Pedestrian Road Safety Audit
MD 355 (Wisconsin Avenue)

MD 410 (Montgomery Avenue) to Leland Street
Montgomery County, Maryland

Prepared For:
Department of Transportation
Montgomery County, Maryland

In partnership with the Maryland State Highway Administration

Prepared By:

Vanasse Hangen Brustlin, Inc.

Silver Spring, Maryland

June 2011

Table of Contents

Index of Figures

1 Introduction

1.1 Objectives of Study

The objective of this study was to complete a pedestrian and bicycle road safety audit (PRSA) for Wisconsin Avenue (MD 355) between Montgomery Avenue and Leland Street in Bethesda, Maryland (Figure 1).

1.2 Background

Wisconsin Avenue is a six-lane north-south highway in a high density, urban area in Bethesda, Maryland. This road serves as a major commuter route and provides access to the central business district in Bethesda, Maryland. Significant pedestrian activity in the area is generated by office, commercial, and residential developments and access to Metro rail and bus stops.

As part of the Montgomery County Executive's Pedestrian Safety Initiative, this area was identified as one of the "High Incidence Areas" (HIA) in Montgomery County. Based on collision data provided by Montgomery County and the Maryland State Highway Administration, 29 pedestrian and bicyclist collisions occurred from January 1, 2003 through December 31, 2007. The purpose of this PRSA was to identify safety issues that may be contributing to the observed pedestrian and bicyclist collisions in the study area.

The PRSA was performed on December 16, 2008 and December 18, 2008, during daytime and nighttime hours. The PRSA team consisted of eight members, representing:

- Montgomery County Department of Transportation (MCDOT),
- Montgomery County Police Department (MCPD),
- Bethesda-Chevy-Chase Regional Services Center,
- Bethesda Urban Partnership,
- Federal Highway Administration (FHWA),
- Maryland State Highway Administration (MDSHA),
- Local community members, and
- Vanasse Hangen Brustlin, Inc. (VHB), the facilitator consultant.

Since the completion of the PRSA in 2008, MCDOT and MDSHA have been working jointly in the implementation of safety-related improvements within this HIA. Given the State jurisdiction over this roadway, any proposed improvements by MCDOT require MDSHA coordination and concurrence. Although this report is based on observations originally made in 2008, updates related to observations and suggestions are provided throughout the report. The following are recent and planned projects that MCDOT and MDSHA have undertaken:

- **Countdown Pedestrian Signal (CPS) Upgrade – Wisconsin Avenue (MD 355) from Leland Street to Old Georgetown Road (MD 187):** In July 2010, MDSHA approved a MCDOT Design Request (DR) to upgrade existing incandescent pedestrian signals with LED CPS along Wisconsin Avenue at five intersections, including Leland Street, Willow Lane/Bethesda Avenue, Elm Street, Elm Street/Waverly Street, and Old Georgetown Road. The upgrades were completed in December 2010.

- **MD 355 (From Bradley Lane to Old Georgetown Road) Resurfacing Project:** MDSHA has a planned fiscal year (FY) 2013 project to resurface Wisconsin Avenue from Bradley Lane to Old Georgetown Road, which includes the repair/replacement of existing inlets, traffic barrier and end treatment upgrades, curb ramp upgrades, and pavement marking (striping) improvements.
- **Wisconsin Avenue (MD 355) at Leland Street:** MDSHA plans to reconstruct the traffic signal at Wisconsin Avenue and Leland Street are on hold due to utility conflicts. There is currently no schedule for the completion of this project.

2 Organization of the Report

This report first presents the existing conditions and general issues for the corridor. Next, the report discusses the existing roadway features, issues, and suggested opportunities for improvement in the study area. The study area is depicted in Figure 1 and study intersections included in the PRSA study corridor are listed below:

1. Wisconsin Avenue at Montgomery Lane / Montgomery Avenue
2. Wisconsin Avenue at Elm Street / Waverly Street
3. Wisconsin Avenue at Elm Street
4. Wisconsin Avenue at Leland Street
5. Wisconsin Avenue at Bethesda Avenue / Willow Lane
6. Wisconsin Avenue at Hampden Lane
7. Wisconsin Avenue at Miller Avenue

This report will be a resource to MDSHA and MCDOT, as well as other stakeholders, for implementing pedestrian safety improvements within the audit area. There will be an ongoing vetting of the suggestions in this report with collaboration among agencies and stakeholders to implement short- and intermediate-term suggestions and assess the feasibility and constructability of long-term projects. Ultimately, this process will assess the merits of these suggestions and establish a process whereby a range of pedestrian safety improvements are implemented.

