



Traffic Engineering & Highway Safety Bulletin



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Pedestrian Safety

MILITARY TRAFFIC MANAGEMENT COMMAND: REDESIGNATED IN 2004

The start of the New Year brings a new name to a veteran Army command. The Military Traffic Management Command, a pivotal player for the past 30 years in surface movements for military contingency, peace-keeping, and training operations, has been redesignated. Effective January 1, 2004, the organization's new name is the (Military) Surface Deployment and Distribution Command (SDDC). The name change better reflects the command's new emphasis on deploying the force and its end-to-end distribution operations in ongoing operations in Afghanistan and Iraq. 

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DID YOU KNOW?

According to FHWA crash data from 2000:

‡ **4,739 pedestrians were killed** and **78,000 pedestrians were injured** in traffic crashes in the United States.

- ‡ On average, a pedestrian was killed or injured in a traffic crash every 7 minutes.
- ‡ In a typical 8-hour workday, 4 to 5 pedestrians were killed.
- ‡ 11 percent of all traffic fatalities involved pedestrians.
- ‡ Most pedestrian fatalities occurred at non-intersection locations (78 percent) and at night (64 percent). 

HOW CAN PEDESTRIAN CRASHES BE REDUCED?

The Institute of Transportation Engineers (ITE) recognizes that reduction of pedestrian crashes can only be accomplished through engineering, education, and enforcement; otherwise known as the 3 E's. The 3 E's are interrelated and only successful if all three are addressed.



Engineering and Maintenance

It is the engineering and maintenance staff's responsibility to provide the appropriate pedestrian accommodations and to ensure that these accommodations are properly maintained.

Education

Education of motorists and pedestrians alike can help ensure that everyone understands their responsibilities.



A common method to educate motorists and pedestrians is through periodic articles or ads in installation newspapers.

Additionally, school-based education campaigns can promote pedestrian safety to children. The Federal Highway Administration's (FHWA) Web site is an excellent source of free educational sources, located at <http://safety.fhwa.dot.gov/pedcampaign/index.htm>.

Enforcement

Proper enforcement can ensure compliance with laws and traffic control devices. Because Security Forces' responsibilities are numerous, their ability to routinely patrol crosswalk compliance is limited. However, even occasional (once a month) enforcement will result in improved compliance. 

WHO HAS THE RIGHT-OF-WAY; PEDESTRIANS OR VEHICLES?

The *Uniform Vehicle Code and Model Traffic Ordinances*

is the model traffic ordinance for most states; however, each state may have its own traffic ordinances, which may vary. The traffic model ordinance states that pedestrians have certain rights and duties (see green box, top right).

So what does that mean? Regarding unsignalized crosswalks, both drivers and pedestrians have responsibilities. The driver must yield to pedestrians, however pedestrians should use caution when entering crosswalks. At unmarked, non-intersection locations, the pedestrian should yield to motorists. 



EXCERPT FROM ARTICLE V - PEDESTRIANS' RIGHTS AND DUTIES

11-502-Pedestrians' right-of-way in crosswalks

- (a) When traffic-control signals are not in place or not in operation, the driver of a vehicle shall yield the right-of-way, slowing down or stopping if need be to yield to a pedestrian crossing the roadway within a crosswalk when the pedestrian is upon the half of the roadway upon which the vehicle is traveling, or when the pedestrian is approaching so closely from the opposite half of the roadway as to be in danger.
- (b) No pedestrian shall suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close as to constitute an immediate hazard.

11-503-Crossing at other than crosswalks

- (a) Every pedestrian crossing a roadway at any point other than within a marked crosswalk or within an unmarked crosswalk at an intersection shall yield the right-of-way to all vehicles upon the roadway.
- (b) Any pedestrian crossing a roadway at a point where a pedestrian tunnel or overhead pedestrian crossing has been provided shall yield the right-of-way to all vehicles upon the roadway.
- (c) Between adjacent intersections at which traffic-control signals are in operation pedestrians shall not cross at any place except in a marked crosswalk.
- (d) No pedestrian shall cross a roadway intersection diagonally unless authorized by official traffic-control devices; and when authorized to cross diagonally, pedestrians shall cross only in accordance with the official traffic-control devices pertaining to such crossing movements.

