

PEDESTRIAN CROSSING GUIDANCE



Hillsborough MPO
Metropolitan Planning
for Transportation

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Purpose

This guide is intended to help Hillsborough MPO create safe pedestrian intersections at both signalized and unsignalized crossings. There are several pedestrian countermeasures that can help address safety, inconvenient crossing locations, and complete pedestrian networks with crossing opportunities. This guide aims to aid planners and engineers in identifying the best crossing treatments based on the context and presents best practice for implementation.

How to Use






This guide has been developed into two sections:

- 1 A matrix that uses roadway characteristics to identify potential crossing treatments that are appropriate for the street context; and,
- 2 A table of treatments and best applications of the treatment.

The first matrix is intended to provide guidance on WHAT treatments should be considered and the second table provides best practice guidance for each of those treatments.

Unsignalized Crossings

Uncontrolled pedestrian crossing locations occur at sidewalks or where other designated walkways intersect with the roadway at a place where there is no traffic control device (i.e. STOP sign or a traffic light). Uncontrolled pedestrian crossing locations typically happen at intersections (marked or unmarked) and midblock (mandatorily need to be marked) or non-intersection locations. Data shows that there is a higher pedestrian crash rate at uncontrolled crossing locations; this is due to a lack of adequate pedestrian crossing accommodations.

Roadway Configuration	Posted Speed Limit and AADT								
	Vehicle AADT <9,000			Vehicle AADT 9,000 - 15,000			Vehicle AADT >15,000		
	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph	≤30 mph	35 mph	≥40 mph
	1 2 4 5 6	1 7 5 6 9	1 7 5 6 9	1 4 5 6	1 7 5 6 9	1 7 5 6 9	1 4 5 6	1 7 5 6 9	1 7 5 6 9
	1 2 3 4 5	1 7 5 9	1 7 5 9	1 4 5 7 9	1 7 5 9	1 7 5 9	1 4 5 7 9	1 7 5 9	1 7 5 9
	1 2 3 4 5 6 7 9	1 7 5 9	1 7 5 6 9	1 4 5 6 7 9	1 7 5 6 9	1 7 5 6 9	1 4 5 6 7 9	1 7 5 6 9	1 7 5 6 9
	1 3 7 5 9	1 7 5 9	1 8 5 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9
	1 3 7 5 6 8 9	1 7 5 6 8 9	1 8 5 6 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9	1 7 5 6 8 9

Signifies that the countermeasure is a candidate treatment at a marked uncontrolled crossing location.

Signifies that the countermeasure should always be considered should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.

Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

1. High Visibility Crosswalk
2. Raised Crosswalk
3. Advanced "Yield Here" to pedestrians Signs
4. In-street Pedestrian Crossing Sign
5. Curb Extension
6. Pedestrian Refuge Island
7. Rectangular Rapid Flashing Beacon (RRFB)
8. Road Diet
9. Pedestrian Hybrid Beacon (PHB)