Figure 1. Study Area

3 Existing Conditions

3.1 Site Characteristics and Pedestrian and Bicycle Accommodations

Wisconsin Avenue is a six-lane major arterial with a raised median. Sidewalks with curb and gutter are located on both sides of the roadway in the study area. The posted speed limit along this segment of the corridor is 25 miles per hour.

Wisconsin Avenue Median

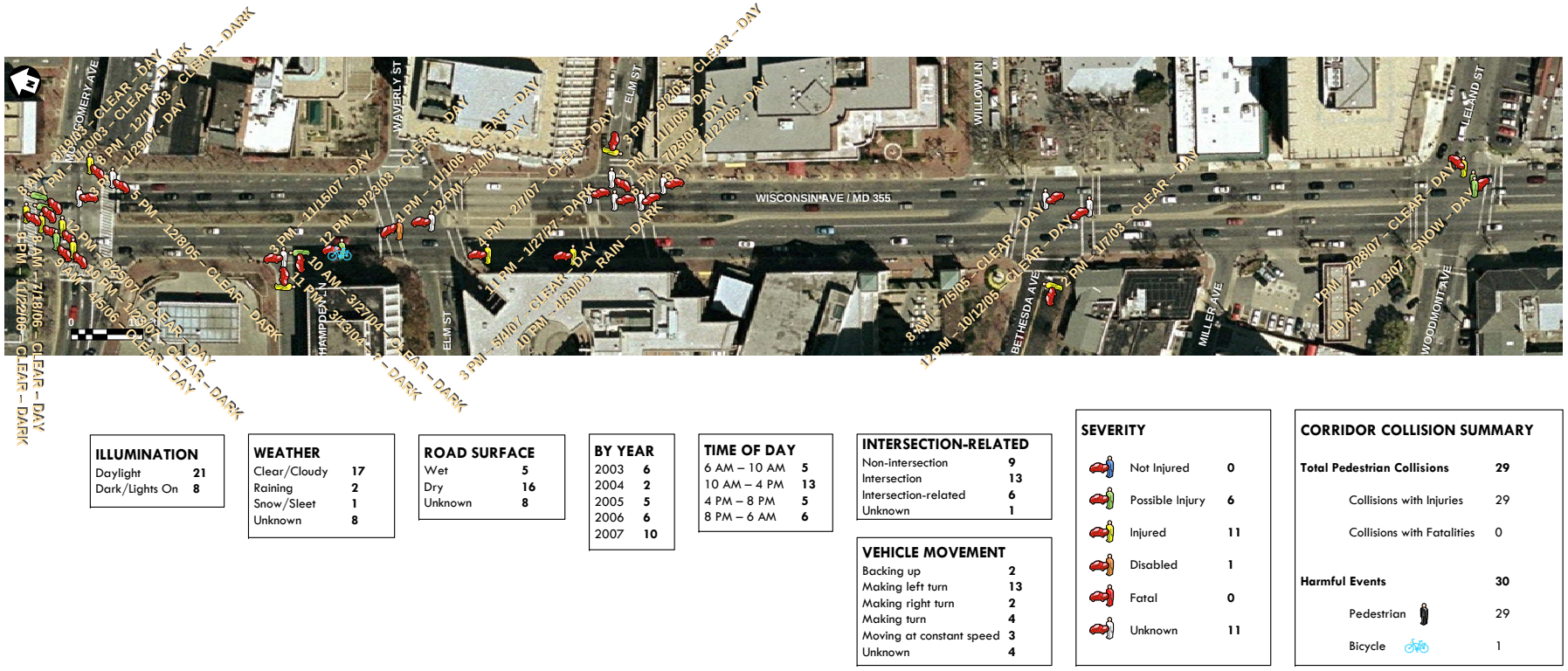
There are five signalized intersections along Wisconsin Avenue in the study area at Montgomery Lane / Montgomery Avenue, Elm Street / Waverly Street, Elm Street, Bethesda Avenue, and Leland Street.

