# MANNAKEE STREET

## Complete Streets Feasibility

February 2024

**Prepared For:**
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Department of Public Works
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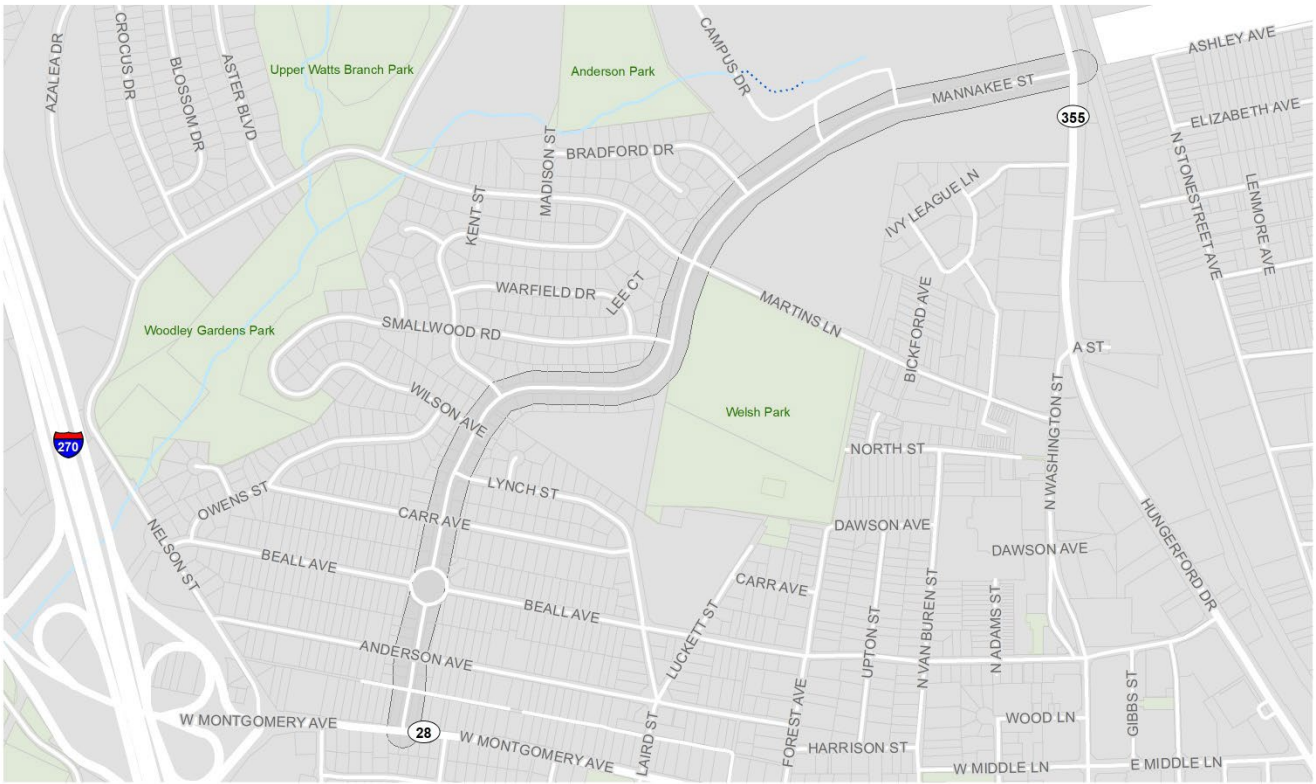
# OVERVIEW

Mannakee Street is owned and maintained by the City of Rockville and primarily runs north to south between Hungerford Drive (MD 355) and West Montgomery Avenue (MD 28) as shown in Figure 1. This corridor is approximately 1.25 miles in length and contains a mix of land uses and destinations, including the largest Montgomery College campus, Welsh Park, the Rockville Swim and Fitness Center, and residential properties. The mix of land uses and destinations along Mannakee Street invites pedestrian and bicycle activity, however, the street primarily serves vehicles and lacks protected bicycle facilities and comfortable pedestrian crossings. Mannakee Street is within a Metropolitan Washington Council of Governments (MWCOG) Equity Emphasis Area and an MWCOG regional activity center, making it a key candidate for safety enhancements. Furthermore, nearly a quarter of residents along and surrounding Mannakee Street are older adults and approximately 15% of residents live with a disability. This Study will advance the City's multimodal network by connecting to a planned National Capital Trail Network trail, providing multimodal connections to the nearby Rockville Metro and MARC stations, and enhancing access to the future Flash BRT.

**Figure 1 Study Area Map**

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**Base Map**
Mannakee Street
Complete Streets Feasiblity Study

This Complete Streets Feasibility Study (Study) aims to improve multimodal safety and comfort for all users on Mannakee Street by exploring corridor redesign alternatives that better accommodate all modes and incorporate Complete Streets design.

> *"Complete Streets is an approach to planning, designing, building, operating, and maintaining streets that enables safe access for all people who need to use them, including pedestrians, bicyclists, motorists, and transit riders of all ages and abilities." – Smart Growth America*

This Study was funded by MWCOG's Transportation Land-use Connections (TLC) program and is managed by the MWCOG and City of Rockville. Kittelson and Associates Inc. is collaborating with T3 Design Corporation to conduct the Study.

# Introduction

Mannakee Street is classified as a Primary Residential Street (Class 2) within the City of Rockville, Maryland, which provides access to the Montgomery College campus, Welsh Park, the Rockville Swim and Fitness Center, and other key community, institutional, and residential sites.

This Study focuses on identifying intersection and corridor recommendations to create protected, comfortable, and low-stress pedestrian and bicycle facilities that align with the principles of Complete Street design. Mannakee Street is bordered by two state roads, W Montgomery Avenue (MD 28) and Hungerford Drive (MD 355). These intersections are owned by the Maryland State Highway Administration (SHA) and operated by Montgomery County Department of Transportation (MCDOT). Consequently, this Study will involve cross-jurisdictional collaboration between the City of Rockville, MCDOT, and MDOT SHA. Additional coordination and collaboration will include Montgomery College, Montgomery Public Schools, and RideOn as needed.

The approach for this Study builds on objectives that have been identified in the City's Comprehensive Plan, Bikeway Master Plan, Vision Zero Action Plan, and the Transportation Planning Board's R3-2021.

# Background

Mannakee Street runs north-south for 1.25 miles between state-owned MD 28 (W. Montgomery Avenue) and Hungerford Drive (MD 355). This Study will evaluate multimodal and Complete Streets-focused improvements. Mannakee Street runs through a mix of residential and institutional land uses, including Montgomery College at the north end. The corridor provides a key connection for students, residents, and employees in the area.

Mannakee Street has a pleasant walking environment throughout most of the corridor, with continuous sidewalks, street trees, pedestrian crosswalks and signage, and a raised crosswalk at Smallwood Road. Additionally, the region has been investing significantly in multimodal transportation. In the future, Mannakee Street will connect to the MD 355 Flash Bus Rapid Transit (BRT). The plans for BRT include enhanced pedestrian and bicycle facilities along MD 355 and will increase the demand for multimodal connectivity to MD 355.

However, the corridor lacks bicycle facilities and enhanced connections to transit. According to the American Community Survey in 2022, a small percentage of employees are commuting in Rockville by walking, biking, or transit, as shown in Figure 2. Residents on Mannakee Street and in the surrounding neighborhood have also indicated that motorists do not always yield to pedestrians crossing the street at crosswalks. Although Mannakee Street has transit service near Montgomery Community College, connected sidewalks, and nearby bike routes, transportation modes are not accommodated equally along Mannakee Street.

This Study recognizes commuter behavior changes that have occurred after the COVID-19 pandemic. American Community Survey data shows commute patterns in Rockville have shifted between 2019 and 2022, with more employees working from home in 2022 and fewer public transportation commuters. The percentage of the population biking and walking has remained relatively steady since 2019.

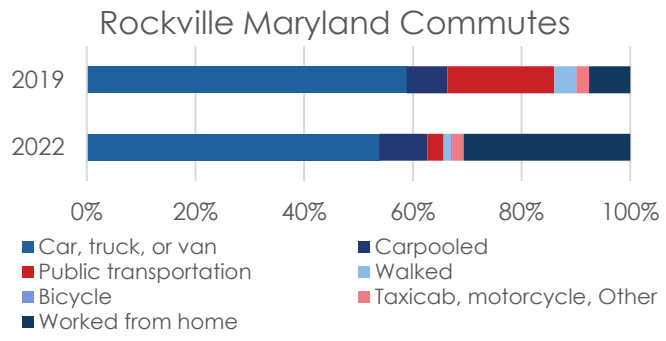



**Figure 2. Census Commute Behavior in Rockville, Maryland**

American Community Survey Data 2019, 2022

# PREVIOUS PLANS AND STUDIES

The project team reviewed relevant plans, studies, and documents to understand the area's context and ongoing projects and plans adjacent to the study corridor.

## MD 355 FLASH BUS RAPID TRANSIT (ONGOING)

The Maryland 355 FLASH BRT will transform driving and riding experiences on MD 355 by significantly enhancing accessibility and mobility options and providing safer and more reliable transit service between Bethesda and Clarksburg. This will help enhance transit connectivity and integration with other travel modes, improve bus speed and reliability, address current and future bus ridership demands, and more. MCDOT anticipates construction to begin in 2025.

