Bike Lanes
REPORT

GROUP FOR SENSIBLE BIKE LANES

OCTOBER 2023

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Group for Sensible Bike Lanes

Who is Group for Sensible Bike Lanes?

Group for Sensible Bike Lanes (GSBL) is an informal group of Westover Hills residents that formed last spring after a Westover Hills neighbor brought his concerns about the city's bike lanes project to a Westover Hills Neighborhood Association (WHNA) meeting. The group's purpose was to study the city's plan and its impact on Westover Hills, and to ensure that Westover Hills residents and other stakeholders had an opportunity to weigh in and be heard.

Original members of the group included Mark Bouziane, Richard Bragg, Bryan Carlson, Tom Flynn, Sandy Gouldin, Diane Holdford, Pat and Debra McClane, Val Murphey, Susy Bork Meyer, Anne Moss Shelton. Almost 50 people are members of our closed Facebook Page.

What has the group done?

Since its formation, we have:

- Submitted a Freedom of Information Act request to the city for additional information about the project, including traffic studies, bike counts, crash data, other options considered, etc.
- Studied the plan and the city's documentation relating to it;
- Developed and distributed a bike lanes survey to every house in Westover Hills;
- Compiled the responses to the bike lanes survey;
- Conducted a 12-hour count of bicyclists on Westover Hills Boulevard;
- Conducted observations of the number of cars parked along WH Blvd;
- Conducted observations of traffic delay at the intersection of WH Blvd and Forest Hill;
- Reviewed how bike lanes are implemented in other parts of the city;
- Developed some alternative bike lanes options for the neighborhood and the city to consider;
- Presented its findings to the neighborhood at WHNA meetings and consulted with leaders of the association;
- Met with our city council representative Kristen Nye; and
- Developed this final report.

GSBL is in favor of bike lanes and traffic calming

The city wants to increase safety for bicyclists and reduce speeding on Westover Hills Boulevard, and we're in favor of that. We support bike lanes. We care about the safety of bicyclists and pedestrians. We care about slowing traffic, and we care about the safety of neighborhood children.

However, we don't support this particular plan for bike lanes because it doesn't take into account the impact on the surrounding neighborhood and it isn't completely safe for bicyclists pedestrians or cars.

While the need for bike lanes on Westover Hills Blvd is not supported by documentation such as bicycle counts and crash data, we support the city's goal of making Richmond a very "bike-friendly" city. We support bike lanes options that would create greater safety for cyclists and pedestrians without creating the traffic congestion that will cause commuters to cut through our residential side streets.

The Westover Hills Bike Lanes Survey

Why do a survey?

GSBL decided to conduct a bike lanes survey in Westover Hills because it was clear that all the stakeholders had not had a chance to learn about the project and to be heard.

At the April meeting of the Westover Hills Neighborhood Association (WHNA), when a neighbor brought the bike lanes project up, most participants were surprised to learn the project had been resurrected after being put on hold in 2017. Most also were unaware of the city's online survey conducted in February 2023.

GSBL found that the February survey was largely geared for bicyclists to express their concerns about cycling safety. Of the 740 respondents, 88% were from the bicycling community. Many stakeholders (Westover Hills residents, businesses facing WH Blvd such as the CVS and Dr Toler's offices, The Westover Hills United Methodist Church, Tablespoons Bakery, users of the Tot Lot, etc.) were not aware of the project then.

On May 25, at the informational meeting at Westover Hills Elementary School, residents learned that the city was collecting additional community input through a second online survey conducted from May 11 to June 1, 2023.

The city's new online survey, identical to the first one, was also oriented toward the bicycling community. It asked for an overall opinion of the project and some demographic questions (such as age, race or ethnicity, whether you live and/or work in city, etc.) The only other questions were if you ride a bike, why you don't ride a bike if you don't, how often you ride your bike, where you ride your bike, and how you rate yourself as a bicyclist. The survey didn't offer any opportunity to express other concerns, and some Westover Hills residents said they tried to fill it out online but didn't feel it pertained to them.

A community meeting on May 25 sponsored by Kristen Nye for city staff to explain the bike lanes project was well-attended. Several Westover Hills residents expressed doubts or concerns about the project, but it was clear from speakers' comments that many participants were cycling enthusiasts who live outside the neighborhood and even outside the Fourth District. Some Westover Hills residents felt their viewpoints were overridden or interrupted, and that the meeting offered insufficient time to get in all their questions and concerns.

Survey and its distribution

GSBL chose to do an old-school paper survey, rather than an online survey, to make sure that only Westover Hills folks were heard from and to prevent individuals or groups from skewing the results by submitting multiple responses. The hard-copy surveys were numbered for the same reason. The numbered copies were distributed randomly so responses were anonymous. Along with the survey, GSBL distributed a drawing from the city's website showing the bike lanes plan.

One survey was distributed to each of the 850 households in Westover Hills. Volunteers began hand-delivering the surveys on August 21, 2023. Most Westover Hills neighbors got their copy hand-delivered within a week. No time limit was given for returning surveys, but most had come in by late September. **See Appendix 1 for a copy of the survey.**

Survey conclusions

Based on the survey results, we drew certain conclusions about how Westover Hills residents reacted to the city's bike lanes plan:

- **Westover Hills is bike friendly.** More than half of residents (53%) said they ride a bike, and of those 8% use their bicycle to commute to work.
- **Westover Hills likes bike lanes.** 82% of respondents said they favor bike lanes in general.
- **Residents are opposed to the city's bike lanes project.** 84% of respondents said they "totally oppose" or "somewhat oppose" the plan.
- **Almost everyone has concerns about the bike lanes project.** 93% of respondents said they had concerns, which included some who said they agreed with the city's plan.
- **The biggest concern of respondents is traffic cutting through our residential side streets,** followed by rush hour traffic back-ups, and the confusion that the project may cause.
- **The most concerning location** is the intersection of Westover Hills Blvd with Evelyn Byrd and Riverside Drive.
- **Parking along Westover Hills Boulevard may not be necessary.** Most people (75%) said they never park on Westover Hill Blvd. Of those who do, 84% said they park once a week or less often. Most people (71%) think parking lanes on WH Blvd are not necessary.
- **The city should consider OTHER methods of calming traffic.** Most people (88%) said they'd prefer other methods of reducing speeding, rather than reducing traffic to one lane. The most common answer was to simply increase enforcement of speeding by police, followed by adding obvious crosswalks (preferably with flashing pedestrian lights), putting in speed monitoring systems like radar speed signs and cameras, reducing the speed limit to 25 mph, and installing speed humps.
- **The city hasn't done a good job informing residents about the bike lanes.** Almost 90% of respondents said the city hasn't informed them about the bike lanes in a proper and timely manner. More than a third of respondents said they learned of the bike lanes project only through the GSBL survey.

Summary of written comments from the survey

- Most people seemed to favor eliminating the parking lane on WH Blvd, adding a bike lane where cars park now, and keeping two lanes of traffic in each direction.
- Some people questioned the need for the project, either because there aren't enough cyclists to justify it or because they don't see speeding as an issue and think cyclists have plenty of room to ride on WH Blvd now.
- Many people noted that other areas of the city have better-designed bike lanes, like Semmes Avenue, Forest Hill Avenue, and Grove Avene, which are less confusing and don't include bollards.

Detailed survey results

As of October 20, 2023, 201 surveys had been received, for a return rate of 24.4%. Each response represents a household rather than an individual. Here are responses to each question on the survey.

Are you a bike rider?

53% YES
- 8% ride to work
- 92% ride for pleasure

47% NO

Were you aware of this project?

68 % YES

32% NO

Of those who knew about the project, a third said this survey was the first they'd heard of the project, or they heard only from WHNA meeting or posts on a Westover Hills Facebook page.

Has the city informed you of this project in a proper and timely manner?

