



May 2009

City of Rockville Pedestrian Inventory Study Safety and Accessibility Evaluation



Rockville, Maryland

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EXECUTIVE SUMMARY

As part of the City of Rockville's *Distinct Neighborhoods, One City: Pedestrian Safety Initiative*, 162 total pedestrian crossings (110 signalized and 52 unsignalized crossings) were evaluated throughout Rockville based on safety and accessibility of the existing pedestrian facilities. A thorough field investigation of existing pedestrian facilities at all the study locations was performed to identify if the sidewalks, sidewalk ramps, crosswalks, pedestrian signals and push buttons, pedestrian signal timing, sight distances, and intersection lighting at the crossings adhere to current safety, traffic control, and American Disabilities Act (ADA) requirements. Pedestrian crossings at City-maintained intersections and Montgomery County-maintained intersections along non-State routes follow Federal requirements, while crossings at intersections along State routes follow State requirements. The deficiencies were identified and recommendations were made to bring the pedestrian crossings to current standards. A rating system was developed to prioritize the recommended improvements.

A list of innovative solutions to pedestrian crossing facilities was included to identify potential advanced improvements to consider for the City's crossings that have systematic safety concerns.

Overall Rockville's pedestrian facilities are generally in good condition (grade of a 'B'). Most of the facilities were built prior to the latest pedestrian facility design guidelines; so most of the recommendations identify improvements to existing sidewalk ramps, pedestrian signing, crosswalks and pedestrian signal clearance timing to bring these features to current design guidelines. The City-maintained facilities seemed to have less serious deficiencies compared to the County-maintained facilities, where they had consistently deficient ramps and pedestrian clearance timings.



A. INTRODUCTION

As requested by the City of Rockville Department of Public Works (DPW), Wallace, Montgomery & Associates, LLP (WM&A) is hereby providing the results of a comprehensive evaluation of 110 signalized intersections and 52 unsignalized pedestrian crossings throughout the City of Rockville. The pedestrian safety evaluations include the review of sight distance (both from the pedestrian's vantage point and the motorist vantage point), identification of obstructions that impact sightlines (on-street parking, horizontal & vertical roadway alignment, signs, trees, etc.), inventory and evaluation of pedestrian facilities (signals, pushbuttons, signs and pavement markings), and appropriate allocation of pedestrian crossing time at signalized crossings. Accessibility evaluations include the analyses of pedestrian ramps, pushbutton locations, and approach walkway characteristics ensuring that pedestrian facilities provide the proper service and access for all pedestrians in accordance with American Disabilities Act (ADA) guidelines.

B. STUDY LOCATIONS

The study area encompasses 162 pedestrian crossing locations within the city limits and surrounding Rockville, Maryland. 110 of the 162 locations are at signalized (Controlled) intersections, and 52 of the 162 locations are at unsignalized locations. The unsignalized locations are typically located near parks, schools, or Metro stations and include both mid-block and stop-controlled crossings. A list of the study locations are provided in **Appendix A**, and a study area map is provided in **Appendix B**.

C. RESOURCES

Various federal and state resources were used as guidelines for determining the evaluation requirements for each pedestrian crossing feature:

1. *(The Green Book) A Policy on Geometric Design of Highways and Streets (2004)* by American Association of State Highway and Transportation Officials (AASHTO) – Chapter 3 has detailed information calculating sight distances and sight lines. The Pedestrian Facilities section in Chapters 4 and 7 discuss general sidewalk, median cut-through and ramp geometric characteristics. They recommend signing for non-intersection pedestrian crossings and to minimize the number of crossings across heavily traveled roadways.
2. *Guide for the Planning, Design, and Operation of Pedestrian Facilities (July 2004)* by American Association of State Highway and Transportation Officials (AASHTO) – Section 2.5 describes pedestrian traffic control criteria within a school zone in order to clearly delineate and maximize visibility of children in pedestrian facilities. Section 3.1 describes the general sight distance and lighting guidelines. Section 3.3 describes design guidelines for pedestrian facilities for an intersection including crossing distances, crosswalks, and sidewalk and ramp treatments for crossings. Section 3.4 describes design guidelines for midblock crossings including raised crossings. Section 4.1 describes design guidelines for pedestrian signals and push buttons. Section 4.2 describes design guidelines for pedestrian-related signing.



