Forest Glen/Montgomery Hills Traffic Analysis

INTRODUCTION

This appendix summarizes the methodology and analysis behind recommendations included in the Montgomery Hills/Forest Glen Sector Plan. Those recommendations are intended to promote a safe and efficient multimodal transportation system through Vision Zero principles that prioritizes safety for all modes above traffic flow and congestion mitigation needs. It is anticipated that an enhanced multimodal transportation network, resulting from this plan's recommendations, will help meet future transportation demand in the Plan area. To achieve this goal, transportation recommendations included in the Sector Plan focus on strategic improvements to existing transportation infrastructure and new protected crossings as a means of improving connectivity and mobility through the horizon year (2040) of this transportation analysis.

GEORGIA AVENUE ROAD CHARACTERISTICS

Georgia Avenue (MD 97) is the spine and focus of the Sector Plan. Classified as a major highway, it is owned and maintained by the Maryland State Highway Administration (MD SHA). One of only a handful of north-south corridors in the County that maintains continuity over nearly 20 miles, it connects the County's southern border with Washington, D.C. to the northern boundary with Howard County. The approximately two-mile segment of Georgia Avenue within the Sector Plan study area is among the most heavily traveled with a daily average traffic volume of 75,000 cars per day and exhibits severe congestion[1] during the three-hour peak travel period. Amongst all roadway segments in the County, Georgia Avenue between the DC Line and the Beltway, is ranked the fourth most congested behind Ridge Road (MD 27)[2], Colesville Road (US 29)[3], and Connecticut Avenue (MD 185)[4],[5].

Within the Plan boundaries, Georgia Avenue is traveled for many kinds of trips. It carries residential traffic from the several single-family homes that front the roadway in the northern segment of Forest Glen. It provides access to local neighborhood businesses, offices, high-density residential buildings, and places of worship in Montgomery Hills and through Woodside Park. It also carries commuters from the far northern County neighborhoods and the Beltway to and from the County's southern urban centers and the District. Washington Metropolitan Area Transit Authority (WMATA) busses travel up and down the corridor making stops along the roadway between Silver Spring and Olney. People walk and bike along Georgia Avenue to get to schools, parks, and neighbors. While the roles of Georgia Avenue overlap, the design of the roadway clearly shows a historic preference for moving large volumes of regional motor vehicle traffic as it spans between six and seven travel lanes, with few signalized intersections between Wheaton and downtown Silver Spring.

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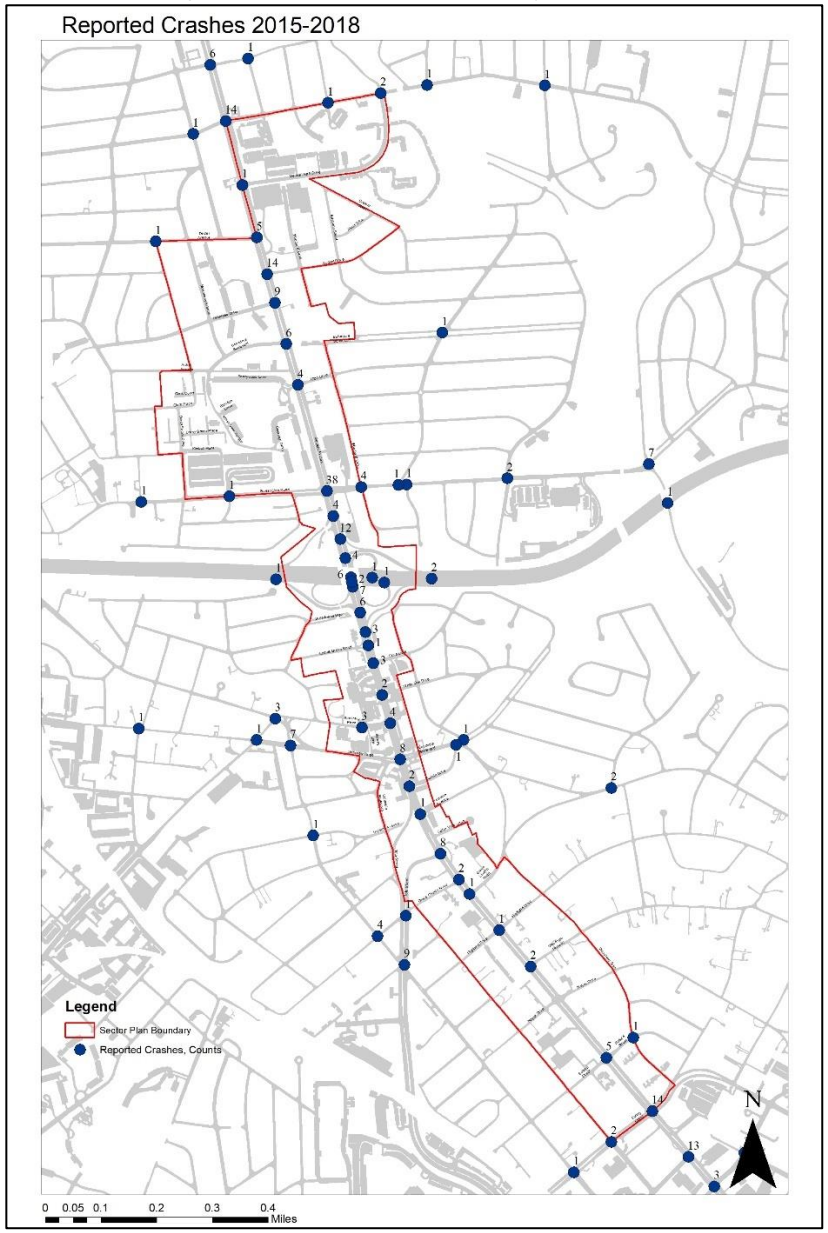
[1] According the Montgomery County Mobility Assessment Report (2017), it experiences 77% congestion during the peak evening 3-hour period.
[2] Southbound, between Brink Road to David Mill Road
[3] Southbound, between the Capital Beltway and the DC city boundary
[4] Southbound, between the Capital Beltway and the DC city boundary
[5] Montgomery County Mobility Assessment Report (2017)

MDOT SHA completed recent improvements at select locations along Georgia Avenue to improve conditions for pedestrians. These improvements include re-poured sidewalks, accessible curb ramps with channelized walkways at intersections, and pedestrian countdown signals. While these improvements were recently completed, significant infrastructure improvements are still necessary to improve safety and enhance connectivity on and along Georgia Avenue.

GEORGIA AVENUE ROAD – SUMMARY OF REPORTED CRASHES IN THE PLAN AREA

The Forest Glen/Montgomery Hills Sector Plan is among the first master plans to commence following the Montgomery County Council's adoption of the Vision Zero Action Plan. This plan, adopted in November 2017, identifies Georgia Avenue as a high-risk roadway and includes the roadway in the county's high injury network. Georgia Avenue, between the intersections of Plyers Mill Road and Forest Glen Road, is identified as a high priority corridor for engineering improvements based on the total number of severe and fatal crashes, the number of crashes per mile per year and the number of crashes per vehicle miles traveled. As shown in Figure 1, between 2015 and 2018, there were 14 fatal or severe injury crashes on Georgia Avenue along this segment. Although travel by motor vehicle represents the majority of person trips along the corridor, pedestrians and bicyclists accounted for four of these crashes. Roadways with at five or more severe fatal collisions and one or more collision per mile, per year were added to the county's high-injury network. The crash rate on the segment of the corridor is 12.51 per mile, which is why it was included in the high-injury network. Given forecasted population increases along the corridor, without intervention, this number is likely to increase. This high-level analysis suggests that infrastructure improvements are critical to improve safety on Georgia Avenue, particularly for vulnerable users such as pedestrians and bicyclists.

Figure 1: Severe and Fatal Crashes Map 2015-2018



COMPLETE STREETS

This sector plan recommends the transformation of Georgia Avenue to a multimodal complete street that increases safety and provides efficient travel through and across the corridor for all transportation modes. The transformation of Georgia Avenue to a multimodal complete street, defined as a street designed, operated and maintained to provide safe accommodations for people who walk, bicycle, use transit and drive, is a long-term vision. As the operation and maintenance of Georgia Avenue is a shared responsibility between the state and the county, the complete streets policies of each agency are relevant to the implementation of this long-term vision.

MDOT SHA adopted a Complete Streets Policy in 2011 that requires the consideration and incorporation of all transportation modes when developing or redeveloping the state's transportation system. The policy is committed to a safe, efficient and multimodal network as well as partnerships with local governments, transit providers and stakeholders to develop and maintain a complete street network.[6]

The Montgomery County Complete Streets Policy and Standards, included in Section 49-25 of the Montgomery County Code, seek to safely and conveniently accommodate all users of the roadway system. Included in Montgomery County's Road Design and Construction Code, the Complete Streets Policy and Standards "guide the planning, design, and construction of transportation facilities in the public right-of-way."[7]

With the planning, design and construction of long-term redevelopment or infrastructure projects, such as bus rapid transit (BRT), it is critical to implement the complete streets policies of the state and the county to facilitate the safe and efficient movement of all transportation modes. Major transportation projects such as BRT can only be successful if they are accompanied by a safe and comfortable environment for pedestrian and bicycle travel.

Creation of a New Street Type and Design Standards for High-Quality Transit Corridors

The Forest Glen/Montgomery Hills Sector Plan Working Draft recommends the creation of a new street type and design standards for high-quality transit corridors in residential communities through the development of Montgomery County's Complete Streets Design Guide. A new street type is needed because roads such as Georgia Avenue between the Wheaton and Silver Spring Central Business Districts (CBDs) do not fit well into the existing urban, suburban and rural classification system. While the majority of Georgia Avenue in the sector plan area is categorized as suburban in land use, it is more urban in its activity level, due to a large amount of walking, bicycling and transit use. The intent of the recommended new street type is to create an environment that prioritizes walking, bicycling and transit use consistent with the urban road classification described in Section 49 of the Montgomery County Code, which reduces

[6] "Complete Streets Policy, Maryland State Highway Administration." (http://roads.maryland.gov/OPPEN/SHA_Complete_Street_Policy.pdf)

[7] "Montgomery County Road Design and Construction Code." (Mont. Co. Code 1965, § 103-8; 2007 L.M.C., ch. 8, § 1; 2007 L.M.C., ch. 8, § 1; 2014 L.M.C., ch. 37, § 1.)

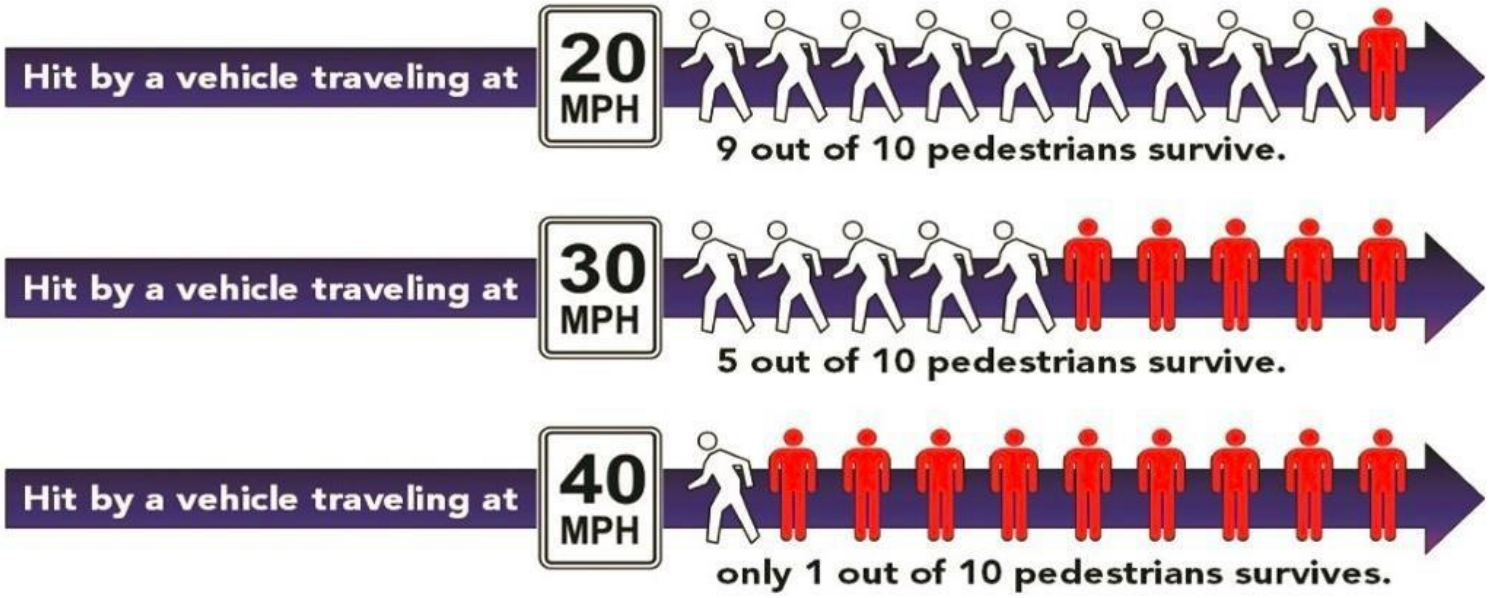
target speeds and lane widths and improves pedestrian and bicycle infrastructure to increase safety for all road users.

ROADWAY SAFETY

Roadway safety is achieved through the reduction of crash frequency and severity. Methods to reduce crash frequency include providing clearly designated space for each road user, as accomplished through a complete street, and regulating the interaction of road users through traffic signals or other traffic control measures. The reduction of crash severity is primarily achieved through reduced vehicle speeds.

The speed of vehicles on Georgia Avenue contributes to the inadequate quality of the environment for all road users and is inconsistent with the County's Vision Zero policy. The posted speed on Georgia Avenue within the sector plan boundary is currently 35 miles per hour from Spring Street to north of Dennis Avenue. There is concern about motor vehicle speeds on Georgia Avenue especially in the Forest Glen and Woodside Park plan area districts, as these segments experience lower levels of congestion and higher speeds are achievable. Similarly, on the few roads that parallel Georgia Avenue, there is concern that motorists appear to be traveling at speeds higher than what's posted (generally 25 miles per hour in the plan area), to make up for time lost sitting in congestion on Georgia Avenue. In recognition of research that shows that pedestrians have an 80 percent chance of survival if they are hit by a motor vehicle at 20 miles per hour, and an 80 percent chance of death if they are hit at 40 miles per hour, reducing traffic speeds is the most important change that is needed to eliminate traffic fatalities and severe injuries in the corridor. While traffic signals can improve safety by controlling conflicts at crossings, a principle tenant of Vision Zero is understanding that people make mistakes and sometimes fail to follow traffic control devices. Roads should be designed so these mistakes do not result in death or severe injury.

Figure 2: Pedestrian Death Risk Declines at Lower Vehicle Speeds (Courtesy of World Resources Institute)



Several strategies can be applied to reduce vehicle speeds, including reducing the posted speed and increasing automated enforcement. As discussed in greater detail below, these strategies can be effective and should be pursued. However, this sector plan also recommends engineering solutions, including reducing lane widths.

Design standards for urban and suburban arterial roadways generally specify 12-foot wide travel lanes. However, transportation officials, including the American Association of State Highway and Transportation Officials (AASHTO) and the National Association of City Transportation Officials (NACTO) have suggested the use of 10- or 11-foot wide lanes to promote slower driving speeds and reduce the severity of crashes without impacting traffic operations. Reducing the width of travel lanes also provides an opportunity to reallocate space to other modes of transportation and streetscape improvements.[8,9,10]

With the long-term transformation of Georgia Avenue to a complete street, this master plan recommends 10-foot-wide travel lanes and 12-foot-wide transit lanes. The reduction in lane widths provides an opportunity to increase safety for road users by slowing speeds and reducing pedestrian crossing times. It also allows reallocation of right-of-way to improve safety for all users by providing adequate width for sidewalks, bikeways, medians, and buffers.

Reducing Speed on Georgia Avenue

Target speeds serve as a key factor for determining design speeds, influencing operating speeds, and serving as a reference for establishing speed limits. Chapter 49 of the Montgomery County Code identifies target speeds to provide consistency among the design characteristics of a roadway, its operating speed, the speed limit, and the required safety and mobility for all road users. The target and design speed ranges identified in Chapter 49 are intended to capture a broad range of conditions, are not suitable to every situation and may be periodically revised to meet the needs of the county.

Although Georgia Avenue is a state road, the county's road standards provide context to evaluate appropriate speeds on a multimodal corridor such as Georgia Avenue, which is classified as a major highway in the Master Plan of Highways and Transitways. Chapter 49 of the County Code identifies the target speed on a major highway in an urban area as 25 miles per hour and 35-to-40 miles per hour in a

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[8] National Association of City Transportation Officials, *Urban Street Design Guide:* 34.

[9] Ingrid Potts, Douglas W. Harwood, and Karen R. Richard, "Relationship of Lane Width to Safety on Urban and Suburban Arterials," accessed April 5, 2018, https://nacto.org/docs/usdg/lane_width_potts.pdf.

[10] Kay Fitzpatrick, Paul Carlson, Marcus Brewer and Mark Wooldridge, "Design Factors that Affect Driver Speed on Suburban Arterials," accessed April 5, 2018, https://nacto.org/docs/usdg/design_factors_that_affect_driver_speed_fitzpatrick.pdf.

suburban area. This master plan recommends the reduction of target speeds on Georgia Avenue to 30 miles per hour, consistent with the lower range of the target speed identified in the County Code.

Pursuant to Maryland State Law Subtitle 8 Section 21-803, a local authority may alter speed limits on a state highway with the approval of the SHA if, based on an engineering and traffic investigation, the local authority determines that the maximum speed limit exceeds or is less than reasonable or safe under existing conditions. The local authority may then establish a reasonable and safe maximum speed limit with the approval of MDOT SHA.

Reducing Turning Speeds along the Corridor

One way to improve pedestrian safety at intersections is to reduce the crossing distance at intersections which decreases the exposure to potential conflicts with motorists, especially those making turns in the intersection. Curb extensions, also known as bulb outs, are effective are reducing the crossing distance and can also make pedestrians queuing on the corner more visible to motorists by bringing the curb closer to the motorists' field of vision. Even simply tightening the curb radii can make a difference as the tighter the curb, the slower the motorist has to drive to navigate the turn with precision. In urban areas, the ideal curb radius is no larger than 15 feet. This can be too tight for trucks and buses. On corridors with higher volumes of larger vehicles, a curb radius of 20 feet can be an effective treatment and navigable for vehicles of all sizes.

Curb extensions can be most easily installed where there is space for on-street parking, the curb extension can repurpose the area closest to the intersection. It is important to note that this design treatment does not remove a legal space, as intersections should be clear as far back at 50 feet from the intersecting roadway to provide adequate visibility for vehicles queuing at the intersection. The following locations haven been identified as potential locations for curb extension treatments. Additional study will be needed before implementation.

- Dexter Avenue (fire hydrant south side)
- Hildarose Drive
- Belvedere Boulevard
- Locust Grove Road (remove channelization island when median on Georgia Avenue installed)
- Flora Lane
- Corwin Drive
- Grace Church South
- Highland Drive
- Woodside Parkway
- Noyes Drive
- Ballard Street

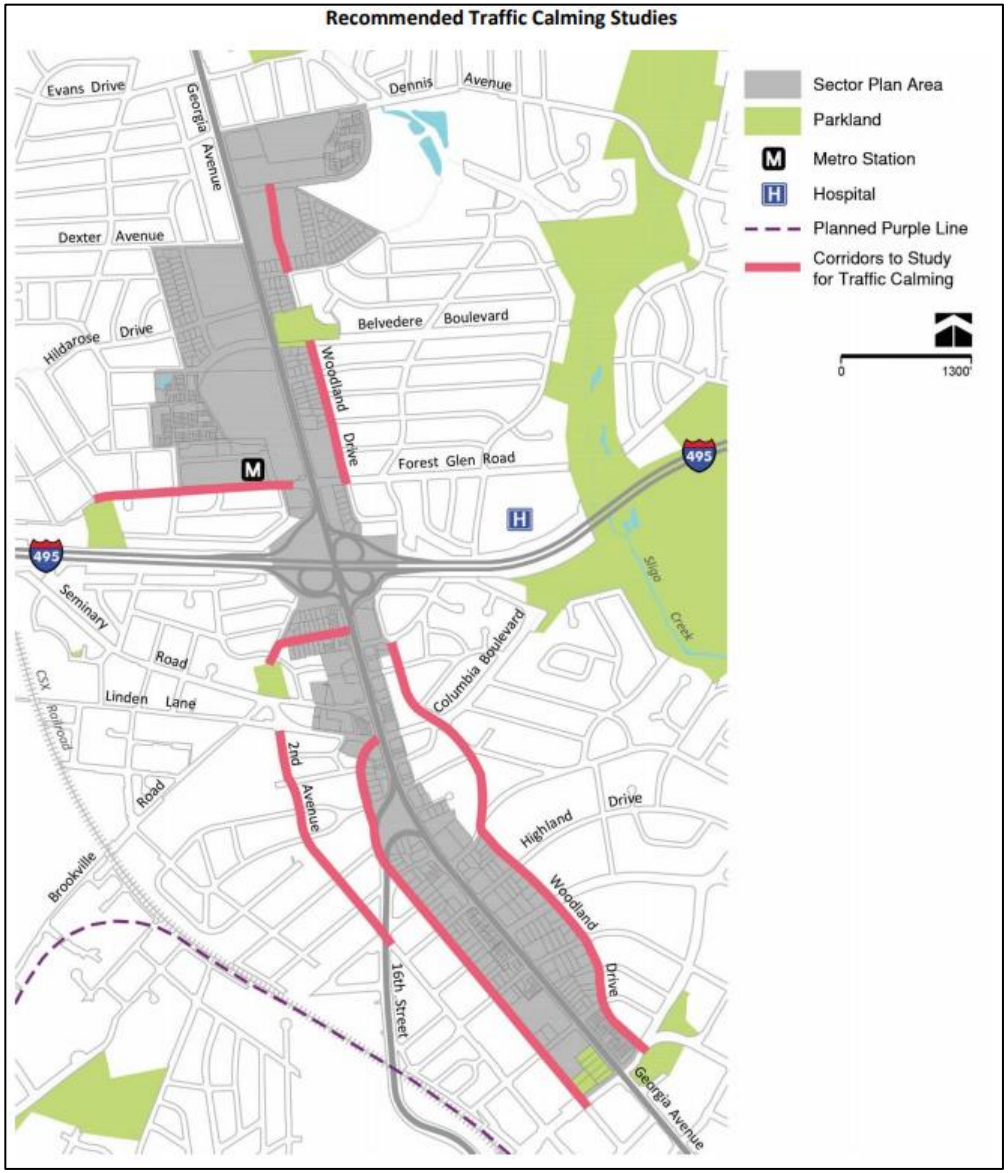
Traffic Calming Studies

This plan recommends Montgomery County Department of Transportation (MCDOT) initiate operational traffic studies of key parallel side streets to consider traffic calming treatments (see Figure 3). These studies should capture and analyze current traffic speeds and identify strategies that align with the county's Vision Zero Initiative and the 2018 *Bicycle Master Plan*. Speed reduction strategies identified should reflect the current best practices and should not decrease access for bicyclists and pedestrians[11]. While maintaining access and connectivity in the road network is important, excessive vehicle speeds on the side streets are detrimental to safety and the residential character of the neighborhoods surrounding the Georgia Avenue corridor.

- East Side of Georgia Avenue
  - Woodland Drive (Medical Park Drive to Forest Glen Road and Flora Lane to Spring Street)
  - Dale Drive (Georgia Avenue to Colesville Road)
  - Forest Glen Road (Georgia Avenue to Sligo Creek Parkway)
  - This plan confirms MCDOT's proposed traffic calming circle at the intersection of Tilton Drive and Woodland Drive to slow traffic.
- West Side of Georgia Avenue
  - Locust Grove Road (Georgia Avenue to Second Avenue)
  - Columbia Boulevard (Seminary Road to 16th Street)
  - Forest Glen Road (Capital View to Georgia Avenue)
  - First Avenue (16th Street to Spring Street)
  - Second Avenue (Lansdowne Way to Riley Road and Linden Lane to Spring Street)
  - Seminary Road (Georgia Avenue to Forest Glen Road)

[11] Note, traffic calming strategies are limited on minor arterials and restricted on arterials.

Figure 3: Traffic Calming Studies



Further Study for Speed Enforcement

Reducing the traveling speed of vehicles is a key component to ensuring safety for all modes of travel. Since 2013, the Montgomery County Police Department (MCPD) has successfully deployed several speed enforcement cameras as part of its Safe Speed campaign. Cameras were installed on Georgia Avenue in both directions within the Woodside Park District. Speed cameras are effective at slowing vehicular speed, because the technology is automatic, unbiased and consistent. This plan recommends MCPD evaluate the following roadway segments for temporary and/or permanent speed camera installation.

- Georgia Avenue between August Drive (near church/private school St. John the Evangelist) and Tilton Drivee.
- Woodland Drive between August Drive and the Capital Beltway.
- Dale Drive between Georgia Avenue and Colesville Road.
- Second Avenue between Linden Lane and Spring Street.

Reducing Conflicts

Consolidate Driveways on Georgia Avenue

The frequency of driveways providing direct access along Georgia Avenue presents the potential for conflicts among different travel modes. Driveways interrupt pedestrian and bicycle travel and introduce numerous and sometimes unexpected vehicle turns into and out of through-traffic.

Redevelopment opportunities along Georgia Avenue should consolidate or eliminate driveways to reduce conflicts among travel modes. New driveways should be considered only in conjunction with the removal or reduction of existing driveways. The following existing driveways should be considered for removal:

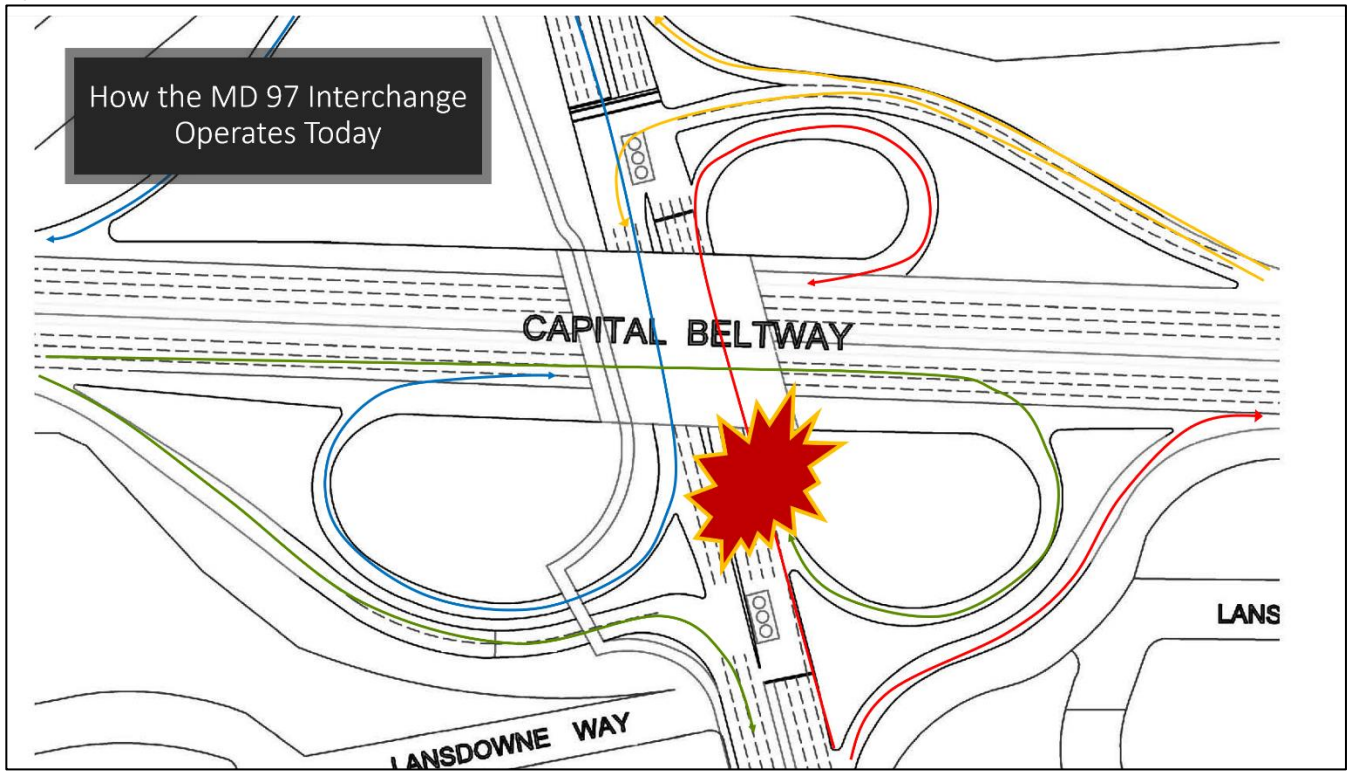
- East Side of Georgia Avenue
    a. Private driveway immediately opposite Seminary Place (could be consolidated with existing parking lane egress driveway).
- West Side of Georgia Avenue
    a. Close middle entrance to Seminary Plaza Shopping Center (immediately south of the car wash).
    b. On-street parking lane and its driveways between Seminary Place and Seminary Road. Drycleaners property and Montgomery Hills Shopping Center.
    c. Close Georgia Avenue driveway onto Montgomery Hills Shopping Center (northwest corner of Georgia Avenue and Seminary Road).

Road Safety at the Beltway Interchange

The cloverleaf design of the interchange negatively impacts traffic safety. This design forces weaving maneuvers for motorists attempting to merge on and off the Beltway. Motorists exiting the inner-loop traveling northbound on Georgia Avenue have limited distance to merge into northbound Georgia Avenue traffic. This situation is complicated by northbound Georgia Avenue traffic attempting to merge onto the outer loop on-ramp all within the same space.

The plan recommends evaluation of two Beltway interchange design alternatives to improve safety and traffic flow. These design alternatives are recommended for further study. Recognizing that transportation planning and design is a rapidly evolving field, it may be determined that, after additional study, a design treatment unique from what is described below would potentially be more effective at improving safety and traffic flow. Should that be the case, the new treatment should be considered for implementation.

Figure 4: Beltway Existing Condition



Short-term Design Alternative: Beltway Ramp Reconfiguration

Removing the existing southeast cloverleaf (Beltway inner loop off-ramp to northbound Georgia Avenue) will eliminate the weaving that occurs between motorists merging onto the outer-loop (westbound) ramp and those motorists exiting the inner loop of the Beltway headed northbound on Georgia Avenue. This change will improve safety on Georgia Avenue approaching and beneath the Beltway underpass. Those motorists exiting the inner-loop and heading northbound on Georgia Avenue would share an expanded inner-loop off-ramp where southbound Georgia Avenue traffic is routed today. This reconfiguration is expected to improve safety and could potentially improve traffic flow on Georgia Avenue northbound as merging would no longer be an issue.

- Remove the existing southeast cloverleaf.
- Re-route inner-loop off-ramp traffic northbound onto Georgia Avenue to existing inner-loop off-ramp southbound onto Georgia Avenue. Use the existing traffic signal to protect left-turning northbound traffic onto Georgia Avenue.
- Evaluate measures to improve safety for pedestrians crossing the Beltway ramps on the east side of Georgia Avenue. Such measures could include a pedestrian-actuated signal to increase pedestrian visibility and improve vehicular stop-compliance.
- Undertake a traffic study to determine potential impacts on both traffic safety and traffic flow on Georgia Avenue and the Beltway.

