

# CROSSWALKS



## POLICY AND STANDARDS



## CITY OF DOVER, NEW HAMPSHIRE

April 26, 2010

City of Dover

J. Michael Joyal, Jr., City Manager  
Christopher G. Parker, Director of Planning and Community Development  
Anthony F. Colarusso, Jr., Chief of Police  
Douglas W. Steele II, Director, Community Services

Prepared by:

Sgt. Marn E. Speidel, Traffic Bureau, Dover Police Department  
Bruce W. Woodruff, City Planner

Transportation Advisory Commission

Councilor Karen Weston, Chair  
John Flick  
Dennis Munson  
Peter Schmidt  
John Scruton  
William Wentworth  
Benjamin Clark (Community Services)  
Marn Speidel (Police)  
Bruce Woodruff (Planning)

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## **1.0 INTRODUCTION**

### **1.1 DEFINITION**

A “crosswalk” is defined as that part of a highway at an intersection included within the connections of the lateral lines on opposite sides of the highway measured from the curbs, or in the absence of curbs from the edges of the traversable highway or any portion of a highway at an intersection or elsewhere distinctly indicated for pedestrian crossing by lines or other markings on the surface.<sup>1</sup>

### **1.2 PURPOSE**

The purpose of this document is to describe the criteria for the installation of marked crosswalks and the design guidelines to be used for crosswalk markings and related signs in the City of Dover. These apply only to roadways and intersections maintained by the municipality. Compliance with these standards will ensure that the pavement markings and signs associated with pedestrian crossings are treated consistently throughout the City of Dover. This document will provide a basis for evaluating proposed new crosswalks as well as a basis for evaluating existing crosswalks in the City.

This policy incorporates guidance and standards contained in the *Manual on Uniform Traffic Control Devices* (MUTCD), 2009 Edition, published by the US Department of Transportation and Federal Highway Administration. Other references include *A Policy on Geometric Design of Highways and Streets*, 5<sup>th</sup> Edition, published by the American Association of State Highway and Transportation Officials (AASHTO).

### **1.3 STATEMENT OF POLICY**

It shall be the policy of the City of Dover to provide for safe pedestrian crossings of public streets by installing and maintaining marked crosswalks at locations where there is substantial conflict between vehicle and pedestrian movements, where significant pedestrian concentrations occur, and where pedestrians would not otherwise recognize the proper place to cross. This policy is predicated on adequate funding for installation and maintenance of any measures described herein.

Under most conditions, state law provides that pedestrians have the right-of-way within a crosswalk. This causes many pedestrians to feel overly secure when using a marked crosswalk. Pedestrians often place themselves in a hazardous situation by assuming that motorists will stop. Sudden or aggressive movements by pedestrians can contribute to a higher rate of pedestrian collisions and a higher rate of rear end collisions. Pedestrian collisions often translate to bodily injury. In contrast, a pedestrian crossing at other than a marked crosswalk (where motorists have the right-of-way) will typically feel less secure and will exercise more caution by waiting for safe gaps in the traffic flow. This can contribute to

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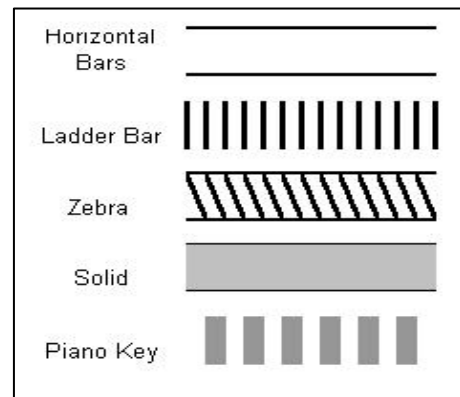
<sup>1</sup> New Hampshire Revised Statutes Annotated (RSA) 259:17

a lower rate of pedestrian collisions. Accordingly, the justification for any crosswalk must be sufficiently compelling as to outweigh this safety concern.