The Wisconsin Avenue and Montgomery Lane / Montgomery Avenue intersection has high-visibility crosswalk markings (incorporating transverse or diagonal striping) for all four pedestrian intersection movements. This intersection also has countdown pedestrian signals and red-light running enforcement. The other four signalized intersections within the HIA have high-visibility crosswalk markings for the east-west pedestrian movements across Wisconsin Avenue and standard MDSHA crosswalk markings (two parallel bars) for the north-south pedestrian movements across the side streets.

Public transportation is heavily utilized in the study area. The Bethesda Metro Rail station is located on the northern end of the study area with elevator access at the northwest corner of the Wisconsin Avenue at Montgomery Lane / Montgomery Avenue intersection. The Montgomery County Ride-On bus route 34 travels along this section of Wisconsin Avenue. There are two bus stops in each direction within the study area.

3.2 Collision Data & Analysis

As part of the PRSA, the team reviewed vehicular collision data from the Montgomery County Accident Information Management System (AIMS) and the Montgomery County police pedestrian reports for the five-year period from January 2003 through December 2007. Figure 2 provides a crash diagram summary all of the locations and critical information regarding the pedestrian and bicycle crashes reported in the study area from 2003-2007. The data indicates that there were 29 total pedestrian and bicyclist-related collisions and 108 intersection-related motorized vehicle collisions. As shown in Figure 3, the intersections with the highest frequencies of crashes were at the Wisconsin Avenue/Montgomery Lane/Montgomery Avenue and Wisconsin Avenue/Elm Street intersections, which experienced ten and seven pedestrian/bicyclist-related collisions, respectively.



ILLUMINATION	
Daylight	21
Dark/Lights On	8

WEATHER	
Clear/Cloudy	17
Raining	2
Snow/Sleet	1
Unknown	8

ROAD SURFACE	
Wet	5
Dry	16
Unknown	8

BY YEAR	
2003	6
2004	2
2005	5
2006	6
2007	10

TIME OF DAY	
6 AM – 10 AM	5
10 AM – 4 PM	13
4 PM – 8 PM	5
8 PM – 6 AM	6

INTERSECTION-RELATED	
Non-intersection	9
Intersection	13
Intersection-related	6
Unknown	1

VEHICLE MOVEMENT	
Backing up	2
Making left turn	13
Making right turn	2
Making turn	4
Moving at constant speed	3
Unknown	4

SEVERITY	
Not Injured	0
Possible Injury	6
Injured	11
Disabled	1
Fatal	0
Unknown	11

CORRIDOR COLLISION SUMMARY	
Total Pedestrian Collisions	**29**
Collisions with Injuries	29
Collisions with Fatalities	0
Harmful Events	**30**
Pedestrian	29
Bicycle	1

Figure 2. Wisconsin Avenue between Montgomery Avenue / Montgomery Lane and Leland Street Pedestrian and Bicyclist Crashes 2003-2007