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3. (ADAAG) American with Disabilities Act and Architectural Barriers Act Accessibility Guidelines (July 2004) by United States Access Board – Chapter 2 describes the forward reach criteria for pedestrians in wheel chairs. Chapter 4 describes the clear width, clear width turn, counter slopes, side flare slopes, landing length, diagonal curb ramp and cut-through island geometric design criteria. Chapter 7 describes the detectable warning design criteria.
4. (MUTCD) Maryland Manual on Uniform Traffic Control Devices for Streets and Highways (2006) by Maryland State Highway Administration (SHA) approved by the Federal Highway Administration (FHWA) – Section 2C describes the design guidelines for pedestrian warning signs including their application and background coloring. Section 3B describes the design guidelines for pavement markings including cross walks, speed humps with cross walks, and street parking and stop line set-backs to cross walks. Section 4E describes the design guidelines for pedestrian signals including horizontal and vertical location and type of devices to use. Section 7B describes the design guidelines for school signing, and Section 7C describes the design guidelines for school pavement markings.
5. Accessibility Policy and Guidelines for Pedestrian Facilities along State Highways (December 2005) by Maryland SHA Office of Highway Development – The Sidewalks section describes the State design guidelines for sidewalk width and cross-slopes. The Ramps and Ramp Locations sections describe the State design guidelines for pedestrian ramp alignment, geometrics and location. The Median Treatments section describes the State design guidelines for median cut-through and ramp geometrics.
6. Accessible Pedestrian System Design and Installation Guidelines (February 2007) by Maryland SHA Office of Traffic and Safety – The guiding design principles describe the proper location for APS systems relative to the pedestrian ramp.

D. INVENTORY SUMMARY

Each study location includes an individual Inventory Summary sheet (See **Appendix D**) that comprises of a:

1. Comprehensive table of all the pedestrian crossing features evaluated in the field.
2. Key photos taken and field sheets completed during the field investigations.

The pedestrian crossing features that were evaluated include the following:

1. *Ramps* – Describes the location, alignment (perpendicular or diagonal relative to crossing), type (perpendicular or parallel), geometrics (dimensions and slopes), obstructions and condition of the sidewalk ramps within the crossing area. The ramps are evaluated based on Federal (ADA) and/or State accessibility guidelines to ensure all pedestrians can safely access designated crossings from adjacent sidewalks. Some key federal minimum requirements include:
 - Flat landing area (2% minimum slope) with a 48” minimum width
 - Existing ramp and wing within the walking path with a 10:1 minimum slope
 - Detectable warning surfaces on all ramps and median cut-through sections
 - 3’ minimum clear width from obstructions on ramps



Figures 1 and 2 illustrate the features of the different types of ramps with their minimum geometric requirements.

The most common ramp deficiencies found were ramps not properly aligned with the crosswalks, slopes of ramp wings (flares) were too steep and the lack of detectable warning surfaces at the bottom of ramps.

