FLOWER AVENUE SEPARATED BIKE LANES STUDY

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4 Executive Summary

The Flower Avenue Separated Bike Lanes is proposed along Flower Avenue approximately 0.2-miles from Piney Branch Road (MD 320) to Arliss Street (MD 594-D) in Silver Spring, Maryland. The purpose and need for the bikeway are as follows:

1. *Improve bicycle and pedestrian safety and comfort in the Flower Avenue corridor.*
2. *Improve bicycle connectivity within and beyond Long Branch.*
3. *Provide balanced, multi-modal transportation options for all Flower Avenue users.*

Existing Flower Avenue is a 40- to 49-ft wide closed-section roadway within the study area. Existing right-of-way widths vary from 39+/- to 71+/-ft. The posted speed limit along Flower Avenue is 25 mph and the average daily traffic volume is 11,650. Generally, the roadway has one northbound lane, one southbound lane, 1 left turn lane, parking lanes on both sides, and sidewalks on both sides of the street south of the Flower Avenue Urban Park. North of the Flower Urban Park there is generally 1 lane of northbound through traffic, 2 lanes for southbound through traffic, a 6-ft painted median, and sidewalks on both sides of the street.

The study herein is founded on topographic survey, utility records, traffic data and analysis, as-built drawings, right-of-way plat research, site investigation, and public/stakeholder input.

There are no property displacements. Impacts to cultural/historical properties, wetlands/waters, or rare/threatened/endangered species are not anticipated. The preliminary cost estimate is $3.7 million, with construction anticipated to begin in 2026.

5 Study Overview

The Flower Avenue Separated Bike Lanes study was prepared between Summer 2022 and Winter 2023 by the Montgomery County Department of Transportation (MCDOT) to evaluate alternatives for the implementation of separated bike lanes on Flower Avenue from Piney Branch Road(MD 320) to Arliss Street (MD 594-D) (0.2 miles). The study area is located within the Long Branch Bicycle and Pedestrian Priority Area (BiPPA), one of 34 designated BiPPAs throughout the County. The overall purpose of the Flower Avenue separated bike lanes is to improve bicyclist and pedestrian safety and comfort, bicycle connectivity, and to provide a balanced, multi-modal corridor for all transportation users.

The study is founded on detailed topographic survey data, utility mapping records, traffic data, as-built drawings, right-of-way plat research, and site investigation. Furthermore, the study recommendations are supported by detailed traffic analyses and public-stakeholder input. Lastly, the study considers several on-going and adjacent projects and how they will interface with the bikeway.

Figure 1 – Enlarged Area: Flower Avenue Separated Bike Lanes Study Area

6 Purpose and Need

1. Improve bicycle and pedestrian safety and comfort in the Flower Avenue corridor.

The primary purpose of the Flower Avenue separated bike lanes is to improve bicyclist and pedestrian safety and comfort in the corridor. Currently, bicyclists use the vehicular travel lanes and are susceptible to collisions with vehicular traffic, particularly adjacent to parking lanes and at intersections with cross streets, alleys, and driveways. Proposed improvements are needed to provide a separated bikeway and mitigation of conflicts at all other uncontrolled access points by means of consistent, intuitive, and highly visible signing and marking treatments.

2. Improve bicycle connectivity within and beyond Long Branch.

At present, bicyclists use the vehicular travel lanes or sidewalks along Flower Avenue to travel to and from destinations within Long Branch, as the corridor provides a direct, continuous north-south route that ties together communities, businesses, employers, retailers, civic buildings, and various other transportation facilities.

3. Provide balanced, multi-modal transportation options for all Flower Avenue users.

Another purpose of the Flower Avenue Separated Bike Lanes project is also about re-balancing the corridor to align with modern complete street principles. In addition to bicyclists, Flower Avenue has many competing user demands, including motorists, pedestrians, transit, businesses, parking, truck loading, driveway access, overhead/underground utilities, landscaping, and various other amenities. With so many demands on the corridor, it is not possible to make improvements focused on one travel mode without affecting other travel modes and uses of the public right-of-way. The bikeway improvements need to be carefully balanced with other transportation modes and uses of the public right-of-way.

7 Existing Conditions

7.1 Project Area

Flower Avenue from Piney Branch Road (MD 320) to Arliss Street (MD 594-D) is a bustling urban, commercial, multi-modal corridor located in Silver Spring, Montgomery County, Maryland. The corridor serves a wide range of needs for the Long Branch community. Primarily it serves as a transportation route for local and commuter vehicular traffic, bicyclists, pedestrians, transit users, and business patrons. The corridor includes on-street parking within the public right-of-way between Piney Branch Road (MD 320) and the Flower Avenue Urban Park. Many private properties, include off-street surface parking as well. Flower Avenue is predominantly fronted by residential, commercial, and mixed-use properties such as retail stores, restaurants, cafes, and grocery stores. To the south and east of the study area is the urban core of Takoma Park, which is centered on University Boulevard (MD 193) and New Hampshire Avenue (MD 650). To the west lies Sligo Creek Park. To the North lies residential communities. The planned Purple Line passes under the corridor at Arliss Street with a nearby station that is under construction at the intersection of Piney Branch Road and Arliss Street.

Flower Avenue is an attractive, inviting street for pedestrians and bicyclists as it is lined with mature street trees, planter beds, potted plants, and a combination of streetscape elements such as median refuge's, decorative light poles, and sidewalk café seating. There are various types of roadway and pedestrian lighting including utility pole mounted cobra-head luminaires, Washington Globes, rectangular luminaries, and luminaires mounted on traffic signal poles.

The Flower Avenue public right-of-way is owned and maintained by the Montgomery County Department of Transportation (MCDOT). According to the Montgomery County Master Plan of Highways and Transitways, dated 05/26/2022, Flower Avenue is designated as route B-1 with a 70-ft right-of-way, two-lanes plus parking, and a target speed of 25 mph. Maryland Department of Transportation (MDOT) State Highway Administration (SHA) has classified Flower Avenue as an urban major collector. The MDOT SHA formerly designated Flower Avenue as MD 787 but that designation has since been removed. MCDOT classifies Flower Avenue as a Town Center Street. Flower Avenue intersects with two roads within the study area which are both state routes: Piney Branch Road (MD 320) and Arliss Street (MD 594-D). Piney Branch Road is a four-lane urban minor arterial with average daily traffic volumes around 19,100 vehicles per day. Arliss Street was recently transferred to the State from the County in 2016 and is currently being reconstructed to accommodate the Purple Line light rail track.

Multiple RideOn bus routes operate throughout the entire length of the corridor with 2 bus stops along Flower Avenue both to the north and south of Piney Branch Road. RideOn bus routes also operate on Piney Branch Road with stops near the intersection at Flower Avenue. Washington Metropolitan Area Transit Authority (WMATA) does not operate bus routes in the study area, nearest routes are on Fenton Street to the west and University Boulevard to the east.

There are existing overhead utilities primarily along the west side of street from the Flower Avenue Urban Park to Arliss Street. The poles are equipped with overhead electric, telecom, and roadway lighting. Existing traffic signals are mounted to steel mast arms and poles. Underground utility infrastructure includes water, sanitary sewer, gas, electrical, and telecom.

Topographic survey of the corridor was performed in 2022.

Table 1 - Study Area Roadway Inventory

Road Name	Designation	Owner	Lanes	Functional Classification	Traffic Control	Average Annual Daily Traffic (vehicles per day)
Flower Avenue	B-1	MCDOT	2	Town Center Street	-	11,650
Piney Branch Road (MD 320)	MD 320	MDOT SHA	4 + LT Lanes	Urban – Minor Arterial	Signalized	19,100
Arliss Street (MD 594-D)	MD 594-D	MDOT SHA	2	Urban - Local	Stop controlled on minor leg only	6,000

*LT = Left Turn

7.2 Typical Section

The entire length of the Flower Avenue corridor is a closed section with an asphalt pavement, concrete curb and gutter, and concrete sidewalks. The curb-to-curb width along Flower Avenue from Piney Branch Road (MD 320) to the Flower Avenue Urban Park is 49+/- feet wide, and from the Flower Avenue Urban Park to Arliss Street (MD 594-D) is 40 feet wide. Travel lanes in the corridor are 11 feet wide. Parking lanes are 8 feet wide. Sidewalks are generally 10 feet wide or more when not adjacent to residential properties, when adjacent to residential properties the sidewalk is 4 feet wide.

7.3 Right-of-Way

The Right-of-way width is generally 39'+/- south of the Flower Avenue Urban Park and is 71'+/- north of the Flower Avenue Urban Park. It should be noted the existing Right-of-way for the Southern portion of this project does not include the entire width of the existing street and sidewalks.

A boundary survey was completed by a licensed surveyor in 2022.

7.4 Utilities

The corridor includes moderate utility congestion. Overhead utility lines are located along the west side of the street from the Flower Avenue Urban Park to Arliss Street (MD 594-D).

Washington Gas owns underground mains along Flower Avenue from Piney Branch Road (MD 320) to Arliss Street (MD 594-D).

The Washington Suburban Sanitary Commission (WSSC) owns water mains along Flower Avenue from Piney Branch Road (MD 320) to Arliss Street (MD 594-D).

The project corridor's storm drain and sanitary sewers are separated. Flower Avenue is a closed drainage system. MCDOT owns and maintains the storm drain system although there is no existing storm drains located along Flower Avenue from Piney Branch Road (MD 320) to Arliss Street (MD 594-D). The watershed drains to Sligo Creek to the west, which runs south to the Northwest Branch of the Anacostia River.

Based on as-built drawing review, telecommunications infrastructure primarily runs underground along the west side of Flower Avenue from Piney Branch Road (MD 320) to the Flower Avenue Urban Park, and overhead along the west side of Flower Avenue from the Flower Avenue Urban Park to Arliss Street (MD 594-D).

Traffic signal and street lighting infrastructure also exist throughout the corridor. MDOT SHA owns the traffic signal at Piney Branch Road (MD 320), however, MCDOT is responsible for signal operations on both County and State roads. Street lighting is a combination of roadway luminaires mounted on utility poles, Washington Globe pedestrian lighting, and rectilinear luminaires mounted on pendent poles. The Washington Globe luminaires appear to be recently retrofitted/upgraded from high-pressure sodium fixtures to LEDs.

Figure 2 - Overhead utilities

7.5 Intersections

7.5.1 Operations

The only existing signalized intersection within the study area is at the intersection of Piney Branch Road (MD 320) and Flower Avenue. Right-turns on red are prohibited at this intersection on all four approaches. The southbound Flower Avenue approach has a shared thru-right lane and a left turn lane while the northbound approach has a shared thru-right lane and a left turn pocket. The westbound and eastbound Piney Branch Road approaches both have a shared thru-right lane, a thru lane and a left turn pocket. All four legs of the intersection have marked crosswalks with curb ramps and pedestrian APS/CPS signals. The southbound, westbound and eastbound left turn movements are exclusive (or protective) / permitted, meaning they have a protective (turn arrow) phase and can also turn on solid green by yielding right-of-way (ROW) to oncoming thru traffic. The northbound left turn movement does not have a protective phase, they yield the ROW to oncoming thru traffic.

Flower Avenue and Arliss Street (MD 594-D) is a T-intersection that is stop controlled on the minor approach (Arliss Street). The Flower Avenue southbound approach includes one thru lane and one dedicated left-turn lane, while Arliss Street includes dedicated right and left turn lanes. The south and east legs have marked crosswalks. Furthermore, the south leg is signed for motorists to stop for pedestrians in the crosswalks. Lane utilization is shown in the figure below.

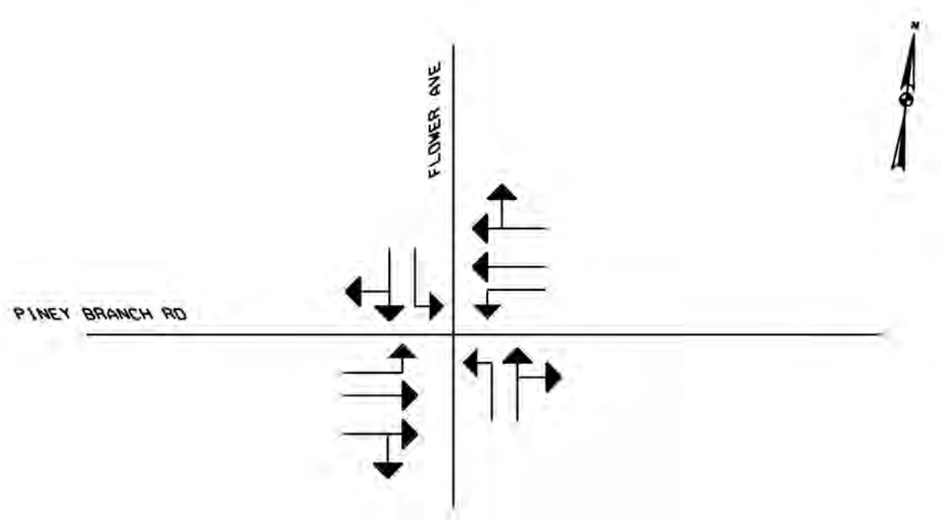


Figure 3 – Lane Utilization, Flower Ave-Piney Branch Rd Intersection

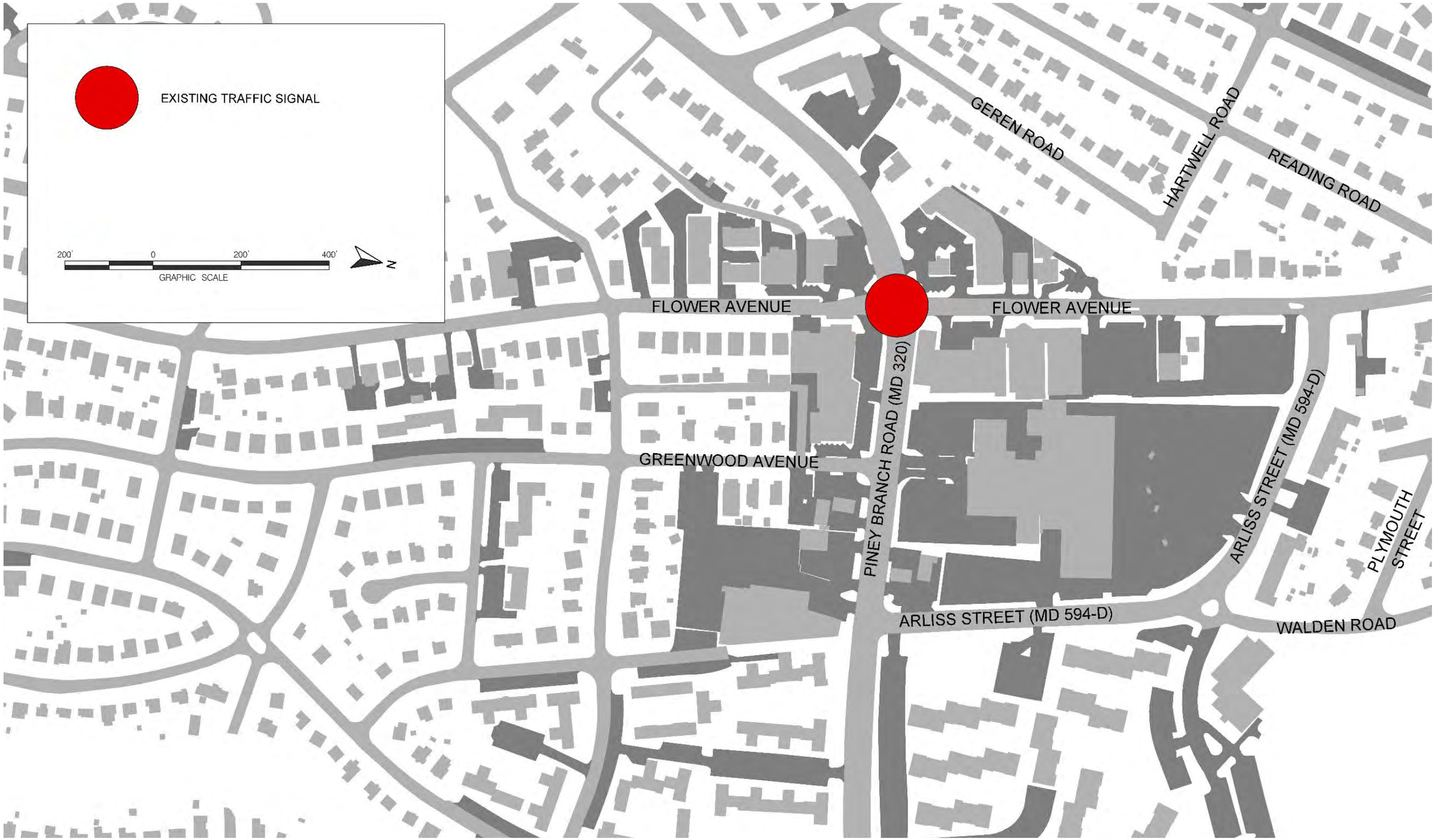


Figure 4 - Existing and Planned Signalized Intersections in the study corridor.

7.5.2 Geometry

The horizontal geometry of the corridor consists of one long tangent south of the Flower Avenue Urban Park a one long left-hand horizontal curve north of the Flower Avenue Urban Park. The Flower Avenue runs primarily along the north-south axis on the grid.

The longitudinal grades in the corridor range from 2.0% to 4.2%.

Curb returns at intersections are generally range from 20- to 30-ft radii.

7.6 Traffic Data

An intersection peak hour turning movement count (TMC) was collected at the intersection of Flower Avenue and Piney Branch Road on September 8th, 2022 (Thursday) for the timer periods of 6:30 AM to 9:30 AM and 3:30 PM to 6:30 PM. This count recorded each movement at the intersection. The AM peak hour was from 7:30 AM to 8:30 AM while the PM peak hour was from 4:45 PM to 5:45 PM. The AM and PM peak hour volumes are shown in the figure below.

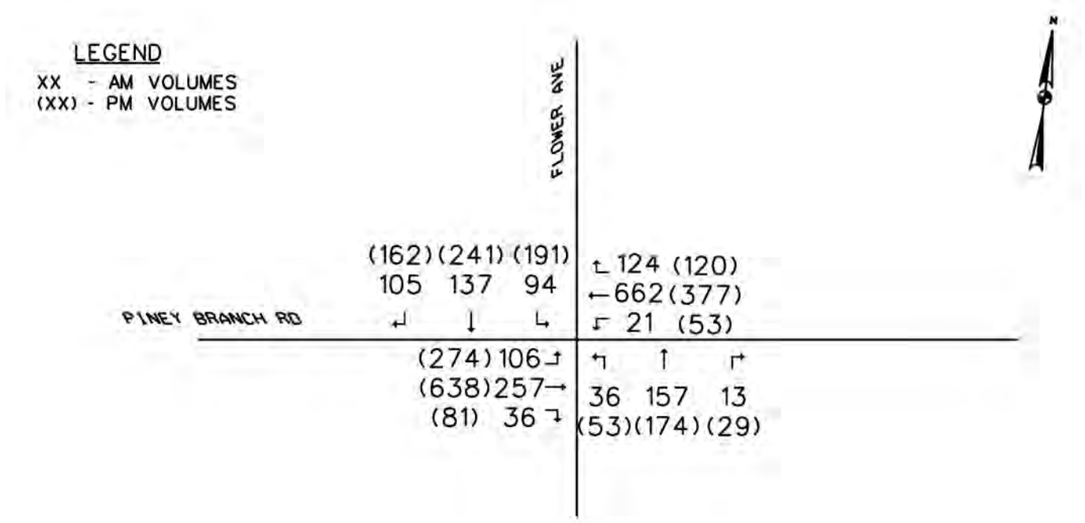


Figure 5 – Network Volumes, Flower Ave at Piney Branch Rd Intersection

The TMC also included pedestrians, bicyclists, buses, and trucks. A summary of the data is as follows:

- Only one cyclist was observed in each of the 3-hour AM and PM peak periods. No cyclists were observed during either peak hour.
- In the AM peak hour, a total of 46 pedestrians were observed on all four crosswalks, while 120 pedestrians were observed on the PM peak hour.
- A total of 79 buses were observed passing through the intersection during the AM peak hour with approximately 30 percent of these buses on Flower Avenue. In the PM peak hour, 46 buses were observed with approximately 25 percent on Flower Avenue.
- A total of 17 trucks were observed in the AM peak hour with approximately 25 percent of these trucks on Flower Avenue. In the PM peak hour, 10 trucks were observed with approximately 20 percent on Flower Avenue.

A 7-day continuous classification count by direction was conducted on from September 6th thru 12th (Tuesday thru following Monday) on Flower Avenue to the north of Piney Branch Road. The typical two-way weekday average daily volume was approximately 11,850 broken out by:

- Passenger cars: 96.7% (rounded)
- Buses: 1.7%
- Straight trucks: 1.6%
- Tractor-trailer: less than 0.1%

Speed data along Flower Avenue was also collected during the same timeframe. A summary is as follows:

- Northbound
  - The median speed was 22.5 mph.
  - Approximately 30 percent of traffic exceeded the posted speed limit of 25mph.
  - The 85th percentile speed was 27.4 mph.
  - Approximately 1 percent of traffic exceeded 35 mph, with a top recorded speed of 58.1 mph.
- Southbound
  - The median speed was 24.5 mph.
  - Approximately 46 percent of traffic exceeded the posted speed limit of 25mph.
  - The 85th percentile speed was 30.2 mph.
  - Approximately 3 percent of traffic exceeded 35 mph, with a top recorded speed of 71.7 mph.

Refer to the appendix for detailed traffic counts and speed data.

7.7 Crash Data

Crash data for the Flower Avenue corridor from Piney Branch Road (MD 320) to Arliss Street (MD 594-D) was obtained from Montgomery County. Between January 1, 2019, and December 31, 2021, 22 crashes were documented within the study area. Of the 22 crashes, 21 (95%) involved only vehicles, and 1 (5%) involved bicycles. There were zero crashes involving pedestrians. The severity of 22 crashes comprised 17 (77%) which involved property damage only and 5 (23%) which had recorded injuries. There were zero fatalities. The highest frequency of crashes occurred between 4 PM and 5 PM. The location where the highest number of crashes (21) occurred was at the intersection of Flower Avenue and Piney Brach Road. The road conditions when the 22 crashes occurred were 18 (82%) dry pavement, 3 (14%) wet pavement, and 1 (4%) did not have information recorded for the pavement conditions. The lighting conditions when the 22 crashes occurred were 15 (68%) daylight, 4 (18%) dark but streetlights were on, and 3 (14%) were at dusk.

