



Report: South Shore Trail Phase II

Burns Crossing Road, Gambrills Road and Holladay Street Crossings

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**ANNE ARUNDEL COUNTY
PEDESTRIAN/BICYCLE CROSSING IMPROVEMENTS ANALYSIS**



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Crossing Location

Burns Crossing Road

Study Area Location



Background

- Phase II of the South Shore Trail is planned to cross Burns Crossing Road about 0.2 miles north of the road's intersection with MD 175 (Annapolis Road). Improvements are needed to ensure a safe crossing for users of the trail.

Traffic Data

- Posted speed limit: 35 mph, with 25 mph advisory warning speed on curve
- Design speed: 45 mph

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Site Information

- Site photos:



Burns Crossing Road, facing south toward future South Shore Trail crossing



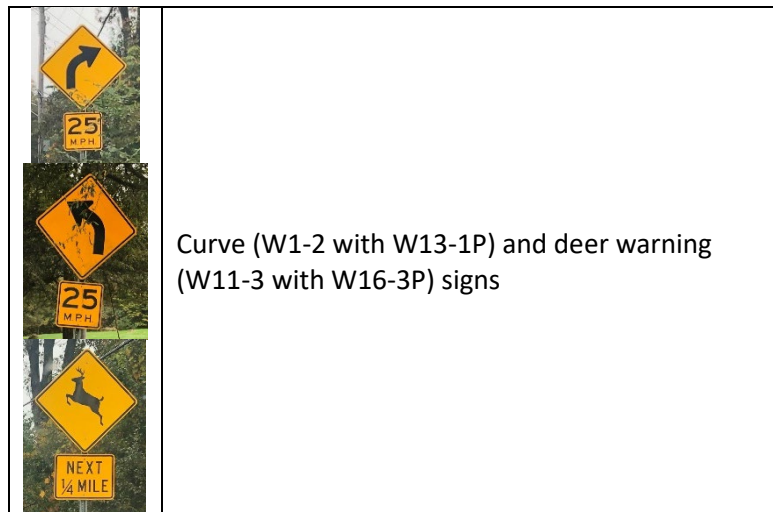
Burns Crossing Road, facing north toward future South Shore Trail crossing

- Crossing type: intersection mid-block
- Roadway configuration: undivided two-lane roadway
- Existing lighting: street lighting about 100' south and 250' north of crossing

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- Existing traffic control devices:
 - Intersection control (if applicable):
 - Signal
 - Two-way stop
 - Four-way stop
 - Other (please explain): not applicable
 - Marked crosswalk:
 - None
 - Solid border only
 - Solid border with transverse hatching
 - Continental (transverse hatching with no border)
 - Other (please explain):
 - Crosswalk length (along center of crosswalk): 37'
 - Other pavement markings: none
 - Signing
 - For pedestrians/bicycles: none
 - For vehicles:



- Pedestrian signals: yes no
- Sight distance:
 - Pedestrian sight distance data provided by County: 350' north of the crossing for southbound vehicles, 380' south of the crossing for northbound vehicles
 - Stopping sight distance measured in field, assuming 42" driver eye height and 24" height for an object at the center of the crossing: 332' on southbound approach, 412' on northbound
 - Required stopping sight distance at 45 MPH: 360'

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- Pedestrian crossing sight distance analysis:
 - Procedure outlined by 2010 MDOT SHA Accessibility Policy & Guidelines for Pedestrian Facilities along State Highways (p. 25)
 - Estimated pedestrian crossing time (using field measured crosswalk length and pedestrian speed of 3-3.5 feet per second or 2.5 feet per second if a concentration of elderly people or people with disabilities)
 - 3.5 feet per second used
 - $37 \text{ ft} / (3.5 \text{ ft/sec}) = 10.6 \text{ seconds}$ for pedestrian crossing time
 - Calculate required sight distance to allow pedestrians to completely cross safely: $[(85\% \text{ speed (mph)} \times 5,280 \text{ ft/mi}) / 3,600 \text{ sec/hr}] \times \text{pedestrian crossing time (sec)}$
 - Ped. crossing sight distance to completely cross 37' of roadway: $[(45 \text{ mph} \times 5,280 \text{ ft/mi}) / 3,600 \text{ sec/hr}] \times 10.6 \text{ sec} = 700'$

Crosswalk:	SB approach	NB approach
Required/ideal pedestrian sight distance to cross entire roadway	700'	700'
Available sight distance	350'	380'
Difference	350'	320'

- Other site-specific information: Sight distance is limited by curvature of roadway. The County has noted a history of run-off-the-road crashes on the curve just north of the proposed crossing.

Field Observations

- Potential Americans with Disabilities Act (ADA) compliance issues: none
- Potential geometric or construction/maintenance issues present:
 - Right-of-way restrictions and existing utility poles and storm drains make a more perpendicular crossing difficult to achieve
- Pedestrian/bicycle approaches: design in progress
- Other field observations: none

Recommended Improvements

For a non-intersection crossing of a roadway with a 35-MPH posted speed, County guidelines recommend a hatched crosswalk.

Given the limited sight distance in each direction, additional improvements are recommended:

- Install rectangular rapid flash beacons (RRFB) at crossing and at least 175' in advance
- Relocate existing signs as needed to maintain proper distance among warning signs

All recommended improvements are shown in **Figure 1**.