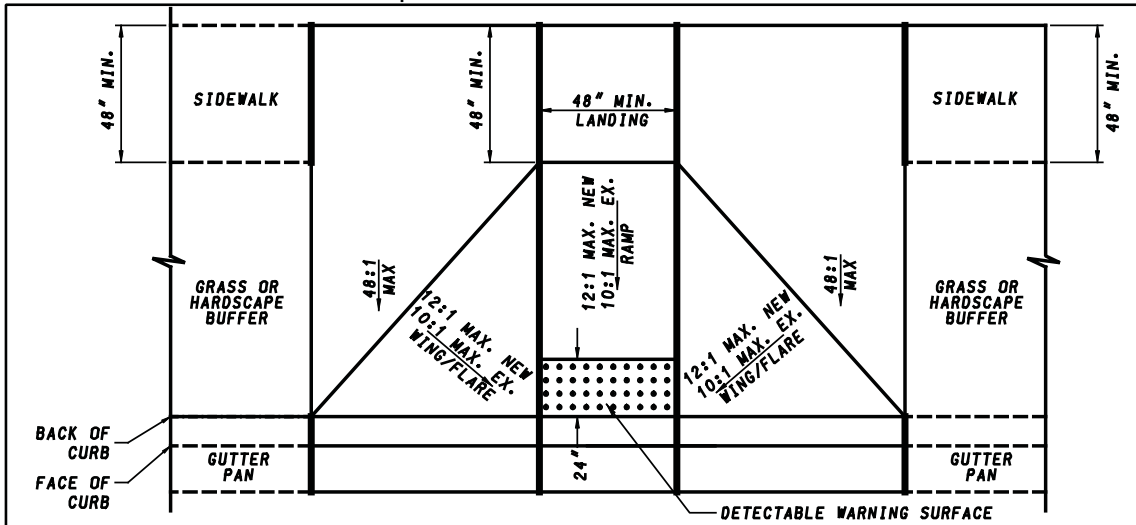


Figure 1 – Perpendicular Ramp

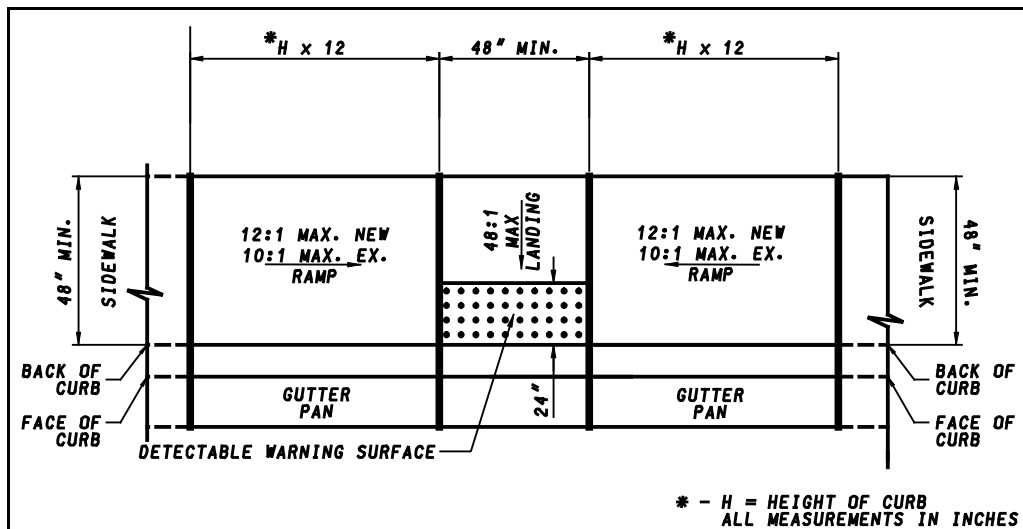


Figure 2 – Parallel Ramp

2. **Sidewalks** – Describes the location, width (4' minimum width, 3' minimum clear width from obstructions) and condition of sidewalks within the crossing area. The sidewalks are evaluated based on Federal (ADA) and/or State accessibility guidelines to ensure all pedestrians can safely access ramps to crossings.

No common sidewalk deficiencies were found within the crossings throughout Rockville.

3. **Crosswalks** – Describes the location; pavement marking geometrics (length, 6' minimum width, 6" minimum marking thickness), pattern (hatching type), condition; and vertical obstructions (3' minimum clear width from obstructions) to striped crossings across



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roadways. The crosswalks are evaluated based on Federal and/or State accessibility and traffic control device guidelines to ensure all pedestrians have uniformly designed marked pathways to identify where to safely cross roadways. **Figure 3** illustrates an example of a crosswalk in Rockville.

The most common crosswalk deficiencies found were faded pavement markings that needed to be restriped.