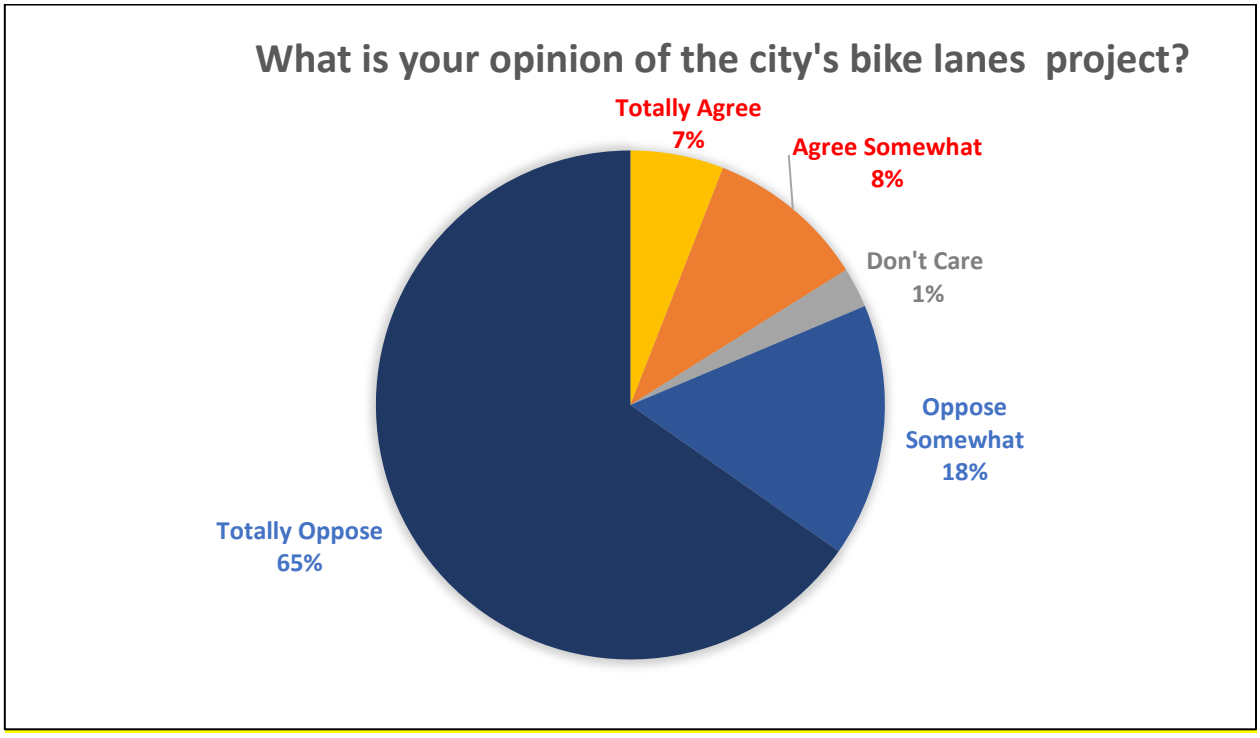
89% NO

11% YES

Are you in favor of bike lanes in general?

82% YES

18% NO



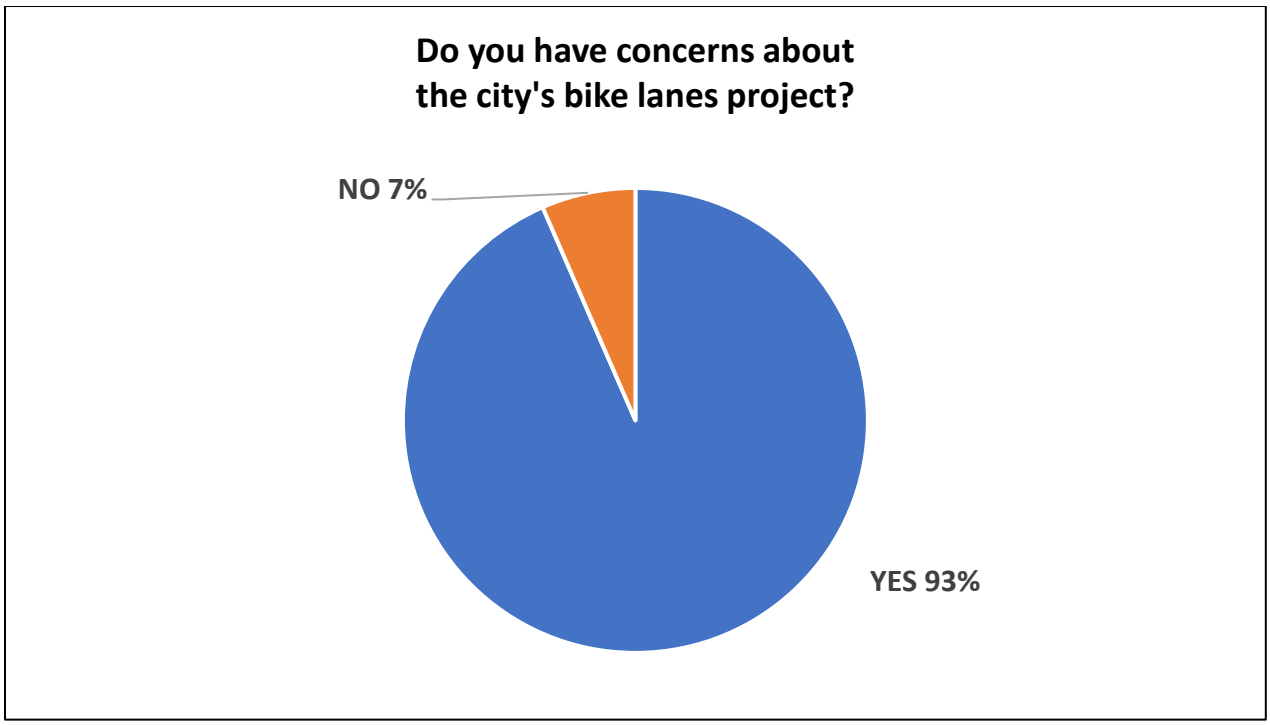
What is your overall opinion of this project as planned?

65% Totally oppose
19% Oppose somewhat
8% Agree somewhat
7% Totally agree
1% Don't care

In other words: 84% oppose (totally or somewhat)
15% of respondents agree (totally or somewhat)

Do you have any concerns about this project?

93% YES
7% NO



Are your concerns about a specific location along Westover Hills Boulevard? *(These are actual numbers, not %)*

166 Traffic near Evelyn Byrd and Riverside Drive entering the bridge.
142 The intersection at Forest Hill Avenue
141 The intersection of New Kent Road
141 Intersections at side streets such as Caledonia, Sylvan, King William, etc.

Are you concerned about any of the following? *(These are actual numbers, not %)*

170 Traffic cutting through side streets.
150 Rush hour traffic slowdowns
149 Confusion for motorists, pedestrians, and bicyclists
110 Safety for pedestrians crossing the street to church and Tot Lot
109 Aesthetics of the project
66 Other
56 Getting into Westover Hills Methodist Church

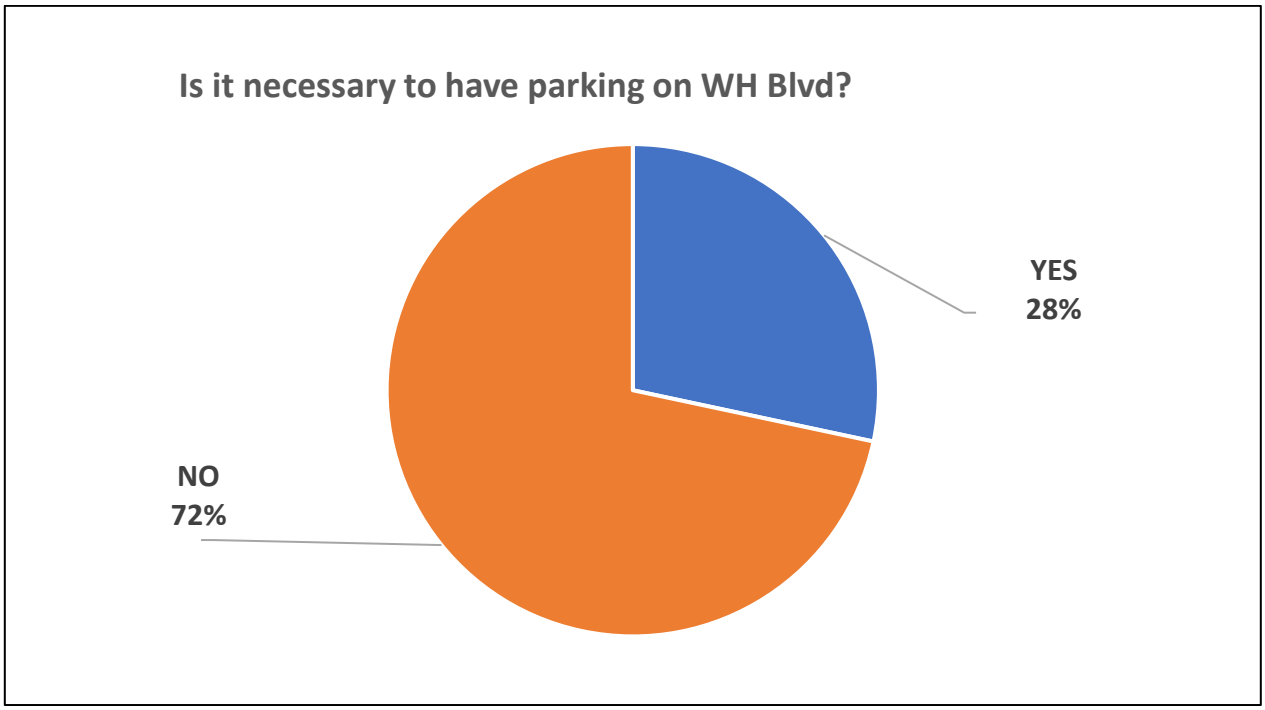
Do you ever park along Westover Hills Blvd.?

76% NO
24% YES%
Daily 2%
Several times a week 12%
Less often 86%

Do you think having parking lanes on Westover Hills Boulevard is essential?

72% NO
28% YES

Note: Of those who said parking is necessary, many mentioned concerns about parking for the church or for homes along the Boulevard that don't have a driveway or alley. We confirmed that all homes along WH Blvd have an alley and that the church has 25 off-street parking places.



Do you think the city should consider other options to slow traffic on WH Blvd?

88% YES
12% NO

Other concerns about the project *(open ended question, most common responses listed in order)*

1. Cut-through traffic in the neighborhood will be dangerous for pedestrians and cyclists.
2. Two lanes of traffic are needed in each direction on WH Blvd.
3. The project is unnecessary based on the number of cyclists.
4. Parking isn't needed on the Boulevard.
5. The intersection at Evelyn Byrd is dangerous and needs to be fixed.
6. The bridge is a problem: How do cyclists get to it from WH Blvd? Why put bike lanes that feed into the bridge, which is unfriendly to cyclists? Cyclists should be prohibited from riding in traffic lanes.
7. How will emergency vehicles have room to pass?
8. How will snow removal be accomplished with the bollards there?
9. How will people get to the mailbox at New Kent and WH Blvd?
10. Right turns onto side streets will be more difficult across bike lanes.