WHAT'S WRONG WITH THIS PHOTOGRAPH?



Answer on Page 7

CROSSWALKS

Where should crosswalks be used?

Crosswalks should not be used where speeds exceed 45 mph at unsignalized intersections, and where sight distance is not adequate. Generally, crosswalks should be marked based on the following guidelines:

- ❖ All signalized intersections with pedestrian signal heads;
- ❖ All locations where a school crossing guard is normally stationed to assist children in crossing the street; and
- ❖ All intersections and mid-block crossings satisfying minimum vehicle and pedestrian volume guidelines.

What about mid-block crosswalks?

The use of mid-block crosswalks is highly debated on military installations. Some proponents argue that marked mid-block crosswalks enhance safety while others argue that they give pedestrians a false sense of security. When developing plans for new facilities, avoid situations such as having the primary parking area on the opposite side of a busy street.



Also, marking mid-block crosswalks at every location where pedestrians cross results in disrespect of crosswalks, including those that truly are warranted.



Should marked or unmarked crosswalks be used?

Recently, the FHWA completed a study entitled *Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations* (www.fhwa.dot.gov/safety/fourthlevel/pdf/Cros.pdf).

The study results reveal that under no condition was the presence of a marked crosswalk alone (absence of other improvements including signing, special pavement, flashing lights, or geometric improvement) at an uncontrolled location associated with a significantly lower pedestrian crash rate, as compared to an unmarked crosswalk.

However, the study notes that this is not justification to do nothing. Pedestrian needs in crossing streets should routinely be identified and appropriate solutions should be selected to improve pedestrian safety and access.

In some cases crosswalks should be marked in association with other improvements.

Use the chart on page 4 to determine if a pedestrian crossing location is

1. A candidate for a marked crosswalk;
2. A candidate for a marked crosswalk combined with other pedestrian improvements; or
3. Not a candidate for a marked crosswalk.

If, based on the chart, additional treatments in association with a marked crosswalk warrant consideration, evaluate the appropriateness of treatments that should be considered such as:

- ❖ Enhancing crosswalk treatments with items such as textured pavements, enhanced crosswalk patterns, and/or in-lane pedestrian signing.

- ❖ Providing raised medians or intersection crossing islands.
 - ❖ Reducing the effective street crossing distance for pedestrians by narrowing the roads or by providing curb extensions (an extension of the sidewalk and curbing across a parking lane to reduce the crossing distance — see page 4, April 2003 Bulletin).
 - ❖ Installing other traffic calming measures where appropriate.
 - ❖ Installing traffic signals (with pedestrian signals) where warranted.
 - ❖ Providing adequate nighttime lighting for pedestrians.
 - ❖ Installing pedestrian warning signs, flashers, and other traffic control devices that are sometimes used to supplement marked crosswalks.
 - ❖ Constructing grade-separated crossings or pedestrian-only streets.
- A traffic engineering study should be performed to identify which treatments, if any, should be used. 

RECOMMENDATIONS FOR INSTALLING MARKED CROSSWALKS AND OTHER NEEDED PEDESTRIAN IMPROVEMENTS AT UNCONTROLLED LOCATIONS*

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT ≤ 9,000			Vehicle ADT 9,001 to 12,000			Vehicle ADT 12,001 to 15,000			Vehicle ADT > 15,001		
	Speed Limit **											
	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph	≤30 mph	35 mph	40 mph	≤30 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
Multilane (4 or More Lanes) With Raised Median	C	C	P	C	P	N	P	P	N	N	N	N
Multilane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

* These guidelines include intersection and mid-block locations with no traffic signals or stop sign on the approach to the crossing. They do not apply to school crossings. A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations which could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, substantial volumes of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will **not** make crossing safer, nor necessarily result in more vehicles stopping for pedestrians. Whether or not marked crosswalks are installed, it is important to consider other pedestrian facility enhancements, as needed, to improve the safety of the crossing (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic calming measures, curb extensions). **These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.**

** Where speed limit exceeds 40 mph, marked crosswalks alone should not be used at unsignalized locations.

C = Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to show whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volumes, vehicle speeds, sight distance, vehicle mix, and so on may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

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.

