic conditions as a starting point for developing future improvement strategies. No-Build conditions were modeled using Vissim 11, the same as for existing conditions.

4.1 Background Improvements

Planned transportation projects within the study area were included as background improvements in the 2030 and 2045 No-Build analyses. ***Table 23*** includes a list of the background improvement projects and identifies which models include each improvement.

Table 23: No Build Vissim Model Background Improvements

Project	Geometry Improvement	Scenario Years
Southbound I-95 Auxiliary Lane	Four southbound lanes between Route 123 (Exit 160) and Route 294 (Exit 158)	2030 and 2045
Route 1 Widening – Phase 1	Six lanes from Annapolis Way to Marys Way	2030 and 2045
Route 1 Widening – North into Fairfax County	Six lanes from Annapolis Way to Telegraph Road	2045 only
Route 123 Widening	Six lanes from Route 1 to Annapolis Way	2045 only *Development Driven*
Old Bridge Road at Occoquan Road Intersection Upgrades	Realigned eastbound approach; southbound right-turn lane	2030 and 2045
Route 1 Bus Rapid Transit (BRT) System	Northbound and southbound BRT routes along Route 1 from Occoquan Road into Fairfax County	2030 and 2045

4.2 Traffic Analysis Assumptions

The existing conditions Vissim models were used as the basis for developing the 2030 and 2045 AM and PM peak hour No-Build models. The geometric changes made to the models within the study area related to the background improvements are listed in ***Table 23***. In addition to the geometric changes, traffic signal timings changes were made to optimize signal operations at locations with background improvements. Traffic signal phasing changes were made along with the geometric improvements to widen Route 123 at the intersections with Horner Road and Annapolis Way. The models were updated with 2030 and 2045 No-Build forecasted traffic volumes. Inputs and analysis methodologies were consistent with the *TOSAM* 2.0 and with the existing conditions analysis.

The VDOT Sample Size Determination Tool was used to confirm that ten simulation runs would provide the acceptable 95 percent confidence level for both the No-Build AM and PM models. Therefore, ten simulation runs were completed for all models using different random number seeds and the average results were reported.

4.3 Measures of Effectiveness

The same MOEs reported for the existing conditions analysis were used for the operational analysis of the roadway network under No-Build 2030 and 2045 conditions. Vissim freeway MOEs were reported for each freeway segment. The methodology for determining the area of influence for the merge, diverge, and weave segments was consistent with the approach defined in the *Highway Capacity Manual*. Intersection results reporting and arterial MOEs were consistent with the existing conditions analysis to focus on the analyses comparing the more critical higher volume intersections in the study area.

4.4 Freeway Analysis

The No-Build (2030 and 2045) conditions freeway traffic analysis results are summarized in the following sections. The AM and PM peak hour average freeway segment densities and speeds are illustrated in ***Figure 45*** through ***Figure 56***. Additional AM and PM peak hour MOE information, including vehicle throughput, travel time, and ramp queue lengths at critical locations, were summarized in ***Appendix K***.

4.4.1 2030 and 2045 AM Peak Hour Freeway Operations

In the 2030 AM peak hour, both directions on the freeway are expected to operate with similar speeds and densities to existing conditions. The peak northbound direction does not worsen at the Route 123 interchange because of oversaturated conditions and capacity constraints at the Route 294 interchange. Queuing occurs on the northbound I-95 off-ramp to northbound Route 123 that does not occur in the existing AM peak hour due to queue spillback from northbound Route 123 traffic signals at Old Bridge Road, Devils Reach Road, and the I-95 Express Lanes ramp.

In the 2045 AM peak hour, both directions are expected to operate with similar speeds and densities to existing and 2030 No-Build conditions. Travel times on northbound I-95 in the study area are expected to increase by 21 seconds (4 percent) compared to 2030 No-Build conditions. Queuing on the northbound I-95 off-ramp to northbound Route 123 in 2030 are expected to increase to 855 feet and extend even further onto mainline I-95 after the peak hour.

4.4.2 2030 and 2045 PM Peak Hour Freeway Operations

In the 2030 PM peak hour, southbound freeway operations are expected to improve when compared to existing conditions due to the background improvements including the southbound auxiliary lane from the Route 123 interchange to the Route 294 interchange. This capacity improvement is expected to reduce queuing and increase speeds on the southbound I-95 on-ramps from both Route 123 and Route 1. The southbound I-95 mainline between Route 123 and Lorton Road is expected to remain congested, but north of Lorton Road to Fairfax County Parkway is expected to improve. Queuing on the southbound I-95 off-ramp to northbound Route 123 is expected to increase to 1,320 feet but is contained on the ramp. In the 2030 PM peak hour, northbound I-95 is expected to operate with similar speeds and densities as existing conditions.

In the 2045 PM peak hour, southbound I-95 is expected to operate with slower speeds and higher densities than 2030 No-Build conditions due to traffic growth. Southbound I-95 travel times between Backlick Road and Route 294 is expected to increase by 87 seconds (8 percent) when compared to 2030 No-Build conditions. The southbound I-95 off-ramp to northbound Route 123 is expected to operate with slower speeds and higher densities when compared to the existing and 2030 No-Build conditions. Queuing on this ramp is expected to extend to 1,930 feet, reaching the mainline, and due to the impacts of traffic signals on Route 123 at Old Bridge Road and Devils Reach Road.

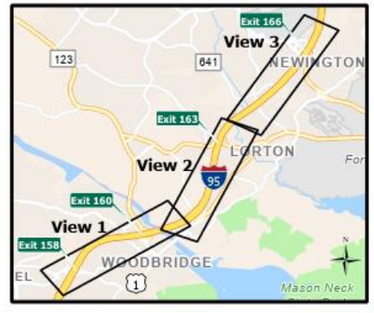
In the 2045 PM peak hour, northbound I-95 is expected to operate with similar speeds and densities as existing and 2030 No-Build conditions. Queuing on the northbound I-95 off-ramp to northbound Route 123 present in the AM peak hour is expected to also be present in the PM peak hour and extend onto mainline I-95.

Figure 45: 2030 No Build AM Peak Hour Mainline and Ramp Density

Figure 46: 2030 No Build AM Peak Hour Mainline and Ramp Speed

Figure 47: 2030 No Build PM Peak Hour Mainline and Ramp Density (1 of 2)

Figure 48: 2030 No Build PM Peak Hour Mainline and Ramp Density (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
No-Build
2030 PM Peak Hour

Density (vplpm)

Miles: 0 — 0.25 — 0.5

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 - 100 | > 100

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 49: 2030 No Build PM Peak Hour Mainline and Ramp Speed (1 of 2)

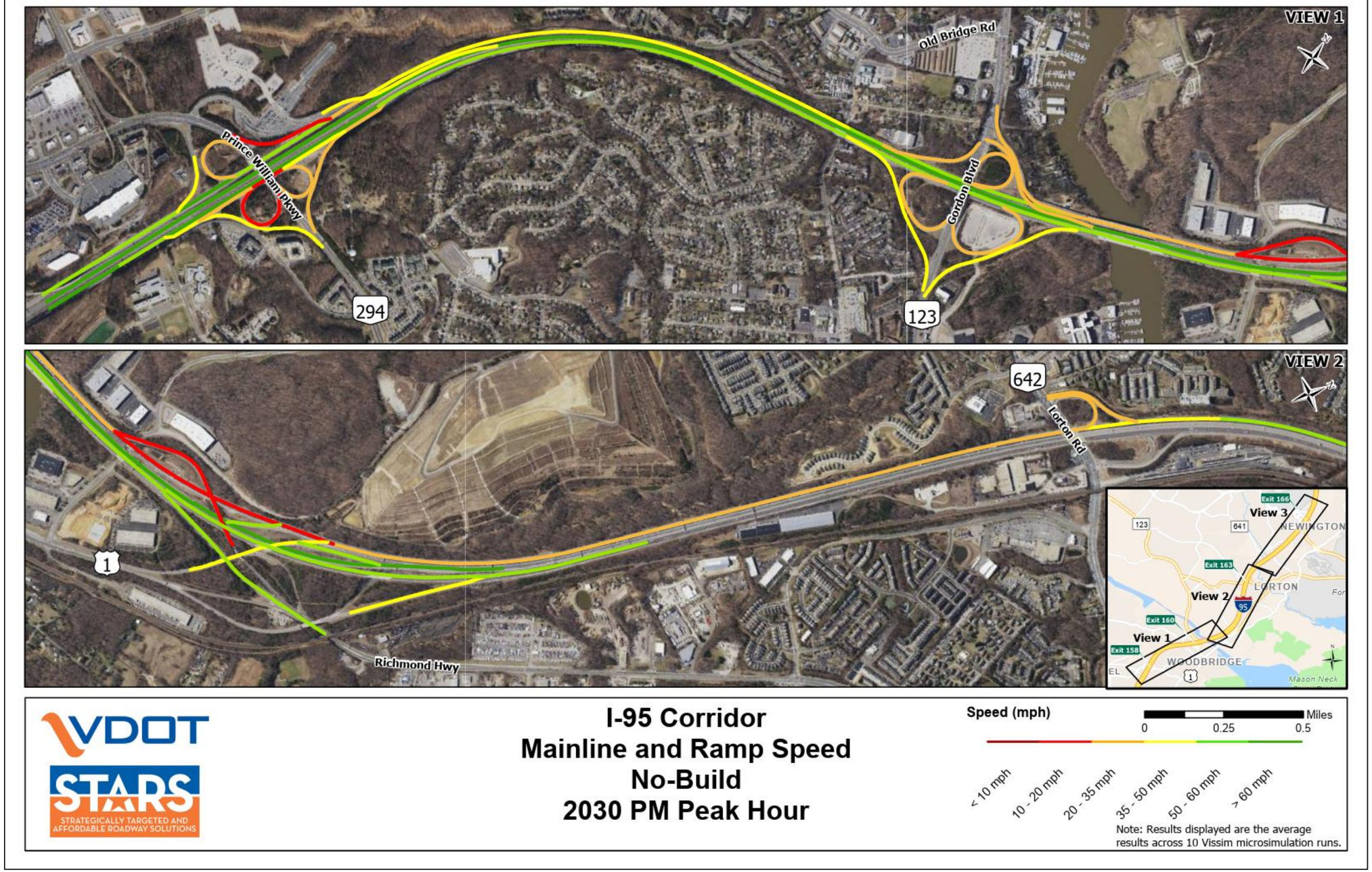
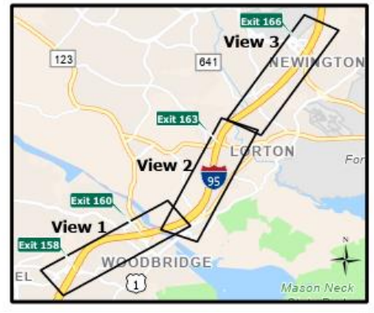


Figure 50: 2030 No Build PM Peak Hour Mainline and Ramp Speed (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
No-Build
2030 PM Peak Hour

Speed (mph)

Miles: 0 0.25 0.5

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 51: 2045 No Build AM Peak Hour Mainline and Ramp Density

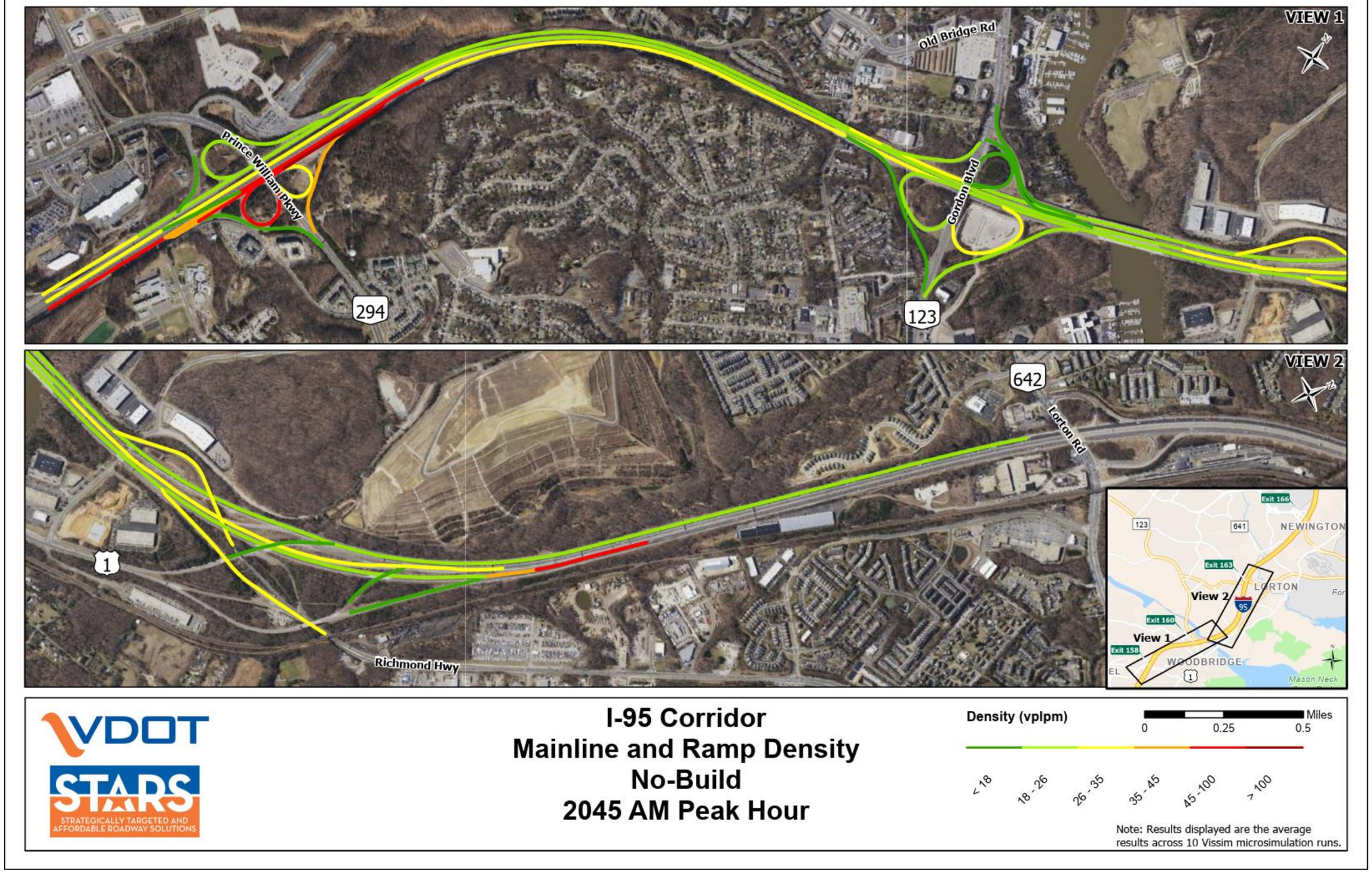


Figure 52: 2045 No Build AM Peak Hour Mainline and Ramp Speed

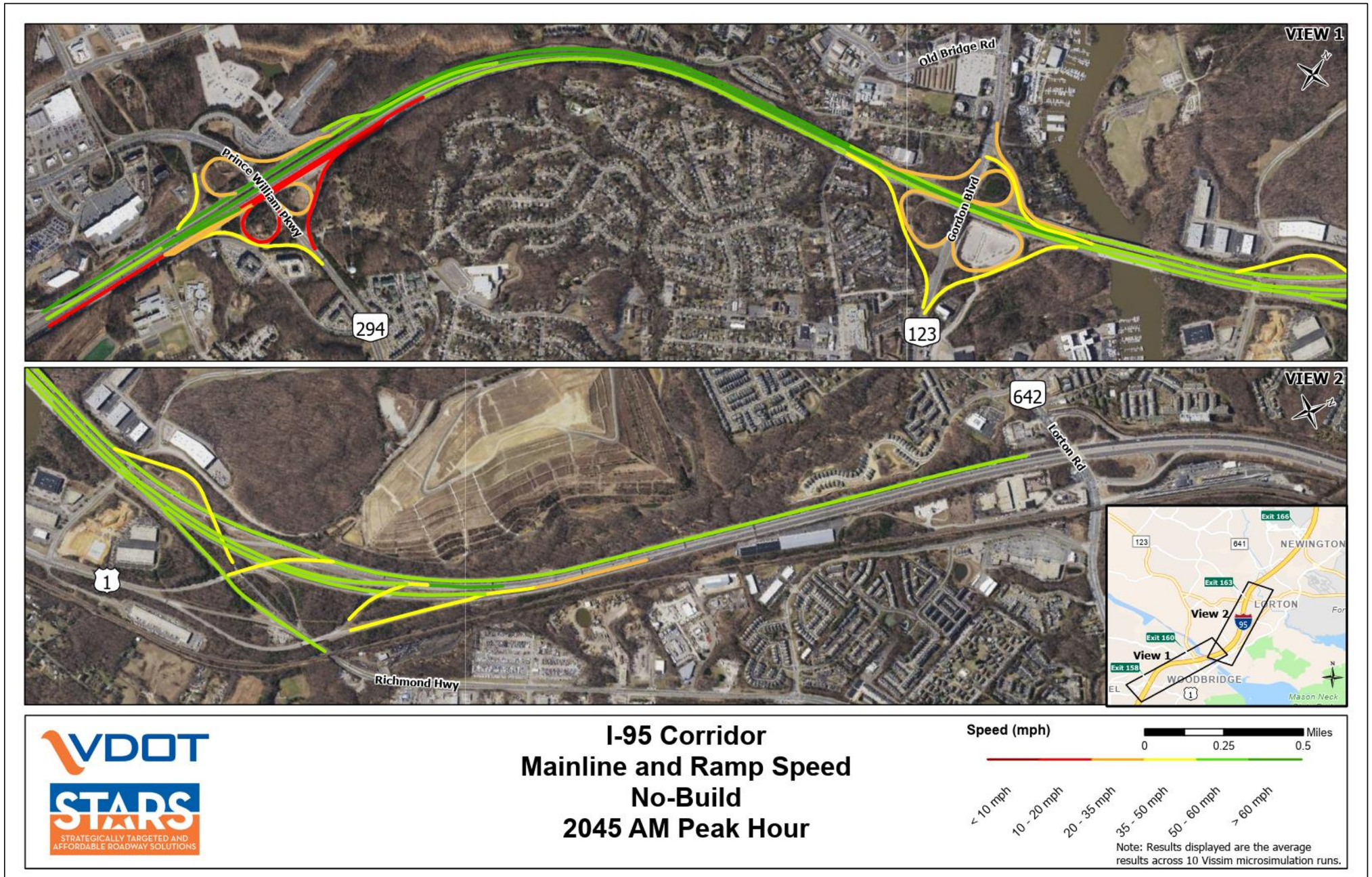


Figure 53: 2045 No Build PM Peak Hour Mainline and Ramp Density (1 of 2)

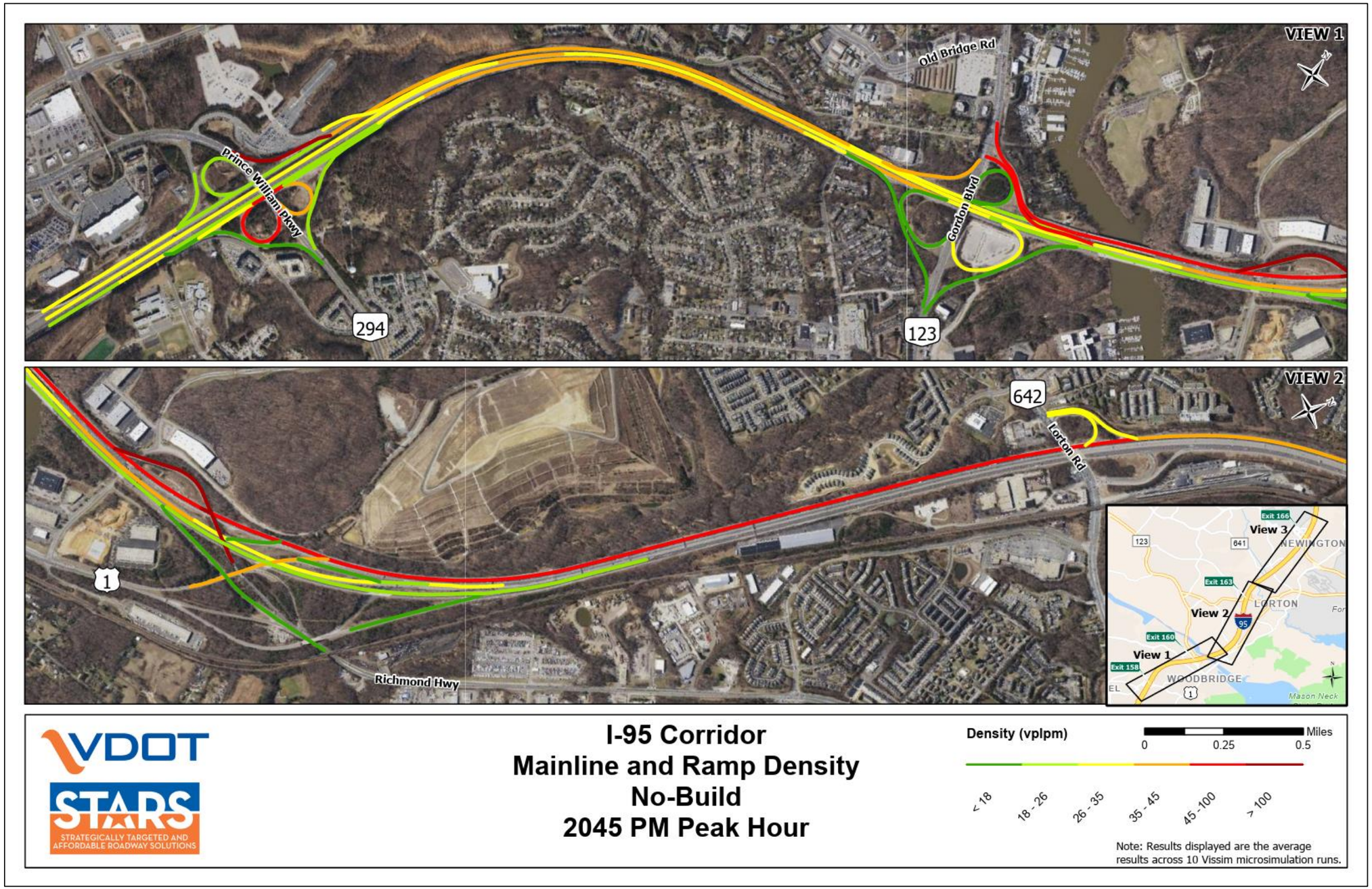
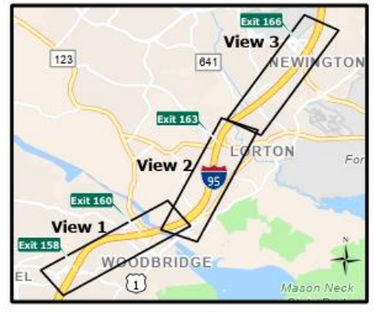


Figure 54: 2045 No Build PM Peak Hour Mainline and Ramp Density (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
No-Build
2045 PM Peak Hour

Density (vplpm)

Miles: 0 0.25 0.5

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 - 100 | > 100

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 55: 2045 No Build PM Peak Hour Mainline and Ramp Speed (1 of 2)

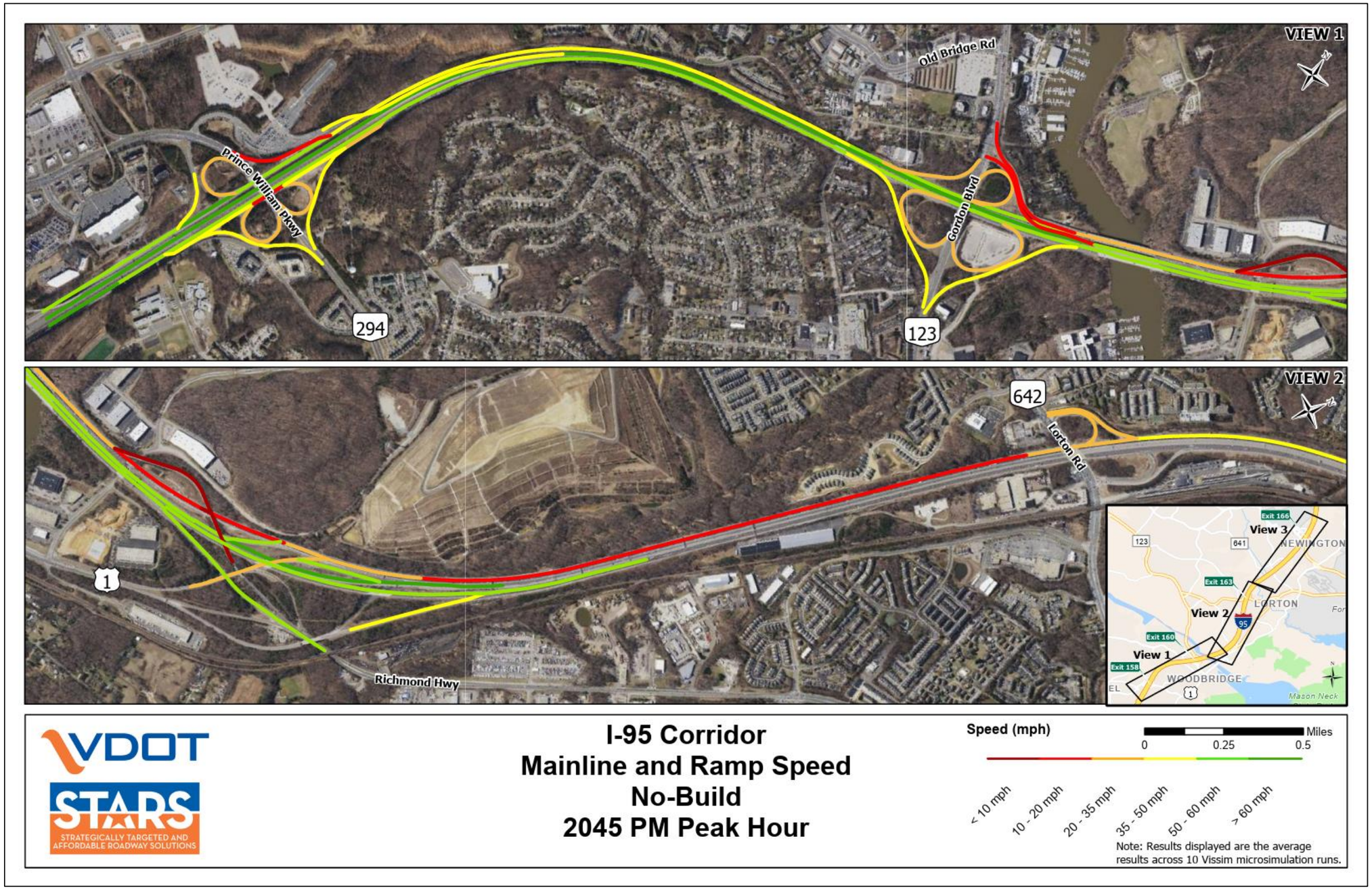
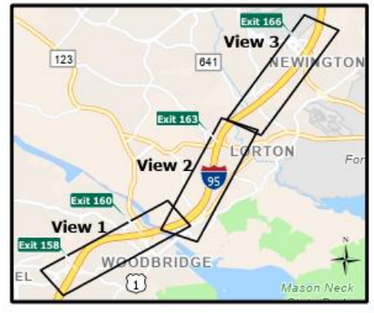


Figure 56: 2045 No Build PM Peak Hour Mainline and Ramp Speed (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
No-Build
2045 PM Peak Hour

Speed (mph)

Miles: 0 0.25 0.5

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

4.5 Arterial Analysis

The No-Build (2030 and 2045) conditions intersection and arterial traffic analysis results are summarized in the following sections. Travel time comparisons are for AM and PM peak hours are shown in ***Figure 57*** and ***Figure 58***, respectively. The AM and PM peak hour microsimulation delay by intersection movement are shown in ***Figure 59*** through ***Figure 70***. Additional AM and PM peak hour MOE information including vehicle throughput, travel time, and queue length are in ***Appendix K***.

4.5.1 2030 and 2045 AM Peak Hour Intersection Operations

In the 2030 AM peak hour, congestion is expected to increase along Route 123 in both directions. Vehicle travel times along northbound Route 123 are expected to increase by 2 minutes and 11 seconds (34 percent) from existing conditions. Travel times along southbound Route 123 are expected to increase by 1 minute and 19 seconds (18 percent) from existing conditions.