The plan proposes BRT treatments along segments of MD 355, including mixed-traffic transit lanes, median-running dedicated transit lanes, and curbside dedicated transit lanes. Along MD 355 near Mannakee Street, the plans propose a northbound BRT and mixed travel lane and a dedicated curbside BRT transit-only lane in the southbound direction. The plans also propose BRT platforms just south of the intersection with Mannakee Street, providing BRT service to Montgomery College. Transit lane configurations for the entire BRT route are shown in  summarizes the proposed and future in-fill stations near Mannakee Street.

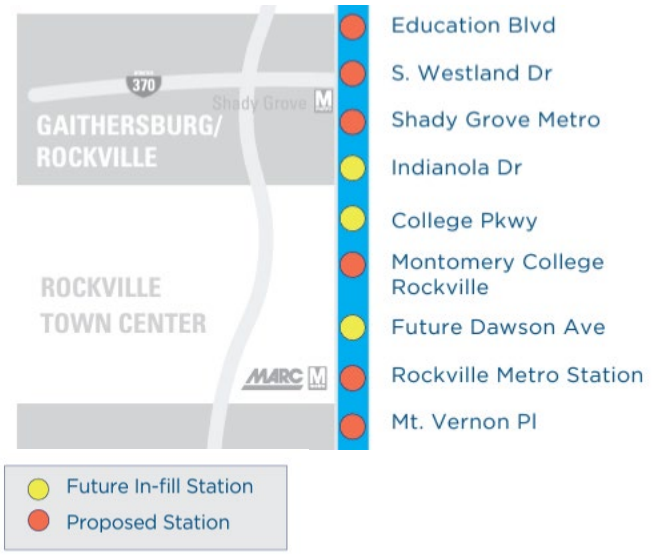



**Figure 3. Flash BRT Proposed and Future In-fill Stations**

Get On Board BRT MD 355 Corridor Summary Report (June 2019)

The plans propose a two-way cycle track on the west side of MD 355 and a pedestrian refuge island on the south intersection leg on Mannakee Street.

## COMPREHENSIVE PLAN OF THE CITY OF ROCKVILLE, MARYLAND (2021)


The City of Rockville's transportation vision is to continue the transition to a more walkable and rollable community and to contribute to regional efforts to create safe, efficient, and environmentally sustainable mobility. Mannakee Street is located within the Rockville Town Center and the Montgomery College Area. The City notes the key issues and opportunities identified in the Rockville Town Center include:

- Improved vehicular and pedestrian signage and wayfinding;
- Implementation of Vision Zero principles to provide a safe environment for pedestrians and bicyclists within the Town Center;
- Connections to the Town Center from nearby neighborhoods; and
- More parks and open space for downtown residents and visitors.

The key issues identified in the Montgomery College Area include:

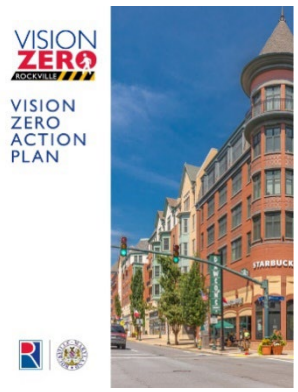
- Accommodate future expansion of the Montgomery College Rockville campus and minimize its impact on the surrounding community;
- Reduce traffic congestion at major intersections in and near the planning area related to Montgomery College;
- Improve pedestrian and bicycle connections among Montgomery College, surrounding neighborhoods, and nearby shopping destinations; and
- Enhance streetscape along MD-355 and WMATA/CSX tracks.

Within the study area of the Rockville Town Center, the City notes that redevelopment of property in the area should contribute to a pedestrian-oriented, urban-scale streetscape. Within the study area of the Montgomery College area, the City notes that opportunities to provide additional vehicular access to the college campus from the north will relieve traffic pressure on the intersection of East/West Gude Drive and MD 355. The plan also discusses opportunities to open or remove barriers to access the college by non-automobile travel modes and physical connections to surrounding areas, while considering community and college safety concerns.

One project note in the plan is located near the study area:

- Project 3 in the Montgomery College Area seeks to improve pedestrian and bicycle access between the college, College Plaza Shopping Center, and Rockville Town Center. This includes significantly improving sidewalks and bicycle facilities on MD-355 and creating a potential new pedestrian path and bikeway connecting the properties owned by the College, MCPS, and the City of Rockville, to each other and to areas north and south.

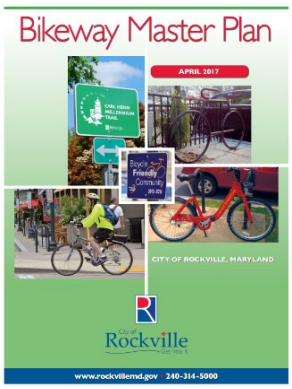
## CITY OF ROCKVILLE VISION ZERO ACTION PLAN (2018)




The Rockville Vision Zero Action Plan seeks to lay the foundation for a long-term strategy for reducing and eliminating transportation related crashes involving serious injuries and fatalities. Four key action areas were identified, including Enforcement, Engineering, Policy, and Education. The applicable action items spanning all four action areas include:

- Conduct a crash analysis;
- Evaluate crossings and unsignalized intersections;
- Expand network of safe bicycle facilities; and
- Review existing traffic safety programs and policies.

## CITY OF ROCKVILLE BIKEWAY MASTER PLAN (2017)




The Rockville Bikeway Master Plan is a component of the City's Comprehensive Master Plan and provides a vision for a safe and efficient multimodal transportation system within the City of Rockville. Within the study area, there are no existing bikeway facilities on Mannakee Street.

The Bikeway Master Plan proposes:

- A bike lane from 355 to Martins Lane;
- A climbing bike lane between Martins Lane and the traffic circle; and
- Shared roadways from the traffic circle to Montgomery Avenue.

# EXISTING CONDITIONS

The project team reviewed the existing conditions along the corridor to understand transportation issues and opportunities. This section provides a summary of the study corridor, focusing on the following topics:

/ Roadway Characteristics
/ Pedestrian Conditions
/ Bicycle Conditions
/ Transit Conditions
/ Curbside Activity
/ Safety
/ Traffic Operations

While the typical section on Mannakee Street remains constant throughout the corridor, the land uses change from residential uses south of Bradford Drive to institutional uses north of Bradford Drive. The project team segmented Mannakee Street based on curb-to-curb widths, land uses, and curbside activity to better evaluate the existing conditions and later develop recommendations for the corridor based on the street segment's context and use.

The project team identified the following corridor segments to evaluate and review existing conditions:

1/ West Montgomery Avenue to Anderson Avenue
2/ Anderson Avenue to Henderson Circle
3/ Henderson Circle
4/ Henderson Circle to Bradford Drive
5/ Bradford Drive to Hungerford Drive

The project team conducted a field visit on December 7, 2023, from 10:00-12:00 PM to observe multimodal activity, take measurements of the sidewalks and lane widths, observe curbside activity, and discuss potential treatment options for the corridor. The team made several observations, summarized below:

/ The area is inviting to pedestrians throughout the corridor, with continuous sidewalks, street trees, pedestrian crosswalks and signage, and a raised crosswalk at Smallwood Road (Figure 4).
/ Sidewalks are available along both sides of Mannakee Street along most of the corridor (Figure 5).
/ A speed bump south of Welsh Park encourages drivers to slow down (Figure 6).
/ Parking restrictions vary along the corridor, and signage can create confusion (Figure 7).

**Figure 4. Raised Crosswalk near Welsh Park on Mannakee Street**

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**Figure 5. Sidewalks near Welsh Park**

Kittelson and Associates, Inc.

**Figure 6. Speed Bump south of Welsh Park**

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**Figure 7. On-Street Parking Restrictions**

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# Existing Roadway Characteristics

The typical cross-section on Mannakee Street varies along the corridor, with curb-to-curb widths summarized in Table 1. The posted speed limit on Mannakee Street is 25 MPH. Figure 8 through Figure 12 depict the typical cross sections for each of the five segments along Mannakee Street.

**Table 1 Curb to Curb Widths along Mannakee Street**

| Segment | Curb to Curb Width |
|---|---|
| **MD 28 to Anderson Avenue** | 36 feet |
| **Anderson Avenue to Henderson Circle** | 26 feet |
| **Henderson Circle** | 22 feet |
| **Henderson Circle to Bradford Drive** | 36 feet |
| **Bradford Drive to MD 355** | 36 feet |