Figure 3 – Pedestrian Crosswalk

4. *Pedestrian Signals* (Signalized locations only) – Describes the location, type and condition of pedestrian crossing indications. The pedestrian signals are evaluated based on Federal and/or State traffic control device guidelines to ensure all pedestrians with or without visual impairments have a uniformly designed indicator to notify when to safely cross roadways. **Figure 4** illustrates an example of a pedestrian signal in Rockville.

A mixture of pedestrian signals with and without countdown capabilities can be found throughout Rockville. Countdown signals (CPS) are not a federal requirement; however the State had been systematically upgrading all of the pedestrian signals at their intersections (which are maintained by Montgomery County) with CPS. Recommendations to upgrade pedestrian signals to CPS are made at State roadway intersections only, however the City has plans to systematically upgrade their pedestrian signals to meet State CPS recommendations. The most common pedestrian signal deficiencies found were the lateral distance of the signal relative to the crosswalk were not to standard width (5' minimum).



Figure 4 – Pedestrian Signal

5. *Push Buttons* (Signalized locations only) - Describes the location, type and condition of pedestrian signal actuation devices. The pedestrian signals are evaluated based on Federal and/or State accessibility and traffic control device guidelines to ensure all pedestrians have a uniformly designed device to notify the traffic signal their presence, to actuate the pedestrian timing phase, and to safely cross roadways. Some key federal minimum requirements include:

- Accessible from sidewalk near end of crosswalk
- 3.5' maximum height
- Sign and push button oriented parallel to crosswalk

Figure 5 illustrates an example of a pedestrian push button in Rockville.

A mixture of pedestrian push buttons with and without Accessible Pedestrian Systems (APS) capabilities can be found throughout Rockville. APS are not a federal requirement; however the State upgrades all of the push buttons at their intersections with APS. Recommendations to upgrade push buttons to APS are made at State roadway intersections only, however the City has plans to systematically upgrade their pushbuttons to APS in the future. The most common push button deficiencies found were improper orientation and height of push buttons relative to their crossing.



Figure 5 – Pedestrian Push Button

6. *Pedestrian Signal Timing* (Signalized locations only) – Describes the pedestrian phase timing of the permitted WALK indication (steady Walking Person) for the actuated pedestrian phases (pedestrian crossings with push buttons) and flashing DON'T WALK indication (flashing Upraised Hand) or pedestrian clearance timing for all pedestrian crossings. The field measured existing pedestrian timings are included with the calculated pedestrian clearance timing (flashing don't walk timing) based on Federal traffic control device guidelines (pedestrian walking speed of 3.5 ft/sec) and existing crossing length. The pedestrian signal timings are evaluated to ensure all pedestrians have adequate amount of time to safely cross signalized roadways. The federal minimum permitted WALK indication is 4 seconds, and the City uses a minimum of 7 seconds at their intersections.

The recommendations are based on adjusting the pedestrian clearance timing, where most signals require the pedestrian clearance timings to be increased due to the recent changes in calculated pedestrian walking speeds (from 4 ft/sec to 3.5 ft/sec). It was noted that the County maintained signals needed more significant timing adjustments.

7. *Pedestrian Signing* – Describes the location (advanced warning or at the crossing) and type of signing specifically for the pedestrian crossings. The pedestrian signs are evaluated based on Federal and/or State traffic control device guidelines to ensure all motorists are aware of the approaching pedestrian crossings with uniformly designed signing. **Figure 6** illustrates an example of a school zone pedestrian crossing sign sequence in Rockville. The most common sign deficiencies found were the lack of supplemental arrow signs beneath pedestrian crossing signs at the crossings and use of old pedestrian/ school crossing type signs.



Figure 6 – School Pedestrian Crossing Signing

8. *Sight Distances* – Describes the sight line characteristics and obstructions of the pedestrian crossing from the pedestrian’s and motorist’s perspectives. The sight distances are evaluated based on Federal guidelines to ensure:

- All motorists are aware and have adequate time to react to the approaching pedestrian crossings.
- All pedestrians have the ability to see oncoming vehicles and decide to safely cross a roadway at a designated crossing.

The most common sight distance deficiencies found were on-street parking locations too close to the mainline crossing.

