

WYDOT

Pedestrian and School Traffic Control Manual

January 2014





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Table of Contents

CHAPTER 1 – INTRODUCTION	1
1.1 GENERAL	1
1.2 CRASH HISTORY	1
1.2.1 UNITED STATES	1
1.2.2 WYOMING	1
1.3 PEDESTRIAN CRASH INFORMATION	1
1.3.1 CHILD PEDESTRIANS	1
1.3.2 ELDERLY PEDESTRIANS	2
1.3.3 PEDESTRIANS WITH DISABILITIES	2
1.3.4 ALCOHOL IMPAIRMENT	2
1.3.5 TIME OF OCCURANCE	2
1.4 DEFINITIONS	2
1.5 PEDESTRIAN AND MOTORIST RIGHTS AND DUTIES	3
1.5.1 ON THE ROADWAY	3
1.5.2 AT A CROSSWALK	3
1.5.3 AT TRAFFIC CONTROL SIGNALS	3
1.5.4 AT STOP OR YIELD SIGNS	4
1.6 RESPONSIBILITY	4
CHAPTER 2 – PEDESTRIAN TRAFFIC CONTROL	7
2.1 GENERAL	7
2.2 MARKED CROSSWALK	7
2.3 PEDESTRIAN WARNING ASSEMBLY	7
2.4 PEDESTRIAN CROSSING ASSEMBLY	8
2.5 TURNING VEHICLES YIELD TO PEDESTRIANS SIGN	8
2.6 DESIGNATED PEDESTRIAN CROSSING WARRANT	8
2.7 FLASHING BEACON	14
2.8 RECTANGULAR RAPID FLASH BEACONS	14
2.8.1 GENERAL CONDITIONS	14
2.8.2 ALLOWABLE USES	14
2.8.3 SIGN/BEACON ASSEMBLY LOCATIONS	15
2.8.4 BEACON DIMENSIONS AND PLACEMENT IN SIGN ASSEMBLY	15
2.8.5 BEACON FLASHING REQUIREMENTS	15
2.8.6 BEACON OPERATION	15
2.9 TRAFFIC CONTROL SIGNAL	16
2.10 PEDESTRIAN HYBRID BEACON	19
2.11 PEDESTRIAN SIGNAL INDICATIONS	20

Pedestrian and School Traffic Control Manual

2.12	MEANING OF PEDESTRIAN SIGNAL INDICATIONS	21
2.13	PEDESTRIAN PUSHBUTTON.....	21
2.14	NO PARKING RESTRICTIONS	21
2.15	PEDESTRIAN PAVEMENT WORD MARKINGS	22
2.16	STOP LINES	22
2.17	YIELD LINES	22
2.18	CURB EXTENSIONS (bulb-outs)	22
2.18.1	ADVANTAGES	22
2.18.2	DISADVANTAGES	22
2.19	MIDBLOCK CROSSWALKS	23
2.20	GRADE SEPARATED CROSSINGS	23
2.21	PEDESTRIANS WITH DISABILITIES	23
CHAPTER 3 – SCHOOL TRAFFIC CONTROL		25
3.1	GENERAL	25
3.2	RESPONSIBILITY.....	25
3.2.1	PARENTS.....	25
3.2.2	SCHOOLS	25
3.2.3	LAW ENFORCEMENT	25
3.2.4	TRAFFIC OFFICIALS	26
3.2.5	CHILDREN	26
3.3	SCHOOL WALKING ROUTE PLAN.....	26
3.4	SCHOOL TRAFFIC CONTROL WARRANTS	27
3.5	MARKED CROSSWALK.....	28
3.6	SCHOOL PAVEMENT WORD MARKING.....	28
3.7	SCHOOL ADVANCE CROSSING ASSEMBLY	28
3.7	SCHOOL CROSSING ASSEMBLY.....	30
3.8	DESIGNATED SCHOOL CROSSING.....	30
3.9	SCHOOL SPEED LIMIT WHEN FLASHING.....	31
3.10	RECTANGULAR RAPID FLASH BEACONS.....	31
3.11	PEDESTRIAN HYBRID BEACON	31
3.12	TRAFFIC CONTROL SIGNAL.....	32
3.13	ADULT CROSSING GUARD	32
3.14	SCHOOL BUS STOP WARNING.....	33

Pedestrian and School Traffic Control Manual

List of Figures

FIGURE 1-1: WYDOT DISTRICT MAP	5
FIGURE 2-1: TYPICAL CROSSWALK PAVEMENT MARKINGS	9
FIGURE 2-2: INTERSECTION DESIGNATED PEDESTRIAN CROSSING (2-LANE ROAD).....	10
FIGURE 2-3: INTERSECTION DESIGNATED PEDESTRIAN CROSSING (4-LANE ROAD).....	11
FIGURE 2-4: MID-BLOCK DESIGNATED PEDESTRIAN CROSSING (2-LANE ROAD).....	12
FIGURE 2-5: MID-BLOCK DESIGNATED PEDESTRIAN CROSSING (4-LANE ROAD).....	13
FIGURE 2-6: PEDESTRIAN FOUR-HOUR VOLUME WARRANT	17
FIGURE 2-7: PEDESTRIAN FOUR-HOUR VOLUME WARRANT (70% Factor).....	17
FIGURE 2-8: PEDESTRIAN PEAK HOUR WARRANT	18
FIGURE 2-9: PEDESTRIAN PEAK HOUR WARRANT (70% Factor)	18
FIGURE 2-10: GUIDELINES FOR PEDESTRIAN HYBRID BEACONS – LOW SPEED	19
FIGURE 2-11: GUIDELINES FOR PEDESTRIAN HYBRID BEACONS – HIGH SPEED	20
FIGURE 2-12: TYPICAL CURB EXTENSIONS	24
FIGURE 3-1: EXAMPLE OF SCHOOL WALKING ROUTE PLAN	27
FIGURE 3-2: ADVANCE SCHOOL WARNING	29
FIGURE 3-3: INTERSECTION DESIGNATED SCHOOL CROSSING (2-LANE ROAD)	34
FIGURE 3-4: INTERSECTION DESIGNATED SCHOOL CROSSING (4-LANE ROAD)	35
FIGURE 3-5: MID-BLOCK DESIGNATED SCHOOL CROSSING (2-LANE ROAD)	36
FIGURE 3-6: MID-BLOCK DESIGNATED SCHOOL CROSSING (4-LANE ROAD)	37
FIGURE 3-7: SCHOOL BUS STOP WARNING	38

Pedestrian and School Traffic Control Manual

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CHAPTER 1 – INTRODUCTION

1.1 GENERAL

The need for both motorists and pedestrians to safely and efficiently share the roadway is of primary concern to the Wyoming Department of Transportation (WYDOT). With the large difference in size and speed between a pedestrian and a motor vehicle, a collision between a pedestrian and a motor vehicle almost always results in at least some injury to the pedestrian.

Pedestrian safety depends upon both the pedestrian and motorist understanding the need for and the function of standard pedestrian traffic control used uniformly in comparable traffic situations. The best way to establish safe and efficient pedestrian control is through the uniform application of realistic policies and standards developed through engineering study and judgment. Therefore, the purpose of this manual is to provide guidance for uniform pedestrian traffic control on all roadways in Wyoming based upon need as determined by engineering study and/or judgment.

1.2 CRASH HISTORY

1.2.1 UNITED STATES

The number of pedestrian fatalities has been dropping since the 1970's; however, pedestrian crashes remain a serious concern. According to the National Highway Traffic Safety Administration, *Traffic Safety Facts* for the year 2010:

- 1) There were 4,280 pedestrians killed in traffic crashes and an estimated 70,000 were injured.
- 2) Most pedestrian fatalities occurred in urban areas (73%), at non-intersection locations (79%), in normal weather conditions (88%), and at night (68%).
- 3) Almost one-fifth (19%) of all children between the ages of 5 and 9 who were killed in traffic crashes were pedestrians. Children age 15 and younger accounted for 7% of the pedestrian fatalities and 23% of all pedestrians injured in traffic crashes.
- 4) Older pedestrians (ages 65+) accounted for 19% of all pedestrian fatalities and an estimated 11% of all pedestrians injured. The fatality rate for this age group is higher than any other age group.

1.2.2 WYOMING

In Wyoming there were a reported 99 pedestrians involved in traffic crashes during 2010, with three pedestrians being killed. A five year average has a total of 92 crashes which remains fairly consistent over the years. Of the pedestrian crashes, 94% occurred within an incorporated city/town and 63% occurred during daylight hours. All three of the pedestrian fatalities occurred between the hours of 8:00 PM and midnight at non-intersection locations.

1.3 PEDESTRIAN CRASH INFORMATION

The pedestrian population involves many variable personal characteristics, such as age, alcohol impairment, disabilities (physical and mental), and persons not familiar with traffic laws or pedestrian traffic control devices. These characteristics may result in collisions because the pedestrian may either take actions likely to result in collisions, or may be unable to avoid them. The personal characteristics of the pedestrians crossing the road under study must be taken into consideration in determining the need for pedestrian traffic control.

1.3.1 CHILD PEDESTRIANS

The behavior of child pedestrians varies from that of adults. The child's perception of safety is poorly formulated and they lack experience and judgment in traffic situations. In addition, their observation and reading skills are not as well developed as those of adult pedestrians.

1.3.2 ELDERLY PEDESTRIANS

Crash rates for pedestrians over the age of 65 are lower than for most age groups; however, pedestrians of that age group are much more vulnerable than younger pedestrians to injury or death when struck by a motor vehicle. This can be due to a number of reasons, including reduced walking speed, limited vision and hearing, slower reaction time, and physical infirmity.

1.3.3 PEDESTRIANS WITH DISABILITIES

People with disabilities are much more mobile than they were in the past. People with disabilities can be classified into one or more of three functional categories: mobility impairments, sensory deficits, or cognitive impairments. Pedestrians can also be temporarily handicapped due to being encumbered by carrying luggage, packages, children, etc.

1.3.4 ALCOHOL IMPAIRMENT

Alcohol impairs the behavior of pedestrians to the extent that they may be the primary collision cause. The National Highway Traffic Safety Administration *Traffic Safety Facts* for the year 2010, states that 33% of the pedestrians killed in 2010 had blood alcohol concentrations in excess of 0.08 %.

1.3.5 TIME OF OCCURANCE

Pedestrian crashes are most prevalent during noon and evening peak traffic periods, normally when traffic levels are at their highest. However, fatal pedestrian crashes typically peak later in the day, between 5:00 PM and 11:00 PM. During the hours of dusk and darkness it is more difficult for the motorist to see the pedestrian. Nationwide, in 2010 the hours between 8:00 PM and midnight accounted for about 30% of the pedestrian fatalities, and nearly half (48%) of all pedestrian fatalities occurred on weekends.

1.4 DEFINITIONS

Adequate Gap – The minimum time between vehicles crossing the pedestrian path in either direction in which 85% of all groups of pedestrians waiting to cross the road will accept as adequate to cross all travel lanes in both directions. Gaps for divided roadways may be considered separately for each direction of travel if the median is 6 feet or more in width (see Chapter 9 of the WYDOT Traffic Studies Manual).

Crosswalk (Unmarked) – That part of a roadway at an intersection included within the connection of the lateral lines of the sidewalks on opposite sides of the road. If sidewalk exists only on one side of the roadway, the crosswalk is that part of the roadway included within the extension of the lateral lines of the existing sidewalk at approximately right angles to the roadway centerline.

Crosswalk (Marked) – Any portion of a roadway, at an intersection or elsewhere, distinctly indicated for pedestrian crossing by lines or other markings on the roadway surface.

Designated Pedestrian Crossing – A fully signed and marked pedestrian crosswalk that has been determined, based on an engineering study, to meet the warrant criteria contained in this manual (see Section 2.6).

Designated School Crossing – A fully signed and marked school crossing on a designated school walking route plan that has been determined, based on an engineering study, to meet the warrant criteria contained in this manual (see Section 3.4).

Engineering Study – The need for pedestrian traffic control shall be based upon an engineering study conducted by a professional engineer. The types and extent of the study will vary, depending upon the location. Most studies will include an adequate gap analysis, crash analysis, pedestrian and vehicle volume count, and field observation of pedestrian and vehicle characteristics and conflicts.

Pedestrian – A person on foot, in a wheelchair, on skates or on a skateboard.

Pedestrian Delay – The time intervals between the available gaps are delay periods, the sum of which is the pedestrian delay.

Pedestrian Hybrid Beacon – A special type of beacon that is intentionally placed in a dark mode (no indications displayed) between periods of operation and, when operated, displays both steady and flashing traffic control signal indications to warn and control traffic at an unsignalized location to assist pedestrians in crossing a street or highway at a marked crosswalk.

Pedestrian Traffic Control – Any traffic control device (signs, signals, or pavement markings) installed for the purpose of controlling the actions of a pedestrian and/or motorist, or to alert the motorist and/or pedestrian of authorized roadway right-of-way usage.

Rectangular Rapid Flash Beacon – A special type of pedestrian actuated beacon that consists of two rapidly and alternately flashing rectangular yellow indications having LED-array based pulsing light sources, and mounted in conjunction with Pedestrian Crossing Sign Assemblies or School Crossing Sign Assemblies on both the right and left hand sides of the approach.

School Traffic Control – A specialized form of pedestrian traffic control due to the age of the pedestrian. It is installed specifically for the use of children going to and returning from school along a designated school route adjacent to or in the immediate vicinity of the school.

Uncontrolled Pedestrian Crossing – A pedestrian or school crossing location where the pedestrian-vehicle conflict is not controlled by a STOP sign, YIELD sign, traffic control signal or pedestrian hybrid beacon.

1.5 PEDESTRIAN AND MOTORIST RIGHTS AND DUTIES

1.5.1 ON THE ROADWAY

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.

Every pedestrian crossing a roadway at any point other than within a marked or unmarked crosswalk shall yield the right-of-way to vehicles.

Where a sidewalk is provided and its use is practicable, it is unlawful for any pedestrian to walk along and upon an adjacent roadway.

Any pedestrian crossing a roadway at a point where a pedestrian tunnel or overhead crossing has been provided shall yield the right-of-way to vehicles.

1.5.2 AT A CROSSWALK

When traffic control signals, or other official traffic control signing are not in place, the motorist shall yield the right-of-way by slowing down or stopping, if need be, to yield to any pedestrian within or entering a crosswalk at either edge of the roadway.

Whenever any vehicle is stopped at a marked crosswalk or at any unmarked crosswalk at an intersection to permit a pedestrian to cross the roadway, the driver of any other vehicle approaching from the rear shall not overtake and pass the stopped vehicle.

Pedestrians shall not cross between adjacent intersections at which traffic-control signals are in operation at any place except in a marked crosswalk.

No pedestrian shall cross a roadway intersection diagonally unless authorized by traffic control devices.

1.5.3 AT TRAFFIC CONTROL SIGNALS

Pedestrians are subject to control by traffic control signals. When facing any green signal, except a sole green turn arrow, a pedestrian may proceed across the roadway within any marked or unmarked crosswalk.

No pedestrian shall start to cross the roadway when facing a steady circular yellow or yellow arrow signal.

Pedestrians facing a steady circular red or red arrow signal alone shall not enter the roadway.

Whenever traffic control signals exhibiting pedestrian signal head indications consisting of the illuminated symbols of a WALKING PERSON (symbolizing WALK) and an UPRAISED HAND (symbolizing DON'T WALK) are in place, the pedestrian shall comply with their indications.

Between adjacent traffic control signalized intersections, pedestrians shall not cross at any place except in a marked crosswalk.

1.5.4 AT STOP OR YIELD SIGNS

Drivers approaching a stop sign shall stop before entering the crosswalk on the near side of the intersection. After having stopped for a stop sign, drivers shall yield the right-of-way to any vehicle in the intersection or approaching on another roadway and shall yield the right-of-way to any pedestrians within an adjacent crosswalk.

