



# SAFE ROUTES TO SCHOOL

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## Overview

The national Safe Routes to School (SRTS) program was established and funded under the *Safe, Accountable, Flexible, Efficient, Transportation Equity Act: A Legacy for Users Act (SAFETEA-LU)* of 2005. However, Moving Ahead for Progress in the 21<sup>st</sup> Century (MAP-21) and the Fixing America's Surface Transportation (FAST) Act subsequently folded the SRTS into another program so it is no longer its own stand-alone funded program withn the Federal Highway Administration (FHWA). As established, the state SRTS coordinator creates and implements the state program and administers the distribution of federal funds to local jurisdictions. These funds are typically not intended for Department of Defense (DoD) installations.

The five Es—Engineering, Education, Enforcement, Encouragement, and Evaluation—are the components of a successful SRTS program. The National Center for Safe Routes to Schools Program Tool Database provides resources, guides, and case studies that specifically address each E in context for transportation professionals. The five Es are defined below:

### A successful SRTS program consists of the 5 Es:

- Engineering
- Education
- Encouragement
- Enforcement
- Evaluation

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1 Soldier Way  
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62225-5006

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- ☑ Engineering – Creating operational and physical improvements to the infrastructure surrounding schools that reduce speeds and potential conflicts with motor vehicle traffic, and establishing safer and fully accessible crossings, walkways, trails, and bikeways.
- ☑ Education – Teaching children about the broad range of transportation choices, instructing them in important lifelong bicycling and walking safety skills, and launching driver safety campaigns in the vicinity of schools.
- ☑ Encouragement – Using events and activities to promote walking and bicycling.
- ☑ Enforcement – Partnering with local law enforcement to ensure traffic laws are obeyed in the vicinity of schools (this includes enforcement of speeds, yielding to or stopping for pedestrians in crossings, and proper walking and bicycling behaviors), and initiating community enforcement such as crossing guard programs.
- ☑ Evaluation – Monitoring and documenting outcomes and trends through the collection of data, including the collection of data before and after the intervention(s).

While all five Es are critical to a successful SRTS program, this bulletin will focus on the Engineering aspects.

The top concerns often cited by parents regarding children walking and biking to school are safety at intersections, distance from school, speed of traffic, and amount of traffic. As members of the stakeholder team, transportation professionals provide technical advice and identify engineering solutions to mitigate these concerns.

The engineer's role may include:

- ☑ Creating school walking and bicycling route maps using a variety of assessment tools and exercises
- ☑ Regulating traffic near schools
- ☑ Providing solutions to common traffic problems at the school site
- ☑ Providing and maintaining bicycle and pedestrian facilities along the school routes
- ☑ Minimizing conflicts to provide safer street crossings for bicyclists and walkers
- ☑ Maximizing safety and efficiency at school drop-off/pick-up points

Specifically, critical aspects on a DoD installation would include identifying the school site and offsite access when the opportunity is available, assessing the walking route whether it be for a new or existing school, preparing maps for distribution, improving traffic operations and safety for roadways and school accesses, and the site. It also would include an Architectural Barriers Act (ABA) assessment for walking routes, traffic control on the route to the school, as well as the use of school zone speed limits.

## School Site Selection and Off-site Access

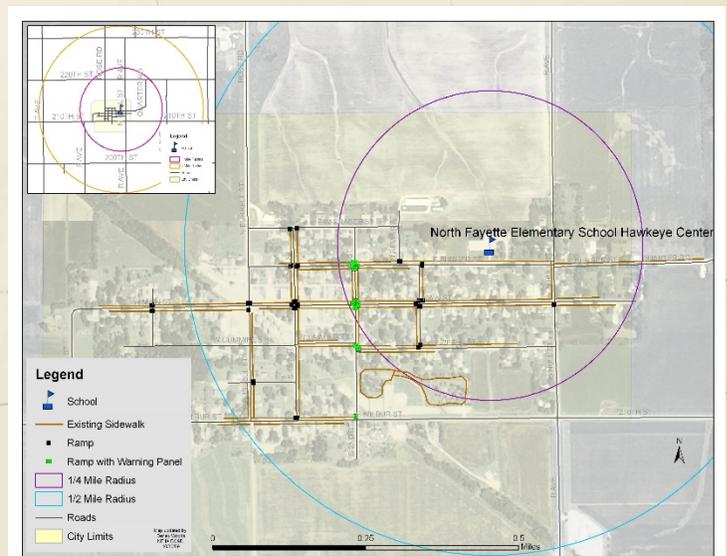
Two key benefits of SRTS include: (a) lowered vehicle demand and (b) exercise for children. The location of a school can influence levels of physical activity. When in the master planning stages, schools should be located to allow easy walking and bicycling for the children who will attend the school. Location varies considerably for elementary schools, middle or junior high schools, and high schools. Schools should provide pedestrian and bicycle access from all sides of the campus.