Long-term Design Alternative: Diverging Diamond Interchange

A diverging diamond interchange (DDI) is an interchange design in which traffic from the lower classified street crosses over to the opposite side of the road to make a free left turn onto the freeway. Installation of this treatment would result in a complete overhaul of the access to the Beltway and would replace all existing cloverleaf on- and off-ramps. The DDI would be installed beneath the Beltway overpass.

- Implementation of the DDI would remove the three cloverleaf on/off ramps.
- Implementation of the DDI would keep the existing slip lanes (northbound Georgia Avenue, southbound Georgia Avenue)
- Install signage and pavement markings in advance of the DDI on either end of Georgia Avenue to help motorists choose the correct lane as early as possible.
- Maintain and improve the existing pedestrian and bicycle bridge on the west side.
- Install a new pedestrian and bicycle bridge on the east side.

Figure 5: Design Alternative 1

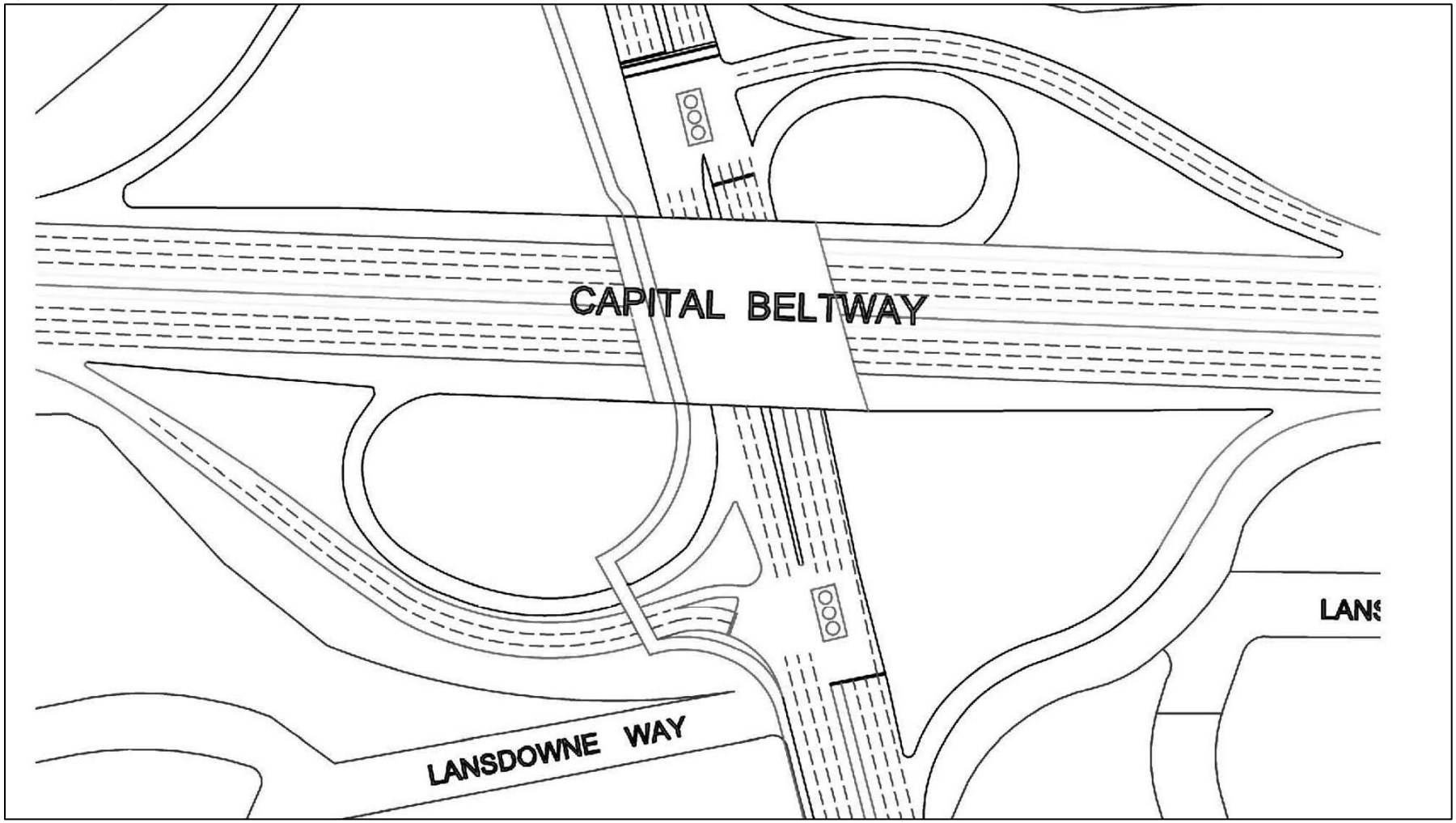
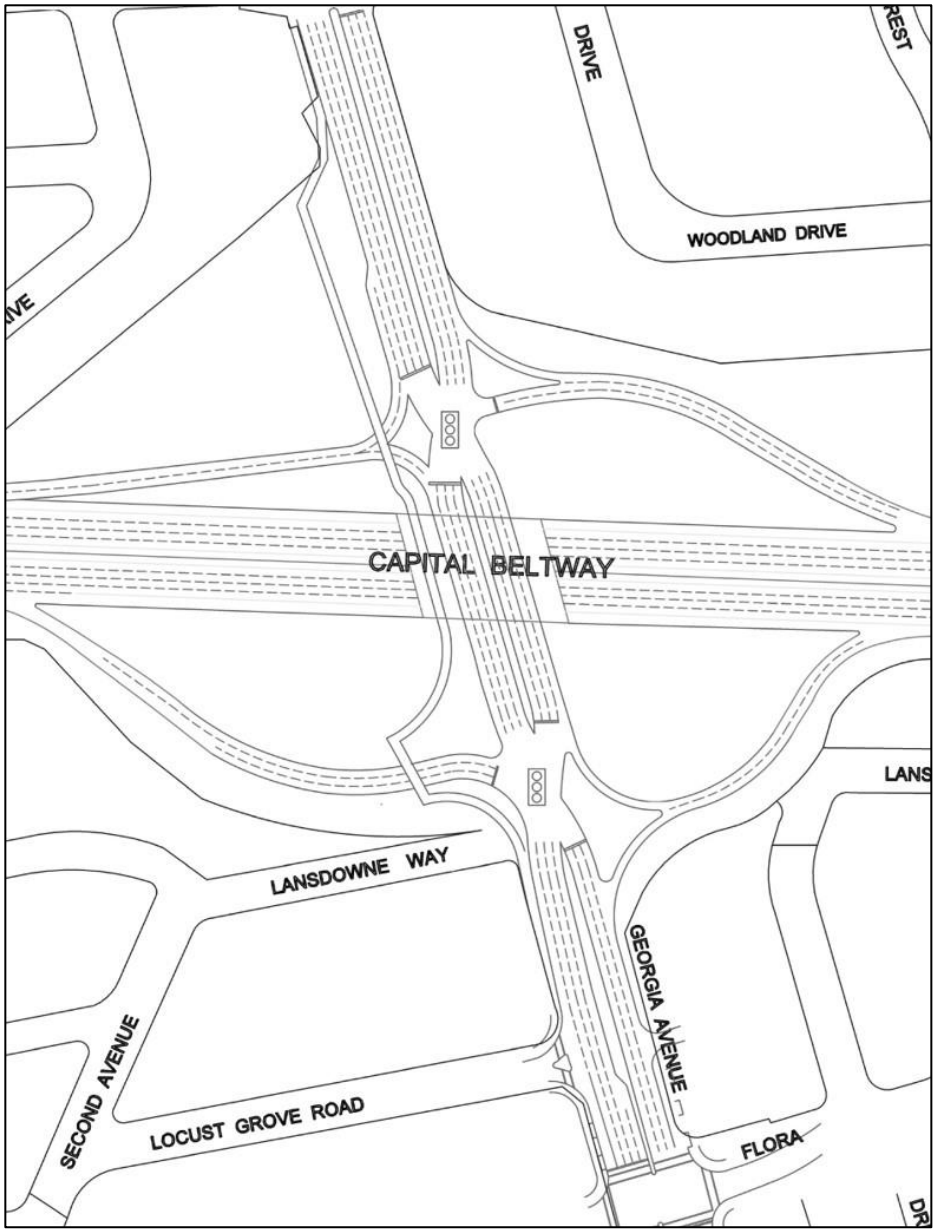


Figure 6: Design Alternative 2



Montgomery Hills Main Street Concept

The Montgomery Hills segment of the Georgia Avenue corridor has been studied in pursuit of making it safer for all transportation modes and improving the flow of vehicular traffic. The 2000 *North and West Silver Spring Master Plan* dedicated an entire section of the document to the study of Georgia Avenue as it runs through Montgomery Hills (Forest Glen Road to 16th Street).

This plan carries forward the previous plan vision with modifications to reflect current best practices. The Montgomery Hills District is envisioned as a walkable grid with Georgia Avenue serving more as a main street for local residents rather than a pass-through for regional commuters.

The Maryland State Highway Administration (MDOT SHA) is completing a comprehensive study and redesign of the segment of Georgia Avenue between Forest Glen Road and 16th Street in response to the county's master plan concept. The MD 97 Georgia Avenue Montgomery Hills Study aims to incorporate public feedback along with a conceptual cost-engineering analysis of the preferred design alternative. This plan confirms the design elements of the MDOT SHA project in the interim term, while supporting a more robust design in the long term.

Interim Term (MDOT SHA Preferred Alternative)

The road segment design elements listed below are what have been confirmed by MDOT SHA staff as of December 31, 2018. This section will be updated when the final project is revealed to the public.

- Maintain the master-planned 120-foot of right-of-way on Georgia Avenue.
- Narrow interior travel lanes to 10-feet wide maximum; 11-feet maximum for curb lanes.
- Remove the reversible lane configuration.
- Install a landscaped median to separate the two directions of traffic, create turn pockets for left turn lanes and provide pedestrian refuge at signalized intersections.
- On the west side of Georgia Avenue, install an 8-foot side walk, an 8-foot two-way separated bike lane and a two-foot buffer from traffic.
- On the east side of Georgia Avenue, install an 8-foot sidewalk.
- Remove the southbound slip lane of 16th Street and realign southbound 16th Street with present alignment of northbound 16th Street.

Plan Vision (Long-Term)

This plan's vision for Georgia Avenue within Montgomery Hills builds on the previous plans, projects and studies, each of which visualized a more walkable and bikable transportation network. The plan advances the vision for Georgia Avenue by designating this segment as a main street corridor with key design elements, including the following:

- Designated spaces for all travel modes.
- Designated space for high-end bus rapid transit station furniture.
- Aesthetically pleasing buffers between motorized and non-motorized traffic with street trees and understory vegetation.
    - Along the west side of Georgia Avenue install a concrete grade-separated buffer between the two-way separated bike lane and vehicular traffic.
    - Along the east side of Georgia Avenue, install a 5-foot buffer (ideally with street trees) and at least a five-foot sidewalk.
- Pedestrian-scale lighting.
- Relatively short blocks to improve navigation throughout the corridor; these blocks are created by spacing crossings ideally no more than 300 to 500 feet apart to facilitate safe crossings for all modes, especially pedestrians and bicyclists.
- A street grid with north/south and east/west options that improves both local and regional travel through the corridor.

Main Street Grid

The long-term vision assumes implementation of all short-term or interim recommendations. Building on the short-term improvements, the vision further improves the pedestrian level of comfort and the bicycle level of traffic stress by providing more separation between these two modes.

To improve circulation, the sector plan envisions a more connected street network on the west side of Georgia Avenue with redevelopment. Several new roadways are recommended to intersect with Georgia Avenue that should be evaluated for new protected pedestrian crossings. Providing more frequent crossings for both vehicles and non-motorized transportation modes on Georgia Avenue would improve the walking experience, while increasing safety for all modes as they travel through and across the corridor.

The plan recommends a new grid of business district roadways, Montgomery Hills Connectors (B-2, B-3, and B-4) with redevelopment of the Seminary Shopping Plaza. Specific recommendations to achieve the long-term vision are detailed in the appendix.

Figure 7: Main Street / Grid Concept

- Improve bicycle and pedestrian conditions along Georgia Avenue.
    - Install a three-foot-wide buffer from vehicular traffic (horizontal/vertical), a 10-foot two-way separated bike lane and five-foot-wide sidewalk on the west side of Georgia Avenue
- Implement a grid of new business district roadways, the Montgomery Hills Connectors (B-2, B-3 and B-4)
    - Provide a business district roadway (B-2) parallel to Georgia Avenue on the west side of the corridor, between the northern limits of the Seminary Place Shopping Center and Seminary Road. This roadway will provide a parallel route to Georgia Avenue and is recommended to align north-south such that it establishes a new connection between Seminary Road and the northern edge of the Seminary Place Shopping Center. It is not intended to connect to Locust Grove Road.

- The intention of the Montgomery Hills Connectors (B-3 and B-4) business district roads is to achieve a true grid on the west side of Georgia Avenue in the Montgomery Hills District. B-3 is envisioned to connect B-2 and align with the intersection of Flora Lane and Georgia Avenue.
- B-4 is envisioned to connect B-2 and align with the intersection of White Oak Drive and Georgia Avenue.
- All roadways should be developed to meet the standards of a business district roadway with two travel lanes and dedicated space for comfortable walking on both sides of the street. Dedication for low-stress (LTS-2) bicycle facilities and on-street parking should also be explored. At the time of this sector plan, the minimum master planned right-of-way for a business district street is 60 feet.
- All three roadways would only be realized with redevelopment of the Seminary Place Shopping Center, the Shell gas station and the car wash on the west side of Georgia Avenue. The configuration should be studied after the implementation of one of the design alternatives for the Beltway interchange outlined earlier in this section.
- With the installation of Montgomery hills Connector B-2, it may be beneficial to abandon or close segments of existing roadway that intersect with Seminary Road and/or Seminary Place at intersections that are deemed too close to Georgia Avenue for safety and circulation reasons. Examples of potential closures anticipated by this plan include:
    - Columbia Boulevard: This segment may be modified from its existing two-way operation between Seminary Road and 16th Street, to operate as a one-way southbound street.
    - Selway Lane: This segment may be modified from its existing two-way operation to operate as a one-way northbound street if the new north-south roadway is constructed. Restricting the access should not impede loading access to the businesses located between Seminary Place and Seminary Road. Altering the operation could also create additional space for a buffered sidewalk on one side of Selway Lane. If the Seminary Place Shopping Center redevelops, improving bicycle and pedestrian access between the shopping center and Kermit Road should be explored by MCDOT.
- If the recommended parallel route to Georgia Avenue is realized on the west side, additional roadway segments are recommended to align and connect with White Oak Drive and Flora Lane. These roadways are intended to be business district roads that provide dedicated space for pedestrians and motor vehicles (B-3 and B-4, respectively). Dedicated bicycle facilities and on-street parking should also be considered. Study of protected crossings at these new intersections with Georgia Avenue is also recommended. These recommendations are likely dependent on consolidation and/or redevelopment of the Seminary Place Shopping Center, the gas station and the car wash properties.
- If the southbound slip lane of 16th Street is removed, a pedestrian and bicycle-only protected crossing is recommended for study at Luzerne Avenue and Georgia Avenue. This crossing is also discussed in more depth in the New Trail Connections subsection of the chapter.
- Restore left turn movements at Forest Glen Road and Seminary Road in the peak periods. Modeling efforts conducted for

the sector plan determined that this could be achieved if the left turning movements are permitted during the peak period in the peak direction only. This condition be re-evaluated after the Interim-term recommendations are realized and when improvements are made to the Beltway interchange.

- Reduce curb radii where possible to 15 feet to reduce turning speeds of vehicles and improve safety for pedestrians crossing the roadway.
- Install curb extensions where feasible to make pedestrians waiting to cross more visible to motorists and to reduce exposure in the crossing.
- Study the potential improvements and impacts of repurposing one of the four southbound lanes (curbside or median alignment) for a peak-direction bus rapid transit guideway.

Automated Enforcement

The Montgomery County Police Department's Safe Speed program is an automated speed enforcement program that enforces speeds in residential areas through speed cameras. Currently, there are no speed cameras on Georgia Avenue in the Forest Glen and Montgomery Hills Plan Districts. However, permanent speed cameras have been installed in both directions on Georgia Avenue between 16th Street and Spring Street as a measure to slow traffic speeds approaching downtown Silver Spring to the south and the Montgomery Hills commercial center to the north. This sector plan encourages the Montgomery County Police Department to add Georgia Avenue as a Speed Camera Corridor as part of the Safe Speed Enforcement program. Other Maryland State Highways, including Colesville Road, Georgia Avenue and Connecticut Avenue are designated speed camera corridors.

Additionally, the sector plan identified local roadways in the sector plan area that given their connectivity, geometric and relationship to Georgia Avenue may be roadways that experience speeding and other unsafe traffic behaviors. This plan recommends MCPD evaluate the following roadway segments for temporary and/or permanent speed camera installation.

- Georgia Avenue between August Drive (near church/private school St. John the Evangelist) and Tilton Drivee.
- Woodland Drive between August Drive and the Capital Beltway.
- Dale Drive between Georgia Avenue and Colesville Road.
- Second Avenue between Linden Lane and Spring Street.

These corridors are identified on a map in the sector plan and are recommended for further study of travel speeds and potential traffic calming mitigation.

Multiple-Threat Conflicts

Pedestrians crossing Georgia Avenue regularly encounter dangerous conflicts with vehicles, transit buses, and commercial trucks. Limiting conflict between pedestrians and vehicles and eliminating injuries is a key component of both the Forest Glen/Montgomery Hills Sector Plan and the plan's Vision Zero goal.

The level of protection and safety provided by pedestrian facilities in the Georgia Avenue corridor varies widely by intersection. Multiple-threat pedestrian conditions exist where crosswalks (both marked and unmarked) span multilane roads, requiring vehicles in multiple travel lanes to stop for pedestrians. These are called multiple threat because while one vehicle may stop for a pedestrian attempting to cross, that stopped vehicle may be blocking the sight lines of the pedestrian crossing and an approaching vehicle in adjacent lane, thereby creating a potential conflict and unsafe crossing condition (see Figure 8 below). Although multiple-threats are most common at mid-block and unsignalized pedestrian crossings, such conditions can also occur at fully signalized and protected crossings.

Driver awareness and pedestrian visibility are critical factors in preventing multiple-threat conflicts. Motorists should be alerted to the presence of pedestrian crossings through signage (e.g. rapid pedestrian flashing beacons) and advance stop/yield lines (20-30 feet from a marked crosswalk). When crossing, pedestrians should actively scan for vehicles in outside lanes that are not slowing or observing cautionary signage. Identifying and improving crossings that include multiple-threat conflicts is key to achieving Montgomery County's Vision Zero objectives.

During the planning process multiple-threat conflicts were observed at four unprotected pedestrian crossings on Georgia Avenue:

Noyes Drive and Georgia Avenue: The Noyes Drive crossing is heavily used on Friday evenings, Saturday mornings and afternoons, and Jewish holidays, as it provides direct access to the Woodside Synagogue on the northeast corner of the intersection. The Woodside Synagogue is an Orthodox Jewish congregation. Congregants of the synagogue strictly observe the laws of the Jewish Sabbath, and therefore refrain from operating machinery of any kind from Friday at sunset until Saturday nightfall. During the Sabbath members of the congregation do not drive, engage in commercial activities, or operate electronic or electric devices of any kind. These also apply to certain major Jewish Holidays throughout the year. For this reason, the protected crossing treatment selected and designed for this intersection should not require pedestrians to activate the traffic control device with a button, switch, or other electrical device during the Sabbath. Members of the congregation should be included in the discussions of this protected crossing's design

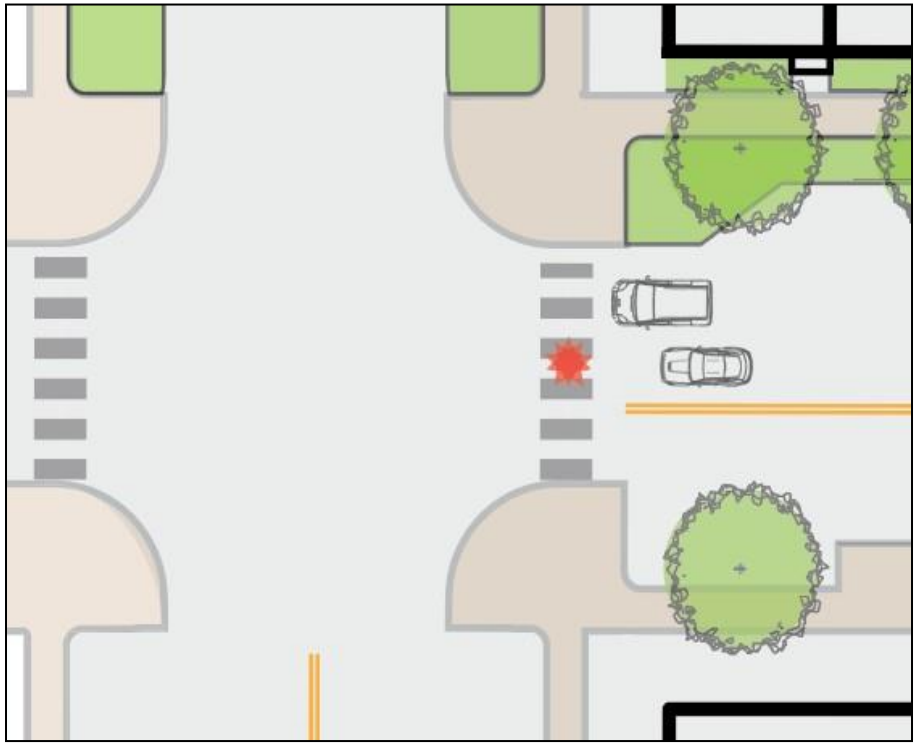
Tilton Drive and Georgia Avenue: One of the largest multi-unit residential developments in the sector plan area is located on the west side of the street. Pedestrians cross here and between this intersection and the intersection at Forest Glen Road to access Metrobus stops. A protected crossing here would benefit the most people directly (based on PLOC analysis) and could potentially improve access for all travel modes originating on the east side of Georgia Avenue, due to low network connectivity within the Forest Glen East

neighborhood.

Belvedere Boulevard and Georgia Avenue: Pedestrians frequently cross at this location accessing General Getty Park and the Metrobus stops.

Luzerne Avenue at Georgia Avenue: The MC React Map included a comment (which received additional "likes" from participants) that described the challenges residents endure when crossing from the east side to the west side to access Woodlin Elementary School, the shopping center on the west side of Georgia Avenue and the daycare and church located at the southwest corner of the 16th Street slip lane and Georgia Avenue.

Figure 8: Multi-Threat Scenario



PEDESTRIAN AND BICYCLE INFRASTRUCTURE

Overall, the look and feel of Georgia Avenue through the plan area feels auto-centric and unwelcoming to non-motorists. Walking and biking along Georgia Avenue is stressful due to a lack of buffer and/or separation from motorists, high volumes of motor vehicles, narrow and frequently obstructed sidewalks and a lack of tree canopy and other greenery. It is also stressful due to the number of lanes to cross

(six, sometimes seven lanes) on Georgia Avenue, lack of median refuge when crossing multiple lanes, minimum crossing time at signalized intersections, unmarked crosswalks on some legs of the intersection, inadequate queuing space, lack of adequate gaps in traffic at uncontrolled intersections, inadequate ADA access, and during peak hours cars "trapped" in the intersection due to spill back can block designated pedestrian crossings (especially within the Montgomery Hills area).

Walking and biking conditions within the neighborhood are inconsistent. Some streets have gaps in the sidewalk network. Buffers, if they are present range in width. Motorists speeding through neighborhoods make pedestrians uncomfortable, especially walking and biking on roads without a designated space for active transportation users.

This plan applies two new tools, developed by the Department's Functional Planning and Policy Division, to identify potential strategies to improve safety and comfort, which can also be used to evaluate and prioritize recommended facility improvements.

Pedestrian Network: Pedestrian Level of Comfort Analysis

The Pedestrian Level of Comfort (PLOC) analysis tool was created by the Montgomery County Planning Department for two reasons:

1. To identify locations in the existing walking network that are uncomfortable due to inadequate or incomplete sidewalks and crossings.
2. To quantify how different investments will increase connectivity.

The approach was inspired by the Bicycle Level of Traffic Stress (LTS) analysis conducted in support of the Montgomery County Bicycle Master Plan. The PLOC is a work in progress. The Planning Department will be retaining assistance from a private contractor in FY 2019 to refine the methodology and the metrics that will be used to evaluate pedestrian connectivity. The following sections describe the PLOC analysis and supporting evaluation metrics as they exist in the fall of 2018.

Pedestrian Connectivity Methodology

PLOC scores range from High-Quality to Unacceptable.

- High-Quality: This walking environment enables parents to walk with young children with a moderate level of supervision.
- Acceptable: This walking environmental is comfortable for families, but parents would hold the hands of young children.
- Unacceptable: This walking environment is uncomfortable, and most adults will only walk if they have no other option.

Sidewalks and crossings are scored based on a "weakest link" approach in which the comfort of a segment of the network is governed by its most uncomfortable characteristic. For example, along the north side of Randolph Road, south of Selfridge Road, a lack of an adequate width buffer between the sidewalk and the road gave the walking routes on both sides of the street an "unacceptable" rating.

Sidewalk and street crossings are evaluated using different methodologies. Sidewalk scoring considers the following inputs:

- Adjacent Land Uses
    - Urban
        - Mixed-use or high-density land use zones
        - ½ mile of rail or 1/4-mile bus rapid transit
    - Suburban
- Walkway Width (sidewalk or sidepath):
    - Less than 3.5 feet
    - 3.5 to less than 5 feet
    - 5 feet to less than 8 feet
    - 8 feet or more
- Walkway Type
    - Pedestrians only
    - Shared with bicyclists
- Walkway Quality:
    - Presence of a buffer that is at least 5 feet wide
    - Frequency of obstructions
- Traffic Volume on Adjacent Roadway

Each leg of the intersection is analyzed as a separate street crossing. Street crossings are scored using the following inputs:

- Adjacent Land Uses
    - Mixed-use or high-density land use zones
    - ½ mile of rail or 1/4-mile bus rapid transit
- Presence of Traffic Control
    - Traffic Signal
    - Stop Sign
    - No Traffic Control
- Presence of a Right Turn on Red Restriction
- Cross Street Characteristics
    - Number of Lanes
    - Posted Speed Limit
- Presence of a Median

- Presence of a Crosswalk Marking

Montgomery Hills Forest Glen Small Area Master Plan Pedestrian Scenarios

In addition to evaluating existing conditions, pedestrian connectivity is evaluated based on conditions that would exist upon implementation of the master plan recommendations. These recommendations include improvements such as reducing speed limits, installing buffers between the roadway and sidewalks along Georgia Avenue, and providing safe pedestrian crossings along the corridor.

Pedestrian Connectivity Analysis

Three approaches are used to evaluate pedestrian connectivity. The first analysis evaluates the connectivity between dwelling units and nearby destinations within a given walkshed. A second analysis measures access to retail and commercial attractions. Finally, a third analysis evaluates how well dwelling units are connected public transit by measuring connectivity between dwelling units and the closest bus stop pair.

Destination Connectivity Methodology

The destination connectivity analysis identifies how recommended long-term improvements may impact pedestrian access to specific destinations. Connectivity is measured by comparing the number of dwelling units accessible to a destination under various scenarios (existing conditions and fully implemented long-term recommendations) to the number of dwelling units accessible to a destination in the "fully walkable" scenario. A distance of 0.5 miles from the destination along the "fully walkable" pedestrian network is used to generate the catchment area for all scenarios. The network for each scenario is based on those segments of the pedestrian environment that are considered to have at least an "acceptable" PLOC score.

Table 1: Destination Pedestrian Connectivity Analysis

Destination Name	Residential Dwelling Units				
Schools	Base	Existing	%	Long-term Recommendations	%
Flora M. Singer	198	191	96%	198	100%
Woodlin	380	334	88%	342	90%
Hospital	Base	Existing	%	Long-term Recommendations	%
Holy Cross Hospital	430	222	52%	393	91%
Forest Glen Metro	Base	Existing	%	Long-term Recommendations	%
North Entrance	1044	152	15%	914	88%
South Entrance	1127	72	6%	939	83%
Total	2171	224	10%	1853	85%
Neighborhood Parks	Base	Existing	%	Long-term Recommendations	%
Forest Glen	242	67	28%	233	96%
Forest Grove	327	311	95%	320	98%
General Getty	1367	399	29%	1158	85%
Montgomery Hills	543	398	73%	526	97%

Retail/Commercial Connectivity Methodology

Connectivity to retail and commercial destinations was measured by comparing access to the total square footage under existing and master plan scenario conditions.

Transit (Bus) Connectivity Methodology

Since people are most likely to access bus stops on both sides of the road, bus stop pairs that serve opposing directions are evaluated together. For each bus stop pair, the number of residential units within the 0.5-mile catchment area that are connected to both bus stops is determined for both existing conditions and the long-term phase of the plan. These figures are then compared to the "fully walkable", or base scenario, to determine the level of connectivity. Under existing conditions, there are zero bus stop pairs that are

accessible from both sides of the street. The results in Table 2 show that with the provision of additional protected crossings, such as signalized intersections and other intersection improvements, recommended in the long-term scenario pedestrian connectivity grows significantly for most bus stop pairs.