Drivers approaching a yield sign shall slow down to a speed reasonable for the existing conditions and, if required for safety to stop, shall stop before entering the crosswalk on the near side of the intersection. After slowing or stopping, drivers shall yield the right-of-way to any vehicle in the intersection or approaching on another roadway and shall yield the right-of-way to any pedestrians within an adjacent crosswalk.

1.6 RESPONSIBILITY

WYDOT is typically responsible for the design, installation, and maintenance of pedestrian traffic control on the State Highway System. This includes developing appropriate statewide warrants for pedestrian traffic control and conducting pedestrian traffic studies to determine its need.

WYDOT District Traffic Engineers are responsible for providing adequate pedestrian traffic control on State Highways. Local jurisdictions, school officials, and other related agencies or groups which have concerns about pedestrian traffic control on state highways should contact the District Traffic Engineer in their area. Figure 1-1 shows a map of the state with the WYDOT district boundaries. The District Traffic Engineer's phone number is also shown for each district.

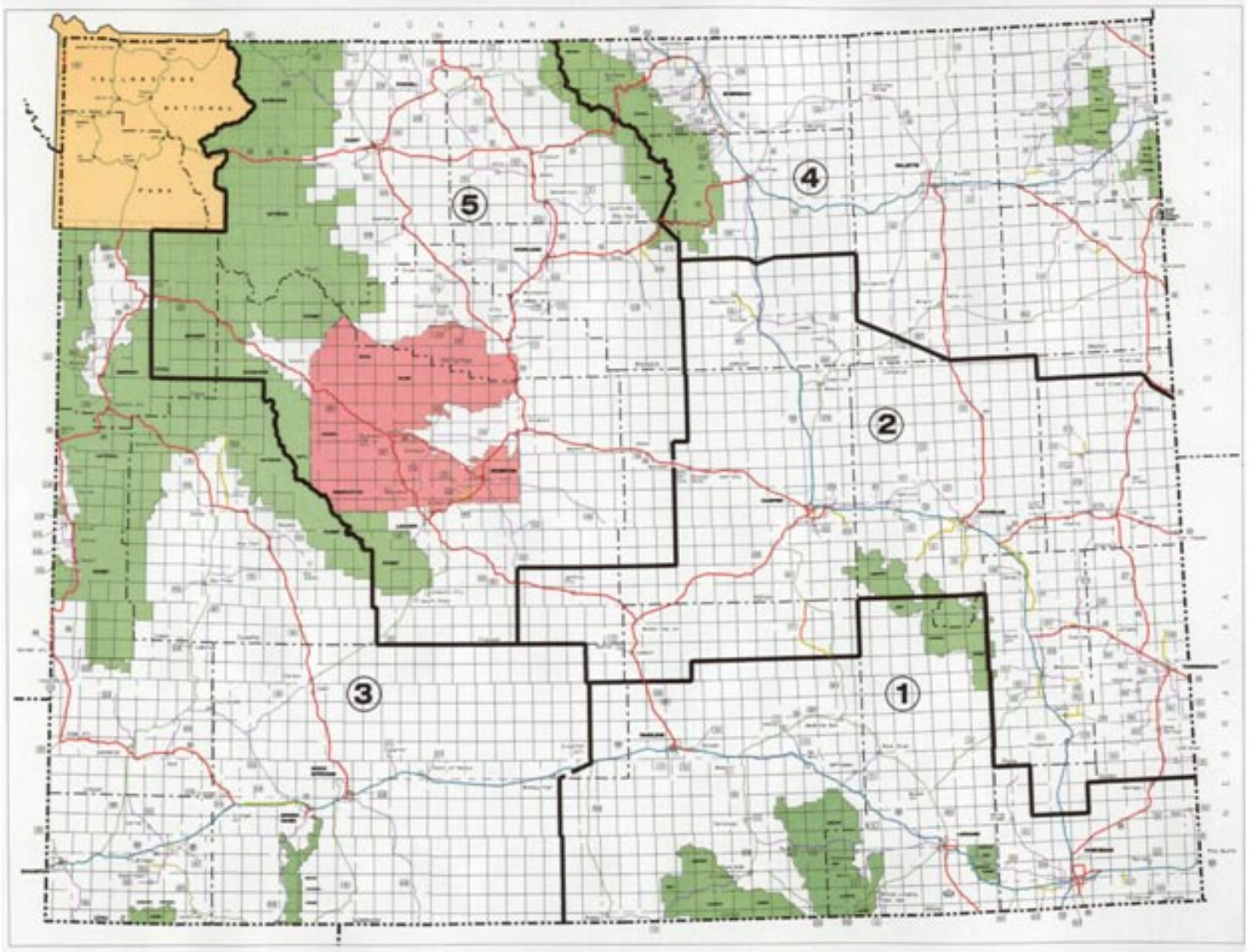


FIGURE 1-1: WYDOT DISTRICT MAP

DISTRICT TRAFFIC ENGINEERS ADDRESSES AND PHONE NUMBERS

DISTRICT 1

3411 So. 3rd St. Suite 1
Laramie, WY 82070
(307) 745-2100

DISTRICT 2

900 Bryan Stock Trail
Casper, WY 82601
(307) 473-3200

DISTRICT 3

3200 Elk St.
Rock Springs, WY 82901
(307) 352-3000

DISTRICT 4

10 East Brundage Lane
Sheridan, WY 82801
(307) 674-2311

DISTRICT 5

218 West C
Basin, WY 82410
(307) 568-3400

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CHAPTER 2 – PEDESTRIAN TRAFFIC CONTROL

2.1 GENERAL

Pedestrian traffic control is normally only provided at locations where motorists do not expect pedestrians to be crossing the roadway; at complex or confusing crossings, or at traffic control signalized intersections.

Pedestrian traffic control devices consist of the following, used either alone or in combination:

- 1) Marked crosswalk
- 2) Advance Pedestrian Crossing sign with an AHEAD supplemental plaque (Pedestrian Warning assembly)
- 3) Pedestrian Crossing sign with a supplemental diagonal downward pointing arrow (Pedestrian Crossing assembly)
- 4) Pedestrian signal indications and pushbutton control
- 5) Flashing beacons or pedestrian hybrid beacons

2.2 MARKED CROSSWALK

The pavement markings for marked crosswalks shall be the longitudinal line crosswalk as shown in Figure 2-1 (see the *WYDOT Pavement Marking Manual* for more information).

Marked crosswalks shall be used at the following locations:

- 1) Designated Pedestrian Crossings
- 2) Designated midblock crossings
- 3) Signalized intersections which meet MUTCD pedestrian volume warrants (see Section 2.9)
- 4) Pedestrian Hybrid Beacon locations

Marked crosswalks may be used at the following locations based upon a traffic engineering study or judgment:

- 1) Complex or confusing crossing paths such as the crossing location across a free right turn lane.
- 2) Intersections in central business districts to discourage jaywalking.

2.3 PEDESTRIAN WARNING ASSEMBLY



A Pedestrian Warning assembly shall be used in advance of all marked crosswalks with Pedestrian Crossing assemblies and shall be supplemented with a plaque with the legend AHEAD.

It may also be used at locations adjacent to the beginning of a section of roadway where a significant number of pedestrians randomly cross the roadway, and it is not practical or possible to consolidate the crossing activity to a single location. In this case a supplemental plaque with the legend NEXT XX FEET or NEXT XX MILES shall be used.

2.4 PEDESTRIAN CROSSING ASSEMBLY



The Pedestrian Crossing assembly is used to alert road users to locations where unexpected entries into the roadway by pedestrians might occur. It shall consist of a Pedestrian Crossing sign supplemented with a diagonal downward pointing arrow plaque. It shall be used adjacent to the marked crosswalk at designated Pedestrian Crossings.

If the pedestrian crossing is located on a road with more than one through lane per approach, a Pedestrian Crossing assembly may be located on each side of the approaching roadway.

2.5 TURNING VEHICLES YIELD TO PEDESTRIANS SIGN



The Turning Vehicles Yield to Pedestrians sign may be used to remind drivers who are making turns to yield to pedestrians, when an engineering study finds that there are an unacceptable number of conflicts between turning vehicles and pedestrians crossing. The signs should be considered when:

- 1) There are more than 100 vehicles per hour turning across the crosswalk in the signed direction during the peak hour, and
- 2) There are more than 50 pedestrians per hour using the crosswalk during the same hour, or
- 3) There have been 2 or more crashes in the past 12 months or 3 or more crashes in the past 3 years involving vehicles turning in the signed direction striking pedestrians in the adjacent crosswalk.

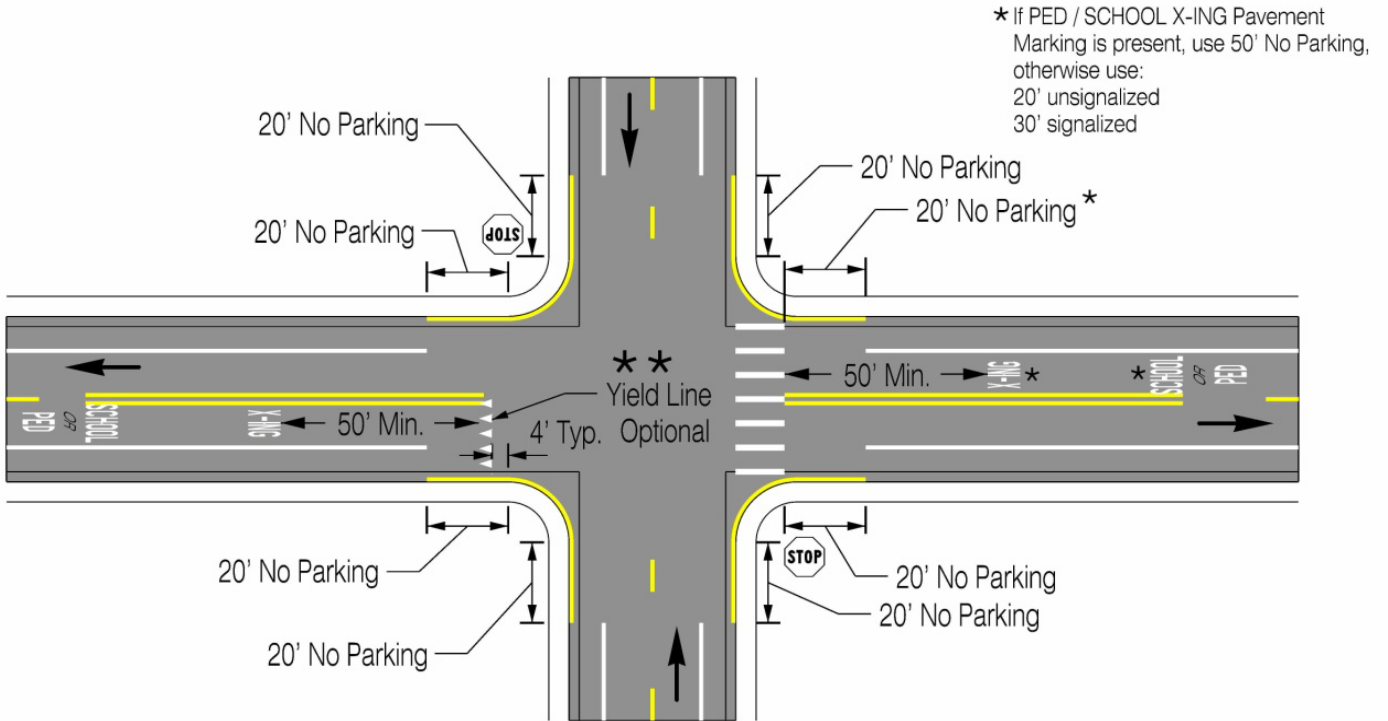
When used, the Turning Vehicles Yield to Pedestrians sign should be mounted on the far right corner of the intersection for right turns or the far left corner for left turns.

2.6 DESIGNATED PEDESTRIAN CROSSING WARRANT

A Designated Pedestrian Crossing shall be justified by an engineering study. Normally a Designated Pedestrian Crossing should be considered when:

- 1) The pedestrian volumes exceed 50% of the minimum pedestrian volume required to meet the pedestrian volume warrant for the installation of a traffic control signal (see Section 2.9), regardless of traffic volumes on the major street; or
- 2) There are a minimum of 20 pedestrians per hour for each of any 4 hours with fewer than 60 adequate gaps per hour during the same time periods.

Typical Designated Pedestrian Crossing installations are shown in Figures 2-2 through 2-5.

