Broadview Access Management Study

2012 Update

Publication Date: February 2013

HNTB

VDOT

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BROADVIEW AVENUE ACCESS MANAGEMENT STUDY - 2012 UPDATE

1. Background

This study is a follow-up to the 2008 Warrenton Broadview Access Management Study that identified and evaluated multiple improvement alternatives for the Route 211 Broadview Avenue corridor located in the Town of Warrenton, Virginia. In the previous study, a modified version of what is referred to as Alternative 4 was selected for implementation. However, due to lack of public support, the study recommendations were not implemented.

Several changes have happened in the area since 2008. Due to the changes in economic conditions, a few of the businesses located on Broadview Avenue closed. Clevenger's Village a major mixed-use development proposed in neighboring Culpeper County, did not materialize. Fauquier County did not endorse the proposed US 211- US 17 connector (Timber Fence Parkway) which would have functioned as a bypass for Broadview Avenue. The traffic operations on Broadview Avenue have continued to deteriorate.

In 2011, due to the number of crashes and complaints on Broadview Avenue, the Transportation Safety Commission of the Town of Warrenton decided to revisit the study and develop an action plan for implementing needed improvements. The Commission established the following goals for improvements to Broadview Avenue:

- Improve safety
- Maintain access to businesses
- Reduce traffic congestion
- Improve aesthetics of the corridor

The Virginia Department of Transportation (VDOT), in association with the Town of Warrenton, decided to re-engage HNTB to update the previous study. The emphasis of this study is to re-examine the previous study recommendations in the current context (2012 traffic conditions) and to assess other options to improve safety, maintain access to businesses, improve traffic operations, and improve aesthetics along the Broadview Avenue corridor.

2. Study Process

The general process of the 2012 study update was as follows:

- Evaluate the previously recommended alternative (Modified Alt 4) in the refined context of current (2012) year traffic levels.
- Validate the effectiveness of the Modified Alternative 4 access management improvements.
- Assess the benefits to traffic operations on Broadview Avenue that an extension of Timber Fence Parkway (a parallel roadway) to Route 211 would provide.

- Engage with the stakeholders, business owners, and town representatives to identify needed improvements and priorities.
- Develop a plan of improvements for Broadview Avenue.
- Develop rough order of magnitude cost estimates.

Photo 1 – Northern Extent of the Study Area during PM Peak Conditions.
Source: HNTB Corporation

3. Study Area

Figure 1 shows the study area for the Broadview Avenue Access Management Study. The study area includes the section of US 211 from West Lee Highway east of US 17 to Frost Avenue west of Van Roijen Street. Between West Lee Highway and Frost Avenue, US 211 is named Broadview Avenue. The study area also includes the section of US 17 (also called Broadview Avenue) from US 211 to north of Warrenton Center and the existing section of Timber Fence Parkway down to Route 211.

3.1. Existing Configuration

Broadview Avenue has a six-lane cross section, with two through lanes and one continuous left-turn lane in each direction. The corridor is lined with commercial development and numerous driveways. There are 72 driveways on Broadview between Frost Avenue and Winchester Street. Broadview Avenue is functionally classified as an "Urban Other Principal Arterial" (GS-5) with an average daily traffic (ADT) volume of 35,000 vehicles.[1]

Photo 2 – Taken from the intersection of Broadview Avenue/Frost Avenue/Waterloo looking north.
Source: HNTB Corporation

[1] 2010 VDOT Daily Traffic Volume Estimates –Special Locality Report for Town of Warrenton

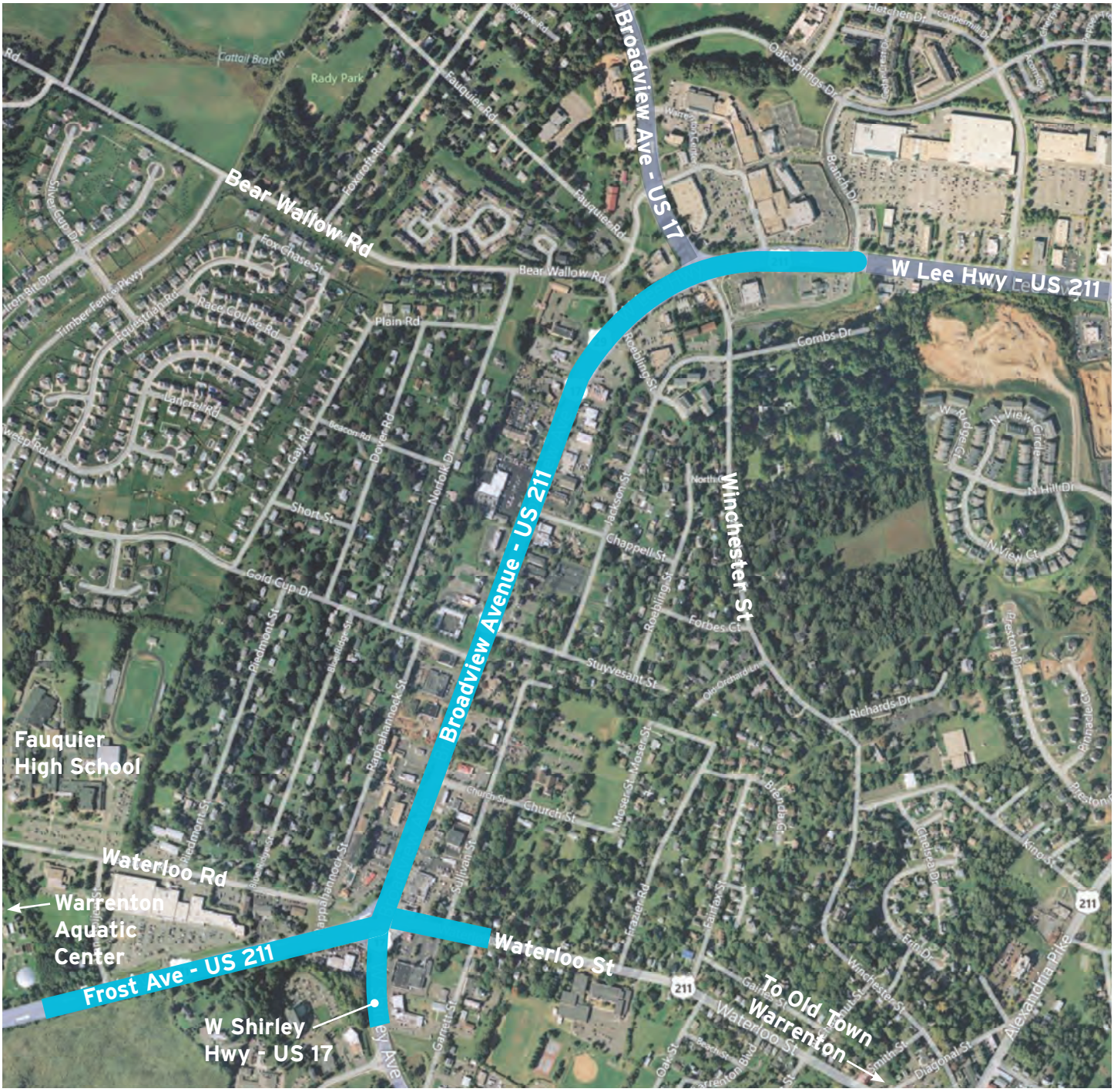

Figure 1
Broadview Access Management Study Area
Warrenton, VA

Study Area

HNTB

There are 11 existing intersections in the study area that are being examined. Intersections 1 through 11 are labeled below and shown in **Figure 2**.

1. Broadview Avenue, Warrenton Center and Old Broadview Avenue
2. Bear Wallow Road, Old Broadview Avenue
3. Broadview Avenue, W Lee Highway, and Winchester Street
4. Broadview Avenue, W Lee Highway, Old Broadview Avenue, and Roebling Street
5. Broadview Avenue and Chappell Street
6. Broadview Avenue and Stuyvesant Street
7. Broadview Avenue and Gold Cup Drive
8. Broadview Avenue and Church Street
9. Broadview Avenue, Frost Avenue, W Shirley Highway, and Waterloo Street
10. Frost Avenue and Van Roijen Street
11. Waterloo Road and Van Roijen Street

Three of these intersections are currently signalized:

- Broadview Avenue, W Lee Highway, and Winchester Street (3)
- Broadview Avenue, Frost Avenue, W Shirley Highway, and Waterloo Street (9)
- Frost Avenue and Van Roijen Street (10)

Photo 3 – Intersection of Broadview and Frost Avenue. Taken looking west from the existing sidewalk landing/crosswalk during PM Peak Conditions.
Source: HNTB Corporation

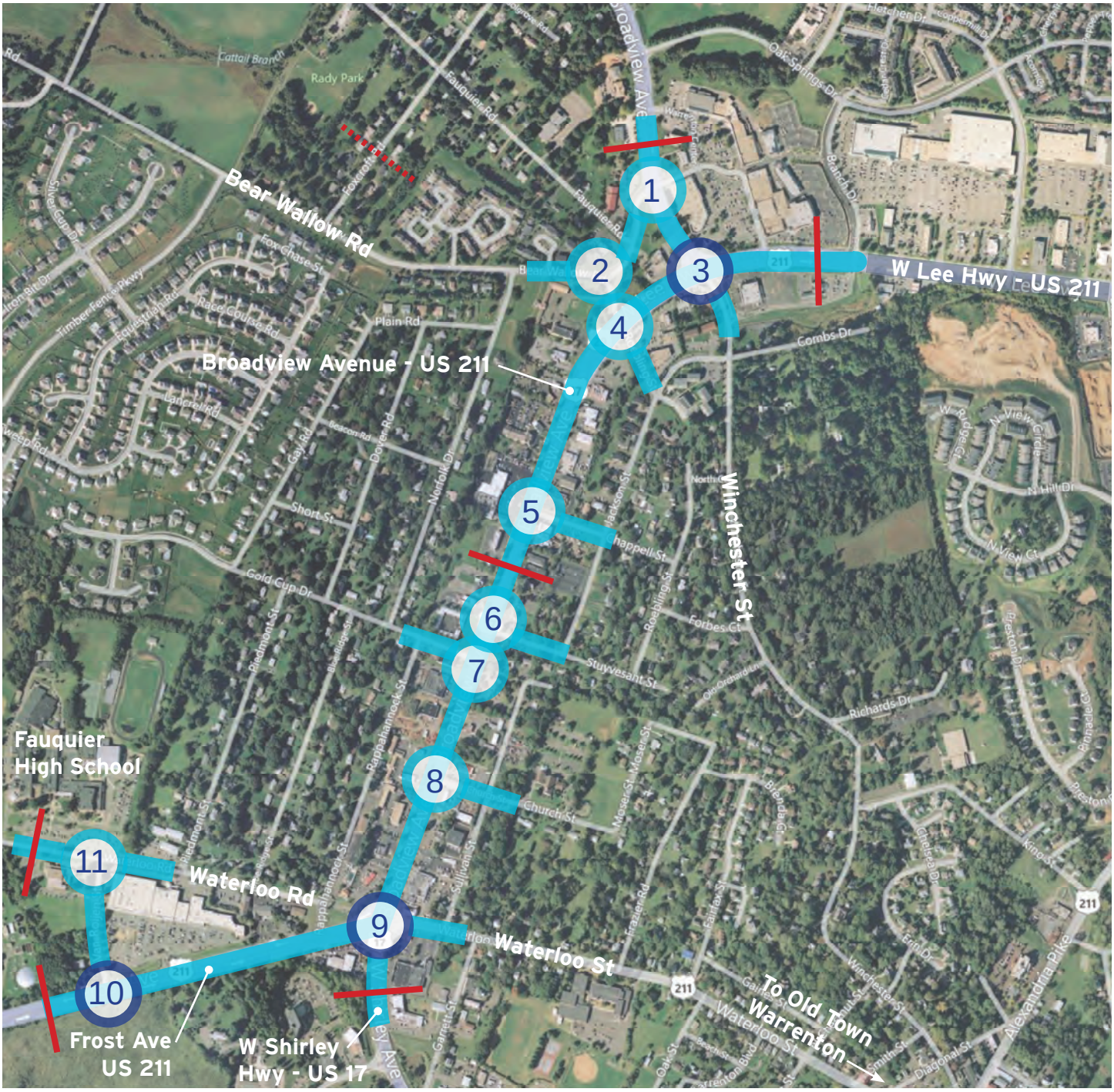

Figure 2

Data Collection Locations

Signalized Intersection and Turning Movement Count Locations
(PM Peak Period Only, 4PM to 7PM)

Un-signalized Intersection and Turning Movement Count Locations
(PM Peak Period Only, 4PM to 7PM)

Tube Count Locations
(7-Day, 24-Hour Counts in 15 Minute Intervals)

Supplemental Tube Count Location (Source: the Town of Warrenton)
(7-Day, 24-Hour Counts in 60 Minute Intervals)

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4. 2012 Baseline Conditions

4.1. Traffic Volumes

Traffic counts previously collected in 2006 (as part of the 2008 Study) were updated as part of this study. **Figure 2** on the previous page shows the data collection locations and study area. The following data were collected during February 2012:

- 24-hour, 7-day tube counts at six locations.
- PM peak period turning movement counts at 11 locations (4PM to 7PM).
- Supplemental 24-Hour, 7-Day tube counts were also collected by the Town of Warrenton at Foxcroft Road.

The traffic counts were adjusted and balanced to represent typical weekday peak hour conditions and were utilized as inputs into the VISSIM micro-simulation model. The count data were adjusted and balanced using the methodology and procedures described in NCHRP 255 - Highway Traffic Data for Urbanized Area Project Planning and Design. Estimates of traffic volumes in individual driveways are based on the ITE trip generation manual.

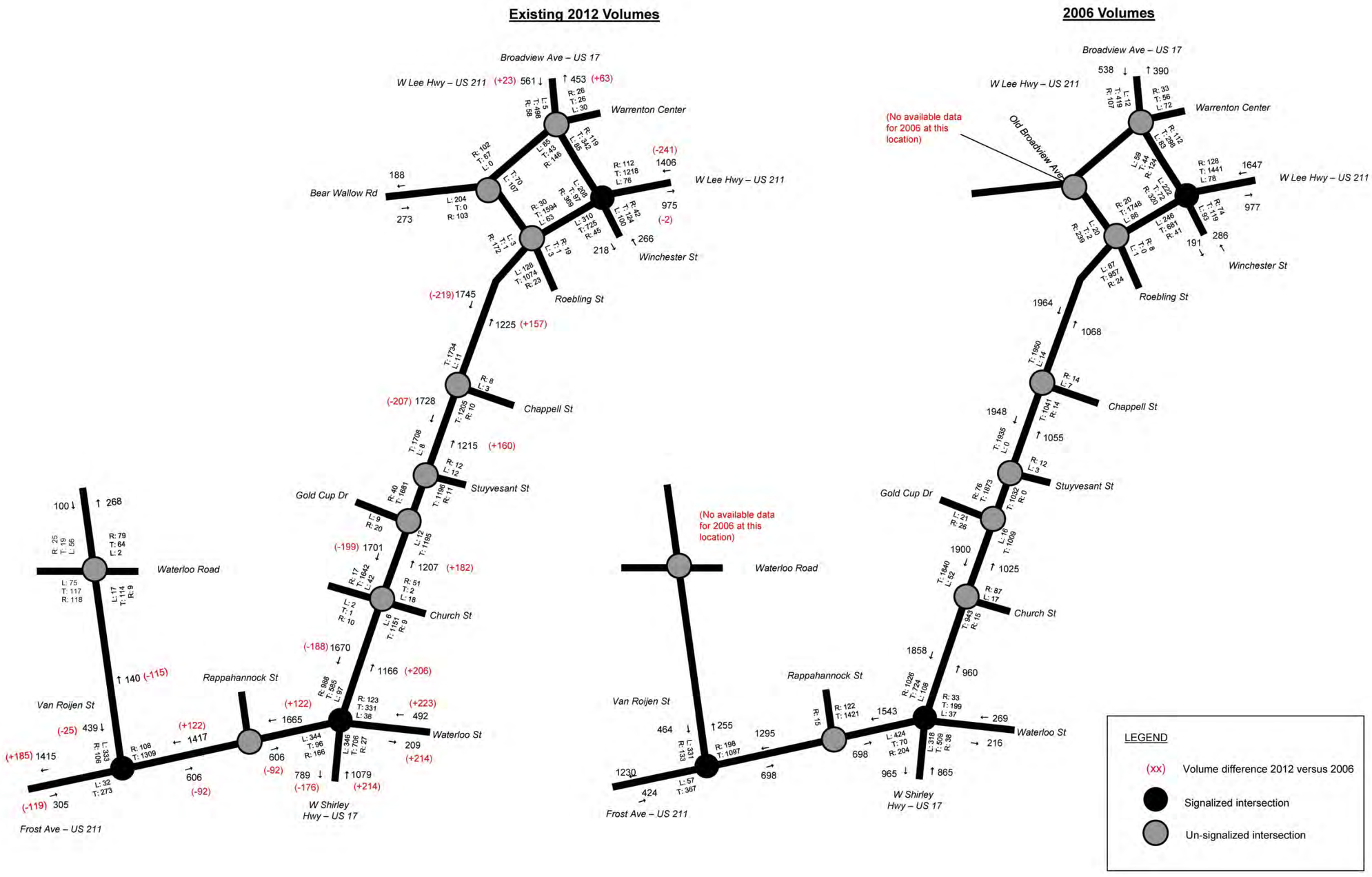
Figure 3 shows the balanced traffic volumes for 2012 and 2006. The primary differences in data are documented in red text.