## 2.0 CROSSWALK MARKINGS

### 2.1 CROSSWALK MARKING PATTERNS

Shown are examples of some of the more common crosswalk marking schemes:



The primary marking scheme employed in the City of Dover will be the **Zebra** configuration. This consists of two parallel white lines connected by diagonal white stripes. The spacing of the diagonal lines shall generally not exceed 2.5 times the line width.



A secondary marking scheme is the **Horizontal Bars** configuration. This consists of two parallel white lines. These will generally be used only at “controlled crossings” - intersections where traffic signals or stop signs are present to control the flow of vehicle traffic.



A third option is the use of **Textured Crosswalks**. This treatment may be used in commercial areas or school zones to enhance the aesthetics of the crosswalks. In areas where the texture is patterned after the connecting sidewalks, this can create a uniform pedestrian facility system that reduces confusion for drivers and pedestrians alike. A colored pigment is used in the interior to give the appearance of brick.



The City Engineer shall have the discretion to employ alternative marking schemes if deemed to meet applicable safety standards.

## 2.2 CROSSWALK MARKING WIDTH AND COLOR

On any of the crosswalk marking schemes, transverse lines shall be solid white in color with a minimum width of 12 inches. Diagonal lines in the Zebra configuration shall have a minimum width of 12 inches. The spacing of these diagonal lines shall generally not exceed 2.5 times the line width.

All crosswalks shall have a minimum width (distance between the outer edges of the transverse lines) of 8 feet. At *mid-block* crossing locations, it is recommended that the crosswalk width be at least 10 feet.

## 2.3 CROSSWALK MARKING MATERIALS

Crosswalk markings should be visible to motorists, should not be slippery or create tripping hazards, and should not be difficult to traverse by persons with diminished mobility or visual impairment. All crosswalk markings shall be installed using one of the following:

- a) a paint suitable for application on asphalt surfaces, in combination with glass beads or suitable other reflective material
- b) an epoxy or thermoplastic material suitable for application on asphalt surfaces, in combination with glass beads or other suitable reflective material
- c) another acceptable material with sufficient reflective properties as determined by the City Engineer

## 2.4 MAINTENANCE

The Community Services Department shall be responsible for the maintenance of crosswalk markings, related signs and signals. All crosswalk markings should be maintained in a high state of visibility and meet reflectivity standards. Reapplication may be appropriate in cases where new asphalt has been applied or where crosswalk markings are substantially faded and no longer visible to approaching motorists. Existing crosswalk markings shall be inspected annually and reapplied at least once in every 12 month period, except in the following situations:

- a) where the markings remain readily visible and appropriately reflective as determined by the City Engineer
- b) where a crosswalk study has recommended that a particular crosswalk be removed

## 2.5 INVENTORY

An inventory of all City-maintained crosswalks shall be maintained by the office of the City Engineer. The inventory will include such features as location, pattern, length, width, and other categories as determined to facilitate an ongoing evaluation. Crosswalks will be categorized into three main groups:

- a) **Signalized** (generally where a signal is timed to accommodate a specific pedestrian phase)
- b) **Intersection Related** (generally where the flow of vehicle traffic is controlled by a stop or yield sign, or at an unregulated intersection where vehicle traffic must yield when entering a main street from a side street or driveway)
- c) **Mid-Block** (generally any crosswalk that does not fall into the previous two categories)

The *Mid-Block* category does not solely include crossings located at a midpoint between connecting side streets; it also includes crossings at intersections where the flow of traffic is uncontrolled on the street served by the crosswalk.

## 3.0 CROSSWALK PLACEMENT STUDY

Crosswalk markings shall not be applied indiscriminately, especially at *mid-block* locations. Requests for marked crosswalks at *intersection related* or *mid-block* locations shall be subject to a crosswalk placement study to determine if the criteria and warrants are satisfied. Crosswalk studies shall be prepared using a team approach involving Planning, Police, and Engineering staff. After collecting any required data, staff will complete (either collectively or individually) a crosswalk study template for each specific location. If necessary, individual templates will be combined to a collective template by arithmetic mean. The collective recommendation of City staff will be provided to the Transportation Advisory Commission.

