

Forest Hill Terrace

Neighborhood Transportation Study



DRAFT

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1

Executive Summary

In response to citizen request from the Forest Hill and Forest Hill Terrace neighborhoods, the City established a study team to investigate the impact of vehicle traffic on the neighborhood (speed and cut-through traffic), the existing accommodations for pedestrians, and the impact of special events in Forest Hill Park. The study team's mission was to evaluate the current state of safety and mobility for all users and identify strategies for improvement if warranted. The team's examination followed a multimodal approach vested in the City's Vision Zero Action Plan and Better Streets policy. The study focused on pedestrian safety and specifically on existing pedestrian accommodations to identify potential enhanced pedestrian connections.

With respect to vehicle speeds, the analysis revealed that vehicles are traveling on average below the posted speed limit. Less than 5% of vehicles are traveling greater than 5 mph over the speed limit, and less than 1% of vehicles are traveling greater than 10 mph over the speed limit. The City recently lowered the posted speed limit (prior to this study) on Forest Hill Avenue from 35 mph to 30 mph, which combined with other roadway conditions, encourage traffic calming.

The analysis also indicated that there is evidence to support claims of cut-through the Forest Hill neighborhood; however, the only evidence of consistent cut-through traffic is on W. 42nd Street (inclusive of the parallel and perpendicular cross-streets that feed the W. 42nd Street connection to Riverside Drive) during the morning peak. While occasional cut-through traffic may occur on other neighborhood streets in the event of significant traffic incidents on Forest Hill Avenue, there was no pattern of consistent cut-through on those other streets. The non-local composition of the 42nd Street cut-through traffic (estimated to be approximately 100 vehicles in the morning peak) is predominantly vehicles destined for

downtown via Riverside Drive and the Lee Bridge (US 301), with a smaller share destined for the James River Park System. Per aggregate travel time data, this neighborhood cut-through route offers considerable travel time saving potential of up to threefold compared to the Forest Hill Avenue – Semmes Avenue route. This behavior is difficult to deter without significant enforcement or an engineering solution to reverse the travel time discrepancy between the neighborhood cut-through and the path along urban arterials. From an engineering perspective, W. 42nd Street – and its parallel routes – are already calmed; the potential for an engineering calming solution lies on Riverside Drive. A master planning study of the entire Riverside Drive corridor is recommended to envision the typology, intersection control, and streetscaping of this corridor.

Per Richmond’s Vision Zero Action Plan, the City is committed to improve pedestrian safety, particularly on high injury designated streets such as Forest Hill Avenue. There has been one significant pedestrian crash on the study corridor in the few years since the Rectangular Rapid Flashing Beacons (RRFBs) were installed at W. 41st and W. 43rd Streets. This ambulatory injury crash occurred in November of 2018, at the W. 43rd Street crosswalk. According to both field observations and citizen input, there is a driver compliance issue at both of these RRFBs with drivers failing to yield to crossing pedestrians. Four pedestrian crossing improvement projects on Forest Hill Avenue (W. 41st Street, W. 43rd Street, Taylor Avenue, and W. 48th Street) are proposed to enhance existing pedestrian crossings and create new connections. The distance between pedestrian crossings will be reduced, the conspicuity of the existing RRFBs will be increased, traffic calming will be encouraged, and driver compliance to the RRFBs should improve.

Forest Hill Park is a regional park located within the neighborhood that hosts special events including the South of the James Farmer’s Market. These events influence the transportation conditions within the neighborhood. The market occurs every Saturday morning and attracts people from across the region. Market visitors park both within Forest Hill Park and on-street in the surrounding neighborhoods where they then walk to the park; most of this walking occurs within the streets due to the lack of sidewalks. While a clear definition of pedestrian walking space is ideal, this current system operates well due to the natural traffic calming that occurs from these three elements (moving vehicles, parked vehicles, and walking pedestrians) being present in the same narrow roadway. In essence, on Saturday mornings during the Farmer’s Market, the neighborhood streets become shared space streets, an urban design concept where all modes of travel share the same pavement space without defined mode segregation. Other than a single missing segment of sidewalk on New Kent Avenue, there is very little potential to add sidewalk due to constrained right-of-way. The existing, naturally occurring shared space streets are the most efficient manner in which to accommodate all modes of travel during the market time. The City could explore other parking strategies to encourage less (and/or eliminate) residential street market parking, including an expansion of the park’s paved parking area into the grass parking area (to increase efficiency) or the introduction of remote parking and shuttle service at George Wythe High School.



2

Introduction

Forest Hill Terrace is a residential neighborhood in the south of the James River in the City of Richmond, Virginia. The neighborhood is convenient to the James River Park System at Reedy Creek and Forest Hill Park. It sits between two major collector streets – Forest Hill Avenue and Riverside Drive and is bisected by New Kent Road, a neighborhood collector. In addition to local residential travel, both commuting traffic and visitors to the parks use the transportation systems.

2.1 Purpose

The City of Richmond (“City”) engaged VHB to conduct a transportation study of the Forest Hill Terrace neighborhood. The purpose of the study is to examine the impact of vehicle traffic on the neighborhood (speed and cut-through traffic), the existing accommodations for pedestrians, and the impact of special events in Forest Hill Park. Pedestrian safety was evaluated, focusing on existing pedestrian accommodations and other factors to identify the potential for enhanced pedestrian connections.

2.2 Study Area

The Forest Hill Terrace neighborhood is bound by Westover Hills Boulevard to the west, W. Roanoke Street to the east, Reedy Avenue / Dunston Avenue to the south, and Riverside Drive to the north. The City identified five roadway corridors within this neighborhood as important data collection and analysis zones.

1. Forest Hill Avenue (from Westover Hills Boulevard to W. Roanoke Street)
2. Reedy Avenue (from Westover Hills Boulevard to W. 43rd Street)
3. Dunston Avenue (from W. 43rd Street to W. Roanoke Street)
4. W. 42nd Street (from Forest Hill Avenue to New Kent Avenue)
5. New Kent Avenue (from Westover Hills Boulevard to W. 42nd Street)

The pedestrian safety component of the study primarily focused on the Forest Hill Avenue corridor, while the vehicle impact component focused on the remaining four corridors.

Figure 1 shows the project study area and the aforementioned five notable road corridors.

2.3 Study Methodology

On Tuesday, March 5th, VHB participated in a Forest Hill Avenue corridor walk-through with City Department of Public Works staff, 4th District Councilwoman Larson, officers from the Richmond Police Department, and local citizens. During this onsite meeting, the various parties present spoke about their experience living in the neighborhood, voiced their local transportation concerns and desires, and asked questions. VHB utilized the input collected at this kickoff meeting to help guide the direction and objectives of the remainder of the study. The full set of notes from this meeting are summarized in **Appendix A**; some of the major input gathered includes:

- › Concerns about drivers yielding to pedestrians at crosswalks
- › Concerns about cut-through traffic on neighborhood residential streets
- › Concerns about pedestrian connectivity

In addition to the input gathered from neighborhood residents, VHB collected vehicular speed and volume data on the four vehicle impact corridors (Wednesday, March 20th) as well as vehicular (Wednesday, March 20th) and pedestrian volume (Tuesday and Wednesday, March 26th-27th) data on the Forest Hill Avenue corridor. VHB obtained crash information from the online statewide crash database maintained by the Department of Motor Vehicles and the Virginia Department of Transportation (VDOT).

VHB utilized several documents to guide the study process. These documents include:

- › City of Richmond *Vision Zero Action Plan*
- › City of Richmond *Better Streets*
- › VDOT's *Traffic Calming for Neighborhood Streets*

Using the principles and guidelines in these documents, VHB analyzed the collected data and identified a series of potential improvement concepts to promote traffic calming and pedestrian safety.

Figure 1 Project Study Area





3

Vehicle Impacts

One of the five fundamental principles of Richmond’s Vision Zero Action Plan is “[that] speed is recognized and prioritized as the fundamental factor in crash severity.” The intent of traffic calming measures is to slow vehicular speeds on residential streets to make the street safer for all users while still maintaining full access for residents. Traffic calming measures should not be placed everywhere; Vision Zero is a data-driven process that prioritizes available resources to target quantified safety needs.

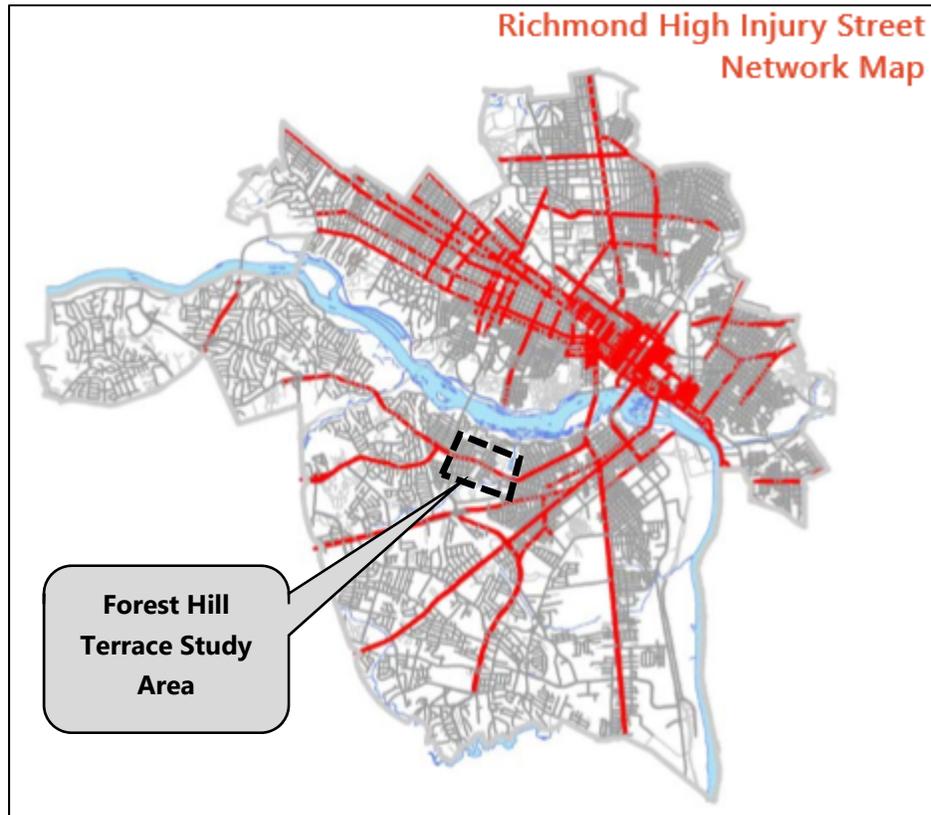
3.1 Data Collection

3.1.1 Crash History

Vision Zero places a strong emphasis on mitigating – and eventually fully eliminating – fatal and serious injury crashes (“KA crashes”), which are acknowledged to be preventable. The *Vision Zero Action Plan* identifies the high injury street network (**Figure 2**), which comprises a collection of streets that represents only 16% of the road mileage within the City, but accounts for 58% of fatal and serious injury crashes. Forest Hill Avenue (from Chippenham

Parkway to Semmes Avenue) is included in this high injury street network; however, there was only one KA crash that occurred on the study segment portion of Forest Hill Avenue through the Forest Hills Terrace neighborhood in the 2015-2018 period – a pedestrian crash in the fall of 2018, when a vehicle struck two pedestrians in a crosswalk on Forest Hill Avenue at 43rd Street. During the same four-year time period, approximately 1,000 KA crashes occurred across the City.

Figure 2 Vision Zero Crash Map



Source: Richmond *Vision Zero Action Plan* page 8.

3.1.2 Speed

The study team collected 24-hours of vehicular speed and volume data on the four vehicle impact road corridors on Wednesday, March 20th. This calendar date represented a typical day for the area (i.e., local schools were in session, weather was dry, and there were no construction projects or other roadway disturbances).