The study intersection of Route 123 at Old Bridge Road is expected to operate with an overall intersection delay of 40 seconds per vehicle. Northbound and southbound queuing on Route 123 is expected to increase by 880 feet (83 percent) and 1,485 feet (156 percent), respectively, from existing conditions at this intersection.

The following intersections operate with average overall intersections delays more than 55 seconds per vehicle:

- Route 123 at Horner Road (71 seconds)
- Old Bridge Road at Occoquan Road (390 seconds)
- Route 294 at Southbound I-95 Ramp/Commuter Lot (155 seconds)
- Route 294 at Summerland Drive/York Drive (267 seconds)
- Dawson Beach Road at Express Drive (58 seconds)

The intersection of Occoquan Road and Old Bridge Road is expected to operate with significantly increased delays compared to existing conditions. Queues on eastbound Old Bridge Road are expected to extend over one mile to Minnieville Road due to the traffic signals at Occoquan Road and Route 123.

In the 2045 AM peak hour, congestion is expected to continue increasing along Route 123 and Old Bridge Road. Vehicle travel times along northbound Route 123 are expected to increase by 3 minutes and 17 seconds (52 percent) and travel times along southbound Route 123 are expected to increase by 3 minute and 43 seconds (50 percent) compared to existing conditions.

The study intersection of Route 123 at Old Bridge Road is expected to operate with an overall intersection delay of 42 seconds per vehicle. Northbound and southbound queuing on Route 123 is expected to increase by 840 feet (83 percent) and 1,435 feet (151 percent), respectively, from existing conditions at this intersection. Eastbound Old Bridge Road congestion remains and results in queuing to Minnieville Road.

The following intersections operate with average overall intersections delays more than 55 seconds per vehicle:

- Route 123 at Commerce Street (72 seconds)
- Old Bridge Road at Occoquan Road (468 seconds)
- Route 1 at Marys Way (88 seconds)
- Route 294 at Southbound I-95 Ramp/Commuter Lot (108 seconds)
- Route 294 at Summerland Drive/York Drive (323 seconds)
- Dawson Beach Road at Express Drive (407 seconds)

4.5.2 2030 and 2045 PM Peak Hour Intersection Operations

In the 2030 PM peak hour, congestion is expected to significantly increase on southbound Route 123. Vehicle travel times along southbound and northbound Route 123 are expected to increase by 11 minutes and 11 seconds (99 percent) and 1 minute and 9 seconds (23 percent), respectively, when compared to existing conditions.

The study intersection of Route 123 at Old Bridge Road is expected to operate with an overall intersection delay of 55 seconds per vehicle. Northbound and southbound queuing on Route 123 is expected to increase by 1,530 feet (151 percent) and 1,240 feet (16 percent), respectively, from existing conditions at this intersection. Northbound queuing is expected to extend onto southbound I-95 mainline, southbound I-95 Express Lanes, and also reaches the loop ramp from northbound I-95 to northbound Route 123.

The following intersections operate with average overall intersections delays more than 55 seconds per vehicle:

- Route 123 at Workhouse Road (323 seconds)
- Route 123 at Commerce Street (275 seconds)
- Route 1 at Hassett Street (106 seconds)
- Route 1 at Route 123 (64 seconds)
- Route 1 at Occoquan Road/Dawson Beach Road (103 seconds)
- Route 294 at Southbound I-95 Ramp/Commuter Lot (116 seconds)
- Route 294 at Summerland Drive/York Drive (113 seconds)
- Dawson Beach Road at Express Drive (271 seconds)

The southbound approaches at the intersections of Route 123 and Workhouse Road and Route 123 and Commerce Street are expected to operate with significantly higher delays compared to existing conditions. While the southbound I-95 auxiliary lane project is expected to eliminate queuing on the southbound I-95 on-ramp from southbound Route 123, congestion is expected to persist along southbound Route 123 due to traffic signals and high volume right turns at Commerce Street, Old Bridge Road, and I-95.

In the 2045 PM peak hour, congestion is expected to remain along Route 123 and increases along Old Bridge Road. Vehicle travel times along southbound Route 123 is expected to increase by 7 minutes and 20 seconds (65 percent) compared to existing conditions. Travel times along northbound Route 123 are expected to increase by 2 minutes and 29 seconds (50 percent) compared to existing conditions. Southbound travel time decreases in 2030 conditions are attributed to the assumed Route 123 widening background improvement between I-95 and Route 1 and accompanying changes in traffic signal timing coordination in the corridor.

The intersection of Route 123 at Old Bridge Road is expected to operate with an overall intersection delay of 58 seconds per vehicle. Northbound and southbound queuing on Route 123 are expected to increase by 2,015 feet (199 percent) and 1,235 feet (16 percent), respectively, when compared to existing conditions at this intersection. Northbound queuing is projected to extend onto southbound I-95 mainline, southbound I-95 Express Lanes, and northbound I-95 mainline.

The following intersections are expected to operate with average overall intersections delays more than 55 seconds per vehicle:

- Route 123 at Workhouse Road (270 seconds)
- Route 123 at Commerce Street (208 seconds)
- Route 123 at Old Bridge Road (58 seconds)
- Route 123 at I-95 Express Lanes Ramp (74 seconds)
- Old Bridge Road at Occoquan Road (128 seconds)

- Route 1 at Hassett Street (148 seconds)
- Route 1 at Furnace Road (267 seconds)
- Route 1 at Annapolis Way (185 seconds)
- Route 1 at Occoquan Road/Dawson Beach Road (83 seconds)
- Route 1 at Marys Way (118 seconds)
- Route 294 at Southbound I-95 Ramp/Commuter Lot (154 seconds)
- Route 294 at Summerland Drive/York Drive (328 seconds)
- Dawson Beach Road at Express Drive (285 seconds)

Congestion on eastbound Old Bridge Road approaching Route 123 is expected to increase significantly from existing and 2030 No-Build conditions. The eastbound queue at the intersection of Old Bridge Road and Occoquan Road is expected to increase from 650 feet in 2030 No-Build conditions to 4,615 feet in 2045.

4.6 No-Build Conditions Summary

No-Build 2030 and 2045 conditions show similar issues to the existing conditions analysis with additional needs identified based on future traffic volumes.

Several background improvements projects such as the southbound I-95 auxiliary lane between the Route 123 interchange and the Route 294 interchange, the widening of Route 1, and the widening of Route 123 between Annapolis Way and Route 1 in 2045 are projected to help relieve some of the congestion in the study area despite the traffic growth, however overall congestion issues persist especially due to over-capacity at the intersections on Route 123, Old Bridge Road, and the southbound I-95 lane reduction and multiple merge points at the Route 123 interchange.

In the AM peak hour, the critical areas of need include:

- Eastbound Old Bridge Road queues due to overcapacity intersections at Route 123 and Occoquan Road
- Northbound Route 123 congestion at the intersection of Old Bridge Road due to overcapacity, with queues reaching northbound I-95 by 2045

In the PM peak hour, the critical areas of need include:

- Overcapacity intersections on Route 123 especially at Old Bridge Road that propagate queues back along both directions of Route 123, southbound I-95 by 2030, and northbound I-95 and southbound I-95 Express Lanes by 2045
- Weaving movement from southbound I-95 off-ramp to northbound left turn at Old Bridge Road
- Southbound I-95 mainline bottleneck near the Route 123 interchange where lanes reduce from four to three

Figure 57: AM Peak Hour Travel Time Comparison (Existing and No-Build)

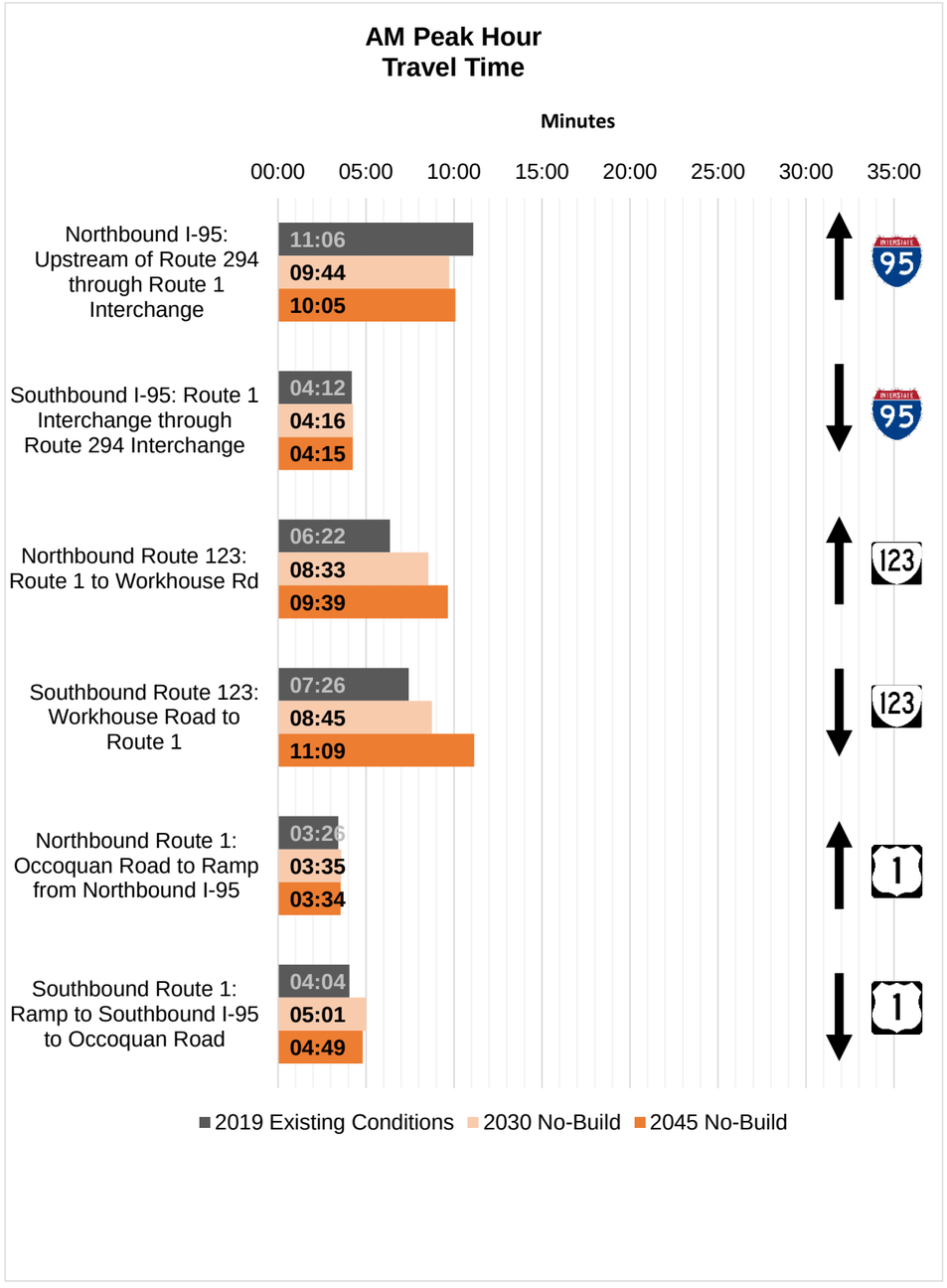


Figure 58: PM Peak Hour Travel Time Comparison (Existing and No-Build)

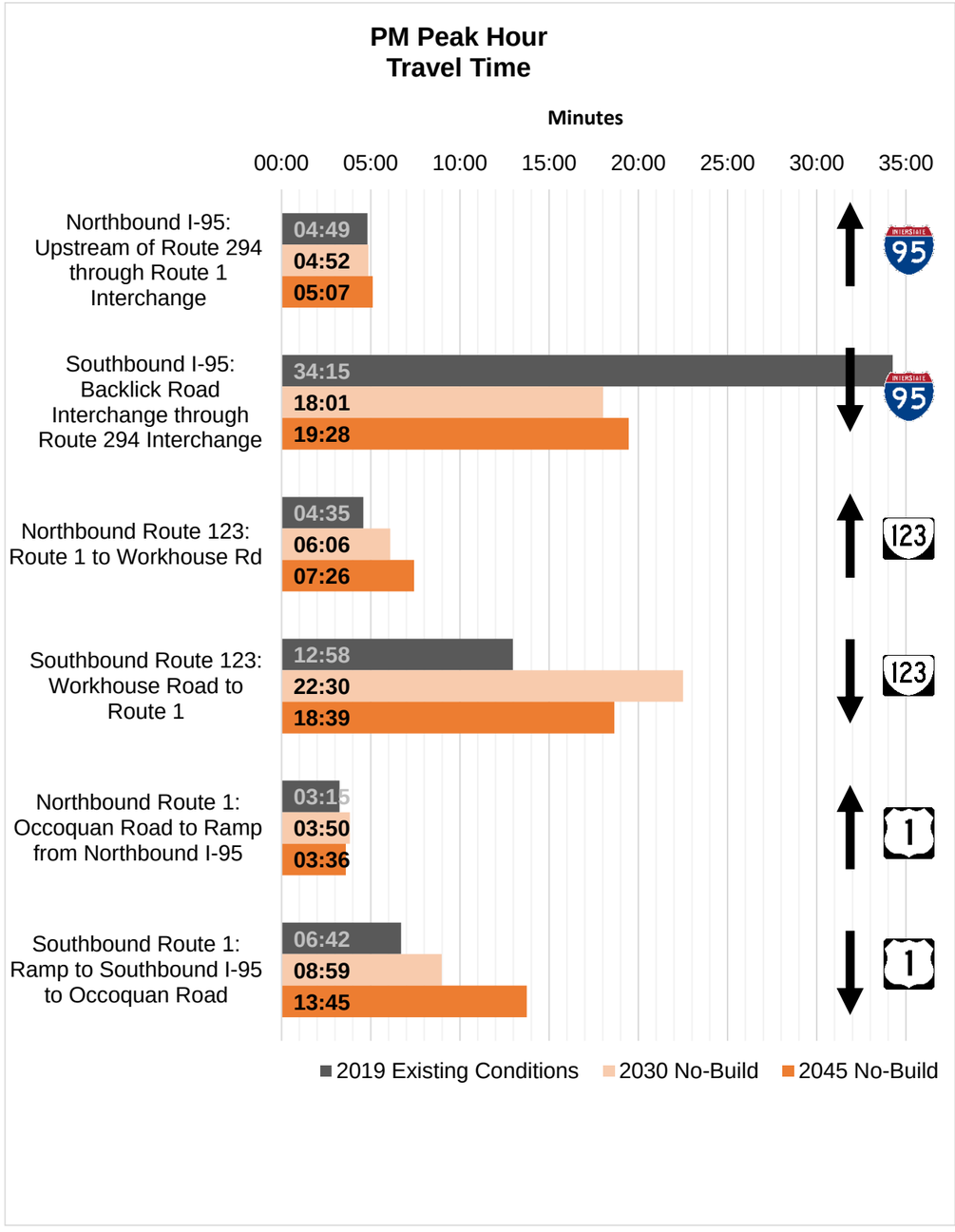


Figure 59: 2030 No Build Conditions – AM Peak Hour Delay (1 of 3)

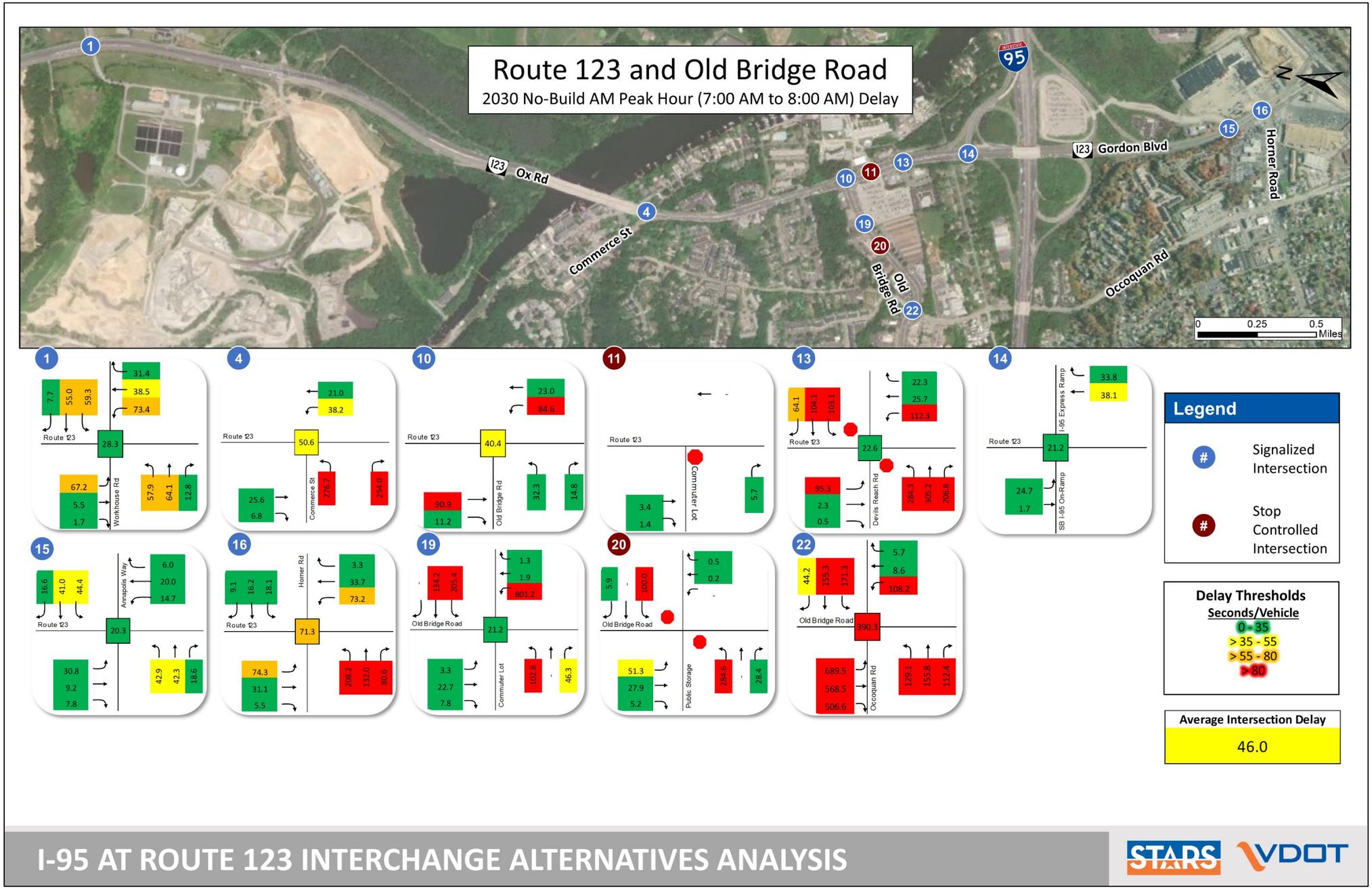


Figure 60: 2030 No Build Conditions – AM Peak Hour Delay (2 of 3)

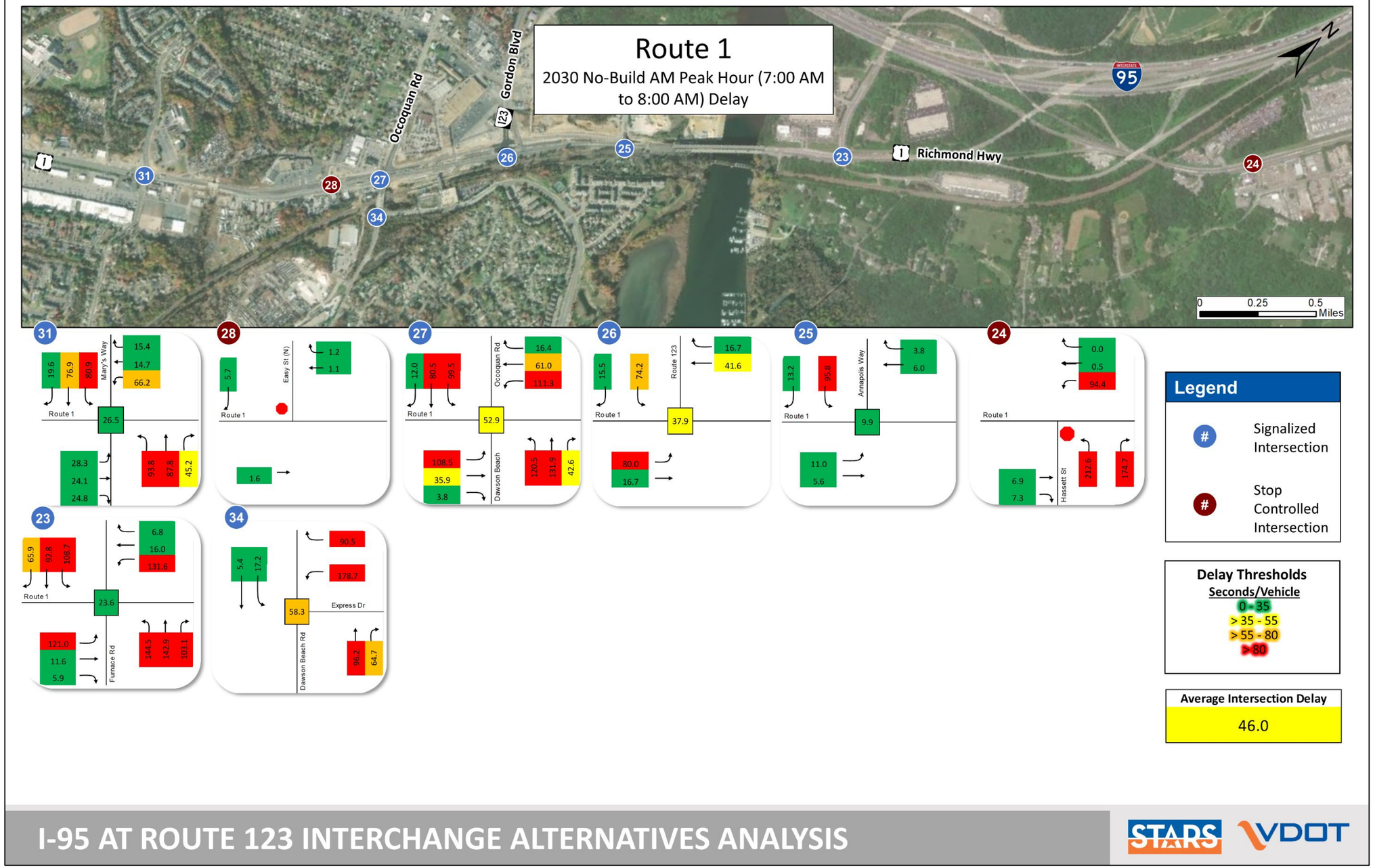


Figure 61: 2030 No Build Conditions – AM Peak Hour Delay (3 of 3)

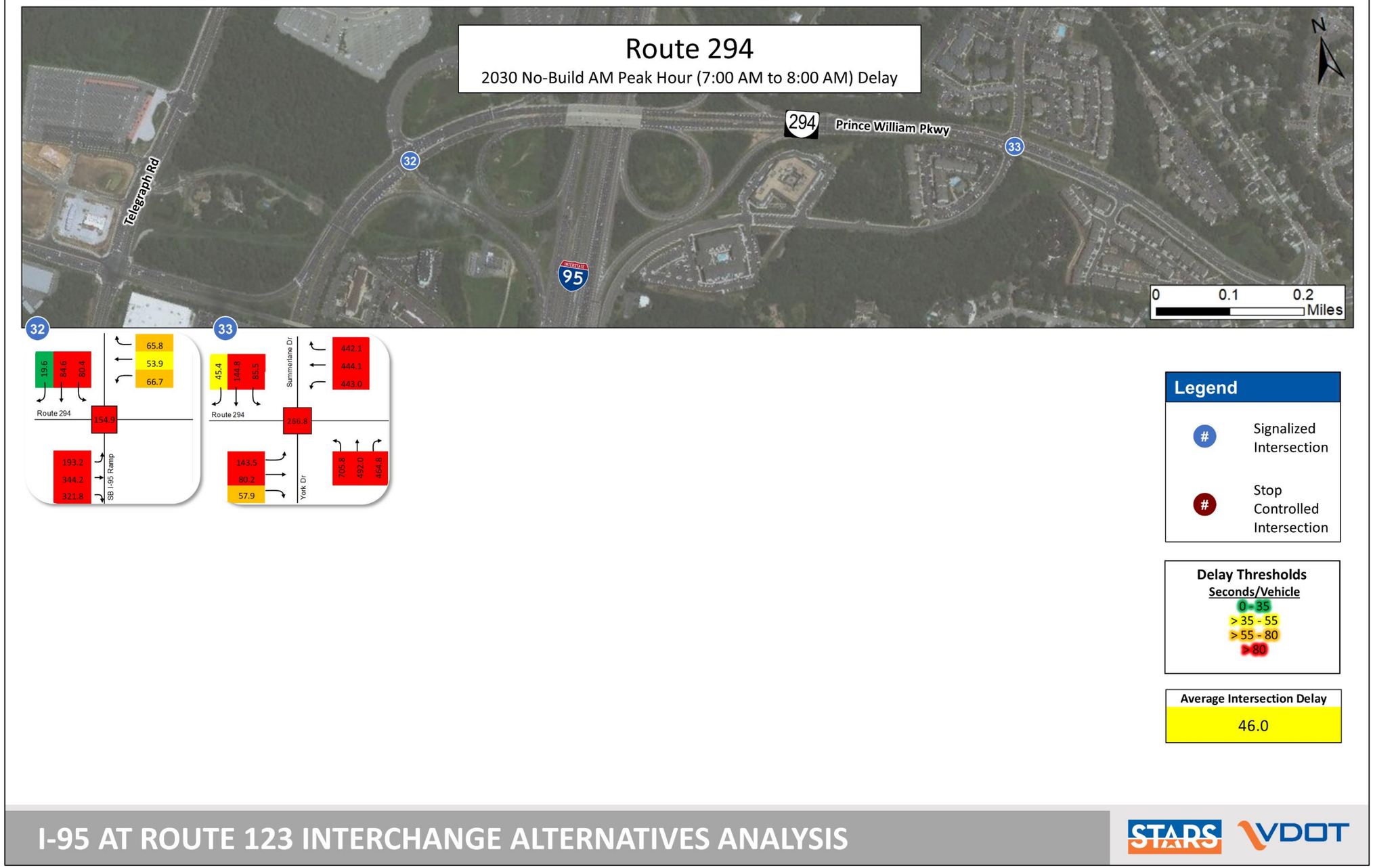


Figure 62: 2030 No Build Conditions – PM Peak Hour Delay (1 of 3)

