BETHESDA TRANSPORTATION PLANNING

UNIFIED MOBILITY PROGRAM

Cost Estimating Analysis

March 29, 2021

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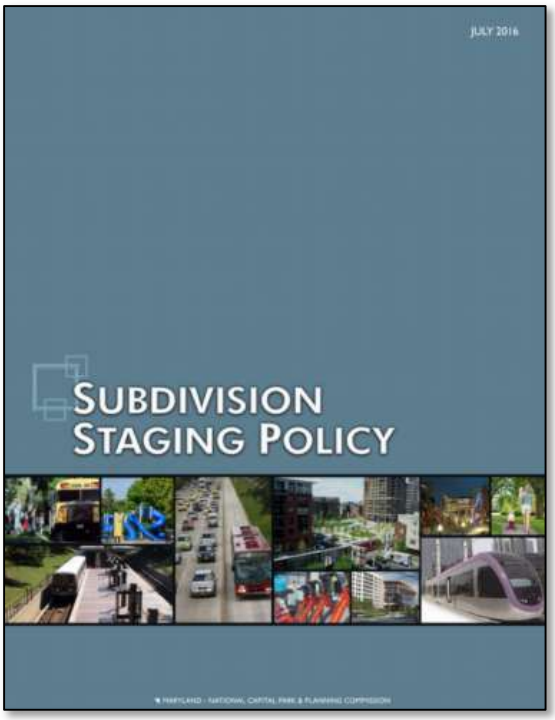
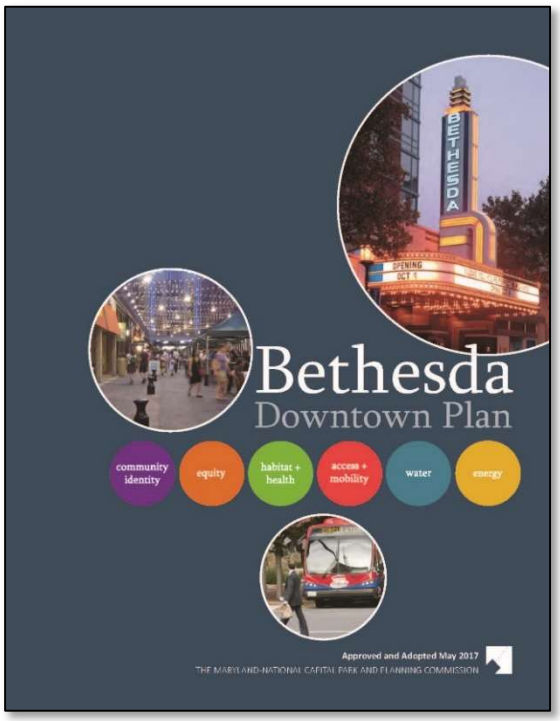
1 Introduction

The Montgomery County Department of Transportation (MCDOT) directed Gannett Fleming, Inc. and AECOM to conduct engineering and transportation planning analysis consistent with the Unified Mobility Program for Bethesda as defined in the 2016 Subdivision Staging Policy[1] (SSP). The Unified Mobility Program includes the capital improvements needed to address intersection capacity, completion of the pedestrian and bicycle network, and transit capital improvements needed to meet the transportation needs of the May 2017 Bethesda Downtown Plan[2].





There are two principal elements to the program:

1) Confirm the concepts and develop construction cost estimates for intersection improvements, bikeway implementation, sidewalk and crosswalk improvements within the Bethesda Downtown.

2) Define the capital needs to allow Bethesda to achieve a 55 percent NADMS (non-auto drive mode share) for both residential and commercial properties. This includes transit service concepts, fixed facilities like Park & Ride lots, and transit fleet requirements. The program also needs to identify and develop a rough order-of-magnitude estimate for the operational requirements and Transportation Demand Management program requirements.

[1] http://montgomeryplanning.org/document-viewer/#http://www.montgomeryplanning.org/research/subdivision_staging_policy/documents/SSPRecSummary.pdf
[2] http://montgomeryplanning.org/planning/communities/area-1/bethesda-downtown-plan/

The ultimate goal of the program is to generate cost estimates that can be used to estimate a per-trip fee for proposed developments in the master plan area. This fee, developed by and for the Unified Mobility Program (UMP), would be applied for every new person-trip a development generates. The applicant would pay the associated fee, satisfying the UMP requirements.

This document describes the analysis used to identify transportation needs and estimate associated costs, identifies the determined fee, and then provides information on how the UMP is to be implemented.

2 Purpose of the UMP Fee

The UMP allows for a unified analysis that can identify all proposed transportation improvements anticipated across the policy area as it grows and develops. Consequently, the UMP fee for these improvements can be assessed equitably to all developers regardless of the timing or size of the development. Implementation of the proposed improvements are, by default, at the behest of public agencies, rather than by developers, coordinated by Council-appropriated funds and each project managed by either County or State transportation agencies.

The UMP fee can also reduce the number of traffic analyses which must be performed. This relieves developers of the need to perform intensive studies and public officials of the resources spent reviewing them, which can often involve many months of comments and revisions. This comprehensive analysis is a significant undertaking, but this approach can provide a fiscal and time savings to all parties. The "pay and go" approach significantly reduces risk to new development by providing a clear one-time payment for an applicant, serving to streamline the development review process.

In addition, this comprehensive analysis offers the potential for greater public awareness of what mitigating treatments are proposed as the policy area develops.

3 Scoping

The scoping process occurred in summer 2018 and was based on the Bethesda Downtown Plan and input from MCDOT, which is detailed in the sections below.

3.1 Assessment of Current Transit Ridership

The Bethesda Downtown Plan identified allowable development densities in downtown Bethesda that are substantially greater than the densities currently in place. Reaching these full allowable densities, however, is contingent on achieving a non-auto mode share for trips destined for the heart of Bethesda of 55 percent. The current non-auto mode share is approximately 37 percent.

The technical approach used to identify potential transit improvements to increase non-auto mode share began with the identification of portions of the Washington region that generate a large number of trips destined for downtown Bethesda. This analysis utilized the MWCOG 2040 trip table and includes all trip purposes. The first element of this analysis was to identify concentrations of trips to Bethesda that are large enough to support completely new transit improvements (consisting of both service and capital

improvements). The highest concentrations of trip origins identified through this first analysis are located predominantly in Montgomery County but also in Howard County and the District of Columbia. These concentrations are displayed in **Figure 3-1** and listed below:

- Columbia, Howard County / U.S. 29 Corridor;
- Olney / Aspen Hill / Wheaton / Georgia Avenue;
- Layhill Road / Wheaton Corridor;
- Veirs Mill Road Corridor / Garrett Park;
- MD 355 Corridor;
- Potomac Avenue Corridor to I-270 Arc; and
- Close-In – Beltway Adjacent and Inside the Beltway.

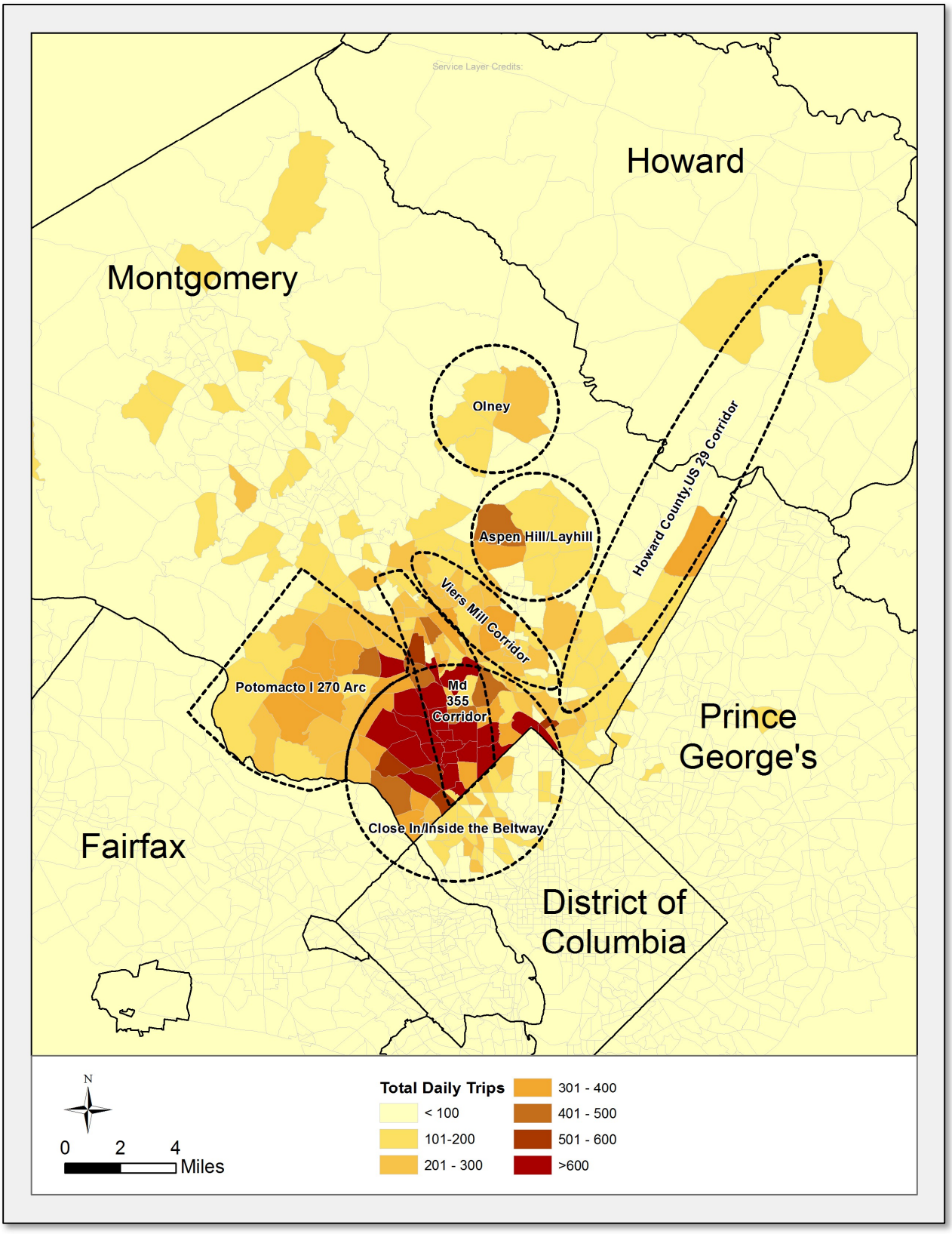
In addition to the specific trip generation concentrations shown in **Figure 3-1**, two additional larger areas were identified as large generators of trips to Bethesda. While there are not large enough adjacent concentrations within these larger areas to support entirely new transit service, there are other potential proposed service and park and ride improvements that were identified as possible catalysts to help convert auto trips from these areas into non-auto trips, especially in light of the constrained parking in downtown Bethesda that would be part of the higher densities outlined in the Downtown Bethesda Plan. These two areas are:

- Washington D.C.
- Northern Virginia

Once the trip generation concentrations that would support new transit improvements were identified, the next step in the analysis was to evaluate existing services from each concentration in order to determine whether a strong transit connection to Bethesda already exists or if new service or enhanced service would make transit more competitive with the auto, thus leading to a higher non-auto mode share. This process yielded a universe of potential transit improvement alternatives that was evaluated and further narrowed to the set of improvements that provided the needed increases in transit ridership to help reach the target non-auto transit mode share as outlined in the Downtown Plan.

The full universe of potential transit improvements is outlined in **Chapter 4**.

Figure 3-1: Washington Region Concentrations of Trips Destined for Downtown Bethesda



3.2 Assessment of Non-Auto Trips

The process that was used to determine the number of additional trips that must be converted to non-auto modes in order to reach the 55 percent non-auto mode share outlined in the Downtown Bethesda Master Plan is shown in **Table 3-1** (the total required non-auto trips is shown in *Row F*). Data in *Rows G and H* show the estimated number of non-auto trips that would be generated by increases in telework, walk, and bike trips (shown in *Row G*) as well as the additional non-auto trips that would be generated by the addition of the Purple Line to the regional transportation network (shown in *Row H*). *Row I* includes the number of non-auto trips that must still be generated by improvements in transit after the telework, walk and bike trips, and the addition of the Purple Line, are accounted for.

Table 3-1: Summary of Transit Trips Required to Meet – Non-Auto Mode Share Requirement

A. Estimated 2040 Downtown Employment	49,360
B. Current Non-Auto Mode Share	37%
C. Estimated 2040 Non-Auto Trips – With - Existing Non-Auto Mode Share	18,263
D. Required 2040 Non-Auto Mode Share – Downtown Bethesda Master Plan	55%
E. Required Non-Auto Trips to Meet New Non-Auto Mode Share Requirement	27,148
F. Required Change in Trips to Reach Required Non-Auto Mode Share (55%) from Current Non-Auto Mode Share (37%)	8,885
G. Trips Generated by Telework, Walk, Bike (see **Table 3-2**)	3,849
H. Additional Trips Resulting from Addition of Purple Line to Network*	1,978
I. Remaining Required Trips to Meet Non-Auto Mode Share from Transit Improvements	*3,058*

*Purple Line trip estimates are based on data in the Purple Line Ridership Forecasting Technical Report

The access estimate for the Purple Line is based on the Purple Line Ridership Forecasting Technical Report, which provides daily boardings and alightings by station. Bethesda daily alightings are approximately 14,990 (based on Origin/Destination format). This daily number was factored to the AM peak hour based on the following formula:

- Daily factored to AM peak based on assumption that 33 percent of ridership will occur in AM peak period: 14,990 * 0.33 = 4,965
- AM Peak period factored to AM peak hour based on assumption that 40 percent of AM peak period ridership occurs in the peak hour: 4,965 * 0.40 = 1,978 = AM peak hour alightings at Purple Line Bethesda Station

The additional non-auto mode trips not provided by the transit improvements that are required to meet the 55 percent non-auto mode share are the subject of **Table 3-2**, which shows the estimated increase in walk, bike, and telework trips based on improvement initiatives already underway or planned as part of the infrastructure improvements outlined in the body of this report.

The estimate of improvements in the number of people who will telework is based on Transportation Demand Management proposals outlined in the County's NextGen TDM initiative. While specific mode share targets are not outlined as part of the initiative, a conservative change of 2.7 percent relative to current telework mode share (based on the Bethesda employer survey) was assumed.

The change in walk trips is based on walk capture rates for mixed use areas throughout the United States. These rates were converted into a conservative assumption regarding the increase in the walk mode share for trips to downtown Bethesda due to the increased density associated with the Bethesda Downtown Master Plan. To ensure the change in walk mode share is not overcounted, the team also calculated, as a check, all the trips to downtown Bethesda within one mile, which represents the typical distance a person would be willing to walk to access an activity. The trips within this one-mile shed represent the total potential walk market and confirmed the conservative walk mode share change assumption.

The assumed change in the bike mode share is based on the assumed bike share resulting from implementation of the first tier of bike improvements as outlined in the *M-NCPPC Bicycle Master Plan*[3].

Table 3-2: Other Non-Auto Modes Contributing to Meeting New Goal

Mode	Current Mode Share	New Mode Share	Actual Trips Applied to 2040 Employment	Source
Telework	7.3%	10% (2.7% change)	1,332	NextGen TDM
Walk	3.2%	6.0% (2.8% change)	1,382	Mixed Use Capture Rates (internal and external)
Bike	0.7%	3.0% (2.3% change)	1,135	Bicycle Master Plan – Tier 1 projects (3% mode share)
Total			*3,849*	

3.3 Proposed Intersection Improvements

There are four intersections completion of the pedestrian and bicycle network, as shown in **Figure 3-2** and described in more detail in **Section 5.1**. Three of the intersections focus on capacity improvement alternatives to reduce the intersection vehicle delay to the SSP performance threshold of 80 seconds based on Highway Capacity Manual (HCM) analysis. Those intersections are:

- East-West Highway and Connecticut Avenue
- Connecticut Avenue and Bradley Lane
- Rockville Pike and Jones Bridge Road

In addition, the intersection of Woodmont Avenue and Bethesda Avenue would be reconfigured to decrease the pedestrian crossing distance by expanding the plaza located in the northwest corner.

[3] https://montgomeryplanning.org/planning/transportation/bicycle-planning/bicycle-master-plan/

3.4 Proposed Pedestrian/Bicycle Improvements

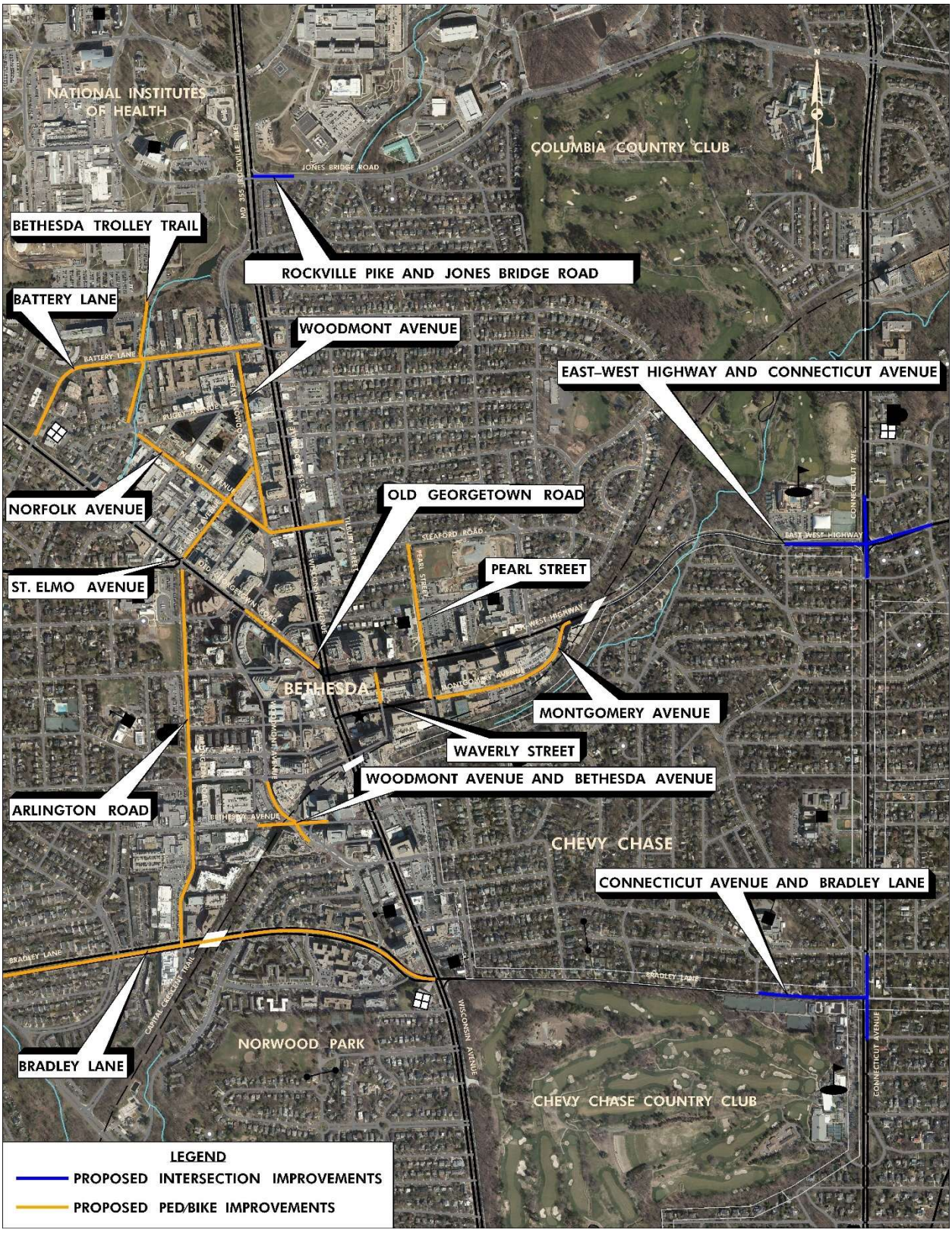
The Pedestrian/Bicycle Improvements Section covers the following stretches of roadways and trails identified in the Bethesda Downtown Plan for completion of the pedestrian and bicycle network, as shown in **Figure 3-2** and described in more detail in **Section 5.2.** The proposed bicycle improvements are also identified in the *M-NCPPC Bicycle Master Plan*, which was approved by the Montgomery County Council on November 27, 2018.

- Separated bike lanes along Bradley Boulevard from Glenbrook Road (or Fairfax Road/West Sector Boundary) to Wisconsin Ave/East Sector Boundary
- Bike lanes/shared street along Norfolk Avenue from Battery Lane Urban Park to Tilbury Street
- Separated bike lanes along Arlington Road from Old Georgetown Road to Bradley Boulevard
- Bike lane along Pearl Street from Montgomery Avenue to Sleaford Road
- New ADA-compliant trail connections between Bradley Boulevard and the Capital Crescent Trail
- Widening of the North Bethesda Trail between Rugby Avenue and the National Institutes of Health (NIH) campus
- Separated bike lanes along Woodmont Avenue from Battery Lane to Norfolk Avenue
- Separated bike lanes along Old Georgetown Road from Woodmont Avenue to Wisconsin Avenue
- Separated bike lanes along Montgomery Avenue from Pearl Street to East-West Highway
- Bike lane along Battery Lane from Old Georgetown Road to Wisconsin Avenue
- Bike lane along Waverly Street from East-West Highway to Montgomery Avenue
- Shared roadway along St. Elmo Avenue from Wilson Lane to Woodmont Avenue
- Protected Intersections
- Bike parking at the Bethesda Metrorail Station and throughout the Central Business District (CBD)
- Bikeshare

Bicycle and pedestrian projects already being designed and/or constructed as part of MCDOT's program have been included in this cost analysis. These projects are:

- Capital Crescent Surface Trail (Bethesda Avenue / Willow Lane) from Woodmont Avenue to 47th Street
- Separated bike lanes along Norfolk Avenue / Cheltenham Drive from Woodmont Avenue to Tilbury Street
- Separated bike lanes along Montgomery Lane / Montgomery Avenue from Woodmont Avenue to Pearl Street
- Separated bike lanes along Woodmont Avenue from Norfolk Avenue south to Wisconsin Avenue

Figure 3-2: Locations of Proposed Intersection and Pedestrian/Bicycle Improvements



3.5 Proposed ADA Fee

A standard Americans with Disabilities Act (ADA) cost was also included in the UMP fee. The unit cost was developed by assessing the cost of proposed ADA improvements included in recent site plans in the sector. This cost was then applied to the linear feet (LF) of all existing sidewalks within a 500 LF buffer, called the "ADA Condition of Approval", of the proposed site limits to develop an average cost per LF. The resulting ADA unit cost is $14 per LF, which was then applied to the length of sidewalk in the Downtown Bethesda area. The total cost of $770,000 will be included in the UMP fee.

4 Universe of Potential Transit Improvements to Improve Non-Auto Mode Share

This chapter describes the universe of potential transit improvements that could be used to increase non-auto mode share in downtown Bethesda. The potential improvement recommendations are structured by each of the trip concentrations listed in **Section 3.1** and detailed below. Detailed traffic information is included in **Appendix A**.

4.1 Howard County – U.S. 29 Corridor

The combination of robust existing transit service within the U.S. 29 corridor as well as the planned implementation of the U.S. 29 Bus Rapid Transit service and the Purple Line light rail service led to the conclusion that there would be very strong connections between the corridor and downtown Bethesda once this full network is in place. Given these robust transit connections, no additional transit service was recommended in this trip origin concentration.

However, in anticipation of greater transit demand for trips to Bethesda from Howard County and the U.S. 29 corridor once the Purple Line link is in place, 350 additional parking spaces were proposed for consideration at the existing Burtonsville Park and Ride. Due to available space and the available capacity at the existing Burtonsville Park and Ride, it is assumed that these spaces would be in structured parking. The estimated daily riders from this expanded Park and Ride is summarized in **Section 4.11.** The estimated capital cost of this additional parking is outlined in **Section 6.1**.

4.2 Olney/Aspen Hill/Georgia Avenue Corridor

The potential improvement to strengthen transit connections between the Olney area concentration and Bethesda would include new express service between the Olney Park and Ride and downtown Bethesda via MD 97, MD 200, and the Shady Grove Metrorail Station, where riders would be able to transfer to the Red Line for the final trip to downtown Bethesda. This service would make stops at Olney, in the vicinity of the Montgomery Medical Center, and at the ICC Park and Ride lot, located at the intersection of the ICC and Georgia Avenue, and would run every 15 minutes utilizing a 40-foot long coach. The potential route is shown in **Figure 4-1**. The estimated one-way trip time for this trip is 54 minutes, which is further broken down by trip component in **Table 4-1**.

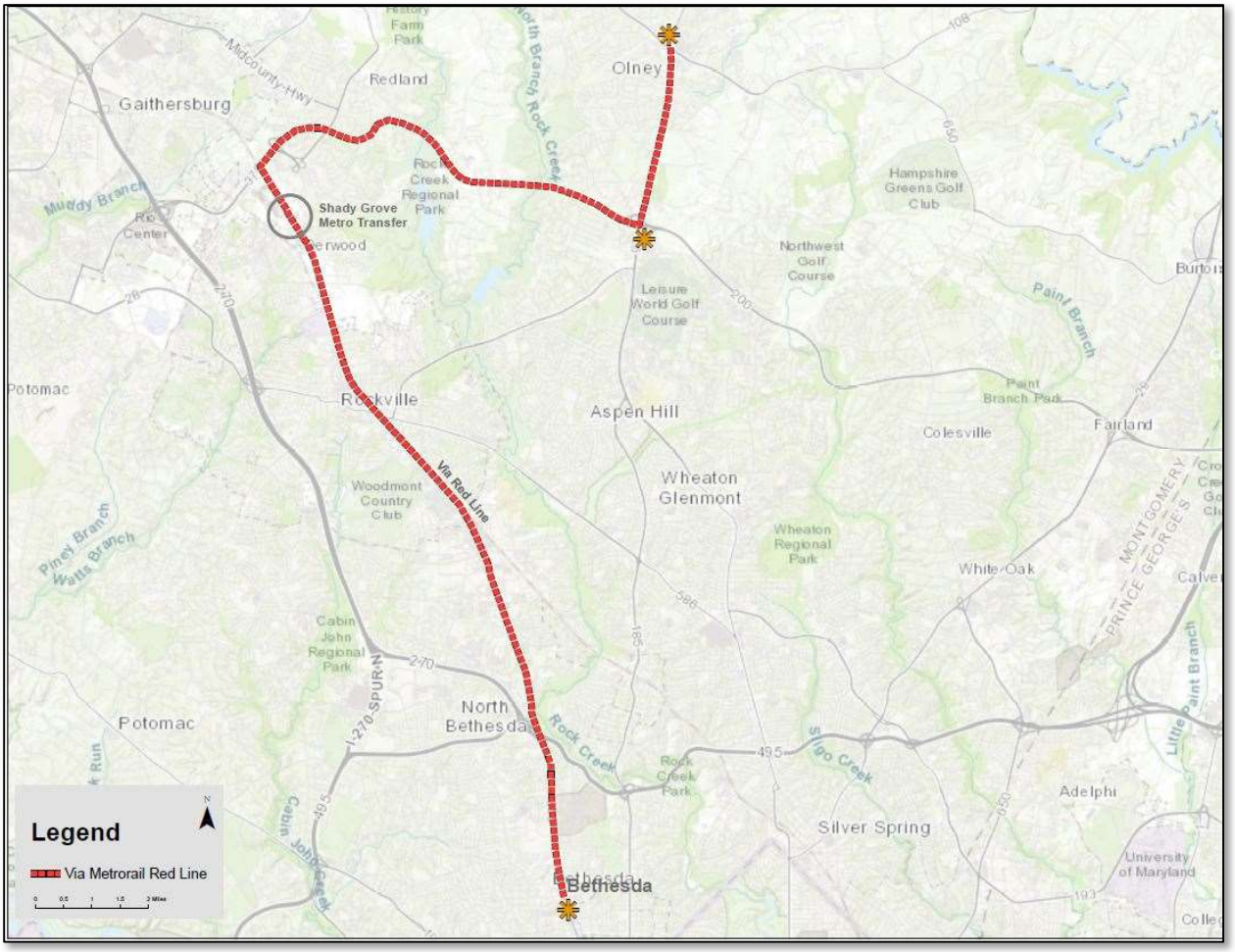
Table 4-1: Estimated One-Way Run Time – New Service Between Olney and Bethesda

Route Pattern	One Way Bus Travel Time	Time on Rail	Transfer Time (bus to rail)	Bus Dwell Time at each Park and Ride	Total Time
Olney – Shady Grove Metro Station – Downtown Bethesda	20	19	5	5 (10 minutes total)	54

The estimated daily riders on the potential service is summarized in **Section 4.11.** The estimated vehicle requirement for this service as well as the vehicle capital cost is provided in **Section 6.1**.

Finally, because of increased transit demand in the corridor due to the new service, 100 parking spaces would also be proposed in the vicinity of Olney that would be served by the new route. This additional parking capacity is assumed to be surface spaces. The estimated cost of these additional parking spaces, including land purchases, are provided in **Section 6.1.**

Figure 4-1: Olney to Bethesda Service Routing



4.3 Layhill Road/Wheaton Corridor

The potential improvement to strengthen the transit connections between the Layhill Road concentration and downtown Bethesda would consist of a new express service between the intersection of Layhill Road and Bel Pre Road and the White Flint Metrorail station, where riders would transfer to the Red Line for the final trip into downtown Bethesda. The intent would be to use excess parking spaces at one of the shopping centers in the vicinity of the intersection of Layhill and Bel Pre Road in order to provide park and ride capacity for riders of the new service. Local stops would also be made at the apartment complexes along Bel Pre Road between Layhill Road and Georgia Avenue. A second park and ride would also be proposed at the intersection of Georgia Avenue and Connecticut Avenue, utilizing excess parking at the shopping center at the intersection. The potential service would run every ten minutes. The routing is shown in **Figure 4-2**.