The collected speed data is binned in 5 mile per hour (“mph”) increments (i.e., “X” vehicles traveled between 20 and 25 mph). VHB analyzed the speed data by computing several typically utilized speed summary metrics, including 15th and 85th percentile speeds, median and average speeds, 10 mph pace speed (the 10 mph range of speeds in which the majority of traffic travels), and the percentage of traffic traveling faster than speeds incrementally greater than the posted speed limit. **Tables 1-2** show these computed metrics for the four study corridors.

Table 1 Speed Summary Part 1

Speed Metric	New Kent Avenue		W. 42 nd Street	
	East	West	North	South
15 th Percentile Speed	18.0 mph	17.1 mph	15.8 mph	15.4 mph
85 th Percentile Speed	27.1 mph	25.9 mph	24.4 mph	24.0 mph
Median Speed	22.6 mph	22.0 mph	20.4 mph	19.9 mph
Average Speed	22.5 mph	21.8 mph	20.2 mph	19.7 mph
10 MPH Pace Speed	20 to 30 mph	15 to 25 mph	15 to 25 mph	15 to 25 mph
Vehicles in Pace	397 (75.9%)	314 (77.3%)	368 (81.2%)	375 (81.5%)
Vehicles > 25 MPH	130 (24.9%)	73 (18.0%)	45 (9.9%)	29 (6.3%)
Vehicles > 30 MPH	9 (1.7%)	8 (1.9%)	1 (0.2%)	2 (0.4%)

New Kent Avenue: speeds recorded on the Woodbine Road – W. 45th Street block.

W. 42nd Street: speeds recorded on the Stonewall Avenue – Springhill Avenue block.

Table 2 Speed Summary Part 2

Speed Metric	Reedy Avenue		Dunston Avenue	
	East	West	East	West
15 th Percentile Speed	14.4 mph	15.9 mph	15.9 mph	15.9 mph
85 th Percentile Speed	22.0 mph	24.5 mph	27.1 mph	27.9 mph
Median Speed	17.8 mph	20.4 mph	21.7 mph	22.1 mph
Average Speed	17.9 mph	20.3 mph	21.6 mph	21.9 mph
10 MPH Pace Speed	15 to 25 mph	15 to 25 mph	15 to 25 mph	15 to 25 mph
Vehicles in Pace	95 (81.9%)	164 (81.2%)	122 (67.0%)	87 (60.0%)
Vehicles > 25 MPH	1 (0.9%)	21 (10.4%)	41 (22.5%)	43 (29.7%)
Vehicles > 30 MPH	0 (0%)	2 (1.0%)	8 (4.2%)	6 (4.0%)

Reedy Avenue: speeds recorded on the W. 46th Street – W. 45th Street block.

Dunston Avenue: speeds recorded on the W. 41st Street – W. Roanoke Street block.

3.2 Speed Evaluation

3.2.1 Data Analysis

VDOT’s *Traffic Calming Guide*, while not enforceable within the City (due to the City maintaining its own streets), is a good resource for conducting traffic calming studies. According to that guide, one of the criteria to determine if a street is suitable for traffic calming is whether the 85th percentile operating speed for the street exceeds a value 10 mph over the posted speed limit. As seen in Tables 1-2, the highest 85th percentile operating speed on the four traffic calming streets in the Forest Hill Terrace neighborhood is 27.9 mph – a value less than 3 mph over the 25-mph posted speed limit. Per the VDOT guide, none of these streets have a speeding issue; and therefore, additional traffic calming would not be warranted.

The data in Tables 1-2 reinforces the conclusion that persistent speeding is not a concern on these four streets. The average speeds on all eight directions of travel on these four streets fall below the posted 25-mph speed limit. The 10-mph pace speed for seven of the eight directions is between 15 and 25 mph, indicating that more traffic is traveling between 15 and 20 mph on these segments than between 25 and 30 mph. The one exception is eastbound New Kent Avenue where the pace speed is 20 to 30 mph. Finally, the data indicates that on three of the four corridors (excluding Dunston Avenue), less than 2% of traffic travels greater than 5 mph over the posted speed limit (on Dunston Avenue it is approximately 4% of traffic). Of those vehicles that exceeded 30 mph, only three vehicles across all four corridors exceeded 35 mph – these three vehicles all traveled between 35 and 40 mph (not shown in Tables 1-2). The complete set of speed study data for these corridors is included in **Appendix B** of this report.

3.2.2 Recommendations

On March 25th, as part of Mayor Stoney's Safe and Healthy Streets Challenge and the Vision Zero plan, the City lowered the posted speed limit on several major streets including Forest Hill Avenue. The City lowered the speed limit on Forest Hill Avenue from 35 mph to 30 mph.

On the four neighborhood streets examined in this study, the data does not suggest any need for further traffic calming infrastructure or techniques to slow vehicular speeds. There are already several traffic control devices (all-way stops at numerous intersections and a traffic mini-circle on Reedy Avenue at the W. 47th Street intersection) and traffic calming measures (e.g., a speed hump on Dunston Avenue just west of the Reedy Creek bridge) in place on these streets that help calm speeds.

A significant component of Vision Zero is education that leads to a shift in safety culture. In fact, one of Richmond's three Vision Zero action categories is culture, which incorporates communication, education, and training. Bike Walk RVA, a bicyclist and pedestrian advocacy group within the Richmond Sports Backers organization, developed yard signs such as the one shown in **Photo 1** to educate drivers and help encourage this safety culture shift. Several of these signs have been distributed throughout the Forest Hill Terrace neighborhood. Initiatives such as this are just as important as any engineering solutions, and VHB recommends that neighbors continue the dialogue on driving slowly and safely.

Photo 1 Public Culture Outreach: Speed



3.3 Cut-Through Traffic

3.3.1 Data Analysis

One of the concerns voiced by local citizens during the corridor walk-through was cut-through traffic, both during daily commuting hours (to bypass Forest Hill Avenue) and during the summer months (to access Riverside Drive and the James River Park System). The concern during commuting hours is that traffic utilizes W. 42nd and W. 43rd Streets to get to Riverside Drive, and New Kent Avenue, Dunston Avenue / Reedy Avenue as alternatives to a congested Forest Hill Avenue.

Origin-destination was not collected as part of this study. Observations were made, but there was no specific vehicle tracking through the neighborhood as part of this analysis. To determine whether there may be significant cut-through traffic, VHB relied on a comparison of actual traffic volumes to anticipated traffic volumes for the adjacent land use. Specifically, VHB utilized the Institute of Transportation Engineer's *Trip Generation Guide, 10th Edition* to estimate the anticipated number of vehicle trips that would be generated by the neighborhood homes. Any excess traffic compared to the recorded street volume may represent cut-through traffic. **Table 3** shows the results of this analysis. A caveat to this cut-through estimation process is that the recorded traffic volumes represent a single day of traffic. It is conceivable that additional neighborhood cut-through traffic occurs on days when there are crashes or other incidents along Forest Hill Avenue.

Table 3 Cut-Through Traffic Quantification

	New Kent Avenue	W. 42 nd Street	Reedy Avenue	Dunston Avenue
Number of Homes ¹	315	115	115	50
Weekday Anticipated Trips ²	3,000	1,100	1,200	600
Weekday Actual Volume ³	930	940	325	340
AM Peak Anticipated Trips ²	225	75	75	50
AM Peak Actual Volume ³	130	175	40	50
PM Peak Anticipated Trips ²	300	100	125	50
PM Peak Actual Volume ³	115	105	30	35

¹ Number of Homes: The estimated number of homes along each street corridor that utilize the street to access their property.

² The number of weekday, AM peak hour, or PM peak hour trips that are expected for the number of homes per *Trip Generation Guide, 10th Edition*.

³ The recorded daily, AM peak hour, or PM peak hour vehicular volume on the street.

As shown in Table 3, the only recorded volume that is higher than the anticipated number of trips in the corresponding time period is on W. 42nd Street during the AM peak hour. On this street, the recorded volume is 133% greater (175 vehicles) than the anticipated number of vehicle trips (75). On the remaining streets and time periods, the recorded vehicle volume is less than the anticipated number of vehicle trips.

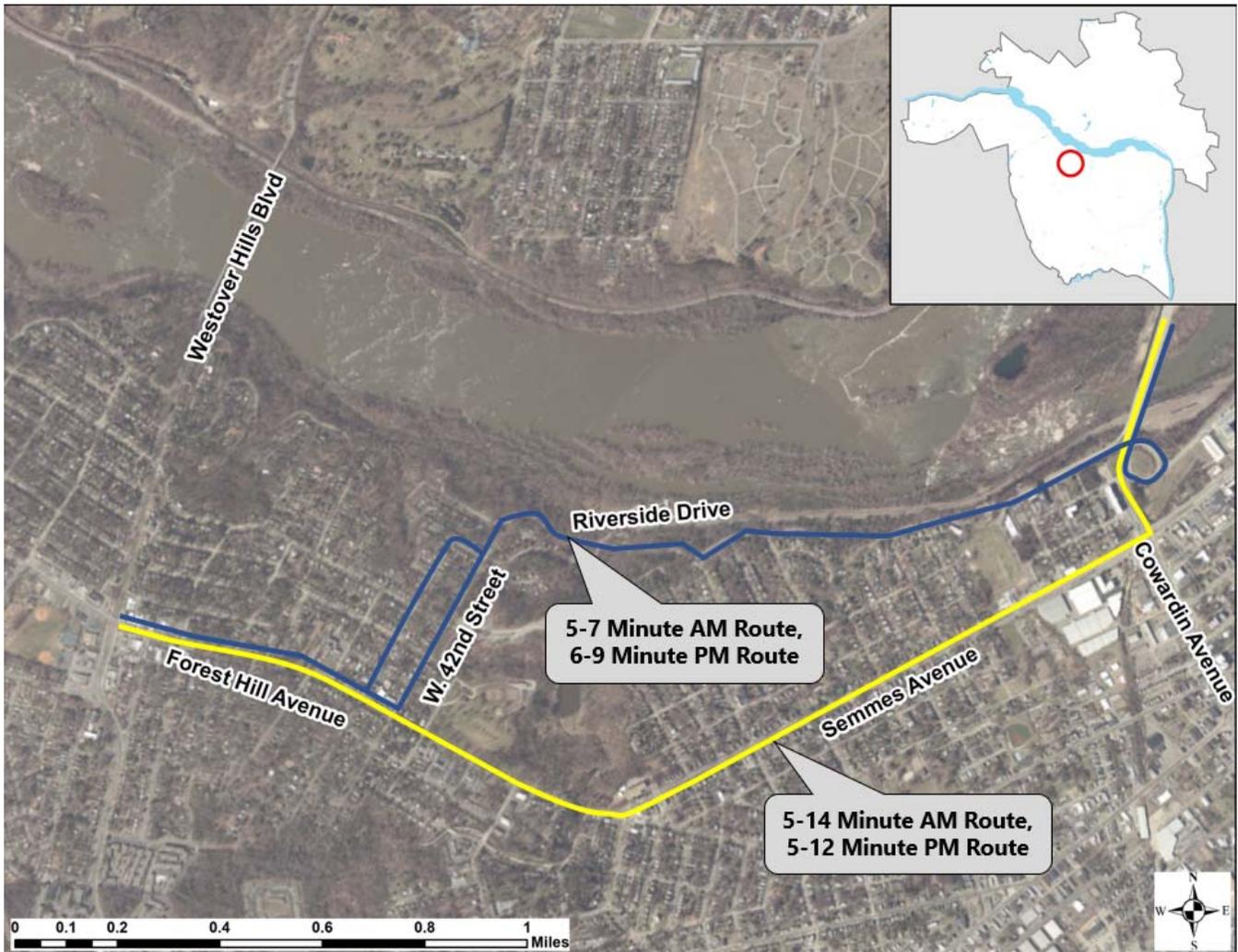
The data suggests that the neighborhood streets west of W. 42nd Street are not being used as an alternative to Forest Hill Avenue. The analysis does not show a similar disparity between actual and anticipated volumes on the parallel routes to Forest Hill Avenue (i.e., New Kent Avenue) like the one revealed on W. 42nd Street. This finding suggests that the inflated volumes on 42nd Street represent vehicles destined toward Riverside Drive to avoid the signal control – and associated queues and delay – on the eastern end of the corridor at W. Roanoke Street, Semmes Avenue, and Cowardin Avenue.