N = Marked crosswalks alone are not recommended, since pedestrian crash risk may be increased with marked crosswalks. Consider using other treatments, such as traffic signals with pedestrian signals to improve crossing safety for pedestrians.

ADT - Average Daily Traffic

Source: www.fhwa.dot.gov/safety/fourthlevel/pdf/Cros/pdf

USE OF TRAFFIC SIGNALS FOR PEDESTRIAN ACCOMMODATIONS

Another perceived cure-all is the installation of traffic signals to accommodate pedestrians. Although properly designed and equipped traffic signals can better accommodate pedestrians, a traffic signal must satisfy one of the warrants contained in the *MUTCD* for installation. The *MUTCD* contains several warrants for traffic

signal installation, including criteria based on traffic volumes and crash history. Warrants 4 and 5, described below, directly correspond to pedestrian activity.

Install **pedestrian signal heads** at any signalized location meeting one or more of the following conditions:

1. If a traffic control signal is justified by an engineering study and meets Warrant 4 or Warrant 5 (see below);
2. If an exclusive signal phase is provided or made available for pedestrian movements with all conflicting vehicular movements being stopped;
3. At an established school crossing at any signalized location; or
4. Where engineering judgment determines that elaborate signal phasing would tend to confuse or cause conflicts with pedestrians. 

WARRANT 4, PEDESTRIAN VOLUME

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

The need for a traffic control signal at an intersection or mid-block crossing shall be considered if an engineering study finds that both of the following criteria are met:

1. The pedestrian volume crossing the major street at an intersection or mid-block location during an average day is **100 or more for each of any 4 hours or 190 or more during any 1 hour; and**
2. There are **fewer than 60 gaps per hour** in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.

WARRANT 5, SCHOOL CROSSING

The School Crossing signal warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal.

The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream, as related to the number and size of groups of school children at an established school crossing across the major street, shows that:

1. The **number of adequate gaps** in the traffic stream during the period when the children are using the crossing **is less than the number of minutes in the same period; and**
2. There is a minimum of **20 students during the highest crossing hour.**

Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.

In both cases the signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.

Figure 1

Proper timing of pedestrian signal phases is critical in ensuring safe pedestrian crossings.



The walk interval should be at least 7 seconds in length so that pedestrians will have adequate opportunity to leave the curb or shoulder before the pedestrian clearance time begins; however, if pedestrian volumes and characteristics do not require a 7-second walk interval, walk intervals as short as 4 seconds may be used.



The pedestrian clearance time should be sufficient to allow a pedestrian crossing in the crosswalk to travel at a walking speed of 4 feet per second, to at least the far side of the traveled way or to a median of sufficient width for pedestrians to wait. Where children, elderly, or disabled populations are present, walking speeds of less than 4 feet per second should be considered.

The pedestrian clearance time may be entirely contained within the vehicular green interval, or may be entirely contained within the vehicular green and yellow change intervals.

HOW SHOULD CROSSWALKS BE SIGNED?

Because mid-block pedestrian crossings are generally unexpected by the road user, warning signs (W11-2) should be installed and adequate visibility should be provided by parking prohibitions.