Unsignalized Crossing Treatments

Treatment	Cost	Typical Application	Requirements
High-Visibility Crosswalk Markings	\$	<ul style="list-style-type: none"> 2-lane roads Travel speed ≤ 25 mph Implementation of crosswalks should be strongly considered in conjunction with the following treatments identified in this matrix for streets over 25 mph and > 2 travel lanes 	<ul style="list-style-type: none"> Crosswalks shall consist of solid white lines not less than 6 inches or greater than 24 inches in width. the gap between the lines should not be less than 6 feet MUTCD Section 3B.18
Raised Crosswalk	\$\$	<ul style="list-style-type: none"> 2-lane or 3-lane roads Travel speed ≤ 30 mph Motor vehicle volumes < 9,000 	<ul style="list-style-type: none"> Drainage needs to be mitigated MUTCD Section 3B.25
Advance Yield Here To (Stop Here For) Pedestrians Sign and Yield (Stop) Line	\$	<ul style="list-style-type: none"> 4-lane roads or greater Travel speed ≥ 35 mph Uncontrolled pedestrian crossing In conjunction with an RFB application 	<ul style="list-style-type: none"> Should only be used where the law specifically requires that a driver must stop for a pedestrian in a crosswalk Place between 30 and 50 feet in advance of the marked crosswalk MUTCD Section 2B.11 and Section 3B.16
In-Street Pedestrian Crossing Sign	\$	<ul style="list-style-type: none"> 2-lane or 3-lane roads Travel speed ≤ 30 mph 	<ul style="list-style-type: none"> MUTCD Section 2B.12 Note: regular maintenance should be planned and budgeted for accordingly
Curb Extension	\$\$\$	<ul style="list-style-type: none"> 2-lane roads or greater Travel speed ≥ 25 mph A candidate treatment for any uncontrolled pedestrian crossing, particularly where parking lanes exist 	<ul style="list-style-type: none"> Should not extend into paths of travel for bicyclists Verify truck turning radius
Pedestrian Refuge Island/Median	\$\$\$	<ul style="list-style-type: none"> Undivided crossing of 4-lanes or greater Travel speed ≤ 35 mph Motor vehicle volumes $\geq 9,000$ A candidate treatment for crossings on wide 3- or 2-lane roads with moderate to high vehicle speeds or volumes 	<ul style="list-style-type: none"> Minimum pedestrian refuge island width is 4 feet; preferred is 6 feet MUTCD Section 3B.10, Section 3B.18, and Section 3B.23
Rectangular Rapid-Flashing Beacon (RRFB)	\$\$\$	<ul style="list-style-type: none"> Install at uncontrolled, marked crosswalks Undivided crossing of 4-lanes or greater Travel speed ≤ 35 mph Consider a PHB instead of RRFBs for roadways with higher speeds 	<ul style="list-style-type: none"> Do not install a PHB and RRFB at the same crossing location State and local agencies must request and receive permission to use Interim Approval 21 (IA-21) before they can use the RRFB Install in combination with pedestrian, school, or trail crossing warning signs
Road Diet	\$\$\$	<ul style="list-style-type: none"> 4-lane roads or greater Motor vehicle volumes < 20,000 	
Pedestrian Hybrid Beacon (PHB)	\$\$\$	<ul style="list-style-type: none"> 3-lane roads or greater Motor vehicle volumes > 9,000 Midblock crossings where the travel speed ≥ 40 mph 	<ul style="list-style-type: none"> Do not install a PHB and RRFB at the same crossing location Locate PHBs at least 100 feet away from an intersection MUTCD Section 4F.01 - See Figure 4F-1 for travel speeds ≤ 35 mph; Figure 4F-2 for travel speeds > 35 mph