Other ways to calm traffic on Westover Hills Boulevard *(open ended question, most common responses listed in order)*

1. More enforcement of the speed limit and ticketing of offenders
2. Pedestrian crosswalks, with flashing lights
3. Speed humps
4. Speed monitoring systems (such as radar speed signs, cameras, etc.)
5. Reduce speed to 25 mph
6. Special higher speeding fines
7. More speed limit signage
8. Don't think speed is an issue
9. Increase tolls on bridge to same as Powhite

Other things to tell the city *(open ended question, most common responses listed in order)*

1. Eliminate parking lanes, add the bike lanes, and keep two lanes of traffic.
2. Bikers could go through the neighborhood rather than WH Blvd.
3. Don't do it. Abort project. Reject it! Cancel it.
4. The bollards are awful and ugly.
5. There should be more evidence of NEED for the project.
6. There needs to be more community input.
7. The city should stop putting in disconnected segments of bike lanes.
8. Other bike lanes designs are better: Forest Hill Ave., Semmes Avenue, Grove Ave.

Written responses to each open-ended survey question are available in a separate document.

Findings

In June 2023, GSBL submitted a Freedom of Information Act (FOIA) request to the city's Department of Public Works to obtain records related to the bike lanes project. The group asked for traffic studies, bicycle counts, crash data, comments from the Virginia Department of Transportation (VDOT), other options considered, and other documents. In early July, GSBL submitted a second FOIA request to follow up.

In addition to studying the city's documentation, GSBL conducted its own observations along Westover Hills Boulevard and reviewed how bike lanes are implemented throughout the city. Here are some of the conclusions reached as a result:

The need for the project hasn't been demonstrated

A comprehensive transportation study is grounded in reliable data that is used to quantify the extent of the project, determine the current deficiencies and possible alternative solutions, and justify the demand for new or modified facilities.

It appears that the city assessed limited data before proceeding to 90% design for the SR 161 (Westover Hills Boulevard) bike lanes project. The city hasn't provided any documentation, such as bike counts and crash data, that justify the need for the project. It may not have reviewed traffic studies, impact on the surrounding neighborhood, or transit issues prior to designing the project.

Traffic volumes. Forest Hill Ave (FHA) and Westover Hills Boulevard (WH Blvd) are major arterials that serve regional traffic movements, generally commuter travel between downtown Richmond and the suburbs of southside Richmond, in addition to the local Westover Hills residential traffic. FHA carries about 34,000 vehicles per day, while 13,000 to 14,000 vehicles per day travel along WH Blvd.

Crash (Accident) Data Analysis. VDOT's online Crash Analysis Tool shows all crashes on WH Blvd for the most recent eight years. It shows only 36 accidents in the period between 2015 and 2023. Overall, WH Blvd is a relatively safe arterial road with far less than one crash per year per intersection. To our knowledge, no pedestrian or bicycle accidents have occurred in the corridor during this time, a safety record the neighborhood can be proud of. **See Appendix 2 for this data.**

Traffic engineers tell us that crashes are more common at signalized intersections than at ones with Stop/Yield signs, and that increased congestion leads to more crashes. Congestion and delay result in driver frustration and increased risk taking, leading to more angle or rear-end collisions. The signalized intersection at New Kent has well under one crash per year, but Forest Hill Avenue has multiple crashes per year--likely the result of its greater traffic volume and congestion.

The city's plan will reduce through-travel lanes along WH Blvd corridor to one in each direction, which in turn will exponentially increase congestion and delay. Substantially increasing congestion and delay will cause a corresponding increase in crashes, especially at the intersection with Forest Hill.

Bike counts. The sense of the neighborhood has been that bike ridership along the WH Blvd corridor was extremely low. GSBL conducted a 12-hour bike count on WH Blvd, between New Kent and Evelyn Byrd, on Friday, September 1, 2023, arguably one of the highest bike usage days of the year, being the Friday before Labor Day when kids were out of school and the weather was perfect. The count was 88 bicyclists. **See Appendix 3 for this data**.

The city's bike counts by Peggy Malone and Associates on September 29, 2022, at the same location are perhaps more representative of WH Blvd bike activity. The consultant observed bicyclists during six peak-time hours (7 to 8:45 am, 11 am to 12:45 pm, and 4 to 5:45 pm). During that time, 21 bicyclists were observed traveling on WH Blvd. This indicates a limited ridership demand, consistent with the general speculation of the community. **See Appendix 4 for this data.**

Transit. FHA is a vital GRTC transit route serving 40 buses per weekday. For transit to be successful, FHA at the WH Blvd intersection must operate with as little delay as possible. A major concern of the city plan is the resultant increase in congestion/delay, which could adversely impact GRTC operations and, ultimately, transit ridership.

The project will create traffic back-ups on Westover Hills Boulevard

While the city hopes reducing traffic to one lane in each direction will help slow down speeders, it will also cause significantly more traffic congestion. The city's own consultant study belies its assurances that Westover Hills won't "notice any difference" in traffic flow on WH Blvd.

The city performed a "Synchro" intersection analysis at Forest Hill Avenue and WH Blvd. It was dated May 24, 2023, after the city released its 90% design plan for bike lanes on Westover Hills Blvd.

Without getting into the technical details, the results can be summarized by average delay in seconds which is given a letter grade "Level of Service" between A (good, free flow) to F (bad, jammed, bumper to bumper).

The Lanes, Volumes, and Timings study done by Kimley-Horn and Associates for the city shows clearly that Levels of Service would be at D and E levels at certain times of day. The Federal Highway Administration, Highway Capacity Manual, defines the city calculated level of service projected for the FHA/WH Blvd intersection as *"E, Intolerable Delay."* **See Appendix 5 for this data.**

Regarding these results, the city stated in a 3/28/23 email: *"The Department (Public Works) finds the level of service throughout the week to be acceptable to allowing WH Blvd to be designed to better manage speeds, minimize exposure to people walking and to be multimodal by better accommodating people who bike."*

In other words, the city is stating their policy is it is acceptable to increase congestion to an official "intolerable" level of delay if it means in their view that pedestrians and bikers are "prioritized." Note, however, that the city plan makes no recommendations regarding pedestrian safety.

On, March 4, 2023, GSBL conducted some sample traffic queue measurements at the Forest Hill/WH Blvd intersection during the 4:30 to 5:30 pm peak travel hour. Observers noted that the queue on WH Blvd typically exceeded 1.5 minutes and sometimes reached 2 minutes, well above F level of Service conditions.

Similarly, these traffic delays were also observed during the construction at the Boulevard and Forest Hill Avenue on May 25, 2023, when the Boulevard was reduced to one lane of southbound traffic due to construction at the Forest Hill intersection. At 3:30 pm, there were 42 cars waiting in line for the traffic light to change, and a traffic surveyor counted many of them turning right or left onto residential side streets, rather than waiting through multiple light changes.

Westover Hills will experience more cut-through traffic on residential streets.

Westover Hills residents have complained for years about commuter traffic cutting through our streets to avoid backups at the New Kent and Forest Hill Avenue traffic lights. There is a history of such cut-through traffic, which resulted in the installation of the "No Turn Between 4 and 6 pm." signs along the Boulevard.

Despite the prohibition, some drivers still ignore the signs and cut through Westover Hills. Anecdotal evidence from neighbors east of WH Blvd. indicates that westbound drivers on Forest Hill Avenue often turn right off Forest Hill to cut through Westover Hills to avoid congestion at the Forest Hill/WH Blvd intersection.

If there is any additional traffic backing up on Westover Hills Blvd, we can be sure that more drivers will turn off onto residential streets to avoid the increased wait at the lights. That means more traffic and higher speeds on streets where children play, neighbors walk, and cyclists enjoy riding. **See photo below showing basketball goal in the street on Dorchester Road.**

Many Westover Hills streets are old and narrow with parking on both sides. Sylvan road is a good example of this. Neighbors know to watch for children and pets, as well as motorists entering and exiting their cars. Commuters from outside the neighborhood may not be as cautious.

If the Boulevard were to be **permanently** reduced to one lane, southbound drivers on Westover Hills Boulevard who want to turn right onto Forest Hill are going to ignore the "no turn" signs. New Kent Road (which is wide) could become a speedway and the narrower streets like Caledonia and Sylvan could also experience heavy traffic, especially at the evening rush hour. Likewise, drivers who want to turn left on Forest Hill will cut through side streets east of the Boulevard.