There are a couple of potential explanations for this higher traffic volume on W. 42nd Street. First, signs on Forest Hill Avenue direct traffic to the James River Park System via this street, which may explain off-peak non-local traffic, but this is most likely not a significant portion of the peak commuting period. Second, a review of aggregate travel time data indicates that the path through the neighborhood via W. 42nd Street / Riverside Drive / Lee Bridge is more reliable in the morning than the arterial route of Forest Hill Avenue / Semmes Avenue / Lee Bridge (see **Figure 3**).

According to FHWA (Federal Highway Administration), travel time reliability is the consistency or dependability of travel times on a day-to-day basis. Some days there may be no traffic congestion and travel is fast; other days there may be traffic congestion and the travel time substantially increases. With no accurate way of predicting which condition will occur on a given time and day, drivers must plan for the longer travel time condition. This range of travel time, or allocated time cushion, is often called a buffer.

According to the data, the buffer travel time during the AM peak on the Riverside Drive cut-through route is 5-7 minutes, while on the arterial route it is 5-14 minutes. In the PM peak, the buffer on the Riverside Drive route is 6-9 minutes, while on the arterial Semmes Avenue route it is 5-12 minutes. From a travel time reliability standpoint, the cut-through route offers a more consistent and likely faster travel time, which makes it easier for drivers to plan their travel. Drivers may also be selecting the Riverside Drive route due to perceived visual cues such as long vehicles queued on Forest Hill Avenue from red traffic signal displays at W. Roanoke Street and Semmes Avenue. Conversely, Riverside Drive has no intersection control that would stop traffic along Riverside Drive between W. 42nd Street and the Lee Bridge.

Figure 3 Cut-Through Traffic Routing



An additional concern raised by neighborhood residents is cut-through traffic on W. 45th Street, Archer Avenue, and Woodbine Road. The residents are concerned that drivers who are apparently looking for a way to access Riverside Drive turn from New Kent Avenue north onto W. 45th Street only to discover that neither Archer Avenue nor Woodbine Road connect to Riverside Drive. There are two groups of people who these drivers might represent: either

the routine commuter who might make this routing mistake once but will not repeat it; or, the infrequent visitor who might be looking for the James River Park System or an alternate route to Forest Hill Avenue.

James River Park System guide signs are located at the intersection of Forest Hill Avenue and W. 42nd Street; however, a driver coming from the west does not see any advance guide signage and may turn into the neighborhood prior to W. 42nd Street. New park system guide signage located at Prince George Road and/or Cedar Lane may help direct visitors to the W. 42nd Street turn from Forest Hill Avenue and thus away from W. 45th Street. At the New Kent Avenue / W. 45th Street intersection, there are difficulties associated with installing a new effective sign. A standard or modified regulatory sign such as "Local Traffic Only" is not specific and is ineffective without enforcement, which is very difficult with these types of signs. Placement of a "No Outlet" sign would be inaccurate since there are alternate outlets. And use of a more specific warning sign that potentially reads "No Access to Riverside Drive" while likely more effective may be out of context for the neighborhood setting. In order to meet MUTCD (Manual on Uniform Traffic Control Devices) standards for font lettering size, the rectangular sign size would likely be in the magnitude of five feet by three feet.

VHB examined various other origin-destination combinations using the aggregate travel time data to determine if there were any other cut-through routes in the Forest Hill Terrace neighborhood that on average are faster than Forest Hill Avenue. On a typical average day, there were no other routes beyond the Riverside Drive route already mentioned. Dunston Avenue and Reedy Avenue are less-likely to attract cut-through traffic since the W. Roanoke Street / Midlothian Turnpike route is normally faster for trips originating/destined south of Forest Hill Avenue.

3.3.2 Recommendations

W. 42nd Street – and its parallel feeder routes – is the only study corridor on which data analysis indicates that there is potential for consistent non-local traffic. The apparent sources of this non-local traffic are the James River Park System (off-peak) and utilization of Riverside Drive to access the Lee Bridge (peak). W. 42nd Street is signed on Forest Hill Avenue as the access to the park system via Riverside Drive; the only way to mitigate this non-local volume would be to sign a different access point. Unfortunately, the most direct access points to the park system are via residential streets such as W. 42nd Street in the Forest Hill neighborhood or W. 30th Street in the Woodland Heights neighborhood. The only other access points to the park system are the partial Lee Bridge interchange at the eastern terminus of Riverside Drive (only provides access to/from the north) or the residential-character western terminus of Riverside Drive at Westover Hills Boulevard. The City and neighborhoods can engage in dialogue about where to best sign access to the park system; however, there does not appear to be a clear better option than W. 42nd Street.

In regard to cut-through traffic on W. 42nd Street – and its parallel feeder routes – that is utilizing Riverside Drive to bypass Forest Hill Avenue / Semmes Avenue, the traditional method to discourage such behavior is to slow down the residential neighborhood route to make it less attractive to cut-through drivers. Passive signage solutions (such as the introduction of "Local Traffic Only" signs on W. 42nd Street at Forest Hill Avenue) are

generally ineffective long-term and are difficult to enforce. W. 42nd Street already has traffic calming measures such as on-street parking and intersection control such as all-way stops that decrease cut-through attractiveness. Riverside Drive does not currently have any traffic calming measures other than its winding horizontal geometry, nor is there any mainline intersection control. The road is designated as a parkway typology per the City's Better Streets Manual, which means that the preferred lane widths for Riverside Drive are 10 feet – a width that will encourage traffic calming. The existing lane widths appear to vary between 11.5 feet and 15 feet; however, the extra width appears to be mostly present in the horizontal curves whereas on tangent road segments the total road cross-section appears to be 24 feet. At this cross-section width, the 4 feet of surplus pavement (with two 10-foot travel lanes) is insufficient to designate as another use such as a bike lane. Other forms of traffic calming such as intersection control do not appear to fit the typology of the road either. Additionally, these potential traffic calming elements are unlikely to decrease the attractiveness of this route significantly enough to overcome the potential threefold travel time savings (5 versus 14 minutes). The City and local communities may want to pursue a broader master planning of the Riverside Drive corridor to re-envision the corridor's typology, intersection control, and streetscaping.

3.4 Forest Hill Park Events - South of the James Farmer's Market

The South of the James Farmer's Market is an extremely popular market that operates on Saturday mornings in Forest Hill Park. While the market operates year-round, the May to October summer hours are longer and more popular than the November to April winter hours. While many market attendees walk to the market from within the neighborhood or bike to Forest Hill Park, many also drive and require parking. There are several hundred off-street parking spaces within the park at the market. Parking lot circulation and operations are handled by several event staff employees (within the site) and by a police officer (W. 42nd Street / New Kent Avenue intersection). Many market attendees also overflow park on the residential streets adjacent to the park.

Photo 2 On-Site Parking Management



VHB observed the parking and traffic operations associated with the market on Saturday, May 18th. During this site visit, VHB observed market on-street parking occurring on the blocks bound by Forest Hill Avenue and Hillcrest Road, and by W. 41st Street and W. 44th

Street. While the market is heavily attended, VHB did not observe significant vehicle circulation within the neighborhood; in other words, drivers are generally finding a parking space (either within the park or on-street) on their first pass through the area.

During the kickoff community meeting held for this study, one of the concerns associated with the market conditions was narrow streets that were perceived to not be able to accommodate on-street parking on both sides of the street, two-way vehicular traffic, and pedestrian traffic. Most of the streets adjacent to the park where on-street market parking occurs do not have sidewalks, which is an infrastructure condition that necessitates pedestrians either walking in the street or on the edge of property front yards. Having observed market conditions, the typical cross-section for these streets (30 feet curb to curb) is in fact too narrow to accommodate all of these users with vehicles moving at speed; however, these conditions appear to be working well during these special events when there is an increased presence of pedestrians and an even greater desire for lower speeds.

On Saturday mornings during the market, the streets adjacent to Forest Hill Park essentially become shared space streets. Pedestrians, bicyclists, parked vehicles, and moving vehicles are all sharing the same space. The narrow travel-way left for moving vehicles naturally imposes a significant traffic calming effect on drivers; an effect that heightens the comfort of pedestrians walking to/from the market. Vehicles moving at higher speeds (due to wider travel-way) would increase the exposure and discomfort of pedestrians.

Photo 3 Effective Shared Street Space



Due to the street widths and reliance of these homes on street-parking, the only way to move pedestrians off-street would be to install sidewalks in homeowners' front yards – an approach that is a long-term, costly investment that would likely require undesirable property acquisition. The alternative is to prohibit one side of on-street parking on every street during the market and to demark with cones a pedestrian walkway on that side of the street, as currently done within the park access. The issue with this approach is the loss of parking supply for both the market and the residents; the extent of market parking would likely spread outward farther from the park into the neighborhood. The current situation, where conditions naturally create traffic calming that accommodates a level of comfort for all modes of travel, appears to be the best option moving forward.

Other parking strategies that could be explored in more detail by the City (Department of Parks, Recreation, and Community Facilities) and the South of the James's Farmer's Market include expansion of Forest Hill Park's paved parking area or the introduction of remote parking. Currently on Saturday mornings, event staff for the Farmer's Market first direct traffic to fill the paved parking lot and then to fill the grass parking area located northwest of the paved parking lot. While the grass parking area provides additional parking capacity, the utilization of the space (i.e., square footage available for parking) is inherently less efficient than a marked, paved parking area. Creation of more parking capacity within the park could lead to fewer vehicles parked on the street within the neighborhood, particularly if the parking expansion occurs simultaneously with the introduction of residential permit parking. The downside of this parking expansion concept includes the long-term, high cost investment, the potential loss of vegetation currently in the space, and the surplus parking supply that will likely exist the 164 hours of the week that the market is not in session.

Photo 4 Demarked Pedestrian Space Entering the Market



The introduction of remote parking could also help alleviate the parking deficit during the Farmer's Market. George Wythe High School, located less than a mile and a half from the park, has more than 200 City-owned parking spaces that are unused on Saturday mornings. The City and the Market could come to an arrangement whereby market-goers could park at the school and be shuttled (10-minute shuttle loop) between the school and park.



4

Pedestrian Study

Another one of the five fundamental principals in the Richmond Vision Zero Action Plan is: “Traffic deaths and severe injuries are acknowledged to be preventable.” Recent pedestrian crashes, future development along the corridor, and a call to action to protect and encourage pedestrian activity encourage the introduction of initiatives to improve the pedestrian experience along the corridor.

4.1 Existing Pedestrian Infrastructure and Land Use

4.1.1 Pedestrian Infrastructure

Within the vicinity of the project site, sidewalks exist along both sides of Forest Hill Avenue. Curb ramps exist at all the street crossings, intersections, and driveways; however, truncated dome tactile pads accompany only a few of the curb ramps and some show clear signs of degradation. Several sections of sidewalk do not meet ADA (Americans with Disability Act) regulations due to the presence of obstacles such as bus stop benches, overgrown vegetation, or tree roots that narrow the available walking zone or cause trip hazards (see **Photo 5**).

Photo 5 Existing Sidewalk Infrastructure



Five locations along the Forest Hill Avenue study corridor have marked crosswalks. Two of these locations have Rectangular Rapid Flashing Beacons (RRFBs), two have pedestrian countdown heads at signalized crossings, and one is an uncontrolled midblock brick crosswalk – a design that is in conflict with the recently adopted Better Streets Manual, which states to not use brick style crosswalks. **Figure 4** displays the existing pedestrian infrastructure along Forest Hill Avenue.