9. *Lighting* – Describe the location and type of roadway lighting within the pedestrian crossing area. The pedestrian lighting is evaluated based on Federal recommendations to ensure designated pedestrian crossing areas are visible during night-time hours for pedestrians to safely cross roadways. **Figure 7** illustrates an example of pedestrian crossing lighting in Rockville. No common deficiencies were found with the lighting at the crossings throughout Rockville.



Figure 7 – Pedestrian Lighting



E. RATING CRITERIA

A priority rating system was incorporated in the evaluation of each pedestrian crossing location as a mechanism to prioritize the recommendations. Each recommendation included in the Inventory Summary sheets has a Priority Rating Value based on the level of significance to pedestrian safety and accessibility of the recommendation:

Low Priority Rating Value 1 – The crossing location provides existing facilities, however the facility is not to current minimum guidelines. The recommendations should be considered in order to bring the pedestrian facility to current standards. Recommended features include:

- Install detectable warning surfaces on existing ramps (per intersection)
- Reconstruct existing ramps to ADA standards (per quadrant)
- Reconstruct existing sidewalks (per segment)
- Re-align or restripe existing crosswalks (per leg)
- Replace existing signs (per intersection)
- Install advanced crossing signs (per intersection)
- Install lighting in residential pedestrian crossing areas (per intersection)
- Relocate existing pedestrian signal heads (per leg)
- Relocate existing accessible push buttons closer to curb (per leg)
- Re-orient existing push buttons and signs (per intersection)
- Upgrade to APS/CPS (County maintained signals along State route – per intersection)
- Install missing push button signs (per intersections)
- Retime pedestrian clearance phase 1 to 4 seconds (per leg)

Medium Priority Rating Value 2 – The crossing location does not provide a facility or a fully accessible facility, but the deficiencies do not have direct/significant safety affects. The recommendations should strongly be considered to bring the pedestrian facility to standards. Recommended features include:

- Remove improper ramps (per quadrant)
- Install missing sidewalk (per segment)
- Install missing mainline crosswalks (per leg)
- Remove crossing obstructions (per each)
- Install crosswalk signs at crossing locations (per leg)
- Install lighting in urban/CBD pedestrian crossing areas (per intersection)
- Relocate push buttons that are not reachable from sidewalk (per each)
- Retime pedestrian clearance phase 5 to 8 seconds (per leg)

High Priority Rating Value 3 – The crossing location does not provide vital crossing facilities or has significant safety and accessibility concerns/deficiencies. Recommendations need to be implemented to bring the pedestrian device to standards. Recommended features include:

- Clear sight distances from obstructions (per leg)



- Install missing ramps (per quadrant)
- Retime pedestrian clearance phase 9 or more seconds (per leg)
- Replace broken pedestrian signal heads (per each)
- Replace broken push buttons (per each)

The priority rating values of the recommendations for each location are added together to generate a Priority Rating Total for the entire location reviewed. **Appendix C** summarizes the recommendations with their corresponding priority ratings and location totals for each study location, and lists all of the locations in order from highest to lowest priority

F. INNOVATIVE SOLUTIONS

Aside from the traditional pedestrian traffic control devices, technology advancements have created other solutions to increase pedestrian safety at roadway crossings. Additional treatments to increase the vehicular visibility, awareness and control at pedestrian crossings, as well as controlling vehicular speeds approaching pedestrian crossings may be necessary at locations that have more systematic pedestrian accident patterns. The following treatments are examples of innovative solutions examples; however it is recommended to perform a traffic study based on pedestrian volumes and accident history to identify appropriate locations to consider implementing any of these devices. Based on discussions with the City of Rockville, the City does not experience any systematic accident problems at any of the pedestrian crossings. Therefore the following examples are provided for informational purposes only. At this time we do not recommend the installation of any particular innovative solution at any specific location.

1. Pedestrian Crossing Awareness Enhancements

Pedestrian crossing enhancers are traffic control devices that enhance the visibility and driver awareness of pedestrian crossings and their respective signs, crosswalks or signals.