VDOT has concerns about the plan's safety

The Virginia Department of Transportation (VDOT), which manages the federal grant money the city received to construct bike lanes, has reviewed the city's plan. Comments from VDOT's traffic engineering section indicated it found a number of major safety concerns and recommended changes to the plan. An example of one comment:

> ***"Recommend other design or additional treatment for bike lane at this section. The alignment in this section may not be safe for bicyclists."***

The plan doesn't adequately address intersection of WH Blvd and Evelyn Byrd Road

This intersection is generally perceived as dangerous. Northbound cars must merge into one lane to access the bridge, there are no crosswalks for pedestrians, and there's no indication as to what a northbound bicyclist is supposed to do. Northbound cyclists must cut across oncoming traffic to access the Nickel Bridge. **See photo below.**

The city's current plan doesn't alter this intersection other than to add additional pavement markings that may create more confusion for drivers and cyclists and make the situation for bicyclists more unsafe. VDOT's comments on the city's plan indicated it has major safety concerns

for bicyclists at this intersection. It stated, ***"Recommend other design or additional treatment for bike lane at the section. The alignment at this section may not be safe for bicyclists."***

The Evelyn Byrd intersection is noted because most people perceive it as dangerous. Perhaps surprisingly, a close look at the crash data **(Appendix 3)** indicates this intersection operates very safely. The "dot" in the intersection map shows a crash that occurred down the hill near Riverside Drive during wet road conditions. VDOT's design review comments on the city's plan characterized the design as "unsafe." To maintain these safe travel conditions, good design dictates as little change as possible, and the city plan calls for major changes in traffic markings.

The plan doesn't address pedestrians

The city has emphasized that this project is being funded with Federal safety grant funds, as "a Complete Streets Design Model" that prioritizes safety for all users of the roadway. However, the city's plan doesn't provide any additional measures for pedestrian safety such as crosswalks or blinking pedestrian signage. Because parking lanes will not be next to the curb, and bollards may interfere with visibility, pedestrians may find it more difficult to cross WH Blvd if the city's plan were implemented.

VDOT's review comments noted the lack of pedestrian safety features at several points along the WH Blvd. It stated, ***"Why not indicate signage for turning vehicles to consider pedestrians at intersections with crosswalks on side streets?"*** and "***Please replace 'Yield Here to Pedestrian' sign to 'Stop Here for Pedestrian per recent bill."***

There are specific technical issues with the plan that must be addressed

For example, drawings of the plan appear to show that the bollards marking the bike lane will continue across the entrance to the CVS off WH Blvd, blocking it from access. Drivers will have to turn right on Forest Hill, then slow immediately to turn right into the CVS parking lot. Hopefully, this is just an oversight that will be fixed. If not, however, traffic on Forest Hill at that intersection will be slowed by drivers turning right into CVS.

The Nickel Bridge will remain a bottleneck for bicyclists and pedestrians

One narrow sidewalk along the west side of the Nickel Bridge must handle two directions of bicycle traffic and two directions of pedestrian traffic. Both walkers and bikers complain frequently about the narrowness of the passage. It is very difficult for walkers or bikers to pass one another on the bridge. **See photo at right..** Installation of bike lanes along WH Blvd will do nothing to solve this problem.

Maintenance of the bike lanes can be a problem

GSBL observers noted that cyclists on Malvern Avenue often ride in vehicular traffic lanes rather than the protected bike lanes. We asked cycling enthusiasts why this might be, and were told that debris in the bike lanes make them less desirable places to ride. Leaves, sticks, glass, and other road debris often accumulate next to the curb on roadways, and cyclists worry about tire damage. The bollards along the city's similar bike lanes on Malvern and Patterson Avenues (and other locations) may prevent regular city street sweeping, or perhaps the city lacks sufficient funds to provide such maintenance. We hope that regular maintenance will be a part of any bike lanes implemented along WH Blvd and across the city.

These photos on Malvern and Patterson Avenues show sticks, leaves, bottles, and cans in the protected bike lane.

Bike Lanes Options

Group for Sensible Bike Lanes supports creating bike lanes in Westover Hills, but does not support the city's plan largely because it reduces vehicular traffic to one lane in each direction. There are other bike lanes options that would be more acceptable. While there are pros and cons to each of the alternatives put forward here, they would all create greater safety for bicyclists—and pedestrians—without reducing vehicular traffic lanes and contributing to cut-through traffic on side streets. Here are the three options GSBL would like the city to consider:

Create bike lanes on WH Blvd but keep two traffic lanes

This is a proven and successful approach to bicycle safety on an arterial road, already in use in Richmond. This option would look very much like the area of Forest Hill Avenue from Rettig Road toward the commercial area. **See photo below.**

Under this option, the city would:

- Maintain two lanes of traffic in each direction on WH Blvd.
- Eliminate parking on Westover Hills Boulevard (with certain exceptions, such as in front of Westover Hills United Methodist Church during church activities). Other spots in the city use this approach, such as in front of First Baptist Church at the intersection of Monument Avenue and Arthur Ash Blvd.
- Create painted bike lanes along the curbs (northbound bike traffic on the east side of the Blvd, southbound traffic on the west side of the Blvd).
- Install a brick crosswalk across WH Blvd at Evelyn Byrd to be shared by pedestrians and northbound cyclists, who will be directed across WH Blvd to access the bridge. This will be

safer for cyclists than the city's plan, which doesn't adequately address the Evelyn Byrd intersection.

- Install brick crosswalks at selected side streets. These crosswalks would provide additional safety for pedestrians, an issue not addressed in the city plan, and provide traffic calming.
- Consider implementing other traffic calming measures such as flashing pedestrian crossing signs, additional speed limit signs, speed monitoring devices, etc.

Route bikers through the neighborhood

This option would route cyclists through Westover Hills neighborhood, which would be safer for cyclists than traveling along the busy WH Blvd corridor. GSBL observed that after southbound cyclists cross the Nickel Bridge, they often turn right onto Riverside Drive rather than continuing along WH Blvd. The city has an existing sign on WH Blvd at Evelyn Byrd marking Bike Route 1. **See photo at right.** The sign directs southbound cyclists onto Evelyn Byrd, but no further signage or markings exist to help cyclists navigate.

Under this approach the city would:

- Create marked bike lanes through the Westover Hills neighborhood, using Prince Arthur to allow cyclists to get from the bridge to Forest Hill Avenue. This wide street runs parallel to WH Blvd, has no houses facing it, and is used infrequently for parking.
- Direct Southbound cyclists on WH Blvd to turn right after the bridge onto Riverside Drive or Evelyn Byrd, then left onto a marked bike path on Prince Arthur.
- Direct Northbound cyclists to those streets to connect to the bridge access, and install appropriate signage at the intersection of Forest Hill and Prince Arthur/Jahnke.
- Install "Bike Route" signs and street markings along the route. Additional signage and street markings (like those used in other parts of the city) would improve safety for cyclists as they biked through the neighborhood. **See photos below.**

If this approach were adopted, we would want to consult with residents along the chosen bike path to get their feedback prior to implementation.

Share the road

This approach is used along many roads in the city. The city has already designated a bikeway on Westover Hill Blvd. between Riverside Drive and Evelyn Byrd with a street marking indicating a shared vehicle/bicycling lane. **See photo below.**

Under this option, the city would:

- Continue these street markings along the curbs on WH Blvd to Forest Hill Avenue and beyond.
- Add “Share the Road” signs along WH Blvd.
- Install a brick crosswalk at Evelyn Byrd to be shared by pedestrians and northbound cyclists, who will be directed across Westover Hills Blvd to access the bridge. This will be safer for cyclists than the city’s plan, which doesn’t adequately address the Evelyn Byrd intersection.
- Consider implementing other traffic calming measures such as brick crosswalks at selected intersections, flashing pedestrian crossing signs, additional speed limit signs, speed monitoring devices, etc.

One Option in Detail

For the purposes of this report, we are fleshing out the details of one option to show how it could work. This is the option that would keep two vehicular lanes of traffic, add a bike lane, and eliminate parking on Westover Hills Boulevard (with certain exceptions for the Westover Hills United Methodist Church and perhaps others).

This option provides for bikes lanes, as supported by the community, but in a safe manner for all users (motorists, pedestrians, transit users, bicyclists), using an accepted and proven design. The prototype proposed is Forest Hill Avenue in the residential vicinity just west of Powhite Parkway.

The photo shown below is of the FHA/Rettig Road intersection, and is typical of the proposed non-signalized WH Blvd bike lane intersections. **See photo below.**

The areas are similar in that both are residential in character with landscaped medians, are major arterials with two through travel lanes per direction, and have limited bike activity. WH Blvd probably has more pedestrian activity than Forest Hill Avenue.

The core of this option is painted bike lanes along the northbound and southbound curbs of WH Blvd, beginning at Evelyn Byrd Road and extending south of FHA, the city's project limits. **See Appendix 6 for a drawing of this option.**

During the design for the FHA roadway/bike lane project several years ago, there was considerable discussion regarding speeding on FHA, similar to WH Blvd, versus the dilemma of making sure the heavier through traffic stays on FHA (and, in the case of WH Blvd, is not tempted to use the neighborhood cross streets). The textured brick crosswalks had been successfully used on some other city traffic calming projects, and they have been found to be safe for bikers, motorcyclists, and emergency vehicles. They provide visible reminders to drivers that pedestrians and bikers are crossing the street, and drivers tend to moderate their speed over them. Further, they

have a more "old Richmond" look which is appealing (versus, say, a painted asphalt speed hump) in residential areas.

The FHA bike lane is a basic four-foot wide curb lane on both sides, with a painted white divider line. WH Blvd operates in a similar fashion presently, as the roadway curb permits parking but is rarely occupied.

This option essentially keeps the two 11-foot-wide travel lanes in each direction on WH Blvd, and converts the parking area to a bike lane, with enhanced brick crosswalks at selected intersections.