An RRFB is a supplemental warning device that alerts drivers to the presence of a crossing pedestrian via an irregular flashing light pattern. RRFBs are pedestrian-actuated, which mean that the flash pattern only activates when a pedestrian pushes the actuation button on the device. RRFBs differ from regulatory devices such as traffic signal control (e.g., Pedestrian Hybrid Beacons [PHBs]), which legally require drivers to stop on a red signal indication.

4.1.2 Other Modes of Transportation Infrastructure

GRTC (Greater Richmond Transit Company) transit stops and on-street bicycle lanes are also present on the corridor, as seen in **Photo 6**. **Figure 5** shows the limits of the bike lanes as well as the location of the GRTC bus stops, which are typically found in pairs on opposing sides of the street. Five of the bus stops are near an adjacent marked crosswalk across Forest Hill Avenue; however, the remaining bus stops along the corridor lack an adjacent Forest Hill Avenue marked pedestrian crossing. These stops lacking nearby marked pedestrian street crossings are located near pedestrian generators including a church, a senior care facility, and restaurants (see **Figure 6**).

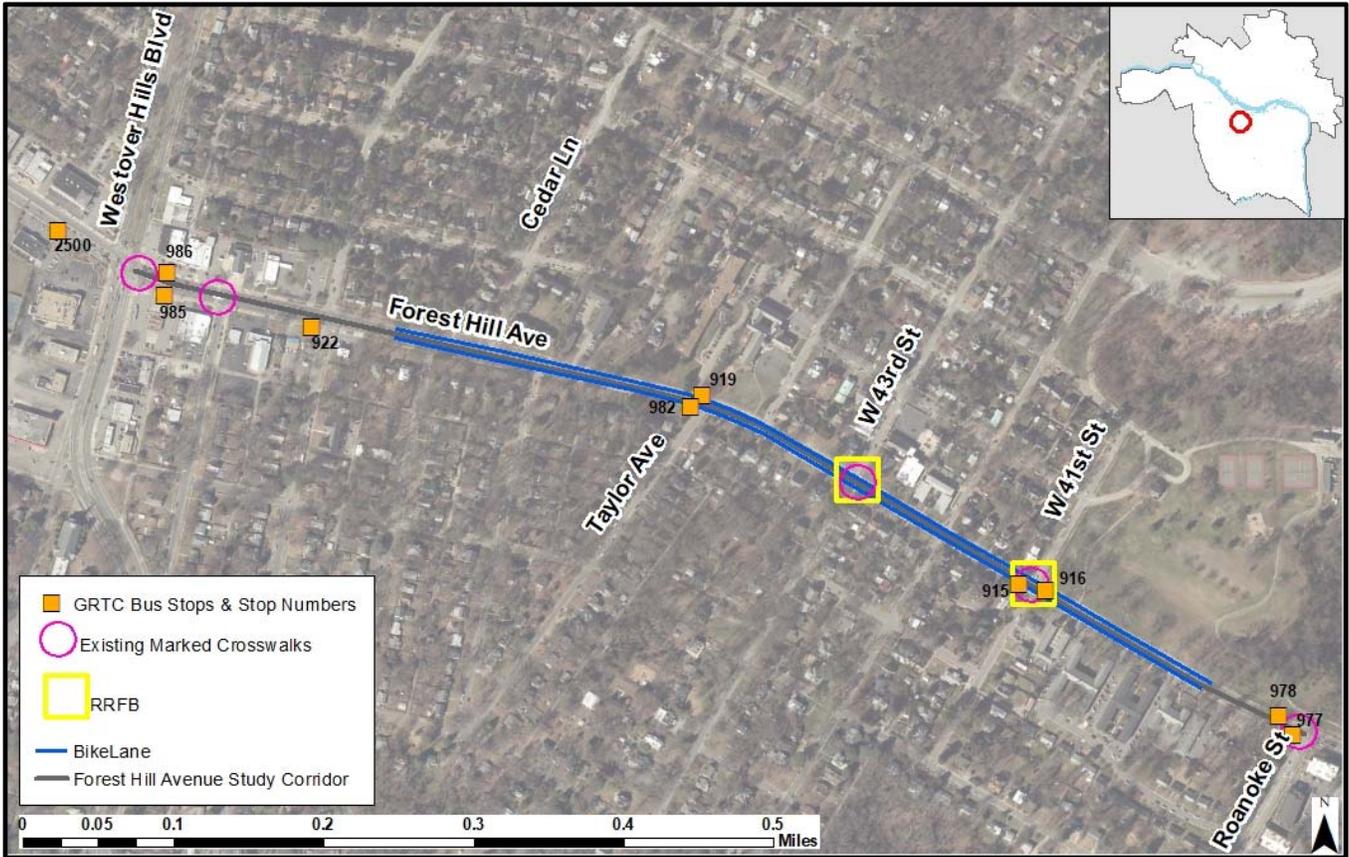
Figure 4 Forest Hill Avenue Pedestrian Infrastructure



Photo 6 Multi-Modal Infrastructure at Forest Hill Avenue / W. 41st Street



Figure 5 Forest Hill Avenue Multi-Modal Infrastructure



The GRTC ridership numbers, as seen in **Table 4**, labeled “2018 Boarding” and “2018 Alighting”, represent the average number of riders getting on and off at each stop, per week.

Table 4 Forest Hill Avenue Bus Stop Ridership

GRTC Stop Number	Direction	Stop Location	2018 Boarding ¹	2018 Alighting ¹
2500	Eastbound	Dialysis Center	78	80
978	Westbound	W. Roanoke Street	53	75
916	Westbound	W. 41 st Street	10	21
919	Westbound	W. 44 th Street	19	72
986	Westbound	Westover Hills Boulevard	178	191
985	Eastbound	Westover Hills Boulevard	195	194
922	Eastbound	W. 47 th Street	56	22
982	Eastbound	Taylor Avenue	43	11
915	Eastbound	W. 41 st Street	25	16
977	Eastbound	W. Roanoke Street	70	36

¹ Weekly average ridership across Fall 2018, after the GRTC route restructuring.

Stops 985 and 986, those closest to the Westover Hills Boulevard and Forest Hill Avenue intersection, have the highest weekly ridership numbers. The ridership values indicate that people are utilizing public transit along the corridor. The two stops closest to Westover Hills Boulevard have the only two shelters along the corridor. Some of the remaining stops have a bench and/or a trashcan, while the rest just have a bus stop sign.

4.1.3 Land Use and Pedestrian Generators

Currently there is a mix of residential, commercial, and institutional land uses along Forest Hill Avenue. These land uses contain pedestrian generators such as residential neighborhoods, restaurants, shops, special services, convenience stores, and parks. Also along the corridor are churches, an elementary school, and a senior living center, land uses which can increase the presence of the more vulnerable populations (i.e., children and the elderly). These land uses can also increase pedestrian activity during specific peaks throughout the week such as school start and end times and Sundays during church services. Another pedestrian generator is the South of the James Farmers Market, which is open all year with varying hours depending on winter and summer months. Forest Hill Park is an important regional amenity, attracting recreational users, many on foot, from the surrounding neighborhoods. **Figure 6** displays the pedestrian generators located along and near Forest Hill Avenue.

Figure 6 Forest Hill Avenue Pedestrian Generators



4.2 Data Analysis

4.2.1 Pedestrian Activity

VHB conducted video surveillance on March 26th – March 27th, which consisted of cameras stationed at four intersections to study RRFB vehicle compliance and pedestrian and bicycle activity. The cameras were stationed at both intersections with the RRFBs: W. 41st Street and W. 43rd Street, as well as the Taylor Avenue and W. 48th Street intersections. **Table 5** indicates the amount of pedestrian activity at each of the intersections during the peak hours of 7:00 AM – 9:00 AM and 4:00 PM – 6:00 PM.

Photo 7 Pedestrian Activity



Table 5 Pedestrian Activity Crossing Forest Hill Avenue

Pedestrian Crossing	AM Volume (7-9 AM)	PM Volume (4-6 PM)
RRFB at W. 41 st Street	3	14
RRFB at W. 43 rd Street	2	6
Forest Hill Avenue at W. 48 th Street	1	6
Forest Hill Avenue at Taylor Avenue	3	2

The highest volume of pedestrian activity recorded during peak hours was between 4:00-6:00 PM at the W. 41st Street RRFB crosswalk, when 14 pedestrians crossed Forest Hill Avenue. A small quantity of pedestrians crossed Forest Hill Avenue at Taylor Avenue, where there are no marked crosswalks, to access the bus stops on either side of the street. Bus stops that do not have a crosswalk near them deter pedestrians from accessing the stops in the safest way possible, which would be crossing at the nearest crosswalk, and instead leads pedestrians to access the stops in the quickest most direct path possible, which involves crossing Forest Hill Avenue where there is no marked crosswalk. There are also pedestrians crossing at W. 48th Street, some of whom are using the narrow median as a pseudo pedestrian refuge island. Near the marked crosswalk at this location, pedestrians were

observed running across the street to avoid oncoming traffic and jaywalking to take a direct path to their destination, regardless of the presence of the nearby crosswalk.

4.2.2 South of the James Farmers Market

VHB conducted site observations on May 18th from 8:00 AM – 12:00 PM at the South of the James Farmers Market. From 10:00-10:30 AM a consistent stream of pedestrians, bicyclists and automobiles entered the farmers market entrance at W. 42nd Street and New Kent Avenue. The area directly around the entrance of the farmers market lacks sidewalks and forces pedestrians to walk in the street or on the grass – often in local homeowner’s lawns. At the entrance, event staff set up a roped off curbside “sidewalk” for pedestrians to enter and exit. After 10:30 AM, waves of large groups of pedestrians entered and exited the farmers market. Many of the pedestrians walking into the farmers market drove and parked in the adjacent neighborhood and then walked a short distance to reach the farmers market.

Photo 8 Pedestrian Activity



Photo 9 Pedestrian Activity



4.3 Pedestrian Crash History

As mentioned previously in this document, an ambulatory injury crash involving two pedestrians occurred in a marked crosswalk with a RRFB in November of 2018. Prior to this crash there were five pedestrian crashes along the corridor, with most (three) of these crashes occurring at the intersection of Westover Hills Boulevard and Forest Hill Avenue. **Figure 7** displays the corridor pedestrian crashes. The crash highlighted in green represents the November 2018 crash, the remaining crashes span the years 2013-2017. The other crash that appears to have taken place in a crosswalk where a RRFB is now located occurred in 2014, before the RRFB was installed. None of these crashes were fatal, with all being categorized either 'A' crashes (severe injury) or 'B' crashes (visible injury).

Figure 7 Pedestrian Crashes 2013-2018



4.4 Future Development

The Forest Hill Terrace neighborhood has grown in population and popularity over the past few years, as residents and business owners see the area’s potential for growth. The Veil Brewery and Stella’s Market, two businesses with other Richmond locations, have planned new locations near the southwest corner of the Westover Hills Boulevard and Forest Hill Avenue intersection, as displayed in **Figure 8**. The area will consist of a building for the brewery tap room, as well as plans to take over the Family Dollar to house the brewery equipment. There are also plans to open a second location of the ice cream store, Charm

School, currently located in the Arts District of downtown. The development of this area should increase the number of pedestrians using Forest Hill Avenue to access the new businesses and it could also incentivize more businesses and people to move into the area. Both of these reasons indicate a need for proactive measures to improve the corridor’s pedestrian experience.

Figure 8 Future Development



4.5 Pedestrian Recommendations

The City has completed several improvements along the Forest Hill Avenue corridor in recent years with the intent of improving pedestrian safety and mobility. These improvements include installing RRFBs at two uncontrolled locations and lowering the speed limit from 35 mph to 30 mph. To continue this trend of providing enhanced pedestrian accommodations, VHB has developed the following recommendations.