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Figure 1: Burns Crossing Road Recommended Improvements



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Crossing Location

Gambrills Road at Maple Road

Study Area Location

Background



- Phase II of the South Shore Trail is planned to cross Gambrills Road just south of Maple Road. Improvements are needed to ensure a safe crossing for users of the trail.

Traffic Data

- Posted speed limit: 25 mph
- Design speed: 35 mph

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Site Information

- Site photos:



Gambrills Road, facing south toward future South Shore Trail crossing



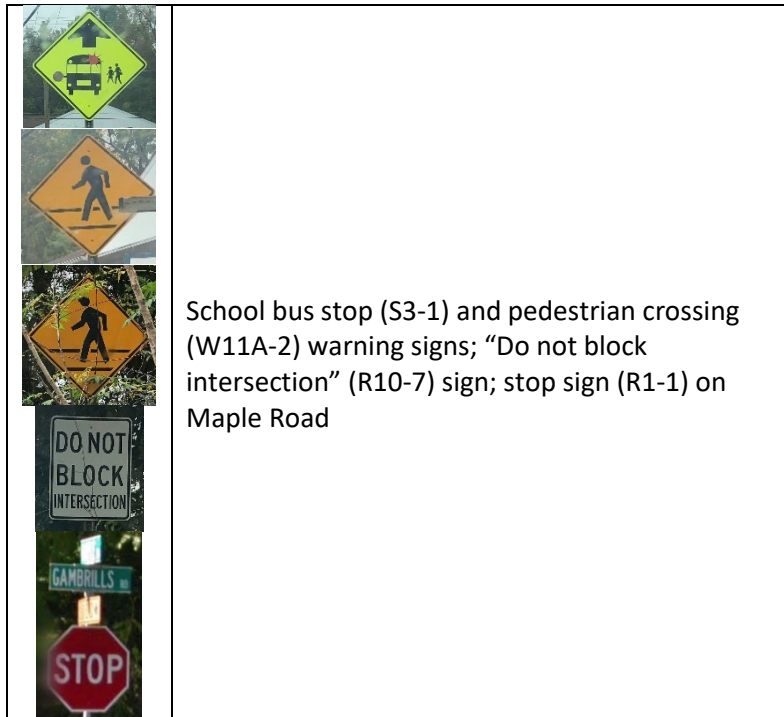
Gambrills Road, facing north toward future South Shore Trail crossing

- Crossing type: intersection mid-block
- Roadway configuration: undivided two-lane roadway
- Existing lighting: street lighting at intersection and along Gambrills Road

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- Existing traffic control devices:
 - Intersection control (if applicable):
 - Signal
 - Two-way stop
 - Four-way stop
 - Other (please explain):
 - Marked crosswalk:
 - None
 - Solid border only
 - Solid border with transverse hatching
 - Continental (transverse hatching with no border)
 - Other (please explain):
 - Crosswalk length (along center of crosswalk): 28'
 - Other pavement markings: none
 - Signing
 - For pedestrians/bicycles: none
 - For vehicles:



- Pedestrian signals: yes no

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- Sight distance:
 - Pedestrian sight distance data provided by County: 350' north of the crossing for southbound vehicles, 430' south of the crossing for northbound vehicles
 - Stopping sight distance measured in field, assuming 42" driver eye height and 24" height for an object at the center of the crossing: 248' on southbound approach, 400' on northbound (full distance from crossing to MD 175)
 - Required stopping sight distance at 35 MPH: 250'
- Pedestrian crossing sight distance analysis:
 - Procedure outlined by 2010 MDOT SHA Accessibility Policy & Guidelines for Pedestrian Facilities along State Highways (p. 25)
 - Estimated pedestrian crossing time (using field measured crosswalk length and pedestrian speed of 3-3.5 feet per second or 2.5 feet per second if a concentration of elderly people or people with disabilities)
 - 3.5 feet per second used
 - $28 \text{ ft} / (3.5 \text{ ft/sec}) = 8.0 \text{ seconds}$ for pedestrian crossing time
 - Calculate required sight distance to allow pedestrians to completely cross safely: $[(85\% \text{ speed (mph)} \times 5,280 \text{ ft/mi}) / 3,600 \text{ sec/hr}] \times \text{pedestrian crossing time (sec)}$
 - Ped. crossing sight distance to completely cross 28' of roadway: $[(35 \text{ mph} \times 5,280 \text{ ft/mi}) / 3,600 \text{ sec/hr}] \times 8.0 \text{ sec} = 411'$

Crosswalk:	SB approach	NB approach
Required/ideal pedestrian sight distance to cross entire roadway	411'	411'
Available sight distance	350'	430'
Difference	61'	-19'

- Other site-specific information: Sight distance on southbound approach is limited by vertical curvature, which crests about 250' north of the proposed crossing, and by vegetation

Field Observations

- Potential Americans with Disabilities Act (ADA) compliance issues: none
- Potential geometric or construction/maintenance issues present: none
- Pedestrian/bicycle approaches: design in progress
- Other field observations: none

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Recommended Improvements

For crossing of a roadway with a 25-MPH posted speed, at an intersection, County guidelines recommend a crosswalk consisting of two parallel white lines. As traffic on Gambrills Road is not required to stop at the intersection, the crossing may be considered unexpected, justifying a hatched crosswalk.