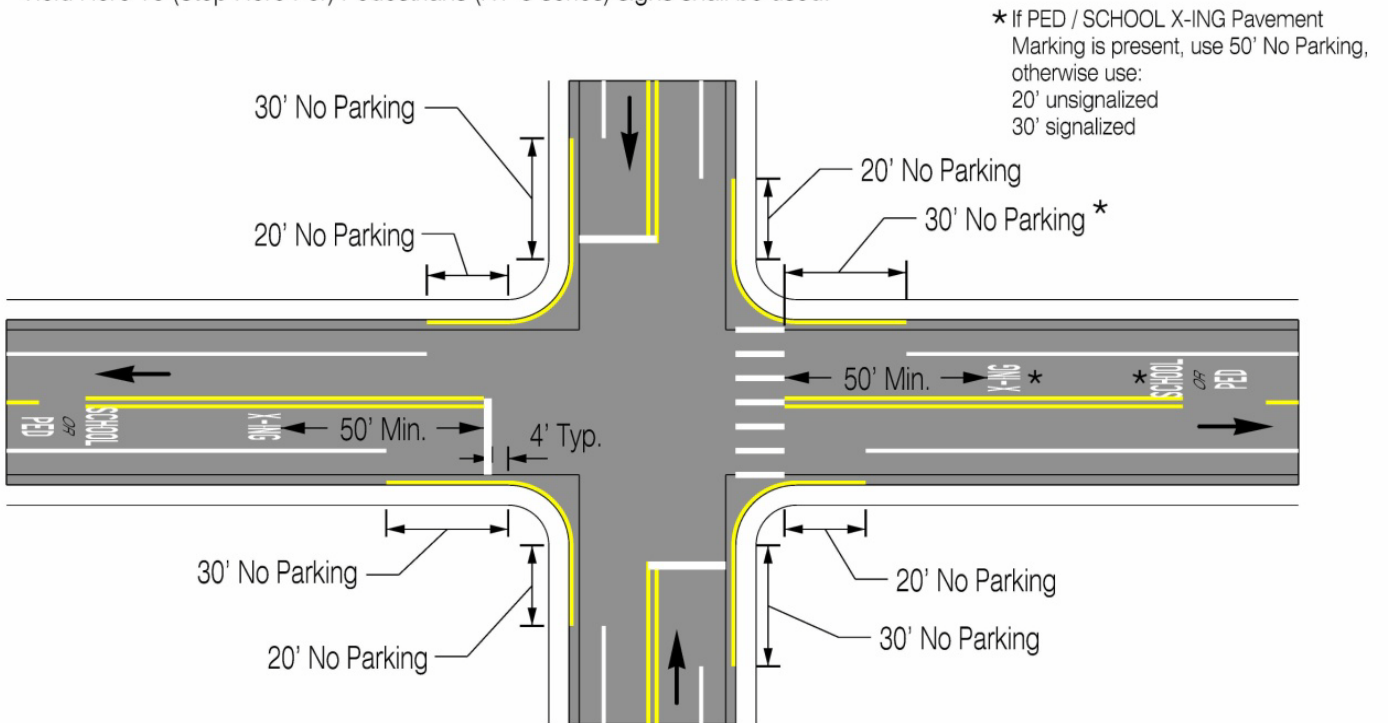


UNSIGNALIZED INTERSECTION

**

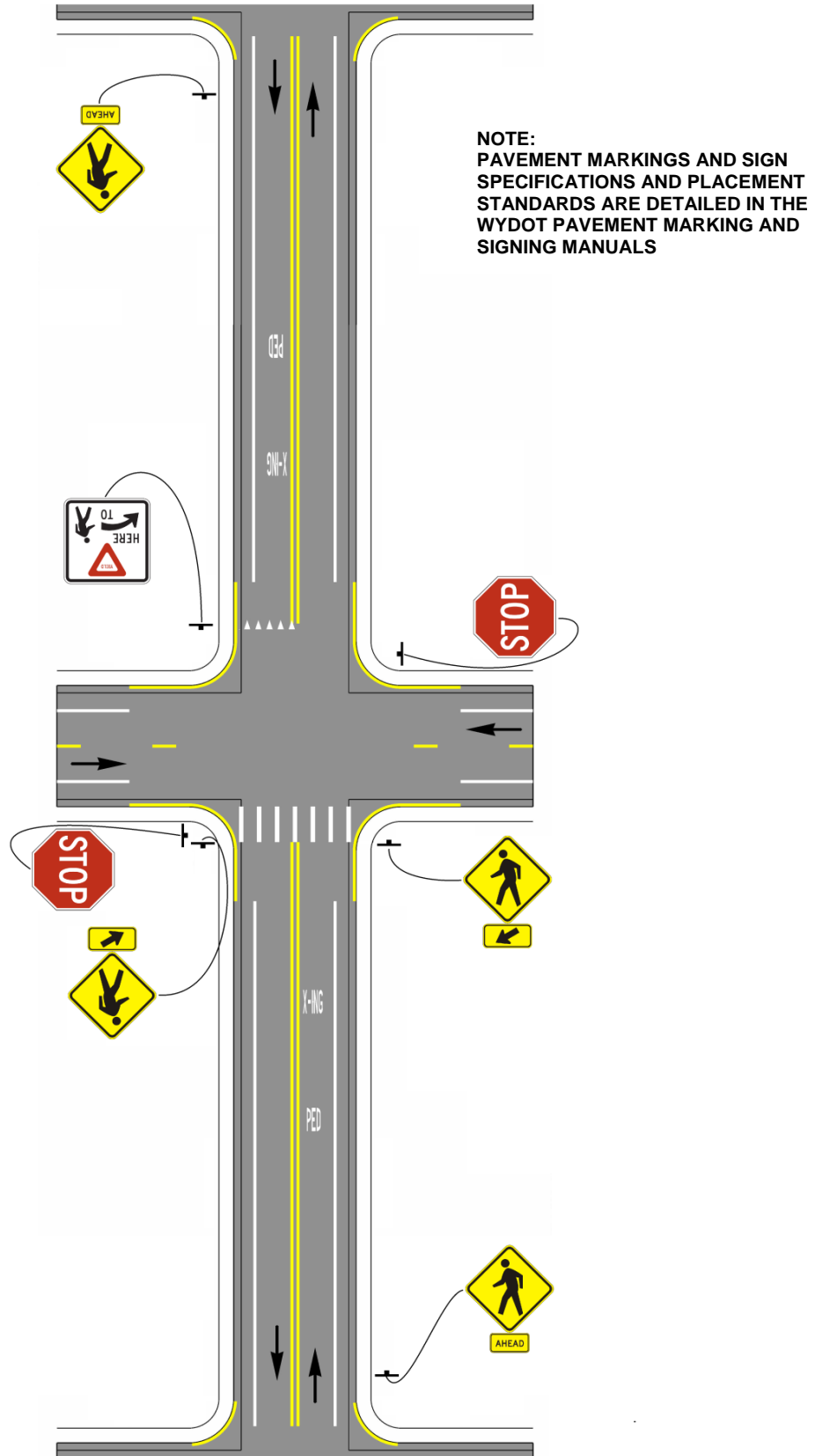
Standard:

If yield (stop) lines are used at a crosswalk that crosses an uncontrolled approach, Yield Here To (Stop Here For) Pedestrians (R1-5 series) signs shall be used.

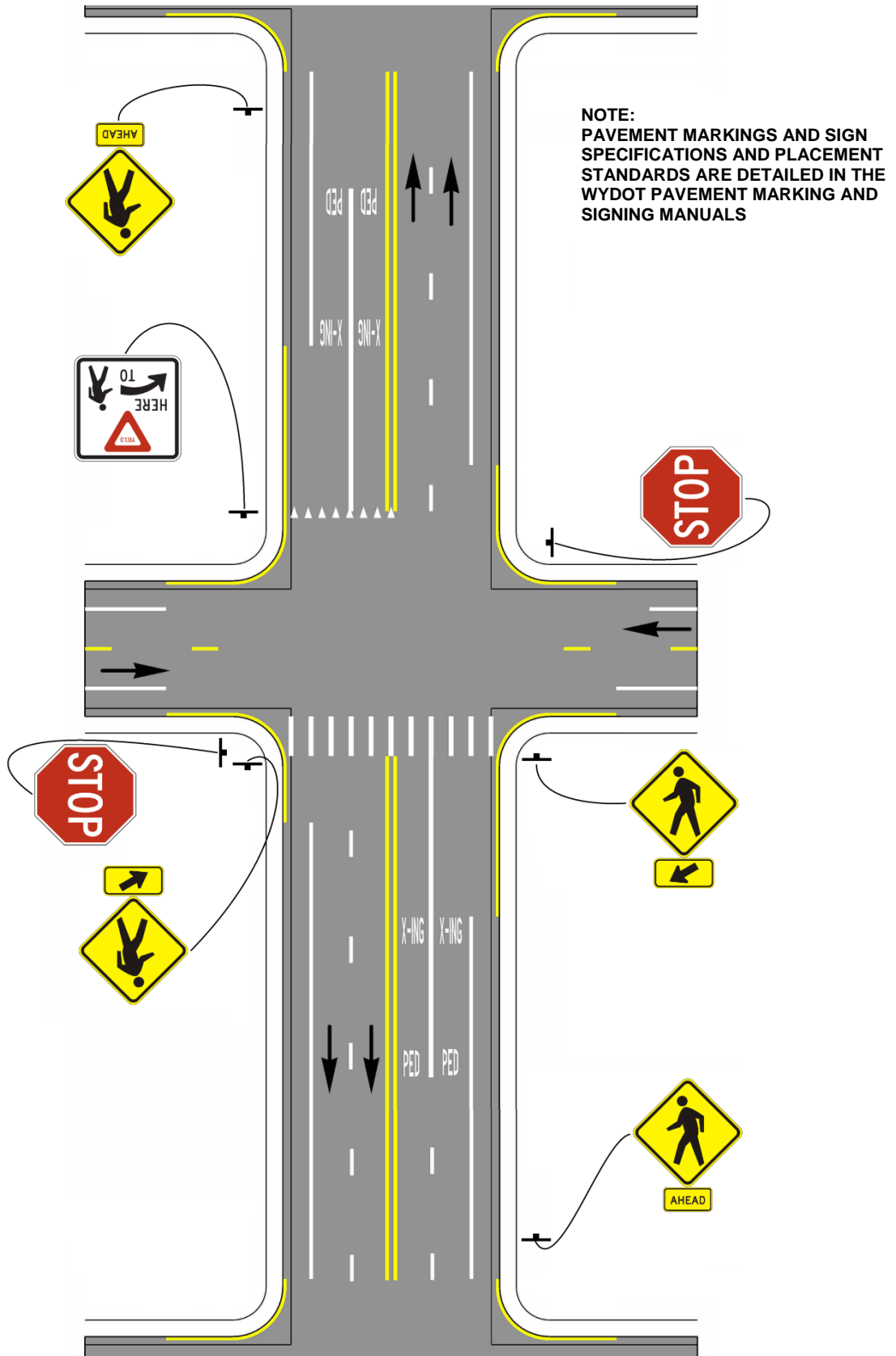


SIGNALIZED INTERSECTION

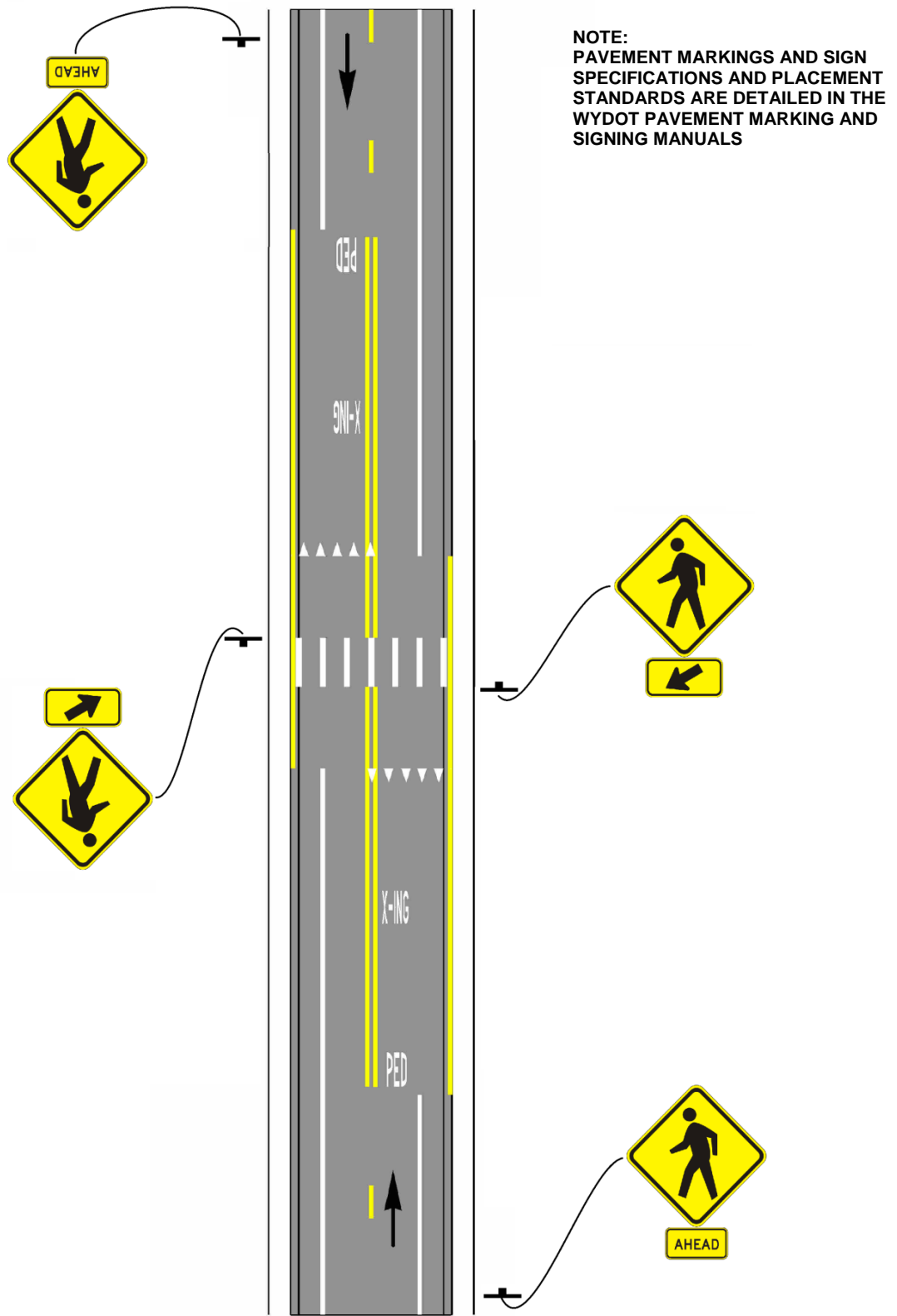
FIGURE 2-1: TYPICAL CROSSWALK PAVEMENT MARKINGS



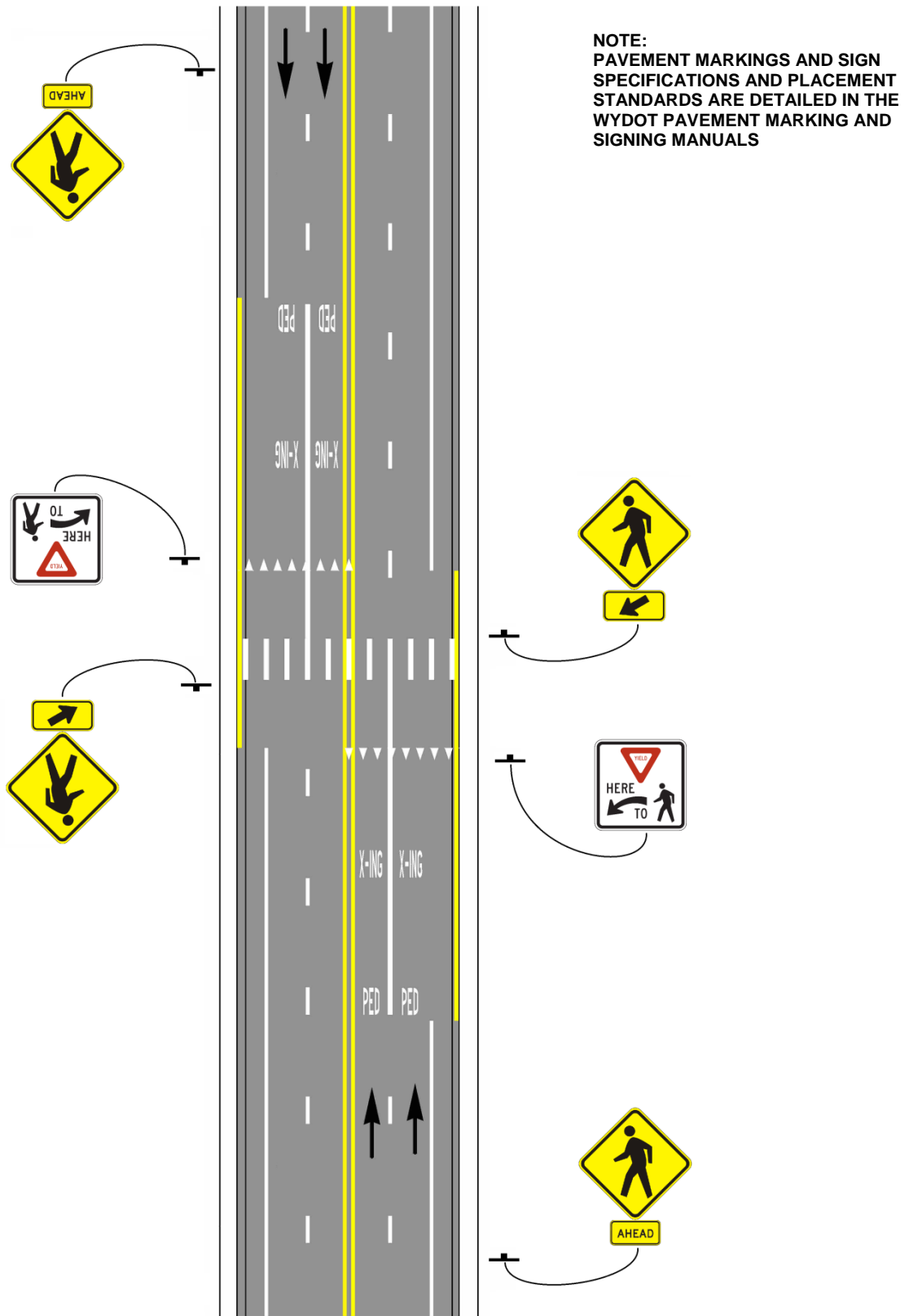
**FIGURE 2-2: INTERSECTION DESIGNATED PEDESTRIAN CROSSING
(2-LANE ROAD)**



**FIGURE 2-3: INTERSECTION DESIGNATED PEDESTRIAN CROSSING
(4-LANE ROAD)**



**FIGURE 2-4: MID-BLOCK DESIGNATED PEDESTRIAN CROSSING
(2-LANE ROAD)**



**FIGURE 2-5: MID-BLOCK DESIGNATED PEDESTRIAN CROSSING
(4-LANE ROAD)**

2.7 FLASHING BEACON

A flashing yellow beacon may be located on the advanced pedestrian warning sign based upon an engineering study or judgment. Consideration should be given to the following:

- 1) The pedestrian volume meets 50% of the minimum pedestrian volume required to meet the pedestrian volume warrant for the installation of a traffic control signal (see Section 2.9), and there are fewer than 60 adequate gaps per hour during the same time periods.
- 2) Numerous traffic violations of the Designated Pedestrian Crossing by motorists failing to yield to pedestrians entering or within the crosswalk.
- 3) Pedestrian crash experience.
- 4) Two or more through lanes per approach.
- 5) The beacon may flash continuously, be controlled by manual pedestrian pushbuttons, or activated by passive pedestrian detection, based on engineering study or judgment.