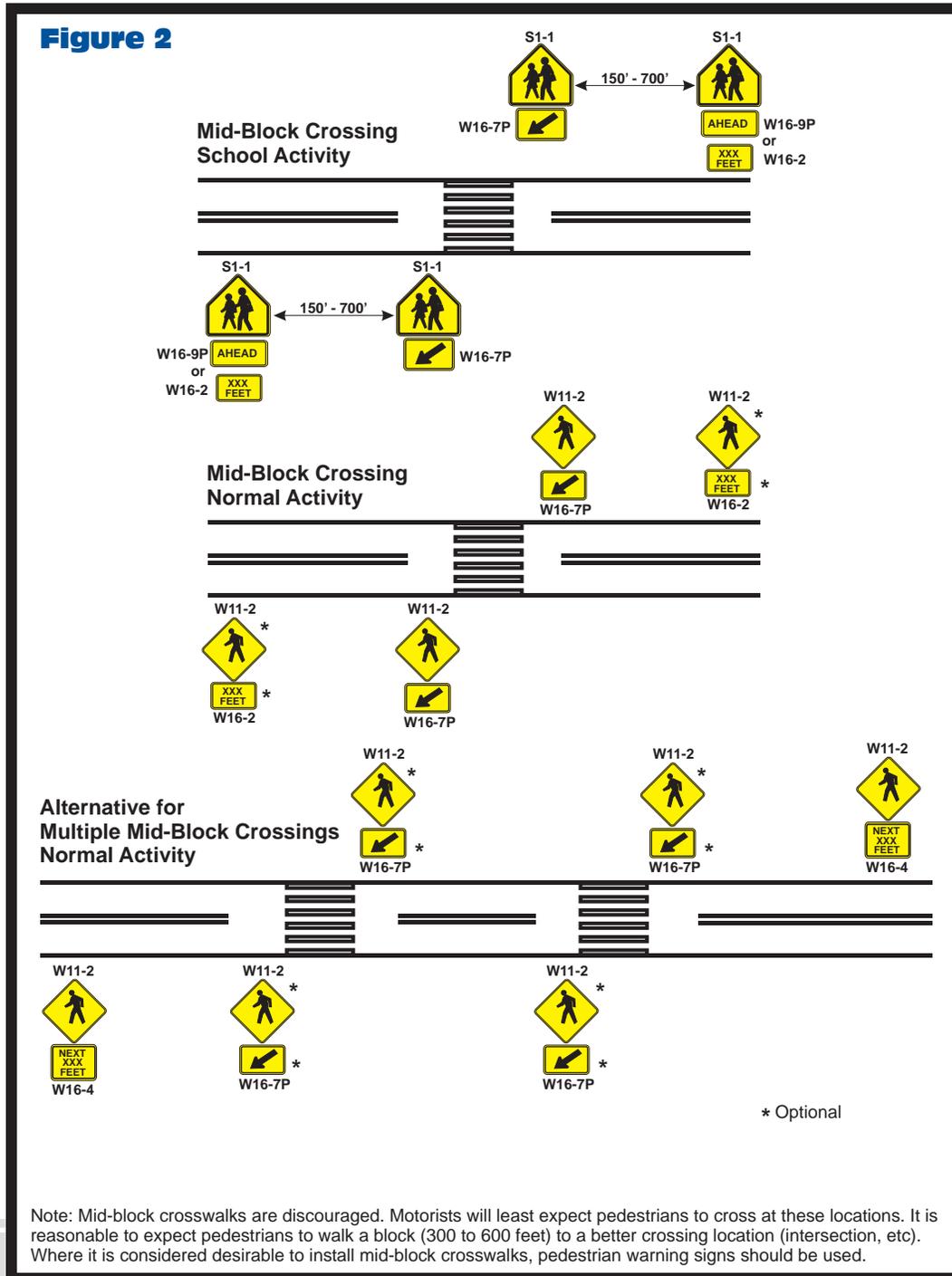
When used in advance of a crossing (Figure 2), warning signs shall be supplemented with plaques AHEAD (W16-9P), XX FEET (W16-2) or NEXT XX FEET (W16-4) to provide advance notice to road users of crossing activity. When used at the crossing, warning signs shall be supplemented with a diagonal down-

ward pointing arrow (W16-7) plaque showing the location of the crossing.

Designated school crossings are signed in a similar fashion, but require a specific type of sign.

Corridors with several crossings can be signed at the start of the corridor to make motorists aware of pedestrian activity. It is important to be consistent in sign placement. If signing a group of crosswalks, take care to ensure that either all of them are signed or none of the intermediate crosswalks are signed.

Pedestrian, bicycle, school signs, and their related supplemental plaques may utilize a fluorescent yellow-green background with a black legend and border instead of the traditional yellow background (Figure 3). Avoid mixing standard yellow and fluorescent yellow-green backgrounds within a selected site area. 



HOW SHOULD CROSSWALKS BE MARKED?