Given the limited sight distance on the southbound approach, additional improvements are recommended:

- Install RRFBs at crossing, and at least 100' in advance of intersection on southbound approach (due to dense vegetation, a distance as great as 250' may be appropriate)
- Remove or relocate existing signs as needed to maintain proper distance among warning signs

All recommended improvements are shown in **Figure 2**.



Figure 2: Gambrills Road Recommended Improvements



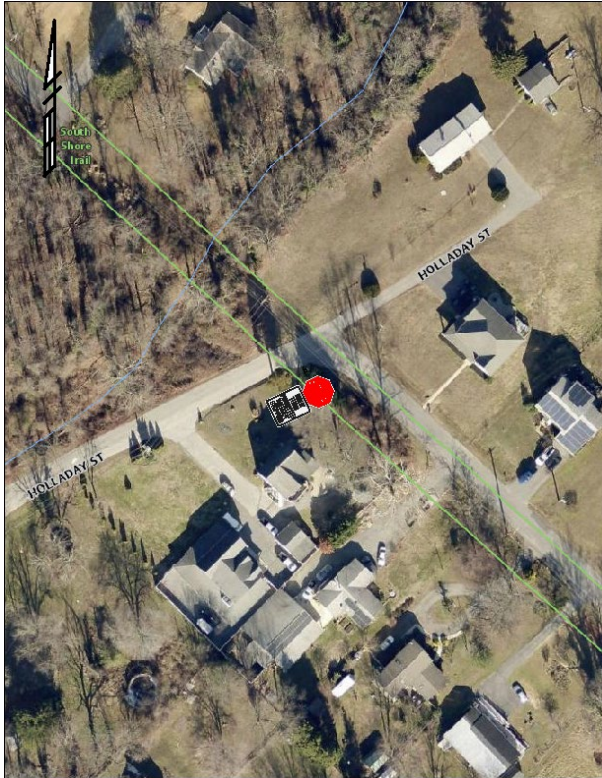
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Crossing Location

Holladay Street at Holladay Park Road

Study Area Location



Background

- Phase II of the South Shore Trail is planned to cross Holladay Street just south of Holladay Park Road. Improvements are needed to ensure a safe crossing for users of the trail.

Traffic Data

- Posted speed limit: 25 mph
- Design speed: 30 mph

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Site Information

- Site photos:



Holladay Street, facing north toward future South Shore Trail crossing



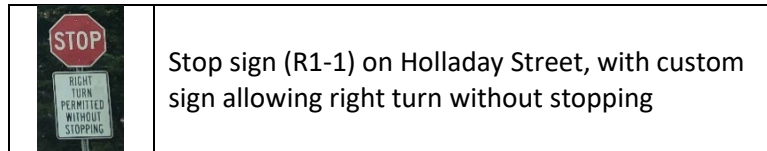
Holladay Park Road, facing west toward future South Shore Trail crossing

- Crossing type: intersection mid-block
- Roadway configuration: undivided two-lane roadway
- Existing lighting: street lighting about 50' north and 150' south of intersection

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- Existing traffic control devices:
 - Intersection control (if applicable):
 - Signal
 - Two-way stop
 - Four-way stop
 - Other (please explain): Through traffic approaching on Holladay Street stops; right turns from Holladay Street and all traffic on Holladay Park Road are not required to stop. A private driveway comprises one leg of the intersection.
 - Marked crosswalk:
 - None
 - Solid border only
 - Solid border with transverse hatching
 - Continental (transverse hatching with no border)
 - Other (please explain):
 - Crosswalk length (along center of crosswalk): 24'
 - Other pavement markings: none
 - Signing
 - For pedestrians/bicycles: none
 - For vehicles:



- Pedestrian signals: yes no
- Sight distance:
 - Stopping sight distance measured in field, assuming 42" driver eye height and 24" height for an object at the center of the crossing: 243' on westbound approach, 466' on northbound (full distance from crossing to MD 175)
 - Required stopping sight distance at 30 MPH: 200'

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- Pedestrian crossing sight distance analysis:
 - Procedure outlined by 2010 MDOT SHA Accessibility Policy & Guidelines for Pedestrian Facilities along State Highways (p. 25)
 - Estimated pedestrian crossing time (using field measured crosswalk length and pedestrian speed of 3-3.5 feet per second or 2.5 feet per second if a concentration of elderly people or people with disabilities)
 - 3.5 feet per second used
 - $24 \text{ ft} / (3.5 \text{ ft/sec}) = 6.9 \text{ seconds}$ for pedestrian crossing time
 - Calculate required sight distance to allow pedestrians to completely cross safely:

$$[(85\% \text{ speed (mph)} \times 5,280 \text{ ft/mi}) / 3,600 \text{ sec/hr}] \times \text{pedestrian crossing time (sec)}$$
 - Ped. crossing sight distance to completely cross 24' of roadway:

$$[(30 \text{ mph} \times 5,280 \text{ ft/mi}) / 3,600 \text{ sec/hr}] \times 6.9 \text{ sec} = 302'$$

Crosswalk:	NB approach	WB approach
Required/ideal pedestrian sight distance to cross entire roadway	302'	302'
Available sight distance	466'	248'
Difference	-164'	54'

- Other site-specific information: Sight distance for the westbound approach is likely to change with construction of trail, as some vegetation will be removed

Field Observations

- Potential Americans with Disabilities Act (ADA) compliance issues: none
- Potential geometric or construction/maintenance issues present: none
- Pedestrian/bicycle approaches: design in progress
- Other field observations: none

Recommended Improvements

For crossing of a roadway with a 25-MPH posted speed, at an intersection, County guidelines recommend a crosswalk consisting of two parallel white lines.

