

To: Mike Sawyer and Afshin Famili
 City of Richmond,
 Department of Public Works

Date: March 14, 2024

Project #: 34966.10

From: Chuck Conran, P.E.
 Chris Daily, P.E.

Re: 7th Street / Semmes Avenue Alternatives Development

Introduction

This memorandum documents the study methodology, analysis findings, and alternatives development process for the intersection of W 7th Street / Semmes Avenue / Manchester Bridge on-ramp in the Manchester neighborhood of the City of Richmond (see **Figure 1** for study area). The City of Richmond Department of Public Works tasked VHB with evaluating existing conditions at this location and with developing three alternative improvement concepts that would increase pedestrian access, improve speed management on the Semmes Avenue approach to the Manchester Bridge on-ramp, and enhance roadway visibility during darkness and inclement weather conditions. All these objectives would be addressed in context of the City’s Vision Zero and Better Streets (complete streets) principles. This study was initiated by Richmond City Council following a vehicle collision in October 2022 that resulted in a vehicle striking a residential property east of the study intersection.



Figure 1: Study Area

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Existing Conditions Analysis

VHB first evaluated the existing conditions of the study area to identify transportation needs and any constraints to potential design concepts. This task consisted of research into prior studies and funded projects, data collection, analysis of crash and traffic data, and a stakeholder site visit.

Prior Studies and Funded Transportation Projects

This study needs to be considered within the context of other previously completed and underway efforts, including safety screening and funded transportation projects.

City and State Safety Screening

The City of Richmond has developed a High Injury Network (HIN) as part of its Vision Zero Action Plan. The HIN represents the roadway mileage within the City that contains a significant overrepresentation of the City's fatal and severe (KA) injury crashes (76% of City KA crashes on just 9% of City roadway mileage). Neither W 7th Street nor Semmes Avenue is included in the City's current HIN.

The Virginia Department of Transportation (VDOT) also conducts a statistical crash overrepresentation analysis that produces the Potential for Safety Improvement (PSI) network of intersections and roadway segments. PSI indicates that a location experiences more crashes than anticipated based upon characteristics such as traffic volume, roadway cross-section, roadway classification, etc. The study area was not designated on the PSI list.

VDOT additionally performs a systemic analysis to develop its VDOT's Pedestrian Safety Action Plan (PSAP). PSAP assigns a risk-based score to every roadway based on a combination of factors that includes historical pedestrian and bicycle crashes, roadway cross-section and speed, surrounding land use, and socio-economic considerations. This process identifies the list of roadways that should be prioritized for multimodal safety improvements; the study area is included in the VDOT Richmond District's list of top 5% priority locations.

Transportation Planning

VTrans is the Commonwealth's Statewide Transportation Plan. VDOT conducts statewide screening to identify specific transportation needs at individual locations. These transportation needs are utilized for a variety of purposes, including to screen-in SMART SCALE funding applications. SMART SCALE is one of the primary funding sources for transportation projects in Virginia. If a project does not address an identified VTrans need, the SMART SCALE application will be screened out. According to VTrans, the study area needs include safety improvements as well as transit, bicycle, and pedestrian access.

In November 2013, the City of Richmond finalized the *Manchester Area Transportation and Land Use Study*. This study identified a long-term recommendation to relieve traffic congestion and improve connectivity at the W 7th Street / Semmes Avenue intersection. The study proposed the evaluation of a roundabout at the intersection as well as the conversion of Semmes Avenue to two-way traffic. **Figure 2** shows these proposed recommendations.



Figure 2: Excerpt from
Manchester Study

Funded Transportation Projects

The following funded transportation projects will enhance multimodal connectivity within the study area vicinity. **Figure 3** shows the portion of these projects proximate to the study area.

Commerce Road SMART SCALE Project

This funded SMART SCALE project will reconstruct the Commerce Road cross-section from Decatur Street to McDonough Street, including a segment of the Fall Line Trail along the west side of Commerce Road.

Manchester Fall Line Trail with Transit SMART SCALE Project

This funded SMART SCALE project will modify the cross-section of 9th Street over the Manchester Bridge to include dedicated transit lanes and a widened median that will accommodate the Fall Line Trail. This project will connect to the Commerce Road SMART SCALE project. It includes a Pedestrian Hybrid Beacon (PHB) at McDonough Street to transition the Fall Line Trail from the west side of Commerce Road to within the median for the Manchester Bridge crossing. This project will remove the existing staircase that provides access from Semmes Avenue up to the existing median sidewalk across the Manchester Bridge.

Manchester Connection Fall Line Trail to James River Park System Project

This funded project will construct a shared use path connection between the Fall Line Trail at Commerce Road / McDonough Street to the James River Park System. This connection will cross Semmes Avenue just east of the Manchester Bridge off-ramp, follow the existing trail alignment behind the parking lot and beneath the Manchester Bridge, and reconstruct the existing bridge over the Norfolk Southern railroad tracks to access the Park System.

Previously Implemented Improvements

The City of Richmond has been proactive at improving the transportation infrastructure within Manchester as development has come online and traffic patterns have changed. Prior to the October 2022 crash at the study intersection, Public Works had made the following traffic sign and pavement marking changes:

- Semmes Avenue northbound approach to W 7th Street
 - Installed two chevron signs within the porkchop island at W 7th Street.
 - Changed the Yield sign to a Stop sign for those turning right onto W 7th Street.
 - Installed STOP AHEAD pavement markings before the stop sign at W 7th Street for right turns.
 - Installed a curve warning sign with a 15mph advisory speed in advance of the ramp to the bridge.

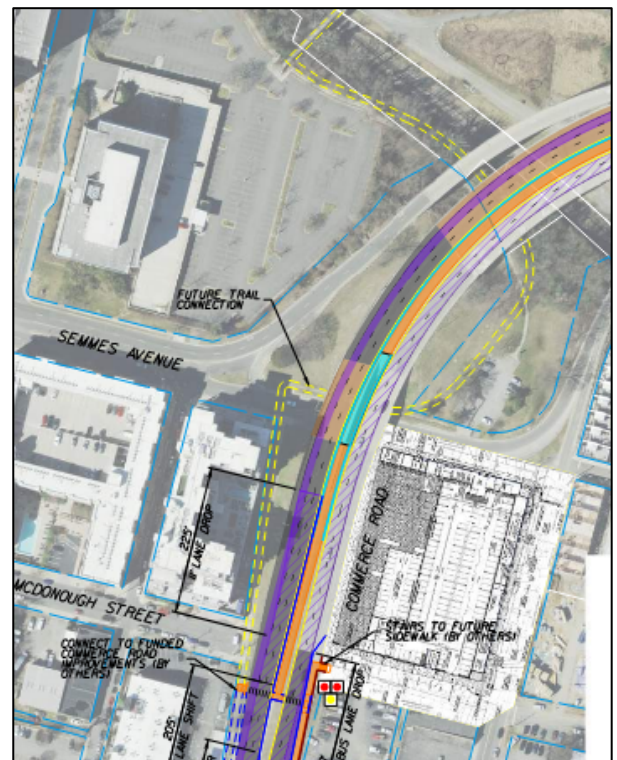


Figure 3: Excerpt from Manchester Fall Line Trail Project Sketch showing the Fall Line Trail, PHB at McDonough Street, and Trail Connection to James River Park System

- W 7th Street westbound approach to Semmes Avenue
 - Changed the free flow to a stopped condition with stop bar and stop ahead sign.
 - Installed yield bars at the Yield sign for W 7th St traffic desiring to go onto the bridge.

In September 2023, Public Works installed a speed table on Semmes Avenue at the existing midblock crossing immediately north of the southbound off-ramp intersection.