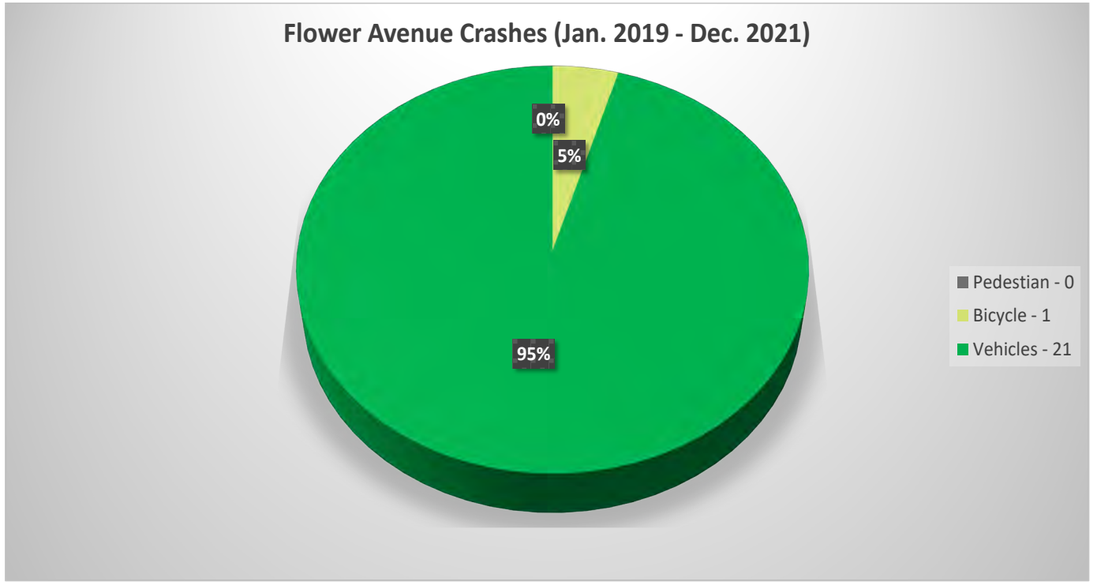


Figure 6 - Flower Avenue Crashes (Jan. 2019 - Dec. 2021)

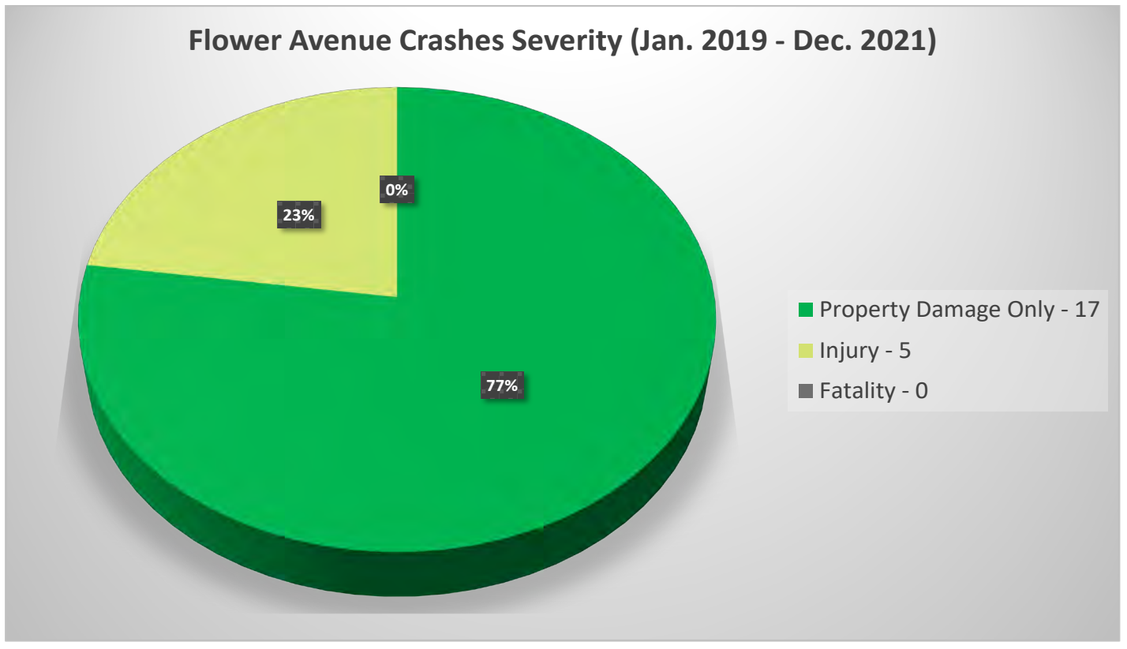


Figure 7 - Flower Avenue Crash Severity (Jan. 2019 - Dec. 2021)

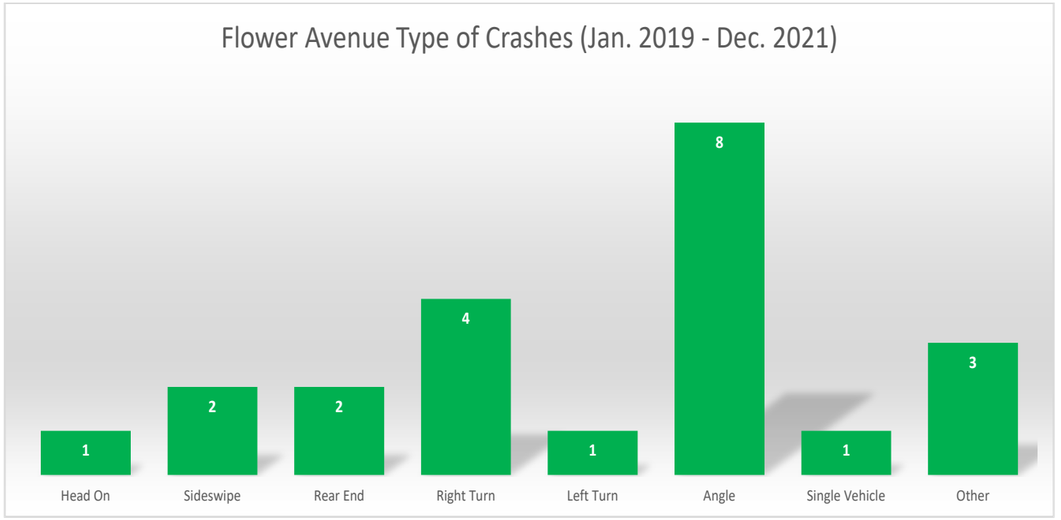


Figure 8 - Flower Avenue Type of Crashes (Jan. 2019 - Dec. 2021)

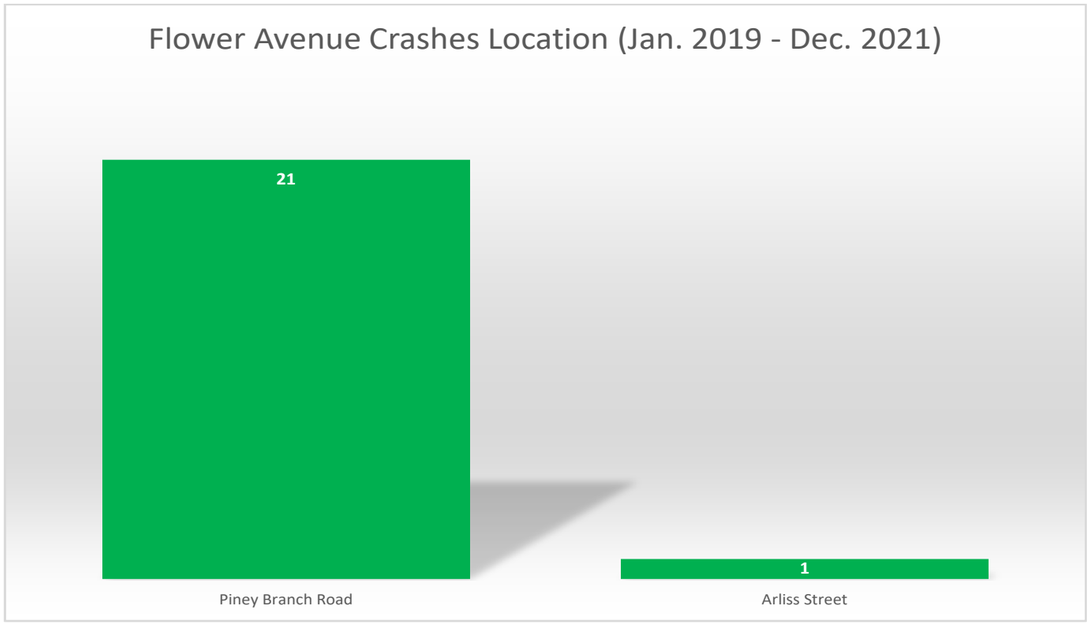


Figure 9 – Flower Avenue Crash Locations (Jan. 2019 - Dec. 2021)

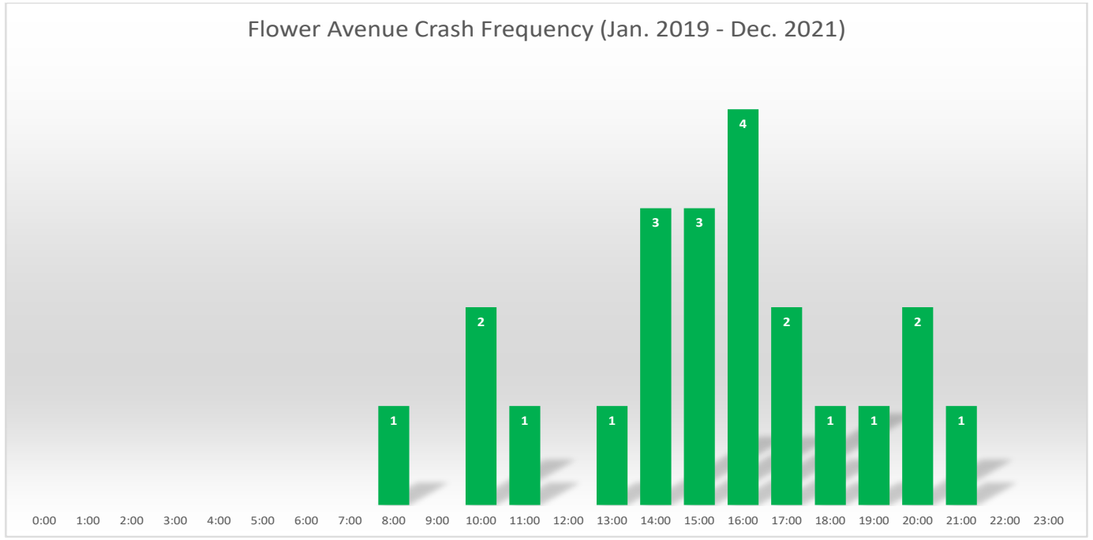


Figure 10 – Flower Avenue Crash Frequency (Jan. 2019 - Dec. 2021)

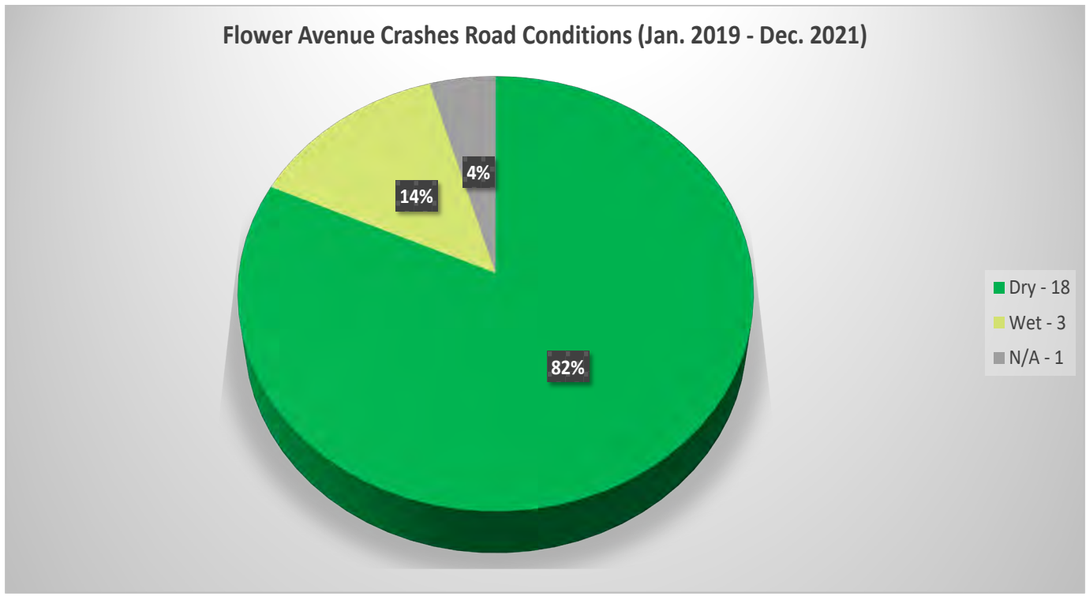


Figure 11 – Flower Avenue Crash Road Conditions (Jan. 2019 - Dec. 2021)

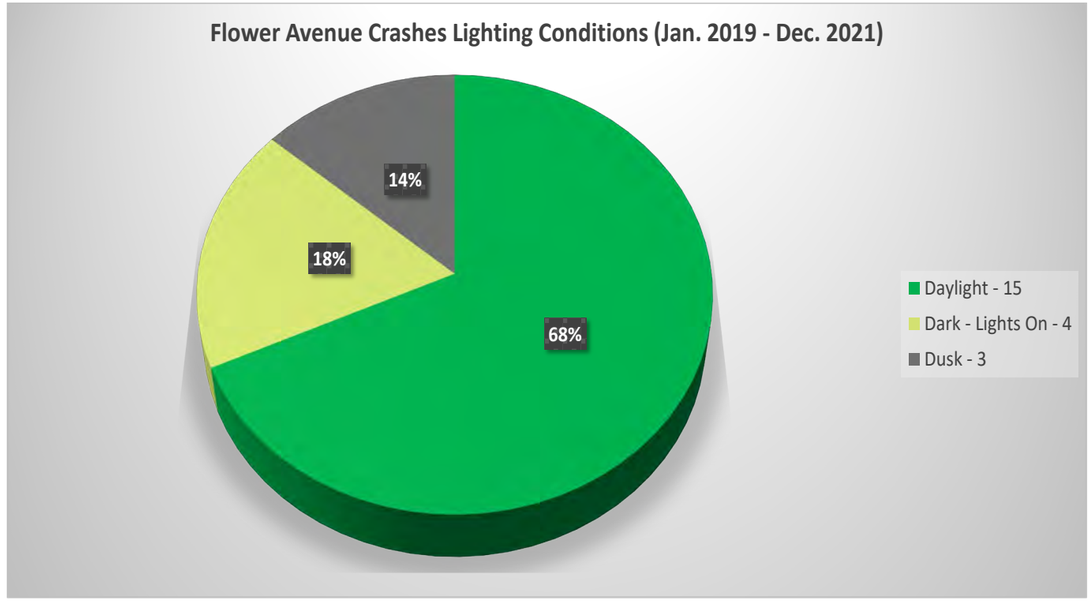


Figure 12 – Flower Avenue Crash Lighting Conditions (Jan. 2019 - Dec. 2021)

7.8 Existing Land Use

The Flower Avenue Separated Bike Lanes will span the Long Branch District.

The Long Branch District includes lower density urban commercial, residential, and mixed-use land uses. In this area, Flower Avenue is fronted by small commercial properties such as restaurants, cafes, dry cleaners, a laundromat, deli/markets, and single-family residents. The area also includes a grocery store, a church, office buildings, and private parking lots. Buildings that front on Flower Avenue are typically 1 – 2 stories with traditional storefront access to the sidewalk. Many of the businesses rely on direct access to the street and parallel parking along Flower Avenue for customer convenience and truck deliveries, as well as sidewalk café seating. To the north lies a large single family detached home residential community.

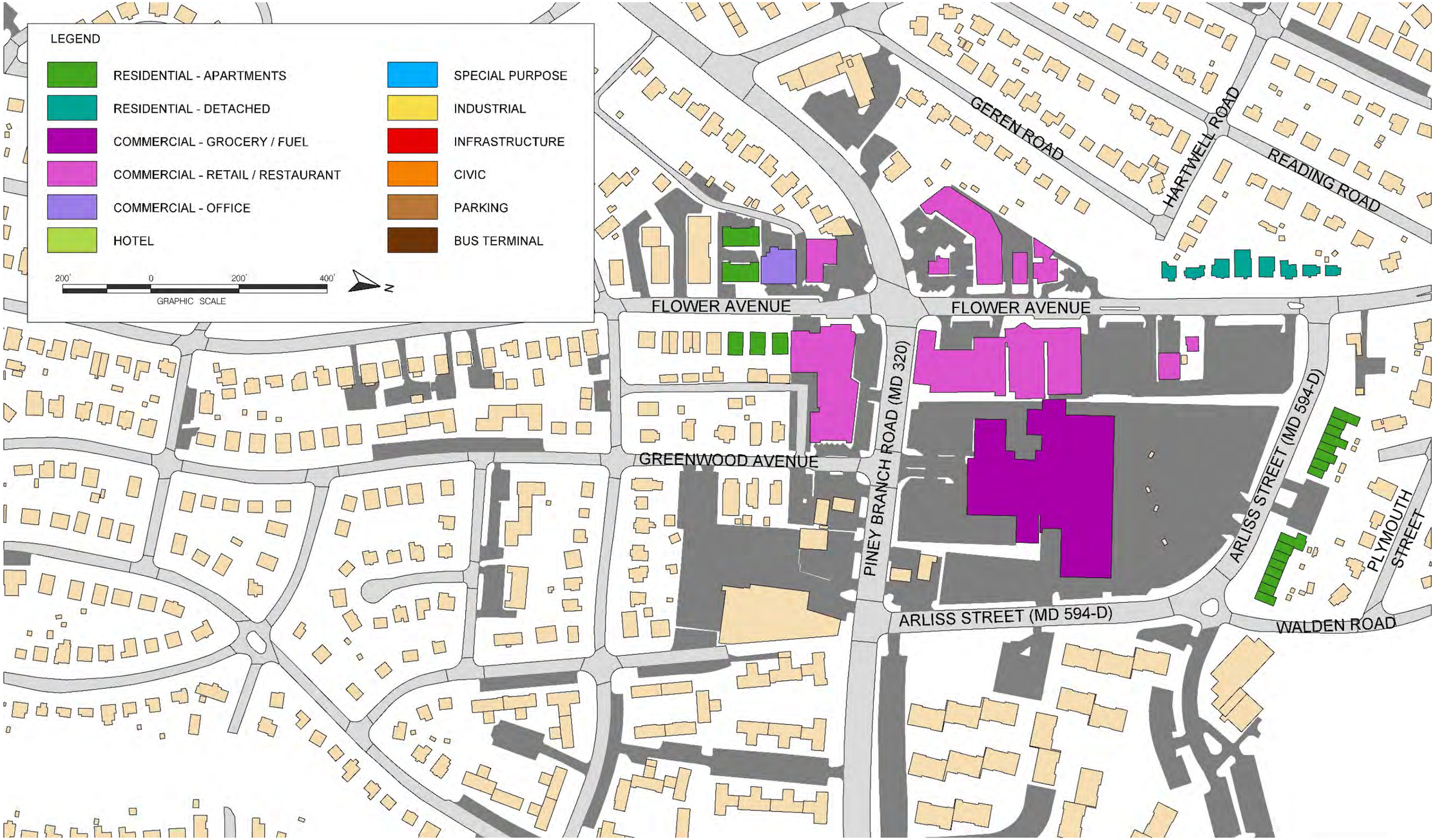


Figure 13 – Flower Avenue - Existing Land Use

7.9 Adjacent Projects / Developments

The most significant project in the corridor is the Purple Line project, which does not directly intersect with Flower Avenue but is nearby via the Plymouth Street tunnel portal on Arliss Street (MD 594-D). The intersections of Flower Avenue with both Arliss Street and Piney Branch Road (MD 320) are both one block from the Long Branch Purple Line station at the intersection of Piney Branch Road and Arliss Street.

With the Purple line development, there is a proposed medical office development, M-NCPPC permit number 820060080, for parcel on the southeast corner of the Flower Avenue Arliss Street (MD 594-D) intersection. This application was approved in February of 2006 but there has not been any development of the site to date. The site is currently being used as a staging and stockpiling site for the Purple Line construction and is set to be restored to its previous condition post Purple Line construction.

7.10 Parking

Public parking along the Flower Avenue study corridor is provided by limited non-metered on-street parking.

Parking is used by small businesses, shops, and restaurants. On-street parking allows for 1-hour from 9 am to 5 pm Monday through Friday on the West side of the street and 1-hour parking from 9am to 5 pm all days of the week on the East side of the street. Figure 14 on the next page presents a parking inventory within the study area.

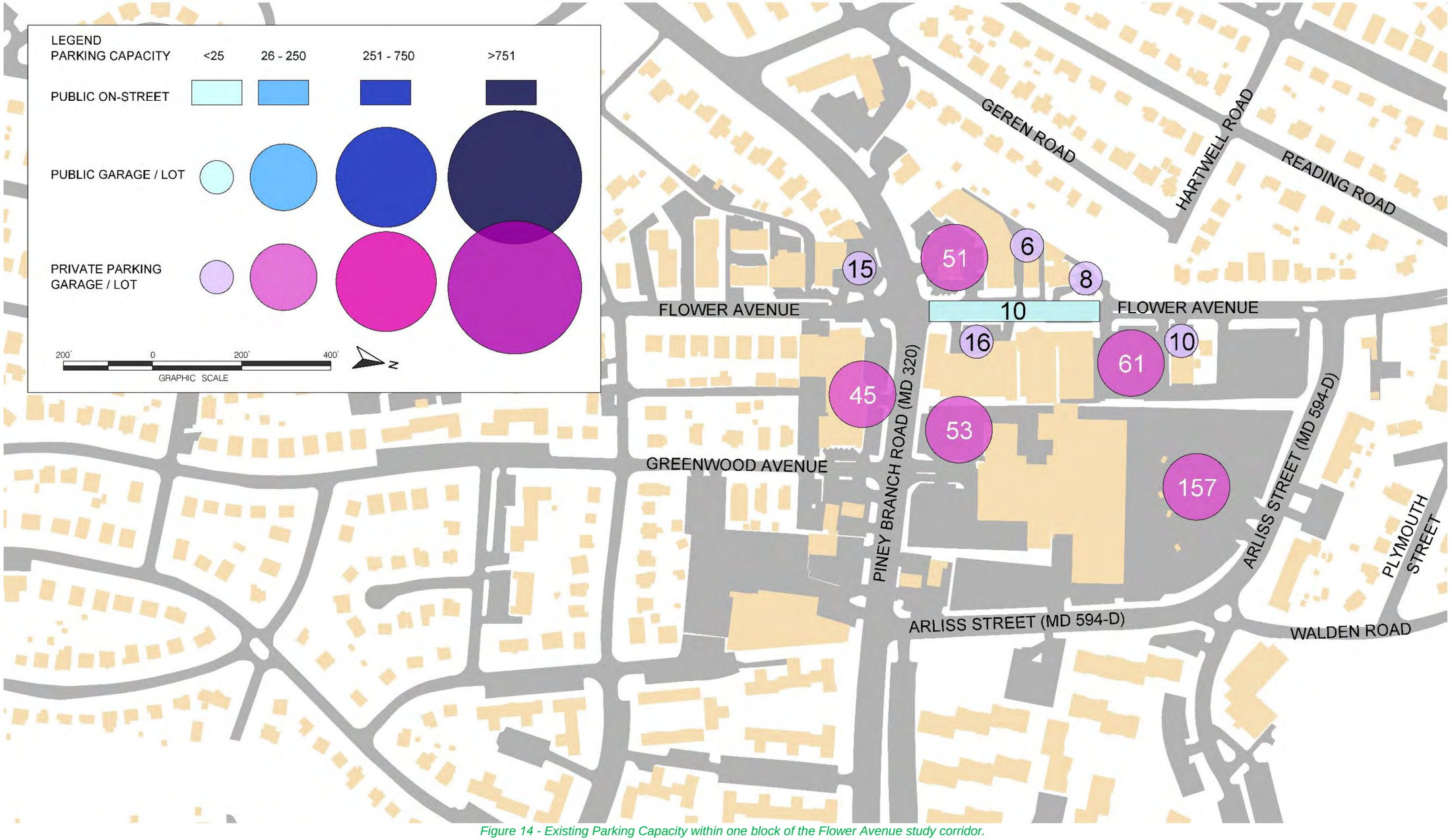


Figure 14 - Existing Parking Capacity within one block of the Flower Avenue study corridor.