2.8 RECTANGULAR RAPID FLASH BEACONS

In July 2008 the Federal Highway Administration gave interim approval to the use of rectangular rapid flash beacons (RRFBs) for optional use in limited circumstances. The interim approval allows for usage as a warning beacon to supplement standard signs and markings at designated pedestrian or school crossings where the crosswalk approach is not controlled by a yield sign, stop sign, traffic-control signal, or at a crosswalk at a roundabout. RRFBs may be installed on 2-lane or multi-lane roadways.

RRFBs are user-actuated amber LEDs that use an irregular flash pattern that is similar to emergency flashers on police vehicles to supplement warning signs at unsignalized intersections or mid-block crosswalks. RRFBs are a lower cost alternative to traffic control signals and have been shown to significantly increase driver yielding behavior at crosswalks when supplementing standard pedestrian and school crossing warning signs and markings. The RRFBs are typically activated by manual pedestrian pushbuttons.

2.8.1 GENERAL CONDITIONS

An RRFB shall consist of two rapidly and alternately flashed rectangular yellow indications having LED-array based pulsing light sources, and shall be designed, located, and operated in accordance with the detailed requirements specified below.

The use of RRFBs is optional. However, if an agency opts to use an RRFB, the following design and operational requirements shall apply, and shall take precedence over any conflicting provisions of the MUTCD for the approach on which RRFBs are used.

2.8.2 ALLOWABLE USES

An RRFB shall only be installed to function as a Warning Beacon (see 2009 MUTCD Section 4L.03 and Section 2.7 of this manual).

An RRFB shall only be used to supplement a Pedestrian Crossing Sign Assembly or School Crossing Sign Assembly located at or immediately adjacent to a marked crosswalk.

An RRFB shall not be used for crosswalks across approaches controlled by YIELD signs, STOP signs, or traffic control signals. This prohibition is not applicable to a crosswalk across the approach to and/or egress from a roundabout.

In the event sight distance approaching the crosswalk at which RRFBs are used is less than deemed necessary by the engineer, an additional RRFB may be installed on that approach in advance of the crosswalk, as a Warning Beacon to supplement the Advance Pedestrian Warning sign or Advance School Warning sign. This additional RRFB shall be supplemental to and not a replacement for RRFBs at the crosswalk itself.

2.8.3 SIGN/BEACON ASSEMBLY LOCATIONS

For any approach on which RRFBs are used, two Pedestrian Crossing Sign Assemblies or School Crossing Sign Assemblies (each with an RRFB) shall be installed at the crosswalk, one on the right-hand side of the roadway and one on the left-hand side of the roadway. On a divided highway, the left-hand side assembly should be installed on the median, if practical, rather than on the far left side of the highway.

2.8.4 BEACON DIMENSIONS AND PLACEMENT IN SIGN ASSEMBLY

Each RRFB shall consist of two rectangular-shaped yellow indications, each with an LED-array based light source. Each RRFB indication shall be a minimum of approximately 5 inches wide by approximately 2 inches high.

The two RRFB indications shall be aligned horizontally, with the longer dimension horizontal and with a minimum space between the two indications of approximately 7 inches, measured from inside edge of one indication to inside edge of the other indication.

The outside edges of the RRFB indications, including any housings, shall not project beyond the outside edges of the crossing assembly signs.

As a specific exception to 2009 MUTCD Section 4L.01 guidance, the RRFB shall be located between the bottom of the crossing warning sign and the top of the supplemental downward diagonal arrow plaque (or, in the case of a supplemental advance sign, the AHEAD plaque), rather than 12 inches above or below the sign assembly.



2.8.5 BEACON FLASHING REQUIREMENTS

When activated, the two yellow indications in each RRFB shall flash in a rapidly alternating “wig-wag” flashing sequence (left light on, then right light on).

As a specific exception to 2009 MUTCD Section 4L.01 requirements for the flash rate of beacons, RRFBs shall use a much faster flash rate. Each of the two yellow indications of an RRFB shall have 70 to 80 periods of flashing per minute and shall have alternating, but approximately equal, periods of flashing light emissions and dark operation. During each of its 70 to 80 flashing periods per minute, the yellow indications on the left side of the RRFB shall emit two slow pulses of light after which the yellow indications on the right side of the RRFB shall emit four rapid pulses of light followed by a long pulse.

The flash rate of each individual yellow indication, as applied over the full on-off sequence of a flashing period of the indication, shall not be between 5 and 30 flashes per second, to avoid frequencies that might cause seizures.

The light intensity of the yellow indications shall meet the minimum specifications of Society of Automotive Engineers (SAE) standard J595 (Directional Flashing Optical Warning Devices for Authorized Emergency, Maintenance, and Service Vehicles) dated January 2005.

2.8.6 BEACON OPERATION

The RRFB shall be normally dark, shall initiate operation only upon pedestrian actuation, and shall cease operation at a predetermined time after the pedestrian actuation.

All RRFBs associated with a given crosswalk (including those with an advance crossing sign, if used) shall, when activated, simultaneously commence operation of their alternating rapid flashing indications and shall cease operation simultaneously.

Pedestrian pushbuttons shall be used to actuate the RRFBs, and a pedestrian instruction sign with the legend PUSH BUTTON TO TURN ON WARNING LIGHTS should be mounted adjacent to or integral with each pedestrian pushbutton.



The duration of operation of the RRFBs following each actuation should be determined by the following equation:

EQUATION 2-1

$$T = W/S + 7$$

Where:

T	=	Time the RRFBs flash, in seconds
W	=	Width of roadway, from curb to curb, in feet
S	=	Assumed walking speed in feet/second (use 3.5 for students and 4.0 for normal pedestrian traffic)
7	=	Pedestrian start-up time in seconds (allows time for drivers to see and react to the RRFBs and for the pedestrian to recognize that traffic has yielded appropriately before starting to cross)

2.9 TRAFFIC CONTROL SIGNAL

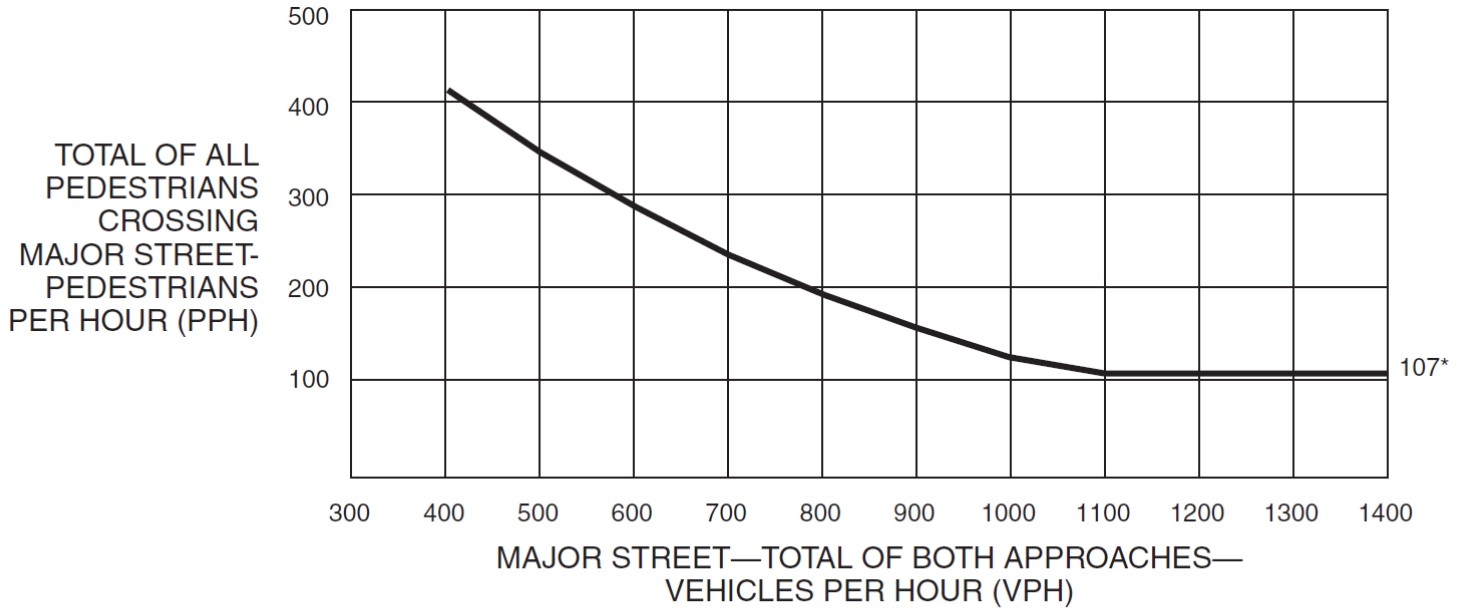
A traffic control signal is used to assign the right-of-way to vehicular and pedestrian traffic. A traffic signal primarily installed for pedestrian traffic may be considered where the vehicular traffic is so heavy that pedestrians experience excessive delay in crossing a roadway.

The need for a pedestrian traffic control signal at an intersection or midblock location shall be considered if a traffic engineering study finds the following criteria met:

- 1) For each of any four hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 2-6; or
- 2) For one hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 2-8.
- 3) Less restrictive traffic control in the form of a Designated Pedestrian Crossing with flashing beacons or RRFBs has been shown to not be effective in creating adequate gaps for the pedestrians to cross the road.

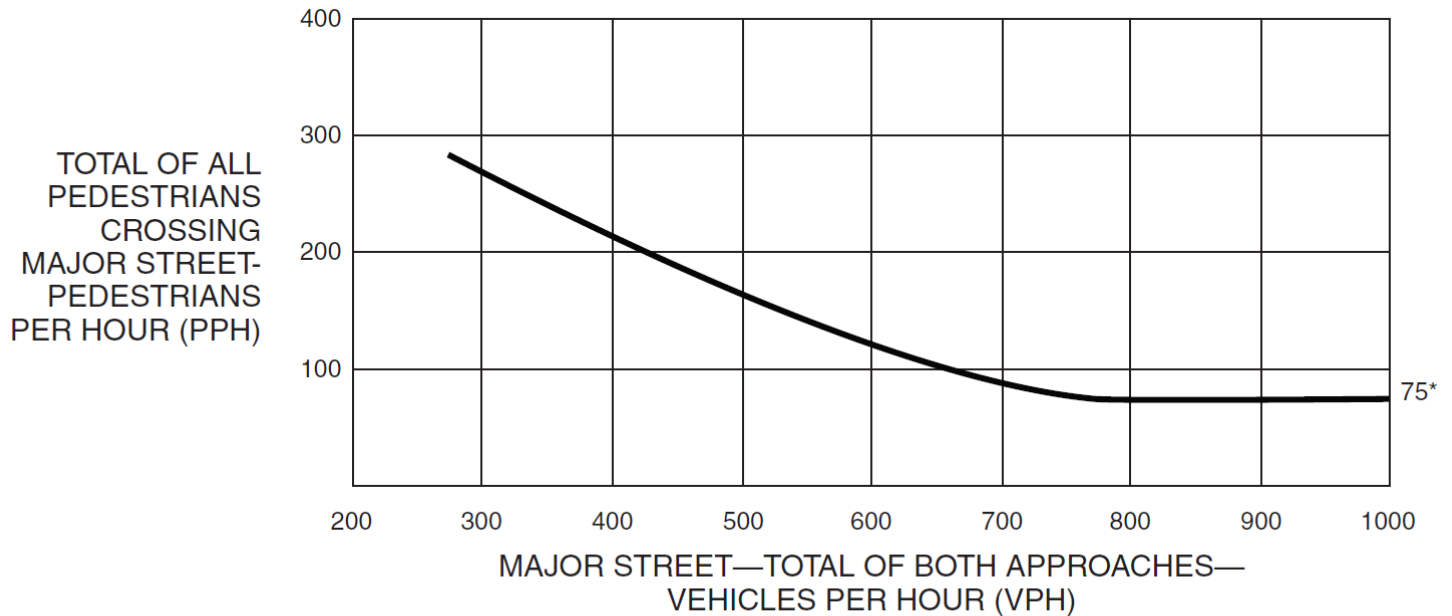
If the posted speed limit on the major street exceeds 35 mph, Figure 2-7 may be used in lieu of Figure 2-6 to evaluate the four-hour criterion, and Figure 2-9 may be used in lieu of Figure 2-8 to evaluate the one-hour criterion.

A traffic control signal is not warranted by the above criteria where a traffic control signal exists within 300 feet of the proposed crossing location.



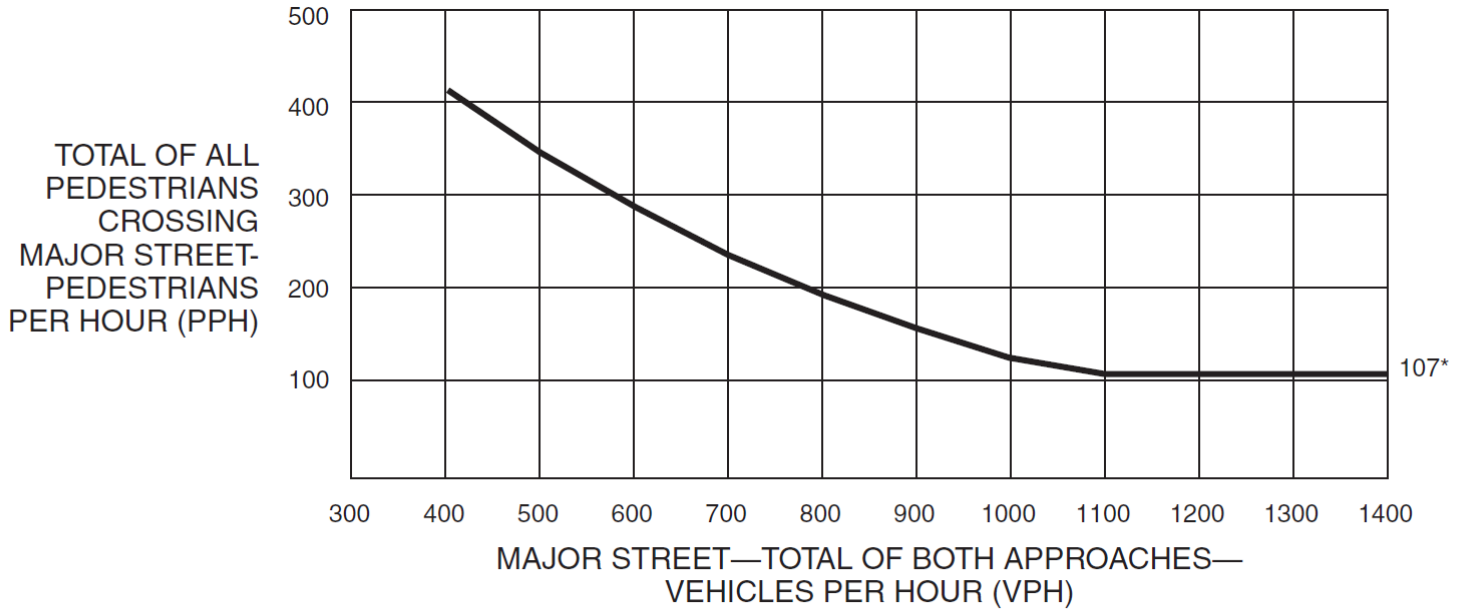
*Note: 107 pph applies as the lower threshold volume.