The components of a crosswalk placement study may vary by location and grouping category. Study criteria will include consideration of the following:

- Traffic speed and volume on the affected street(s)
- Stopping sight distance in all approach directions
- Street characteristics including grade, curvature, pavement width, number of lanes, location of drainage structures, location of adjacent driveways
- Pedestrian origins, destinations and crossing patterns, including the following:
  - Known walking routes to a school
  - Connections to and from transit services
  - Connections to significant retail, services, and medical sites
- Pedestrian volume, age, and level of mobility - especially where potential mobility limitations may be present
- On street parking
- Area and street lighting
  - May include evaluation of light intensity from nearby street lamps and/or a recommendation for dedicated down lighting near the crosswalk
- Distance to nearest marked crossing
- Potential conflicting attention demands for motorists
- Potential to concentrate multiple pedestrian crossings to a single area
  - *Mid-block* crosswalks are unlikely to be effective if pedestrian crossings occur at random locations within a block and if vehicle volumes are low or moderate (adequate gaps are available for pedestrians)
- Potential to clarify a preferred crossing location because the proper location would otherwise be confusing
- Potential for rear-end collisions

Proposals for new marked crosswalks at *mid-block* locations should automatically be rejected if any of the following criteria is determined to exist:

- Posted speed limit exceeds 35 mph or the 85<sup>th</sup> percentile speed exceeds 40 mph
- Less than 15 pedestrians use the crossing during the peak AM and PM periods of vehicular traffic (lesser volumes may be considered where children, elderly, or disabled individuals make up a large percentage of the pedestrian population)
- Average daily traffic volume for the roadway (both directions combined) is less than 3,000 vehicles per day
- A sidewalk or adequate shoulder for use by pedestrians, or a distinct pedestrian destination such as a recreation field, does not exist on both sides of the roadway approach
- Existing street lighting at the proposed location is inadequate and is not scheduled for installation (note: installation of lighting may be made a condition of the recommendation)
- Another crosswalk across the same roadway is located within 300 feet (200 feet if the location is on an established school route)

- Inadequate stopping sight distance exists for either approach direction as determined in accordance with AASHTO standards

This policy does not preclude an informal review and evaluation of a requested crosswalk by any member of the Police, Planning or Engineering staff, if the requestor is satisfied with the review. Any citizen or group requesting a formal review of a crosswalk proposal shall be referred to the Transportation Advisory Commission, whereupon a more detailed crosswalk study may be prescribed.

A crosswalk placement study should include a recommendation on any **supplemental measures**, including any **special treatments**, which may be required to enhance pedestrian safety. These measures may be expressed conditions of any recommendation. No new crosswalk should be installed without provision for all expressly conditioned supplemental measures.

#### **4.0 SUPPLEMENTAL MEASURES**

##### **4.1 SIGNALS**

Pedestrian crossing signals work with vehicular traffic signals to provide an interval for pedestrians to cross the roadway with limited (or no) conflicting vehicular movement. At signalized intersections, programmed phases must allow adequate time for pedestrians to cross. Protected pedestrian phase timings shall meet the minimum standards provided in the MUTCD.

Audible pedestrian signals should be used when an engineering study indicates that there is significant use of the adjacent sidewalk system by blind pedestrians.

At *mid-block* crossing locations, signals should be activated only when pedestrians are present. Pedestrian signals should be used at crossings where vehicle movements alone could confuse the pedestrian in terms of when and where they should cross, or if the crossing of one leg of an intersection is broken into two phases due to conflicting vehicle movements. Pedestrian phased signals shall be used at any signalized school crossing location.

##### **4.2 WARNING SIGNS**

Crossing signs alert road users to possible entries into the roadway by pedestrians, bicyclists, animals, and others, and are used to indicate either a specific crossing area, or a region in which crossings may randomly occur. These signs can be supplemented with additional information that specifies the location, distance ahead, or length of the crossing area. These signs should be recommended at all *mid-block* crossing locations. They are not recommended for controlled intersection approaches, except where special circumstances exist that may require enhanced driver awareness.