7.11 Transit

MCDOT RideOn operates bus services within the corridor. Buses operate along Piney Brach Road and cross Flower Avenue.

The following tables include a summary of transit routes, headways, and bus stop locations in the corridor.

Figure 15 - MCDOT RideOn routes 12 and 13 operates in the Flower Avenue corridor

Table 2 - MCDOT RideOn Routes

Route #	Directions and Limits within Flower Avenue corridor	Weekday AM/PM Peak Headway
12	NB/SB from Wayne Avenue to Carroll Avenue	20 - 30 minutes
13	NB/SB from Wayne Avenue to Carroll Avenue	24 - 30 minutes

Table 3 - Bus Stop Locations and Types

Bus Stop ID	Direction and Location within Flower Avenue corridor	Route	Type	Shelter
22314	SB, Mid-Block	12, 13	N/A	Yes
22292	NB, Mid-Block	12, 13	N/A	Yes

Figure 16 - RideOn Routes (in green)

7.12 Environmental Resources

According to the Maryland Environmental Resource and Land Information Network (MERLIN), there are no environmental resources in the study area. There are no wetlands or waters of the US within the project area. There are no 100-year floodplains within the project area.

The project watershed drains to Sligo Creek (MDE watershed number 021402) to the east, which runs south to the Northwest Branch of the Anacostia River.

There are no rare, threatened, or endangered species anticipated within the project area, but this will be confirmed during the early design phase. This should be confirmed with the Maryland Department of Natural Resources (MD-DNR) and US Fish and Wildlife Service (USFWS).

The entire project area is comprised of previously disturbed, urban soils.

There are 42 street trees in the study area, 25 which are greater than 12-inch diameter. A natural resource inventory should be performed to characterize all street trees.

7.13 Historic and Cultural Resources

According to the Maryland Historic Trust (MHT) MEDUSA GIS database, there are records for the following addresses and/or districts, which either overlap with or are contiguous with the study corridor:

Table 4 - Summary of Maryland Historic Trust Records

Description	Address/Location	Status	Record Number	Notes
Flower Avenue Theatre and Shopping Center	8701 Flower Avenue	Listed on MIHP	M: 37-25	
Residential House used for commercial purposes	8807 Flower Avenue	Eligible	DOE-MO-0259	
Central Square Shopping Center	8541-8547 Piney Branch Road	Eligible	DOE-MO-0273	
Staging area used for Purple Line Construction	8821 Flower Avenue	Eligible	DOE-MO-0260	Any structures on this site have been demolished

Multiple properties are listed in the Maryland Inventory of Historic Places (MIHP). There are no properties listed on the National Register of Historic Places (NRHP).

Although there are several records in the corridor, no adverse effects are anticipated at this time based on the current scope of improvements. Further coordination should be initiated with MHT and M-NCPPC as the study progresses.

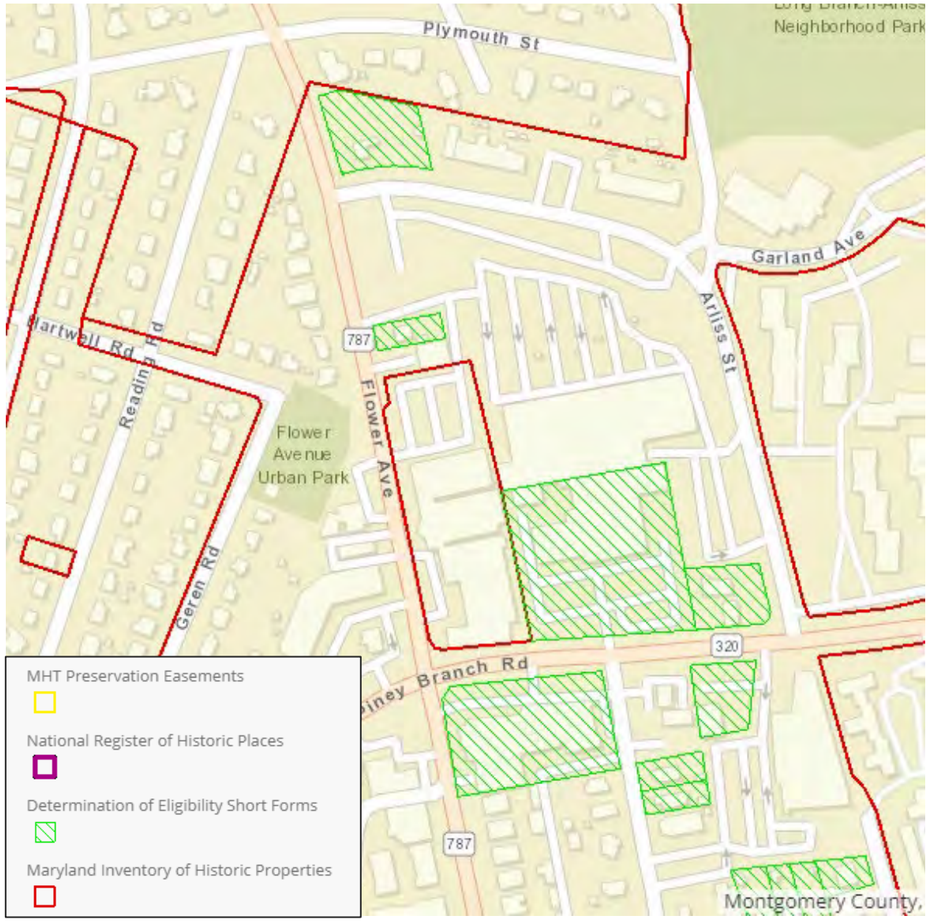


Figure 17 - Historic Properties in the Study Area (Source: MEDUSA)

8 Master Plan Summary

8.1 Bicycle Master Plan (2018)

According to the Maryland National Capital Park and Planning Commission (M-NCPPC), the Flower Avenue Separated Bike Lanes lies within its high priority network of bicycle improvements. The 2018 Bicycle Master Plan recommends separated bike lanes along Flower Avenue from Piney Branch Road (MD 320) to Arliss Street (MD 594-D).

The bikeway will connect with multiple other existing and proposed master planned bikeways, improve connectivity between regional trail systems such as the Sligo Creek Trail and the Capital Crescent Trail.

9 Public Outreach

The Montgomery County Department of Transportation (MCDOT) and the design team met with number of representatives from local community groups to discuss the project on the morning of December 7, 2022, at the project location to discuss their goals for this project. The goals and concerns from these groups regarding this proposed project are as follows:

- speeding is a concern, especially in front of the Flower Avenue Urban Park
- there is no buffer between the sidewalk and the roadway
- future public outreach should be made during design
- consider developing the street for private use
- the local businesses are open to losing some on-street parking
- brick pavers should be avoided
- a HAWK signal or rapid flashing beacons investigated for the mid-block crossing at the Flower Avenue Urban Park

10 Basis of Design

Based on the urban setting of the corridor, competing priorities of use, and the complex interaction between different design elements of the project, it will be essential to establish a basis of design during the study phase. Design criteria should remain consistent with the purpose and need of the project.

Critical to developing a typical roadway section that requires numerous features will be to assure there is required space for existing and proposed underground utilities. All of the roadway features must fit into the limited Right of Way.

10.1 Typical Section Elements

Generally, the project goal is to implement separated bike lanes along the Flower Avenue corridor within the existing right-of-way. It is also desirable to maintain all existing functionalities within the existing right-of-way, including northbound and southbound travel lanes, parking lanes, turning lanes, sidewalks, planting / furnishing buffers, and utilities. Therefore, it is anticipated that impacts will be spread across the entire width of the right-of-way and all travel modes. In other words, the recommended solution will likely involve a compromise for all users.

Each bike lane will have a minimum width of 5 feet, however 6 feet is desirable. In general the buffer will have a width of 3 feet. Proposed travel lanes will be a minimum 10-ft width, but desirably 11-ft wide. Parking lanes will be a minimum 8-ft width. Turning lane widths will be a minimum 9 feet, but desirably 10 feet wide. Sidewalks will include a minimum 5-ft clear width. The remaining available space will be dedicated to a planting/furnishing zone width.

The following is a detailed tabulation of typical section criteria that will be used for the project:

Table 5 - Design Criteria: Typical Section Elements

Criterion	Existing	Absolute	Desired	Reference
Bike Lane widths	N/A	5-ft min.	6-ft	AASHTO
Vehicle lane widths Thru Lanes Thru Lanes, adj to parking Thru Lanes, adj to curb Turn Lanes	 11-ft 10.5-ft	 10-ft min. 11-ft (with 7-ft parking) 11-ft	 11-ft 10-ft (with 8-ft parking)	MC Road Code
Parking Lane widths	7-ft	7-ft	8-ft	
Bus pad width		11-ft		
Bus pad length		90-ft		
Bus stop landing width x depth (not including curb)		5-ft x 8-ft		
Bike Lane buffer width Adj to parking lane	 N/A	 2-ft	 3-ft	
Shy strip, adj. to parking	1.5-ft	2-ft		
Horizontal clearance to obstructions	1.5-ft	1.5-ft		
Sidewalk clear widths	3-ft to 10-ft	5-ft	6-ft	
Curb extension width	6-ft	4-ft	6-ft	
Landscape/BMP zone	5-ft	3-ft	5-ft	
Street Tree spacing	35-ft to 60-ft			
Café zone		8-ft		
Driveway width				
Cross slope		2% max.		
Vertical clearance Sidewalk Bikeway Roadway		 7-ft 8-ft 14-ft	 10-ft	
Utility pole dia.		18-in		

10.2 Geometric Elements

The following table outlines proposed geometric criteria for the project:

Table 6 - Design Criteria: Geometric Elements

Criterion	Existing	Absolute	Desired	Reference
Design Speed Bicycles Pedestrians Vehicles	 N/A 3.5 fps 30 mph	 15 mph 3.5 fps 30 mph		 AASHTO BG MUTCD AASHTO GB
Posted Speed	25 mph	25 mph		AASHTO GB
Stopping Sight Distance	200-ft	200-ft		AASHTO GB Table 5-3
Max. Vertical Grade	4.2%	7.0%	5%	AASHTO GB / BG
Curb return radii Adjacent to travel lane Adjacent to parking lane Adjacent to bikeway	30-ft		15-ft min.	MC Road Code
Curb extensions	6-ft	4-ft	6-ft	
Shifting taper			L = DxS^2 / 60, posted or 85th percentile operating speed	MUTCD MDOT SHA
Islands/aprons at intersections w/ obstacle markers		4-ft min.	6-ft min.	
Driveways Grade breaks Min. K-value Width		 6% max. 4 25-ft (commercial)		
Curb and gutter		6-in height; 1-ft gutter width		MC Road Code
Curb ramps Width Running slope Cross slope Landing dimensions Push button locations		 5-ft min. 12:1 max. 2% max. 5-ft x 5-ft 18-in max from land; 10-ft min. b/w push buttons	Match ped zone	ADA guidelines 2010
Parallel Parking Lane Length	21-ft	21-ft		Montgomery County Zoning Ordinance S 59-E-2.22
No parking in front of hydrant	20-ft	20-ft		Montgomery County Code S 31-20
No Parking adjacent to Driveway (ft)	5-ft	5-ft		Montgomery County Code S 31-19
No Parking adjacent to cross street (ft)	35-ft	35-ft		Montgomery County Code S 31-17

10.3 Design Vehicles

Various design vehicles will need to be considered during design process. Transit vehicles, emergency vehicles, and trucks will all play a role in determining the geometric layout and design of the project. Buses will need to be considered for turning movements and bus stop design. Emergency vehicles will need to be considered for turning movements and access. Montgomery County uses a specific design vehicle based on a tower truck used in the County. Turning movement simulations will be run for large design vehicles at all intersections during the design phase, especially where turning lanes are immediately adjacent to the curb and where left-turning vehicles may encroach on the opposing lane stop bar.

Figure 18 - Montgomery County Fire and Rescue Service ladder truck navigating an intersection in Silver Spring, MD

Table 7 - Design Vehicles

Description	Vehicle Class	Applicability	Characteristics	Source
Tower Truck	Emergency Vehicle	Turning movements	50-ft length; 8-ft width; 21.75-ft wheelbase; 10-ft from front axle to front overhang	MCFRS
Single Unit / Delivery truck	SU-30	Turning movements; Loading zones		AASHTO
Montgomery County RideOn Bus	CITY-BUS	Turning movements; Bus stops		AASHTO

10.4 Intersections

Flower Avenue is a bustling urban, commercial, multi-modal corridor with on-street parking that serves residential, commercial, and mixed-use properties. Within the study area, there is a signalized intersection, an unsignalized intersection and a number of business and residential driveways. There are three concepts under consideration for this project: separated bike lanes, on-street bike lanes (with buffer) and a two-way cycle track. Regardless which option is selected, the bike lanes will still have various conflict points with turning vehicles at both intersections and driveways as shown in the figure below (separated bike lanes are similar to sidepaths but there is only one direction of travel on each side of the road and have fewer conflicts). With proper design and signage, the risk of collisions and severity can be mitigated.

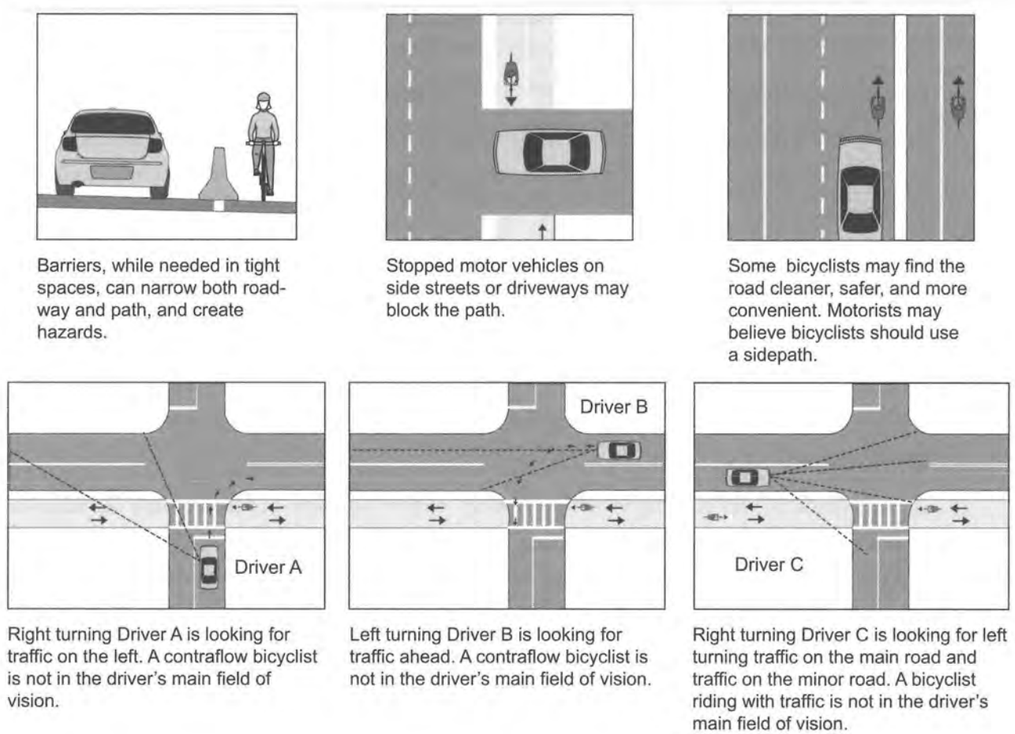


Figure 19 - Common Sidepath Conflicts. Source: AASHTO, Bike Guide

10.4.1 Intersection Signalization and Traffic Control Measures

Bicyclists are subject to the same traffic laws as motor vehicles, therefore, planning for traffic signal modifications at each signalized intersection is critical to facilitate safe implementation and operation separated bike lanes. Ideally, the proposed signal phasing will eliminate all conflicting movements between bicyclists and motorists. However, a practical approach must be weighed against safety considerations so as not to create unreasonable delays or restrictions for any one travel mode. The following is discussion of the proposed signalization and traffic control measures for the project.

Shared lanes; no turning movement controls – This treatment requires less width in the roadway because all movements through the intersection are made via a shared lane, however, this may result in longer queues and delay to motorists, especially when a left-turning vehicle is stopped and waiting for a gap in traffic coming from the opposing direction. Uncontrolled or permissive turning movements across the two-way cycle track also present hazards to bicyclists as discussed in section 10.4. Permissive left-turns across the separated bike lane should generally be avoided due to the risk of collision. Permissive right-turns are more commonly used in combination with separated bike lanes, especially adjacent to crosswalks across the minor street where motorists are accustomed to yielding to pedestrians. However, bicyclists remain vulnerable to the "right-hook" crash (see Driver C scenario in Figure 17). Signing indicating right-turning drivers to yield to bicyclists / pedestrians should be used to mitigate this risk.

Figure 20 - Signal Section used with a shared lane that has no turning movement controls. Source: MD-MUTCD

Dedicated turning lanes; permissive left-turns and/or right-turns – This is the existing condition at many intersections throughout Silver Spring. A dedicated turn lane is provided to allow vehicles to queue without impeding through traffic. Motorists then wait for a gap in traffic before making a permissive turning movement. However, additional width is needed to provide for a dedicated turn lane.

Dedicated turn lanes; exclusive left-turns and/or right-turns – This treatment provides a dedicated lane with queuing space for turning vehicles. Typically, an exclusive (also known as protected) traffic signal phase is provided for turning movements, eliminating the need for a motorist to decide when to turn. When combined with a pedestrian or bicycle signal, this treatment would effectively eliminate conflicting movements between bicyclists, pedestrians, and motorists. Where implementation is possible, from a safety standpoint, this is the most ideal intersection operation for separated bike lanes as it provides the highest level of safety for bicyclists. However, this approach also requires additional width within the roadway and may create additional delays to users, therefore, should not be used indiscriminately or without detailed study.

Dedicated turn lanes; exclusive/permissive left-turns and/or right-turns – This treatment provides a dedicated lane with queuing space for turning vehicles. Typically, a leading exclusive (also known as protected) traffic signal phase is provided for turning movements, followed by a permissive phase. This benefits motorists by providing an exclusive turn movement under heavy traffic conditions when gaps in opposing traffic may be limited, but also a permissive movement when traffic is lighter, so as not to cause unnecessary delays to turning motorists. This approach also requires additional width within the roadway. As with the shared lane discussion above, permissive left-turns across the separated bike lanes should generally be avoided due to the risk of collision. Permissive right-turns should be used with signing indicating right-turning drivers to yield to bicyclists / pedestrians should be used to mitigate the risk of collision.

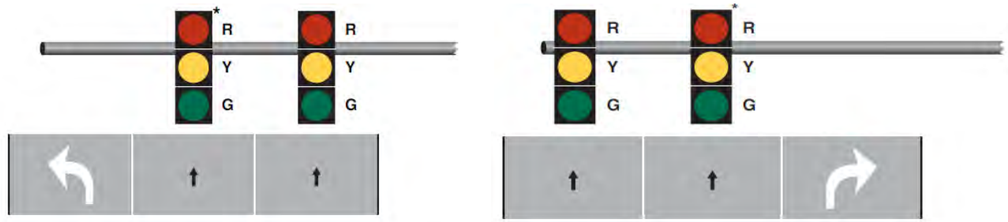


Figure 21 - Typical Positions and Arrangements of Shared Signal Faces for Permissive Only Turn Modes. Source: MD-MUTCD

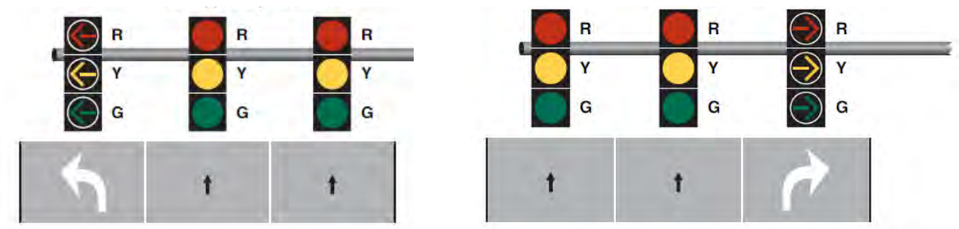


Figure 22 - Typical Positions and Arrangements of Separate Signal Faces for Exclusive Only Turn Modes. Source: MD-MUTCD

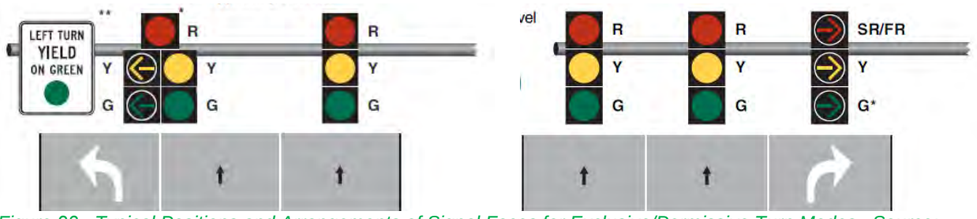


Figure 23 - Typical Positions and Arrangements of Signal Faces for Exclusive/Permissive Turn Modes. Source: MD-MUTCD

The following additional signal phasing enhancements should be considered for protecting bicyclists at intersections:

Bike signals - Ideally, bike signals should be used at all intersections to provide a uniform indication for bicyclists to follow. However, bike signals should be used only where exclusive movements for bicyclists can be provided. Permissive vehicular turning movements cannot be used in combination with a bike signal. According to FHWA Interim Approval IA-16, bike signal use shall be limited to situations where bicycles moving on a green or yellow signal indication in a bicycle signal face are not in conflict with any simultaneous motor vehicle movement at the signalized location, including right (or left) turns on red. There are no traffic signal warrants specific to the use of bicycle signals. Bike signals cannot be used with pedestrian hybrid beacons or with shared lane markings.