Given the nonstandard operation of the intersection, additional improvements are recommended:

- Remove the “Right turn permitted without stopping” sign mounted below the stop sign
- Install a stop sign and stop line pavement marking on the westbound approach to the intersection. These changes to the intersection operation will require the temporary placement of notice signs advising of the change prior to the removal and installation of any signs.
- Install pedestrian crossing warning signs at intersection

All recommended improvements are shown in **Figure 3**.

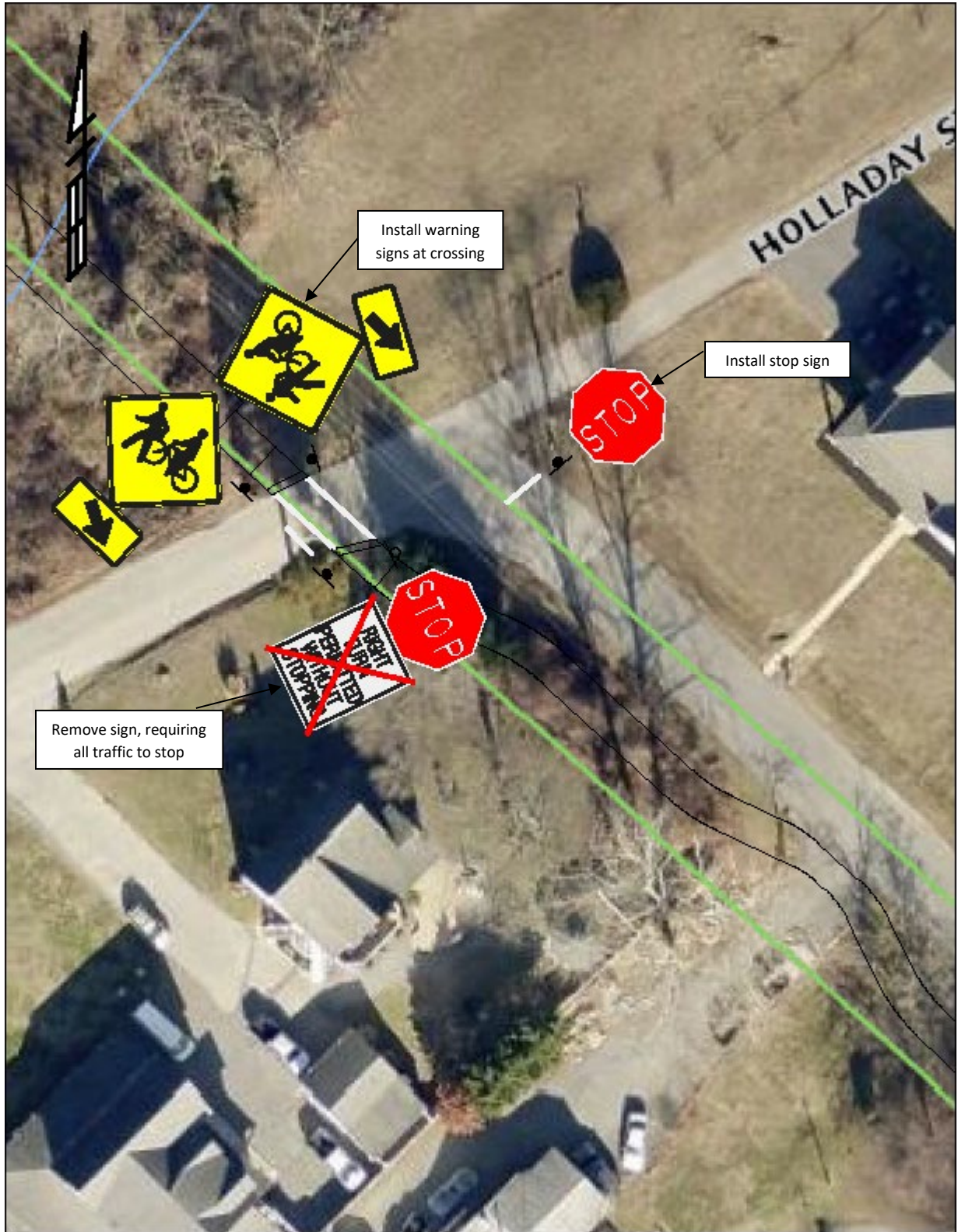


Figure 3: Holladay Street Recommended Improvements



Guidelines for Pedestrian/Bicycle Crossing Improvements

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MdMUTCD Guidelines

The MdMUTCD (Section 3B.18, page 486) states that crosswalks shall be marked at all school crossings, all recreational pedestrian and/or bicycle crossings, all locations having pedestrian crossing warning signs, all pedestrian crossings having pedestrian signal indications, all mid-block/non-intersection locations, and any point where pedestrians crossing would be unexpected.