Sign shapes shall be the standard diamond warning symbol (W11-2) or, in the case of crosswalks within school zones or on established school routes, the School Advance Warning or School Crossing Warning signs (S1-1).



Advance warning signs, when used, shall be installed in each direction at a distance of at least 150 feet but not exceeding 700 feet in advance of the crosswalk. When a warning sign is placed at a crosswalk, a diagonal downward arrow plaque (W16-7p) shall be installed at each end of the crosswalk adjacent to the travel lane and facing the driver. On two-lane, one-way roadways, warning signs shall be placed on both sides of the roadway. Where substantial pedestrian/vehicle conflicts exist on two-way roadways, warning signs may be installed on both sides facing both directions.

Such signs shall be of reflective yellow or yellow-green background color with black lettering and symbols. The fluorescent yellow-green sign is more visible in the dark as it reflects light better than the traditional yellow warning signs, and stands out better in the daylight as well. This color scheme is recommended for use in the downtown area and for new installations on school routes.



The use of any particular color scheme for pedestrian warning signs should be consistent through any particular zone or area. The mixing of standard yellow and fluorescent yellow-green within a selected site area should be avoided.

The recommended size for the W11-2 and related signs is 30" x 30" on conventional single lane roadways. The minimum size used shall be 24" x 24". Signs should be placed at sufficient height to be visible to approaching drivers above any other obstructions.

### 4.3 LIGHTING

The distance at which a driver can see a pedestrian well enough to be able to respond appropriately to the pedestrian's presence is an important factor in night time considerations. The greater the visibility distance, the more time a driver will have to react to the pedestrian before a conflict occurs. The fundamental basis of an object's visibility is its contrast.<sup>2</sup>

Contrast is the difference between the visual appearance of an object of interest and the visual background against which the object is observed. There are generally two aspects of contrast: color contrast and luminance contrast. Color contrast is based on the difference in color between an object and its background (for example, a blue object against a green background). Luminance contrast is based on a difference in the measured brightness of the object and its background. At night, luminance contrast is the primary means by which an object is detected.

Several factors affect the luminance contrast between pedestrians and their visual backgrounds. These include roadway lighting, headlamp lighting, pedestrian clothing, and the characteristics of the visual backgrounds. Of these factors, only roadway lighting can be controlled and evaluated for purposes of a crosswalk placement study. Headlamps are determined by vehicle manufacturers, clothing is chosen by pedestrians, and visual background is a function of many potentially variable factors.

Overhead road lighting installed at crosswalks generally provides greater visibility distance than headlamps alone to illuminate a scene. The effectiveness of overhead lighting (by increasing luminance contrast) is a function not only of the color and intensity of the emitted light source but the location and orientation of the light source.

Arrangements may be made at the discretion of the City Engineer to measure the specific intensity of light sources as part of a crosswalk placement study, which shall be evaluated in accordance with AASHTO or other applicable standards. In the absence of specific measurements, City staff should still consider:

- The general intensity and sufficiency of nearby street lamps
- The position of nearby light sources in relation to the crosswalk
  - A downward pointed light source directly over the crosswalk may provide high pavement luminance but may not provide sufficient luminance contrast of the pedestrian.<sup>3</sup> Consideration should be given to offsetting the light source to help illuminate the pedestrian from the driver's perspective.

