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CITY OF DUBLIN

CROSSWALK TREATMENT GUIDELINES

PREPARED FOR



PREPARED BY

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The City of Dublin has long understood that providing sidewalks and paths is an integral ingredient in creating a great community. The City's more than 100 miles of



shared-use paths and 195 miles of sidewalks are evidence of a commitment to providing an environment for walking and biking throughout the City. As such, there are thousands of locations at which pedestrians and bicyclists may cross the City's streets.

Purpose

The purpose of this document is to provide the City of Dublin a consistent procedure when considering the installation of crossing treatments at uncontrolled crosswalk locations. These guidelines are intended to supplement the guidelines of the Ohio Manual of Uniform Traffic Control Devices (OMUTCD) and provide general criteria for uniform application of treatments and to assist the City in creating a safer and more consistent travel environment for all users.

The development of these guidelines is based on an inventory and review of crosswalk installations within the City, as well as reviews of guidelines from other communities, the OMUTCD, and research of the Federal Highway Administration (FHWA).

Crosswalk Definitions

The following definitions are helpful when considering the guidelines in the following sections.

An ***uncontrolled crosswalk*** is a legal crosswalk across a roadway approach not controlled by a stop sign or traffic signal.

A ***controlled crosswalk*** is a legal crosswalk across a roadway approach controlled by a stop sign or traffic signal. Controlled crosswalks are not included in the guidance in this document.

A ***midblock crosswalk*** is a location not at an intersection, featuring traffic control markings to indicate that it is a legal crosswalk.

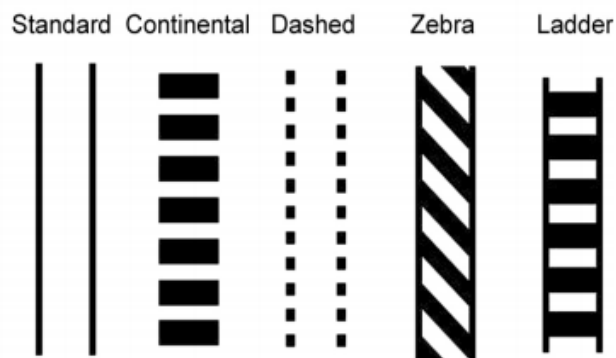
The installation of marked crosswalks should follow the guidance of the City of Dublin "Department of Public Works Policy and Procedure Traffic 15," which states that the City has adopted and follows the Ohio Manual on Uniform Traffic Control Devices (OMUTCD), Part 3 to ensure consistency in the use and placement of pavement

markings. All markings in the City of Dublin conform to the design standards contained in the manual.

Per the City of Dublin policy, crosswalk pavement markings include a variety of styles with the following guidance.

1. Continental style crosswalks are reserved for roundabout crosswalks.
2. Standard crosswalks, with 12-inch wide bars, typically spaced 8-feet apart, are used in normal crosswalk applications.
3. Ladder or zebra crosswalks, or stamped and colored asphalt, can be used, as determined by the City Engineer.

All crosswalk pavement markings shall be white. The figure below shows examples of crosswalk styles.



Recommendations regarding the use of ladder style crosswalk markings are included in the crosswalk treatment guidelines in this document.



Signing at Crosswalks

There are a variety of warning signs to designate crossing locations. Examples include S1-1 (School); W11-1 (Bicycle); W11-2 (Pedestrian); and W11-15 (Bicycle and Pedestrian). These signs can be used in combination with an arrow plaque (W16-7P) to designate a crossing location.

School (S1-1) signs are used to identify a school zone or a school crossing, following the guidance of Part 7 of the OMUTCD. The S1-1 signs also provide advanced warning for a school zone or crossing.

The preferred sign face color for signing at “School” crossings is fluorescent yellow-green. The preferred sign face color for other crossings is standard highway yellow.



Pedestrian Crossing Sign
W11-2 with W16-7P



School Sign S1-1



Bicycle Crossing Sign W11-1



Bicycle and Pedestrian
Crossing Sign W11-15

An active W11-2 sign could have LEDs in the border of the sign or flashing lights next to the sign. To maximize the effectiveness of the lights, the active portion of the sign should be activated only when a pedestrian or bicyclist is crossing. This can be done actively with a push button or passively with pedestrian/bicyclist detection.