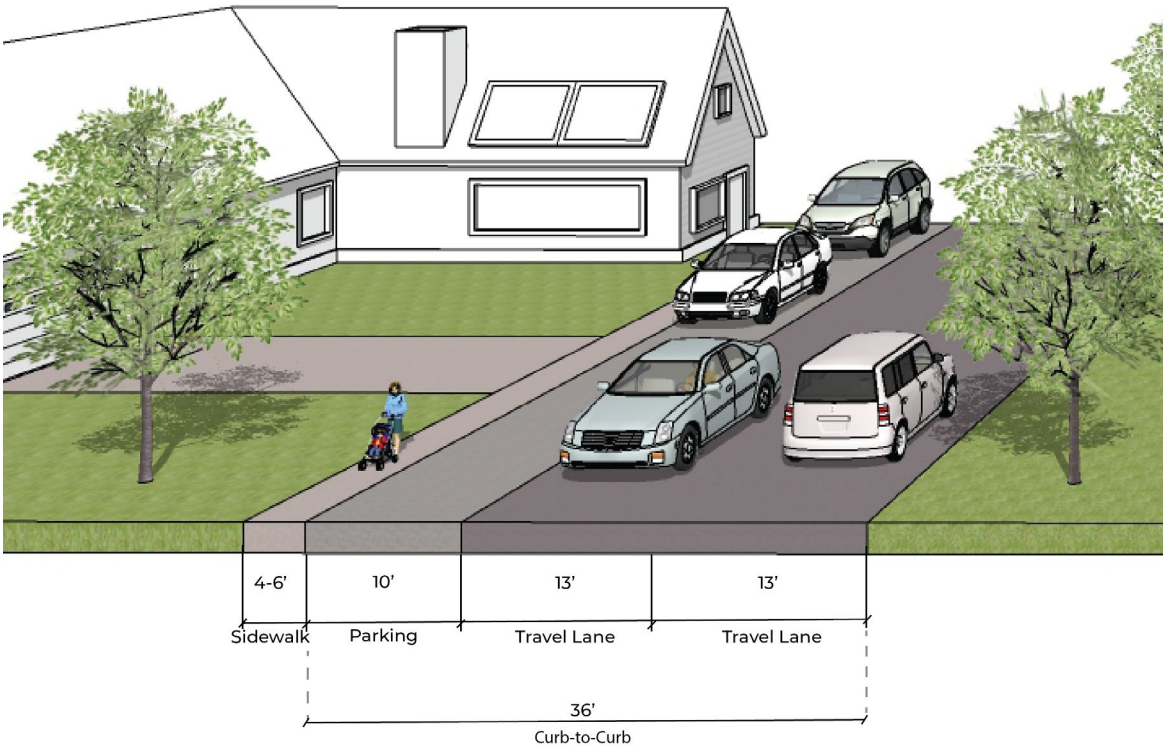


**Figure 8. Segment 1: MD 28 to Anderson Avenue (facing north)**

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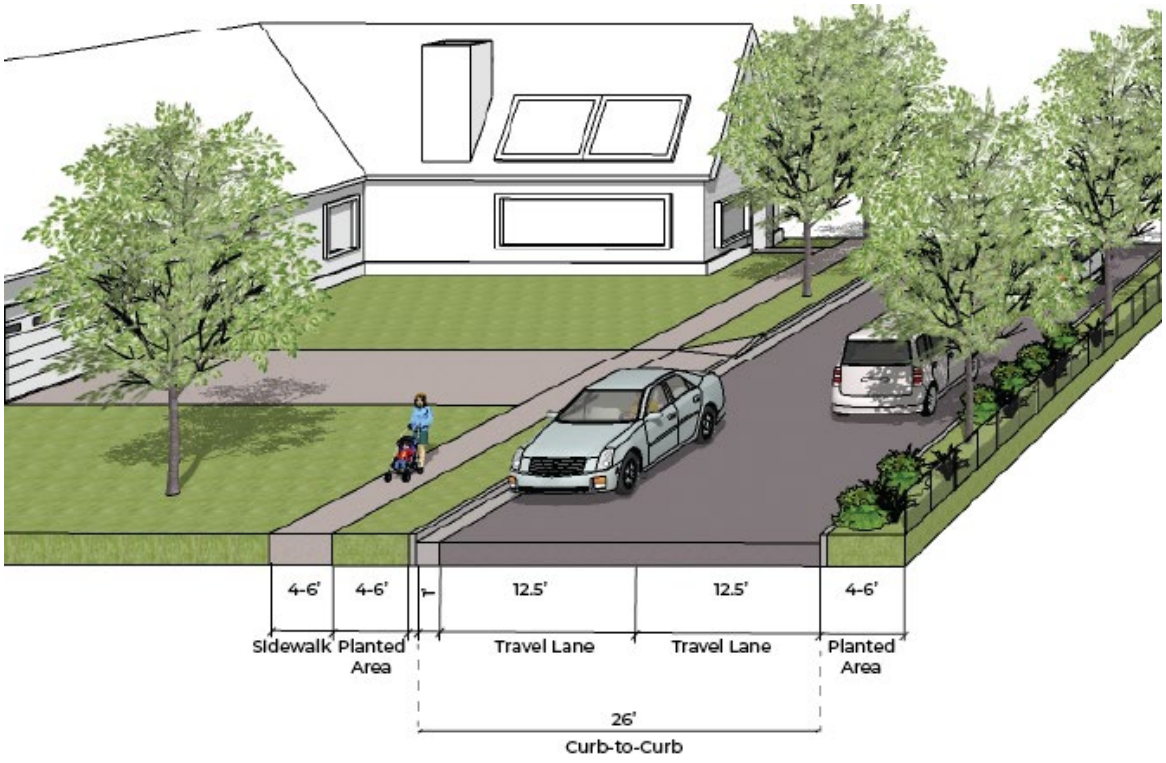


**Figure 9. Segment 2: Anderson Avenue to Henderson Circle (facing north)**

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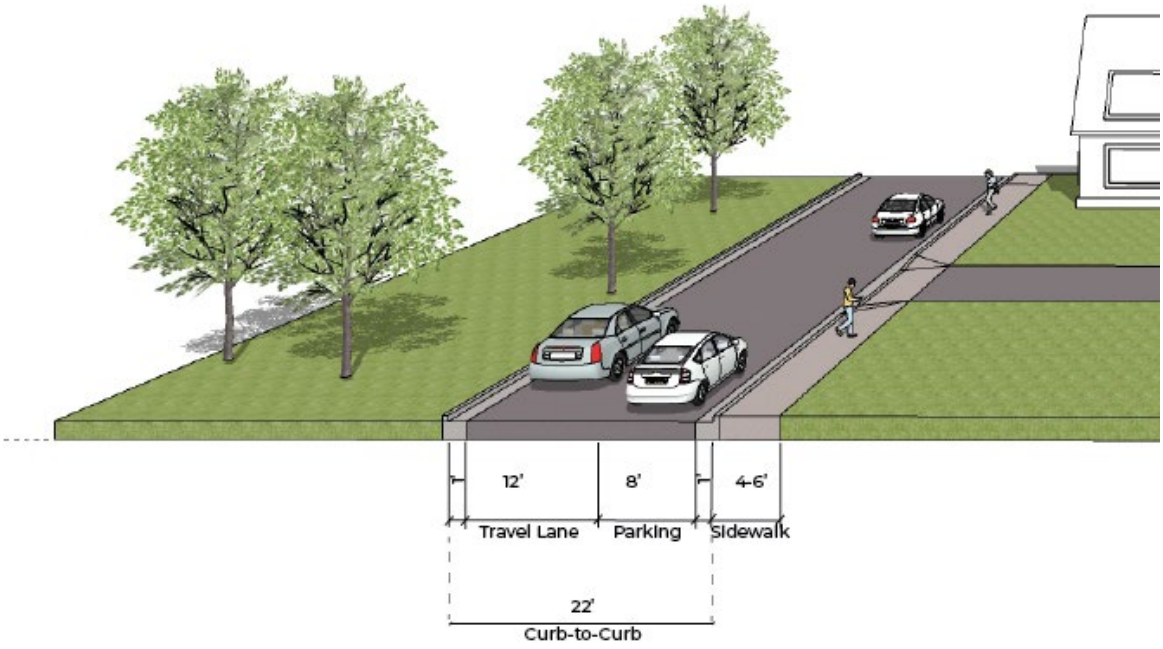


**Figure 10. Segment 3: Henderson Circle**

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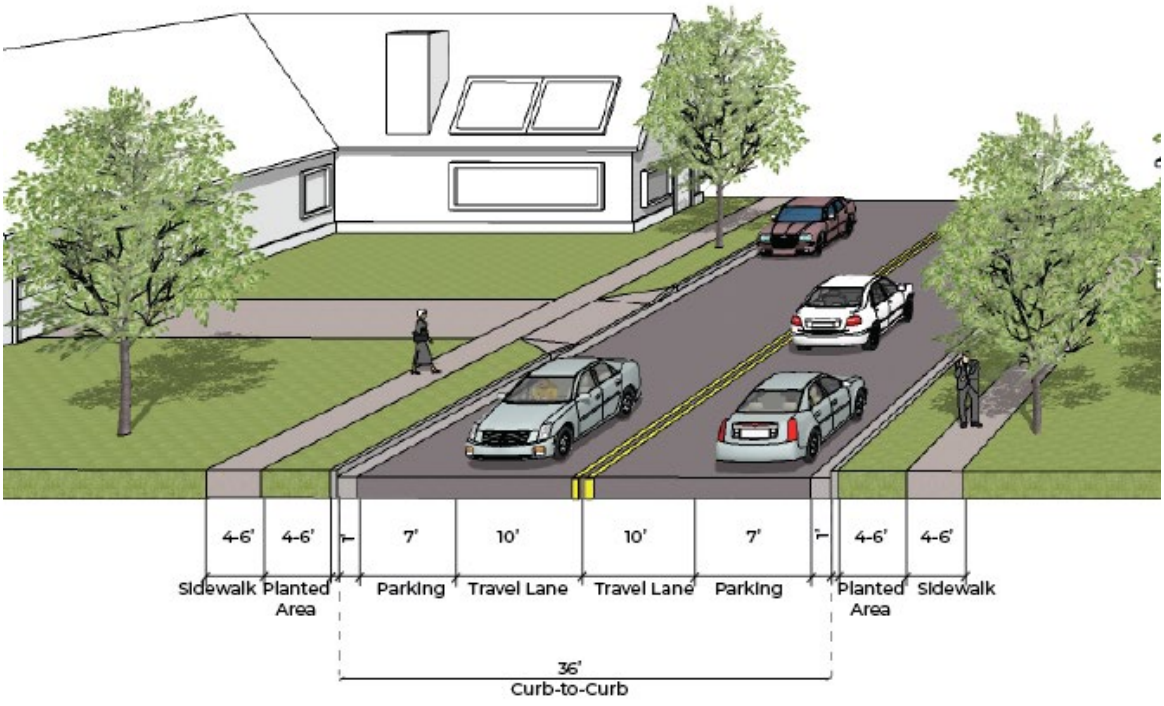