Data Collection

Volume Data

VHB collected peak period (7-9 AM, 4-6 PM) traffic volumes at the W 7th Street / Semmes Avenue / Manchester Bridge on-ramp intersection on Thursday, May 18th, 2023. VHB then computed peak hours of 7:45-8:45 AM and 4:30-5:30 PM. These peak hour turning movement counts can be seen in **Figure 4**. VHB did not collect traffic volumes at the Semmes Avenue / Manchester Bridge off-ramp intersection; however, VHB estimated the volumes at this location based on the traffic patterns at the counted intersection.

VHB also reviewed the average annual daily traffic (AADT) volume on Semmes Avenue. The 2021 data (most recent data) was 12,000 vehicles per day, and the AADT has stayed relatively consistent over the past five years, with a linear average annual growth rate of 0.5% per annum.

VHB forecasted the 2023 traffic volumes forward to a 2030 analysis year utilizing an annual growth rate of 0.5%. VHB also added site trips for the Eddy on the James apartment building at the corner of W 7th Street / Semmes Avenue as this project was still under construction during the May 2023 data collection. For the two-way Semmes Avenue scenario, VHB assumed a certain quantity of traffic utilizing the W 7th Street to westbound Semmes Avenue movement. The 2030 forecasted peak hour traffic volumes can also be seen in **Figure 4**.



Figure 4: Peak Hour Traffic Volumes

Speed Data

The City of Richmond conducted a speed study on Semmes Avenue (between Cowardin Avenue and Manchester Bridge) over a three-day period in October 2018. This speed study indicated that most traffic is travelling below 35 MPH on Semmes Avenue, with the highest concentration of higher speeds seen during the overnight hours. **Figure 5** displays the data from the speed study.

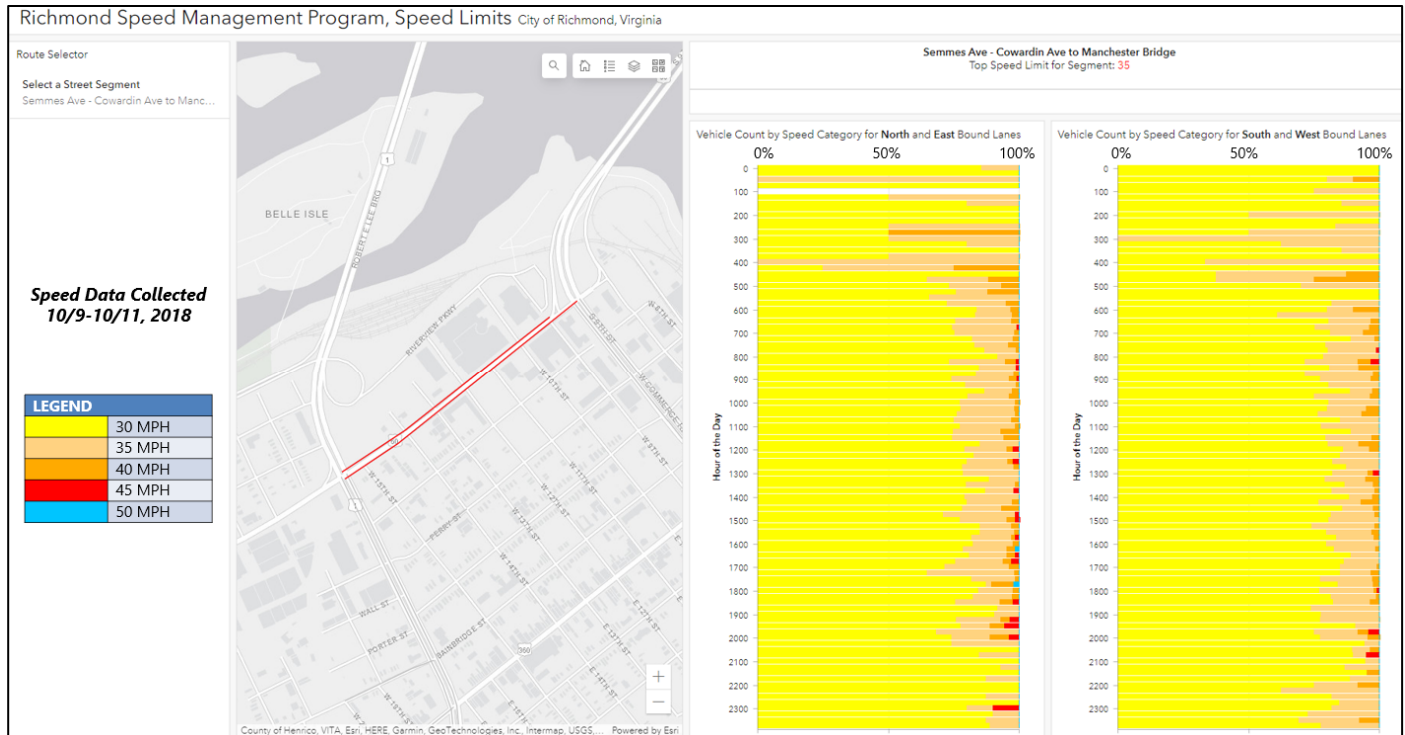


Figure 5: City of Richmond Speed Study of Semmes Avenue

Analysis of Crash History and Traffic Operations

Crash History

VHB reviewed the most recent set of five complete years of crash data (2018-2022). At the W 7th Street / Semmes Avenue / Manchester Bridge on-ramp intersection, there were a total of eight reported crashes of varying severities and crash types. One of these crashes resulted in a non-incapacitating injury ("B"), while the other seven resulted only in property damage. Two of the eight crashes involved drivers who lost control on the channelized turn lane from Semmes Avenue onto the Manchester Bridge during clear weather conditions, likely indicating a speed issue. Two more drivers lost control during inclement weather, icy road conditions. An additional two crashes involved construction activity on the on-ramp, and the final two crashes involved atypical driver behavior, the most notable of which is the crash that occurred in October 2022 – two drivers were street-racing on Semmes Avenue, collided with another, and ran off the road into the 7West townhomes east of W 7th Street. There have not been any crashes involving pedestrians. In total, three crashes occurred in darkness conditions and three crashes occurred in inclement weather conditions. **Figure 6** displays the collision diagram for these eight reported crashes.