FIGURE 2-6: PEDESTRIAN FOUR-HOUR VOLUME WARRANT



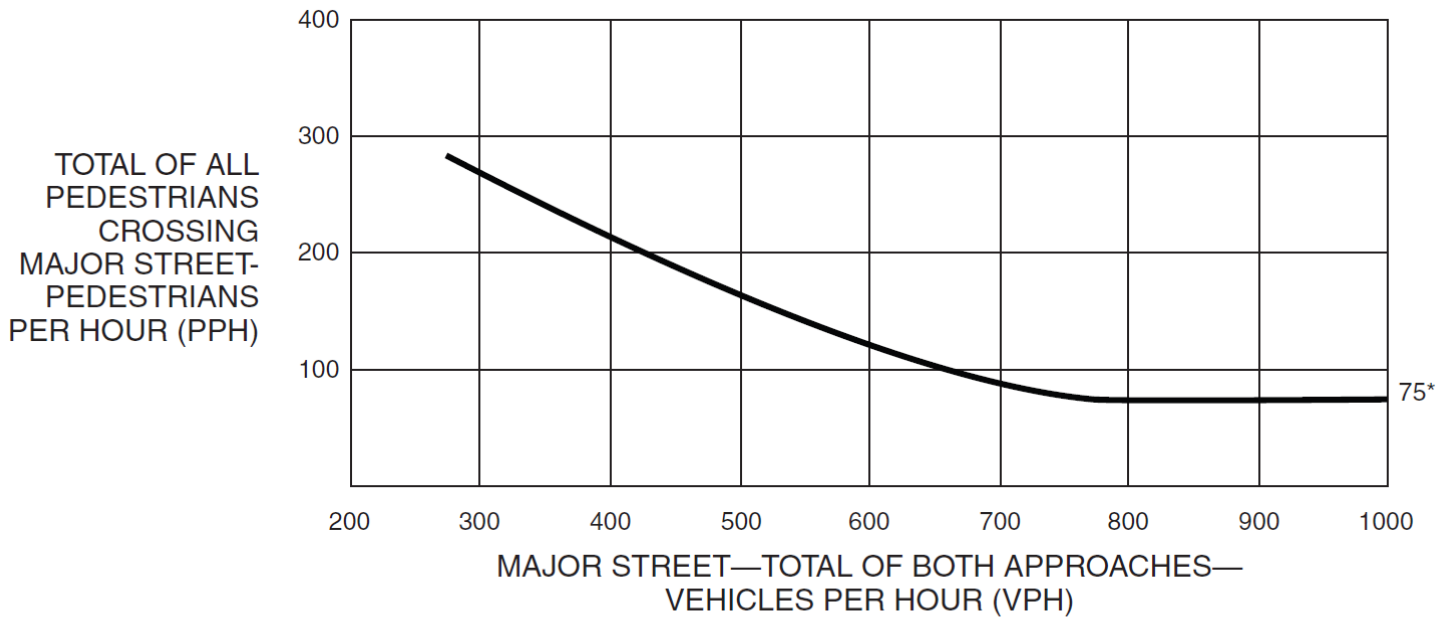
*Note: 75 pph applies as the lower threshold volume.

FIGURE 2-7: PEDESTRIAN FOUR-HOUR VOLUME WARRANT (70% Factor)



*Note: 107 pph applies as the lower threshold volume.

FIGURE 2-8: PEDESTRIAN PEAK HOUR WARRANT



*Note: 75 pph applies as the lower threshold volume.

FIGURE 2-9: PEDESTRIAN PEAK HOUR WARRANT (70% Factor)

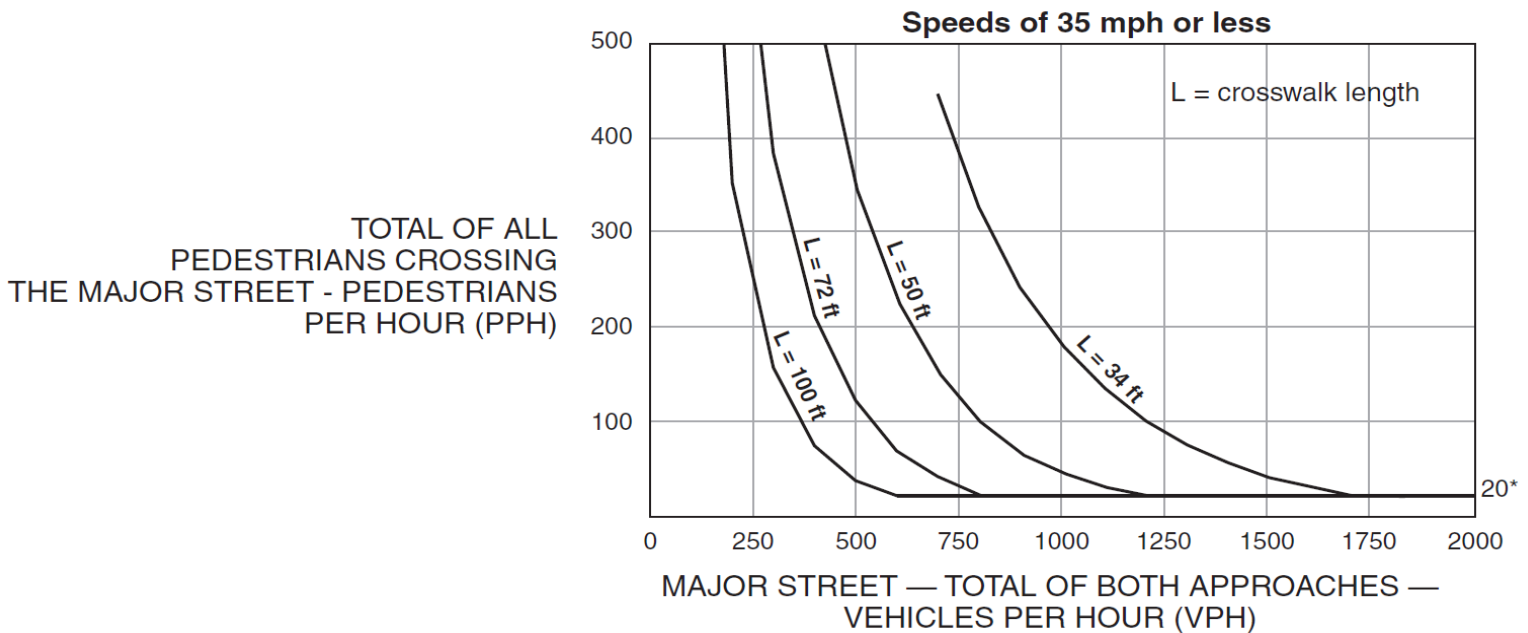
2.10 PEDESTRIAN HYBRID BEACON

A pedestrian hybrid beacon may be considered for installation to facilitate pedestrian crossings at a Designated Pedestrian Crossing that does not meet traffic signal warrants (see Section 2.9), or at a location that meets traffic signal warrants under Section 2.9 but a decision is made to not install a traffic control signal.

If a traffic control signal is not justified under the signal warrants of Section 2.9 and if gaps in traffic are not adequate to permit pedestrians to cross, or if the speed for vehicles approaching on the major street is too high to permit pedestrians to cross, or if pedestrian delay is excessive, the need for a pedestrian hybrid beacon should be considered on the basis of an engineering study that considers major-street volumes, speeds, widths, and gaps in conjunction with pedestrian volumes, walking speeds, and delay.

The need for a pedestrian hybrid beacon should be considered if the engineering study finds that the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding total of all pedestrians crossing the major street for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 2-10 or 2-11 for the length of the crosswalk. For a major street where the posted speed limit is 35 mph or less, use Figure 2-10; and for a major street where the posted speed limit is 40 mph use Figure 2-11. For crosswalks that have lengths other than the four that are specifically shown in Figures 2-10 and 2-11, the values should be interpolated between the curves.

Pedestrian hybrid beacons should not be installed at locations where the distance to the nearest traffic control signal along the major road is less than 300 feet, nor should they be installed where the posted speed limit on the major street is 45 mph or higher.



* Note: 20 pph applies as the lower threshold volume

FIGURE 2-10: GUIDELINES FOR PEDESTRIAN HYBRID BEACONS – LOW SPEED

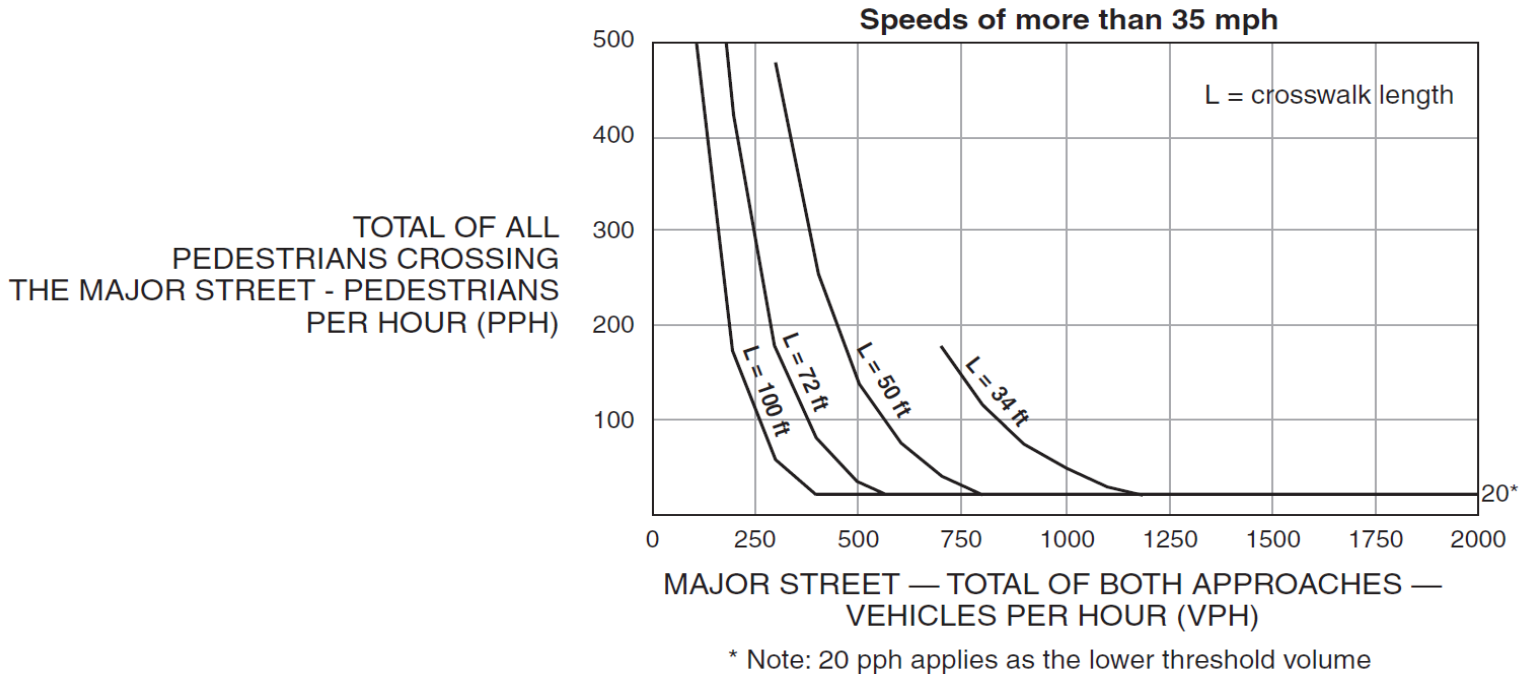


FIGURE 2-11: GUIDELINES FOR PEDESTRIAN HYBRID BEACONS – HIGH SPEED

2.11 PEDESTRIAN SIGNAL INDICATIONS

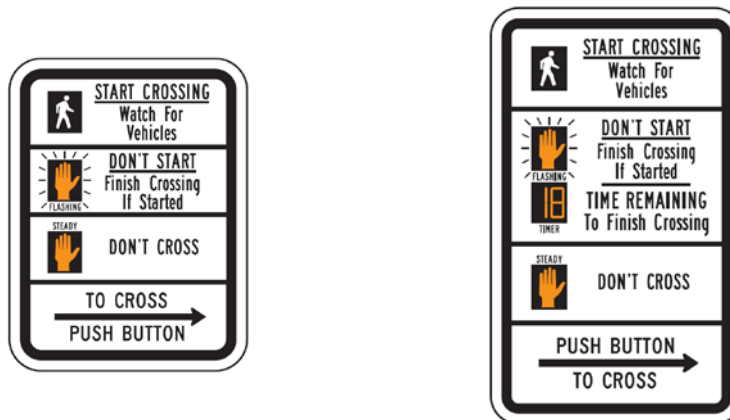
Pedestrian signal indications consist of the illuminated symbols of a WALKING PERSON (symbolizing WALK) and an UPRAISED HAND (symbolizing DON'T WALK). See Section 2.12 for more information on the meaning of pedestrian indications.

Pedestrian signal indications shall be installed at all signalized locations as follows:

- 1) If the traffic control signal is warranted by a traffic engineering study and meets either the WYDOT pedestrian or school crossing warrants.
- 2) If an exclusive signal phase is available for a pedestrian movement with all conflicting traffic being stopped.

Pedestrian signal indications should be used at other signalized locations based upon engineering judgment.

Many pedestrians do not understand the intended actions required by the pedestrian indications. Therefore, educational plaques shall be mounted at the crossing locations to inform the pedestrians of their proper usage.



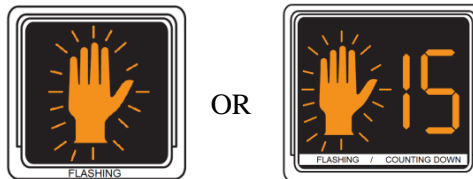
2.12 MEANING OF PEDESTRIAN SIGNAL INDICATIONS

The pedestrian signal indications facing the pedestrian shall have the following meanings:

- 1) A steady WALKING PERSON signal indication means the pedestrian may start to cross the roadway in the direction of the signal indication, possibly in conflict with turning traffic.



- 2) A flashing UPRAISED HAND signal indication, with or without a concurrent countdown display, means the pedestrian shall not start to cross the roadway in the direction of the signal indication, but if in the crosswalk shall finish crossing the traveled way. The signal timings are set to allow the average pedestrian sufficient time to finish crossing the traveled way before releasing stopped traffic.



- 3) A steady UPRAISED HAND signal indication means the pedestrian shall not enter the crosswalk in the direction of the signal indication.



2.13 PEDESTRIAN PUSHBUTTON

Pedestrian pushbutton control should be installed for all permitted crossing locations at signalized locations that are vehicle-actuated or where longer signal timings are needed for pedestrians to cross the road. An educational plaque shall be mounted next to the pushbutton to inform the pedestrian to use the pushbutton to cross the road, as well as the meaning of the pedestrian signal indications (see Section 2.11).