The timing of the “flashing” interval of a Heightened Awareness Crossing device should be consistent with Section 4E.06 (Pedestrian Intervals and Signal Phases) of the OMUTCD.



Activated Pedestrian
Crossing Sign W11-2
with W16-7P

Types of Crossing Installations

The appropriate combination of pavement markings and signs at individual crossings are dependent on the conditions at the crossing and the surrounding context of land use and pedestrian/bicycle connections. The following categories provide a typology for the application of crosswalk treatments in Dublin to provide consistent treatments at similar locations.

Unmarked Crossings (Category 1)

This category includes locations where pedestrians and bicycles can legally cross, but no crosswalk markings, signs, or signals are present.

Marked Crosswalks (Category 2)

A pedestrian or bicycle crossing that is delineated by white parallel line crosswalk pavement markings.

Marked Crosswalks with Signs (Category 3)

These installations include white crosswalk pavement markings (parallel lines, ladder, or zebra) supplemented by Pedestrian Crossing (W11-2), Bicycle Crossing (W11-1), Bicycle and Pedestrian Crossings (W11-15), or School (S1-1) signs, typically with supplemental W16-7P arrow plaques.

Heightened Awareness Crossings (Category 4)

This category includes a marked crosswalk (parallel lines, ladder, or zebra) with activated crossing warning signs (W11-2, W11-1, W11-15, or S1-1) with LEDs or flashing lights. The signs are mounted on either pedestals or posts at the side of the road and are activated by a push button or a motion sensor. In special circumstances, these may include the use of mast arms with the active signs installed over the street.



Crosswalk Treatments Guidelines

The following guidelines are provided relative to the installation of crossing treatments at uncontrolled crossing locations. For any location being considered, the appropriate treatment may be no markings or signing. To be eligible for consideration of any type of crosswalk treatment, the crossing must include curb ramps and sidewalk or path connections.

Unless there are extenuating circumstances, crosswalk treatments should generally not be considered on a street classified as “Local” by the city’s thoroughfare plan.

Where the combination of the ADT, number of lanes, and posted speed limit result in a “N” when plotted in Table 1, marked crosswalks and signing alone are not recommended (see the Additional Treatments section of this guidance).

Marked Crosswalk (Category 2)

Installation of a marked crosswalk should be considered where the following criteria are met:

- Two- or three-lane crossing; and
- Concentrated pedestrian/bicyclist demand or pedestrian/bicyclist destination such as a school or park; and
- The combination of the ADT, number of lanes, and posted speed limit result in a “C” square when plotted in Table 1.

Marked Crosswalk with Signs (Category 3)

Installation of crossing signs with the marked crosswalk may be considered where the criteria for Category 2 are met, and:

- The roadway is two- or three-lanes and is classified as a “Collector” or higher level; and
- One of the following are met;
 - The crosswalk is adjacent to a school; or
 - The roadway has an average daily traffic greater than 3,000 vehicles per day; and

The combination of the ADT, number of lanes, and posted speed limit result in a “C” square when plotted in Table 1.

Heightened Awareness Crossings (Category 4)

Consider installation of “Heightened Awareness” active signs at an uncontrolled crossing of a two- or three-lane roadway classified as a “Collector” or higher, when one of the following criteria are also met:

- The average daily traffic is 3,000 vehicles per day or greater at a midblock crossing, or 6,000 vehicles per day or greater at an intersection; and
 - The crossing is adjacent to a School, or
 - The crossing is adjacent to a Park or Special Point of Interest, or
 - The crossing is part of an important Shared-Use Path connection. The crossing should be part of a path designated by the Dublin Bikeway Map with the SUP being more than one mile in length and connecting to at least one point of interest as designated by the City. Another factor for consideration may be a crossing where the SUP changes from one side of a street to the other, and users must cross to continue on the SUP.
- The street has an average daily traffic greater than 9,000 vehicles per day and the combination of the ADT, number of lanes, and posted speed limit result in a “C” or “P” when plotted in Table 1.

Additional enhancements that provide notice for drivers in the inside lane, such as redundant signs or other possible treatments, should be considered for uncontrolled crossings of four or more lanes where the Heightened Awareness crossing is determined to be the appropriate treatment.