An initial evaluation was conducted by comparing the 2012 PM Peak traffic levels to the 2006 PM Peak traffic levels. The observations can be summarized as follows:

- Peak spreading was observed due to the increase in travel demand. The 2006 peak traffic levels were observed for approximately one hour from 5:15 pm to 6:15 pm, whereas in 2012 the peak levels were observed for a longer period of time from 4:00 pm to 6:00 pm.
- On Broadview Avenue SB, the PM peak hour volumes were about 200 vehicles (approximately 10 percent) **lower** in 2012 than reported in 2006. This can be attributed to peak spreading and metering of traffic due to increased traffic and the proliferation of new traffic signals upstream on Route 29 (Lee Highway) towards I-66.

On Broadview Avenue NB, the PM peak hour volumes were about 150 vehicles (approximately 10 percent) **higher** in 2012 than reported in 2006.

Figure 3: PM Peak Hour Volume Comparison (2012 vs. 2006)



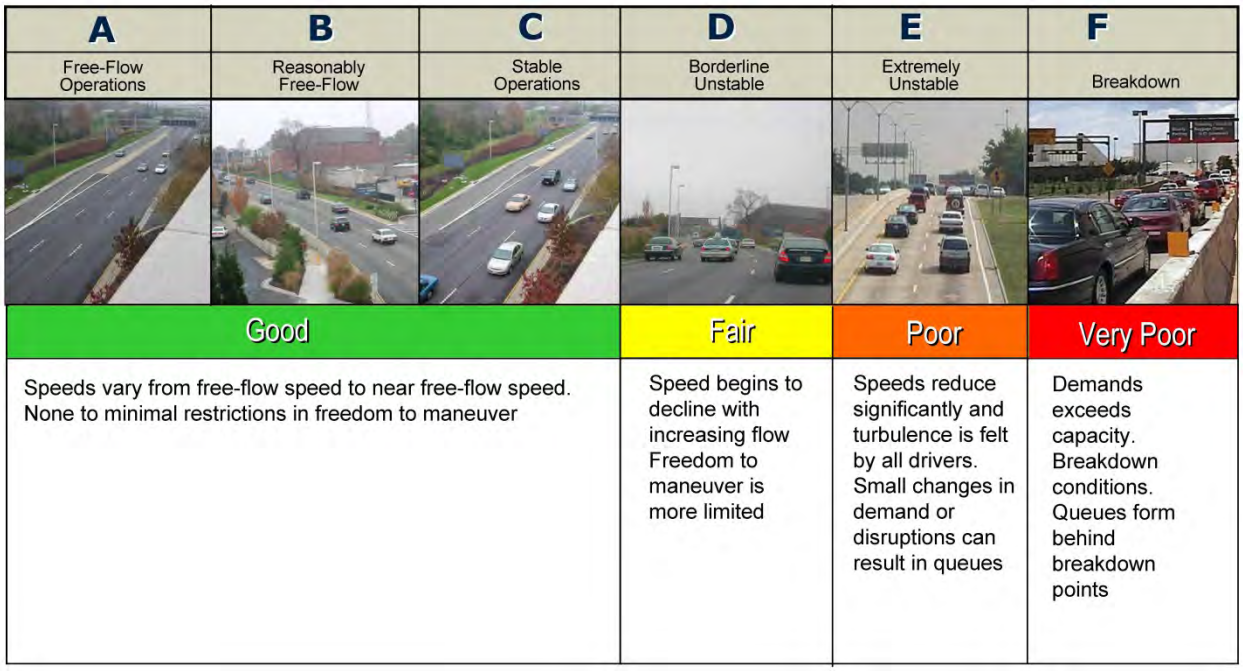
4.2. Traffic Operational Analysis

To evaluate the baseline traffic operations, the VISSIM micro-simulation model developed in the previous study for this corridor was used. The model was updated to incorporate the current geometry, traffic volumes and signal timing information.

A key metric used in the coming section is Level of Service (LOS). LOS is an estimate of the performance efficiency and quality of an intersection or roadway as established by the *Highway Capacity Manual* (2010) methodology. The HCM methodology measures the degree of delay at intersections using the letter rating "A" for the least amount of congestion and letter rating "F" for the most amount of congestion. An LOS of "D" or better is typically considered to be acceptable for an urban setting during peak hours. If the LOS falls below the allowable threshold, improvements are required to improve the capacity of the intersection or roadway section in question.

Figure 4 below depicts the range of LOS ratings, the state of conditions at each, a photo representing what each "looks like", and the associated characteristics of each rating.

Figure 4: LOS Rating Summary



The existing 2012 LOS and delay per vehicle were calculated for study area intersections using VISSIM. The results are shown in **Table 1** along with the LOS and delay per vehicle calculated from the 2006 study.

Table 1: PM Peak Hour Intersection Level of Service (2012 and 2006)

Intersection	2012	2012	2006	2006
	Intersection LOS	Intersection Delay (sec)	Intersection LOS	Intersection Delay (sec)
Broadview/Lee/Winchester	C	34.8	D	40.1
Broadview/Frost/Shirley/Waterloo	C	29.3	E	67.8
Frost/Van Roijen	B	14.4	B	14.8

The analysis shows that the intersections in the study corridor are currently operating at LOS C or better during the PM peak hour. Comparing the 2012 results with 2006 results shows reductions in average delay and improvements to LOS at all signalized intersections.

- At the intersection of Broadview/Lee/Winchester Avenue, the provision of an additional turn bay and associated signal timing improvements has improved the LOS from LOS D to LOS C.
- At the intersection of Broadview/Frost/Shirley/Waterloo Street, the signal operation has been improved from a fixed cycle operation to a free flow operation. This has vastly improved the LOS from LOS E to LOS C.
- At the intersection of Frost/Van Roijen Street, the improvement to delay and LOS are minimal.

Travel times along the corridor were also calculated using VISSIM for both directions of Broadview Avenue between Winchester Street and Frost Avenue. **Table 2** shows the results of travel times.

Table 2: PM Peak Hour Travel Times (2012 and 2006)

Travel Time (in minutes)	2012	2006
Southbound from Winchester St to Frost Avenue	2.4	2.3
Northbound from Frost Avenue to Winchester St	2.0	2.1

During the PM peak hour, the travel time in the southbound (peak) direction is 2.4 minutes, while the travel time for the northbound (off-peak) direction is just slightly shorter at 2.0 minutes. Comparison with 2006 travel times shows a minor increase in southbound and a minor decrease in northbound due to the changes in traffic volumes discussed earlier.

4.3. Field observations

The 2012 PM VISSIM micro-simulation model was run to observe queues, delays and congested locations to evaluate traffic operations on the corridor. To validate the model observations, a field visit was conducted on February 22, 2012 to observe traffic and travel conditions during the PM peak hour. The following observations were made:

- The traffic yield control at the right turn lane from southbound Broadview Avenue to westbound US 211 Frost Avenue created congestion and queues on Broadview Avenue (see Photo 4 below).
- Several conflicting movements were observed between through traffic and turning traffic to and from driveways. Most often, the turning traffic had to wait for longer periods of time to find a gap in the through traffic stream.
- On southbound Broadview Avenue, the outer lane (right lane) is disproportionately more heavily utilized compared to the inner lane. This is due to the vehicles accessing the adjacent businesses through driveways located on the right as well as the heavy right turning volume positioning on the right lane from southbound Broadview Avenue to westbound US 211 Frost Avenue.
- On the northern end of the study area at the Winchester Street/Lee Highway/Broadview Avenue intersection, the queues on the westbound approach backs up as far as the adjacent intersection on Broadview Avenue.

Photo 4 –Traffic approaching the intersection of Broadview Avenue and Waterloo Street during PM Peak Conditions. Source: HNTB Corporation

5. Evaluation of Alternatives

5.1. Previously Recommended Alternative (Modified Alt 4)

The improvements proposed in the Modified Alt 4 were evaluated using the 2012 PM peak hour volumes to assess traffic operations. Previously developed VISSIM models were modified to include the following infrastructure improvements:

- Four lane cross-section with a central raised median.
- Median openings and left turn lanes at Church Street, Gold Cup Drive, Stuyvesant Street, Chappell Street, and Roebling Street.
- Driveway consolidation and inter-parcel connections for elimination of redundant access points.
- Dedicated right turn lane from southbound Broadview Avenue to westbound Frost Avenue.
- Dual left-turn lanes from Shirley Highway to Frost Avenue.

As elaborated in the previous report, traffic volumes were reassigned at locations where driveways are consolidated. Vehicles making left turns were re-routed to make U-turns at the upstream intersection or median break.

It should be noted that the recommendation to provide dual left-turn lanes from West Lee Highway to Broadview Avenue is already in place as part of existing conditions.

Table 3 shows the comparison of intersection LOS results from the VISSIM model runs. **Table 4** shows the comparison of travel times from the VISSIM model runs for both directions of Broadview Avenue between Winchester Street and Frost Avenue.

Table 3: 2012 PM Peak Hour Intersection LOS (Modified Alt 4 vs. Existing)

Intersection	Modified. Alt. 4	Modified. Alt. 4	Existing	Existing
	Intersection LOS	Intersection Delay (s)	Intersection LOS	Intersection Delay (s)
Broadview/Lee/Winchester	C	33.7	C	34.8
Broadview/Frost/Shirley/Waterloo	C	26.9	C	29.3
Frost/Van Roijen	B	14.1	B	14.4

Table 4: 2012 PM Peak Hour Travel Times (Modified Alt 4 vs. Existing)

Travel Time (in minutes)	Modified. Alt. 4	Existing
Southbound from Winchester Street to Frost Avenue	2.2	2.4
Northbound from Frost Avenue to Winchester Street	2.7	2.0

With the analysis results noted in the previous section as well as the observations of the model runs, the following conclusions can be made.

- Improvements to Broadview Avenue/Frost Avenue intersection reduce queues and delays, specifically the southbound right turn movement from Broadview Avenue to Frost Avenue.
- Modified Alt 4 resulted in slight improvements to traffic operational performance when compared to the existing 2012 PM peak hour traffic conditions.

It is evident that the improvements do not produce significant operational benefits for the current year traffic conditions. However, the previous study included analysis of forecast 2020 conditions where Modified Alt 4 demonstrated significant traffic operational benefits compared to the no-build scenario.

5.2. Extensions to Timber Fence Parkway

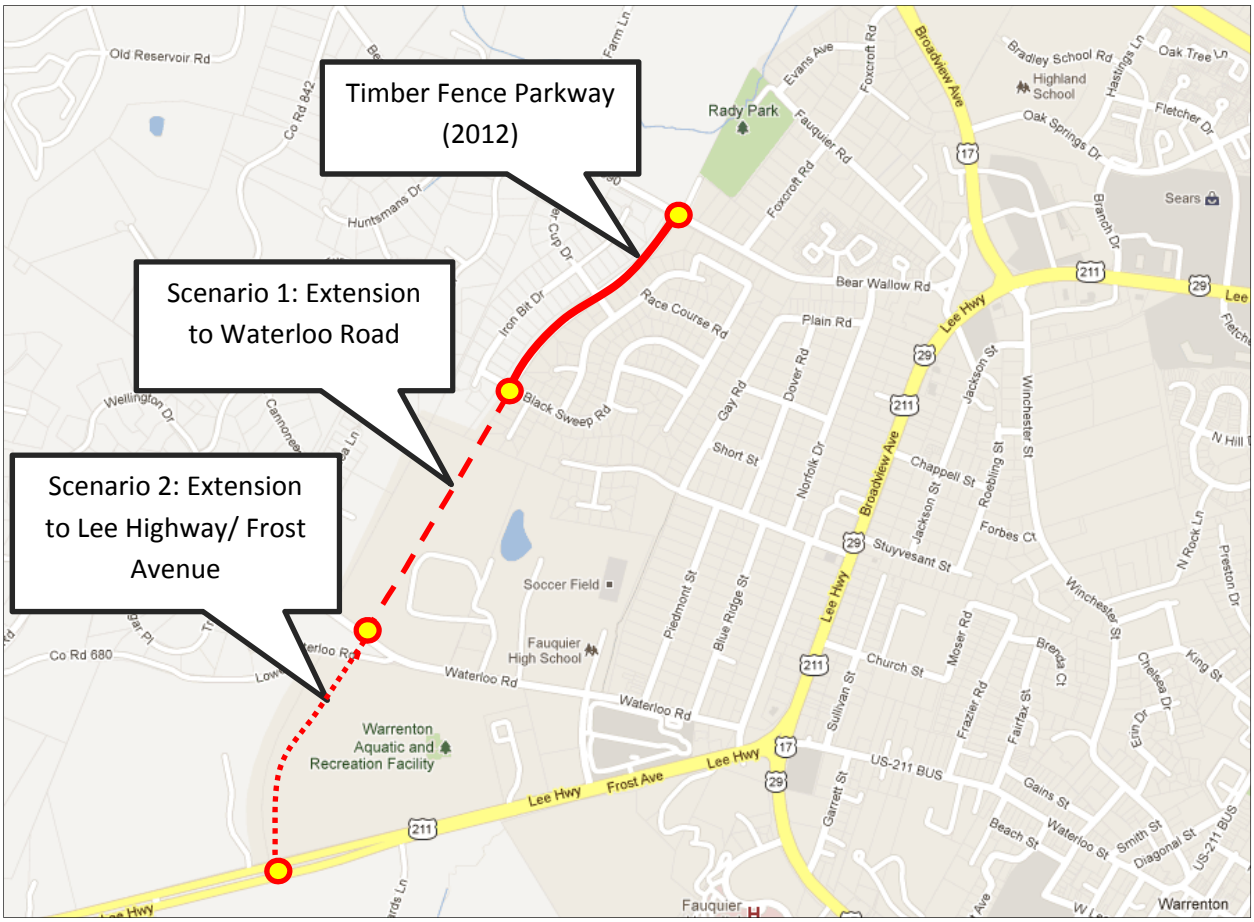
Timber Fence Parkway is currently a two-lane, two-way roadway running parallel to Broadview Avenue along the western edge of Warrenton. Presently, Timber Fence Parkway functions as an access road to the Gold Cup and Silver Cup subdivisions. This section assesses and summarizes the effectiveness of the Timber Fence Parkway extension in terms of anticipated impacts to traffic operations on Broadview Avenue and Bear Wallow Road.

According to the Town of Warrenton Comprehensive Plan, Timber Fence Parkway would eventually connect US 17 and US 211. This would provide an alternative route for through traffic presently using Broadview Avenue. Timber Fence Parkway would provide the required access to subdivisions located west of the town and reduce cut-through traffic in residential neighborhoods. As a first step towards completion of Timber Fence Parkway, the plan recommends extending the southern terminus of Timber Fence Parkway to Waterloo Road. **Figure 5** shows the existing and planned extensions of Timber Fence Parkway.

Two different scenarios of the proposed extension were analyzed:

- **Scenario 1**: Extending the southern terminus of Timber Fence to Waterloo Road.
- **Scenario 2**: Extending the southern terminus of Timber Fence beyond Waterloo Road to US 211 / Frost Avenue.

Figure 5: Timber Fence Parkway



Analysis Assumptions and Methodology

This analysis focusses on southbound traffic, which is the dominant direction of flow during the PM peak hour. To estimate the traffic diversion percentages, it was assumed that 65 percent of traffic on Broadview Avenue during the PM peak hour is "through" traffic. Phase 1 of the study (2006) assumed a lower percentage (54 percent). Based on field observations, the Project Team decided to adopt a higher percentage reflective of the current conditions in the corridor.

The through traffic on Broadview Avenue was further categorized based on the entry and exit points in the study area to assess diversion percentages for the two scenarios described above.

For estimating new volumes:

- If Timber Fence Parkway is extended just to Waterloo Road it was assumed that all traffic on Broadview Avenue traveling to Waterloo Road will divert to Timber Fence Parkway.
- If Timber Fence Parkway is extended beyond Waterloo Road to Lee Highway/ Frost Avenue, the percent traffic that will divert to Timber Fence Parkway was assumed as:

- 25 percent of traffic from Westbound Lee Highway to Lee Highway/ Frost Avenue will divert to Timber Fence Parkway.
- 50 percent of traffic from Southbound Broadview Avenue to Lee Highway / Frost Avenue will divert to Timber Fence Parkway.