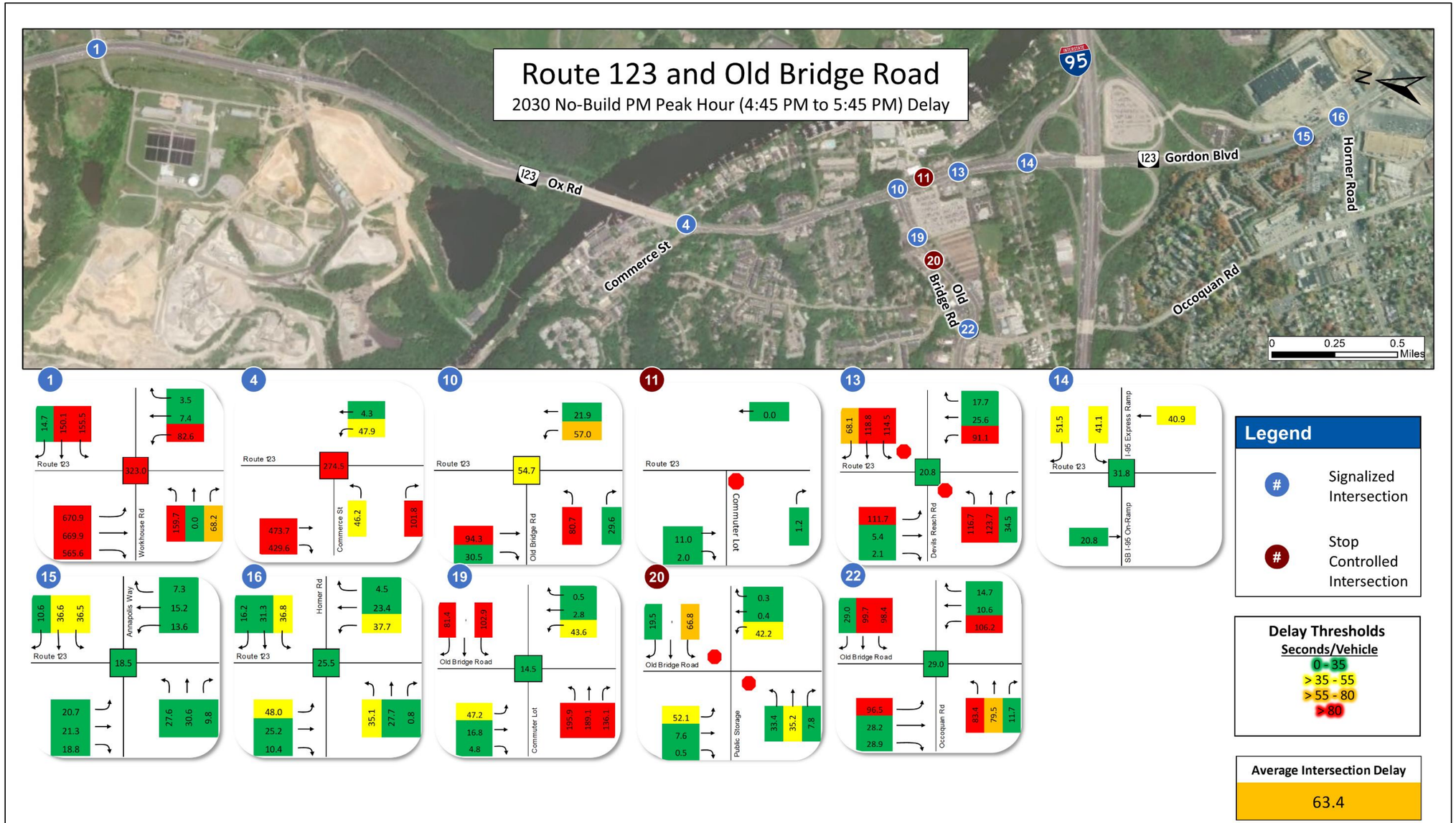
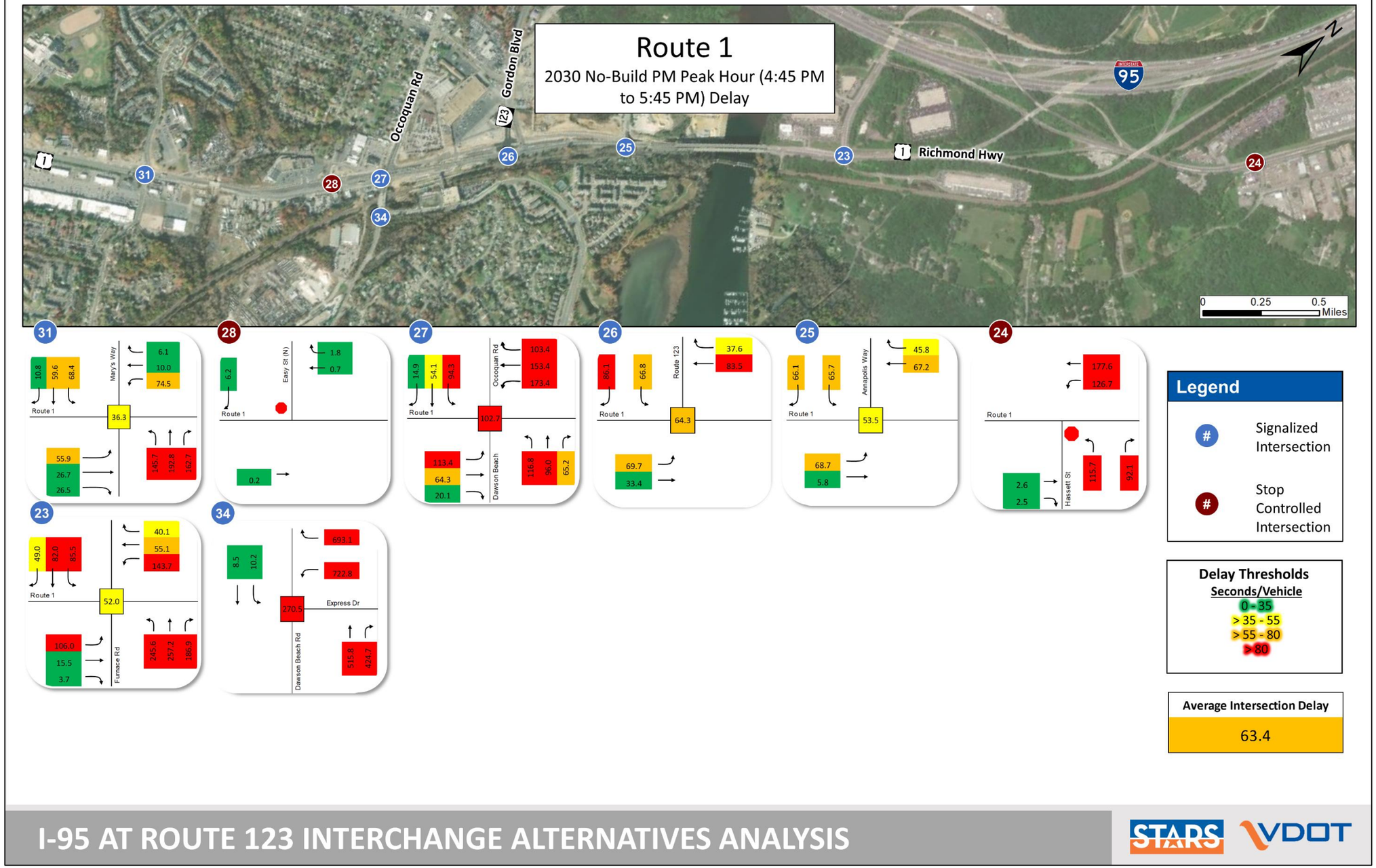


Figure 63: 2030 No Build Conditions – PM Peak Hour Delay (2 of 3)



I-95 AT ROUTE 123 INTERCHANGE ALTERNATIVES ANALYSIS

Figure 64: 2030 No Build Conditions – PM Peak Hour Delay (3 of 3)

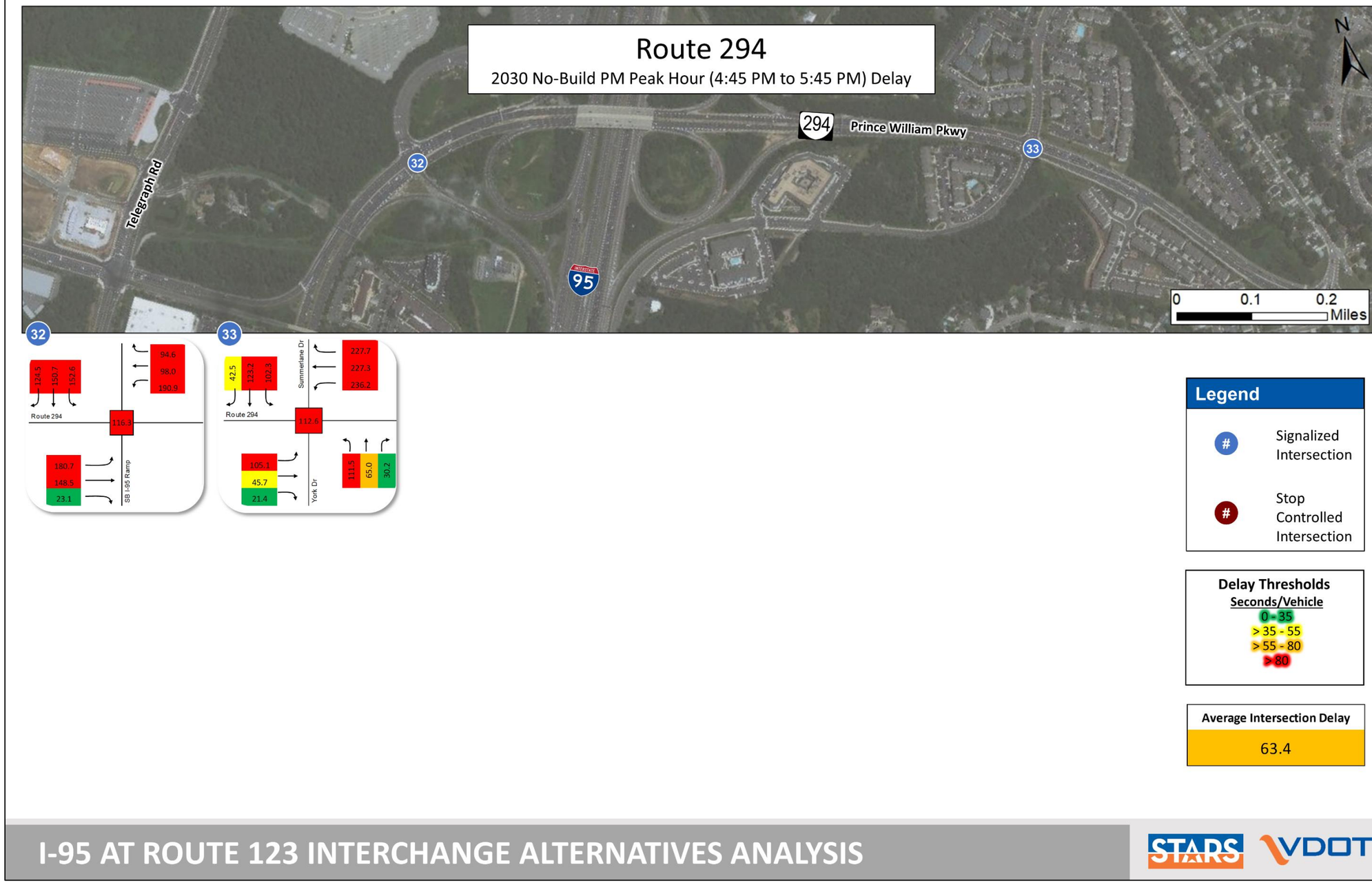


Figure 65: 2045 No Build Conditions – AM Peak Hour Delay (1 of 3)

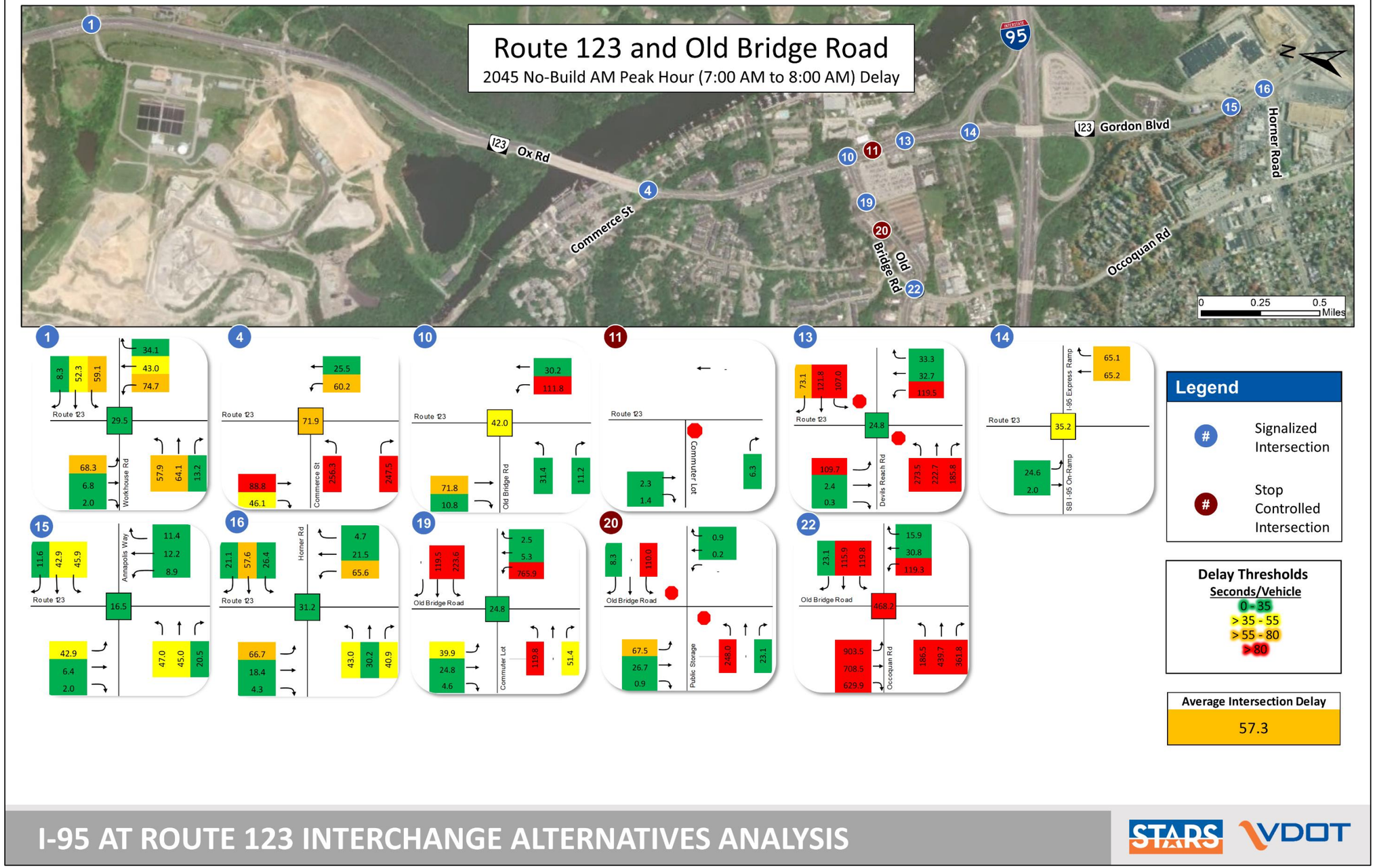


Figure 66: 2045 No Build Conditions – AM Peak Hour Delay (2 of 3)

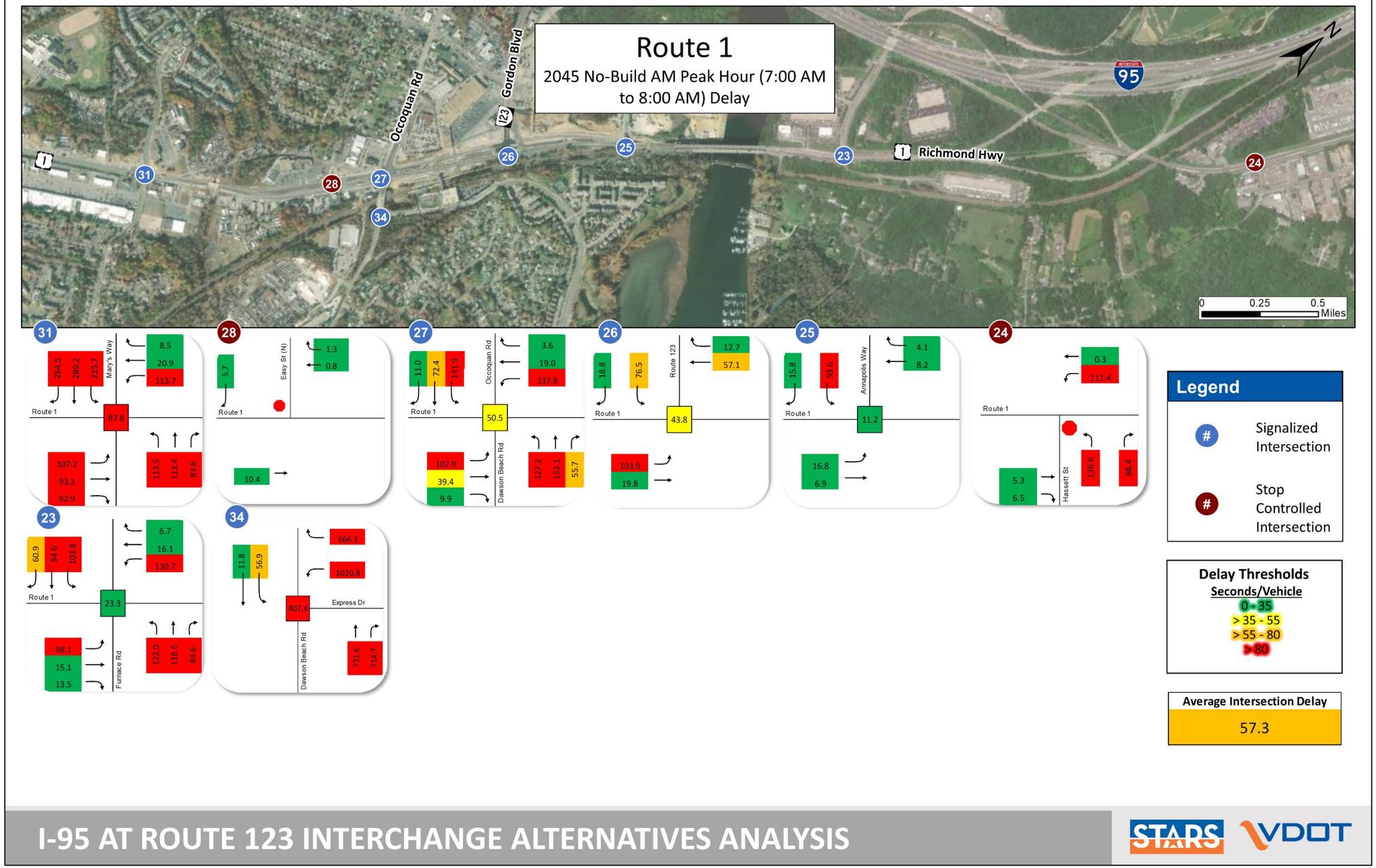


Figure 67: 2045 No Build Conditions – AM Peak Hour Delay (3 of 3)

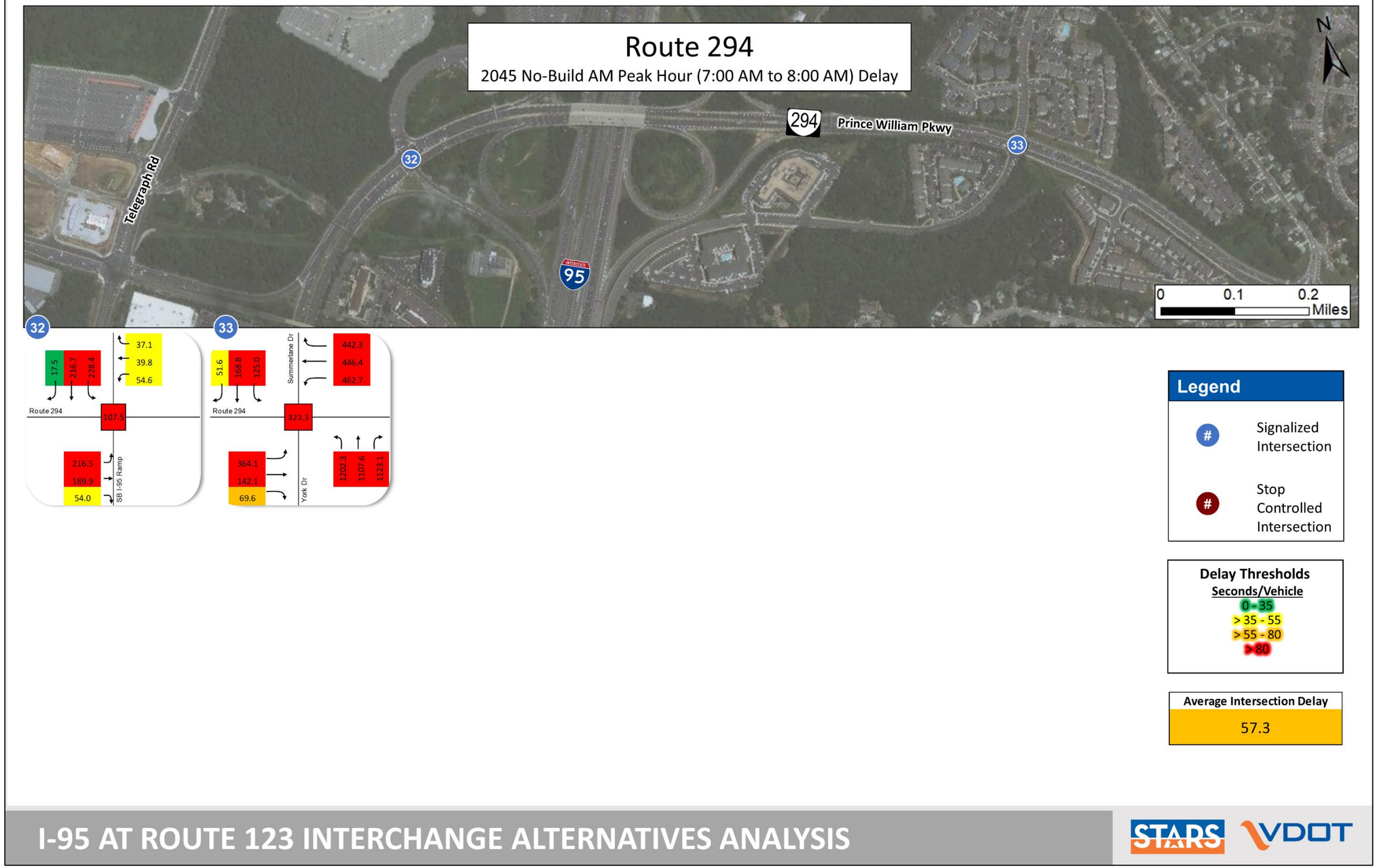


Figure 68: 2045 No Build Conditions – PM Peak Hour Delay (1 of 3)

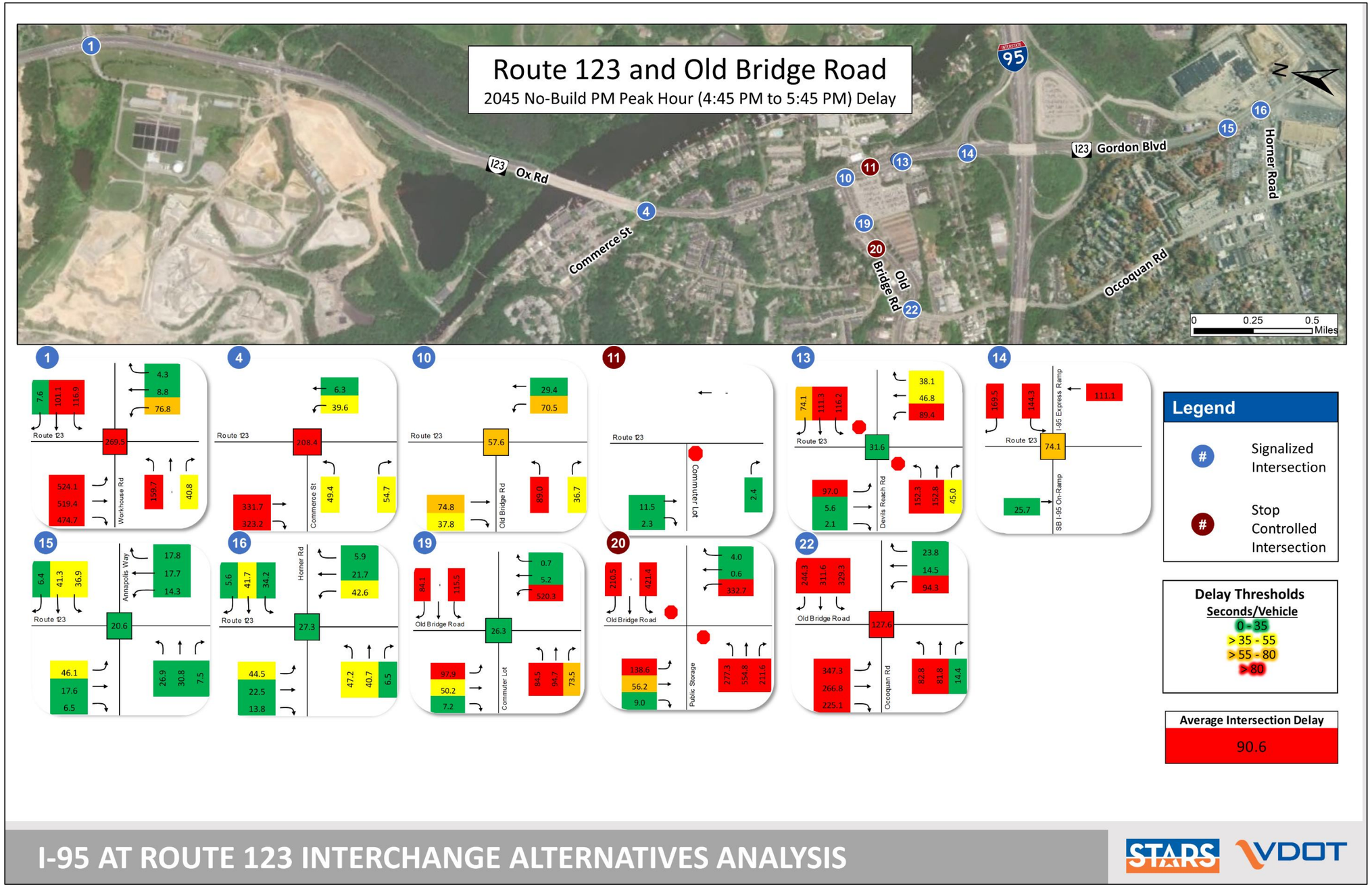


Figure 69: 2045 No Build Conditions – PM Peak Hour Delay (2 of 3)