Evelyn Byrd Road Intersection

Figure 1 (in Appendix 6) graphically depicts this bike lanes option beginning at its northern most point, the intersection at Evelyn Byrd Road. This option calls for a brick crosswalk at the Evelyn Byrd intersection, to be shared by pedestrians and bicyclists.

Perhaps over half the bikers that ride the northbound WH Blvd curb and cross over to reach the west side sidewalk to the Nickel Bridge already do so at the Evelyn Byrd intersection. They use this location because it connects to the curb painted bike lane/designation and sidewalk to the Nickel Bridge. It is also the logical place for pedestrians to cross the Boulevard because it connects to the sidewalk on both sides.

The city plan adds many additional signs, bollards, and painted lines in the intersection that would be confusing to motorists and distract them from observing other drivers while merging in with Bridge traffic and watching for pedestrians and bikers. It calls for northbound cyclists to cut across oncoming traffic to access the bridge. In its formal plan review, VDOT stated about this intersection that, ***"The alignment at this section may not be safe for bicyclists."***

This option builds on the current safety record of this intersection by not adding any more demands to the driver beyond merging with other cars and watching for bikers and pedestrians. The natural travel patterns used by today's commuters and residents would continue. The proposed brick crosswalk will enhance pedestrian/bike safety by formally identifying a crosswalk at this intersection. It will need to be signed as a bike crosswalk). Further, it tells the regional drivers that they are entering a more residential area (cobblestone like, slower speeds, etc.) even though it is still State Route 161.

New Kent Avenue Intersection

Figure 1 also depicts recommendations for the signalized New Kent intersection. The bike lanes would continue on both sides of WH Blvd, through both north and south legs of the intersection. Bikers would cross New Kent, parallel to the pedestrian crosswalks (see Forest Hill/Rettig intersection photo). The brick crosswalks on both WH Blvd crossings are recommended to further enhance driver awareness of bike and pedestrian crossings, as well as to calm driving speeds.

On occasion, during the evening rush hour, the two lanes of southbound WH Blvd traffic have been observed backing up from a New Kent red signal nearly to Evelyn Byrd, then clearing out on the following green signal. It is not unreasonable to expect that traffic in the afternoon peak would regularly back up to Evelyn Byrd if one of the two through WH Blvd lanes were eliminated, as the city's plan calls for.

Caledonia, King William, and Sylvan Roads Intersections

Figures 2 and 3 (in Appendix 6) depict the WH Blvd section continuing the painted curb bike lanes. It is recommended that parking not be allowed in the bike lanes, with the exception of Sunday mornings in front of the Westover Hills United Methodist Church. This is the same approach as used for the First Baptist Church, at the intersection of Monument Avenue and Arthur Ash Blvd. Another brick crosswalk is proposed at Sylvan, placed here because it is about midway between the signalized intersections, with similar crosswalks at New Kent and Forest Hill. The precise number and location of the crosswalks can be refined.

Forest Hill Avenue Intersection and South

Figures 4 and 5 (in Appendix 6) depict the remaining WH Blvd blocks from Devonshire through Forest Hill and terminating before Clarence Street. Importantly, the bike lanes stop at the alley between CVS and the City Library, transitioning to the existing Forest Hill intersection traffic lanes. South of FHA, the bike lanes continue, essentially past Walgreens, until before Clarence Street.

The existing brick crosswalks at this intersection should be replaced with the style proposed at the other WH Blvd intersections (per photo). The existing ones are torn up from numerous utility repairs and have not been repaired.

Why this option is more acceptable than the city's

This option is a superior "Complete Streets Design Model" because:

- It accommodates motorists safer and more efficiently by not eliminating WH Blvd traffic lanes and therefore not encouraging commuter traffic to cut through residential side streets.
- It better serves pedestrians with brick crosswalks at selected intersections. Pedestrians would not have to contend with the more congested traffic on WH Blvd caused by the reduction in car travel lanes. Pedestrians will not have to contend with obstructed vision caused by parked cars between the bike lane and travel lane. Driver's vision of pedestrians will not be limited by bollards and parked cars.
- Bikers will be better served because this option provides a designated place for northbound cyclists to cross WH Blvd to access the Nickel Bridge. Bikers will be able to cross WH Blvd at other side streets more safely because this option provides for more crosswalks. The city's plan makes it harder for cyclists to see through bollards and provides fewer opportunities to cross streets (especially during right turn traffic) since there will be fewer gaps in traffic with half the lanes to carry it. If the Malvern Avenue bollard experience is relevant, this plan will be more appealing for bikers throughout its entire length.
- It better serves transit users who would have been further delayed on Forest Hill throughout the day due to overall intersection traffic congestion, decreasing the appeal of transit, and possibly resulting in reduced ridership.

This option is based on sound, proven traffic safety principles that have been successful in other locations in Richmond. It further follows the habits and natural patterns of the Westover Hills residents and, as such, we trust will be favorably received by all.

APPENDIX 1: Bike Survey

Group for Sensible Bike Lanes

Westover Hills Bicycle Lane Survey

We'd like to make sure the city hears from all Westover Hills residents about the bike lanes project. Please fill out this survey so YOUR opinions can be reported to the city. (The plans can be seen in detail at: https://www.rva.gov/public-works/pedestrian-bicycling-and-trails.)

Do you live in Westover hills? Yes ❑ No ❑

Are you a bike rider? Yes ❑ No ❑

If yes, do you bike to work? Yes ❑ No ❑ For pleasure? Yes ❑ No ❑

Are you aware of the city's project for bike lanes on WH Blvd? Yes ❑ No ❑

If yes, how did you learn of the project?_____

_____

Do you think the city has informed you about this project in a proper and timely manner?
Yes ❑ No ❑

Are you in favor of bike lanes in general? Yes ❑ No ❑

After reviewing the proposed plan, what is your overall opinion of this project as planned?

- ❑ Totally agree
- ❑ Agree somewhat
- ❑ Don't care
- ❑ Oppose somewhat
- ❑ Totally oppose

Do you have any concerns about this project? Yes ❑ No ❑

If yes, do your concerns relate to a specific location along Westover Hills Boulevard? *Check all that apply*

- ❑ The intersection at Forest Hill Avenue
- ❑ The intersection of New Kent Road
- ❑ The flow of traffic entering and exiting the bridge near Evelyn Byrd and Riverside Drive intersections
- ❑ Intersections at side streets such as Caledonia, Sylvan, King William, etc.

If yes, are you concerned about any of the following? *Check all that apply*

- ❑ Rush hour traffic slowdowns
- ❑ Traffic cutting through side streets
- ❑ Getting into Westover Hills Methodist Church (which has 25 off-street parking places)
- ❑ Confusion for motorists, pedestrians, and bicyclists
- ❑ Safety for pedestrians crossing the street to church and Tot Lot
- ❑ Aesthetics of the project
- ❑ Other If other, what?_____

_____

Do you ever park along Westover Hills Blvd. Yes ❑ No ❑

If yes, how often? ❑ Daily

❑ Several times a week

❑ Less often

Do you think having parking lanes on Westover Hills Boulevard is essential? Yes ❑ No ❑

Do you think the city should consider other options to slow traffic on Westover Hills Boulevard?
Yes ❑ No ❑ If yes, please comment_____

_____

_____

_____

_____

Is there anything you'd like to suggest that the city change about this project? _____

_____

_____

_____

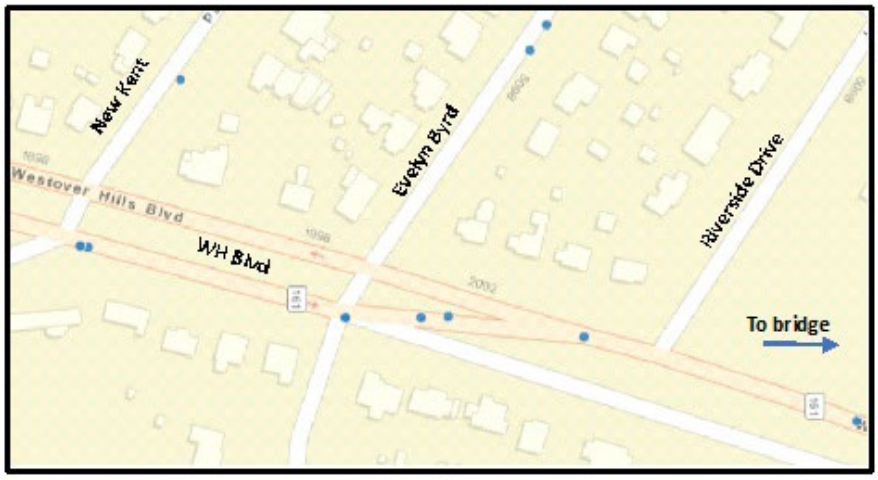
_____

To return your survey:

1. **Mail to:** Group for Sensible Bike Lanes, 5430 Dorchester Road **OR**
2. **Drop it off:** at 5430 Dorchester Road **OR**
3. **Text for pick-up:** Text 804-339-9739 with your address, leave the survey at your door, and we'll come pick it up.