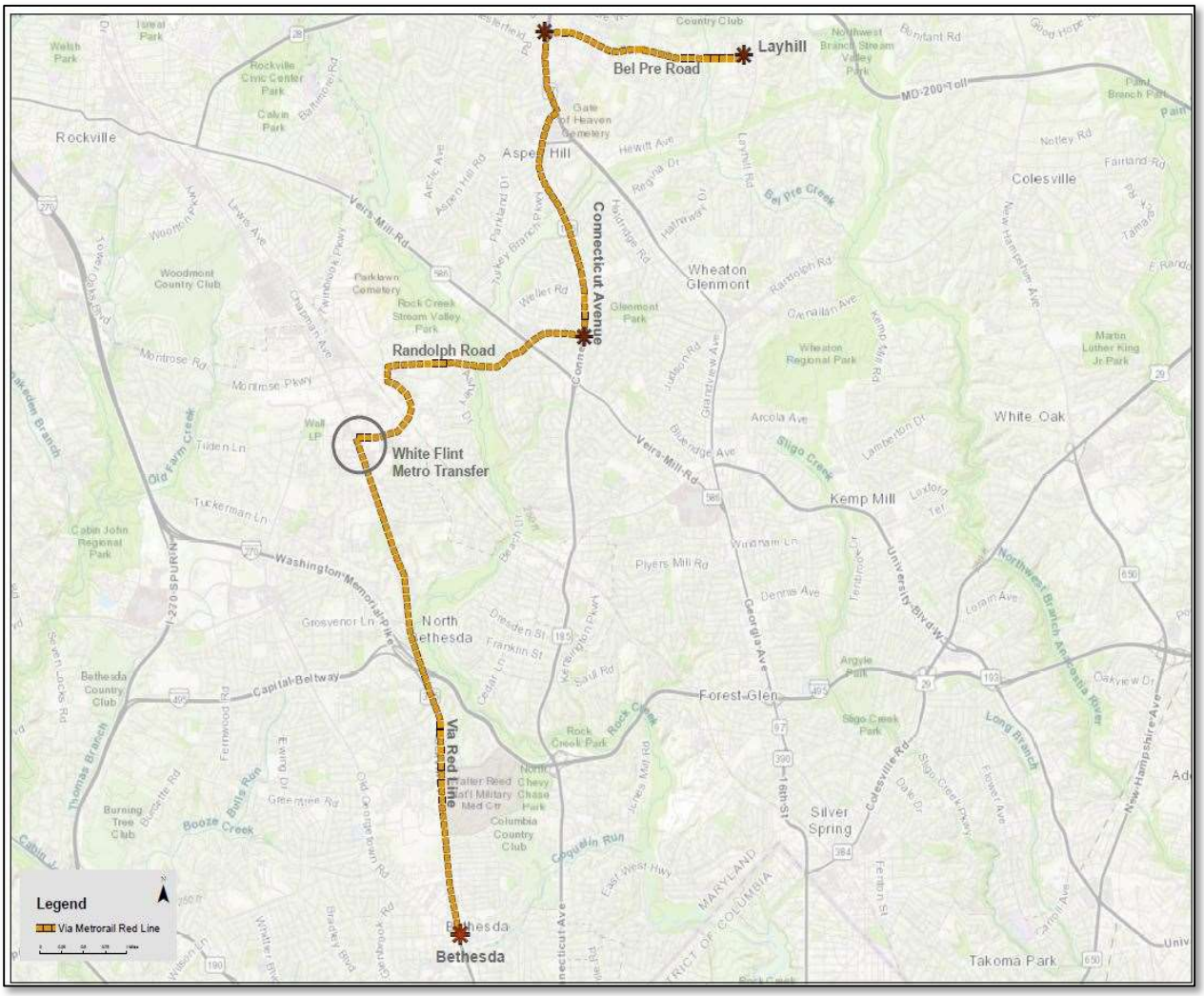
The estimated one-way travel time for this service is shown in **Table 4-2**.

Table 4-2: Estimated One-Way Run Time – New Service Between Layhill Road and Bethesda

Route Pattern	One Way Bus Travel Time	Time on Rail	Transfer Time (bus to rail)	Bus Dwell Time at each Park and Ride	Total Time
Layhill – White Flint Station – Downtown Bethesda	30	11	5	5 (10 minutes total)	56

The estimated daily ridership on the service is summarized in **Section 4.11**. The estimated vehicle requirement for this service as well as the vehicle capital cost is provided in **Section 6.1**. No other capital costs would be associated with this potential improvement.

Figure 4-2: Layhill Road to Bethesda Service Routing



4.4 Veirs Mill Road Corridor

The Veirs Mill corridor currently has a robust transit network comprised of the Metrobus Q service as well as a number of Ride On routes that enter the corridor and run on it for short distances. These services are generally oriented east-west with final destinations at the Wheaton and Rockville Metrorail Stations. One route that uses the corridor for a short distance before running into Bethesda is the Ride On Route 34. Peak period service frequencies on the route north of the Wheaton Metrorail Station are 30 minutes while south of Wheaton peak period frequencies are 15 minutes.

In the instance of this Bethesda-focused concentration, the density of the existing transit network led to the potential recommendation of improving service levels on the existing Ride On Route 34 rather than implementing new service. The framework for evaluating the adequacy of service frequencies on the existing service were Transportation Policy Area Review (TPAR) service standards that flow from guidelines developed to ensure the development intensity for various area within the County is accompanied by appropriate and sufficient transportation facilities. The relevant standard for this analysis is the standard related to service frequency, which states that the time between bus arrivals in an urban area such as Bethesda should be no greater than 15 minutes in peak periods and 30 minutes in off-peak periods.

Given this framework, the peak period 30 minute headway on the Ride On 34 north of Wheaton does not meet TPAR standards and therefore the proposed service improvements in this trip origin concentration would improve peak period service frequencies north of Wheaton on the Ride On 34 from 30 minutes to 15 minutes to meet the TPAR standards (service frequencies of 15 minutes south of Wheaton already meet TPAR standards).

The estimated ridership increase due to this potential improvement is summarized in **Section 4.11.** The vehicle requirement and capital cost estimate associated with this improvement is provided in **Section 6.1**.

4.5 MD 355 Corridor

Currently, there are two transit services in the MD 355 corridor that terminate at the Medical Center Metrorail Station, short of the three TAZs comprising downtown Bethesda as identified in the Downtown Bethesda Master Plan. The first is the Ride On Route 46, which is a local service running between Rockville and Medical Center on MD 355. The second is the limited stop Ride On Route 101 (Ride On extRa), which runs between the Lakeforest Transit Center and Medical Center, also on MD 355. The Ride On extRa service is currently a peak period only service, running every ten minutes in the peak period.

The potential improvement recommendation for the MD 355 corridor is focused on identifying a means of providing a transit connection between the current terminal at Medical Center for transit services coming from the north, into the heart of downtown Bethesda.

This potential connection would come from the proposed MD 355 Flash, a Bus Rapid Transit (BRT) corridor along Maryland 355 that is currently in the planning and design phase. As currently planned, the proposed corridor would consist of three route patterns covering the MD 355 corridor from Bethesda to Clarksburg in the north of the County. Implementation of the Flash service would provide the final connection into the heart of Bethesda that does not currently exist. Based on existing plans for the MD 355 BRT, the route pattern serving Bethesda would run every ten minutes in the peak and 15 minutes in the off-peak and would operate approximately 18 hours per day. The estimated Flash ridership is summarized in **Section 4.11.** The capital cost estimate, which would relate to costs associated with right-of-way, running way, and station improvements, is outlined in **Section 6.1**.

4.6 Potomac River to I-270 Arc (outside Beltway)

This concentration is located outside the I-495 Capital Beltway in an arc generally running between the Potomac River and the western spur of I-270. This area already has a robust transit network in place that provides extensive geographic coverage. Given this extensive coverage, the primary potential service change would be improvements in peak period headways on existing routes in order to meet TPAR standards for service frequency. In addition, a new limited stop service running between Bethesda and the Westfield Montgomery shopping mall was also considered as a potential service improvement. Each of these potential improvements is outlined in greater detail below.

4.6.1 Improved Service Frequencies on Existing Services

The routes and proposed service changes for this origin concentration are outlined below.

4.6.1.1 Ride On Route 29

Ride On Route 29 runs between the Bethesda Metrorail Station and the Friendship Heights Metrorail Station via Massachusetts Avenue, Whittier Boulevard, and Wilson Lane. Current peak period frequencies are 30 minutes. This potential service change would improve peak period frequencies to 15 minutes to meet TPAR standards and strengthen transit connections to downtown Bethesda. The route is shown in **Figure 4-3**.

4.6.1.2 Ride On Route 32

Ride On Route 32 runs between the Bethesda Metrorail Station and the David Taylor Naval Ship Research and Development Center. Current peak period frequencies are 30 minutes. This potential service change would improve peak period frequencies to 15 minutes to meet TPAR standards and strengthen transit connections. The route is shown in **Figure 4-4**.

4.6.1.3 Ride On Route 47

Ride On Route 47 runs between the Rockville Metrorail Station and the Bethesda Metrorail Station via the Westfield Montgomery Mall and Suburban Hospital. Current peak period frequencies are 30 minutes. This potential service change would improve peak period frequencies to 15 minutes to meet TPAR standards. The route is shown in **Figure 4-5**.

The estimated change in ridership associated with these frequency improvements is summarized in **Section 4.11.** The estimated capital costs associated with these changes are summarized in **Section 6.1**.

Figure 4-3: Ride On Route 29 Routing

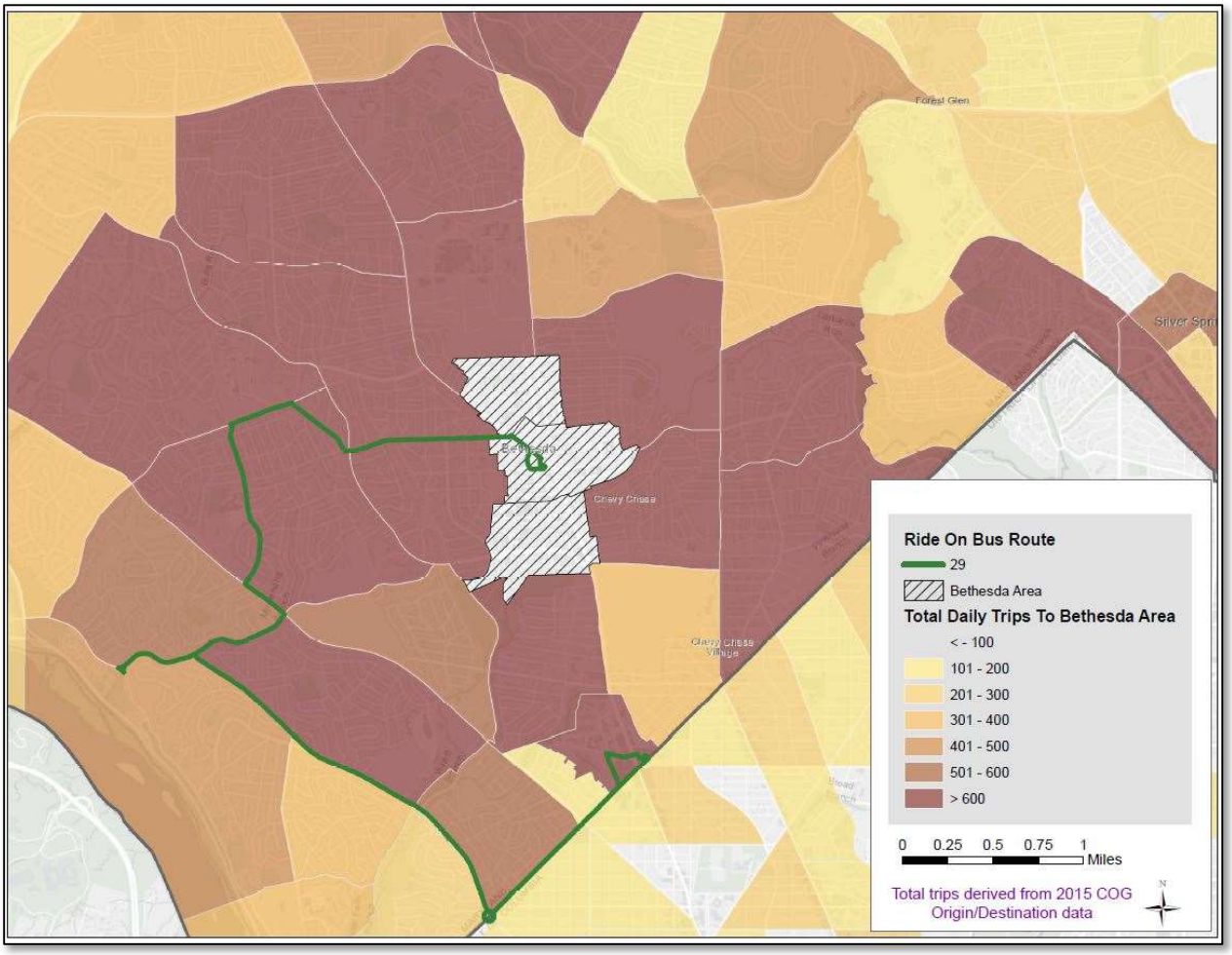


Figure 4-4: Ride On Route 32 Routing

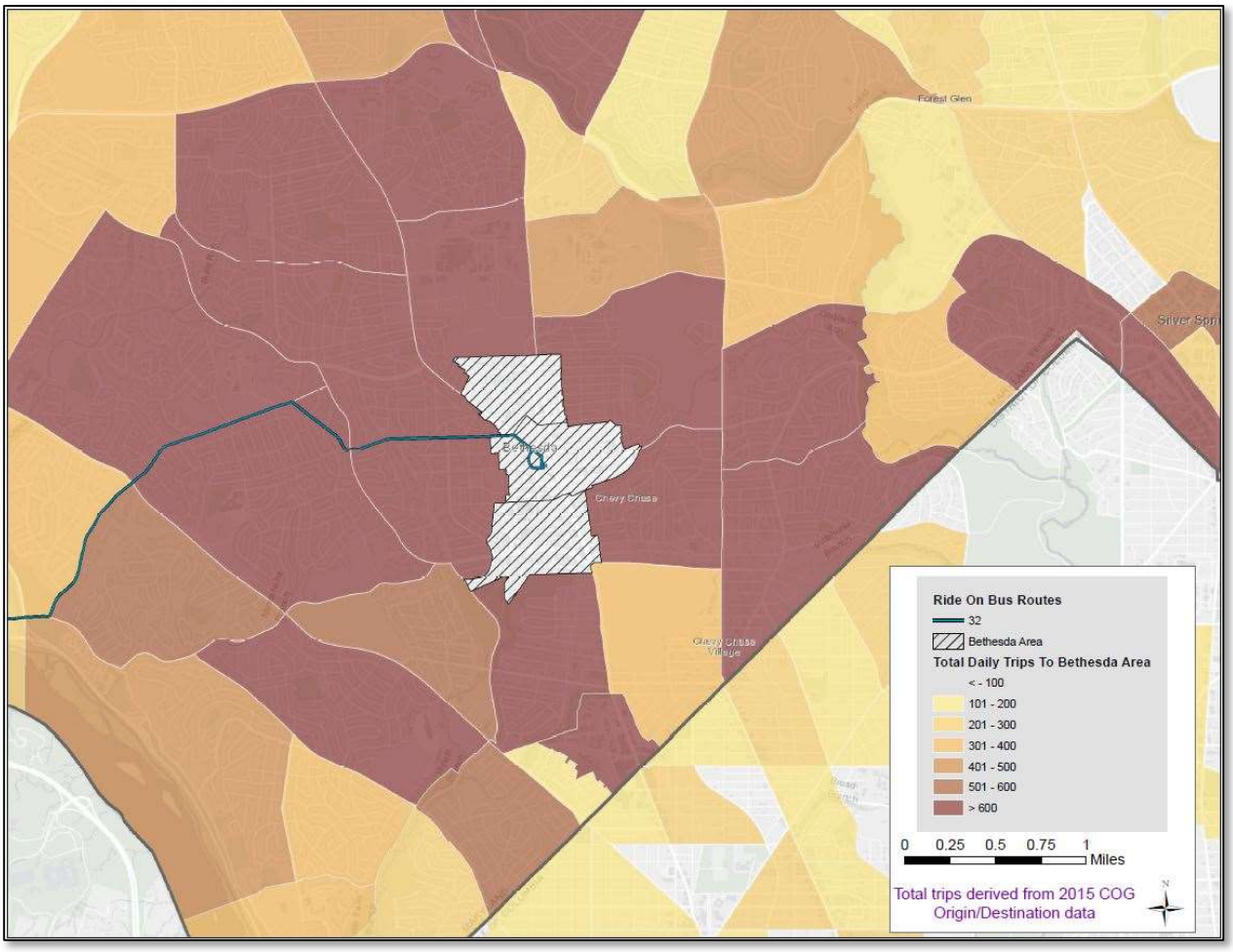
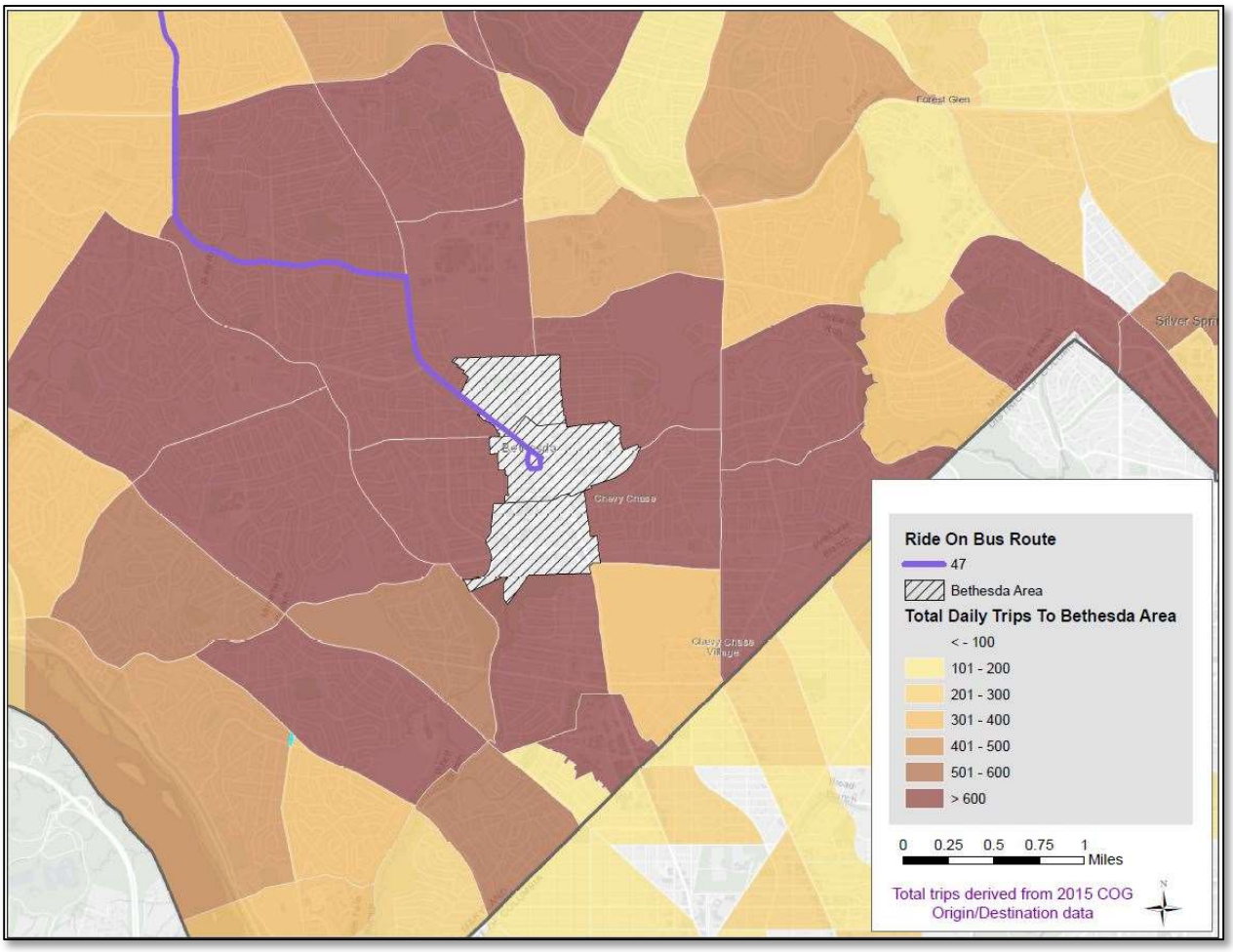


Figure 4-5: Ride On Route 47 Routing



4.6.2 New Limited Stop Service – Westfield Montgomery Mall to Bethesda

This potential improvement would include a new park and ride-based service that would run between the Westfield Montgomery Mall and downtown Bethesda. The potential service is shown in **Figure 4-6**.

This service would have two purposes. The first would be to serve a number of the TAZs within this trip origin concentration that generate a large number of trips to downtown Bethesda. The estimated demand for trips from this trip concentration area is outlined in **Section 4.11.**

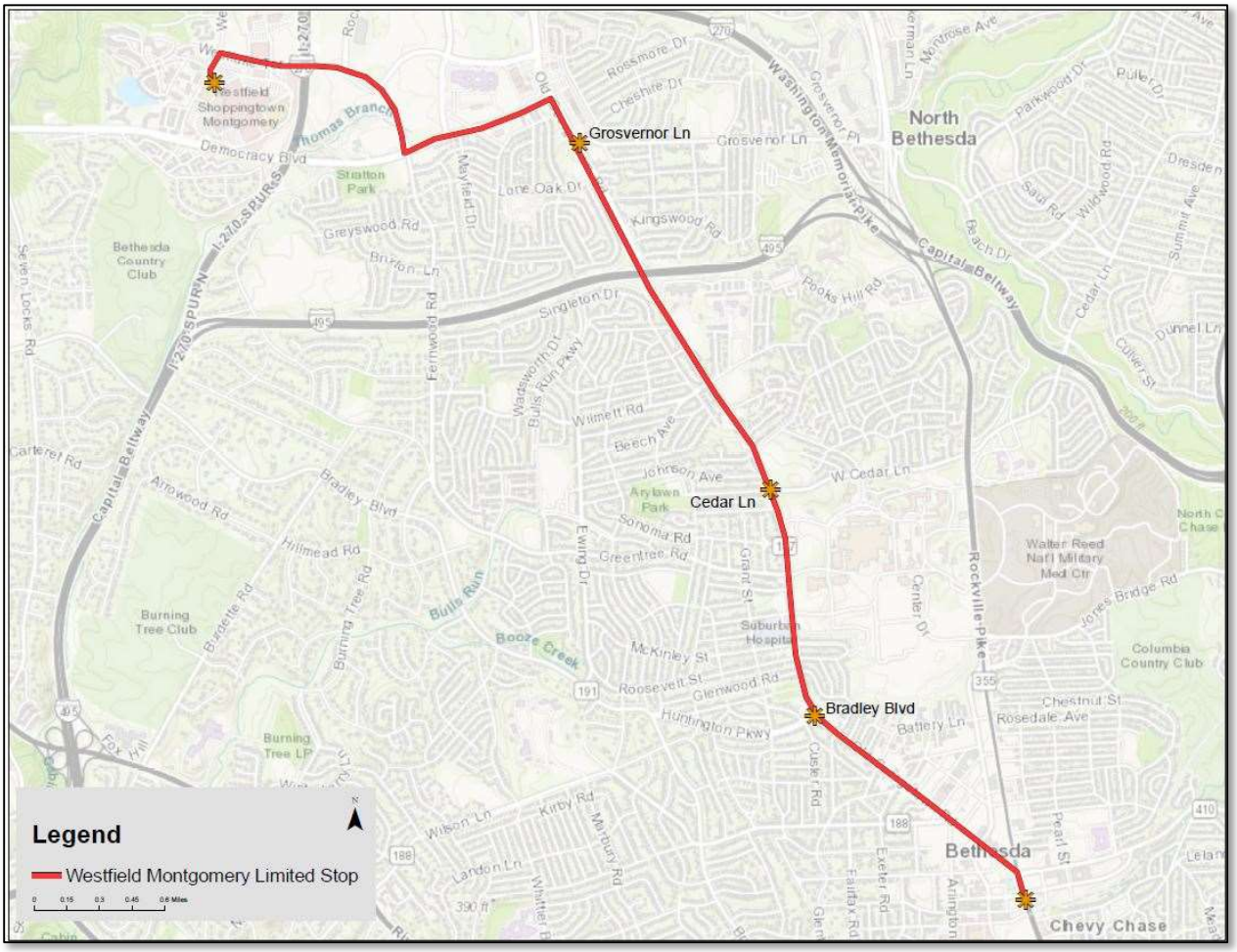
The second purpose would be to act as a connection between the mall and commuters destined to Bethesda from northern Virginia that would park at the Westfield Mall rather than drive into Bethesda. This "capture" of Virginia commuters would reflect the increased difficulty of finding parking in downtown as it redevelops as well as increased parking cost. More detail on the capture of trips from Virginia is provided in **Section 4.9**.

The estimated demand on the "Westfield Montgomery Mall to Bethesda" service from the Northern Virginia trip intercept is summarized in **Section 4.11.**

Based on the demand from the two markets, it was determined that a service running every eight minutes would be required. This new service would require five 60-foot long articulated vehicles running during the AM peak period. A comparable service would also run in the PM peak period to provide the connection between downtown Bethesda and the mall.

The estimated capital cost for the additional vehicles is outlined in **Section 6.1.**

Figure 4-6: New Limited Stop Service – Montgomery Mall to Bethesda



4.7 Close-In Beltway Adjacent and Inside Beltway

This origin concentration is located inside the Beltway in the TAZs surrounding downtown Bethesda on both sides of MD 355 (Wisconsin Avenue). This area already has a robust transit network in place that provides extensive geographic coverage. Given the density of trip origins to downtown Bethesda in this origin concentration, three potential service improvements have been identified: improved headways on existing service, a new micro transit network providing additional service to close in TAZs, and expansion of the existing Bethesda Circulator. Each of these service improvements is outlined in greater detail below.

4.7.1 Improved Service Frequencies on Existing Routes

Service frequency changes to two existing Ride On routes within this origin concentration have been identified as potential improvements and are outlined below.

Ride On 30 runs between the National Institutes of Health and downtown Bethesda via Bulls Run Parkway, Broadmoor Drive, and Old Georgetown Road, serving an area directly west of downtown Bethesda. Current peak period frequencies are 30 minutes. The potential service change would improve peak period frequencies to 15 minutes to meet TPAR standards. The route is shown in **Figure 4-7**.

Ride On 36 operates between the Connelly School of the Holy Child, located off of River Road, and the Bethesda Metrorail Station. Current peak period frequencies are 30 minutes. The potential service change would improve peak period frequencies to 15 minutes to meet TPAR standards. The route is shown in **Figure 4-8**.

Figure 4-7: Ride On Route 30 Routing

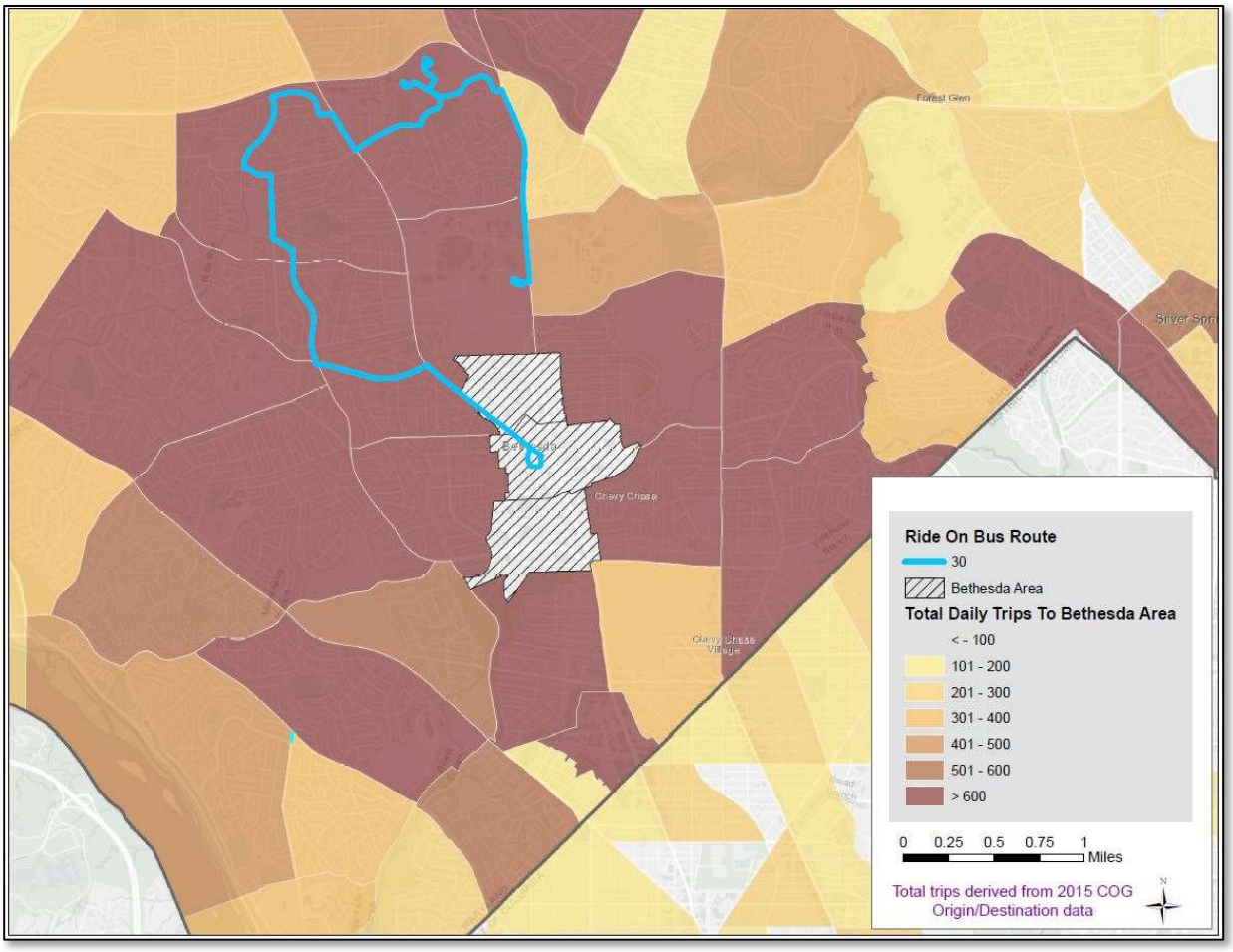
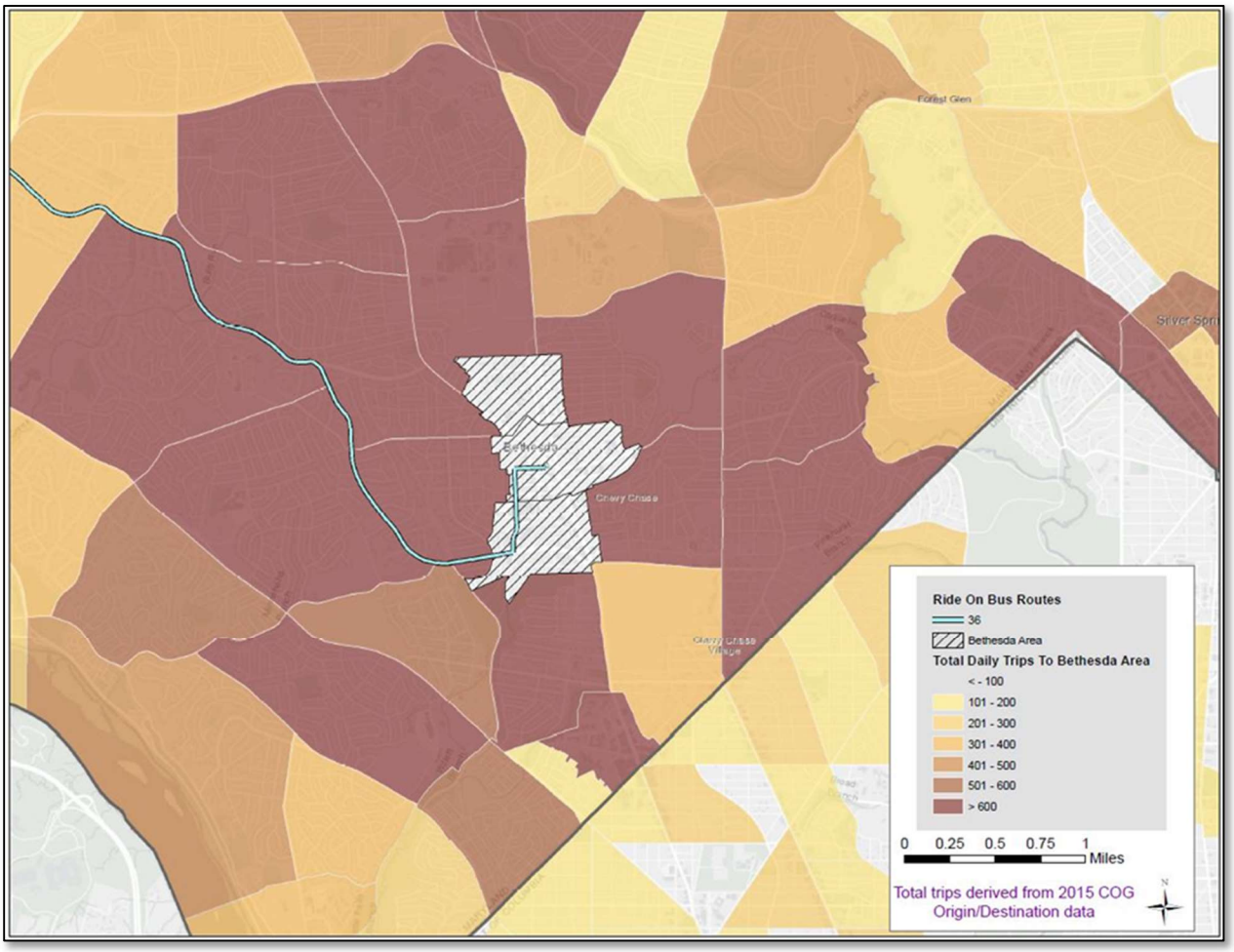