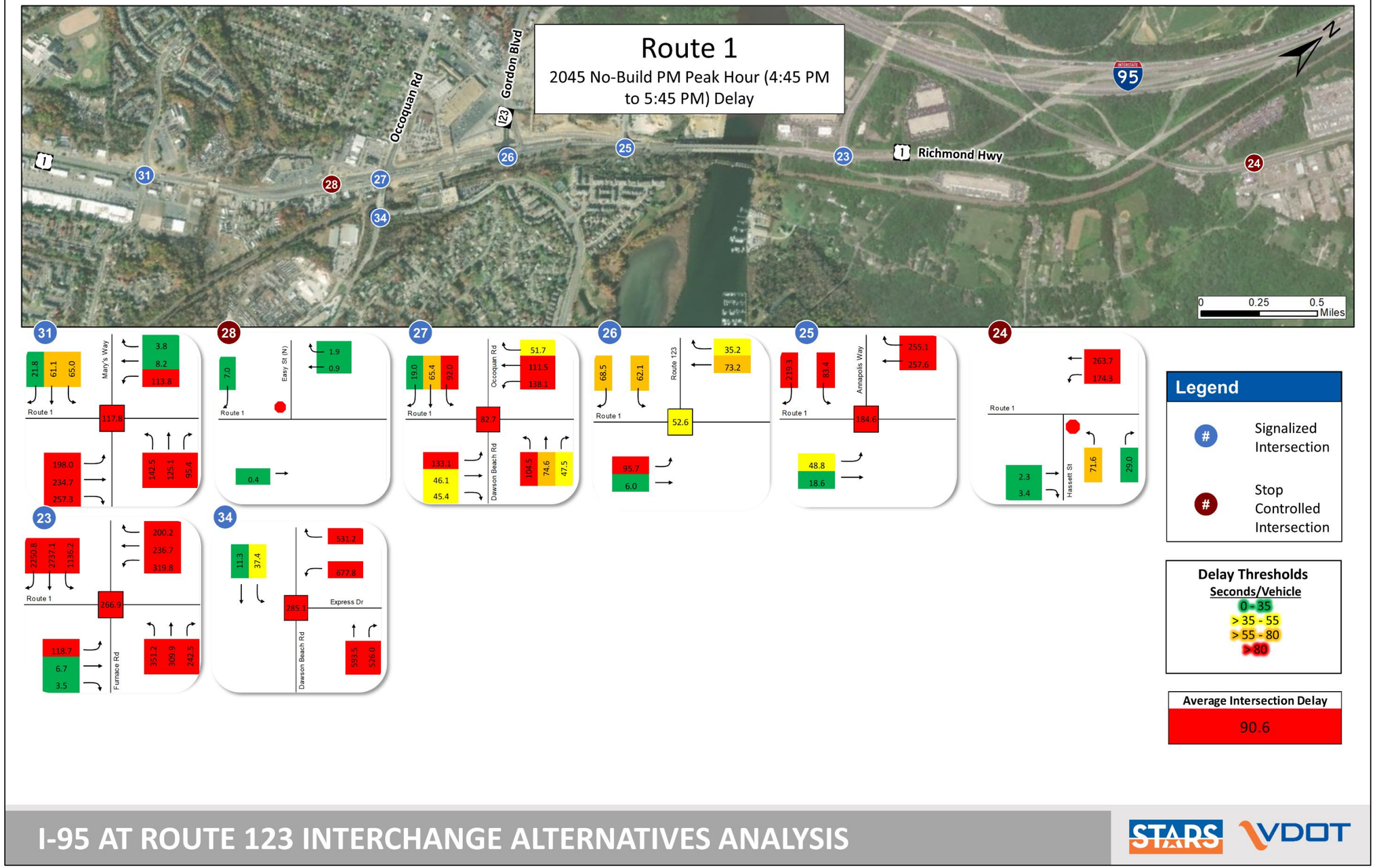
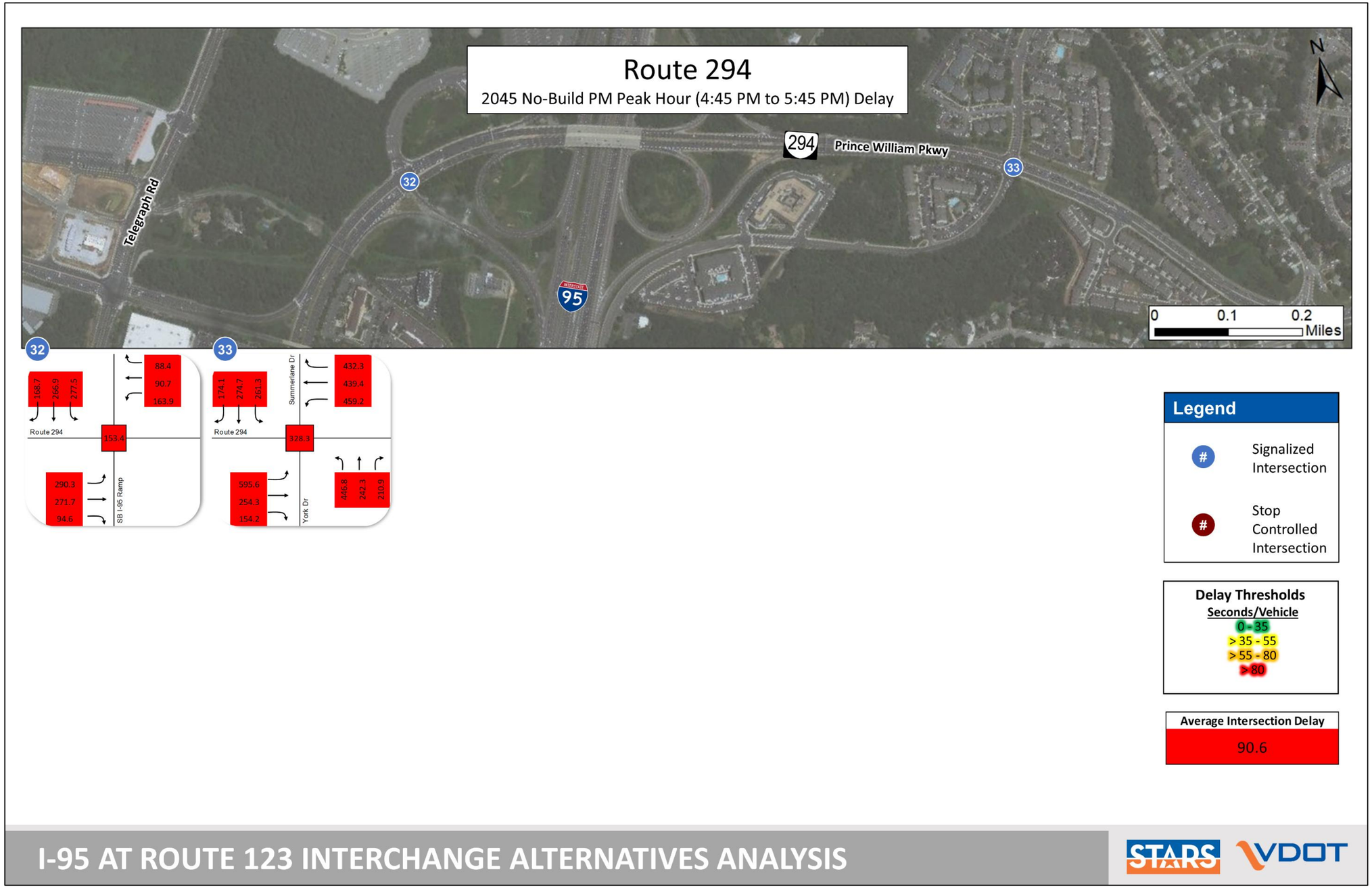


Figure 70: 2045 No Build Conditions – PM Peak Hour Delay (3 of 3)



5 Screening of Alternatives and Alternatives Considered

Improvement concepts were identified for the I-95 at Route 123 interchange and the Route 123 at Old Bridge Road intersection to address safety, geometric, and operational deficiencies identified in the existing and No-Build conditions analyses. Concepts were vetted through internal meetings, shared with the SWG at multiple concept development meetings, and then screened based on preliminary operational analyses and feedback on feasibility from the SWG. Based on the screening results, multiple concepts were selected by the SWG to develop alternatives for refined analysis. This section summarizes the screening and selection process to develop alternatives that were advanced to conceptual design, more detailed analysis, and cost and schedule estimates.

5.1 No-Build Alternative

The analysis of the No-Build alternative for years 2030 and 2045 were conducted for the study area network. The results of the analysis are reported in ***Section 4.***

5.2 Concept Development

5.2.1 I-95 at Route 123 Interchange Concepts

The following preliminary concepts were identified for improvements to the I-95 at Route 123 interchange:

- **Concept 1 (Southbound)**: Remove the northbound Route 123 to southbound I-95 loop ramp to remove a merge point. Modify the existing Route 123 at I-95 Express Lanes ramp intersection to allow northbound Route 123 left turns the southbound I-95 and to allow southbound Route 123 right turns to bypass the traffic signal. Widen the southbound I-95 on-ramp to two lanes and connect to the southbound I-95 auxiliary lane widening. Relocate the southbound I-95 off-ramp to northbound Route 123 further south to increase the distance to the traffic signals at Devils Reach Road and Old Bridge Road intersections. Add a pedestrian and bicycle connection along Route 123 through the interchange.
- **Concept 2 (Southbound)**: Replace the I-95 Express Lanes ramp with a new reversible flyover ramp to the I-95/Route 123 Commuter Lot. Remove the northbound Route 123 to southbound I-95 loop ramp to remove a merge point. Modify the existing Route 123 at I-95 Express Lanes ramp intersection to allow northbound Route 123 left turns to southbound I-95 and southbound Route 123 right turns to bypass the traffic signal. Widen the southbound I-95 on-ramp to two lanes and connect to the southbound I-95 auxiliary lane widening. Relocate the southbound I-95 off-ramp to northbound Route 123 further south to increase the distance to the traffic signals at Devils Reach Road and Old Bridge Road. Add a pedestrian and bicycle connection along Route 123 through the interchange.
- **Concept 3 (Northbound)**: Remove the northbound I-95 to northbound Route 123 loop ramp to eliminate the weaving traffic movement. Relocate access to the I-95/123 Commuter Lot to Annapolis Way. Remove the ramp from northbound Route 123 to northbound I-95. Add a new traffic signal on Route 123 to allow left turns onto and off the existing northbound I-95 ramps in the southwest quadrant. Widen the ramp from Route 123 to northbound I-95 to two lanes and add a third southbound Route 123 through lane. Add a pedestrian and bicycle connection along Route 123 through the interchange.
- **Concept 4 (Northbound)**: Remove the northbound I-95 to northbound Route 123 loop ramp to eliminate the weaving traffic movement. Add a new traffic signal on Route 123 to allow left turns from the northbound I-95 off-ramp to northbound Route 123. Allow access into the I-95/Route 123 Commuter Lot via the traffic signal from northbound I-95 and southbound Route 123, and out of the lot to northbound Route 123. Widen the ramp from southbound Route 123 to northbound I-95 to two lanes and add a third southbound Route 123 through lane. Add a pedestrian and bicycle connection along Route 123 through the interchange.
- **Concept 5 (Northbound)**: Remove the southbound Route 123 to northbound I-95 loop ramp. Add a new traffic signal on Route 123 to allow left turns from southbound Route 123 to the existing northbound I-95 on-ramp. Relocate access from southbound Route 123 to the I-95/Route 123 Commuter Lot to Annapolis Way. Add a pedestrian and bicycle connection along Route 123 through the interchange.
- **Concept 6 (Northbound and Southbound)**: Convert to a diverging diamond interchange (DDI) by closing all loop ramps and providing two-lane entrance and exit ramp spurs where needed. Replace the I-95 Express Lanes ramp with a new reversible flyover ramp to the I-95/Route 123 Commuter Lot. Add a pedestrian and bicycle connection along Route 123 through the interchange.

All concepts were selected by the SWG to advance to screening except for Concept 3, which had failing operations due to consolidating four northbound ramps to two and traffic volume from northbound off- and on-ramps conflicting at the same intersection. Other concepts considered by the SWG during the study but not advanced for further study include:

- **Southbound I-95 Auxiliary Lane Extension**: Extend the southbound I-95 auxiliary lane between Route 123 and Route 294 further north to start at the existing lane drop at the Route 123 interchange. In 2018, VDOT studied two options prior to starting the auxiliary lane project: 1) construct an auxiliary lane between the on-ramp from Route 123 and off-ramp to Route 294, and 2) construct an auxiliary lane between the existing lane drop at Route 123 and the off-ramp to Route 294. Option 2 was determined to reduce peak southbound I-95 travel time by approximately 10% to 15% compared to option 1, but consequently congestion would be shifted south between Route 123 and Route 294 and would be equally congested in terms of queue lengths and delays, or potentially worse depending on the time of day. These options were revisited during this STARS study, which found similar results. The auxiliary lane extension improvement was not further pursued as part of the recommended improvements in this STARS study that could be advanced through VDOT's current funding opportunities. The feasibility of the auxiliary lane at the lane drop could be considered further by VDOT as a potential component of other I-95 corridor studies or future improvements to I-95 once other improvements from this STARS study and the auxiliary lane project are completed and operational.
- **Collector-Distributor Road System**: Add a C-D lane system for northbound and/or southbound I-95 at the Route 123 interchange to reduce the number of entrance and exit points on I-95. Given existing interchange spacing, the C-D road may need to connect north through the Route 1 interchange and potentially connect south to the Route 294 C-D lane. The C-D lane system was not pursued as part of the recommended improvements in the STARS study because of the impacts of the required additional C-D lanes, additional shoulders, and widening of the Occoquan River bridge.

5.2.2 Route 123 at Old Bridge Road Intersection Concepts

The following preliminary concepts were identified for improvements to the Route 123 at Old Bridge Road intersection:

- **Concept A (Flyover Inside/Inside)**: Replace the northbound left-turn movement from Route 123 to Old Bridge Road at the traffic signal with a two-lane flyover ramp from the inside lanes of Route 123 to the inside lanes of Old Bridge Road. *This concept was not advanced because it would not eliminate the northbound Route 123 weaving movement due to the inside lane configuration.*
- **Concept B (Flyover Outside/Outside)***: Replace the northbound left-turn movement from Route 123 to Old Bridge Road at the traffic signal with a two-lane flyover ramp from the outside lanes of Route 123 to the outside lanes of Old Bridge Road.
- **Concept C (Flyover Outside/Inside)***: Replace the northbound left-turn movement from Route 123 to Old Bridge Road at the traffic signal with a two-lane flyover ramp from the outside lanes of Route 123 to the inside lanes of Old Bridge Road.
- **Concept D (Flyover Inside/Outside)**: Replace the northbound left-turn movement from Route 123 to Old Bridge Road at the traffic signal with a two-lane flyover ramp from the inside lanes of Route 123 to the outside lanes of Old Bridge Road. *This concept was not advanced because it would not eliminate the northbound Route 123 weaving movement due to the inside lane configuration.*

- **Concept E (Flyover Outside Bypass)**: Add a two-lane flyover ramp from the southbound I-95 off-ramp to the outside lanes of westbound Old Bridge Road. Restrict the northbound left-turn movement from Route 123 to Old Bridge Road and reroute non-I-95 traffic to Commerce Street and an upgraded Union Street/Tanyard Hill Road bypass roadway. *This concept was not advanced because of traffic impacts to the Town of Occoquan with rerouted movements and impacts of upgrading Union Street/Tanyard Hill Road.*
- **Concept F (Elevate Southbound Route 123)***: Elevate southbound Route 123 over the intersection and retain the existing traffic signal for the remaining movements.
- **Concept G (Echelon)***: Elevate southbound Route 123 and eastbound Old Bridge Road approaches at a new traffic signal. The northbound left-turn and through movements would remain at-grade. Relocate the Occoquan Commuter Lot driveway further west along Old Bridge Road.
- **Concept H (Trumpet)**: Replace the northbound left-turn movement from Route 123 to Old Bridge Road at the traffic signal with a two-lane elevated loop ramp from northbound Route 123 to westbound Old Bridge Road. *This concept was not advanced because of the property impacts and terrain east of Route 123.*
- **Concept I (Superstreet)**: Reroute northbound left-turn movement from Route 123 to Old Bridge Road to a signalized U-turn north of the existing intersection. *This concept was not advanced because it was not able to accommodate the future traffic volumes.*
- **Concept J (Quadrant)**: Add a new southwest quadrant one-way roadway around the Occoquan Commuter Lot between the existing Old Bridge Road/Commuter Lot and Route 123/Devils Reach Road intersections. Reroute left turns from eastbound Old Bridge Road to northbound Route 123 to the new roadway. Terminate Devils Reach Road in a cul-de-sac but retain access to Occoquan Road. *This concept was not advanced because it was not able to accommodate the future traffic volumes and moves congestion closer to the I-95 interchange.*
- **Concept K (Extended DDI)**: Extend the I-95 interchange Concept 6 DDI further north through the Old Bridge Road intersection. *This concept was not advanced because it did not accommodate a connection from southbound I-95 to westbound Old Bridge Road.*
- **Concept L (Continuous Flow)**: Reconfigure as a continuous flow or displaced left-turn intersection. Cross northbound Route 123 and eastbound Old Bridge Road vehicles to the other side of opposing through traffic in advance of the intersection. *This concept was not advanced because of insufficient intersection spacing and driveway access impacts.*
- **Concept M (Bypass 1)**: Upgrade Union Street/Tanyard Hill Road as a bypass roadway between Old Bridge Road and Route 123. Reroute eastbound left turns from Old Bridge Road to the bypass. *This concept was not advanced because of traffic impacts to the Town of Occoquan with rerouted movements and impacts of upgrading Union Street/Tanyard Hill Road.*
- **Concept N (Bypass 2)**: Upgrade Union Street/Tanyard Hill Road as a bypass roadway between Old Bridge Road and Route 123. Reroute northbound left turns coming from southbound I-95 to Commerce Street and the bypass. *This concept was not advanced because of traffic impacts to the Town of Occoquan with rerouted movements and impacts of upgrading Union Street/Tanyard Hill Road.*
- **Concept O (Bypass 3)**: Upgrade Union Street/Tanyard Hill Road as a bypass roadway between Old Bridge Road and Route 123. Reroute all northbound left turns to Commerce Street and the bypass. Reroute all eastbound left turns from Old Bridge Road to the bypass. *This concept was not advanced because of traffic impacts to the Town of Occoquan with rerouted movements and impacts of upgrading Union Street/Tanyard Hill Road.*
- **Concept P (Grade-Separated)***: Elevate Route 123 through movements over the intersection and retain the existing traffic signal for the remaining movements.
- **Concept Q (Direct Bypass)**: Realign Old Bridge Road to connect more directly from the Route 123/I-95 Express Lanes ramp intersection and the Old Bridge Road/Occoquan Road intersection. Provide direct access from southbound I-95 and Express Lanes to Old Bridge Road. *This concept was not advanced because of property impacts since it was unable to accommodate the magnitude of traffic volumes while moving congestion closer to I-95.*
- **Concept R (Direct Bypass Flyover)**: Add a two-lane flyover ramp from southbound I-95 to westbound Old Bridge Road west of Occoquan Road. Replace the I-95 Express Lanes ramp with a new reversible flyover ramp to the I-95/Route 123 Commuter Lot and remove the existing traffic signal at the Express Lanes ramp. *This concept was not advanced because of property impacts and the high cost of multiple long elevated ramps.*
- **Concept S (Southbound I-95 Ramp Diversion)***: Reroute southbound I-95 traffic destined for Old Bridge Road to a signal-controlled right-turn movement at Route 123. Remove traffic signal at Devils Reach Road and convert this intersection to right-in/right-out. Extend northbound left-turn lanes for Old Bridge Road to receive signal-controlled I-95 ramp traffic.
- **Concept T (Elevated Left Turns)***: Elevate left-turn movements for northbound Route 123 and eastbound Old Bridge Road at a new traffic signal. The remaining movements remain at-grade at the existing intersection. Relocate the Occoquan Commuter Lot driveway further west along Old Bridge Road.

The concepts marked with an asterisk were selected by the SWG to advance to screening. Other concepts considered by the SWG during the study but not advanced include:

- **Continuous Green-T**: Covert to a continuous green-T intersection where northbound Route 123 could pass through the intersection without stopping and left-turn vehicles from eastbound Old Bridge Road could use a channelized receiving lane on Route 123. This concept does not remove conflicts between the remaining high-volume movements and does not eliminate the northbound Route 123 weaving movement.
- **Eastbound Old Bridge Road Left-Turn Flyover**: Replace the eastbound left-turn movement from Old Bridge Road to Route 123 at the traffic signal with a two-lane flyover ramp. This configuration does not eliminate the northbound Route 123 weaving movement.

5.3 Concepts Screening

Through collaboration with the SWG an evaluation matrix was developed to screen the concepts and select alternatives for further analysis. The concepts were evaluated relative to each other based on the following criteria:

- **Right-of-way and utility impacts**: evaluated based on conceptual sketches and associated impacts to adjacent properties and known utilities
- **Commuter lot access and transit**: assessed based on impacts to access for the I-95/123 Commuter Lot and/or the Occoquan Commuter Lot, and existing transit services
- **Express Lanes impact**: assessed based on impacts to access for the I-95 Express Lanes
- **Safety improvements**: assessed using a comparison of relative number of conflict points and ability to separate major conflicting movements
- **Operational improvements**: assessed using Synchro, Vissim, or HCS traffic analysis tools based on a comparison of delay, travel time, queuing, density, and speed, as applicable, under 2045 conditions
- **Constructability**: assessed based on considerations regarding phasing of construction and the relative difficulty of maintaining traffic during construction of the alternative
- **Pedestrian and bicycle connections**: assessed based on new facilities (e.g., shared-use path, sidewalk) and crossings
- **Environmental impacts**: assessed based on a review of readily available databases pertaining to wetlands, historic resources, and hazardous materials. Each concept was scored based on its potential impact to wetlands, historic resources, or areas with known hazardous materials
- **Maintenance**: assessed on the various components of each concept that would require maintenance, such as the number of structures (e.g., bridges, retaining walls, ramps)
- **Cost of construction**: planning-level costs estimates were compared relative to other concepts

The criteria for each concept were assigned a score using the definitions shown in ***Table 24***. Each criterion was given a weight based on feedback from the SWG. The individual category scores were multiplied by the criteria weight and were summed to create a total score for the concept. The alternatives were than ranked relative to each other based on total score.

Table 24: Concept Screening Scoring Definitions

Symbol	Description	Score
++	Generally best concept	3
+	Generally better concept	2
o	Generally moderate concept	1
-	Generally worse concept	0
--	Generally worst concept	-1

A summary matrix of the criteria and rankings is shown in ***Table 25*** for the I-95 interchange concepts and ***Table 26*** for the Route 123 at Old Bridge Road intersection concepts. More detailed matrices are included in ***Appendix F***.

For the I-95 interchange, Concepts 5 and 6 were screened out. Concept 5, a northbound improvement, was screened out due to poor access from Route 123 to the I-95/123 Commuter Lot compared to Concept 4 and worse operations from converting the high-volume ramp from southbound Route 123 to northbound I-95 to a signalized left-turn movement. Concept 6, the DDI, was screened out due to poor commuter lot access and degraded operations along Route 123. Concepts 1, 2, and 4 were advanced from screening to further refinement and alternatives analysis.

For the Old Bridge Road intersection, three of the concepts advanced to screening were removed:

- **Concept F (Elevate Southbound Route 123)**: This concept was not advanced because it does not address the weaving movement from the southbound I-95 off-ramp to northbound left turn at Old Bridge Road.
- **Concept G (Echelon)**: This concept was not advanced because it does not address the weaving movement from the southbound I-95 off-ramp to northbound left turn at Old Bridge Road and would create barriers to accessing the Occoquan Commuter Lot.
- **Concept S (Southbound I-95 Ramp Diversion)**: This concept was not advanced due to the long-term operational and safety risks of signalizing the southbound I-95 off-ramp and the resulting ramp queuing. The concept also does not address other needs aside from controlling the northbound Route 123 weaving movement.

Four concepts were advanced from screening to further refinement and alternatives analysis: Concept B (Flyover Outside/Outside), Concept C (Flyover Outside/Inside), Concept G (Grade-Separated), and Concept T (Elevated Left Turns).

Table 25: Preliminary Concept Screening Matrix for I-95 at Route 123 Interchange

Concept	Right-of-Way and Utility Impacts	Commuter Lot Access and Transit	Express Lanes Impact	Safety Improvements	Operational Improvements	Constructability	Pedestrian and Bicycle Connections	Environmental Impacts	Maintenance	Cost of Construction	Score (out of 75 possible)	Rank (out of 6)
Category Weighting	2	2	3	5	5	1	2	1	1	3		
No-Build	++	○	++	--	--	++	--	++	++	++	23	5
Concept 1 (Southbound I-95)	○	○	○	++	++	○	○	○	+	○	46	2
Concept 2 (Southbound I-95)	○	+	-	++	++	-	○	○	○	-	40	4
Concept 4 (Northbound I-95)	+	++	++	+	+	++	○	○	○	+	52	1
Concept 5 (Northbound I-95)	+	-	++	○	+	+	+	+	-	+	42	3
Concept 6 (Northbound and Southbound I-95)	-	--	--	++	-	--	-	-	--	--	5	6

Key: ++ Best + Better ○ Moderate - Worse -- Worst

Table 26 Preliminary Concept Screening Matrix for Route 123 at Old Bridge Road Intersections

Concept	Right-of-Way and Utility Impacts	Commuter Lot Access and Transit	Express Lanes Impact	Safety Improvements	Operational Improvements	Constructability	Pedestrian and Bicycle Connections	Environmental Impacts	Maintenance	Cost of Construction	Score (out of 78 possible)	Rank (out of 8)
Category Weighting	2	2	2	5	5	1	4	1	1	3		
No-Build	++	++	○	--	--	++	-	+	○	++	18	5
Concept B Flyover (Outside/Outside)	+	+	+	+	+	+	○	○	+	+	45	2
Concept C Flyover (Outside/Inside)	○	+	+	+	++	○	+	○	+	○	48	1
Concept F Elevate Southbound Route 123	-	-	-	--	○	○	+	-	○	○	13	6
Concept G Echelon	--	○	+	-	+	--	-	-	-	--	8	8
Concept P Grade-Separated	--	-	-	+	++	--	++	-	+	-	36	3
Concept S Southbound I-95 Ramp Diversion	+	+	--	-	--	-	+	○	+	-	13	6
Concept T Elevated Left Turns	--	+	+	+	+	○	+	-	+	--	32	4

Key: ++ Best + Better ○ Moderate - Worse -- Worst

5.4 Alternatives Selected for Refined Analysis

Based on concept screening, the SWG selected three I-95 improvement concepts and four Old Bridge Road improvement concepts to form alternatives for more refined analysis. During the study process and because of stakeholder and public input, southbound I-95 Concept or Alternative 1 evolved into several variations as described in the following section.

5.4.1 I-95 at Route 123 Interchange Alternatives

I-95 Southbound Improvement Alternative 1

Three variations of Alternative 1 were developed through the study process.

I-95 Southbound Improvement Alternative 1A (see ***Figure 71***)

- Remove the northbound Route 123 to southbound I-95 loop ramp to eliminate a merge point
- Modify the existing Route 123 at I-95 Express Lanes ramp intersection to allow northbound Route 123 left turns to southbound I-95 and to allow southbound Route 123 right turns to bypass the traffic signal
- Widen the southbound I-95 on-ramp to two lanes and connect to the southbound I-95 auxiliary lane widening
- Relocate the southbound I-95 off-ramp to northbound Route 123 further south to increase the distance to the traffic signals at Devils Reach Road and Old Bridge Road intersections
- Add a pedestrian and bicycle connection along Route 123 through the interchange

I-95 Southbound Improvement Alternative 1B (see ***Figure 72***)

- Same improvements as Alternative 1A, except the southbound I-95 off-ramp to northbound Route 123 remains in its existing location

I-95 Southbound Improvement Alternative 1C (see ***Figure 73***)

Alternative 1C was developed and refined later in the study process after receiving public and stakeholder input on Alternatives 1A and 1B. It contains the features of Alternative 1A listed above with a few modifications. The shared-use path is located along northbound Route 123 through the interchange to minimize the number of uncontrolled and multi-lane ramp crossings and is also extended further south to Annapolis Way so the improvement can be implemented independently of a northbound I-95 improvement. Lastly, the location of the signalized intersection of Route 123, the southbound I-95 on-ramp, and the I-95 Express Lanes ramp is adjusted to limit impacts and potential modifications to the Express Lanes flyover bridge structure.