The MdMUTCD (Section 4D.01, page 567) states that mid-block crosswalks shall not be signalized if they are located within 300 feet from the nearest traffic control signal, unless the proposed signal will not restrict the progressive movement of traffic.

Anne Arundel County Guidelines

Current Anne Arundel County guidelines call for crosswalks under the following circumstances:

- Where there are a significant number of pedestrians crossing a roadway.
- At pedestrian and school walking route crossings which are marked with warning signs.
- At all crossings which are controlled by pedestrian signals.
- At other locations where an engineering study has shown that a marked crosswalk might be helpful in controlling pedestrians and/or improving traffic safety.

Where the posted speed limit is 35mph or less or the locations is controlled by a stop sign or traffic signal:

- Two parallel solid white lines, 12 inches in width, at least six feet apart
- At non-intersection locations, school walking routes, or unexpected crossing locations, cross hatching with 12 inch lines, 24 inches apart, perpendicular to the two parallel crosswalk lines

Where the posted speed limit is 40mph or more:

- Two parallel solid white lines, 16 inches in width, at least six feet apart
- Cross hatching with 12 inch lines, 24 inches apart, perpendicular to the two parallel crosswalk lines

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MDOT-SHA Pedestrian Safety Treatments Best Practices Guidelines

The following table presents minimum criteria for installing a marked crosswalk at uncontrolled locations and provides guidance where additional treatments are necessary. Pedestrian walking speed is included as a criterion for each roadway type – reduced walking speeds can be considered in areas where elderly or school-age pedestrians are expected. **It should be noted that engineering judgment is required for determining potential additional treatments at locations identified in the table as “standard marked crosswalk is acceptable”, where additional pedestrian issues are present.**

Average Daily Traffic	Posted Speed (MPH)	2 Lanes		3 Lanes		4 or More Lanes (with raised median)		4 or More Lanes (without raised median)	
		Std. Ped. Speed (3.5 fps)	Reduced Ped. Speed (2.5 fps)	Std. Ped. Speed (3.5 fps)	Reduced Ped. Speed (2.5 fps)	Std. Ped. Speed (3.5 fps)	Reduced Ped. Speed (2.5 fps)	Std. Ped. Speed (3.5 fps)	Reduced Ped. Speed (2.5 fps)
≤ 10,000	25	✓	✓	✓	✓	✓	✓	✓	✓
	30/35	✓	✓	✓	✓	✓	✓	✓	◇
	40	✓	◇	✓	◇	✓	◇	◇	◇
> 10,000 and ≤ 15,000	25	✓	✓	✓	✓	✓	◇	✓	◇
	30/35	✓	✓	✓	◇	◇	◇	◇	◇
	40	✓	◇	◇	◇	◇	◇	◇	◇
> 15,000 and ≤ 20,000	25	✓	✓	✓	✓	◇	◇	◇	◇
	30/35	✓	◇	✓	◇	◇	◇	◇	◇
	40	◇	◇	◇	◇	◇	◇	◇	◇
> 20,000 and ≤ 35,000	25	◇	◇	◇	◇	◇	◇	◇	◇
	30/35	◇	◇	◇	◇	◇	◇	◇	◇
	40	◇	◇	◇	◇	◇	◇	◇	◇
<p align="center">ONLY FULLY CONTROLLED MARKED CROSSINGS OR GRADE SEPARATED PEDESTRIAN CROSSINGS ARE RECOMMENDED FOR ROADWAYS WITH SPEEDS GREATER THAN 40 MPH</p>									
<p align="center">✓ STANDARD MARKED CROSSWALK IS ACCEPTABLE</p>					<p align="center">◇ REQUIRES ADDITIONAL TREATMENTS</p>				

Source: Modified from DRAFT Pedestrian Safety Treatments Best Practices Guidelines (MDOT-SHA, 2018)

Possible additional treatments, if desired, in addition to a marked crosswalk:

- High visibility crosswalk markings
- Advanced yield/stop line
- In-pavement warning markings
- Rumble strips
- Pedestrian refuge areas with minimum dimensions of 4’ long by 6’ wide
- Reduced curb radii
- Advanced warning beacons
- Pedestrian activated warning beacons
- Automated pedestrian detection





Potential Improvement Options

Approved MdMUTCD Options

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Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2, 3)	Pros/Cons
Passive traffic control devices	Advance stop/yield lines and appropriate signage in advance of crosswalk Recommended setback of 20-50 feet		MdMUTCD Section 3B.16, page 482	N/A	<u>Pros</u> <ul style="list-style-type: none"> Enhanced driver attention <u>Cons</u> <ul style="list-style-type: none"> Routine application
	Highly visible crosswalk striping (may include features such as contrasting pavement markings, longitudinal markings, increased width of markings, or increased overall width of crosswalk) Per MDOT-SHA, the standard for high visibility crosswalk markings as of 4/15/19 will utilize longitudinal lines without transverse lines (continental crosswalk) – as shown in the bottom photo. The County will continue with the traditional crosswalk approach and consider the continental crosswalk if there is an unusual/special case where this could cause the crosswalk to stand out more.		MdMUTCD Section 3B.18, page 485 for crosswalk markings; no guidance on visibility requirements	<u>Mid-block crossings (1)</u> Recommended regardless of ADT and speed limit <u>Intersections (1)</u> All of the following: <ul style="list-style-type: none"> ADT (vehicles): <ul style="list-style-type: none"> Local Roads: 100-700 Minor Collectors: 1,300-3,600 Major Collectors: 3,600-5,600 Minor Arterials: 3,500-14,600 Posted speed > 30 mph At least one of the following: <ul style="list-style-type: none"> Pedestrian peak hour volume > 50 (3) Two or more pedestrian-related crashes within the most recent five year period 	<u>Pros</u> <ul style="list-style-type: none"> Enhanced visibility of pedestrian crossing <u>Cons</u> <ul style="list-style-type: none"> Potential maintenance and durability issues