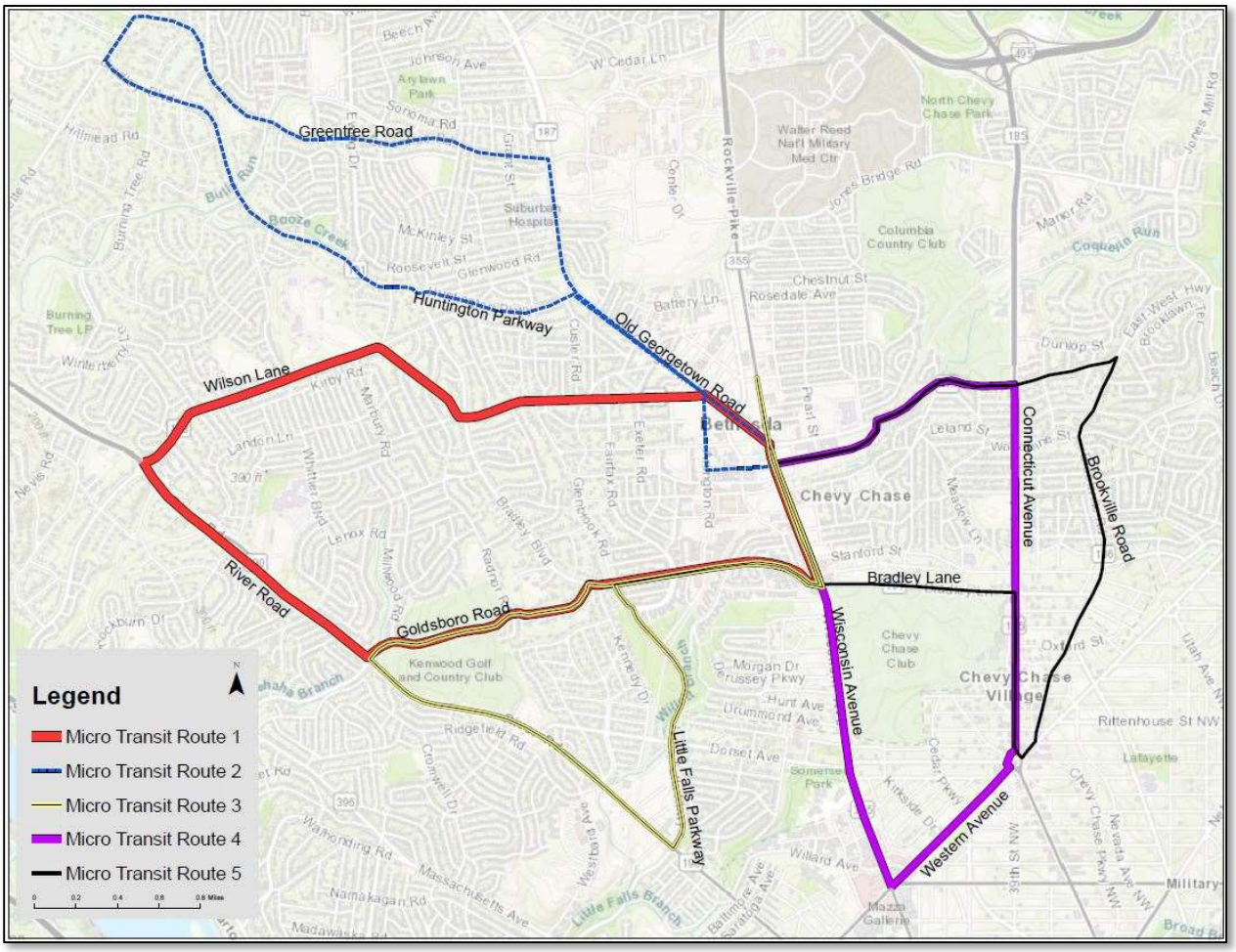
Figure 4-8: Ride On Route 36 Routing



4.7.2 Micro Transit Network to Serve Close in Neighborhoods

This potential service improvement would include a micro transit network serving the TAZs directly adjacent to Bethesda that are significant sources of trips destined for downtown Bethesda. The intent is that this network would supplement the existing services in this close-in area and provide frequent service that provides strong transit connections to downtown. The proposed micro transit network is shown in **Figure 4-9**. Service would run in the peak periods, every ten minutes on each loop route, utilizing vehicles with a capacity of 12 riders. Service would run each way on the loop. Estimated daily riders for the service are summarized in **Section 4.11.** The capital costs associated with this improvement is outlined in **Section 6.1**.

Figure 4-9: Micro Transit Network Routing



4.7.3 Expansion of the Existing Bethesda Circulator

The purpose of the existing Bethesda Circulator is to provide connections between key destinations within downtown Bethesda. The service runs approximately every 10 to 15 minutes on Monday through Saturday. Hours of service are between 7 AM and 11 PM on Monday through Thursday, 7 AM and 12 AM on Friday and 10 AM and 12 AM on Saturday. The current Circulator route is located on the west side of MD 355 and runs generally north/south between Bradley Boulevard (MD 191) in the south and Battery Lane in the north.

This potential improvement would modify the existing Circulator route or possibly add a new Circulator route to serve additional points of interest, notably the Pearl District and the Bethesda South / Purple Line station. The service frequency on this route would be the same as on the existing route, and the service would utilize the same types of vehicles as run on the existing route. While this service would generate an estimated 126 additional riders**,** as this service is already assumed by the master plan in estimating the background Non-Auto Drive Mode Share its additional trips for purposes of achieving the target NADMS is effectively zero. The capital cost associated with this improvement is outlined in **Section 6.1**.

4.8 District of Columbia

The Metrobus 30N, 30S, 31, and 33 lines currently run along Wisconsin Avenue within the District of Columbia and terminate at the Friendship Heights Metrorail Station. This leaves a gap along Wisconsin Avenue between Friendship Heights and downtown Bethesda that makes it inconvenient for residents of the District of Columbia to use transit to access downtown Bethesda. This potential service improvement would include extending the 30-series lines to downtown Bethesda via Wisconsin Avenue. Estimated ridership on this extension is summarized in **Section 4.11.** The estimated capital cost of the extension is summarized in **Section 6.1**.

4.9 Virginia

Figures 4-10 and 4-11 show the TAZs within northern Virginia that were evaluated as part of the catchment area of trips going to Bethesda. The distribution of trips among TAZs shows that there are not large concentrations of adjacent TAZs that would support a new transit service from Virginia to Bethesda. However, there is an opportunity to capture trips from Virginia at an interceptor park and ride at the Westfield Montgomery Mall such that auto trips from Virginia would not travel all the way into downtown Bethesda but would terminate at this park and ride. This interception of trips would reflect the growing lack of available parking as well as increasing parking costs in downtown Bethesda as it redevelops. Opportunity may exist for transit connections directly to/from Virginia, though this analysis focused entirely on treatments that could be implemented exclusively via Montgomery County resources.

Two potential improvements are proposed to support this interception of trips. The first would be the new limited stop service running between the mall and downtown Bethesda that is described in **Section 4.6**.

The second improvement would be additional park and ride capacity at the Montgomery Mall. Given the physical constraints at the mall and in adjacent parcels, it is assumed that the additional parking capacity would be structured. The estimated number of captured Virginia trips is approximately 1,000 trips. It is assumed an additional 800 parking spaces would be required to accommodate Virginia trips that cannot be accommodated with existing spaces. The estimated cost of the additional 800 spaces is outlined in **Section 6.1**.

As noted previously, the vehicle requirements, operating cost, and capital cost for the Montgomery Mall to Downtown Bethesda limited stop service is also summarized in **Section 6.1**.

Figure 4-10: Virginia TAZs Evaluated for Trips to Bethesda – East and West of Beltway

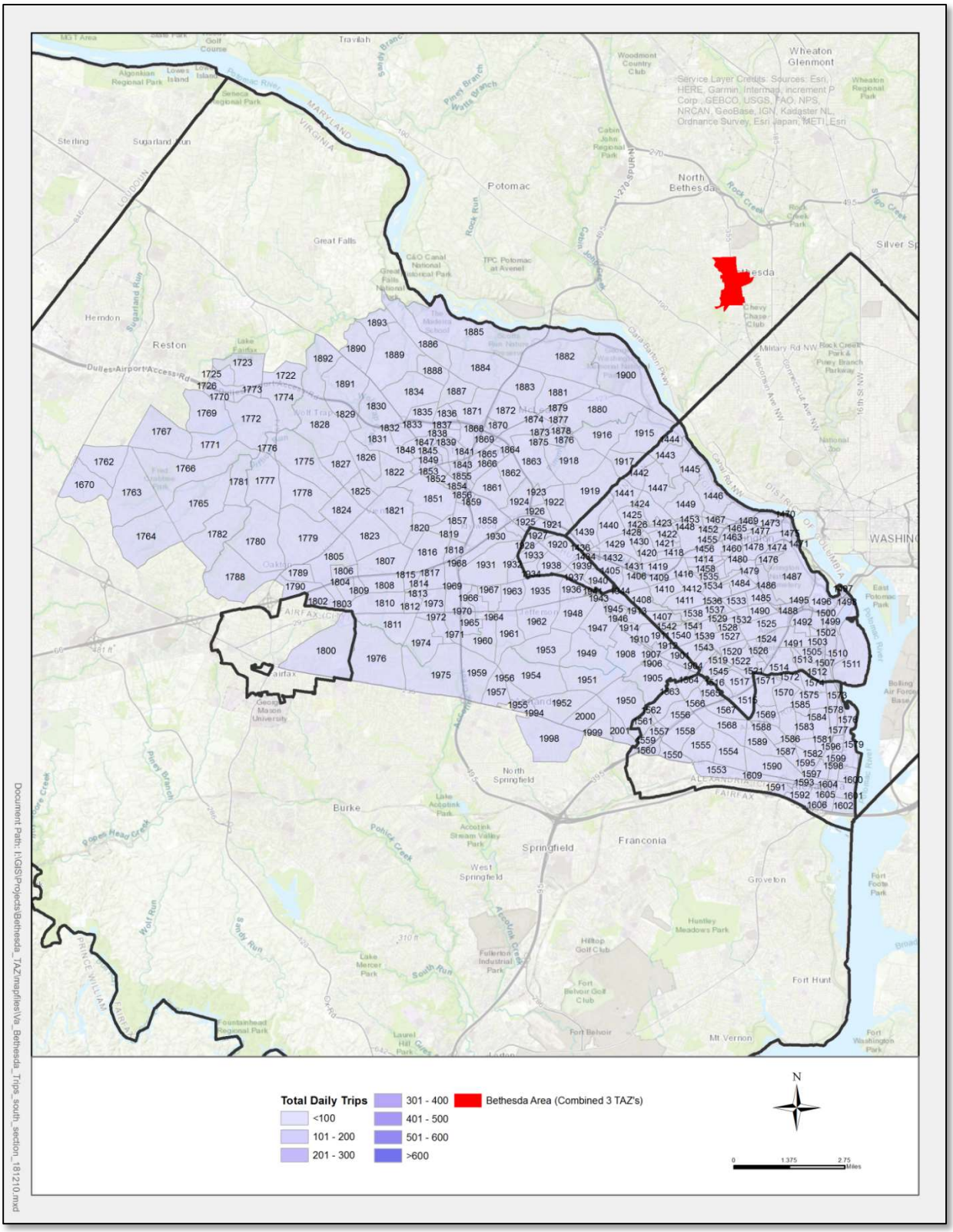
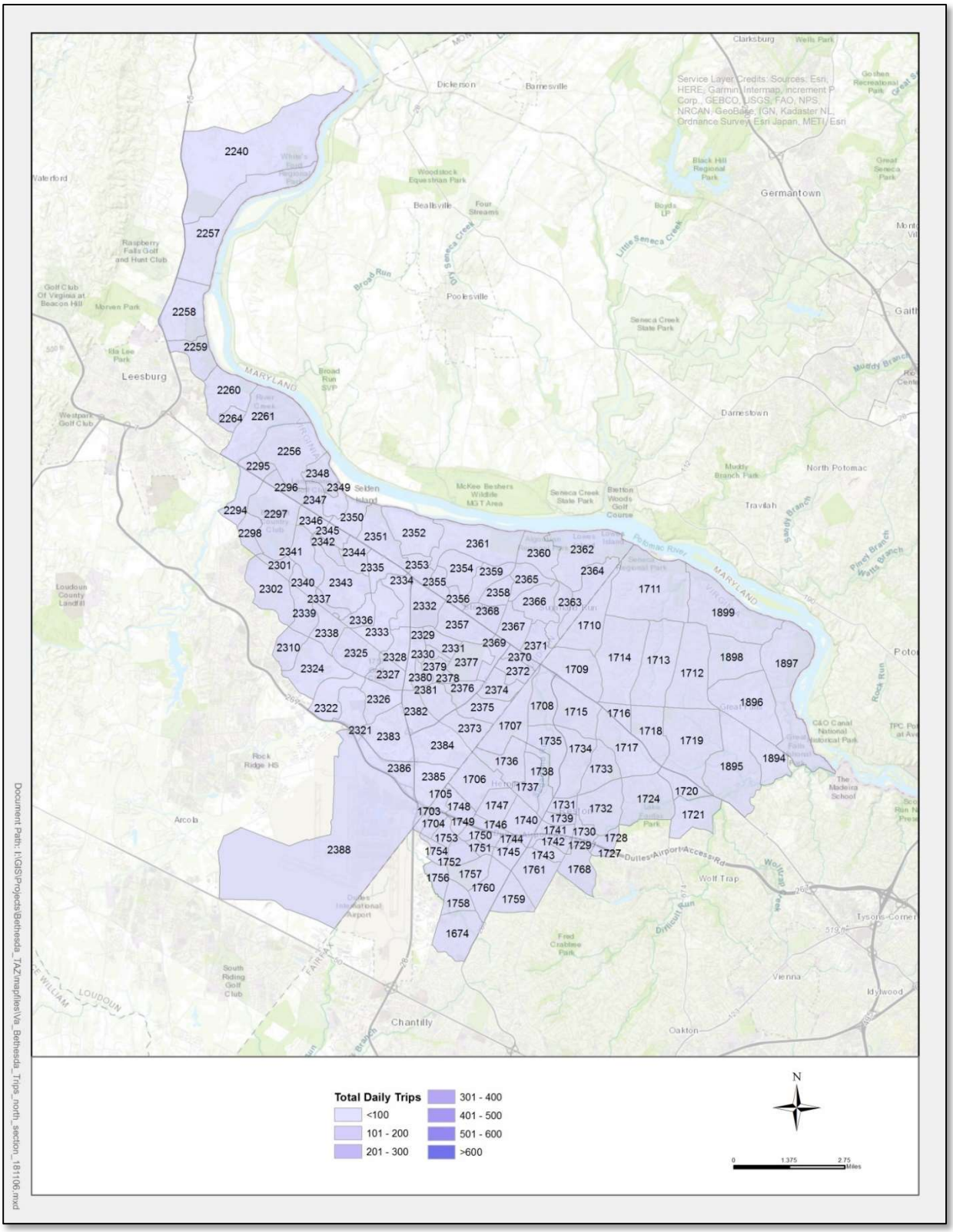


Figure 4-11: Virginia TAZs Evaluated for Trips to Bethesda – North of Beltway



4.10 Support Facilities

Because of the large number of additional vehicles that would be required to support the potential service improvements described in the previous sections, in conjunction with the fact that existing Ride On Operations and Maintenance facilities are generally at capacity, additional storage and maintenance capacity would be required to support the potential service expansions described above. The estimated capital cost of this required expansion based on the full universe of potential improvements is outlined in **Section 6.1**.

4.11 Assessment of Future Transit Ridership

The estimated ridership for each of the potential service improvements in the full universe of alternatives described above is outlined in **Table 4-3**. The recommended subset of transit improvement alternatives that provide the ridership increase needed to meet the transit improvement portion of the additional non-auto mode share increase are shown in **Table 4-4**. These recommendations were developed by identifying the lowest cost means of achieving the target ridership needed to meet non-auto driver mode share goals.

Table 4-3: Estimated Ridership for Full Universe of Potential Service Improvements

Trip Origin Concentration	Proposed Transit Improvement	Estimated Ridership
Howard County – U.S. 29 Corridor	Expanded Park & Ride spaces in Burtonsville	342
Olney/Aspen Hill/Georgia Avenue Corridor	New express service to Shady Grove Metrorail Station	200
Layhill/Wheaton Corridor	New express service to White Flint Metrorail Station	747
Veirs Mill Road Corridor	Improve service frequencies on Ride On 34	43
MD 355 Corridor	New Bus Rapid Transit Service - MD 355 Flash	869
Potomac to I-270 Arc	Improved Frequency on Existing Ride On Routes (routes 29, 32, 47)	155
	Westfield Montgomery Mall to downtown Bethesda Limited Stop Service	1,839
Close-In Beltway Adjacent and Inside Beltway	Improved Frequency on Existing Ride On Routes (routes 30, 36)	66
	Micro transit network	1,536
Virginia (see Westfield Montgomery Mall to downtown Bethesda Limited Stop Service)		
Washington DC	Extend 30 Lines to downtown Bethesda	530
Total		**6,327**

Table 4-4: Ridership on Transit Improvements Recommended for Implementation to Meet Transit Improvement Portion of Increased Non-Auto Mode Share

Proposed Transit Improvement	Estimated Ridership	Needed Trips to Meet Required Non-Auto Mode Share
Expanded Park & Ride spaces in Burtonsville	342	
New Bus Rapid Transit Service on MD 355 – MD 355 Flash	869	
Micro Transit Network	1,536	
Extend 30s Line to Downtown Bethesda	530	
Expanded Bethesda Circulator	0*	
Total	**3,277**	**3,058**

* *The Circulator is already accounted for in the background condition. It is recommended for inclusion in the UMP as required by the Master Plan, but its additional trips have already been accounted for.*

5 Proposed Intersection and Pedestrian/Bicycle Improvements

This chapter details the proposed intersection and pedestrian/bicycle improvements as recommended in the *Downtown Bethesda Plan* that were developed to generate the UMP fee. The improvements have taken into account historic properties, and minimization of impacts to adjacent properties, environmental features, and community facilities.

5.1 Intersection Improvements

Three intersections were identified in the *Bethesda Downtown Plan* for capacity improvements because they did not fall within the 2016 Subdivision Staging Policy (SSP) standard for acceptable vehicle delay during the morning and evening peak periods. The SSP evaluated key intersections using Highway Capacity Manual (HCM) methodology, which estimates seconds of delay per vehicle. Intersections within the Sector Plan limits were tested against a policy area standard of 120 seconds/vehicle delay while intersections outside the Sector Plan limits were tested against a policy area standard of 80 seconds/vehicle delay. As a result of this analysis, all intersections within the Sector Plan limits were found to be within the policy area standard, however, three intersections outside the Sector Plan limits are estimated to exceed the policy area standard.

Those intersections are:

- East-West Highway and Connecticut Avenue
- Connecticut Avenue and Bradley Lane
- Rockville Pike and Jones Bridge Road

This study reviewed the previous HCM analysis at these three intersections, and developed intersection improvements that would meet the performance threshold of 80 seconds per vehicle delay from the SSP.

In addition, the Bethesda Downtown Plan recommends pedestrian improvements to the intersection of Woodmont Avenue and Bethesda Avenue, which were developed as part of this study.

The proposed intersection improvements are described below, and the proposed intersection improvements are included in **Appendix B**.

5.1.1 Rockville Pike and Jones Bridge Road

The proposed intersection improvement would include a reconfiguration of westbound Jones Bridge Road at the intersection of MD 355 (Rockville Pike) as shown on **Figure 1** in **Appendix B**. Currently, westbound Jones Bridge Road includes one exclusive left turn lane, one shared through and left turn lane, one through lane, and one exclusive right turn lane that is separated by a raised median in the westbound direction.

The proposed reconfiguration on westbound Jones Bridge Road would include one dedicated left turn lanes, one through lane, and two dedicated right turn lanes. The proposed westbound Jones Bridge Road would include a second dedicated right turn lane, which would be created by shortening and narrowing the raised concrete median.

Additional improvements as part of the Base Realignment and Closure projects along eastbound and westbound Jones Bridge Road would reconfigure the westbound shared through and left turn lanes to exclusive left turn lanes, which would remove the need for split phasing and allow concurrent eastbound and westbound left turn or through movements. This flexibility, along with the additional right turn lane along westbound Jones Bridge Road, would reduce the performance threshold to 77.5 seconds per vehicle delay for the AM peak and 42.6 seconds per vehicle delay for the PM peak. The target congestion threshold is 80.0 seconds per vehicle.

5.1.2 East-West Highway and Connecticut Avenue

The proposed intersection improvement would include a reconfiguration of all four quadrants of the intersection of East-West Highway and Connecticut Avenue as shown on **Figure 2** in **Appendix B**. Currently, eastbound East-West Highway includes two exclusive left turn lanes, one through lane, and one shared through and right turn lane. Westbound East-West Highway includes one exclusive left turn lane, one through lane, and one shared through and right turn lane. Northbound Connecticut Avenue (MD 185) includes one exclusive left turn lane, two through lanes, and one shared through and right turn lane. Southbound Connecticut Avenue also includes one exclusive left turn lane, two through lanes, and one shared through and right turn lane.

East-West Highway would be widened to include an additional eastbound through lane as it approaches and leaving the Connecticut Avenue intersection. Widening along westbound East-West Highway would add an additional exclusive left turn and exclusive right turn lane and allow the shared through and right turn lane to become a through lane, increasing the westbound lanes at the intersection from three to five.

East of the intersection, the widening would occur to the north for westbound improvement and to the south for eastbound improvement in order to maintain the roadway centerline. West of the intersection, the widening would occur to the south to avoid impacts to the existing brick wall at Columbia Country Club.

Connecticut Avenue would also be widened to include one dedicated right turn lane in each direction as it approaches East-West Highway. In addition, along both northbound and southbound Connecticut Avenue, the shared through and right turn lane would be converted to an additional through lane. North of the intersection, the widening would occur to the west and south of the intersection, the widening would occur to the east in order to maintain the roadway centerline.

This reconfiguration would also include restriping and signal modifications. By providing more lanes and thus more capacity at the intersection, the proposed intersection improvement would reduce the performance threshold to 64.0 seconds per vehicle delay for the AM peak and 78.8 seconds per vehicle delay for the PM peak. The target congestion threshold is 80.0 seconds per vehicle.

There may be other design options available at this location which may vary where the right-of-way impacts occur. The alternative utilized for this analysis was the higher cost option as to provide a more conservative analysis. Updates to the UMP fee shall include any more detailed designs for this location as they become available.

5.1.3 Connecticut Avenue and Bradley Lane

The proposed intersection improvement would include a reconfiguration of northbound Connecticut Avenue and eastbound Bradley Lane as shown on **Figure 3** in **Appendix B**. Currently, northbound Connecticut Avenue includes one shared through and left turn lane, one through lane, and one shared through and right turn lane. The lone eastbound Bradley Lane includes one shared through, left, and right turn lane.

Eastbound Bradley Lane would be widened to include one exclusive left turn lane and one shared through and right turn lane. This reconfiguration would also include restriping and signal modifications. By providing more lanes and thus more capacity at the intersection, the proposed intersection improvement would reduce the performance threshold to 57.9 seconds per vehicle delay for the AM peak and 68.6 seconds per vehicle delay for the PM peak. The target congestion threshold is 80.0 seconds per vehicle.

5.1.4 Woodmont Avenue and Bethesda Avenue

This intersection is an important crossing for pedestrians on Woodmont Avenue, Bethesda Avenue and the Capital Crescent Trail. Additional demand is anticipated in the future with the implementation of the Bethesda South Station and future park on the east side of Woodmont Avenue. The angle at which Woodmont Avenue and Bethesda Avenue cross combined with flat curb radii create long pedestrian crossings at this busy intersection.

The proposed improvements would decrease the pedestrian crossing distance by expanding the plaza located on the northwest side of the intersection. The proposed intersection improvement is shown on **Figure 4** in **Appendix B**.

5.2 Pedestrian/Bicycle Improvements

The Bethesda Downtown Plan recommends Bicycle and Pedestrian improvements within the Sector Plan area to increase the connectivity, safety, and quality for all modes of transportation. This study developed bicycle and pedestrian improvements at the following locations:

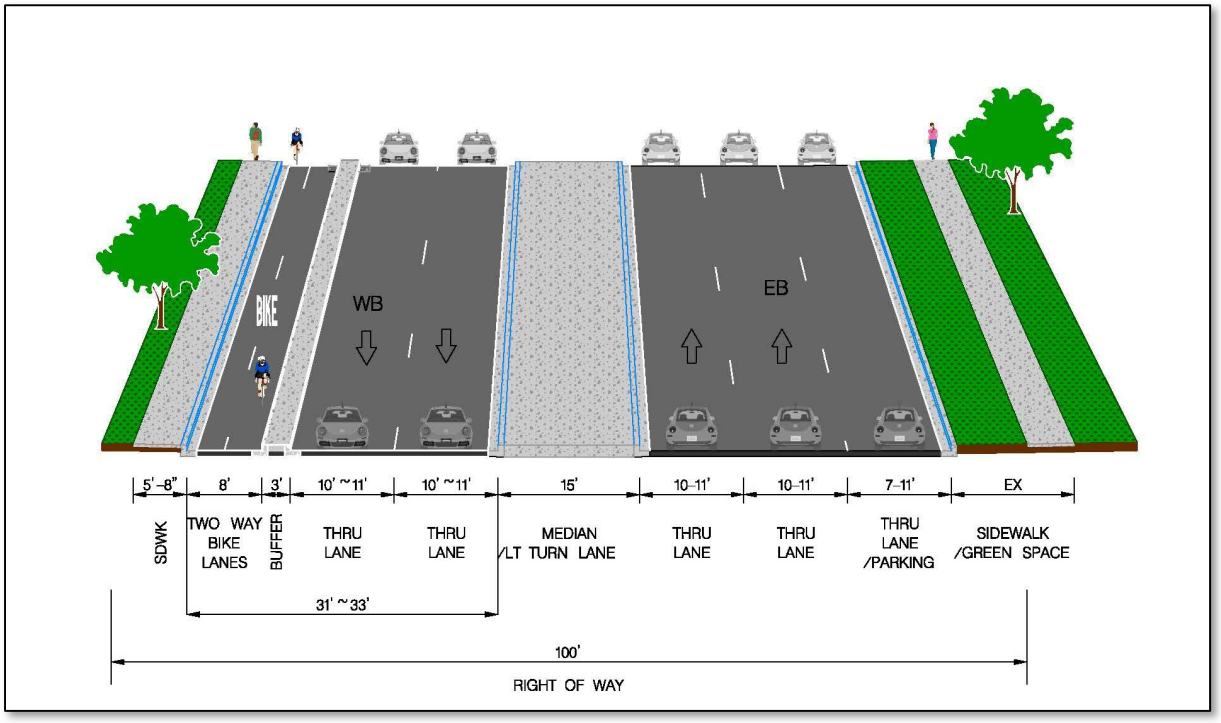
- Bradley Boulevard from Glenbrook Road to Wisconsin Ave;
- Norfolk Avenue and Cheltenham Drive from Battery Lane Urban Park to Tilbury Street;
- Arlington Road from Old Georgetown Road to Bradley Boulevard;
- Pearl Street from Montgomery Avenue to Sleaford Road;
- Trail connections between Bradley Boulevard and Capital Crescent Trail; and
- North Bethesda Trail between Rugby Avenue and the NIH Campus
- Woodmont Avenue from North Sector Plan Boundary to Norfolk Avenue
- Old Georgetown Road from Woodmont Avenue to Wisconsin Avenue and East-West Highway from Wisconsin Avenue to Montgomery Avenue
- Montgomery Avenue from Pearl Street to East-West Highway
- Battery Lane from Old Georgetown Road to Wisconsin Avenue
- Waverly Street from East-West Highway to Montgomery Avenue
- St. Elmo Avenue from Wilson Lane to Woodmont Avenue

5.2.1 Bradley Boulevard from Glenbrook Road to Wisconsin Avenue

Proposed bicycle improvements along Bradley Boulevard would improve east-west connectivity within the Sector Plan area and would bridge an area that is currently inaccessible to most bicyclists. The segment of Bradley Boulevard from Glenbrook Road to Wisconsin Avenue was previously recommended for a dual bikeway with both a shared use path and a signed shared roadway in the 2005 Countywide Bikeways Functional Bethesda Downtown Plan. From Wilson Lane to Glenbrook Road, the bikeway is being designed by the Department of Transportation as a shared use path on the north side and conventional marked bike lanes on both sides. However, after further discussion and coordination, MCDOT directed this study to use the recommended typical section per the County's Bicycle Master Plan within the study limit.

From Glenbrook Road to Leland Street, the proposed improvement would include an eight-foot wide two-way bike lane with a monolithic median along westbound Bradley Boulevard as shown in **Figure 5-1**. The existing travel lanes and grass median would be narrowed in order to accommodate the bike lane. From Leland Street to Wisconsin Avenue, the existing roadway narrows down the outmost through lanes for parallel parking along both eastbound and westbound Bradley Boulevard. In this location, two options were developed. The first option would eliminate the parallel parking along the westbound roadway to accommodate the bike lane. The second option would maintain the existing parallel parking and further impact the grass median to both accommodate the bike lane and maintain the parking. For the purpose of this cost analysis, the option that retains the parallel parking along westbound Bradley Boulevard was utilized.

Figure 5-1: Proposed Bradley Boulevard Typical Section from Glenbrook Road to Leland Street



5.2.2 Norfolk Avenue from Battery Lane Urban Park (Rugby Lane) to MD 355 and Cheltenham Drive from Wisconsin Avenue to Tilbury Street

Proposed bicycle improvements along Norfolk Avenue and Cheltenham Drive would improve connectivity within the Sector Plan area and would serve as the primary alternative to Old Georgetown Road for bicyclists. The master plan recommends that a portion of Norfolk Avenue from Rugby Avenue to Woodmont Avenue be reconfigured as a shared street, as shown on **Figure 5-2**. Norfolk Avenue from Woodmont Avenue to Wisconsin Avenue would narrow the existing travel lanes to accommodate on-road striped bike lanes, as shown on **Figure 5-3.** Cheltenham Drive from Wisconsin Avenue to Tilbury Street would narrow the existing travel lanes to accommodate a five-foot wide bike lane with a monolithic median in both directions.