The timing of the “flashing” interval of a Heightened Awareness Crossing device should be consistent with Section 4E.06 (Pedestrian Intervals and Signal Phases) of the OMUTCD. At a minimum, the “flashing” interval should include the sum of a start-up time of 5 to 7 seconds and a clearance interval sufficient to allow a pedestrian crossing in the crosswalk who left the curb or shoulder at the end of the start-up interval to travel at a walking speed of 3.5 feet per second, to at least the far side of the traveled way or to a median of sufficient width for pedestrians to wait. It is acceptable to have a longer “flash” interval, if observations or engineering judgement of the local conditions deem this necessary.



Table 1 – Guidelines for Installation of Crosswalk Treatments at Uncontrolled Crossings

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT <9,000			Vehicle ADT >9,000 to 12,000			Vehicle ADT >12,000 to 15,000			Vehicle ADT >15,000		
	<35 mph	35 mph	40 mph	<35 mph	35 mph	40 mph	<35 mph	35 mph	40 mph	<35 mph	35 mph	40 mph
Two Lanes	C	C	P	C	C	P	C	C	N	C	P	N
Three Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Four or more lanes with raised median *	C	C	P	C	P	N	P	P	N	N	N	N
Four or more lanes without raised median	C	P	N	P	P	N	N	N	N	N	N	N

(adapted from "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations" - FHWA, 2005).

*- see the reference for of a raised median on Page 8 of this document.

C = Candidate sites for marked crosswalks.

P = Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk. These are locations for which Heightened Awareness Crosswalk treatments may be considered, however the appropriate treatment may also be no markings or signing.

N = Marked crosswalks alone are insufficient and not recommended, since pedestrian crash risk may be increased by providing marked crosswalks alone. Consider using other treatments to reduce the crash risk, such as a median refuge, pedestrian hybrid beacon, or a pedestrian traffic signal (see Additional Treatments section). The appropriate treatment may also be no markings or signing, or removal of an existing crosswalk.

Additional Considerations

The following information has been compiled from the literature research including the OMUTCD, "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations" - FHWA, 2005, and the crosswalk guidelines of other communities such as Boulder, Colorado.

The Ohio Manual of Uniform Traffic Control Devices (OMUTCD, 2012) provides support, standards and guidance for traffic control devices used for marking and enhancing crosswalks. The OMUTCD has incorporated research from "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations" - FHWA, 2005, and states:

Crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic

control signal or an approach controlled by a STOP or YIELD sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and either:

- A. The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater; or*
- B. The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater.*

The number of lanes, speed, and ADT referenced in the above OMUTCD guidance are consistent with the selection criteria outlined in Table 1.

Crosswalks should not be installed at locations that could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing intersections, a substantial volume of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding marked crosswalks alone will not make crossings safer, nor will they necessarily result in more vehicles stopping for pedestrians.¹

Crosswalk Markings

Ladder style crosswalks markings are appropriate for Category 3 and Category 4 crossings at midblock locations where the ADT is 3,000 vehicles per day or greater, and at intersection crossings where the ADT is 6,000 vehicles per day or greater.

Raised Medians (Pedestrian Refuge Island)

A raised median or crossing island must extend through the crosswalk and be at least 4 feet wide and 6 feet long (in the direction of pedestrian travel) to serve adequately as a refuge area for pedestrians. A two-way center turn lane is not considered a median.¹

¹ Source: FHWA, Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations

Midblock Crossings

Consideration should be given to keeping midblock crosswalks away from locations where there are auxiliary lanes (left or right turn lanes or their transitions) because it is anticipated that vehicles will be changing lanes and may be distracted from observing pedestrians in the crosswalk.² The driver's view of pedestrians may be blocked at locations where traffic stops or is queued, a situation that should also be avoided.

Proximity to Nearest Marked or Protected Crossing

A new marked crossing should be at least 300 feet from the nearest controlled or Heightened Awareness (Category 4) crossing. However, this spacing criterion may be waived if the proposed crossing serves an important shared-use path, or there is a significant pedestrian crossing volume.³

Distance to Grade-Separated Crossing

A new marked crossing should be at least 300 feet from the nearest grade-separated crossing. However, this spacing criterion may be waived if the proposed crossing serves an important shared-use path, or there is a significant pedestrian crossing volume.