(1) DRAFT Pedestrian Safety Treatments Best Practices Guidelines (MDOT-SHA, 2018)
 (2) Maryland Manual on Uniform Traffic Control Devices for Streets and Highways (2011 Edition)
 (3) Lower values may be used, on a case-by-case basis, on County facilities

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Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2, 3)	Pros/Cons
	<p>Transverse rumble strips extending across the travel lane in advance of crosswalk created with stacked pavement markings</p> <p>Use of rumble strips must be done with caution. The County does not use these devices within residential environments due to noise pollution.</p>		<p>MdMUTCD Section 6F.87, page 731 for transverse rumble strips; no guidance on placement location</p>	<p>N/A</p>	<p><u>Pros</u></p> <ul style="list-style-type: none"> Enhanced driver attention <p><u>Cons</u></p> <ul style="list-style-type: none"> Potential issue for bicyclists on roadway must be considered (minimum clear path of 4' at each edge of roadway/paved shoulder) Potential noise concerns near residential areas Potential maintenance and durability issues Potential additional maintenance costs
	<p>In-pavement text warning markings</p> <p>Standard messages include PED X-ING AHEAD, SCHOOL ZONE, and PED AREA</p>		<p>MdMUTCD Section 3B.20, page 495</p>	<p>At least one of the following (1):</p> <ul style="list-style-type: none"> Limited sight distance Posted speed \geq 35 mph Crossing location $>$ 1/2 mile from a signalized intersection Two or more pedestrian-related crashes within the most recent five year period 	<p><u>Pros</u></p> <ul style="list-style-type: none"> Increased driver attention <p><u>Cons</u></p> <ul style="list-style-type: none"> Potential additional maintenance costs Less visible than signs or active warning devices in certain lighting and weather conditions

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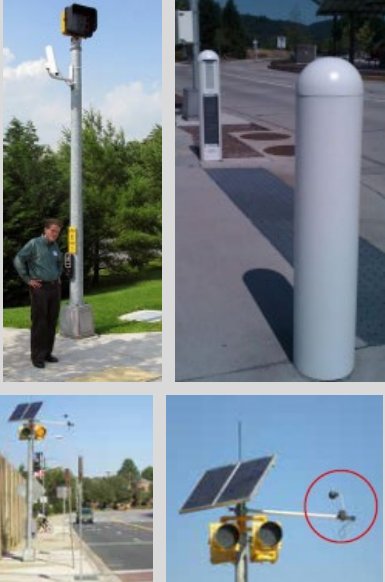


Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2, 3)	Pros/Cons
Active traffic control devices	<p>Rectangular rapid flashing beacon (RRFB) with solar unit:</p> <ul style="list-style-type: none"> Flashing, yellow, rectangular LEDs that are activated by a pedestrian push button and supplement a marked crosswalk Post mounted installation for 4 lanes or less/divided roadway Overhead installation supplemented with post mounted installation for undivided roadway <p>Typical application where Maryland Pedestrian Signal or Pedestrian Hybrid Beacon (HAWK signal) is requested but is not warranted</p>	 	No specific direction in the MdMUTCD; MDOT-SHA received an approved FHWA request for interim approval for RRFBs and all local highway agencies are included in the interim approval	<p>All of the following (1):</p> <ul style="list-style-type: none"> ADT (vehicles): <ul style="list-style-type: none"> Local Roads: 100-700 Minor Collectors: 1,300-3,600 Major Collectors: 3,600-5,600 Minor Arterials: 3,500-14,600 Posted speed \geq 25 <p>At least one of the following (1):</p> <ul style="list-style-type: none"> Undivided roadway with $<$ 4 lanes Divided roadway with $<$ 6 lanes Two or more pedestrian-related crashes within the most recent five year period where the pedestrian was not at fault 1/4 of daily pedestrian crossings is of special populations (e.g. senior, school children) 	<p><u>Pros</u></p> <ul style="list-style-type: none"> Increased driver attention Active only when actuated <p><u>Cons</u></p> <ul style="list-style-type: none"> Potential additional maintenance costs Potential light pollution issues in residential areas