**Figure 11. Segment 4: Henderson Circle to Bradford Drive (facing north)**

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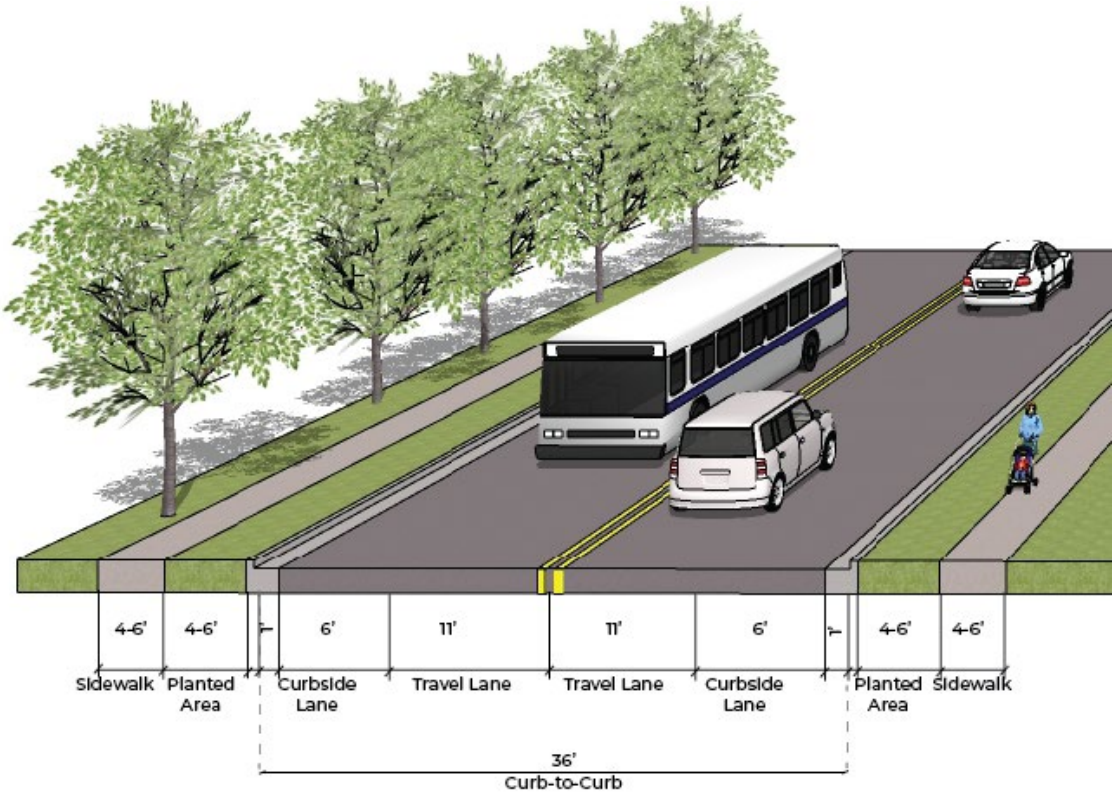


**Figure 12 Segment 5: Bradford Drive to Hungerford Drive (facing north)**

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As shown in the typical cross sections, there are no bicycle facilities along Mannakee Street, the on-street parallel parking varies, and the sidewalk network is mostly complete, with a missing connection on the east side of Mannakee Street from West Montgomery Avenue to Henderson Circle. Table 2 summarizes the existing conditions observed along Mannakee Street for each street segment.

**Table 2 Existing Conditions along Mannakee Street**

| Mannakee Street Segment | Sidewalk | | Curbside Use | | Curb to Curb Width | Transit Facilities |
|---|---|---|---|---|---|---|
| | West | East | West | East | | |
| MD 28 to Anderson Avenue | Yes | No | Parking permitted | No parking permitted | 36 feet | N/A |
| Anderson Avenue to Henderson Circle | Yes | No | No parking permitted | | 26 feet | N/A |
| Henderson Circle | Sidewalk available within Henderson Circle and outside of the Circle | | Right side parking permitted (except from Mannakee St to Beall Ave) | | 22 feet | N/A |
| Henderson Circle to Bradford Drive | Yes | Yes | Parking permitted in most areas | | 36 feet | N/A |
| Bradford Drive to MD 355 | Yes | Yes | Parking restrictions vary | | 36 feet | Ride On: 46, 55<br>WMATA: Q2, Q6 |

# Pedestrian Conditions

Mannakee Street has several comfortable and safe pedestrian facilities, including sidewalks that connect most of the corridor, trees that provide shade, speed humps and a raised crosswalk that encourage traffic calming, high visibility pedestrian crossing signage, and several opportunities for protected crossings. The team's review of existing conditions highlighted several gaps and opportunities to improve the existing pedestrian network and improve connections to other modes, as summarized in the following section.

Most of the corridor along Mannakee Street includes sidewalks that are approximately four to five feet wide. There are no sidewalks on the east side of Mannakee Street from MD 28 to Henderson Circle, as shown in Figure 13. Given the mix of residential and commercial land uses, as well as the proximity to several bus routes and nearby MARC and Rockville Metro stations, the corridor experiences primarily residential and college visitor pedestrian, bicycle, and scooter activity.

The City provided pedestrian counts that were collected at the following locations:

- MD 355 and Mannakee Street (October 2, 2014), shown in Table 3
- MD 28 and Mannakee Street (October 18, 2022), shown in Table 4

**Figure 13. Missing Sidewalks on the East side of Mannakee Street north of MD 28**

Google Streetview

Twenty-hour hour pedestrian activity at Mannakee Street and MD 355 and MD 28 are provided in Table 3 and Table 4, respectively.

**Table 3 24-Hour Pedestrian Volumes at MD 355**

| North | South | East | West | Total |
|---|---|---|---|---|
| 23 | 4 | - | 114 | 141 |

**Table 4 24-Hour Pedestrian Volumes at MD 28**

| North | South | East | West | Total |
|---|---|---|---|---|
| 25 | - | 0 | 5 | 30 |

# PEDESTRIAN CROSSINGS

Crosswalks allow pedestrians to safely cross the corridor. Vehicles must stop at crosswalks when pedestrians are in the crosswalk, which increases the visibility of pedestrians and improves overall safety. Crosswalks with high-visibility markings and/or signage further improve visibility and safety.

The City has made several investments in pedestrian safety along Mannakee Street. The list below summarizes the various pedestrian crossing treatments along the corridor:

Crosswalks across Mannakee Street vary between stop-controlled crosswalks, signalized crosswalks, and a midblock crosswalk by the Montgomery College.

There are 14 crosswalks across Mannakee Street, with the average spacing between crosswalks being 650 feet. The greatest distance between crosswalks is 1,650 feet between Smallwood Road and Lynch Street. Approximately half of the crosswalks are high-visibility and help to increase the visibility of crosswalks and crossing pedestrians. The study area has lighting approximately every 80 to 150 feet along Mannakee Street, helping to further increase pedestrian visibility.

There is a raised crosswalk located at Smallwood Road, which doubles as a traffic calming treatment to encourage slower vehicular speeds and a more comfortable pedestrian experience. Additionally, there is a Rectangular Rapid-Flashing Beacon (RRFB) located at the Mannakee Street/Parking Lot 13 intersection, on the south approach to help facilitate pedestrian crossings near Montgomery College, shown in Figure 14. There are several locations with missing crossings, including:

- Anderson Ave – west and east legs
- Carr Avenue – west leg
- Mannakee Street – north of Carr Avenue, north of Smallwood Road
- Wilson Ave – west leg
- Goldsborough Drive – west leg
- Smallwood Road – west leg
- Bradford Drive – west leg
- Henderson Circle – cross streets

**Figure 14. Rectangular Rapid-Flashing Beacon on Mannakee Street/Parking Lot 13 Entrance**

Kittelson and Associates, Inc.

# Bicycle Conditions

Mannakee Street does not have existing bicycle infrastructure. However, there is an existing Capital Bikeshare station located within the Montgomery College (Figure 15). Figure 16 depicts existing bicycle facilities on surrounding streets, including a mix of shared use paths, bike lanes, and shared lanes.

Additionally, dockless e-bikes and e-scooters are available within the City. Bicycle parking along the study corridor is primarily located within Montgomery College.

The Rockville Bikeway Master Plan proposes a bike lane from MD 355 to Martins Lane, a climbing lane between Martins Lane and the traffic circle, and shared roadways from the traffic circle to Montgomery Avenue, as shown in Figure 17.