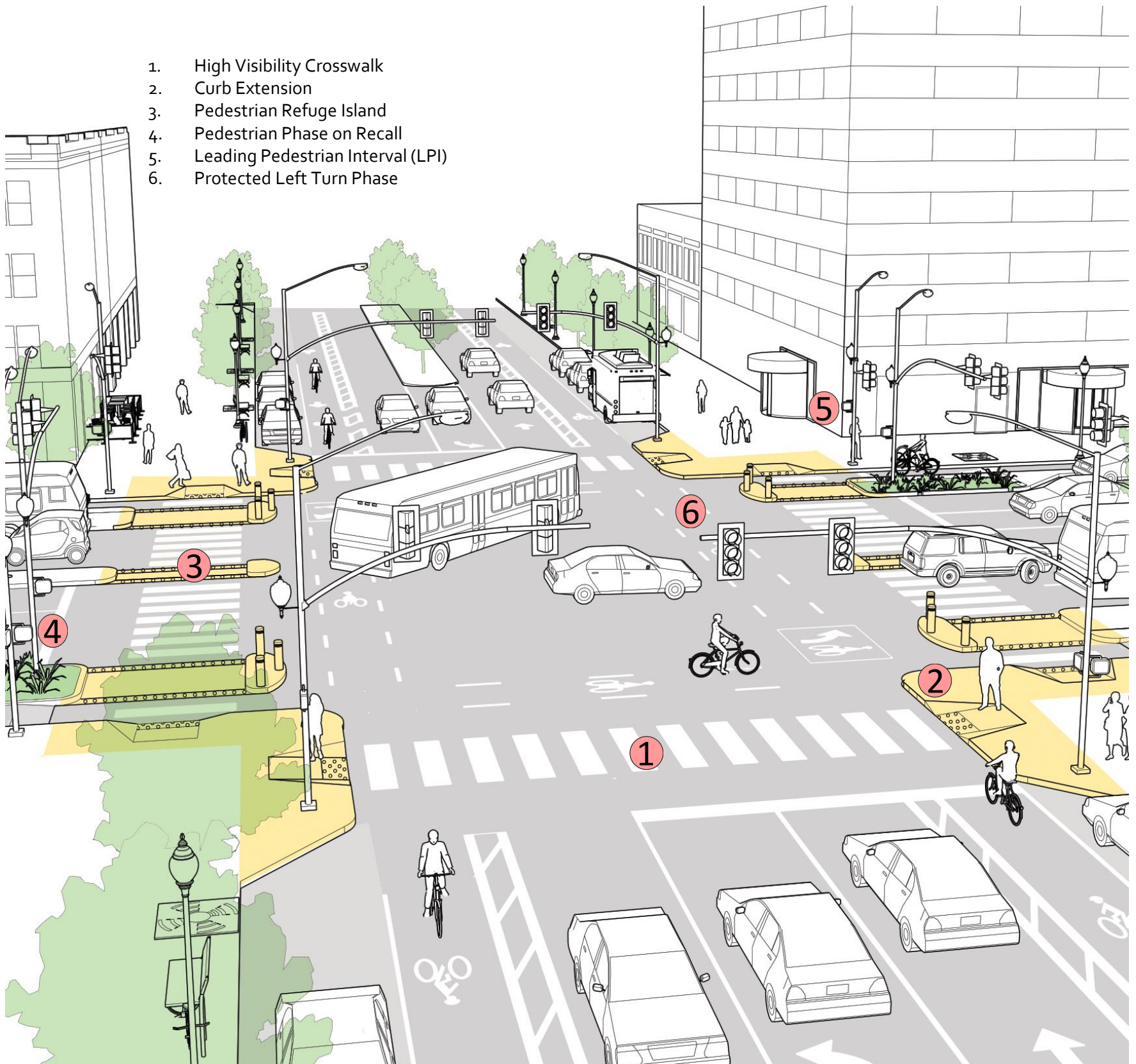
Signalized Crossings

While traffic movements are controlled by a signal, pedestrian crossings at signalized intersections still present conflict points. Managing the conflicts and minimizing the crossing distances can improve pedestrian safety and comfort. The key principals for signalization in a pedestrian-oriented environment includes:

- Keep cycle lengths short, between 60 seconds and 90 seconds.
- Provide a minimum walk time of 7 seconds before the Flash Don't Walk.
- In urban areas, coordinate signals for a 12 to 15 mph vehicle progression speed.
- In appropriate locations, have pedestrian phase on recall.
- Consider adjusting the cycle length and phasing for off-peak times of day.

In addition to signal treatments, geometric design that shortens crossing distances and slows turning vehicles manages conflict points and helps the environment line up with expectations for pedestrians and motorist.

1. High Visibility Crosswalk
2. Curb Extension
3. Pedestrian Refuge Island
4. Pedestrian Phase on Recall
5. Leading Pedestrian Interval (LPI)
6. Protected Left Turn Phase