I-95 Southbound Improvement Alternative 2 (see ***Figure 74***)

- Remove the northbound Route 123 to southbound I-95 loop ramp to eliminate a merge point
- Modify the existing Route 123 at I-95 Express Lanes ramp intersection to allow northbound Route 123 left turns to southbound I-95 and to allow southbound Route 123 right turns to bypass the traffic signal
- Replace the I-95 Express Lanes ramp with a new flyover ramp into the I-95/Route 123 Commuter Lot, and reconfigure the lot to allow traffic to enter and exit the Express Lanes from Route 123 (i.e., Alternative 2 must be implemented with Alternative 4)
- Widen the southbound I-95 on-ramp to two lanes and connect to the southbound I-95 auxiliary lane widening
- Relocate the southbound I-95 off-ramp to northbound Route 123 further south to increase the distance to the traffic signals at Devils Reach Road and Old Bridge Road intersections
- Add a pedestrian and bicycle connection along Route 123 through the interchange

I-95 Northbound Improvement Alternative 4 (see ***Figure 75***)

- Remove the northbound I-95 to northbound Route 123 loop ramp and combine with the ramp from northbound I-95 to southbound Route 123
- Add a new traffic signal on Route 123 to maintain access to the I-95/123 Commuter Lot from northbound I-95 and southbound Route 123
- Widen the northbound I-95 on-ramp to accept two lanes of traffic for its full length
- Add a pedestrian and bicycle connection along Route 123 through the interchange

Figure 71: I-95 Southbound Improvement Alternative 1A

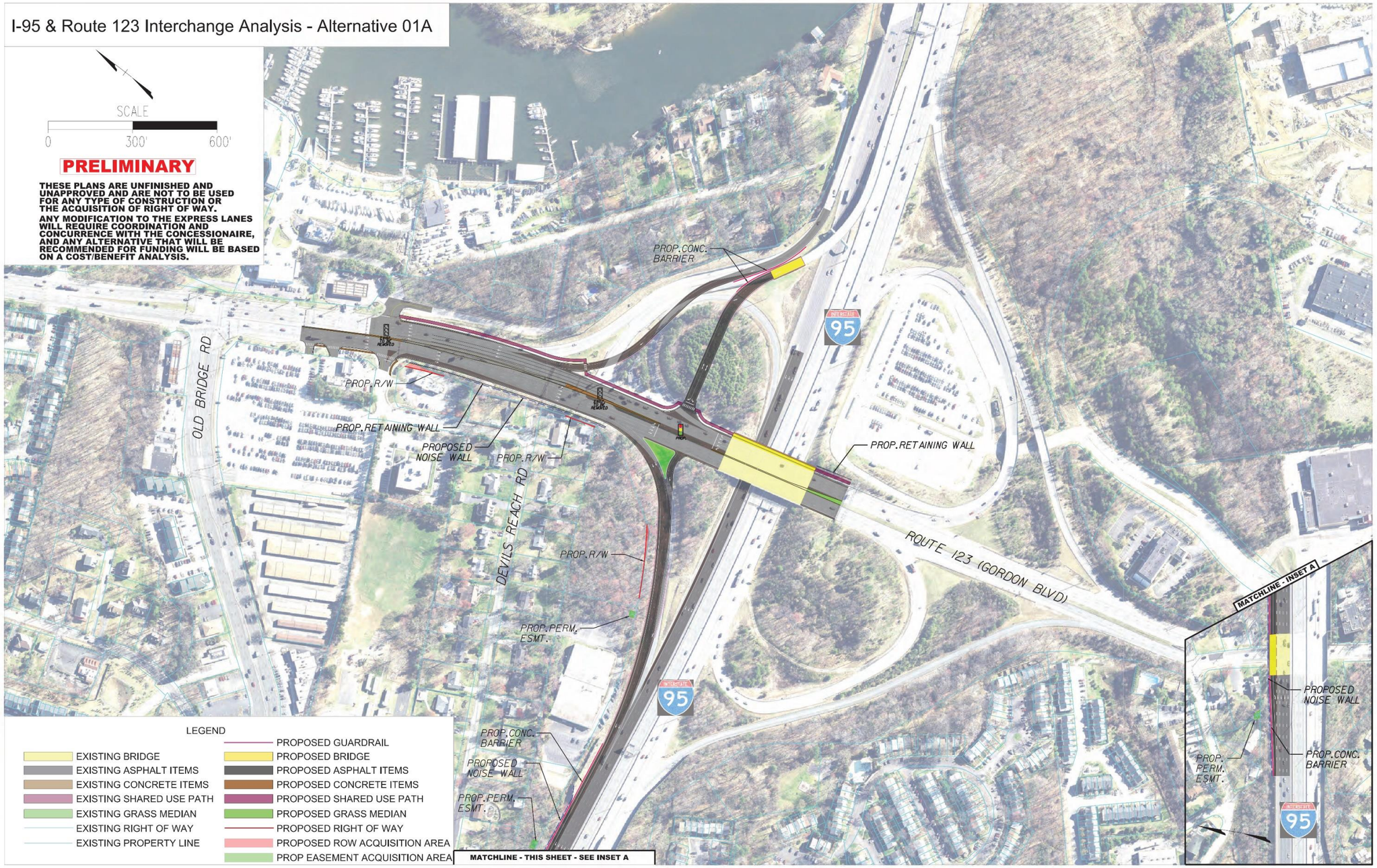


Figure 72: I-95 Southbound Improvement Alternative 1B

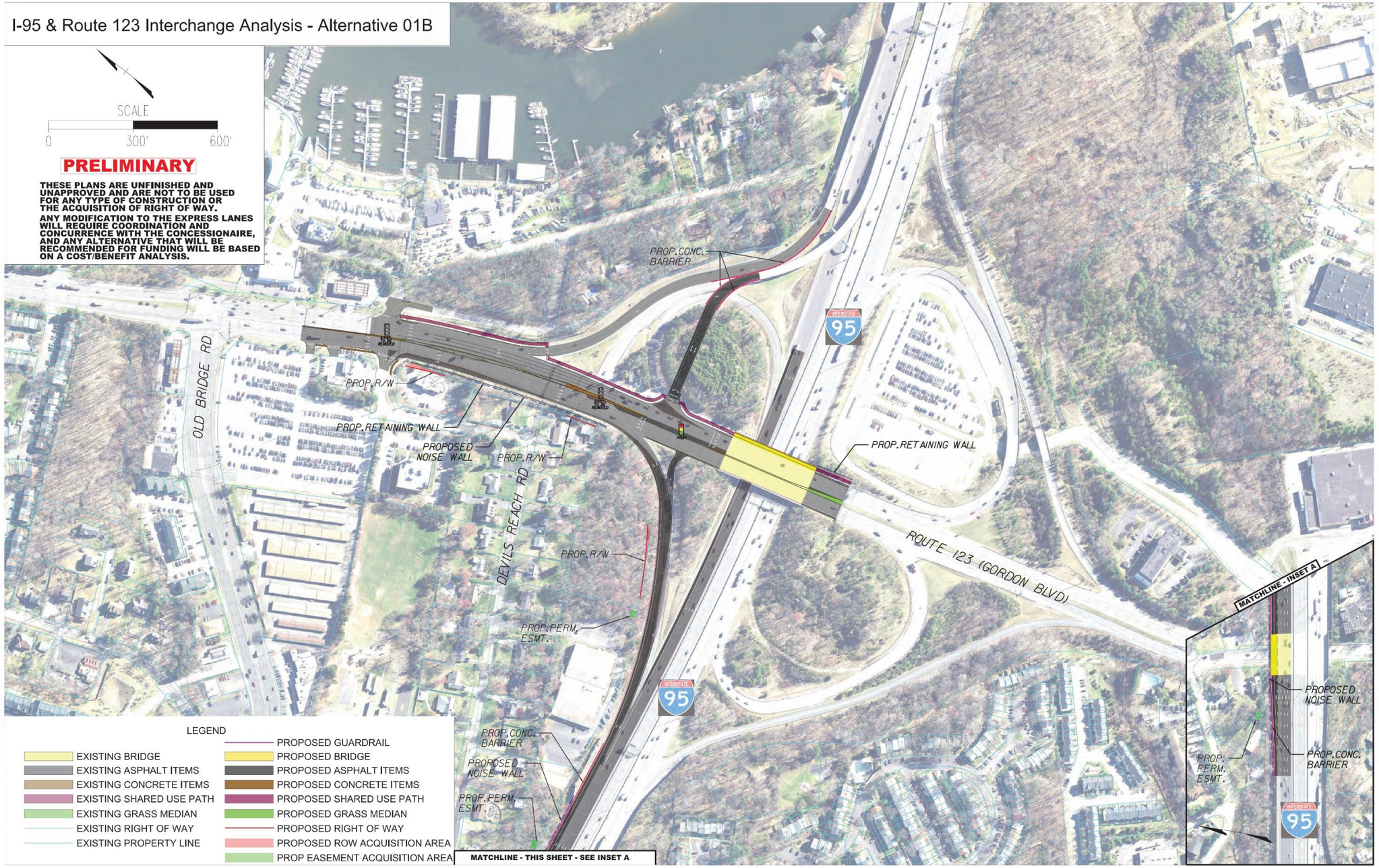


Figure 73: I-95 Southbound Improvement Alternative 1C

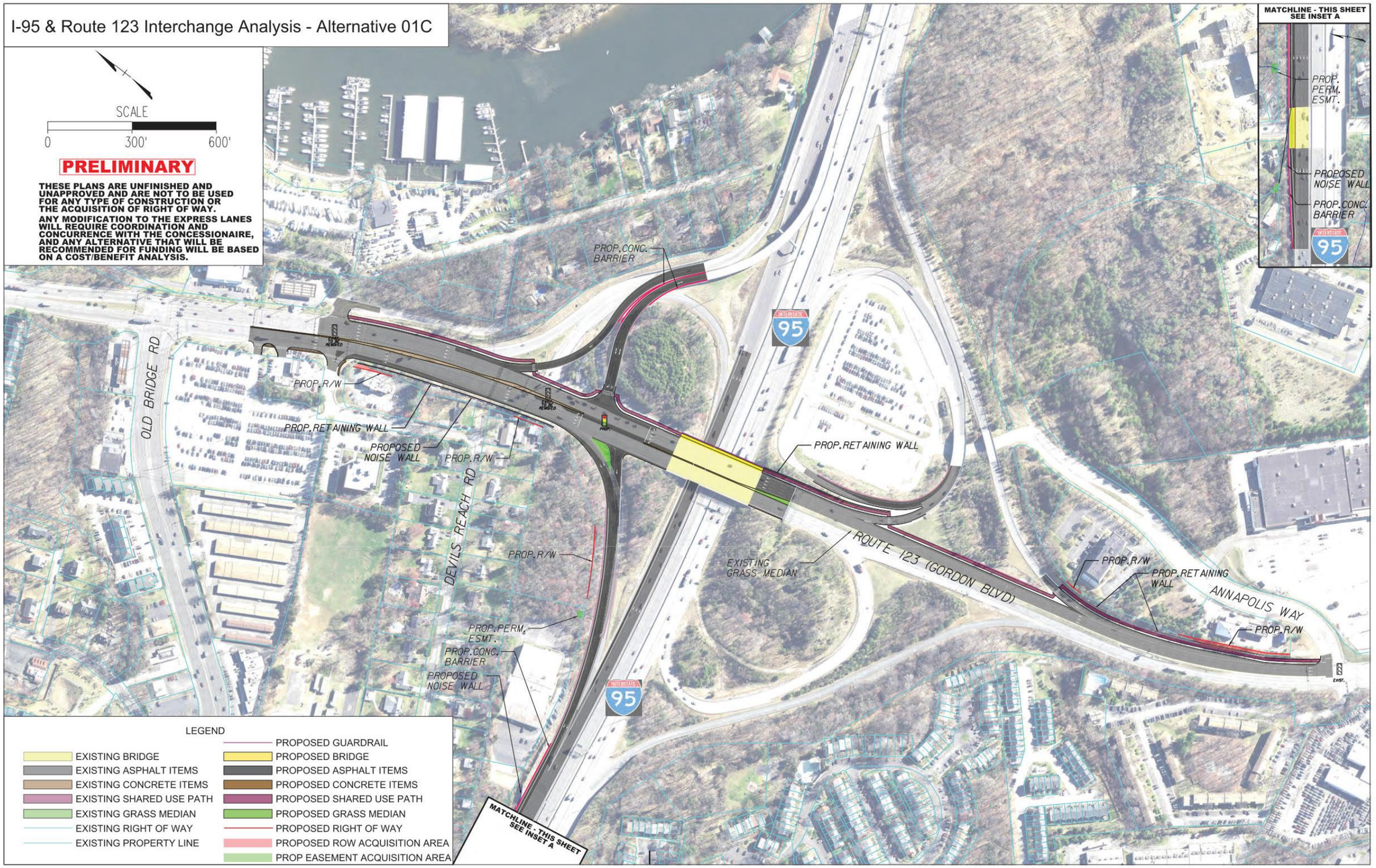


Figure 74: I-95 Southbound Improvement Alternative 2

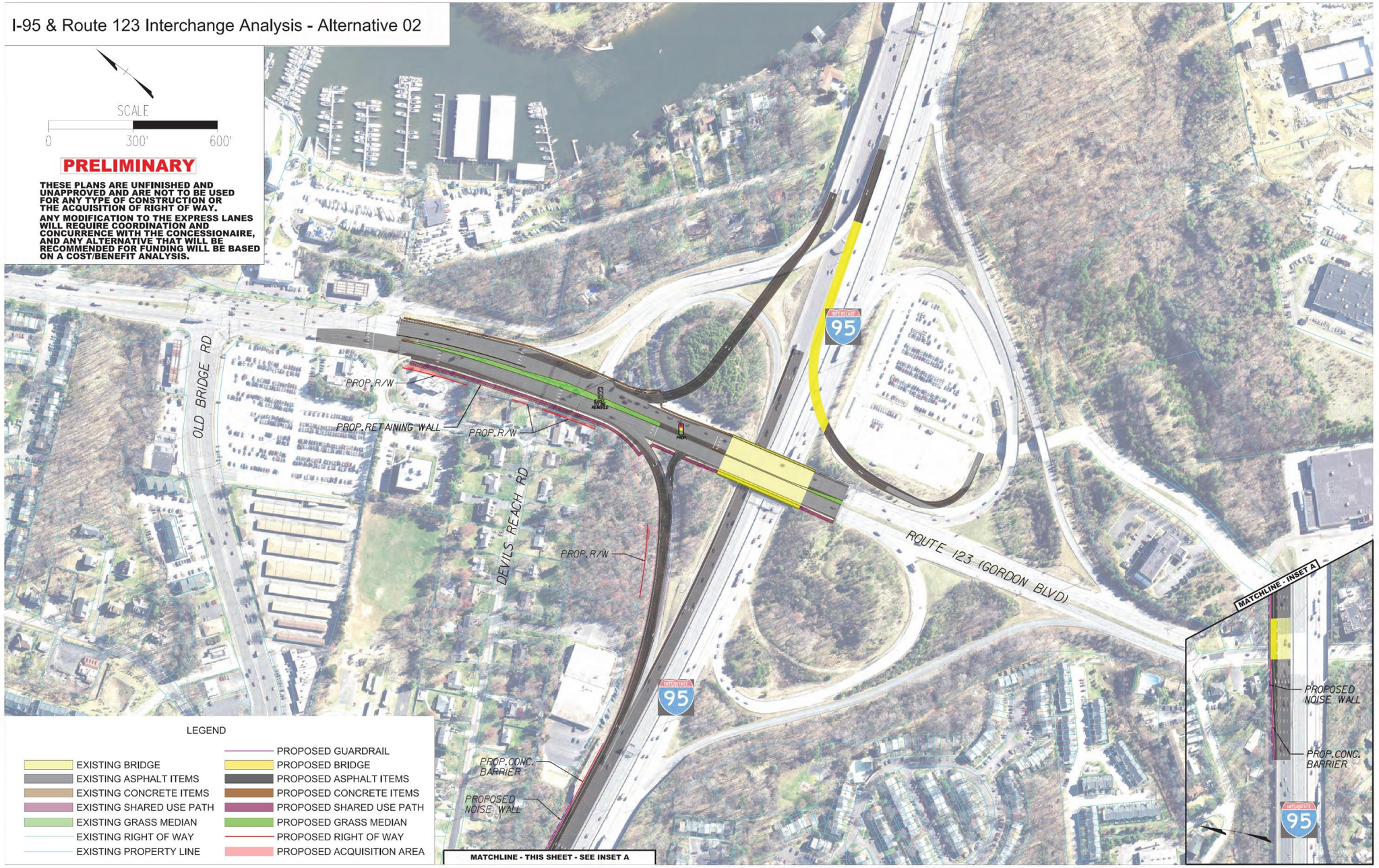
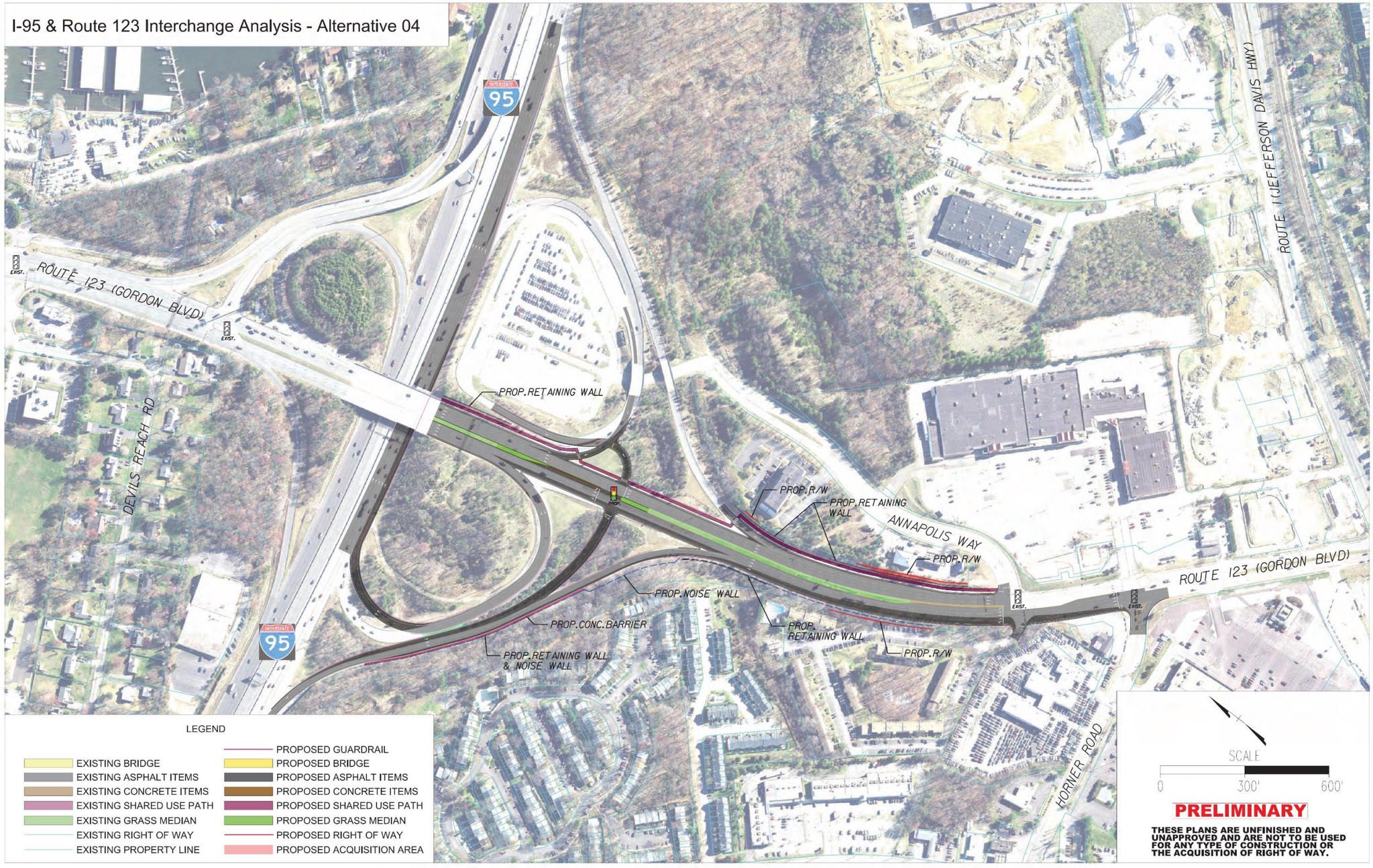


Figure 75: I-95 Northbound Improvement Alternative 4



5.4.2 Route 123 at Old Bridge Road Intersection Alternatives

Old Bridge Road Improvement Alternative – Flyover (Outside/Outside) (see ***Figure 76***)

- Construct a two-lane two-span flyover ramp from the outside right lanes of northbound Route 123 to the outside right lanes of westbound Old Bridge Road for left-turn traffic and to eliminate the weaving movement from southbound I-95
- Reconfigure the signalized intersection of Old Bridge Road and the Occoquan Commuter Lot to allow vehicles into the lot from the flyover ramp
- Widen northbound Route 123 to three lanes through the Old Bridge Road intersection
- Remove the traffic signal at Devils Reach Road and close the median opening to allow right-in-right-out access; left-turn and side street through movements are rerouted as U-turns at adjacent intersections
- Close the median opening on Old Bridge Road at the Fast Fuels gas station to provide additional storage for vehicles turning left to northbound Route 123
- Construct a shared-use path along northbound Route 123 that crosses to southbound Route 123 at the intersection, and relocate the sidewalk on the north side of Old Bridge Road to north of the flyover

Old Bridge Road Improvement Alternative – Flyover (Outside/Inside) (see ***Figure 77***)

- Construct a two-lane two-span flyover ramp from the outside right lanes of northbound Route 123 to the inside left lanes of westbound Old Bridge Road for left-turn traffic and to eliminate the weaving movement from southbound I-95
- Reconfigure the signalized intersection of Old Bridge Road and the Occoquan commuter lot to allow vehicles into the lot from the flyover ramp
- Relocate the right turn from southbound Route 123 to Old Bridge Road to the outside of the flyover to bypass the traffic signal and reduce conflicts at the intersection of Old Bridge Road at the Occoquan commuter lot
- Widen northbound Route 123 to three lanes through the Old Bridge Road intersection
- Remove the traffic signal at Devils Reach Road and close the median opening to allow right-in-right-out access; left-turn and side street through movements are rerouted as U-turns at adjacent intersections
- Construct a shared-use path along northbound Route 123 that crosses to southbound Route 123 at the intersection, and relocate the sidewalk on the north side of Old Bridge Road to north of the flyover

Old Bridge Road Improvement Alternative – Grade Separation (see ***Figure 78***)

- Construct a four-lane single-span bridge (two lanes in each direction plus shoulders) over Old Bridge Road for Route 123 through traffic
- Maintain a traffic signal under the bridge for turns to and from Old Bridge Road and pedestrian crossings; all traffic from southbound I-95 must travel through the signalized intersection to eliminate the weaving movement from southbound I-95
- Remove the traffic signal at Devils Reach Road and close the median opening to allow right-in-right-out access; left-turn and side street through movements are rerouted as U-turns at adjacent intersections
- Close the median opening on Old Bridge Road at the Fast Fuels gas station to provide additional storage for vehicles turning left to northbound Route 123
- Close the median opening on Route 123 at Admiral Drive and Riverview Lane, and provide a southbound U-turn movement under the proposed bridge
- Close the existing commuter lot driveway on southbound Route 123 and reroute traffic to the driveway on Old Bridge Road
- Construct a shared-use path along northbound Route 123 that crosses to southbound Route 123 at the intersection to connect to the existing path at Commerce Street, north into Fairfax County

Old Bridge Road Improvement Alternative – Elevated Left Turns (see ***Figure 79***)

- Construct ramps and a grade-separated intersection using a single span bridge for left turns from northbound Route 123 to westbound Old Bridge Road and from eastbound Old Bridge Road to northbound Route 123; all traffic coming from southbound I-95 must travel through the elevated intersection to eliminate the weaving movement from southbound I-95
- Relocate the right turn from southbound Route 123 to Old Bridge Road to the outside of the elevated ramps to bypass the traffic signal
- Remove the traffic signal at Devils Reach Road and close the median opening to allow right-in-right-out access; left turn and side street through movements are rerouted as U-turns at adjacent intersections
- Close the median opening on Route 123 at Admiral Drive, and prohibit southbound left turns from Route 123 to Riverview Lane (reroute local traffic for this movement to Poplar Lane)
- Relocate the traffic signal for Old Bridge Road and the Occoquan Commuter Lot further west to a new access driveway
- Construct a shared-use path along northbound Route 123 that crosses to southbound Route 123 at the intersection to connect to the existing path at Commerce Street, north into Fairfax County
- Construct a pedestrian tunnel through the northbound elevated ramp to provide an east-west crossing of Route 123 at Old Bridge Road

Figure 76: Old Bridge Road Improvement Alternative – Flyover (Outside/Outside)

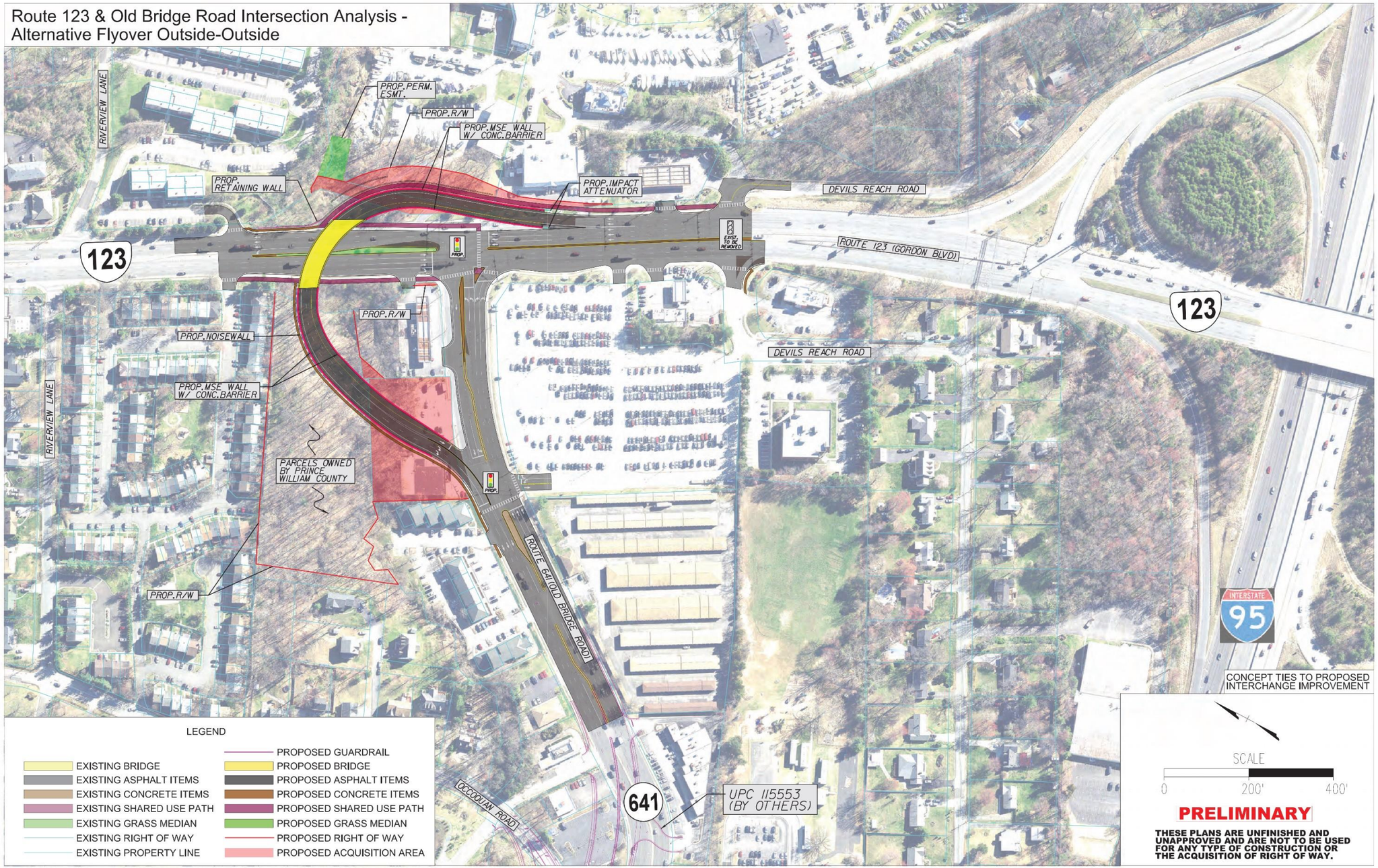


Figure 77: Old Bridge Road Improvement Alternative – Flyover (Outside/Inside)