Figure 24 - Bicycle signal at Second Ave / Wayne Ave & Colesville Road (MD 384)

Leading interval - Provides an advanced green indication for the bike signal. Lead interval may provide 3 to 7 seconds of green time for bicycles prior to the green phase for the concurrent vehicle traffic. Lead bike intervals may typically be provided concurrently with lead pedestrian intervals (Source: MassDOT Separate Bike Lane Planning and Design Guide).

Volume thresholds for providing a separated bicycle phase or leading interval at a signalized intersection are provided in Table 13. These volume-based signalization thresholds are intended to mitigate the risk of collisions, while minimizing impacts to parking or the costs of widening the road to accommodate a dedicated lane.

Table 8 - Protected signalization thresholds for sidepaths.

Source: MassDOT Separated Bike Lane Planning and Design Guide

Sidepath Protected Signalization Thresholds	Motor Vehicles per Hour Crossing Two-way Sidepath
Right-turn	100
Left-turn across one lane	50

Bicycle Detection - Bicycle detection is used at traffic signals to alert the signal controller to bicycle demand on a particular approach. Properly located detection enables the length of green time to fluctuate based on demand (Source: MassDOT Separate Bike Lane Planning and Design Guide).

Bicyclists Use Pedestrian Signal (MUTCD R9-5) – This sign can be used in combination with permissive vehicular turning movements when it is not practical to provide an exclusive bicycle movement.

Figure 25 - Bicyclists Use Ped Signal (R9-5)

Turning restrictions – Full-time turning restrictions are generally only appropriate where turning movement volumes are very low and/or there are other alternatives for accessing the destination street. In some locations, it may be necessary to restrict turns during the peak hour if there is insufficient storage for queuing vehicles, which creates excessive delay to thru movements.

Due to heavy pedestrian volumes, No-Right-Turns-On-Red have previously been implemented at the signalized intersection of Flower Avenue and Piney Branch Road, as well as throughout Silver Spring. This existing policy will benefit bicyclist safety at this intersection as part of the separated bike lanes project along Flower Avenue.

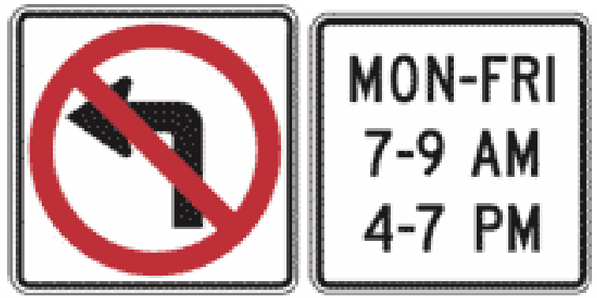


Figure 26 - No Left Turn (R3-2) (top, left); Day(s) and Time(s) (R10-20-aP) (top, right); No Turn on Red (R10-11a) (bottom)

Uncontrolled access – Driveways and alleys should be given specific focus where in conflict with the cycle track. A distinctive signing and marking treatments should be consistently used along the corridor that alerts motorists turning across separated bike lanes or the two-way cycle track.

10.5 Traffic Analysis

The traffic analysis, provided herein, evaluates existing and proposed conditions using the principles and methods defined in the Highway Capacity Manual (HCM) for intersection capacity and queuing. To develop the existing conditions analysis, the AM and PM peak hour was evaluated in the Highway Capacity Software (HCS) which is based on the HCM. Intersection turn lanes and signal phasing operations are inputted into HCS and the HCS provides delay and Level of Service (LOS) outputs. The existing conditions is used as a base to compare any proposed improvements changes to delay and LOS. Level of Service of D or better is considered acceptable.

10.6 Signing and Marking

10.6.1 Conflict zones

MCDOT utilizes green epoxy paint to delineate bikeway conflicts at driveways. To limit maintenance, green thermoplastic markings should be utilized at both MDOT SHA intersections and County intersections. Green markings should be placed with a 3' long green segment and a 3' long gap for MDOT SHA intersections and a 2' long green segment and a 2' long gap for MCDOT intersections and all driveways.

Figure 27 - Green paint conflict zone at Second Ave / Wayne Ave and Colesville Road (MD 384)

10.6.2 Intersections

For crosswalks, MCDOT uses continental or “piano” striping at major roadway intersections to enhance motorists’ visibility of the crosswalk. Generally, crosswalks should be 10-ft wide at Flower Avenue intersections.

Stop bar placements should be established based on turning movement simulations. Due to the constraints within the corridor, it will be necessary to set back stop bars on inside lanes from the intersection to accommodate larger design vehicle turns.

Thicker 6-in longitudinal markings should be used to promote slower speeds in the corridor as well.

Flex post bollards should not be used for the sole purpose of creating barrier between vehicles and bicyclists, without the expectation of needing perform routine maintenance. MCDOT uses a combination of physical barriers and flex post bollards to effectively at separate bicycle and vehicular traffic.
Bike boxes and two-stage queue boxes should be considered where intersecting bikeways will connect with the Flower Avenue Separated Bike Lanes, such as at Piney Branch Road. At other intersections bicycles should either transition to the vehicular travel lanes to turn from Flower Avenue or use crosswalks to perform turning maneuvers.

Right-turning vehicles yield to bikes/peds signs should be used at intersections where exclusive movements cannot be provided to separate conflicting bicyclist and vehicular movements.

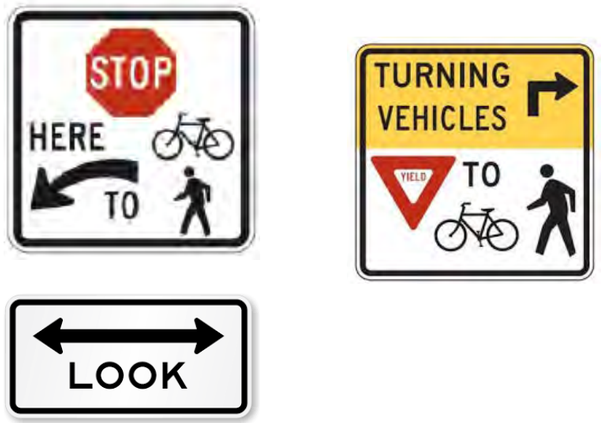


Figure 28 – Recommended sign combination for facing vehicles entering Flower Avenue from uncontrolled access points adjacent to two-way cycle track (R1-5b-MOD, R15-8, left); Yield signing with permissive right-turns should be used along Flower Avenue to mitigate against the risk of “right-hook” crashes (R1-15b, right).

Parking restrictions near intersections/driveway entrances and fire hydrants should adhere to Montgomery County regulations. Intersection sight distance should be checked and maintained based on the established design speed for the project.

Figure 29 - Example treatment at side street intersection with a one-way cycle track in Cambridge, MA.

10.7 Lighting

Proposed lighting from Piney Branch Road (MD 320) to Arliss Street (MD 954-D) should be replaced in kind with either Washington Globe LEDs or rectangular lights on pendant poles as directed by MCDOT. MCDOT appears to have recently retrofitted existing poles with Washington Globe LED luminaires throughout the study corridor.

Proposed lighting designs layouts should be supported by a photometric analysis. Light pole locations should be coordinated with tree spacing, underground utilities, furnishings, and other amenities.

Figure 30 – Rectangular Light on pendent poles (left) and Washington Globe pedestrian light poles (right).

10.8 Storm Water Management

It is assumed that the project will disturb more than 20,000 square feet throughout the corridor, therefore, will require both storm water management concept approval and erosion & sediment control approvals from the Montgomery County Department of Permitting Services (MCDPS). Generally, the bikeway project will not add new impervious surfaces to the existing corridor but will redevelop impervious surfaces.

The landscape buffer should be used to meet storm water management goals for the project. BMP types, sizes, and locations should be determined early in the design process in concurrence with MCDPS. Permeable pavements (with overdrains) and vegetated planter/tree boxes should be evaluated.

Erosion and sediment control will consist primarily of inlet protection measures.

10.9 Drainage

The entire corridor drains to a closed system. Although the project will likely not create significant changes to existing drainage patterns, the existing condition should be modeled using the rational method and verified to meet MCDOT standards. Points of investigation (POIs) and drainage areas should be established for each existing inlet. The 15-year design storm and 5-minute time of concentration should be used for the basis of design.

Inlet structures should be located as needed to limit spread from encroaching more than half the width of a travel lane. MCDOT standard inlets should be used throughout the corridor, except for the intersections with Piney Branch Road and Arliss Street, where MDOT SHA standards should be used. Drainage grates located within the bikeway should be designed for bicycle compatibility. Openings should be limited to 1-inch max.

Proposed storm drains, especially on new alignments, should be checked thoroughly for conflicts with existing underground utilities. If horizontal conflicts cannot be avoided, test holes should be taken to design for vertical avoidance.

Care should be taken to prevent surface run-off from entering private property, however, because the project is a closed section, this is likely not a concern.

10.10 Sidewalks

Sidewalks should be designed to provide a minimum 5-ft continuous concrete sidewalk, clear of obstacles.

Curb ramps should be as wide as the pedestrian zone.

10.11 Parking

Parallel parking space dimensions should be designed for 21- to 22-ft length. Parking should be restricted in the vicinity of entrances, intersections, and fire hydrants in accordance with Montgomery County regulations.

Additional parking restrictions and/or curbside parking management should be considered on a block-by-block basis.

10.12 Transit and Loading Zones

Standard bus stops should be designed with a 5'x8' clear space for ramp deployment.

Bus stop lengths should be 40-ft long designed to accommodate RideOn buses. All bus stops should be designed to have room and foundation for roughly 5'W x 12'L x 9'H shelters.

Concrete bus pads should be 90-ft long and the full width of the travel lane or 11-ft minimum. The pavement section should be a 10- to 12-inch reinforced concrete.

According to the NACTO Urban Design Guide, "streets with both heavy freight and parking demand, as well as on-street bike lanes, benefit from dedicated loading zones near the intersection. Loading zones help reduce obstruction of the bike lane and make deliveries easier for businesses. Loading zones can be striped and signed or managed for off-peak deliveries."

10.13 Utilities

Utility pole diameters should be assumed to be 18-inches. Permanent cut around a utility pole should be assumed to be 1-ft max. Clearances between overhead/underground utilities and proposed features such as stormwater management facilities and trees should be confirmed by utility companies prior to beginning design. The table below provides guidelines for utility clearances criteria between stormwater management facilities and utilities. These requirements should be confirmed by utility companies during the design phase.

Table 9 - SWM BMP Clearances from Utilities

	Horizontal Clearance	Vertical Clearance	Remarks
Power / Telecom • In concrete conduit • Not in concrete conduit • Utility Poles • Manholes	 N/A 2-ft	 N/A 6-in	 May run through BMP facilities Can be located in permeable pavement Can be located in permeable pavement but not bioretention
Gas • Gas lines	2-ft	2-ft	6-in to 2-ft requires shield; Less than 6-in requires shield and sleeve Underdrains: 12-in min. clearance
Water • Mains • Laterals • Hydrants • Cleanouts, valves, manholes	 N/A N/A 3-ft clear on sidewalk; 4-ft x 20-ft clear along street.	 12-in N/A N/A	 Provide concrete collars
Sewer • Mains • Laterals	 N/A N/A	 12-in 12-in	
Street Lights • Poles • Conduit	N/A	N/A	Can be located in BMPs

10.14 Landscape/Streetscape

- Planting/furnishing zone
  - Tree species, spacing
  - Tree grates and guards
  - Shrubs
  - Moveable planters
- Frontage Zone
- Sidewalk Zone
  - Paving
- Wayfinding/Branding
- Furnishings
  - Bicycle racks
  - Benches
  - Trash receptables

Refer to Montgomery County Department of Permitting Services Requirements for Outdoor Café Seating.

10.15 Special considerations

10.15.1 Property access: ADA compliance

Access to adjacent buildings must meet or exceed existing conditions with respect to ADA compliance.

Where the right-of-way is located at the building face and door entrances are not recessed within the building face, a 3- to 4-ft buffer should be maintained between the building and the clear sidewalk width to avoid conflicts between pedestrians and doors that swing open toward the street.

10.15.2 Floating Bus Stops

Floating bus stops should be used to eliminate conflicts between boarding transit users and bicyclists. The minimum width of the floating bus stop, not including the top of curb, should be 9-ft to accommodate deployment of the buses' retractable ramp for wheelchair users. The length of the floating bus stop should be designed to accommodate RideOn buses. Shelter widths and lighting locations should also be taken into consideration. The entire facility should be ADA compliant. Hand railings and detectable warning surfaces should be used to direct visually impaired users to the bus door. The bus flag should be located immediately ahead of where the bus door will come to a stop. It may be necessary to eliminate the planting / furnishing zone within the limits of the floating bus stop to accommodate the minimum bike lane width.

Figure 31 - Floating bus stop located at Second Avenue, north of Colesville Road, Silver Spring, MD.

11 Proposed Improvements

As stated in section 6, the purpose and need for the project is to:

1. Improve bicycle and pedestrian safety and comfort in the Flower Avenue corridor;
2. Improve bicycle connectivity within and beyond Long Branch;
3. Provide balanced, multi-modal transportation options for all Flower Avenue users.

To meet the first objective, MCDOT's approach is to provide a separated bicycle facility that minimizes conflicts between users. According to the National Association of City Transportation Officials (NACTO), "a separated bicycle facility is a bikeway within or adjacent to the roadway and separated from moving traffic by barriers or curbs, parking lanes, striped buffers, and other means." It is not possible or practical to eliminate all conflicts between users, especially within an urban area. Therefore, to minimize conflicts, the proposed improvements and recommendations rely on sound engineering principles and best practices with respect to signalization, separation, signing, and pavement marking in the context of a constrained urban right-of-way.

The second objective is primarily met by simply constructing the separated bike lanes and connecting with adjacent bikeway facilities. This concept meets this goal.

To meet the third objective, it is necessary to evaluate the entire right-of-way based on complete streets principles. According the Montgomery County Complete Streets Design Guide, "Complete Streets are roadways that are designed and operated to provide safe, accessible, and healthy travel for all users of our roadway system, including pedestrians, bicyclists, transit riders, and motorists. On a Complete Street, it is intuitive and safe to cross the street, walk to shops, and bicycle to school."

With these objectives in mind, a concept was developed and analyzed based upon the design criteria in the previous section in the context of the following goals and considerations:

- Implement a safe, continuous, separated bikeway facility,
- Minimize impacts to existing parking,
- Minimize short- and long-term economic impacts to commercial interests,
- Maximize vehicular and pedestrian traffic movement,
- Meet accessibility/ADA-compliance requirements and improve accessibility to the maximum extent,
- Minimize impacts to existing street trees; implement new landscape features,
- Accommodate transit, loading, and property access,
- Implement storm water management to the maximum extent practicable,
- Minimize right-of-way and utility impacts, and
- Minimize construction costs.

The ultimate goal is to strike a balance where all users are accommodated in a practical manner and the design meets the absolute minimum requirement where the project is constrained. In unconstrained locations, the design will more comfortably accommodate user demands and meet or exceed the minimum criteria.

11.1 Concept Summary

Based on review of project objectives, existing conditions, constraints, master plans, public feedback, and design criteria, three concepts were developed and analyzed for the study.

Concept 1: Separated bike lanes (by curb median) from Arliss Street to just south of Piney Branch Road. This option includes a signalized, separated bike lane in each direction crossing the intersection. At the ends of the separated bike lanes, cyclists would transition into the general traffic lanes.

Concept 2: On-street bike lanes separated by a painted buffer. The bike lanes extend from the south leg of the Arliss Street intersection to the north leg of the Piney Branch Road intersection. The bike lanes do not extend across either intersection. For southbound cyclists, a bike box will be provided between the southbound stop bar and the crosswalk.

Concept 3: A two-way cycle track along the east side of the roadway from just north of Piney Branch Road to just south of Arliss Street. For northbound cyclists, a separated bike lane begins just south of intersection (identical to concept 1) and will include a signalized bike lane crossing the intersection. at the north end, the cycle track transitions onto the northbound general travel lane. For southbound cyclists, they would use the crosswalk at Arliss Street to access the two-way cycle track. When they reach the end of the cycle track just before Piney Branch Road, they would use the crosswalks to reach the southbound general travel lane to the south of Piney Branch Road.

A conceptual plan for each concept is provided in the appendix.

Because this is an urban area and intersections are spaced relatively close together, the roadway typical section dimensions vary significantly within any given block. At intersections, the roadway dimensions often need to deviate from the typical section in order accommodate turning movement operations and queue storage. In other words, it would be incorrect to simply evaluate one typical section for an entire block. Therefore, the concept is comprised of multiple mid-block typical sections.

The typical sections are presented in section 11.2 and the traffic scenarios are presented in section 11.3. These building blocks or components were used to develop and analyze impacts.

11.2 Typical Sections

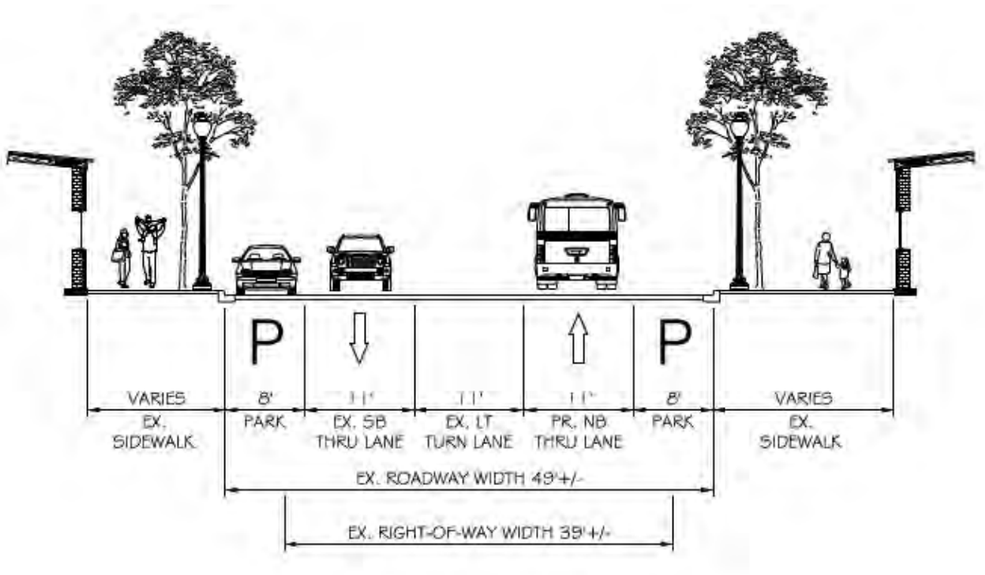
Typical sections were developed for the Flower Avenue Corridor from Piney Branch Road (MD 320) to Arliss Street (MD 594-D).

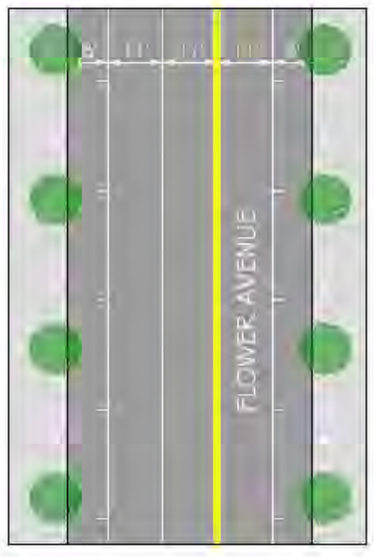
11.2.1 Flower Avenue from Piney Branch Road (MD 320) to the Flower Avenue Urban Park

Existing Typical Section

This existing typical section is comprised of one 11-foot southbound through lane, one 11-foot northbound through lane, one 11-foot southbound left-turn lane, two 8-foot on-street parking lanes on either side of the street, and sidewalks of varying dimensions on both sides of the street.

Figure 32 - Existing Typical Section, Flower Avenue from Piney Branch Road (MD 320) to the Flower Avenue Urban Park



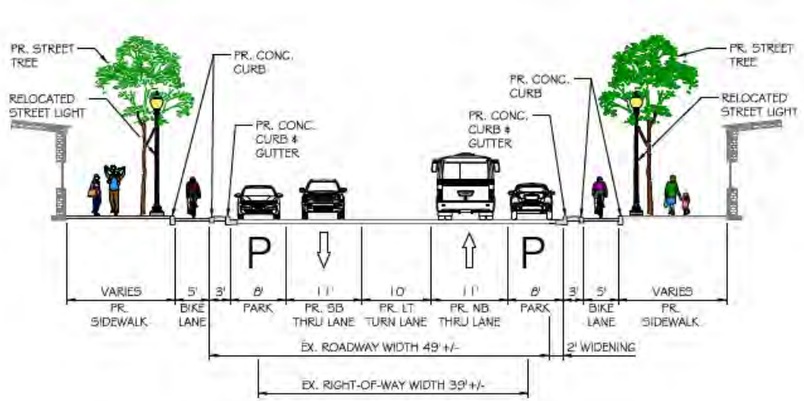


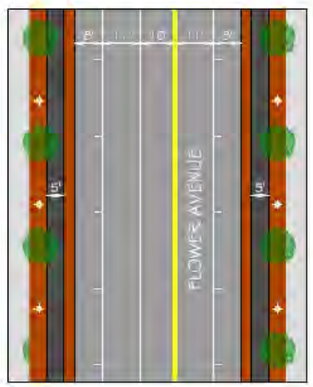
Proposed Typical Section – Concept 1

This typical section includes widening the roadway 2-ft to the east side of the street. The existing roadway would be widened not be made to make the street wider but account for the shifting of the center line of the roadway to the east.

This proposed typical section is comprised of one 11-foot southbound through lane, one 11-foot northbound through lane, one 10-foot southbound left-turn lane, two 8-foot on-street parking lanes on either side of the street, two 3-foot buffers between the parking lanes and the 5-foot bike lanes on either side of the street, and sidewalks of varying dimensions on both sides of the street.