Signalized Crossing Treatment

Treatment	Cost	Typical Application	Requirements
High-Visibility Crosswalk Markings	\$	<ul style="list-style-type: none"> 2-lane roads Travel speed \leq 25 mph Implementation of crosswalks should be strongly considered in conjunction with the following treatments identified in this matrix for streets over 25 mph and > 2 travel lanes 	<ul style="list-style-type: none"> Crosswalks shall consist of solid white lines not less than 6 inches or greater than 24 inches in width. the gap between the lines should not be less than 6 feet If diagonal or longitudinal lines are used without transverse lines to mark a crosswalk, the crosswalk should be not less than 6 feet wide. MUTCD Section 3B.18
Curb Extension	\$\$	<ul style="list-style-type: none"> 2-lane roads or greater Travel speed \geq 25 mph A candidate treatment for any uncontrolled pedestrian crossing, particularly where parking lanes exist 	<ul style="list-style-type: none"> Should not extend into paths of travel for bicyclists
Pedestrian Refuge Island/Median	\$\$\$	<ul style="list-style-type: none"> Undivided crossing of 4-lanes or greater Travel speed \leq 35 mph Motor vehicle volumes \geq 9,000 A candidate treatment for uncontrolled pedestrian crossings on wide 3-lane or 2-lane roads with moderate to high vehicle speeds or volumes 	<ul style="list-style-type: none"> Minimum pedestrian refuge island width is 6 feet MUTCD Section 3B.10, Section 3B.18, and Section 3B.23
Road Diet	\$\$\$	<ul style="list-style-type: none"> 4-lane roads or greater Motor vehicle volumes < 20,000 	
All Pedestrian Phase/Pedestrian Scramble	\$	<ul style="list-style-type: none"> Allows pedestrians to cross diagonally while vehicles on all sides of the intersection are stopped at a red signal High pedestrian volumes Removes pedestrian/vehicle conflicts in the intersection Note: should be used in conjunction with standard pedestrian crossing timing 	<ul style="list-style-type: none"> Bike phase should not be activated during a pedestrian scramble
Pedestrian Phase on Recall	\$	<ul style="list-style-type: none"> A pedestrian phase is typically served concurrently with the adjacent through movement At high pedestrian crossing locations, pedestrian recall ensures that the WALK indication is visible without having to use the push button 	

Sources:
 1.Blackburn, L., Zegeer, C., & Brookshire, K. (2018). *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* (No. FHWA-SA-17-072).
 2.Sadik-Khan, J. (2012). *Urban Street Design Guide*. New York: NACTO.

Signalized Crossing Treatments (Continued)

Treatment	Cost	Typical Application	Requirements
Leading Pedestrian Interval (LPI)	\$	<ul style="list-style-type: none"> Minimize conflicts between pedestrians and a high volume of left or right turning vehicles Provides pedestrians with a 3-7 second head start before vehicles are given a green light 	<ul style="list-style-type: none"> Accompany the LPI with an audible noise that lets visually impaired pedestrians know that it's safe to cross
No Right Turn on Red (NRTOR)	\$	<ul style="list-style-type: none"> Inadequate sight distance to vehicles approaching from the left (or right, if applicable) Geometrics or operational characteristics of the intersection that might result in unexpected conflicts An exclusive pedestrian phase An unacceptable number of pedestrian conflicts with right-turn-on-red maneuvers, especially involving children, older pedestrians, or persons with disabilities More than three right-turn-on-red accidents reported in a 12-month period for the particular approach The skew angle of the intersecting roadways creates difficulty for drivers to see traffic approaching from their left 	<ul style="list-style-type: none"> MUTCD Section 2B.54
Protected Left Turns	\$\$	<ul style="list-style-type: none"> Inadequate sight distance to vehicles approaching from the right Geometrics or operational characteristics of the intersection that might result in unexpected conflicts An exclusive pedestrian phase An unacceptable number of pedestrian conflicts with left turn only signalization maneuvers, especially involving children, older pedestrians, or persons with disabilities The skew angle of the intersecting roadways creates difficulty for drivers to see traffic approaching from their right 	<ul style="list-style-type: none"> MUTCD Section 4D
Cycle Lengths	\$	<ul style="list-style-type: none"> Short cycle lengths reduce overall pedestrian wait times as well as side street delay Long cycle lengths result in reduce pedestrian non-compliance Short green band reduces pedestrian delay 	<ul style="list-style-type: none"> A minimum WALK time of 7 seconds is required (MUTCD Section 4E.06) Adequate crossing time for pedestrians should be based on a crossing speed between 2.5–3.5 feet per second

Sources:
 1.Blackburn, L., Zegeer, C., & Brookshire, K. (2018). *Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations* (No. FHWA-SA-17-072).
 2.Sadik-Khan, J. (2012). *Urban Street Design Guide*. New York: NACTO.