A central principle of traffic safety is to eliminate or minimize conflicts, such as those between streams of moving vehicles and between pedestrians and vehicles. When conflicts cannot be avoided, measures should be taken to minimize speeds. When designing a new school site, the opportunity is readily available to incorporate various design components (buildings, driveways, walkways, bus loading areas, parking lots, etc.) intended to eliminate or minimize conflicts.

**Site Selection.** The selection of a site for a new school greatly influences the resulting design and operations of the facility. For example, if the site is located on a high-speed two-lane highway, there will be vehicles near the school traveling at high speeds and congestion will probably occur during drop-off and pick-up times due to the lack of turn lanes. Another example is a school site in a remote location with natural barriers, or built barriers such as railroad tracks. Few children will probably walk or bike to the school due to distance and limited travel paths. Siting a school within a (walkable) residential area will decrease vehicle trips and alleviate many undesirable conflicts.

The U.S. Environmental Protection Agency, in consultation with the Departments of Education and Health and Human Services, recommend locating a school such that a large portion of the student body lives within 1/2 mile (elementary) to 1 1/2 miles (high school) of the school, and ensuring that safe routes to and from school are available for students. School location versus radius are shown in figure 1.

FIGURE 1: School Location Versus Radius



It is desirable to locate school sites with appropriate access from the adjacent roadway, walkway, and bikeway networks. One of the widely accepted site selection criteria is to avoid locations with direct access to high-speed roadways. Others are to provide access from more than one direction to the immediate vicinity of the site, and provide access to the site from at least two adjacent streets. Access from more than one street has several potential benefits, including easier separation of parent and bus operations, better driveway spacing, and greater dispersion of traffic into and out of the site.

**Road Network.** Schools need to be accessible from a street system capable of handling both school and non-school traffic. Consider availability of width adjacent to the roadway for sidewalks, bike lanes, and/or turn lanes (if not already present) and feasibility of establishing a reduced school speed limit zone. Accommodation of pedestrian and bicycle traffic is especially important in areas surrounding schools. The siting needs of an elementary school within the road network differ significantly from those of a high school. Elementary school siting should avoid streets that carry high volumes of traffic and higher speeds. Those streets are incompatible with the slow speeds of vehicles trying to access the school during school peak periods and with the pedestrian skills of younger children. Elementary and middle schools should be located on a collector street, and preferably at the intersection of two collector streets. Schools should not be located at the end of a cul-de-sac or have only one primary vehicle access. Special care should be considered when developing parking/drop off/pickup areas as more conflicts occur in these locations than anywhere else.

**Sidewalks.** Sidewalks and designated paths leading to schools promote the use of non-motorized modes of travel. For better pedestrian comfort, especially adjacent to high-speed traffic, it is desirable to provide a buffer space between the traveled way and the sidewalk. Sidewalks should be wide enough to accommodate the volume and type of pedestrian traffic expected in the area. They should be wider than minimum in the immediate vicinity of schools, where there are heavier pedestrian volumes. All sidewalks and curb ramps are required to be ABA-compliant.

Sidewalks will more likely be used if they are well-maintained and free of debris, encroaching shrubbery, and tree limbs.