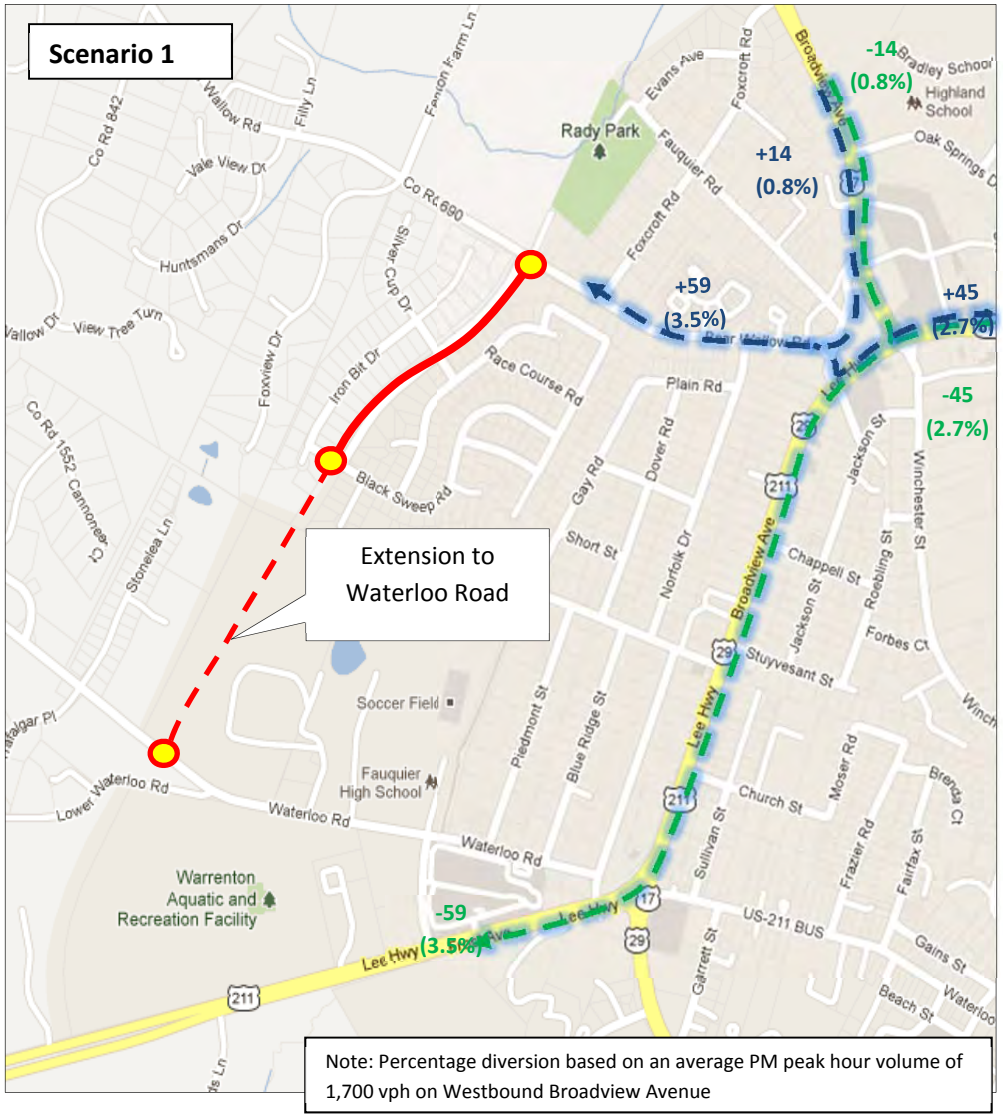
Table 5 and **Figure 6** summarize the volumes that will be diverted due to the proposed extension of Timber Fence Parkway for Scenarios 1 and 2.

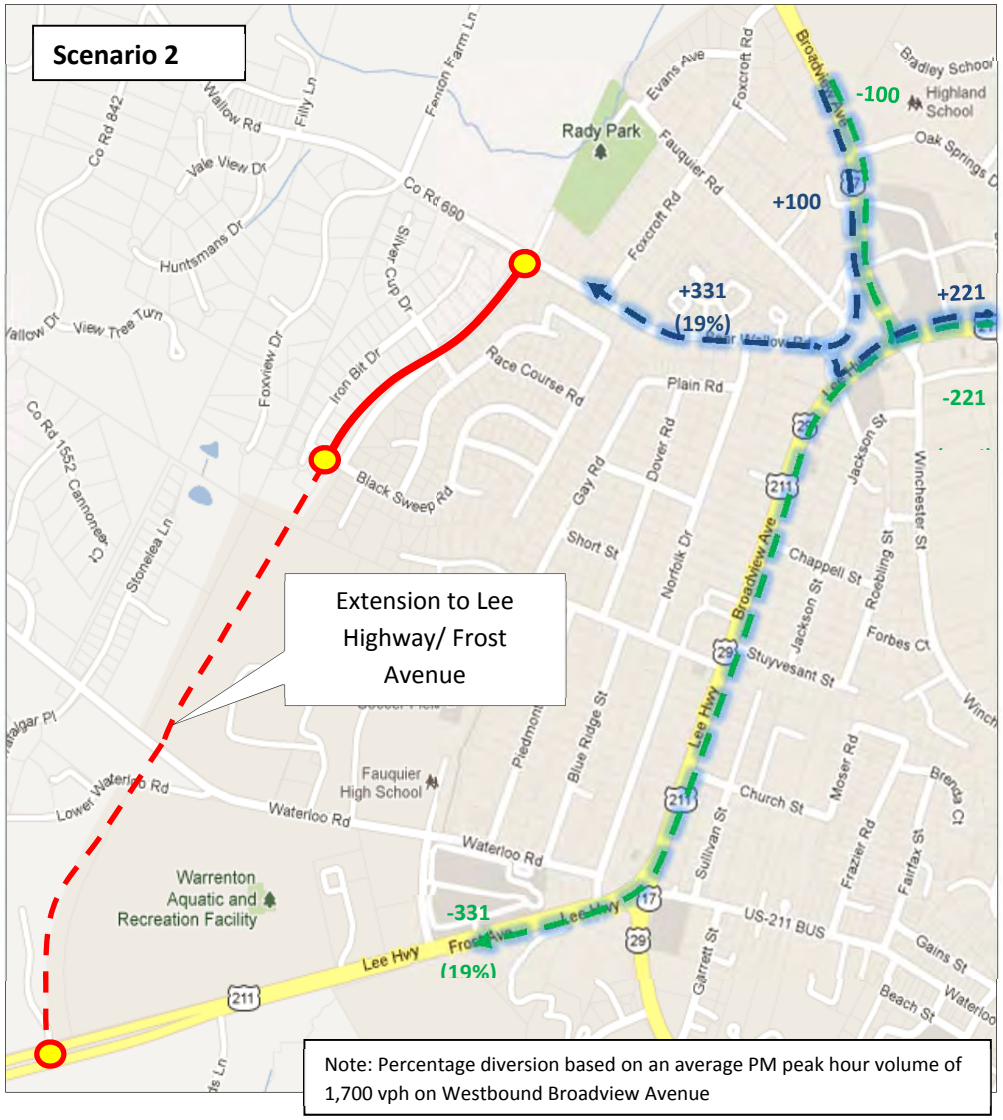
Table 5: Diversion Volumes and Percentages

From	To	PM Peak Hour Volume	Diversion Scenario 1 Volume	Diversion Scenario 1 %	Diversion Scenario 2 Volume	Diversion Scenario 2 %
WB Lee Highway	WB Waterloo Road	45	45	100%	45	100%
	WB Lee Highway/ Frost Avenue	704	0	0%	176	25%
SB Broadview Avenue	WB Waterloo Road	14	14	100%	14	100%
	WB Lee Highway/ Frost Avenue	192	0	0%	96	50%
Others*		745	0	0%	0	0%
TOTAL		**1700**	**59**	**3.5%**	**331**	**19.5%**

Note*: Others includes all through traffic on WB Broadview avenue that will not divert due to the completion of Timber Fence Parkway.

Figure 6: Traffic Diversion Map





Original Route
Revised Route

X (%Y) Traffic Volume Re-routed (Percent Re-routed)

Original Route
Revised Route

X (%Y) Traffic Volume Re-routed (Percent Re-routed)

Analysis Results

To evaluate the traffic operations, VISSIM models created for the 2012 base case scenario were modified to account for traffic diversion from Broadview Avenue to Timber Fence Parkway.

Table 6 shows the comparison of intersection LOS results from the VISSIM model runs for the two scenarios as well as the 2012 base case scenario. **Table 7** shows the comparison of travel times for both directions of Broadview Avenue between Winchester Street and Frost Avenue intersections.

Table 6: 2012 PM Peak Hour Intersection LOS (Timber Fence Extension Scenarios vs. 2012 Existing)

Intersection	2012 Existing		Timber Fence Scenario 1		Timber Fence Scenario 2	
	LOS	Average Delay (Sec)	LOS	Average Delay (Sec)	LOS	Average Delay (Sec)
Broadview/Lee/ Winchester	C	34.8	C	34.2	C	34.5
Broadview/Frost/ Shirley/ Waterloo	C	29.3	C	27.2	C	28.7
Frost/ Van Roijen	B	14.4	B	14.3	B	13.0

Table 7: 2012 PM Peak Hour Travel Times (Timber Fence Extension Scenarios vs. Existing)

Travel Time (in minutes)	Existing	Scenario 1	Scenario 2
Southbound from Winchester St to Frost Avenue	2.4	2.4	2.4
Northbound from Frost Avenue to Winchester St	2.0	2.0	2.0

With the analysis results noted above as well as the observations of the model runs, the following conclusions can be made.

- The two Timber Fence Parkway extension scenarios will not provide significant operational benefits to Broadview Avenue for 2012 PM Peak traffic conditions.
    - PM peak intersection LOS will not improve between existing operational levels and the two scenarios analyzed.
    - PM peak hour intersection delay reduction ranged from 0.1 sec/vehicle to 1.4 sec/vehicle; a minimal improvement.
    - PM peak hour travel times showed no measurable improvement.
- Queues on the southbound right turn at the intersection of Broadview Avenue/ Frost Avenue would be reduced due to the traffic diversion. Currently, the queues were as high as 380 feet from the intersection (extending well north of Burger King). Based on a standard planning factor of 20 feet per vehicle (including fore and aft spacing), a 380 foot long queue equates to an

estimated 19 vehicles in queue. With the diversion, the maximum queues will reduce to 305 feet (approximately 15 vehicle queue) for Scenario 1 and 170 feet (approximately 9 vehicle queue) for Scenario 2.

5.3. Conclusion

It can be concluded from the analyses that none of the alternatives meet the goals and objectives established for the Broadview Avenue corridor improvements. Modified Alt 4 proposes construction of a raised central median with limited openings and driveway consolidation, which will result in loss of direct access to many businesses located along Broadview Avenue. The extensions to Timber Fence Parkway provide minimal near-term benefits and require right-of-way acquisition and support from the County.

It is also clear that traditional performance measures such as travel time, delay and LOS are not adequate for evaluating access management improvements. The study team decided to refine the previously recommended alternative by engaging the stakeholders and business owners located on Broadview Avenue to place greater focus on developing a set of context-sensitive solutions for Broadview Avenue.

6. Refinements to Previously Recommended Alternative (Modified Alt 4)

6.1. Initial Considerations

The study team began with the initial set of improvements from the previously recommended Modified Alt 4, with a focus on refining that alternative to collectively address the goals and objectives of the study – improve safety, maintain access to businesses, reduce congestion, and improve aesthetics along the Broadview Avenue corridor. To address public and stakeholder concerns on the impacts of the previously recommended Modified Alt 4, greater emphasis was placed on stakeholder involvement and context-sensitive planning. This shift in focus was required to balance technically viable improvements with concerns of the public and stakeholders.

6.2. Stakeholder Involvement

Stakeholders identified for the study included the Virginia Department of Transportation (VDOT), Town of Warrenton, local communities, business owners and advocacy groups. Several meetings were conducted to solicit input and feedback from the stakeholders. The meetings consisted of attendees from VDOT, Town of Warrenton staff, Town Council members, community representatives, business owners and advocacy groups.

There were a total of seven meetings held throughout the study process. The meetings happened at key points in the study, with a scope review meeting held in July 2011 and a meeting with the Town Transportation Safety Committee in August 2011. The complete list of meetings is provided below:

1. Project Kick-Off Meeting (March 1, 2012)
2. Tenant Meeting (May 29, 2012)

3. Broadview Avenue Site Walk – East side of Broadview Avenue (June 26, 2012)
4. Broadview Avenue Site Walk – West side of Broadview Avenue (June 27, 2012)
5. Steering Committee Meeting (October 1, 2012) – See Photo 5
6. Town Council Meeting (November 17, 2012)
7. Town Council Plan Approval Meeting (December 11, 2012)

These meetings provided an opportunity for VDOT, the Town of Warrenton, HNTB and stakeholders including citizens and business owners, to discuss the progress of the project. Critical issues discussed included access management to businesses, congestion along Broadview Avenue and safety concerns along the corridor.

Photo 5 –Broadview Avenue Improvements discussion at the Steering Committee Meeting on October 1, 2012.
Source: Fauquier Now (http://www.fauquiernow.com)

6.3. Site Walk

A two-day "site-walk" was planned and conducted to get direct feedback from tenants, business and property owners located along Broadview Avenue. On Tuesday June 26, 2012 and Wednesday June 27, 2012 the study team conducted a walk-through of the Broadview Avenue study area, visiting each business located along the Broadview Avenue and soliciting comments and feedback from business owners/operators on the previously recommended alternative (Modified Alt 4).

A wide range of responses were received, but in general the following were concluded:

- Tenants expressed general concern over the driveway closures and driveway consolidation shown on the 2008 Plan. Many expressed concern that changing access to their business or property would have detrimental effects to the welfare of their business.
- Many tenants highlighted issues on Broadview Avenue, particularly excessive speed, and the illegal use of central turn lanes as a way to bypass traffic queues. This creates a potential for conflicts with the turning vehicles.
- Tenants expressed general concern over the addition of a median and loss of direct access to their businesses and properties.
- Tenants expressed general concern over safety of the corridor and that something needs to be done to facilitate improvements on Broadview Avenue.

Photo 6 –Site walk participants getting feedback from business and property owners on Broadview Avenue.
Source: HNTB Corporation

6.4. Plan Refinements

Following the site walk, a preliminary improvement plan was developed. The project team coordinated with VDOT and the Town of Warrenton to incorporate the ideas and concerns expressed by tenants, business and property owners into the plan. Following the development of the initial plan, an iterative process refined the plan to incorporate the following main elements:

- Provision of a dual two-lane cross-section to ensure adequate capacity for traffic flow on Broadview Avenue.

- Elimination of the continuous adjacent left-turn lanes to reduce the potential for conflicts and eliminate the illegal usage of these lanes as through lanes.
- Addition of edge striping from the curbs (6 foot width) as a traffic calming measure that will also improve lines of sight, and provide informal accommodation of bicycles. The addition of a dedicated and marked bicycle lane on Broadview was discouraged due to the nature of the corridor. It should be noted that adequate width is available to accommodate true bike lanes and associated markings.
- Provision of partial medians with left-turn bays to ensure adequate access to businesses and properties located on Broadview Avenue.
- Improvement of pedestrian accommodations on Broadview Avenue. Particularly, additional crosswalks, pedestrian refuges on medians, and upgrades to crosswalks to enable pedestrians to safely cross Broadview Avenue.
- Modifications to intersection geometry at Broadview Avenue and Frost Avenue intersection to improve traffic operations and reduce queues that may block driveways located close to the intersections.
- Employing “entrance only” and “exit only” signage at businesses with multiple driveways to reduce conflict points instead of closing driveways.
- Installation of “No Left Turn” signs on driveways to reduce traffic conflicts.
- Driveway consolidation and closure where practical and acceptable to the owner.

Some of these features were already incorporated in the previously recommended alternative (Modified Alt 4). However, as noted in the previous study, there was considerable public opposition to the number of driveway closures recommended in Modified Alt 4. Therefore, driveway closures were removed from consideration and only those closures that are acceptable to the property owner were included.

6.5. Other Considerations

During the plan refinement process a number of concerns and considerations were raised by Town Staff and Broadview business and property owners. These are discussed and clarified below.

U-Turn Capacity

The construction of a partial median on Broadview Avenue resulted in vehicles having to perform “U-Turns” at the median openings. The stakeholders expressed concern over the volume of traffic that will need to perform U-turns, whether adequate storage bays are available for these vehicles, and whether the geometry allowed these vehicles, especially trucks, to perform a safe U-turn maneuver.

To address this issue, the study team estimated the peak hour demand for U-turns from the 2012 PM peak hour volumes and performed a Highway Capacity Manual (HCM) analysis to determine if these U-turns can be adequately accommodated on the corridor.

The analysis results show that there will be enough capacity in the short term for drivers to make the U-Turns, particularly for northbound vehicles wishing to turn around during peak hour conditions.

Southbound vehicles (the primary flow during the PM Peak) will have plenty of capacity to make U-turns based on the data available and assumptions made. Specifics of the calculations are as follows:

- Broadview Avenue can accommodate 500 U-Turn movements (going northbound from southbound) during the PM peak hour - the capacity is higher due to more gaps available in the northbound through traffic (about 1,300 vehicles per hour in 2012).
- Broadview Avenue can accommodate about 250 U-Turn movements (going southbound from northbound) during the PM peak hour – this is based on the gaps available in the southbound through traffic (about 1,800 vehicles per hour in 2012).
- About 232 U-turns are created in each direction from the previous study for the Modified Alt 4 concept, which assumes only five breaks in the median. The configuration that is now proposed will have fewer U- turns as it provides for more median breaks.