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<sup>2</sup> Informational Report on Lighting Design for Midblock Crosswalks, FHWA-HRT-08-053, April 2008

<sup>3</sup> Informational Report on Lighting Design for Midblock Crosswalks, FHWA-HRT-08-053, April 2008

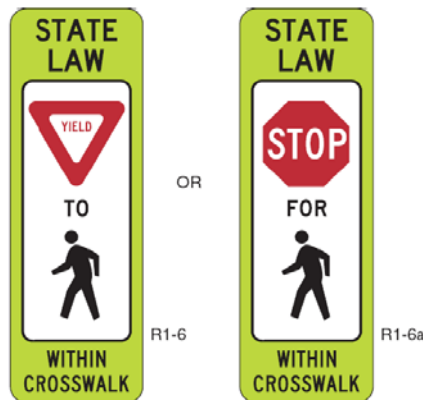
- For roadways with traffic traveling in both directions, particularly those without a center median, two light sources may be necessary.
- Other ambient light sources
- Propensity for night time use of crosswalk vs. exclusive day time use (it should be assumed that all crosswalks will be used at night unless specific pedestrian origin and destination data suggests otherwise)

**5.0 SPECIAL TREATMENTS**

Studies have shown that the speed of the vehicle is a significant factor in determining the level of injury to a pedestrian when involved in a collision with a motor vehicle. As vehicle speed increases, the percentage of collisions resulting in a pedestrian fatality increases and the percentage of pedestrians who escape the collision with little or no injury declines. Traffic Calming works to reduce the speed, volume and/or pattern of movement of motor vehicles through residential and other sensitive areas. This is accomplished in a variety of different methods that are useful for improving pedestrian safety and mobility as well. The City shall employ special treatments at all new crosswalks, if indicated as a requirement by the individual crosswalk study. To the extent of available funding, the City will employ special treatments at existing crosswalk locations if recommended by an individual crosswalk study.

**5.1 IN-STREET PEDESTRIAN CROSSING SIGNS**

The In-street Pedestrian Crossing (R1-6) sign may be used to remind road users of the state law that a driver must yield to a pedestrian in a crosswalk at an uncontrolled pedestrian crossing. Permission to place an In-street Pedestrian Crossing sign at a particular location requires review and recommendation of the Transportation Advisory Commission and concurrence by the City Engineer.



Guidelines for sign use and placement include:

- a) One In-street Pedestrian Crossing sign is allowed per crosswalk location.
- b) The In-street Pedestrian Crossing sign shall not be used on the approaches to a signalized intersection.

- c) The In-street Pedestrian Crossing sign should be placed at the roadway centerline adjacent to the crosswalk, not within the crosswalk itself.
- d) If a central island is provided in the street, the sign should be placed on the island.
- e) If used, the In-Street Pedestrian Crossing sign shall have a black legend (except for the red YIELD sign symbol) and border on either a white and/or florescent yellow-green background.
- f) If the In-Street Pedestrian Crossing sign is placed in the roadway, the sign support shall comply with the breakaway requirements of the latest edition of AASHTO's *Specification for Structural Supports for Highways Signs, Luminaries, and Traffic Signals*.
- g) The In-Street Pedestrian Crossing sign may be used seasonably to prevent damage in winter because of plowing operations, and may be removed at night if the pedestrian activity at night is minimal.

## 5.2 MEDIAN REFUGE ISLANDS

Median Refuge Islands provide a safe place for pedestrians in the middle of the roadway while also serving the purpose of separating two directions of traffic. They are especially helpful at locations where the roadway is wider than two lanes and pedestrians may have difficulty crossing the entire roadway in one attempt either due to high volumes of traffic, or short traffic signal phases. A median refuge island is recommended at any signalized intersection where pedestrian crossings of a single leg are done in two phases, and at *mid-block* crossings of large roadways with multiple lanes. In lieu of raised curbs, Median Refuge Islands could be painted on the pavement as a cost saving measure unless traffic volumes and patterns are deemed to negate safety aspects of the striped refuge area.



## 5.3 CURB EXTENSIONS AND BULB-OUTS

Extending the sidewalk and curb out into the roadway narrows the crossing distance at that location, and provides multiple benefits for the area. This type of improvement usually expands the curb/sidewalk out beyond any portion of the roadway set aside for parking, which improves visibility for both drivers approaching the crosswalk and pedestrians waiting to cross. Shorter crossing distances for the pedestrian also translate into less

exposure to oncoming traffic, and shorter vehicle waiting times when a pedestrian is crossing.