Figure 33 - Proposed Typical Section, Flower Avenue from Piney Branch Road (MD 320) to the Flower Avenue Urban Park





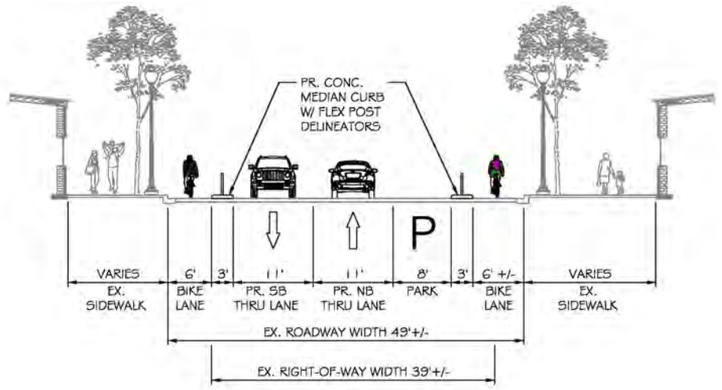
NOT TO SCALE

Proposed Typical Section – Concept 2

This typical section includes on-street bike lanes separated by a painted buffer. The bike lanes extend from the south leg of the Arliss Street intersection to the north leg of the Piney Branch Road intersection. The bike lanes do not extend across either intersection. For southbound cyclists, a bike box will be provided between the southbound stop bar and the crosswalk.

This proposed typical section is comprised of one 11-foot southbound through lane, one 11-foot northbound through lane, one 10-foot southbound left-turn lane, two 8-foot on-street parking lanes on either side of the street, two 3-foot buffers between the parking lanes and the 6-foot bike lanes on either side of the street, and sidewalks of varying dimensions on both sides of the street.

Figure 34 - Proposed Typical Section, Flower Avenue from Piney Branch Road (MD 320) to the Flower Avenue Urban Park



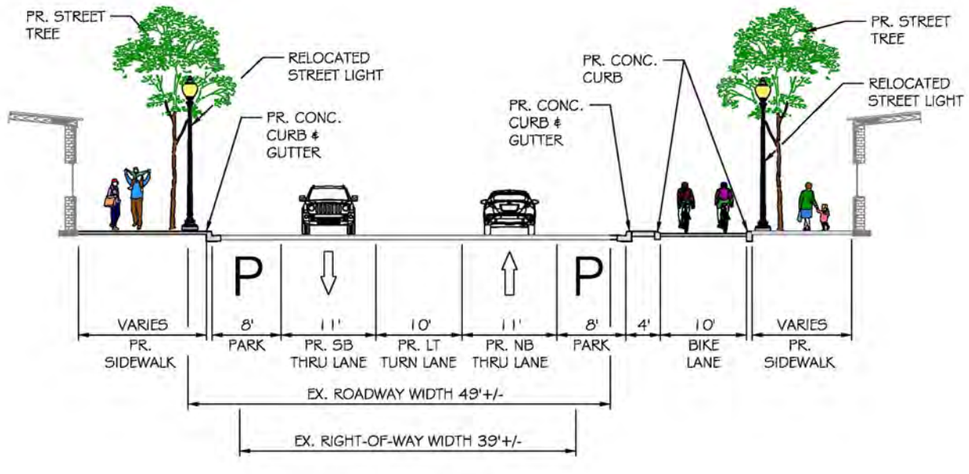
NOT TO SCALE

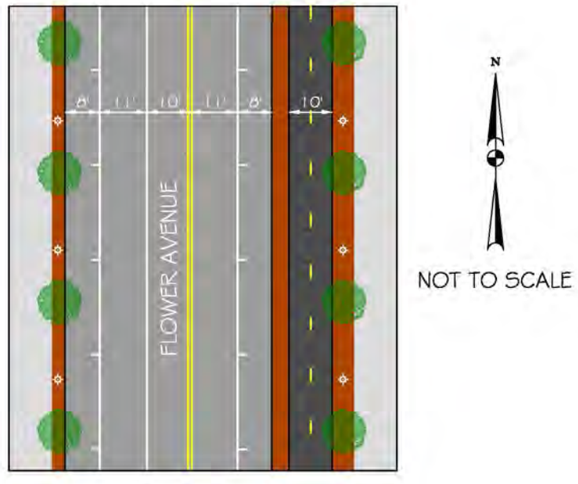
Proposed Typical Section – Concept 3

This typical section includes a two-way cycle track along the east side of the roadway from just north of Piney Branch Road to just south of Arliss Street. For northbound cyclists, a separated bike lane begins just south of intersection (identical to concept 1) and will include a signalized bike lane crossing the intersection. at the north end, the cycle track transitions onto the northbound general travel lane. For southbound cyclists, they would use the crosswalk at Arliss Street to access the two-way cycle track. When they reach the end of the cycle track just before Piney Branch Road, they would use the crosswalks to reach the southbound general travel lane to the south of Piney Branch Road.

This proposed typical section is comprised of one 11-foot southbound through lane, one 11-foot northbound through lane, one 10-foot southbound left-turn lane, two 8-foot on-street parking lanes on either side of the street, a 4-foot buffers between the parking lanes on the east side of the street and the 10-foot two-way cycle track on the east side of the street, and sidewalks of varying dimensions on both sides of the street.

Figure 35 - Proposed Typical Section, Flower Avenue from Piney Branch Road (MD 320) to the Flower Avenue Urban Park



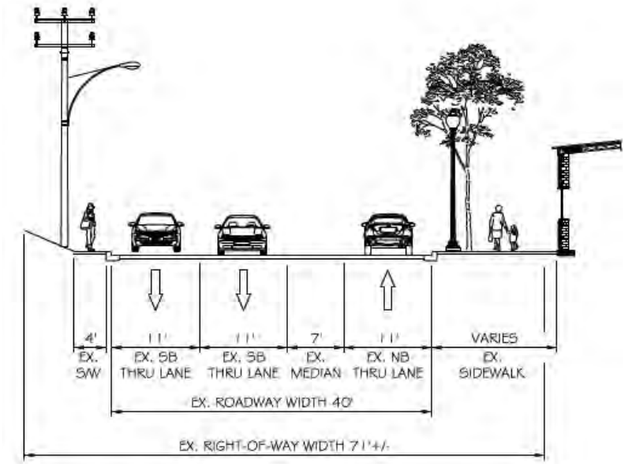


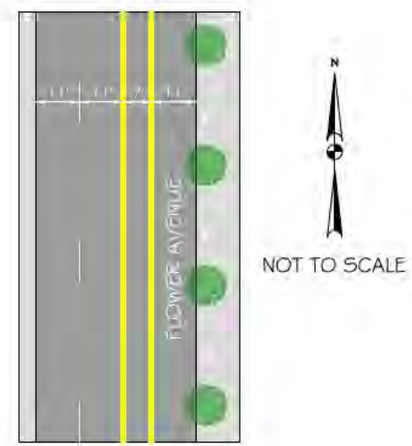
11.2.2 Flower Avenue from the Flower Avenue Urban Park to Arliss Street (MD 594-D)

Existing Typical Section

This existing typical section is comprised of two 11-foot southbound through lanes, one 11-foot northbound through lane, one 7-foot striped median, one 4-foot sidewalk of the west side on the street, and a sidewalk of varying width on the east side of the street.

Figure 36- Existing Typical Section, Flower Avenue from the Flower Avenue Urban Park to Arliss Street (MD 594-D)



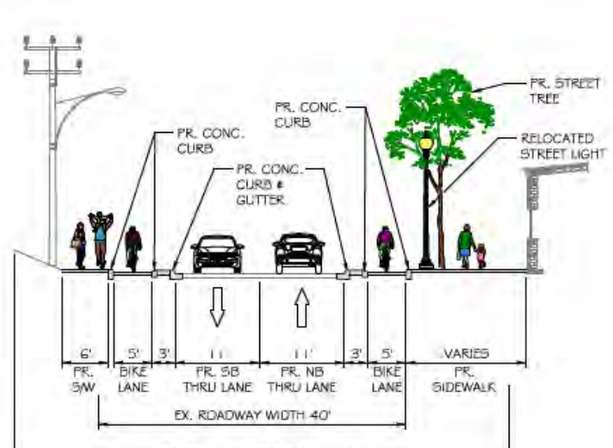


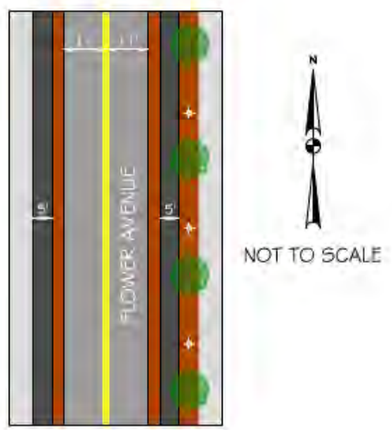
Proposed Typical Section – Concept 1

This typical section does not include any roadway widening.

This proposed typical section is comprised of one 11-foot southbound through lane, one 11-foot northbound through lane, two 3-foot buffers between the parking lanes and the 5-foot bike lanes on either side of the street, one 6-foot sidewalk of the west side on the street, and a sidewalk of varying width on the east side of the street.

Figure 37- Proposed Typical Section, Flower Avenue from the Flower Avenue Urban Park to Arliss Street (MD 594-D)





Proposed Typical Section – Concept 2

This typical section does not include any roadway widening.

This proposed typical section is comprised of one 11-foot southbound through lane, one 11-foot northbound through lane, two 3-foot painted buffers between the road and the 6-foot bike lanes on either side of the street, tying into existing sidewalks of varying width on the east and west side of the street.

Figure 38- Proposed Typical Section, Flower Avenue from the Flower Avenue Urban Park to Arliss Street (MD 594-D)

Proposed Typical Section – Concept 3

This proposed typical section is comprised of one 11-foot southbound through lane, one 11-foot northbound through lane, an 8-foot buffer between the northbound lanes and the 10-foot two-way cycle track on the east side of the street, and sidewalks of varying width on the both sides of the street.

Figure 39- Proposed Typical Section, Flower Avenue from the Flower Avenue Urban Park to Arliss Street (MD 594-D)

11.3 Traffic Scenarios

Several concepts have been developed for the proposed improvements of the corridor. The concepts are as follows:

1. Separated bike lanes (by curb median) from Arliss Street to just south of Piney Branch Road. This option includes a signalized, separated bike lane in each direction crossing the intersection. At the ends of the separated bike lanes, cyclists would transition into the general traffic lanes.
2. On-street bike lanes separated by a painted buffer. The bike lanes extend from the south leg of the Arliss Street intersection to the north leg of the Piney Branch Road intersection. The bike lanes do not extend across either intersection. For southbound cyclists, a bike box will be provided between the southbound stop bar and the crosswalk.
3. A two-way cycle track along the east side of the roadway from just north of Piney Branch Road to just south of Arliss Street. For northbound cyclists, a separated bike lane begins just south of intersection (identical to concept 1) and will include a signalized bike lane crossing the intersection. at the north end, the cycle track transitions onto the northbound general travel lane. For southbound cyclists, they would use the crosswalk at Arliss Street to access the two-way cycle track. When they reach the end of the cycle track just before Piney Branch Road, they would use the crosswalks to reach the southbound general travel lane to the south of Piney Branch Road.

Several changes were evaluated for the phasing operations of the signal that can be used to incorporate the proposed improvements. These changes prioritize pedestrian and cyclist safety. The two changes were evaluated for feasibility and then compared to existing conditions. For all scenarios, a Level of Service (LOS) of D or better were observed, which demonstrates acceptable operations for the evaluated intersection. A summary of the two scenarios explored are as follows:

1. A 7 second interval was added to the signal plan for the northbound and southbound pedestrian crosswalk and bike lanes, this is a leading pedestrian interval (LPI). By providing a 7-second head start for pedestrian and cyclists crossing Piney Branch Road. However, this reduces the available greentime for vehicle movement by 7 seconds as the cycle length was held the same as existing conditions.
2. The permissive southbound and northbound left turning movement was changed to protective-only (i.e. exclusive) phase. This reduces the amount of green time that the left-turning vehicles have available to execute their maneuver through the intersection and they would see an increase in delay. It is noted that this would require a signal modification to be able to implement protective-only left turns, as new signal heads are necessary for these movements.

For some of the approaches evaluated in these two scenarios, there are slight decreases in LOS as a result of the modification to phasing operations. It is noted that for the two scenarios evaluated, no geometric improvements are proposed at this time. A summary of overall intersection operations for the existing conditions and the 2 scenarios can be found in Table 10.

Table 10 – Traffic Scenarios

Scenario	Time Period	OVERALL	
		Delay (sec/veh)	LOS
Existing Conditions	AM	24.9	C
	PM	31.2	C
LPI	AM	29.7	C
	PM	38.9	D
Protected Lefts Only	AM	28.4	C
	PM	46.2	D

12 Impacts Analysis and Summary

12.1 Parking

On-street parking in the corridor is highly utilized.

Table 11 - Net Change in On-Street Parking Spaces along Flower Avenue

	Piney Branch Road To the Flower Ave Urban Park	The Flower Ave Urban Park to Arliss Street	Net change
Flower Avenue Existing On-Street Parking Spaces	10		-
Concept 1	19		+9
Concept 2	8		-2
Concept 3	17		+7

12.2 Transit

There are no proposed impacts to the existing RideOn bus lines and stops.

12.3 Traffic Analysis

Two signal operation changes were evaluated that can be implemented to support adding separated bike lanes into the intersection. The first option is a leading pedestrian interval (LPI) that would give northbound / southbound pedestrian and cyclists a 7-second head-start to cross Piney Branch Road before the northbound / southbound receive greentime. The other option is to convert the existing northbound / southbound permissive left turn phase to be protected-only (this requires a signal modification), so to eliminate any left turns across the separated bike lanes. these changes will change operations at the signalized intersection of Flower Avenue and Piney Branch Road. The traffic analysis for these two concepts indicate that overall operations are expected to remain in acceptable thresholds.

There are not any changes to operations at the unsignalized intersection of Flower Avenue and Arliss Street.

12.4 Street Trees

Street trees are anticipated to be impacted. Street trees would be replaced where possible. The following table summarizes impacts to street trees:

Table 12 - Street Tree Impacts

	Piney Branch Road to the Flower Ave Urban Park	The Flower Ave Urban Park to Arliss Street	Total
Concept 1	15	14	29
Concept 2	4	3	7
Concept 3	19	10	29

12.5 Utilities

Utility impacts will be an inevitable component of the project as well. Early coordination with utilities will be essential to successful design development and construction.

Roadway widening has greater impacts to fire hydrants, utility poles, and light poles. Manhole and valve adjustments will be necessary where there are grade changes. Underground utility conflicts and impacts will be determined during the design phase.

It is assumed that one traffic signal will need to be modified.

12.6 Right-of-way and Property Access

Right-of-way widths are not sufficient south of the Flower Avenue Urban Park. Acquisition of right-of-way will allow roadway construction for ped ramp, and sidewalk reconstruction in front of these buildings that meets or exceeds existing conditions with respect to ADA compliance. Sidewalk café seating should be rearranged and may require reductions in some areas based on the redistribution of the typical section. Providing a continuous, clear width sidewalk should be the highest priority.

For widening typical sections and/or intersection options, the following is a list of properties where MCDOT should consider ROW acquisitions. There are no displacements proposed with this project.

Table 13 - Summary of Potential Right-of-Way Impacts

Address	Acquisition Type	Area Concept 1	Area Concept 2	Area Concept 3	Comments
8435 Piney Branch Road	Fee simple or easement	614 SF	0	0	Needed for the bike lane transition
8501 Piney Branch Road	Fee simple or easement	245 SF	0	1,110 SF	Needed for the bike lane transition
8701 Flower Avenue	Fee simple or easement	12,140 SF	12,352 SF	13,218 SF	The existing roadway is not within the existing ROW
8472 Piney Branch Road	Fee simple or easement	6,084 SF	3,821 SF	4,198 SF	The existing roadway is not within the existing ROW
8736 Flower Avenue	Fee simple or easement	514 SF	476 SF	787 SF	The existing roadway is not within the existing ROW

Additionally, driveway entrance modifications will need to be evaluated during the design phase. Temporary construction easements may be needed to tie-in driveways. Grade-breaks at the back of the driveway apron should be limited to 6% and crest vertical curve min K-values should not be less than 4. Existing driveway aprons are generally not ADA compliant, and if replaced, should include a 2% max cross slope for a minimum 4-ft width that aligns with the adjacent sidewalks. There are no driveway closures or relocations proposed with this study.

12.7 Preliminary Costs

Preliminary costs were developed. The order of magnitude is $3.6 million. An escalation of 3% was assumed for three years until the anticipated construction start in 2026. Costs were developed based guidance and methodology from the MDOT SHA Cost Estimating Manual (2015) and the most current MDOT SHA Price Index, which includes unit pricing for common pay items. A 40% contingency is included to account for unknown costs. A conservative estimate of right-of-way costs was also included. Refer to the appendix for detailed cost estimates.

Table 14 - Summary of Preliminary Cost Estimates

Flower Avenue Separated Bike Lanes Preliminary Cost Estimate Summary

	Concept 1	Concept 2	Concept 3
Category 1 - Mobilization, MOT	$371,000	$152,000	$313,000
Category 2 - Excavation	$18,250	$4,850	$16,800
Category 3 - Drainage / SWM	$417,000	$108,000	$224,000
Category 5 - Paving	$271,983	$148,587	$303,619
Category 6 - Sidewalks, C&G	$635,998	$278,067	$573,821
Category 7 - Landscape/Amenities	$93,000	$22,000	$45,000
Category 8 - Traffic	$235,000	$26,000	$206,000
3% Escalation (2026)	$189,370	$68,572	$155,989
40% Contingency	$817,000	$296,000	$673,000
ROW Costs	$648,670	$549,417	$465,054
Total	**$3.6 million**	**$1.7 million**	**$3.0 million**

Table 15 – Flower Avenue Separated Bike Lanes - Impacts Summary

Flower Avenue Impact Summary							
		Concept 1		Concept 2		Concept 3	
Section		SP	NP	SP	NP	SP	NP
	Roadway Length, mi	0.08	0.09	0.08	0.09	0.08	0.09
Right-of-Way Impacts	Number of Parcels Impacted	5	1	3	0	4	0
	Right-of-Way Acquired, SF	17,662	1,935	15,472	0	19,127	0
	Displaced Properties	0	0	0	0	0	0
	Driveways Impacted (during construction)	9	11	8	11	9	11
	Café Zone Impacted	1	0	0	0	1	0
Potential Relocations	Storm Drains	0	0	0	0	0	0
	Utility Poles	1	1	0	0	1	0
	Fire Hydrants	2	0	0	0	2	0
	Street Lights	12	3	4	2	14	7
Potenial Enviommental Impacts	Street Trees	15	14	3	1	15	7
	Rare, Threatened, or Endangered Species Impacts	Impacts not anticipated		Impacts not anticipated		Impacts not anticipated	
	Historic and Cultural Impacts	Impacts not anticipated		Impacts not anticipated		Impacts not anticipated	
	Wetlands/Waters of US	N/A		N/A		N/A	
	Soil Contamination Issues	Impacts not anticipated		Impacts not anticipated		Impacts not anticipated	
	Floodplain Impacts	N/A		N/A		N/A	
	Parkland Impacts	N/A		N/A		N/A	
	Cultural Impacts	Impacts not anticipated		Impacts not anticipated		Impacts not anticipated	
Traffic Impacts	Acceptable Level of Service (D or greater) at all intersections	Yes		Yes		Yes	
	Average Travel Time (Change from Existing), min	7.5 (+3.4)		7.5 (+3.4)		7.5 (+3.4)	
	Reconstruct Traffic Signal	0	0	0	0	0	0
	Modify Traffic Signal	1	0	0	0	1	0
Parking Impacts	Change In On-Street Parking Spots	+9	0	+2	0	+9	0
	Cost	$3.6 million		$1.7 million		$3.0 million	

SP - Flower Avenue, Piney Branch Road to the Flower Avenue Urban Park
NP - Flower Avenue, the Flower Avenue Urban Park to Arliss Street

13 Permits and Approvals

A natural resource inventory (NRI), which will mostly consist of street trees, should be prepared for M-NCPPC review and approval. Once the NRI is approved, DPS will review the storm water management concept. Once the SWM concept is approved, detailed storm water management design can begin as well as, erosion and sediment control design.

At 30%, the project will be required to submit to M-NCPPC for mandatory referral.

This project will require a M-NCPPC Parks construction permit since a portion of this project will be adjacent to the M-NCPPC Park property at the Flower Avenue Urban Park.

The project will require an access permit from MDOT SHA for improvements at the intersections of Flower Avenue and Piney Branch Road, and Flower Avenue and Arliss Street. The first step will be obtaining approval of the traffic impact study (TIS). Following TIS approval, a design request should be submitted to MDOT SHA Office of Traffic Safety through the District 3 office for traffic signal plan development. MDOT SHA will also review 30%, 65%, and 90% submittals. Once the plans have been reviewed and approved, MCDOT can apply for the access permit.

Utility clearances should also be obtained from all utility owners with facilities in the project area.

Coordination should also occur with the Maryland Historic Trust regarding any potential impacts to cultural and historic resources identified herein.

Although the project is in an urban area, the Maryland Department of Natural Resources should be contacted to rule out environmental impacts.

14 Recommendations

Based on review and analysis of the purpose and need, existing conditions, master plans, public and stakeholder input, design guidance and best practices, MCDOT has developed proposed improvements and quantified the associated impacts. The concepts developed herein should not be considered exhaustive or definitive, rather, these concepts are works in progress.

Concept 1 meets the objectives stated in the purpose and need, while providing the most equitable distribution of impacts to parking, traffic, transit, and business interests.

- **Widening the roadway by 2-ft south of the Flower Avenue Urban Park;**
- **Protecting bicyclists with a 3-foot physical barrier;**
- **Preserving 100% of on-street parking in the corridor;**
- **Removing and replacing up to 29 street trees;**
- **Relocating up to 2 utility poles;**
- **Maintaining bus transit service with modifications to bus stops;**
- **Maintaining all property access;**
- **Limiting right-of-way acquisitions to sidewalk areas only (20,788 SF).**

Loading zones with parking restrictions should be located on each block. Alternatively, side street loading zones with parking restrictions should be created.

Bus stops on the east and west side of the street should be converted to floating bus stops.

15 Conclusion

As stated in the beginning of this study, the overall purpose of the Flower Avenue Separated Bike Lanes is to improve bicyclist and pedestrian safety and comfort, bicycle connectivity, and to provide a balanced, multi-modal corridor for all transportation users.

It is anticipated that with other local and regional bicycle facilities coming online recently and over the next few years, combined with the completion of the Purple Line and various private developments, the importance of providing bicycle connectivity and alternative transportation modes will affect a higher demand for a north-south bicycling route in East Silver Spring. These separated bike lanes have also been designated in the Montgomery County Bicycle Master Plan.