Table 2: Bus Stop Pedestrian Connectivity Analysis

Bus Stop Description	Station Pair ID	Base Conditions			Long Term Conditions		
		Dual Connectivity	NB Only	SB Only	***Dual Connectivity Percent***	NB Only	SB Only
GEORGIA AVE & DENNIS AVE	1	58	0	0	***83%***	5	0
GEORGIA AVE & DEXTER AVE	2	47	0	0	***26%***	0	35
GEORGIA AVE & AUGUST DR/HILADROSE	3	586	14	0	***98%***	18	0
GEORGIA AVE & BELVEDERE BLVD	4	305	3	0	***20%***	54	121
GEORGIA AVE & TILTON DR/AMERICANA FINNMARK	5	496	5	0	***100%***	5	0
GEORGIA AVE & FOREST GLEN RD	6	301	0	0	***75%***	1	5
GEORGIA AVE & SEMINARY PL/SEMINARY RD	7	530	9	2	***97%***	10	2
GEORGIA AVE & LUZERNE AVE	8	152	0	43	***62%***	20	40
GEORGIA AVE & GRACE CHURCH RD	9	89	43	0	***73%***	0	0
GEORGIA AVE & HIGHLAND DR	10	493	0	0	***38%***	0	0
GEORGIA AVE & NOYES DR	11	164	0	0	***51%***	0	0
GEORGIA AVE & BALLARD ST	12	512	13	0	***1%***	111	0

Sidewalk Recommendations

The results of the PLOC analysis helped to both identify new and vet proposed changes to the pedestrian network. The following includes a list of sidewalk projects.

a. Improve sidewalks on major highways
    i. Improve existing sidewalks along **16th Street** such that all sidewalks are at least 5 feet wide, are buffered by a 5-foot tree lawn, and a free of obstructions.
    ii. Close the sidewalk gap on **16th Street** between Grace Church Road and Georgia Avenue with sidewalks on both sides that are at least 5 feet wide, are buffered by a 5-foot tree lawn, and are free of obstructions.
b. Improve sidewalks on arterial roadways
    i. Widen sidewalks to a minimum 5-feet, install a minimum 5-foot landscaped buffer, and remove all obstructions from sidewalks on both sides of **Forest Glen Road** from Georgia Avenue to Seminary Road.
    ii. Improve walking conditions on **Forest Glen Road** east of Georgia Avenue
        1. **Interim Term**: Close the sidewalk gap between Forest Grove Road and Sligo Creek Parkway on the north side of the roadway by installing a 5-foot (minimum) sidewalk. (Included in the Forest Glen Passageway CIP project)
        2. **Long Term**: Improve existing sidewalks along Forest Glen Road such that all sidewalks are at least 5-feet wide, are buffered by a 5-foot (minimum) tree lawn, and free of obstructions.
    iii. Widen sidewalks on both sides of **Seminary Road** from Georgia Avenue to Forest Glen Road and install a minimum 5-foot landscape buffer on the north side of **Seminary Road** from Georgia Avenue to Sutton Place.
    iv. Widen sidewalks to a minimum of 5-feet, install a minimum 5-foot landscaped buffer, and remove all obstructions from sidewalks on both sides of **Columbia Boulevard** from Georgia Avenue to Flora Lane.
    v. Improve pedestrian and bicycle conditions along **Dale Drive** from Georgia Avenue to Colesville Road. A study for both long- and short-term interventions is underway by MCDOT.
c. Close key sidewalk gaps in the pedestrian network
    i. Install continuous sidewalks on both sides of all residential streets which provide a connection between existing and proposed transit stops/stations, retail centers, schools, parks and community facilities.
d. Improve existing sidewalks on business district streets
    i. Install 5-foot (minimum) buffers on **Spring Street** from Georgia Avenue to 1st Avenue.
e. Improve existing sidewalks on residential streets
    i. Install buffers at least 5 feet in width on the south side of **Medical Park Drive** between Georgia Avenue and Green Holly Terrace.
    ii. Widen the existing sidewalks on **Dexter Avenue** to a minimum of 5 feet from Georgia Avenue to McKenny Avenue.
    iii. Install 5-foot (minimum) sidewalks with 5-foot (minimum) landscaped buffer on the west side of **McKenney Ave** between Dexter Avenue and Hildarose Drive. Widen the sidewalks on the east side of **McKenny Avenue** from Dexter Avenue to at least

5 feet wide Belvedere Boulevard. Widen sidewalks on the west side of **McKenny Avenue** from Hildarose Drive to Belvedere Boulevard to at least 5-feet wide.

iv. Widen sidewalks on **Hildarose Drive** from Georgia Avenue to McKenney Avenue to at least 5 feet.
v. Widen sidewalks on **Belvedere Boulevard from** Georgia Avenue to Arthur Avenue to at least 5 feet.
vi. Install 5-foot (minimum) sidewalks with 5-foot (minimum) buffers on both sides of **Arthur Avenue** from Georgia Avenue to Belvedere Boulevard**.**
vii. Widen sidewalks to a minimum of 5 feet on both sides of **Flora Lane** from Georgia Avenue to Columbia Boulevard.
viii. Install 5-foot (minimum) buffers on both sides of **White Oak Drive** between Georgia Avenue and the alley behind the shopping Centers.
ix. Widen sidewalks to a minimum of 5 feet, install a minimum 5-foot landscaped buffer, and remove all obstructions from sidewalks on both sides of **Seminary Place** from Georgia Avenue to Second Avenue.
x. Install 5-foot (minimum) sidewalk with 5-foot (minimum) buffers on **Luzerne Avenue** from Georgia Avenue to Woodland Drive.
xi. Install 5-foot (minimum) sidewalks with 5-foot (minimum) buffers on **Woodland Drive** from Medical Park Drive to August Drive, and Ballard Street to Spring Street
xii. Install 5-foot (minimum) sidewalks with 5-foot (minimum) buffers on **Grace Church Road N** from Georgia Avenue to 1st Avenue.
xiii. Install 5-foot (minimum) sidewalks with 5 -foot (minimum) buffers along **Highland Drive** from Georgia Avenue to 1st Avenue.
xiv. Improve walking conditions **Ballard Drive** from Georgia Avenue to Woodland Drive. Widen the sidewalk and buffer on the south side such the both are at least 5-feet wide. Install 5-foot (minimum) sidewalks with 5-foot (minimum) buffers on the north side.
xv. Install 5-foot minimum sidewalks with 5-fot minimum buffers on the north/east side of **2nd Avenue** between Highland Drive and Grace Church Road.

First Tier Priorities for New Sidewalks

One of the purposes of developing a geo-databased analysis tool like the PLoC is to analyze and rank projects that, given their location in the network, will have the highest benefit for pedestrians. Queries were developed and run to determine which sidewalk improvement projects would connect the most parcels to important local destinations, such as transit stops and stations, neighborhood retail centers, schools, places of employment and parks.

Georgia Avenue

Improve the existing sidewalks on Georgia Avenue such that they are at least 5 feet wide and are buffered by a 5-foot landscaped buffer. In some road segments, such as in front of Grace Church, this width may not be feasible due to the proximity of the grave sites and other

sensitive historic resources. However, every effort should be made to achieve the master-planned right-of-way and incorporate a comfortable, pedestrian-scale streetscape.

Other considerations to make the walking experience on Georgia Avenue more comfortable include:

- Remove or relocate obstructions in the sidewalk
- Lowering the target speed on Georgia Avenue to no faster than 30 miles per hour.
- Planting trees in the median.

Forest Glen Road

Widen existing sidewalks to a minimum of 5 feet, install a minimum 5-foot landscaped buffer and remove all obstructions from sidewalks on both sides of Forest Glen Road from Georgia Avenue to Seminary Road.

Short Term: Close the sidewalk gap between Forest Grove Road and Sligo Creek Parkway on the north side of the roadway by installing a five-foot sidewalk (this improvement is Included in the Forest Glen passageway CIP project).

Long Term: Improve existing sidewalks along Forest Glen Road such that all sidewalks are at least five feet in width, are buffered from the street by a 5-foot-wide tree lawn and free of obstructions.

16th Street

Install new sidewalks along 16th Street such that all sidewalks are at least 5 feet wide, are buffered by a 5-foot tree lawn and free of obstructions. Note, separated bicycle facilities are recommended along the east side of 16th Street in the 2017 Greater Lyttonsville Sector Plan and the 2018 Bicycle Master Plan to connect the Montgomery Hills neighborhoods and the 16th Street Purple Line Station.

Seminary Place

Widen sidewalks to a minimum of 5 feet, install a minimum 5-foot-wide landscaped buffer and remove all obstructions from sidewalks on both sides of Seminary Place from Georgia Avenue to Second Avenue.

Seminary Road

Widen sidewalks on both sides of Seminary Road from Georgia Avenue to Forest Glen Road and install a minimum 5-foot-wide landscape buffer on the north side of Seminary Road from Georgia Avenue to Sutton Place.

Applying the PLOC analysis, proximity within the sector plan area, and industry best practices, the first-tier sidewalk projects are listed in priority order in Table 3 below.

Table 3: First-tier Sidewalk Projects

Roadway	From	To
Forest Glen Road	Seminary Road	Dameron Drive
Georgia Avenue	Forest Glen Road	16th Street
Seminary Road	Georgia Avenue	Forest Glen Road
Seminary Place	Georgia Avenue	Brookville Road
Georgia Avenue	Forest Glen Road	Dennis Avenue
Georgia avenue	16th Street	Spring Street

The second-tier projects are listed in priority order in Table 4 below.

Table 4: Second-tier Sidewalk Projects

Roadway	From	To
Medical Park Drive	Georgia Avenue	Green Holly Ter - North Side
Columbia Boulevard	Seminary Road	16th Street - East Side
Columbia Boulevard	Georgia Avenue	Woodland Drive - North Side
Columbia Boulevard	Georgia Avenue	Corwin Drive - South Side
Belvedere Boulevard	Georgia Avenue	Greely Avenue - North Side
Hildarose Drive	Georgia Avenue	Greeley Avenue - North Side
August Drive	Georgia Avenue	Everett Street - South Side
August Drive from	Georgia Avenue	Everett Street - North Side
Hildarose Drive	Georgia Avenue	Greeley Avenue - South Side
Columbia Boulevard	Seminary Road	16th Street - West Side
Belvedere Boulevard	Georgia Avenue	Greely Avenue - South Side
Medical Park Drive	Georgia Avenue	Green Holly Ter - South Side

All remaining sidewalk projects are to be included in the third-tier project list.

Safety Issues Affecting Pedestrians at Intersections

The design and construction of the transportation network along the Georgia Avenue corridor has prioritized automobile travel. Crossing Georgia Avenue for pedestrians and bicyclists, especially at intersections lacking traffic control devices, is challenging and can create conditions that result in unsafe behavior. Within the two-mile corridor that makes up the plan area, there are seven protected crossings

for bicyclists and pedestrians.[12] The greatest distance between protected crossings is more than 3,000 feet or a 15-minute walk for a pedestrian.

At intersections, multiple turning lanes typically result in wide intersections without pedestrian refuge and inconsistent of implementation of the Americans with Disabilities Act (ADA)-accessible facilities. These conditions impede pedestrian and bicycle access along and across the major roadways: Georgia Avenue, Forest Glen Road and 16th Street.

Restricting left turns for vehicles on Georgia Avenue between 16th Street and Forest Glen Road in the peak periods makes it difficult for residents to access their homes. The restriction also appears to have the added effect of encouraging both local and commuter traffic to seek out circuitous routes along local roadways to be able to make the turns in an indirect way.

To improve traffic safety for all modes, this plan recommends retrofitting existing signalized intersections to meet current best practices for safe and comfortable multi-modal travel. This change can be achieved by reducing turning radii ideally to 15 feet to reduce speeds of turning vehicles. The radii can be wider if needed to accommodate fire and rescue vehicles or to address other pedestrian and bicycle safety concerns.

The plan also recommends the following safety measures:

- Install curb extensions where feasible to reduce crossing distance and pedestrian conflict exposure.
- Install high-visibility crosswalks at all legs of all signalized intersections.
- Provide ADA-accessible curb ramps on all crosswalk approaches.
- Ensure that accessible pedestrian signals (APS) and countdown pedestrian signals are present at all signalized pedestrian crossings.
- At intersections with separated bike lanes and/or shared use paths on at least one approach, protected intersection treatments are recommended.
- Avoid widening the roadways at intersections to accommodate additional left-turn lanes. While increasing the number of left turn lanes can increase intersection capacity, wider pavement increases the exposure of pedestrians crossing and introduces additional potential conflicts for motorists.
- Mark crosswalks across the shortest distances of the intersection to minimize pedestrian exposure to conflict with motor vehicle traffic.

[12] There are nine total signalized intersections in the corridor, but two control traffic flows for the Beltway on- and off-ramps. There are no pedestrian crossing facilities provided at these intersections.

One intersection has particular challenges given the geometry of the intersection. The intersection of 16th Street, 2nd Avenue and Elkhart street creates five legs of an askew intersection. A brief description of key design elements is included below:

- The southern crossing is marked with high-visibility markings (ladder style).
- The western crossing of 2nd Avenue has a marked crosswalk (parallel lines).
- Sidewalks are present at some but not all approaches
    - 16th Street
        - East side – 4ft sidewalk with buffer both north and south of the intersection
        - West side – 4ft sidewalk with buffer *only* south of the intersection. Sidewalks do not connect to the northwestern corner of the intersection
    - 2nd Avenue
        - 4ft sidewalk with a buffer is present on the south side of the road both east and west of the intersection
        - No sidewalks are present on the north side of the road
    - Elkhart Street
        - No sidewalks are present on either the north or south sides
- 2nd Avenue southbound restricts access to local traffic, bicyclists and buses during morning rush hour (6:30 AM – 9:30 AM).
- Right turns on red at 2nd Avenue eastbound are not permitted.

By marking the longest leg of the intersection for the pedestrian crossing, pedestrians feel uncomfortable and exposed. There is a desire to cross the northern leg, which would be shorter. The median in the southern leg does not provide a refuge; it's only a few feet wide as the NB left turn pocket has carved space from the median. The pedestrian must cross 160 feet for this crossing. To address the pedestrian safety issues, the sector plan recommends MCDOT, in coordination with MDOT SHA, review the intersection design and operations for potential upgrades. The following includes a list of potential considerations for study:

- Marking crosswalks across all five legs of the intersection. This would require adding APS pedestrian countdown signals at all crossings.
- Replace the existing high-visibility ladder style crossing with a new crosswalk that connects the northeast corner of 2nd Avenue with the southwest corner of 16th Street, thereby creating the shortest connection and least exposure of pedestrians.
    - A separate pedestrian-on phase may be needed, or perhaps the pedestrian crossing interval could run concurrently with the protected left turns from eastbound 2nd Avenue.
- Increase pedestrian queuing space on the southeast corner of 2nd Avenue
- Installing curb extensions on 2nd Avenue on either side of 16th street

        - This could have the benefit of reducing the speeds of vehicles turning and decreasing the exposure of pedestrians crossing on the eastern and western legs of the intersection.
    - Constructing sidewalks on north side of 2nd Avenue
    - Constructing sidewalk on west side of 16th street north of intersection for connection to Columbia boulevard
        - This would enable pedestrians to access the Seminary Place commercial district without a substantial detour

Recommended New Protected Crossings

This plan recommends locations for new protected crossings to provide safer crossing conditions closer together and where pedestrians and bicyclists naturally want to cross. The intention of the protected crossings is to create safer crossing conditions for all modes and to ensure stop compliance from motorists. The intersections identified for new protected crossings are included in Table 5.

It is important to note the Manual for Uniform Control Devices (MUTCD) criteria for pedestrian-activated signals and pedestrian beacons are not as robust as the criteria for full- color traffic signals. For this reason, the Forest Glen/Montgomery Hills Sector Plan has evaluated the need for additional protected crossings with planning judgement and recognizes that additional technical studies are required prior to implementation. They need to be studied to determine the most appropriate traffic control device which could include (but is not limited to) the following treatments: a full traffic signal, a high activity walk signal (HAWK), a pedestrian-activated signal, stop-signs, etc. The locations recommended for protected crossings are based on the proximity to schools, parks, community facilities and bus stops, distance between existing signalized crossings, and pedestrian, bicycle and vehicular crashes.

Table 5: Recommendations for New Protected Crossings

Priority	Location
1	Georgia Avenue at Dexter Avenue
2	Georgia Avenue at Tilton Drive
3	Georgia Avenue at Flora Lane
4	Georgia Avenue at White Oak Drive
5	Luzerne Avenue at Georgia Avenue (Bicycle and Pedestrian only)
6	Georgia Avenue at Highland Drive
7	Georgia Avenue at Noyes Drive
8	Elkton Avenue and Forest Glen Road
9	Kimball Place and Darcy Forest Drive
10	Belvedere Place and Darcy Forest Drive
11	Grace Church Road and 16th Street

The factors considered to determine the high priority protected crossings are included in Table 6 and discussed in greater detail below.

Table 6: Factors Considered to Prioritize New Protected Crossings

Priority	Location	Proximity to a Bus Stop	Bus Ridership	Recent Crash History (2015-2018)	Proximity to School / Community Facility
High	Georgia Avenue at Dexter Avenue	Recommended BRT Bus stop WMATA Bus Stop (Q & Y Lines)	Georgia Avenue SB (133 Stops) Georgia Avenue NB (68 Stops)	Dexter Avenue. (3 crashes. 1 resulting in injuries.)	St. John Evangelist Catholic Church and School
High	Georgia Avenue at Tilton Drive	WMATA Bus Stop (Q & Y Lines)	Georgia Avenue SB (37 Stops) Georgia Avenue NB (30 Stops)	Tilton Drive. (7 crashes involving motorists, 3 resulted in injuries.)	N/A
High	Georgia Avenue at Highland Drive	WMATA Bus Stop (Q & Y Lines)	Georgia Avenue SB (8 Stops) Georgia Avenue NB (14 Stops)	No crashes reported between 2015 and 2018	IMAAM Center
High	Georgia Avenue at Noyes Drive	WMATA Bus Stop (Q & Y Lines)	Georgia Avenue SB (7 Stops) Georgia Avenue NB (9 Stops)	No crashes reported between 2015 and 2018	Woodside Synagogue and Ahavas Torah

Notes:
Bus Ridership: Stops include total boarding and alighting for WMATA routes only in 2015.
Crash Data includes crashes between January 1, 2015 and February 2, 2019.

Georgia Avenue at Dexter Avenue

This intersection is located directly in front of St. John the Evangelist Catholic Church and School's main entrance. On the opposite side of the intersection is the Fields of Silver Spring apartment complex, which houses 223 multifamily residential units. Currently none of the crosswalks are marked, and pedestrians need to cross six lanes of traffic (77 feet) without refuge. There are landscaped medians on

Georgia Avenue, but they are not ADA accessible and do not provide queuing space or protection from motor vehicles. The closest signalized crossing is over three hundred feet away. Bus stops served by WMATA's Y and Q lines are located on the southwest corner and east side of the intersection. This location experiences the highest transit activity (boardings and alightings) outside of a signalized intersection (201 total stops). The sector plan is also confirming the 2013 Countywide Transit Corridors Functional Master Plan recommendation for a bus rapid transit stop at this location.

The Sector Plan recommends a protected crossing at this location, which may include a full traffic signal or a pedestrian-activated signal.

Georgia Avenue at Tilton Drive

Tilton Drive is a four-way intersection, of which the western approach is the main entrance to the Americana Finnmark condominium community, which houses 325 residential units. The closest signalized intersection is over 1,000 feet away. Just over 100 feet south of the intersection are bus stops on either side of Georgia Avenue that are served by WMATA's Y and Q lines.

Seven crashes have occurred at this location in the last four years. All of the crashes involved two vehicles, and most were rear-end or sideswipe collisions. This is likely due to the strong demand for northbound left turns into the Americana Finnmark community. There is a designated turn lane, but the lack of traffic signal can make it difficult to find gaps in southbound traffic.

Another reason why this intersection was considered for a recommended protected crossing is because it is one of the few places where the Forest Glen east local roads connect to Georgia Avenue. The local road network on the east side of Georgia Avenue only has two roadways that connect to Georgia Avenue, and they are over 2,000ft apart. This is a stark contrast to Forest Glen West which has five local road connections to Georgia Avenue.

The Sector Plan recommends a protected crossing at this location, which may include a full traffic signal or a pedestrian-activated signal.

Georgia Avenue at Highland Drive

The distance between existing protected crossings in the southern residential segment of the sector plan boundary is over 3,000ft. Ideally these distances should be closer to 250ft. Staff reviewed the street network and surrounding land uses to determine appropriate locations for new protected crossings. The intersection Highland Drive was a good candidate for multiple reasons. Installing a protected crossing here still wouldn't reach the goal of 250ft, but at 780ft, it would be a significant improvement.

Additionally, as a four-way intersection a full signal, should it be determined the appropriate crossing facility), would assist not only pedestrians and bicyclists attempting to cross but would also improve access and turning movements for motorists as well.

Currently none of the crosswalks are marked, and pedestrians need to cross six lanes of traffic (77 feet) without refuge. There are landscaped medians on Georgia Avenue, but they are not ADA accessible and do not provide queuing space or protection from motor vehicles.

The IMAAM Center is located on the northwest corner, and a community of attached residential dwellings are located on the southwestern corner.

Bus stops served by WMATA's Y and Q lines are located on the northwest and southeast corners of the intersection.

The Sector Plan recommends a protected crossing at this location, which may include a full traffic signal or a pedestrian-activated signal.

Georgia Avenue at Noyes Drive

This intersection is the only unprotected crossing that includes a high-visibility crosswalk marking with pedestrians warning signs. This crossing is heavily used on the Friday evenings, weekends and Jewish holidays, as it provides direct access to the Woodside Synagogue Ahavas Torah on the northeast corner of the intersection. Congregants of the shul strictly observe Jewish Law, and therefore refrain from operating machinery of any kind during Shabbat. For this reason, the protected crossing treatment selected and designed for this intersection must not require pedestrians to activate the traffic control device with a button, switch, or other mechanical device during the Shabbat. Members of the congregation should be included in the discussions of the protected crossing's design.

In addition to the synagogue bus stops serving WMATA's Q and Y lines are located on the northwest and southeast corners of the intersection.

The Sector Plan recommends a protected crossing at this location, which may include a full traffic signal or a pedestrian-activated signal that can function without the use of a button, switch or other mechanical device during the Shabbat.

Grade-Separated Crossings

1. Existing and Recommended Beltway Crossings

Following the recommendations of the 1996 *Forest Glen Sector Plan,* a grade-separated crossing for pedestrians and bicyclists was constructed on the west side of Georgia Avenue to facilitate a connection between the Montgomery Hills neighborhoods and the Forest Glen Metro Station. This plan recommends improving the comfort and accessibility of the existing bicycle/pedestrian bridge on the west side of the Beltway interchange to encourage non-motorized travel within the plan area. It may be feasible to address the current design, look and feel of the bridge if the Beltway interchange is modified, or if an alternative design and/or maintenance is proposed.

If modifications are made to the Beltway, the following recommendations for the existing bridge should be considered and addressed:

- Widen the bridge to a consistent 14-foot width, if possible. The pinch points on either end make it difficult for pedestrians and bicyclists to navigate the points of entry together.
- Install additional public art to more accurately reflect the culture of the surrounding neighborhoods and give the bridge a sense of place.
- Install pedestrian-scale lighting that improves visibility especially under the bridge under all lighting conditions.
- Introduce vegetation that does not impair personal safety.
- Improve visibility throughout the bridge. Blind, opaque corners inspire feelings of unease and uncertainty.
- Build on the existing wayfinding signage so that it more clearly points to the Forest Glen Metro Station, the Montgomery Hills shopping centers and when realized, future development in Forest Glen.

The connection on the west side of the interchange has helped facilitate travel for bicyclists and pedestrians between the Forest Glen Metro Station, Forest Glen East and Montgomery Hills. The east side would benefit from a similar connection providing a more direct route between Montgomery Hills and Holy Cross Hospital. The Bicycle Master Plan also recommends a grade-separated crossing on the east side of Georgia Avenue across the Beltway as part of the Breezeway network.

This plan recommends improving pedestrian and bicycle crossing conditions on the east side of the Beltway Interchange and identifies short-and long-term strategies. Both the short- and long-term design alternatives should be evaluated and included as part of any project that improves the Beltway or the interchange.

BREEZEWAY NETWORK: As defined by the Bicycle Master Plan (2018)

A high-capacity network of arterial bikeways between major activity centers, enabling bicyclists to travel with fewer delays, and where all users – including slower moving bicyclists and pedestrians – can safely and comfortably coexist.

- Short-Term Treatment: Install pavement markings across all access ramps where non-motorized modes would cross. Install traffic controls to improve motorist stop-compliance.

- Long-Term Solution: Install a grade-separated pedestrian and bicycle crossing across the Beltway Interchange. This crossing could run along the east side of Georgia Avenue and connect to the southeast corner of Forest Glen Road and Georgia Avenue or perhaps connect to Woodland Drive on the northern side of the Beltway at some point.

Figure 9: Maya Lin Bridge in Vancouver, WA

Forest Glen Metro Station Access

The 1996 Forest Glen Sector Plan recommends a grade-separated crossing to reduce the conflicts and safety concerns between motorists and non-motorists at the Georgia Avenue and Forest Glen Road intersection. This intersection is especially challenging because of the heavy volumes of motorists approaching the Beltway and the high-volume of pedestrians and bicyclists accessing bus stops, the Forest Glen Metrorail Station, Holy Cross Hospital and surrounding neighborhoods.

In 2013, the Montgomery County Department of Transportation (MCDOT) initiated a project to determine the alignment and type of facility for improving pedestrian safety and access to the station. A passageway under Georgia Avenue connecting the northwest corner to the southeast corner was the preferred alignment. It would provide direct access to the Metrorail station with surface access on both ends. This plan confirms and supports the funded project and recommends detailed considerations for the final design stage. See Transportation Appendix.

This plan confirms the pedestrian passageway project and its alignment and recommends the following design and operation considerations for the final planning stages:

- The design for the passageway is a diagonal orientation from the northeast corner to the southwest corner.
- Elevators will be provided on both ends of the passageway.
- The passageway should always maintain access, even when the Metrorail station is closed.
- Additional considerations for design are to:
- Reduce exposure to conflicts with vehicles by installing an additional elevator on the northwest corner so pedestrians with strollers and other walking assistance devices do not have cross Forest Glen Road to access the planned elevators on the southwest corner.
- Consider the placement of future bus rapid transit stations as part of the project design.

The Montgomery County Department of Transportation (MCDOT) should explore the possibility of connecting the Montgomery Hills commercial area to the Forest Glen Metro Station in a safe, convenient and direct way. Doing so would improve access and patronage to the commercial center in Montgomery Hills and could perhaps increase ridership (without increasing the need for additional parking) at the Forest Glen Metro Station.

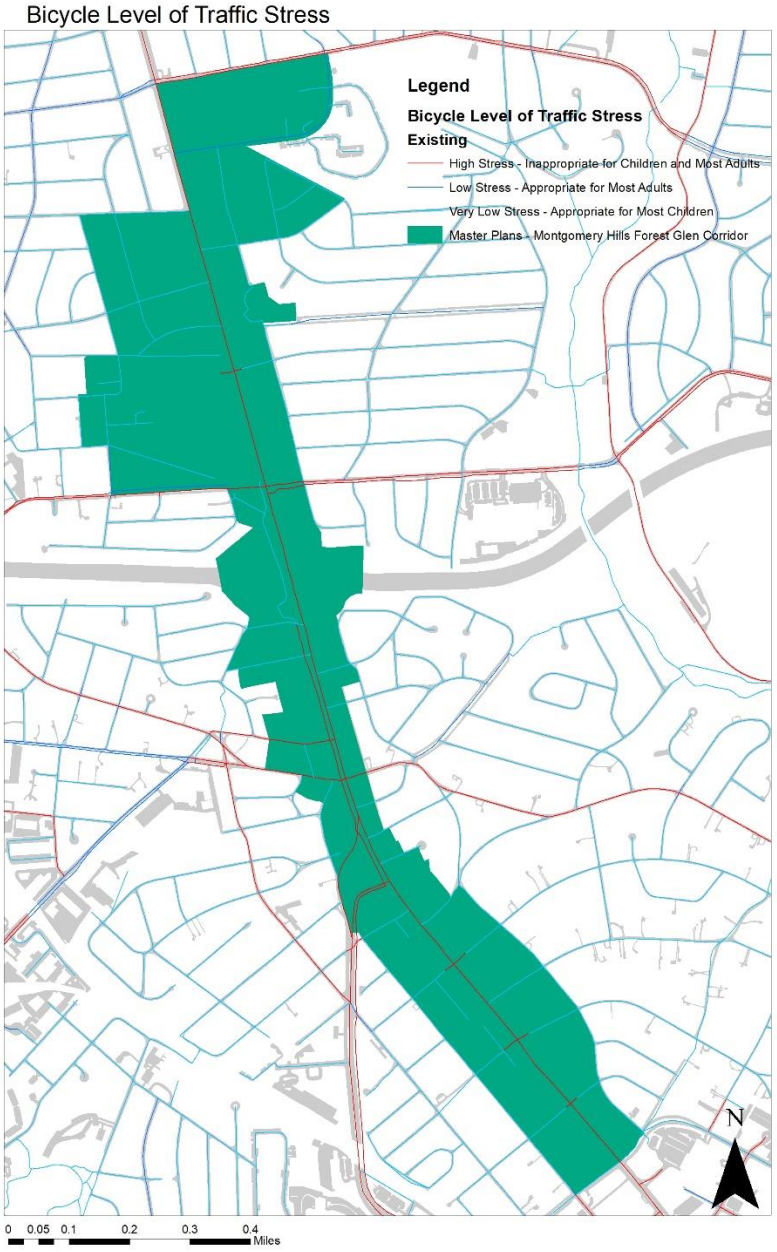
One possibility for the future connection may be an escalator accessed from around the Locust Grove Road area to the station's platform underground. Any new Metro station connection not already identified in the county's Capital Improvements Program (CIP) would need to be studied and would likely not be implemented before the horizon year of the plan.

Bicycle Level of Traffic Stress

The Montgomery County Bicycle Planning Guidance, developed in July 2014, provides an award-winning, innovative planning tool for determining the suitability of specific bicycle facilities and identifying alternate bicycle routes around streets with higher vehicular speed and traffic volumes. This has come to be known as the “level of traffic stress” (LTS).

The analysis of existing conditions in Figure 10 shows that there are islands of low-stress bicycling (LTS 1 and LTS 2), typically in the residential neighborhoods isolated by streets with moderate-to-high levels of traffic stress (LTS 3 and LTS 4). Connecting these low-stress islands at key locations can create a robust bicycling network that spans high stress roadways (and other barriers) that can be comfortable to the majority of the adult population.

Figure 10: Bicycle Level of Traffic Stress Map



Master Plan Approach

The recommendations in this sector plan were based on analysis that followed the Level of Traffic Stress Analysis criteria discussed above. Bicycle recommendations in the sector plan were then refined using the following criteria:

- Accommodate bicyclists with different levels of ability: While some bicyclists are comfortable riding on the road, either sharing the lane with traffic or in separated bike lanes, other bicyclists are more comfortable riding on off-road shared use paths that are physically separated from the roadway. The sector plan includes recommendations for both on-road and off-road bicycle facilities.
- Separation from Pedestrians in Urban Areas: Due to the substantial volumes and meandering travel patterns of pedestrians in urban environments, on-road bikeways (such as separated bike lanes, buffered bike lanes, traditional bike lanes) are recommended instead of shared use paths along roadways. In these urban environments, the speed differential between pedestrian and bicycle traffic on public sidewalks often leads to conflicts and a degradation of quality for both parties. As a result, bicyclists are often reluctant to travel in what is perceived as a pedestrian-only space. The only exception to this criterion exists along the pedestrian and bicycle bridge over the Beltway interchange at Georgia Avenue, where there is an expectation from pedestrians and bicyclists that the trail is a shared facility between both groups.
- Enhance connections to transit: A robust bikeway network with direct connections to the transit can attract people who live beyond the walking area around transit stations, typically considered to be a distance of 0.5 to 1.0 miles (5 to 10-minute walk, respectively). The pedestrian and bicycle bridge over the Beltway interchange at Georgia Avenue, and local bikeways serve as the primary regional bikeways to the transit stations.
- Facilitate east-west connectivity: Located between the larger North and West Silver Spring Sector Plan Area, Forest Glen Sector Plan Area, Lyttonsville sector plan area, and ultimately, the Silver Spring Central Business District, bikeway recommendations in this sector plan area are a vital component to create an east-west bikeway network.
- Facilitate north-south connectivity: The sector plan area is also located between the Wheaton and Silver Spring CBDs. The Georgia Avenue Breezeway and local on-street bicycle network will provide connectivity between these areas.