4.5.1 Infrastructure

While sidewalk connectivity along Forest Hill Avenue is strong, the City should consider reconstructing and/or repairing sections of sidewalk and curb ramps where there are signs of degradation, damage, or non-compliance to ADA standards (ADA standard slope and tactile pads). The sidewalks along the corridor should meet ADA standards with a minimum five foot clear walking width, which accommodates users in wheelchairs. Sidewalks should be

clear of any encroaching vegetation. Street furniture such as bus stop benches should be located within the sidewalk such that the minimum clear walking width is present.

Richmond's Better Streets Manual emphasizes the value of short pedestrian crossing distances. A longer crossing distance translates to longer pedestrian exposure to vehicles and a need for pedestrians to identify longer time gaps between successive vehicles during which they can successfully cross the street. VHB developed several concept improvements at the intersections of Taylor Avenue, W. 48th Street, W. 43rd Street, and W. 41st Street to construct curb bump outs and pedestrian refuge islands to shorten the pedestrian crossing distance. These proposed improvements also fulfill recommendations made in Richmond's Vision Zero Action Plan; notably to implement safety treatments on the high injury street network and to provide safe access to transit stops in high priority areas.

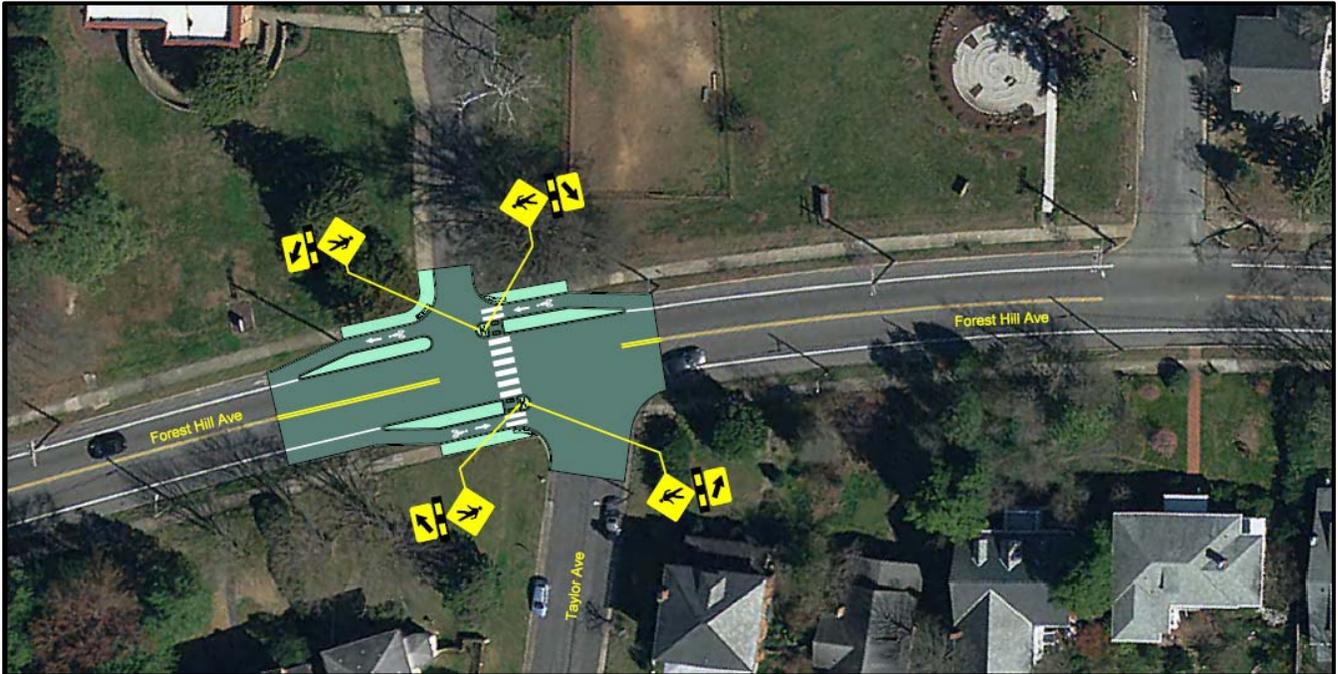
These recommendations enhance the two existing RRFB devices and call for the installation of a third RRFB device at Taylor Avenue. VHB considered the potential installation of Pedestrian Hybrid Beacon devices along the corridor; however, the pedestrian crossing counts of Forest Hill Avenue (**Table 5**) do not come close to meeting the minimum pedestrian volumes to warrant the installation of a PHB device (minimum of 20 pedestrians per hour or three consecutive hours of 10 pedestrians if they are elderly or school children). In these conditions, PHB devices are cost prohibitive while the proposed enhanced RRFB devices can achieve similar improvement to the pedestrian experience at a lower cost and minimum disturbance.

4.5.1.1 Taylor Avenue Recommendations

Currently, there is no marked pedestrian crossing of Forest Hill Avenue between W. 48th Street and W. 43rd Street – a distance of approximately 2,300 feet (over four tenths of a mile). Per the City's Better Streets Manual, on a neighborhood connector street typology (such as Forest Hill Avenue), the preferred distance to a crossing is 400 feet and the maximum distance should be 900 feet. The introduction of a new pedestrian crossing at Taylor Avenue reduces the distance without a crossing (Taylor Avenue to W. 43rd Street) to about 600 feet. Additionally, there are multiple pedestrian generators at the Taylor Avenue intersection including the Envoy of Westover Hills retirement home, a dog park, and GRTC bus stops in both directions. VHB observed pedestrians crossing Forest Hill Avenue at this location.

VHB proposes the conceptual improvement shown in **Figure 9** at this intersection. A new pedestrian crossing and RRFB will be installed to encourage vehicles to yield to crossing pedestrians. The existing bike lanes on Forest Hill Avenue will be tapered out into the existing buffer between the curb and sidewalk to create space for 6-foot wide pedestrian refuge islands between the bike lanes and the vehicle travel zone, thereby reducing the pedestrian crossing distance by a third – from 36 feet to 24 feet.

The RRFBs will also be placed in the islands, which will increase the device's conspicuity to drivers. Both the device and the waiting pedestrians are brought inwards from the traditional sidewalk placement (existing condition at 41st and 43rd Streets), a condition which will improve drivers' sightlines to both. The perceived narrowing of the roadway will also induce traffic calming on Forest Hill Avenue, encouraging drivers to slow their speeds. All of these elements put together are expected to increase driver compliance to the RRFB device.

Figure 9 Taylor Avenue Concept

4.5.1.1 Cedar Lane Consideration

The proposed pedestrian crossing at Taylor Avenue reduces the distance without a crossing to 600 feet east of Taylor Avenue, an acceptable condition per the Better Streets Manual. West of Taylor Avenue, there is still a 1,700-foot gap without a pedestrian crossing – Taylor Avenue to W. 48th Street. As outlined in Better Streets, this exceeds the maximum distance without a pedestrian crossing by 800 feet. The Cedar Lane intersection splits that stretch of Forest Hill Avenue in half; a new pedestrian crossing at this location would leave pedestrian crossing gaps of 900 feet to the west and 800 feet to the east, both at or under the maximum distance. There are no pedestrian generators at this location, however, and no crossing is currently proposed.

4.5.1.2 W. 48th Street Recommendation

The existing brick crosswalk at W. 48th Street was installed in the late 1990s when the City utilized brick crosswalks to designate the transition from a residential to a commercial neighborhood. Unfortunately, this brick crosswalk no longer meets ADA standards and is at odds with the Better Street Manual guidelines regarding crosswalk design. VHB proposes the conceptual improvement shown in **Figure 10** for the block between Westover Hills Boulevard and W. 48th Street. This improvement will bring this crosswalk up to ADA and Better Streets standards, and it will shorten the pedestrian crossing distance by creating pedestrian bump-outs along both the north and south side of Forest Hill Avenue.

Figure 10 Westover Hills Boulevard – W. 48th Street Concept

4.5.1.3 W. 41st Street and W. 43rd Street Recommendations

The existing RRFBs at W. 41st and W. 43rd Streets have 36-foot pedestrian crossing distances (two 12-foot travel lanes and two 6-foot bike lanes). One of the public's main concerns raised at the corridor walkthrough was driver compliance to these two RRFBs; in other words, concern that drivers do not yield to pedestrians when the flashers are activated.

VHB proposes the conceptual improvements shown in **Figures 11 and 12** at these two intersections. The two concepts are identical to each other and very similar to the proposed conceptual improvement at Taylor Avenue. The bike lanes taper into the existing buffer to create room for 6-foot wide pedestrian refuge islands between the bike lanes and the vehicle travel zone. This reduces the existing 36-foot long single movement pedestrian crossing to three shorter crossings – two 5-foot bike lane crossings and one 24-foot vehicle crossing. The RRFBs are relocated to the refuge islands; the new location of the RRFBs and waiting pedestrians are expected to increase conspicuity and driver compliance to the RRFBs.

An additional benefit of these concepts is that they will physically resolve an existing safety hazard that occurs at these intersections. Drivers on Forest Hill Avenue currently stop to turn left onto the side streets; some following drivers will pull around the left-turning vehicle rather than wait for that vehicle to complete its turn. In order to pull around the turning vehicle, the following vehicle pulls into the bike lane, thereby creating a scenario whereby the following vehicle might strike a pedestrian that has entered the crosswalk (see **Photo 10**). The introduction of the refuge islands physically eliminates the potential for this vehicle movement to occur.