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Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2, 3)	Pros/Cons
	<p>Pedestrian warning sign with embedded LEDs and solar unit</p> <p>County LED signs are pedestrian activated, not always active</p>		<p>MdMUTCD Section 2A.07, page 37 for LED sign borders</p>	<p>N/A</p>	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Increased driver attention • Active only when actuated <p><u>Cons</u></p> <ul style="list-style-type: none"> • Potential additional maintenance costs
	<p>Passive pedestrian detection system instead of pedestrian activated for crossing signal</p> <p>Bottom photos – the Prince George’s County Department of Public Works & Transportation is currently using FLIR Systems C-Walk pedestrian presence detectors at a busy mid-block crossing. The C-Walks were installed by Control Technologies (Florida)</p>		<p>MdMUTCD Section 4E.08, page 614</p> <p>Pedestrian detectors may be push buttons or passive detection devices</p>	<p>N/A</p>	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Active only when actuated <p><u>Cons</u></p> <ul style="list-style-type: none"> • Unusual application; may not be apparent to pedestrians • Additional maintenance costs

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Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2, 3)	Pros/Cons
	<p>Partial traffic signal (also known as fire station type signal or Maryland Pedestrian Signal)</p>		<p>MdMUTCD does not explicitly mention this signal setup, but Section 4L.03, page 634 “Warning Beacons” supports the three-section signal head with pedestrian sign</p>	<p>Must meet the following (1):</p> <ul style="list-style-type: none"> • Pedestrian volume crossing the major roadway ≥ 20 per hour <p>At least one of the following (1):</p> <ul style="list-style-type: none"> • Posted speed limit ≥ 35 mph • Limited existing sight distance • Two or more pedestrian-related crashes on the mainline within the most recent five year period 	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Increased driver attention <p><u>Cons</u></p> <ul style="list-style-type: none"> • Possible lack of driver differentiation between standard and rapid flashing yellow before turning red • Potential additional maintenance costs • Phasing/timing coordination required if existing traffic signal nearby
	<p>Pedestrian-activated overhead flashing beacon</p> <p>Overhead signage can be supplemented with a warning beacon as emphasis for mid-block crosswalks</p>		<p>MdMUTCD Section 4L.03, page 634 for flashing beacons</p>	<p>N/A</p>	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Increased driver attention • Active only when actuated <p><u>Cons</u></p> <ul style="list-style-type: none"> • Potential additional maintenance costs

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PEDESTRIAN/BICYCLE CROSSING IMPROVEMENTS ANALYSIS**



Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2, 3)	Pros/Cons
Physical improvements	Roundabout		MdMUTCD Section 3C.05, page 531 for crosswalk markings at roundabouts	N/A	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Enhanced vehicular flow • May provide pedestrian refuge in median island(s) <p><u>Cons</u></p> <ul style="list-style-type: none"> • Longer pedestrian paths • Significant construction costs

(1) DRAFT Pedestrian Safety Treatments Best Practices Guidelines (MDOT-SHA, 2018)
(2) Maryland Manual on Uniform Traffic Control Devices for Streets and Highways (2011 Edition)
(3) Lower values may be used, on a case-by-case basis, on County facilities



Potential Improvement Options

Additional Options Not Included in the MdMUTCD

**ANNE ARUNDEL COUNTY
PEDESTRIAN/BICYCLE CROSSING IMPROVEMENTS ANALYSIS**





Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2)	Pros/Cons
Passive traffic control devices	<p>Sidewalk pavement markings designed to direct pedestrians to marked crosswalks</p> <p>2012 SHA pilot program in Ocean City: www.roads.maryland.gov/pages/release.aspx?newsId=1076</p>		No specific direction in the MdMUTCD	N/A	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Pedestrians guided to specific crossing location <p><u>Cons</u></p> <ul style="list-style-type: none"> • No effect on drivers • Effectiveness may be diminished over time, with repeated use • Additional maintenance costs
Active traffic control devices	Curb extensions (converting existing parking lane) or reduced curb radii		No specific direction in the MdMUTCD	<p><u>For curb extensions</u> N/A</p> <p><u>For reduced curb radii</u> All of the following (1):</p> <ul style="list-style-type: none"> • Number of mainline lanes > 4 • Turning speeds > 15 mph • Pedestrian peak hour volume > 20 <p>At least one of the following (1):</p> <ul style="list-style-type: none"> • Side street is collector road or lower functional class <p>Impact to truck activity is minimal</p>	<p><u>Pros</u></p> <ul style="list-style-type: none"> • May reduce speed and calm traffic <p><u>Cons</u></p> <ul style="list-style-type: none"> • Potential to make turning more difficult for larger vehicles • Must consider school bus, emergency service, and truck access • Potential loss of parking spaces • Snow removal concerns • Construction costs

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**ANNE ARUNDEL COUNTY
PEDESTRIAN/BICYCLE CROSSING IMPROVEMENTS ANALYSIS**