Bumps and uneven surfaces created by settling or underlying tree roots can cause tripping and discourage sidewalk use by students traveling by foot and in wheelchairs. Public works agencies must not pile snow on sidewalks when clearing snow from streets and should clear curb ramps at crosswalks.

**Major Crossings.** One way to encourage pedestrian and bicycle access is to supplement marked crosswalks with crossing guards. Other infrastructural improvements can be made if appropriate, such as raised crosswalks or speed tables to slow vehicles and maximize pedestrian visibility. It is also important to consider crosswalks within the school campus itself, particularly those across entrance driveways where vehicles may frequently turn in conflict with pedestrians or bicyclists.

Figure 2 shows an example of school walking routes.

FIGURE 2: School Walking Route Examples



## Assess the Walking Route

Once the walking route is identified, perform an assessment of the entire route to determine its adequacy. In advance of the assessment, stakeholders should be consulted to determine specific areas of concern. This could take the form of distributing surveys to parents, neighborhood associations or police agencies; and meeting with key parties, such as school officials, school bus drivers, crossing guards, and state, county or city department of transportation or installation public works personnel.

When conducting an audit, participants need to consider the perspectives children have when walking and bicycling to and from school. Keep in mind that younger children have difficulty seeing and evaluating traffic conditions because of their height, processing information because of their limited peripheral vision and visual acuity, correctly perceiving the direction and sound of traffic, and understanding the use of traffic control devices and crosswalks.

Within the school zone, participants should inventory facilities and behavior of students and parents. Many audit forms and templates are available online. The National Center for Safe Routes to School website is a very helpful resource for these items: <http://www.saferoutesinfo.org/>.

The following information should be collected:

- ☑ School area traffic controls and sidewalks—presence and condition of all sidewalks and signs that serve the school, including signs indicating the school zone, speed limit, and drop-off/pick-up area. Also, ABA accessibility, including compliant curb ramps, accessible push-buttons, and sidewalk width. Sight distance at crosswalks should be verified considering parked cars, and geometric or infrastructural sight distance limitations.
- ☑ Drop-off/pick-up site—conditions of route for students getting dropped off/picked up
- ☑ Route for students walking or bicycling to/from school—conflicts with driveways and/or traffic flow, presence of dedicated route up to the school entrance
- ☑ Crossing guards—number and location, condition of crossing guard equipment (STOP paddles, safety vest, etc.), and level of training
- ☑ Bicycle parking—presence, location, visibility, surface treatment (paved, gravel, grass), and use
- ☑ School policy—staggered dismissal time for students who walk or bike, policies for bus loading and parent drop-off/pick-up (designating separate entrances and loading zones, drop-off/pick-up queuing, timed arrivals or dismissal, student or teacher valets, etc.)
- ☑ School education and encouragement efforts—traffic safety, walking and/or bicycling education; walking school buses; contests; events; etc.
- ☑ Visibility—adequate lighting, line of sight to pedestrian paths, presence of obstructions (light poles, signs, vegetation, parked buses or other vehicles, etc.)

As the study team walks around identified locations of interest, they should observe the following information:

- ☑ Sidewalk conditions—presence and continuity of sidewalks, width, condition of the surface, ABA accessibility, buffer from the travel lane, obstacles such as utility poles, signs, or vegetation
- ☑ Pathways—presence of formal or informal off-street paths or cut-throughs
- ☑ Bikeways—bike lane characteristics (width, continuity, and presence of adjacent parking), bikeway signs and pavement markings, speed and volume of traffic, pavement condition, street crossing treatments or conflicts
- ☑ Traffic patterns—location of streets where drivers tend to speed, intersections with a high rate of turning cars, and conflicts between walking or bicycling routes and traffic patterns
- ☑ Visibility—whether pedestrian and driver sight distances are sufficient for pedestrians less than 5 ft. tall

At street crossings, interviews with crossing guards or police forces can identify ongoing or critical programs with circulation, including driver behavior, student behavior, or infrastructure issues. Information to collect at street crossings includes the following. See figure 3 for example locations of common features.