Figure 11 W. 41st Street Concept

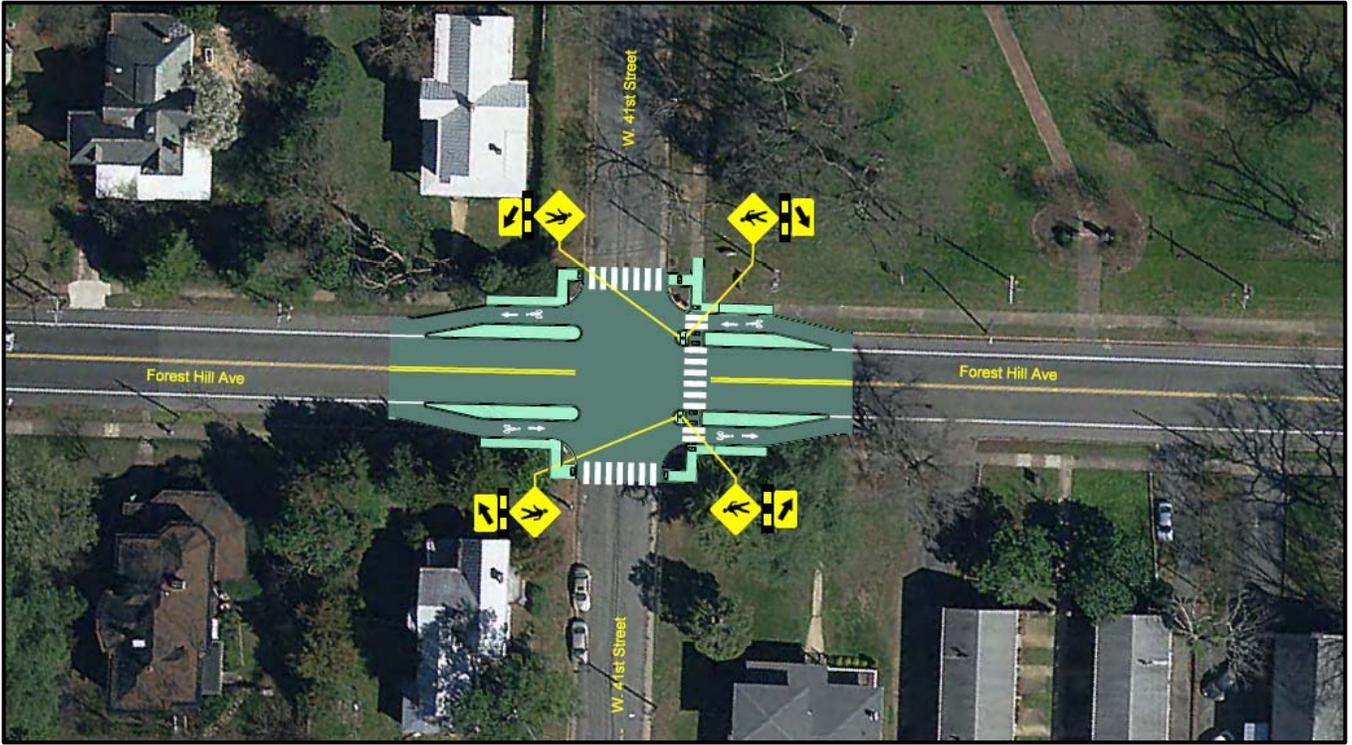


Figure 12 W. 43rd Street Concept

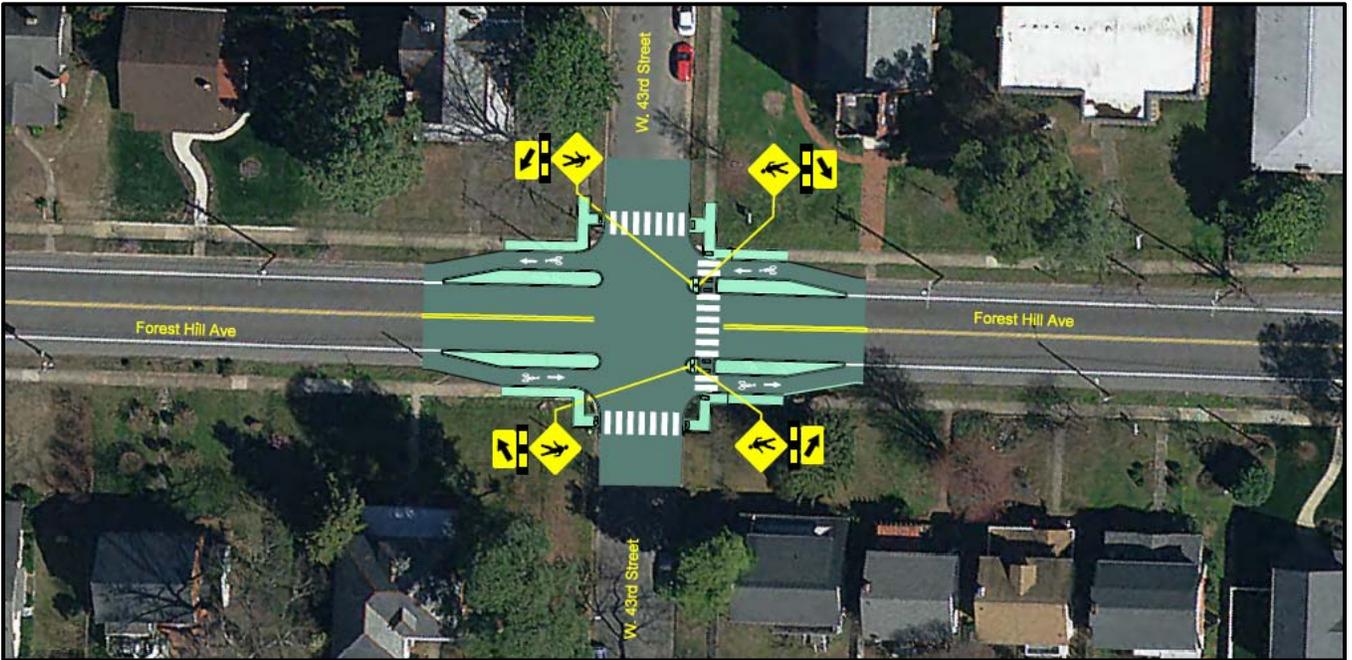


Photo 10 Following Vehicle Pulling Around Left-Turning Vehicle



An additional concern raised at the corridor walkthrough and later observed in the field by VHB is associated with the afternoon student pickup at the Good Shepherd Episcopal School. Parents enter the blacktop at the corner of W. 43rd Street and Springhill Avenue to pick up their children. Parents waiting to enter the blacktop queue along the east side of W. 43rd Street. Occasionally during this process, the vehicle queue will extend to Forest Hill Avenue. Some drivers get stuck in the crosswalks waiting to complete their right turn from Forest Hill Avenue onto W. 43rd Street. VHB recommends that the City engage in conversation with the school regarding their pickup process, how its efficiency can be increased, and how the process can be potentially modified to ensure that vehicles never queue back through the crosswalks at Forest Hill Avenue.

4.5.2 Blind Spot Mitigation

During the corridor walkabout, a citizen raised the issue of a bush at the base of the Envoy of Westover Hill facility's driveway. The bush is on the eastern side of the driveway and when in bloom creates a blind spot for drivers exiting the driveway to oncoming automobiles and bicyclists. VHB recommends the removal of the bush.

4.5.3 Drainage

Certain locations along the corridor have stormwater drainage issues that can impact pedestrian safety and experience. VHB performed site observations on a rainy day to see areas that pooled and the overall impact rain had on the corridor. The images below show how certain sections were affected, including the impedance created for pedestrians. Pooling by the RRFB crosswalks and at the intersections can cause pedestrians to walk around the puddle and into the bike lane or travel lane. Large puddles on the sidewalks could also push pedestrians to walk in the roadside buffer, increasing their exposure to vehicles and potentially creating maintenance issues for the buffer. Low hanging branches, when combined with rainwater weight, droop lower and interfere with pedestrians.

VHB recommends clearing and maintaining the clogged and degraded drains, trimming the low-hanging branches, and looking into sustainable stormwater management practices such as the installation of rain gardens.

Photo 11 Ponding Issues at W. 43rd Street (left) and W. 41st Street (right)



Photo 12 Ponding Issues along Forest Hill Avenue Sidewalks



4.5.4 Lighting

As stated previously, the development of the area could increase the number of pedestrians utilizing the street at night, especially pedestrians walking between the residential neighborhoods and the restaurants/brewery. The existing street lights are vehicle oriented and not pedestrian scale. Pedestrian level lights would create a safer, more comfortable pedestrian experience and allow for automobiles, bicyclists and other pedestrians to see who is walking on the sidewalks and crossing the street.

4.5.5 South of the James Farmer's Market

As discussed in Chapter Three, the existing and naturally occurring shared street approach is managing conditions well. Moving vehicles drive slowly out of necessity, which allows pedestrians to safely maneuver around parked and moving vehicles to enter the market. On-street parking could be removed on one side of the street and replaced with a temporary demarcated pedestrian walking space (similar to the cone/rope system currently used within

the market parking lot); however, this approach will negatively impact homeowners who rely on on-street parking and it will inevitably lead to market goers parking farther away and thus walking exposed for greater distances.

Off-street pedestrian facilities (i.e., sidewalks), would be ideal, but the cost of construction and impact to properties limits the feasibility of sidewalk construction. The one feasible spot for the addition of a sidewalk facility is on the south side of New Kent Avenue on the block between W. 43rd and W. 42nd Streets. The existing sidewalk terminates approximately 175 feet west of W. 42nd Street; this sidewalk gap is currently a well-worn "goat track" (see **Photo 13**) that is heavily utilized on Saturday mornings by Farmer's Market foot traffic. This one sidewalk segment could be completed as a City CIP (Capital Improvement Project) – see **Figure 13**. Construction of this sidewalk would likely require the removal of a mature growth tree.

Photo 13 "Goat Track" / Missing Sidewalk on New Kent Avenue



Figure 13 New Kent Avenue Sidewalk Concept



4.6 Cost Estimates

The conceptual cost estimates for the four proposed pedestrian improvement projects are shown in **Table 6**. These cost estimates were developed from line item costs, which are fully shown in **Appendix C**. Funding for these improvements could come from a variety of sources, including the City CIP budget, Highway Safety Improvement Program (HSIP) bike/pedestrian program, Safe Routes to School, Federal Highway Administration’s Transportation Alternatives Program (TAP) through the Transportation Planning Organization (TPO), or VDOT’s Smart Scale program, among other grant and funding programs.

Table 6 Conceptual Improvement Cost Estimates

Improvement Project	Construction Estimate*
Forest Hill Avenue at W. 41 st Street	\$214,000
Forest Hill Avenue at W. 43 rd Street	\$214,000
Forest Hill Avenue at W. 48 th Street	\$219,000
Forest Hill Avenue at Taylor Avenue	\$197,000
New Kent Avenue Sidewalk	\$17,000
Total	\$860,000

* Note: Each project’s construction estimate includes a mobilization task. Grouping some or all of these projects together under a single construction contract would lower the total estimate by approximately \$100,000.



5

Conclusion

This chapter summarizes the conclusions and recommendations of the study, focusing on the critical findings.

The Forest Hill Terrace and Forest Hill neighborhoods are single-family residential neighborhoods that border the James River. Bifurcated by Forest Hill Avenue, the neighborhoods lie on a significant commuter route into downtown Richmond. Vehicle speeds on Forest Hill Avenue are moderated by three elements: bike lanes, speed limit, and congestion. The bike lanes on the road not only provide cyclists with dedicated infrastructure, they also impart a traffic calming effect on vehicular traffic. As part of the Vision Zero initiative, the City recently lowered the speed limit from 35 mph to 30 mph. Peak period congestion on either end of the corridor also serves to limit vehicle speeds along the corridor.

Data collected on four adjacent corridors within the neighborhoods – New Kent Avenue, W. 42nd Street, Dunston Avenue, and Reedy Avenue – indicates that speeding is not a problem within the neighborhood. The average vehicle speeds on all four streets are below the 25 mph speed limit, the highest 85th percentile speed across the four streets is less than 3 mph over the speed limit (compared to the recommended introduction of traffic calming when the 85th percentile speed exceeds 10 mph over the speed limit), and only three vehicles across all four streets exceeded 10 mph over the speed limit. A combination of narrow streets, on-street parking, intersection control, and existing traffic calming infrastructure is successfully calming vehicular speeds.

An analysis of cut-through traffic indicated that the only likely persistent day-to-day instance of cut-through traffic is occurring on W. 42nd Street – and its parallel feeder routes – primarily during the AM peak hour. A combination of drivers (estimated at approximately 100) is utilizing W. 42nd Street to either access the James River Park System (minor peak movement) or to utilize eastbound Riverside Drive as an alternative route to access the Lee bridge over the James River (primary peak movement). The average travel time of this cut-through route is sometimes as much as three times faster than the primary route of Forest Hill Avenue / Semmes Avenue. Given that W. 42nd Street is signed as the park system’s access route and the limited other routing options to the park, this minor portion of “extra” non-local traffic is likely to remain. The existing geometry and intersection control of the primary and cut-through route appear to significantly limit the available options to discourage the commuter cut-through. A re-envisioning planning process for the Riverside Drive corridor is needed to potentially address the issue. While additional cut-through traffic may utilize parallel routes to Forest Hill Avenue (such as New Kent Avenue or Dunston Avenue / Reedy Avenue) during incidents, traffic data and aggregative travel time analysis does not indicate that this is a persistent daily occurrence.

Photo 14 W. 42nd Street Park Access



Forest Hill Avenue is a well-trafficked pedestrian corridor, with sidewalks lining both sides of the street. The pedestrian crossings of Forest Hill Avenue are less frequent, with five marked crossings from Westover Hills Boulevard to W. Roanoke Street. Of those five crossings, two are signalized, two are serviced by RRFBs, and one is uncontrolled. The largest existing gap in pedestrian crossings lies between W. 48th Street and W. 43rd Street (nearly 2,300 feet). Only one pedestrian crash has occurred within the corridor since the construction of the RRFBs at W. 41st and W. 43rd Streets (three others have occurred at the Westover Hills intersection). That one crash occurred in November 2018, when two pedestrians were struck within the crosswalk at W. 43rd Street.