- *Sign Lighting* – Incorporate LED lights into pedestrian crossing signs to enhance the presence and visibility of the signs. The lights begin to flash once actuated by a push button. This device is currently being used in Rockville at the intersection of Twinbrook Parkway and Twinbrook Community Center. **Figure 8** illustrates examples of different types of sign lights in pedestrian crossing signs. This device has been federally approved (see MUTCD Section 2A.08).



Figure 8 – LED Lights in Pedestrian Crossing Signs

- *Crosswalk Lighting* – Incorporate lights into the pavement along crosswalks to enhance the presence and visibility of the crosswalk. The lights begin to flash once actuated by a push button or pedestrian presence detector. This device is currently being used in Rockville at the intersection of Twinbrook Parkway and Twinbrook Community Center and along Chapman Avenue between Bouic Avenue and Halpine Road to access the Twinbrook Metro Station. **Figure 9** illustrates examples of in-pavement lights at crosswalks. This device has been federally approved (see MUTCD Section 4L.01).



Figure 9 – In-pavement Lights at Crosswalks



- *Pedestrian Signal Eye* – Pedestrian signal with white LED animated eyes display above the WALK and DON'T WALK displays that scan left to right at a rate of one cycle per second. This device promotes pedestrians to look left and right prior to crossing. **Figure 10** illustrates an example of a pedestrian signal eye display. This device has been federally approved (see MUTCD Section 4E.04).



Figure 10 – Pedestrian Signal Eye Display

- *Pedestrian Flashing Beacons* – Incorporate flashing amber signals adjacent to pedestrian crossing signs to enhance the presence and visibility of the signs and crossing. The lights can be pre-empted to flash once actuated by a push button. **Figure 11** illustrates examples of different types of pedestrian flashing beacons. This device has been federally approved (see MUTCD Section 4K.03).



Figure 11 – Pedestrian Crossing Flashing Beacon

2. Pedestrian Controlled Crossings

Pedestrian controlled crossings are traffic control devices that control vehicular traffic for pedestrian crossings at unsignalized intersections.

- *High-Intensity Activated Cross Walk Beacon (HAWK)* – A traffic signal that has two round red lenses side by side above a single yellow lens, and only lights up when actuated by a pushbutton. This device has an interim federal approval and is expected to be adopted in



the future MUTCD. **Figure 12** illustrates an example of a HAWK beacon and the sequencing of the different signal indications. The phase sequencing as shown in **Figure 12** is as follows:

1. The HAWK is dark when not actuated. The conventional pedestrian signal heads at either end of the crosswalk are in DON'T WALK mode.
2. When actuated the HAWK beacon first flashes yellow. The pedestrian signal heads are in DON'T WALK mode when the HAWK beacon is activated.
3. Then goes to steady yellow while the pedestrian signal heads are still in DON'T WALK mode
4. Finally steady red, where sequence 2-4 occurs over a period of several seconds. The pedestrian signal heads go to WALK mode when the HAWK beacon goes to steady red.

Like a conventional signalized crossing, the pedestrian signals go to flashing DON'T WALK when typical pedestrians would no longer be able to get all the way across during the time the HAWK beacon stops cross traffic.

5. When cross traffic is about to restart, the pedestrian signal goes to steady DON'T WALK. At or near the same time as the DON'T WALK indication, the HAWK beacon goes to flashing red (the equivalent of a stop sign), indicating that vehicles on the roadway may proceed if pedestrians have cleared the crosswalk.
6. Then, finally, the HAWK beacon goes dark.