2.14 NO PARKING RESTRICTIONS

Curb parking restrictions shall be marked at all marked pedestrian crossings. Their primary purpose is to improve sight distance at the crossing location for both the pedestrian and driver.

For roads with on-street parallel parking, the advance No Parking restriction at a Designated Pedestrian Crossing should begin 50 feet in advance of the crosswalk. At mid-block, Designated Pedestrian Crossings the restriction shall be a minimum of 100 feet. At signalized intersections the No Parking restriction should be 30 feet, and at stop controlled intersection approaches 20 feet in advance of the crosswalk, respectively.

At all marked and unmarked crossings, parking should be restricted for 20 feet beyond the crosswalk or intersection.

Parking restriction signs shall be used with curb markings in those areas where curb markings are frequently obliterated by snow or ice accumulations, unless the no parking zone is controlled by statute or local ordinance.

2.15 PEDESTRIAN PAVEMENT WORD MARKINGS

The pavement word markings PED – X-ING shall be placed in each through approach lane in advance of all Designated Pedestrian Crossings.

2.16 STOP LINES

Stop lines indicate the point at which vehicles are required to stop. They are typically only used on the near side of a stop controlled or signalized intersection where the Designated Pedestrian Crossing is marked across the far side of the intersection from the normal stopping point.

2.17 YIELD LINES

Yield lines indicate the point at which vehicles are required to yield in compliance with a YIELD sign or to a pedestrian crossing the roadway at a Designated Pedestrian Crossing. They may be used on the through approach lanes on 2-Lane roadways, and should be used on all through approach lanes on multi-lane roads. When used, they should be located 4 feet to 50 feet in advance of the crosswalk. If the desired yield location is greater than 4 feet in advance of the crosswalk, a yield line should be installed. If a yield line is used at a crosswalk that crosses an uncontrolled multi-lane approach, the yield line should be located between 20 and 50 feet in advance of the crosswalk and a Yield Here to Pedestrian sign installed adjacent to the yield line.



2.18 CURB EXTENSIONS (bulb-outs)

Curb extensions are extensions to the curb line that extend to the edge of the parking lane and eliminate one or more parking spaces on the corner of the intersection or at a mid-block crossing (see Figure 2-12).

2.18.1 ADVANTAGES

Curb extensions have the following advantages:

- 1) They may reduce the pedestrian travel distance on the road.
- 2) By tightening up the corner radius of an intersection they can slow the speed of turning vehicles.
- 3) They improve the visibility of pedestrians by placing them where drivers can see them as well as improving the pedestrians' visibility of approaching vehicles.
- 4) They can improve the visibility of the crossing warning signs by allowing them to be placed closer to the traveled lane.
- 5) They make it difficult for drivers to park illegally at the crosswalk which assures better sight distance at the intersection.
- 6) They may slow down through traffic.

2.18.2 DISADVANTAGES

Curb extensions have the following disadvantages:

- 1) They constitute a fixed object in the roadway that drivers may run into at night or in inclement weather conditions unless on-street parking is present immediately adjacent to the curb extension.
- 2) There is less buffer space between the pedestrian waiting at the curb and the passing vehicle.

- 3) They can pose obstacles to road sweepers and snowplows.
- 4) They can complicate storm water runoff drainage.

Curb extensions should be considered at heavy pedestrian and vehicle volume crossings where their advantages outweigh their disadvantages. Types of vehicles, road drainage, and other physical roadway features must be considered before a decision to install curb extensions is made.

2.19 MIDBLOCK CROSSWALKS

Midblock crosswalks may be considered based on the following criteria:

- 1) No traffic controlled crossing location exists within 300 feet of the midblock location; and
- 2) The demand by pedestrians to cross within a concentrated midblock area exceeds the lower threshold volume criterion of the guidelines for the installation of pedestrian hybrid beacons (see Section 2.10), regardless of crossing length or vehicle volumes and speeds; and
- 3) A high midblock pedestrian generator exists nearby.

2.20 GRADE SEPARATED CROSSINGS

Grade-separated crossings refer to facilities that provide for pedestrians and motor vehicles to cross at different levels, and such facilities can greatly reduce pedestrian-vehicle conflicts and potential crashes. Not only have grade-separated structures been found to substantially improve pedestrian safety, they can also reduce vehicle delay, increase highway capacity, and reduce vehicle crashes when appropriately located and designed.

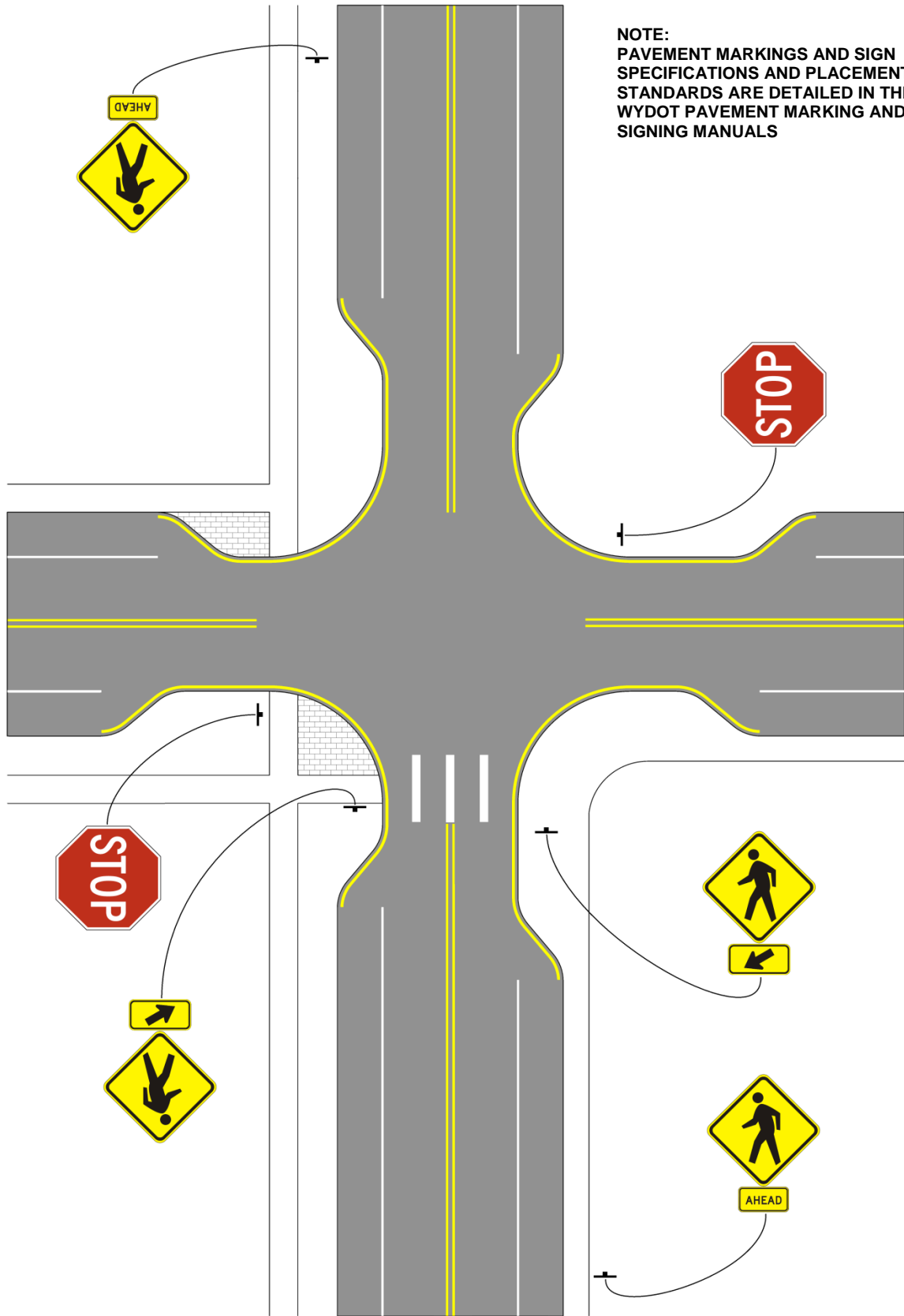
Grade-separated crossings (overpasses or underpasses) may be warranted where heavy pedestrian volumes face unusual risk or inconvenience to cross the roadway at-grade. Locations that are prime candidates for grade-separated crossings are located in areas where the pedestrian attractors such as shopping centers, large schools, recreational facilities, parking garages, or other activity centers are separated from the pedestrian generators by high-volume and/or high-speed arterial streets.

The effectiveness of grade-separated crossings depends on their perceived ease of accessibility by pedestrians, because an overpass or underpass will not necessarily be used simply because it improves safety. Instead, pedestrians tend to weigh the perceived safety of using the facility against the extra effort and time required to use the grade-separated crossing. Overpasses or underpasses at arterial streets are not likely to be used unless it is obvious to the pedestrian that it is easier to use such a facility than to cross at-grade.

The long term future need for the overpass/underpass, the physical characteristics of the location to make the structure feasible, and an economic comparison between the cost and maintenance of the structure and other controls indicating the structure is justified must be considered.

2.21 PEDESTRIANS WITH DISABILITIES

Special pedestrian traffic control for pedestrians with disabilities may be warranted. The engineering study should determine the number and type of pedestrians with disabilities using the crossing. Special traffic control may be needed due to pedestrians being visually impaired (audible pedestrian signals), or having restricted mobility (have trouble walking or are wheelchair-bound). Pedestrians with slower walking speeds require longer crossing times, and therefore longer gaps in traffic (longer pedestrian signal timings or special pedestrian traffic control), in order to cross the roadway safely. The location of pedestrian-activated controls may also need to be modified in order to provide access to the controls by pedestrians with disabilities.



NOTE:
 PAVEMENT MARKINGS AND SIGN
 SPECIFICATIONS AND PLACEMENT
 STANDARDS ARE DETAILED IN THE
 WYDOT PAVEMENT MARKING AND
 SIGNING MANUALS

FIGURE 2-12: TYPICAL CURB EXTENSIONS

CHAPTER 3 – SCHOOL TRAFFIC CONTROL

3.1 GENERAL

No pedestrian-vehicle crash causes more indignation and concern than the injury or death of a child, especially when going to or from school. No traffic control issue provokes parents, school officials, and civic leaders to demand crosswalks, signs, and traffic control signals more than the exposure of children to vehicular traffic. These requests are sincere and represent definite concerns for child safety.

Pedestrian-vehicle crash experience for the school walking trip clearly demonstrates that the major concern is with the younger students. The *Design and Safety of Pedestrian Facilities*, Institute of Transportation Engineers, states that the 5 to 8 year old age group is not able to judge the speed of approaching vehicles, nor the adequacy of gaps in traffic, and their peripheral vision is not well developed. Young children are also often inattentive and careless in crossing roads. A study that has extensively examined the behaviors and cognitions of children suggests that the necessary degree of maturity for safe behavior is reached between the ages of 9 and 12. In Wyoming, the pedestrian crash experience shows the 7 to 14 age group consistently experiences the highest annual number of injury crashes.

Therefore, school traffic control should focus on the elementary and junior high school age students. Analysis for protection of older students should focus on situations which are unusual or otherwise beyond normal experience utilizing standard pedestrian traffic control warrants.

The type of school traffic control used, either warning or regulatory, should be related to the volume and speed of traffic, street width and number of travel lanes, existing traffic control, and number of children crossing the road. Therefore, the school traffic control needed on a major road may not be needed on a residential road, and uniform standard warrants for school traffic control are needed to assure the use of similar controls for similar situations. This uniform application of school traffic control promotes uniform behavior on the part of the motorist and child, which in turn provides the safest practical traffic control system.

3.2 RESPONSIBILITY

3.2.1 PARENTS

The importance of teaching children to cross roads safely is basic. They must be taught early that at locations not controlled by a traffic signal it is only safe to cross the road when there is a safe gap between vehicles, and to know the difference between a safe and unsafe gap. To train children to look in both directions, and to recognize and wait for a safe gap is difficult and takes time. However, there is no other way. At traffic controlled locations they must be taught the meaning of the traffic control and how to properly use it.

Parents must start the safety education of the child before school age and continue it for many years. They should also field review the school walking route plan with their children.

3.2.2 SCHOOLS

The schools should supplement the students' safety education by education/training programs and by taking a leadership role in developing a school walking route plan for elementary and middle schools.

3.2.3 LAW ENFORCEMENT

The local law enforcement agency should be available to assist schools in their education/training programs, serve on school traffic safety committees, and provide enforcement of school traffic control locations.

3.2.4 TRAFFIC OFFICIALS

Roadway jurisdiction officials responsible for pedestrian traffic control should provide traffic engineering analysis of any school traffic control issue. They shall design, install, and maintain warranted school traffic control. They should serve on school traffic safety committees, assist with school education/training programs, and assist in the development of the school walking route plan.

3.2.5 CHILDREN

The child must be responsible for following the school walking route plan, understand the meaning and proper usage of school traffic control, select adequate gaps in traffic, and to cross the road safely. Younger children may need assistance of student or adult crossing guards, depending upon the situation.

It should not be the public responsibility to lead children across the road or to tell them at all locations when to cross the road going to or from school. At all other times this remains their and their parents' responsibility. To assume this responsibility part of the time may result in their improper conditioning for assuming this responsibility at other times than the school trip.

3.3 SCHOOL WALKING ROUTE PLAN

A nationally known and recommended practice for providing safe and efficient school trips is "School Trip Safety Program Guidelines", by the Institute of Transportation Engineers, 1984. WYDOT recommends the use of these guidelines by local officials who are responsible for improving the safety of young school pedestrians, as well as other school traffic safety concerns. It is designed to provide background and a systematic approach to this subject. However, the actual traffic analysis and recommendations must be developed by a qualified professional engineer.

A school walking route plan should be developed in a systematic manner for all elementary and junior high schools by the school, law enforcement, and traffic officials responsible for school pedestrian safety. The school officials should take the leadership role in developing the plan and in the preparation and distribution of the plan to parents and students.

The plan along with instructions for parents, students, and teachers should show the following:

- 1) The school and entrances
- 2) Designated routes for the students
- 3) Marked crosswalks, roads, and sidewalks
- 4) Traffic control devices affecting operation of the walking route
- 5) Adult crossing guard locations

The school walking route plan should take advantage of existing traffic controls and sidewalks. This may make it necessary for students to walk an indirect route to a Designated School Crossing located where there is existing traffic control, and to avoid the use of a direct crossing where there is no existing traffic control. Factors to consider when determining the feasibility of requiring students to walk longer distances include: the number and age of the students; the availability of sidewalks or off-roadway sidewalk areas to and from the location of the existing traffic control location; and, the total extra walking distance (see Figure 3-1).

The school walking route plan should be reviewed annually to determine the possible need for revision. Such revisions may be necessary due to new schools, changes in school boundaries, changes in roads or traffic patterns, or installation of new traffic or pedestrian controls.

Frequent field reviews should be made along the school walking route to determine whether it is being properly used, and if traffic control is adequate.



FIGURE 3-1: EXAMPLE OF SCHOOL WALKING ROUTE PLAN

3.4 SCHOOL TRAFFIC CONTROL WARRANTS

Whenever a designated school walking route crosses a road or any other school related activity takes place on or adjacent to the road, the location should be evaluated as to whether school traffic control is necessary.

If a current school route plan exists which has been approved by the WYDOT District Traffic Engineer, WYDOT will install and maintain Designated School Crossings at all non-controlled school walking route crossings on the State Highway System.

If no school walking route plan exists, WYDOT will, upon request by school or local officials, conduct a school crossing study at specific requested locations on the State Highway System. The school traffic control devices needed should be based upon the following guidelines.

3.5 MARKED CROSSWALK

A marked crosswalk shall be placed at all Designated School Crossings. It shall be a longitudinal line crosswalk as shown in Figure 2-1.