Figure 5-2: Norfolk Avenue Typical Section from Rugby Avenue to Woodmont Avenue

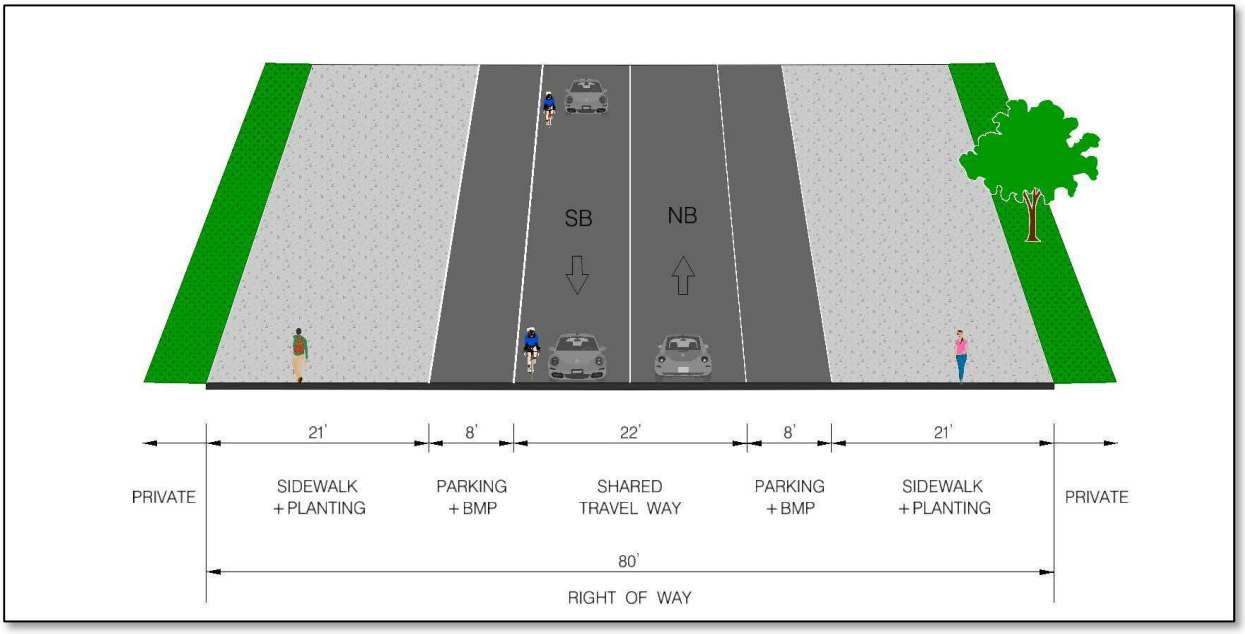
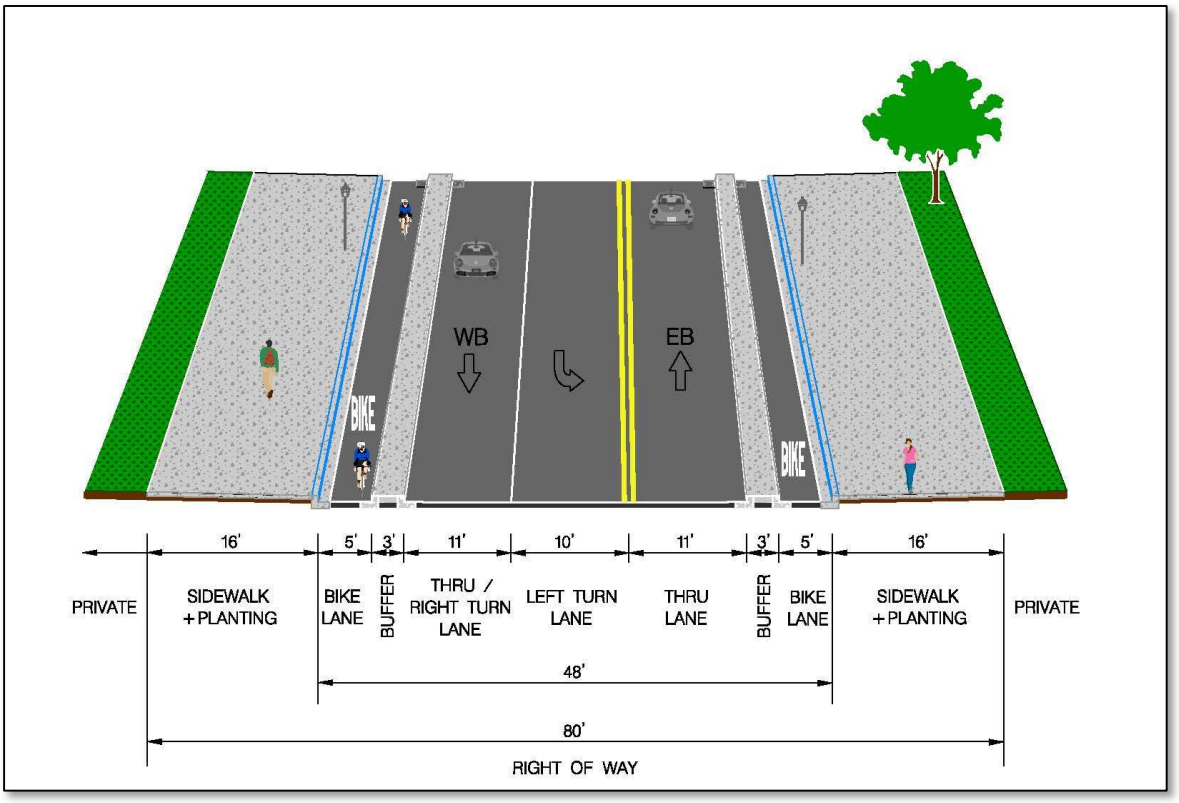


Figure 5-3: Cheltenham Drive Typical Section from Wisconsin Avenue to Tilbury Street



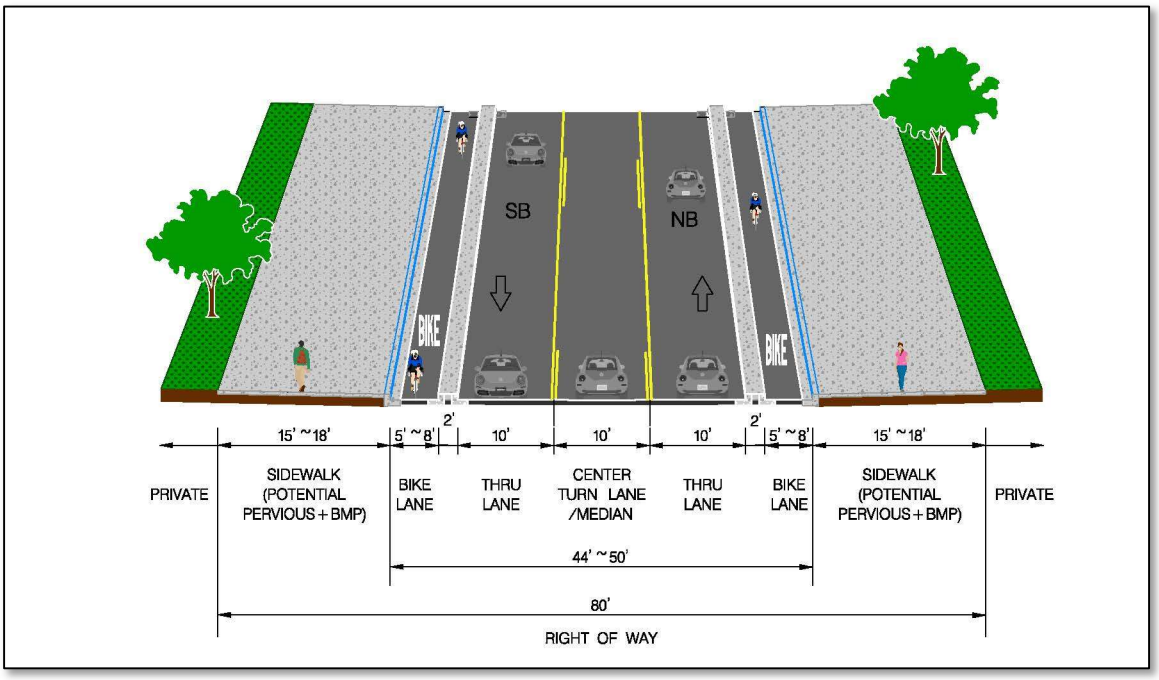
5.2.3 Arlington Road from Old Georgetown Road to Bradley Boulevard

Proposed bicycle improvements along Arlington Road would improve north-south connectivity on the west side of the Sector Plan area and would provide a direct connection between the Woodmont Triangle and recommended Bradley Boulevard bikeway via Bethesda Row.

The existing typical section of Arlington Road includes two 11-foot wide through lanes in each direction from Old Georgetown Road to Bradley Boulevard, and two ten-foot wide through lanes in each direction plus a ten-foot wide continuous center turn lane from Elm Street to Bethesda Avenue.

The proposed improvements would eliminate one through lane in each direction and add a five-foot wide to eight-foot wide bike lane with a monolithic median. Ten-foot wide travel lanes and a ten-foot wide continuous center turn lane would run the length of the improvement. **Figure 5-4** shows the proposed typical section.

Figure 5-4: Proposed Arlington Road Typical Section

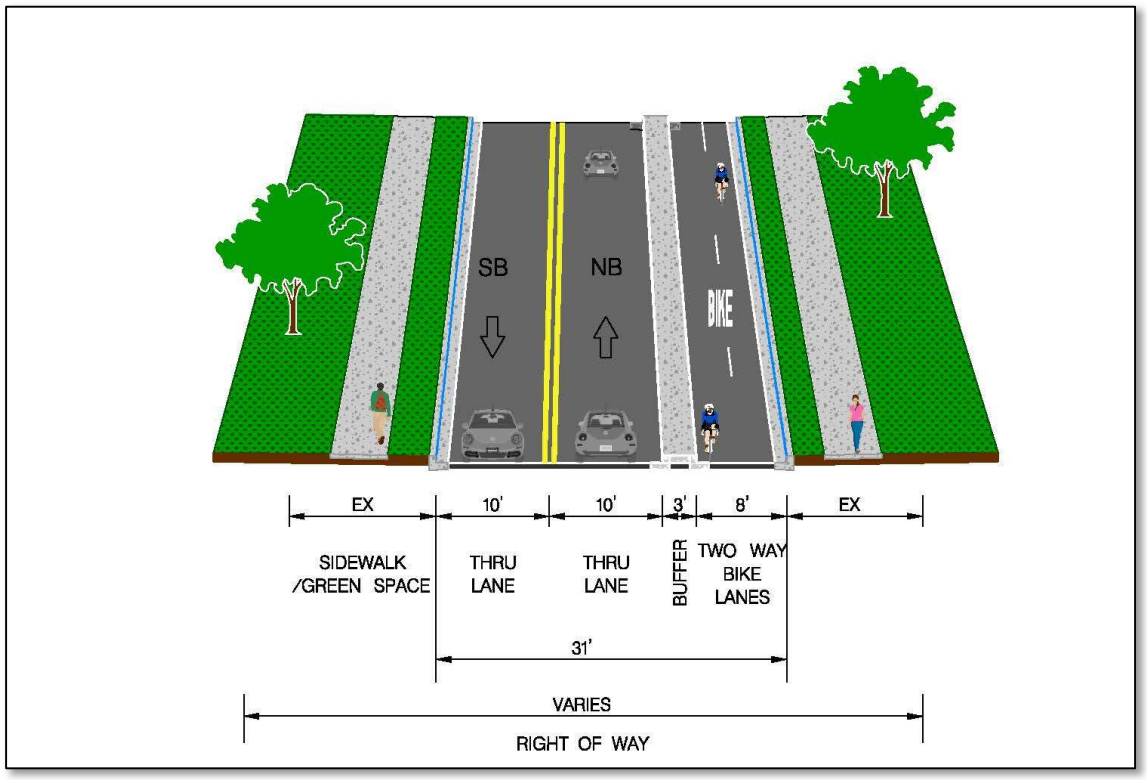


5.2.4 Pearl Street from Montgomery Avenue to Sleaford Road

Proposed bicycle improvements along Pearl Street would improve north-south connectivity on the east side of the Sector Plan and would provide a direct connection between the emerging Pearl District and the single-unit residential neighborhood to the north and east of the Sector Plan area.

The existing typical section of Pearl Street includes two 12-foot wide lanes plus varying width sidewalk and green space in each direction. The Bethesda Downtown Plan recommends bike lanes given the anticipated level of activity in that area of the Pearl District. The proposed typical section would include two ten-foot wide travel lanes plus an eight-foot wide two-way cycle track, separated by a monolithic median. Widening would occur to the east to accommodate these improvements. **Figure 5-5** shows the proposed Pearl Street typical section.

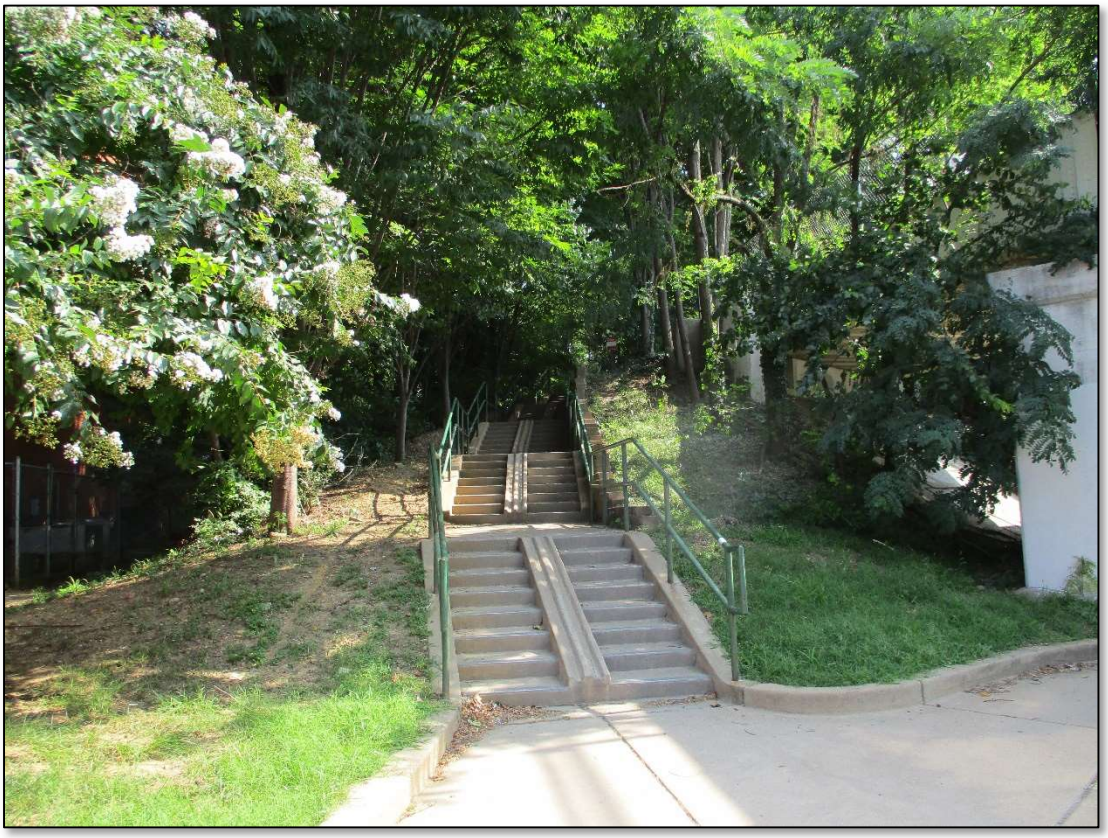
Figure 5-5: Proposed Pearl Street Typical Section



5.2.5 Trail Connection between Bradley Boulevard and Capital Crescent Trail

The northwest side of the Bradley Boulevard/Capital Crescent Trail Bridge includes an existing stairway, shown in **Figure 5-6**. The *Bethesda Downtown Plan* recommends a new ADA-compliant bicycle ramp at this location to better facilitate the connection between the existing regional bikeway (Capital Crescent Trail) and a recommended regional bikeway along Bradley Boulevard. Based on ADA Guidelines, the proposed eight-foot wide ramp would include with a 12:1 running slope with a five-foot long landing between each 30-foot long running section to accommodate the elevation difference. The proposed improvement is shown on **Figure 5** in **Appendix B**.

Figure 5-6: Existing Connection to Capital Crescent Trail



5.2.6 North Bethesda Trail between Rugby Avenue and the NIH Campus

The North Bethesda Trail provides a critical regional trail connection between Downtown Bethesda and Rockville via White Flint. This section of the trail currently features substandard width of six feet for a shared use path. The Bethesda Downtown Plan recommends that the trail be widened to a width of 12 feet with one-foot wide shoulders on either side.

From Rugby Avenue to Battery Lane, the existing trail will be widened equally on each side to achieve the recommended width. Just north of Battery Lane, the proposed widening would occur to the west to minimize impacts to the adjacent senior living community. As the trail moves to the north, the widening would occur to the east to avoid impacts to an adjacent large concrete culvert and stream channel.

Additionally, pedestrian-scaled lighting was included in the cost to reflect its importance as a regional connection. **Figure 5-7** shows a photograph of the existing North Bethesda Trail and **Figure 5-8** shows the proposed North Bethesda Trail typical section.

Figure 5-7: Existing North Bethesda Trail

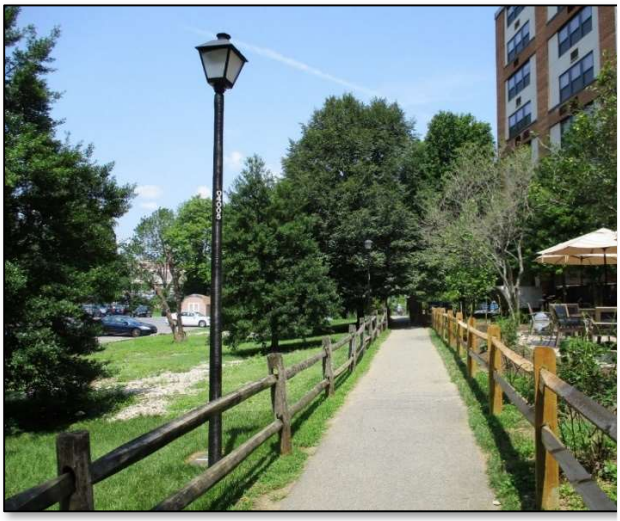
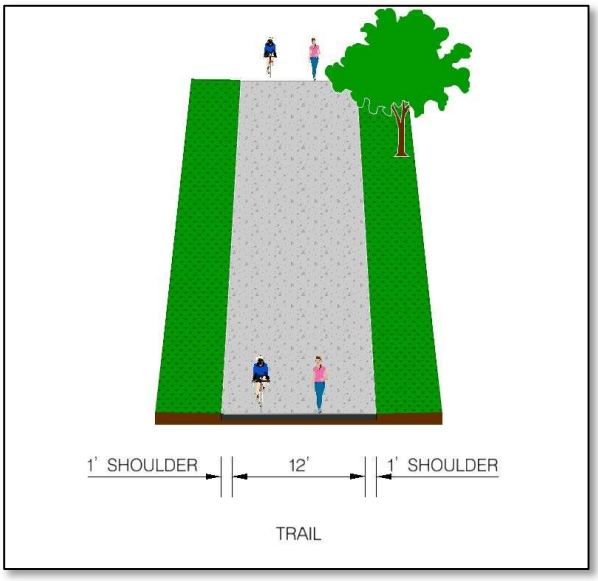


Figure 5-8: Proposed North Bethesda Trail Typical Section



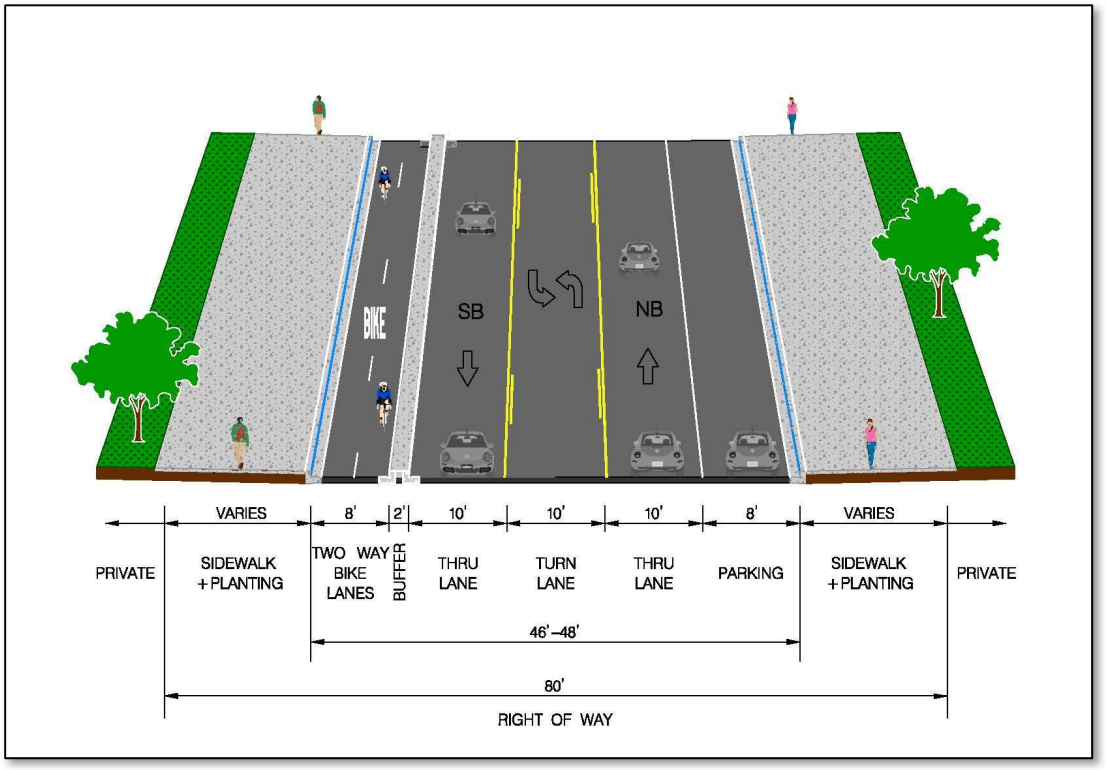
5.2.7 Woodmont Avenue from Battery Lane to Norfolk Avenue

Proposed bicycle improvements along Woodmont Avenue would improve north-south connectivity on the west side of the Sector Plan area.

The existing typical section of Woodmont Avenue includes one ten-foot wide through lane in each direction, one eight to ten-foot wide off-peak parking lane in each direction, plus one ten-foot wide center turn lane from Battery Lane to Norfolk Avenue.

The proposed improvements would eliminate the southbound off-peak parking lane to accommodate an eight-foot wide two-way bicycle lane with a monolithic median along the west side of the roadway. **Figure 5-9** shows the proposed typical section.

Figure 5-9: Proposed Woodmont Avenue Typical Section



5.2.8 Old Georgetown Road from Woodmont Avenue to Wisconsin Avenue

Proposed bicycle treatments along Old Georgetown Road and East-West Highway would improve east-west connectivity across Wisconsin Avenue.

Old Georgetown Road is one-way westbound, and the existing typical section includes two 12-foot wide through lanes from Woodmont Avenue to Wisconsin Avenue. A 12-foot wide off-peak parking lane is included on the north side of the roadway and a 12-foot wide full-time parking lane is included on the south side of the roadway. On the south side of the roadway at the intersection of Old Georgetown Road and Woodmont Avenue, the curb bumps out to create a pedestrian plaza.

The proposed improvements would include three ten-foot wide through lanes, one eight-foot wide full-time parking lane on the south side of the roadway, and an eight-foot wide two-way bicycle lane with a monolithic median on the north side of the roadway from Woodmont Avenue to Commerce Lane and three ten-foot wide through lanes and an eight-foot wide two-way bicycle lane with a monolithic median on the north side of the roadway from Commerce Lane to Wisconsin Avenue. The off-peak parking lane would be eliminated in order to accommodate these improvements. **Figures 5-10** and **5-11** show the proposed typical sections.

Figure 5-10: Proposed Old Georgetown Road Typical Section from Woodmont Avenue to Commerce Lane

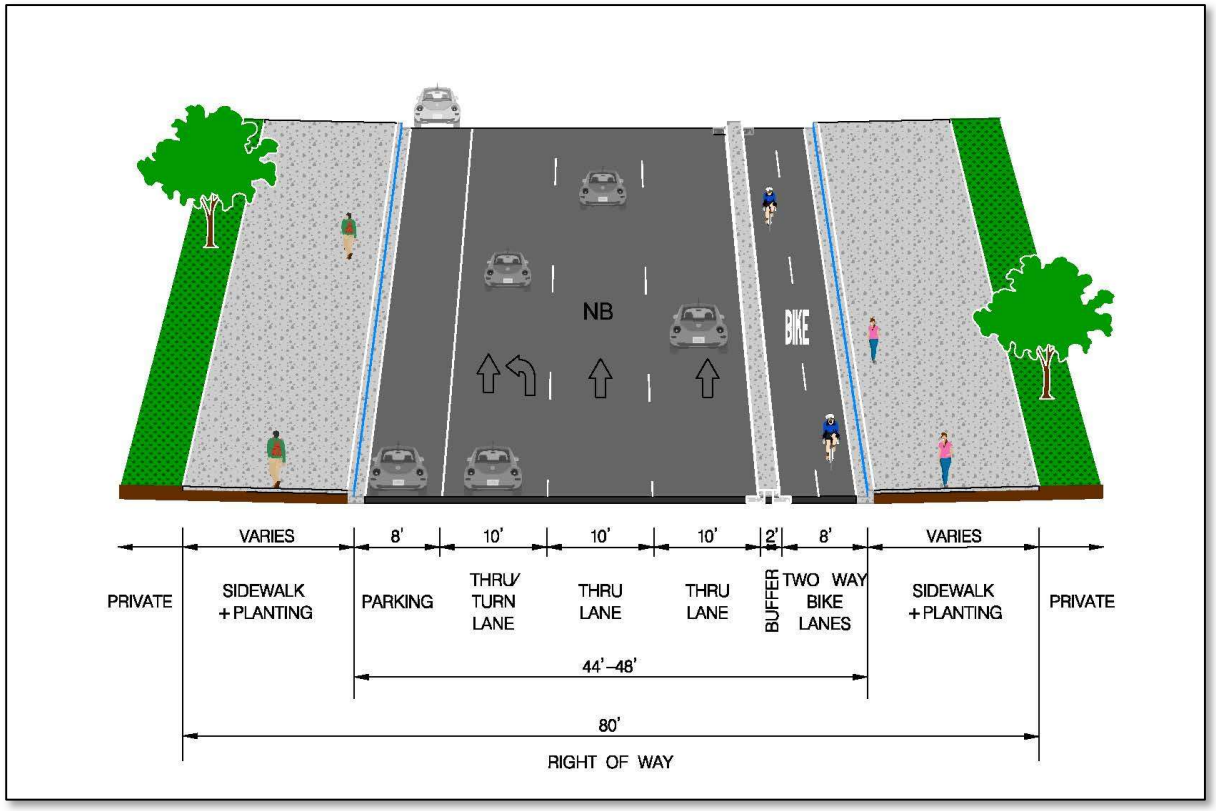
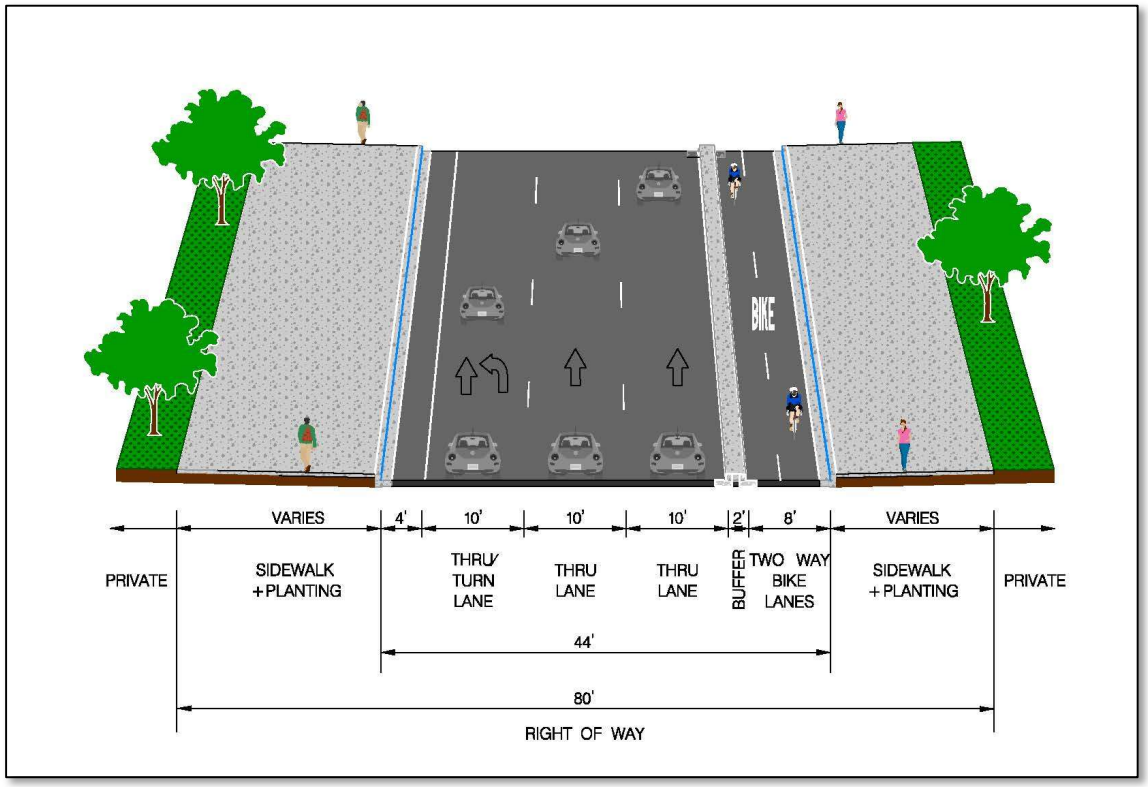


Figure 5-11: Proposed Old Georgetown Road Typical Section from Commerce Lane to Wisconsin Avenue

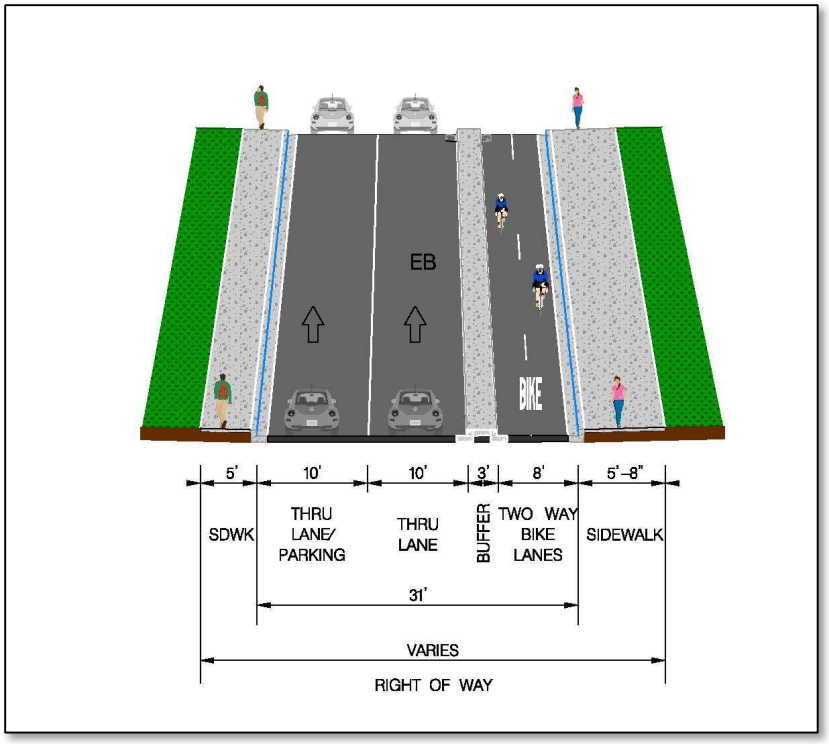


5.2.9 Montgomery Avenue from Pearl Street to East-West Highway

Montgomery Avenue is a one-way eastbound roadway with three ten to 11-foot wide lanes. Off-peak parking is accommodated in the southernmost travel lane from Pearl Street to about 500 feet east of Pearl Street.