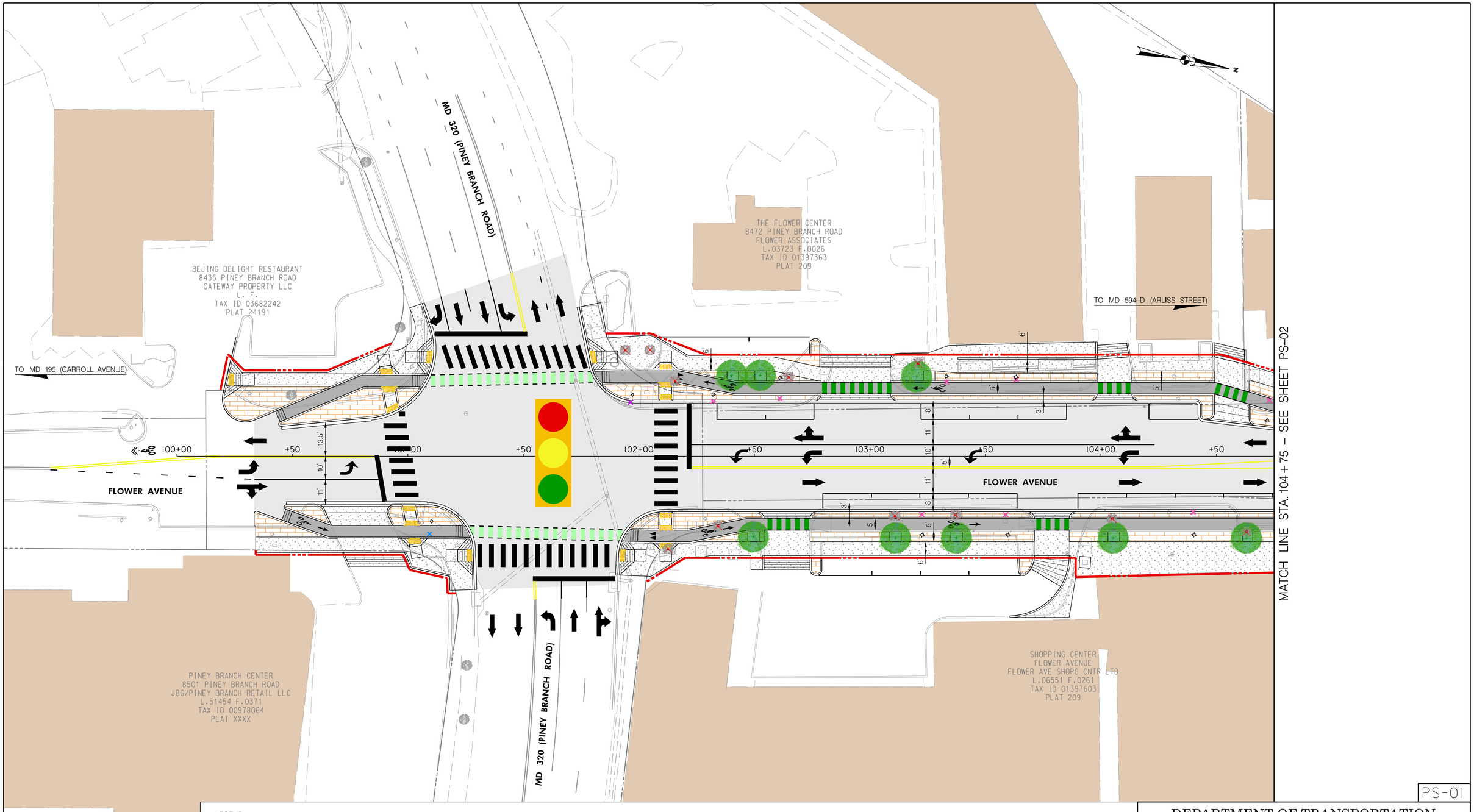
This study has demonstrated that the Flower Avenue corridor is a complex, urban arterial that serves the needs of many types of users. Implementation of separated bike lanes will certainly add to those complexities. But as with almost any transportation project, there are trade-offs and compromises. MCDOT has performed a thorough investigation of the existing conditions and has herein presented proposed improvements and their associated impacts, resulting in what it considers a viable alternative that meets the purpose and need.

The goal of this study process is to develop and produce a preferred alternative that MCDOT, the project stakeholders, and the public have built a consensus through an open discourse.

16 References

1) Montgomery County Road Code and Standard Drawings
2) Montgomery County Bicycle Master Plan – 2018
3) Montgomery County Complete Street - 2021
4) AASHTO Green Book - 2018
5) AASHTO Guide to Development of Bicycle Facilities - 2012
6) MDOT SHA Cost Estimating Manual – 2015
7) MDOT SHA Price Index – 2023
8) MassDOT Separated Bike Lane Planning and Design Guide
9) Michigan DOT Sidepath Intersection & Crossing Treatment Guide – June 2018
10) NACTO Urban Bikeway Design Guide
11) Highway Capacity Manual
12) FHWA Manual on Uniform Traffic Control Devices / Maryland Manual on Uniform Traffic Control Devices
13) FHWA Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations Final Report and Recommended Guidelines

17 Appendix – Detailed Drawings



MATCH LINE STA. 104+75 – SEE SHEET PS-02

PS-01

LEGEND

- PROP. DETECTABLE WARNING SURFACE
- PROP. CONCRETE
- PROP. ASPHALT PAVEMENT RESURFACING
- PROP. BRICK PAVERS
- PROP. BIKE LANES
- PROP. FLOATING BUS STOP
- BUILDING
- GREEN BIKE CONFLICT PAINT
- PROP. GEOMETRY
- PROP. PURPLE LINE IMPROVEMTS
- EX. GEOMETRY
- PROP. RIGHT OF WAY LINE
- EX. RIGHT OF WAY LINE
- PROP. STREET LIGHT
- EX. STREET LIGHT TO BE REMOVED
- EX. STREET LIGHT TO REMAIN
- PROP. UTILITY POLE
- EX. UTILITY POLE TO BE REMOVED
- EX. UTILITY POLE TO REMIAN
- PROP. STREET TREE
- EX. STREET TREE TO BE REMOVED
- EX. STREET TREE TO REMAIN
- PROP. FIRE HYDRANT
- EX. FIRE HYDRANT TO BE REMOVED
- EX. FIRE HYDRANT
- EX. GAS VALVE
- EX. SANITARY SEWER MANHOLE
- EX. TELECOM MANHOLE
- EX. ELECTRIC MANHOLE
- EX. WATER VALVE
- EX. STORM DRAIN MANHOLE
- EX. TRAFFIC SIGNAL

20' 0 20' 40'
SCALE: 1" = 20'

Bicycle and Pedestrian Priority Areas

DEPARTMENT OF TRANSPORTATION
DIVISION OF TRANSPORTATION ENGINEERING
MONTGOMERY COUNTY, MARYLAND

FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 1

SHEET 01 of 03

4/3/2023
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MATCH LINE STA. 104+75 – SEE SHEET PS-01

MATCH LINE STA. 109+50 – SEE SHEET PS-03

FLOWER AVE URBAN PARK
8723 GEREN ROAD
M-NCPPC
L.03529 F.0527
TAX ID 01376931
PLAT 1231

RESIDENTIAL
209 HARTWELL ROAD
IBIROGBA ADERONKE O
L.28894 F.0414
TAX ID 01007974
PLAT 1150

RELIABLE CLEANERS
8736 FLOWER AVENUE
KIM HYE SOOK & YONG
L.32736 F.0041
TAX ID 01397385
PLAT 3915

TO MD 320 (PINEY BRANCH ROAD)

POTENTIAL RAISED CROSSWALK AND RECTANGULAR RAPID FLASHING BEACONS

RESIDENTIAL
8804 FLOWER AVENUE
EAM PHAY
L.61879 F.0153
TAX ID 01011316
PLAT 1150

RESIDENTIAL
8806 FLOWER AVENUE
MILLARD MICHAEL P&O P
L.06480 F.0661
TAX ID 01010675
PLAT 1150

RESIDENTIAL
8808 FLOWER AVENUE
ONUZULIKE GODFREY
L.20483 F.0106
TAX ID 01007883
PLAT 1150

RESIDENTIAL
8810 FLOWER AVENUE
OP MARLENE
L.55585 F.0197
TAX ID 01008205
PLAT 1150

TO MD 594-D (ARLISS STREET)

105+00 +50 106+00 +50 107+00 +50 108+00 +50 109+00

FLOWER AVENUE

FLOWER AVENUE

EL GAVILAN RESTAURANT
8805 FLOWER AVENUE
8805 FLOWER AVE PTNSHP
L.07140 F.0106
TAX ID 01397443
PLAT 209

GHIM'S DENTAL ARTS
8807 FLOWER AVENUE
GHIM RAY C ET AL TR
L.00000 F.0000
TAX ID 01397578
PLAT 209

VACANT
FLOWER AVENUE
ARLYSS AVENUE LLC
L.32437 F.0264
TAX ID 0354464
PLAT 209

PS-02

LEGEND

- PROP. DETECTABLE WARNING SURFACE
- PROP. CONCRETE
- PROP. ASPHALT PAVEMENT RESURFACING
- PROP. BRICK PAVERS
- PROP. BIKE LANES
- PROP. FLOATING BUS STOP
- BUILDING
- GREEN BIKE CONFLICT PAINT
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- PROP. STREET LIGHT
- EX. STREET LIGHT TO BE REMOVED
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- PROP. UTILITY POLE
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- EX. UTILITY POLE TO REMIAN
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- EX. STREET TREE TO REMAIN
- PROP. FIRE HYDRANT
- EX. FIRE HYDRANT TO BE REMOVED
- EX. FIRE HYDRANT
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- EX. SANITARY SEWER MANHOLE
- EX. TELECOM MANHOLE
- EX. ELECTRIC MANHOLE
- EX. WATER VALVE
- EX. STORM DRAIN MANHOLE
- EX. TRAFFIC SIGNAL

20' 0 20' 40'
SCALE: 1" = 20'

Bicycle and Pedestrian Priority Areas

DEPARTMENT OF TRANSPORTATION
DIVISION OF TRANSPORTATION ENGINEERING
MONTGOMERY COUNTY, MARYLAND

FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 1

SHEET 02 of 03

4/3/2023
\\usl527-f01\shared_projects\2026213116\700 CADD\702 Display\Public Meeting_01\Concept Plans\pHD-P002_FlowerAve_01.dgn

RESIDENTIAL
8812 FLOWER AVENUE
PINTO EDWIN R & DELMY F
L.28610 F.0298
TAX ID 01008216
PLAT 1150

RESIDENTIAL
8814 FLOWER AVENUE
SANCHEZ YOLANDA
L.06431 F.0253
TAX ID 01010048
PLAT 1150

RESIDENTIAL
8816 FLOWER AVENUE
ROJAS KATYA
L.60683 F.0270
TAX ID 01009288
PLAT 1150

RESIDENTIAL
8818 FLOWER AVENUE
GARTH JESSICA LOWELL
L.54739 F.0170
TAX ID 01009814
PLAT 1150

READING ROAD

TO MD 320 (PINEY BRANCH ROAD)

TO E. WAYNE AVENUE

MATCH LINE STA. 109+50 – SEE SHEET PS-02

110+00 +50 111+00 +50 112+00 +50

FLOWER AVENUE

FLOWER AVENUE

VACANT
FLOWER AVENUE
ARLYSS AVENUE LLC
L.32437 F.0264
TAX ID 0354464
PLAT 209

VACANT
8821 FLOWER AVENUE
STATE OF MARYLAND
L.46798 F.0162
TAX ID 01391614
PLAT 810

MD 594-D (ARLISS STREET)

PLYMOUTH STREET

PS-03

LEGEND

- PROP. DETECTABLE WARNING SURFACE
- PROP. CONCRETE
- PROP. ASPHALT PAVEMENT RESURFACING
- PROP. BRICK PAVERS
- PROP. BIKE LANES
- PROP. FLOATING BUS STOP
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- PROP. STREET TREE
- EX. STREET TREE TO BE REMOVED
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- PROP. FIRE HYDRANT
- EX. FIRE HYDRANT TO BE REMOVED
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- EX. GAS VALVE
- EX. SANITARY SEWER MANHOLE
- EX. TELECOM MANHOLE
- EX. ELECTRIC MANHOLE
- EX. WATER VALVE
- EX. STORM DRAIN MANHOLE
- EX. TRAFFIC SIGNAL

20' 0 20' 40'
SCALE: 1" = 20'

BiPPA Bicycle and Pedestrian Priority Areas

DEPARTMENT OF TRANSPORTATION
DIVISION OF TRANSPORTATION ENGINEERING
MONTGOMERY COUNTY, MARYLAND

FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 1

SHEET 03 of 03

4/3/2023
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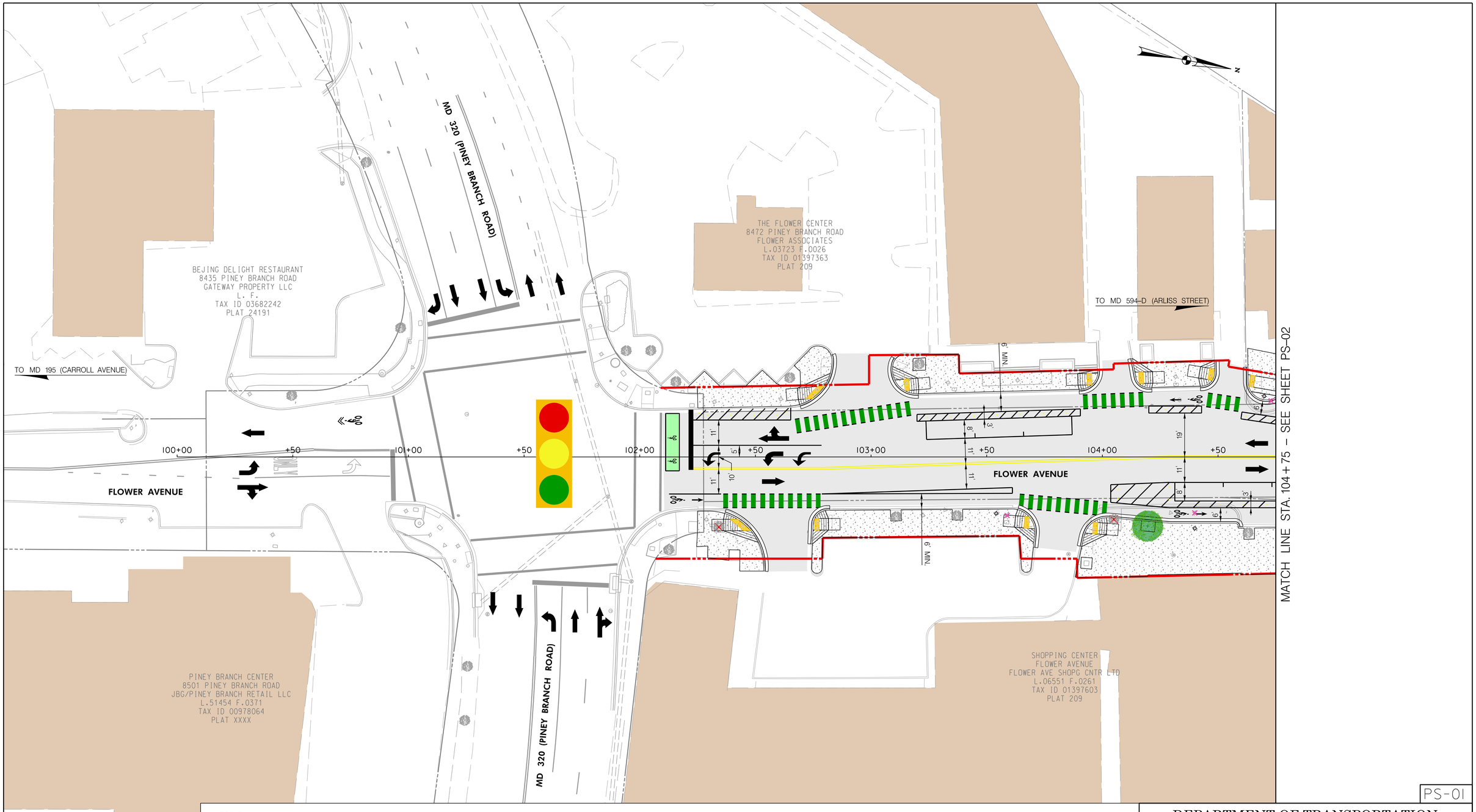

MATCH LINE STA. 104+75 – SEE SHEET PS-02

PS-01

LEGEND

- PROP. DETECTABLE WARNING SURFACE
- PROP. CONCRETE
- PROP. ASPHALT PAVEMENT RESURFACING
- EX. BUS STOP
- BUILDING
- GREEN BIKE CONFLICT PAINT
- PROP. GEOMETRY
- PROP. PURPLE LINE IMPROVEMTS
- EX. GEOMETRY
- PROP. RIGHT OF WAY LINE
- EX. RIGHT OF WAY LINE
- PROP. STREET LIGHT
- EX. STREET LIGHT TO BE REMOVED
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- EX. UTILITY POLE TO REMIAN
- PROP. STREET TREE
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- EX. STREET TREE TO REMAIN
- EX. FIRE HYDRANT
- EX. GAS VALVE
- EX. SANITARY SEWER MANHOLE
- EX. TELECOM MANHOLE
- EX. ELECTRIC MANHOLE
- EX. WATER VALVE
- EX. STORM DRAIN MANHOLE
- EX. TRAFFIC SIGNAL

20' 0 20' 40'
SCALE: 1" = 20'

BiPPA Bicycle and Pedestrian Priority Areas

DEPARTMENT OF TRANSPORTATION
DIVISION OF TRANSPORTATION ENGINEERING
MONTGOMERY COUNTY, MARYLAND

FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 2

SHEET 01 of 03

4/3/2023
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MATCH LINE STA. 104+75 – SEE SHEET PS-01

MATCH LINE STA. 109+50 – SEE SHEET PS-03

FLOWER AVE URBAN PARK
8723 GEREN ROAD
M-NCPPC
L.03529 F.0527
TAX ID 01376931
PLAT 1231

RESIDENTIAL
209 HARTWELL ROAD
IBIROGBA ADERONKE O
L.28894 F.0414
TAX ID 01007974
PLAT 1150

RELIABLE CLEANERS
8736 FLOWER AVENUE
KIM HYE SOOK & YONG
L.32736 F.0041
TAX ID 01397385
PLAT 3915

RESIDENTIAL
8804 FLOWER AVENUE
EAM PHAY
L.61879 F.0153
TAX ID 01011316
PLAT 1150

RESIDENTIAL
8806 FLOWER AVENUE
MILLARD MICHAEL P&O P
L.06480 F.0661
TAX ID 01010675
PLAT 1150

RESIDENTIAL
8808 FLOWER AVENUE
ONUZULIKE GODFREY
L.20483 F.0106
TAX ID 01007883
PLAT 1150

RESIDENTIAL
8810 FLOWER AVENUE
OP MARLENE
L.55585 F.0197
TAX ID 01008205
PLAT 1150

TO MD 320 (PINEY BRANCH ROAD)

TO MD 594-D (ARLISS STREET)

6' MIN.

105+00 +50 106+00 +50 107+00 +50 108+00 +50 109+00

FLOWER AVENUE

FLOWER AVENUE

POTENTIAL RECTANGULAR
RAPID FLASHING BEACONS

EL GAVILAN RESTAURANT
8805 FLOWER AVENUE
8805 FLOWER AVE PTNSHP
L.07140 F.0106
TAX ID 01397443
PLAT 209

GHIM'S DENTAL ARTS
8807 FLOWER AVENUE
GHIM RAY G ET AL TR
L.00000 F.0000
TAX ID 01397578
PLAT 209

VACANT
FLOWER AVENUE
ARLYSS AVENUE LLC
L.32437 F.0264
TAX ID 0354464
PLAT 209

PS-02

LEGEND

- PROP. DETECTABLE WARNING SURFACE
- PROP. CONCRETE
- PROP. ASPHALT PAVEMENT RESURFACING
- EX. BUS STOP
- BUILDING
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20' 0 20' 40'
SCALE: 1" = 20'

Bicycle and Pedestrian Priority Areas

DEPARTMENT OF TRANSPORTATION
DIVISION OF TRANSPORTATION ENGINEERING
MONTGOMERY COUNTY, MARYLAND

FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 2

SHEET 02 of 03

4/3/2023
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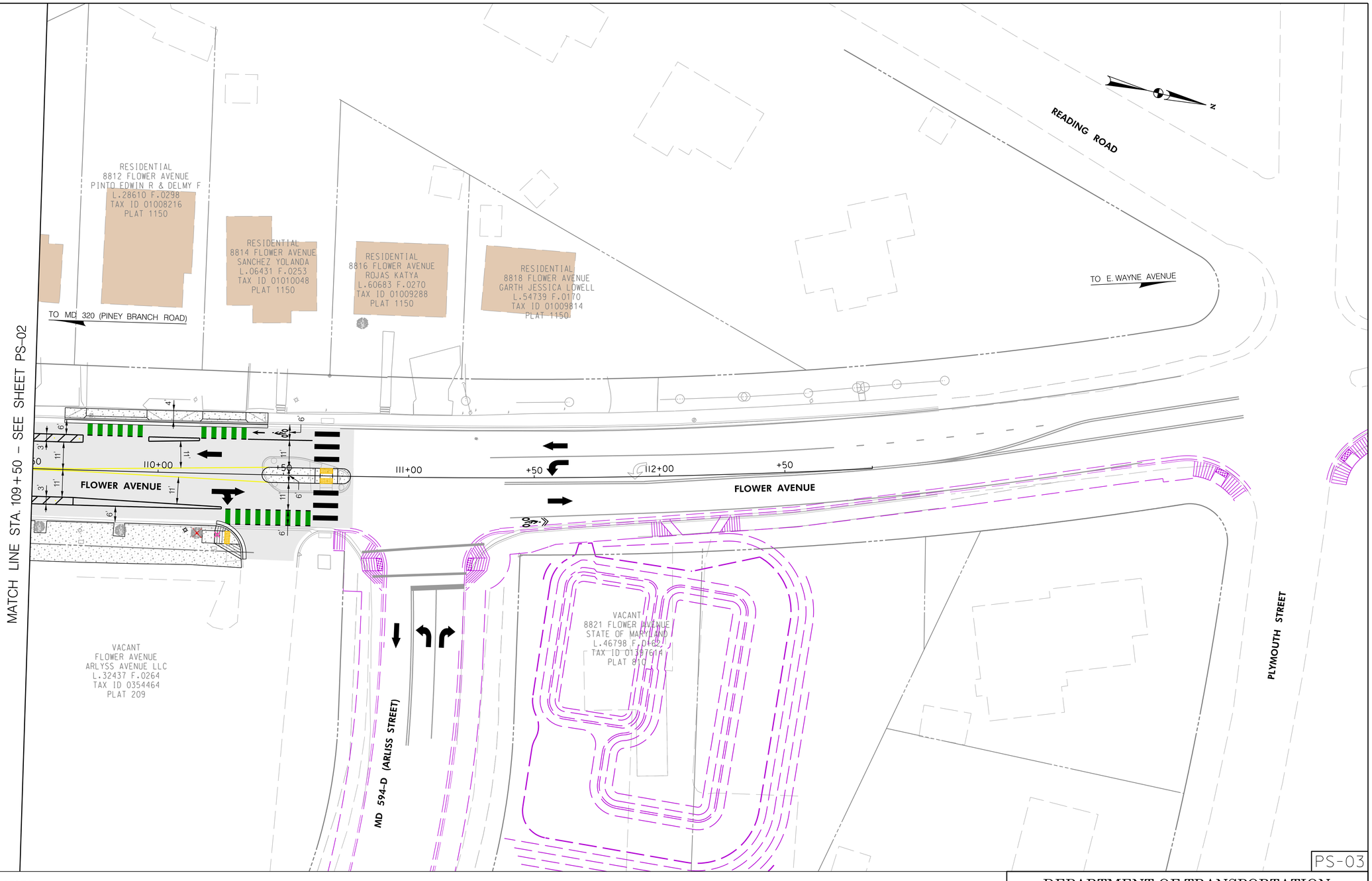