A marked crosswalk may also be placed at signalized or stop controlled locations if additional guidance for the students is needed.

3.6 SCHOOL PAVEMENT WORD MARKING

Advance pavement word markings SCHOOL – X-ING shall be placed at all marked school crossings. They shall be placed in each through approach lane to the crossing.

3.7 SCHOOL ADVANCE CROSSING ASSEMBLY



The School Advance Crossing assembly shall consist of a School sign supplemented with an AHEAD plaque to warn road users that they are approaching an area of school activity.

A School Advance Crossing assembly shall be used in advance of a Designated School Crossing.

A School Advance Crossing assembly should be placed in advance of the following (see Figure 3-2):

- 1) An unfenced school playground which is next to the roadway.
- 2) A designated school bus or parent drop-off or pick-up location which is next to the roadway or on the roadway shoulder and adjacent to the school facility.

A School Advance Crossing assembly or reduced speed limits should not be used where school activities are not next to the roadway since their need is not justified. If used in these locations, disrespect for the signs by motorists will result. This reduces the sign's effectiveness and can decrease the safety benefits where the signs are needed.

If the school crossing is located on a road with more than one through lane per approach, a School Advance Crossing assembly may be located on each side of the approaching roadway

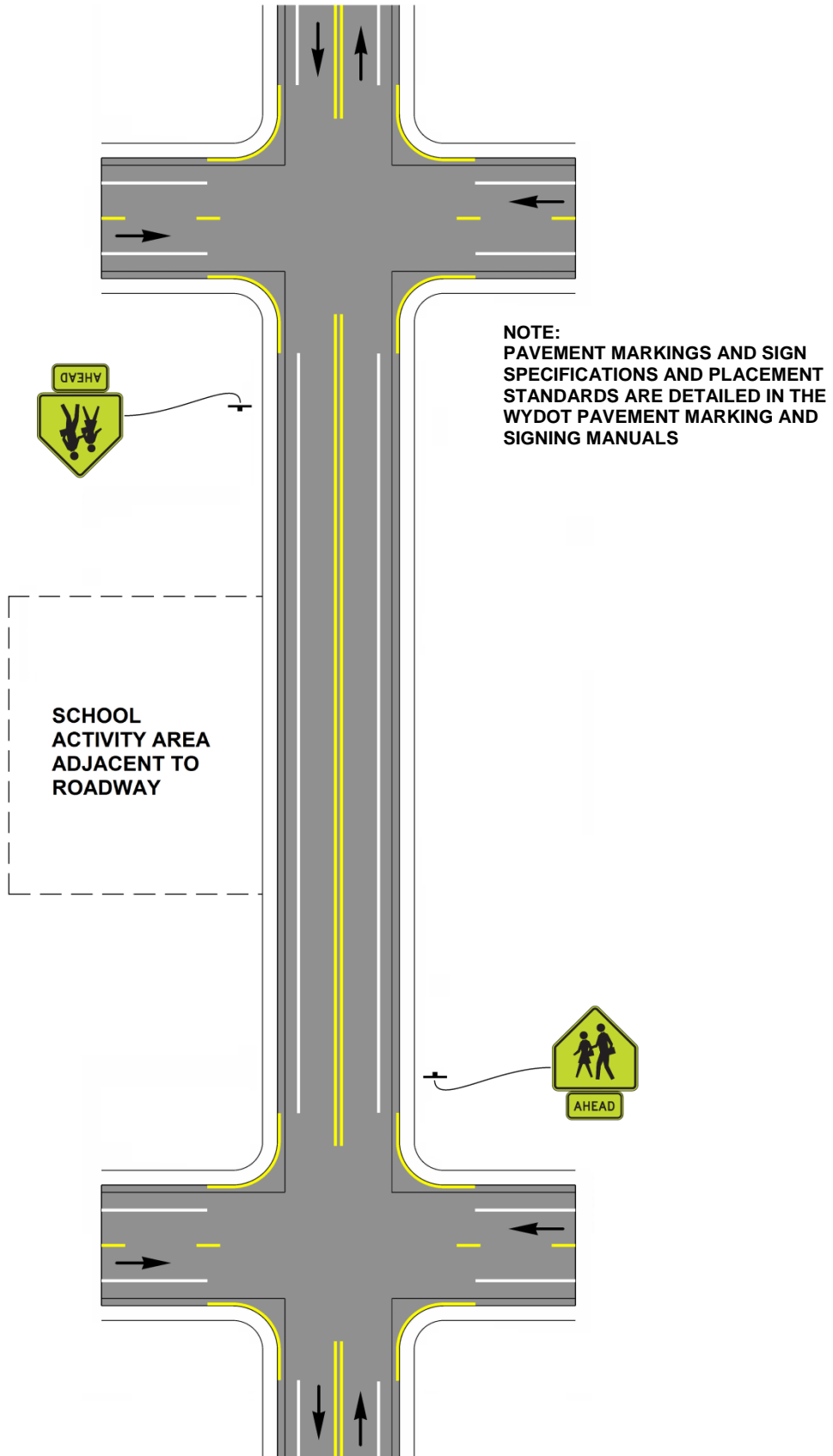


FIGURE 3-2: ADVANCE SCHOOL WARNING

3.7 SCHOOL CROSSING ASSEMBLY



The School Crossing assembly shall consist of a School sign supplemented with a diagonal downward pointing arrow plaque to show the location of the crossing.

A School Crossing assembly shall be used at the crosswalk at all Designated School Crossings.

If the school crossing is located on a road with more than one through lane per approach, a School Crossing assembly should be located on each side of the approaching roadway

3.8 DESIGNATED SCHOOL CROSSING



A Designated School Crossing consists of the following traffic control devices (see Figures 3-3 through 3-6):

- 1) School Advance Crossing assembly
- 2) School Crossing assembly
- 3) Marked crosswalk
- 4) Advance SCHOOL – X-ING pavement word markings
- 5) Curb parking restriction markings and signs
- 6) Yield lines (optional)

A Designated School Crossing should be considered:

- 1) When the frequency of adequate gaps in the traffic stream during the time period students are using the crossing is less than the number of minutes in the same time period and there are at least 10 students using the crossing during the highest crossing hour;
- 2) At all uncontrolled designated school walking route crossings on the State Highway System.

If the school crossing is located on a road with more than one through lane per approach, the signs should be located on each side of the approaching roadway.

A Designated School Crossing should not be installed on high speed roads (45 mph or higher). In that case, students should be bused or taken to school or across the road by parents, or school boundaries revised to eliminate the need for the crosswalk.

3.9 SCHOOL SPEED LIMIT WHEN FLASHING



A SCHOOL SPEED LIMIT WHEN FLASHING sign should be used at a Designated School Crossing if:

- 1) There are at least 20 students during the highest crossing hour regardless of gaps; or
- 2) There are at least 10 students during the highest crossing hour and there are less than 60 adequate gaps in traffic during that period.

A school speed limit shall not be used at any school crossing controlled by Stop signs, Yield signs, or traffic control signals unless an engineering study indicates a special need. A school speed limit higher than 20 mph may be appropriate at a Designated School Crossing when based upon an engineering study.

For added visibility, a second SCHOOL SPEED LIMIT WHEN FLASHING sign may also be located on the left side of the approaching roadway. For even more emphasis, the SCHOOL SPEED LIMIT WHEN FLASHING sign may be mounted overhead over the approximate center of the approach.

3.10 RECTANGULAR RAPID FLASH BEACONS

Rectangular rapid flash beacons (RRFBs) and their operational requirements are discussed in Section 2.8. RRFBs may be used to enhance a Designated School Crossing when there are a minimum of 20 students crossing during the highest crossing hour and engineering judgment determines that extra emphasis is needed to increase drivers' requirement to yield to pedestrians in the crossing.

Rectangular rapid flash beacons should not be installed at locations where the distance to the nearest traffic control signal along the major road is less than 300 feet. If elementary school children use the crossing equipped with RRFBs an adult crossing guard shall be provided to assist and instruct the students in the proper use of the beacons and selection of safe gaps in which to cross. If junior high students use the signal an adult crossing guard should be provided.

3.11 PEDESTRIAN HYBRID BEACON

A pedestrian hybrid beacon may be used to control a Designated School Crossing when an engineering study finds that the combination of the traffic volumes on the major street, the speed of traffic on the major street and the length of the crosswalk meet the guidelines for installation of pedestrian hybrid beacons as described in Section 2.10.

Pedestrian hybrid beacons should not be installed at locations where the distance to the nearest traffic control signal along the major road is less than 300 feet, nor should they be installed where the posted speed limit on the major street is 45 mph or higher. If elementary school children use the crossing an adult crossing guard shall be provided to assist and instruct the students in the proper use of the beacons. If junior high students use the signal an adult crossing guard should be provided.

3.12 TRAFFIC CONTROL SIGNAL

With the abundance of less restrictive, yet equally effective traffic control options for school crossings, new traffic control signals should not be installed based solely on school crossing needs. Instead, less restrictive measures such as pedestrian hybrid beacons or a Designated School Crossing supplemented with RRFBs and an adult crossing guard should first be pursued.

If one of the vehicular warrants are met at the intersection, and the crossing of the major street at the intersection is part of the designated school walking route plan, then the installation of a traffic control signal should 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 schoolchildren crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Chapter 9 of the WYDOT Traffic Studies Manual for information on conducting a gap study) and there are a minimum of 20 schoolchildren during the highest crossing hour.

The traffic control signal installed at a Designated School Crossing shall include pedestrian signal indications and pushbutton control. If elementary school children use the signal an adult crossing guard shall be provided to assist and instruct the students in the proper use of the signal. If junior high students use the signal an adult crossing guard should be provided.

An analysis of potential heavy right or left turning vehicles over the crosswalk at the same time the students are using the crosswalk should be evaluated. Special signal timings or adult crossing guards may be needed if adequate gaps in the turning traffic do not exist.

Traffic signal control is not necessarily a positive protection for students. Students should be warned about the hazard of turning vehicles at signalized locations and trained not to rely too heavily on their WALK (or green light) indication.

3.13 ADULT CROSSING GUARD

Adult crossing guards assist students across roads by providing or lengthening a gap in traffic or by educating and assisting the students in the proper usage of existing traffic control such as signal pushbuttons. They may also assist students where special situations exist such as complicated walking paths, high vehicular speeds, or heavy vehicular turning movements.

On-site supervision of school crossings shall be provided for elementary students and should be provided for junior high students where the school walking route crosses major high volume roads. This supervision should be provided by adult crossing guards meeting the 2009 MUTCD Chapter 7D requirements for adult crossing guards. Since they are acting as an official traffic control device, adult crossing guards shall wear high-visibility retroreflective safety apparel labeled as ANSI 107-2004 standard performance for Class 2 risk exposure and carry a STOP paddle.

Adult crossing guards should be trained by a responsible agency on how to stop traffic, and should be physically and mentally alert. They should not relieve students of all crossing safety responsibilities at school crossings. It is essential that they take advantage of their position to properly instruct and develop in the students the ability to take care of themselves at any pedestrian crossing.

Adult crossing guards should be on duty at all Designated School Crossings during the time periods the school speed limit signs are flashing when elementary and junior high school students must cross high volume state highways. They should be on duty at all signalized school crossings used by elementary and junior high students during the time periods the students are present.

3.14 SCHOOL BUS STOP WARNING

The School Bus Stop Ahead sign should be installed in advance of designated school bus stop locations used to pick up or drop off students where adequate sight distance does not exist. The signs shall only be installed for the direction that does not have adequate sight distance.



Bus stops without adequate stopping sight distance should be relocated if at all practical since a warning sign does not replace the safety benefits of adequate stopping sight distance.

Students may be on or next to the roadway at school bus stop locations without the bus being present with its lights flashing. Therefore the sight distance required should be 3.5 feet (driver eye height) to 3.5 feet (assumed student height) and should be based upon the posted speed of the road. These stopping sight distances are located in Table II-1 of the WYDOT Access Manual.