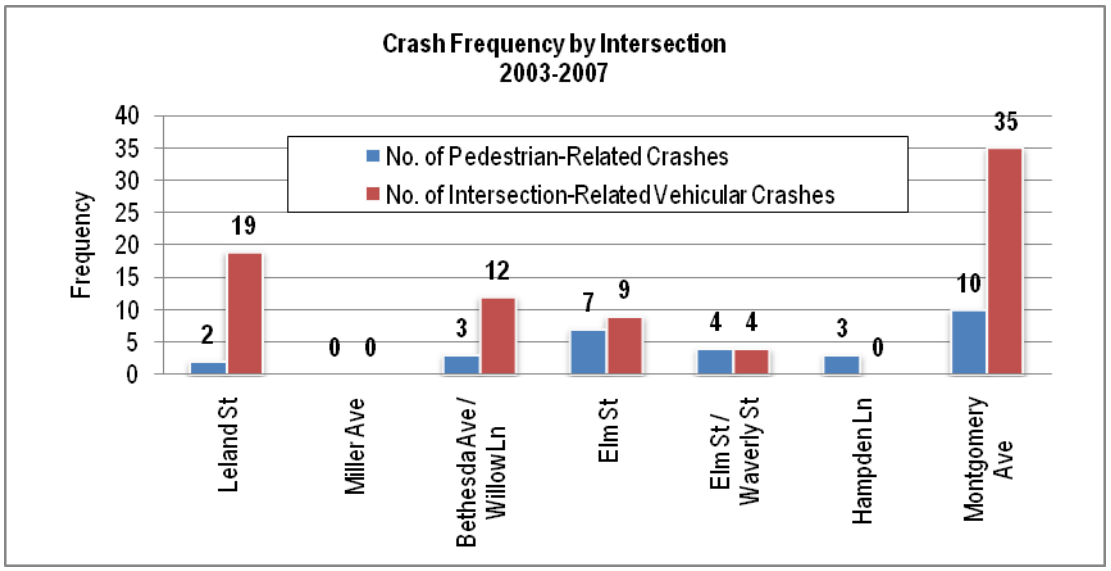


Figure 3. Crash Frequency by Intersection (2003-2007)

Of the 29 reported pedestrian and bicyclist-related collisions, 28 collisions involved pedestrians and one involved a bicyclist. Seventeen of the 29 collisions resulted in injuries or possible injuries, one collision was disabling, and all others were not reported. None of the injuries related to these collisions were fatal. Figure 4 shows that a large number of the collisions (13 of 29) occurred during mid-day, between the morning and evening peak period. The majority of the vehicles (19 of 29) involved in the collisions were making turning movements prior to the collision, with the majority of turning movements being left turns (Figure 5). Over the five year study period there appears to be a gradual increase in the number of pedestrian and bicycle related crashes within the study area (Figure 6).

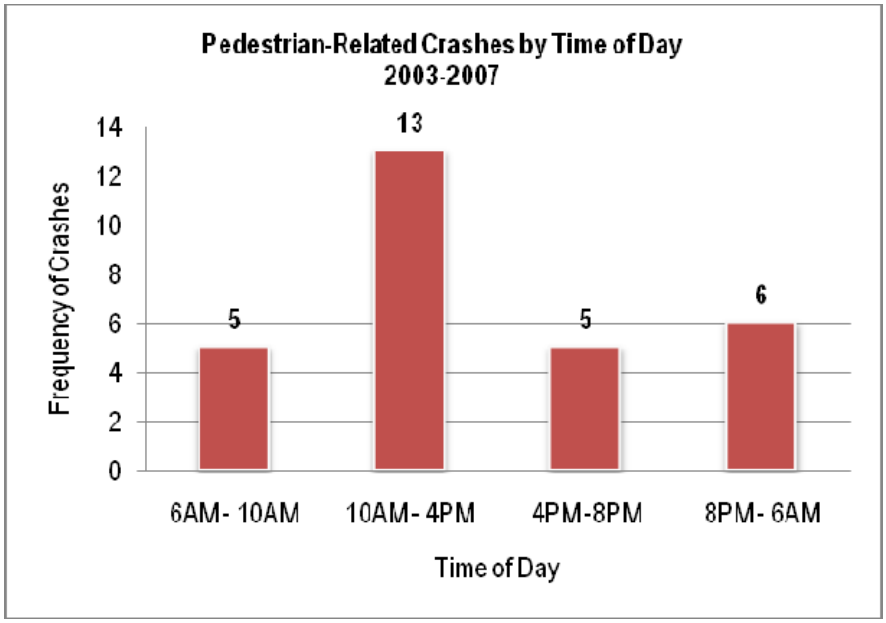


Figure 4. Pedestrian and Bicyclist Related Crashes by Time of Day (2003-2007)

As shown above in Figure 4, the majority of pedestrian-related crashes occurred during the midday period. While this duration is two hours longer than the morning and afternoon periods, the difference in the number of crashes would indicate an overrepresentation of crash activity during this time period, given that the midday total is higher than the morning and afternoon periods combined. This can be attributed to the significant pedestrian activity generated by the surrounding office and retail developments in the Bethesda CBD area during this time-period.