The proposed improvements would eliminate the southernmost through and off-peak parking lane to accommodate an eight-foot wide two-way bicycle lane with a monolithic median. **Figure 5-12** shows the proposed typical section.

Figure 5-12: Proposed Montgomery Avenue Typical Section

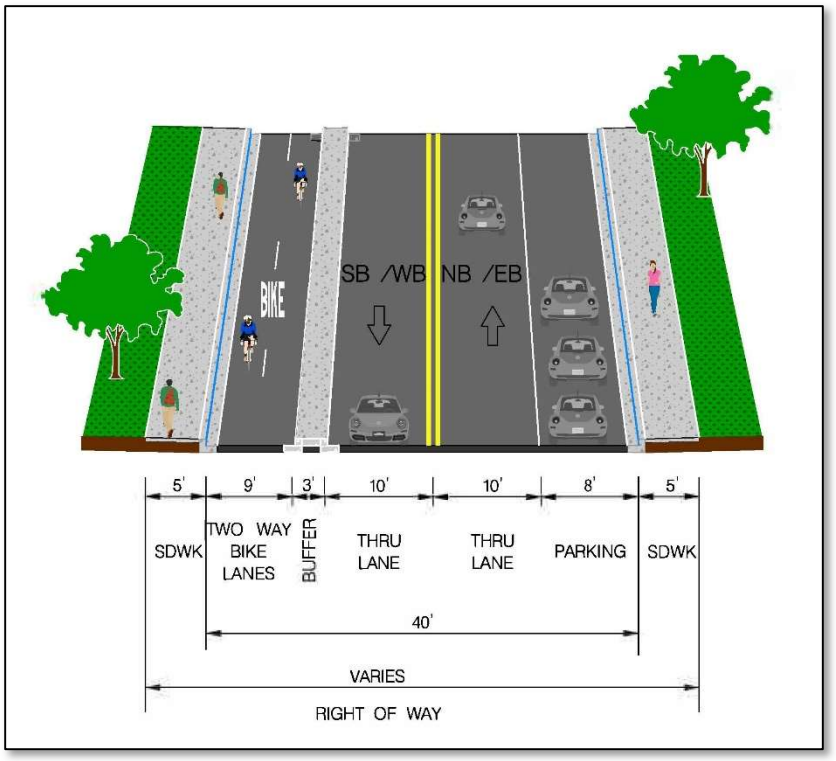


5.2.10 Battery Lane from Old Georgetown Road to Wisconsin Avenue

The existing typical section of Battery Lane includes two 11-foot wide through lanes plus a five-foot wide shoulder and bike lane in each direction plus an eight-foot wide parking lane on the north side for the roadway from Old Georgetown Road to Woodmont Avenue, and four ten-foot wide through lanes in each direction from Woodmont Avenue to Wisconsin Avenue.

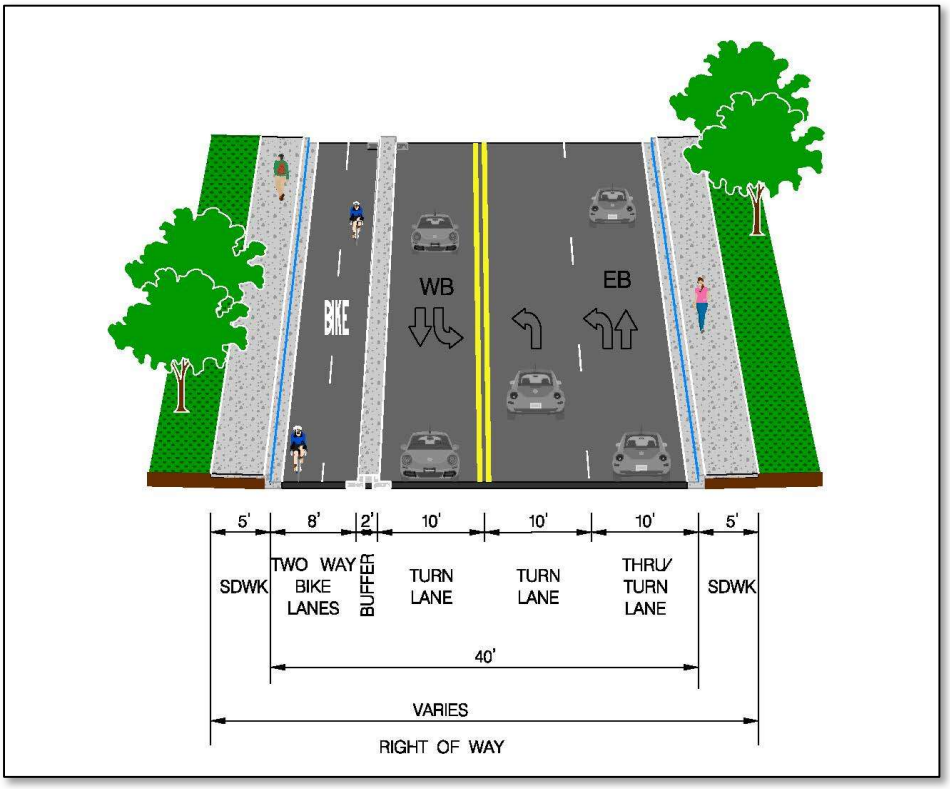
From Old Georgetown Road to Woodmont Avenue, the proposed improvements would include an nine-foot wide two-way bicycle lane with a monolithic median along the south side of the roadway, a ten-foot wide travel lane in each direction plus an eight-foot wide parking lane on the north side for the roadway. **Figure 5-13** shows the proposed typical section.

Figure 5-13: Proposed Battery Lane Typical Section from Old Georgetown Road to Woodmont Avenue



From Woodmont Avenue to Wisconsin Avenue, the proposed improvements would include an eight-foot wide two-way bicycle lane with a monolithic median along the south side of the roadway, one westbound ten-foot wide through and turn lane, and two eastbound ten-foot wide through and turn lanes. **Figure 5-14** shows the proposed typical section.

Figure 5-14: Proposed Battery Lane Typical Section from Woodmont Avenue to Wisconsin Avenue

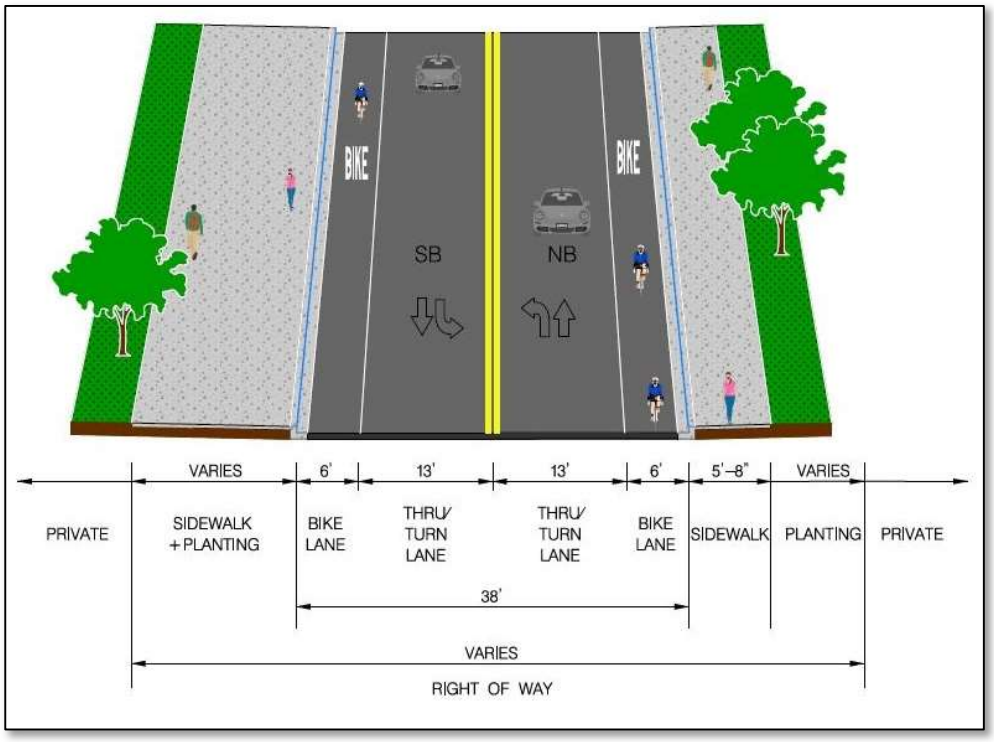


5.2.11 Waverly Street from East-West Highway to Montgomery Avenue

The existing typical section of Waverly Street includes two 13-foot wide through/turn lanes in each direction plus a six-foot wide shoulder.

The proposed improvements would convert the shoulder to a six-foot wide striped bike lane as per the Bicycle Master Plan. **Figure 5-15** shows the proposed typical section.

Figure 5-15: Proposed Waverly Street Typical Section

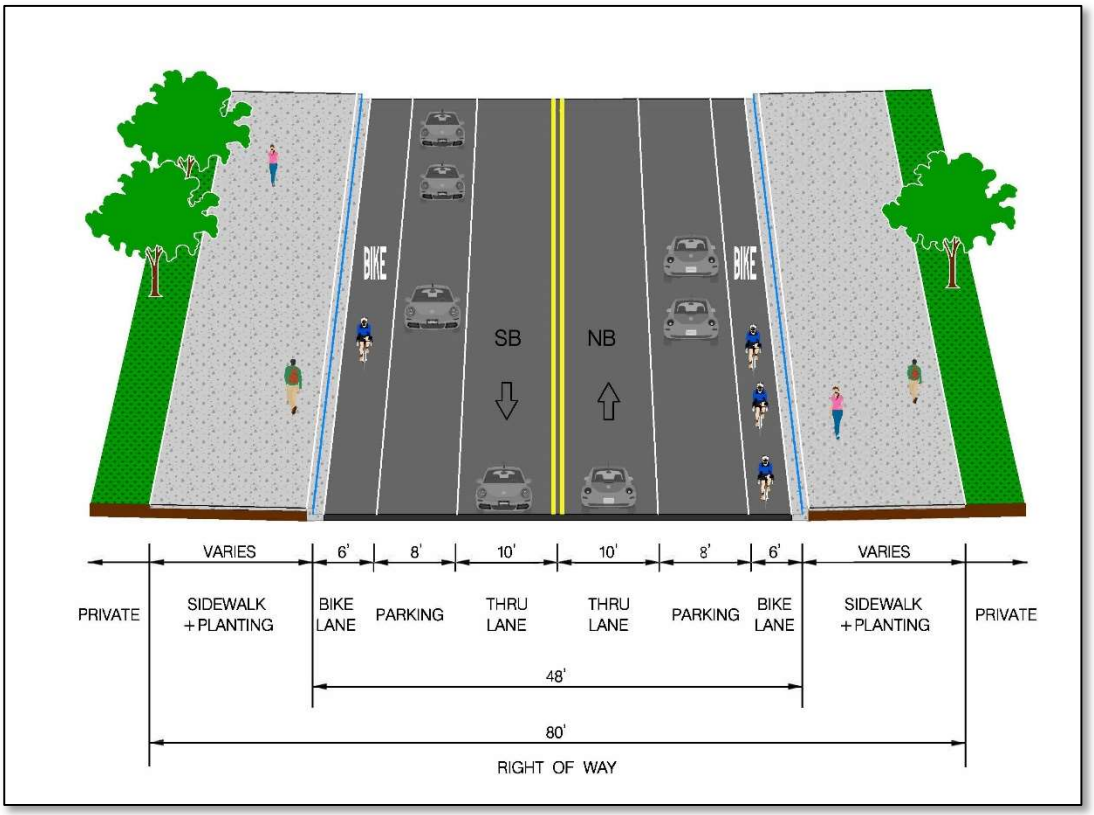


5.2.12 St. Elmo Avenue from Wilson Lane to Woodmont Avenue

The existing typical section of St. Elmo Avenue includes two 12-foot wide through lanes plus two 12-foot wide parking lanes in each direction.

The proposed improvements would narrow the through lanes to ten feet wide and the parking lanes to eight feet wide to accommodate a six-foot wide striped bike lane on each side of the roadway. **Figure 5-16** shows the proposed typical section.

Figure 5-16: Proposed St. Elmo Avenue Typical Section



5.2.13 Protected Intersections

Protected intersections are four-way intersection treatments which improve safety by including features to increase the visibility of pedestrians and bicyclists and slowing down turning drivers and cyclists. The first protected intersection has been completed in Silver Spring, and several more proposed around the County, including in Downtown Bethesda in the following locations:

- East-West Highway at Montgomery Avenue
- East-West Highway at Old Georgetown Road / Wisconsin Avenue
- Old Georgetown Road at Commerce Lane
- Old Georgetown Road at Woodmont Avenue
- Edgemoor Lane at Woodmont Avenue
- Edgemoor Lane at Commerce Lane
- Woodmont Avenue at Bethesda Avenue

5.2.14 Bicycle Parking

Bicycle parking facilities provide safe and convenient storage adjacent to key destinations and makes cycling more convenient and attractive to use. The following bicycle parking facilities are proposed:

- Long-term bicycle parking facility at the Bethesda Metrorail Station North entrance
- Short-term bicycle racks throughout the Central Business District
- Furnish equipment for the recently constructed space at the Bethesda Metrorail Station

5.2.15 Projects Currently in MCDOT Program

Bicycle and pedestrian projects already being designed and/or constructed as part of MCDOT's program have been included in this cost analysis. These projects are:

- Capital Crescent Surface Trail (Bethesda Avenue / Willow Lane) from Woodmont Avenue to 47th Street
- Separated bike lanes along Norfolk Avenue / Cheltenham Drive from Woodmont Avenue to Tilbury Street
- Separated bike lanes along Montgomery Lane / Montgomery Avenue from Woodmont Avenue to Pearl Street
- Separated bike lanes along Woodmont Avenue from Norfolk Avenue south to Wisconsin Avenue

6 Cost Estimates

The cost estimate methodology to generate the Unified Mobility Program fee is described in the following sections.

6.1 Transit Improvements

Capital costs for the full universe of potential transit improvements described in **Chapter 4** are summarized below by capital cost category and more information on transit cost estimates are included in **Appendix A**. **Table 6-1** includes capital costs associated with vehicles. This data is further broken out by origin concentration and potential improvement.

Table 6-1: Vehicle-Related Capital Costs – Full Universe of Potential Improvements

Trip Origin Concentration	Transit Improvement	Required Vehicles to Meet Service	Vehicle Type	Cost per Vehicle	Total Cost	Total Cost through 2040*
Olney/Aspen Hill/Georgia Avenue Corridor	Express Service to Shady Grove	3	40-foot coach	$535,000	$1,605,000	$4,815,000
Layhill Road/Wheaton Corridor	Express Service to White Flint	7	60-foot articulated coach	$875,000	$6,125,000	$18,375,000
Veirs Mill Corridor	Service Frequency Improvements on Ride On 34	1	40-foot coach	$535,000	$535,000	$1,605,000
MD 355 Corridor	Extend Ride On 101 to downtown Bethesda from Medical Center Extend Service to mid-day from current peak only	1	40-foot coach	$535,000	$535,000	$1,605,000
Potomac to I-270 Arc	Service Frequency Improvements on Ride On 29, 32, 47	8	40-foot coach	$535,000	$4,280,000	$12,840,000
	Limited Stop Service – Westfield Montgomery Mall to Bethesda	5	60-foot articulated coach	$875,000	$4,375,000	$13,125,000
Close-In Beltway Adjacent and Inside Beltway	Service Frequency Improvements on Ride On 30, 36	5	40-foot coach	$535,000	$2,675,000	$8,025,000
	Micro Transit Network	36	12-seat bus	$150,000	$5,400,000	$16,200,000
	Expanded Bethesda Circulator	3	20-seat bus	$250,000	$750,000	$2,250,000
Washington DC	Extend 30s Line Trips to Bethesda from Friendship Heights	2	Metrobus 40-foot coach	$535,000	$1,070,000	$3,210,000
Total Vehicle-Related Capital Costs – Potential Improvements					**$27,350,000**	**$82,050,000**

*This cost reflects the fact that vehicles will need to be replaced through 2040, the horizon year for the analysis. Based on a ten-year life of a vehicle, vehicles will need to be purchased three times through 2040.

Table 6-2 outlines capital costs associated with the construction of potential new park and ride capacity needed to support proposed transit improvements.

Table 6-2: Park and Ride Expansion Construction Costs

Trip Origin Concentration	Transit Improvement	Number of Additional Space	Cost per Space	Total Cost
Howard County – U.S. 29 Corridor	Expand Park and Ride – Support Riders on Existing and Future Service	350 (structured)	$25,000	$8,750,000
Olney/Aspen Hill/Georgia Avenue Corridor	New Express Service to Shady Grove Metrorail Station	100 (surface)*	$8,000	$800,000
Potomac to I-270 Arc	Westfield Montgomery to Bethesda Limited Stop Service	800 (structured)	$25,000	$20,000,000
			Total Park and Ride Expansion Construction Cost	**$29,550,000**

* Land costs for this option are included in Table 6-3

Table 6-3 contains the capital costs associated with land purchases that will be used for potential park and ride expansion.

Table 6-3: Park and Ride Expansion Land Costs

Trip Origin Concentration	Transit Improvement	Number of Acres	Cost per Acre (undeveloped)	Total Cost
Olney/Aspen Hill/Georgia Avenue Corridor	New Express Service to Shady Grove Metrorail Station	2	$100,000	$200,000
			Total Park and Ride Expansion Land Cost	**$200,000**

Table 6-4 outlines the capital costs associated with potential additional operations and maintenance capacity required to support the additional vehicles added to the Ride On fleet to support the new potential transit services described in **Chapter 4**.

Table 6-4: Operations & Maintenance Facility Expansion to Accommodate Additional Vehicles

Number of Additional Vehicles to Provide Service*	Estimated Cost per Vehicle	Total Cost
30	$700,000	$21,000,000

* This total only includes 40-foot and 60-foot coaches that would be run by Ride On. 12-seat passenger buses to run the Bethesda micro transit network and the 20 seat vehicles to run the expanded Bethesda Circulator are not included. The two Metrobus vehicles on the extended Metrobus 30s Line are also not included.

Table 6-5 shows the estimated right-of-way and construction costs to implement transit priority and station improvements between the Bethesda Metrorail Station and the Grosvenor Metrorail Station in support of the planned Bus Rapid Transit system along MD 355, the Flash.

Table 6-5: Capital Cost for BRT along MD 355

Improvement	Estimated Capital Cost
Transit priority and station improvements to Support the Flash Bus Rapid Transit System on MD 355 – Bethesda Metrorail Station to Grosvenor Metrorail Station	$18,000,000

Tables 6-1 through 6-5 show the estimated capital costs of each element of the full universe of potential transit improvements to support the increased non-auto mode share for trips to downtown Bethesda.

Table 6-6 provides the total capital costs associated with just those improvements that were selected to be part of the final set of improvements to increase non-auto mode share. This represents the capital costs that will be incorporated into the final per-trip fee for downtown Bethesda development.

Table 6-6: Capital Costs for Transit Improvements Selected from Full Universe of Potential Improvements for Implementation

Improvement	Capital Cost Items	Total Estimated Capital Cost
Flash Bus Rapid Transit	Implement Transit Priority Improvements in Support of BRT The Flash	$18,000,000
Burtonsville P&R – U.S. 29 Corridor	Expand Burtonsville Park and Ride to Accommodate Increased Demand (requires structured parking)	$8,750,000
Implement Micro-Transit Network	Vehicles Required for Service	$16,200,000
Extend 30s Line to Downtown from Friendship Heights to Downtown Bethesda	Additional Vehicles Required for Extension	$3,210,000
Expanded Bethesda Circulator	Vehicles Required for Service	$2,250,000
	Total Transit Improvements	**$48,410,000**

6.2 Intersection and Pedestrian/Bicycle Improvements

Tables 6-7 through 6-9 include the intersections and pedestrian/bicycle improvement locations with identified treatments and cost estimates as described in **Chapter 5**.

The cost estimates were developed using MDOT SHA's Major Quantities Estimate for the Conceptual Cost Estimates. It includes contingency factors for items that do not have enough details to develop estimate quantities such as maintenance of traffic (MOT); drainage and stormwater management; utilities; and landscape and environmental design.

In addition, due to the preliminary nature of this design, an overall project contingency of 50 percent was added. These contingencies were applied before adding in estimated right-of-way costs.

Detailed Cost Estimates for the proposed intersection and pedestrian/bicycle improvements are included in **Appendix D**.

It is expected that all values, particularly items covered by contingencies, could change should a project enter into detailed design. Future reassessment of project costs would be expected to consider the most accurate and precise information available, refining these costs over time and adjusting the associated Unified Mobility Program fee accordingly.

Table 6-7: Proposed Intersection Improvement Costs

Location	Proposed Improvement	Estimated Cost
Rockville Pike and Jones Bridge Road	Lane Reconstruction	$517,700
East-West Highway and Connecticut Avenue	Additional lanes	$4,137,400
Connecticut Avenue and Bradley Lane	Additional lanes	$4,162,200
Woodmont Avenue and Bethesda Avenue	Intersection Pedestrian Improvements	$1,121,300
TOTAL PROPOSED INTERSECTION IMPROVEMENT COSTS		**$9,938,600**

Table 6-8: Proposed Pedestrian/Bicycle Improvement Costs

Location	Proposed Improvement	Estimated Cost
Bradley Boulevard from Glenbrook Road to Wisconsin Avenue	Separated bike lanes	$6,726,500
Norfolk Avenue from Battery Lane Urban Park to Woodmont Avenue	Shared street	$4,522,200
Arlington Road from Old Georgetown Road to Bradley Boulevard	Separated bike lanes	$2,994,900
Pearl Street from Montgomery Avenue to Sleaford Road	Separated bike lanes	$3,242,300
Trail connections between Bradley Boulevard and Capital Crescent Trail	ADA compliant Trail Connection	$2,307,800
North Bethesda Trail between Rugby Avenue and the NIH campus	Trail widening; Pathway lighting	$2,029,400
Woodmont Avenue from Battery Lane to Norfolk Avenue	Separated bike lanes	$552,600
Old Georgetown Road from Woodmont Avenue to Wisconsin Avenue	Separated bike lanes	$363,700
Montgomery Avenue from Pearl Street to East-West Highway	Separated bike lanes	$224,300
Battery Lane from Old Georgetown Road to Wisconsin Avenue	Bike lane	$422,500
Waverly Street from East-West Highway to Montgomery Avenue	Bike lane	$50,000
St. Elmo Avenue from Wilson Lane to Woodmont Avenue	Shared roadway	$262,400
Capital Crescent Surface Trail (Bethesda Avenue / Willow Lane) from Woodmont Avenue to 47th Street	Off-Street Trail	$1,449,000
Norfolk Avenue / Cheltenham Drive from Woodmont Avenue to Tilbury Street	Separated bike lanes	$387,600
Montgomery Lane / Montgomery Avenue from Woodmont Avenue to Pearl Street	Separated bike lanes	$1,004,000
Woodmont Avenue from Norfolk Avenue south to Wisconsin Avenue	Separated bike lanes	$1,860,000
Bicycle Amenities at Bethesda Metrorail Station	Bicycle Parking	$400,000
Long-term Bicycle Parking Facility at Bethesda Metrorail North Entrance/ Bus Bays	Bicycle Parking	$517,500
Short-term Bicycle Racks throughout the CBD	Bicycle Parking	$166,250
18 Bikeshare stations	Bikeshare	$1,608,500
TOTAL PROPOSED PEDESTRIAN/BICYCLE IMPROVEMENT COSTS		**$29,642,450**

Table 6-9: Proposed Protected Intersection Costs

Location	Estimated Cost
East-West Highway and Montgomery Avenue	$500,000
East-West Highway and Old Georgetown Road / Wisconsin Avenue	$500,000
Old Georgetown Road and Commerce Lane	$500,000
Old Georgetown Road and Woodmont Avenue	$500,000
Edgemoor Lane and Woodmont Avenue	$500,000
Edgemoor Lane and Commerce Lane	$500,000
Woodmont Avenue and Bethesda Avenue	$500,000
TOTAL PROPOSED PROTECTED INTERSECTION COSTS	**$3,500,000**

7 Fee Calculation

7.1 Costs included in UMP Fee

In coordination with MCDOT staff the following projects are suggested for inclusion into the UMP. The omission of other projects identified in **Chapter 4** and in **Sections 5.1 and 5.2** of this report is not to imply that they will not proceed, but that they are not strictly necessary to achieve SSP adequacy or are already fully funded for design and construction. The proposed transit improvements and their associated costs that are included in the fee calculation are included below in **Table 7-1** and the intersection and pedestrian/bicycle improvements and their associated costs that are included in the fee calculation are included below in **Table 7-2.**

Table 7-1: Transit Improvement Capital Costs Included in UMP Fee

Location	Proposed Improvement	Estimated Cost
FLASH Bus Rapid Transit	Implement Transit Priority Improvements in Support of BRT The Flash	$18,000,000
Extend 30s Line to Downtown from Friendship Heights to Downtown Bethesda	Additional Vehicles Required for Extension	$3,210,000
Implement Micro-Transit Network	Vehicles Required for Service	$16,200,000
Burtonsville Park and Ride – US 29 Corridor	Expand Burtonsville Park and Ride to Accommodate Increased Demand (requires structured parking)	$8,750,000
Expanded Bethesda Circulator	Vehicles Required for Service	$2,250,000
Operations & Maintenance Facility Expansion	Accommodation of three additional Circulator vehicles	$2,100,000
TOTAL PROPOSED TRANSIT IMPROVEMENT COSTS		**$50,510,000**

Table 7-2: Intersection and Pedestrian/Bicycle Capital Costs Included in UMP Fee

Location	Proposed Improvement	Estimated Cost
Rockville Pike and Jones Bridge Road	Lane Restriping	$517,700
East-West Highway and Connecticut Avenue	Additional lanes	$4,137,400
Connecticut Avenue and Bradley Lane	Additional lanes	$4,162,200
Bradley Boulevard from Glenbrook Road to Wisconsin Avenue	Separated bike lanes	$6,726,500
Norfolk Avenue from Battery Lane Urban Park to Woodmont Avenue	Shared street section	$4,522,200
Arlington Road from Old Georgetown Road to Bradley Boulevard	Separated bike lanes	$2,994,900
Pearl Street from Montgomery Avenue to Sleaford Road	Separated bike lanes	$3,242,300
Trail connections between Bradley Boulevard and Capital Crescent Trail	ADA compliant Trail Connection	$2,307,800
North Bethesda Trail between Rugby Avenue and the NIH campus	Trail widening; Pathway lighting	$2,029,400
Woodmont Avenue from Battery Lane to Norfolk Avenue	Separated bike lanes	$552,600
Montgomery Avenue from Pearl Street to East-West Highway	Separated bike lanes	$224,300
Battery Lane from Old Georgetown Road to Wisconsin Avenue	Bike lane	$422,500
St. Elmo Avenue from Wilson Lane to Woodmont Avenue	Shared roadway	$262,400
Norfolk Avenue / Cheltenham Drive from Woodmont Avenue to Tilbury Street	Separated bike lanes	$387,600
Bicycle Amenities at Bethesda Metrorail Station	Bicycle Parking	$400,000
Long-term Bicycle Parking Facility at Bethesda Metrorail North Entrance/ Bus Bays	Bicycle Parking	$517,500
Short-term Bicycle Racks throughout the CBD	Bicycle Parking	$166,250
18 Bikeshare stations	Bikeshare	$1,608,500
East-West Highway at Montgomery Avenue	Protected Intersection	$500,000
Old Georgetown Road at Woodmont Avenue	Protected Intersection	$500,000
Edgemoor Lane at Woodmont Avenue	Protected Intersection	$500,000
Proposed ADA Fee		$770,000
TOTAL PROPOSED INTERSECTION AND PEDESTRIAN/BICYCLE IMPROVEMENT COSTS		**$37,452,050**

In order to calculate the UMP fee, the cost of the proposed improvements included in **Tables 7-1 and 7-2** were added together. In addition, a cost to provide updates to the UMP fee every six years at $100,000 per analysis resulting in a $400,000 total cost, has been included in the total.

Total Proposed Transit Improvement Costs	$50,510,000
Total Intersection and Pedestrian/Bicycle Improvement Costs	$37,452,050
UMP Updates (Every six years @ $100,000/analysis)	$400,000
Total	**$88,362,050**

7.2 Trip Generation

In order to develop the UMP Fee, vehicle-trip generation rates were developed specifically for downtown Bethesda for each of the land use types found in the area in coordination with M-NCPPC and is based on information reported in the *Bethesda Downtown Master Plan Transportation Appendix*[4] (pp. 15 and 19) and the *Bethesda Downtown Development Monitoring and Tracking Program*[5]. Using the mode split assumptions included in the *Local Area Transportation Review Guidelines*[6], the vehicle-trip generation rates were used to develop person-trip rates and ultimately vehicle-trips and person-trips. These values are shown in **Table 7-3**.

Table 7-3: Downtown Bethesda Vehicle-Trip and Person-Trip Generation Rates

Land Use Type	Unit*	Amount of Units	Vehicle-Trip Rate**	Vehicle-Trips	Person-Trip Rate**	Person-Trips
Single Family	DU	606	0.78 /unit	474	1.25 /unit	758
Multi-Family	DU	17,351	0.15 /unit	2,604	0.24 /unit	4,167
Office	GSF	8,619,126	0.55 /kSF	4,724	0.74 /kSF	6,367
Retail	GSF	6,211,780	3.00 /kSF	18,643	4.16 /kSF	25,857
Industrial	GSF	191,525	0.39 /kSF	75	0.53 /kSF	101
Other	GSF	936,943	0.74 /kSF	691	1.00 /kSF	934

* Units measured in Gross Square Feet (GSF) or Dwelling Units (DU)
** kSF is kilo-Square Footage, where 1 kSF is equal to 1000 GSF

[4] http://www.montgomeryplanning.org/community/bethesda_downtown/documents/BDP_TechnicalAppendix_E.pdf
[5] https://montgomeryplanning.org/planning/communities/downcounty/bethesda-downtown-plan/bethesda-downtown-development-tracking/
[6] https://montgomeryplanning.org/wp-content/uploads/2017/12/LATR-Guidelines-Production-Final_122017-PRODUCTION-WEB.pdf#https://montgomeryplanning.org/wp-content/uploads/2017/12/LATR-Guidelines-Production-Final_122017-PRODUCTION-WEB.pdf#page=54

7.3 UMP Fee Estimation

Dividing the total cost of the proposed improvements as shown in **Section 7.1** by the trip rates shown in **Table 7-3**, the UMP fee can be estimated in $/person-trip and $/vehicle-trip. This is shown in **Table 7-4**.

Table 7-4: UMP Fees ($/Person-Trip and $/Vehicle-Trip)

Total Cost of Proposed Improvements	Person-Trips		Vehicle-Trips	
	Total Person-Trips	UMP ($/Person-Trip)	Total Vehicle-Trips	UMP ($/Vehicle-Trip)
$88,362,050	*38,184*	**$2,314**	*27,211*	**$3,247**

The UMP rates in **Table 7-4** allow for a direct conversion of the fee ($/($/person-trip fee estimate and a $/vehicle-trip fee estimate) and land uses (trips per unit) into a value in $/unit. **Table 7-5** shows the resulting UMP fee per unit.