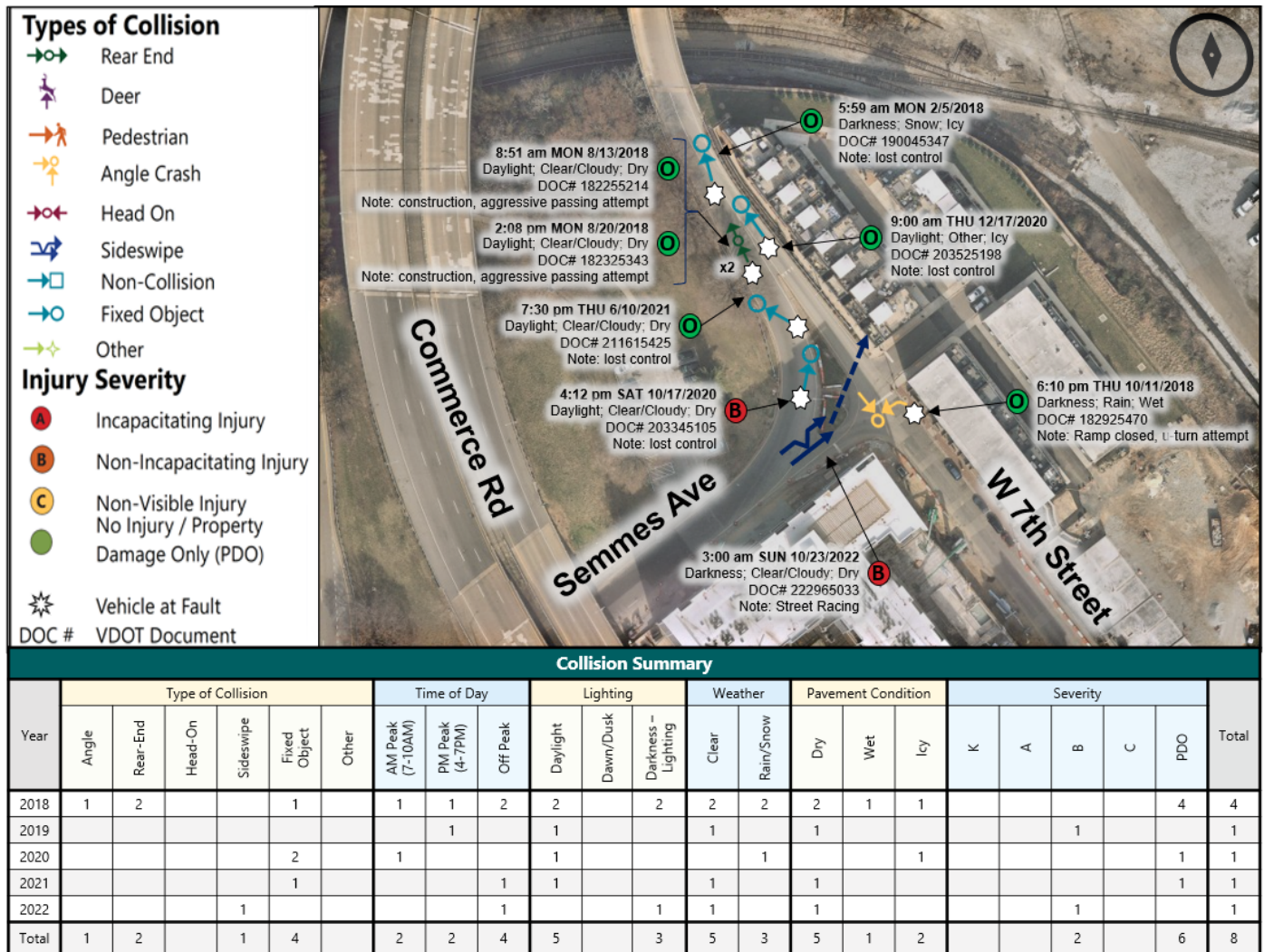


Figure 6: 2018-2022 Crash Data

Following the October 2022 crash, a neighborhood meeting was held at the subject intersection on November 10, 2022, with attendance from citizens, Councilwoman Robertson, Public Works staff, and Richmond Police (RPD). During this meeting, the previous intersection improvements were discussed as well as additional safety improvements that Public Works had already taken (or planned to take) after the crash, including:

- Replacing the damaged signs.
- Replacing the damaged guardrail and installing reflectorized tape.
- Installing one more chevron sign.
- Relocating the temporary stop sign on Semmes Avenue at W 7th Street for the right turn movement to a metal post.
- Installing three more 35mph speed limit signs on Semmes Avenue between Cowardin Avenue and W 7th Street.
- Installing a No Parking zone on W 7th Street north curb east of Semmes Avenue extended to enhance intersection sight distance.

- Relocating the yodock barricades from Semmes Avenue west curb to the “porkchop” island.
- RPD to deploy a speed feedback radar on Semmes Avenue northbound between Cowardin Avenue and W 7th Street.

Traffic Operations

VHB analyzed the traffic capacity of both Existing 2023 and No Build 2030 conditions at the two study intersections utilizing Synchro. **Table 1** displays the vehicle delay, corresponding level of service (LOS), and 95th percentile queue lengths for the controlled movements at each intersection. Of note, in both scenarios, the high-volume movements from the bridge onto westbound Semmes Avenue and eastbound Semmes Avenue onto the bridge are both free flow, uncontrolled movements with no vehicle delay or queueing. As seen in the table, the controlled movements operate with nearly no delay or queueing during weekday peak periods.

Table 1 Existing 2023 and No Build 2030 Delay, Level of Service, and Queuing

Intersection Movement	Existing 2023 AM	Existing 2023 PM	No Build 2030 AM	No Build 2030 PM
Semmes Avenue / Manchester Bridge Off-Ramp				
Off-Ramp Left Turn	11.1 (B) / 3 ft	11.2 (B) / 5 ft	13.3 (B) / 10 ft	13.6 (B) / 18 ft
Semmes Avenue / W 7th Street / Manchester Bridge On-Ramp / 7West				
Semmes Avenue EB	6.7 (A) / 5 ft	6.9 (A) / 8 ft	7.2 (A) / 10 ft	7.6 (A) / 18 ft
W 7 th Street NB	7.4 (A) / 5 ft	7.4 (A) / 5 ft	8.1 (A) / 15 ft	8.1 (A) / 13 ft
7West WB	6.8 (A) / 0 ft	7.0 (A) / 0 ft	7.1 (A) / 0 ft	7.3 (A) / 3 ft
Intersection	7.0 (A)	7.1 (A)	7.6 (A)	7.8 (A)

Source: Synchro HCM 6th Edition Analysis. 95th Percentile Queue Length.

Transportation Connectivity

Multimodal (Pedestrian and Bicycle)

The funded projects previously referenced will greatly enhance the multimodal connectivity of the study area, particularly for bicycle traffic. There remain constraints to pedestrian connectivity though, particularly along and across Semmes Avenue. While the funded Manchester Fall Line Trail to James River Park System project will construct a midblock crossing of Semmes Avenue, it does not include traffic calming improvements for Semmes Avenue to implement a crossing that best aligns with the City’s Vision Zero and Better Streets principles. No other Semmes Avenue crossing exists today northeast of the traffic signal at W 12th Street. There are also no pedestrian crossings across the Manchester Bridge ramps.

Vehicular

In existing conditions, Semmes Avenue is one-way northbound for vehicular traffic between W 9th Street and W 7th Street. East of Semmes Avenue, Commerce Road is functionally a dividing barrier between the portions of Manchester north and south of the corridor. The nearest controlled crossing of Commerce Road is Bainbridge Street, four blocks east. The one-way configuration of Semmes Avenue is thus a limiting constraint to the neighborhood’s connectivity. **Figure 7** shows the street grid, including direction of travel and intersection control at Commerce Road and Hull Street.



Figure 7: Manchester Transportation Connectivity

Stakeholder Site Visit

On August 9th, 2023, VHB met with citizens, Public Works staff, RPD, and Richmond Fire at the study intersection. During this meeting, the City and VHB discussed the ongoing transportation initiatives within Manchester, solicited feedback from citizens on their concerns and ideas for the study area, and discussed potential improvement ideas such as the two-way conversion of Semmes Avenue. During this meeting, VHB heard from citizens about drivers on westbound W 7th Street conducting rolling stops at the stop sign and drivers heading the wrong way on Semmes Avenue to access the James River Park System parking lot. VHB also heard from Richmond Fire about access into the townhomes east of W 7th Street – fire trucks must pull in forward and then reverse out. **Figure 8** shows site photos.



Figure 8: VHB Site Photos of the Study Intersection

Design Concepts

VHB explored a variety of possible design concepts for the study area, with the primary objective to enhance pedestrian and vehicular connectivity, as well as to improve traffic calming / speed management along the Semmes Avenue approach to the Manchester Bridge on-ramp. VHB evaluated the projected operations of the concepts that would modify movement control. The concept screening process led to the conclusion that some concepts were infeasible due to significant peak period vehicle delay or queueing.

Screened Out Concepts

Urban 4-Leg Intersection, All-Way Stop-Control (AWSC) or Signal

VHB first evaluated whether the existing channelized turn lane from eastbound Semmes Avenue onto the Manchester Bridge could be removed, converting the intersection to a more urban four-leg design where all movements occurred within the primary intersection footprint. This concept would better accommodate pedestrians as crosswalks would traverse controlled vehicular approaches (via either stop-control or signal control) and it would slow eastbound Semmes Avenue traffic by converting a free flow, channelized movement to an urban left-turn movement. In both alternatives, the eastbound Semmes Avenue approach maintains a left turn lane and a shared thru/right lane.