**Figure 15 Capital Bikeshare Station at Montgomery College**

Google Streetview


**Figure 16. Bicycle Facilities in Rockville**

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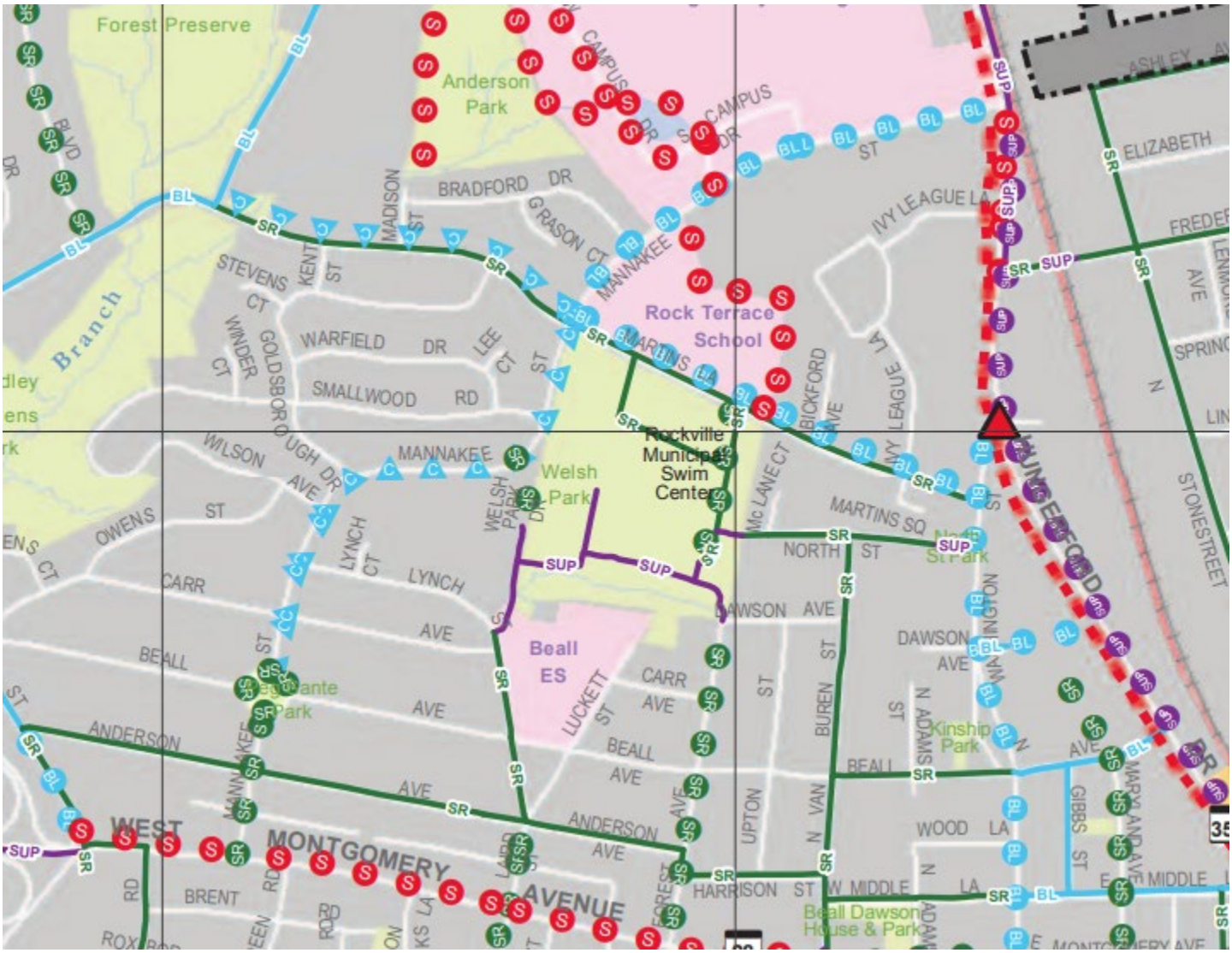


**Figure 17. Proposed Bicycle Facilities in Rockville**

City of Rockville Bikeway Master Plan

Anderson Avenue has shared lane markings and provides a lower-stress east-west bicycle connection than MD 28, as shown in Figure 18. Additionally, there is an ongoing project to evaluate the feasibility and design of bicycle facilities on Martins Lane.

The City has been making strides in advancing bicycle improvements, with separated bicycle lanes provided on N. Washington Street and E. Middle Lane. The City is actively reviewing other nearby corridors to evaluate safety improvements for people biking and walking, including improvements on Martins Lane and Beall Avenue. Mannakee Street serves as a critical connector in the City's bicycle network.

**Figure 18. Shared Lane Markings on Anderson Lane**

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# Transit Conditions

Ride On and WMATA transit service is provided along a portion of Mannakee Street, near Montgomery Community College. WMATA's Metro Red Line service runs parallel to MD 355, with the Rockville Metro station located approximately one mile from Mannakee Street and MD 355.

There are two Metro Bus lines that service this area, including:

/ Metro bus Q2 and Q6 serve the neighborhoods in the west providing connectivity to Shady Grove, Silver Spring, and Wheaton stations, as summarized in Table 5.

**Table 5 WMATA Transit Service**

| Route | Headways | Service |
|---|---|---|
| Q2 | 16-30 mins | Serves Shady Groves station, Montgomery College, Rockville station, Wheaton station, Forest Glen station, and Silver Spring station. |
| Q6 | 16-30 mins | Serves Shady Grove station, Montgomery College, Rockville station, and Wheaton station. |

**Source: WMATA, 2023**

Montgomery County transit service, Ride On, ensures connectivity within Rockville to adjacent towns. The Ride On routes that service Mannakee Street are shown in Table 6 and include:

/ Ride-On Routes 46, 55, 101, detailed in Table 6.

**Table 6 Ride On Transit Service**

| Route | Headways | Service |
|---|---|---|
| 46 | 15-30 mins | Montgomery College to Southern Oakmont area |
| 55 | 12-30 mins | Rockville station north to the Germantown area |
| 101 | 10 mins | Gaithersburg area south to the North Bethesda area |

**Source: WMATA, 2023**

Amenities at the nearby transit stations include shelters, benches, and wayfinding signage. The transit stop located near the Mannakee Street and MD 355, across from the Montgomery College, has wayfinding signage but lacks pedestrian-oriented amenities, such as seating and shade (Figure 19). The transit stops located within Montgomery College have shelters and benches (Figure 20).


**Figure 19. Transit Stop near Mannakee Street and MD 355**

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**Figure 20. Transit Stops at Montgomery College**

Google Streetview

# Curbside Activity

The curbside activity along Mannakee Street varies throughout the corridor. On-street parking is provided in the more residential, southern portion of Mannakee Street whereas no on-street parking is provided near Montgomery College. Table 7 details the curbside uses for each segment along Mannakee Street.

**Table 7 Curbside Uses on Mannakee Street**

| Mannakee Street Segment | Curbside Use | |
|---|---|---|
| | West | East |
| West Montgomery Avenue to Anderson Avenue | Parking permitted | N/A |
| Anderson Avenue to Henderson Circle | N/A | |
| Henderson Circle | N/A | |
| Henderson Circle to Bradford Drive | Parking permitted in most areas | |
| Bradford Drive to Hungerford Drive | Parking is generally restricted along the segment | |

Parking signs along Mannakee Street indicate parking restrictions along the corridor. No parking signage, as displayed in Figure 21, indicates where on-street parking is not permitted, typically near intersections. Figure 22 notes parking restrictions, which vary along the corridor. The remainder of the corridor allows on-street parking without restrictions, as shown in Figure 23.


**Figure 21. No Parking**

Kittelson and Associates, 2023



**Figure 22. Restricted Parking**

Google Streetview

**Figure 23. No Restricted Parking**

Kittelson and Associates, 2023

# Safety

The City provided crash data for Mannakee Street from 2018-2023, with 2023 data provided through October 31st. The project team reviewed this data to understand crashes and safety concerns along the corridor. The crash data presented in this section only accounts for crashes recorded in this dataset and should function as a reference.

Between 2018 and 2023, there were twenty-one crashes along Mannakee Street. In this five-year period, there were no fatal crashes or pedestrian crashes. Figure 24 displays crash severity over the last five years.

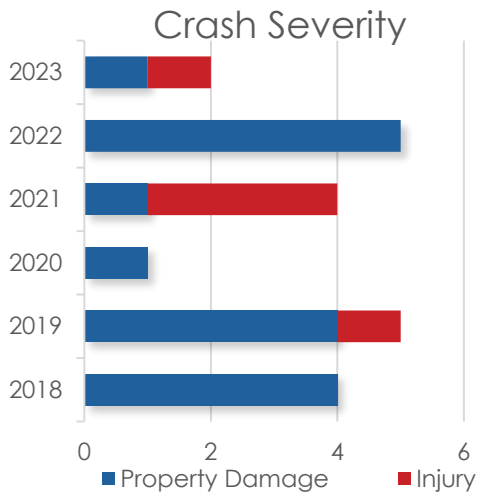



**Figure 24. Crash Severity**

Maryland Department of Transportation, 2023

Figure 25 displays the crashes by type. As shown, angle crashes, or crashes that include motorists turning left or right, accounted for approximately 40% of total crashes along Mannakee Street from 2018 to October 2023. Other crash types included collisions with fixed objects and parked vehicles.

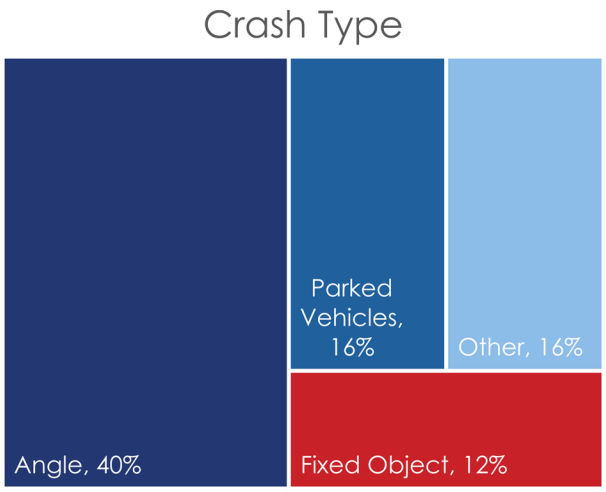



**Figure 25. Crash Severity**

Maryland Department of Transportation, 2023

# Traffic Operations

This section provides an overview of the existing traffic operations observed and evaluated along Mannakee Street. The City provided turning movement counts and vehicular speed and volume data for analysis.