Bicycle Facility Classification

Bicycle facilities in Montgomery County are designed to be used by a wide variety of bicyclists with differing travel purposes, abilities, and levels of comfort with vehicular traffic. In response to that variety, there exists a range of bicycle accommodations available for implementation. Existing and proposed bicycle facilities within the sector plan area include the following (See also, Figure 11):

1. Shared use path: A paved path that is typically 10 feet wide but can vary between 8 and 14 feet wide, designated for bicycles and pedestrians that is separated from motorized traffic by a curb, barrier, or landscape panel.
2. Bike lane: A portion of a roadway designated by striping, signing, or pavement markings for the preferential or exclusive use of bicycles, and on which through-travel by motor vehicles is not allowed.
3. Shared use roadway: A roadway open to both bicycle and motor vehicle travel and which is designated as a preferred route for

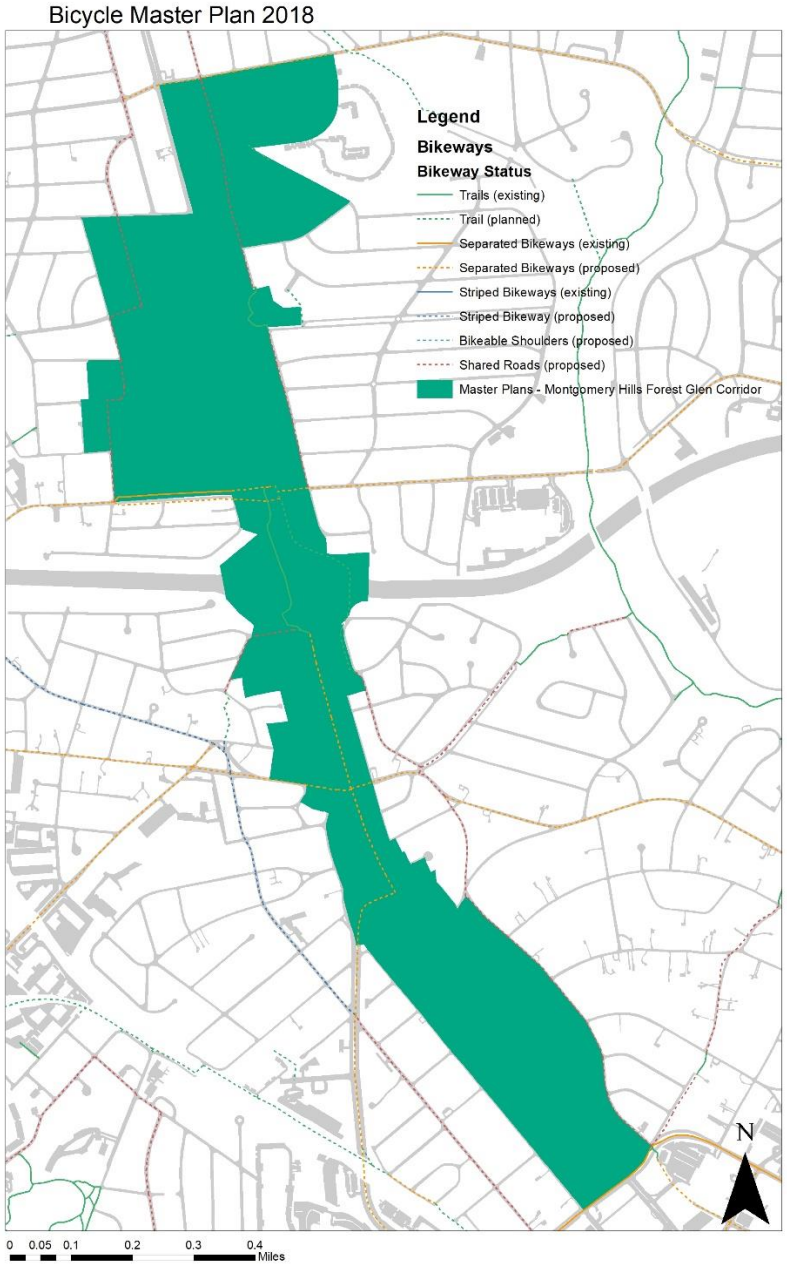
bicycle use by warning or informational signs.

4. Separated bike lane: also known as a protected bike lane or cycle track; a bikeway that is physically separated from motor vehicles and pedestrian facilities. The separation may be vertical, such as a curb; horizontal, such as a landscape panel or parking lane; or a combination.
5. Buffered bike lane: a bikeway separated from a motor vehicle travel lane with an area of striped pavement.

Figure 11: Types of Bicycle Facilities

Existing and proposed bikeways, identified in the Master Plan of Bikeways, are illustrated in are illustrated in Figure 12.

Figure 12: Existing and Proposed Master Plan Bikeways



Bicycle Parking

Bicycle parking facilities are of equal importance to active bicycle facilities (bike lanes, paths, etc.) because bicycle parking at each trip end influences the quality and utility of that particular trip. At this time, there is a shortage of short- and long-term bicycle parking facilities throughout the sector plan area. The Sector Plan confirms the Bicycle Master Plan recommendation for 300 long- and 100 short-term bicycle parking spaces be provided at the Forest Glen Metro Station. The Plan estimates that 3,200 square-foot area will be needed for accommodating the long-term spaces and a 2,400 square-foot area will be needed for accommodating the short-term at the station. Long-term bicycle parking spaces are assumed to require 9 square feet per space and short-term bicycle parking spaces are assumed to require 20 square feet per space. A 20 percent contingency is applied to the number of bike parking spaces each station.

The Plan determined there is an area-wide deficit of eight short-term bicycle parking spaces within the Montgomery Hills BiPPA. When these sites redevelopment, this Plan strongly recommends against providing waivers for short-term bicycle parking.

- Seminary Place Shopping Center (west side of Georgia Avenue between Seminary Place and Flora Lane)
- Dale Center (west side of Georgia Avenue between Seminary Road and 16th Street
- The east side shopping center between Columbia Boulevard and White Oak Drive
- The gas station and Woodside deli property on the east side of Georgia Avenue between Corwin Drive and Columbia Boulevard.

Bike Share

The intention of bike share is to provide a convenient way to bicycle for short trips (1-3 miles). Therefore, the success of docked bike share systems is tied directly to the proximity of its stations. The County's bike share system is well-established within the Silver Spring and Wheaton CBDs. Many of the residences, shopping centers, and office uses are located within two miles of these urban centers. Expanding the system in the plan area would serve both the residents and the visitors from nearby neighborhoods and CBDs. Such an expansion should be directly tied to new development. Bike share stations should also be timed to open with bikeway recommendations identified in the Sector Plan.

Bike share stations should be located so that they can provide access to key destinations within the Plan area which include but are not limited to

- Forest Glen Metrorail Station
- Holy Cross Hospital
- Forest Glen and Montgomery Hills shopping destinations
- Multi-unit residential sites
- General Getty Park

- Sligo Creek Trailheads
- Planned BRT Stations

To the extent possible, bike share station sites should be located near existing and master planned bicycle infrastructure. Specific bike share station sites for development projects will be selected in concert with M-NCPPC and the Montgomery County Department of Transportation (MCDOT) to ensure consistency with bike share system objectives and siting requirements.

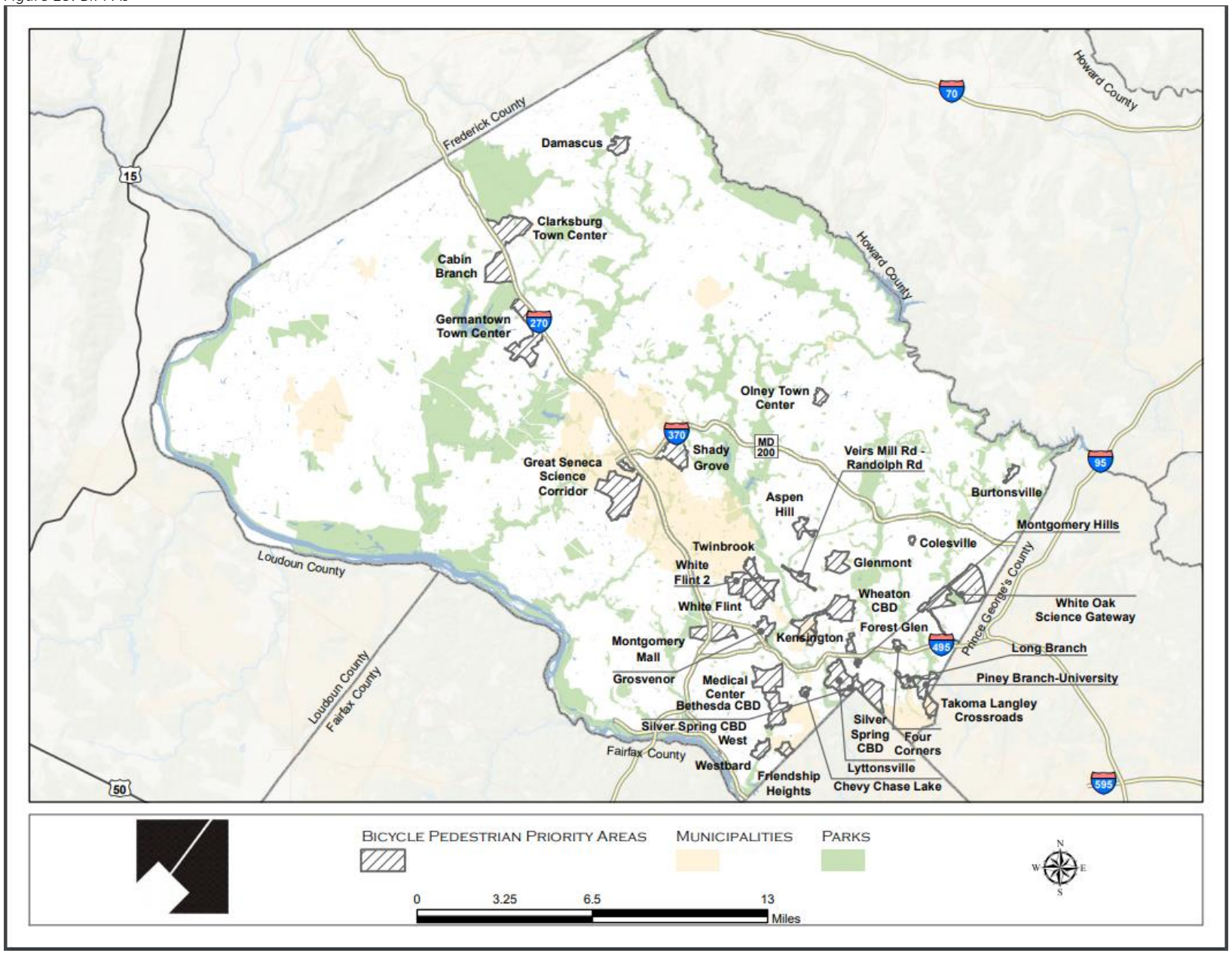
The Montgomery Hills area was included in the 2017-2018 dockless bikeshare pilot, although the epicenter of the pilot area was downtown Silver Spring. Considerations should be made to expand the dockless bike share pilot to the entire Forest Glen/Montgomery Hills Sector Plan area.

Bicycle Pedestrian Priority Area

The 2013 Countywide Transit Corridors Functional Master Plan established bicycle and pedestrian priority areas (BiPPAs), which are geographic areas where bicycle and pedestrian traffic enhancements are prioritized. Separate BiPPA boundaries were initially established around the Forest Glen Metro Station and the Montgomery Hills commercial areas.

The plan recommends MCDOT initiate a joint BiPPA plan for the two BiPPAs in the plan area to identify and prioritize small but necessary pedestrian improvements. These upgrades should include retrofitting existing curb ramps to meet ADA design standards, removing obstructions in sidewalks and improving existing and master-planned protected crossings. Ideally, this effort will be launched soon after the adoption of this plan to capitalize on the momentum generated for these recommendations.

Figure 13: BiPPAs



TRANSIT

WMATA Metrorail, WMATA Metrobus and Montgomery County Ride On bus, serve the sector plan area. The Forest Glen Metrorail Red Line station is located just north of the Beltway interchange with Georgia Avenue. WMATA provides local bus service along Georgia Avenue and RideOn serves Forest Glen Road and local routes between Wheaton and Silver Spring. A shuttle for Holy Cross Hospital also has a designated stop within the Forest Glen Metrorail station bus loop. Ridership volumes for each of the transit systems serving the sector plan area are provided in Table 7, below.

Figure 14: Sector Plan Area Transit Source: WMATA

Table 7: Transit Route Ridership

FOREST GLEN/MONTGOMERY HILLS TRANSIT RIDERSHIP (PASSENGER BOARDINGS)

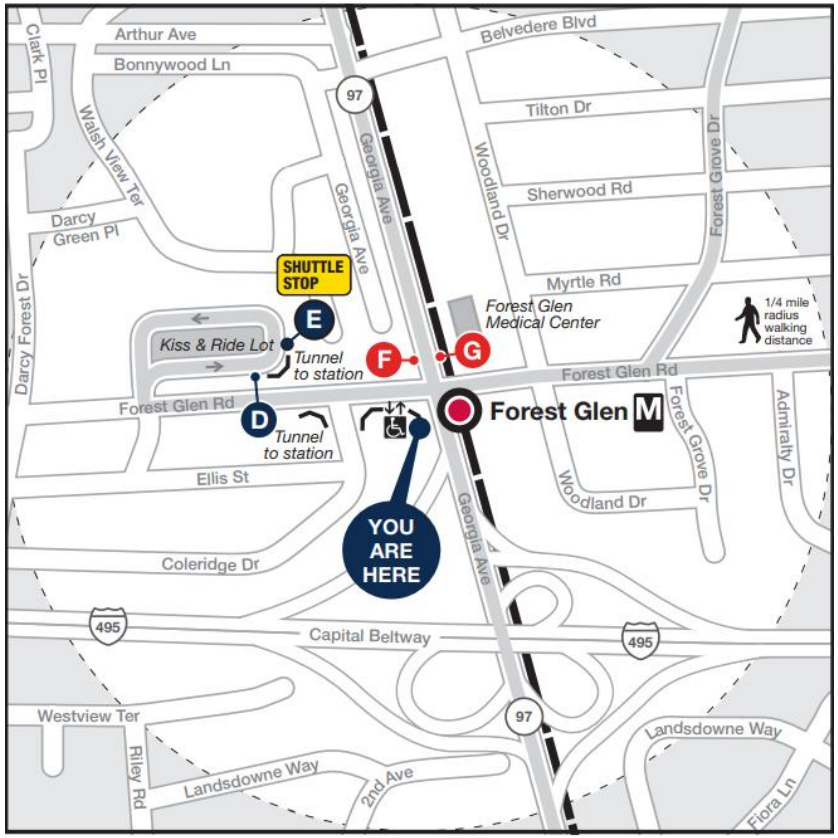
RANK	Route	Average Weekday Ridership	Name	Destination
1	WMATA[1] – Y2, Y7, Y8	7,612	Georgia Avenue – Maryland	Medstar Montgomery Medical Center/ Silver Spring Transit Center
2	WMATA[1] – Q1, Q2, Q4	6,759	Veirs Mill Line	Shady Grove/ Silver Spring Transit Center
3	WMATA[2] - Forest Glen Metrorail	2,045	Metrorail Red Line	Silver Spring Transit Center Shady Grove via Downtown DC
4	RideOn[3] – 5	1,773	RideOn Bus 5	Twinbrook/ Silver Spring Transit Center
5	RideOn[3] – 7	74.3	RideOn Bus 7	Wheaton/ Forest Glen
6	RideOn[3] – 8	671	RideOn Bus 8	Wheaton/ Silver Spring Transit Station
7	RideOn [3]– 4	225	RideOn Bus 4	Kensington/ Silver Spring Station

1 2017 data, provided by WMATA
2 2018 data, provided by WMATA
3 2017 data, provided by MWCOG

Metrorail

The sector plan area is directly served by the WMATA Metrorail Red Line via the Forest Glen Metro Station, located west of the intersection of Georgia Avenue and Forest Glen Metro Station. The station opens at: 4:56 AM - Monday-Friday with the first trains departing for Shady Grove at 7:06 AM and Glenmont at 5:35 AM. The last trains depart for those stations at 11:09 AM and 12:01 AM, respectively. The typical weekend schedule shifts two hours later in the morning (Saturday & Sunday) and shifts three hours later in the evening (Friday & Saturday).

Figure 15: Forest Glen Metrorail Station Vicinity (Source: WMATA)



Metrobus

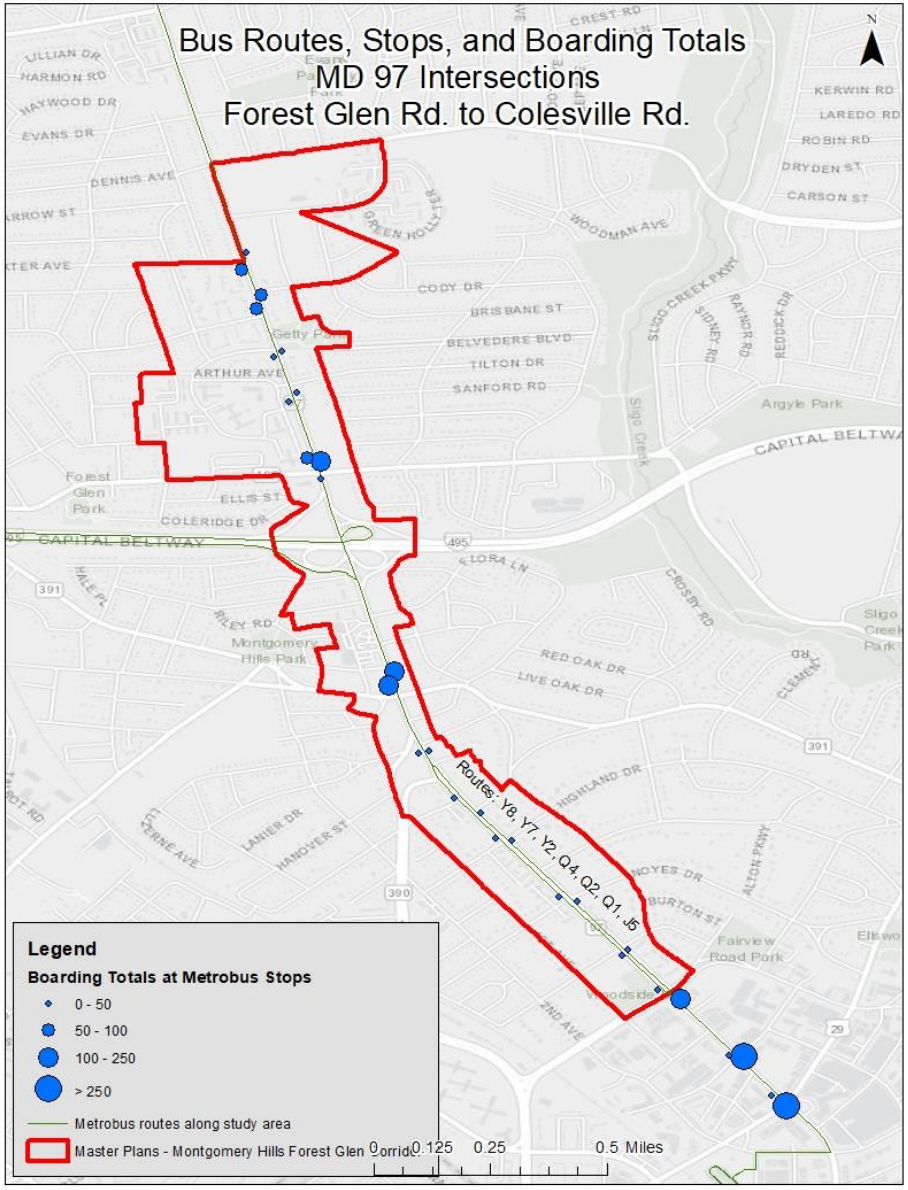
WMATA Metrobus Y2, Y7, and Y8 – Georgia Avenue-Maryland Line
These lines provide service between the Medstar Medical Center and the Silver Spring Metro Station (Red Line) every 20 minutes. This route has the highest ridership of any Montgomery County Ride On route within the sector plan area.

WMATA Metrobus Q1, Q2, Q4 – Veirs Mill Line
This line provides service between the Shady Grove Metro Station (Red Line) and the Silver Spring Transit Center every 20 minutes.

Table 8: WMATA Metro Bus Average Daily Boardings

Georgia Avenue Stop Location (Northbound and Southbound)	Average Daily Boardings
Dexter Avenue	108
August Drive	145
Belvedere Boulevard	86
Tilton Drive	37
Forest Glen Road	213
Seminary Place	243
16th Street	31
Grace Church Road	11
Highland Drive	12
Noyes Drive	10
Ballard Street	63
Spring Street	172

Figure 16: Bus Stop Activity (Source: WMATA)



Montgomery County Ride On 4
This route provides service between Kensington and the Silver Spring Transit Center via Second Avenue and points west of the sector plan boundary. Typical weekday service begins at the Armory-Knowles stop in Kensington at 6:39 AM and continues through 6:36 PM with half-hour headways. No weekend service is provided.

Montgomery County Ride On 5
This route provides service between the Twinbrook Metrorail station and Silver Spring Transit Center via Capitol View Avenue and points west of the sector plan boundary. Typical weekday service begins at the Twinbrook Metrorail station at 5:40 AM and continues through 12:28 AM with 20-minute headways. This route has the highest ridership of any Montgomery County Ride On route within the sector plan area.

Montgomery County Ride On 7
This route provides peak-hour service between the Forest Glen Metrorail station and the Wheaton Metrorail Station via points east of the sector plan boundary. Typical weekday service begins at the Forest Glen Metrorail station at 5:55 AM and continues through 8:35 AM with half-hour headways. Afternoon service begins at 4:10 PM and continues through 6:55 PM with half-hour headways. No weekend service is provided.

Montgomery County Ride On 8
This route provides service between the Wheaton Metrorail station, Forest Glen Metrorail station and the Silver Spring Transit Center via University Boulevard Forest Glen Road and Colesville Road. Typical weekday service begins at the Wheaton Metrorail station at 6:03 AM and continues through 7:45 AM with half-hour headways. No service is provided on Sundays.

Table 9: FY 2017 RideOn Average Daily Ridership by Route

Route	Routes Description	AM Average Headway	PM Average Headway	Average Daily Riders	Saturday Service	Sunday Service
4	Kensington to the Silver Spring Transit Center via Second Avenue	30	30	226		
5	Twinbrook Metrorail station to Silver Spring Transit Center via Capitol View Avenue	27	27	1,774	X	X
7	Forest Glen Metrorail station to Wheaton Metrorail Station	30	30	74		
8	Wheaton Metrorail station to Forest Glen Metrorail station and the Silver Spring Transit Center via University Boulevard Forest Glen Road and Colesville Road	30	30	672	X	

Recommendations to consolidate bus stops

To address safety concerns of people crossing Georgia Avenue mid-block and away from protected crossings, WMATA should consider consolidating bus stops along Georgia Avenue. The stops recommended for consolidation are located within one block of an existing or master-planned protected crossing and the existing crossings should only be eliminated once the nearby protected crossings are in place. Consolidating stops in the future could have the added benefit of reducing the number of pedestrians crossing Georgia Avenue away from protected crossings, when trying to access bus stops on the opposite side of the road more directly. With these considerations in mind, the plan recommends exploring the consolidation of the bus stops.

- Both sides of Dexter Ave
- At General Getty Park and Belvedere Boulevard
- At Grace Church Road North and Grace Church Road South
- Both sides of Woodside Parkway
- Both sides of Ballard Drive

Local Micro-Transit Pilot

The Beltway and Georgia Avenue create barriers for pedestrians and bicyclists trying to access important destinations as they are difficult to cross. The two roadways divide the plan area into four, somewhat isolated quadrants. Until additional protected crossings are installed across the Beltway and Georgia Avenue, local bus transit can help people safely navigate the high-volume roadways.

The plan recommends the study and implementation of "micro transit" service for the local area through Ride On buses. This service should provide an on-demand transit service, rather than a fixed route service with scheduled and predetermined stops. Patrons of the service would request a transit vehicle within the designated service zone, within designated hours. This on-demand function makes transit more convenient to the patron and more efficient for the transit service.

The micro-transit strategy has the added benefit of catering to transit riders' specific needs and can be a helpful tool in determining potential new fixed routes. For example, there currently is not a planned transit connection between the Forest Glen Metro Station and the 16th Street Purple Line Station which is under construction.
Similarly, there appears to be a desire for local transit connections between the Capital View neighborhoods (east side of the plan study area) and the

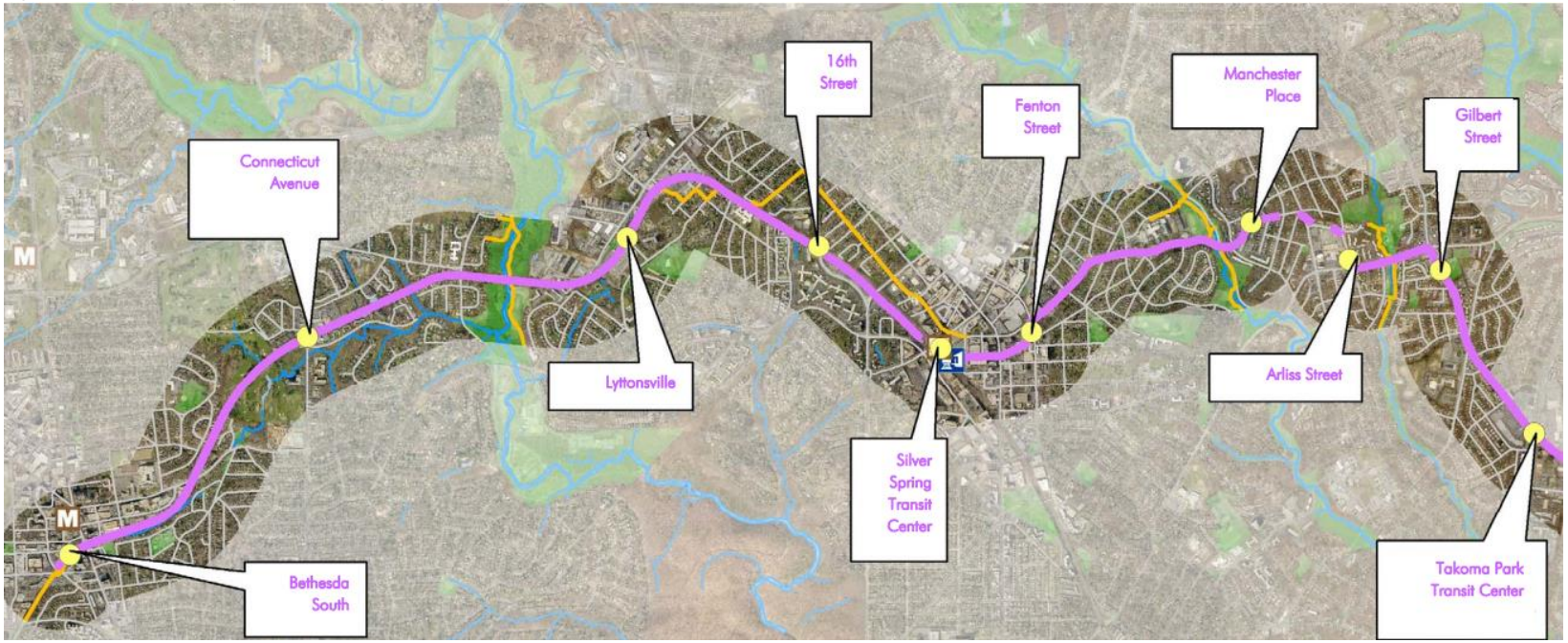
Forest Glen Metrorail Station; transit service does connect these neighborhoods to the Silver Spring Metro Station, which is one station further south on the Red Line. Residents appear to favor a shorter bus ride to access the Metrorail system over a shorter Metrorail ride. Should data show that people are making that connection with the micro-transit, an important gap in the transit network could be identified.
The sector plan recommends the following connections be considered as short-term improvements:

- Forest Glen East/Forest Glen Metro Station.
- Capital View, Linden/Forest Glen Metro Station.
- Forest Glen Metro Station/future 16th Street Purple Line Station.
- Forest Glen Metro Station/future Dale Drive Purple Line Station.
- The following additional origins/destinations should be considered in the long-term:
- Forest Glen east and West/Montgomery Hills east and west.
- Holy Cross Hospital/Montgomery Hills east and west
- Woodside Park/Forest Glen Metro Station.
- Woodside Park/Montgomery Hills west.

Future Purple Line Light Rail

As previously noted, the Purple Line is a planned 16-mile long light rail transit facility that will extend from Bethesda to New Carrollton and will include a station just outside the sector plan area at the corner of 16th Street and Second Avenue. The Purple Line will provide east-west service between Montgomery and Prince George's County and will result in direct connections to Metrorail Red, Green and Orange Lines, local and inter-city bus, the MARC train and Amtrak. According to an August 2013 Purple Line Travel Forecast, the Purple Line is expected to operate on a 6-minute[13] headway frequency during a typical weekday peak period and serve approximately 14,990 riders per day. No new parking will be provided to serve the new Purple Line station; therefore, it is anticipated that most riders will arrive at the station by means other than car (as is the case with Metrorail in Bethesda now). The M-NCPPC Purple Line Functional Master Plan was approved and adopted in September 2010. The Purple Line alignment through the plan area as depicted in the Functional Plan is shown below in Figures 13, 14, and 15. It should be noted that although the illustrative plans refer to a "potential" Dale Drive station in Silver Spring, the determination has been made to include the Dale Drive station as part of the initial Purple Line construction.

Figure 17: Purple Line Alignment in Montgomery County



[13] Train headways were extended from 6-minutes to 7.5-minutes as part of a project cost savings measure in summer 2015.