Table 2 displays the peak hour vehicle delay, corresponding level of service (LOS), and 95th percentile queue lengths for both an AWSC and signal alternative. As seen in the table, the Semmes Avenue approach in the AWSC alternative experiences significant delay and queueing that would have operational and safety impacts. The signalized alternative operates with acceptable delay; however, Semmes Avenue continues to have projected queue impacts that extend through both the midblock shared use path crossing and the Manchester Bridge off-ramp intersection, both of which have safety implications. The signal alternative also has a conflicting movement between the heavy left turn volume onto the bridge and pedestrians crossing that leg of the intersection. This analysis also did not consider a two-way conversion of Semmes Avenue – that conversion would induce more traffic on W 7th Street and would degrade Semmes Avenue further. For these reasons, VHB screened out the urban, 4-leg AWSC/signal intersection concepts.

Table 2 AWSC and Signal 2030 Delay, Level of Service, and Queuing

Intersection Movement	2030 AWSC AM	2030 AWSC PM	2030 Signal AM	2030 Signal PM
Semmes Avenue / W 7th Street / Manchester Bridge On-Ramp / 7West				
Semmes Avenue EB	191.4 (F) / 1,078 ft	134.2 (F) / 848 ft	17.5 (B) / #746 ft ¹	10.0 (A) / #636 ft ¹
W 7 th Street NB	8.5 (A) / 20 ft	11.0 (B) / 20 ft	33.1 (C) / 120 ft	30.7 (C) / 116 ft
7West WB	11.5 (B) / 3 ft	8.5 (A) / 3 ft	2.7 (A) / 4 ft	2.3 (A) / 5 ft
Intersection	169.8 (F)	119.2 (F)	19.0 (B)	12.2 (B)

Source: Synchro HCM 2000/6th Edition Analysis. 95th Percentile Queue Length.

1 # 95th percentile volume exceeds capacity, queue may be longer.

Alternatives to Facilitate Two-Way Conversion of Semmes Avenue – Manchester Bridge Off-Ramp

To convert Semmes Avenue to two-way vehicular traffic, the Semmes Avenue / Manchester Bridge Off-Ramp intersection must be reconfigured. VHB considered several alternatives for this reconfiguration, including the concept shown in **Figure 9** as well as a variation where Semmes Avenue was placed under stop-control in addition to the off-ramp left-turn movement. VHB screened out the alternative that included Semmes Avenue stop-control due to

significant delay and queueing on Semmes Avenue. VHB also screened out the concept shown in Figure 9 following discussions with City Public Works for the following reasons:

- There is limited stopping sight distance (SSD) on the bridge off-ramp approaching the proposed pedestrian crossing. The fence for the 901 Semmes Avenue property precludes shifting the crosswalk.
- There is no speed management on the bridge off-ramp to calm vehicular speeds prior to reaching the pedestrian crossing.
- The bridge off-ramp and westbound Semmes Avenue approaches are deflected towards each other, increasing the potential risk for lane departure crashes, particularly if off-ramp speeds are a concern.



Figure 9: Two-Way Semmes Avenue Conversion Concept

Three Recommended Concept Alternatives

Based on the existing conditions review, screening analysis, and discussion with City Public Works, VHB developed three feasible design concepts. The concepts are presented below, followed by planning-level cost estimates.

Concept 1: Roundabout with Two-Way Conversion of Semmes Avenue

The first concept proposes reconfiguring the Semmes Avenue / W 7th Street / Manchester Bridge on-ramp intersection into a single-lane roundabout, tying the 7th West roadway into W 7th Street, converting Semmes Avenue to two-way traffic, and reconfiguring the Manchester Bridge off-ramp as a more urban T-intersection with Semmes Avenue. This concept can be seen in **Figure 10**. The following are some of the notable features of this alternative:

- Conversion of Semmes Avenue / Manchester Bridge on-ramp intersection into single-lane roundabout.
- T-ing 7th West private roadway into W 7th Street as a right-in/right-out access. Mountable median will accommodate fire truck access but discourage vehicular traffic left turns.
- Two-way conversion of Semmes Avenue.
- Continuous median on Semmes Avenue between Manchester Bridge off-ramp and roundabout.
- Raised crosswalk and pedestrian refuge within median for Manchester Fall Line Trail Connection crossing of Semmes Avenue.
- Conversion of Semmes Avenue / Manchester Bridge off-ramp intersection into a more urban T-intersection, placing the off-ramp under stop-control and providing pedestrian crossing of off-ramp.