VHB recommends four pedestrian crossing improvement projects that will fulfill objectives laid out in both the City’s Vision Zero Action Plan and the Better Streets Manual. The first, at Taylor Avenue, creates a new marked crossing with an RRFB and reduces the 2,300-foot gap

without a pedestrian crossing. This new crossing also connects a retirement home, a dog park, and two GRTC bus stops. Enhancement projects are proposed at W. 41st and W. 43rd Streets. These three projects are all similar in that they will shorten the pedestrian crossing distance, provide vehicular traffic calming, enhance the conspicuity of waiting pedestrians and the RRFB flashers, and should increase driver compliance to the RRFB devices. The fourth project at W. 48th Street will enhance the existing crossing with pedestrian bump-outs, a pedestrian refuge island, and an ADA compliant crosswalk.

The South of the James Farmer's Market is a popular event for both Forest Hill residents and the greater Richmond area. The on-site parking lot is insufficient to accommodate all vehicles, so the remainder of people park on-street within the adjacent neighborhood and walk to Forest Hill Park. At the park entrance, event staff and police officers direct vehicular traffic while pedestrians are provided demarcated walking space via cones and rope. There are very few sidewalk facilities on the neighborhood streets (with extremely limited options to add new facilities); as such, parked vehicles, moving vehicles, and pedestrians all interact together on narrow streets. This naturally occurring shared street approach is actually an extremely efficient traffic calming measure that is gaining increasing popularity in cities. Removal of on-street parking on even one side of the road may encourage higher vehicle speeds, placing the walking pedestrians in greater risk. VHB recommends the short-term continuation of the current access and parking strategy. Long-term, additional parking strategies could be explored such as the expansion of the paved parking area into the grass parking area (thereby increasing parking efficiency) or the introduction of remote parking at satellite locations such as George Wythe High School. An additional long-term improvement concept is filling in the missing sidewalk link on New Kent Avenue at W. 42nd Street.

Forest Hill Terrace is a neighborhood that marries commuting traffic, residential concerns, and regional-drawing attractions together in one place. The transportation needs of all parties can and should be met. Part of meeting these needs is proper infrastructure; the existing infrastructure and travel patterns have been analyzed in this study, and several new and enhanced pieces of infrastructure are proposed in this report. A second, and potentially more significant, piece of meeting these transportation needs is adjusting and promoting culture. Proper infrastructure can encourage appropriate behavior, but ultimately, driver behavior has a human element that relies on the ingrained culture of a neighborhood and a City. Vision Zero and Better Streets are policy and design guidelines from the City that will help improve that culture for the better. Neighbor-to-neighbor interactions will also help improve that culture, and ultimately, the interaction of pedestrians, bikes, and vehicles within the Forest Hill Terrace neighborhood lies in the hands of its residents.

Photo 15 Neighborhood Advocacy



Appendix A: Community Input Meeting

Introduction

On Tuesday, March 5th, 2019, VHB participated in a Forest Hill Avenue corridor walk-through with City Department of Public Works staff, 4th District Councilwoman Larson, officers from the Richmond Police Department, and local citizens. During this onsite meeting, the various present parties spoke about their experience living in the neighborhood, voiced their local transportation concerns and desires, and asked questions.

Meeting Notes

- › RRFBs on Forest Hill Avenue (41st Street and 43rd Street) installed in 2014
- › Crosswalk at Fire Station #20 (west side of W. 48th Street intersection)
 - Foot traffic presence at this location
 - Mike Sawyer (City Transportation Engineer and Vision Zero Coordinator):
 - Brick crosswalks were a gateway treatment constructed in the late 1990's in commercial areas
 - It is no longer ADA compliant
 - Recommends CIP funding to remove brick and install high visibility markings
- › Westover Hills intersection
 - Citizen observation: turning vehicles blow through the crosswalks, i.e., do not yield to pedestrians
 - Mike Sawyer:
 - City increased walk clear time interval about 1 year ago (Jan/Feb 2018)
 - CIP request could be made to tighten the intersection radii
 - Potential Westover Hills Boulevard buffered bike lanes would help calm traffic
 - Citizen observation:
 - Restaurant area (Forest Hill Avenue between W. 47th Street and Westover Hills Boulevard) is a high-volume pedestrian area with drivers parking in neighborhoods and walking to the restaurants.
 - New developments and a brewery coming soon on the western side of Westover Hills Boulevard (block between Westover Hills Boulevard and Jahnke Road) could increase transportation activity along these streets
 - Bus stops on Forest Hill Avenue east of Westover Hills Boulevard cause buses to stack up on Forest Hill Avenue and cause clustering of traffic.
 - The side-streets east of Westover Hills Boulevard on Forest Hill Avenue do not line up

- Drivers turning right onto Westover Hills Boulevard do not yield for pedestrians attempting to enter crosswalk.
- › General Culture
 - Mike Sawyer:
 - Need a cultural shift even more than engineering solutions. “000RVA” on Twitter shares vision zero related items. We need to encourage people in the neighborhood to slow down
 - DPW.is working with Department of Health to develop newsletters
 - Bike lanes (road narrowing) and congestion help keep vehicle speeds on Forest Hill Avenue low
 - Jake Humboldt (City Pedestrian/Bicycle Coordinator) explains Virginia state code regarding yielding to pedestrians
 - Citizen observation: a uniform speed limit would help
 - Travis Bridewell (City DPW Engineer): a uniform 30 mph speed limit for Forest Hill Avenue is coming soon
- › Neighbors aren’t trimming vegetation along sidewalks, which narrows sidewalks (potentially below 4 ft ADA minimum requirement)
- › Mike Sawyer: should investigate the potential for a pedestrian crossing near Cedar Lane
 - Big distance gap in crossing options of Forest Hill Avenue
 - Where to locate crossing with offset intersections?
 - How do we create gaps for pedestrians to cross the street?
 - Need warranted pedestrian crossings
- › Mike Sawyer: existing problem where cars on Forest Hill Avenue pull around another car that has stopped to either wait for a pedestrian to cross the street or to turn left onto the side-street. The cars that pull around use the bike lane pavement to do so. This movement threatens both bicyclist and pedestrian traffic
- › Mike Sawyer: No existing pedestrian crossing at the Envoy of Westover Hills nursing home. There’s a bus stop right across the street. Desired location for a new crossing.
- › Brantley (Bike Walk RVA): tested compliance of the 43rd Street RRFB after the November 2018 crash. He estimates 80% driver compliance and some tendency of other 20% of drivers to speed up to beat pedestrians through the intersection
- › Richmond Police Department: 95% of traffic on Forest Hill Avenue was going 42 mph or less (35 mph speed limit at the time) during an 8-day, 24-hour observation study
- › Citizen Observation: Good Shephard Episcopal School – during school dismissal parents are stacked through crosswalks at 43rd Street / Forest Hill Avenue (both 43rd Street crossing and RRFB Forest Hill Avenue crossing)
- › Citizen Observation: 42nd Street is a trouble spot, especially during Farmer’s Market on Saturdays. People use it cut through to Riverside Drive and the market
 - Mike Sawyer and Travis Bridewell made note to add a stop bar on the southbound approach of this intersection

- Citizens state that there can be a lengthy delay on southbound approach
- › Citizen observation: pedestrian connectivity is important – broken sidewalk links (not on Forest Hill Avenue but within the neighborhood residential streets)
- › Field Observation: Old sign post on 41st Street in front of RRFB on north side has been hit and has dented casing for the RRFB flasher (still functional)
- › Citizen’s Observations regarding Farmer’s Market traffic
 - Year-round but not nearly as heavy in winter
 - 1st weekend of May is when heavy summer opens
 - Mike Sawyer suggests an off-duty police officer associated with market could help with event traffic management
 - Contact: Nate Parell with Parks Department
 - Cars parked on both sides of the street reduces perceived travel-way width to one car
 - No sidewalk on the last block of New Kent Avenue near the market parking lot – pedestrians forced into the street
 - One idea: Put out signs that prohibit market parking on this block allowing pedestrians space within the street to walk
 - There’s an existing MOU (Memorandum of Understanding) between the City and the market – this study could recommend new roles for onsite personnel
 - Could pursue a CIP project to fill in sidewalk gap on New Kent Avenue
- › Citizen observation: Dunston Avenue / Reedy Avenue experience cut-through traffic if there is an incident on Forest Hill Avenue
- › Mike Sawyer:
 - From 2015-2017 there were no KA (fatality / ambulatory injury) crashes in the area. In 2018 there was the one involving the two pedestrians at the RRFB at 43rd Street. Compared to ~1,000 citywide over same four years
 - How do we create gaps to let pedestrians cross the street?
- › Bike Walk RVA received funding for signs in yards/parks/schools that emphasize slower speeds; these graphics can be shared with neighborhood association
- › Mike Sawyer
 - 17,000 AADT Forest Hill Avenue, 11,000 AADT Westover Hills Boulevard
 - Enforcement follows communication
 - Richmond Police Department to send VHB citation and speed study data
 - Citizen Observation: bush in front of Forest Hill Presbyterian Church, when in bloom, causes blind spots for drivers exiting driveway.
 - Citizen Observation: Gutter near bus stop at Taylor Ave is crumbling.

Separate Citizen Request

A separate citizen request was made via a letter to City Hall on May 12th, 2019. This letter requested the consideration of a sign installation similar to “No Outlet / No Access to Riverside Drive” at the intersection of W. 45th Street and New Kent Avenue to address traffic that is apparently attempting to use W. 45th Street to access Riverside Drive. According to the citizen request, drivers are turning down W. 45th Street, Archer Avenue, and Woodbine Road only to turn around when they realize that these routes do not access Riverside Drive.

Appendix B: Speed Study Data

Station #: Site A
Site ID: 000000009347
Loc: New Kent Ave, Woodbine Rd-W 45th St
Direction: EAST
Lane: 1

File: A-New Kent Ave, Woodbine Rd-W 45th St.prn
Info: 19-125 TO Max
GPS: 37.52281, -77.48059

TIME <10 <15 <20 <25 <30 <35 <40 <45 <50 <55 <60 <65 <70 <75 Total

Statistical Information...

15th Percentile Speed
18.0 mph

85th Percentile Speed
27.1 mph

Median Speed
22.6 mph

Average Speed
22.5 mph

10 MPH Pace Speed
20 mph to 30 mph
397 vehicles in pace
Representing 75.9% of the total vehicles

Vehicles > 25 MPH
130
24.9%

Station #: Site A
Site ID: 000000009347
Loc: New Kent Ave, Woodbine Rd-W 45th St
Direction: WEST
Lane: 2

File: A-New Kent Ave, Woodbine Rd-W 45th St.prn
Info: 19-125 TO Max
GPS: 37.52281, -77.48059

TIME	<10	<15	<20	<25	<30	<35	<40	<45	<50	<55	<60	<65	<70	<75	Total
------	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-------

Statistical Information...

15th Percentile Speed
17.1 mph

85th Percentile Speed
25.9 mph

Median Speed
22.0 mph

Average Speed
21.8 mph

10 MPH Pace Speed
15 mph to 25 mph
314 vehicles in pace
Representing 77.3% of the total vehicles

Vehicles > 25 MPH
73
18.0%

Station #: Site B
Site ID: 000000009395
Loc: W 42nd St, Stonewall Ave-Springhill Ave
Direction: NORTH
Lane: 1

File: B-W 42nd St, Stonewall Ave-Springhill Ave.prn
Info: 19-125 TO Max
GPS: 37.51981, -77.47742

TIME <10 <15 <20 <25 <30 <35 <40 <45 <50 <55 <60 <65 <70 <75 Total

Statistical Information...