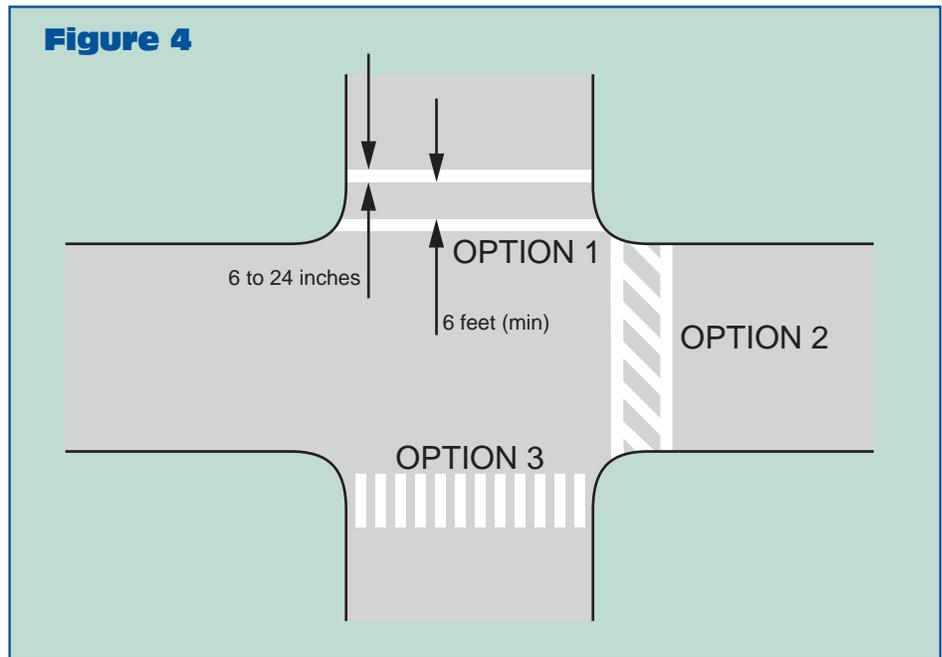
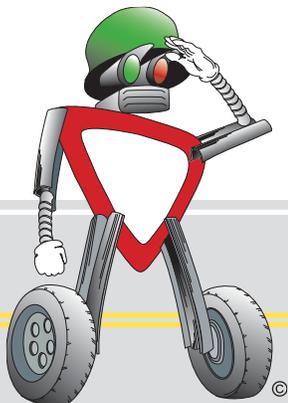
When crosswalk lines are used, they should be solid white lines and should not be less than 6 inches nor greater than 24 inches in width (Figure 4, OPTION 1).

For added visibility, the area of the crosswalk may be marked with white diagonal lines at a 45-degree angle to the line of the crosswalk (OPTION 2) or with white longitudinal lines parallel to traffic flow (OPTION 3). These type of markings may be used at locations where:

- ❖ Substantial numbers of pedestrians cross without any other traffic control device;
- ❖ At locations where physical conditions are such that added visibility of the crosswalk is desired; or
- ❖ At places where a pedestrian crosswalk might not be expected.

If used, the diagonal or longitudinal lines should be 12 to 24 inches wide and spaced 12 to 60 inches apart.

Crosswalks should be at least 6 feet wide and located at least 4 feet in front of the stop bar. Crosswalk widths should be increased where pedestrian demand is high. 



Answer from Page 2

1. It is hard to see, but the crosswalk is less than 30 feet from another crosswalk (circled in red). It is unlikely that two marked crosswalks are warranted in such close proximity.
2. No signs are provided for the specific crosswalk or for the corridor.



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REFERENCE LIST

- ❖ Federal Highway Administration. *Manual on Uniform Traffic Control Devices*. Washington, D.C. 2003.
- ❖ Federal Highway Administration. *Safety Effects of Marked vs Unmarked Crosswalks at Uncontrolled Locations*, www.fhwa.dot.gov/safety/fourthlevel/pdf/Cros.pdf.
- ❖ National Committee on Uniform Traffic Laws and Ordinances. *Uniform Vehicle Code and Model Traffic Ordinances*. 2000.
- ❖ Institute of Transportation Engineers. *Design and Safety of Pedestrian Facilities*. Washington, D.C.
- ❖ Institute of Transportation Engineers. *Traffic Calming, State of the Practice*. Washington, D.C.
- ❖ <http://safety.fhwa.dot.gov>



TRAINING

Continuing Education	Phone	Web Site
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