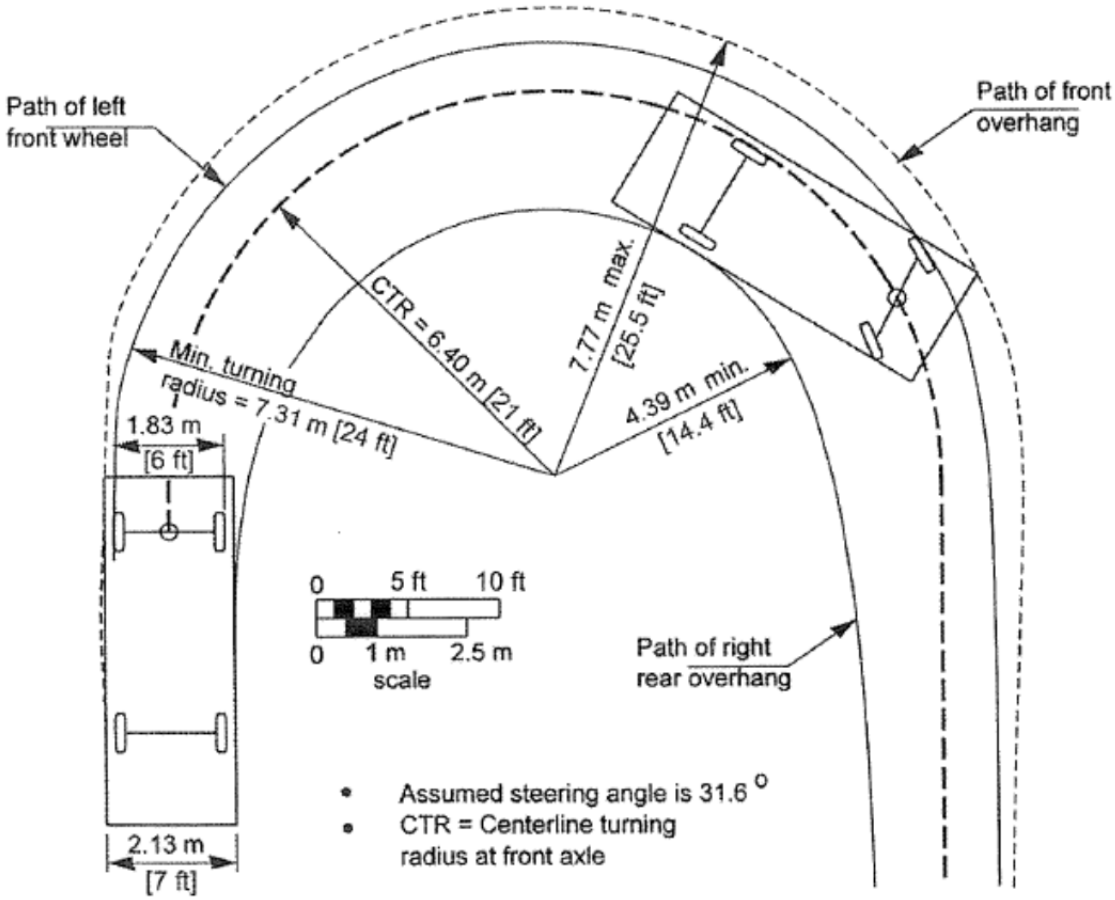
It should be noted that these are estimates based on rough calculations using ITE trip generation rates and HCM capacity calculation equations.

U-Turn Geometry

Some tenants on Broadview Avenue expressed concern over the proposed geometry changes (lane configuration, median placement etc.) and potential resulting impacts to motorist's ability to successfully make U-turns within the available corridor width. To assess the proposed scenario, the American Association of State Highway Transportation Officials (AASHTO) Geometric Designs of Highways and Streets "Greenbook" was consulted. From a typical left turn bay at a median there is 50-feet of space between the outermost edge of the left turn bay striping to the curb on the opposing side of the road where a vehicle would be turning. Based on the turning characteristics of a standard passenger car (Large Car), adequate space is available to successfully make the turn. See **Figure 7** for a typical vehicle turn path as depicted in AASHTO Geometric Designs of Highways and Streets.

In addition, AutoTurn vehicle turn simulation software was utilized to model and show that a standard passenger car (Large Car) can successfully turn within the available space. This analysis confirmed that the proposed geometry meets the criteria for U-Turns. Sufficient storage bays are provided where feasible at the turn bays to accommodate turning vehicles. Larger delivery vehicles typically utilize side streets and alternate approach roadways to access their destinations from the appropriate direction. In general, U-Turns of such vehicles are discouraged and are not typically utilized as a design vehicle on this type of roadway.

Figure 7: Minimum Turning path for Passenger Car Design Vehicle



Source: AASHTO Geometric Designs of Highways and Streets

Traffic Signal at Gold Cup Drive

During the various stakeholder meetings and the site walk, business owners and stakeholders expressed their desire for a traffic signal at the intersection of Broadview Avenue and Gold Cup Drive.

VDOT procedures require a Warrant Study; a detailed traffic engineering analysis for a traffic signal installation. This is beyond the scope of the current study. Additional data collection is also needed to perform the required analysis. Nine warrants, listed below, are potential justification for a new signal. These warrants are described in the Manual of Uniform Traffic Control Devices (MUTCD) publication.

1. Warrant 1, Eight-Hour Vehicular Volume
2. Warrant 2, Four-Hour Vehicular Volume
3. Warrant 3, Peak Hour
4. Warrant 4, Pedestrian Volume
5. Warrant 5, School Crossing

6. Warrant 6, Coordinated Signal System
7. Warrant 7, Crash Experience
8. Warrant 8, Roadway Network
9. Warrant 9, Intersection Near a Grade Crossing

With the available 2012 PM peak hour traffic data, the study team was able to informally test and satisfy the Warrant #3 (Peak hour) requirement. It should be noted, however, that satisfaction of a traffic signal warrant or warrants shall not in itself justify the installation of a traffic control signal. Further data collection and analysis are required to justify the need for installing a traffic signal at this location.

Pedestrian Accommodations

While the initial focus of this effort was on access management, operational improvements, and traffic calming of Broadview Avenue; providing accommodations for pedestrians is also a key area of focus. Broadview Avenue is a relative barrier to pedestrian and bicycle connectivity in Warrenton, particularly since it divides downtown Warrenton with community resources and residential developments to the west.

Adequately accommodating pedestrians is not only a goal of the community involved in this study, but a goal of the State (VDOT) of Virginia. As stated in the Commonwealth Transportation Board Policy for Integrating Bicycle and Pedestrian Accommodations, VDOT initiates all highway/roadway construction projects with the presumption that projects shall accommodate bicycling and walking. This project is no exception. Following typical protocol, planning studies like this effort and the Fauquier-Warrenton Destinations Plan include specific planned bicycle and pedestrian accommodations. This current study looks to carry those initiatives forward one step closer to implementation by recommending them to be included in the design phase of the process.

Pedestrian accommodations along Broadview Avenue were found to be intermittent and inadequate with an incomplete network of sidewalks and pedestrian crosswalk locations. The Town of Warrenton is in the process of adding to the sidewalk network along Broadview Avenue with a goal of providing a contiguous network of sidewalks on both sides of the street. As such, sidewalks are already in the process of being addressed.

Along the approximately 1.1 mile corridor, there are only two marked crosswalk locations approximately 0.9 miles from one another; at the southern end of the study area at Broadview and Frost Avenue, and near the northern terminus of the corridor at Broadview Avenue and Winchester Street. Between those two points are a number of cross streets and many trip generators. Notably, towards the southern half of the corridor are Fauquier High School and the Warrenton Aquatic and Recreation Facility (WARF) facility. The school is situated approximately 1,800 feet west of Broadview Avenue between Waterloo Road and Gold Cup Drive, while the WARF Facility is slightly further away just north of Frost Avenue. Students and the community utilize Waterloo Road and Gold Cup Drive as key pedestrian routes. As such, emphasis has been placed on providing adequate pedestrian accommodations and connectivity across Broadview Avenue, Frost Avenue, and to the Warrenton Town Center to support high school foot traffic as well as the foot traffic from the surrounding community. The proposed improvements are

intended to work towards promoting safe connectivity across Broadview Avenue for pedestrians. A series of crosswalk upgrades and additions have been included in the plan as shown in **Appendix B** as well as **Figure 8, Figure 9,** and **Figure 10**.

The study team proposed crosswalks at locations that ensure approaching vehicles have clear lines of sight to the crosswalk, signals, and associated signage. The locations for crosswalks are primarily based on needs identified by the community.

Table 8 shows the mix of traffic conditions, such as Average Daily Traffic (ADT), speed limit and number of lanes that necessitate additional pedestrian facility enhancements along with the crosswalk, to improve the safety of the crossing. Utilizing this table below and the recommendations from the 2009 Fauquier-Warrenton Destinations Plan[2] recommendations, pedestrian actuated signals are recommended at crosswalks with high visibility markings and appropriate signage. **Appendix A** describes one specific pedestrian actuated signal system knows as the "HAWK" signal.

Apart from the mid-block crosswalks, the study team investigated the provision of crosswalks at all approaches of the intersection of Broadview Avenue and Frost Avenue. This intersection provides a direct link between Fauquier High School, the WARF and other commercial facilities located west of Broadview Avenue with the neighborhoods and downtown area located east of Broadview Avenue. The recommendations provided in the 2009 Fauquier-Warrenton Destinations Plan were also incorporated in the study.

The final improvements plan after incorporating all the above considerations are described and illustrated in the next section.

[2] A pedestrian and Bicycle master plan prepared for Warrenton by VDOT by Toole Design Group Inc.

Table 8: VDOT Recommendations for Marked Crosswalks

	≤ 9,000 ADT			> 9,000 ADT to ≤ 12,000 ADT			> 12,000 ADT to ≤ 15,000 ADT			> 15,000 ADT		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph[b]
2 lanes												
3 lanes												
++4 lanes, raised median[c]												
++4 lanes, no median												

Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. First, an engineering study is needed to determine whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, but a more in-depth study of pedestrian volume, vehicle speed, sight distance, vehicle mix, etc., may be needed at other sites. If the speed limit is less than or equal to 30 mph, use **Level 1** or **Level 2** devices. If the speed limit exceeds 30 mph, use **Level 2** devices. *Refer to Level 1 and Level 2 devices in the Special Treatments section*.

Probable candidate sites for marked crosswalks. Pedestrian crash risk may increase if marked crosswalks are added without other pedestrian facility enhancements. Add **Level 3** or **Level 4** devices if feasible. *Refer to Level 3 and Level 4 devices in the Special Treatments section*.

Marked crosswalks alone are insufficient, since pedestrian crash risk may increase if only marked crosswalks are provided. Consider using **Level 5** devices if feasible. If not feasible, use multiple treatments from **Level 2, Level 3,** or **Level 4** devices. *Refer to Level 5 devices in the Special Treatments section*.

[a]These guidelines include intersection and mid-block locations with no traffic signal or stop sign on the approach to the crossing. They do not apply to school crossings. A two -way center turn lane is not considered a median. Crosswalks should not be installed at locations that could pr esent an increased safety risk to pedestrians, such as where there is poor site distance, complex or confusing designs, substantial volumes of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make a crossing safer or necessarily result in more drivers stopping for pedestrians. Whenever marked crosswalks are installed, it is important to consider other pedestrian facility enhancements, as needed, to improve the safety of the crossing (for example, raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic calming measures, curb extensions). **These are general recommendations; an engineering study should be performed to determine where to install marked crosswalks.**

[b]Where the posted speed limit or 85th percentile speed exceeds 40 mph, marked crosswalks alone should not be used at uncontrolled intersections with an ADT greater than 15,000.

[c]The raised median or refuge island must be at least 4 feet (1.2 meters) wide and 6 feet (1.8 meters) long to adequately serve as a refuge area for pedestrians.

Source: VDOT - Guidelines for the Installation of Marked Crosswalks, Table 1. Recommendations for Considering Marked Crosswalks and Other Needed Pedestrian Improvements at Uncontrolled Locations.

7. Recommended Alternative

7.1. Overview

As mentioned earlier, the study team worked to refine the previously recommended alternative by engaging the stakeholders and business owners located on Broadview Avenue to place greater focus on developing a set of context-sensitive solutions for Broadview Avenue.

The recommended alternative balances the previously recommended alternative (Modified Alt 4), which employed greater access control, with the needs of the community. The outcome is a compromise of controlling access in exchange for community acceptance and consensus, meeting the objectives of improving safety and reducing congestion, and maintaining access to businesses.

It should be noted that the plan developed is at a level of detail suitable for a planning effort of this nature. A preliminary engineering review was conducted to assess the feasibility of the planned improvements; however additional review, consideration, and modification will likely be required during the design process. It is anticipated that waivers to design standards will be required for many of the recommended improvements to address non-standard left turn taper distances, storage lengths, and median break spacing.

7.2. Summary of Features

The list below provides a high-level summary of the recommended elements. See **Figures 8, 9,** and **10** for a representative 3D cross-section of a portion of Broadview Avenue and the proposed improvements therein. These have been included to show the proposed lane configuration, typical median configurations, pedestrian accommodations etc. from multiple perspectives. **Figure 8** Illustrates a birdseye view of a representative portion of the corridor cross-section. A numbered list of all the recommended elements along the Broadview Avenue corridor has been prepared and is contained in **Appendix B**. Each element is numbered in the list and correlates with the segments and numbered elements in **Appendix B Figures 1** through **5**.

- Four lane typical section with two twelve foot travel lanes in each direction, six foot shoulders (inclusive of approximately 2 feet of gutter pan) and twenty foot wide raised landscaped median that includes provisions for turn lanes. **Figure 9** shows the proposed cross section with a turn lane.
- Nine median breaks to allow access to properties located on either side of Broadview Avenue.
- Landscaped median with context appropriate plantings and pedestrian refuge areas.
- Modification to intersection geometry and configuration at the intersection of Broadview Avenue and Frost Avenue that includes an additional lane for free right turns onto Frost Avenue from Broadview Avenue.
- Three mid-block pedestrian crosswalks along with corridor with high-visibility signals and signs. **Figure 10** shows one of the proposed crosswalks near Gold Cup Drive and Stuyvesant Street with a pedestrian refuge area.

- Crosswalks at all approaches of the intersection of Broadview Avenue at Frost Avenue.
- Installation of rapid flashing beacon for the crosswalk located at the end of the slip ramp from Broadview Avenue onto Frost Avenue to alert vehicles to pedestrians.
- Extension of the sidewalk from Waterloo Street to Rappahannock Street.
- Single driveway closures on corner of Broadview to Frost Avenue (northeast corner) and at McDonald's.
- Realignment of the driveway at Warrenton Plaza driveway with Chappell Street.

7.3. Preliminary Cost Estimates

Planning level cost estimates were developed using VDOT Standard Pay Items for the proposed improvements to the study area; including milling and overlay of the pavement, median construction, pavement markings, earthwork, drainage improvements, and signal installations. Preliminary engineering costs are estimated at 25 percent of the construction costs and include surveying, design, and permitting. An additional 30 percent is set aside for contingency costs. Additional costs may be incurred due to Right-of-Way (RoW) acquisition and are not included in this preliminary cost estimate.

Figure 11 summarizes the estimated costs for improvements on Broadview Avenue. The cost estimates are broken down into three segments to enable the Town to phase the construction improvements. Segment A provides the most operational and safety benefits to the corridor, followed by Segment B and Segment C, respectively.

Figure 12 shows an additional cost estimate for an option that does not include repaving (milling and overlay) of the existing pavement. The existing pavement is reported by the Town to be nearing the end of its useful life. As such, this option was provided as a low-cost alternative if sufficient funds are not available upfront for including the milling and overlay of pavement. While it is feasible to construct the improvements without milling and overlaying the existing pavement, it is recommendable to construct the improvements and pavement in parallel with one another. This would have the greatest overall impact and would maximize the intended "change of environment".

Appendix C shows the breakdown of VDOT pay items, quantities and unit costs used for preparing the cost estimates.

8. Next Steps

The next step in the overall process is to develop design documents for the proposed improvements to Broadview Avenue. As mentioned previously, the design work (engineering, permitting, survey, right-of-way analysis, coordination, etc.) will cost about 25 percent of the overall construction cost of the Project. The intent is to bring the project to a point in which it is "shovel-ready".