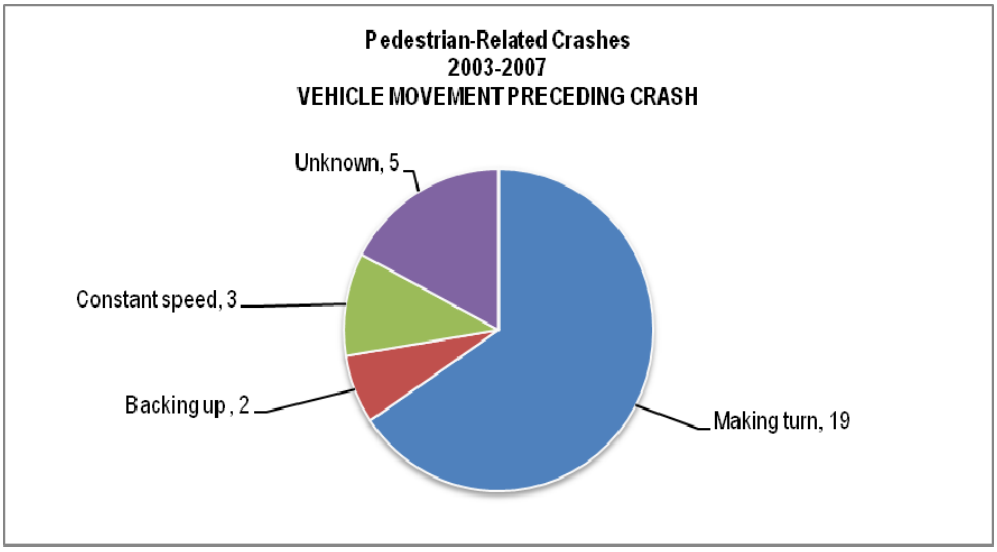


Figure 5. Pedestrian and Bicyclist Related Crashes by Vehicular Movement (2003-2007)

Figure 5 shows that the majority of pedestrian-related crashes involved vehicles making turns (66%). This may be related to the prevalence of pedestrians in the area and the repetitive potential for turning movement conflicts at intersections, coupled with shorter block segments, which increase the proportion of pedestrian-vehicle conflicts at intersections within a defined segment of roadway.

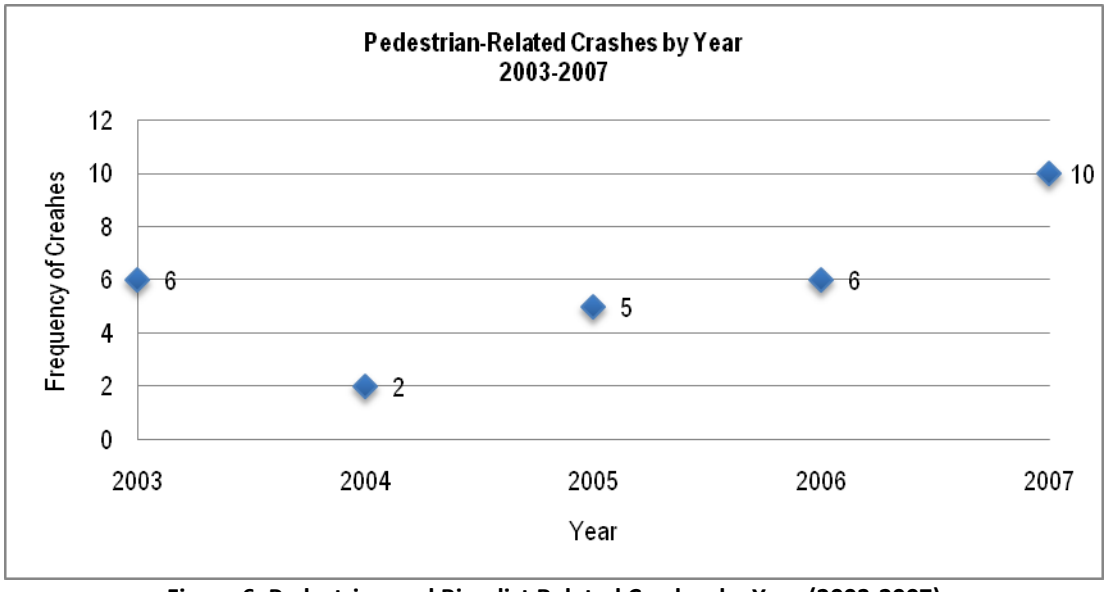


Figure 6. Pedestrian and Bicyclist Related Crashes by Year (2003-2007)

3.3 Traffic Data

According to the data provided by MDSHA, the 2007 average annual daily traffic (AADT) volume on Wisconsin Avenue was 39,860 vehicles per day (vpd), at a location near the intersection of Wisconsin Avenue and Hampden Lane.