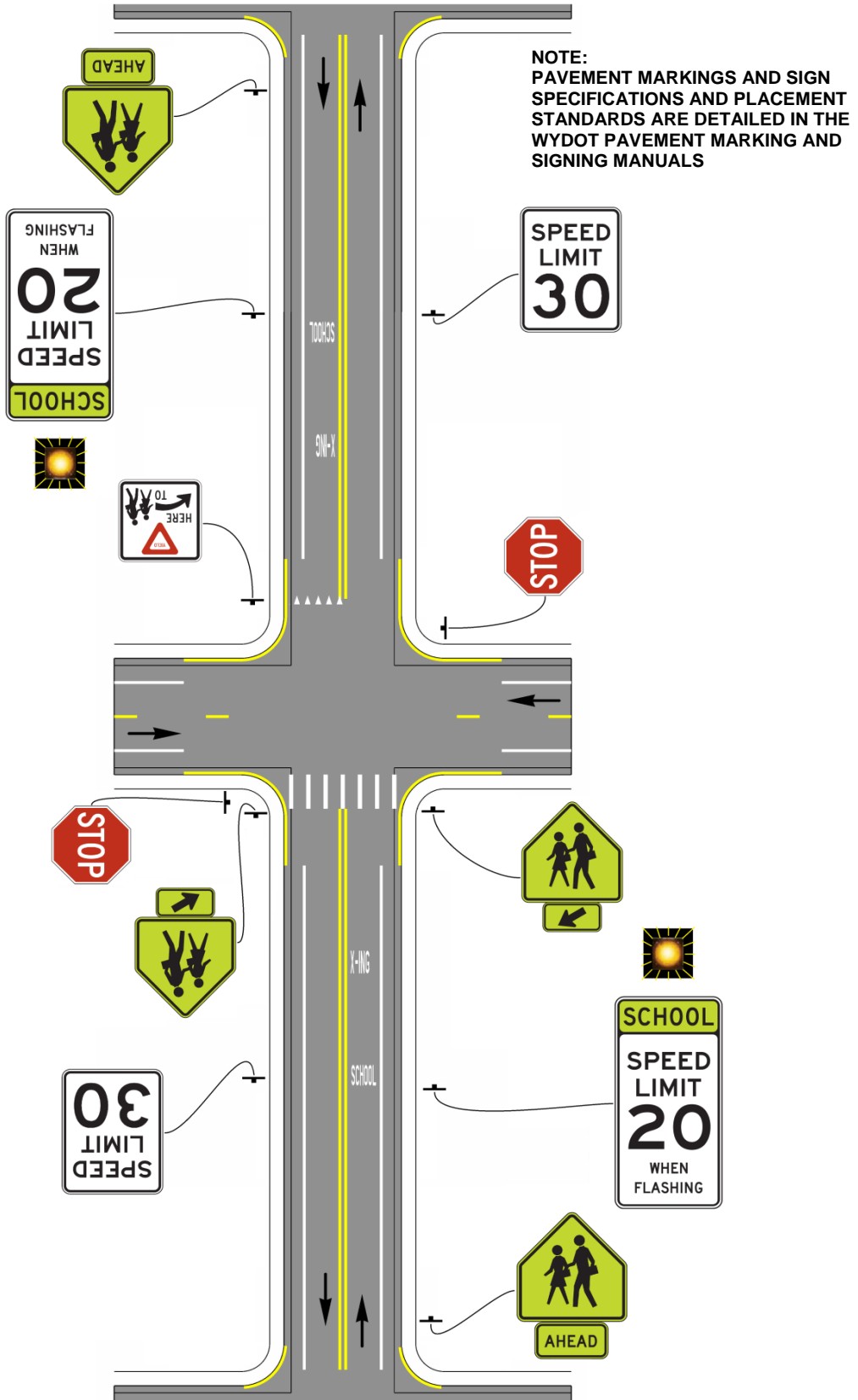
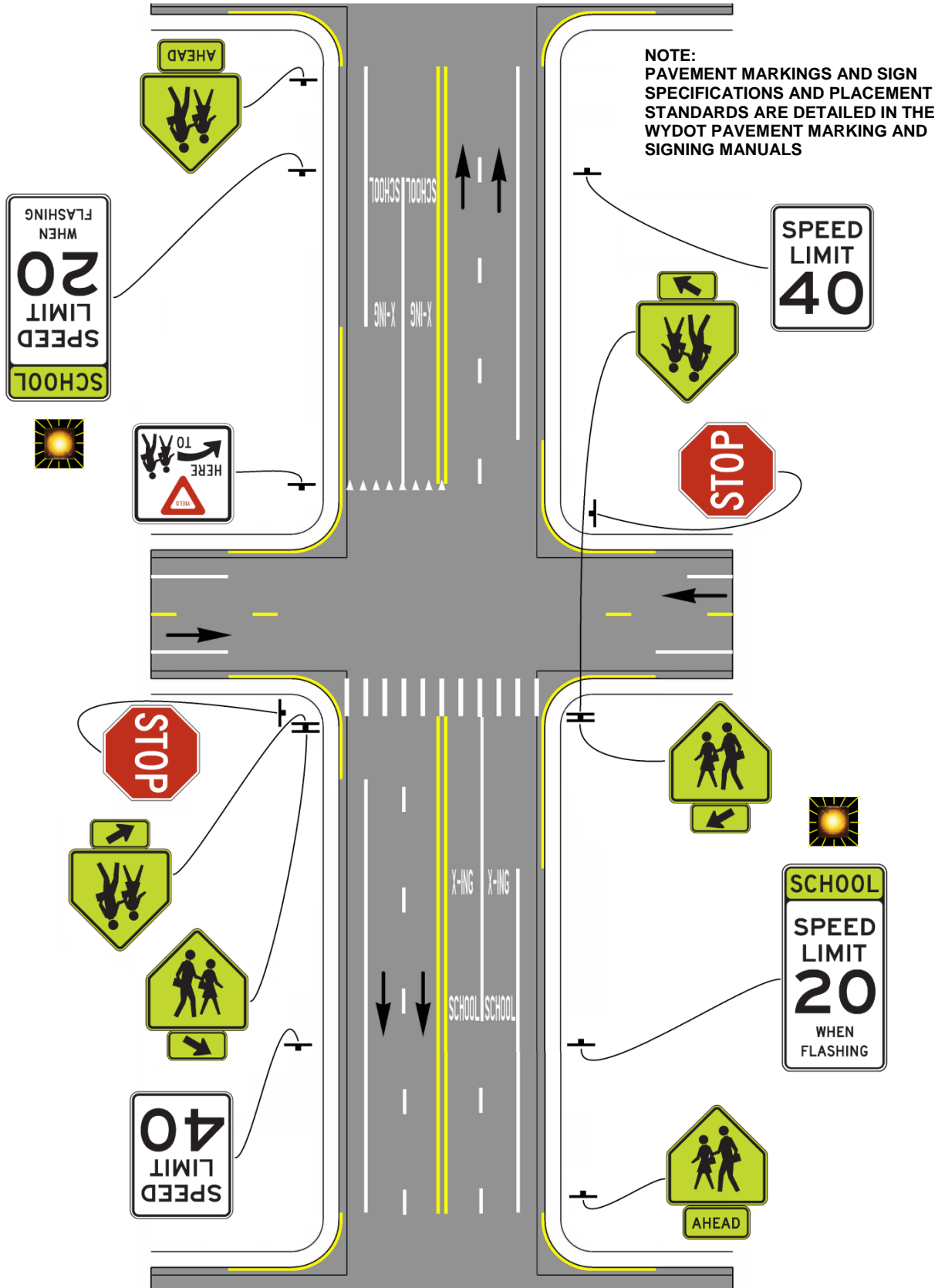
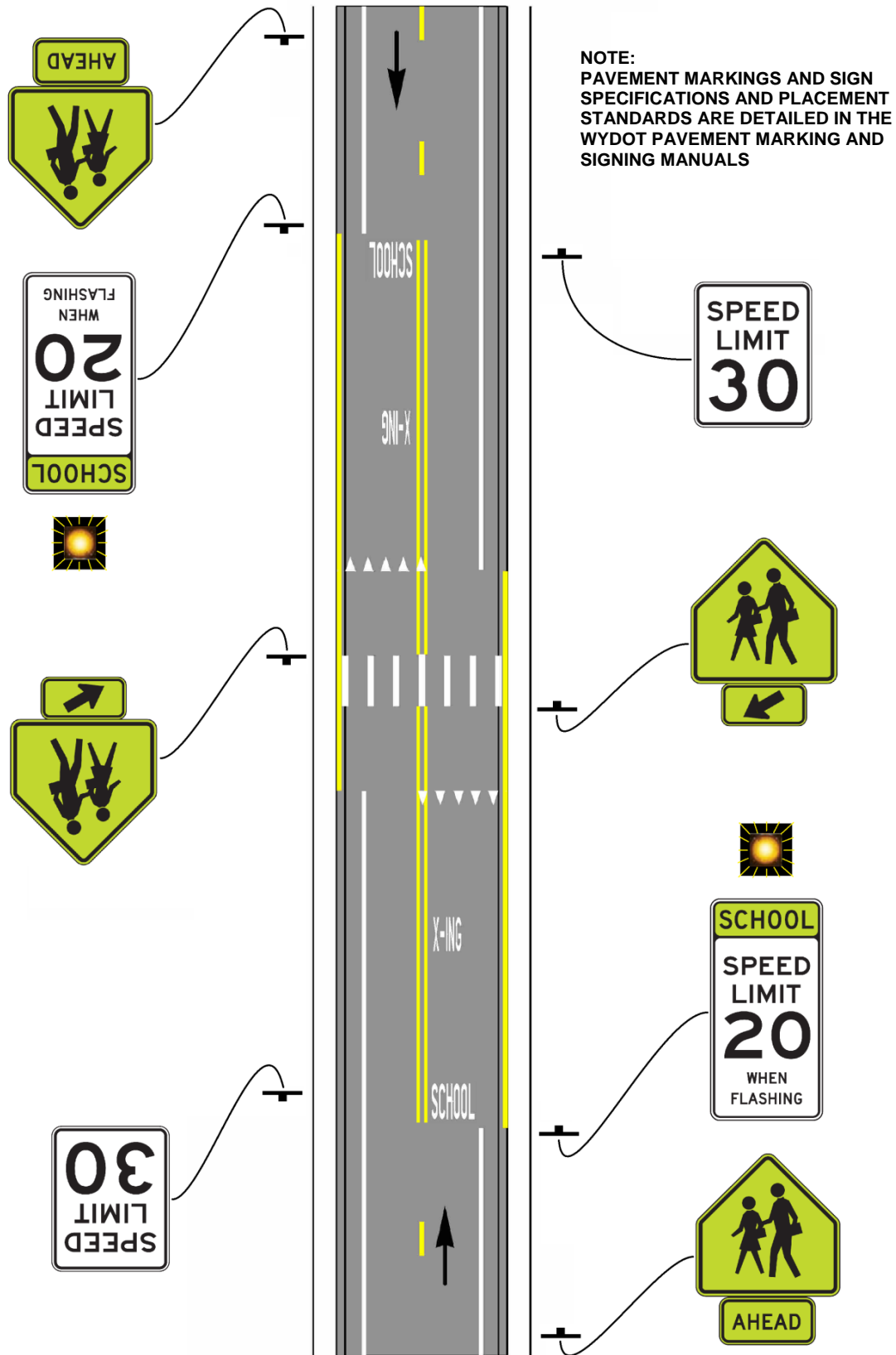


FIGURE 3-3: INTERSECTION DESIGNATED SCHOOL CROSSING (2-LANE ROAD)



**FIGURE 3-4: INTERSECTION DESIGNATED SCHOOL CROSSING
(4-LANE ROAD)**



**FIGURE 3-5: MID-BLOCK DESIGNATED SCHOOL CROSSING
(2-LANE ROAD)**

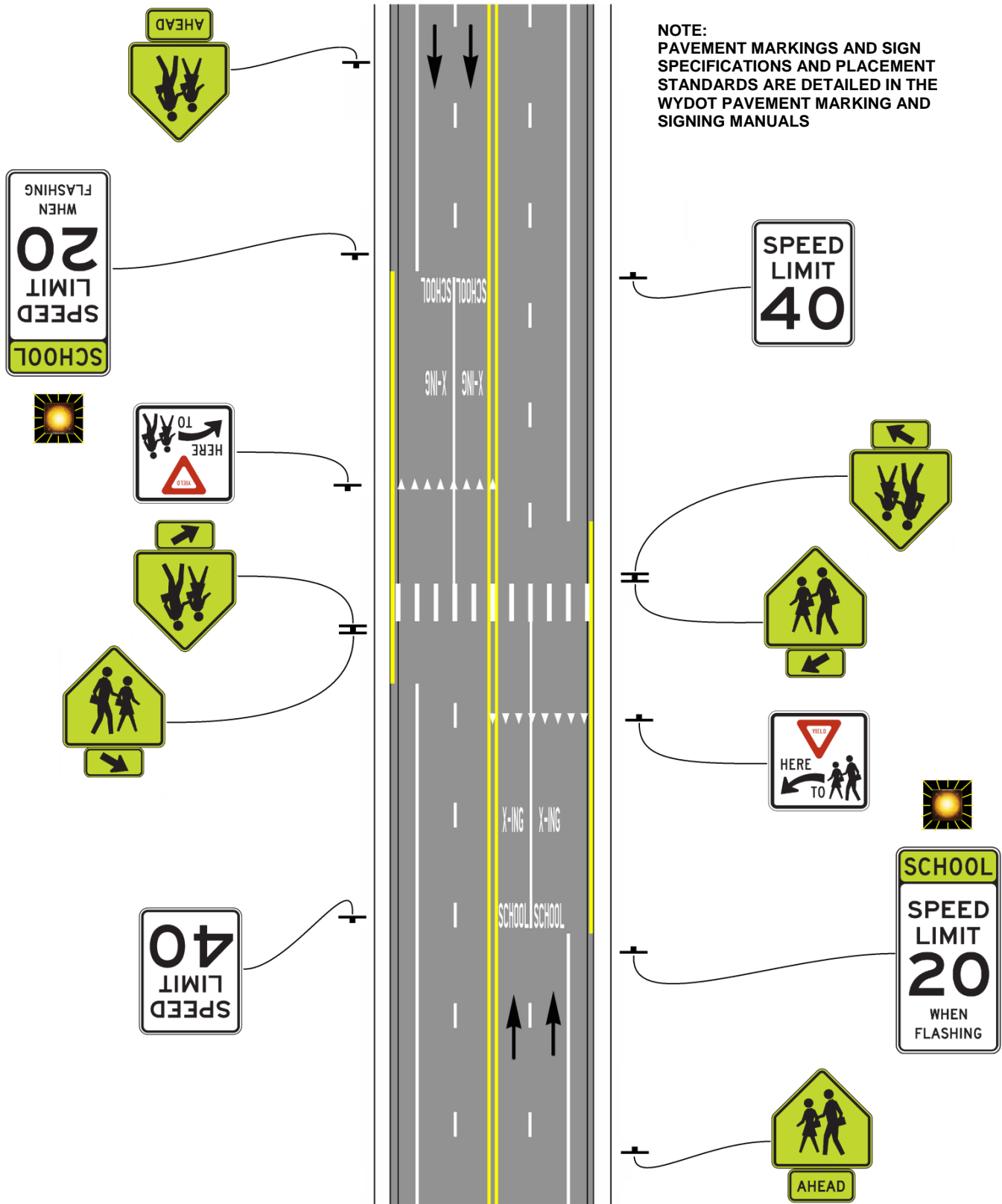


FIGURE 3-6: MID-BLOCK DESIGNATED SCHOOL CROSSING (4-LANE ROAD)

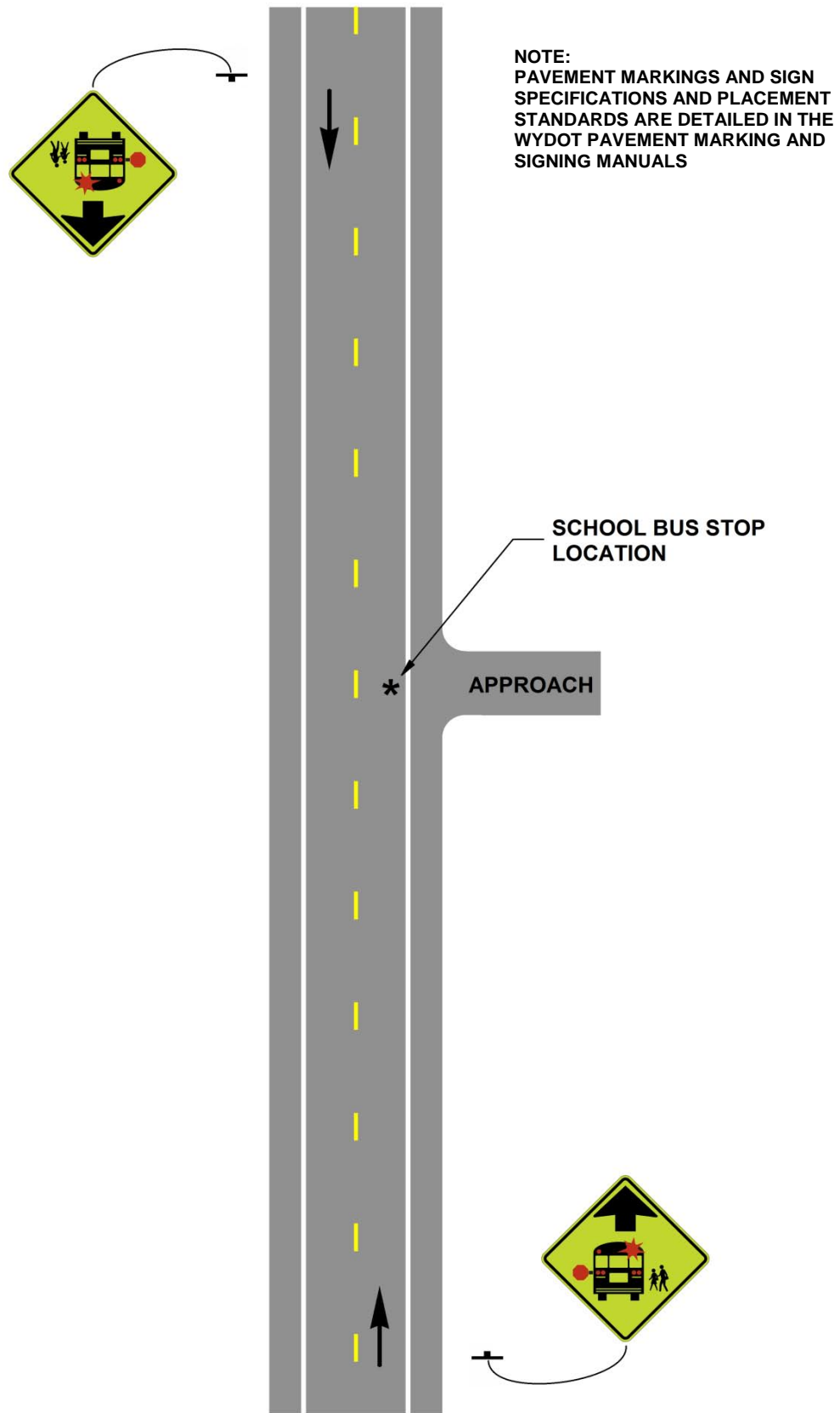


FIGURE 3-7: SCHOOL BUS STOP WARNING