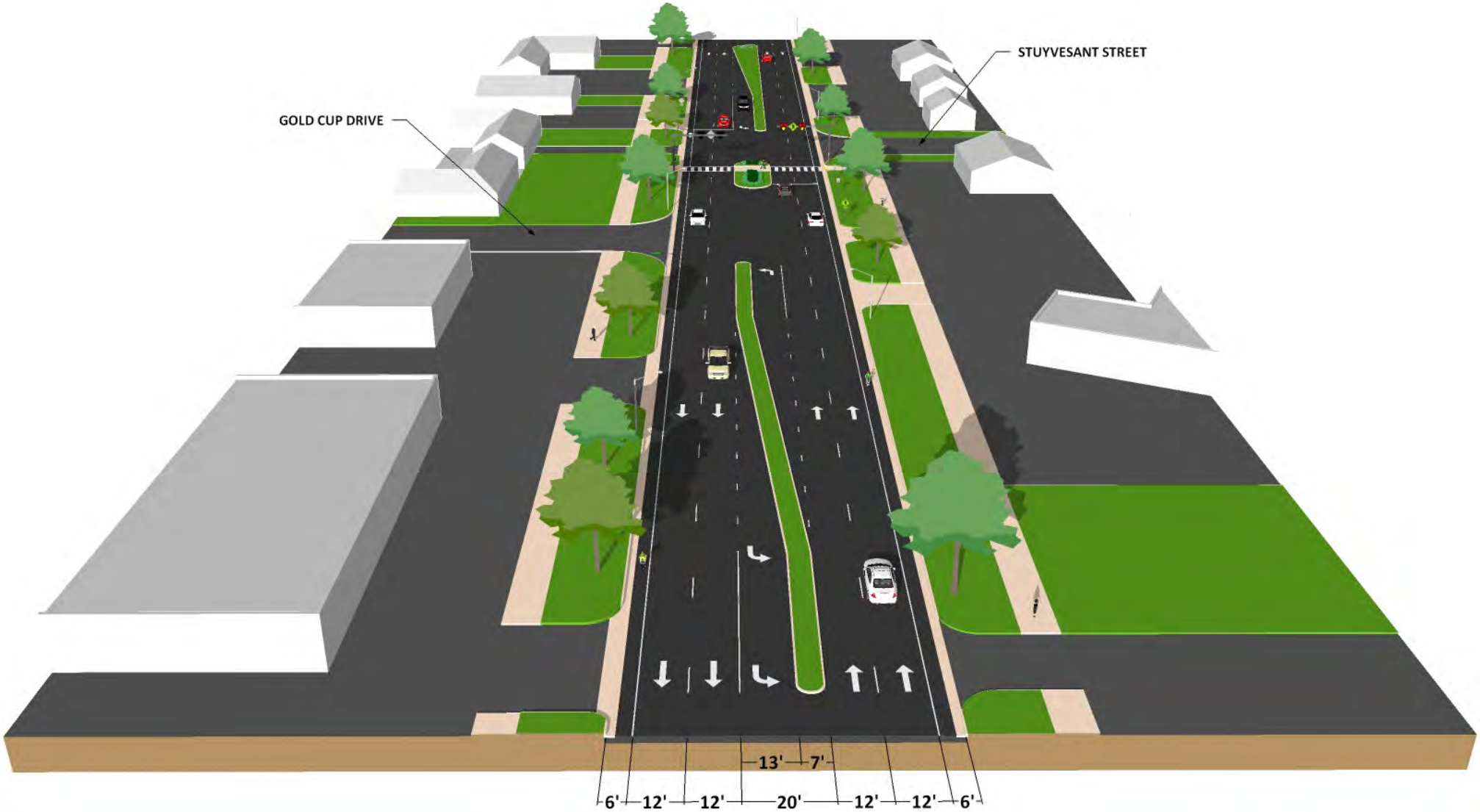


Figure 8
Broadview Avenue Access Management Study
Cross-Section Overview

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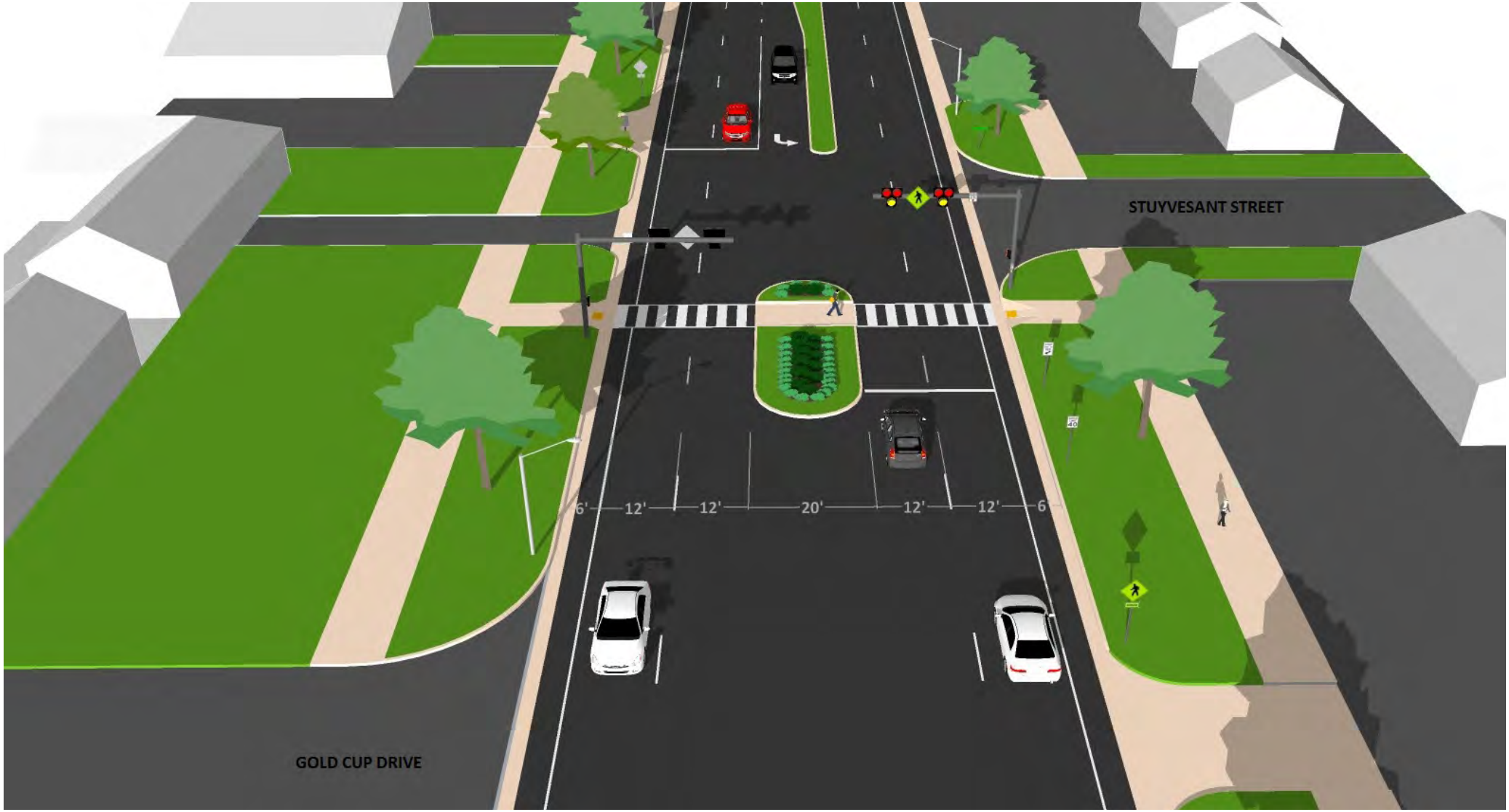

Figure 9
Broadview Access Management Study
Crosswalk and Turn Lane

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Figure 10
Broadview Access Management Study
Crosswalk with Pedestrian Refuge and HAWK Signal

HNTB

TOTAL ESTIMATED COST OF IMPROVEMENTS (WITH MILL AND OVERLAY) = $4.7 MILLION

SEGMENT A - EST. $2.04 MILLION

- Mill and overlay pavement
- Construct partial medians
- Add lane for free right turn onto Frost Ave
- Modification of intersection geometry and configuration
- Install high-visibility crosswalks at every crossing point
- Install Rapid Flash Beacon on slip ramp for pedestrians
- Extend sidewalk from Waterloo/Rappahannock
- Single driveway closure on corner
- Landscaping of median and pedestrian refuge areas

Construction Cost Subtotal	$1,175,000
Mobilization & Construction Surveying	$100,800
Contingency (30%)	$353,000
Survey/Design/ROW/Permitting (25%)	$408,000
Total Project Cost	**$2,037,000**

SEGMENT B - EST. $1.34 MILLION

- Mill and overlay pavement
- Construct 5 partial medians
- Install two high visibility crosswalks
- Install High Intensity Activated Crosswalk Signal (HAWK)
- Landscaping of median and pedestrian refuge areas

Construction Cost Subtotal	$770,000
Mobilization & Construction Surveying	$70,700
Contingency (30%)	$231,000
Survey/Design/ROW/Permitting (25%)	$268,000
Total Project Cost	**$1,340,000**

SEGMENT C - EST. $1.3 MILLION

- Mill and overlay pavement
- Construct 4 partial medians and extend one existing median at the north end of the study area
- Realign Warrenton Plaza driveway with Chappell Street
- Install one high visibility crosswalks
- Single driveway closure at McDonalds
- Landscaping of median and pedestrian refuge areas

Construction Cost Subtotal	$745,000
Mobilization & Construction Surveying	$68,500
Contingency (30%)	$224,000
Survey/Design/ROW/Permitting (25%)	$260,000
Total Project Cost	**$1,298,000**

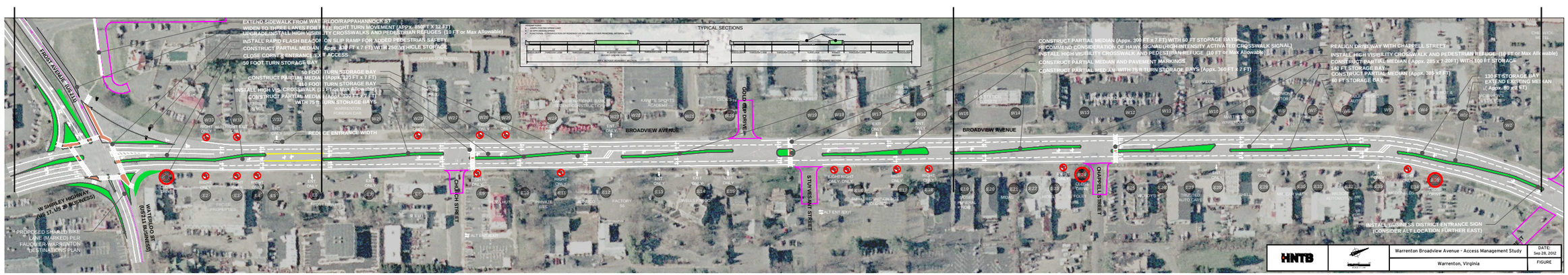

Figure 11
Broadview Avenue Access Management Study
Recommended Alternative and Estimated Cost By Segment (with Mill and Overlay)

Note: Costs are rounded.

HNTB

TOTAL ESTIMATED COST OF IMPROVEMENTS (NO MILL AND OVERLAY) = $3.2 MILLION

SEGMENT A - EST. $1.56 MILLION

- Construct partial medians
- Add lane for free right turn onto Frost Ave
- Modification of intersection geometry and configuration
- Install high-visibility crosswalks at every crossing point
- Install Rapid Flash Beacon on slip ramp for pedestrians
- Extend sidewalk from Waterloo/Rappahannock
- Single driveway closure on corner
- Landscaping of median and pedestrian refuge areas

Construction Cost Subtotal	$895,000
Mobilization & Construction Surveying	$82,000
Contingency (30%)	$269,000
Survey/Design/ROW/Permitting (25%)	$312,000
Total Project Cost	**$1,558,000**

SEGMENT B - EST. $0.83 MILLION

- Construct 5 partial medians
- Install two high-visibility crosswalks
- Install High Intensity Activated Crosswalk Signal (HAWK)
- Landscaping of median and pedestrian refuge areas

Construction Cost Subtotal	$472,000
Mobilization & Construction Surveying	$45,800
Contingency (30%)	$142,000
Survey/Design/ROW/Permitting (25%)	$165,000
Total Project Cost	**$825,000**

SEGMENT C - EST. $0.82 MILLION

- Construct 4 partial medians and extend one existing median at the north end of the study area
- Realign Warrenton Plaza driveway with Chappell Street
- Install one high-visibility crosswalk
- Single driveway closure at McDonalds
- Landscaping of median and pedestrian refuge areas

Construction Cost Subtotal	$467,000
Mobilization & Construction Surveying	$45,700
Contingency (30%)	$141,000
Survey/Design/ROW/Permitting (25%)	$164,000
Total Project Cost	**$818,000**

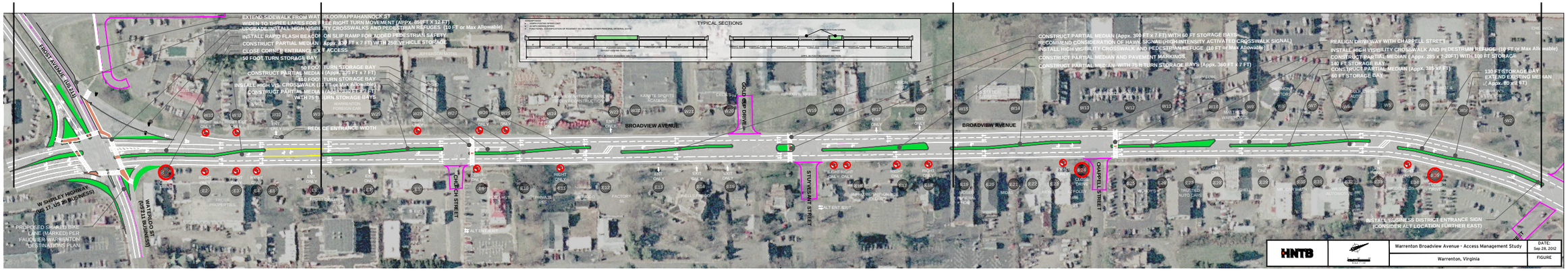

Figure 12
Broadview Avenue Access Management Study
Recommended Alternative and Estimated Cost By Segment (No Mill and Overlay)

Note: Costs are rounded.

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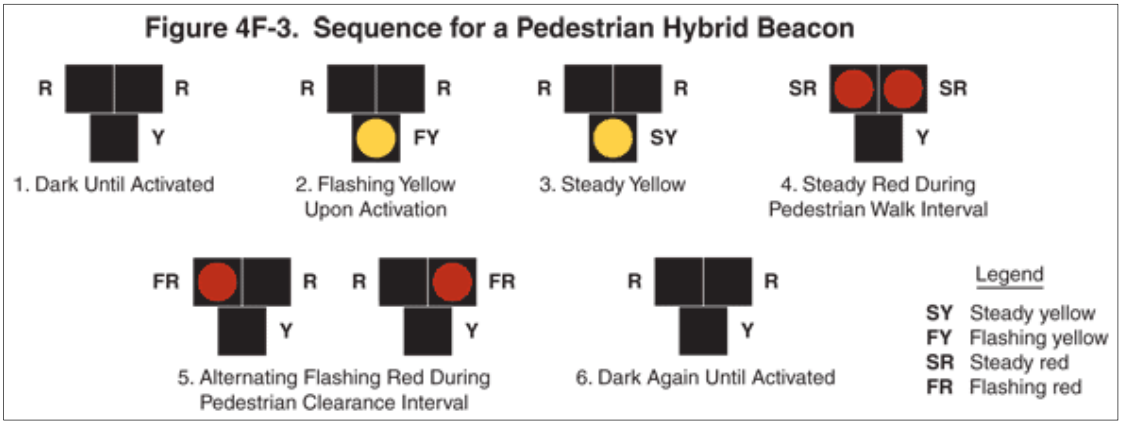
Appendix A

Pedestrian HAWK Signal

Pedestrian HAWK Signal

'HAWK' is an acronym for High intensity Activated crosswalk. The HAWK is technically a pedestrian hybrid beacon. It consists of three signal sections, with a CIRCULAR YELLOW signal indication centered below two horizontally aligned CIRCULAR RED signal indications. The figure below shows an example of a HAWK signal.

Figure below shows the sequence of operation of the HAWK signal.



Source MUTCD 2009 Chapter 4F

The signal remains dark for traffic unless a pedestrian activates the push-button. When the pedestrian presses the button, approaching drivers will see a FLASHING YELLOW for a few seconds followed by a SOLID YELLOW, indicating that they should reduce speed and be prepared to stop for a pedestrian in the crosswalk. The YELLOW is followed by a solid RED, requiring drivers to stop for pedestrians at the stop line. At this time, the pedestrian receives a WALK indication on the associated countdown timer. Visually impaired pedestrians will hear the signal indicate that it is safe to cross. At the end of the WALK indication, the pedestrian is displayed a FLASHING DON'T WALK indication and motorist sees an ALTERNATING FLASHING RED signal. During this period, drivers are required to stop or remain stopped until pedestrians have finished crossing the street, and then may proceed.

Guidelines for the installation of the HAWK signal are provided in the FHWA MUTCD Chapter 4F.

Appendix B

Recommended Alternative

Recommended Alternative Elements

The location and layout of elements such as crosswalks, vehicle storage bays, taper lengths, median breaks, signs and signals identified below and shown in Appendix B Figures 1 through 5 are preliminary. Additional considerations are required for these elements during the subsequent detailed design phase. Design exceptions and waivers may be required to construct these improvements.

The study corridor has been divided into three segments (A, B, C), which correlate to the included cost estimate. The major recommended elements are listed below. The numbering of each improvement correlates to the circled numbering shown on each improvement. Please note, that driveway numbers are also included in the figure for reference (i.e. E7, W33).