4 Assessment Findings

4.1 Safety Benefits of Existing Roadway Features

Notable existing roadway features that enhance pedestrian safety in the study area include but are not limited to:

- *Continuous sidewalks and crossings:* Sidewalks within the corridor are continuous and of sufficient width for the heavy pedestrian traffic generated in the study area. The sidewalk network helps provide a comfortable walking environment where pedestrians are encouraged to cross at intersections rather than mid-block locations. Furthermore, the spacing of crossings provides ample access to marked crosswalks and pedestrian generators within the corridor.
- *High visibility crosswalk markings:* High visibility crosswalk markings (i.e. transverse or diagonal markings within the crosswalk) are used across Wisconsin Avenue at all signalized intersections.
- *Countdown signals:* At Montgomery Lane / Montgomery Avenue, pedestrian countdown signals are provided. Countdown pedestrian signal research has shown that pedestrians easily understand how the signal works and will use the countdown timers to decide when to cross the street. More pedestrians start walking during the clearance phase when CPS is provided than when standard pedestrian signals are provided; however, fewer people initiate walking late in the clearance phase. Studies have also shown that fewer pedestrians remain in crosswalks during the steady "Don't Walk" phase where countdown signals are used. Countdown pedestrian signals have also been found to reduce pedestrian injury crashes and improve pedestrian compliance to traffic controls in several national studies.

Photo of a countdown signal

- *Red light-running enforcement:* Red-light enforcement cameras are in place at the Wisconsin Avenue/Montgomery Lane/Montgomery Avenue intersection to deter red light violations which may contribute to pedestrian crashes.

These measures help improve driver awareness of pedestrians and compliance with traffic signal indications.

4.2 Identified Safety Issues and Suggestions for Improvement

The PRSA team identified the following corridor-wide safety issues. Many of these issues are described in further detail in the intersection assessment and improvements section in Appendix A.

- *Pedestrian and Vehicular Conflicts:* Pedestrian-vehicle conflicts at intersections are the most significant safety issue in the study area. Of the 29 pedestrian and bicycle crashes on the corridor, 19 occurred at intersections. In other words, nearly three quarters of the crashes were intersection related. Furthermore, as previously indicated in Figure 5, nearly three quarters of the crashes involved a turning

vehicle, and two thirds of these crashes involved left turning vehicles. Pedestrian-vehicle conflicts may be reduced by using signs or signals to improve awareness between drivers and pedestrians, restricting right turn on red or permissive left turns, implementing pedestrian-friendly signal timings, and adding pedestrian refuge islands.

- *Limited Maintenance:* Continued maintenance of roadway pavement, pavement markings, pedestrian and bicyclist facilities, drainage facilities, and street trees and foliage are important for safe operations. Uneven pavement and worn pavement markings, especially at crosswalks, may discourage crosswalk use and may pose safety issues for disabled persons. Sidewalks, as well as other pedestrian and bicyclist facilities, also need to be properly maintained to encourage their use and to prevent tripping hazards or barriers for wheelchair users. Additionally, drainage problems at or near curb ramps can discourage ramp usage in inclement weather conditions. In such a case, pedestrians may have to use an alternate path which may expose them to conflicting vehicular traffic. Lastly, street trees and other foliage may obstruct sight distance for both pedestrians and drivers. These issues can be improved along the corridor by continuing maintenance of pavement, markings, pedestrian facilities, drainage, and street trees and foliage.

Truncated domes can be retrofitted easily on existing curb ramps

Accessibility issue at a missing sidewalk south of Leland Street.