Figure 18: Purple Line Alignment 16th Street

Future Bus Rapid Transit

As previously noted, Georgia Avenue (MD 97) is recommended to be a future Bus Rapid Transit (BRT) corridor by the Approved and Adopted 2013 Countywide Transit Corridors Functional Master Plan (CTCFMP). The CTCFMP envisions 10 rapid transit corridors over a 102-mile-long countywide network (Figure 17) as a means of increasing person throughput while managing impacts to private property outside of a very constrained public right-of-way. The only CTCFMP designated corridor within the sector plan area is the "Georgia Avenue South Corridor," (Figure 18) which recommends three stations in the following locations:

1. Georgia Avenue/Seminary Road
2. Forest Glen Metrorail station
3. Georgia Avenue/Dexter Avenue

Figure 19: Countywide Transit Corridors System

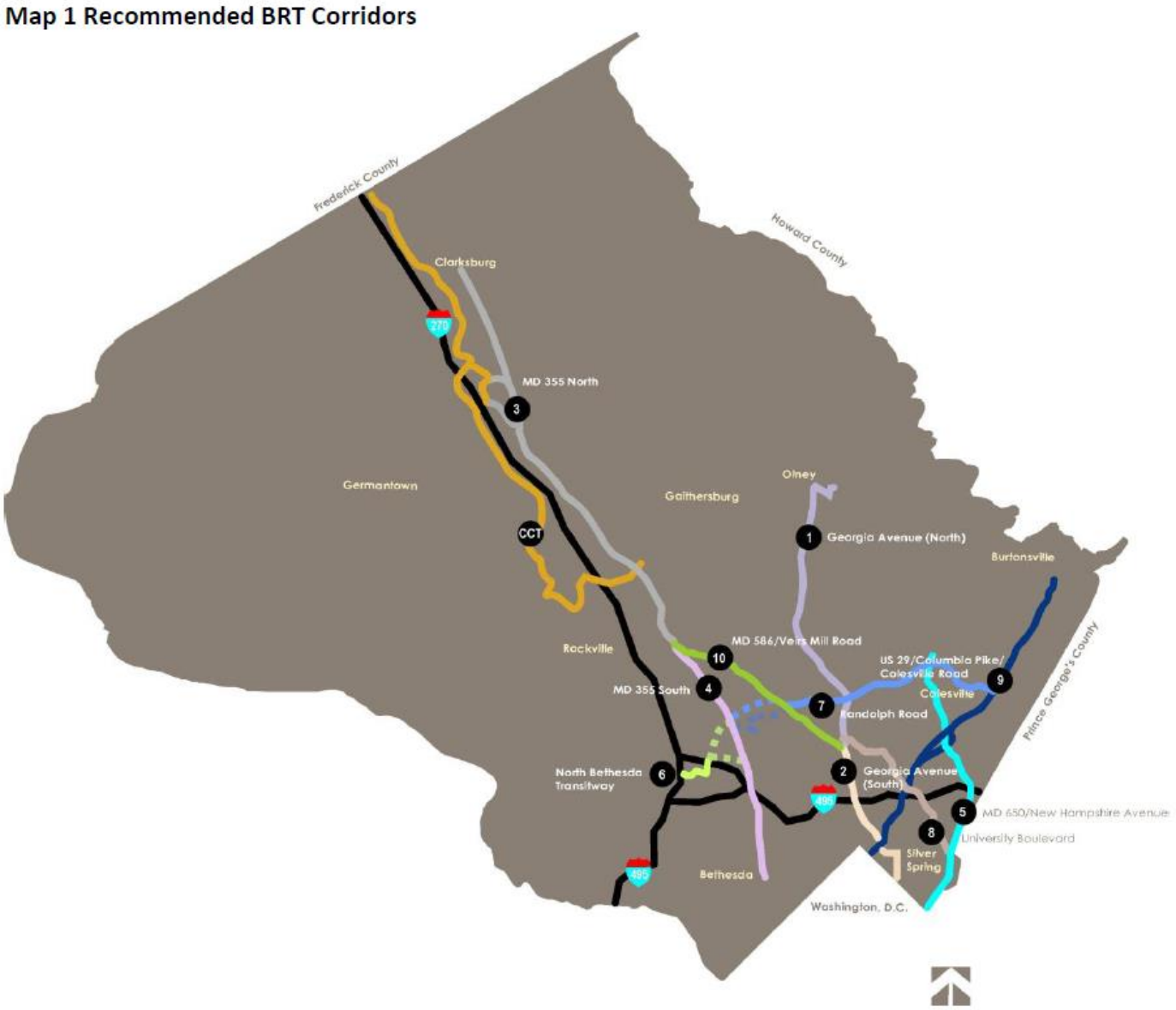


Figure 20: Georgia Avenue South Transit Corridor

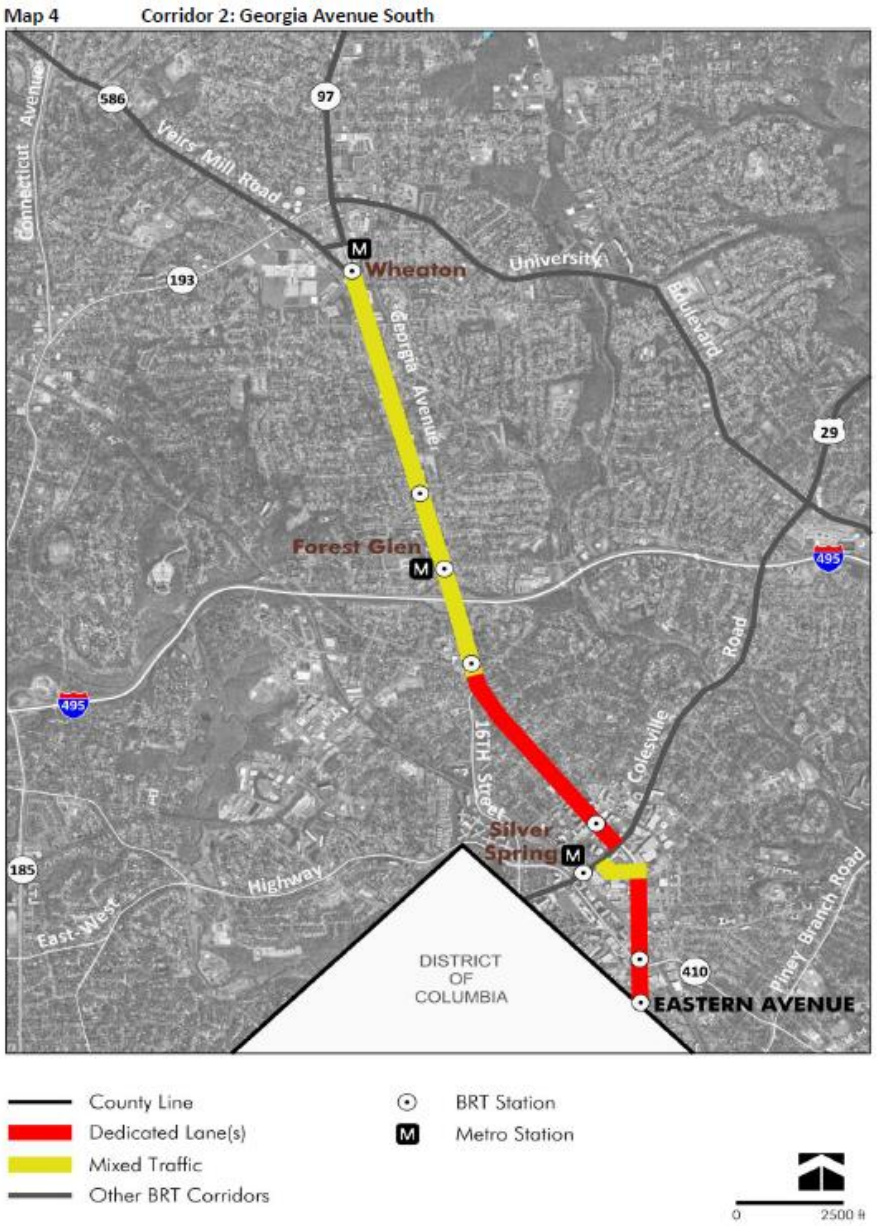


Figure 21: Georgia Avenue Transit Right-of-Way Recommendations

Road	From	To	Dedicated Lane(s)?	R.O.W.*	Maximum Additional Transit Lanes
Georgia Avenue	Veirs Mill Rd	Dennis Ave	No	120	0
Georgia Avenue	Dennis Ave	I-495		110	0
Georgia Avenue	I-495	Flora Ln		120	0
Georgia Avenue	Flora Ln	16th St		120	0
Georgia Avenue	16th St	Spring St	Yes	122	0
Georgia Avenue	Spring St	Colesville Rd		126	0
Wayne Avenue	Colesville Rd	Georgia Ave	No	120	0
Georgia Avenue	Wayne Ave	Blair Mill Rd	Yes	125-140	0
Georgia Avenue	Blair Mill Rd	DC Line	Yes	125	0

* Reflects the minimum right-of-way, and may not include land needed for spot improvements such as turn lanes and stations.

TRANSIT ANALYSIS

Transportation Policy Area Review (TPAR) was the policy area transportation adequacy test developed and adopted in the context of the 2012 Subdivision Staging Policy. The description and analysis framework of the TPAR process is documented in the 2012 TPAR report.[14] TPAR measured the impacts of development on traffic flow and transit capacity by policy area, established standards for roadway and transit adequacy and determined which policy areas achieved the established adequacy standards. TPAR was eliminated by the County Council with the adoption of the 2016 Subdivision Staging Policy (SSP). The Local Area Transportation Review (LATR) Guidelines are now used to prepare and review transportation studies for development in Montgomery County.

While TPAR is no longer used in support of subdivision review, the transit adequacy component of the test continues to have some utility for master plan analysis. For this reason, this Transportation Appendix includes a summary of the transit adequacy for the Montgomery Hills/Forest Glen Sector Plan area based on TPAR. As discussed in greater detail below, roadway adequacy is analyzed using Local Area Transportation Review methodologies, consistent with the 2016 SSP.

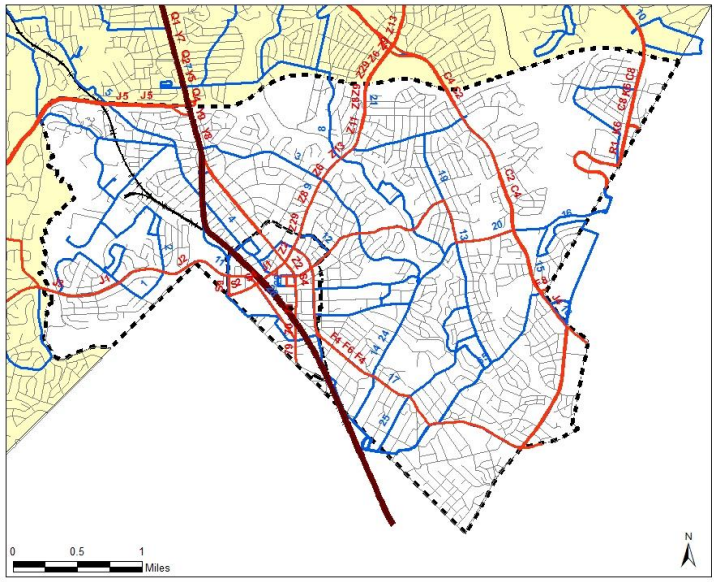
The Montgomery Hills/Forest Glen Sector Plan area is a relatively small portion of the Silver Spring/Takoma Park policy area located along Georgia Avenue (MD 97) --- just north of the Silver Spring CBD and south of Dennis Avenue. Given the spatial relationship of sector plan area relative to the larger Silver Spring Takoma Park policy area, it is challenging to directly interpret the policy area level transit adequacy results reported in the 2012 TPAR report specifically for the Montgomery Hills/Forest Glen Sector Plan area. That said, it is assumed that selected elements of transit service metrics pertaining to the Silver Spring/Takoma Park policy area as reported in the 2012 TPAR report can be reasonably applied to the Montgomery Hills/Forest Glen Sector Plan area. In this regard, it is also important to note that the local transit information reported in the 2012 TPAR report reflects observed conditions as of January 2011. Given that TPAR was eliminated with the adoption of the 2016 Subdivision Staging Policy, this transit service information has not been updated to reflect more current conditions.

As described in the 2012 Subdivision Staging Policy, TPAR considers all transit services in Montgomery County: Metrorail, commuter rail, existing local bus service, future light rail transit, and future bus rapid transit. TPAR evaluates the quality of local bus service through the measurement of three "performance factors" including coverage of service (proximity of potential users to the transit service), peak headways (frequency of service) and span of service (duration during a typical weekday when service is available to potential users).

The following paragraphs summarize the transit service performance factors for the Silver Spring/Takoma Park policy area, which includes the Montgomery Hills/Forest Glen Sector Plan area, as generally described in the 2012 TPAR report.

[14] https://montgomeryplanning.org/document-viewer/#https://www.montgomeryplanning.org/research/subdivision_staging_policy/2012/documents/SSPappendix2TPAR.pdf

Figure 22: Silver Spring/Takoma Park Policy Area TPAR Transit Adequacy



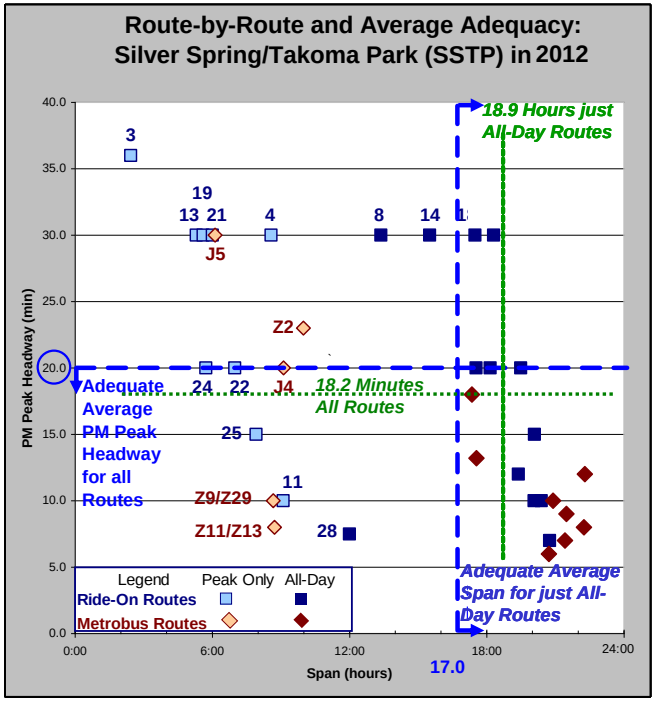


Figure 23: Route by Route Average Adequacy Silver Spring/Takoma Park SSTP in 2012

The Silver Spring/Takoma policy area includes two Metrorail Stations: Silver Spring and Takoma Park and a third, Forest Glen, is within walking distance of portions of the policy area. It should be noted that a significant portion of the Montgomery Hills/Forest Glen Sector Plan area is with walking distance of the Forest Glen Metrorail station. The policy area also will have future stations on the Purple Line, and the existing Silver Spring Transit Center will also tie into the Purple Line.

Coverage of Service: About 96% of the Silver Spring/Takoma Park policy area is located within 1 mile of a Metrorail station or 1/3 of a mile of one of the 35 bus routes currently serving the area as well as several Commuter Bus routes from the Baltimore area. The graphic to the left shows where bus service coverage is provided in the Silver Spring/Takoma Park policy area. The standard for TPAR coverage for an Urban Policy Area is 80%. Therefore, transit coverage in the Silver Spring/Takoma Park policy area is adequate.

Peak Headways: On average, all buses provide 18.2 minutes between stop arrivals during the weekday evening peak period in the Silver Spring/Takoma Park policy area. Some provide very frequent service such as the J1-J3 or Q2 Metrobuses. In areas like the Silver Spring/Takoma Park policy area where Metrorail or future LRT are provided, the TPAR standard for average peak headway is 20 minutes or less. Thus, the average peak headway for the Silver Spring/Takoma Park policy area is adequate.

Span of Service: The average value of span is 18.9 hours per day for routes that operate all-day. The TPAR urban standard is 17.0 hours per day on average for all-day routes. Therefore, transit span in the Silver Spring/Takoma Park policy area is adequate.

NON-AUTO DRIVER MODE SHARE (NADMS)

The Forest Glen/Montgomery Hills Sector Plan acknowledges the countywide goal to reduce single-occupancy vehicle trips and increase mode share among transit users, bicyclists and pedestrians. A non-auto driver mode share (NADMS) goal was considered but ultimately not recommended as part of the plan for three reasons.

First, the plan recommends a comparatively modest density increase to the plan area. Specific targets for reducing automobile travel are typically identified in long-range plans that recommend significant increases to existing densities to offset the potential traffic impacts. Applying a NADMS goal to local development within the plan area would likely have a marginal impact on traffic along the corridor. Secondly, the plan area encompasses a relatively small area within the corridor that connects two larger policy areas. The character of the existing and forecasted future traffic patterns suggests that a NADMS target would not be effective, as most of the traffic volume consists of people passing through the area.

Finally, the Montgomery County Department of Transportation is exploring a new approach to Transportation Demand Management (NextGen TDM), which proposes dividing the county into policy areas and which would have context-sensitive NADMS targets. Should that proposal be approved by the Montgomery County Council, the plan area would be included within a larger policy area and subject to the NADMS target of that policy area.

Right-of-Way and Street Classification

Table 10 summarizes all Residential streets within the sector plan boundary. This table is intended to provide guidance on minimum right-of-way dedication widths for streets falling below the Primary Residential roadway classification in the transportation hierarchy.

Table 10: Residential Street Right-of-Way Summary

Designation	***Roadway***	***Limits***	***Minimum Right-of-Way***
Residential			
	Ballard Street	1st Ave to Woodland Drive	60'
	Noyes Drive	1st Ave to Woodland Drive	60'
	Woodland Drive	Spring Street to I-495 I495 to General Getty Park General Getty Park to Medical Park Drive	60'
	Woodside Parkway	Georgia Avenue to Alton Parkway	100'
	Highland Drive	Georgia Avenue to Colesville Road	60'
	Grace Church Road	Georgia Avenue to Woodland Drive	60'

	Grace Church Road	First Ave to Georgia Avenue	50'
	Cedar View Court	Georgia Avenue to end	40'
	Luzerne Avenue	Georgia Avenue to Woodside Parkway	50'
	Corwin Drive	Georgia Avenue to Columbia Boulevard	50'
	White Oak Drive	Georgia Avenue to Woodland Drive	50'
	Flora Lane	Georgia Avenue to Woodland Drive	50'
	Locust Grove Road	Georgia Avenue to 2nd Avenue	60'
	Landsdowne Way	2nd Avenue to roadway western end	72'
	Selway Lane	Seminar Road to Seminary Place	20'
	1st Avenue	Spring Street to Columbia Boulevard	60'
	Belvedere Place	Coleridge Drive to Forest Glen Road	60'
	Coleridge Drive	Forest Glen Neighborhood Park to Belvedere Place	60'
	Coleridge Drive	Belvedere Place to Ellis Street	50
	Ellis Street	Belvedere Place to Coleridge Drive	50'
	Elkton Avenue	Ellis Street to Forest Glen Road	60'
	Bonnywood Lane	N/A	N/A
	Walsh View Terrace	N/A	N/A
	Tilton Drive	Georgia Avenue to Woodland Drive	60'
	Belvedere Boulevard	Georgia Avenue to Arthur Avenue	100'
	Arthur Avenue	Georgia Avenue to Greeley Avenue	50'
	August Drive	Georgia Avenue to Woodland Drive	50'
	Dexter Avenue	Georgia Avenue to McKenney Avenue	60'
	Medical Park Drive	Georgia Avenue to Woodland Drive	60'
	East side Alley	Luzerne Ave to White Oak Drive	20'

PARKING

Parking Lot District

A parking lot district (PLD) in the plan area was created to support the retail and commercial uses in Montgomery Hills. Due to the size of the existing lots, the minimum onsite parking requirements could not be accommodated without the addition of public parking lots 12 and 48 located at Seminary Road (west side of Georgia Avenue) and Columbia Boulevard (east side of Georgia Avenue) respectively. Combined, they provide 63 spaces of metered, long-term parking spaces and 34 metered, short-term spaces[15].

[15] Long-term parking is 12 hours and short-term parking is 2 hours.

Table 11: Bethesda Parking Lot District Usage Summary FY2013 (Source: MCDOT)

Public Parking Lot	Capacity	Percent Occupied Weekday 2017	Percent Occupied Saturday 2018
Lot 12 - Seminary Road			
Short-term	13	8%	35%
Long-term	50	18%	
Lot 48 - Columbia Boulevard			
Short-term	21	24%	97%
Long-term	13	69%	

On-street short-term parking is also provided along both sides of Flora Lane between Georgia Avenue and Woodland Drive, on the east side of Georgia Avenue between Columbia Boulevard and Seminary Place, on the south side of Corwin Drive between Georgia Avenue and Columbia Boulevard, and on the east side of Columbia Boulevard between Seminary Road and Rookwood Road. On-street long-term parking is available on the north side of White Oak Drive between Georgia Avenue and Woodland Drive.

The current boundaries of the PLD do not include Lot 12 even though the intent of the lot is to supplement parking capacity within the district. Therefore, this plan recommends MCDOT evaluate potential changes to the boundaries to include the full extent of Lot 12 along with properties comprising the Seminary Place Shopping Center, adjacent Shell gas station and the Montgomery Hills Car Wash.

Figure 24: PLD Map

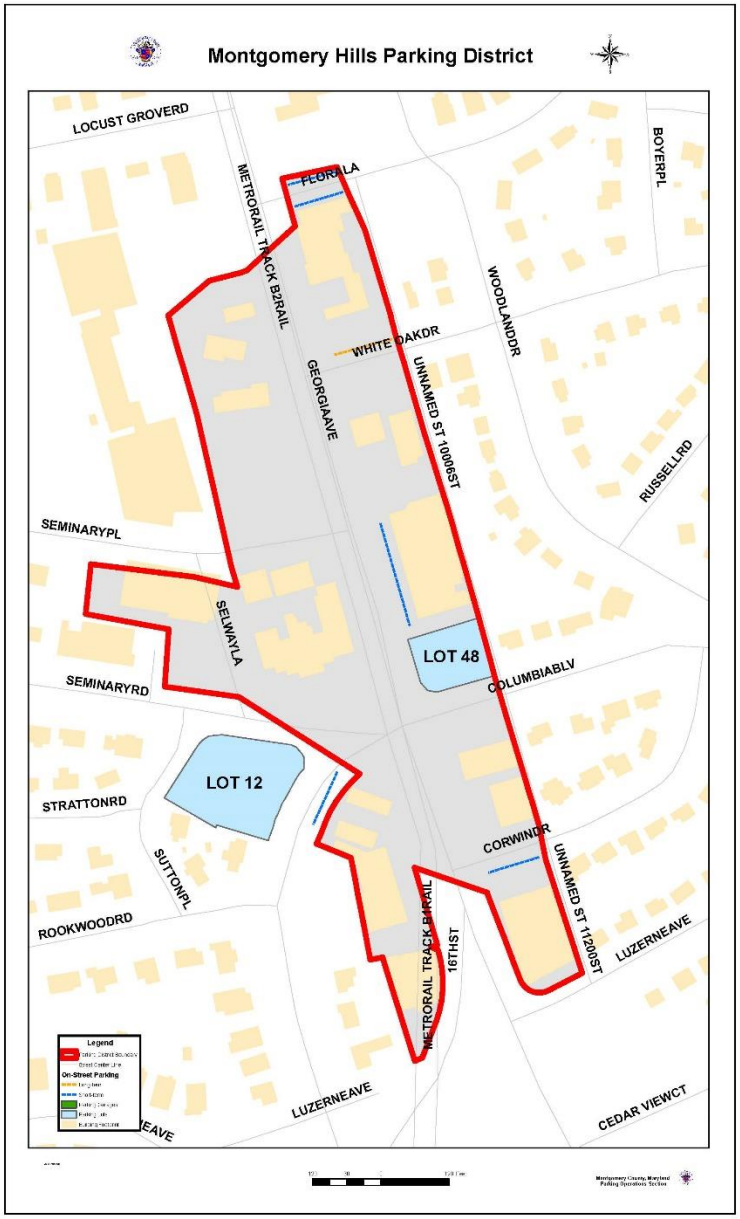
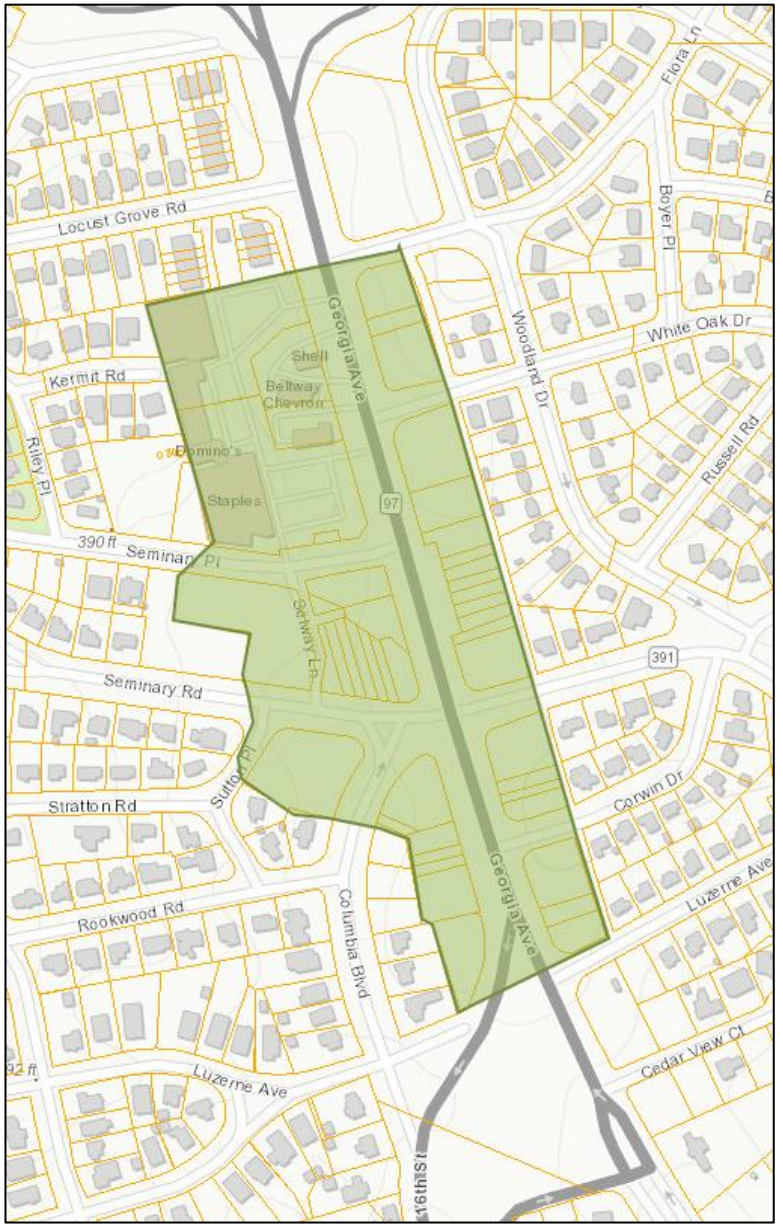


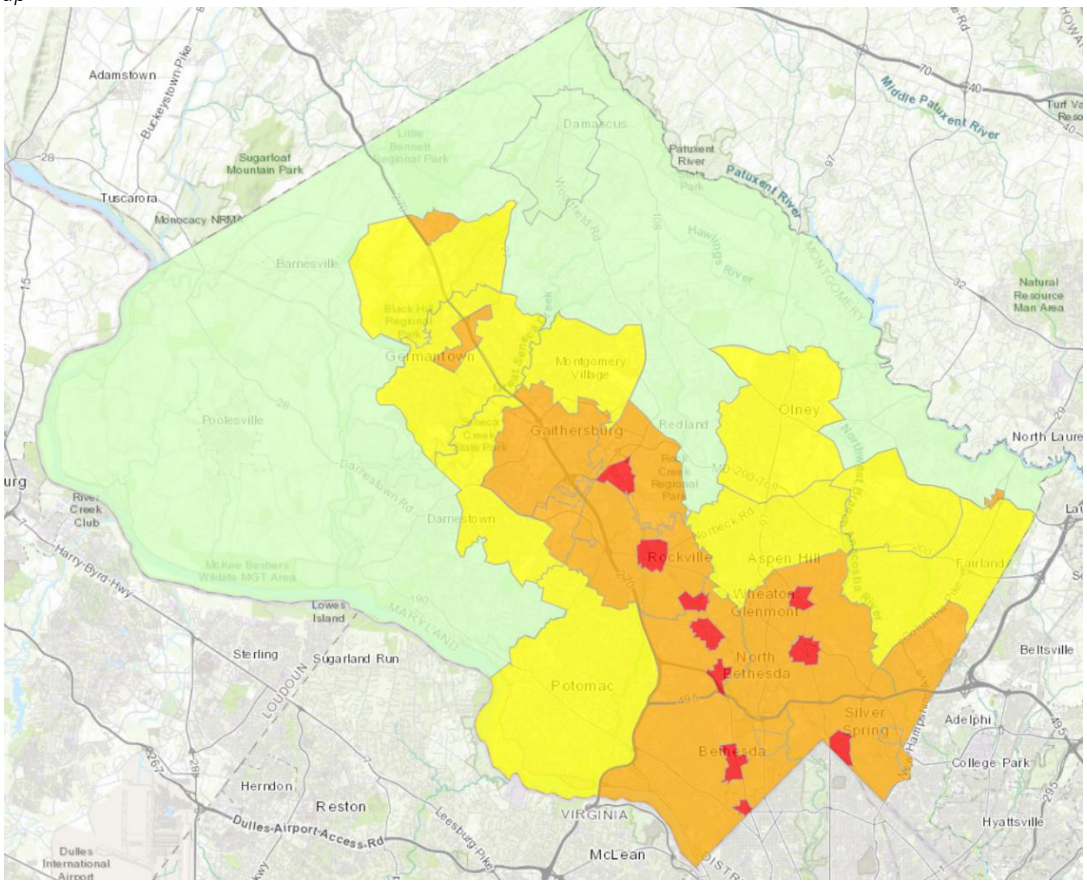
Figure 25: Recommended PLD Map



TRAVEL FORECASTING – MASTER PLAN AND STUDY AREA

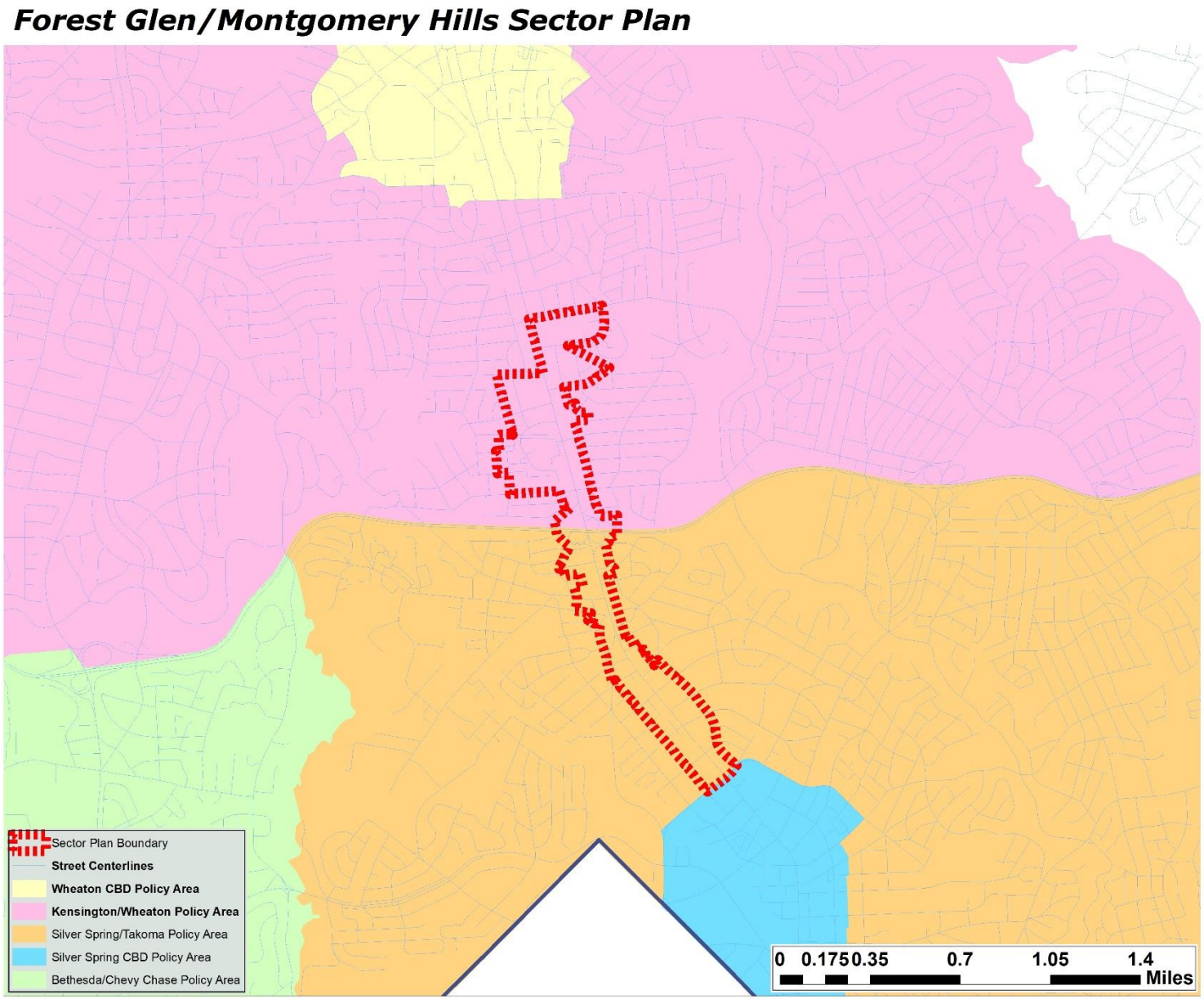
Figures 26 and 27 depict the spatial relationship of the Forest Glen/Montgomery Hills Sector Plan area relative to two county policy areas[16]. The plan boundary roughly corresponds to one block east and west of Georgia Avenue between Dennis Avenue to the north and Spring Street to the south. The sector plan area and larger study area is located within two transportation policy areas: Kensington/Wheaton and Silver Spring/Takoma Park.