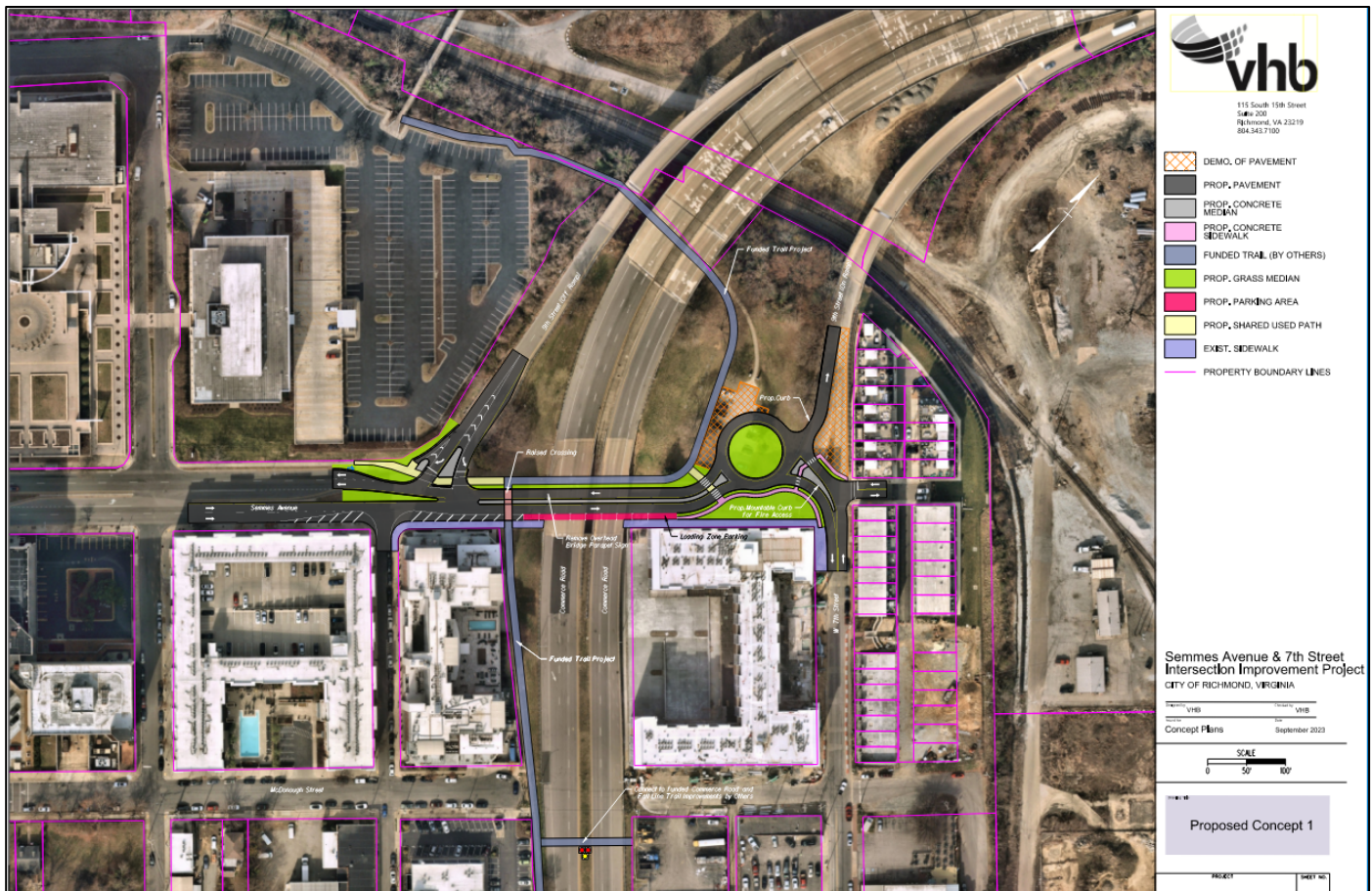


Figure 10: Concept 1 – Roundabout with Two-Way Conversion of Semmes Avenue

Table 3 displays the peak hour vehicle delay, corresponding level of service (LOS), and 95th percentile queue lengths for Concept 1. As seen in the table, the peak hour vehicle operations should be acceptable; while the off-ramp has increased congestion during the PM peak, it should operate fine for the remaining 23 hours. The SIDRA-reported roundabout queue on eastbound Semmes Avenue should be a quick-moving rolling queue that does not signify an operational or safety concern (see note beneath table).

A negative of this concept is that it necessitates removal of the existing Department of Parks, Recreation, and Community Facilities (DPRCF) 20-space parking lot. This parking supply could potentially be accommodated along W 10th Street or Riverview Parkway, where there are currently on-street parking restrictions on some curb faces. The road widths appear sufficiently wide to accommodate on-street parking on both sides of the roadway. This concept also limits direct access into the 7West townhomes; the roundabout could not accommodate a direct connection and there are safety concerns with allowing left turns into 7West so close to the roundabout. Finally, this concept removes existing curb frontage for the Eddy on the James apartment building; designated loading/delivery spaces are recommended to facilitate necessary curbside activity.

Table 3 Concept 1: Roundabout and T-Intersection – 2030 Delay, Level of Service, and Queuing

Intersection Movement	Build 2030 AM	Build 2030 PM	Controlled Crosswalk (No Build→Build)
Semmes Avenue / Manchester Bridge Off-Ramp (TWSC)			
Off-Ramp Left Turn	26.1 (D) / 28 ft	29.6 (D) / 45 ft	No→Yes
Off-Ramp Right Turn	33.2 (D) / 330 ft	55.3 (F) / 495 ft ¹	No→Yes
Semmes Avenue / W 7th Street / Manchester Bridge On-Ramp (Roundabout)			
Semmes Avenue EB	7.8 (A) / 836 ft ¹	7.5 (A) / 687 ft ²	No→Yes
W 7 th Street NB	17.6 (C) / 109 ft	13.9 (B) / 93 ft	No→Yes
Intersection	9.6 (A)	8.8 (A)	

Source: Synchro HCM 6th Edition Analysis and SIDRA Analysis. 95th Percentile Queue Length.

- 1 Projected 95th percentile queue length will occupy approximately 55% of the available storage (~900 ft) between the stop bar at Semmes Avenue and the marked gore on the Manchester Bridge.
- 2 SIDRA reported 95th percentile queue length; however, for the most part, this should be a rolling queue as the eastbound Semmes Avenue approach has very few conflicts to enter the roundabout – only vehicular traffic U-turning from W 7th Street or pedestrians crossing Semmes Avenue. Combined with the low delay (<8 seconds), this does not indicate a static queue.

Concept 2: Traffic Signal with Two-Way Conversion of Semmes Avenue

This second concept is fairly similar to Concept 1, with the primary distinction of a traffic signal rather than a roundabout at the Semmes Avenue / W 7th Street / Manchester Bridge on-ramp intersection. Concept 2 also ties the 7West roadway into W 7th Street, converts Semmes Avenue to two-way traffic, and reconfigures the Manchester Bridge off-ramp as a more urban T-intersection with Semmes Avenue. This concept can be seen in **Figure 11**. The following are some of the notable features of this alternative:

- Conversion of Semmes Avenue / W 7th Street / Manchester Bridge on-ramp intersection into a traffic signal where the Semmes Avenue to Manchester Bridge movement is the “thru” movement.
- T-ing 7West private roadway into W 7th Street as a right-in/right-out access. Mountable median will accommodate fire truck access but discourage vehicular traffic left turns.
- Two-way conversion of Semmes Avenue.
- Preservation of the existing Department of Parks, Recreation, and Community Facilities 20-space parking lot.
- Raised crosswalk and pedestrian refuge island for Manchester Fall Line Trail Connection crossing of Semmes Avenue.
- Conversion of Semmes Avenue / Manchester Bridge off-ramp intersection into a more urban T-intersection, placing the off-ramp under stop-control and providing pedestrian crossing of off-ramp.

Table 4 displays the peak hour vehicle delay, corresponding level of service (LOS), and 95th percentile queue lengths for Concept 2, comparing 2 thru lanes on eastbound Semmes Avenue to a single thru lane. Based on the projected queuing results from the single thru lane concept, VHB recommends the 2 thru lane concept to keep vehicle queue from extending through the midblock crossings and the Bridge off-ramp intersection. The Bridge off-ramp has increased congestion during the PM peak hour; however, it should operate fine for the remaining 23 hours of the day.

This concept preserves the DPRCF parking lot and more of the existing curb frontage for the Eddy on the James apartment building. Like Concept 1, it limits direct access into the 7West townhomes due to safety concerns associated with allowing left turns so close to a signalized intersection.