- ☑ Curb ramps—presence of curb ramps, presence and adequacy of detectable warning surface at the base of the ramp, ABA compliance, number of curb ramps per corner, alignment and orientation of curb ramp (detectable warning surface aligned to direct people into crosswalk), presence and condition of landing area (4-ft. flat section at the top of the ramp)

- ☑ Marked crosswalks—condition, type of pavement markings, signing compliance (if appropriate), visibility at the crosswalk, and whether the ramp is contained within the crosswalk markings
- ☑ Traffic signals—pedestrian signals, push-button location and signing, countdown feature, audible pedestrian signal features, and sufficient crossing time. Verify that the push button and pedestrian signals work and that the button location meets ABA requirements
- ☑ Behavior—where the students cross the street, crosswalk use compliance, whether drivers tend to yield for students, whether speeding is a problem
- ☑ Volume of students crossing—if signalized crossings have large volumes of students crossing, it may be necessary to either provide a longer WALK interval, or provide the ability for the pedestrian buttons to extend the WALK phase

In addition, participants should gather information about potential personal safety issues, such as locations without adequate lighting, locations where overgrown vegetation impedes visibility, areas with unleashed dogs or abandoned buildings, and areas of known (or suspected) crime.

After the audit, the leaders work with public works and school district staff who would be implementing the improvements to identify potential short-term, low-cost solutions as well as longer term options. Solutions should include education, encouragement, and enforcement strategies in addition to engineering-related improvements. Non-infrastructure examples include walking buddies, police or community enforcement, student loading policies, and student education on proper walking and bicycling behavior. Check with your state's SRTS program for resources. A list of state SRTS coordinators can be found on the Pedestrian and Bicycle Information Center Website ([www.pedbikeinfo.org/data/state.cfm](http://www.pedbikeinfo.org/data/state.cfm)). Many state programs offer free resources and materials, including templates for stickers that can be printed, ideas for a walking club, or ideas for organizing walking events.

FIGURE 3: ABA-Compliant Pedestrian Features at Signalized Intersection



# School Route Maps

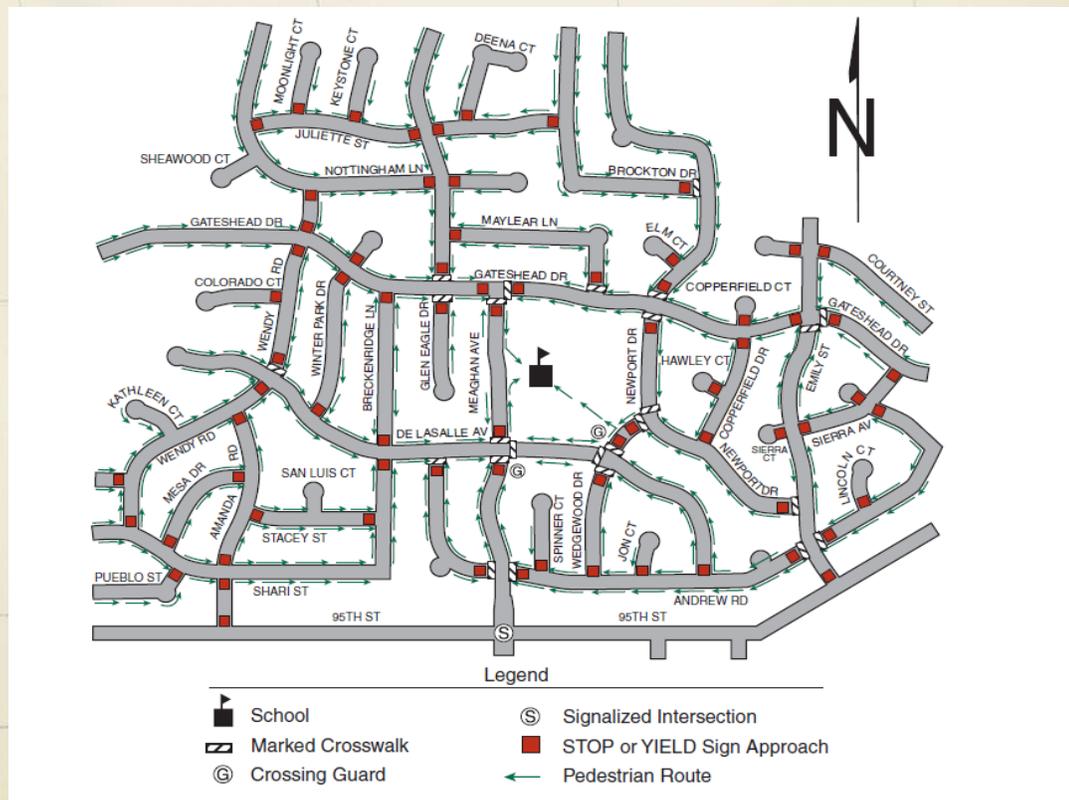
School route maps are effective tools for informing parents and students of traffic conditions and bicycle/pedestrian infrastructure around their schools. These maps can indicate the preferred, most convenient, and most accessible walking and bicycling routes to and from school and also identify areas to avoid (i.e., roadways with characteristics such as high traffic volumes, lack of walkways, absence of controlled street crossings, and other conditions). These maps can show off-street trails, marked crosswalks, crossing guards, and pedestrian/bicycle facilities that assist students walking or bicycling, as well as challenging intersections, sidewalk gaps, and other barriers.