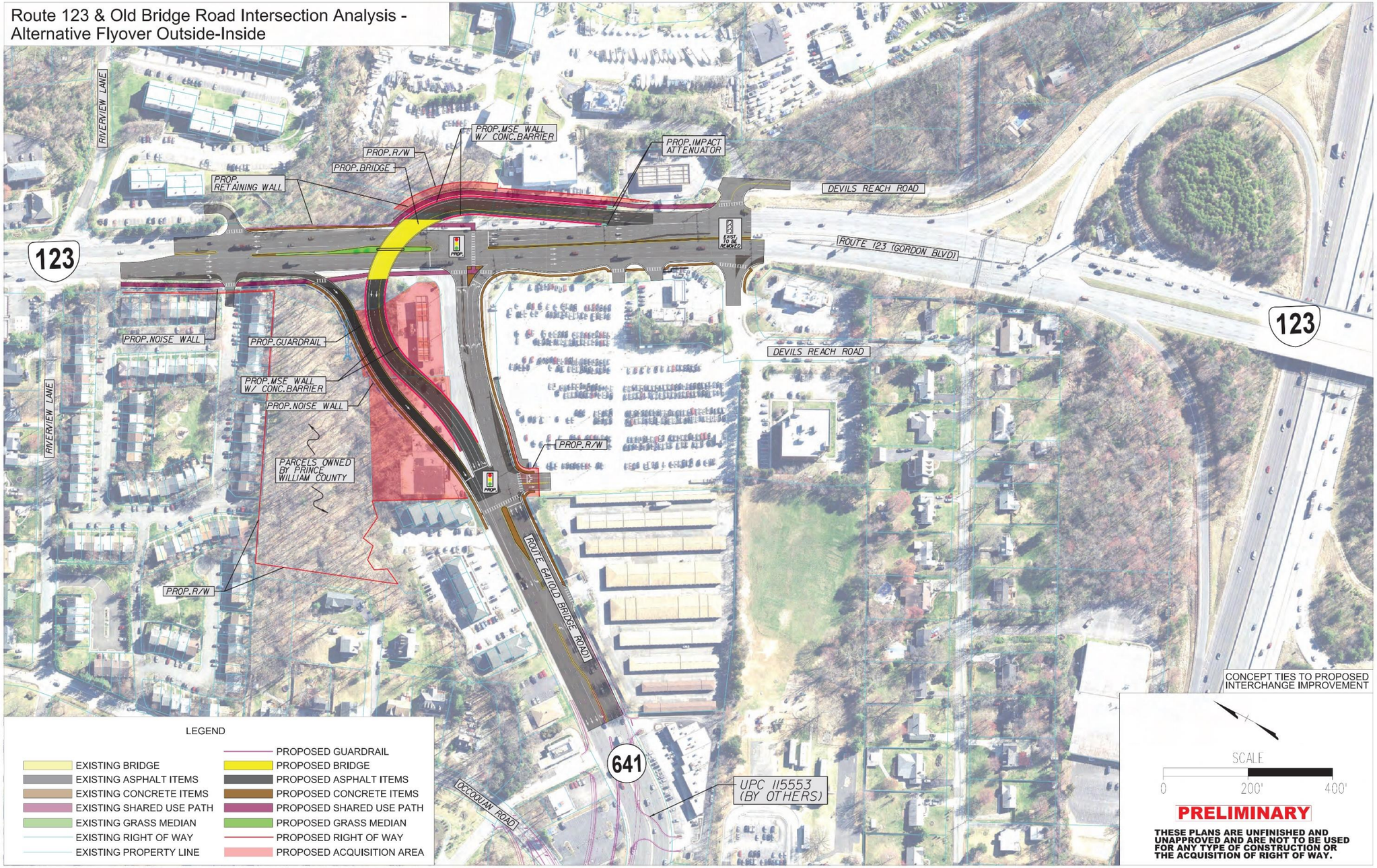


Figure 78: Old Bridge Road Improvement Alternative – Grade-Separated

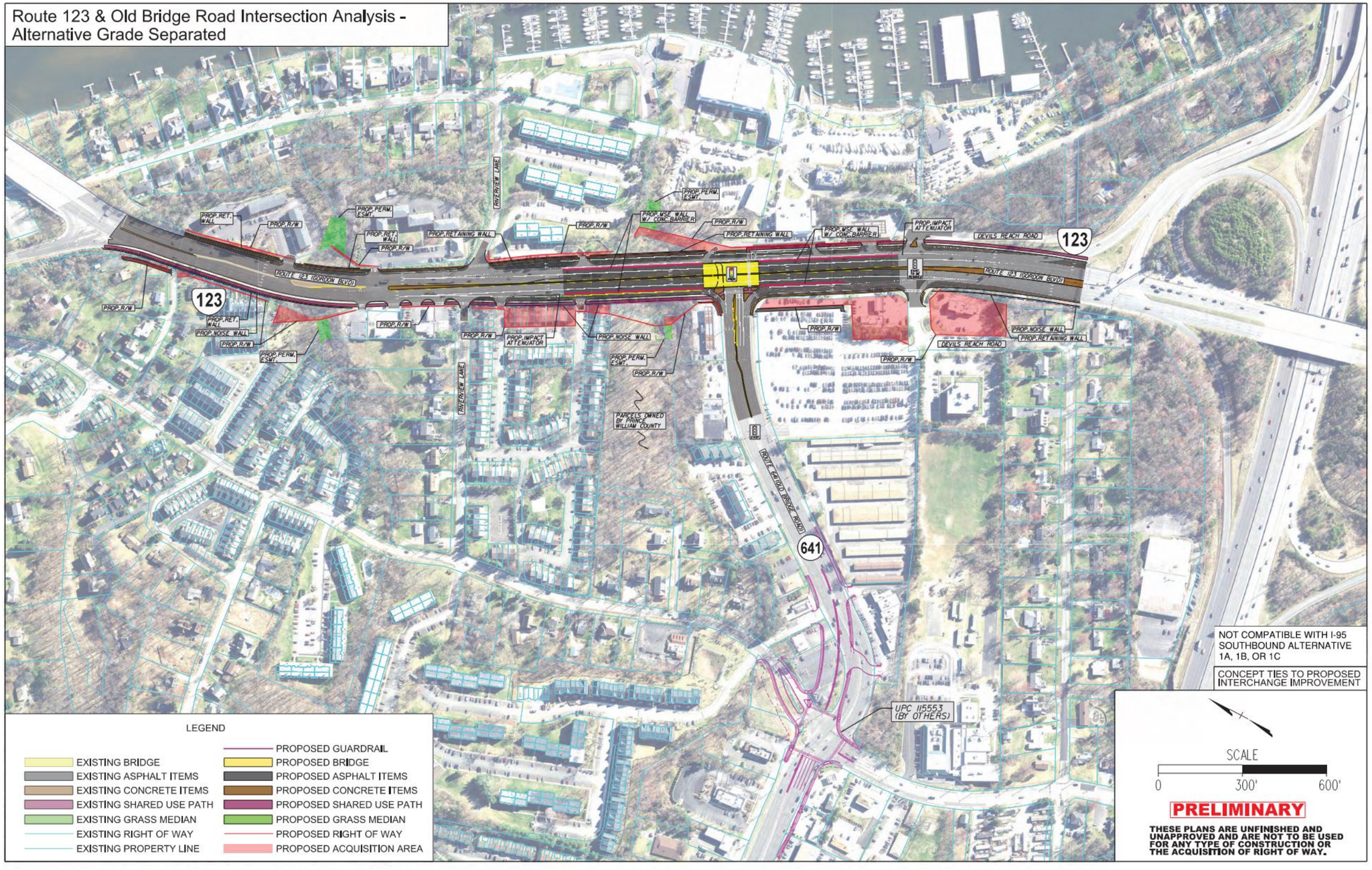
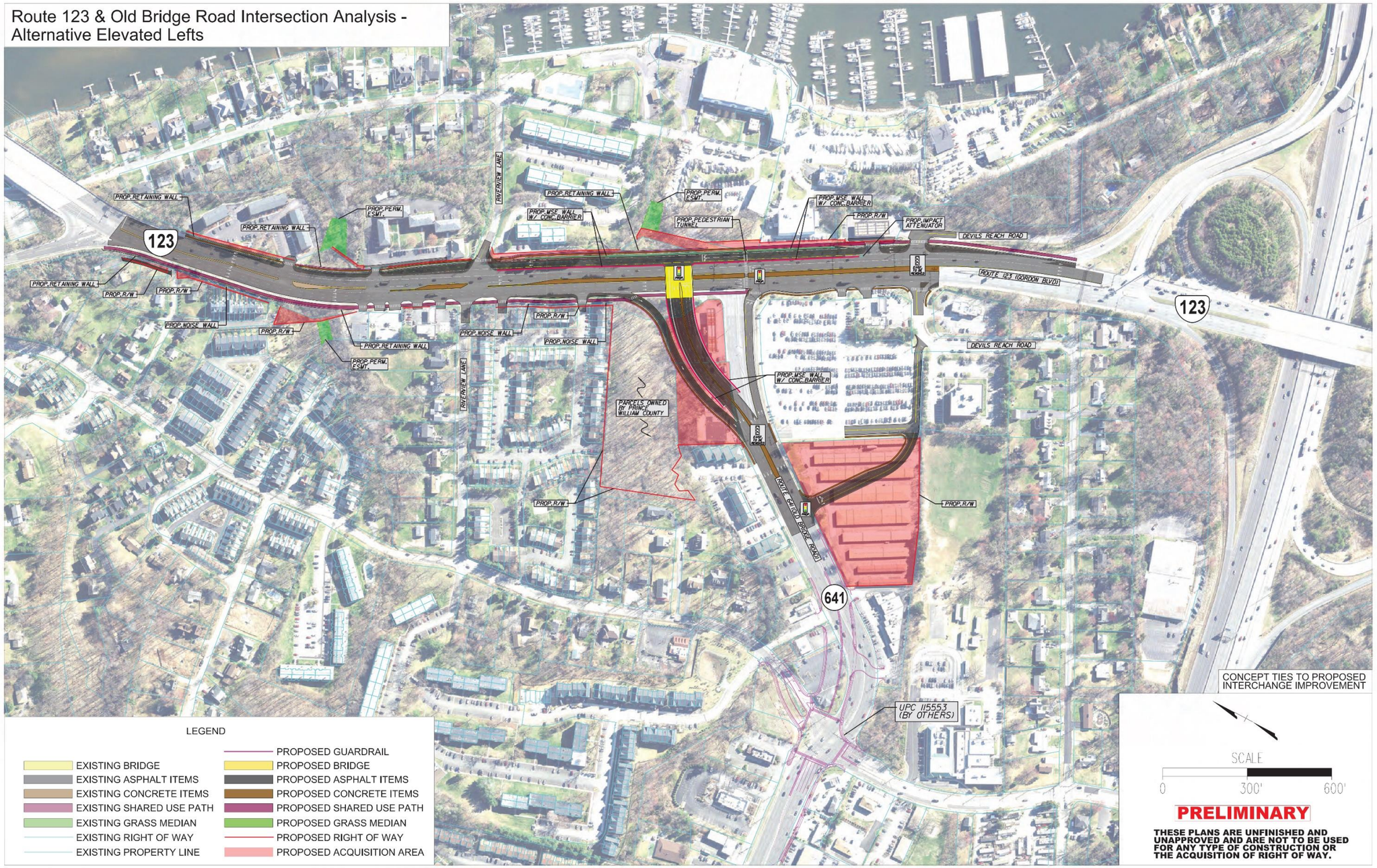


Figure 79: Old Bridge Road Improvement Alternative – Elevated Left Turns



5.4.3 Combined Alternatives for Traffic Analysis

Alternatives for the I-95 interchange were evaluated for compatibility with alternatives for the Old Bridge Road intersection. ***Table 27*** shows the qualitative assessment. The Old Bridge Road Grade-Separated Alternative is least compatible with I-95 Alternative 1 because of the short lane-change distance on southbound Route 123 for traffic coming from Old Bridge Road or the Occoquan Commuter Lot and going to the northbound I-95 Express Lanes.

Table 27: Compatibility of I-95 and Old Bridge Road Alternatives

		Route 123 at Old Bridge Road			
		Flyover (Outside/Outside)	Flyover (Outside/Inside)	Grade-Separated	Elevated Left Turns
I-95	Alternative 1 (1A, 1B, 1C)	Yes	Yes	**No**	Yes
	Alternative 2	Yes	Yes	Yes	Yes
	Alternative 4	Yes	Yes	Yes	Yes

For the purpose of traffic operational analysis of the Build alternatives as described in ***Section 7*** and per the study Framework Document, I-95 and Old Bridge Road alternatives were packaged into combined alternatives to include one alternative in each of the three improvement locations—southbound I-95, northbound I-95, and Old Bridge Road, however, it is anticipated that improvements at each location would be implemented independently.

Combined Alternative 1

- **Southbound I-95**: Alternative 1A
- **Northbound I-95**: Alternative 4
- **Old Bridge Road**: Flyover (Outside/Outside)

Combined Alternative 2

- **Southbound I-95**: Alternative 1A
- **Northbound I-95**: Alternative 4
- **Old Bridge Road**: Flyover (Outside/Inside)

Combined Alternative 3

- **Southbound I-95**: Alternative 2
- **Northbound I-95**: Alternative 4
- **Old Bridge Road**: Grade Separated

Combined Alternative 4

- **Southbound I-95**: Alternative 1A
- **Northbound I-95**: Alternative 4
- **Old Bridge Road**: Elevated Left Turns

Southbound I-95 Alternative 1A was advanced over 1B because of the benefits of modifying the southbound I-95 off-ramp to northbound Route 123 to provide additional distance to Devils Reach Road and Old Bridge Road intersections. While southbound I-95 Alternative 2 is compatible with all Old Bridge Road alternatives, it was only paired with Grade-Separated and evaluated in one combined alternative because it was lower scoring in the concept screening phase.

The three I-95 alternatives and four Old Bridge Road alternative that make up the Combined Alternatives were also advanced for conceptual design, planning-level cost estimates, and schedule as described in ***Section 6***.

5.5 Public Outreach

Public outreach was conducted during spring 2021 (I-95 interchange) and summer 2021 (Old Bridge Road intersection) that consisted of an online survey, videos, and conceptual design drawings posted to the study website, and several presentations to community groups and other stakeholders.

Nearly 1,300 responses with nearly 250 other responses and email comments were received in the I-95 survey. The Old Bridge Road survey received nearly 600 responses and 124 other responses and email comments. A summary of feedback received during public outreach is included in ***Appendix H***.

For I-95, the outreach established that the top priorities of the public were traffic congestion, southbound and northbound travel reliability, and southbound traffic safety. For Old Bridge Road, top priorities of the public were Route 123 and Old Bridge Road travel time reliability and safety.

Survey respondents could rate each alternative on a one to five scale with five being the most favorable. ***Table 28*** summarizes the average rating received for each I-95 alternative, with southbound Alternative 1A and northbound Alternative 4 being the highest rated. Note that southbound Alternative 1C had not be developed yet, as it was formed by feedback gathered through outreach activities. ***Table 29*** summarizes the average rating received for each Old Bridge Road alternative, with Flyover (Outside/Inside) being the highest rated.

Table 28: Alternative Rating from Public Survey—I-95 at Route 123 Interchange

Alternative	Average Rating *(1 to 5; higher is better)*
I-95 Southbound No-Build	2.52
I-95 Southbound Alternative 1A	3.41
I-95 Southbound Alternative 1B	2.98
I-95 Southbound Alternative 2	3.36
I-95 Northbound No-Build	2.62
I-95 Northbound Alternative 4	3.66

Table 29: Alternative Rating from Public Survey—Route 123 at Old Bridge Road Intersection

Alternative	Average Rating *(1 to 5; higher is better)*
No-Build	1.43
Flyover (Outside/Outside)	3.28
Flyover (Outside/Inside)	3.70
Grade Separated	3.30
Elevated Left Turns	2.88

The themes of the received comments are summarized below.

- I-95 at Route 123 Interchange comments
  - Eliminate the southbound I-95 bottleneck south of the Occoquan Bridge at the study interchange
  - Maintain four southbound through lanes
  - Address issues at Route 123 and Old Bridge Road intersection
  - Build more lanes
  - The merge from Route 123 onto southbound I-95 is too short/dangerous
  - Pedestrian and bicycle mobility should not be a priority on a busy road like Route 123
  - Interest in better pedestrian and bicycle connections

- Route 123 at Old Bridge Road Intersection comments
  - Desire for improved safety
  - Appreciation/support for the study
  - Concern over southbound Route 123 congestion and backups
  - Concerns over property impacts/local access
  - Concerns over the northbound weaving movement/northbound left-turn to Old Bridge Road
  - Interest in improved pedestrian, bicycle, and commuter lot connectivity

6 Conceptual Design, Costs, and Schedules

6.1 I-95 at Route 123 Interchange

6.1.1 Conceptual Design Plans and Geometric Data

Conceptual design alternatives were developed in MicroStation for improvements to the I-95 interchange with Route 123. The following standards and manuals were referenced in the development of these alternatives:

- VDOT Road Design Manual (Issued January 2005, Revised July 2021)
- VDOT Road and Bridge Standards (2016, latest revisions)
- VDOT Structure and Bridge Manual (Revised 10/29/2021)
- Policy on Geometric Design of Highways and Streets (AASHTO 2018)
- A Policy on Design Standards – Interstate System (AASHTO May 2016)

Design standards and guidance from these documents were used to determine the appropriate criteria given the functional classification and design speeds of the facilities.

Publicly available Prince William County GIS data and VGIN orthophotography were used to determine the locations of existing infrastructure and approximate vertical elevations.

Conceptual design drawings are provided in ***Appendix G***. One-page project summary sheets were developed for each alternative and are provided in ***Appendix I***.

6.1.2 Potential Design Waivers and Exceptions

Using the current VDOT and AASHTO design standards, there are no known roadway design waivers or design exceptions required for any of the alternatives. The bridge component of Alternatives 1A and 2 were not analyzed against all potential Structure and Bridge design waiver, design exception, or design approval requirement. During the development of the Stage 1 Bridge Reports, certain elements may require these approvals.

However, as noted above, the conceptual design utilized non-survey grade information to make horizontal and vertical determinations and design decisions. As more detailed information is collected and incorporated during the preliminary design phase, certain elements may need to be adjusted or require design waivers and/or design exceptions.

6.1.3 Potential Right-of-Way Acquisition

A goal of the conceptual design for each alternative was to minimize new right-of-way (R/W), limited access (L/A), and easement acquisition by utilizing the existing right-of-way/limited access. With each alternative, small, localized right-of-way and limited access impacts are expected. The following list includes a summary of the impacts:

- **Alternative 1A**: Deviations from the existing R/W and L/A line in the southwest and northeast quadrants of the interchange to install retaining walls and perform tie in grading. Similar deviations are anticipated with Alternative 1B and Alternative 1C.
- **Alternative 2**: Deviations from the existing R/W and L/A line in the southeast quadrant of the interchange to install retaining walls and perform tie in grading.
- **Alternative 4**: Deviations from the existing R/W and L/A line in the southwest quadrant of the interchange to install retaining walls and perform tie in grading.

As minimal utility information was available during the conceptual design, the potential exists for the need of additional utility easements. It is assumed these would primarily be required in the northeast interchange quadrant.

6.1.4 Future Design Considerations

Based on a review of the alternative limits and constraints, the following are needs or may require additional consideration during the design of the project:

- **Data Collection:** Topographic/planimetric survey, subsurface utility location and designation, geotechnical exploration and analysis, etc. are needed to confirm and validate the conceptual design prior to preliminary design activities.
- **Route 123 Bridge Maintenance:** VDOT S&B and Maintenance may desire to include certain Route 123 bridge maintenance components into the alternatives. Additional bridge activities will need to be coordinated and included in the design of the alternatives.
- **95 Express Coordination:** As Alternatives 1A and 2 have direct impacts to the I-95 Express Lanes, coordination will be required with 95 Express during the design and construction phases of the project. This coordination may result in additional approvals, incorporation of preferences, more restrictive construction schedule, etc. that need to account for in the project design.
- **OmniRide Coordination:** Like the 95 Express coordination, impacts to the functionality and access to the park and ride lot in the northeast quadrant may necessitate coordination with OmniRide. This coordination may result in additional approvals, incorporation of preferences, more restrictive construction schedule, etc. that need to account for in the project design.
- **Revisit Bike and Pedestrian Routes/Connectivity:** Bicycle and pedestrian accommodations were a prominent discussion topic and design element during conceptual design. As the project corridor is experiencing growth and redevelopment, reassessing the needs of the bicycle and pedestrian community nearer to the construction date of the project should be considered. Additionally, phasing/timing of the potential interchange improvements west and east of I-95 should be reviewed to determine if extension of the shared-use path to existing pedestrian routes is needed to provide interim connectivity.
- **I-95/123 Commuter Lot:** Depending on the alternative, commuter lot access and circulation will need to be refined and further evaluated. Alternatives 2 and 4 will need greater consideration. In Alternative 1A, traffic exiting and destined for southbound I-95 may need to exit via Annapolis way given the relatively short distance to the proposed left-turn movement to the southbound I-95 ramp.
- **Route 123 Corridor Improvements:** Regardless of alternative, the improvements to the Route 123 corridor need to be assessed as a whole to ensure all proposed projects are compatible. Adjustments to the alternatives may be required to seamlessly align all corridor improvements.
- **Noise Analysis:** Alternative 4 has the potential to require a noise wall along the northbound I-95 off-ramp and corresponding through lane on Route 123. A noise analysis needs to be completed to determine if noise walls are feasible and reasonable.

6.1.5 Planning-Level Cost Estimate

Planning level cost estimates in 2021 dollars were developed for the alternatives as summarized in ***Table 30***. Construction (CN) costs were estimated using a combination of PCES, VDOT Planning Level Cost Estimate worksheet, and recent bid costs. Preliminary engineering (PE) and construction engineering and inspection (CEI) costs were estimated as a percentage of construction costs. A 30% contingency for unidentified project risk was included in the construction estimate not including CEI. A detailed cost estimate should be prepared during the design phase for the preferred alternative. See ***Appendix J*** for additional information on the cost estimates.

Table 30: I-95 at Route 123 Interchange Planning-Level Cost Estimate

Description	1A (Southbound)	2 (Southbound)	4 (Northbound)
Preliminary Engineering	$ 4.8 M	$ 9.6 M	$ 3.8 M
Right-of-Way and Utility Relocation	$ 0.4 M	$ 0.5 M	$ 0.7 M
Construction	$ 33.2 M	$ 66.8 M	$ 25.8 M
Total (2021 Dollars)	**$ 38.4 M**	**$ 76.9 M**	**$ 30.3 M**

6.1.6 Schedule Estimate

Schedule estimates were developed for the alternatives. ***Table 31*** summarizes the projected timeframes for the PE, RW, and CN phases.

Table 31: I-95 at Route 123 Interchange Schedule Estimate

Alternative	Schedule Estimate (months)			
	PE	RW	CN	TOTAL
1A (Southbound)	30	18	30	**78**
2 (Southbound)	36	12	36	**84**
4 (Northbound)	33	18	42	**93**

6.2 Route 123 at Old Bridge Road Intersection

6.2.1 Conceptual Design Plans and Geometric Data

Conceptual design alternatives were developed in MicroStation for improvements to the Route 123 at Old Bridge Road intersection. The following standards and manuals were referenced in the development of these alternatives:

- VDOT Road Design Manual (Issued January 2005, Revised July 2021)
- VDOT Road and Bridge Standards (2016, latest revisions)
- VDOT Structure and Bridge Manual (Revised 10/29/2021)
- Policy on Geometric Design of Highways and Streets (AASHTO 2018)

Design standards and guidance from these documents was used to determine the appropriate criteria given the functional classification and design speeds of the facilities. All existing design/posted speeds are maintained. Specific to Alternatives Flyover (Outside/Outside) and Flyover (Outside/Inside), the flyover movement for each alternative adheres to a 25 mph design speed, a TC-5.11U standard, and a maximum vertical grade of 8%.

Publicly available Prince William County GIS data and VGIN orthophotography were used to determine the locations of existing infrastructure and approximate vertical elevations.

Conceptual design drawings are provided in ***Appendix G***. One-page project summary sheets were developed for each alternative and are provided in ***Appendix I***.

6.2.2 Potential Design Waivers and Exceptions

Using the current VDOT and AASHTO design standards, no known roadway design waivers or design exceptions have been identified for any of the alternatives based on the level of detail. The bridge component of each alternative was not analyzed against all potential Structure and Bridge design waiver, design exception, or design approval requirement. During the development of the Stage 1 Bridge Reports, certain elements may require these approvals.

However, as noted above, the conceptual design utilized non-survey grade information to make horizontal and vertical determinations and design decisions. As more detailed information is collected and incorporated during the preliminary design phase, certain elements may need to be adjusted or require design waivers and/or design exceptions.

6.2.3 Potential Right-of-Way Acquisition

All alternatives were developed with the intent to reduce as many property impacts as possible. As the Route 123 corridor within the project limits is highly urbanized, all alternatives resulted in a combination of total and partial takes. There is the potential to utilize permanent easement in some locations in lieu of acquiring new right-of-way, and some of these locations are depicted on the conceptual drawings. Due to potential variability associated with access management, right-of-way impacts and negotiations; the project estimates have taken a conservative approach to account for more substantial impacts than depicted in the alternative graphics.

Specific details are noted below:

- **Alternative Flyover (Outside/Outside)**: Deviations from the existing R/W line north and in the southwest quadrant of the intersection. This includes total takes of 4 parcels adjacent to the intersection (2 which have already been secured by Prince William County) and several other partial R/W impacts primarily to the north of the intersection.
- **Alternative Flyover (Outside/Inside)**: Deviations from the existing R/W line north and in the southwest and southeast quadrants of the intersection. This includes total takes of 4 parcels adjacent to the intersection (2 which have already been secured by Prince William County) and several other partial R/W impacts to the north and southeast of the intersection.
- **Alternative Grade-Separated**: Deviations from the existing R/W line along northbound and southbound Route 123 between the I-95 and Route 123 interchange and the bridge over the Occoquan River. The primary right-of-way impacts involve total takes of several businesses and a group of townhomes along southbound Route 123. Partial right-of-way impacts occur on both sides of Route 123 to in order to accommodate minor widening associated with the proposed concept.
- **Alternative Elevated Left Turns**: Deviations from the existing R/W line along northbound and southbound Route 123 between the I-95 and Route 123 interchange and the bridge over the Occoquan River. This includes total takes of 6 parcels adjacent to the intersection (2 which have already been secured by Prince William County). Partial right-of-way impacts occur on both sides of Route 123 to in order to accommodate minor widening associated with the proposed concept.

As minimal utility information was available during the conceptual design, the potential exists for the need of additional utility easements. It is assumed these would primarily be required in the northeast interchange quadrant.

6.2.4 Future Design Considerations

Based on a review of the alternative limits and constraints, the following are needs or may require additional consideration during the design of the project:

- **Data Collection:** Topographic/planimetric survey, subsurface utility location and designation, geotechnical exploration and analysis, etc. are needed to confirm and validate the conceptual design prior to preliminary design activities.
- **95 Express Coordination:** All alternatives potentially could impact the direct access to the I-95 Express Lanes either via design elements or during construction. Coordination will be required with 95 Express during the design and construction phases of the project and may result in additional approvals, incorporation of preferences, more restrictive construction schedule, etc. that need to accounted for in the project design.
- **OmniRide Coordination:** Similar to the 95 Express coordination, impacts to the functionality and access to the Occoquan Commuter Lot may necessitate coordination with stakeholders such as OmniRide. This coordination may result in additional approvals, incorporation of preferences, more restrictive construction schedule, etc. that need to accounted for in the project design.
- **Revisit Bike and Pedestrian Routes/Connectivity:** Bicycle and pedestrian accommodations were a prominent discussion topic and design element during conceptual design. As the project corridor is experiencing growth and redevelopment, reassessing the needs of the bicycle and pedestrian community nearer to the construction date of the project should be considered. In addition, project stakeholders have expressed concern over the location and indirect path of the shared-use path on Alternative Flyover (Outside/Outside) and Flyover (Outside/Inside). The addition of a pedestrian tunnel in this area may be one option to aid in reducing some of these concerns. This needs to be studied more in depth to determine the most efficient means of connectivity, especially for crossing Route 123 at this location. Several options for refinement that were considered with the SWG are included in ***Appendix L***.
- **Route 123 Corridor Improvements:** Regardless of alternative, the improvements to the Route 123 corridor need to be assessed as a whole to ensure all proposed projects are compatible. Adjustments to the alternatives may be required to seamlessly align all corridor improvements.
- **Noise Analysis:** All alternatives have the potential to require noise walls along southbound Route 123 and/or the flyover ramp. A noise analysis needs to be completed to determine if noise walls are feasible and reasonable. Depending on the results of the analysis noise walls could be ground mounted or affixed to barrier/retaining walls.
- **Flyunder Concept:** A potential alternative discussed during concept development was the feasibility of using a 'flyunder' concept where the northbound Route 123 to Old Bridge Road traffic would cross under Route 123 and not over. There was insufficient field data available during the conceptual design to make a clear determination as to the viability of this alternative. This could be evaluated further during preliminary design.
- **Commuter Lot Access:** In both flyover alternatives the need for a traffic signal at the commuter lot entrance on Old Bridge Road introduces certain design and traffic challenges. The Alternative Elevated Left Turns proposes a relocated access to this park and ride facility that may be worth exploring as an addition to either flyover concept. Benefits include design, safety, and traffic improvements while negatives are right-of-way and cost impacts.
- **Number of Future Route 123 Through Lanes:** Alternatives Grade-Separated and Elevated Left Turns were developed to accommodate additional Route 123 through lanes in the future. These lanes would take the place of the paved shoulders shown in the concepts. More detailed assessment of these areas during preliminary design may be needed to ensure proposed and 'ultimate' lane configurations are sufficient.

6.2.5 Planning-Level Cost Estimate

Planning level cost estimates in 2021 dollars were developed for the alternatives as summarized in ***Table 32.*** Construction (CN) costs were estimated using a combination of PCES, VDOT Planning Level Cost Estimate worksheet, and recent bid costs. Preliminary engineering (PE) and construction engineering and inspection (CEI) costs were estimated as a percentage of construction costs. A 40% contingency for unidentified project risk was included in the construction estimate not including CEI. A detailed cost estimate should be prepared during the design phase for the preferred alternative. See ***Appendix J*** for additional information on the cost estimates.

Table 32: Route 123 at Old Bridge Road Intersection Planning-Level Cost Estimate

Description	Flyover (Outside/Outside)	Flyover (Outside/Inside)	Grade-Separated	Elevated Left Turns
Preliminary Engineering	$ 5.7 M	$ 5.9 M	$ 8.8 M	$ 9.4 M
Right-of-Way and Utility Relocation	$ 19.2 M	$ 33.4 M	$ 38.4 M	$ 34.3 M
Construction	$ 39.1 M	$ 37.3 M	$ 57.2 M	$ 61.5 M
Total (2021 Dollars)	**$ 64.0 M**	**$ 76.6 M**	**$104.4 M**	**$ 105.2 M**

6.2.6 Schedule Estimate

Schedule estimates were developed for the alternatives. ***Table 33*** summarizes the projected timeframes for the PE, RW, and CN phases.