LEGEND

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Bicycle and Pedestrian Priority Areas

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MONTGOMERY COUNTY, MARYLAND

FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 2

SHEET 03 of 03

4/3/2023
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BEJING DELIGHT RESTAURANT
8435 PINEY BRANCH ROAD
GATEWAY PROPERTY LLC
L. F.
TAX ID 03682242
PLAT 24191

MD 320 (PINEY BRANCH ROAD)

THE FLOWER CENTER
8472 PINEY BRANCH ROAD
FLOWER ASSOCIATES
L.03723 F.0026
TAX ID 01397363
PLAT 209

TO MD 195 (CARROLL AVENUE)

TO MD 594-D (ARLISS STREET)

FLOWER AVENUE

100+00 +50 101 +50 102+00 +50 103+00 +50 104+00 +50

MATCH LINE STA. 104+75 – SEE SHEET PS-02

PINEY BRANCH CENTER
8501 PINEY BRANCH ROAD
JBG/PINEY BRANCH RETAIL LLC
L.51454 F.0371
TAX ID 00978064
PLAT XXXX

MD 320 (PINEY BRANCH ROAD)

SHOPPING CENTER
FLOWER AVENUE
FLOWER AVE SHOPG CNTR LTD
L.06551 F.0261
TAX ID 01397603
PLAT 209

PS-01

LEGEND

- PROP. DETECTABLE WARNING SURFACE
- PROP. CONCRETE
- PROP. ASPHALT PAVEMENT RESURFACING
- PROP. BRICK PAVERS
- PROP. BIKE LANES
- PROP. FLOATING BUS STOP
- BUILDING
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FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 3

SHEET 01 of 03

4/3/2023
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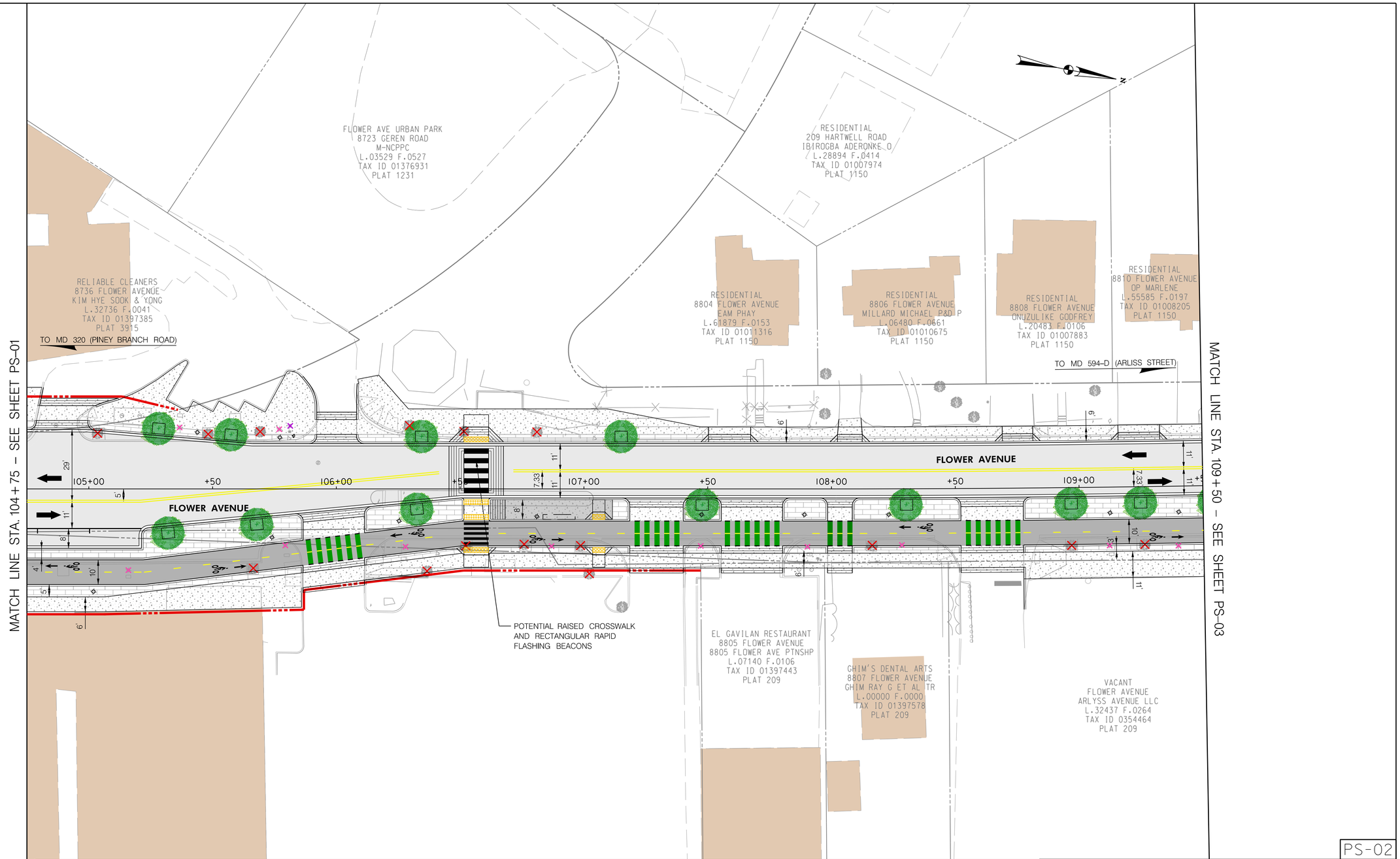

PS-02

LEGEND

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Bicycle and Pedestrian Priority Areas

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FLOWER AVENUE SEPARATED BIKE LANES CONCEPT – 3

SHEET 02 of 03

4/3/2023
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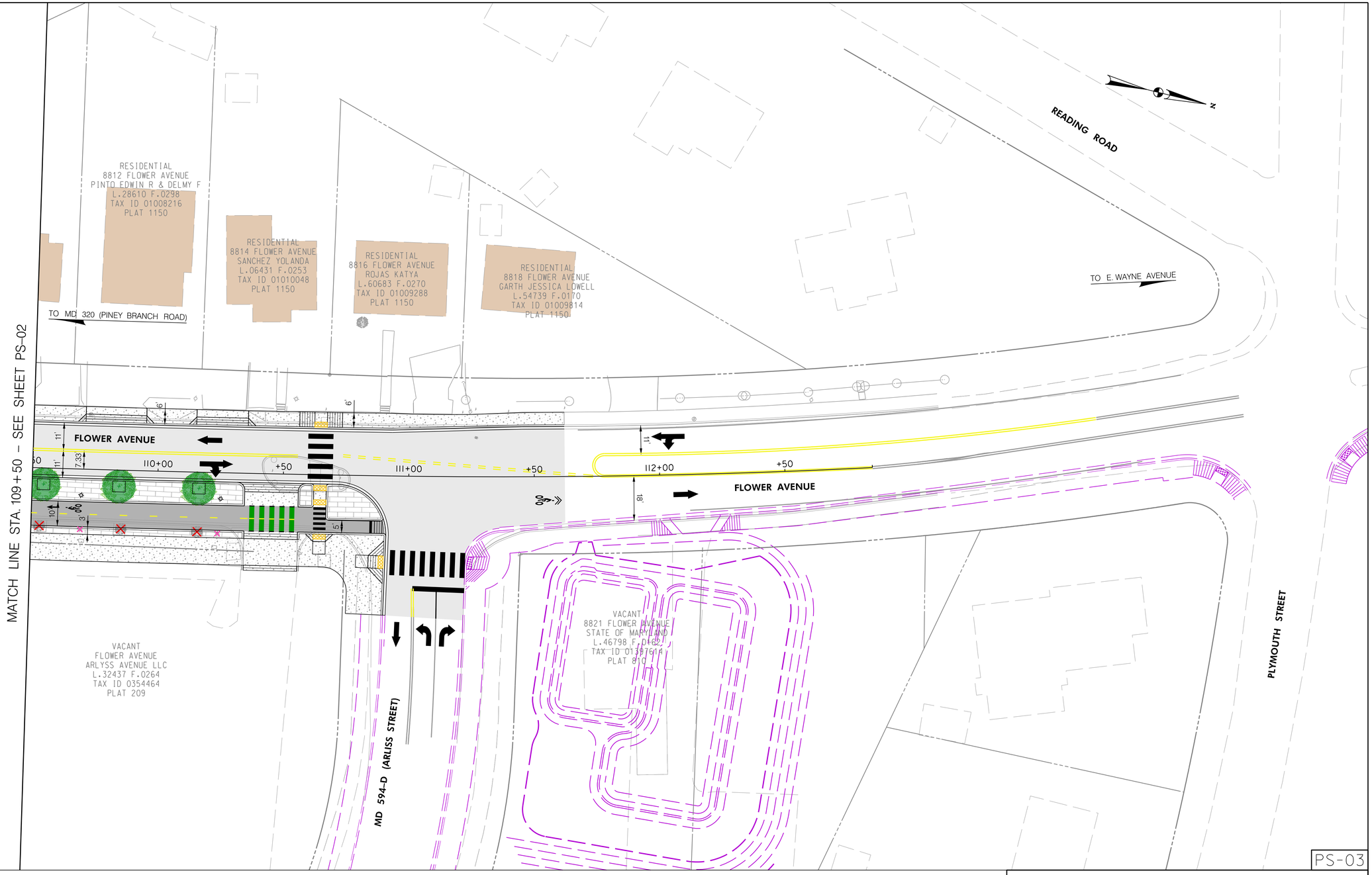

PS-03

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SHEET 03 of 03

4/3/2023
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18 Appendix - Preliminary Cost Estimates

Flower Avenue - Concept 1

Date: MARCH 2023

CONCEPT COST ESTIMATE

Item No.	Cat Code	Description	Quantity	Unit	Unit Price	Cost
		CATEGORY 1 - PRELIMINARY (MOT/MOBILIZATION)				
1001	100000-A	PRELIMINARY (MOT/MOBILIZATION)	1	LS	$354,000.00	$354,000.00
CAT 1 SUBTOTAL						**$354,000.00**
		CATEGORY 2 - GRADING				
2001	201030	CLASS 1 EXCAVATION	365	CY	$50.00	$18,250.00
CAT 2 SUBTOTAL						**$18,250.00**
		CATEGORY 3 - DRAINAGE/SWM				
3001	300000-A	DRAINAGE/SWM	1	LS	$253,000.00	$253,000.00
CAT 3 SUBTOTAL						**$253,000.00**
		CATEGORY 5 - PAVING				
5001	500000-A	SUPERPAVE ASPHALT MIX 9.5MM FOR SURFACE, PG 64S-22, LEVEL 1	90	TON	$150.00	$13,500.00
5002	500000-B	SUPERPAVE ASPHALT MIX 25.0MM FOR BASE, PG 64S-22, LEVEL 1	149	TON	$150.00	$22,350.00
5003	500000-C	PREFORMED THERMOPLASTIC GREEN PAINT	422	SF	$67.00	$28,274.00
5004	500000-D	EPOXY-MODIFIED ACRYLIC WATERBORNE GREEN PAINT	1,445	SF	$16.00	$23,120.00
5005	504500	SUPERPAVE ASPHALT MIX 9.5MM FOR SURFACE, PG 64S-22, LEVEL 2	542	TON	$150.00	$81,300.00
5006	504580	SUPERPAVE ASPHALT MIX 25.0MM FOR BASE, PG 64S-22, LEVEL 2	48	TON	$150.00	$7,200.00
5007	508003	STANDARD MILLING ASPHALT PAVEMENT OVER 1 INCH TO 2.5 INCH DEPTH	4,540	SY	$2.00	$9,080.00
5008	520111	4 INCH GRADED AGGREGATE BASE COURSE	1,096	SY	$8.00	$8,768.00
5009	520113	6 INCH GRADED AGGREGATE BASE COURSE	438	SY	$10.00	$4,380.00
5010	549401	5 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	1,712	LF	$1.25	$2,140.00
5011	549403	5 INCH YELLOW THERMOPLASTIC PAVEMENT MARKINGS	2,898	LF	$1.25	$3,622.50
5012	549405	10 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	132	LF	$3.00	$396.00
5013	549419	24 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	766	LF	$12.00	$9,192.00
5014	549620	WHITE PREFORMED THERMOPLASTIC PAVEMENT MARKING LEGENDS AND SYMBOLS	60	SF	$25.00	$1,500.00
5015	549622	BIKE LANE PREFORMED THERMOPLASTIC PAVEMENT MARKING WITH ARROW	116	SF	$38.00	$4,408.00
5016	549624	SHARED BIKE LANE PREFORMED THERMOPLASTIC PAVEMENT MARKING	10	SF	$38.00	$380.00
5017	561119	6 INCH PORTLAND CEMENT CONCRETE PAVEMENT FOR DRIVEWAY MIX 9	697	SY	$150.00	$104,550.00
CAT 5 SUBTOTAL						**$324,160.50**
		CATEGORY 6 - SHOULDERS				
6001	600000-A	MCDOT CURB AND GUTTER	119	LF	$32.00	$3,808.00
6002	600000-B	MODIFIED TYPE D CURB	1,619	LF	$32.00	$51,808.00
6003	634131	STANDARD TYPE C CURB 8 INCH X 11 INCH MINIMUM	1,534	LF	$32.00	$49,088.00
6004	634146	STANDARD TYPE D CURB 8 INCH X 14 INCH MINIMUM	1,318	LF	$32.00	$42,176.00
6005	634344	STANDARD TYPE D COMBINATION CURB AND GUTTER 12 INCH GUTTER PAN 8 INCH MINIMUM DEPTH	2,043	LF	$32.00	$65,376.00
6006	655105	5 INCH CONCRETE SIDEWALK	16,962	SF	$13.00	$220,506.00
6007	655120	DETECTABLE WARNING SURFACE FOR CURB RAMPS	410	SF	$75.00	$30,750.00
6008	655383	BRICK SIDEWALKS	8,174	SF	$25.00	$204,350.00
CAT 6 SUBTOTAL						**$667,862.00**
		CATEGORY 7 - LANDSCAPING/AMENITIES				
7001	700000-A	LANDSCAPE/AMENITIES	1	LS	$51,000.00	$51,000.00
CAT 7 SUBTOTAL						**$51,000.00**
		CATEGORY 8 - TRAFFIC				
8001	800000-A	MODIFY PINEY BRANCH ROAD TRAFFIC SIGNAL	1	LS	$60,000.00	$60,000.00
8002	800000-B	ORNAMENTAL STREET LIGHT	15	EA	$1,000.00	$15,000.00
8003	800000-C	UTILITY POLE RELOCATION	2	EA	$75,000.00	$150,000.00
8004	800000-D	RELOCATE FIRE HYDRANT	2	EA	$5,000.00	$10,000.00
8005	800000-E	RECTANGULAR RAPID FLASHING BEACONS	1	EA	$20,000.00	$20,000.00
CAT 8 SUBTOTAL						**$255,000.00**
SUBTOTAL - ALL CATEGORIES						**$1,923,272.50**
3% ESCALATION FOR FY 2026 CONSTRUCTION						**$178,339.29**
CONTINGENCY (40%)						**$770,000.00**
Right-of-Way COSTS						**$687,973.00**
					TOTAL CONSTRUCTION COST	**$3,559,584.79**

*** DOES NOT INCLUDE U/G UTILITY RELOCATION OR ADMINISTRATIVE COSTS**

Flower Avenue - Concept 2

Date: MARCH 2023

CONCEPT COST ESTIMATE

Item No.	Cat Code	Description	Quantity	Unit	Unit Price	Cost
		CATEGORY 1 - PRELIMINARY (MOT/MOBILIZATION)				
1001	100000-A	PRELIMINARY (MOT/MOBILIZATION)	1	LS	$152,000.00	$152,000.00
CAT 1 SUBTOTAL						**$152,000.00**
		CATEGORY 2 - GRADING				
2001	201030	CLASS 1 EXCAVATION	97	CY	$50.00	$4,850.00
CAT 2 SUBTOTAL						**$4,850.00**
		CATEGORY 3 - DRAINAGE/SWM				
3001	300000-A	DRAINAGE/SWM	1	LS	$108,000.00	$108,000.00
CAT 3 SUBTOTAL						**$108,000.00**
		CATEGORY 5 - PAVING				
5001	500000-A	PREFORMED THERMOPLASTIC GREEN PAINT	149	SF	$67.00	$9,983.00
5002	500000-B	EPOXY-MODIFIED ACRYLIC WATERBORNE GREEN PAINT	1,486	SF	$16.00	$23,776.00
5003	504500	SUPERPAVE ASPHALT MIX 9.5MM FOR SURFACE, PG 64S-22, LEVEL 2	505	TON	$150.00	$75,750.00
5004	504580	SUPERPAVE ASPHALT MIX 25.0MM FOR BASE, PG 64S-22, LEVEL 2	38	TON	$150.00	$5,700.00
5005	508003	STANDARD MILLING ASPHALT PAVEMENT OVER 1 INCH TO 2.5 INCH DEPTH	4,293	SY	$2.00	$8,586.00
5006	520113	6 INCH GRADED AGGREGATE BASE COURSE	348	SY	$10.00	$3,480.00
5007	549401	5 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	3,662	LF	$1.25	$4,577.50
5008	549403	5 INCH YELLOW THERMOPLASTIC PAVEMENT MARKINGS	1,573	LF	$1.25	$1,966.25
5009	549419	24 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	161	LF	$12.00	$1,932.00
5010	549620	WHITE PREFORMED THERMOPLASTIC PAVEMENT MARKING LEGENDS AND SYMBOLS	30	SF	$25.00	$750.00
5011	549622	BIKE LANE PREFORMED THERMOPLASTIC PAVEMENT MARKING WITH ARROW	77	SF	$38.00	$2,926.00
5012	549624	SHARED BIKE LANE PREFORMED THERMOPLASTIC PAVEMENT MARKING	20	SF	$38.00	$760.00
5013	561119	6 INCH PORTLAND CEMENT CONCRETE PAVEMENT FOR DRIVEWAY MIX 9	56	SY	$150.00	$8,400.00
CAT 5 SUBTOTAL						**$148,586.75**
		CATEGORY 6 - SHOULDERS				
6001	600000-A	MCDOT CURB AND GUTTER	847	LF	$32.00	$27,104.00
6002	655105	5 INCH CONCRETE SIDEWALK	15,836	SF	$13.00	$205,868.00
6003	655120	DETECTABLE WARNING SURFACE FOR CURB RAMPS	300	SF	$75.00	$22,500.00
6004	648170	MONOLITHIC CONCRETE MEDIAN 6 FEET 0 INCH WIDE TYPE A-3	148	LF	$125.00	$18,500.00
6005	670210	POST MOUNTED DELINEATOR	63	EA	$65.00	$4,095.00
CAT 6 SUBTOTAL						**$278,067.00**
		CATEGORY 7 - LANDSCAPING/AMENITIES				
7001	700000-A	LANDSCAPE/AMENITIES	1	LS	$22,000.00	$22,000.00
CAT 7 SUBTOTAL						**$22,000.00**
		CATEGORY 8 - TRAFFIC				
8001	800000-A	ORNAMENTAL STREET LIGHT	6	EA	$1,000.00	$6,000.00
8002	800000-B	RECTANGULAR RAPID FLASHING BEACONS	1	EA	$20,000.00	$20,000.00
CAT 8 SUBTOTAL						**$26,000.00**
SUBTOTAL - ALL CATEGORIES						**$739,503.75**
3% ESCALATION FOR FY 2026 CONSTRUCTION						**$68,571.96**
CONTINGENCY (40%)						**$296,000.00**
Right-of-Way COSTS						**$549,417.00**
					TOTAL CONSTRUCTION COST	**$1,653,492.71**