Table 7-5: UMP Fee Per Unit

Land Use Type	Unit*	UMP ($/Unit) (Using Person-Trips)	UMP ($/Unit) (Using Vehicle-Trips)
Single Family	DU	$2,896	$2,540
Multi-Family	DU	$556	$487
Office	GSF	$1.71	$1.78
Retail	GSF	$9.63	$9.75
Industrial	GSF	$1.22	$1.27
Other	GSF	$2.31	$2.40

* Units measured in Gross Square Feet (GSF) or Dwelling Units (DU)

An applicant can use this table to estimate the trips being generated by the existing land use as well as the proposed land use. Subtracting the existing land use condition from the proposed land use condition yields the total fee due. If there is a net reduction in trips from existing conditions (i.e., if the existing trip generation is greater than the proposed trip generation), then the LATIP fee due is zero.

Reductions for internal capture and pass-by trips are already accounted for by the Local Area Model trip generation rates.

Appendices

Appendix A

Traffic Information

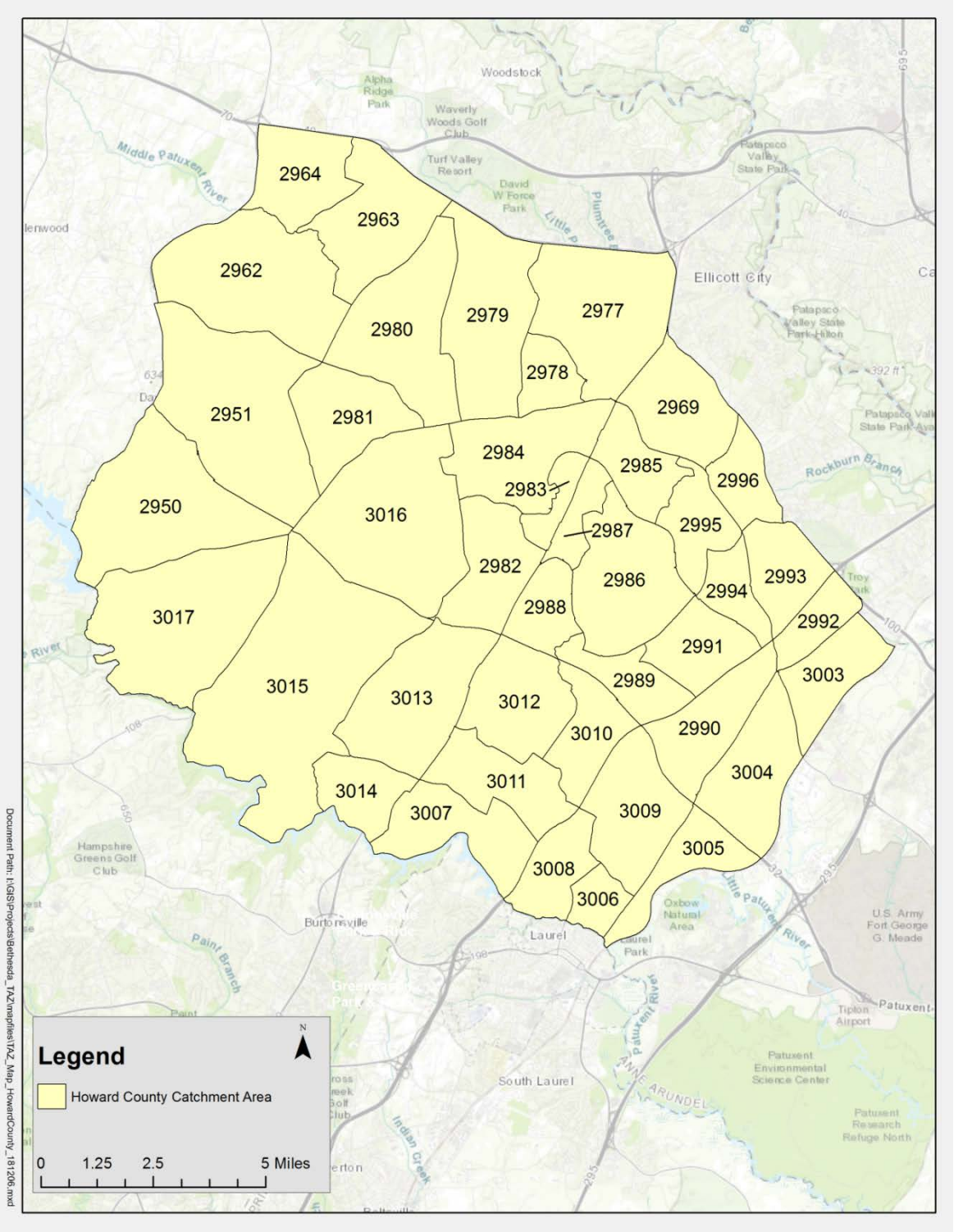
1 Howard County – US 29 Corridor Improvements

This Appendix section contains backup technical data on the analysis used to estimate the number of additional parking spaces that would be required at the Burtonsville Park and Ride Lot to accommodate the additional demand for trips to Bethesda.

Included first in Figure A-1 is a map of the TAZs that are included in the Park and Ride's catchment area in Howard County. These TAZs correspond to the concentrations of trips destined for Bethesda that are displayed in **Figure 3-1** in the body of the report.

The second piece of technical data is a table (**Table A-1**) containing the number of trips destined for downtown Bethesda from each of the TAZs in the Howard County catchment area as displayed in **Figure A–1**. The number of additional required spaces at Burtonsville is based on the assumption that 20% of trips destined for downtown Bethesda will take advantage of the improved transit opportunities presented by the U.S. 29 BRT and the Purple Line, which in turn identifies the number of new parking spaces that will be required for these new transit trips.

Figure A-1: Burtonsville Park and Ride Howard County Catchment Area



Source: MWCOG Regional Model – TAZ Structure

Table A-1: Howard County Catchment Area Trips to Bethesda by TAZ

Catchment Area TAZ	Trips to Bethesda
3005	23.87
2964	9.54
2963	10.19
2962	19.66
2980	8.24
2969	35.4
2977	76.54
2978	10.31
2979	24.12
3013	58.69
3014	6.65
3015	70.62
2951	27.19
2950	30.37
2981	9.4
2984	103.6
2983	19.12
2982	71.92
2987	31.32
2991	18.59
2986	120.58
2994	25.74
2995	54.85
3016	176.03
2988	25.96
2989	29.09
3010	33.42
2996	26.5
2993	55.91
2992	30.49
3007	45.67
3012	53.93
3011	54.55
3008	54.15
3009	68.35
3006	65.17
3003	8.23
3004	14.41
2990	36.64
3017	39.94

Catchment Area TAZ	Trips to Bethesda
2985	23.88
TOTAL Trips to Bethesda	1708.83
20% mode share	341.766

Source: MWCOG 2040 Trip Table – All Trip Purposes

2 Olney/ Aspen Hill/ Georgia Avenue Corridor Improvements

This Appendix section contains backup technical data on the analysis used to estimate the number of riders that would utilize new transit service from the Olney area of Montgomery County to downtown Bethesda. This section also includes the backup data on the operating cost estimate for the new service and the backup for the calculation of the number of vehicles needed to provide the service.

Included first in **Figure A-2** is a map of the TAZs that are included in the assumed catchment area for the new service to Bethesda. These TAZs correspond to the concentrations of trips destined for Bethesda from the Olney area as displayed in Figure 1 in the body of the report.

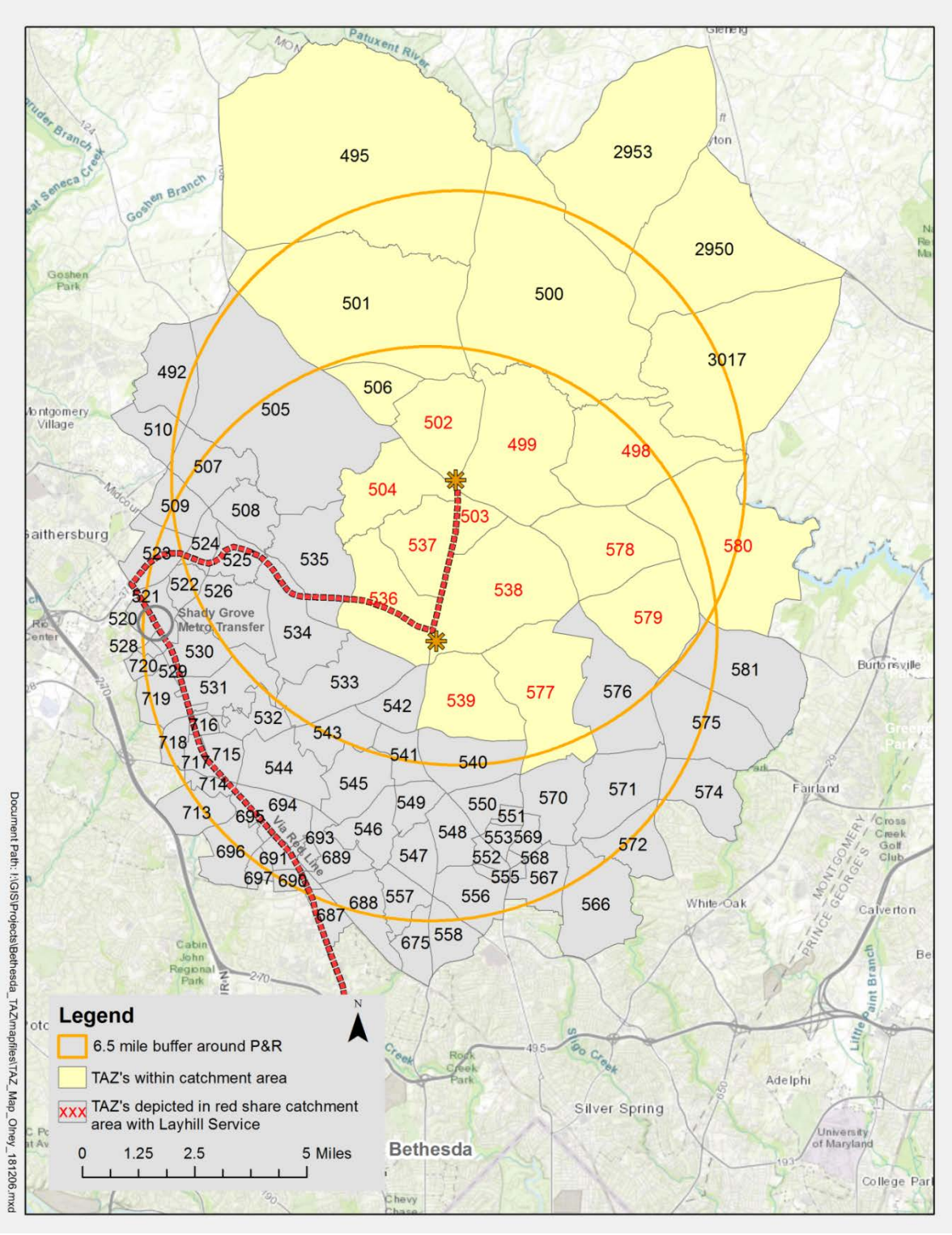
Included next is a table containing the number of trips destined for downtown Bethesda in each of the TAZs within the catchment area displayed in **Figure A-2**. The estimated number of riders that will use the Olney service, as well as the Layhill/Wheaton service outlined in the next report section, is based on the assumed number of total trips to Bethesda from the catchment area that will utilize the new service. In the instance of the Olney service, two different mode share percentages were used in the ridership calculations.

In the first instance, some TAZs in the Olney catchment area also fall into the catchment area of the Layhill/Wheaton service. In the instance where a TAZ falls into catchment area of both the Olney service and the Layhill service, a 10% mode share from that TAZ is assumed on each service (reflecting an overall mode share of 20% for both services combined). In those instances where the TAZ falls only in the catchment area of the Olney service, a mode share of 20% is assumed.

Total riders on the Olney service are estimated to be 200 (400 daily trips). Based on 7 AM peak trips, this would result in an average of 29 boardings per trip.

The final technical backup for this transit improvement is data outlining the estimated operations and maintenance costs and vehicle requirements, as shown in **Table A-4**. The cost estimate is based on the run time of each individual trip between Olney and Shady Grove, which also includes deadhead service back to Olney for the first two vehicles in service in order to provide a second trip later in the AM peak (the service structure in the AM peak, as outlined in the Table, is assumed to be the same in the PM peak).

Figure A-2: Olney/ Aspen Hill/ Georgia Avenue Corridor Catchment Area



Source: MWCOG Regional Model – TAZ Structure

Table A-2: Olney Catchment Area Trips to Bethesda by TAZ

TAZ (Olney Catchment Area Only)	Trips to Bethesda
2953	25.63
2950	30.37
3017	39.94
501	20.55
500	47.27
495	26.05
506	2.17
Total Trips (Olney Catchment Area Only)	191.98
20% mode share	38.40
TAZ (Olney and Layhill Catchment Areas)	**Trips to Bethesda**
503	73.87
580	48.86
577	161.85
504	138.28
499	202.98
502	142.40
578	52.22
579	27.62
498	26.78
539	483.22
536	99.10
538	35.47
537	129.27
Total Trips (Olney and Layhill Catchment Areas)	1621.92
10% mode share	162.19
TOTAL Olney Riders	**200.59**

Source: MWCOG 2040 Trip Table – All Trip Purposes

Table A-3: Olney Service Trip and Service Frequency Requirement

Demand and Headway Requirement	
Total AM Peak Riders	200
Load Standard - Each Trip	35
Required AM Peak Trips	5.71
Peak Period Length - in Minutes	120
Required Frequency - Calculated (minutes)	21.00
Required Frequency - Assumed (minutes)	21.00

Table A-4: Olney Service Operating Cost Estimate/Vehicle Requirement

	Leave Olney	Arrive Shady Grove	Deadhead (Arrive Olney)	Bus #	Revnue Hours	Feeds Into
Trip 1	6:00 AM	6:30 AM	6:50 AM	1	0.83	trip 4
Trip 2	6:20 AM	6:50 AM	7:10 AM	2	0.83	trip 5
Trip 3	6:40 AM	7:10 AM	7:30 AM	3	0.83	trip 6
Trip 4	7:00 AM	7:30 AM	7:50 AM	1	0.83	trip 7
Trip 5	7:20 AM	7:50 AM		2	0.5	pull in
Trip 6	7:40 AM	8:10 AM		3	0.5	pull in
Trip 7	8:00 AM	8:30 AM		1	0.5	pull in
Total Revenue Hours - AM					4.83	
Total Revenue Hours - PM					4.83	
Total Revenue Hours					9.66	
Cost per Revenue Hour					$130	
Total Daily Cost					$1,256	

3 Layhill Road/Wheaton Corridor

This Appendix section contains backup technical data on the analysis used to estimate the number of riders that would utilize new transit service from the Layhill Road/Wheaton corridor area of Montgomery County to downtown Bethesda. This section also includes the backup data on the operating cost estimate for the new service and the backup for the calculation of the number of vehicles needed to provide the service.

Included first in **Figure A-3** is a map of the TAZs that are included in the assumed catchment area for the new service to Bethesda. These TAZs correspond to the concentrations of trips destined for Bethesda from the Layhill Road/Wheaton area as displayed in Figure 1 in the body of the report.

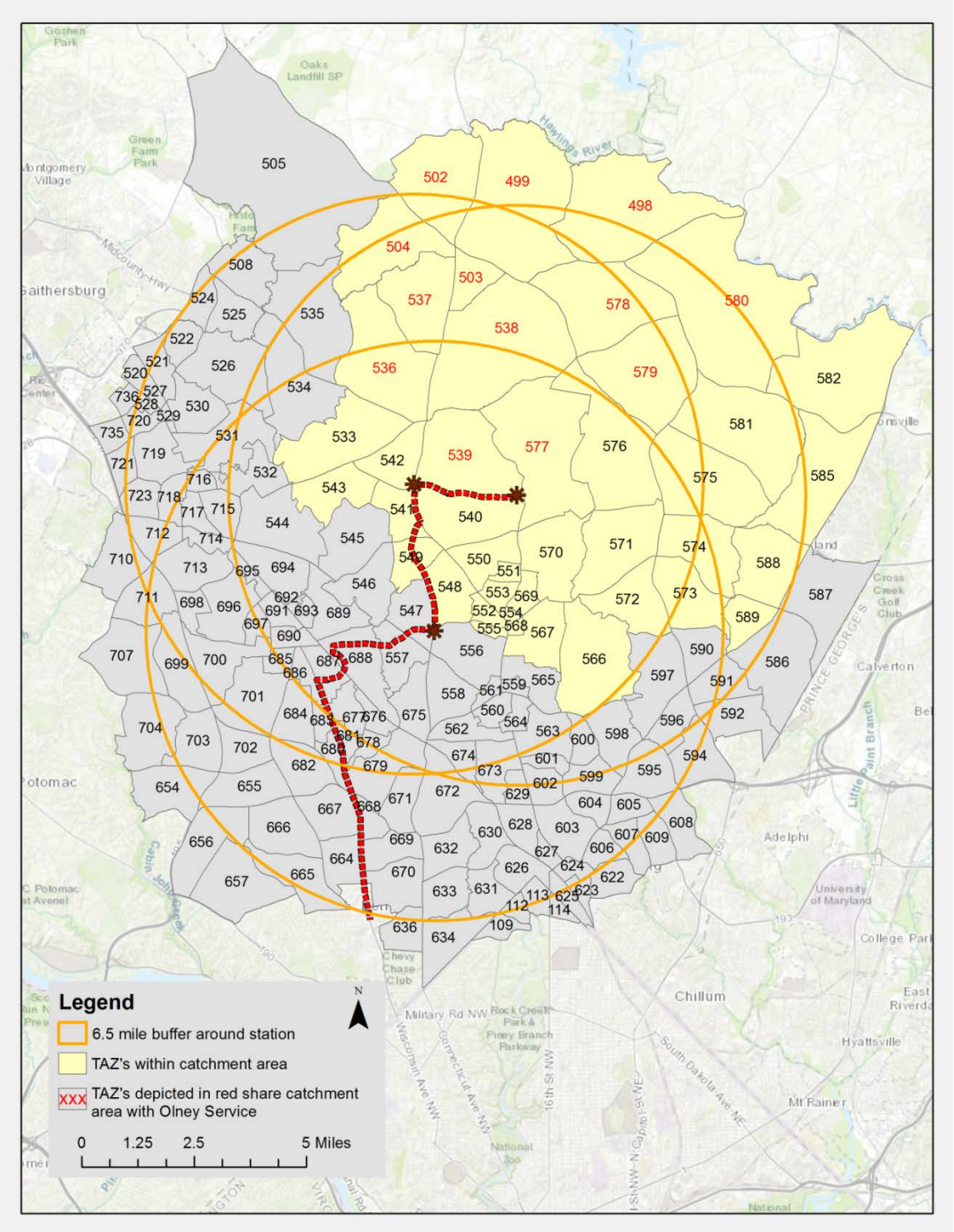
Included next is a table containing the number of trips destined for downtown Bethesda in each of the TAZs within the catchment area displayed in **Figure A-3**. The estimated number of riders that will use the Layhill service is based on the assumed number of total trips to Bethesda from the catchment area that will utilize the new service. In the instance of the Layhill service, two different mode share percentages were used in the ridership calculations.

In the first instance, some TAZs in the Layhill catchment area also fall into the catchment area of the proposed Olney service. In the instance where a TAZ falls into catchment area of both the Layhill service and the Olney service, a 10% mode share from that TAZ is assumed on each service (reflecting an overall mode share of 20% for both services combined). In those instances where the TAZ falls only in the catchment area of the Layhill service, a mode share of 20% is assumed.

Total riders on the Layhill service are estimated to be 750 (1,500 daily trips). Based on 21 AM peak trips, this would result in an average of 35 boardings per trip.

The final technical backup for this transit improvement is data outlining the estimated operations and maintenance costs and vehicle requirements, as shown in **Table A-7**. The cost estimate is based on the run time of each individual trip between Layhill and Shady Grove, which also includes deadhead service back to Layhill for the first eight vehicles in service in order to provide a second trip later in the AM peak (the service structure in the AM peak, as outlined in the Table, is assumed to be the same in the PM peak).

Figure A-3: Layhill Road/Wheaton Corridor Catchment Area



Source: MWCOG Regional Model – TAZ Structure

Table A-5: Layhill Catchment Area Trips to Bethesda by TAZ

TAZ (Layhill Catchment Area Only)	Trips to Bethesda
566	269.9
567	93.35
570	118.88
550	75.88
575	96.15
576	123.43
540	392.66
541	129.28
549	127.25
551	21.1
548	206.29
555	21.48
568	62.92
552	53.04
554	28.64
553	50.55
569	64.97
571	102.83
574	81.63
573	109.78
589	54.62
572	54.69
588	89.74
585	86.16
581	83.71
582	24.14
533	104.19
543	134.75
542	62.91
Total	2,924.92
20% mode share	584.984

TAZ (Olney and Layhill Catchment Area)	Trips
503	73.87
580	48.86
577	161.85
504	138.28
499	202.98
502	142.4
578	52.22
579	27.62
498	26.78
539	483.22
536	99.1
538	35.47
537	129.27
Total	1,621.92
10% mode share	162.192
TOTAL Layhill Trips	**747.18**

Source: MWCOG 2040 Trip Table – All Trip Purposes

Table A-6: Olney Service Trip and Service Frequency Requirement

Total AM Peak Riders	742
Load Standard - Each Trip	60
Required AM Peak Trips	12.37
Peak Period Length - in Minutes	120
Required Frequency - Calculated (minutes)	9.70
Required Frequency - Assumed (minutes)	10.00

Table A-7: Layhill Service Operating Cost Estimate/Vehicle Requirement

	Leave Layhill	Arrive White Flint	Deadhead (Arrive Layhill)	Bus #	Revenue Hours	Feeds Into
Trip 1	6:00 AM	6:40 AM	7:10 AM	1	1.17	Trip 8
Trip 2	6:10 AM	6:50 AM	7:20 AM	2	1.17	Trip 9
Trip 3	6:20 AM	7:00 AM	7:30 AM	3	1.17	Trip 10
Trip 4	6:30 AM	7:10 AM	7:40 AM	4	1.17	Trip 11
Trip 5	6:40 AM	7:20 AM	7:50 AM	5	1.17	Trip 12
Trip 6	6:50 AM	7:30 AM	8:00 AM	6	1.17	Trip 13
Trip 7	7:00 AM	7:40 AM		7	0.67	pull in
Trip 8	7:10 AM	7:50 AM		1	0.67	pull in

	Leave Layhill	Arrive White Flint	Deadhead (Arrive Layhill)	Bus #	Revenue Hours	Feeds Into
Trip 9	7:20 AM	8:00 AM		2	0.67	pull in
Trip 10	7:30 AM	8:10 AM		3	0.67	pull in
Trip 11	7:40 AM	8:20 AM		4	0.67	pull in
Trip 12	7:50 AM	8:30 AM		5	0.67	pull in
Trip 13	8:00 AM	8:40 AM		6	0.67	pull in
Total Revenue Hours - AM					11.67	
Total Revenue Hours - PM					18.00	
Total Revenue Hours					29.67	
Cost per Revenue Hour					$130	
Total Daily Cost					$3,857	

4 Veirs Mill Road Corridor

This Appendix section outlines the estimated ridership change associated with the change in service frequency on the portion of the Ride On 34 Route north of Wheaton during the AM and PM peak, as well as the estimated cost of the improvement. The change in ridership estimate is outlined in **Table A-8**. The estimated change in cost is outlined in **Table A-9**.

Table A-8: Estimated Ridership Change Based on Change in Ride On 34 Service Frequency

Ride On 34 Frequency Change	
Total Ridership Affected - Peak Periods (R1)	409
Current Frequency (F1)	30
Planned Frequency (F2)	15
E	-0.15
New Daily Riders	43
New Projected Total Ridership (R2)	452

Formula Source: Federal Transit Administration

Note: The equation and elasticity value (the percentage change in ridership associated with the percentage improvement in travel time based on an improvement in service frequency) used to calculate the change in ridership is outlined below and is based on an elasticity formula developed by the Federal Transit Administration.

Formula:

r2=r1*(((f1+f2)+-e*(f2-f1))/((f1+f2)- -e*(f2-f1)))

r2 = projected ridership

r1 = current ridership

f1 = current frequency

f2 = planned frequency

e= .15

Table A-9: Estimated Cost – Improvement in Ride On 34 Route Peak Period Service Frequency

1. Calculation of Buses in Service - Portion of 34 Route N/O Wheaton		
	Two Way Run Time On Segment with Recovery Time Included	42
	Buses Required to Run Service - Current (Run Time/Frequency (42/30), rounded up)	2
	Buses Required to Run Service - Future (Run Time/Frequency (42/15), rounded up)	3
	Additional Buses in Service Required	1
2. Calculate Cost of Additional Bus in Service		
	Number of Daily Hours Additional Bus is in Service	7
	Additional Daily Revenue Hours of Service	7
	Cost per Revenue Hour	$130
	Daily Cost - Additional Service	$910

5 MD 355 Corridor Improvements

This Appendix section provides detailed backup on the estimated cost of expanding Ride On extRa service beyond the Medical Center Metrorail Station to the Bethesda Metrorail Station, as well as expanding the service from a peak period service to an all-day service. Also included in this section is back up on the estimated change in ridership due to this improvement.

Outlined first in **Table A-10** is the estimated operating cost of the improvement, along with an estimate of the additional number of vehicles required to support the service change.

Outlined second in **Table A-11** is detail on the estimated ridership change associated with the service change.

Table A-10: Ride On extRa Service Change – Estimated Operating Cost and Estimated Change in Vehicle Requirements

PEAK PERIOD SERVICE EXTENSION			
1. Calculate Peak Period Number of Buses in Service - Current Service			
	One Way Run Time - Lakeforest Transit Center to Medical Center	55	minutes
	Two Way Run Time	110	minutes
	Add Recovery Time - 15% of Revenue Run Time	17	minutes
	Total Round Trip Cycle Time	127	minutes
	Headway	10	minutes
	Vehicles Required - Calculated	12.65	vehicles
	Vehicles Required - Rounded Up	**13**	vehicles
2. Calculate Peak Period Number of Buses in Service - New Service Structure			
	Additional one way Distance - Medical Center to Bethesda Metro Station	1.25	miles
	Estimated travel speed - route extension	14	mph
	Additional run time - one way	6	minutes
	Additional run time - two way	12	minutes
	New Revenue Run Time (110+12)	122	minutes
	Add Recovery Time - 15% revenue run time	18	minutes
	New Round Trip Cycle Time	140	minutes
	Headway	10	minutes
	Vehicles Required - Calculated	14	vehicles
	Change in vehicles required	**1**	vehicle
3. Calculate Cost of Route Extension in Peak Period			
	Number of hours additional bus is in service	7	hours
	Additional daily revenue hours of service	7	hours
	Cost per revenue hour	$130	
	Total Daily Additional Cost - peak period route extension	**$910**	
EXPANSION OF SERVICE TO MID-DAY			
4. Calculate Number of buses in service - mid-day			
	Mid-day round trip cycle time	140	minutes
	Mid-day headway	15	minutes
	Number of vehicles required to meet service	9	
5. Calculate Cost of Additional Mid-day service			
	Number of hours additional bus is in service	7	hours
	Additional daily revenue hours of service	61	hours
	Cost per revenue hour	$130	
	Total Daily Additional Cost - route extension	$7,887	
6. Calculate Cost - All Service Changes			
	Route Extension	**$910**	
	Additional Hours of Service	**$7,887**	
	Total Additional Cost	**$8,797**	

Table A-11: Ride On extRa Service Change – Estimated Ridership Change

1. Estimate Ridership Associated with Expansion of Hours of Service		
	Current Daily Ridership	1,671
	Current Daily Trips	84
	Average Boardings per Trip	20
	Estimated Boardings per Trip - Mid-Day Service (66% of peak boardings per trip)	13
	Number of Additional Mid-Day Trips	48
	Estimated Ridership from Expansion of Service to Mid-day	630
2. Estimate Ridership Associated with Extension		
	Boardings along 355 Corridor destined for downtown Bethesda	2,384
	Estimated mode share resulting from expanded market resulting from extension	10.00%
	New ridership resulting from extension	238
3. Calculate Total Ridership Associated with Service Change		
	Total Estimated Additional Daily Ridership	**869**

6 Potomac to I-270 Arc (Outside Beltway)

This Appendix section provides detailed backup on the estimated cost and vehicle requirement of improving existing Ride On Service in "Potomac to I-270 Arc" trip concentration. It also provides detailed backup on the estimated ridership increase resulting from these service improvements.

In addition, it provides detailed cost, vehicle requirement, and ridership estimate backup for a new proposed limited stop service within this trip concentration that would run between Montgomery Mall and downtown Bethesda.

1. Ride On Service Improvements

Outlined first is the estimated ridership change based on the service frequency improvement for the three Ride On routes located within this trip concentration area.

Table A-11: Estimated Ridership Change – Improved Service Frequency – Ride On Route 29

Ride On 29 Frequency Change	
Total Ridership Affected - Peak Periods	392
Current Frequency (F1)	30
Planned Frequency (F2)	15
E	-0.15
New Daily Riders	41
New Projected Total Ridership (R2)	433

Formula Source: Federal Transit Administration

Table A-12: Estimated Ridership Change – Improved Service Frequency – Ride On Route 32

Ride On 32 Frequency Change	
Total Ridership Affected - Peak Periods	234
Current Frequency (F1)	30
Planned Frequency (F2)	15
E	-0.15
New Daily Riders	25
New Projected Total Ridership (R2)	259

Formula Source: Federal Transit Administration

Table A-13: Estimated Ridership Change – Improved Service Frequency – Ride On Route 47

Ride On 47 Frequency Change	
Total Ridership Affected - Peak Periods	846
Current Frequency (F1)	30
Planned Frequency (F2)	15
E	-0.15
New Daily Riders	89
New Projected Total Ridership (R2)	935

Formula Source: Federal Transit Administration

Outlined next in **Tables A-14** through **A-16** is detail on the change in operating cost associated with the change in frequency on each of the three Ride-On routes in this trip concentration area. Also included in the Tables is the change in vehicle requirements for each route.

Table A-14: Ride On Route 29 Service Change – Cost Change and Vehicle Requirement Change

Ride On 29	
One Way Run Time (from public timetable)	31
Two Way Run Time	62
Estimated layover (15%)	9.3
Round trip cycle time	71.3
Vehicles required - 30 minutes - calculated	2.38
Vehicles required -30 minutes - round up	3
Vehicles required - 15 minutes - calculated	4.75
Vehicles required -15 minutes - round up	5

Ride On 29	
Change in vehicle requirement	2
Hours of Service - 15 minute headway	7
Additional Revenue Hours from service change	14
Cost per revenue hour	$130
Total Daily Cost Change	$1,820

Table A-15: Ride On Route 32 Service Change – Cost Change and Vehicle Requirement Change

Ride On 32	
One Way Run Time (from public timetable)	26
Two Way Run Time	52
Estimated layover (15%)	7.8
Round trip cycle time	59.8
Vehicles required - 30 minutes - calculated	1.99
Vehicles required -30 minutes - round up	2
Vehicles required - 15 minutes - calculated	3.99
Vehicles required -15 minutes - round up	4
Change in vehicle requirement	2
Hours of Service - 15 minute headway	7
Additional Revenue Hours from service change	14
Cost per revenue hour	$130
Total Daily Cost Change	$1,820

Table A-16: Ride On Route 47 Service Change – Cost Change and Vehicle Requirement Change

Ride On 47	
One Way Run Time (from public timetable)	52
Two Way Run Time	104
Estimated layover (15%)	15.6
Round trip cycle time	119.6
Vehicles required - 30 minutes - calculated	3.99
Vehicles required -30 minutes - round up	4
Vehicles required - 15 minutes - calculated	7.97
Vehicles required -15 minutes - round up	8
Change in vehicle requirement	4
Hours of Service - 15 minute headway	7
Additional Revenue Hours from service change	28
Cost per revenue hour	$130
Total Daily Cost Change	$3,640

7 New Limited Stop Service – Westfield Montgomery Mall to Bethesda

This section contains detailed backup on the calculation of the estimated operating costs and vehicle requirements for this limited stop service between the Westfield Montgomery Mall and Downtown Bethesda.