Table 33: Route 123 at Old Bridge Road Intersection Schedule Estimate

Alternative	Schedule Estimate (months)			
	PE	RW	CN	TOTAL
Flyover (Outside/Outside)	30	30	26	**86**
Flyover (Outside/Inside)	30	30	30	**90**
Grade-Separated	33	30	36	**99**
Elevated Left Turns	33	30	36	**99**

7 Build Conditions Analysis

Traffic operational analyses were conducted to evaluate the overall performance of the study corridor under future (2030 and 2045) Build AM and PM peak hour conditions. The intent of the Build conditions analyses was to evaluate the effectiveness of the selected improvement alternatives and understand how they work in conjunction with one another. Build conditions were modeled using Vissim 11, the same as for existing and No-Build conditions.

7.1 Traffic Analysis Assumptions

The No-Build conditions Vissim models were used as a basis to develop the Build models for the AM and PM peak hour conditions. Roadway geometric and traffic signal timing adjustments were made to reflect the improvements set forth in the Build alternatives.

The models were updated with rerouted future traffic volumes to account for traffic movement restrictions and ramp reconfigurations in the Build alternatives. At intersections where traffic is restricted, vehicles were assumed to U-turn at an adjacent intersection, or turn left or right to use adjacent streets to reach their destination.

Traffic signal timing changes were made to optimize signal operations at locations with Build improvements. Inputs and analysis methodologies were consistent with the *TOSAM* 2.0 and with the existing conditions and No-Build conditions analyses.

For the traffic analyses, Build alternatives for three locations—southbound I-95, northbound I-95, and Route 123 at Old Bridge Road—were packaged to form Combined Alternatives or analysis scenarios per the project Framework Document. ***Table 34*** indicates the combinations of alternatives that were evaluated.

Given their similar ramp configuration, southbound I-95 Alternative 1A and Alternative 1C are expected to have negligible operational differences. Southbound Alternative 1B has the same access point locations on southbound I-95 as Alternative 1A, so freeway operations are expected to be the same, however the northbound Route 123 weave distance to the Route 123 at Old Bridge Road intersection is not lengthen in Alternative 1B, so worse operations on northbound Route 123 are expected compared to Alternatives 1A and 1C.

Table 34: Build Conditions Traffic Analysis Scenarios

Combined Alternative for Traffic Analysis	Southbound I-95 Alternative	Northbound I-95 Alternative	Old Bridge Road Alternative
Combined Alternative 1	Alternative 1A	Alternative 4	Flyover (Outside/Outside)
Combined Alternative 2	Alternative 1A	Alternative 4	Flyover (Outside/Inside)
Combined Alternative 3	Alternative 2	Alternative 4	Grade-Separated
Combined Alternative 4	Alternative 1A	Alternative 4	Elevated Left Turns

7.2 Measures of Effectiveness

The same MOEs reported for the existing conditions and No-Build conditions analyses were used for the operational analyses of the roadway network under Build 2030 and 2045 conditions. Vissim freeway MOEs are reported for each freeway segment. The methodology for determining the area of influence for the merge, diverge, and weave segments was consistent with the approach defined in the *Highway Capacity Manual*. Intersection results reporting and arterial MOEs were consistent with the previous analyses and focused on comparing the more critical higher volume intersections in the study area

7.3 2030 Build Conditions

The 2030 Build conditions freeway and intersection traffic analysis results are summarized in the following sections. Additional AM and PM peak hour MOE information, including vehicle throughput, speed, density, delay, travel time, and queue lengths at critical locations for all Build alternatives are in ***Appendix K***.

Representative Build Conditions AM and PM peak hour average freeway segment densities and speeds are illustrated in ***Figure 80*** through ***Figure 85*** for Combined Alternative 2, which consists for southbound I-95 Alternative 1A, northbound I-95 Alternative 4, and Old Bridge Road Alternative Flyover (Outside/Inside). Figures for other alternatives are in ***Appendix K***.

7.3.1 2030 AM Peak Hour Freeway Operations

In the 2030 AM peak hour, all Combined Alternatives operated similarly in the northbound direction of I-95 given that all include the northbound I-95 Alternative 4 configuration. Speeds and densities were similar to No-Build conditions with the exception of a few locations. Speeds increased slightly at the Route 123 interchange from No-Build conditions to free-flow in Build conditions due to eliminating the weave area and ramp reconfiguration. Speeds decreased and density increased at the merge area from northbound Route 1 due to increased throughput that reaches this point from capacity improvements on Route 123 and Old Bridge Road. Average speed in this area ranged from 15 to 25 mph. Queuing on the reconfigured northbound off-ramp to northbound Route 123 extended approximately 400 feet from the proposed traffic signal on Route 123. Northbound travel time increased slightly from No-Build conditions (see ***Figure 86***) due to less metering of traffic on the arterials and more throughput reaching the mainline.

In the off-peak southbound direction of I-95, negligible change in operations from No-Build conditions is expected.

7.3.2 2030 PM Peak Hour Freeway Operations

In the 2030 PM peak hour, all Combined Alternatives operated similarly in the southbound direction of I-95 given that all include similar ramp reconfiguration. Speeds and densities were similar to No-Build conditions, with congestion remaining between Lorton Road and Route 123. Queuing on the southbound off-ramp to northbound Route 123 improved in Combined Alternatives 1 and 2 compared to No-Build conditions due to the flyover configurations at the Route 123 and Old Bridge Road intersection. With the Grade-Separated Old Bridge Road alternative, queues increased from 1,320 feet to 1,550 feet but did not extend onto the mainline.

Southbound travel time increased slightly from No-Build conditions due to greater throughput reaching southbound I-95 from Route 123 after arterial improvements. This increase rangeed from 30 seconds (3 percent) with Combined Alternative 1/Flyover (Outside/Inside) to 47 seconds (4 percent) with Combined Alternative 3/Grade-Separated (see ***Figure 87***).

In the off-peak northbound direction of I-95, negligible change in operations from No-Build conditions is expected.

Figure 80: 2030 Build AM Peak Hour Mainline and Ramp Density

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
Build Combined Alternative 2
2030 AM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Density (vplpm)

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 - 100 | > 100

Miles
0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 81: 2030 Build AM Peak Hour Mainline and Ramp Speed

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
Build Combined Alternative 2
2030 AM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Speed (mph)

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Miles: 0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 82: 2030 Build PM Peak Hour Mainline and Ramp Density (1 of 2)

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
Build Combined Alternative 2
2030 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

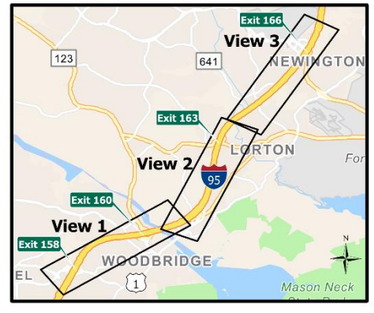
Density (vplpm)

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 -100 | > 100

Miles
0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 83: 2030 Build PM Peak Hour Mainline and Ramp Density (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
Build Combined Alternative 2
2030 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Density (vplpm)

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 - 100 | > 100

Miles
0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 84: 2030 Build PM Peak Hour Mainline and Ramp Speed (1 of 2)

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
Build Combined Alternative 2
2030 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

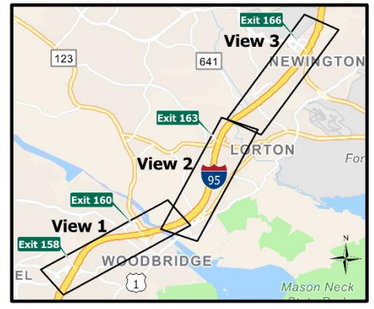
Speed (mph)

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Miles: 0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 85: 2030 Build PM Peak Hour Mainline and Ramp Speed (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
Build Combined Alternative 2
2030 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Speed (mph)

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Miles
0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

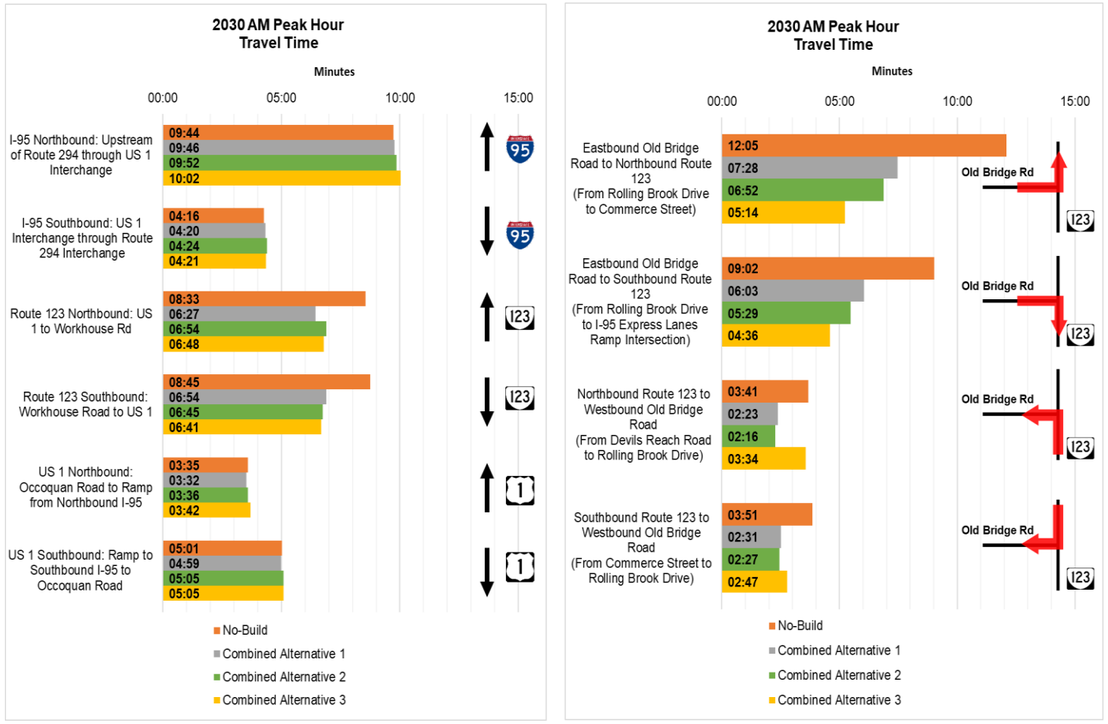
7.3.3 2030 AM Peak Hour Intersection Operations

Table 35 shows a comparison of average delay at key study area intersections. ***Figure 86*** shows a comparison of travel times.

Table 35: 2030 AM Peak Hour Average Delay Comparison

Intersection	No-Build	Combined Alt. 1 Flyover (Outside/ Outside)	Combined Alt. 2 Flyover (Outside/ Inside)	Combined Alt. 3 Grade-Separated
	Average Intersection Delay (Seconds per Vehicle)			
Route 123 at Workhouse Road	28.3	8.8	8.8	9.8
Route 123 at Commerce Street	50.6	52.2	52.4	50.7
Route 123 at Old Bridge Road	40.4	24.5	28.8	11.4
Route 123 at Commuter Parking Lot	3.5	0.8	0.9	-
Route 123 at Devils Reach Road	22.6	2.8	3.4	1.3
Route 123 at I-95 Express Lanes Ramp	21.2	8.8	9.2	4.9
Route 123 at Northbound I-95 Ramp	-	24.7	24.4	28.9
Route 123 at Annapolis Way/Monroe Drive	20.3	21.0	22.9	26.4
Route 123 at Horner Road	71.3	56.4	58.7	83.9
Old Bridge Road at Commuter Parking Lot	21.2	9.1	7.5	10.2
Old Bridge Road at Public Storage Driveway	22.4	5.9	4.1	3.2
Old Bridge Road at Occoquan Road	390.3	249.9	210.5	124.0
Volume-Weighted Study Area Average	**46.0**	**34.8**	**34.6**	**30.8**

Figure 86: 2030 AM Peak Hour Travel Time Comparison



I-95 Alternatives—Route 123 Ramp Intersections

In the 2030 AM peak hour, the southbound I-95 ramp intersection (includes access to northbound Express Lanes in Combined Alternatives 1 and 2) operated with overall intersection delay less than 10 seconds per vehicle in all Combined Alternatives, an improvement from 21 seconds in No-Build conditions due to intersection reconfiguration. The northbound I-95 ramp intersection (includes access into the I-95/123 Commuter Lot) operated with overall intersection delay less than 30 seconds in all Combined Alternatives. The southbound left-turn into the commuter lot from Route 123 operated with a delay of 83 seconds in Combined Alternative 1 and 89 seconds in Combined Alternative 2 due to conflicting higher-volume eastbound left-turn (from northbound I-95) and northbound though movements. The northbound I-95 ramp intersection (includes access into the I-95/123 Commuter Lot) operated with overall intersection delay less than 30 seconds in all Combined Alternatives.

Old Bridge Road Alternative—Flyover (Outside/Outside)

In the 2030 AM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 1, which includes the Old Bridge Road Alternative Flyover (Outside/Outside). The study area average delay decreased from 46 second per vehicle to 35 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 40 seconds to 25 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 45 percent (880 feet) and southbound Route 123 queuing reduced by 72 percent (1,750 feet). Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123,

but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road.

Old Bridge Road Alternative—Flyover (Outside/Inside)

In the 2030 AM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 2, which includes the Old Bridge Road Alternative Flyover (Outside/Inside). The study area average delay decreased from 46 second per vehicle to 35 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 40 seconds to 29 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 38 percent (735 feet) and southbound Route 123 queuing reduced by 77 percent (1,865 feet). Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road.

Old Bridge Road Alternative—Grade-Separated

In the 2030 AM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 3, which includes the Old Bridge Road Alternative Grade-Separated. The study area average delay decreased from 46 second per vehicle to 31 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 40 seconds to 11 seconds. Delay for the intersection of Route 123 at Horner Road increased due to traffic signal retiming needed to accommodate additional demand to/from the relocated Express Lanes connection via Annapolis Way with southbound I-95 Alternative 2. Northbound Route 123 queuing at Old Bridge Road reduced by 68 percent (1,330 feet) and southbound Route 123 queuing was eliminated. Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road, and this alternative showed the lowest travel time along Route 123 and Old Bridge Road for the 2030 AM peak hour.

Old Bridge Road Alternative—Elevated Left Turns

This alternative was not analyzed for 2030 conditions because it was screened out from further consideration by the SWG after 2045 conditions analysis.

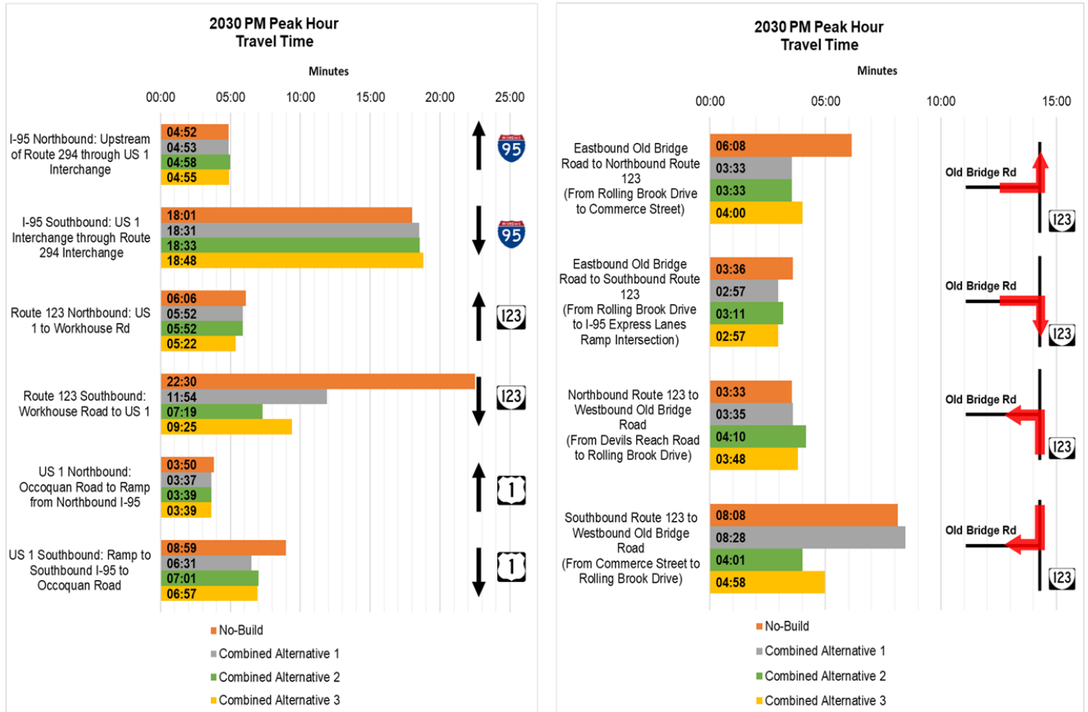
7.3.4 2030 PM Peak Hour Intersection Operations

Table 36 shows a comparison of average delay at key study area intersections. ***Figure 87*** shows a comparison of travel times.

Table 36: 2030 PM Peak Hour Average Delay Comparison

Intersection	No-Build	Combined Alt. 1 Flyover (Outside/ Outside)	Combined Alt. 2 Flyover (Outside/ Inside)	Combined Alt. 3 Grade-Separated
	Average Intersection Delay (Seconds per Vehicle)			
Route 123 at Workhouse Road	323.0	115.6	26.2	94.2
Route 123 at Commerce Street	274.5	136.1	35.1	104.5
Route 123 at Old Bridge Road	54.7	18.6	15.1	15.4
Route 123 at Commuter Parking Lot	10.2	0.4	0.5	-
Route 123 at Devils Reach Road	20.8	0.9	8.5	10.5
Route 123 at I-95 Express Lanes Ramp	31.8	16.7	16.9	3.6
Route 123 at Northbound I-95 Ramp	-	16.8	16.3	14.0
Route 123 at Annapolis Way/Monroe Drive	18.5	17.5	20.2	26.0
Route 123 at Horner Road	25.5	29.7	29.1	31.2
Old Bridge Road at Commuter Parking Lot	14.5	21.7	21.9	18.9
Old Bridge Road at Public Storage Driveway	3.2	11.0	9.6	5.6
Old Bridge Road at Occoquan Road	29.0	44.7	43.8	40.5
Volume-Weighted Study Area Average	**63.4**	**44.0**	**34.8**	**40.9**

Figure 87: 2030 PM Peak Hour Travel Time Comparison



I-95 Alternatives—Route 123 Ramp Intersections

In the 2030 PM peak hour, the southbound I-95 ramp intersection (includes access from southbound Express Lanes in Combined Alternatives 1 and 2) operated with overall intersection delay less than 17 seconds per vehicle in all Combined Alternatives, an improvement from 32 seconds in No-Build conditions due to intersection reconfiguration and improvements at Old Bridge Road. Queueing on the westbound approach from the southbound Express Lanes reduced from 810 feet in No-Build conditions to less than 340 feet in Combined Alternatives 1 and 2. This was primarily attributed to less congestion on northbound Route 123 approaching Old Bridge Road.

The northbound I-95 ramp intersection (includes access into the I-95/123 Commuter Lot) operated with overall intersection delay less than 17 seconds in all Combined Alternatives.

Old Bridge Road Alternative—Flyover (Outside/Outside)

In the 2030 PM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 1, which includes the Old Bridge Road Alternative Flyover (Outside/Outside). The study area average delay decreased from 63 second per vehicle to 44 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 55 seconds to 19 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 76 percent (1,940 feet) while southbound Route 123 queuing remained similar to No-Build conditions. Queuing on the southbound I-95 off-ramp to northbound Route 123 was also eliminated. Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road, with significant improvements to southbound Route 123 which reduced over 10 minutes (47 percent).

Old Bridge Road Alternative—Flyover (Outside/Inside)

In the 2030 PM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 2, which includes the Old Bridge Road Alternative Flyover (Outside/Inside). The study area average delay decreased from 63 second per vehicle to 35 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 55 seconds to 15 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 64 percent (1,640 feet), and southbound Route 123 queuing at Commerce Street reduced by 40 percent (2,690 feet) due to the reconfigured southbound right-turn to Old Bridge Road. Queuing on the southbound I-95 off-ramp to northbound Route 123 also reduced by 47 percent and was contained on the ramp. Congestion reduced on eastbound Old Bridge Road, with the queue length from Route 123 reduced from 700 feet to 245 feet. Travel time reduced on both Route 123 and Old Bridge Road, with significant improvements to southbound Route 123 which reduced over 15 minutes (67 percent).

Old Bridge Road Alternative—Grade-Separated

In the 2030 PM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 3, which includes the Old Bridge Road Alternative Grade-Separated. The study area average delay decreased from 63 second per vehicle to 41 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 55 seconds to 15 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 28 percent (700 feet) and queuing on the southbound I-95 off-ramp to northbound Route 123 was similar to No-Build conditions Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road, with significant improvements to southbound Route 123 which reduced over 13 minutes (58 percent).

Old Bridge Road Alternative—Elevated Left Turns

This alternative was not analyzed for 2030 conditions because it was screened out from further consideration by the SWG after 2045 conditions analysis.

7.4 2045 Build Conditions

The 2045 Build conditions freeway and intersection traffic analysis results are summarized in the following sections. Additional AM and PM peak hour MOE information, including vehicle throughput, speed, density, delay, travel time, and queue lengths at critical locations for all Build alternatives are in ***Appendix K***.

Representative Build Conditions AM and PM peak hour average freeway segment densities and speeds are illustrated in ***Figure 88*** through ***Figure 93*** through for Combined Alternative 2, which consists for southbound I-95 Alternative 1A, northbound I-95 Alternative 4, and Old Bridge Road Alternative Flyover (Outside/Inside). Figures for other alternatives are in ***Appendix K***.

7.4.1 2045 AM Peak Hour Freeway Operations

In the 2045 AM peak hour, all Combined Alternatives operated similarly in the northbound direction of I-95 given that all include the northbound I-95 Alternative 4 configuration. Similar changes in operations are expected in 2045 as what was observed in 2030. Speeds increased slightly within the Route 123 interchange due to eliminating the weave area and ramp reconfiguration. Speeds decreased and density increased further from 2030 conditions at the

merge area from northbound Route 1, with speeds ranging from 10 to 15 mph. This was attributed to less metering of traffic on the arterials and more throughput reaching the mainline. The queuing on the northbound off-ramp to northbound Route 123 seen in 2045 No-Build conditions reduced from 855 feet to approximately 360 feet due to ramp reconfiguration and arterial improvements.

Northbound travel time increased from No-Build conditions due to arterial improvements and less metering of traffic. The increase varied among the Combined Alternatives because of different configurations of the Route 123 at Old Bridge Road intersection, and ranged from 31 seconds (5 percent) with Combined Alternative 1/Flyover (Outside/Inside) to 79 seconds (13 percent) with Combined Alternative 3/Grade-Separated (see ***Figure 94***).

I-95 express lanes operated similarly among the Build alternatives, but speed in the merge area from the Route 123 ramp decreased by approximately 10 to 15 mph when the flyover ramp is relocated to connect directly to the I-95/123 Commuter Lot (I-95 Southbound Alternative 2/Combined Alternative 3). This was likely attributed to different vehicle arrival patterns compared to the existing signalized ramp intersection on Route 123.

In the off-peak southbound direction of I-95, negligible change in operations from No-Build conditions is expected.

7.4.2 2045 PM Peak Hour Freeway Operations

In the 2045 PM peak hour, all Combined Alternatives operated similarly in the southbound direction of I-95 given that all include similar ramp reconfiguration. Speeds and densities were similar to No-Build conditions, with congestion remaining north to the Fairfax County Parkway interchange, but greater throughput was carried on I-95 south of the Occoquan River due to ramp reconfiguration and arterial improvements. For example with Combined Alternative 2, southbound I-95 moved up to 360 vph (6 percent) more throughput between Route 1 and Route 123 and 550 vph (9 percent) more throughput between Route 123 and Route 294 than No-Build conditions. The queuing on the southbound off-ramp to northbound Route 123 that was seen in No-Build conditions was reduced with the Build alternatives—especially with Combined Alternatives 1 and 2 that include a flyover configuration at Old Bridge Road.

Southbound travel time decreased by about one minute (6 percent) with Combined Alternatives 1, 2, and 4 compared to No-Build conditions (see ***Figure 95***). Travel time remained approximately the same with Combined Alternative 3, which includes the Grade-Separated Old Bridge Road alternative, due to slower speeds approaching the queues on the off-ramp to northbound Route 123.

In the off-peak northbound direction of I-95, operations improved at the Route 123 interchange due to off-ramp reconfiguration and reduced ramp queuing from Route 123. With elimination of the northbound weave area at Route 123, speeds increased by approximately 10 mph to free-flow conditions. Queueing from northbound Route 123 that impacted the mainline is No-Build conditions was mitigated with improvements at Old Bridge Road. Northbound travel time improved by approximately 10 seconds (3 percent) from No-Build conditions.

Figure 88: 2045 Build AM Peak Hour Mainline and Ramp Density

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
Build Combined Alternative 2
2045 AM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Density (vplpm)

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 -100 | > 100

Miles
0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 89: 2045 Build AM Peak Hour Mainline and Ramp Speed

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
Build Combined Alternative 2
2045 AM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Speed (mph)

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Miles: 0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 90: 2045 Build PM Peak Hour Mainline and Ramp Density (1 of 2)

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
Build Combined Alternative 2
2045 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

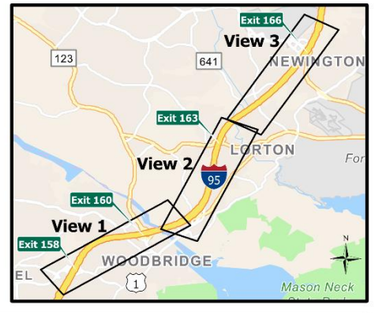
Density (vplpm)

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 - 100 | > 100

0 0.25 0.5 Miles

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 91: 2045 Build PM Peak Hour Mainline and Ramp Density (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Density
Build Combined Alternative 2
2045 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Density (vplpm)

< 18 | 18 - 26 | 26 - 35 | 35 - 45 | 45 -100 | > 100

Miles
0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 92: 2045 Build PM Peak Hour Mainline and Ramp Speed (1 of 2)

VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
Build Combined Alternative 2
2045 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

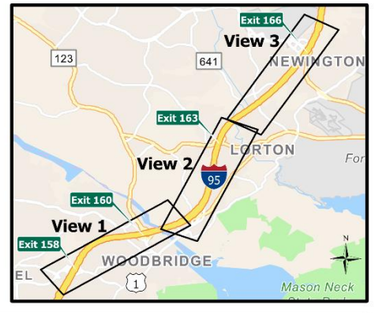
Speed (mph)

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Miles: 0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

Figure 93: 2045 No Build PM Peak Hour Mainline and Ramp Speed (2 of 2)



VDOT STARS STRATEGICALLY TARGETED AND AFFORDABLE ROADWAY SOLUTIONS

I-95 Corridor
Mainline and Ramp Speed
Build Combined Alternative 2
2045 PM Peak Hour

Northbound I-95: 1A Southbound I-95: 4 Old Bridge Road: Flyover (Outside/Inside)

Speed (mph)

< 10 mph | 10 - 20 mph | 20 - 35 mph | 35 - 50 mph | 50 - 60 mph | > 60 mph

Miles
0 0.25 0.5

Note: Results displayed are the average results across 10 Vissim microsimulation runs.

7.4.3 2045 AM Peak Hour Intersection Operations

Table 37 shows a comparison of average delay at key study area intersections. ***Figure 94*** shows a comparison of travel times.