An additional benefit is that the narrowing of the roadway causes drivers to generally reduce their speed due to the perception that there is less room for the vehicle to pass through. This can work well in areas such as business and retail districts where angle or parallel parking is allowed on the street and pedestrians must use crosswalks that are close to parked cars. Although in some cases extensions and bulb-outs may be installed to restrict turning movements, care must be used in their placement so as not to unintentionally impinge on the turning movements of larger vehicles and trucks. Consideration should also be given to winter maintenance and surface drainage.

#### 5.4 PARKING RESTRICTIONS

Parking restriction is a method of improving pedestrian safety near crossings by increasing the sight distance for both drivers and pedestrians. Restricting parking within a certain distance of a crosswalk enables the pedestrian to better see approaching vehicles, as well as allowing approaching drivers to better see pedestrians. A minimum parking setback of 20 feet from the near side of the crosswalk to the nearest parking space should be used. When curb extensions or bulb-outs are present, this distance may be shortened. A crosswalk study may recommend increasing the distance near schools, on roadways where the speeds are greater than 35 mph, in areas where sight distance is obstructed by road geometry or roadside objects, or at unsignalized intersections.



Consideration for parking restrictions as a special treatment to enhance safety should, if applicable, take into account the City’s downtown parking inventory or any other parking demands in the affected area.

## CITY OF DOVER CROSSWALK STUDY TEMPLATE

Location (primary street): \_\_\_\_\_  
 Cross street or location: \_\_\_\_\_  
 Crosswalk Category: \_\_\_\_\_  
 (Intersection Related / Mid Block)

**DATA (include "e" if estimated):**

Posted speed limit	_____	Volume (VPD)	_____
Traffic speed (average)	_____	Volume (AM / PM peak)	_____
Traffic speed (85th percentile)	_____	Sight Distance (all approaches)	_____

**RATING CRITERIA (circle one):**

1 = *Strongly Disagree*      4 = *Possibly*      7 = *Probably*      10 = *Strongly Agree*

- |   |   |   |   |   |   |   |   |   |   |    |
|---|---|---|---|---|---|---|---|---|---|----|
| Proposed location connects existing sidewalks, stairways, walkways, or other pedestrian paths.            | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Comments: _____   |   |   |   |   |   |   |   |   |   |    |
| Pedestrian origins, destinations and crossing patterns are sufficient for a crosswalk installation.       | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Comments: _____   |   |   |   |   |   |   |   |   |   |    |
| Proposed location is unlikely to require special measures for pedestrians with mobility limitations.      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Comments: _____   |   |   |   |   |   |   |   |   |   |    |
| Adequate stopping sight distance exists or can be obtained in all applicable directions.                  | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Comments: _____   |   |   |   |   |   |   |   |   |   |    |
| At this location, a single crossing point is safer than a diffuse pedestrian flow across multiple points. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Comments: _____   |   |   |   |   |   |   |   |   |   |    |
| Area and street lighting is sufficient to cover this crosswalk in all approach directions.                | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Comments: _____   |   |   |   |   |   |   |   |   |   |    |
| Nearest marked crossing(s) are not sufficient to meet the demand at this location.                        | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Comments: _____   |   |   |   |   |   |   |   |   |   |    |

**SUPPLEMENTAL MEASURES NEEDED (N/A if Not Applicable):**

(ex.- Signals, Warning Signs, Lighting)

\_\_\_\_\_  
 \_\_\_\_\_

**SPECIAL TREATMENTS NEEDED (N/A if Not Applicable):**

(ex.- In Street Pedestrian Crossing Sign, Median Refuge Island, Curb Extensions and Bulb Outs, Parking)

\_\_\_\_\_  
 \_\_\_\_\_

I/we **RECOMMEND / DO NOT RECOMMEND** that a crosswalk be **INSTALLED / REMOVED** at/from this location, subject to any conditions noted above.

Date: \_\_\_\_\_

By: Name(s): \_\_\_\_\_

Title(s): \_\_\_\_\_