Figure 26: Countywide Policy Area Map



[16] http://www.montgomeryplanning.org/transportation/highways/documents/countywide_transit_corridors_plan_2013-12.pdf

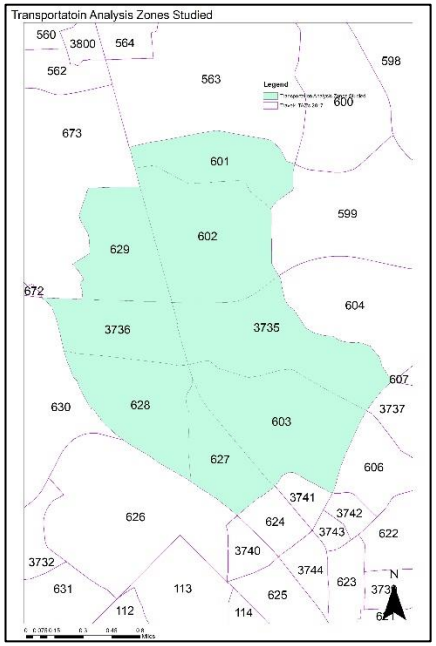
Figure 27: Transportation Policy Area Map w/Plan Boundary



The Wheaton CBD And Silver Spring CBD Metro Station Policy Areas (MSPAs) are located within close proximity to the sector plan area – to the north and south, respectively.

One major highway, Georgia Avenue, traverses the sector plan area oriented in the north/south direction. 16th Street, a major highway oriented in the north/south direction, intersects the plan area, separating the Montgomery Hills Sector Plan Area District from the Woodside Park Sector Plan Area District. Two major arterials, Forest Glen Road and Seminary Road, traverse the sector plan area oriented in the east/west direction. The study area, which includes the sector plan area, is comprised of eight traffic analysis zones (TAZs). The geographical definition of the sector plan area and plan study is important in that it is the first step in establishing the interface between the Planning Department's regional travel demand model (Travel/4) and the subarea master-plan specific local area travel demand model (referred to as Travel/4MP[17]).

Figure 28: TAZs in Study Area



[17]Travel/4MP reflects a more detailed traffic analysis zone and transportation network structure relative to Travel/4.

Existing Conditions Local Intersection Traffic Analysis

Observed intersection turning movements at selected locations within the master plan and study areas were collected (generally reflecting existing conditions). Traffic congestion at these locations was evaluated. Observed counts of vehicles, pedestrians and bicycles per 15-minute intervals (the minimum time interval unit used in traffic engineering analysis), were collected and analyzed.

Figure 29: Study Intersections

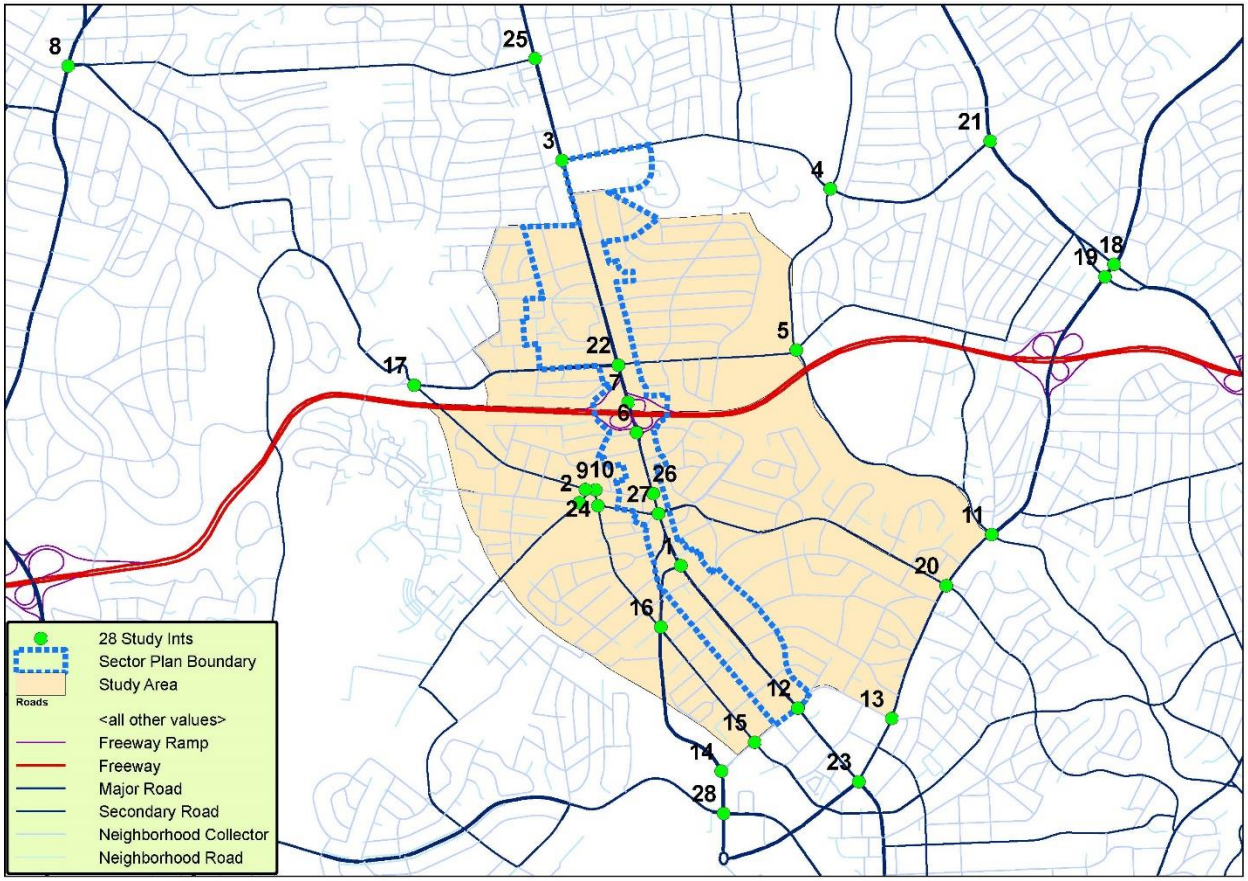


Figure 29 depicts the location of the eight intersections identified within the sector plan area for detailed performance evaluation. Additionally, due to the limited grid network within and surrounding the plan area, an additional 20 intersections beyond the sector plan area boundary were included in the traffic analysis, recognizing these are major intersections that could be impacted by

improvements intended to increase traffic flow along Georgia Avenue. The full set of 20 intersections are also shown in Figure 29 and Table 12. This Technical Appendix, focuses primarily on the eight intersections located within the Plan Area (listed north to south along the corridor):

- Dennis Avenue and Georgia Avenue (ID 3)
- Forest Glen Road and Georgia Avenue (ID 22)
- Outer Loop Beltway Ramps and Georgia Avenue (ID 7)
- Inner Loop Beltway Ramps and Georgia Avenue (ID 6)
- Seminary Place and Georgia Avenue (ID 26)
- Seminary Road and Georgia Avenue (ID 27)
- 16th Street and Georgia Avenue (ID 1)
- Spring Street and Georgia Avenue (ID 12)

Figure 30: Plan Area Intersection Map

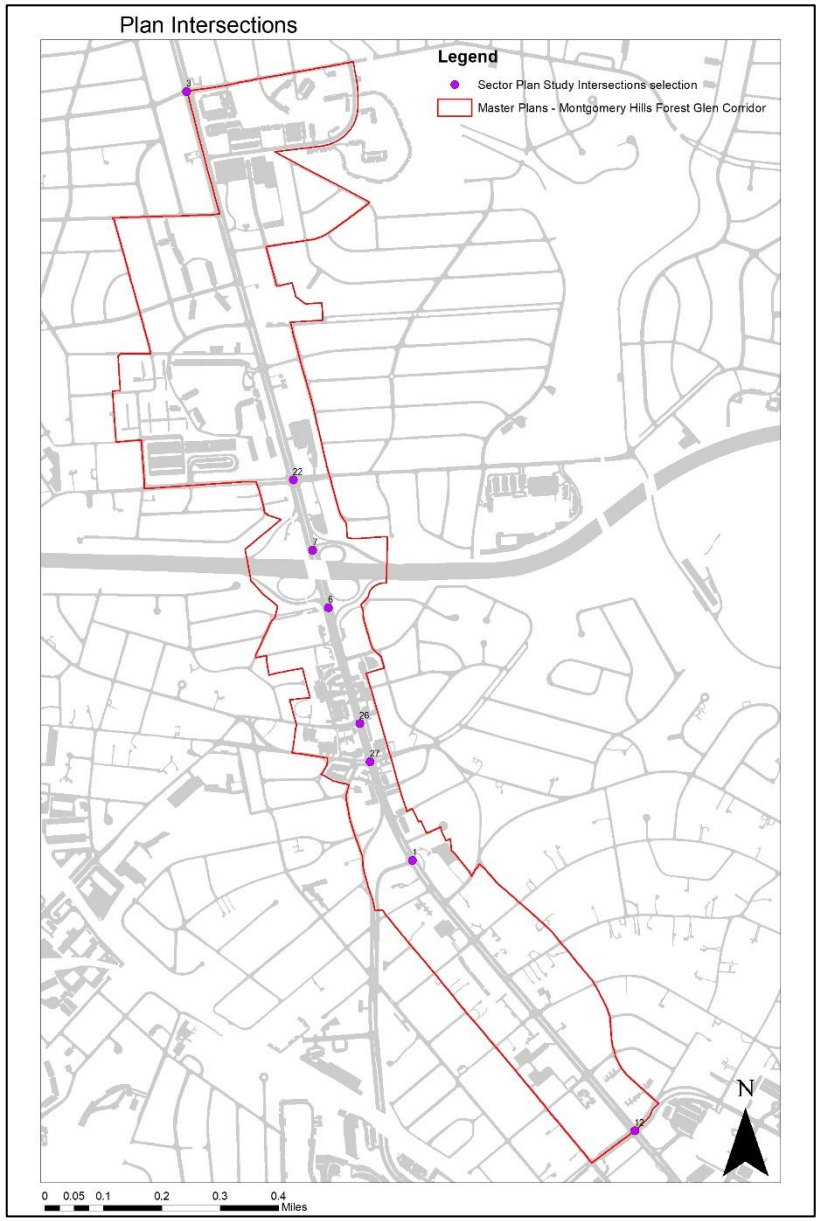


Table 12: List of Study Intersections

Intersection ID	East-West Road	North-South Road	Plan Area Study Intersection
1	16th Street	Georgia Avenue	Yes
2	Linden Lane	Brookville Road	
3	Dennis Avenue	Georgia Avenue	Yes
4	Dennis Avenue	Sligo Creek Parkway	
5	Forest Glen Road	Sligo Creek Parkway	
6	Inner Loop Beltway Ramps	Georgia Avenue	Yes
7	Outer Loop Beltway Ramps	Georgia Avenue	Yes
8	Plyers Mill Road	Connecticut Avenue	
9	Seminary Place	2nd Avenue	
10	Seminary Road	Brookville Road	
11	Sligo Creek Parkway	Colesville Road	
12	Spring Street	Georgia Avenue	Yes
13	Spring Street	Colesville Road	
14	Spring Street	16th Street	
15	Spring Street	2nd Avenue	
16	2nd Avenue	16th Street	
17	Forest Glen Road	Seminary Road / Capital View Avenue	
18	University Boulevard (North)	Colesville Road	
19	University Boulevard (South)	Colesville Road	
20	Dale Drive	Colesville Road	
21	Dennis Avenue	University Boulevard	
22	Forest Glen Road	Georgia Avenue	Yes
23	Georgia Avenue	Colesville Road	
24	Linden Lane	Seminary Road	
25	Plyers Mill Road	Georgia Avenue	
26	Seminary Place	Georgia Avenue	Yes
27	Seminary Road / Columbia Boulevard	Georgia Avenue	Yes
28	East-West Highway	16th Street	

The 2016-2020 Subdivision Staging Policy (SSP) changed the Local Area Transportation Review (LATR) test for new subdivisions and created a multimodal transportation adequacy test. This process requires the application of the delay-based Highway Capacity Manual

(HCM) methodology to evaluate the operational performance of local intersections. In addition, the process evaluates the adequacy of transit, pedestrian and bike facilities for new development. The performance of these non-auto modes is not evaluated in the sector plan context.

The relevant policy area HCM delay congestion standards are used to evaluate traffic conditions for the 28 study area intersections in the context of the existing conditions and alternative sector plan land use/transportation scenarios. Table 13 shows the policy area HCM delay congestion standards used in support of the intersection performance evaluation.

Table 13. Subdivision Staging Policy Intersection Congestion Standards

Policy Area	HCM Volume-to-Capacity Standard	HCM Average Vehicle Delay Equivalent (seconds/vehicle)	Intersection IDs
Silver Spring/Takoma Park	*1.00*	*80*	*1,2, 6, 9, 10, 11, 16, 20, 24, 26, 27*
Kensington/Wheaton	*1.00*	*80*	*3, 4, 5, 7, 8, 17, 18, 19, 21, 22, 25*
Silver Spring CBD	*1.13*	*120*	*12, 13, 14, 15, 23, 28*

It should be noted that several intersections are located on a boundary shared by two policy areas. Georgia Avenue (MD 97) at Spring Street (ID 12), Spring Street and Colesville Road (ID 13), Spring Street Spring Street and 16th Street (ID 14), Spring Street and Second Avenue (ID 15) and 16th and East-West Highway (ID 28) are located on the boundary between the Silver Spring/Takoma Park and Silver Spring CBD policy areas. In these circumstances, county policy dictates the application of the higher congestion delay standard when evaluating intersection performance adequacy.

Table 14 summarizes the analysis results of the year 2017 (existing conditions) HCM delay during the AM and PM peak hours for eight selected signalized intersections depicted in Figure 9. Traffic delay (measured in seconds) represents the estimated average vehicle delay for vehicles that travel through an intersection. Intersections estimated to operate at or above the congestion delay threshold reflected by the applicable policy area HCM delay standards are considered “failing” (i.e., the delay is estimated to be above the adequacy standard for the relevant policy area). The ratio of estimated HCM delay relative to the applicable policy area congestion delay standard above 1.0 represents a failing traffic condition.

Table 14. Existing Condition (Year 2017) Traffic Delay

ID	E-W Road	N-S Road	Delay Standard (sec.)	AM		PM	
				Delay (sec.)	Ratio	Delay (sec.)	Ratio
3	Dennis Avenue	Georgia Avenue	*80*	42.2	0.53	26.4	0.33
22	Forest Glen Road	Georgia Avenue	*80*	66.9	0.84	**79.4**	**0.99**
6	Inner Loop Beltway Ramps	Georgia Avenue	*80*	6.8	0.09	34.7	0.43
7	Outer Loop Beltway Ramps	Georgia Avenue	*80*	66.5	0.83	**84.2**	**1.05**
26	Seminary Place	Georgia Avenue	*80*	19.4	0.24	28.5	0.36
27	Seminary Road / Columbia Boulevard	Georgia Avenue	*80*	63.4	0.79	46.2	0.58
1	16th Street	Georgia Avenue	*80*	20.9	0.26	34.0	0.43
12	Spring Street	Georgia venue	*120*	53.8	0.45	34.1	0.28

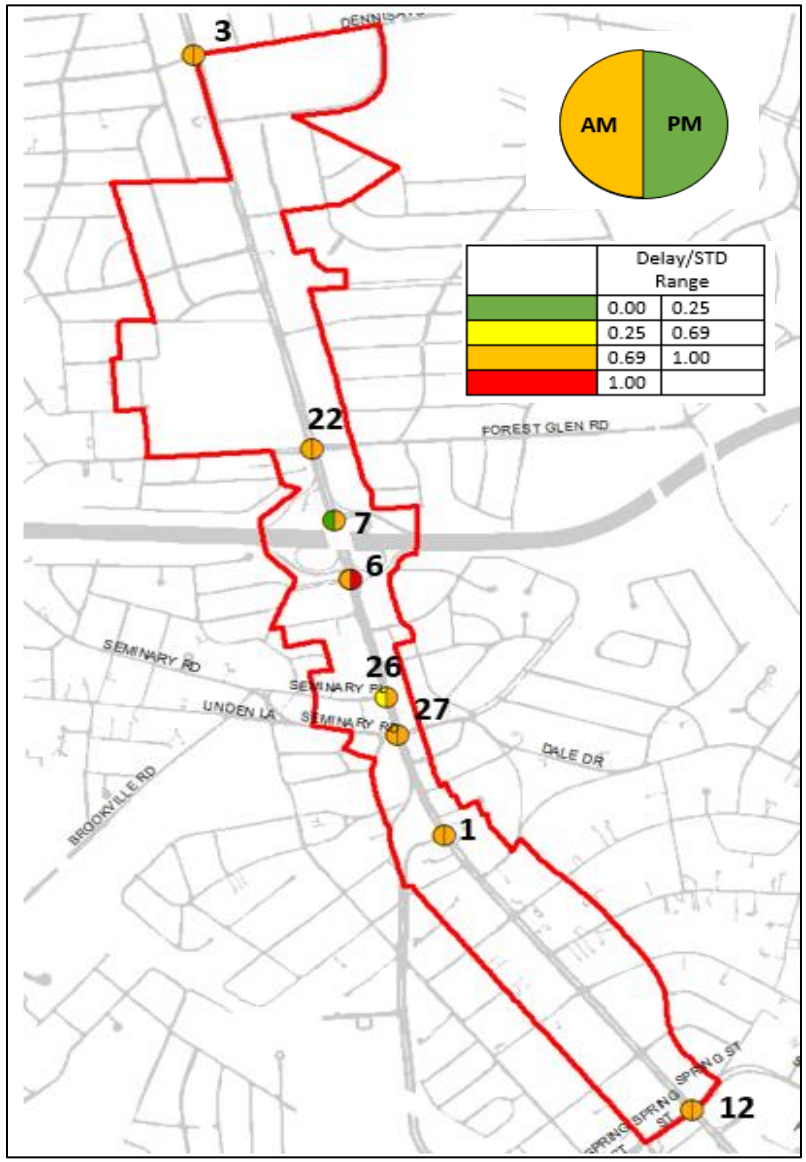
Two intersections in the master plan area exhibited failing, or near failing conditions during the evening peak hour of travel:

- Forest Glen Road and Georgia Avenue (Intersection 22), is approaching the threshold for the Kensington/Wheaton policy area congestion standard during the PM peak hour of travel.
- Outer Loop Beltway Ramp and Georgia Avenue (Intersection 7) exceeds the Kensington/Wheaton policy area congestion standard during the PM peak hour of travel.

Figure 31 shows the intersection level of service (LOS) “dot map” based on the ratio of estimated HCM delay and the applicable policy area delay standard during AM and PM peak period as shown above in Table 9. The colors of the dots depicted on the map is determined by the ratio between the estimated HCM delay and the relevant policy area congestion delay standard as described below. The left-hand side of the dot shows LOS during the AM peak period. The right-hand side of the dot shows LOS during the PM peak period.

- **Green**: less than 0.25
- **Yellow**: between 0.25 and 0.69
- **Orange**: between 0.69 and 1.0
- Red: greater than 1.0

Figure 31. Traffic Congestion Scenario - Existing Traffic Condition (2017)



TRAFFIC ANALYSIS METHODOLOGY

Travel Demand Forecasting Process and Assumptions

The department's regional travel demand forecasting model, TRAVEL/4, is used to develop forecast travel demand results for weekday travel and evening peak periods. The application of Travel/4 included the validation of 2010 base-year traffic conditions and the forecast of future traffic conditions in the county and the Washington metropolitan region. Travel/4 is a traditional four-step regional travel demand model, consisting of:

- **Trip generation:** the number of person trips that are generated by given types and densities of land uses within each transportation analysis zone (TAZ).
- **Trip distribution:** how many person trips generated by each TAZ will travel to each of the other TAZs within the metropolitan area.
- **Mode split:** which mode of travel the person will use, including single-occupant auto, multiple-occupant auto, transit, or a non-motorized mode such as walking or bicycling.
- **Traffic assignment:** the roadways that will be used for vehicular travel between TAZs.

The TRAVEL/4 model incorporates land use and transportation assumptions for the metropolitan Washington region, using the same algorithms as applied by the Metropolitan Washington Council of Governments (MWCOG) regional travel demand modeling tool, Version 2.3.57.

Figure 32 shows the relationship of Montgomery County in the regional travel demand network, featuring the coding of street network characteristics to reflect the general level of adjacent development density.

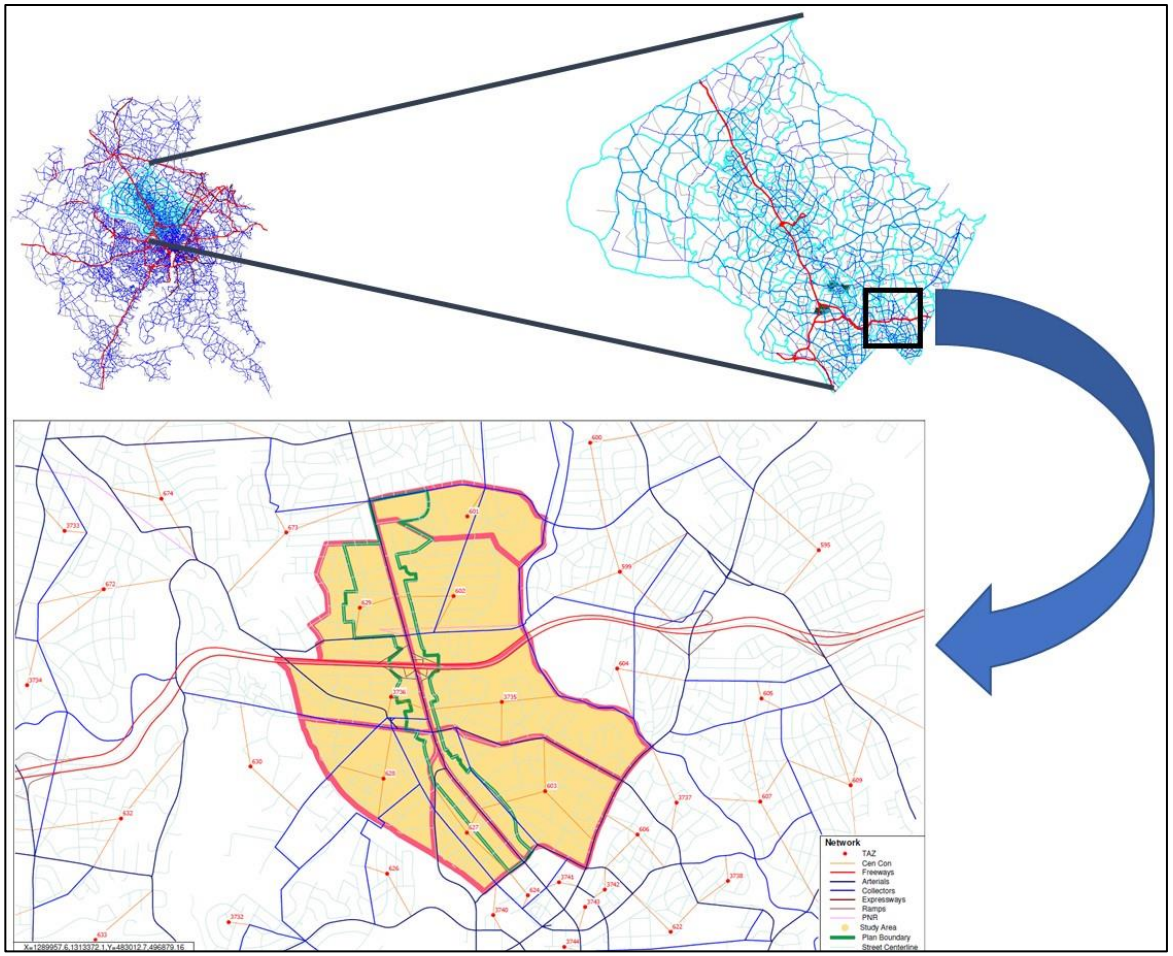


Figure 32. Study Area Network Reflected in the Travel Demand Model, Travel/4MP

Travel/4 for Countywide Traffic Analysis

Travel/4 is used to reflect countywide and regional traffic effects. This tool is an adaptation of the Metropolitan Washington Council of Government's (MWCOG) regional travel demand forecasting model reflecting a more detailed transportation system network

structure coupled with refined model inputs that are compliant with the more detailed structure. In addition, a more detailed TAZ structure is incorporated into Travel/4 reflecting the expansion from 376 to 466 TAZs in Montgomery County (an increase of 90 TAZs). Consequently, this change resulted in an expansion from 3,709 TAZs reflected in the MWCOG regional travel demand model to 3,799 TAZs in Travel/4.

The baseline 2010 and 2040 future year model applications incorporated land use data from the Round 8.3 Cooperative Forecasts reflected in the MWCOG V2.3.57a regional travel demand forecasting model. Additional model run scripting enhancements were made to the model code. In addition to these specific adjustments to the network and zone structure, other inputs, such as aggregate socio-demographic data, lookup tables, and model parameters were used. When network and TAZ structures in Montgomery County area were expanded, the regional sum total of socio-demographic data (e.g., population, employment) in the model remained consistent with MWCOG Cooperative Forecasts.

The MWCOG model algorithm structure was retained in Travel/4, including the year 2020 transit constraint and two-step assignment feature for High-Occupancy Toll (HOT) lanes. Intra-step distributed processing was included in the model run applications with four sub-nodes.

Travel/4MP for Local Area Traffic Analysis

The subarea master plan application of the Travel/4 regional travel demand model, referred to as "Travel/4MP", was used in support of the traffic impact analysis of the Forest Glen/Montgomery Hills Sector Plan. This subarea modeling approach consists of three levels. As the first level of analysis, Travel/4MP provides system-level intersection approach volume results that are used as inputs to the finer grain analytic tools described below. The second level of analysis consists of post processing techniques applied to the Travel/4MP forecasts, as described in the National Cooperative Highway Research Program (NCHRP) Report 255. These techniques include refining the morning and evening peak hour forecasts to reflect a finer grain of land use and network assumptions than those included in the regional model, such as the location of local streets and localized travel demand management assumptions. The NCHRP 255 techniques are used to produce estimated intersection turning movement volumes. The third level of analysis includes an evaluation of local intersection congestion, using the HCM methodologies described in the Department's 2017 Local Area Transportation Review Guidelines.[18]

[18] http://montgomeryplanning.org/wp-content/uploads/2017/12/LATR-Guidelines-Production-Final_122017-PRODUCTION-WEB.pdf

Select Link Analysis

A select link analysis was conducted to determine the ratio of local traffic to the overall traffic volume. This type of analysis works by estimating the number of trips that would be generated by the surrounding US Census block based on the current land use and density. Estimates are calculated for census blocks both traveling towards and away from the study area. That estimated total number of trips are then subtracted from current traffic volumes to estimate the ratio of local to pass-through traffic on the transportation network.

The conclusion of the analysis was that with the current and master-planned densities, approximately 25 percent of the traffic on Georgia Avenue through the study area is local, and the balance originates outside the surrounding transportation analysis zones (TAZs). Much of this traffic is attributed to high traffic volumes that enter the local network via the MD 97 Beltway interchange.

Figure 33: Select Link Analysis 1

Figure 34: Select Link Analysis 2

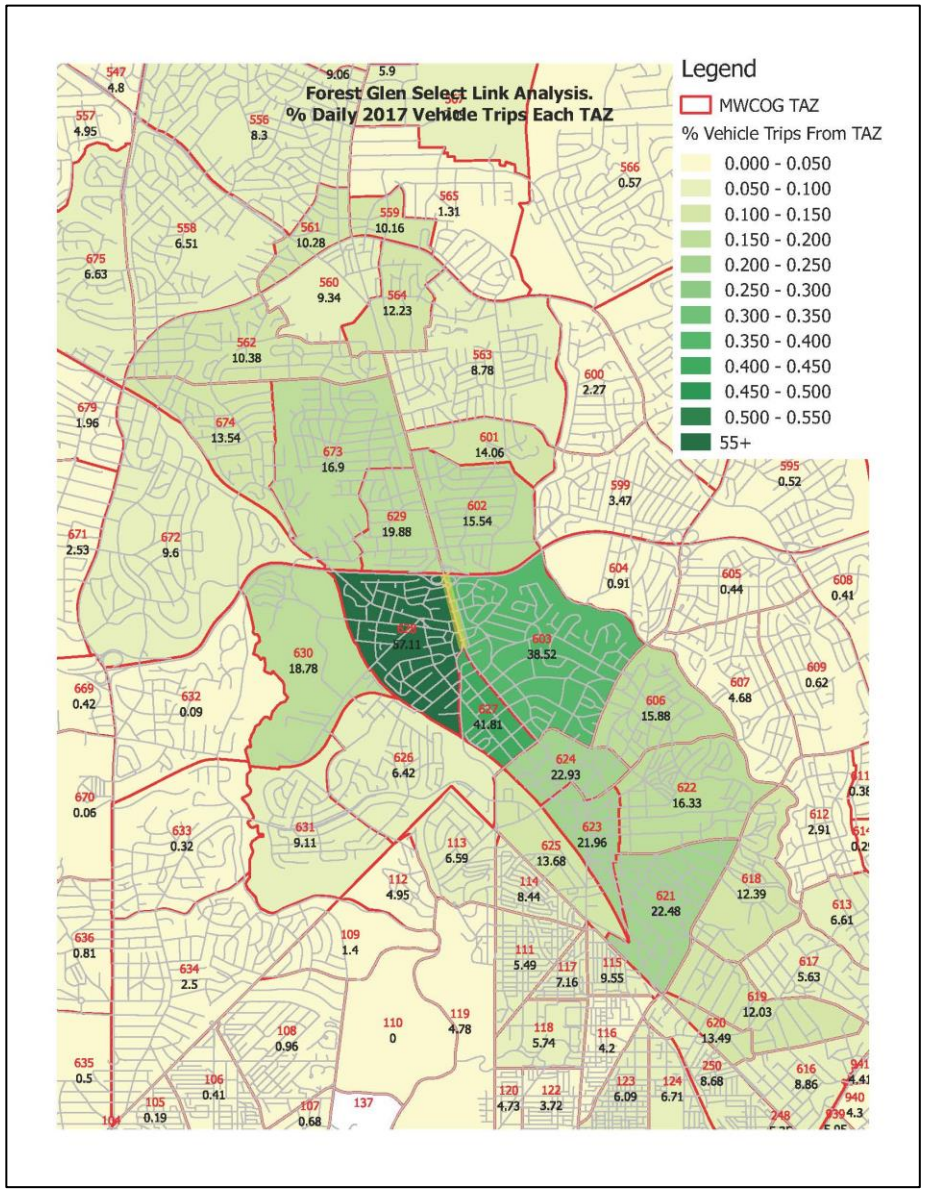
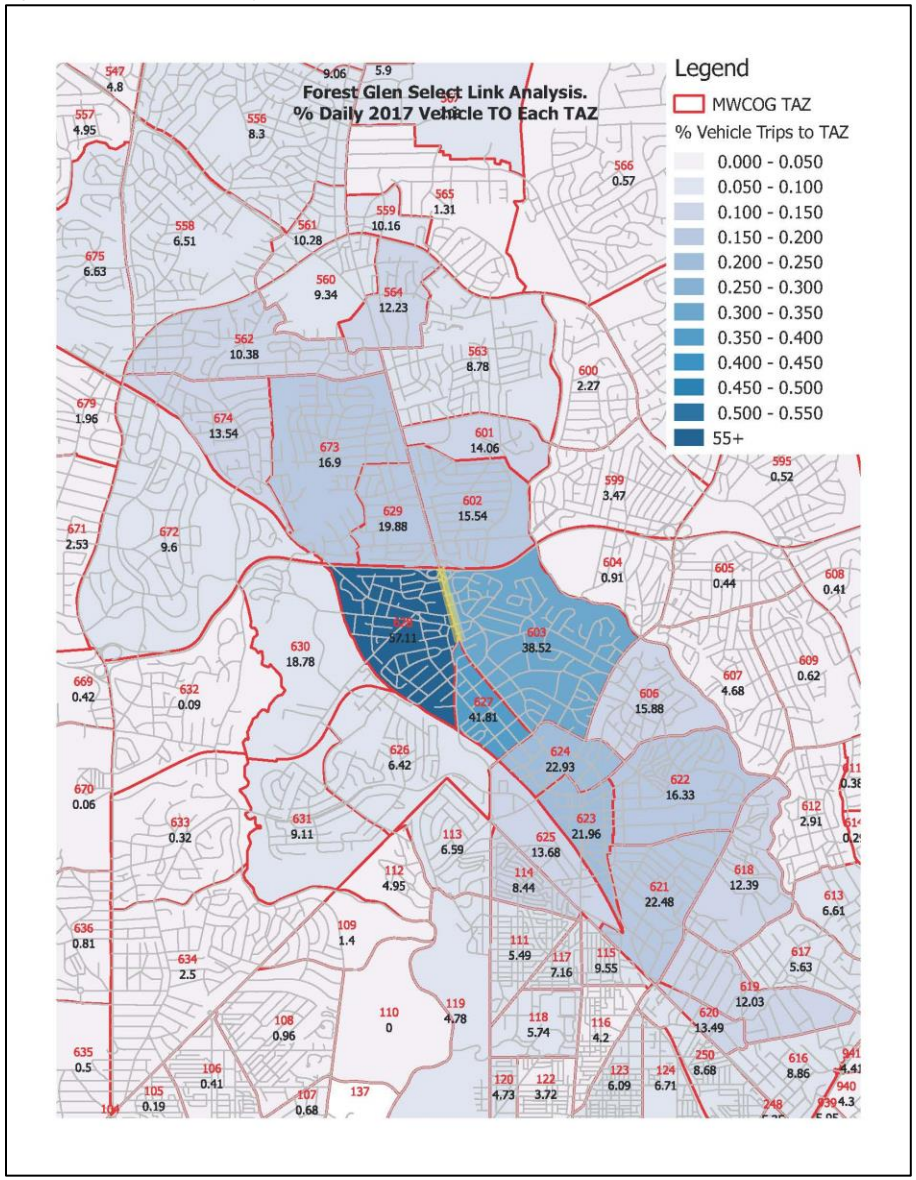


Figure 35: Select Link Analysis 3



Given the high proportion of regional traffic traveling through the plan area, the comparatively small master-plan recommended densities and the plan area's location between two central business districts (CBDs), this plan recommends increasing the policy area average intersection delay standard for the seven signalized intersections within its plan boundaries to 120 seconds. Doing so accepts the unique circumstances and provides flexibility for future development, which is the only viable means of achieving the safety and placemaking goals set forth in this plan.