Crosswalk Lighting

FHWA research indicates that adequate nighttime lighting should be provided at marked crosswalks to enhance the safety of pedestrians crossing at night. Crosswalk lighting should be provided at all Heightened Awareness (Category 4) crosswalks, at Pedestrian Hybrid Beacons, and at traffic signals. Crosswalk lighting should be considered for marked crosswalks, unless engineering judgement suggests crosswalk lighting is not needed. The City of Dublin's neighborhood dark skies policy will need to be considered as part of this determination. If crosswalks are installed at a location where street lighting is not present, reflective pavement markings should be used.

Avoiding Overuse of Crossing Treatments

The FHWA recommends that overuse of crosswalk markings be avoided to maximize their effectiveness. Crosswalks and sign treatments (such as the "State Law – Yield to Pedestrians" and heightened awareness crosswalk treatments) should be used discriminately within the City so that the effectiveness of these treatments is not deteriorated by overuse. Although these treatments may be effective at individual

² Source: City of Boulder, CO, Pedestrian Crossing Treatment Installation Guidelines

³ Source: City and County of Denver, Uncontrolled Pedestrian Crossing Guidelines

locations, overuse of these treatments city-wide may lead to a decrease in their value as drivers become desensitized to them.

Textured and Colored Pavement Treatments

Textured, brick, and/or colored pavement treatments should typically not be used in lieu of a marked crosswalk. However, in those instances when such treatments are used they should include retroreflective pavement markings or street lighting. ⁽⁴⁾

Removal of Treatments

Conditions that contribute to the need for a crosswalk or crossing treatments may change over time, and an existing crosswalk or treatment may no longer be needed. In other cases, traffic volume or speed increases, roadway widening, or installation of nearby traffic signals may make the crosswalk location no longer an appropriate or viable crossing treatment location. When a roadway surface is to be impacted by reconstruction or resurfacing, a review of any uncontrolled crosswalks should be performed to determine their appropriateness.⁴

Additional Treatments

For locations where the traffic volumes, speeds, and number of lanes indicate that treatments beyond markings, signs, or heightened awareness crosswalk installations may be necessary, the following should also be given consideration.

Pedestrian Hybrid Beacon

The Pedestrian Hybrid Beacon (PHB), formerly called a HAWK signal, is a special type of hybrid beacon used to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk. The device is a hybrid between a pedestrian traffic signal and a stop sign. It can be actuated by a push button or passive detection device and uses a combination of circular yellow and red traffic signal displays to first warn motorists of a pedestrian that is about to cross the street, then require the motorist to stop for the pedestrian crossing, and then releases the motorist to proceed once the pedestrian



Pedestrian Hybrid Beacon
Displaying Alternating Flashing Red
During Pedestrian Change Interval

⁴ Source: City of Boulder, CO, Pedestrian Crossing Treatment Installation Guidelines

has cleared the crossing. Guidance on the use of PHB's is contained in Chapter 4F of the OMUTCD.

Pedestrian Traffic Signal

A traffic signal with circular red, yellow, and green displays for motorists and Walk/Don't Walk signals for pedestrians may be installed to control a crosswalk location. Guidance and warrants for the use of pedestrian signals is included in sections 4C and 4E of the OMUTCD.

Reference Documents

The following documents were reviewed to help develop criteria and guidelines for the installation of traffic control devices at a crosswalk location.

- 1- "Ohio Manual of Uniform Traffic Control Devices," Ohio Department of Transportation, 2012
- 2- "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations," (FHWA, 2005).
- 3- "Uncontrolled Pedestrian Crossing Guidelines" (City and County of Denver, October 2017)
- 4- "Pedestrian Crossing Treatment Installation Guidelines" (City of Boulder, November 2011)
- 5- Crosswalk Evaluation Guidance, Hennepin County, Minnesota
- 6- NCDOT Pedestrian Crossing Treat Evaluation Guidance
- 7- Pedestrian Crossing Site Evaluation Guidelines for Uncontrolled Crossings, City of Saint Paul, May 2018
- 8- SFMTA Crosswalk Guidelines, May 2014
- 9- Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations, FHWA, July 2018 (Updated)
- 10- Pedestrian Safety Guide and Countermeasure Selection System, Pedbikesafe.org

Most of these documents refer to FHWA research documented in "Safety Effects of Marked Versus Unmarked Crosswalks at Uncontrolled Locations" (FHWA, 2005).