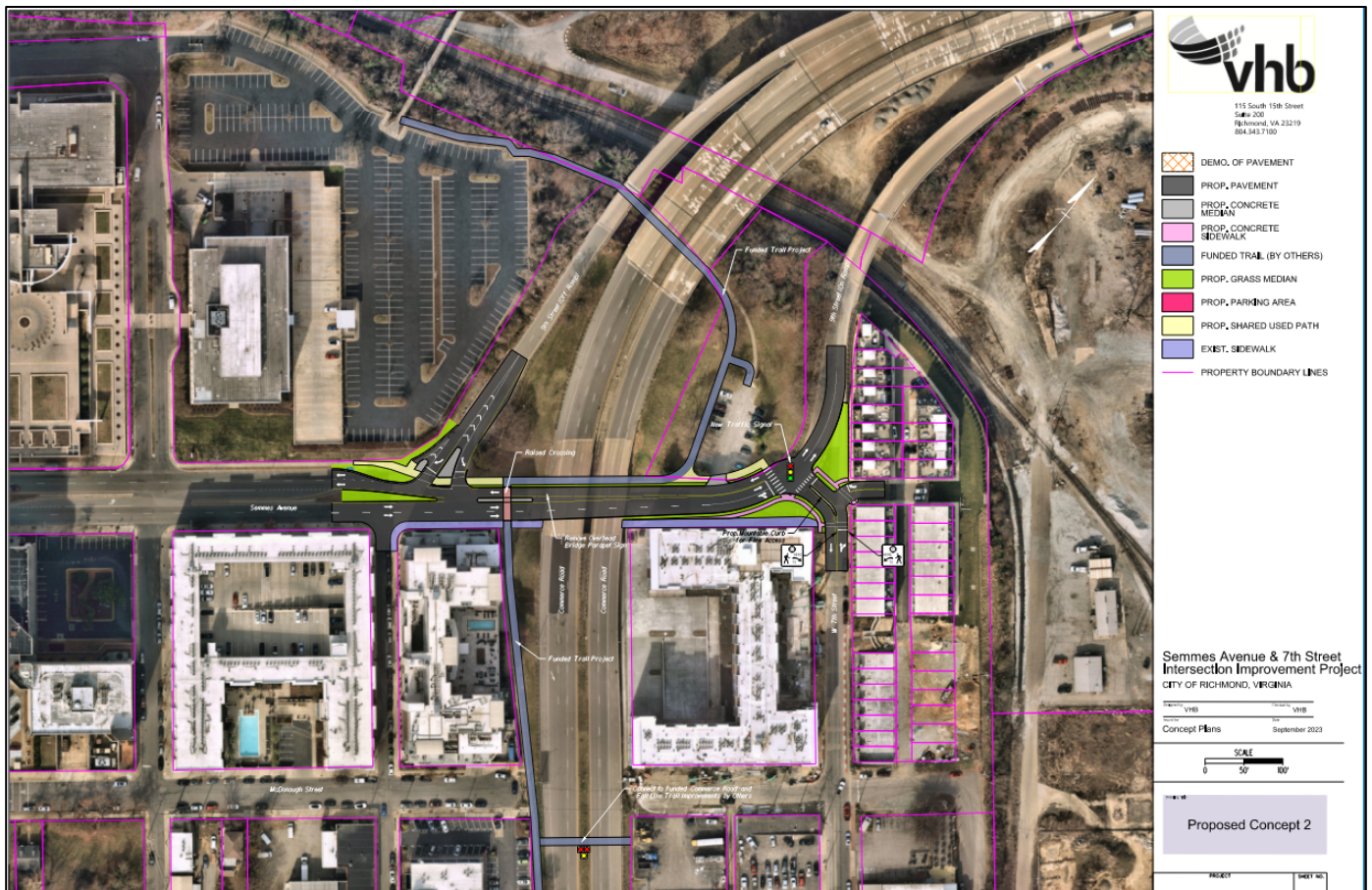


Figure 11: Concept 2 – Traffic Signal with Two-Way Conversion of Semmes Avenue

Table 4 Concept 2: Traffic Signal and T-Intersection – 2030 Delay, Level of Service, and Queuing

Intersection Movement	2 Thru Lanes AM ¹	2 Thru Lanes PM ¹	1 Thru Lane AM ²	1 Thru Lane PM ²
Semmes Avenue / Manchester Bridge Off-Ramp (TWSC)				
Off-Ramp Left Turn	14.5 (B) / 13 ft	15.3 (C) / 20 ft	26.1 (D) / 28 ft	29.6 (D) / 45 ft
Off-Ramp Right Turn	33.4 (D) / 333 ft	55.3 (F) / 495 ft ³	33.2 (D) / 330 ft	55.3 (F) / 495 ft
Semmes Avenue / W 7th Street / Manchester Bridge On-Ramp (Traffic Signal)				
Semmes Avenue EB	5.5 (A) / 114 ft	5.5 (A) / 107 ft	9.1 (A) / #602 ft ⁴	12.6 (B) / #620 ft ⁴
W 7 th Street NB	11.7 (B) / 41 ft	11.6 (B) / 47 ft	23.9 (C) / 82 ft	22.3 (C) / 93 ft
Intersection	6.7 (A)	6.7 (A)	11.9 (B)	14.5 (B)

Source: Synchro HCM 2000/6th Edition Analysis. 95th Percentile Queue Length.

- 1 Two thru lanes on eastbound Semmes Avenue continuing through traffic signal onto Bridge on-ramp before transitioning to one lane.
- 2 One thru lane on eastbound Semmes Avenue continuing through traffic signal onto Bridge on-ramp.
- 3 Projected 95th percentile queue length will occupy approximately 55% of the available storage (~900 ft) between the stop bar at Semmes Avenue and the marked gore on the Manchester Bridge.
- 4 # 95th percentile volume exceeds capacity, queue may be longer.

Concept 3: Speed Management, Pedestrian Enhancements, and Intersection Alignment

The third concept maintains much more of the existing infrastructure and functionality of Semmes Avenue, introducing physical infrastructure to induce traffic calming along Semmes Avenue. This concept can be seen in **Figure 12**. The following are some of the notable features of this alternative:

- Realignment of the Semmes Avenue approach to W 7th Street to align with 7West roadway.
- Continuous median on Semmes Avenue between Manchester Bridge off-ramp and W 7th Street.
- Raised crosswalks and pedestrian refuges within median for both midblock crossings of Semmes Avenue.
- Deflection and lane pinching to manage vehicular speeds on Semmes Avenue approach to channelized turn onto Manchester Bridge on-ramp.

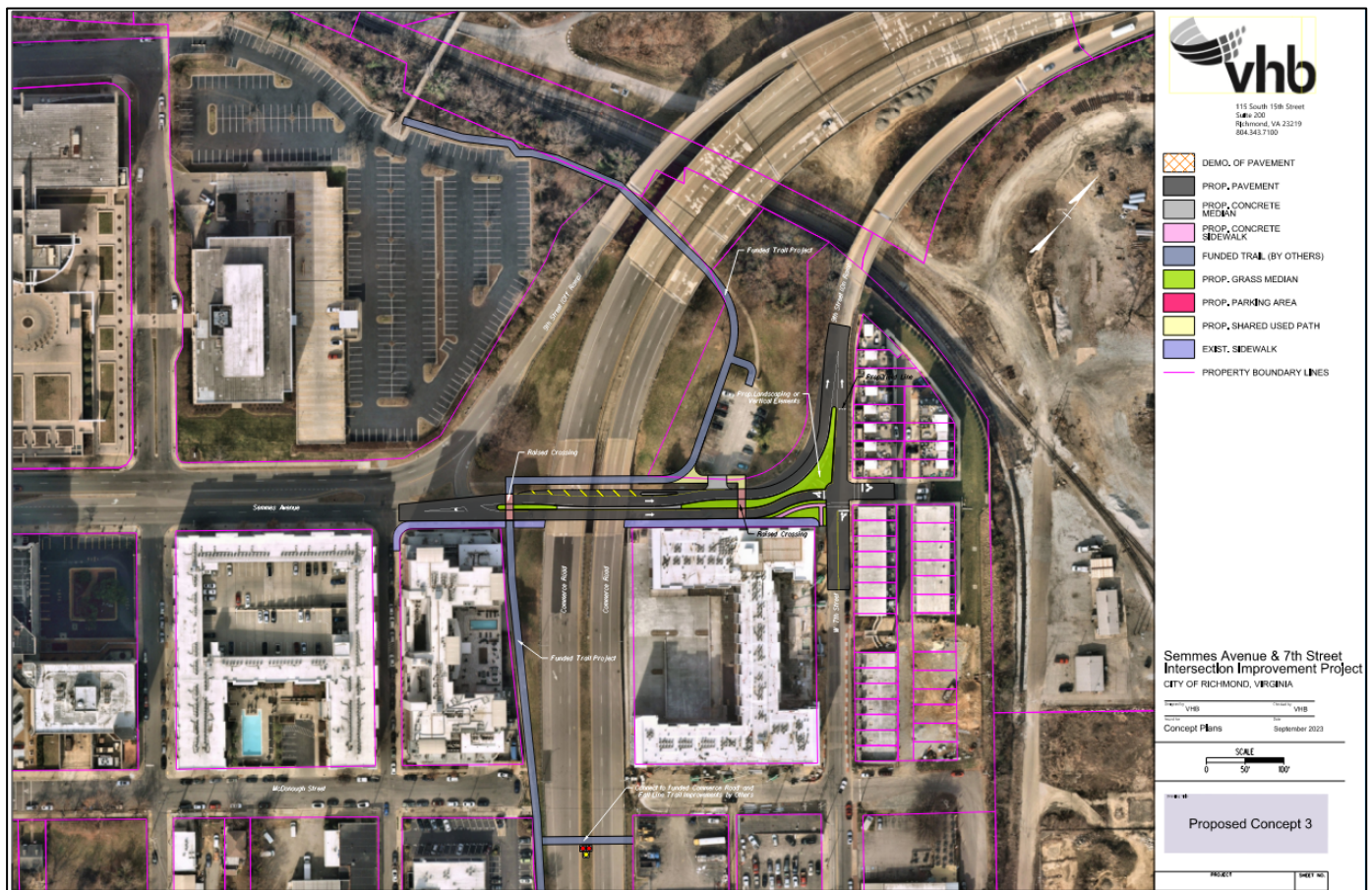


Figure 12: Concept 3 – Speed Management, Pedestrian Enhancements, and Intersection Alignment

This concept does not modify the existing intersection control at either study intersection. It also does not convert Semmes Avenue to two-way traffic or provide pedestrian crossing of the Manchester Bridge off-ramp. It maintains the existing direct access to and from the 7West townhomes, preserves the DPRCF parking lot, and most of the existing curb frontage for the Eddy on the James apartment building.