APPENDIX 2: Crash Data

Total Crash Summary on Westover Hills Boulevard: 2015 to 2023



Each dot represents one crash

Figure 1: From bridge access to New Kent

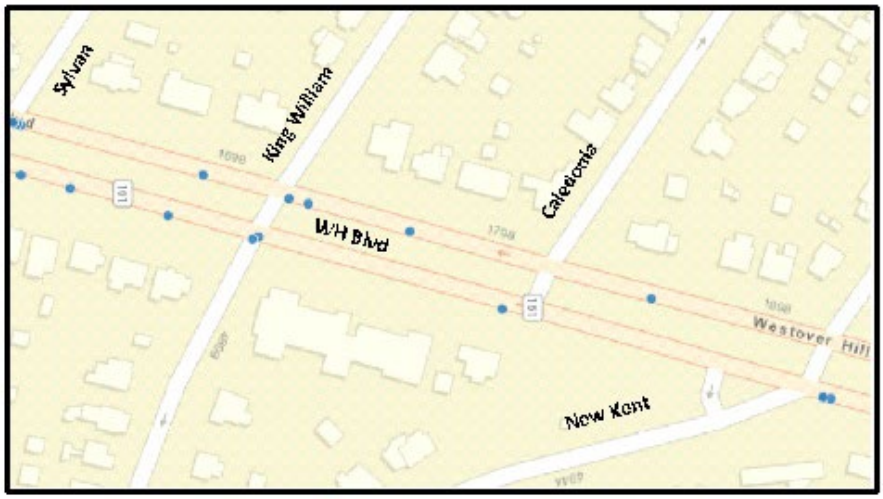


Figure 2: From New Kent to Sylvan

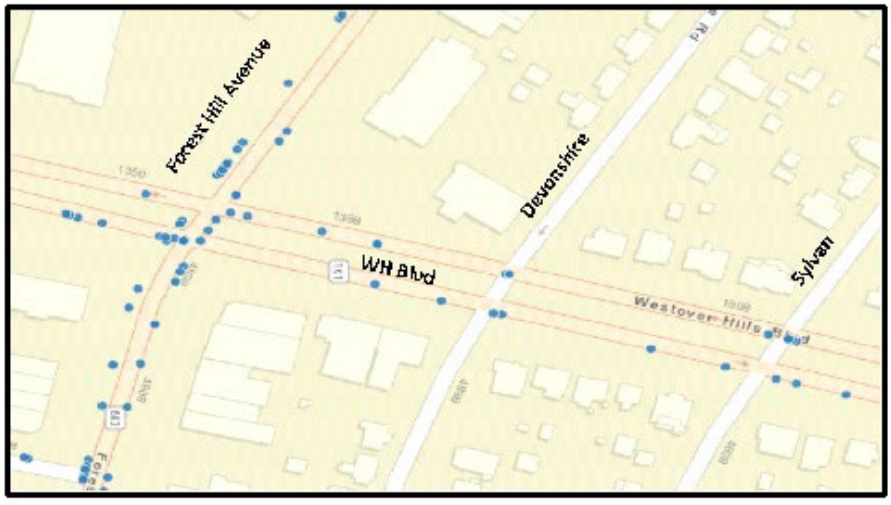


Figure 3: From Sylvan to Forest Hill

Source: VDOT Crash Data Analysis Tool (https://www.virginiaroads.org/maps/1a96a2f31b4f4d77991471b6cabb38ba/about)

APPENDIX 3

Bicycle Count by Group for Sensible Bike Lanes

September 1, 2023

Time	Cyclists going South *(toward Forest Hill)*	Cyclists going North *(toward the bridge)*	Total cyclists
7 am to 8 am	1	2	3
8 am to 9 am	2	1	3
9 am to 10 am	3	6	9
10 am to 11 am	5	5	10
11 am to noon	5	4	9
Noon to 1 pm	2	3	5
1 pm to 2 pm	6	6	12
2 pm to 3 pm	1	2	3
3 pm to 4 pm	3	5	8
4 pm to 5 pm	2	8	10
5 pm to 6 pm	5	4	9
6pm to 7 pm	0	7	7
Total	35	49	88

Methodology: Seven volunteers from Group for Sensible Bike lanes counted bicycles each hour from 7 am to 7 pm on Friday, September 1, 2023. The count was conducted between New Kent Road and Evelyn Byrd Road. Weather was perfect for cycling: sunny, low-humidity, temperature ranged from about 60 to 80 degrees.

Of the total number of bicyclists, seven (7) rode on Westover Hills Blvd for only one block, turning off WH Blvd. onto New Kent or onto Evelyn Byrd or Riverside Drive. That's 8% of the total bicyclists.

Of bicyclists going south, five (5) were riding on the sidewalk rather than in the street. Of bicyclists going north, eleven (11) were riding on the sidewalk. In total, 18% of bicyclists rode on the sidewalk and 82% in the street.

Bicyclists who traveled across Westover Hills Blvd, from New Kent to New Kent or from Evelyn Byrd to Evelyn Byrd, were not counted.

APPENDIX 4: City Bike Lanes Study

Peggy Malone and Associates
904-992-8072

File Name : WH 1-Westover Hills Blvd & New Kent Rd AM
Site Code :
Start Date : 9/29/2022
Page No : 1

Groups Printed- Bicycles on Road

	New Kent Rd Eastbound					New Kent Rd Westbound					Westover Hills Blvd Northbound					Westover Hills Blvd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
07:00 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
07:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	2
07:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
07:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	1	0	0	1	3
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
08:15 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
08:30 AM	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	2
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total	0	0	0	0	0	0	2	0	0	2	0	1	0	0	1	0	2	0	0	2	5
Grand Total	0	0	0	0	0	0	2	0	0	2	0	3	0	0	3	0	3	0	0	3	8
Apprch %	0	0	0	0		0	100	0	0		0	100	0	0		0	100	0	0		
Total %	0	0	0	0	0	0	25	0	0	25	0	37.5	0	0	37.5	0	37.5	0	0	37.5	

	New Kent Rd Eastbound					New Kent Rd Westbound					Westover Hills Blvd Northbound					Westover Hills Blvd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 07:00 AM to 08:45 AM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 08:00 AM																					
08:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
08:15 AM	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1
08:30 AM	0	0	0	0	0	0	1	0	0	1	0	1	0	0	1	0	0	0	0	0	2
08:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1
Total Volume	0	0	0	0	0	0	2	0	0	2	0	1	0	0	1	0	2	0	0	2	5
% App. Total	0	0	0	0		0	100	0	0		0	100	0	0		0	100	0	0		
PHF	.000	.000	.000	.000	.000	.000	.500	.000	.000	.500	.000	.250	.000	.000	.250	.000	.500	.000	.000	.500	.625

This document shows bike counts during peak hours (from 7 am to 8:45 am,; 11 am to 12:45 pm; and 4 pm to 5:45 pm) at Westover HIlls Boulevard and New Kent Road on 9/29/22.The study was conducted by Peggy Malone and Associates for the City.

Peggy Malone and Associates
904-992-8072

File Name : WH 1-Westover Hills Blvd & New Kent Rd MID
Site Code :
Start Date : 9/29/2022
Page No : 1

Groups Printed- Bicycles on Road

	New Kent Rd Eastbound					New Kent Rd Westbound					Westover Hills Blvd Northbound					Westover Hills Blvd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
11:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:15 AM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
11:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	3
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
12:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	4
Grand Total	0	0	0	0	0	0	0	0	0	0	0	5	0	0	5	0	0	0	0	0	5
Apprch %	0	0	0	0		0	0	0	0		0	100	0	0		0	0	0	0		
Total %	0	0	0	0	0	0	0	0	0	0	0	100	0	0	100	0	0	0	0	0	

	New Kent Rd Eastbound					New Kent Rd Westbound					Westover Hills Blvd Northbound					Westover Hills Blvd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 11:00 AM to 12:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 11:45 AM																					
11:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12:15 PM	0	0	0	0	0	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	3
12:30 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
Total Volume	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	0	0	0	0	0	4
% App. Total	0	0	0	0		0	0	0	0		0	100	0	0		0	0	0	0		
PHF	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.333	.000	.000	.333	.000	.000	.000	.000	.000	.333

Peggy Malone and Associates
904-992-8072

File Name : WH 1-Westover Hills Blvd & New Kent Rd PM
Site Code :
Start Date : 9/29/2022
Page No : 1

Groups Printed- Bicycles on Road

	New Kent Rd Eastbound					New Kent Rd Westbound					Westover Hills Blvd Northbound					Westover Hills Blvd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
04:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:15 PM	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
04:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04:45 PM	0	1	0	0	1	0	0	1	0	1	0	0	1	0	1	0	1	0	0	1	4
Total	0	1	2	0	3	0	0	1	0	1	0	0	1	0	1	0	1	0	0	1	6
05:00 PM	0	0	0	0	0	0	0	1	0	1	0	4	0	0	4	1	0	0	0	1	6
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
05:30 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	3
05:45 PM	0	0	1	0	1	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2	5
Total	0	1	1	0	2	0	0	1	0	1	0	7	0	0	7	2	3	0	0	5	15
Grand Total	0	2	3	0	5	0	0	2	0	2	0	7	1	0	8	2	4	0	0	6	21
Apprch %	0	40	60	0		0	0	100	0		0	87.5	12.5	0		33.3	66.7	0	0		
Total %	0	9.5	14.3	0	23.8	0	0	9.5	0	9.5	0	33.3	4.8	0	38.1	9.5	19	0	0	28.6	