Additionally, the team conducted a field visit and observed traffic and operations.

## Existing Speed and Volume Analysis

The City of Rockville provided speed and volume data for the team to analyze to understand existing traffic operations along the corridor. The City provided turning movement counts at the following intersections:

- Mannakee Street and MD 28 (October 18. 2022)
- Mannakee Street and MD 355 (October 2, 2014)
- Mannakee Street and Martins Lane (September 20, 2023)

The City provided additional tube count data for vehicular speeds and volumes on Mannakee Street at the following locations:

- **Mannakee Street between MD 28 and Anderson Avenue (April 22-29, 2019)**
- **Mannakee Street between Anderson Avenue and Beall Avenue (November 5-12, 2019)**
- **Mannakee Street between Lynch Street and Wilson Avenue (April 22-29, 2019)**

Table 8 summarizes weekdays (Tuesday, Wednesday, Thursday) average daily traffic (ADT), average speeds, 85th percentile speeds, total vehicles exceeding the posted speed limit, and maximum speeds for the three different segments. The ADT along Mannakee Street varies between 3,827 to 6,344 vehicle per day (vpd) with the segment between Lynch Street and Wilson Avenue being most travelled with an ADT of 6,344 vpd.

Currently, Mannakee Street has a posted speed limit of 25 Miles per Hour (MPH). The project team observed that between 40.66 % to 67.83% of the total traffic travels at a speed higher than the posted speed limit. Additionally, vehicles traveling between Anderson Avenue and Beall Avenue generally travel at a higher speed in comparison with the other two segments, with the 85$^{th}$ percentile speed reported as 44.4 MPH.

It is expected that the proposed traffic calming measures in this study would help reduce high speed along the corridor and improve safety for pedestrians and cyclists.

**Table 8 Mannakee Street Speed and Volume Analysis**

| Speed and Volume Data along Mannakee St (Both Directions) | Btw Lynch St and Wilson Ave | Btw W. Montgomery & Anderson Ave | Btw Anderson Ave & Beall Ave |
|---|---|---|---|
| Data Collection Period | From April 22 to April 29, 2019 | | From Nov 5 to Nov 12, 2019 |
| Average Daily Traffic (ADT) | 6,322 (VPD) | 5,709 (VPD) | 3,827 (VPD) |
| Average Speed | 26.60 MPH | 24.62 MPH | 28.48 MPH |
| 85th Percentile Speed* | 30.77 MPH | 29.29 MPH | 44.40 MPH |
| Exceeding Posted Speed Limit (25 MPH) | 4,290 (67.83%) | 2,659 (46.57%) | 1,499 (40.66%) |
| Maximum Speed | 56.2 MPH | 49.9 MPH | 50.1 MPH |

**Source: City of Rockville, 2023**

* 85th Percentile Speed is reported as the maximum over a 72-hour period.

# Existing Intersection Operations

The team evaluated existing intersection operations at the two signalized intersections along Mannakee Street, including MD 355 and Nelson Street/Martins Lane. A review of the turning movement counts at both intersections indicates the AM peak hour to be between 7:15 AM to 8:15 AM and the PM peak hour between 5:00 PM and 6:00 PM. Figure 26 presents the AM and PM peak hour turning movement counts.

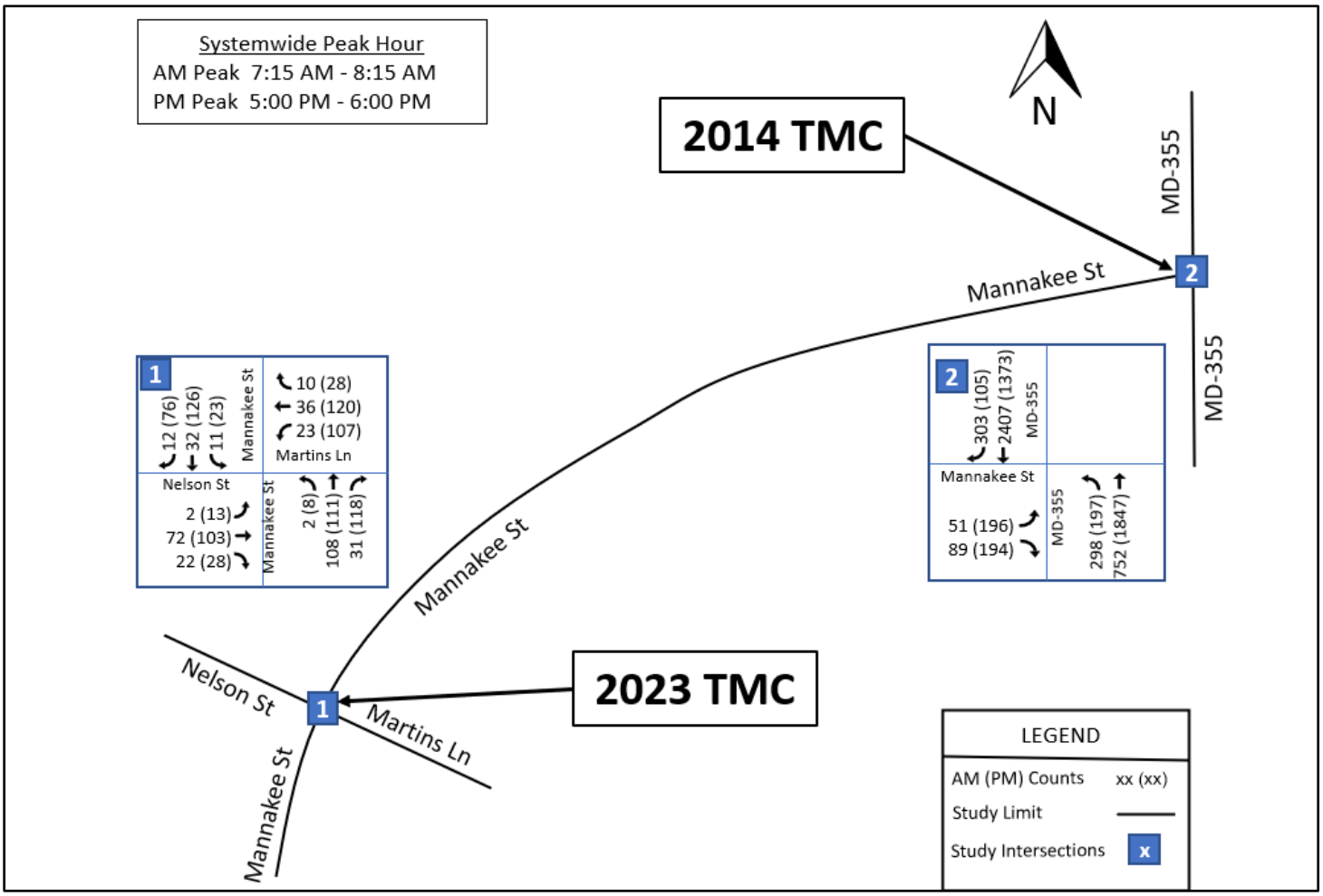



**Figure 26. AM and PM Peak Hour Turning Movement Counts**

Maryland Department of Transportation, 2023

# Traffic Growth Rate

Due to the difference in data collection years for each signalized intersection, the project team calculated an annual growth rate to adjust the 2014 counts at MD 355 to better reflect existing 2023 volumes. The annual growth rate was calculated based on a 5-year historical Average Annual Daily Traffic (AADT) as shown in Table 9.

**Table 9 Mannakee Street 5-year Historical AADT**

| Mannakee Street AADT | | | | |
|---|---|---|---|---|
| Year | Between MD 28 and Beall Ave | | Between MD 355 and Beall Ave | |
| | AADT | GR | AADT | GR |
| 2015 | 4,293 | 2% | 9,223 | 2% |
| 2016 | 4,384 | 3% | 9,404 | 2% |
| 2017 | 4,495 | -1% | 9,635 | -3% |
| 2018 | 4,470 | 0% | 9,330 | 0% |
| 2019 | 4,471 | | 9,331 | |
| Average Growth Rate (GR) | | 1% | | 0% |

**Source: Maryland Department of Transportation, 2023**

The traffic growth along Mannakee Street fluctuates throughout the 5-year study period, with a few years showing minimal growth. The overall average growth rate along Mannakee Street between MD 28 and Beall Avenue was 1% while there was no growth between Beall Avenue and MD 355. This is likely because the study area is mostly built-out and had little to no traffic growth during the 5-year study period. Based on the historical volumes review, 2014 volumes were used to evaluate the intersection of MD 355 and Mannakee Street without growing them to the year 2023. This approach was discussed and approved by the City.

# Capacity Analysis – Existing Year Traffic Conditions

Synchro Professional (Version 11) was used to develop AM and PM peak hour existing conditions analysis models. Both peak hour models were prepared based on existing lane configuration, peak hour volumes shown in Figure 26, and traffic signal timings and phasing provided by the City of Rockville.

Control delay (seconds per vehicle) and Level of Service (LOS) are presented based on HCM 2000 methodologies.