This segment of Georgia Avenue provides an urban functionality as it is directly accessed by high-density residential housing, office and retail uses. The intersections to which this recommendation applies are listed below:

- Dennis Avenue
- August Drive
- Forest Glen Road
- Capital Beltway off-ramp signals (north and south)
- Seminary Place
- Seminary Road
- 16th Street
- This recommendation also applies to any future traffic signals that are recommended to be installed within the plan area boundary.

Recognizing the role this segment plays within the larger transportation network, the plan recommends the development of a unified mobility program (UMP) that includes the sector plan area with the Silver Spring Central Business District. To develop the framework for an UMP, a long-range comprehensive transportation analysis for the Plan area (as described below) has been conducted for determining the future traffic conditions and identifying facility improvements that will reduce congestion and improve traffic flow.

Master Plan Local Intersection Traffic Analysis Master Plan Scenarios

Intersection performance was evaluated within the plan study area in the context of three master plan land use/transportation network scenarios:

- No Build
- 2040 Build Out (Plan Vision)
- 2040 Build Out (Zoning Envelope)

The two future scenarios include assumptions made about the plan designated "opportunity sites" and zoning recommendations. A map of the opportunity sites and the zoning recommendations are included in Figure 36 and 37 respectively.

Figure 36: Opportunity Sites Map

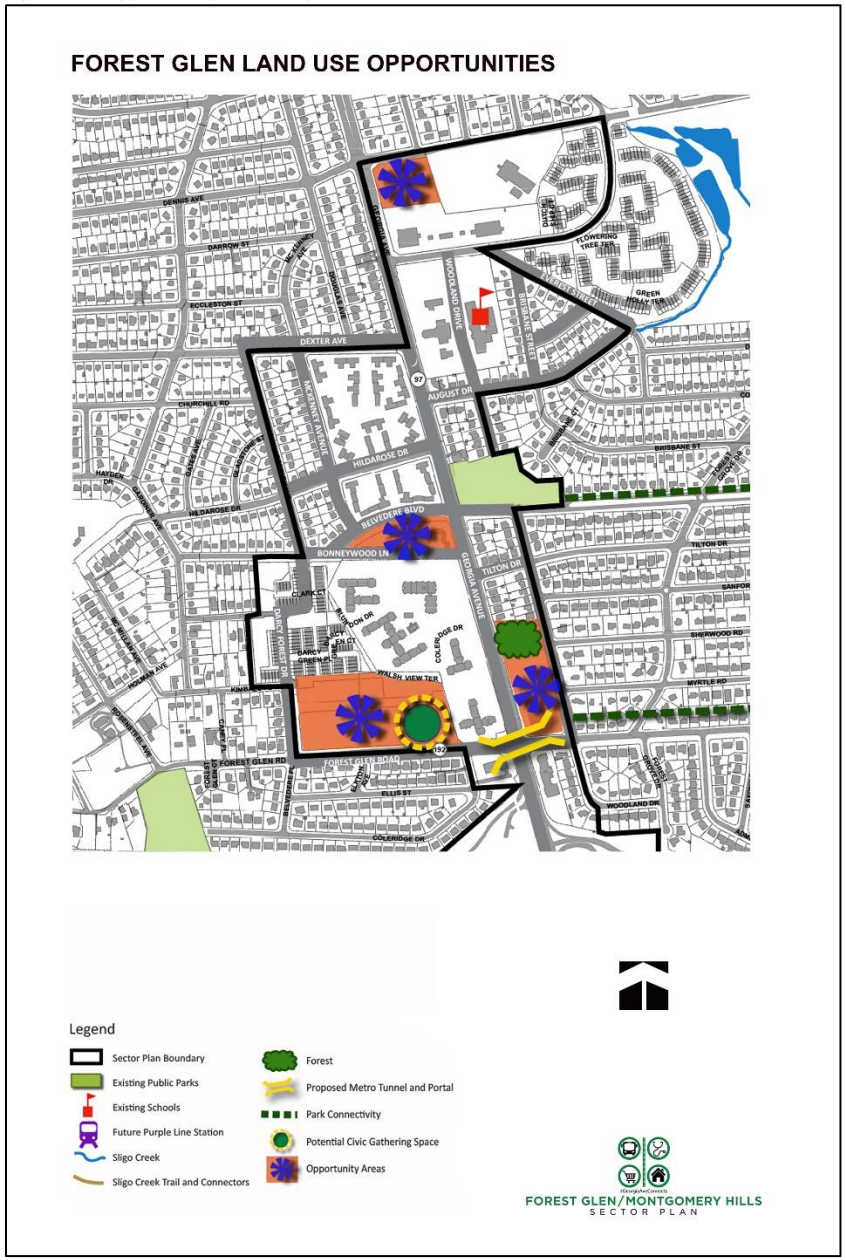
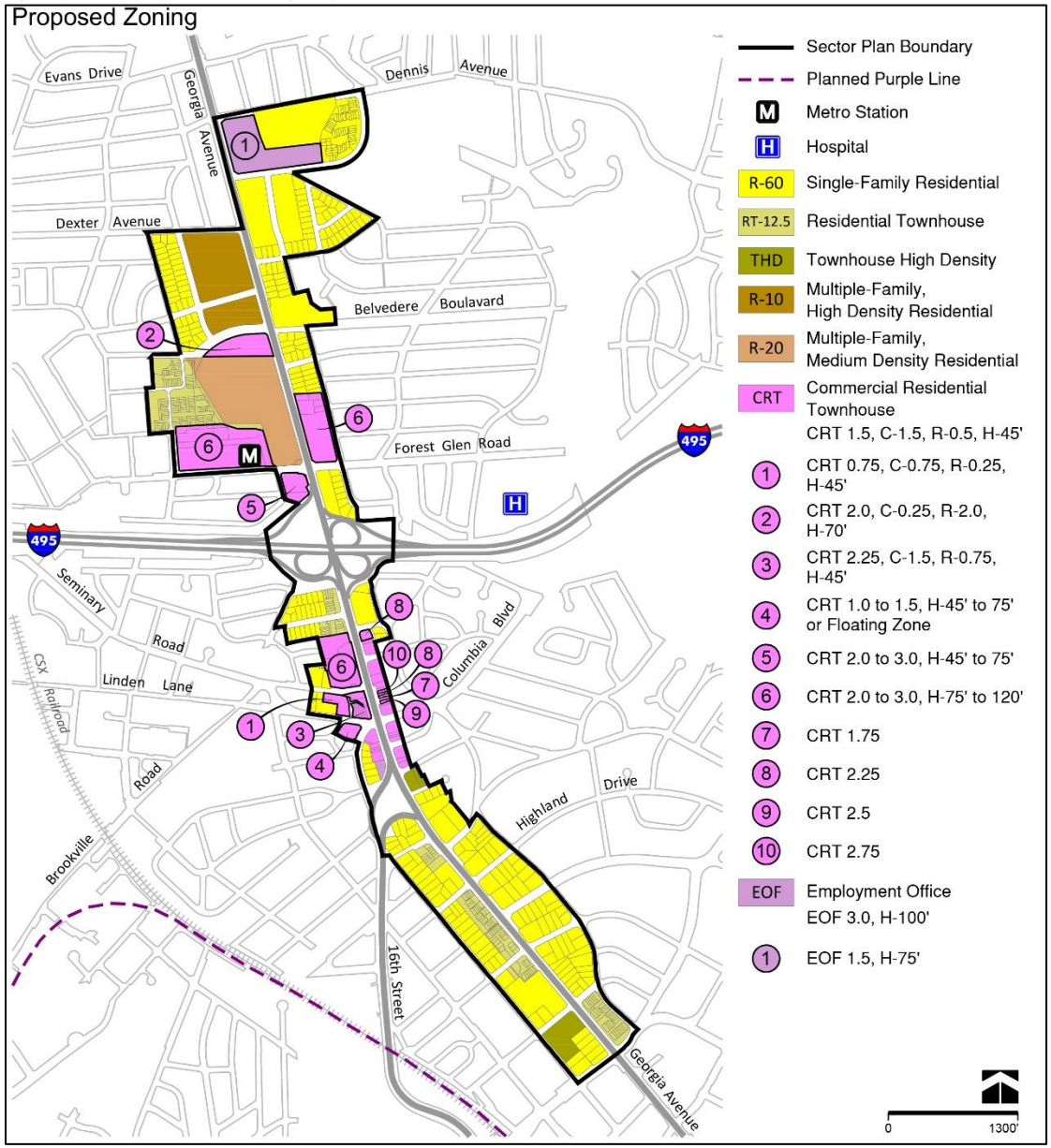


Figure 37: Recommended Zoning Map



The TAZ-level land use assumptions for these scenarios are shown in Table 12, Table 13 and Table 14, respectively. The major assumptions reflected in these scenarios are briefly described below.

"No Build": 2040 Adopted Master Plan Land Use and Transportation Network

- Includes existing development, pipeline development, some additional development in the master plan area based on existing zoning and adopted Greater Lyttonsville Sector Plan, Wheaton Master Plan, Bethesda Downtown Master Plan, and Westbard Sector Plan land use and transportation network recommendations.
- Includes the adopted Visualize 2045 Regional Long-Range Transportation Plan transportation network (reflecting five Montgomery County BRT lines – including mixed traffic operations on US 29).

2040 Build Out: Plan Vision

- Assumes the "No Build": 2040 Adopted Master Plan scenario land use and transportation network assumptions described above plus 100 percent (which represents a modest increase) of additional development in in the master plan area based on the Working Draft Plan land use recommendations.
- Assumes the opportunity sites achieve 100 percent of density permitted
- Assumes Georgia Avenue achieves the "boulevard concept" on Georgia Avenue established by the approved and adopted *2000 North and West Silver Spring Master Plan*, which is currently being studied by MDOT SHA as part of their MD 97 Montgomery Hills project. Key elements include removing the dynamic lane, four lanes southbound and three lanes northbound on Georgia Avenue between Forest Glen Road and 16th Street.
- Assumes BRT on Georgia Avenue and Veirs Mill Road per the 2013 CTC plan

2040 Build Out: Zoning Envelope

- Assumes the 2040 Build Out: Plan Vision land use and transportation network assumptions described above plus 100 percent of the sites located within either mixed-use or high-density residential zones achieve 100 of density permitted.
- The purpose of this is to test the highest possible density ("worst-case") scenario.

Table 15. Land Use Inputs for 2040 "No Build" (Adopted Master Plan) Scenario

TAZ	Residential				Employment				
	Household	Household Population	Group Quarters	Total	Industrial	Retail	Office	Other	Total
601	363	1,114	0	**1,114**	0	0	593	102	**747**
602	705	2,165	0	**2,165**	0	0	165	1,891	**2,056**
603	802	2,222	0	**2,222**	0	52	1133	39	**1,224**
627	301	923	0	**923**	0	0	0	105	**105**
628	448	1,376	0	**1,376**	688	31	68	296	**1,083**
629	1,036	2,537	0	**2,537**	0	0	0	18	**18**
3735	532	1,627	0	**1,627**	11	147	138	111	**407**
3736	363	1,114	0	**1,114**	11	216	0	16	**243**

Table 16. Land Use Inputs for 2040 Plan Vision Sector Plan Scenario

TAZ	Residential				Employment				
	Household	Household Population	Group Quarters	Total	Industrial	Retail	Office	Other	Total
601	363	1,114	0	**1,114**	0	83	3009	154	**3,246**
602	727	2,232	0	**2,232**	0	43	1,482	1,891	**3,415**
603	818	2,271	0	**2,271**	0	52	1133	39	**1,224**
627	441	1,276	0	**1,276**	0	0	0	125	**125**
628	458	1,397	0	**1,397**	688	31	68	296	**1,083**
629	2,130	4,812	0	**4,812**	0	57	0	18	**76**
3735	532	1,627	0	**1,627**	11	147	138	111	**407**
3736	735	1,892	0	**1,892**	11	452	0	0	**463**

Table 17. Land Use Inputs for 2040 Plan Vision Sector Plan Scenario

TAZ	Residential				Employment				
	Household	Household Population	Group Quarters	Total	Industrial	Retail	Office	Other	Total
601	363	1,114	0	**1,114**	0	83	3,009	154	**3,246**
602	727	2,232	0	**2,232**	0	43	1,482	1,891	**3,415**
603	840	2,317	0	**2,317**	0	122	1133	39	**1,293**
627	441	1,276	0	**1,276**	0	0	0	125	**125**
628	458	1,397	0	**1,397**	688	109	191	296	**1,284**
629	2,438	5,453	0	**5,453**	0	57	0	18	**76**
3735	700	1,977	0	**1,977**	11	824	0	0	**835**
3736	764	1,952	0	**1,952**	11	543	0	0	**554**

Background on Modeling Assumptions

Daily traffic forecasts were estimated utilizing procedures from the *NCHRP Report 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design. NCHRP Report 255* techniques were used to convert the Travel/4MP system-level forecasts to intersection-level forecasts. In support of the travel demand modeling analysis using Travel/4MP, the following key assumptions were incorporated in the context of the 2040 horizon year traffic analysis:

- Highway and transit improvements reflected in the adopted Visualize 2045 Regional Long-Range Transportation Plan (including the five planned BRT lines in Montgomery County)
- BRT related service attributes including run time, station dwelling time, signalized intersection delay, signal prioritization option, time of day (peak vs. off-peak) were derived from the latest available GIS layers of transit data
- Adopted Greater Lyttonsville Sector Plan, Wheaton Master Plan, Bethesda Downtown Master Plan, and Westbard Sector Plan

land use and transportation network
- Beyond the plan study area, regional growth reflecting the MWCOG Round 8.3 Cooperative Forecast

Future Conditions – Local Intersection Traffic Analysis

Consistent with other master plans, intersection performance within the plan area was also evaluated for the future. The intersection performance for the future was evaluated for a "no build" land use scenario reflecting existing zoning as well as a land use scenario reflecting the zoning recommendations proposed in the Working Draft of the Sector Plan. This scenario also did not modify any of the traffic operations at the signals. The future conditions land use assumptions that were analyzed included existing development, pipeline development and development anticipated based on the plan's land use and zoning recommendations.

In addition to the future conditions land use scenarios, the traffic analysis also assumed the plan's transportation recommendations that seek to increase safety, enhance connectivity and prioritize the safety of all road users consistent with Vision Zero – including some transportation recommendations that could reduce intersection performance. These recommendations include: (1) removing the dynamic lane on Georgia Avenue (2) a permanent street cross section of four travel lanes southbound and three northbound on Georgia Avenue between the Seminary Place and 16th Street[19]; (3) interior travel lanes were reduced to 10 feet and curb lanes to 11 feet which shortens crossing distances for pedestrians. Additionally, left turns were introduced during the peak hour, in the peak direction at the Georgia Avenue intersections at Forest Glen and Seminary Road. Adding these turning movements is intended to improve east-west access in the plan area, but it is important to recognize adding new protected turning movements will further decrease the capacity at the intersection.

Tables 18 and 19 summarizes the AM and PM peak hour average intersection delay results of the future conditions analysis for each study area intersection in the context of the two scenarios described above. With respect to the Forest Glen/Montgomery Hills Sector Plan scenario, the following two sets of results are reported in Tables 18 and 19 and are briefly described below:

- **2040 Forest Glen/Montgomery Hills Sector Plan – Standard Mitigation:** Estimated year 2040 intersection delay results with the most effective mitigation strategies available, which includes signal timing improvements, additional and repurposing of travel lanes. This exercise determined what it would take to achieve the current delay standard.
- **2040 Forest Glen/Montgomery Hills Sector Plan – Mitigated (increased standard to 120 seconds)**: Estimated year 2040 intersection delay results reflecting signal timing mitigation, scaled-back geometric changes (adding/repurposing travel lanes) with an assumed increase of delay standard to 120 seconds within the plan area. This exercise determined what would mitigation

[19] The modeled cross section of Georgia Avenue between Forest Glen Road and Seminary Place is four lanes in each direction.

would still be necessary is the delay standard were increased to 120 seconds.

Without mitigation, observation of these results indicates that unacceptable traffic congestion conditions are forecasted during the AM and/or PM peak hours of travel at the following study area intersections:

- Forest Glen Road at Georgia Avenue
- Inner Loop Ramp signal at Georgia Avenue
- Seminary Road at Georgia Avenue

With the standard mitigation applied, acceptable traffic congestion conditions can be achieved at seven out of the eight study area intersections. However, many of the mitigation strategies identified would require widening the roadway for new, additional lanes. Doing so would increase the pedestrian crossing distance and increase exposure to conflicts with motor vehicles. The notable exceptions are:

- Forest Glen Road at Georgia Avenue – Forecasted delay is estimated to approach the current 80 second delay standard, with an estimated delay of 79.6 seconds.

With the application of signal timing mitigation coupled with the policy assumption to increase the intersection delay standard to 120 seconds within the plan area, acceptable traffic congestion conditions can be achieved at seven out of the eight study area intersections. The notable exceptions are:

- Forest Glen Road at Georgia Avenue – Forecasted delay is estimated to approach the proposed 120 second delay standard, with an estimated delay of 98.5 seconds.

Table 20. HCM Delay Results- 2040 Scenarios

ID	E-W Road	N-S Road	Delay Standard (seconds)	2040 No Build		2040 Build Out: Plan Vision		2040 Build Out: Zoning Envelope		2040 Zoning Envelope **(Standard Mitigation)**		2040 Zoning Envelope **(Congestion standard increased to 120 secs in Plan Area)**	
				AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
3	Dennis Avenue	Georgia Avenue	*80*	55.7	41.9			58.2	41.9	N/A[1]		N/A[1]	
22	Forest Glen Road	Georgia Avenue	*80*	**91.5**	106	**102**	**105.6**	**99**	**106**	79.6	52.3	98.5	73.0
7	Beltway Outer Loop Ramp	Georgia Avenue	*80*	7.2	44.6	9.9	43.9	9.8	44.6	See Table 22 for interchange sensitivity tests[2]			
6	Beltway Inner Loop Ramp	Georgia Avenue	*80*	**80.6 F**	**116.4**	**105.9**	**116.9 F**	**109.3**	**116.4**				
26	Seminary Place	Georgia Avenue	*80*	31.2	50.6	47.7	51	48.3	50.6	40.9	19.4	40.9	19.4
27	Seminary Road	Georgia Avenue	*80*	**80.8**	74.5	**106.1**	74.7	**106.1**	74.5	79.3	42.1	79.3	42.1
1	16th Street	Georgia Avenue	*80*	22.3	35.1	21.6	35.5	21.6	35.1	22.6	48.5	22.6	48.5
12	Spring Street	Georgia Avenue	*120*	62	37.7	61.6	37.1	65.1	37.7	N/A[1]		N/A[3]	

[1] Mitigation was not identified for these intersections because the forecasted traffic volumes do not exceed the standard in any scenario, and they are located far enough away from intersections that require mitigation such that it would not be affected by geometric changes such as additional/repurposing of lanes.

[2] Two design alternatives were considered to improve safety and traffic flow at the Beltway Interchange. The results of this analysis are included in Tables 22.

[3] In this case the intersection delay standard is already 120 seconds.

Table 21. Ratio of HCM Delay Relative to Policy Area Congestion Standard: 2040 Scenarios

ID	E-W Road	N-S Road	Delay Standard (seconds)	2040 No Build		2040 Zoning Envelope		2040 Zoning Envelope **(Standard Mitigation)**		2040 Zoning Envelope **(Congestion standard increased to 120 secs in Plan Area)**	
				AM	PM	AM	PM	AM	PM	AM	PM
3	Dennis Avenue	Georgia Avenue	*80*	0.70	0.52	0.73	0.52	N/A[1]		N/A[1]	
22	Forest Glen Road	Georgia Avenue	*80*	**1.14**	**1.33**	**1.24**	**1.33**	**1.00**	0.65	**1.00**	52.30
7	Beltway Outer Loop Ramp	Georgia Avenue	*80*	0.09	0.56	0.12	0.56	See Table 22 for interchange sensitivity tests[2]			
6	Beltway Inner Loop Ramp	Georgia Avenue	*80*	**1.01**	**1.46**	**1.37**	**1.46**				
26	Seminary Place	Georgia Avenue	*80*	0.39	0.63	0.60	0.63	0.51	0.24	0.51	0.24
27	Seminary Road	Georgia Avenue	*80*	1.01	0.93	1.33	0.93	0.99	0.53	0.99	0.53
1	16th Street	Georgia Avenue	*80*	0.28	0.44	0.27	0.44	0.28	0.61	0.28	0.61
12	Spring Street	Georgia Avenue	120	0.52	0.31	0.54	0.31	N/A[1]		N/A[3]	

1 Mitigation was not identified for these intersections because the forecasted traffic volumes do not exceed the standard in any scenario, and they are located far enough away from intersections that require mitigation such that it would not be affected by geometric changes such as additional/repurposing of lanes.

[2] Two design alternatives were considered to improve safety and traffic flow at the Beltway Interchange. The results of this analysis are included in Table 22.

[3] In this case the intersection delay standard is already 120 seconds.

Figure 38 shows the 2040 No Build scenario HCM delay dot map for the eight study area intersections for both AM and PM peak periods. Comparing the 2040 No Build scenario relative to 2017 existing conditions, four intersections reflect the same colors on the dot map even though the HCM delay ratio at these locations showed a modest increase. The remaining four intersections are showing increasing traffic delays as reflected by changes in dot map colors based on congestion thresholds in both AM and PM peak hours are described below.

- Forest Glen Road at Georgia Avenue (Intersection 22): orange to red in the AM peak hour and PM peak hour
- Inner Loop Ramp signal at Georgia Avenue (Intersection 6): orange to red in the AM peak hour
- Seminary Place at Georgia Avenue (Intersection 26): yellow to orange in the AM peak hour
- Seminary Road at Georgia Avenue (Intersection 27): orange to red in the AM peak hour

As shown as Figure 14, the results of the 2040 Forest Glen/Montgomery Hills Sector Plan Build Out scenarios are generally comparable to those described above for the 2040 No Build scenario.

In general, transportation system performance analysis results of these future scenarios showed that 2040 traffic conditions for roadways within the master plan and plan study area are forecasted to be generally similar or marginally worse relative to existing conditions. Three intersections show a HCM delay ratio greater than 0.8, indicating traffic conditions approaching or exceeding the relevant policy area congestion standard in AM and/or PM peak hour.

Figure 38: 2040 No Build Scenario

	Delay/STD Range	
	0.00	0.25
	0.25	0.69
	0.69	1.00
	1.00	1.00+

22. Forest Glen Road at Georgia Avenue
6. Inner Loop Ramp signal at Georgia Avenue
26. Seminary Road at Georgia Avenue

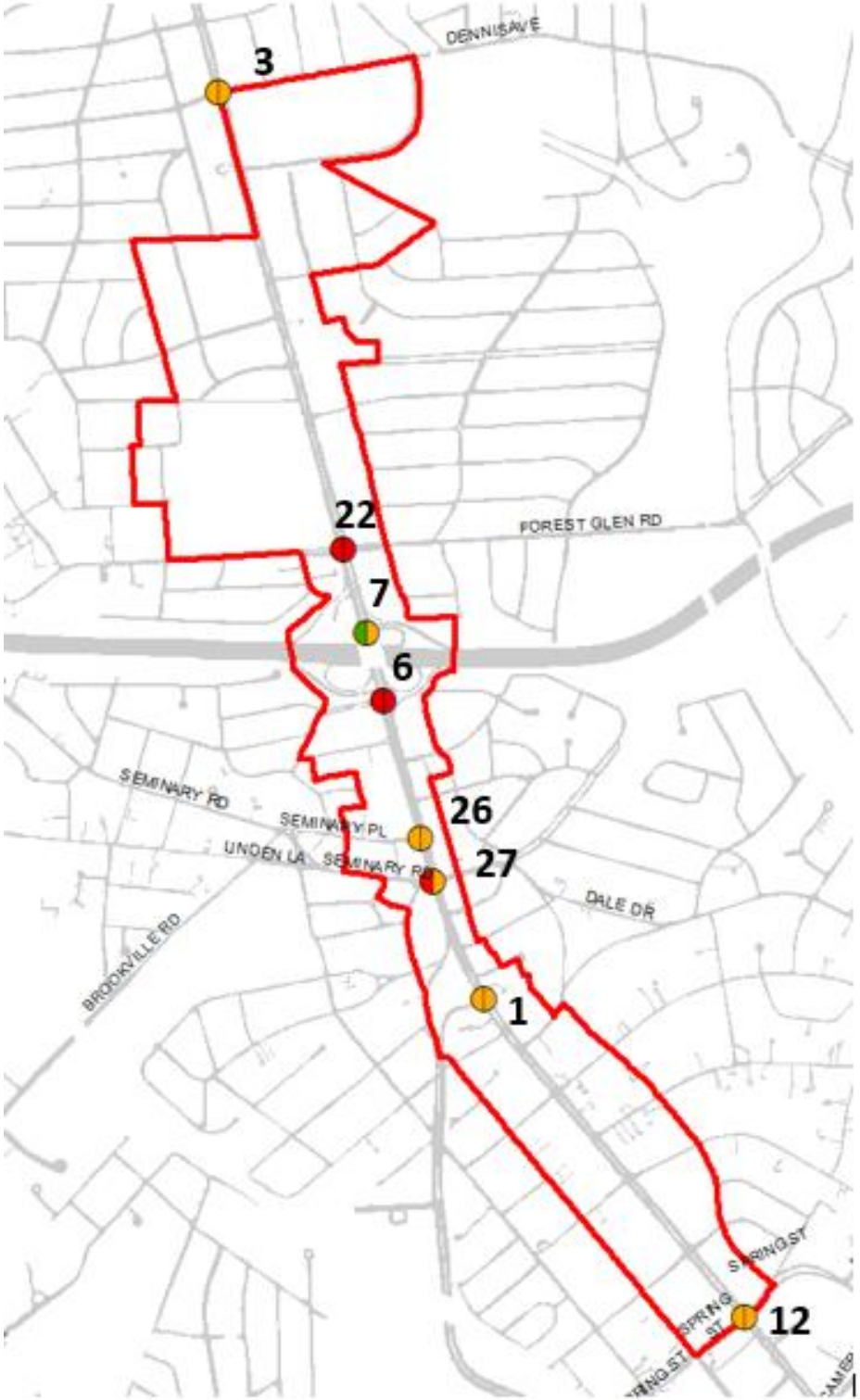
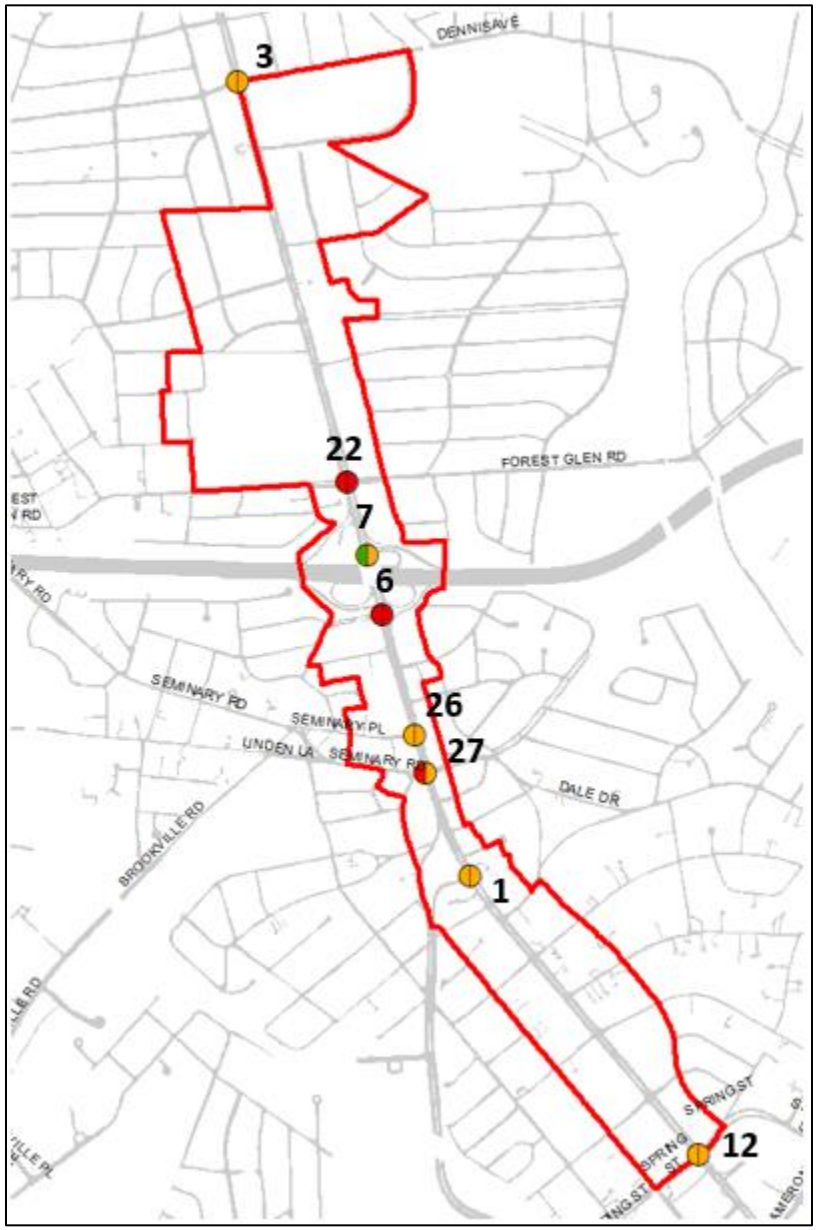


Figure 39: Plan Vision

Figure 40: Traffic Congestion Scenario - 2040 Build Out: Zoning Envelope

	Delay/STD Range	
	0.00	0.25
	0.25	0.69
	0.69	1.00
	1.00	1.00+

22. Forest Glen Road at Georgia Avenue
6. Inner Loop Ramp signal at Georgia Avenue
26. Seminary Road at Georgia Avenue



Conceptual Intersection Mitigation

Based on forescasted traffic volumes for the horizon year of the sector plan (2040), multiple intersections within the sector plan area are expected to exceed their capacity. Althought the recommended zoning is estimated to generate a moderate number of net new trips in the sector plan area, staff thought it was important to identify what it would take to increase capacity at the intersections to meet the the delay standard as set forth in the *2016 Subdivision Staging Policy (SSP).* Staff commissioned the help of Sabra and Associates to test two approaches to the migitation analysis. The first scenario anlyzed the forecasted traffic volumes and suggest potential mitigation strategies to meet the current SSP standard.