Segment A

1. Provide dual northbound left turn lanes from West Shirley Avenue to Frost Avenue and consider modifying the intersection geometry as shown in the Fauquier-Warrenton Destinations plan.
    - Consider slip ramp realignments to reduce the distance that pedestrians have to cross and to slow turning vehicles.
    - Consider a raised table crosswalk to slow motor vehicles turning onto Waterloo Street from West Shirley Avenue. Raised table crosswalks could also be considered on the other slip ramps at the intersection.
    - Consider realigned slip lanes and other design retrofits to tighten the area where vehicles access the slip ramp, in order to slow them down.
    - Replace the striped median with a raised median and provide a crosswalk on the south side of the intersection.
    - Increase the distance between motor vehicle stop lines and the pedestrian crosswalk.
    - Consider increasing the crossing time for pedestrians crossing Broadview Avenue, to ensure that they have enough time to comfortably negotiate the intersection.
    - Consider leading pedestrian intervals at the traffic signal to reduce potential conflicts with turning vehicles.
    - Consider shared bike markings and signage on Waterloo Street and Frost Avenue.
2. Extend the third lane (by approximately 850 feet) on westbound Frost Avenue to enable free right turns from southbound Broadview Avenue. It should be noted that further engineering, survey and investigation are required to verify feasibility and right-of-way needs.
3. Provide 10 foot-wide (or max feasible) crosswalks on all legs of the Broadview/Frost/Waterloo intersection. Pedestrian crossing signals/push buttons can also be provided as appropriate. Provide connections to existing sidewalk infrastructure from these crosswalks.
4. Provide flashing beacons on the crosswalk across the right turn slip ramp from Broadview Avenue to Frost Avenue. Consider high-visibility crosswalk markings or stamped pavement at this location.
5. Extend sidewalk from Waterloo Street/Rappahannock Street intersection to connect to the existing sidewalk network at the corner of Broadview and Frost Avenue.
6. Construct partial median on Broadview Avenue (Approximately 430 feet long by seven feet wide) with a 250 foot storage bay in the southbound direction and a 50 foot storage bay in the northbound direction.
7. Close the driveway on the northeast corner of Waterloo Street and Broadview Avenue (Frost Properties).

8. Install “no left turn” signs as shown in the recommended plan.
9. Install “entrance only/exit only” signage as shown in the recommended plan (i.e. Burger King, Frost Diner, Oakview National, Wells Fargo, Union First, Shell, McDonalds) to reduce conflicting vehicle movements.
10. Reduce driveway entrance (W31) width to 15 feet to control entrance/exit flow and minimize potential vehicle conflict points.
11. Provide reconfigured pavement markings and striping as shown in the recommended plan.

Segment B

12. Construct partial median (Approximately 330 feet long by seven feet wide) with 75 foot storage bays in both directions.
13. Construct partial median (Approximately 330 feet long by seven feet wide) with a 50 foot storage bay in the northbound direction and a 110 foot storage bay in the southbound direction.
14. Provide a 10 foot-wide (or max feasible) high-visibility crosswalk on the north side of the Broadview/Church Street Intersection. Due to the location and the characteristics of Broadview Avenue, a marked crosswalk alone would not be sufficient (based on VDOT guidelines for the Installation of Marked Crosswalks, Table 1). Additionally, a pedestrian refuge can be provided at the median to complete the associated pedestrian accommodations.
15. Construct partial median (Approximately 300 feet long by seven feet wide) with 60 feet of storage bays in both directions.
16. Construct partial median (Approximately 50 feet long by 20 feet wide) between the intersections of Gold Cup Drive and Stuyvesant Street.
17. Provide a 10 foot-wide (or max feasible) high-visibility crosswalk on Broadview between the intersections of Gold Cup Drive and Stuyvesant Street. A marked crosswalk alone would not be sufficient (based on VDOT guidelines for the Installation of Marked Crosswalks, Table 1). Additionally, a pedestrian refuge can be provided at the median to complete the associated pedestrian accommodations. It should also be noted that this location is at/near a highpoint of Broadview Avenue. Care should be taken to locate the crosswalk at the point with the best line of sight for both pedestrians and northbound/southbound travelling vehicles.
18. Construct partial median (Approximately 290 feet long, ranging from seven to 20 feet wide) with a 100 foot storage bay in the southbound direction. Turn bays could not be accommodated in the northbound directions due to limitations in the roadway geometry.

Segment C

19. Construct partial median (Approximately 360 feet long by seven feet wide) with an 80 foot storage bay in the northbound direction and 100 foot storage bay in the southbound direction.
20. Realign the driveway at Warrenton Plaza to match up with with Chappell Street.
21. Provide a 10 foot-wide (or max feasible) high-visibility crosswalk on the north side of the Broadview/Chappell Street Intersection. Due to the location and the characteristics of Broadview Avenue, a marked crosswalk alone would not be sufficient (based on VDOT guidelines for the Installation of Marked Crosswalks, Table 1). Additionally, a pedestrian refuge can be provided at the median to complete the associated pedestrian accommodations.

22. Construct partial median (Approximately 285 feet long, ranging from seven to 20 feet wide) with a 100 foot storage bay in the southbound direction. A storage bay could not be provided in the northbound direction due to limitations in roadway geometry.
23. Construct partial median (Approximately 385 feet long by seven feet wide) with a 60 foot storage bay in the northbound direction and a 140 foot storage bay in the southbound direction.
24. Modify and extend the existing median on Broadview just south of Roebling Street (Approximately 80 foot extension by seven feet wide). This will provide a 90 foot storage bay in the northbound direction and a 130 foot storage bay in the southbound direction. .
25. Close the third driveway (E35) at McDonalds. It should be noted that McDonalds is in the process of reconstructing the existing establishment and potentially reconfiguring access to Broadview Avenue. The recommended plan can be reviewed during the design process to review access and make modifications, if necessary.

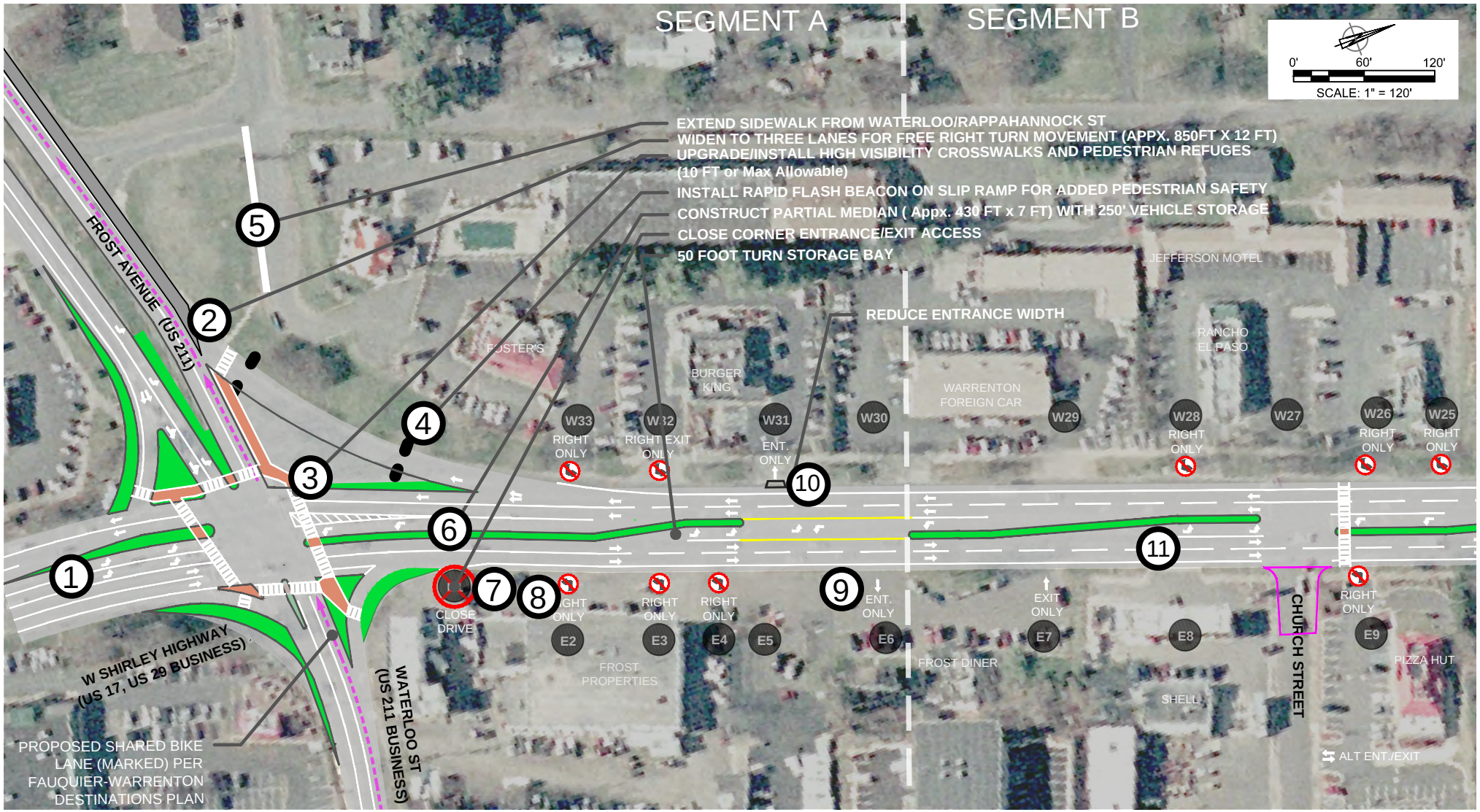


Figure 1
Broadview Access Management Study
Recommended Plan - Segment A

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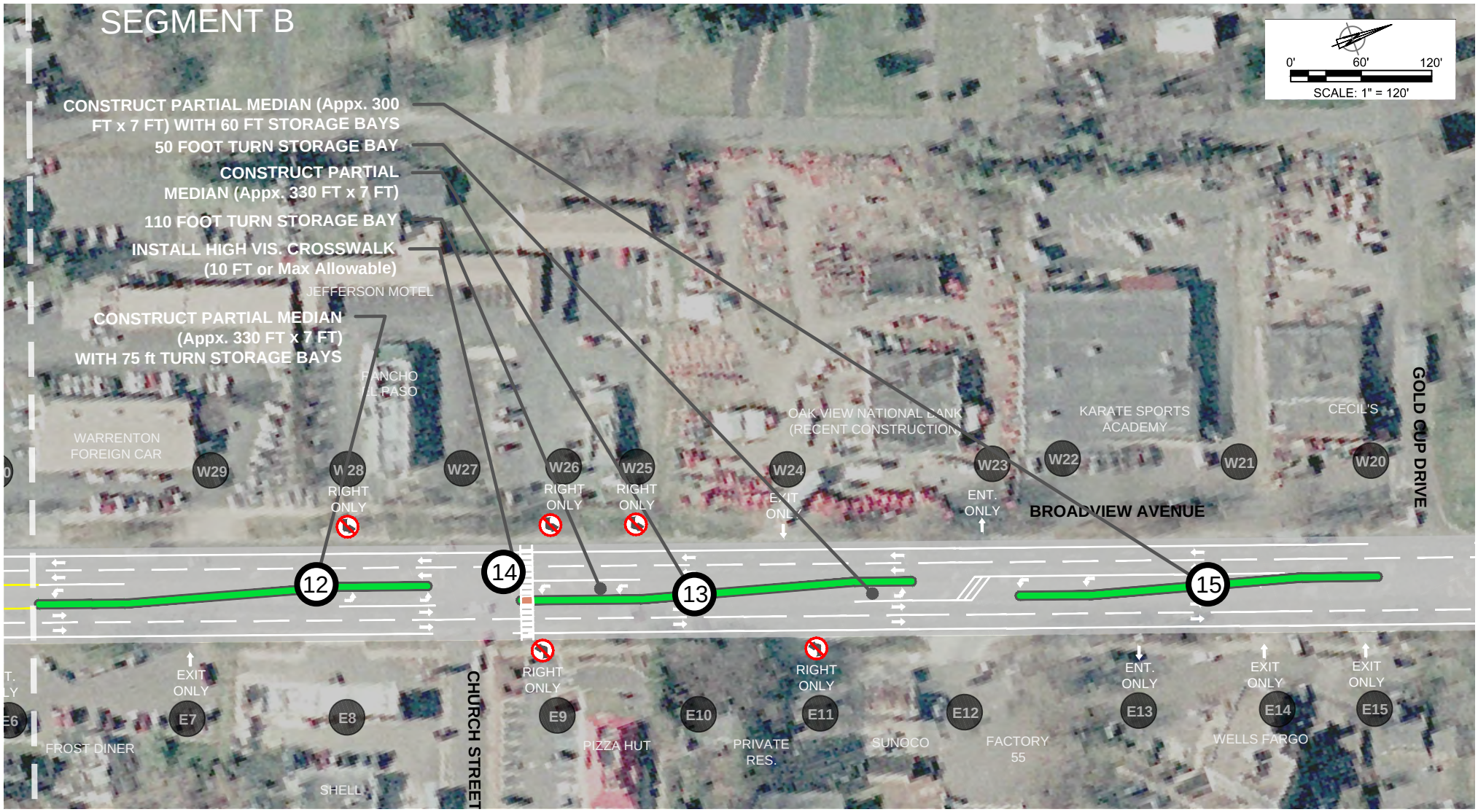

Figure 2
Broadview Access Management Study
Recommended Plan - Segment B

HNTB

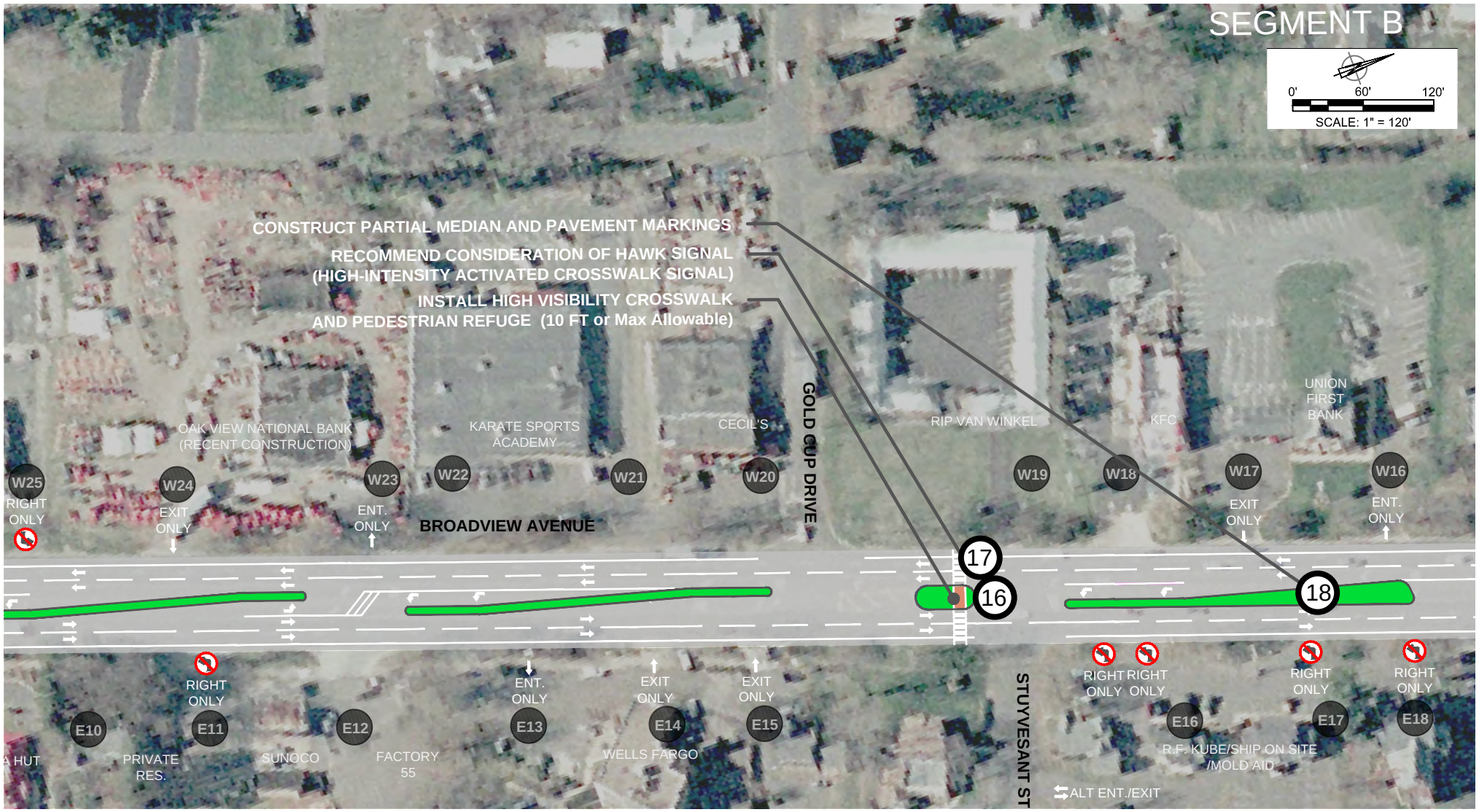

Figure 3
Broadview Access Management Study
Recommended Plan - Segment B (Continued)