15th Percentile Speed
15.8 mph

85th Percentile Speed
24.4 mph

Median Speed
20.4 mph

Average Speed
20.2 mph

10 MPH Pace Speed
15 mph to 25 mph
368 vehicles in pace
Representing 81.2% of the total vehicles

Vehicles > 25 MPH
45
9.9%

Station #: Site B
Site ID: 000000009395
Loc: W 42nd St, Stonewall Ave-Springhill Ave
Direction: SOUTH
Lane: 2

File: B-W 42nd St, Stonewall Ave-Springhill Ave.prn
Info: 19-125 TO Max
GPS: 37.51981, -77.47742

TIME <10 <15 <20 <25 <30 <35 <40 <45 <50 <55 <60 <65 <70 <75 Total

Statistical Information...

15th Percentile Speed
15.4 mph

85th Percentile Speed
24.0 mph

Median Speed
19.9 mph

Average Speed
19.7 mph

10 MPH Pace Speed
15 mph to 25 mph
375 vehicles in pace
Representing 81.5% of the total vehicles

Vehicles > 25 MPH
29
6.3%

Station #: Site C
Site ID: 000000020168
Loc: Reedy Ave, W 46th St-W 45th St
Direction: EAST
Lane: 1

File: C-Reedy Ave, W 46th St-W 45th St.prn
Info: 19-125 TO Max
GPS: 37.51658, -77.48502

TIME <10 <15 <20 <25 <30 <35 <40 <45 <50 <55 <60 <65 <70 <75 Total

Statistical Information...

15th Percentile Speed
14.4 mph

85th Percentile Speed
22.0 mph

Median Speed
17.8 mph

Average Speed
17.9 mph

10 MPH Pace Speed
15 mph to 25 mph
95 vehicles in pace
Representing 81.9% of the total vehicles

Vehicles > 25 MPH
1
0.9%

Station #: Site C
Site ID: 000000020168
Loc: Reedy Ave, W 46th St-W 45th St
Direction: WEST
Lane: 2

File: C-Reedy Ave, W 46th St-W 45th St.prn
Info: 19-125 TO Max
GPS: 37.51658, -77.48502

TIME <10 <15 <20 <25 <30 <35 <40 <45 <50 <55 <60 <65 <70 <75 Total

Statistical Information...

15th Percentile Speed
15.9 mph

85th Percentile Speed
24.5 mph

Median Speed
20.4 mph

Average Speed
20.3 mph

10 MPH Pace Speed
15 mph to 25 mph
164 vehicles in pace
Representing 81.2% of the total vehicles

Vehicles > 25 MPH
21
10.4%

Station #: Site D
Site ID: 000000003729
Loc: Dunston Ave, W 41st St-W Roanoke St
Direction: EAST
Lane: 1

File: D-Dunston Ave, W 41st St-W Roanoke St.prn
Info: 19-125 TO Max
GPS: 37.51590, -77.47806

TIME <10 <15 <20 <25 <30 <35 <40 <45 <50 <55 <60 <65 <70 <75 Total

Statistical Information...

15th Percentile Speed
15.9 mph

85th Percentile Speed
27.1 mph

Median Speed
21.7 mph

Average Speed
21.6 mph

10 MPH Pace Speed
15 mph to 25 mph
122 vehicles in pace
Representing 67.0% of the total vehicles

Vehicles > 25 MPH
41
22.5%

Station #: Site D
Site ID: 000000003729
Loc: Dunston Ave, W 41st St-W Roanoke St
Direction: WEST
Lane: 2

File: D-Dunston Ave, W 41st St-W Roanoke St.prn
Info: 19-125 TO Max
GPS: 37.51590, -77.47806

TIME <10 <15 <20 <25 <30 <35 <40 <45 <50 <55 <60 <65 <70 <75 Total

Statistical Information...

15th Percentile Speed
15.9 mph

85th Percentile Speed
27.9 mph

Median Speed
22.1 mph

Average Speed
21.9 mph

10 MPH Pace Speed
15 mph to 25 mph
87 vehicles in pace
Representing 60.0% of the total vehicles

Vehicles > 25 MPH
43
29.7%

Appendix C: Cost Estimate

PROJECT DESCRIPTION:

Forrest Hill Ave Pedestrian Improvements

LINE NO	ITEM DESCRIPTION	41st	43rd	Taylor	48th	New Kent	UNIT	UNIT PRICE	AMOUNT (41ST)	AMOUNT (43RD)	AMOUNT (Taylor)	AMOUNT (48Th)	Amount (New Kent Ave)
0020	MOBILIZATION	1	1	1	1	0.25	LS	\$ 40,000.00	\$ 40,000.00	\$ 40,000.00	\$ 40,000.00	\$ 40,000.00	\$ 10,000.00
0130	REMOVAL OF COMB. CURB AND GUTTER	240	240	240	350		LF	\$ 29.12	\$ 6,988.80	\$ 6,988.80	\$ 6,988.80	\$ 10,192.00	\$ -
0140	SAW CUT SIDEWALK	40	40	40	50		LF	\$ 3.49	\$ 139.60	\$ 139.60	\$ 139.60	\$ 174.50	\$ -
0150	SAW CUT CURB, GUTTER AND ENTRANCES	8	8	8	80		LF	\$ 3.49	\$ 27.92	\$ 27.92	\$ 27.92	\$ 279.20	\$ -
0300	SIGN PANEL	36	36	36			SF	\$ 32.30	\$ 1,162.80	\$ 1,162.80	\$ 1,162.80	\$ -	\$ -
0400	ELECTRICAL SERVICE SE-5	1	1	1			EA	\$ 2,690.17	\$ 2,690.17	\$ 2,690.17	\$ 2,690.17	\$ -	\$ -
0410	PEDESTRIAN ACTUATION PA-2	2	2	2			EA	\$ 206.54	\$ 413.08	\$ 413.08	\$ 413.08	\$ -	\$ -
0470	CONCRETE FOUNDATION PF-2	2	2	2			EA	\$ 385.95	\$ 771.90	\$ 771.90	\$ 771.90	\$ -	\$ -
0520	SIGNAL POLE PEDESTAL POLE PF-2, 15'	2	2	2			EA	\$ 859.46	\$ 1,718.92	\$ 1,718.92	\$ 1,718.92	\$ -	\$ -
0790	14/4 CONDUCTOR CABLE	60	60	60			LF	\$ 1.35	\$ 81.00	\$ 81.00	\$ 81.00	\$ -	\$ -
1340	TRAFFIC SIGNALIZATION RECTANGULAR RAPID FLASHING BEACON ASSEMBLY	2	2	2			EA	\$ 11,356.93	\$ 22,713.86	\$ 22,713.86	\$ 22,713.86	\$ -	\$ -
1400	TYPE B CLASS I PVMT LINE MRKG 4"	100	100	100	550		LF	\$ 1.18	\$ 118.00	\$ 118.00	\$ 118.00	\$ 649.00	\$ -
1410	TYPE B CLASS I PVMT LINE MRKG 6"				160		LF	\$ 1.80	\$ -	\$ -	\$ -	\$ 288.00	\$ -
1440	TYPE B CLASS IV PVMT LINE MRKG 24"	240	240	100	30		LF	\$ 32.52	\$ 7,804.80	\$ 7,804.80	\$ 3,252.00	\$ 975.60	\$ -
1480	PVMT MESSAGE, 8', CHARACTER, TY. B, CL. II	4	4	3			EA	\$ 291.34	\$ 1,165.36	\$ 1,165.36	\$ 874.02	\$ -	\$ -
1490	PVMT SYMB MRKG (SGL TURN EA ARROW) TY B, CL II	4	4	3	3		EA	\$ 409.99	\$ 1,639.96	\$ 1,639.96	\$ 1,229.97	\$ 1,229.97	\$ -
1510	8 CONDUCTOR CABLE	60	60	60			LF	\$ 1.41	\$ 84.60	\$ 84.60	\$ 84.60	\$ -	\$ -
1540	JUNCTION BOX JB-S2	1	1	1			EA	\$ 947.55	\$ 947.55	\$ 947.55	\$ 947.55	\$ -	\$ -
1560	ELECT. SER. GRD. ELECTRODE(10')	3	3	3			EA	\$ 104.41	\$ 313.23	\$ 313.23	\$ 313.23	\$ -	\$ -
1620	2" PVC CONDUIT	20	20	20			LF	\$ 3.82	\$ 76.40	\$ 76.40	\$ 76.40	\$ -	\$ -
1640	TRENCH EXCAVATION ECI-1	20	20	20			LF	\$ 7.32	\$ 146.40	\$ 146.40	\$ 146.40	\$ -	\$ -
1920	COMMUNICATION EQUIP. CAT. 6 OUTDOOR CABLE						LF	\$ 1.37	\$ -	\$ -	\$ -	\$ -	\$ -
0020	Drop Inlet Cover						EA	\$ 650.90	\$ -	\$ -	\$ -	\$ -	\$ -
0030	Saw-Cut Asphalt Full Depth	480	480	480	970		LF	\$ 4.60	\$ 2,208.00	\$ 2,208.00	\$ 2,208.00	\$ 4,462.00	\$ -
0040	Std. Curb CG-2	240	240	160	350		LF	\$ 21.00	\$ 5,040.00	\$ 5,040.00	\$ 3,360.00	\$ 7,350.00	\$ -
0050	Radial Curb CG-2	80	80	60	50		LF	\$ 23.00	\$ 1,840.00	\$ 1,840.00	\$ 1,380.00	\$ 1,150.00	\$ -
0130	CG-12 Detectable Warning Surface	10	10	7	3	5	SY	\$ 176.00	\$ 1,760.00	\$ 1,760.00	\$ 1,232.00	\$ 528.00	\$ 880.00
0140	Removal of Sidewalk and Entrance	100	100	250	65		SY	\$ 11.50	\$ 1,150.00	\$ 1,150.00	\$ 2,875.00	\$ 747.50	\$ -
0160	Cement Concrete Sidewalk 4"	100	100	250	65	80	SY	\$ 51.75	\$ 5,175.00	\$ 5,175.00	\$ 12,937.50	\$ 3,363.75	\$ 4,140.00
0180	Pavement Restoration	60	60	40			TON	\$ 575.00	\$ 34,500.00	\$ 34,500.00	\$ 23,000.00	\$ -	\$ -
0190	Comb. Curb & Gutter Removal	240	240	160	340		LF	\$ 11.50	\$ 2,760.00	\$ 2,760.00	\$ 1,840.00	\$ 3,910.00	\$ -
0200	Class A-3 Concrete	22	22	15	37		CY	\$ 450.00	\$ 9,900.00	\$ 9,900.00	\$ 6,750.00	\$ 16,650.00	\$ -
0230	Flexible Pavement Planing 0" - 2"	885	885	860	2280		SY	\$ 40.25	\$ 35,621.25	\$ 35,621.25	\$ 34,615.00	\$ 91,770.00	\$ -
	Tree Removal					1	LS	\$ 1,000.00	\$ -	\$ -	\$ -	\$ -	\$ 1,000.00
0315	ASPHALT CONCRETE TY. SM-12.5A	100	100	90	205		TON	\$ 110.00	\$ 11,000.00	\$ 11,000.00	\$ 9,900.00	\$ 22,550.00	\$ -

		41ST	43rd	Taylor	48th	New Kent Avenue
CONTRACT ESTIMATE TOTAL		\$199,958.60	\$199,958.60	\$183,847.72	\$206,269.52	\$16,020.00
CONTINGENCY		\$5,998.76	\$5,998.76	\$5,515.43	\$6,188.09	\$480.60
CEI		\$5,998.76	\$5,998.76	\$5,515.43	\$6,188.09	\$480.60
ELECTRICAL SERVICE INSTALLATION		\$2,000.00	\$2,000.00	\$2,000.00	\$0.00	\$0.00
TOTAL		\$213,956.12	\$213,956.12	\$196,878.58	\$218,645.69	\$16,981.20
ALL INTERSECTIONS TOTAL		\$860,417.71				