It also provides backup on the portion of total estimated ridership that would be generated from TAZs between the mall and downtown Bethesda (backup for the Virginia Capture trips is provided below in **Section 9** of this Appendix).

Outlined in **Table A-17** is the calculation of the number of the required headway necessary to meet the demand from two sources of trips on the service: a) the Virginia Capture trips and b) trips generated in the close-in TAZs that generate large numbers of trips to Bethesda.

Table A-17: Montgomery Mall Limited Stop Service – Estimated Required Headway

Demand and Headway Requirement	
Virginia Capture Trips	997
Close In TAZs	862
Total AM Peak Demand	1,859
Load Standard	80
Required AM Peak Trips	23.2375
Peak Period Length - in Minutes	180
Required Frequency - Calculated (minutes)	7.75
Required Frequency - Assumed (minutes)	8.00

Outlined in **Table A-18** is the estimated vehicle requirement to meet service based on the required headway.

Table A-18: Vehicle Requirements to Run Montgomery Mall Limited Stop Service

One Way Trip Distance	5	miles
Assumed Travel Speed	20	mph
One way run time	15	minutes
Two way run time	30	minutes
Layover time (15% of run time)	4.5	minutes
Round trip cycle calculated	34.5	minutes
Round Trip - rounded up	35	minutes
Vehicle Requirement - 8 minute Headway	4.375	
Vehicle Requirement - Round Up	**5**	

Outlined in **Table A-19** is the estimated operating cost for the Montgomery Mall Limited Stop Service based on the estimated vehicles in service.

Table A-19: Estimated Operating Cost – Montgomery Mall to Bethesda Limited Stop Service

Vehicles in Service	Hours of service	Total Revenue Hours	Cost per Revenue Hour	Total Daily
5	7	35	130	$4,550

Table A-20 provides the detailed backup on the ridership estimate for the demand generated by close-in TAZs between the Mall and downtown.

Table A-20: Demand Estimate – High Trip Generation Close-In TAZs

TAZ	Trips Going to Downtown Bethesda
666	976
682	454
655	338
703	445
702	665
654	195
665	1,319
661	634
636	855
667	1,017
664	915
670	814
Total Trips	8,627
10% Mode Share	863

Source: MWCOG 2040 Trip Table – All Trip Purposes

8 Close-In Beltway Adjacent and Inside Beltway

This Appendix section provides detailed backup on estimated costs, vehicle requirements, and ridership estimates for two different service improvements in the "Close-In-Beltway Adjacent and Inside Beltway" trip concentration. The service improvements include frequency improvements to existing Ride On service and a new micro transit service running in the close environs around downtown Bethesda. Detail for each of these improvements is provided below.

1.1 Ride On Service Improvements

This section contains detailed backup on estimated ridership, operating costs, and vehicle requirements for improved service frequencies on two Ride On Routes (Ride On 30 and Ride On 36) that fall within the "Close-In Beltway Adjacent and Inside Beltway" trip concentration area.

Tables A-21 and A-22 provide backup on the estimated ridership increase that would occur due to the frequency improvements.

Table A-21: Ride On Route 30: Estimated Ridership Increase Due to Frequency Improvement

Ride On 30 Frequency Change	
Total Ridership Affected - Peak Periods	374
Current Frequency (F1)	30
Planned Frequency (F2)	15
E	-0.15
New Daily Riders	39
New Projected Total Ridership (R2)	413

Formula Source: Federal Transit Administration

Table A-22: Ride On Route 36: Estimated Ridership Increase Due to Frequency Improvement

Ride On 36 Frequency Change	
Total Ridership Affected - Peak Periods	259
Current Frequency (F1)	30
Planned Frequency (F2)	15
E	-0.15
New Daily Riders	27
New Projected Total Ridership (R2)	286

Formula Source: Federal Transit Administration

Tables A-23 and A-24 provides detailed backup on the estimated cost and vehicle requirements of the frequency improvements to the Ride on 30 and Ride 36 routes.

Table A-23: Ride On Route 30 Service Change – Cost Change and Vehicle Requirement Change

Ride On 30	
One Way Run Time (from public timetable)	37
Two Way Run Time	74
Estimated layover (15%)	11.1
Round trip cycle time	85.1
Vehicles required - 30 minutes - calculated	2.84
Vehicles required -30 minutes - round up	3
Vehicles required - 15 minutes - calculated	5.67
Vehicles required -15 minutes - round up	6
Change in vehicle requirement	3
Hours of Service - 15 minute headway	7
Additional Revenue Hours from service change	21
Cost per revenue hour	$130
Total Daily Cost Change	$2,730

Table A-24: Ride On Route 36 Service Change – Cost Change and Vehicle Requirement Change

Ride On 36	
One Way Run Time (from public timetable)	29
Two Way Run Time	58
Estimated layover (15%)	8.7
Round trip cycle time	66.7
Vehicles required - 30 minutes - calculated	2.22
Vehicles required -30 minutes - round up	3
Vehicles required - 15 minutes - calculated	4.45
Vehicles required -15 minutes - round up	5
Change in vehicle requirement	2
Hours of Service - 15 minute headway	7
Additional Revenue Hours from service change	14
Cost per revenue hour	$130
Total Daily Cost Change	$1,820

2.1 Micro Transit

This section contains detailed backup on the Micro Transit Network estimated vehicle requirements, operating costs, and ridership. **Table A-25 through A-29** includes the calculation of the estimated vehicle requirements by Route.

Table A-25: Vehicle Requirement Calculation – Micro Transit Route 1

Route 1		
Travel Time	30	minutes
Layover Time 15%	4.5	minutes
Total Cycle Time	34.5	minutes
Headway	10	minutes
Required vehicles - Calculated	3.45	
Required Vehicles - round up	4	
Doubled - reflect 2-way service	8	

Table A-26: Vehicle Requirement Calculation – Micro Transit Route 2

Route 2		
Travel Time	30	minutes
Layover Time 15%	4.5	minutes
Total Cycle Time	34.5	minutes

Route 2		
Headway	10	minutes
Required vehicles - Calculated	3.45	
Required Vehicles - round up	4	
Doubled - reflect 2-way service	8	

Table A-27: Vehicle Requirement Calculation – Micro Transit Route 3

Route 3		
Travel Time	31	minutes
Layover Time 15%	4.65	minutes
Total Cycle Time	35.65	minutes
Headway	10	minutes
Required vehicles - Calculated	3.565	
Required Vehicles - round up	4	
Doubled - reflect 2-way service	8	

Table A-28: Vehicle Requirement Calculation – Micro Transit Route 4

Route 4		
Travel Time	23	minutes
Layover Time 15%	3.45	minutes
Total Cycle Time	26.45	minutes
Headway	10	minutes
Required vehicles - Calculated	2.645	
Required Vehicles - round up	3	
Doubled - reflect 2-way service	6	

Table A-29: Vehicle Requirement Calculation – Micro Transit Route 5

Route 5		
Travel Time	24	minutes
Layover Time 15%	3.6	minutes
Total Cycle Time	27.6	minutes
Headway	10	minutes
Required vehicles - Calculated	2.76	
Required Vehicles - round up	3	
Doubled - reflect 2-way service	6	

Outlined in **Table A-30** is the estimated operating cost of the Micro Transit Network, by route, and total.

Table A-30: Estimated Operating Cost by Micro Transit Route

Route	Vehicles in Service	Hours of Service (AM & PM Peak)	Total Revenue Hours	Cost per Revenue Hour	Total Cost
1	8	7	56	$110	$6,160
2	8	7	56	$110	$6,160
3	8	7	56	$110	$6,160
4	6	7	42	$110	$4,620
5	6	7	42	$110	$4,620
	36				**$27,720**

The final backup outlines the method used to calculate daily Micro Transit riders. The method for estimating riders is based on the assumption that boardings per Micro Transit trip would, on average, utilize 75% of the capacity of each trip, which is 8 passengers per trip based on the assumed vehicle capacity of 12. **Table A-31** below shows the calculation of trips in the AM peak. It is important to note that this estimate is for riders utilizing the Micro Transit network. It is assumed a rider would make two trips, one in the morning, and one in the afternoon, so the number of ridership show below would be doubled to identify total daily boardings.

Table A-31: Estimated Micro Transit Network Riders

Route	Loop Cycle Time	Minutes in Hour	Average Trips per Hour	Hours of AM Peak Period Service	AM Peak Trips Calculated	Trips Round down - per vehicle	Vehicles in Service	Total AM Peak Trips - Per Route	Estimated Average Boardings per Trip	AM Boardings by Route
1	35	60	1.71	3	5.14	5.00	8	40	8	320
2	35	60	1.71	3	5.14	5.00	8	40	8	320
3	36	60	1.67	3	5.00	5.00	8	40	8	320
4	27	60	2.22	3	6.67	6.00	6	36	8	288
5	28	60	2.14	3	6.43	6.00	6	36	8	288
Total										**1,536**

9 Virginia

This appendix section contains backup on the estimated number of trips from Virginia that would utilize the intercept park and ride at the Westfield Montgomery Mall. Trips to Bethesda generated by each TAZ in the catchment area are shown below in **Table A-32**. At the bottom of the Table are the total trips and the assumed percentage of trips captured at the park and ride lot.

Table A-32: Estimated Trips to Bethesda from Virginia Captured at Intercept Park and Ride

TAZ	Trips		TAZ	Trips		TAZ	Trips
2388	11.98		2354	14.45		2310	12.98
2386	0.57		2353	8.74		2302	27.63
2385	0.13		2352	3.32		2301	4.3
2384	11.78		2351	10.7		2298	5.03
2383	1.56		2350	0.65		2297	16.87
2382	5.32		2349	0.39		2296	7.17
2381	16.11		2348	6.62		2295	2.45
2380	7.82		2347	0.74		2294	0.02
2379	6.82		2346	0.13		2264	4.88
2378	1.52		2345	5.91		2261	29.57
2377	0.98		2344	1.68		2260	9.78
2376	4.42		2343	27.17		2259	6.6
2375	15.62		2342	4.91		2258	2.2
2374	8.18		2341	18.02		2257	0.37
2373	12.88		2340	4.24		2256	11.54
2372	16.3		2339	14.24		2240	1.37
2371	4.13		2338	11.9		1899	9.51
2370	3.17		2337	7		1898	7.11
2369	10.25		2336	3.04		1897	9.05
2368	6.72		2335	0.2		1896	8.41
2367	26.05		2334	0		1895	15.34
2366	22.54		2333	0.17		1894	3.92
2365	20.6		2332	6.1		1768	29.21
2364	35.36		2331	1.08		1761	19.62
2363	14.93		2330	0.27		1760	15.79
2362	25.99		2329	0.97		1759	12.52
2361	12.86		2328	0.16		1758	8.9
2360	7.62		2327	1.48		1757	8.3
2359	23.49		2326	1.04		1756	3.74
2358	10.11		2325	0.64		1754	6.65
2357	11.77		2324	6.13		1753	3.13
2356	4.1		2322	0		1752	24.64
2355	8.15		2321	0.59		1751	23.5
1750	10.75		1703	3.29		1413	11.35
1749	0.35		1674	24.37		1482	1.92
1748	13.53		1508	15.99		1511	7.51
1747	15.64		1437	1.4		1509	0.32
1746	8.18		1440	16.51		1535	4.95
1745	7.62		1442	10.16		1445	9.82
1744	1.04		1444	7.84		1539	7.44
1743	2.01		1443	13.96		1479	10.32
1742	2.01		1423	4.08		1526	1.26
1741	2.21		1433	2.04		1446	10.33

TAZ	Trips		TAZ	Trips		TAZ	Trips
1740	5.55		1447	19.62		1464	1.31
1739	19.63		1405	10.6		1457	9.38
1738	7.83		1432	6.1		1456	4.7
1737	12.49		1430	6.85		1417	2.67
1736	18.21		1473	23.82		1416	12.3
1735	19.09		1471	0		1412	12.72
1734	22.67		1468	4.31		1536	7.09
1733	22.35		1475	39.29		1474	10.91
1732	40.79		1520	8.96		1470	7.14
1731	7.11		1491	7.9		1530	2.7
1730	7.33		1478	55.76		1533	7.48
1729	3.55		1441	9.63		1485	8.65
1728	3.35		1477	15.17		1543	18.88
1727	1.17		1528	4.13		1527	20.39
1724	21.9		1532	6		1501	40.3
1721	5.99		1490	15.52		1505	6.41
1720	3.66		1484	8.86		1503	2.05
1719	22.8		1480	16.48		1492	31.75
1718	9.64		1460	10.03		1493	15.4
1717	21.87		1455	2.12		1499	12.89
1716	2.93		1418	4.43		1500	11.41
1715	9.33		1458	18.82		1502	16.65
1714	10.96		1534	5.83		1506	0.75
1713	9.73		1415	29.6		1513	4.73
1712	11.97		1411	16.38		1476	1.61
1711	5.95		1414	17.75		1472	30.29
1710	6.98		1419	9.28		1498	0
1709	10.85		1431	3.64		1497	0
1708	10.07		1406	8.66		1504	3.63
1707	25.84		1409	4.56		1507	4.79
1706	26.45		1408	8.03		1510	0.55
1705	7.98		1410	8.84		1496	29.53
1704	11.45		1537	5.52		1562	0.25
1708	10.75		1463	3.25		1522	6.44
1523	1.15		1481	8.98		1805	16.52
1521	6.61		1483	1.89		1812	2.12
1544	3.21		1518	1.69		1810	23.99
1529	0.16		1459	0.1		1973	10.15
1531	1.67		1495	0.05		1969	10.85
1538	5.15		1488	1.91		1817	18.95
1541	2.58		1917	11.59		1816	18.17
1540	21.61		1827	15.87		1968	15.62
1542	3.62		1858	50.83		1818	3.25
1407	4.09		1941	1.53		1823	22.06
1487	0.43		1929	2.27		1822	13.62

TAZ	Trips		TAZ	Trips		TAZ	Trips
1494	0		1931	27.93		1821	23.63
1486	4.93		1932	10.84		1820	10.04
1489	0.18		1963	16.72		1851	40.31
1524	5.85		1966	8.74		1836	5.45
1525	30.9		1967	14.56		1833	6.21
1438	1.62		1819	4.97		1847	18.94
1439	14.23		1936	10.21		1813	1.01
1429	13.33		1937	8.65		1814	3.45
1435	0		1939	8.26		1970	2.22
1436	5.39		1940	15.32		1857	15.37
1434	7.93		1920	21.66		1845	7.2
1426	4.84		1922	14.74		1842	10.3
1425	8.99		1928	3.39		1871	18.81
1424	14.87		1938	20.51		1855	6.71
1428	1.53		1933	8.27		1844	2.55
1449	14.93		1934	4.03		1849	6.23
1448	8.03		1935	24.27		1832	8.96
1420	9.1		1869	14.8		1889	10.08
1427	0.57		1861	22.38		1888	3.85
1421	14.13		1885	8.1		1788	12.88
1422	9.95		1866	20.15		1850	6.13
1452	4.49		1927	6.74		1790	23.14
1462	1.44		1884	17.21		1789	6.84
1454	11.71		1876	8.25		1802	14.48
1451	5.6		1918	30.64		1856	15.95
1467	2.83		1919	36.08		1859	2.79
1450	1.34		1915	24.98		1828	12.71
1453	9.5		1916	20.92		1891	17.22
1461	0.66		1880	20.36		1874	20.72
1466	1.11		1900	18.82		1830	11.74
1465	12.52		1879	15.78		1890	7.82
1519	0.37		1848	6.92		1878	6.22
1469	0.17		1804	7.09		1881	34.03
1860	2.47		1962	16.54		1875	5.12
1838	16.61		1954	24.59		1873	5.94
1765	8.89		1959	13.16		1877	8.4
1774	10		1976	27.35		1872	13.49
1723	2.7		1975	17.89		1883	32.31
1826	9.31		1824	16.72		1882	34.51
1893	2.87		1825	9.05		1867	13.18
1767	19.7		1854	5.67		1865	9.38
1764	10.48		1776	0.42		1843	12.88
1782	8.17		1777	4.17		1841	2.39
1781	1.81		1762	13.92		1840	3.42
1766	12.29		1863	21.44		1846	8.63

TAZ	Trips		TAZ	Trips		TAZ	Trips
1780	12.39		1948	11.59		1839	9.54
1779	29.83		1949	8.99		1831	16.63
1775	11.91		1902	18.22		1834	15.16
1778	10.01		1771	9.73		1835	5.01
1886	9.31		1769	31.04		1837	3.13
1887	7.19		1772	18.21		1868	9.22
1901	9.32		1853	5.88		1870	5.44
1904	2.69		1852	2.35		1864	14.87
1906	2.24		1670	15.15		1829	3.18
1912	4.14		1763	8.74		1892	10.06
1910	0.55		1913	10.2		1722	1.53
1909	0.61		1914	3.17		1725	2.11
1944	12.74		1947	10.48		1773	2.2
1945	7.74		1905	19.13		1726	1.55
1946	3.12		1907	0.67		1770	1.6
1943	2.06		1951	9.27		1950	10.94
1942	0.51		2001	8.18		1911	9.53
1953	10.01		1952	12.57		1554	8.86
1908	23.04		2000	10.72		1555	22.66
1955	0.29		1999	2.49		1588	5.34
1994	2.74		1803	5.17		1589	6.51
1957	14.9		1806	22.5		1558	21.21
1956	5.59		1809	10.4		1586	5.96
1998	20.29		1808	8.98		1584	10.18
1800	26.29		1807	16.55		1556	14.77
1965	6.32		1815	7.38		1585	13.44
1811	5.89		1930	9.17		1553	12.57
1974	17.5		1925	3.69		1590	17.66
1960	10.08		1926	2.38		1595	9.53
1972	14.42		1921	6.81		1550	15.82
1971	1.95		1923	1.65		1582	6.36
1964	5.22		1924	5.19		1587	4.53
1961	19.16		1862	13.58		1560	0.6
1860	2.47		1962	16.54		1875	5.12
1838	16.61		1954	24.59		1873	5.94
1765	8.89		1959	13.16		1877	8.4
1774	10		1976	27.35		1872	13.49
1723	2.7		1975	17.89		1883	32.31
1826	9.31		1824	16.72		1882	34.51
1893	2.87		1825	9.05		1867	13.18
1767	19.7		1854	5.67		1865	9.38
1764	10.48		1776	0.42		1843	12.88
1782	8.17		1777	4.17		1841	2.39
1781	1.81		1762	13.92		1840	3.42
1766	12.29		1863	21.44		1846	8.63

TAZ	Trips		TAZ	Trips		TAZ	Trips
1780	12.39		1948	11.59		1839	9.54
1779	29.83		1949	8.99		1831	16.63
1775	11.91		1902	18.22		1834	15.16
1778	10.01		1771	9.73		1835	5.01
1886	9.31		1769	31.04		1837	3.13
1887	7.19		1772	18.21		1868	9.22
1901	9.32		1853	5.88		1870	5.44
1904	2.69		1852	2.35		1864	14.87
1906	2.24		1670	15.15		1829	3.18
1912	4.14		1763	8.74		1892	10.06
1910	0.55		1913	10.2		1722	1.53
1909	0.61		1914	3.17		1725	2.11
1944	12.74		1947	10.48		1773	2.2
1945	7.74		1905	19.13		1726	1.55
1946	3.12		1907	0.67		1770	1.6
1943	2.06		1951	9.27		1950	10.94
1942	0.51		2001	8.18		1911	9.53
1953	10.01		1952	12.57		1554	8.86
1908	23.04		2000	10.72		1555	22.66
1955	0.29		1999	2.49		1588	5.34
1994	2.74		1803	5.17		1589	6.51
1957	14.9		1806	22.5		1558	21.21
1956	5.59		1809	10.4		1586	5.96
1998	20.29		1808	8.98		1584	10.18
1800	26.29		1807	16.55		1556	14.77
1965	6.32		1815	7.38		1585	13.44
1811	5.89		1930	9.17		1553	12.57
1974	17.5		1925	3.69		1590	17.66
1960	10.08		1926	2.38		1595	9.53
1972	14.42		1921	6.81		1550	15.82
1971	1.95		1923	1.65		1582	6.36
1964	5.22		1924	5.19		1587	4.53
1961	19.16		1862	13.58		1560	0.6
1581	5.91		1570	10.64			
1578	7.92						
1583	11.25		**Total**			5,542	
1516	11.15						
1545	3.98		**10% of Trips Made by Metrorail**			554	
1565	24.47						
1903	10.97		**Trips made by Auto**			4,988	
1566	18.39						
1564	5.53		**20% Capture of Auto Trips**			997	
1559	18.64						
1563	14.07						

TAZ	Trips		TAZ	Trips		TAZ	Trips
1609	0.89						
1603	4.52						
1605	2.45						
1606	0.64						
1591	7.5						
1593	5.15						
1604	4.81						
1598	5.76						
1597	10.24						
1599	3.92						
1596	14.45						
1580	7.16						
1594	6.75						
1592	18.69						
1579	19.23						
1600	12.07						
1601	11.82						
1602	9.13						
1577	5.91						
1572	15.14						
1514	20.33						
1517	26.91						
1515	14.46						
1571	16.52						
1575	11.66						
1574	12.28						
1512	0.12						
1567	9.37						
1568	6.54						
1569	10.4						
1576	0.02						
1573	9.6						
1561	3.75						
1557	3.42						

Source: MWCOG 2040 Trip Table

10 Washington DC

This section contains backup on the Washington DC trip concentration. The first piece of backup is the TAZs that fall within ¼ mile of the 30s Routes along Wisconsin Avenue. The TAZs within this buffer are the foundation for the estimated ridership that will use the extended service.

The next piece of backup shows the estimated ridership on the extended service based on the number of trips in the TAZs within the buffer going to Bethesda. This is shown in **Table A-33**.

The final piece of backup provides detail on the estimated operating cost and vehicle requirements for the extended service. This is provided in **Table A-34**.

Figure A-4: TAZs within ¼ Mile Buffer of Wisconsin Avenue

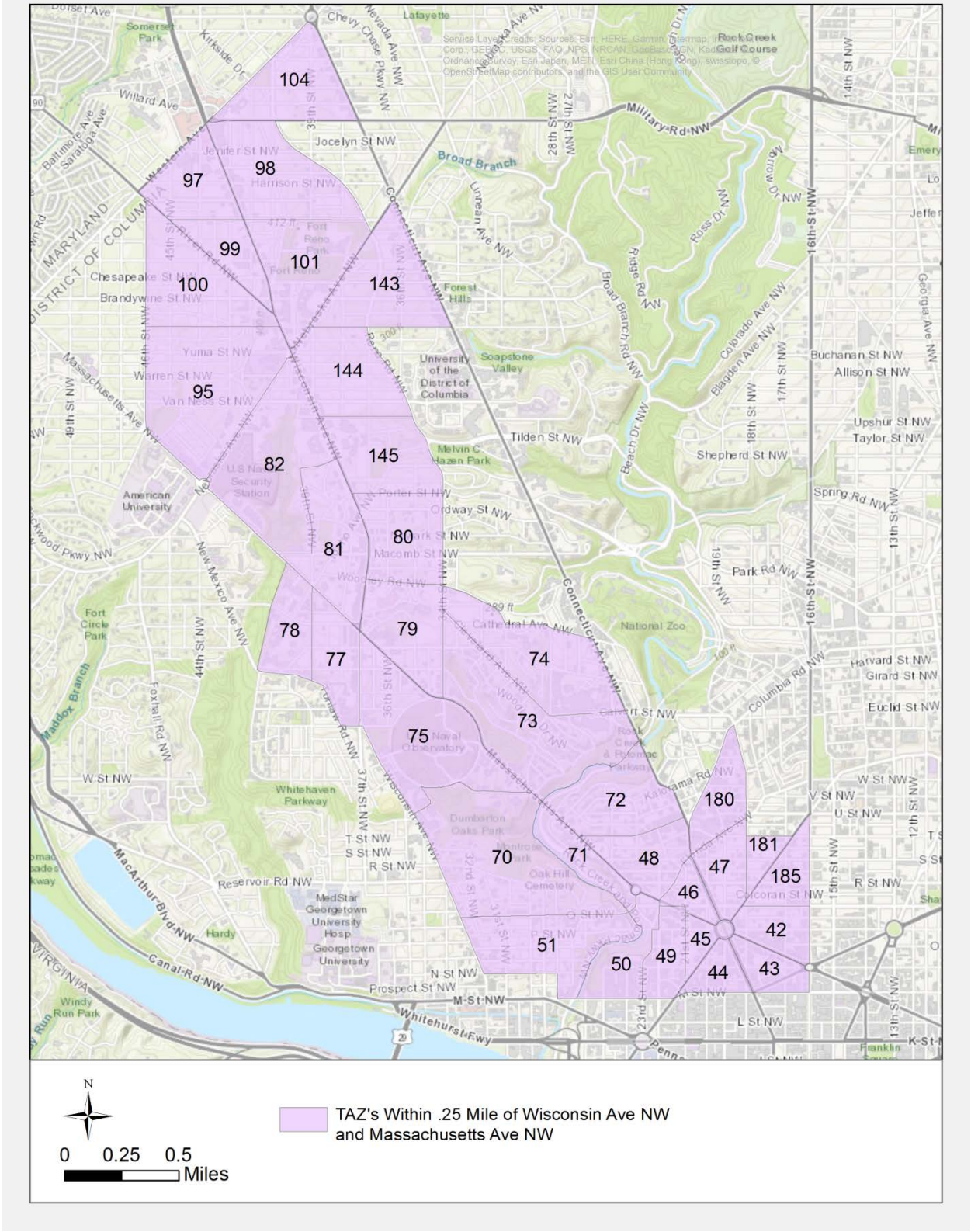


Table A-33: Trips Destined for Bethesda – From TAZs within ¼ Mile Buffer of Wisconsin Avenue

TAZs Falling within 1/4 mile Buffer	Trips Destined to Bethesda
80	57
82	178
81	217
79	16
78	106
77	113
145	52
144	110
181	11
42	23
185	33
45	11
44	11
49	33
43	2
50	14
46	7
47	34
51	38
70	36
71	6
48	18
72	28
75	56
73	25
74	129
180	49
95	109
100	179
97	162
99	93
143	203
98	235
104	193
101	65
Total Trips	**2,652**
20% mode share	**530.38**

Source: MWCOG 2040 Trip Table – All Trip Purposes

Table A-34: 30s Line Extension – Estimated Operating Cost and Vehicle Requirement

Calculate Run Time of Extension		
Assumed Speed	12.1	mph
One Way distance - Friendship Heights to Bethesda	2	miles
Travel Time Calculation 12.1x = (2*60) 120/12.1 =	 9.92	 Minutes
One way travel time	10	minutes

Calculate Additional Buses Required		
Round Trip Run Time	20	minutes
Headway	12	
Additional Buses - Calculated	1.67	
Additional Buses - Round Up	**2**	

Calculate Operating Cost				
Additional Buses in Service	Hours of Extended Service	Total Revenue Hours	Cost per Hour	Total Daily Cost
2	13	26	$130	$3,380

Appendix B

Intersection and Pedestrian/Bicycle Improvements Concept Plans

BETHESDA UNIFIED MOBILITY PROGRAM

ROCKVILLE PIKE AND JONES BRIDGE ROAD INTERSECTION IMPROVEMENTS

MCDOT Montgomery County Department of Transportation

SCALE: 1" = 60'

DECEMBER 2018

FIGURE 1

COLUMBIA COUNTRY CLUB

MD 185 (CONNECTICUT AVE.)