Table 37: 2045 AM Peak Hour Average Delay Comparison

Intersection	No-Build	Combined Alt. 1 Flyover (Outside/ Outside)	Combined Alt. 2 Flyover (Outside/ Inside)	Combined Alt. 3 Grade-Separated	Combined Alt. 4 Elevated Left Turns
	Average Intersection Delay (Seconds per Vehicle)				
Route 123 at Workhouse Road	29.5	10.4	10.5	11.5	11.2
Route 123 at Commerce Street	71.9	52.4	54.2	51.9	57.1
Route 123 at Old Bridge Road	42.0	26.9	34.2	11.0	23.2
Route 123 at Commuter Parking Lot	2.5	0.9	1.0	-	1.2
Route 123 at Devils Reach Road	24.8	3.8	12.0	1.8	1.3
Route 123 at I-95 Express Lanes Ramp	35.2	8.7	11.1	6.0	10.0
Route 123 at Northbound I-95 Ramp	-	24.3	24.1	30.2	26.2
Route 123 at Annapolis Way/Monroe Drive	16.5	18.2	17.8	24.0	18.7
Route 123 at Horner Road	31.2	31.8	31.3	39.0	31.1
Old Bridge Road at Commuter Parking Lot	24.8	9.4	7.2	9.8	-
Old Bridge Road at Public Storage Driveway	20.3	6.7	4.3	2.9	6.1
Old Bridge Road at Occoquan Road	468.2	309.0	271.0	220.7	233.5
Volume-Weighted Study Area Average	**57.3**	**43.9**	**44.1**	**40.5**	**43.0**

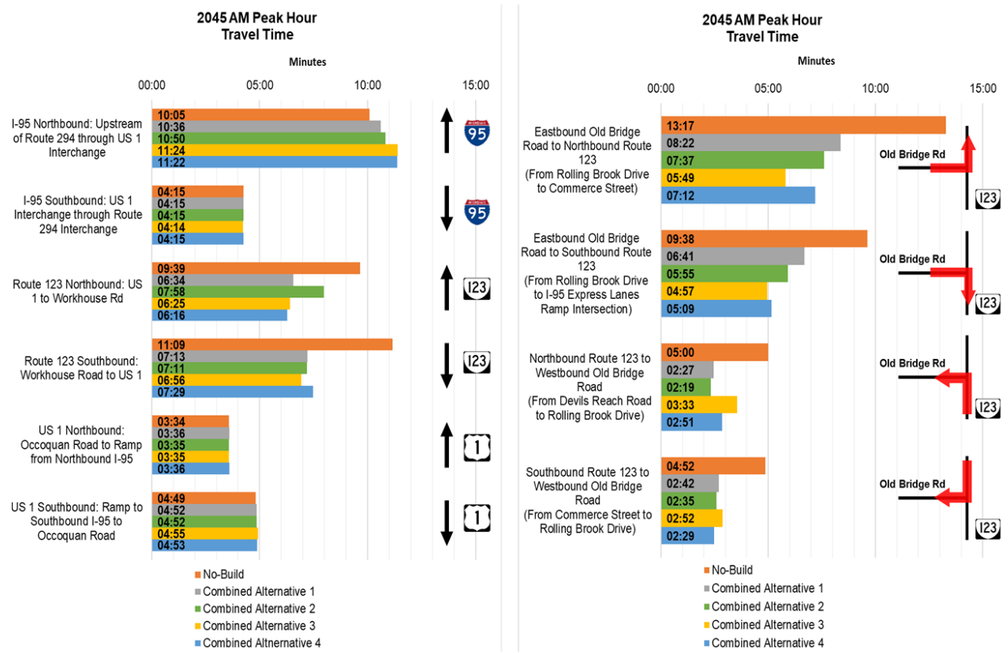
I-95 Alternatives—Route 123 Ramp Intersections

In the 2045 AM peak hour, the southbound I-95 ramp intersection (includes access to northbound Express Lanes in Combined Alternatives 1, 2, and 4) operated with overall intersection delay less than 11 seconds per vehicle in all Combined Alternatives, an improvement from 35 seconds in No-Build conditions due to intersection reconfiguration. The northbound I-95 ramp intersection (includes access into the I-95/123 Commuter Lot) operated with overall intersection delay less than 30 seconds in all Combined Alternatives. The southbound left-turn into the commuter lot from Route 123 operated with a delay of 89 seconds in Combined Alternative 1 and 91 seconds in Combined Alternative 2 due to conflicting higher-volume eastbound left-turn (from northbound I-95) and northbound though movements.

Old Bridge Road Alternative—Flyover (Outside/Outside)

In the 2045 AM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 1, which includes the Old Bridge Road Alternative Flyover (Outside/Outside). The study area average delay decreased from 57 second per vehicle to 44 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 42 seconds to 27 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 31 percent (585 feet) and southbound Route 123 queuing reduced by 28 percent (675 feet). Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by over 3 minutes (32 percent) and southbound Route 123 travel time reduced by nearly 4 minutes (41 percent) from No-Build conditions.

Figure 94: 2045 AM Peak Hour Travel Time Comparison



Old Bridge Road Alternative—Flyover (Outside/Inside)

In the 2045 AM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 2, which includes the Old Bridge Road Alternative Flyover (Outside/Inside). The study area average delay decreased from 57 second per vehicle to 44 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 42 seconds to 34 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 11 percent (210 feet) and southbound Route 123 queuing reduced by 26 percent (620 feet). Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by over 1.5 minutes (17 percent) and southbound Route 123 travel time reduced by nearly 4 minutes (41 percent) from No-Build conditions.

Old Bridge Road Alternative—Grade-Separated

In the 2045 AM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 3, which includes the Old Bridge Road Alternative Grade-Separated. The study area average delay decreased from 57 second per vehicle to 41 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 42 seconds to 11 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 62 percent (1,185 feet) and southbound Route 123 queuing reduced by 96 percent (2,290 feet). Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by over 3 minutes (34 percent) and southbound Route 123 travel time reduced by over 4 minutes (44 percent) from No-Build conditions.

Old Bridge Road Alternative—Elevated Left Turns

In the 2045 AM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 4, which includes the Old Bridge Road Alternative Elevated Left Turns. The study area average delay decreased from 57 second per vehicle to 43 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 42 seconds to 23 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 92 percent (1,750 feet) and southbound Route 123 queuing reduced by 30 percent (720 feet). Congestion reduced on eastbound Old Bridge Road due to separating left turns at Route 123 from other intersection movements. Queuing on eastbound Old Bridge Road from Route 123 reduced from 1,990 feet to 990 feet. Travel time reduced on both Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by over 3 minutes (35 percent) and southbound Route 123 travel time reduced by over 3.5 minutes (38 percent) from No-Build conditions.

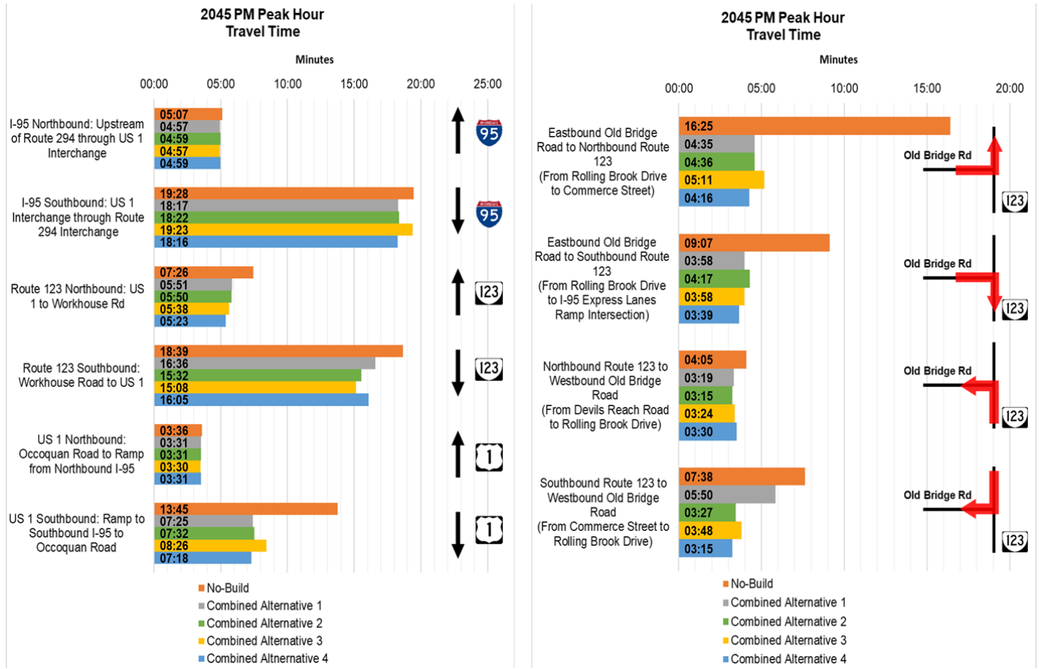
7.4.4 2045 PM Peak Hour Intersection Operations

Table 38 shows a comparison of average delay at key study area intersections. ***Figure 95*** shows a comparison of travel times.

Table 38: 2045 PM Peak Hour Average Delay Comparison

Intersection	No-Build	Combined Alt. 1 Flyover (Outside/ Outside)	Combined Alt. 2 Flyover (Outside/ Inside)	Combined Alt. 3 Grade-Separated	Combined Alt. 4 Elevated Left Turns
	Average Intersection Delay (Seconds per Vehicle)				
Route 123 at Workhouse Road	269.5	197.2	160.8	174.2	170.2
Route 123 at Commerce Street	208.4	135.6	101.4	110.1	109.9
Route 123 at Old Bridge Road	57.6	19.4	17.1	13.9	16.7
Route 123 at Commuter Parking Lot	10.7	0.5	0.6	-	0.5
Route 123 at Devils Reach Road	31.6	0.8	1.4	11.9	7.9
Route 123 at I-95 Express Lanes Ramp	74.1	18.9	20.1	3.6	19.7
Route 123 at Northbound I-95 Ramp	-	17.3	16.9	14.7	14.4
Route 123 at Annapolis Way/Monroe Drive	20.6	28.7	23.6	35.5	33.0
Route 123 at Horner Road	27.3	37.4	39.6	42.8	38.9
Old Bridge Road at Commuter Parking Lot	26.3	17.4	17.1	19.4	-
Old Bridge Road at Public Storage Driveway	22.1	7.8	7.5	4.7	14.4
Old Bridge Road at Occoquan Road	127.6	68.7	63.7	67.7	63.4
Volume-Weighted Study Area Average	**90.8**	**62.4**	**59.2**	**60.4**	**60.6**

Figure 95: 2045 PM Peak Hour Travel Time Comparison



I-95 Alternatives—Route 123 Ramp Intersections

In the 2045 PM peak, hour the southbound I-95 ramp intersection (includes access from southbound Express Lanes in Combined Alternatives 1, 2, and 4) operated with overall intersection delay less than 20 seconds per vehicle in all Combined Alternatives, an improvement from 74 seconds in No-Build conditions due to intersection reconfiguration and improvements at Old Bridge Road. Queueing on the westbound approach from the southbound Express Lanes reduced from 3,670 feet in No-Build conditions to less than 480 feet in Combined Alternatives 1, 2, and 4. This was primarily attributed to less congestion on northbound Route 123 approaching Old Bridge Road. The northbound I-95 ramp intersection (includes access into the I-95/123 Commuter Lot) operated with overall intersection delay less than 17 seconds in all Combined Alternatives.

Old Bridge Road Alternative—Flyover (Outside/Outside)

In the 2045 PM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 1, which includes the Old Bridge Road Alternative Flyover (Outside/Outside). The study area average delay decreased from 91 second per vehicle to 62 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 58 seconds to 19 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 83 percent (2,510 feet), and southbound Route 123 queuing at Old Bridge Road reduced by 14 percent (345 feet). Queuing on the southbound I-95 off-ramp to northbound Route 123 was also eliminated. Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both

Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by over 1.5 minutes (21 percent) and southbound Route 123 travel time reduced by 2 minutes (11 percent) from No-Build conditions.

Old Bridge Road Alternative—Flyover (Outside/Inside)

In the 2045 PM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 2, which includes the Old Bridge Road Alternative Flyover (Outside/Inside). The study area average delay decreased from 91 second per vehicle to 59 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 58 seconds to 17 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 73 percent (2,220 feet), and southbound Route 123 queuing at Old Bridge Road reduced by 30 percent (720 feet). Queuing on the southbound I-95 off-ramp to northbound Route 123 was nearly eliminated and extended 185 feet on the ramp. Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by over 1.5 minutes (22 percent) and southbound Route 123 travel time reduced by over 3 minutes (17 percent) from No-Build conditions.

Old Bridge Road Alternative—Grade-Separated

In the 2045 PM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 3, which included the Old Bridge Road Alternative Grade-Separated. The study area average delay decreased from 91 second per vehicle to 60 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 58 seconds to 14 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 40 percent (1,200 feet), and southbound Route 123 queuing at Old Bridge Road reduced by 44 percent (1,075 feet). Queuing on the southbound I-95 off-ramp to northbound Route 123 remained due to the signalized intersection of Route 123 and Old Bridge Road under the proposed bridge. Queuing extended 1,615 feet along the ramp. Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by nearly 2 minutes (24 percent) and southbound Route 123 travel time reduced by over 3.5 minutes (19 percent) from No-Build conditions.

Old Bridge Road Alternative—Elevated Left Turns

In the 2045 PM peak hour, intersection operations along Route 123 and Old Bridge Road improved from No-Build conditions with Combined Alternative 4, which includes the Old Bridge Road Alternative Elevated Left Turns. The study area average delay decreased from 91 second per vehicle to 61 seconds. Overall intersection delay of Route 123 at Old Bridge Road decreased from 58 seconds to 17 seconds. Northbound Route 123 queuing at Old Bridge Road reduced by 72 percent (2,180 feet), and southbound Route 123 queuing at Old Bridge Road reduced by 80 percent (1,935 feet). Queuing on the southbound I-95 off-ramp to northbound Route 123 remained due to the elevated signalized intersection of left turns between Route 123 and Old Bridge Road. Queuing extended 1,580 feet along the ramp. Congestion remained on eastbound Old Bridge Road due to traffic signals at Occoquan Road and Route 123, but throughput increased and travel time decreased compared to No-Build conditions. Travel time reduced on both Route 123 and Old Bridge Road. Northbound Route 123 travel time reduced by 2 minutes (28 percent) and southbound Route 123 travel time reduced by 2.5 minutes (14 percent) from No-Build conditions.

7.5 Future Safety Analysis

Crash modification factors (CMFs) were used where possible to determine the potential safety benefits of the recommended improvements. CMFs were chosen from the approved list of CMFs used for Round 4 (Fiscal Year 2022) of the VDOT SMART SCALE safety scoring process. The CMFs selected are applicable to all crash types but were only applied to fatal and injury (FI) crashes. The best applicable CMF was applied to crashes in the influence area of each intersection or interchange segment. If CMFs were not available from the SMART SCALE CMF List, CMFs from the Virginia State-Preferred CMF List and CMF Clearinghouse were used to calculate the projected crash reduction.

CMFs were applicable to four improvement components: retiming arterial signals, converting the northbound left turn at Route 123 and Old Bridge Road to a flyover and adding a through lane, converting Devils Reach Road to a right-in/right-out, and converting the southbound I-95 on-ramp from southbound Route 123 to a free-flow right turn. As shown in ***Table 39***, these improvements are projected to reduce approximately 37 total fatal and injury crashes in the study area over a 5.5-year period based on crash data from January 1, 2015 to July 31, 2020. Where CMFs were not applicable, a qualitative analysis was performed to evaluate safety impacts of Build improvements to the corridor.

Removing the southbound I-95 on-ramp from northbound Route 123 is likely to reduce the number of merging crashes on southbound I-95; however, adding a signalized northbound left-turn lane to provide access to southbound I-95 is projected to increase crashes on Route 123. Additionally, five total ramp crashes will be eliminated by removing the loop ramp.

While converting the southbound I-95 on-ramp from southbound Route 123 to a free-flow right turn is projected to reduce the number of crashes at the intersection, widening the ramp to two lanes is projected to increase the number of merging and lane-change crashes on the ramp itself. A similar increase in crashes is projected for the widening of the northbound I-95 on-ramp from southbound Route 123 to two lanes.

Removing the northbound I-95 off-ramp to northbound Route 123 eliminates the northbound weaving segment, which is likely to reduce crashes on northbound I-95. However, adding a signalized northbound left turn to provide access to northbound Route 123 is projected to increase crashes on Route 123. Fifty crashes will be eliminated by removing the loop ramp.

The proposed improvements are also projected to improve pedestrian safety by providing new pedestrian facilities along the east side of Route 123 and providing multimodal connectivity and access through the I-95 interchange.

Table 39: Expected 5-Year Fatal and Injury Crash Reduction

Location	Improvement Description	Crash Modification Factor (CMF)	5.5-Year Fatal + Injury Crash Reduction
Intersections			
Route 123 at Workhouse Road	Signal retiming	0.91	1.27
Route 123 at Occoquan Regional Park	Signal retiming	0.91	0.72
Route 123 at Commerce Street	Signal retiming	0.91	1.19
Route 123 at Old Bridge Road	Northbound left turn flyover	0.65	6.18
Route 123 at Old Bridge Road	Add lane	0.80	3.18
Route 123 at Devils Reach Road	Signal to right-in/right-out	0.40	13.23
Route 123 at Annapolis Way/Monroe Drive	Signal retiming	0.91	0.48
Route 123 at Horner Road	Signal retiming	0.91	0.72
Old Bridge Road at Commuter Parking Lot	Signal retiming	0.91	0.32
Old Bridge Road at Occoquan Road	Signal retiming	0.91	1.27
Route 1 at Route 123	Signal retiming	0.91	2.15
Route 294 at Southbound I-95 Ramp/Commuter Lot	Signal retiming	0.91	2.07
Route 294 at Summerland Drive/York Drive	Signal retiming	0.91	1.27
Interchange			
Southbound I-95 on-ramp from southbound Route 123	Convert to free flow right turn	0.65	3.10
		Total	37.14

8 Project Advancement

This study should be used as a planning tool to achieve the next steps of planning, programming, designing, and constructing the identified improvements in the study area. To continue the progress made during this study, VDOT and Prince William County should continue to coordinate to pursue the advancement and funding for preferred alternative improvements at the I-95 at Route 123 interchange and Route 123 at Old Bridge Road intersection.

8.1 Gain Consensus for Preferred Alternatives

VDOT, Prince William County, and other SWG members should gain consensus on preferred alternatives to advance for project funding and development using the outcomes of this study.

8.1.1 I-95 at Route 123 Interchange

From the initial concept screening, the top ranked southbound I-95 improvement was Alternative 1A and the top ranked northbound I-95 improvement was Alternative 4. As the study progressed and as a result of alternatives analysis results, SWG input, and public input, a preferred alternative for the I-95 interchange was identified as Alternative 1C as shown as shown in ***Figure 96***. This alternative was developed by refining Alternative 1A.

Alternative 1B was not preferred because it did not address the weave distance on northbound Route 123 at Old Bridge Road like the other southbound I-95 alternatives that included a modification of the southbound off-ramp. Alternative 2 was not preferred because of the impacts to the I-95 Express Lanes and high overall project cost relative to the other options.. This improvement would also require a northbound I-95 improvement be implemented concurrently to provide more direct access to the relocated express lanes access point and I-95/Route 123 Commuter Lot via Route 123. Alternative 4 remained a viable option for a northbound I-95 improvement to advance for project funding and development in the future.

The preferred southbound I-95 improvement, Alternative 1C, combined both southbound on-ramps from Route 123, expanding the capacity of the existing on-ramp and removing the existing loop ramp from northbound Route 123 to southbound I-95 to improve traffic flow and safety at this location. Combining the two on-ramps would reduce the number of successive merges and conflict points thereby allowing the consolidated merge to happen in the auxiliary lane between Route 123 and Route 294. Having a longer acceleration and weaving area would also make it easier for motorists to merge into and out of traffic between the ramps at Route 123 and Route 294 and create more space for through trips on southbound I-95. Reconfiguring the Route 123 intersection, the southbound I-95 on-ramp, and the I-95 Express Lanes ramp would also provide congestion relief on southbound Route 123 approaching the interchange. Modifying the southbound off-ramp to northbound Route 123 would provide additional lane-changing distance before the traffic signals at Devils Reach Road and Old Bridge Road. The alternative would also add a missing pedestrian and bicycle connection in the Route 123 corridor, providing connectivity between pedestrian and bicycle networks being considered by VDOT and Prince William County to the north and south of the interchange.

8.1.2 Route 123 at Old Bridge Road Intersection

Of the four Build alternatives selected by the SWG for refined analysis—Flyover (Outside/Outside), Flyover (Outside/Inside), Grade-Separated, and Elevated Left Turns—the SWG reached consensus on a preferred improvement for this location being a left-turn flyover from northbound Route 123 to westbound Old Bridge Road. The two flyover alternatives are shown in ***Figure 97***.

Flyover (Outside/Inside) was the highest scoring alternative based on the evaluation conducted through the STARS study while Flyover (Outside/Outside) was the second highest scoring. The Outside/Inside configuration offers several additional benefits over the Outside/Outside:

- Provides greater operational benefits to southbound Route 123, particularly by adding capacity to the right-turn to westbound Old Bridge Road
- Provides more opportunity for a direct crossing of the proposed shared-use path across Route 123 at the Old Bridge Road intersection
- Reduces conflicting high volume movements at the intersections of Old Bridge Road at Route 123 and at the Occoquan Commuter Lot driveway by separating southbound right-turn traffic
- Reduces potential right-of-way impacts by changing the location of the flyover compared to the Outside/Outside configuration.

The Grade-Separated alternative was not preferred because of its greater property impacts, right-of-way needs, and higher cost. It would also create a short weave area on southbound Route 123 approaching the ramp to southbound I-95 and the northbound I-95 Express Lanes access intersection. Multiple lane changes over a short distance (approximately 400 to 500 feet) would be needed to access I-95 .

The Elevated Left Turns alternative was not preferred due to its greater property impacts, right-of-way needs, and cost. It was also the lowest scoring Build alternative from the public survey.

Figure 96: Recommended I-95 Interchange Alternative 1C

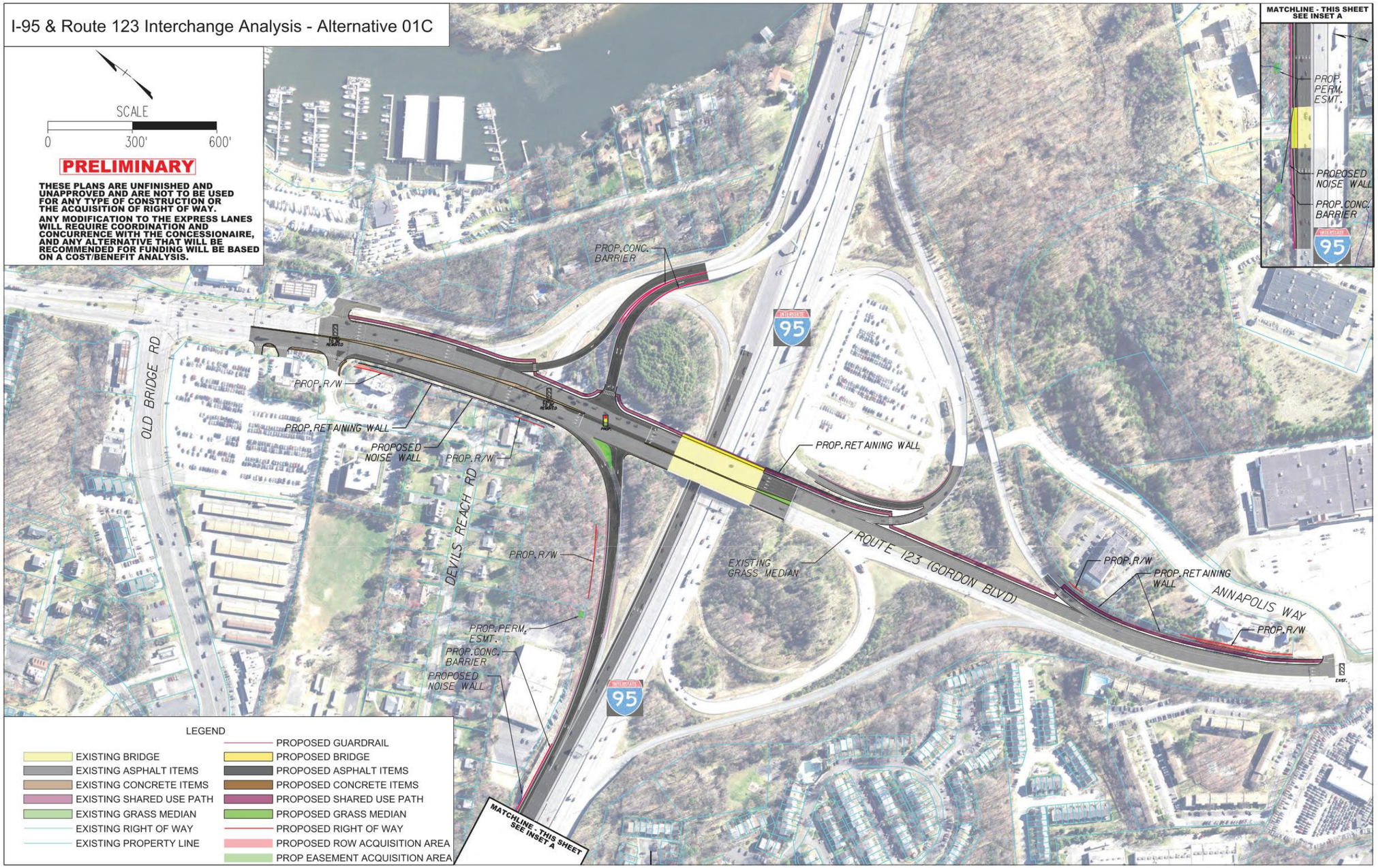


Figure 97: Recommended Route 123 at Old Bridge Road Alternatives

8.2 Prepare Projects for Advancement

The improvements should advance and be confirmed for consistency with:

- Constrained Long Range Transportation Plan (CLRP)
- Transportation Improvement Plan (TIP)
- Statewide Transportation Improvement Plan (STIP)

The improvements should next advance to an Interchange Access Report (IAR) and environmental assessment to develop the Final Preferred Alternative. VDOT and Prince William County should determine the most appropriate and efficient project delivery method. Interchange improvements to southbound I-95 at Route 123 are being advanced by VDOT through a Progressive Design-Build project.

8.3 Apply for Prioritized Funding Programs

In September 2021, the Commonwealth Transportation Board (CTB) approved and adopted the Interstate 95 Corridor Improvement Plans and thereby approved a suite of projects to be funded by the Interstate Operations and Enhancement Program (IOEP), including interchange improvements to southbound I-95 at Route 123. These improvements were incorporated into the VDOT Six Year Improvement Program.

For potential northbound I-95 improvements at Route 123 and improvements for the Route 123 at Old Bridge Road intersection, VDOT and Prince William County should pursue funding from one or more of the following programs.

8.3.1 SMART SCALE

SMART SCALE allocates funding from the construction District Grants Program (DGP) and High-Priority Projects Program (HPPP) to transportation projects based on a scoring process. The scoring process evaluates, scores and ranks projects based on congestion mitigation, economic development, accessibility, safety, environmental quality, and land use factors. The location of the project determines the weight of each of these scoring factors in the calculation of the total score. For projects in the Northern Virginia District, the scoring factor with the highest weight is congestion mitigation (45 percent).

8.3.2 Northern Virginia Transportation Authority (NVTA)

NVTA (also known as the "Authority") is a regional body that is focused on delivering transportation solutions for Northern Virginia's transportation dollars by bringing Northern Virginia jurisdictions and agencies together to prioritize projects and implement solutions. NVTA's primary function is to develop and update a regional transportation plan for Northern Virginia, conduct project planning, prioritization, and funding of transportation projects for counties and cities embraced by the Authority.

On April 3, 2013, the Governor's substitute for House Bill 2313 ("HB 2313") was adopted by the Virginia General Assembly. HB 2313 provided a dedicated funding stream for transportation projects in Northern Virginia. HB 2313 provided a permanent, annual source of revenue for the Authority to implement its mandate. The new revenue streams commenced on July 1, 2013.

All moneys received by the Authority and the proceeds of bonds and other debt instruments are required to be used solely for transportation purposes benefiting the member jurisdictions. Of the HB 2313 revenues received, 30 percent are distributed to member jurisdictions on a pro rata basis (based on contributions to total revenue) for transportation projects and purposes authorized under § 33.2-2510 and selected by the Member Jurisdiction. Seventy percent of the HB 2313 revenues are pledged to the payment of bonds and other debt instruments and will otherwise be available to fund regional transportation projects contained in the regional transportation plan in accordance with § 33.2-2500 and that have been rated in accordance with § 33.2-257.

8.3.3 Congestion Mitigation and Air Quality (CMAQ)

CMAQ allocates funding to surface transportation projects that improve air quality by reducing congestion.

8.3.4 Revenue Sharing

Revenue Sharing is a program that provides a dollar-for-dollar state match to local funds for transportation projects. Projects eligible for Revenue Sharing funds include construction, reconstruction, improvement, and maintenance projects.

8.3.5 Highway Safety Improvement Program (HSIP)

HSIP provides funding for improvements that correct or improve safety on a section of roadway or intersection with a high incidence of crashes.

8.3.6 Federal Grant Programs

The US Department of Transportation offers several discretionary grant programs including:

- The Mega Program
- Infrastructure for Rebuilding America (INFRA)
- Rebuilding American Infrastructure with Sustainability and Equity (RAISE)

8.4 Implementation

Once project applications are approved for funding through one or more of the aforementioned funding sources, the projects should be incorporated in the VDOT Six Year Improvement Program (SYIP) or one of the partner agencies programs, so they can enter the project development process.