HNTB

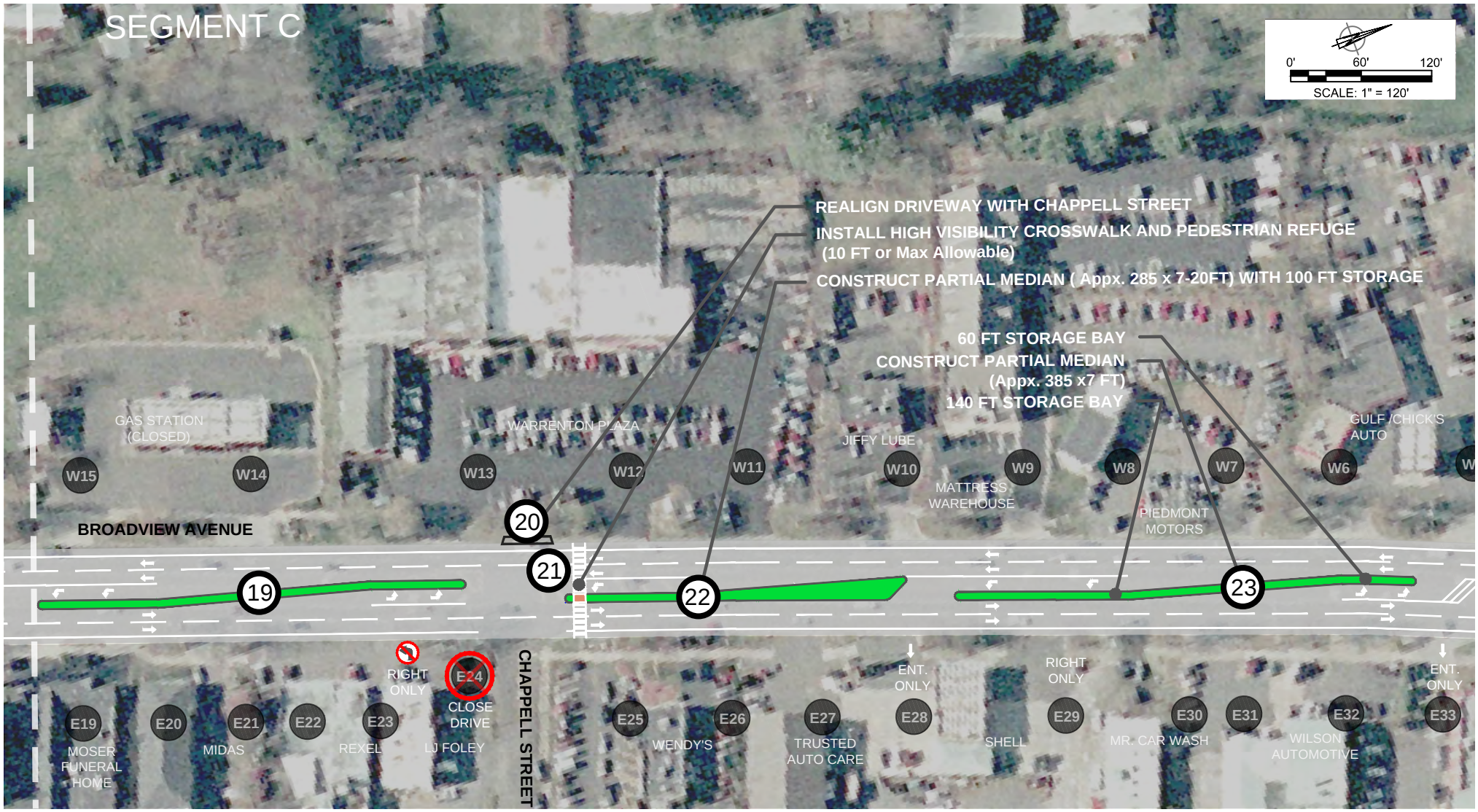

Figure 4
Broadview Access Management Study
Recommended Plan - Segment C

HNTB

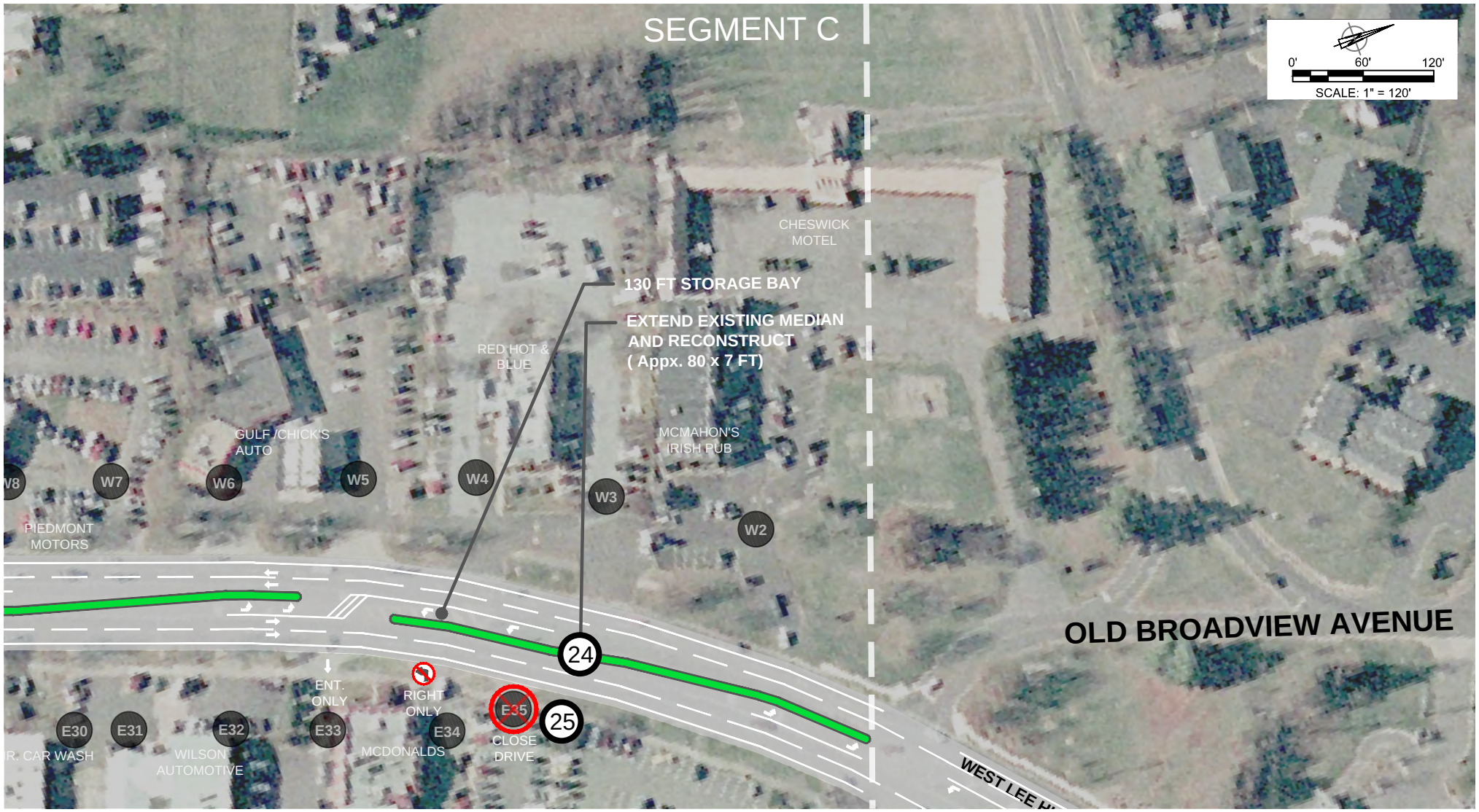

Figure 5
Broadview Access Management Study
Recommended Plan - Segment C (Continued)

HNTB

Appendix C

Cost Estimates

Concept Level Construction Cost Estimate

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Segment A - From Frost Ave. to approximately 612 ft North (Entrance of Frost Diner)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$89,000	$89,000
00101	Construction Surveying	LS	1	$11,750	$11,750
00110	Clearing and Grubbing	LS	1	$50,000	$50,000
00585	Underdrain UD-2	LF	636	$13	$8,433
00595	Outlet Pipe	LF	78	$12	$944
01302	30" Conc. Pipe	LF	100	$95	$9,500
06xxx	Standard SWM-1	EA	1	$1,000	$1,000
06301	30" End Section ES-1	EA	1	$1,300	$1,300
09056	Manhole MH-1 or 2	EA	2	$433	$866
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	905	$31	$28,272
10062	Asphalt-Stabilized Open-Graded Material	TON	370	$70	$25,900
10628	Flexible Pave. Planing 0"-2"	SY	13,356	$16	$213,696
10635	Asphalt Concrete Ty. SM-12.5E	TON	1,259	$88	$111,296
10642	Asphalt Concrete Ty. BM-25.0A	TON	954	$74	$70,138
12020	Std. Curb CG-2	LF	1,908	$15	$29,383
12600	Std. Comb. Curb & Gutter CG-6	LF	1,551	$16	$24,273
13220	Hydr. Cement Conc. Sidewalk 4"	SY	332	$31	$10,288
14100	Removal of Sidewalk and Entrance	SY	50	$5	$250
14120	Removal of Comb. Curb and Gutter	LF	961	$13	$12,493
23600	NS Fence Chain Link (H=8' with Barbed Wire)	LF	500	$25	$12,500
23602	NS Gate FE-CL L=18' (H=8' with Barbed Wire)	EA	1	$1,000	$1,000
24265	NS Maintenance of Traffic	LS	1	$250,000	$250,000
24430	Demo. of Pavement (Flexible)	SY	2,635	$3	$7,115
27022	Topsoil Class B 2"	ACRE	0.4	$12,754	$5,102
27300	Sod	SY	1,640	$7	$11,513
27xxx	Plantings	LS	1	$50,000	$50,000

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Segment A - From Frost Ave. to approximately 612 ft North (Entrance of Frost Diner)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
27401	Erosion Control Riprap	TON	0	$100	$0
27451	Inlet Protection, Type A	EA	10	$263	$2,634
27545	Storm Water Management Basin Excavation	CY	7,500	$7	$49,500
27566	Stormwater Management Riser Pipe	LF	6	$800	$4,800
50903	NS Traffic Signage	LS	1	$3,500	$3,500
51910	Sawcut	LF	7,949	$2	$15,103
52002	NS Traffic Signalization	EA	1	$150,000	$150,000
54100	NS Pavement Marking	LF	6,154	$2	$12,308
54300	Pavement Message Marking Elongated Arrow Single	EA	15	$122	$1,826

Subtotal (without Mobilization & Construction Surveying)		$1,175,000
Mobilization & Construction Surveying		$100,750
Contingency	30%	$353,000
Total, Construction		**$1,629,000**
Engineering Cost	25%	$408,000
Total Project Cost		**$2,037,000**

Notes:

1. Reflects estimated pavement section of 10" HMA over 3" open graded
2. Contingency includes costs related to erosion and sediment control, miscellaneous items, and aspects of work unidentified or unquantified to date.
3. Costs do not include VDOT administrative costs, financing, or staffing. Construction costs do not include environmental remediation (if needed), right-of-way acquisition, or utility relocations.
4. Estimate reflects development of preliminary design work products as of the date shown.
5. Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.
11. Assumes modification of existing signal, not replacement of all existing traffic signal equipment.
12. Assumes installation of new equipment for actuated rapid flash pedestrian beacon.

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Segment B - From Entrance of Frost Diner to approximately 1732 ft North (Entrance to Moser Funeral Home)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$63,000	$63,000
00101	Construction Surveying	LS	1	$7,700	$7,700
00110	Clearing and Grubbing	LS	1	$50,000	$50,000
00585	Underdrain UD-2	LF	1,321	$13	$17,516
00595	Outlet Pipe	LF	132	$12	$1,597
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	266	$31	$8,310
10062	Asphalt-Stabilized Open-Graded Material	TON	109	$70	$7,630
10628	Flexible Pave. Planing 0"-2"	SY	13,571	$16	$217,136
10635	Asphalt Concrete Ty. SM-12.5E	TON	1,167	$88	$103,163
10642	Asphalt Concrete Ty. BM-25.0A	TON	287	$74	$21,100
12020	Std. Curb CG-2	LF	2,579	$15	$39,717
12600	Std. Comb. Curb & Gutter CG-6	LF	0	$16	$0
13220	Hydr. Cement Conc. Sidewalk 4"	SY	30	$31	$937
24265	NS Maintenance of Traffic	LS	1	$100,000	$100,000
24430	Demo. of Pavement (Flexible)	SY	1,866	$3	$5,038
27022	Topsoil Class B 2"	ACRE	0.3	$12,754	$3,826
27300	Sod	SY	1,202	$7	$8,438
27xxx	Plantings	LS	1	$50,000	$50,000
27451	Inlet Protection, Type A	EA	12	$263	$3,161
50903	NS Traffic Signage	LS	1	$3,500	$3,500
51910	Sawcut	LF	6,236	$2	$11,848
52002	NS Traffic Signalization	EA	1	$100,000	$100,000
54100	NS Pavement Marking	LF	7,343	$2	$14,686
54300	Pavement Message Marking Elongated Arrow Single	EA	13	$122	$1,583

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Segment B - From Entrance of Frost Diner to approximately 1732 ft North (Entrance to Moser Funeral Home)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
	Subtotal (without Mobilization & Construction Surveying)				$770,000
	Mobilization & Construction Surveying				$70,700
	Contingency			30%	$231,000
	Total, Construction				**$1,072,000**
	Engineering Cost			25%	$268,000
	Total Project Cost				**$1,340,000**

Notes:

1. Reflects estimated pavement section of 10" HMA over 3" open graded
2. Contingency includes costs related to erosion and sediment control, miscellaneous items, and aspects of work unidentified or unquantified to date.
3. Costs do not include VDOT administrative costs, financing, or staffing. Construction costs do not include environmental remediation (if needed), right-of-way acquisition, or utility relocations.
4. Estimate reflects development of preliminary design work products as of the date shown.
5. Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.
11. Assumes installation of new equipment at HAWK pedestrian signal.

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Segment C - From Entrance to Moser Funeral Home to Roebling Street (1667 ft North)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$61,000	$61,000
00101	Construction Surveying	LS	1	$7,450	$7,450
00110	Clearing and Grubbing	LS	1	$50,000	$50,000
00585	Underdrain UD-2	LF	1,430	$13	$18,962
00595	Outlet Pipe	LF	102	$12	$1,234
01302	30" Conc. Pipe	LF	100	$95	$9,500
06xxx	Standard SWM-1	EA	1	$1,000	$1,000
06301	30" End Section ES-1	EA	1	$1,300	$1,300
09056	Manhole MH-1 or 2	EA	2	$433	$866
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	304	$31	$9,497
10062	Asphalt-Stabilized Open-Graded Material	TON	124	$70	$8,680
10628	Flexible Pave. Planing 0"-2"	SY	12,785	$16	$204,560
10635	Asphalt Concrete Ty. SM-12.5E	TON	1,109	$88	$98,036
10642	Asphalt Concrete Ty. BM-25.0A	TON	328	$74	$24,115
12020	Std. Curb CG-2	LF	2,944	$15	$45,338
12600	Std. Comb. Curb & Gutter CG-6	LF	0	$16	$0
13220	Hydr. Cement Conc. Sidewalk 4"	SY	8	$31	$245
23600	NS Fence Chain Link (H=8' with Barbed Wire)	LF	500	$25	$12,500
23602	NS Gate FE-CL L=18' (H=8' with Barbed Wire)	EA	1	$1,000	$1,000
24265	NS Maintenance of Traffic	LS	1	$100,000	$100,000
24430	Demo. of Pavement (Flexible)	SY	1,925	$3	$5,198
27022	Topsoil Class B 2"	ACRE	0.3	$12,754	$3,826
27300	Sod	SY	1,239	$7	$8,698
27xxx	Plantings	LS	1	$50,000	$50,000
27451	Inlet Protection, Type A	EA	12	$263	$3,161
27545	Storm Water Management Basin Excavation	CY	7,500	$7	$49,500
27566	Stormwater Management Riser Pipe	LF	6	$800	$4,800

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Segment C - From Entrance to Moser Funeral Home to Roebling Street (1667 ft North)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
50903	NS Traffic Signage	LS	1	$3,500	$3,500
51910	Sawcut	LF	6,309	$2	$11,987
54100	NS Pavement Marking	LF	7,844	$2	$15,688
54300	Pavement Message Marking Elongated Arrow Single	EA	14	$122	$1,704

Subtotal (without Mobilization & Construction Surveying)		$745,000
Mobilization & Construction Surveying		$68,450
Contingency	30%	$224,000
Total, Construction		**$1,038,000**
Engineering Cost	25%	$260,000
Total Project Cost		**$1,298,000**

Notes:

1. Reflects estimated pavement section of 10" HMA over 3" open graded
2. Contingency includes costs related to erosion and sediment control, miscellaneous items, and aspects of work unidentified or unquantified to date.
3. Costs do not include VDOT administrative costs, financing, or staffing. Construction costs do not include environmental remediation (if needed), right-of-way acquisition, or utility relocations.
4. Estimate reflects development of preliminary design work products as of the date shown.
5. Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Total of Segments A, B, and C - From Frost Ave to Roebling Street (approximately 4011 ft)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$213,000	$213,000
00101	Construction Surveying	LS	1	$26,900	$26,900
00110	Clearing and Grubbing	LS	3	$50,000	$150,000
00585	Underdrain UD-2	LF	3,387	$13	$44,912
00595	Outlet Pipe	LF	312	$12	$3,775
01302	30" Conc. Pipe	LF	200	$95	$19,000
06xxx	Standard SWM-1	EA	2	$1,000	$2,000
06301	30" End Section ES-1	EA	2	$1,300	$2,600
09056	Manhole MH-1 or 2	EA	4	$433	$1,732
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	1,475	$31	$46,079
10062	Asphalt-Stabilized Open-Graded Material	TON	603	$70	$42,210
10628	Flexible Pave. Planing 0"-2"	SY	39,712	$16	$635,392
10635	Asphalt Concrete Ty. SM-12.5E	TON	3,535	$88	$312,494
10642	Asphalt Concrete Ty. BM-25.0A	TON	1,569	$74	$115,353
12020	Std. Curb CG-2	LF	7,431	$15	$114,437
12600	Std. Comb. Curb & Gutter CG-6	LF	1,551	$16	$24,273
13220	Hydr. Cement Conc. Sidewalk 4"	SY	370	$31	$11,543
14100	Removal of Sidewalk and Entrance	SY	50	$5	$250
14120	Removal of Comb. Curb and Gutter	LF	961	$13	$12,493
23600	NS Fence Chain Link (H=8' with Barbed Wire)	LF	1,000	$25	$25,000
23602	NS Gate FE-CL L=18' (H=8' with Barbed Wire)	EA	2	$1,000	$2,000
24265	NS Maintenance of Traffic	LS	1	$450,000	$450,000
24430	Demo. of Pavement (Flexible)	SY	6,426	$3	$17,350
27022	Topsoil Class B 2"	ACRE	1	$12,754	$12,754
27300	Sod	SY	4,081	$7	$28,649
27xxx	Plantings	LS	1	$150,000	$150,000
27451	Inlet Protection, Type A	EA	34	$263	$8,956

Concept Level Construction Cost Estimate

Warrenton Broadview Avenue - Access Management Study

Total of Segments A, B, and C - From Frost Ave to Roebling Street (approximately 4011 ft)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
27545	Storm Water Management Basin Excavation	CY	15,000	$7	$99,000
27566	Stormwater Management Riser Pipe	LF	12	$800	$9,600
50903	NS Traffic Signage	LS	3	$3,500	$10,500
51910	Sawcut	LF	20,494	$2	$38,939
52002	NS Traffic Signalization	EA	1	$250,000	$250,000
54100	NS Pavement Marking	LF	21,341	$2	$42,682
54300	Pavement Message Marking Elongated Arrow Single	EA	42	$122	$5,113
			Subtotal (without Mobilization & Construction Surveying)		$2,690,000
			Mobilization & Construction Surveying		$239,900
			Contingency	30%	$807,000
			Total, Construction		**$3,737,000**
			Engineering Cost	25%	$935,000
			Total Project Cost		**$4,672,000**

Notes:

1. Reflects estimated pavement section of 10" HMA over 3" open graded
2. Contingency includes costs related to erosion and sediment control, miscellaneous items, and aspects of work unidentified or unquantified to date.
3. Costs do not include VDOT administrative costs, financing, or staffing. Construction costs do not include environmental remediation (if needed), right-of-way acquisition, or utility relocations.
4. Estimate reflects development of preliminary design work products as of the date shown.
5. Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.
11. Assumes modification of existing signal, not replacement of all existing traffic signal equipment.
12. Assumes installation of new equipment at HAWK pedestrian signal.
13. Assumes installation of new equipment for actuated rapid flash pedestrian beacon.

Concept Level Construction Cost Estimate – No Mill and Overlay

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Segment A - From Frost Ave. to approximately 612 ft North (Entrance of Frost Diner)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$73,000	$73,000
00101	Construction Surveying	LS	1	$8,950	$8,950
00110	Clearing and Grubbing	LS	1	$50,000	$50,000
00585	Underdrain UD-2	LF	636	$13	$8,433
00595	Outlet Pipe	LF	78	$12	$944
01302	30" Conc. Pipe	LF	100	$95	$9,500
06xxx	Standard SWM-1	EA	1	$1,000	$1,000
06301	30" End Section ES-1	EA	1	$1,300	$1,300
09056	Manhole MH-1 or 2	EA	2	$433	$866
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	905	$31	$28,272
10062	Asphalt-Stabilized Open-Graded Material	TON	370	$70	$25,900
10635	Asphalt Concrete Ty. SM-12.5E	TON	157	$88	$13,879
10642	Asphalt Concrete Ty. BM-25.0A	TON	954	$74	$70,138
12020	Std. Curb CG-2	LF	1,908	$15	$29,383
12600	Std. Comb. Curb & Gutter CG-6	LF	1,551	$16	$24,273
13220	Hydr. Cement Conc. Sidewalk 4"	SY	332	$31	$10,288
14100	Removal of Sidewalk and Entrance	SY	50	$5	$250
14120	Removal of Comb. Curb and Gutter	LF	961	$13	$12,493
23600	NS Fence Chain Link (H=8' with Barbed Wire)	LF	500	$25	$12,500
23602	NS Gate FE-CL L=18' (H=8' with Barbed Wire)	EA	1	$1,000	$1,000
24265	NS Maintenance of Traffic	LS	1	$250,000	$250,000
24430	Demo. of Pavement (Flexible)	SY	2,635	$3	$7,115
27022	Topsoil Class B 2"	ACRE	0.4	$12,754	$5,102
27300	Sod	SY	1,640	$7	$11,513
27xxx	Plantings	LS	1	$50,000	$50,000

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Segment A - From Frost Ave. to approximately 612 ft North (Entrance of Frost Diner)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
27401	Erosion Control Riprap	TON	0	$100	$0
27451	Inlet Protection, Type A	EA	10	$263	$2,634
27545	Storm Water Management Basin Excavation	CY	7,500	$7	$49,500
27566	Stormwater Management Riser Pipe	LF	6	$800	$4,800
50903	NS Traffic Signage	LS	1	$3,500	$3,500
51910	Sawcut	LF	7,949	$2	$15,103
52002	NS Traffic Signalization	EA	1	$165,000	$165,000
54100	NS Pavement Marking	LF	6,154	$2	$12,308
54105	Erad. Of Exist. Pave. Markings	LF	6,277	$2	$15,253
54300	Pavement Message Marking Elongated Arrow Single	EA	15	$122	$1,826
				Subtotal (without Mobilization & Construction Surveying)	$895,000
				Mobilization & Construction Surveying	$81,950
				Contingency 30%	$269,000
				Total, Construction	**$1,246,000**
				Engineering Cost 25%	$312,000
				Total Project Cost	**$1,558,000**

Notes:

1. Reflects estimated pavement section of 10" HMA over 3" open graded
2. Contingency includes costs related to erosion and sediment control, miscellaneous items, and aspects of work unidentified or unquantified to date.
3. Costs do not include VDOT administrative costs, financing, or staffing. Construction costs do not include environmental remediation (if needed), right-of-way acquisition, or utility relocations.
4. Estimate reflects development of preliminary design work products as of the date shown.
5. Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.
11. Assumes modification of existing signal, not replacement of all existing traffic signal equipment.
12. Assumes installation of new equipment for actuated rapid flash pedestrian beacon.

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Segment B - From Entrance of Frost Diner to approximately 1732 ft North (Entrance to Moser Funeral Home)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$41,000	$41,000
00101	Construction Surveying	LS	1	$4,720	$4,720
00110	Clearing and Grubbing	LS	1	$50,000	$50,000
00585	Underdrain UD-2	LF	1,321	$13	$17,516
00595	Outlet Pipe	LF	132	$12	$1,597
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	266	$31	$8,310
10062	Asphalt-Stabilized Open-Graded Material	TON	109	$70	$7,630
10635	Asphalt Concrete Ty. SM-12.5E	TON	48	$88	$4,243
10642	Asphalt Concrete Ty. BM-25.0A	TON	287	$74	$21,100
12020	Std. Curb CG-2	LF	2,579	$15	$39,717
12600	Std. Comb. Curb & Gutter CG-6	LF	0	$16	$0
13220	Hydr. Cement Conc. Sidewalk 4"	SY	30	$31	$937
24265	NS Maintenance of Traffic	LS	1	$100,000	$100,000
24430	Demo. of Pavement (Flexible)	SY	1,866	$3	$5,038
27022	Topsoil Class B 2"	ACRE	0.3	$12,754	$3,826
27300	Sod	SY	1,202	$7	$8,438
27xxx	Plantings	LS	1	$50,000	$50,000
27451	Inlet Protection, Type A	EA	12	$263	$3,161
50903	NS Traffic Signage	LS	1	$3,500	$3,500
51910	Sawcut	LF	6,236	$2	$11,848
52002	NS Traffic Signalization	EA	1	$100,000	$100,000
54100	NS Pavement Marking	LF	7,343	$2	$14,686
54105	Erad. Of Exist. Pave. Markings	LF	7,490	$2	$18,200
54300	Pavement Message Marking Elongated Arrow Single	EA	13	$122	$1,583

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Segment B - From Entrance of Frost Diner to approximately 1732 ft North (Entrance to Moser Funeral Home)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
	Subtotal (without Mobilization & Construction Surveying)				$472,000
	Mobilization & Construction Surveying				$45,720
	Contingency			30%	$142,000
	Total, Construction				**$660,000**
	Engineering Cost			25%	$165,000
	Total Project Cost				**$825,000**

Notes:

1. Reflects estimated pavement section of 10" HMA over 3" open graded
2. Contingency includes costs related to erosion and sediment control, miscellaneous items, and aspects of work unidentified or unquantified to date.
3. Costs do not include VDOT administrative costs, financing, or staffing. Construction costs do not include environmental remediation (if needed), right-of-way acquisition, or utility relocations.
4. Estimate reflects development of preliminary design work products as of the date shown.
   Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.
11. Assumes installation of new equipment at HAWK pedestrian signal.

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Segment C - From Entrance to Moser Funeral Home to Roebling Street (1667 ft North)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$41,000	$41,000
00101	Construction Surveying	LS	1	$4,670	$4,670
00110	Clearing and Grubbing	LS	1	$50,000	$50,000
00585	Underdrain UD-2	LF	1,430	$13	$18,962
00595	Outlet Pipe	LF	102	$12	$1,234
01302	30" Conc. Pipe	LF	100	$95	$9,500
06xxx	Standard SWM-1	EA	1	$1,000	$1,000
06301	30" End Section ES-1	EA	1	$1,300	$1,300
09056	Manhole MH-1 or 2	EA	2	$433	$866
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	304	$31	$9,497
10062	Asphalt-Stabilized Open-Graded Material	TON	124	$70	$8,680
10635	Asphalt Concrete Ty. SM-12.5E	TON	54	$88	$4,774
10642	Asphalt Concrete Ty. BM-25.0A	TON	328	$74	$24,115
12020	Std. Curb CG-2	LF	2,944	$15	$45,338
12600	Std. Comb. Curb & Gutter CG-6	LF	0	$16	$0
13220	Hydr. Cement Conc. Sidewalk 4"	SY	8	$31	$245
23600	NS Fence Chain Link (H=8' with Barbed Wire)	LF	500	$25	$12,500
23602	NS Gate FE-CL L=18' (H=8' with Barbed Wire)	EA	1	$1,000	$1,000
24265	NS Maintenance of Traffic	LS	1	$100,000	$100,000
24430	Demo. of Pavement (Flexible)	SY	1,925	$3	$5,198
27022	Topsoil Class B 2"	ACRE	0.3	$12,754	$3,826
27300	Sod	SY	1,239	$7	$8,698
27xxx	Plantings	LS	1	$50,000	$50,000
27451	Inlet Protection, Type A	EA	12	$263	$3,161
27545	Storm Water Management Basin Excavation	CY	7,500	$7	$49,500
27566	Stormwater Management Riser Pipe	LF	6	$800	$4,800

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Segment C - From Entrance to Moser Funeral Home to Roebling Street (1667 ft North)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
50903	NS Traffic Signage	LS	1	$3,500	$3,500
51910	Sawcut	LF	6,309	$2	$11,987
54100	NS Pavement Marking	LF	7,844	$2	$15,688
54105	Erad. Of Exist. Pave. Markings	LF	8,001	$2	$19,442
54300	Pavement Message Marking Elongated Arrow Single	EA	14	$122	$1,704

Subtotal (without Mobilization & Construction Surveying)		$467,000
Mobilization & Construction Surveying		$45,670
Contingency	30%	$141,000
Total, Construction		**$654,000**
Engineering Cost	25%	$164,000
Total Project Cost		**$818,000**

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3. Costs do not include VDOT administrative costs, financing, or staffing. Construction costs do not include environmental remediation (if needed), right-of-way acquisition, or utility relocations.
4. Estimate reflects development of preliminary design work products as of the date shown.
5. Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Total of Segments A, B, and C - From Frost Ave to Roebling Street (approximately 4011 ft)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
00100	Mobilization	LS	1	$155,000	$155,000
00101	Construction Surveying	LS	1	$18,320	$18,320
00110	Clearing and Grubbing	LS	3	$50,000	$150,000
00585	Underdrain UD-2	LF	3,387	$13	$44,912
00595	Outlet Pipe	LF	312	$12	$3,775
01302	30" Conc. Pipe	LF	200	$95	$19,000
06xxx	Standard SWM-1	EA	2	$1,000	$2,000
06301	30" End Section ES-1	EA	2	$1,300	$2,600
09056	Manhole MH-1 or 2	EA	4	$433	$1,732
10017	Cement Stabilized Aggregate Base Material, Type I, Size No. 21A	TON	1,475	$31	$46,079
10062	Asphalt-Stabilized Open-Graded Material	TON	603	$70	$42,210
10635	Asphalt Concrete Ty. SM-12.5E	TON	259	$88	$22,896
10642	Asphalt Concrete Ty. BM-25.0A	TON	1,569	$74	$115,353
12020	Std. Curb CG-2	LF	7,431	$15	$114,437
12600	Std. Comb. Curb & Gutter CG-6	LF	1,551	$16	$24,273
13220	Hydr. Cement Conc. Sidewalk 4"	SY	370	$31	$11,543
14100	Removal of Sidewalk and Entrance	SY	50	$5	$250
14120	Removal of Comb. Curb and Gutter	LF	961	$13	$12,493
23600	NS Fence Chain Link (H=8' with Barbed Wire)	LF	1,000	$25	$25,000
23602	NS Gate FE-CL L=18' (H=8' with Barbed Wire)	EA	2	$1,000	$2,000
24265	NS Maintenance of Traffic	LS	1	$450,000	$450,000
24430	Demo. of Pavement (Flexible)	SY	6,426	$3	$17,350
27022	Topsoil Class B 2"	ACRE	1	$12,754	$12,754
27300	Sod	SY	4,081	$7	$28,649
27xxx	Plantings	LS	1	$150,000	$150,000
27451	Inlet Protection, Type A	EA	34	$263	$8,956

Concept Level Construction Cost Estimate - No Mill and Overlay

Warrenton Broadview Avenue - Access Management Study

Total of Segments A, B, and C - From Frost Ave to Roebling Street (approximately 4011 ft)

Warrenton, Virginia (printed) 02/26/13

Item Code	Description	Unit	Quantity	Unit Price	Amount
27545	Storm Water Management Basin Excavation	CY	15,000	$7	$99,000
27566	Stormwater Management Riser Pipe	LF	12	$800	$9,600
50903	NS Traffic Signage	LS	3	$3,500	$10,500
51910	Sawcut	LF	20,494	$2	$38,939
52002	NS Traffic Signalization	EA	1	$265,000	$265,000
54100	NS Pavement Marking	LF	21,341	$2	$42,682
54105	Erad. Of Exist. Pave. Markings	LF	21,768	$2	$52,896
54300	Pavement Message Marking Elongated Arrow Single	EA	42	$122	$5,113
			Subtotal (without Mobilization & Construction Surveying)		$1,832,000
			Mobilization & Construction Surveying		$173,320
			Contingency	30%	$550,000
			Total, Construction		**$2,556,000**
			Engineering Cost	25%	$639,000
			Total Project Cost		**$3,195,000**

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4. Estimate reflects development of preliminary design work products as of the date shown.
5. Estimate does not include the environmental mitigation measures.
6. Assumes compliance with current state statutes and DCR regulations regarding storm water management.
7. Assumes reuse of all signal equipment at the Broadview Ave/Frost Ave intersection.
8. Assumes no lighting improvements.
9. Assumes all existing features to remain are ADA compliant.
10. Assumes that design waivers and design exceptions for the proposed layout will be approved by VDOT, as needed.
11. Assumes modification of existing signal, not replacement of all existing traffic signal equipment.
12. Assumes installation of new equipment at HAWK pedestrian signal.
13. Assumes installation of new equipment for actuated rapid flash pedestrian beacon.