- *ADA Compliance:* ADA-compliance issues in the corridor include non-compliant curb ramp slopes, curb cut locations and crosswalk alignments, and missing truncated domes (i.e., detectable warning surfaces). Steep curb ramps make maneuvering the ramp difficult for pedestrians with mobility limitations, while curb ramps that are not aligned with crosswalks may misdirect pedestrians with visibility impairments into inappropriate areas. Truncated domes provide positive guidance to pedestrians with visibility impairments as they approach a crossing location. These issues may be addressed by updating curb ramps and sidewalks to comply with current ADA regulations.
- *Driveway Access Conflicts:* Wide private driveways in the study area may unnecessarily expose pedestrian to turning vehicles. These driveways may enable higher speed conflicts between motorists and pedestrians than narrower driveways and limit pedestrian use of sidewalks.
- *Traffic Control Visibility:* The roadway geometry and street trees in some areas limit the visibility of traffic signal heads.
- *Lighting Conditions:* Low street lighting levels were observed at several intersections in the corridor. These conditions may make it difficult for drivers to see pedestrians crossing at night. In general, low lighting may foster a less secure pedestrian environment. Insufficient street lighting may be improved by installing new lighting or upgrading existing street lights.

- *Pedestrian and Bicyclist Conflicts on Sidewalks:* There are no bicycle lanes or shoulders along Wisconsin Avenue, and bicyclists were observed riding on the sidewalks. The width of the sidewalk at several locations in the study area does not appear adequate to simultaneously accommodate bicyclists and the high number of pedestrians in the study area. Roads that are parallel to Wisconsin Avenue with fewer numbers of pedestrians and vehicles could be used to accommodate the bicycle traffic. Appropriate wayfinding signs for bicycle routes should also be posted.
- *Limited Sidewalk Accessibility:* The PRSA team noted a couple of locations along side streets where sidewalk conditions present accessibility difficulties or limit continuity and walkability within downtown Bethesda. Gaps or narrow widths along some sidewalks could be addressed through future planning efforts, community development, or Policy Area Mobility Review (PAMR) improvements.

4.3 Summary of Issues and Suggestions

The following section provides a summary of the issues identified during the PRSA process and the suggestions for improvements throughout the study corridor. The anticipated timeframe for completion [Short Term (ST), Intermediate (I), and Long Term (LT)] is referenced after each suggestion. Depending on the nature of the safety issue, the scope of one particular suggestion may vary among intersections. For example, eliminating a sidewalk obstruction could include the relocation of a planter (i.e., short term) at one location, while it encompasses the relocation of a utility pole (i.e., long term) at another location. In these cases, multiple timeframes may be indicated below. The scope and timeframe of suggestions throughout the study area will be verified through the vetting process performed by the appropriate transportation staff (i.e., MDSHA, MCDOT, local jurisdiction).

Safety Issue	Suggestions
Pedestrian and Vehicular Conflicts	▪ Consider signage to improve driver awareness of pedestrians and reduce turning movement conflicts at intersections (ST). ▪ Work with the Transportation Management Section to evaluate the need for signal timing and phasing modifications to reduce pedestrian-vehicle conflicts at some intersections (ST, I). ▪ Determine the feasibility and constructability of modifications to medians to direct turning vehicles and provide additional protection for pedestrians (LT). ▪ Determine the feasibility and constructability of geometric roadway improvements to reduce pedestrian crossing distances or improve pedestrian refuge spaces (LT). ▪ Consider modifications to crosswalks to minimize pedestrian crossing distance (I, LT).
Pedestrian Facility Issues	▪ Determine the feasibility of relocating or removing sidewalk obstructions (ST, LT).
Driveway Access Conflicts	▪ Evaluate the feasibility and constructability of modifications to sidewalk and driveway access points (LT).
Visibility of Traffic Signal Head	▪ Work with the Transportation Management Section to evaluate the need to install near-side traffic signal heads to improve signal visibility (LT).
Lighting Conditions	▪ Evaluate the need to instal additional street lighting (ST).

Safety Issue	Suggestions
Pedestrian Clearance Interval	▪ Work with the Transportation Management Section to determine the need to extend pedestrian clearance intervals at some locations (I).
Bus Stop Waiting Areas	▪ Work with Transit Services to evaluate the feasibility and constructability of installing bus stop shelters or designated waiting areas (I). ▪ Determine the feasibility of removing sidewalk obstructions in some locations (ST, LT).
Maintenance	▪ Coordinate with the MDSHA to evaluate the need and feasibility for resurfacing pavement and some crossing surfaces (LT). ▪ Consider refreshing pavement markings (ST). ▪ Explore the constructability of drainage improvements to divert flow away from crosswalks (I). ▪ Consider installing new traffic control signage in some locations (ST). ▪ Work with the Transportation Management Section to evaluate the need to upgrade some traffic signal heads along the corridor (LT).