	New Kent Rd Eastbound					New Kent Rd Westbound					Westover Hills Blvd Northbound					Westover Hills Blvd Southbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour Analysis From 04:00 PM to 05:45 PM - Peak 1 of 1																					
Peak Hour for Entire Intersection Begins at 05:00 PM																					
05:00 PM	0	0	0	0	0	0	0	1	0	1	0	4	0	0	4	1	0	0	0	1	6
05:15 PM	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1
05:30 PM	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	0	2	3
05:45 PM	0	0	1	0	1	0	0	0	0	0	0	2	0	0	2	0	2	0	0	2	5
Total Volume	0	1	1	0	2	0	0	1	0	1	0	7	0	0	7	2	3	0	0	5	15
% App. Total	0	50	50	0		0	0	100	0		0	100	0	0		40	60	0	0		
PHF	.000	.250	.250	.000	.500	.000	.000	.250	.000	.250	.000	.438	.000	.000	.438	.500	.375	.000	.000	.625	.625

APPENDIX 5: City Traffic Study

Simulation Settings
3: 05/24/2023

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	139	627	230	72	774	60	359	234	34	118	295	179
Future Volume (vph)	139	627	230	72	774	60	359	234	34	118	295	179
Satd. Flow (prot)	1770	3398	0	1770	3500	0	1770	1863	1583	1770	3337	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1770	3398	0	1770	3500	0	1770	1863	1583	1770	3337	0
Satd. Flow (RTOR)		46			7				125		82	
Adj. Flow (vph)	151	682	250	78	841	65	390	254	37	128	321	195
Lane Group Flow (vph)	151	932	0	78	906	0	390	254	37	128	516	0
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases									2			
Total Split (s)	20.0	53.0		15.0	48.0		38.0	40.0	40.0	22.0	24.0	
Total Lost Time (s)	4.0	4.4		4.0	4.4		4.0	4.0	4.0	4.2	5.1	
Act Effct Green (s)	14.7	54.5		10.5	47.7		31.2	22.2	22.2	28.7	18.8	
Actuated g/C Ratio	0.11	0.42		0.08	0.37		0.24	0.17	0.17	0.22	0.14	
v/c Ratio	0.76	0.64		0.55	0.70		0.92	0.80	0.10	0.33	0.93	
Control Delay	78.8	32.5		72.0	39.5		75.2	69.6	0.5	46.0	71.2	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	78.8	32.5		72.0	39.5		75.2	69.6	0.5	46.0	71.2	
LOS	E	C		E	D		E	E	A	D	E	
Approach Delay		39.0			42.0			69.1			66.2	
Approach LOS		D			D			E			E	
Queue Length 50th (ft)	124	334		64	355		313	208	0	89	195	
Queue Length 95th (ft)	#214	414		118	437		#479	285	0	159	#603	
Internal Link Dist (ft)		463			549			515			939	
Turn Bay Length (ft)	350			80			550		100	60		
Base Capacity (vph)	217	1450		149	1289		462	515	528	391	555	
Starvation Cap Reductn	0	0		0	0		0	0	0	0	0	
Spillback Cap Reductn	0	0		0	0		0	0	0	0	0	
Storage Cap Reductn	0	0		0	0		0	0	0	0	0	
Reduced v/c Ratio	0.70	0.64		0.52	0.70		0.84	0.49	0.07	0.33	0.93	

Intersection Summary

Cycle Length: 130
Actuated Cycle Length: 130
Offset: 62 (48%), Referenced to phase 4:EBT and 8:WBT, Start of 1st Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.93
Intersection Signal Delay: 51.1 Intersection LOS: D
Intersection Capacity Utilization 79.4% ICU Level of Service D
Analysis Period (min) 15
95th percentile volume exceeds capacity, queue may be longer.
Queue shown is maximum after two cycles.

Splits and Phases: 3:

Page 1

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	139	627	230	72	774	60	359	234	34	118	295	179
Future Volume (vph)	139	627	230	72	774	60	359	234	34	118	295	179
Satd. Flow (prot)	1770	3383	0	1770	3493	0	1770	1863	1583	1770	3302	0
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	1757	3383	0	1761	3493	0	1755	1863	1553	1758	3302	0
Satd. Flow (RTOR)		47			7				176		83	
Lane Group Flow (vph)	151	932	0	78	906	0	390	254	37	128	516	0
Turn Type	Prot	NA		Prot	NA		Prot	NA	Perm	Prot	NA	
Protected Phases	7	4		3	8		1	6		5	2	
Permitted Phases									6			
Total Split (s)	20.0	53.0		15.0	48.0		38.0	40.0	40.0	22.0	24.0	
Total Lost Time (s)	3.9	3.3		3.7	3.2		4.6	3.1	3.1	5.2	3.6	
Act Effct Green (s)	16.1	49.7		11.3	44.8		33.4	36.9	36.9	16.8	20.4	
Actuated g/C Ratio	0.12	0.38		0.09	0.34		0.26	0.28	0.28	0.13	0.16	
v/c Ratio	0.69	0.70		0.51	0.75		0.86	0.48	0.07	0.56	0.88	
Control Delay	50.0	15.7		69.0	42.0		53.0	30.5	0.3	58.8	56.9	
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0	0.0	0.0	0.0	
Total Delay	50.0	15.7		69.0	42.0		53.0	30.5	0.3	58.8	56.9	
LOS	D	B		E	D		D	C	A	E	E	
Approach Delay		20.5			44.2			41.7			57.2	
Approach LOS		C			D			D			E	

Intersection Summary	
Cycle Length: 130	
Actuated Cycle Length: 130	
Offset: 0 (0%), Referenced to phase 4:EBT and 8:WBT, Start of Yellow	
Control Type: Pretimed	
Maximum v/c Ratio: 0.88	
Intersection Signal Delay: 38.6	Intersection LOS: D
Intersection Capacity Utilization 87.2%	ICU Level of Service E
Analysis Period (min) 15	