The intersection delay and LOS results for the study intersections are presented in Table 10. The accompanying Synchro reports are provided in Appendix A. Levels of service (LOS) results of D or better are considered acceptable, and LOS E or F are considered unacceptable and are presented in red font and highlight.

The analysis results indicate that all movements at the intersection of Martins Lane/ Nelson Street and Mannakee Street operate at LOS C or better and the overall intersection operates at LOS B during both peak hours.

During the AM peak hour, the eastbound and southbound approaches at intersection of MD 355 and Mannakee Street, operate at LOS E and the overall intersection also operates at LOS E. During the PM peak hour, the eastbound approach operates at LOS E, but the overall intersection operates at LOS B.

**Table 10 Capacity Analysis Results - Existing Year (2023) Conditions**

| Intersection/ Signalized | Approach Label | Approach/ Movement | AM Peak | | PM Peak | |
|---|---|---|---|---|---|---|
| | | | Delay (veh/sec) | LOS | Delay (veh/sec) | LOS |
| MD 355 Hungerford Dr & Mannakee St | Mannakee St | EBL | 70.5 | E | 73.1 | E |
| | | EBR | 64.8 | E | 52.3 | D |
| | | **EB Overall** | **66.9** | **E** | **62.8** | **E** |
| | MD 355 (Hungerford Dr.) | NBL | 49.6 | D | 25.5 | C |
| | | NBT | 2.2 | A | 8.3 | A |
| | | **NB Overall** | **15.6** | **B** | **9.9** | **A** |
| | MD 355 (Hungerford Dr.) | SBLTR | 75.1 | E | 18.0 | B |
| | | **SB Overall** | **75.1** | E | **18.0** | **B** |
| | **Overall Intersection** | | **55.9** | **E** | **19.2** | **B** |
| Martins Ln./ Nelson St. & Mannakee St | Mannakee St | EBLTR | 33.0 | C | 33.9 | C |
| | | **EB Overall** | **33.0** | **C** | **33.9** | **C** |
| | Mannakee St | WBT | 26.2 | C | 30.7 | C |
| | | WBR | 24.3 | C | 21.5 | C |
| | | **WB Overall** | **25.8** | **C** | **27.6** | **C** |
| | Martins Ln | NBL | 5.0 | A | 7.9 | A |
| | | NBTR | 5.0 | A | 7.5 | A |
| | | **NB Overall** | **5.0** | **A** | **7.7** | **A** |
| | Nelson St | SBTL | 3.2 | A | 3.7 | A |
| | | SBR | 3.0 | A | 3.4 | A |
| | | **SB Overall** | **3.2** | A | **3.7** | A |
| | **Overall Intersection** | | **19.8** | **B** | **18.9** | **B** |

**Source: T3, 2023**

# Issues & Opportunities

Based on the existing conditions analysis, creating protected, comfortable, and low-stress pedestrian and bicycle facilities on Mannakee Street would enhance regional connectivity by creating a route that connects to MD 355 and MD 28. The field visit additionally enhanced the project team's understanding of the street's context and the challenges faced by residents and bicycle commuters on Mannakee Street.

This section will outline the issues and opportunities identified for Mannakee Street.

# Preliminary Design and Impact Analysis

This section will outline the three preliminary design alternatives to construct Complete Streets facilities along the study area. This section will discuss corridor-wide treatments and spot treatments, including:

- Bicycle facility treatments
- Bus stop treatments
- Bicycle and pedestrian crossing enhancements
- Traffic calming treatments (speed humps, raised crosswalks)

Additionally, this section will discuss opportunities for quick build implementation and will evaluate the anticipated traffic impacts of each design alternative and recommendation.

# RECOMMENDATIONS

## RECOMMENDATION 1

Text



**Cost:** $$$ Low/Medium/High

**Timeline:** Short/Medium/Long

**Location:** Text

## RECOMMENDATION 2

Text



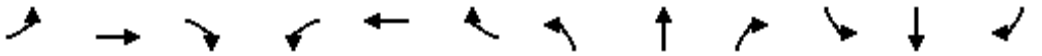
**Cost:** $$$ Low/Medium/High

**Timeline:** Short/Medium/Long

**Location:** Text

✓ Opportunity for short-term implementation

# APPENDIX A SYNCHRO OUTPUT REPORTS



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 2 | 108 | 31 | 11 | 32 | 12 | 23 | 36 | 10 | 22 | 72 | 2 |
| Future Volume (vph) | 2 | 108 | 31 | 11 | 32 | 12 | 23 | 36 | 10 | 22 | 72 | 2 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.5 | | | 4.5 | 4.5 | 4.5 | 4.5 | | | 4.5 | 4.5 |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | | 0.97 | | | 1.00 | 0.85 | 1.00 | 0.97 | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 1806 | | | 1839 | 1583 | 1770 | 1803 | | | 1841 | 1583 |
| Flt Permitted | | 1.00 | | | 0.86 | 1.00 | 0.69 | 1.00 | | | 0.95 | 1.00 |
| Satd. Flow (perm) | | 1801 | | | 1595 | 1583 | 1281 | 1803 | | | 1769 | 1583 |
| Peak-hour factor, PHF | 0.66 | 0.66 | 0.66 | 0.72 | 0.72 | 0.72 | 0.69 | 0.69 | 0.69 | 0.88 | 0.88 | 0.88 |
| Adj. Flow (vph) | 3 | 164 | 47 | 15 | 44 | 17 | 33 | 52 | 14 | 25 | 82 | 2 |
| RTOR Reduction (vph) | 0 | 16 | 0 | 0 | 0 | 14 | 0 | 5 | 0 | 0 | 0 | 1 |
| Lane Group Flow (vph) | 0 | 198 | 0 | 0 | 59 | 3 | 33 | 61 | 0 | 0 | 107 | 1 |
| Turn Type | Perm | NA | | Perm | NA | pm+ov | Perm | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | 1 | | 2 | | 1 | 6 | |
| Permitted Phases | 8 | | | 4 | | 4 | 2 | | | | | 6 |
| Actuated Green, G (s) | | 11.7 | | | 11.7 | 12.7 | 45.5 | 45.5 | | | 51.0 | 51.0 |
| Effective Green, g (s) | | 11.7 | | | 11.7 | 12.7 | 45.5 | 45.5 | | | 51.0 | 51.0 |
| Actuated g/C Ratio | | 0.16 | | | 0.16 | 0.18 | 0.63 | 0.63 | | | 0.71 | 0.71 |
| Clearance Time (s) | | 4.5 | | | 4.5 | 4.5 | 4.5 | 4.5 | | | 4.5 | 4.5 |
| Vehicle Extension (s) | | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 293 | | | 260 | 379 | 812 | 1144 | | | 1259 | 1125 |
| v/s Ratio Prot | | | | | | 0.00 | | 0.03 | | | c0.00 | |
| v/s Ratio Perm | | c0.11 | | | 0.04 | 0.00 | 0.03 | | | | c0.06 | 0.00 |
| v/c Ratio | | 0.68 | | | 0.23 | 0.01 | 0.04 | 0.05 | | | 0.08 | 0.00 |
| Uniform Delay, d1 | | 28.2 | | | 26.1 | 24.3 | 4.9 | 5.0 | | | 3.2 | 3.0 |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 4.8 | | | 0.2 | 0.0 | 0.1 | 0.1 | | | 0.0 | 0.0 |
| Delay (s) | | 33.0 | | | 26.2 | 24.3 | 5.0 | 5.0 | | | 3.2 | 3.0 |
| Level of Service | | C | | | C | C | A | A | | | A | A |
| Approach Delay (s) | | 33.0 | | | 25.8 | | | 5.0 | | | 3.2 | |
| Approach LOS | | C | | | C | | | A | | | A | |

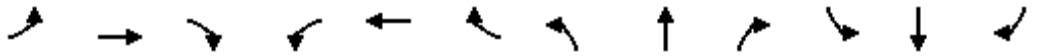
| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.8 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.21 | | |
| Actuated Cycle Length (s) | 71.7 | Sum of lost time (s) | 13.5 |
| Intersection Capacity Utilization | 48.8% | ICU Level of Service | A |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 51 | 89 | 298 | 752 | 0 | 2407 | 303 |
| Future Volume (vph) | 51 | 89 | 298 | 752 | 0 | 2407 | 303 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.0 | 6.0 | 4.5 | 5.0 | | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.91 | | 0.91 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | | 0.98 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | | 1.00 | |
| Satd. Flow (prot) | 1770 | 1583 | 1770 | 5085 | | 5000 | |
| Flt Permitted | 0.95 | 1.00 | 0.05 | 1.00 | | 1.00 | |
| Satd. Flow (perm) | 1770 | 1583 | 87 | 5085 | | 5000 | |
| Peak-hour factor, PHF | 0.73 | 0.73 | 0.73 | 0.73 | 0.93 | 0.93 | 0.93 |
| Adj. Flow (vph) | 70 | 122 | 408 | 1030 | 0 | 2588 | 326 |
| RTOR Reduction (vph) | 0 | 113 | 0 | 0 | 0 | 11 | 0 |
| Lane Group Flow (vph) | 70 | 9 | 408 | 1030 | 0 | 2903 | 0 |
| Turn Type | Prot | Perm | pm+pt | NA | Perm | NA | |
| Protected Phases | 4 | | 1 | 6 | | 2 | |
| Permitted Phases | | 4 | 6 | | 2 | | |
| Actuated Green, G (s) | 11.3 | 11.3 | 127.7 | 127.7 | | 81.2 | |
| Effective Green, g (s) | 11.3 | 11.3 | 127.7 | 127.7 | | 81.2 | |
| Actuated g/C Ratio | 0.08 | 0.08 | 0.85 | 0.85 | | 0.54 | |
| Clearance Time (s) | 6.0 | 6.0 | 4.5 | 5.0 | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 133 | 119 | 545 | 4329 | | 2706 | |
| v/s Ratio Prot | c0.04 | | c0.21 | 0.20 | | c0.58 | |
| v/s Ratio Perm | | 0.01 | 0.43 | | | | |
| v/c Ratio | 0.53 | 0.08 | 0.75 | 0.24 | | 1.07 | |
| Uniform Delay, d1 | 66.8 | 64.5 | 44.0 | 2.1 | | 34.4 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 3.7 | 0.3 | 5.6 | 0.1 | | 40.7 | |
| Delay (s) | 70.5 | 64.8 | 49.6 | 2.2 | | 75.1 | |
| Level of Service | E | E | D | A | | E | |
| Approach Delay (s) | 66.9 | | | 15.6 | | 75.1 | |
| Approach LOS | E | | | B | | E | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 55.9 | HCM 2000 Level of Service | E |
| HCM 2000 Volume to Capacity ratio | 0.93 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 86.0% | ICU Level of Service | E |
| Analysis Period (min) | 15 | | |