*** DOES NOT INCLUDE U/G UTILITY RELOCATION OR ADMINISTRATIVE COSTS**

Flower Avenue - Concept 3

Date: MARCH 2023

CONCEPT COST ESTIMATE

Item No.	Cat Code	Description	Quantity	Unit	Unit Price	Cost
		CATEGORY 1 - PRELIMINARY (MOT/MOBILIZATION)				
1001	100000-A	PRELIMINARY (MOT/MOBILIZATION)	1	LS	$313,000.00	$313,000.00
CAT 1 SUBTOTAL						**$313,000.00**
		CATEGORY 2 - GRADING				
2001	201030	CLASS 1 EXCAVATION	336	CY	$50.00	$16,800.00
CAT 2 SUBTOTAL						**$16,800.00**
		CATEGORY 3 - DRAINAGE/SWM				
3001	300000-A	DRAINAGE/SWM	1	LS	$224,000.00	$224,000.00
CAT 3 SUBTOTAL						**$224,000.00**
		CATEGORY 5 - PAVING				
5001	500000-A	SUPERPAVE ASPHALT MIX 9.5MM FOR SURFACE, PG 64S-22, LEVEL 1	84	TON	$150.00	$12,600.00
5002	500000-B	SUPERPAVE ASPHALT MIX 25.0MM FOR BASE, PG 64S-22, LEVEL 1	140	TON	$150.00	$21,000.00
5003	500000-C	PREFORMED THERMOPLASTIC GREEN PAINT	310	SF	$67.00	$20,770.00
5004	500000-D	EPOXY-MODIFIED ACRYLIC WATERBORNE GREEN PAINT	860	SF	$16.00	$13,760.00
5005	504500	SUPERPAVE ASPHALT MIX 9.5MM FOR SURFACE, PG 64S-22, LEVEL 2	553	TON	$150.00	$82,950.00
5006	504580	SUPERPAVE ASPHALT MIX 25.0MM FOR BASE, PG 64S-22, LEVEL 2	42	TON	$150.00	$6,300.00
5007	508003	STANDARD MILLING ASPHALT PAVEMENT OVER 1 INCH TO 2.5 INCH DEPTH	4,694	SY	$2.00	$9,388.00
5008	520111	4 INCH GRADED AGGREGATE BASE COURSE	1,029	SY	$8.00	$8,232.00
5009	520113	6 INCH GRADED AGGREGATE BASE COURSE	384	SY	$10.00	$3,840.00
5010	549401	5 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	1,136	LF	$1.25	$1,420.00
5011	549403	5 INCH YELLOW THERMOPLASTIC PAVEMENT MARKINGS	3,198	LF	$1.25	$3,997.50
5012	549409	12 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	127	LF	$5.00	$635.00
5013	549419	24 INCH WHITE THERMOPLASTIC PAVEMENT MARKINGS	974	LF	$12.00	$11,688.00
5014	549620	WHITE PREFORMED THERMOPLASTIC PAVEMENT MARKING LEGENDS AND SYMBOLS	58	SF	$25.00	$1,450.00
5015	549622	BIKE LANE PREFORMED THERMOPLASTIC PAVEMENT MARKING WITH ARROW	106	SF	$38.00	$4,028.00
5016	549624	SHARED BIKE LANE PREFORMED THERMOPLASTIC PAVEMENT MARKING	20	SF	$38.00	$760.00
5017	561119	6 INCH PORTLAND CEMENT CONCRETE PAVEMENT FOR DRIVEWAY MIX 9	672	SY	$150.00	$100,800.00
CAT 5 SUBTOTAL						**$303,618.50**
		CATEGORY 6 - SHOULDERS				
6001	600000-A	MODIFIED TYPE D CURB	817	LF	$32.00	$26,144.00
6002	634131	STANDARD TYPE C CURB 8 INCH X 11 INCH MINIMUM	785	LF	$32.00	$25,120.00
6003	634146	STANDARD TYPE D CURB 8 INCH X 14 INCH MINIMUM	925	LF	$32.00	$29,600.00
6004	634344	STANDARD TYPE D COMBINATION CURB AND GUTTER 12 INCH GUTTER PAN 8 INCH MINIMUM DEPTH	2,117	LF	$32.00	$67,744.00
6005	655105	5 INCH CONCRETE SIDEWALK	15,776	SF	$13.00	$205,088.00
6006	655120	DETECTABLE WARNING SURFACE FOR CURB RAMPS	251	SF	$75.00	$18,825.00
6007	655383	BRICK SIDEWALKS	8,052	SF	$25.00	$201,300.00
CAT 6 SUBTOTAL						**$573,821.00**
		CATEGORY 7 - LANDSCAPING/AMENITIES				
7001	700000-A	LANDSCAPE/AMENITIES	1	LS	$45,000.00	$45,000.00
CAT 7 SUBTOTAL						**$45,000.00**
		CATEGORY 8 - TRAFFIC				
8001	800000-A	MODIFY PINEY BRANCH ROAD TRAFFIC SIGNAL	1	LS	$60,000.00	$60,000.00
8002	800000-B	ORNAMENTAL STREET LIGHT	17	EA	$1,000.00	$17,000.00
8003	800000-C	UTILITY POLE RELOCATION	1	EA	$75,000.00	$75,000.00
8004	800000-D	RELOCATE FIRE HYDRANT	1	EA	$5,000.00	$5,000.00
8005	800000-E	RECTANGULAR RAPID FLASHING BEACONS	2	EA	$20,000.00	$40,000.00
CAT 8 SUBTOTAL						**$197,000.00**
SUBTOTAL - ALL CATEGORIES						**$1,673,239.50**
3% ESCALATION FOR FY 2026 CONSTRUCTION						**$155,154.48**
CONTINGENCY (40%)						**$670,000.00**
Right-of-Way COSTS						**$465,054.00**
					TOTAL CONSTRUCTION COST	**$2,963,447.98**

*** DOES NOT INCLUDE U/G UTILITY RELOCATION OR ADMINISTRATIVE COSTS**

19 Appendix - Traffic Analysis

Speed Statistics by Hour

Site: FLOWER NB.0.0N
Description: **FLOWER NB**
Filter time: **0:00 Tuesday, September 6, 2022 => 0:00 Tuesday, September 13, 2022**
Scheme: Vehicle classification (Scheme F3)
Filter: Cls(1-13) Dir(N) Sp(6,99) Headway(>0) Span(0 - 328.084) Lane(0-16)

Vehicles = 40482
Posted speed limit = 25 mph, Exceeding = 12131 (29.97%), Mean Exceeding = 28.18 mph
Limit 1 (25 * 100%) + 10 = 35 mph, Exceeding = 365 (0.902%)
Maximum = 58.1 mph, **Minimum** = 6.2 mph, **Mean** = 22.3 mph
85% Speed = 27.40 mph, **95% Speed** = 30.53 mph, **Median** = 22.48 mph
12 mph Pace = 17 - 29, **Number in Pace** = 30658 (75.73%)
Variance = 27.22, **Standard Deviation** = 5.22 mph

Hour Bins

Time	Bin	Min	Max	Mean	Median	85%	95%	>PSL 25 mph	Limit 1 35 mph
0000	333 0.823%	9.0	39.2	25.8	25.7	30.5	34.8	189 56.76%	15 4.505%
0100	169 0.417%	10.2	54.8	27.2	26.7	32.3	34.4	118 69.82%	7 4.142%
0200	118 0.291%	12.5	42.7	26.8	25.9	32.8	35.4	66 55.93%	8 6.780%
0300	151 0.373%	12.3	56.1	27.8	27.7	33.2	37.3	106 70.20%	11 7.285%
0400	277 0.684%	7.3	52.0	28.3	28.3	33.2	37.7	205 74.01%	23 8.303%
0500	611 1.509%	8.3	42.4	27.5	27.5	32.3	35.2	438 71.69%	35 5.728%
0600	1357 3.352%	7.9	47.4	25.9	25.6	30.6	33.8	751 55.34%	45 3.316%
0700	2422 5.983%	7.3	45.3	24.8	24.9	28.9	31.9	1174 48.47%	30 1.239%
0800	2234 5.519%	7.1	45.8	25.0	24.9	29.4	32.1	1107 49.55%	38 1.701%
0900	1881 4.647%	7.4	58.1	24.0	24.2	28.3	31.0	799 42.48%	17 0.904%
1000	1967 4.859%	7.9	44.9	22.9	23.0	27.5	30.1	616 31.32%	8 0.407%
1100	2203 5.442%	6.9	47.1	21.9	21.9	27.0	30.1	604 27.42%	15 0.681%
1200	2351 5.808%	6.3	42.2	21.2	21.3	26.5	29.5	557 23.69%	9 0.383%
1300	2461 6.079%	6.9	39.7	21.9	22.0	27.0	29.8	698 28.36%	12 0.488%
1400	2716 6.709%	6.2	42.7	21.8	22.0	27.0	29.8	742 27.32%	9 0.331%
1500	2670 6.596%	6.9	45.7	21.7	21.7	26.4	29.4	630 23.60%	8 0.300%
1600	3011 7.438%	7.0	43.9	21.1	21.1	25.7	28.4	583 19.36%	4 0.133%
1700	3402 8.404%	6.5	40.6	20.2	20.2	24.9	27.7	492 14.46%	8 0.235%
1800	2936 7.253%	7.0	38.0	19.9	20.0	24.9	27.5	426 14.51%	4 0.136%
1900	2382 5.884%	6.3	39.7	19.8	20.0	25.4	27.7	395 16.58%	3 0.126%
2000	1840 4.545%	6.7	40.3	20.4	20.6	25.4	28.6	322 17.50%	9 0.489%
2100	1455 3.594%	7.4	46.4	22.5	22.6	27.2	30.4	414 28.45%	13 0.893%
2200	946 2.337%	9.4	43.7	24.2	24.3	28.4	31.9	399 42.18%	13 1.374%
2300	589 1.455%	9.6	47.3	25.2	25.2	29.8	33.6	300 50.93%	21 3.565%
----	**40482 100.0%**	**6.2**	**58.1**	**22.3**	**22.5**	**27.4**	**30.5**	**12131 29.97%**	**365 0.902%**

Speed Statistics by Hour

Site: FLOWER SB.2.0S
Description: **FLOWER SB**
Filter time: **0:00 Tuesday, September 6, 2022 => 0:00 Tuesday, September 13, 2022**
Scheme: Vehicle classification (Scheme F3)
Filter: Cls(1-13) Dir(S) Sp(6,99) Headway(>0) Span(0 - 328.084) Lane(0-16)

Vehicles = 40812
Posted speed limit = 25 mph, Exceeding = 18950 (46.43%), Mean Exceeding = 29.33 mph
Limit 1 (25 * 100%) + 10 = 35 mph, Exceeding = 1281 (3.139%)
Maximum = 71.7 mph, **Minimum** = 6.2 mph, **Mean** = 23.5 mph
85% Speed = 30.20 mph, **95% Speed** = 33.67 mph, **Median** = 24.49 mph
12 mph Pace = 19 - 31, **Number in Pace** = 26207 (64.21%)
Variance = 48.82, **Standard Deviation** = 6.99 mph

Hour Bins

Time	Bin	Min	Max	Mean	Median	85%	95%	>PSL 25 mph	Limit 1 35 mph
0000	331 0.811%	8.1	65.3	30.1	29.5	35.1	40.6	270 81.57%	52 15.71%
0100	178 0.436%	8.5	56.4	30.2	29.9	36.4	40.3	145 81.46%	34 19.10%
0200	94 0.230%	9.9	44.2	30.0	29.7	36.4	39.3	81 86.17%	18 19.15%
0300	80 0.196%	14.0	71.7	30.8	30.5	35.9	39.7	70 87.50%	16 20.00%
0400	150 0.368%	17.0	49.1	30.1	29.5	36.1	42.2	125 83.33%	28 18.67%
0500	356 0.872%	9.0	52.2	30.6	30.1	37.1	40.7	300 84.27%	79 22.19%
0600	856 2.097%	10.1	43.3	27.8	27.8	33.0	36.8	626 73.13%	70 8.178%
0700	1772 4.342%	7.0	46.6	27.3	27.3	32.3	35.3	1251 70.60%	103 5.813%
0800	2153 5.275%	6.8	49.3	26.5	27.0	31.8	34.8	1412 65.58%	100 4.645%
0900	2040 4.999%	6.6	48.0	26.4	27.0	32.1	35.0	1324 64.90%	103 5.049%
1000	2121 5.197%	6.2	48.1	25.3	25.8	30.9	33.8	1193 56.25%	58 2.735%
1100	2282 5.591%	6.3	47.8	24.2	25.1	30.3	33.4	1155 50.61%	67 2.936%
1200	2413 5.912%	6.2	49.4	23.2	24.4	29.6	32.9	1101 45.63%	54 2.238%
1300	2412 5.910%	6.2	47.1	23.2	24.0	29.6	32.7	1052 43.62%	46 1.907%
1400	2600 6.371%	6.3	42.7	23.6	24.5	29.9	33.3	1202 46.23%	75 2.885%
1500	3072 7.527%	6.2	45.9	23.0	23.8	29.5	32.7	1294 42.12%	58 1.888%
1600	3396 8.321%	6.2	46.1	21.4	22.1	28.2	31.4	1113 32.77%	28 0.824%
1700	3468 8.498%	6.2	40.5	19.6	20.0	27.0	30.4	818 23.59%	25 0.721%
1800	3201 7.843%	6.2	42.6	19.8	20.6	27.6	30.8	904 28.24%	32 1.000%
1900	2635 6.456%	6.2	45.3	21.0	22.3	27.8	30.9	828 31.42%	21 0.797%
2000	2017 4.942%	6.2	42.9	22.5	23.4	28.6	32.0	762 37.78%	32 1.587%
2100	1515 3.712%	6.5	46.0	24.6	25.2	30.6	33.6	772 50.96%	42 2.772%
2200	1002 2.455%	7.8	56.0	27.1	27.2	32.7	36.2	672 67.07%	71 7.086%
2300	668 1.637%	8.5	64.8	28.1	27.8	33.4	38.0	480 71.86%	69 10.33%
----	**40812 100.0%**	**6.2**	**71.7**	**23.5**	**24.5**	**30.2**	**33.7**	**18950 46.43%**	**1281 3.139%**

Start Date: 9/8/2022 VEHICLES AND PEDS
Start Time: 6:30:00 AM
Site Code: PINEY BRANC RD AT FLOWER AVE TMC

	FLOWER AVE From North				PINEY BRANCH RD From East				FLOWER AVE From South				PINEY BRANCH RD From West			
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds
6:30:00 AM	5	4	10	4	2	180	25	3	7	24	5	3	17	17	1	8
6:45:00 AM	17	7	15	3	2	188	15	2	16	24	2	1	19	22	7	2
7:00:00 AM	8	17	19	3	2	172	18	4	14	43	1	1	16	39	2	4
7:15:00 AM	21	16	25	11	5	190	28	4	14	61	0	3	36	36	4	4
7:30:00 AM	17	32	27	2	5	179	37	1	13	44	10	4	30	46	5	2
7:45:00 AM	24	42	20	3	4	167	28	3	5	39	2	2	18	72	9	6
8:00:00 AM	33	40	26	1	6	133	31	2	10	37	1	2	32	70	11	3
8:15:00 AM	20	23	32	3	6	183	28	6	8	37	0	2	26	69	11	4
8:30:00 AM	24	29	28	3	4	175	24	4	11	29	6	2	32	58	2	2
8:45:00 AM	25	25	21	4	12	178	17	6	14	32	7	1	26	64	7	4
9:00:00 AM	20	25	26	3	10	155	20	8	12	33	5	2	28	74	7	2
9:15:00 AM	24	21	22	6	9	96	15	7	10	19	4	1	28	51	11	3
	238	**281**	**271**	**46**	**67**	**1996**	**286**	**50**	**134**	**422**	**43**	**24**	**308**	**618**	**77**	**44**
4:00:00 PM	39	39	47	7	2	85	22	16	10	37	3	3	52	137	11	8
4:15:00 PM	56	49	41	9	9	95	17	18	13	35	12	8	60	160	14	5
4:30:00 PM	45	49	42	15	6	94	28	16	9	38	11	5	53	151	14	2
4:45:00 PM	47	65	39	10	14	93	38	11	10	36	10	3	56	158	21	2
5:00:00 PM	48	65	38	8	15	90	25	15	12	45	6	5	74	156	14	9
5:15:00 PM	46	57	35	5	14	111	22	10	14	54	5	4	75	164	16	6
5:30:00 PM	50	54	50	11	10	83	35	15	17	39	8	4	69	160	30	2
5:45:00 PM	45	58	36	12	19	102	28	18	16	47	7	6	60	122	11	2
6:00:00 PM	46	87	43	10	10	103	29	19	13	34	12	2	48	136	10	4
6:15:00 PM	42	64	47	11	6	107	28	13	11	43	9	2	55	125	10	6
6:30:00 PM	50	62	46	12	9	81	24	19	11	45	6	6	37	133	18	4
6:45:00 PM	45	44	36	4	12	69	22	21	8	34	4	2	39	95	11	3
	559	**693**	**500**	**114**	**126**	**1113**	**318**	**191**	**144**	**487**	**93**	**50**	**678**	**1697**	**180**	**53**

Start Date: 9/8/2022 BUSES
Start Time: 6:30:00 AM
Site Code: PINEY BRANC RD AT FLOWER AVE TMC

	FLOWER AVE From North			PINEY BRANCH RD From East			FLOWER AVE From South			PINEY BRANCH RD From West		
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
6:30:00 AM	0	1	1	1	7	0	1	2	0	0	3	1
6:45:00 AM	0	2	0	0	4	1	0	1	0	0	3	0
7:00:00 AM	0	2	0	1	8	0	0	5	1	0	3	0
7:15:00 AM	0	1	1	0	7	1	0	3	0	0	3	1
7:30:00 AM	1	0	2	1	4	3	0	3	0	0	6	0
7:45:00 AM	0	4	0	0	4	2	0	2	0	0	2	0
8:00:00 AM	1	2	0	1	8	0	0	2	0	0	8	0
8:15:00 AM	0	2	0	2	3	2	1	3	0	0	9	1
8:30:00 AM	2	3	1	0	4	1	3	1	1	0	4	1
8:45:00 AM	2	4	0	1	7	3	1	1	0	0	3	1
9:00:00 AM	0	1	0	0	7	1	0	2	0	1	6	0
9:15:00 AM	0	0	0	0	3	0	0	0	0	0	4	0
	6	**22**	**5**	**7**	**66**	**14**	**6**	**25**	**2**	**1**	**54**	**5**
4:00:00 PM	0	2	0	0	6	1	0	3	0	1	5	1
4:15:00 PM	2	1	1	0	5	0	0	0	0	0	8	1
4:30:00 PM	0	2	0	0	2	2	0	2	0	0	6	1
4:45:00 PM	0	3	0	0	6	0	0	2	0	0	4	0
5:00:00 PM	1	0	0	0	3	0	0	2	0	0	7	0
5:15:00 PM	1	1	0	0	3	0	0	0	0	0	4	0
5:30:00 PM	0	0	0	0	3	0	0	1	0	0	5	0
5:45:00 PM	0	3	0	0	4	0	0	2	0	0	4	0
6:00:00 PM	0	0	0	0	2	0	0	0	0	0	6	0
6:15:00 PM	1	1	0	0	3	0	0	2	0	0	4	0
6:30:00 PM	0	2	0	0	3	0	0	1	0	0	3	0
6:45:00 PM	0	1	0	0	1	0	0	1	0	0	5	0
	5	**16**	**1**	**0**	**41**	**3**	**0**	**16**	**0**	**1**	**61**	**3**

Start Date: 9/8/2022 BICYCLES
Start Time: 6:30:00 AM
Site Code: PINEY BRANC RD AT FLOWER AVE TMC

	FLOWER AVE From North			PINEY BRANCH RD From East			FLOWER AVE From South			PINEY BRANCH RD From West		
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
6:30:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
6:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:00:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
7:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:00:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:15:00 AM	0	0	0	0	0	0	0	0	0	0	1	0
8:30:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
8:45:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:00:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
9:15:00 AM	0	0	0	0	0	0	0	0	0	0	0	0
	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**0**
4:00:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:15:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
4:45:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:00:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:15:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:45:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:00:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:15:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:45:00 PM	0	0	0	0	1	0	0	0	0	0	0	0
	0	**0**	**0**	**0**	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**

Start Date: 9/8/2022 LARGE TRUCKS
Start Time: 6:30:00 AM
Site Code: PINEY BRANC RD AT FLOWER AVE TMC

	FLOWER AVE From North			PINEY BRANCH RD From East			FLOWER AVE From South			PINEY BRANCH RD From West		
Start Time	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
6:30:00 AM	1	0	0	0	5	0	1	1	0	0	0	0
6:45:00 AM	0	0	0	0	7	0	0	0	0	0	1	0
7:00:00 AM	0	1	0	0	1	0	2	0	0	1	1	0
7:15:00 AM	0	0	0	1	4	0	0	0	0	0	0	1
7:30:00 AM	1	0	1	0	4	0	0	1	1	0	0	0
7:45:00 AM	0	0	0	0	4	0	0	0	0	0	0	0
8:00:00 AM	0	0	0	0	3	0	0	0	0	0	0	0
8:15:00 AM	0	0	0	0	1	1	0	0	0	0	0	0
8:30:00 AM	0	0	0	0	3	0	0	0	0	0	0	0
8:45:00 AM	0	0	0	0	5	1	1	0	1	0	0	0
9:00:00 AM	0	0	0	0	3	0	0	1	0	0	0	0
9:15:00 AM	0	0	0	0	1	0	1	0	0	0	0	0
	2	**1**	**1**	**1**	**41**	**2**	**5**	**3**	**2**	**1**	**2**	**1**
4:00:00 PM	1	0	0	0	1	0	0	0	0	1	1	0
4:15:00 PM	0	0	0	0	1	0	0	1	0	0	1	0
4:30:00 PM	0	0	0	0	0	0	0	0	0	1	1	0
4:45:00 PM	0	0	1	0	1	0	0	1	0	1	1	1
5:00:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
5:15:00 PM	0	0	0	0	1	0	0	0	0	0	0	0
5:30:00 PM	0	0	0	1	1	0	0	0	0	1	0	0
5:45:00 PM	0	1	0	0	1	0	0	1	0	0	0	0
6:00:00 PM	0	0	0	0	1	0	0	0	0	0	2	0
6:15:00 PM	0	0	0	0	0	0	0	0	0	0	1	0
6:30:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
6:45:00 PM	0	0	0	0	0	0	0	0	0	0	0	0
	1	**1**	**1**	**1**	**7**	**0**	**0**	**3**	**0**	**4**	**7**	**1**

		EB				WB				NB				SB				OVERALL
Period	**MOE**	**EBL**	**EBT**	**EBR**	**App.**	**WBL**	**WBT**	**WBR**	**App.**	**NBL**	**NBT**	**NBR**	**App.**	**SBL**	**SBT**	**SBR**	**App.**	
Existing Conditions																		
AM	**Delay**	11.8	11.9	12.0	11.9	10.8	17.2	17.4	17.1	51.1	54.2		53.7	41.4	41.7		41.6	24.9
	LOS	B	B	B	B	B	B	B	B	D	D		D	D	D		D	C
	Queue	29.5	51.5	47		6.8	178.1	160.1		27.1	140			62.6	176			
PM	**Delay**	17.7	22.2	22.3	21.0	19.9	27.0	27.4	26.5	54.3	54.9		54.8	40.1	43.9		42.7	31.2
	LOS	B	C	C	C	B	C	C	C	D	D		D	D	D		D	C
	Queue	106.2	182.3	173.3		22.2	146	129.3		40.8	166			126	308			
Lead Pedestrian Interval (LPI)																		
AM	**Delay**	17.6	17.5	17.6	17.5	16.2	25.7	25.9	25.6	58.0	47.0		48.8	53.0	38.0		42.4	29.7
	LOS	B	B	B	B	B	C	C	C	E	D		D	D	D		D	C
	Queue	38.1	65.3	59.7		8.8	228.1	204.7		29	131			73	168			
PM	**Delay**	21.4	25.6	25.8	24.5	23.1	31.4	32.1	30.9	140	51.2		69.6	68	51.8		57.0	38.9
	LOS	C	C	C	C	C	C	C	C	F	D		E	E	D		E	D
	Queue	119.5	199.2	189.3		24.3	160.2	141.4		75	161			171	335			
Protected Left																		
AM	**Queue**	12.3	12.4	12.4	12.4	11.2	17.8	18.0	17.7	68.0	54.5		56.9	62.0	53.4		55.8	28.4
	Delay	B	B	B	B	B	B	B	B	E	D		E	E	D		E	C
	LOS	30.2	52.7	48.1		7	182.3	163.8		32	140.8			79.7	201.6			
PM	**Queue**	22.2	25.8	26.0	24.9	23.0	31.1	31.7	30.6	64.7	47.3		50.9	127.7	78.5		94.3	46.2
	Delay	C	C	C	C	C	C	C	C	E	D		D	F	E		F	D
	LOS	121.9	199.8	189.9		24.2	159	140.5		44.6	153.4			242.5	415.8			