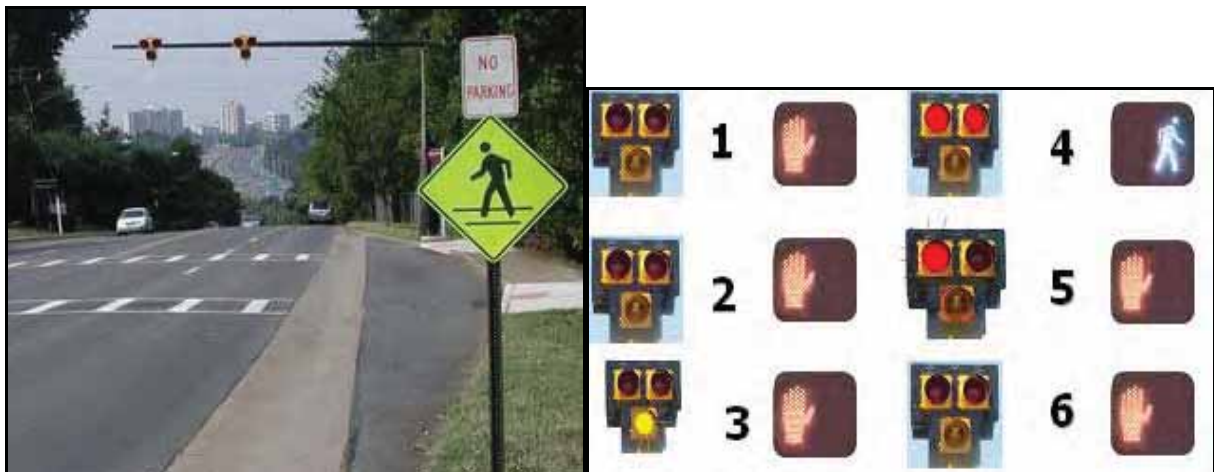


Figure 12 – HAWK Signal and Signal Sequencing

- *Half Signal* – A vehicular traffic signal that is actuated by a push button used to stop traffic for pedestrians at a stop-controlled intersection or mid-block crossing. **Figure 13** illustrates examples of different types of half signals. This device has not been federally approved.



Figure 13 – Half Signals

3. Pedestrian Related Traffic Calming Devices

Pedestrian related traffic calming devices are traffic control devices that control vehicular speeds at uncontrolled pedestrian crossings. All of the following devices are federally approved.

- *Raised Crosswalks* – A speed hump/table that incorporates a crosswalk to slow motorist as they approach the uncontrolled crossing. **Figure 14** illustrates examples of different types of raised crosswalks.



Figure 14 – Raised Crosswalk

- *Raised Intersections* – A large speed table that spans through an intersection and a pedestrian crossing to slow motorist as they approach the crossing and the intersection. As shown in **Figure 15**, this device is currently being used in Rockville at the intersection of Baltimore Road and Woodburn Road.



Figure 15 – Raised Intersection

- *Chokers at Pedestrian Crossings* – Roadway curblines designed to narrow the roadway cross section at pedestrian crossings. This geometric effect reduces the crossing length for pedestrians and creates an illusion of a narrow roadway to slow down vehicular speeds as motorists approach the uncontrolled crossing. **Figure 16** illustrates examples of different types of chokers at pedestrian crossings.



Figure 16 – Chokers at Pedestrian Crossings

G. SUMMARY AND RECOMMENDATIONS

Overall the pedestrian crossings in the City of Rockville are in good condition. The pedestrian signals and push buttons at the signalized intersections are adequately provided, and the equipment is generally up to current standards. Most of the pedestrian clearance timings (flashing DON'T WALK interval) need to be increased based on recent revisions to calculated walking speeds; however it was observed that the clearance timings at the City maintained signals required less adjustment than the County maintained signals.

For the uncontrolled locations stopping sight distances are generally adequate approaching the crossings, where only a few locations have pedestrian sight-line concerns with on-street parking too close to the marked crosswalks. Only a few locations were missing ramps for marked crossings.



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Most of the facilities were built prior to the latest pedestrian facility design guidelines, so most of the recommendations identify improvements to sidewalk ramps, pedestrian signing, crosswalks and pedestrian signal clearance timing to bring these features to current design guidelines. These types of improvements could easily be implemented using the City's maintenance forces or through general maintenance contracts.

It was observed while performing field evaluations that motorists frequently do not adhere to State Law or obey existing regulatory signing to yield to pedestrians in crosswalks. It is recommended to implement improved enforcement or motorist education to correct this matter.

Appendix C provides summary tables of the recommendations for each pedestrian crossing location in order of highest to lowest priority rating; and further grouped as High, Medium and Low priority locations.