EAST-WEST HIGHWAY

EXISTING BUS STOP

EXISTING BUS STOP

PROPOSED

EXISTING

EXISTING

PROPOSED

EXISTING

PROPOSED

LOD

DRAFT

DELAY = 78.8 SEC/VEH

LEGEND

- RESURFACING
- FULL-DEPTH
- SIDEWALK
- LOD — LIMIT OF DISTURBANCE
- EXISTING
- PROPOSED

BETHESDA UNIFIED MOBILITY PROGRAM

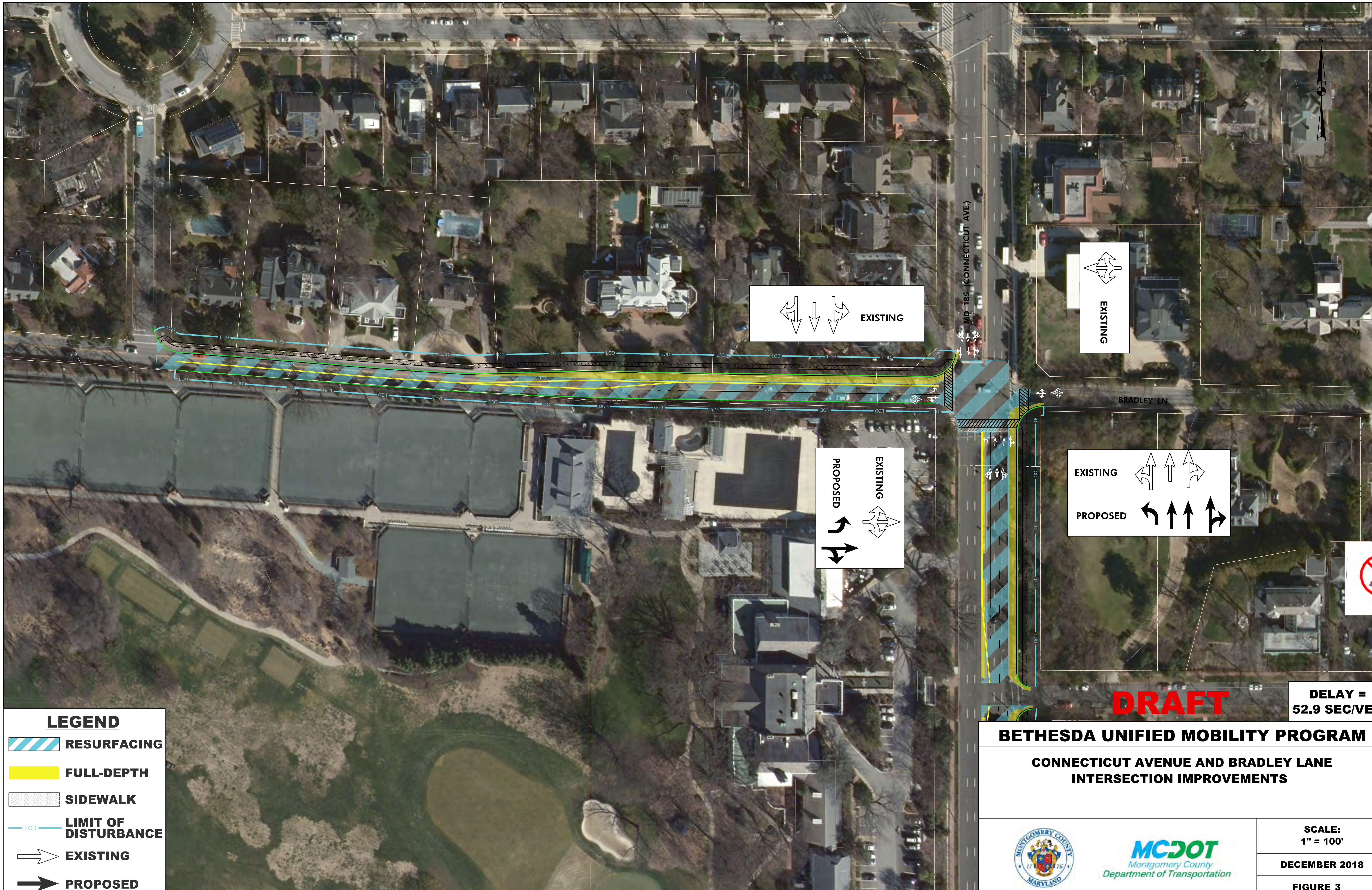
EASTIWEST HIGHWAY AND CONNECTICUT AVENUE INTERSECTION IMPROVEMENTS

MCDOT Montgomery County Department of Transportation

SCALE: 1" = 100'

DECEMBER 2018

FIGURE 2



BETHESDA UNIFIED MOBILITY PROGRAM

CONNECTICUT AVENUE AND BRADLEY LANE INTERSECTION IMPROVEMENTS

MCDOT
Montgomery County
Department of Transportation

SCALE:
1" = 100'

DECEMBER 2018

FIGURE 3

ELM STREET

GEORGETOWN BRANCH TRAIL

WISCONSIN AVENUE

BETHESDA AVENUE

CAPITAL CRESCENT TRAIL

WOODMONT AVENUE

MILLER AVE

LELAND STREET

EXISTING

EXISTING

EXISTING

PROPOSED

LOD

N

LEGEND

- RESURFACING
- BIKE PATH
- SIDEWALK
- LOD — LIMIT OF DISTURBANCE
- EXISTING
- PROPOSED

DRAFT

BETHESDA UNIFIED MOBILITY PROGRAM

WOODMONT AVENUE AND BETHESDA AVENUE PEDESTRIAN CROSSING IMPROVEMENTS

MONTGOMERY COUNTY MARYLAND 1776

MCDOT Montgomery County Department of Transportation

SCALE: 1" = 100'

DECEMBER 2018

FIGURE 4

BETHESDA TROLLEY TRAIL RAMP

HORIZ: 1" = 40'
VERT: 1" = 8'

LEGEND

- RESURFACING
- FULL-DEPTH
- SIDEWALK
- LIMIT OF DISTURBANCE (LOD)
- EXISTING
- PROPOSED

BETHESDA UNIFIED MOBILITY PROGRAM

TRAIL CONNECTION BETWEEN BRADLEY BOULEVARD AND CAPITAL CRESCENT TRAIL

MONTGOMERY COUNTY MARYLAND 1776

MCDOT Montgomery County Department of Transportation

SCALE: 1" = 40'

DECEMBER 2018

FIGURE 5

Appendix C

Intersection and Pedestrian/Bicycle Improvements

Conceptual Cost Estimates

Bethesda Unified Mobility Plan Intersection and Pedestrian/Bicycle Improvement Costs					
Location of Proposed Improvement	**Subtotal Construction Cost**	**Design Contingency (50%)**	**Total Construction Cost**	**Right of Way Cost**	**Total Cost**
Intersection Improvements					
Rockville Pike and Jones Bridge Road	$ 313,151.00	$ 156,575.50	$ 517,638.60	$ -	$ 517,700.00
East-West Highway and Connecticut Avenue	$ 1,109,802.59	$ 554,901.29	$ 1,834,503.68	$ 2,302,800.00	$ 4,137,400.00
Connecticut Avenue and Bradley Lane	$ 814,863.25	$ 407,431.63	$ 1,346,968.96	$ 3,082,050.00	$ 4,429,100.00
Woodmont Avenue and Bethesda Avenue	$ 678,311.43	$ 339,155.72	$ 1,121,248.80	$ -	$ 1,121,300.00
Pedestrian/Bicycle Improvements					
Bradley Boulevard from Glenbrook Road to the west section boundary	$ 1,249,117.88	$ 624,558.94	$ 2,064,791.86	$ 3,899,400.00	$ 5,964,200.00
Norfolk Avenue from Battery Lane Urban Park to Tilbury Street Short-Term Improvements	$ 234,441.67	$ 117,220.84	$ 387,532.08	$ -	$ 387,600.00
Norfolk Avenue from Battery Lane Urban Park to Tilbury Street Long-Term Improvements	$ 2,694,529.52	$ 1,347,264.76	$ 4,454,057.29	$ -	$ 4,454,100.00
Arlington Road from Old Georgetown Road to Bradley Boulevard	$ 1,162,016.13	$ 581,008.06	$ 1,920,812.66	$ -	$ 1,920,900.00
Pearl Street from Montgomery Avenue to Sleaford Road	$ 884,447.77	$ 442,223.88	$ 1,461,992.16	$ 1,540,200.00	$ 3,002,200.00
Trail connections between Bradley Boulevard and Capital Crescent Trail	$ 1,396,097.35	$ 698,048.68	$ 2,307,748.92	$ -	$ 2,307,800.00
North Bethesda Trail between Rugby Avenue and the NIH campus	$ 1,396,097.35	$ 698,048.68	$ 2,307,748.92	$ -	$ 2,029,400.00
Woodmont Avenue from Battery Lane to Norfolk Avenue	$ 166,892.20	$ 83,446.10	$ 275,872.80	$ -	$ 275,900.00
Old Georgetown Road from Woodmont Avenue to Wisconsin Avenue	$ 133,527.78	$ 66,763.89	$ 220,721.42	$ -	$ 220,800.00
Montgomery Avenue from Pearl Street to East-West Highway	$ 143,922.64	$ 71,961.32	$ 237,904.13	$ -	$ 238,000.00
Battery Lane from Old Georgetown Road to Wisconsin Avenue	$ 266,960.40	$ 133,480.20	$ 441,285.54	$ -	$ 441,300.00
Waverly Street from East-West Highway to Montgomery Avenue	$ 30,214.30	$ 15,107.15	$ 49,944.23	$ -	$ 50,000.00
St. Elmo Avenue from Wilson Lane to Woodmont Avenue	$ 158,726.18	$ 79,363.09	$ 262,374.37	$ -	$ 262,400.00
				Total Cost	***$31,760,100.00***

Jones Bridge Road and Rockville Pike Intersection Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	293	LF	$15.00	$4,395.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	94	CY	$75.00	$7,045.37
			Total Category 2 Cost:	***$11,440.37***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	2,529	SY	$2.00	$5,058.22
HMA Surface Course (2")	312	TON	$80.00	$24,940.13
HMA Base Course (6")	43	TON	$75.00	$3,197.06
6" Graded Aggregate Base	242	SY	$10.00	$2,415.56
5" Thermoplastic White Pavement Markings	1,510	LF	$1.50	$2,265.00
12" Thermoplastic White Pavement Markings	438	LF	$4.00	$1,750.00
24" Thermoplastic White Pavement Markings	60	LF	$10.00	$600.00
5" Thermoplastic Yellow Pavement Markings	640	LF	$1.50	$960.00
Pavement Marking Symbols	80	SF	$7.00	$560.00
			Total Category 5 Cost:	***$41,745.97***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	360	LF	$30.00	$10,800.00
			Total Category 6 Cost:	***$10,800.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.1	CPM	$17,600.00	$1,056.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	3	EA	$65,000.00	$195,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$196,056.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$25,594.54	***$25,594.54***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$22,395.22	***$22,395.22***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$1,919.59	***$1,919.59***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$3,199.32	***$3,199.32***
			Subtotal	**$313,151.00**
Design Contingency	**50%**			**$156,575.50**
Admin. / Overhead	**15.30%**			**$47,912.10**
Total Construction Cost				**$517,638.60**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$517,638.60***
			SAY	***$517,700.00***

East-West Highway and Connecticut Avenue Intersection Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	332	LF	$15.00	$4,980.00
Removal of Existing Pavement	50	CY	$30.00	$1,485.93
Removal of Existing Sidewalk	140	CY	$75.00	$10,493.52
			Total Category 2 Cost:	***$16,959.44***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	10,956	SY	$2.00	$21,912.44
HMA Surface Course (2")	1,566	TON	$80.00	$125,295.69
HMA Base Course (6")	832	TON	$75.00	$62,376.47
6" Graded Aggregate Base	4,713	SY	$10.00	$47,128.89
5" Thermoplastic White Pavement Markings	5,573	LF	$1.50	$8,359.13
12" Thermoplastic White Pavement Markings	1,337	LF	$4.00	$5,348.00
24" Thermoplastic White Pavement Markings	209	LF	$10.00	$2,090.00
5" Thermoplastic Yellow Pavement Markings	3,808	LF	$1.50	$5,712.00
15" Thermoplastic Yellow Pavement Markings	120	LF	$5.00	$600.00
Pavement Marking Symbols	320	SF	$7.00	$2,240.00
			Total Category 5 Cost:	***$281,062.62***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	12,153	SF	$8.00	$97,224.00
Standard Type A Curb and Gutter	2,387	LF	$30.00	$71,610.00
			Total Category 6 Cost:	***$168,834.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.3	CPM	$17,600.00	$5,456.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	1	EA	$250,000.00	$250,000.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$255,456.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$186,742.42	***$186,742.42***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$163,399.62	***$163,399.62***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$14,005.68	***$14,005.68***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$23,342.80	***$23,342.80***
			Subtotal	**$1,109,802.59**
Design Contingency	**50%**			**$554,901.29**
Admin. / Overhead	**15.30%**			**$169,799.80**
Total Construction Cost				**$1,834,503.68**
Right of Way Costs	15,352	SF	$150.00	**$2,302,800.00**
			Total Cost	***$4,137,303.68***
			SAY	***$4,137,400.00***

Connecticut Avenue and Bradley Lane Intersection Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	773	LF	$15.00	$11,595.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	145	CY	$75.00	$10,911.11
			Total Category 2 Cost:	***$22,506.11***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	795	SF	$120.00	$95,400.00
			Total Category 4 Cost:	***$95,400.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	4,180	SY	$2.00	$8,360.89
HMA Surface Course (2")	634	TON	$80.00	$50,737.78
HMA Base Course (6")	427	TON	$75.00	$32,041.18
6" Graded Aggregate Base	2,421	SY	$10.00	$24,208.89
5" Thermoplastic White Pavement Markings	2,980	LF	$1.50	$4,470.00
12" Thermoplastic White Pavement Markings	529	LF	$4.00	$2,114.00
24" Thermoplastic White Pavement Markings	105	LF	$10.00	$1,050.00
5" Thermoplastic Yellow Pavement Markings	3,098	LF	$1.50	$4,647.00
15" Thermoplastic Yellow Pavement Markings	50	LF	$5.00	$250.00
Pavement Marking Symbols	112	SF	$7.00	$784.00
			Total Category 5 Cost:	***$128,663.73***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	6,891	SF	$8.00	$55,128.00
Standard Type A Curb and Gutter	2,338	LF	$30.00	$70,140.00
			Total Category 6 Cost:	***$125,268.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.3	CPM	$17,600.00	$4,400.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	2	EA	$65,000.00	$130,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$134,400.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$148,735.14	***$148,735.14***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$130,143.25	***$130,143.25***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$11,155.14	***$11,155.14***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$18,591.89	***$18,591.89***
			Subtotal	**$814,863.25**
Design Contingency	**50%**			**$407,431.63**
Admin. / Overhead	**15.30%**			**$124,674.08**
Total Construction Cost				**$1,346,968.96**
Right of Way Costs	20,547	SF	$150.00	**$3,082,050.00**
			Total Cost	***$4,429,018.96***
			SAY	***$4,429,100.00***

Woodmont Avenue and Bethesda Avenue Intersection Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	41	CY	$30.00	$1,220.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$1,220.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	5,513	SY	$2.00	$11,025.78
HMA Surface Course (2")	718	TON	$80.00	$57,411.76
HMA Base Course (6")	207	TON	$75.00	$15,541.18
6" Graded Aggregate Base	1,174	SY	$10.00	$11,742.22
5" Thermoplastic White Pavement Markings	2,249	LF	$1.50	$3,373.13
12" Thermoplastic White Pavement Markings	0	LF	$4.00	$0.00
24" Thermoplastic White Pavement Markings	465	LF	$10.00	$4,650.00
5" Thermoplastic Yellow Pavement Markings	3,782	LF	$1.50	$5,673.00
Pavement Marking Symbols	200	SF	$7.00	$1,400.00
Post Mounted Delineator	20	EA	$50.00	$1,000.00
			Total Category 5 Cost:	***$110,817.07***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	600	SF	$8.00	$4,800.00
Standard Type A Curb and Gutter	7,204	LF	$30.00	$216,120.00
			Total Category 6 Cost:	***$220,920.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.2	CPM	$17,600.00	$4,000.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	1	EA	$65,000.00	$65,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$69,000.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$133,182.83	***$133,182.83***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$116,534.97	***$116,534.97***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$9,988.71	***$9,988.71***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$16,647.85	***$16,647.85***
			Subtotal	**$678,311.43**
Design Contingency	**50%**			**$339,155.72**
Admin. / Overhead	**15.30%**			**$103,781.65**
Total Construction Cost				**$1,121,248.80**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$1,121,248.80***
			SAY	***$1,121,300.00***

Bradley Boulevard Bicycle/Pedestrian Improvements (with parking)

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	22,601	SY	$2.00	$45,201.56
HMA Surface Course (2")	2,745	TON	$80.00	$219,607.84
HMA Base Course (6")	259	TON	$75.00	$19,391.18
6" Graded Aggregate Base	1,465	SY	$10.00	$14,651.11
5" Thermoplastic White Pavement Markings	14,764	LF	$1.50	$22,145.63
12" Thermoplastic White Pavement Markings	1,512	LF	$4.00	$6,048.00
24" Thermoplastic White Pavement Markings	180	LF	$10.00	$1,800.00
5" Thermoplastic Yellow Pavement Markings	5,489	LF	$1.50	$8,233.50
Pavement Marking Symbols	448	SF	$7.00	$3,136.00
Post Mounted Delineator	180	EA	$50.00	$8,990.00
			Total Category 5 Cost:	***$340,214.81***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	22,167	SF	$8.00	$177,336.00
Standard Type A Curb and Gutter	1,731	LF	$30.00	$51,930.00
			Total Category 6 Cost:	***$229,266.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.7	CPM	$17,600.00	$11,968.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	3	EA	$65,000.00	$195,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$206,968.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$227,792.32	***$227,792.32***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$199,318.28	***$199,318.28***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$17,084.42	***$17,084.42***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$28,474.04	***$28,474.04***
			Subtotal	**$1,249,117.88**
Design Contingency	**50%**			**$624,558.94**
Admin. / Overhead	**15.30%**			**$191,115.04**
Total Construction Cost				**$2,064,791.86**
Right of Way Costs	25,996	SF	$150.00	**$3,899,400.00**
			Total Cost	***$5,964,191.86***
			SAY	***$5,964,200.00***

Norfolk Avenue Bicycle/Pedestrian Short-Term Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	8,938	SY	$2.00	$17,876.67
HMA Surface Course (2")	1,052	TON	$80.00	$84,125.49
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	0	SY	$10.00	$0.00
5" Thermoplastic White Pavement Markings	5,571	LF	$1.50	$8,356.50
12" Thermoplastic White Pavement Markings	1,831	LF	$4.00	$7,322.00
24" Thermoplastic White Pavement Markings	275	LF	$10.00	$2,750.00
5" Thermoplastic Yellow Pavement Markings	2,706	LF	$1.50	$4,059.00
Pavement Marking Symbols	160	SF	$7.00	$1,120.00
			Total Category 5 Cost:	***$125,609.66***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$0.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.3	CPM	$17,600.00	$4,576.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$4,576.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$50,243.86	***$50,243.86***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$43,963.38	***$43,963.38***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$3,768.29	***$3,768.29***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$6,280.48	***$6,280.48***
			Subtotal	**$234,441.67**
Design Contingency	**50%**			**$117,220.84**
Admin. / Overhead	**15.30%**			**$35,869.58**
Total Construction Cost				**$387,532.08**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$387,532.08***
			SAY	***$387,600.00***

Norfolk Avenue Bicycle/Pedestrian Long-Term Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	0	SY	$2.00	$0.00
HMA Surface Course (2")	2,154	TON	$80.00	$172,318.95
HMA Base Course (6")	6,462	TON	$75.00	$484,647.06
6" Graded Aggregate Base	36,618	SY	$10.00	$366,177.78
5" Thermoplastic White Pavement Markings	5,586	LF	$1.50	$8,379.00
12" Thermoplastic White Pavement Markings	4,312	LF	$4.00	$17,248.00
24" Thermoplastic White Pavement Markings	582	LF	$10.00	$5,820.00
5" Thermoplastic Yellow Pavement Markings	2,706	LF	$1.50	$4,059.00
Pavement Marking Symbols	40	SF	$7.00	$280.00
			Total Category 5 Cost:	***$1,058,929.79***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$0.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.4	CPM	$17,600.00	$6,688.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	3	EA	$250,000.00	$750,000.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$756,688.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$423,571.92	***$423,571.92***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$370,625.43	***$370,625.43***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$31,767.89	***$31,767.89***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$52,946.49	***$52,946.49***
			Subtotal	**$2,694,529.52**
Design Contingency	**50%**			**$1,347,264.76**
Admin. / Overhead	**15.30%**			**$412,263.02**
Total Construction Cost				**$4,454,057.29**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$4,454,057.29***
			SAY	***$4,454,100.00***

Arlington Road Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	14,529	SY	$2.00	$29,058.22
HMA Surface Course (2")	1,709	TON	$80.00	$136,744.58
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	0	SY	$10.00	$0.00
5" Thermoplastic White Pavement Markings	10,780	LF	$1.50	$16,170.44
12" Thermoplastic White Pavement Markings	1,152	LF	$4.00	$4,606.00
24" Thermoplastic White Pavement Markings	251	LF	$10.00	$2,510.00
5" Thermoplastic Yellow Pavement Markings	6,860	LF	$1.50	$10,290.00
Pavement Marking Symbols	652	SF	$7.00	$4,564.00
Post Mounted Delineator	250	EA	$50.00	$12,475.00
			Total Category 5 Cost:	***$203,943.24***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$0.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.5	CPM	$17,600.00	$8,800.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	12	EA	$65,000.00	$780,000.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$788,800.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$81,577.30	***$81,577.30***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$71,380.13	***$71,380.13***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$6,118.30	***$6,118.30***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$10,197.16	***$10,197.16***
			Subtotal	**$1,162,016.13**
Design Contingency	**50%**			**$581,008.06**
Admin. / Overhead	**15.30%**			**$177,788.47**
Total Construction Cost				**$1,920,812.66**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$1,920,812.66***
			SAY	***$1,920,900.00***

Pearl Street Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	3,517	SY	$2.00	$7,034.89
HMA Surface Course (2")	536	TON	$80.00	$42,864.31
HMA Base Course (6")	366	TON	$75.00	$27,447.06
6" Graded Aggregate Base	2,074	SY	$10.00	$20,737.78
5" Thermoplastic White Pavement Markings	2,793	LF	$1.50	$4,189.69
12" Thermoplastic White Pavement Markings	641	LF	$4.00	$2,562.00
24" Thermoplastic White Pavement Markings	62	LF	$10.00	$620.00
5" Thermoplastic Yellow Pavement Markings	2,426	LF	$1.50	$3,639.00
Pavement Marking Symbols	120	SF	$7.00	$840.00
Post Mounted Delineator	55	EA	$50.00	$2,755.00
			Total Category 5 Cost:	***$109,934.73***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	7,138	SF	$8.00	$57,104.00
Standard Type A Curb and Gutter	1,361	LF	$30.00	$40,830.00
			Total Category 6 Cost:	***$97,934.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.2	CPM	$17,600.00	$4,048.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	2	EA	$250,000.00	$500,000.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$504,048.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$83,147.49	***$83,147.49***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$72,754.05	***$72,754.05***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$6,236.06	***$6,236.06***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$10,393.44	***$10,393.44***
			Subtotal	**$884,447.77**
Design Contingency	**50%**			**$442,223.88**
Admin. / Overhead	**15.30%**			**$135,320.51**
Total Construction Cost				**$1,461,992.16**
Right of Way Costs	10,268	SF	$150.00	**$1,540,200.00**
			Total Cost	***$3,002,192.16***
			SAY	***$3,002,200.00***

Trail Connection between Bradley Boulevard and Capital Crescent Trail

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	3,205	SF	$125.00	$400,625.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$400,625.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	0	SY	$2.00	$0.00
HMA Surface Course (2")	0	TON	$80.00	$0.00
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	1,760	SY	$10.00	$17,600.00
5" Thermoplastic White Pavement Markings	0	LF	$1.50	$0.00
12" Thermoplastic White Pavement Markings	0	LF	$4.00	$0.00
24" Thermoplastic White Pavement Markings	0	LF	$10.00	$0.00
5" Thermoplastic Yellow Pavement Markings	0	LF	$1.50	$0.00
Pavement Marking Symbols	0	SF	$7.00	$0.00
			Total Category 5 Cost:	***$17,600.00***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	19,040	SF	$8.00	$152,320.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$152,320.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.0	CPM	$17,600.00	$0.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.3	CPM	$1,408,000.00	$352,000.00
			Total Category 9 Cost:	***$352,000.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$228,218.00	***$228,218.00***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$199,690.75	***$199,690.75***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$17,116.35	***$17,116.35***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$28,527.25	***$28,527.25***
			Subtotal	**$1,396,097.35**
Design Contingency	**50%**			**$698,048.68**
Admin. / Overhead	**15.30%**			**$213,602.89**
Total Construction Cost				**$2,307,748.92**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$2,307,748.92***
			SAY	***$2,307,800.00***

North Bethesda Trail Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	2,100	SF	$150.00	$315,000.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$315,000.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	0	SY	$2.00	$0.00
HMA Surface Course (2")	0	TON	$80.00	$0.00
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	1,760	SY	$10.00	$17,600.00
5" Thermoplastic White Pavement Markings	0	LF	$1.50	$0.00
12" Thermoplastic White Pavement Markings	0	LF	$4.00	$0.00
24" Thermoplastic White Pavement Markings	0	LF	$10.00	$0.00
5" Thermoplastic Yellow Pavement Markings	0	LF	$1.50	$0.00
Pavement Marking Symbols	0	SF	$7.00	$0.00
			Total Category 5 Cost:	***$17,600.00***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	18,240	SF	$8.00	$145,920.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$145,920.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.0	CPM	$17,600.00	$0.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.3	CPM	$1,408,000.00	$352,000.00
			Total Category 9 Cost:	***$352,000.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$191,408.00	***$191,408.00***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$167,482.00	***$167,482.00***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$14,355.60	***$14,355.60***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$23,926.00	***$23,926.00***
			Subtotal	**$1,227,691.60**
Design Contingency	**50%**			**$613,845.80**
Admin. / Overhead	**15.30%**			**$187,836.81**
Total Construction Cost				**$2,029,374.21**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$2,029,374.21***
			SAY	***$2,029,400.00***

Woodmont Avenue Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	6,993	SY	$2.00	$13,986.67
HMA Surface Course (2")	823	TON	$80.00	$65,819.61
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	0	SY	$10.00	$0.00
5" Thermoplastic White Pavement Markings	1,447	LF	$1.50	$2,170.50
12" Thermoplastic White Pavement Markings	0	LF	$4.00	$0.00
24" Thermoplastic White Pavement Markings	210	LF	$10.00	$2,100.00
5" Thermoplastic Yellow Pavement Markings	2,660	LF	$1.50	$3,990.00
Pavement Marking Symbols	200	SF	$7.00	$1,400.00
Post Mounted Delineator	65	EA	$50.00	$3,237.50
			Total Category 5 Cost:	***$89,466.77***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$0.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.18	CPM	$17,600.00	$3,168.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$3,168.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$35,786.71	***$35,786.71***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$31,313.37	***$31,313.37***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$2,684.00	***$2,684.00***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$4,473.34	***$4,473.34***
			Subtotal	**$166,892.20**
Design Contingency	**50%**			**$83,446.10**
Admin. / Overhead	**15.30%**			**$25,534.51**
Total Construction Cost				**$275,872.80**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$275,872.80***
			SAY	***$275,900.00***

Old Georgetown Road Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	4,869	SY	$2.00	$9,737.33
HMA Surface Course (2")	573	TON	$80.00	$45,822.75
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	0	SY	$10.00	$0.00
5" Thermoplastic White Pavement Markings	4,215	LF	$1.50	$6,322.13
12" Thermoplastic White Pavement Markings	1,330	LF	$4.00	$5,320.00
24" Thermoplastic White Pavement Markings	90	LF	$10.00	$900.00
5" Thermoplastic Yellow Pavement Markings	250	LF	$1.50	$375.00
Pavement Marking Symbols	100	SF	$7.00	$700.00
Post Mounted Delineator	33	EA	$50.00	$1,632.50
			Total Category 5 Cost:	***$69,177.20***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	75	LF	$30.00	$2,250.00
			Total Category 6 Cost:	***$2,250.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.16	CPM	$17,600.00	$2,816.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$2,816.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$28,570.88	***$28,570.88***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$24,999.52	***$24,999.52***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$2,142.82	***$2,142.82***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$3,571.36	***$3,571.36***
			Subtotal	**$133,527.78**
Design Contingency	**50%**			**$66,763.89**
Admin. / Overhead	**15.30%**			**$20,429.75**
Total Construction Cost				**$220,721.42**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$220,721.42***
			SAY	***$220,800.00***

Montgomery Lane Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	5,465	SY	$2.00	$10,929.56
HMA Surface Course (2")	643	TON	$80.00	$51,433.20
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	0	SY	$10.00	$0.00
5" Thermoplastic White Pavement Markings	8,018	LF	$1.50	$12,026.25
12" Thermoplastic White Pavement Markings	123	LF	$4.00	$492.00
24" Thermoplastic White Pavement Markings	18	LF	$10.00	$180.00
5" Thermoplastic Yellow Pavement Markings	0	LF	$1.50	$0.00
Pavement Marking Symbols	100	SF	$7.00	$700.00
Post Mounted Delineator	75	EA	$50.00	$3,765.00
			Total Category 5 Cost:	***$75,761.01***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$0.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.3	CPM	$17,600.00	$5,280.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$5,280.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$30,304.40	***$30,304.40***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$26,516.35	***$26,516.35***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$2,272.83	***$2,272.83***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$3,788.05	***$3,788.05***
			Subtotal	**$143,922.64**
Design Contingency	**50%**			**$71,961.32**
Admin. / Overhead	**15.30%**			**$22,020.16**
Total Construction Cost				**$237,904.13**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$237,904.13***
			SAY	***$238,000.00***

Battery Lane Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	10,262	SY	$2.00	$20,523.11
HMA Surface Course (2")	1,207	TON	$80.00	$96,579.35
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	0	SY	$10.00	$0.00
5" Thermoplastic White Pavement Markings	10,287	LF	$1.50	$15,430.50
12" Thermoplastic White Pavement Markings	0	LF	$4.00	$0.00
24" Thermoplastic White Pavement Markings	65	LF	$10.00	$650.00
5" Thermoplastic Yellow Pavement Markings	4,582	LF	$1.50	$6,873.00
Pavement Marking Symbols	200	SF	$7.00	$1,400.00
Post Mounted Delineator	114	EA	$50.00	$5,692.50
			Total Category 5 Cost:	***$141,455.96***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$0.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.46	CPM	$17,600.00	$8,096.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$8,096.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$56,582.38	***$56,582.38***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$49,509.59	***$49,509.59***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$4,243.68	***$4,243.68***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$7,072.80	***$7,072.80***
			Subtotal	**$266,960.40**
Design Contingency	**50%**			**$133,480.20**
Admin. / Overhead	**15.30%**			**$40,844.94**
Total Construction Cost				**$441,285.54**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$441,285.54***
			SAY	***$441,300.00***

Waverly Street Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	1,199	SY	$2.00	$2,397.56
HMA Surface Course (2")	141	TON	$80.00	$11,282.61
HMA Base Course (6")	0	TON	$75.00	$0.00
6" Graded Aggregate Base	0	SY	$10.00	$0.00
5" Thermoplastic White Pavement Markings	553	LF	$1.50	$829.50
12" Thermoplastic White Pavement Markings	0	LF	$4.00	$0.00
24" Thermoplastic White Pavement Markings	40	LF	$10.00	$400.00
5" Thermoplastic Yellow Pavement Markings	560	LF	$1.50	$840.00
Pavement Marking Symbols	40	SF	$7.00	$280.00
Post Mounted Delineator	0	EA	$50.00	$0.00
			Total Category 5 Cost:	***$16,029.67***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	0	LF	$30.00	$0.00
			Total Category 6 Cost:	***$0.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.1	CPM	$17,600.00	$880.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$880.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$6,411.87	***$6,411.87***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$5,610.38	***$5,610.38***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$480.89	***$480.89***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$801.48	***$801.48***
			Subtotal	**$30,214.30**
Design Contingency	**50%**			**$15,107.15**
Admin. / Overhead	**15.30%**			**$4,622.79**
Total Construction Cost				**$49,944.23**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$49,944.23***
			SAY	***$50,000.00***

St. Elmo Avenue Bicycle/Pedestrian Improvements

Item	Quantity	Unit	Unit Cost	Total Cost
Category 2: Earthwork				
Removal of Existing Curb and Gutter	0	LF	$15.00	$0.00
Removal of Existing Pavement	0	CY	$30.00	$0.00
Removal of Existing Sidewalk	0	CY	$75.00	$0.00
			Total Category 2 Cost:	***$0.00***
Category 4: Structures				
Retaining Wall - 4 feet and higher	0	SF	$150.00	$0.00
Retaining Wall - less than 4 feet	0	SF	$120.00	$0.00
			Total Category 4 Cost:	***$0.00***
Category 5: Paving				
Fine Milling Asphalt Pavement	5,227	SY	$2.00	$10,453.78
HMA Surface Course (2")	623	TON	$80.00	$49,844.71
HMA Base Course (6")	24	TON	$75.00	$1,829.41
6" Graded Aggregate Base	138	SY	$10.00	$1,382.22
5" Thermoplastic White Pavement Markings	5,440	LF	$1.50	$8,160.00
12" Thermoplastic White Pavement Markings	1,484	LF	$4.00	$5,936.00
24" Thermoplastic White Pavement Markings	83	LF	$10.00	$830.00
5" Thermoplastic Yellow Pavement Markings	1,764	LF	$1.50	$2,646.00
Pavement Marking Symbols	100	SF	$7.00	$700.00
Post Mounted Delineator	0	EA	$50.00	$0.00
			Total Category 5 Cost:	***$81,782.12***
Category 6: Shoulders				
5 Inch Concrete Sidewalk	0	SF	$8.00	$0.00
Standard Type A Curb and Gutter	101	LF	$30.00	$3,030.00
			Total Category 6 Cost:	***$3,030.00***
Category 9: Traffic				
Signing - Arterial Cost Per Mile	0.2	CPM	$17,600.00	$3,520.00
New Traffic Signal - T intersection with pedestrians	0	EA	$200,000.00	$0.00
New Traffic Signal - 4 leg with pedestrians	0	EA	$250,000.00	$0.00
Existing Signal Modification/Impact - per leg	0	EA	$65,000.00	$0.00
Pedestrian/Ornamental/Decorative Lighting – Per Mile (Adjacent to Shared Use Path only)	0.0	CPM	$1,408,000.00	$0.00
			Total Category 9 Cost:	***$3,520.00***
Category 1: Preliminary - 40% of Categories 2, 4, 5 & 6	1	LS	$33,924.85	***$33,924.85***
Category 3: Drainage - 35% of Categories 2, 4, 5 & 6	1	LS	$29,684.24	***$29,684.24***
Category 7: Landscape - 3% of Categories 2, 4, 5 & 6	1	LS	$2,544.36	***$2,544.36***
Category 8: Utilities - 5% of Categories 2, 4, 5 & 6	1	LS	$4,240.61	***$4,240.61***
			Subtotal	**$158,726.18**
Design Contingency	**50%**			**$79,363.09**
Admin. / Overhead	**15.30%**			**$24,285.10**
Total Construction Cost				**$262,374.37**
Right of Way Costs	0	SF		**$0.00**
			Total Cost	***$262,374.37***
			SAY	***$262,400.00***