Need for Additional Control or Warning Device for Midblock Pedestrian Crossings

In all three recommended concepts, there are midblock crossings of Semmes Avenue. VHB proposed that these crossings be raised crosswalks with pedestrian refuge within a median. VHB additionally considered the potential need for supplementary control (i.e., Pedestrian Hybrid Beacon) or warning devices (i.e., rectangular rapid flashing beacons) at these midblock crossings, but ultimately decided that the included treatments should be sufficient to facilitate pedestrian crossings. The recommended design concepts should sufficiently slow traffic speed and encourage drivers to yield to pedestrians at crossings as they are legally required to do. Additionally, VHB conducted a gap analysis that indicates that pedestrians will not need to wait longer than 50 seconds in any of the three concepts (assuming zero driver compliance to yielding right of way to pedestrians). **Table 5** shows the results of the gap analysis, which is based on a Poisson Distribution of vehicle arrivals. Concept 2, which includes a two-lane pedestrian crossing of eastbound Semmes Avenue, is projected to have the longest pedestrian wait times of the three concepts by a significant margin. Concepts 1 and 3 have comparable pedestrian wait times to fully cross Semmes Avenue.

Table 5 Midblock Crossing Gap Analysis

Concept	Vehicle Volume	Crossing Distance (ft)	Vehicle Arrival (veh/sec)	Crossing Time (sec) ¹	P (0, CT) ²	Wait Time to Cross (sec)
Southern Half of Semmes Avenue Midblock Crossing – AM Peak Hour						
Concept 1 (Roundabout)	984	13	0.273	5.71	20.97%	13.78
Concept 2 (Signal)	984	26	0.273	9.43	7.60%	44.29
Concept 3 (Traffic Calming)	119	13	0.033	5.74	82.79%	6.29
Northern Half of Semmes Avenue Midblock Crossing – AM Peak Hour						
Concept 1 (Roundabout)	102	13	0.028	5.71	85.05%	6.20
Concept 2 (Signal)	102	13	0.028	5.71	85.05%	6.20
Concept 3 (Traffic Calming)	864	13	0.240	5.71	25.37%	12.25
Southern Half of Semmes Avenue Midblock Crossing – PM Peak Hour						
Concept 1 (Roundabout)	966	13	0.268	5.71	21.58%	13.54
Concept 2 (Signal)	966	26	0.268	9.43	7.97%	43.06
Concept 3 (Traffic Calming)	177	13	0.049	5.74	75.51%	6.60
Northern Half of Semmes Avenue Midblock Crossing – PM Peak Hour						
Concept 1 (Roundabout)	117	13	0.033	5.71	83.05%	6.28
Concept 2 (Signal)	117	13	0.033	5.71	83.05%	6.28
Concept 3 (Traffic Calming)	789	13	0.219	5.71	28.58%	11.40

1 Time to cross at walking speed of 3.5 feet per second plus a 2-second buffer.

2 Probability of zero vehicles arriving within requisite crossing time window. Based on Poisson Distribution.

Planning-Level Cost Estimates

VHB developed planning-level cost estimates (2023 dollars) for each of the three recommended concepts (**Table 6**). The roundabout and two-way conversion concept is the most expensive, at \$5.4 million, followed by the traffic signal and two-way conversion concept, at \$3.1 million, with the traffic calming concept the cheapest at \$1.6 million.

Table 6 Planning-Level Cost Estimates (2023 Dollars)

Concept	Base Construction	PE, Survey, Utilities, CEI, Contingency	Estimate Total (Unrounded)	Estimate Total (Rounded)
Concept 1 (Roundabout)	\$2,608,705	\$2,750,023	\$5,358,728	\$5,400,000
Concept 2 (Signal)	\$1,553,260	\$1,546,047	\$3,099,307	\$3,100,000
Concept 3 (Traffic Calming)	\$756,185	\$776,203	\$1,532,388	\$1,600,000

Source: Derived via a combination of bid items, quantity takeoffs from conceptual CAD drawings, and appropriate contingencies that represent the planning-level that this study is operating at. Right-of-way is presumed to not be needed on any concept.

Short-Term Implementation Concept

Following the development of the three alternative concepts, the City asked VHB to develop a short-term concept that could be largely implemented with signing and marking, a concept that could potentially be implemented as an interim measure prior to securing funding for one of the alternative concepts. This short-term concept can be seen in **Figure 13**. The following are some of the notable features of this alternative:

- Pavement striping to reallocate pavement space and better manage vehicular speeds on Semmes Avenue approach to channelized turn onto Manchester Bridge on-ramp.
- Raised crosswalk for midblock crossing of Semmes Avenue.