c Critical Lane Group



| Movement | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Traffic Volume (vph) | 8 | 111 | 118 | 23 | 126 | 76 | 107 | 120 | 28 | 28 | 103 | 13 |
| Future Volume (vph) | 8 | 111 | 118 | 23 | 126 | 76 | 107 | 120 | 28 | 28 | 103 | 13 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | | 4.5 | | | 4.5 | 4.5 | 4.5 | 4.5 | | | 4.5 | 4.5 |
| Lane Util. Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Frt | | 0.93 | | | 1.00 | 0.85 | 1.00 | 0.97 | | | 1.00 | 0.85 |
| Flt Protected | | 1.00 | | | 0.99 | 1.00 | 0.95 | 1.00 | | | 0.99 | 1.00 |
| Satd. Flow (prot) | | 1735 | | | 1848 | 1583 | 1770 | 1810 | | | 1843 | 1583 |
| Flt Permitted | | 0.99 | | | 0.82 | 1.00 | 0.66 | 1.00 | | | 0.93 | 1.00 |
| Satd. Flow (perm) | | 1715 | | | 1534 | 1583 | 1223 | 1810 | | | 1733 | 1583 |
| Peak-hour factor, PHF | 0.88 | 0.88 | 0.88 | 0.85 | 0.85 | 0.85 | 0.78 | 0.78 | 0.78 | 0.83 | 0.83 | 0.83 |
| Adj. Flow (vph) | 9 | 126 | 134 | 27 | 148 | 89 | 137 | 154 | 36 | 34 | 124 | 16 |
| RTOR Reduction (vph) | 0 | 50 | 0 | 0 | 0 | 68 | 0 | 7 | 0 | 0 | 0 | 5 |
| Lane Group Flow (vph) | 0 | 219 | 0 | 0 | 175 | 21 | 137 | 183 | 0 | 0 | 158 | 11 |
| Turn Type | Perm | NA | | Perm | NA | pm+ov | Perm | NA | | Prot | NA | Perm |
| Protected Phases | | 8 | | | 4 | 1 | | 2 | | 1 | 6 | |
| Permitted Phases | 8 | | | 4 | | 4 | 2 | | | | | 6 |
| Actuated Green, G (s) | | 13.2 | | | 13.2 | 17.1 | 42.2 | 42.2 | | | 50.6 | 50.6 |
| Effective Green, g (s) | | 13.2 | | | 13.2 | 17.1 | 42.2 | 42.2 | | | 50.6 | 50.6 |
| Actuated g/C Ratio | | 0.18 | | | 0.18 | 0.23 | 0.58 | 0.58 | | | 0.70 | 0.70 |
| Clearance Time (s) | | 4.5 | | | 4.5 | 4.5 | 4.5 | 4.5 | | | 4.5 | 4.5 |
| Vehicle Extension (s) | | 2.0 | | | 2.0 | 2.0 | 2.0 | 2.0 | | | 2.0 | 2.0 |
| Lane Grp Cap (vph) | | 310 | | | 278 | 469 | 708 | 1049 | | | 1210 | 1100 |
| v/s Ratio Prot | | | | | | 0.00 | | 0.10 | | | c0.01 | |
| v/s Ratio Perm | | c0.13 | | | 0.11 | 0.01 | c0.11 | | | | 0.08 | 0.01 |
| v/c Ratio | | 0.71 | | | 0.63 | 0.04 | 0.19 | 0.17 | | | 0.13 | 0.01 |
| Uniform Delay, d1 | | 28.0 | | | 27.5 | 21.5 | 7.2 | 7.2 | | | 3.7 | 3.4 |
| Progression Factor | | 1.00 | | | 1.00 | 1.00 | 1.00 | 1.00 | | | 1.00 | 1.00 |
| Incremental Delay, d2 | | 5.9 | | | 3.2 | 0.0 | 0.6 | 0.4 | | | 0.0 | 0.0 |
| Delay (s) | | 33.9 | | | 30.7 | 21.5 | 7.9 | 7.5 | | | 3.7 | 3.4 |
| Level of Service | | C | | | C | C | A | A | | | A | A |
| Approach Delay (s) | | 33.9 | | | 27.6 | | | 7.7 | | | 3.7 | |
| Approach LOS | | C | | | C | | | A | | | A | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 18.9 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.31 | | |
| Actuated Cycle Length (s) | 72.8 | Sum of lost time (s) | 13.5 |
| Intersection Capacity Utilization | 57.2% | ICU Level of Service | B |
| Analysis Period (min) | 15 | | |

c Critical Lane Group

| Movement | EBL | EBR | NBL | NBT | SBU | SBT | SBR |
|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | |
| Traffic Volume (vph) | 196 | 194 | 197 | 1847 | 0 | 1373 | 105 |
| Future Volume (vph) | 196 | 194 | 197 | 1847 | 0 | 1373 | 105 |
| Ideal Flow (vphpl) | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 | 1900 |
| Total Lost time (s) | 6.0 | 6.0 | 4.5 | 5.0 | | 5.0 | |
| Lane Util. Factor | 1.00 | 1.00 | 1.00 | 0.91 | | 0.91 | |
| Frt | 1.00 | 0.85 | 1.00 | 1.00 | | 0.99 | |
| Flt Protected | 0.95 | 1.00 | 0.95 | 1.00 | | 1.00 | |
| Satd. Flow (prot) | 1770 | 1583 | 1770 | 5085 | | 5031 | |
| Flt Permitted | 0.95 | 1.00 | 0.10 | 1.00 | | 1.00 | |
| Satd. Flow (perm) | 1770 | 1583 | 184 | 5085 | | 5031 | |
| Peak-hour factor, PHF | 0.77 | 0.77 | 0.94 | 0.94 | 0.91 | 0.91 | 0.91 |
| Adj. Flow (vph) | 255 | 252 | 210 | 1965 | 0 | 1509 | 115 |
| RTOR Reduction (vph) | 0 | 207 | 0 | 0 | 0 | 4 | 0 |
| Lane Group Flow (vph) | 255 | 45 | 210 | 1965 | 0 | 1620 | 0 |
| Turn Type | Prot | Perm | pm+pt | NA | Perm | NA | |
| Protected Phases | 4 | | 1 | 6 | | 2 | |
| Permitted Phases | | 4 | 6 | | 2 | | |
| Actuated Green, G (s) | 26.8 | 26.8 | 112.2 | 112.2 | | 90.6 | |
| Effective Green, g (s) | 26.8 | 26.8 | 112.2 | 112.2 | | 90.6 | |
| Actuated g/C Ratio | 0.18 | 0.18 | 0.75 | 0.75 | | 0.60 | |
| Clearance Time (s) | 6.0 | 6.0 | 4.5 | 5.0 | | 5.0 | |
| Vehicle Extension (s) | 3.0 | 3.0 | 3.0 | 3.0 | | 3.0 | |
| Lane Grp Cap (vph) | 316 | 282 | 318 | 3803 | | 3038 | |
| v/s Ratio Prot | c0.14 | | c0.08 | 0.39 | | 0.32 | |
| v/s Ratio Perm | | 0.03 | c0.42 | | | | |
| v/c Ratio | 0.81 | 0.16 | 0.66 | 0.52 | | 0.53 | |
| Uniform Delay, d1 | 59.1 | 52.1 | 20.5 | 7.8 | | 17.3 | |
| Progression Factor | 1.00 | 1.00 | 1.00 | 1.00 | | 1.00 | |
| Incremental Delay, d2 | 14.0 | 0.3 | 5.1 | 0.5 | | 0.7 | |
| Delay (s) | 73.1 | 52.3 | 25.5 | 8.3 | | 18.0 | |
| Level of Service | E | D | C | A | | B | |
| Approach Delay (s) | 62.8 | | | 9.9 | | 18.0 | |
| Approach LOS | E | | | A | | B | |

| Intersection Summary | | | |
|---|---|---|---|
| HCM 2000 Control Delay | 19.2 | HCM 2000 Level of Service | B |
| HCM 2000 Volume to Capacity ratio | 0.70 | | |
| Actuated Cycle Length (s) | 150.0 | Sum of lost time (s) | 15.5 |
| Intersection Capacity Utilization | 65.7% | ICU Level of Service | C |
| Analysis Period (min) | 15 | | |

c Critical Lane Group