Second, recognizing that any strategies that would change the geometry or total width of the roadway would be in direct conflict with the goals and intentions of both the countywide Vision Zero initiative, and the primary transportation goal of the sector Plan, staff requested a follow-up task to identify what mitigation would be necessary if the delay standard were increased.

Figure 41 shows the migitation that would be necessary under each mitigation scenario. In the figure, each arrow represents a lane at the intersection with Georgia Avenueidentified by the row heading. The No-Build column reflects the lane configuration that exists currently. The Existing Standard scenario is shown in the second column and the Proposed Standard, which recommends increasing the delay standard from 80 seconds to 120, is shown in the third column. The orange arrows indicate that a current lane is intenteded to be repurposed and a red line represents a new lane that will require widening roadway.

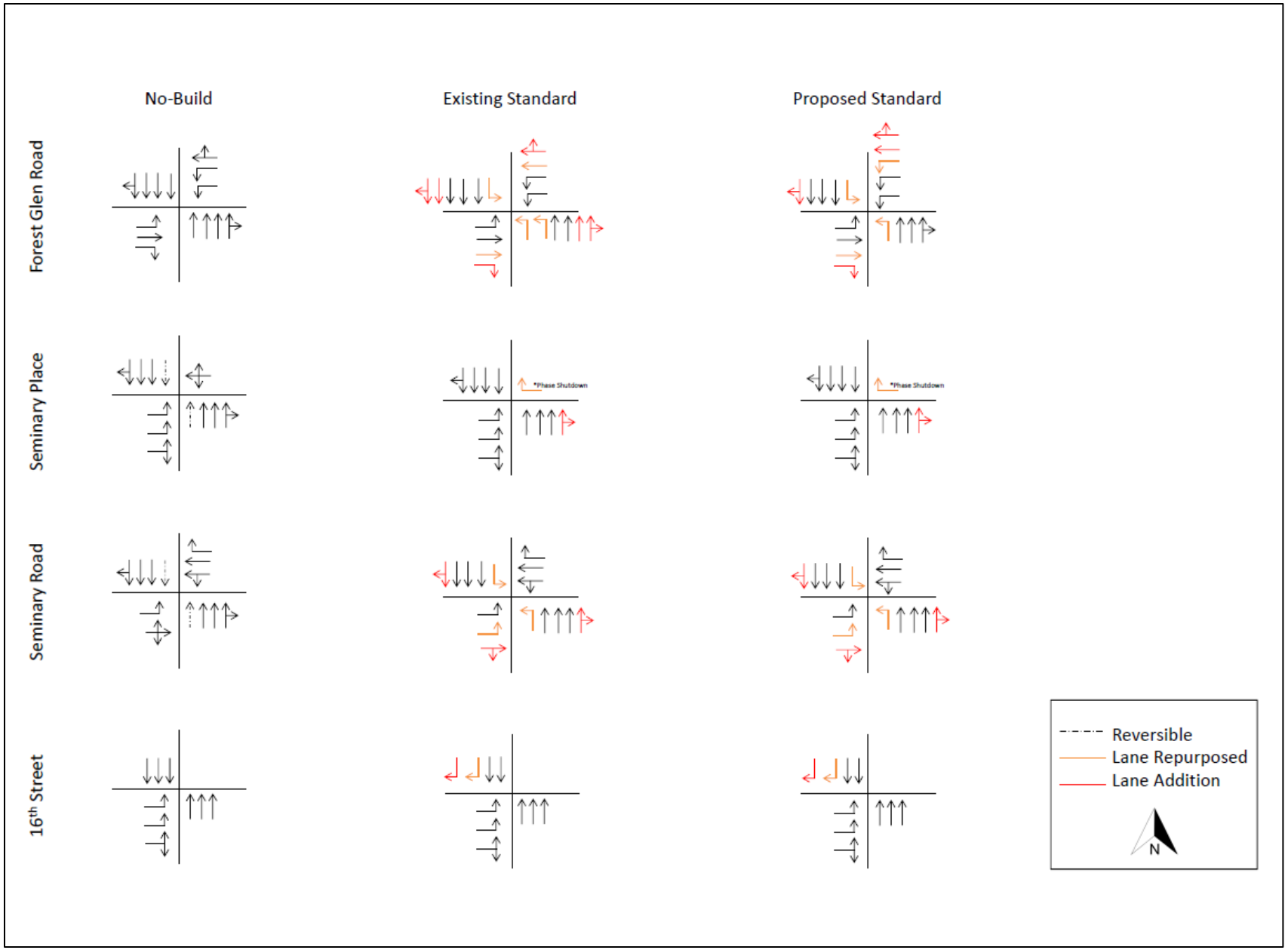


Figure 41: Mitigation exercise

Summary of Findings from the Two Scenarios

- Based on the traffic modeling exercise conducted for the sector plan, potential mitigation strategies are recommended to improve the capacity of the intersections. The resulting list of recommended changes are reflective of the Vision Zero approach and, therefore, do not include every tool available, specifically widening the roadway or adding additional left turn lanes where high pedestrian volumes are expected.
- The Intersection of Forest Glen Road and Georgia Avenue is driving both scenarios.
    - In scenario 1, an additional lane is needed in both directions on Georgia Avenue and on Forest Glen Road.
    - In scenario 2, additional lanes are needed southbound on Georgia Avenue, and both direction of Forest Glen Road.
- For the remaining intersections, the identified mitigation strategies are the same between the two scenarios.
- While the two scenarios result in capacity increases that meet both the existing and proposed standards, widening roadways widths increases exposure to conflict between pedestrians and motor vehicles.

Furthermore, the following recommendations are contingent on the implementation of either Alternative 1 or Alternative 2 of the Beltway Interchange recommendations. These recommended mitigation strategies are intended to inform future studies of these intersections after the Beltway interchange is improved or another significant change is made to the transportation network within the corridor. Staff reviewed the mitigation scenarios and made the following determinations for the Working Draft recommendations:

- Forest Glen Road and Georgia Avenue
    - The mitigation analysis recommends widening the road and other changes to the lane configuration. These strategies should only be only considered following implementation of the Forest Glen Passageway, which would provide a safe, grade-separated crossing that would not be impacted by the mitigation treatments. The specific recommended treatments include the following:
        - Repurpose the inmost through lane to a left-turn only lane in the northbound direction.
        - Repurpose the inmost through lane to a left-turn only lane in the southbound direction. Add an additional through-right lane.
        - Widen the roadway in the eastbound direction to make room for an additional through lane and a new right turn only lane.
        - Create a new left turn only lane in the westbound direction by repurposing an existing through lane. Add an additional through lane and an additional through-right lane.
        - Add bike boxes on the Forest Glen Road approaches
        - Reduce curb radii on all four corners to reduce vehicle turning speed and improve pedestrian safety.
        - Consider and study the impact of “dropping” or blocking far right lane after southbound I-495 on-ramp to improve lane utilization.
- Seminary Place and Georgia Avenue

- Staff reviewed the proposed mitigation and generally supports the proposed mitigation. Because the intersection does not appear to be approaching the capacity standard in any of the 2040 scenarios, staff determined that widening the roadway is not needed. This proposal was likely included based on the analysis of Seminary Road and Georgia Avenue, located directly south of this intersection. Therefore, the recommendations for the Working Draft include the following:
    - Restrict southbound left turns from shopping center driveway (use rear alleys for circulation). Make the driveway right out only.
    - Add a leading pedestrian interval to give pedestrians a head start crossing Georgia Avenue and Seminary Place and increase their visibility to motorists turning.

- Seminary Road and Georgia Avenue
    - According to the analysis, mitigation is clearly needed to meet the current standard; however, staff determined widening the road would increase potential conflicts between pedestrians and motorists. This intersection is at the heart of the commercial center of Montgomery Hills and with retail, bus stops and other pedestrian generators on both sides, and comparatively higher traffic volumes on all approaches of the intersection. Therefore, reducing pedestrian safety was not an acceptable trade-off to increasing motor-vehicle capacity at the intersection. Furthermore, increasing the delay standard to 120 seconds would not require mitigation based on traffic volume forecasts in the 2040 scenarios. Therefore, the following recommendations were included in the Working Draft:
        - Reduce curb radii to reduce turning speed an increase pedestrian safety.
        - Carve out left turn pockets from the median to be installed as part of the Maryland SHA Georgia Avenue MD 97 Montgomery Hills project.
        - Restore left turns in the peak hour.
- 16th Street and Georgia Avenue
    - Two additional right turn lanes are shown in Figure 41 on Georgia Avenue in the southbound direction. This proposal comes from the recommended closure of the 16th Street southbound slip lane that is carried forward by the *2000 North and West Silver Spring Master Plan* and is expected to be included in the MDOT SHA MD 97 Montgomery Hills project. While this will require widening the road, this will only affect the northern pedestrian crossing, which is currently unmarked. Today, the marked crossings are on the west and south legs[20]. Staff recognizes the need for providing two right- turn lanes for southbound Georgia Avenue (as that duplicates the lane configuration on the southbound slip lane, which is to be eliminated) and supports the proposal as the width of the southern leg will not be changed.
        - Relocate or abandon 16th Street south slip lane and replace with a bicycle and pedestrian connection. Reroute 16th southbound to 16th Street northbound intersection.
        - Widen the west side of Georgia Avenue to allow for a new additional right turn lane from the southbound direction.

[20] The eastern leg is a grade-separated sidewalk as this is a T-intersection.

- Related to the traffic analysis, but not specifically studied in these scenarios, staff recommends a study of the impact of adding a second right turn lane at the I-495 outer loop off-ramp in the northbound direction.

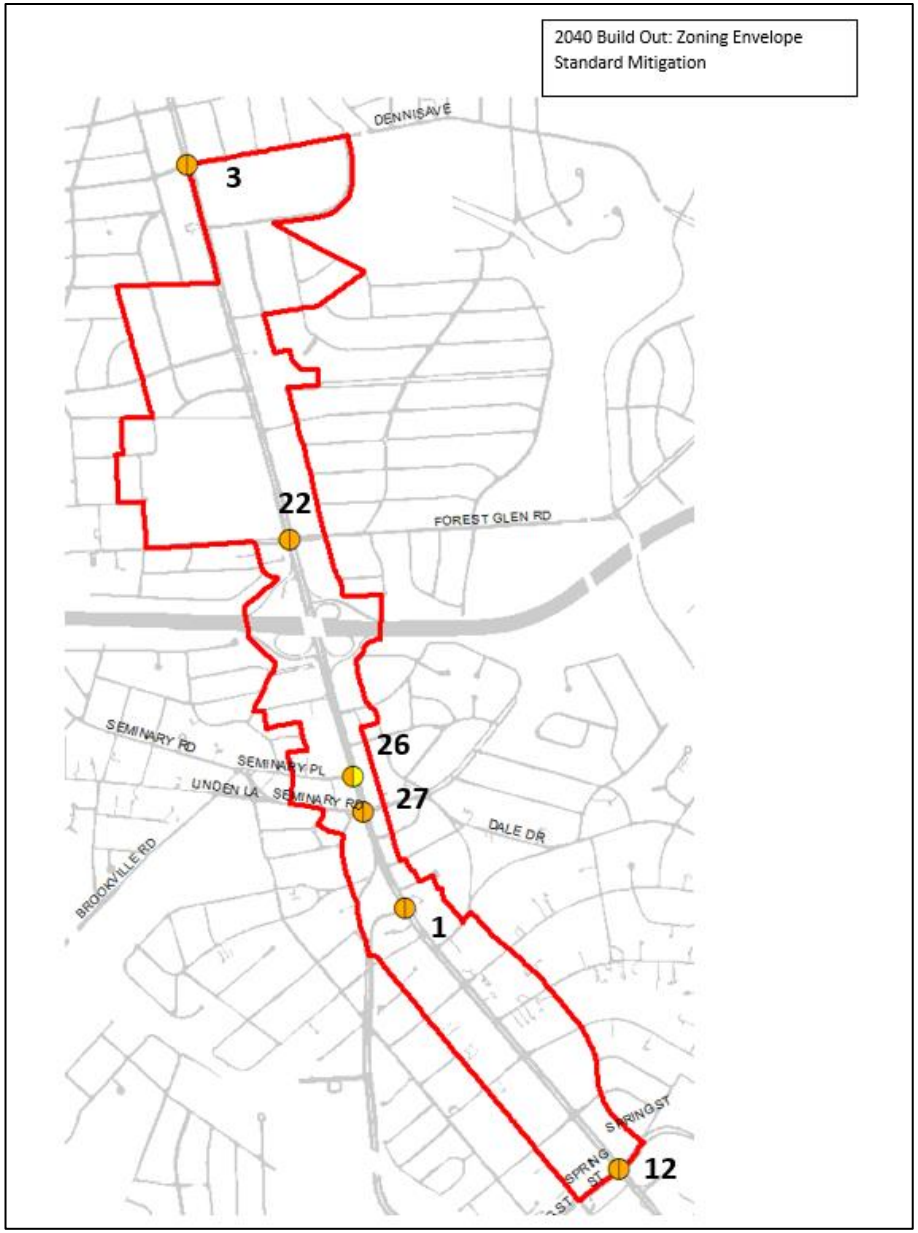


Figure 42: Traffic Congestion Scenario - 2040 Build Out: Zoning Envelope Standard Mitigation

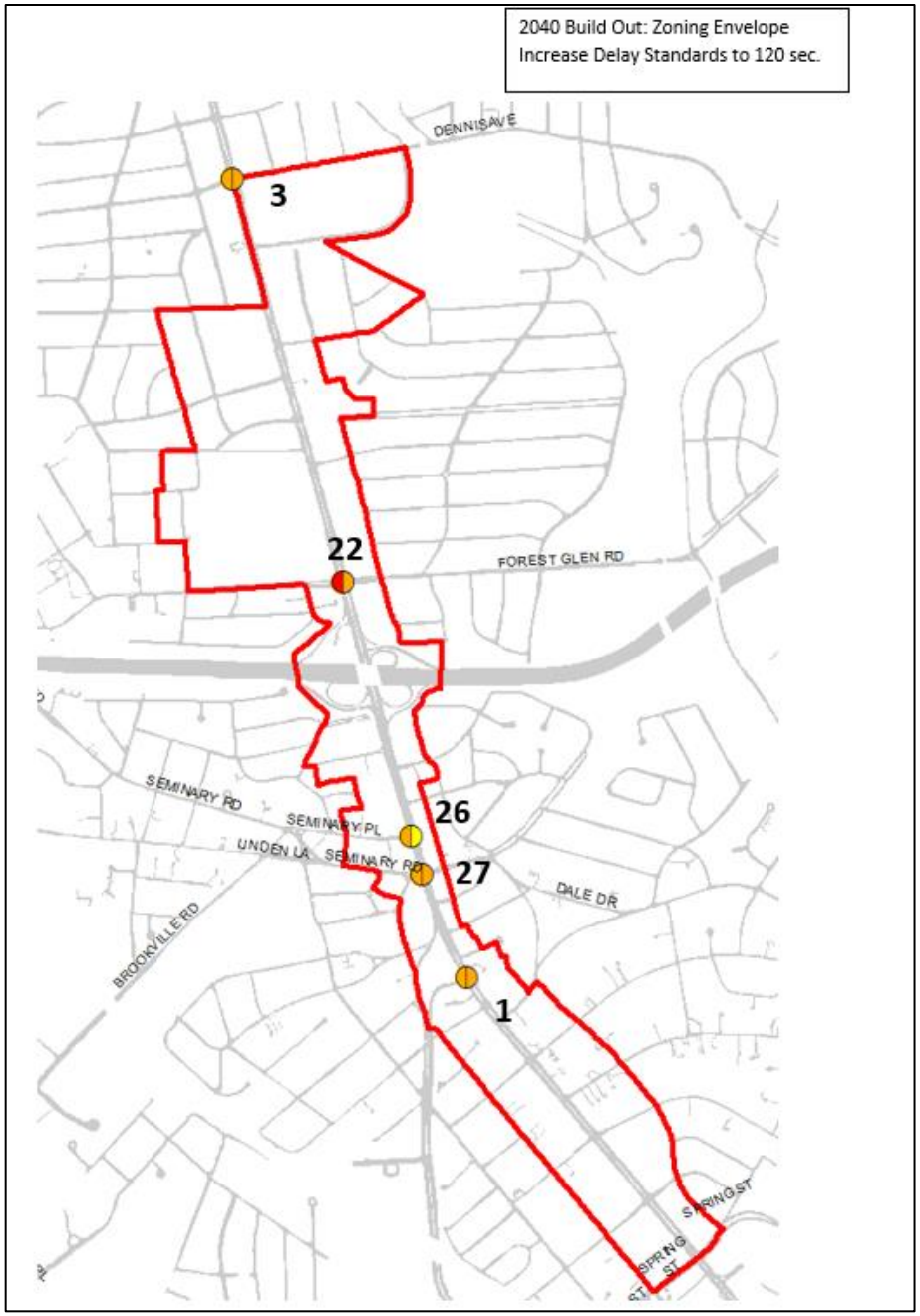


Figure 43: Traffic Congestion Scenario - 2040 Build Out: Zoning Envelope Increase Delay Standard to 120 seconds

Beltway Interchange Design Alternatives Sensitivity Tests

The design of the Beltway Interchange as it exists today presents a significant safety concern. The inner loop off-ramp of the of the Beltway (eastbound) that transitions to northbound Georgia Avenue merges directly into the rightmost northbound lane on Georgia Avenue. See Figure X below for an illustration of this conflict. This merging maneuver is especially concerning as it approaches Georgia Avenue as it transitions below the Beltway which is where visibility is decreased.

Additionally, after observing traffic patterns on Georgia Avenue and analyzing traffic volumes and turning movements, staff determined the design of the Beltway Interchange has a significant impact on how Georgia Avenue operates immediate south and north of the Beltway.

For these reasons, two design alternatives were considered for the Beltway interchange with Georgia Avenue; a short-term alternative that removes the outer loop off-ramp and a long-term alternative that replaces the entire clover leaf interchange with a diverging diamond. The intersections that would be most affected by these design alternatives are the Beltway off-ramp signals; the outer loop signal and the inner-lop signal. Sensitivity tests for these two alternatives were applied to the model and the results, organized by turning movement, are included in Table 22.

Table 22: Sensitivity Test Results of Two Beltway Interchange Design Alternatives

		Average Vehicle Delay in Seconds					
Intersection	Movement	2040 No Build		Alt 1: 2040 Loop Ramp Removal		Alt 2: 2040 DDI	
		AM	PM	AM	PM	AM	PM
Outer Loop Signal	Overall	9.8	44.6	7.0	47.4	156.3	97.6
	WBL	76.7	51.9	76.7	51.9	31.4	22.2
	WBR	78.8	344.1	78.8	344.1	26.1	206.4
	NBT	0.5	5.2	5.2	12.5	-	-
	NBR	17.5	2.7	3.5	0.3	-	-
	NBL	-	-	-	-	129.6	132.7
	NBTL	-	-	-	-	45.0	97.6
	SBT	2.4	7.8	1.3	9.4	-	-
	SBR	-	-	-	-	271.6	41.8
	SBTR	-	-	-	-	199.6	81.0
Inner Loop Signal	Overall	109.3	116.4	86.1	67.5	59.2	70.1
	EBL	-	-	-	-	33.8	49.5
	EBR	>300	56.2	213.7	102.1	139.6	21.3
	WBR	0.2	0.3	-	-	-	-
	NBTR	65.0	206.4	59.3	89.2	-	-
	NBT					46.8	61.8
	NBR					1.4	1.7
	SBT	44.3	19.2	44.8	28.9	61.3	160.2
	SBR	1.6	1.2	1.6	1.2	-	-
	SBL					0.1	0.5

It is important to note that implementation of either of these design alternatives would likely improve lane utilization on Georgia Avenue throughout the plan area compared to current traffic distribution patterns but given their distance from the Beltway the transportation engineers took a conservative approach and tested the impact on only the signals closest to the interchange. Once the Beltway Interchange is augmented, traffic study of the intersections in the sector plan area should be conducted to determine if mitigation is needed and if it can be achieved without decreasing the safety of pedestrians, bicyclists, and transit users.

Summary of findings from Table 22:

- One intersection already exceeds capacity today in the evening peak hour (Georgia Avenue and the Inner Loop Beltway Ramp).

- The Inner Loop Beltway Ramp signal and two others are expected to exceed the 80 second delay standard regardless of what this plan recommends; Forest Glen Road and Seminary Road/Columbia Boulevard.
- The differences between the 2040 No Build scenario and the 2040 Build Out and Zoning Envelope scenarios are generally minor.
- The Outer loop signal benefits overall more with the loop ramp removal design alternative and the inner loop signal benefits overall more with the DDI.

Staff notes that average vehicle delay does not tell the whole story, and therefore additional metrics should be applied to further study these alternatives. Metrics to consider include vehicle throughput, queue length and network (rather than intersection) delay.

TRAFFIC IMPLICATIONS OF VISION ZERO RELATED RECOMMENDATIONS

As described elsewhere in this document, Georgia Avenue in Montgomery Hills, is the heart of the sector plan area and carries traffic volumes upwards of 75,000 cars daily. For comparison, other major highways in the County such as Rockville Pike (MD 355) have observed traffic volumes between 55-57,000 vehicles per day near its interchange with the Beltway[21]. Due to the lack of street grid within the Forest Glen. Montgomery Hills and Woodside Park plan districts, both local and regional traffic is dependent on Georgia Avenue to get to major city centers such as Wheaton, Silver Spring and the District. Few of the intersections along the corridor have any traffic control, which is likely because traffic flow along Georgia Avenue has been prioritized over crossing movements to and from the intersecting side streets. This makes crossing Georgia Avenue challenging and potentially for any travel mode.

Improving the safety of all road users is consistent with Vision Zero, an international strategy to eliminate traffic related fatalities and severe injuries, which was adopted by the County Council in 2016. The adoption of Vision Zero, just prior to the approval of the 2016 SSP, represents a significant change in County policy, as Vision Zero prioritizes the safety of all road users rather than focusing on vehicular mobility. As one of the first master plans to commence following the adoption of Vision Zero, the Forest Glen/Montgomery Hills Sector Plan seeks to prioritize safety and asserts that increased vehicular delay is acceptable, particularly coupled with the availability of transit, as well as the pedestrian and bicycle recommendations for the plan area.

Achieving increased safety for all road users requires reducing speeds and eliminating conflicts. For example, the removal of the dynamic lane on Georgia Avenue makes it possible to provide pedestrian crossing safety improvements such as median refuges. Replacing the dynamic lane with a raised median also reduces conflicts between motorists as it eliminates all uncontrolled crossings between 16th Street and Forest Glen Road.

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[21] ArcGIS Web Application. (2019). Maryland.maps.arcgis.com. Retrieved 27 February 2019, from http://maryland.maps.arcgis.com/apps/webappviewer/index.html?id=223148a698214294a7b43ed612a4e67d

In previous master plans, transportation adequacy provides a higher tolerance for traffic congestion in areas with greater activity and transit service opportunities. In the context of the Forest Glen/Montgomery Hills Sector Plan, the adoption of Vision Zero inevitably requires a higher tolerance for traffic congestion to achieve increased safety for all road users and to eliminate traffic related fatalities and severe injuries in line with the County's Vision Zero policy.

As mentioned above, the higher tolerance for traffic congestion can be achieved through the proposed introduction of a new traffic congestion standard for signalized intersections on multimodal transit corridors, such as Georgia Avenue. Such a standard would increase the delay standard along Georgia Avenue, which connects two Central Business Districts, to 120 seconds. As a high- ridership bus corridor and a recommended bus rapid transit corridor, a higher tolerance for traffic congestion should be considered. While the transit services opportunities are not commensurate with those of Metro Station Policy Areas, the transit service opportunities along multimodal transit corridors are robust and the delay standard should reflect the existing and planned services.

The approach of adjusting the traffic congestion standard for multimodal corridors was most recently tested by the Veirs Mill Corridor Master Plan which, similar to this Sector Plan, was focused primarily on improving safety and comfort for pedestrians, bicyclists and transit users along a highly-traveled corridor. The Planning Board determined higher levels of congestion would be tolerated along corridors that both experience high levels of multimodal travel and connect to urban, high-activity areas. As of writing this document, the Council has not completed its review of the Planning Board Draft of the Veirs Mill Corridor Master Plan.

Traffic Evaluation Analysis Context

A major goal of the master plan is to improve safety for pedestrians, cyclists and transit users within the Georgia Avenue corridor in accordance with the county's Vision Zero policy to reduce traffic-related fatalities and severe injuries. The plan also seeks to achieve a balance between land use density and transportation infrastructure by maintaining adequate transportation capacity in accordance with 2016 Subdivision Staging Policy (SSP). There is an inevitable tension between these goals that limits consideration of strategies designed to mitigate inadequate traffic conditions. These mitigation strategies are described below and conceptually depicted in Figure 44.

- **Geometric Improvements:** The addition of intersection geometric improvements (i.e., turn lanes and through lanes) conflict with the major plan to facilitate pedestrian and bike travel and improve safety for all travelers.
- **Mode Share Goals:** The consideration of mode share goals as a traffic mitigation strategy along the Georgia Avenue travel corridor (rather than in a specific policy area or subarea) is problematic given the high proportion of through traffic over which the plan has little control, coupled with relatively limited non-auto travel options in the corridor area.

- **Traffic Redistribution/Balancing:** Traffic in the corridor is primarily served by a single major roadway, Georgia Avenue. There is limited opportunity to assign alternative traffic routes or add new roadway connections to disperse traffic.

- **Traffic Operations/Management:** The implementation of signal timing/phasing improvements, shared lane traffic movements, and turn restrictions may be considered – as appropriate.

Figure 44: Mitigation Strategy Menu

Synchro and Highway Capacity Manual methodologies are limited in their ability to quantify changes in capacity and/or intersection delay for many of the types of traffic calming, streetscape, and pedestrian-activated traffic calming improvements proposed in a "Vision Zero" context. Examples of these types of improvements are described below.

Midblock Pedestrian Hybrid Beacons/HAWK: These signals are only operational part time when activated on demand. The ability to coordinate these crossing maneuvers with adjacent signals limits the increases vehicular traffic delays. Furthermore, pedestrian activation makes these crossings "non-standard" in terms of signal timing plans and HCM reporting.

Pedestrian Median Refuges, Curb Extensions, and Right-Turn Channelization: In terms of vehicular traffic, reduction in curb radii and

removal of channelization do not impact lane utilization and thus intersection capacity or delay.

Traffic Signal Upgrades/Minor Phasing Adjustments: High-visibility crosswalk markings, pedestrian countdown signal indicators, and Leading Pedestrian Intervals (typically 3-4 seconds) have limited effects on intersection vehicle capacity as they generally impact vehicle clearance time or start-up delays.

Challenges with Exclusive Reliance on Level of Service (LOS)

Ideally, every master plan should have a balance between its proposed land use and its proposed transportation network and services. For more than two decades this "balance" has been defined as what is needed to meet the current adequate public facilities (APF) requirements as described in the Subdivision Staging Policy (SSP). Achieving this balance in a master plan is not an academic exercise: if a plan is not balanced, then at some point in the future a proposed master-planned development will be unable to proceed because it will have no means to meet the APF requirements.

In the past quarter century there have been only two master plans adopted which did not achieve this balance. The Potomac Sub- Region Plan (most recently revised in 2002) stipulates that its two-lane roads would not be widened, except at intersections; the community is willing to accept congestion to retain its pastoral ambiance. The Council has rationalized this by recognizing that relatively little through-traffic flows on these roads, and so the future congestion would not significantly affect County residents living outside the sub-region.

The other plan is the Chevy Chase Lake Sector Plan (2013), which forecasts that three intersections will fail Local Area Transportation Review (LATR) at buildout. However, the failure will be at the margin, mainly because the Council included in the plan certain intersection improvements that would bring the sector plan area much closer to passing LATR at buildout.

While not an adopted plan, the Veirs Mill Corridor Master Plan is also challenging the priority on traffic flow over transportation safety. As of writing this document, the Planning Board has recommended increasing the delay standard along the corridor, recognizing that many of the capacity improvements that exist today and would be recommended to increase capacity are in direct conflict with Vision Zero principles. The final approved and adopted draft could set a percent for how long-range plans address traffic safety and capacity deficiencies.

According to the adopted 2016-2020 SSP, the congestion standard for signalized intersections in county policy areas is based on volume/capacity ratio (using the Highway Capacity Manual method), which translates to an average vehicle delay measured in seconds/vehicle (s/v) and equivalent level of service (LOS) for automobile travel.

To determine whether or not a master plan is in balance, the Council has applied the current SSP transportation test in the context of a long-term time planning horizon. This test consists of a Local Area Transportation Review (LATR) analysis reflecting a master plan

buildout time horizon that evaluates the traffic generated by the buildout of planned development on a network that assumes certain intersection improvements.

The concept of LOS has been used by traffic and transportation engineers for over 50 years to describe operating conditions for automobile travel on existing or planned roads. LOS is most commonly measured using average vehicle delay at an intersection. It is expressed as a letter grade, ranging from LOS A to LOS F, where LOS A represents completely free-flow conditions, LOS E represents capacity conditions, and LOS F represents over-capacity conditions with considerable delay (Table 23).

This report-card grading is based on a driver's perspective and the notion that delay is to be minimized. The grading ignores intersection performance from the perspective of other users such as people who walk, people who bicycle and people that take transit. Further, LOS grades below LOS E also represent a low level of utilization, which normally would constitute a poor rating for public infrastructure. Many cities have adopted policies to maintain LOS D or better conditions during peak hours, based on guidance from A Policy on Geometric Design of Highways and Streets (American Association of State Highway and Transportation Officials 2011) and other sources.

Table 23: Equivalency Between LOS and Average Vehicle Delay

HCM LOS Threshold/ Boundary	Corresponding Average Vehicle Delay per HCM (seconds)	Description
A / B	10	Operations with very slight delay, with no approach phase fully utilized.
B / C	20	Operations with slight delay, with occasional full utilization of approach phase.
C / D	35	Operations with moderate delay. Individual cycle failures begin to appear.
D / E	55	Operations with heavier, but frequently tolerable delay. Many vehicles stop, and individual cycle failures are noticeable.
E / F	80	Operations with very high delays and congestion volumes vary widely depending on downstream queue conditions.
n/a	120	Operations with extremely high delays and congestion volumes vary widely depending on downstream queue conditions.

LOS can be a very useful and effective metric for designing infrastructure and understanding the consequences to automobile traffic of planning and design decisions. However, that is generally the extent of its utility. It does not help to inform us about a number of other factors that are important such as the availability of and access to other modes of travel and potential impacts to safety for all road users resulting from increased vehicular speeds and infrastructure design that prioritizes motor vehicle travel. The Forest Glen/Montgomery Hills Sector Plan seeks to provide safe and efficient travel for all transportation modes and the LOS metric does not consider operations or conditions for other modes of transportation, including walking, bicycling and transit use.