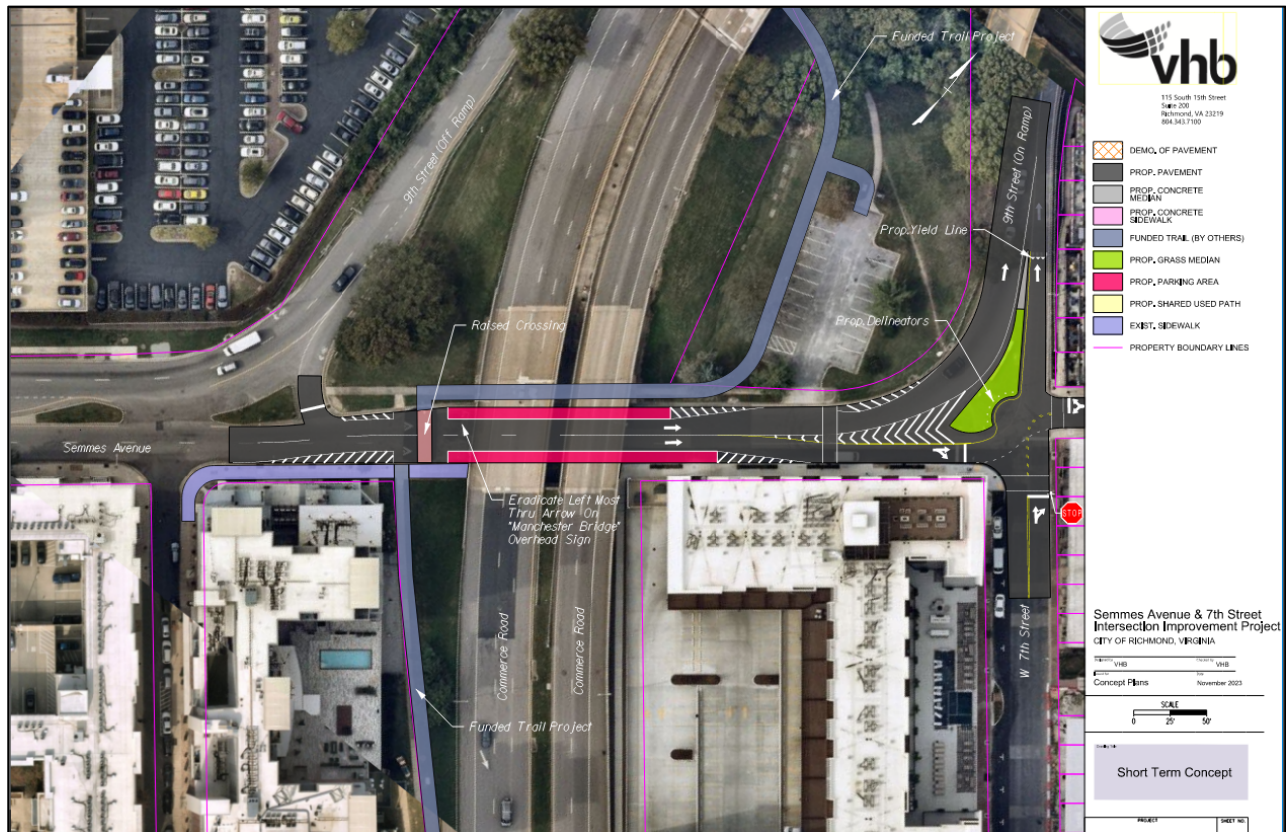


Figure 13: Short-Term Concept – Speed Management and Pavement Delineation

Public Input

The City of Richmond conducted an online public engagement process to solicit feedback on the study intersection and proposed alternative concept improvements. A total of 168 individuals participated in the survey. **Table 7** documents the respondents' comparative ratings of existing conditions, the short-term concept, and the three alternative concepts, while **Table 8** documents the respondents' ratings of two specific concept elements.

Table 7 Public Engagement Response to Concepts

Survey Response	Existing Conditions	Short-Term, Signing and Marking	Concept 1, Two-Way, Roundabout	Concept 2, Two-Way, Traffic Signal	Concept 3, One-Way, Calming
Strongly Approve	8%	10%	23%	17%	20%
Approve	6%	40%	29%	33%	29%
Neutral	10%	21%	12%	15%	14%
Disapprove	34%	17%	18%	21%	21%
Strongly Disapprove	40%	8%	18%	12%	14%
No Response	2%	3%	1%	2%	4%

Table 8 Public Engagement Response to Specific Concept Elements

Survey Response	Semmes Avenue Two-Way conversion	Parking Lot Removal and Provision of Parking on Riverview Parkway
Strongly Approve	23%	16%
Approve	29%	18%
Neutral	21%	28%
Disapprove	8%	21%
Strongly Disapprove	13%	14%
No Response	7%	3%

The results indicate that the public holds a significant disapproval of existing conditions, that they support a short-term signing and marking interim improvement solution, and that there is general support for a long-term improvement concept. While the responses to the individual support questions for Concepts 1-3 do not indicate a strong difference in public opinion among the three, the responses to the follow-up concept element questions provide an indication of a preferred concept. The survey respondents significantly favor the two-way conversion of Semmes Avenue, which would preclude one-way Concept 3, and are neutral about the removal of the parking lot, which is a requisite component of Concept 1.

The following pages summarize the top three comment themes in each survey question.

Comments on Existing Conditions

1. Pedestrian and cyclist safety: Many respondents are concerned about the lack of safe crossing opportunities, the speed of vehicles, inadequate lighting, and lack of safe pedestrian and cyclist infrastructure. The community requests improvements in these areas to improve their safety.

2. **Speed of Vehicles:** Respondents highlighted that drivers often speed in this area, in particular exceeding the speed limit at the intersections and bridge ramps. They suggested that this not only poses a threat to pedestrians and cyclists but also to other motorists. Respondents suggested traffic calming measures, such as additional speed humps or lowering speed limits.
3. **Infrastructure and design improvements:** The community members expressed dissatisfaction with the current infrastructure and street design, feeling that it is not conducive to the increased residential and mixed-use nature of the area. They want clearly marked crosswalks, improved lighting, dedicated bike lanes, and better road signs. Some suggested consideration of a roundabout or traffic signal for better traffic management and pedestrian safety.

Comments on Short-Term Conditions

1. **Pedestrian and cyclist safety:** Respondents were concerned that this concept does not do enough to improve pedestrian and cyclist safety. They suggested that an additional pedestrian crossing be included closer to the parking lot.
2. **Parking concerns:** Several people expressed doubts about the proposed on-street parking areas on Semmes Avenue. Concerns included vehicles speeding past parked cars and potential hazards for individuals exiting their vehicles. Furthermore, some participants questioned the need for additional parking, suggesting that existing parking supply is usually sufficient.
3. **Traffic flow and speed regulation:** The need for traffic calming measures was a common theme among the comments. Participants suggested various modifications, such as moving stop signs, adding more signs, or potentially adjusting the raised crosswalk's location. The underlying concern is the high speeds at which cars travel in this area and whether the short-term plan adequately mitigates this issue.

Comments on Concept 1 (Two-Way, Roundabout)

1. **Traffic Management:** Opinions are divided about the inclusion of a roundabout, with some believing it will slow down traffic and improve traffic flow, while others fear it is unnecessary and could result in driver confusion. Several respondents indicated concern regarding the small size of the roundabout, which could be difficult for larger vehicles like trucks to navigate. Some respondents felt the two-way conversion of Semmes Avenue would be a positive, while others felt it would be confusing.
2. **Pedestrian and Cyclist Safety:** Some participants appreciate the pedestrian-focused infrastructure, including raised and well-marked crossings that are perceived to enhance accessibility and safety. Others noted a lack of adequate cyclist infrastructure and suggested the incorporation of bike lanes into the design.
3. **Parking and Green Space:** The loss of the current parking lot is a major concern for several respondents, with concerns about how it affects access to local trails and parks. Some also commented on the increased green space, with views varying between appreciation for more greenery and concern over responsibility for its maintenance.

Comments on Concept 2 (Two-Way, Traffic Signal)

1. **Traffic Management:** Many individuals in the comments find the idea of a traffic signal unnecessary due to the current lack of heavy traffic volume in the area. Others believe the new traffic signal might even induce congestion during peak hours.
2. **Pedestrian and Cyclist Safety:** Some respondents expressed the need for clearly designated bike lanes due to the high cyclist usage. Others appreciated the pedestrian-infrastructure included in this concept, pointing out the need for raised crosswalks and suggesting that speed bumps would promote pedestrian safety.
3. **Parking:** The inclusion of the existing parking lot in this concept generated positive reactions as it facilitates accessibility to local trails and parks. Some respondents were concerned about the impact of three travel lanes on parking, as well as the potential increase in hazardous conditions for those unloading or loading cars.

Comments on Concept 3 (One-Way, Speed Management)

1. **Traffic Management:** Participants had a mixed opinion regarding the proposed raised pedestrian crossing, with some concerned that it could create hazards due to potential for drivers not to appropriately yield to pedestrians. There were also concerns expressed about the one-way traffic prohibiting left turns from certain intersections.
2. **Pedestrian and Cyclist Safety:** The lack of specific cyclist infrastructure is a recurrent concern. Commenters were pleased with the inclusion of traffic calming measures and pedestrian infrastructure to enhance safety.
3. **Cost-Efficiency and Parking:** Many participants favored this concept due to its cost-effectiveness and minimal impact on current parking supply.

Conclusion

All three alternative concepts developed within this study will help manage traffic speeds on Semmes Avenue and enhance pedestrian accessibility. Based on a review of existing conditions, anticipated performance, projected cost, and public feedback, Concept 2 – two-way Semmes Avenue with a traffic signal at W 7th Street – appears to be the preferred alternative. It is more cost effective than the roundabout (Concept 1), while also being the only concept to meet all the objectives of maintaining the existing parking lot, addressing the off-ramp intersection, and restoring two-way traffic to the street grid.