Splits and Phases: 2939: Westover Hills Boulevard & Forest Hill Avenue

APPENDIX 6: One Option in Detail

Figure 1: From Bridge to New Kent

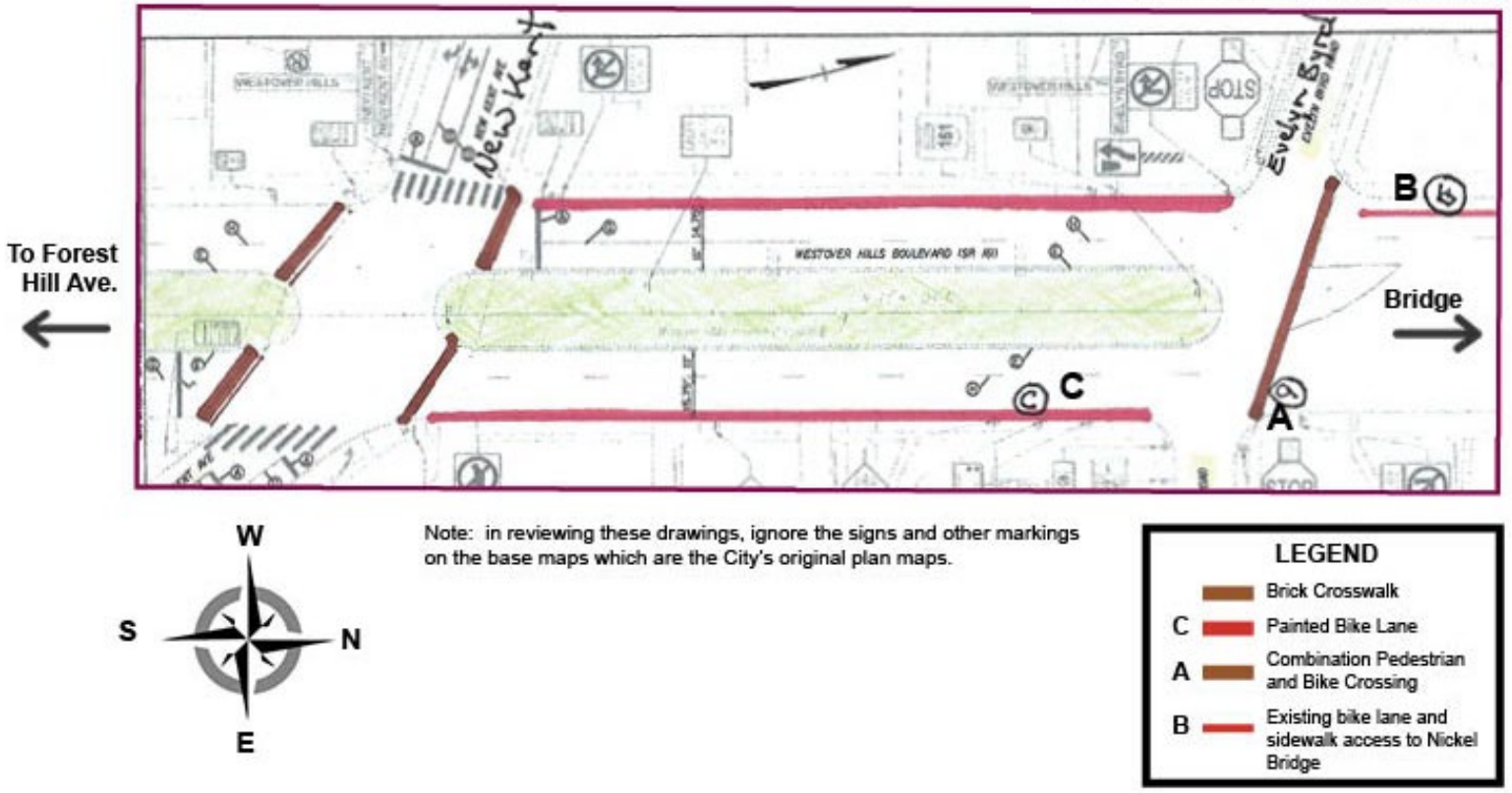


Figure 3: From New Kent to King William

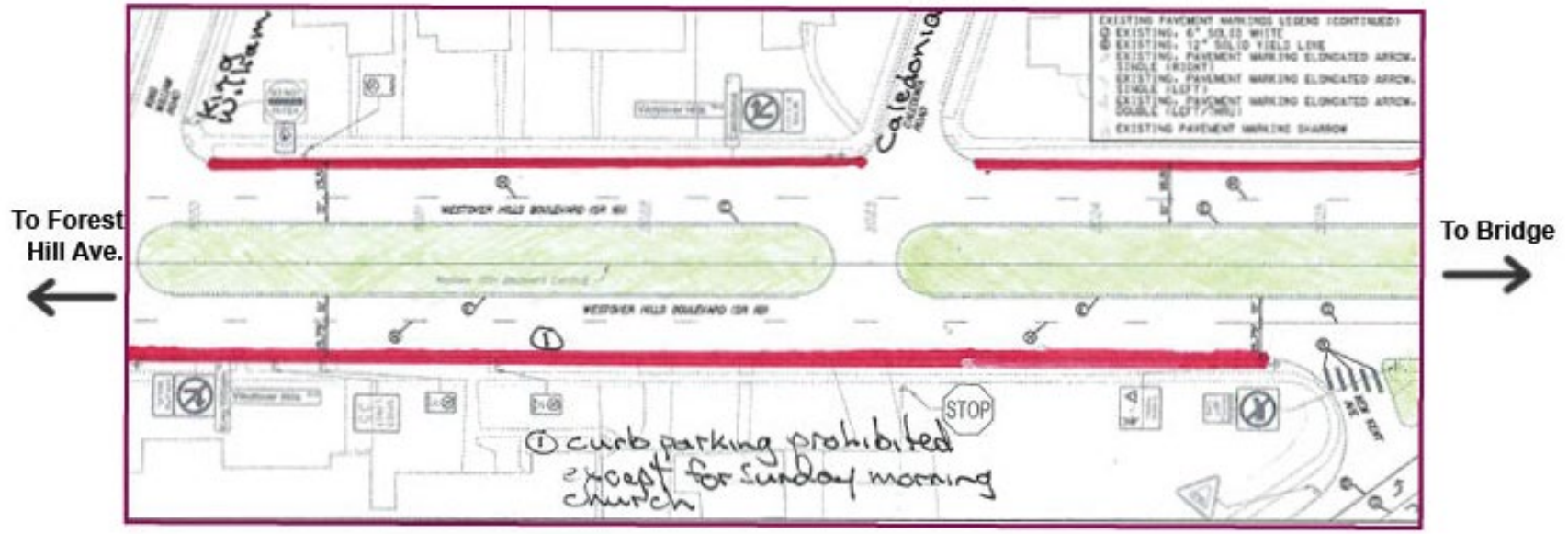


Figure 4: King William to Devonshire

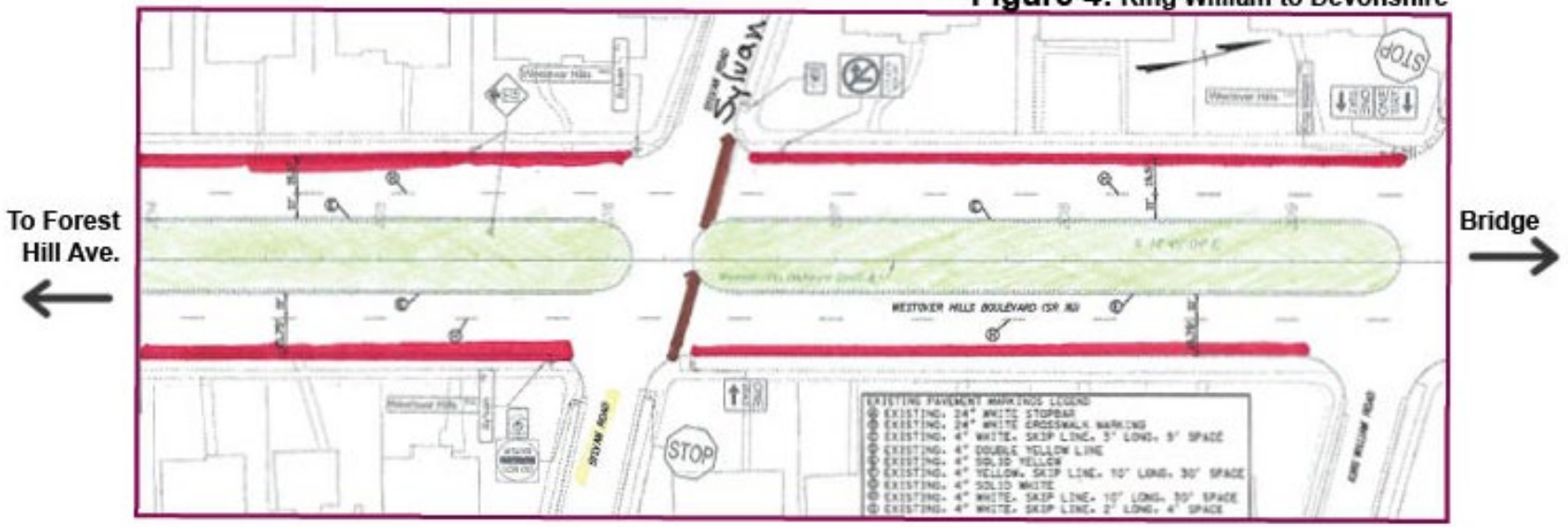


Figure 5: From Devonshire to Forest Hill

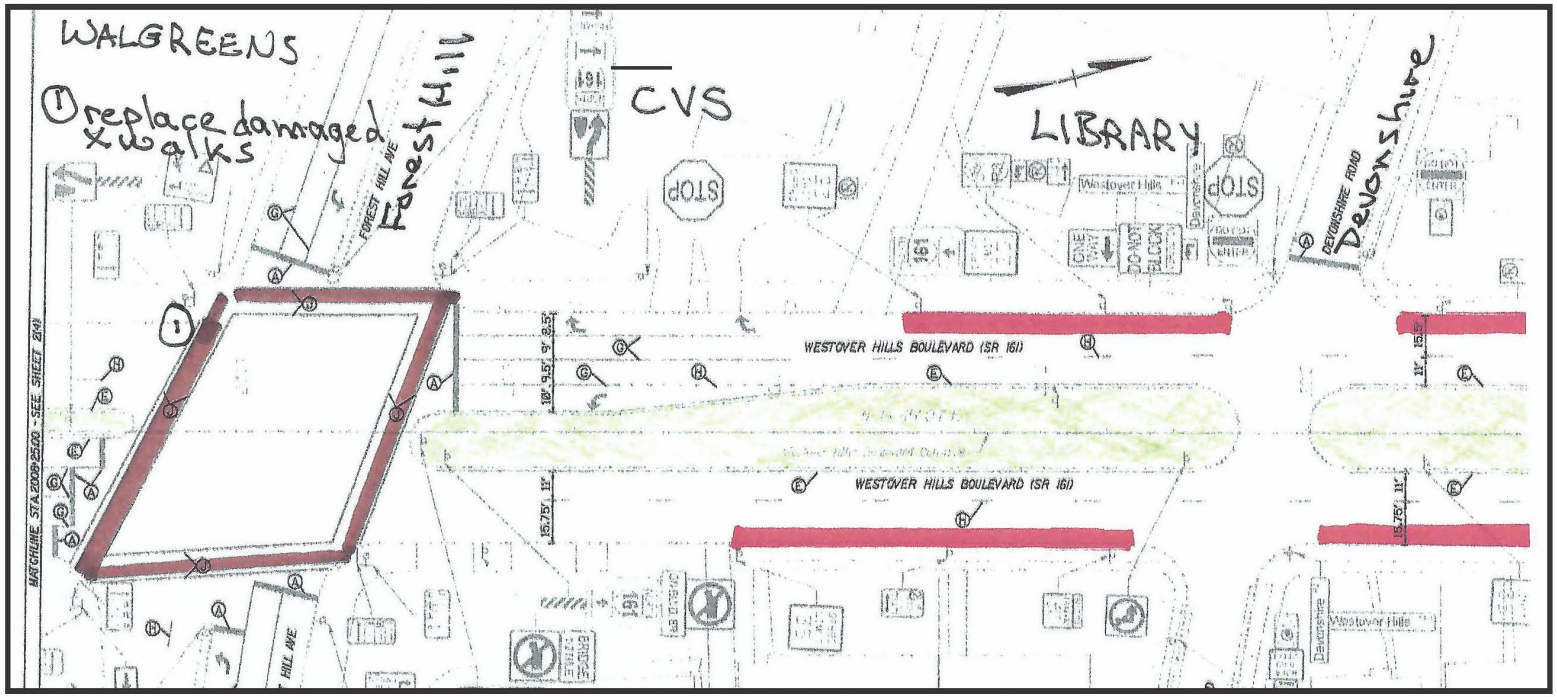


Figure 6: On the <u>other</u> side of Forest Hill Avenue