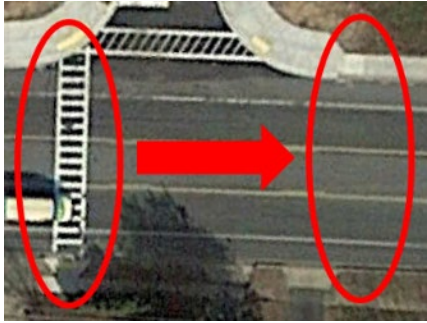



Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2)	Pros/Cons
Physical improvements	Lane width reduction/narrowing Buffer area outlined by two solid lines (no cross hatching, due to maintenance concerns)		No specific direction in the MdMUTCD	N/A	<u>Pros</u> <ul style="list-style-type: none"> • May reduce speed and calm traffic <u>Cons</u> <ul style="list-style-type: none"> • Must consider school bus, emergency service, and truck access • Potential traffic diversion to other roads
	Raised mid-block crossing/speed table		No specific direction in the MdMUTCD	<u>Anne Arundel County Traffic Engineering Division – Neighborhood Traffic Control Guidelines</u> Speed tables: <ul style="list-style-type: none"> • Will not be considered on arterial or higher function roadways • Will not be considered on roadways that are less than 1,000' long • Will generally not be considered on roadways where the average daily volume is more than 10,000 vehicles • Will only be considered on roadways with posted speed limit of 25 or 30 mph 	<u>Pros</u> <ul style="list-style-type: none"> • May reduce speed and calm traffic • Enhanced visibility • Curb ramps not required <u>Cons</u> <ul style="list-style-type: none"> • Must consider school bus, emergency service, and truck access • Potential for increased emergency response time • Can create drainage issues if not designed properly

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PEDESTRIAN/BICYCLE CROSSING IMPROVEMENTS ANALYSIS**




Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2)	Pros/Cons
	Crosswalk realignment or relocation		No specific direction in the MdMUTCD	N/A	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Potential for increased pedestrian and driver visibility compared to old location • Can be effective, depending on predominant turning movements <p><u>Cons</u></p> <ul style="list-style-type: none"> • Potential additional costs for corresponding sidewalk/ramp improvements
	<p>Trail chicane</p> <p>Top photo - Easton, MD Rails-to-Trails road crossing</p> <p>Justification: unusual configuration of trail/road crossing where increased trail user awareness is necessary for slower speeds or a stop condition</p>		No specific direction in the MdMUTCD	N/A	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Increased trail user awareness of roadway traffic and safety • Reduction in bicycle speeds at the crossing location <p><u>Cons</u></p> <ul style="list-style-type: none"> • Potential additional maintenance costs • Potential snow removal and emergency access concerns if in the closed position

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Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2)	Pros/Cons
	<p>Pedestrian refuge island</p> <p>County guidelines: 6' wide (min.) x 22' long (min.)</p>		<p>No specific direction in the MdMUTCD</p>	<p>N/A</p>	<p><u>Pros</u></p> <ul style="list-style-type: none"> • May reduce speed and calm traffic • Enhanced visibility • Increased driver attention <p><u>Cons</u></p> <ul style="list-style-type: none"> • Potential additional maintenance costs and snow removal concerns

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Potential Improvement Options

Additional Options Prohibited by the MdMUTCD

**ANNE ARUNDEL COUNTY
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Category	Description/ Additional Information	Photo	MdMUTCD Reference	Threshold Guidelines (1, 2)	Pros/Cons
Passive traffic control devices	<p>In-street signs at crosswalks</p> <p>May be permitted in protected locations with curbs such as pedestrian refuge islands or on the side of the street</p>		-	N/A	<p><u>Pros</u></p> <ul style="list-style-type: none"> • Increased driver attention <p><u>Cons</u></p> <ul style="list-style-type: none"> • Possible obstruction and decrease in crossing visibility • Devices easily damaged if placed in roadway • Snow removal concerns

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Appendix

Preliminary Cost Estimate

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In their Innovative Intersection Safety Treatment summary for the RRFB (https://safety.fhwa.dot.gov/intersection/conventional/unsignalized/tech_sum/fhwasa09009/), the FHWA estimates the cost of the purchase and installation of two RRFBs, including a solar power unit and associated signs and posts, at \$10,000–\$15,000. The highest value is used for this estimate. Other costs are derived from the MDOT SHA Price Index (July 2020). A 10-percent planning-level contingency is also included.

Burns Crossing Road crossing

Rectangular Rapid Flash Beacons (RRFB): 4 @ \$7,500 each = \$30,000
Crosswalk pavement markings: 175 LF @ \$8/LF = \$1,400
Removal of existing pavement markings = 50 LF @ \$1/LF = \$50
Conduit and wiring to connect advance RRFBs: 380 LF @ \$13.50/LF = \$5130
Relocation of existing signs: 2 @ \$120 each = \$240
Estimated subtotal: \$36,820
10% contingency: \$3,682
Estimated total: \$40,502

Gambrills Road crossing

Rectangular Rapid Flash Beacons (RRFB): 3 @ \$7,500 each = \$22,500
Crosswalk pavement markings: 130 LF @ \$8/LF = \$1,040
Removal of existing pavement markings: 20 LF @ \$1/LF = \$20
Conduit and wiring to connect advance RRFB: 270 LF @ \$13.50/LF = \$3,645
Removal of existing signs: 2 @ \$80 each = \$160
Estimated subtotal = \$27,365
10% contingency = \$2,737
Estimated total: \$30,102

Holladay Street crossing

Stop line and crosswalk pavement markings: 75 LF @ \$8/LF = \$600
Stop and warning signs: 25 SF @ \$33/SF = \$825
Posts for signs: 45 LF @ \$15/LF = \$675
Removal of existing signs: 1 @ \$80 each = \$80
Removal of existing pavement markings: 80 LF @ \$1/LF = \$80
Estimated subtotal: \$2,260
10% contingency: \$226
Estimated total: \$2,486

Estimate grand total: \$73,090