The Manual on Uniform Traffic Control Devices (MUTCD) recommends the development of a school route plan: “The school route plan, developed in a systematic manner by the school, law enforcement, and traffic officials responsible for school pedestrian safety, should consist of a map showing streets, the school, existing traffic controls, established school walk routes, and established school crossings” (Section 7A.07).

School route maps can be developed through the use of aerial imagery and GIS. At a minimum, the following information should be shown: roadways, sidewalks, bike lanes, shared-use paths, traffic control (crosswalks, traffic signals, etc.), railroads, and locations regularly manned with crossing guards.

School route maps are developed primarily for use by students and their parents, and they should be readable, attractive, and informative. Streets should be named and consistent graphics used to indicate features such as crosswalks, signals, and crossing guard locations. The legend should be clearly readable and include a scale bar and north arrow. Color can be used to indicate the type of feature; reds and oranges may indicate caution or challenges, while blues, purples, and greens imply appealing routes. However, be mindful of how the map will read if copied in black and white or to a color-blind person. The map should provide relevant information for users and not be cluttered with extraneous detail. An example school route map is shown in figure 4.

FIGURE 4: Example School Route Plan



Similar maps can be developed intended for parents to show circulation routes, parent pick-up and drop-off locations, specific locations where parents can wait to pick up their kids, and locations where they can park if their child is in a car seat or needs extra time.

# Improving Traffic Operations and Safety

High volumes of traffic at schools during drop-off and pick-up times can lead to poor traffic circulation and often unsafe conditions for bicyclists and pedestrians. For example, vehicle congestion and queuing during drop-off and pick-up times can conflict with pedestrian and bicycling circulation; students walking or bicycling to or from school may not use or have access to sidewalks or crosswalks; school parking areas may be unorganized and lack traffic controls and markings; buses may block visibility of pedestrians and bicyclists. Parents may engage in a variety of illegal or unsafe behaviors, including parking in a crosswalk, double-parking, speeding, parking in NO PARKING areas or fire lanes, ignoring turn restrictions, or parking in locations that encourage their children to cross a travel lane.

SRTS programs should aim to improve safety for pedestrians and bicyclists. Changes to traffic operations during arrival and release can make a difference in safety for these modes. They may also improve traffic congestion, which can have the negative consequence of increasing traffic speeds and thus increasing risk for student pedestrians and bicyclists. Therefore, before making changes to traffic operations, a thorough understanding of the dynamics of traffic operations around a school is needed. Often improvements to traffic control and operations on a school campus can be noted by a study from an outside source. SDDCTEA is available to assist with this type of study.

If a large volume of drop offs and pickups occur over a short time period, congested conditions can be expected. Conflicts can be observed in several different areas.

Potential solutions to conflicts between pedestrians and bicyclists versus motor vehicles on school grounds include:

- ☑ Provide a sidewalk or pathway for students who are walking and bicycling
- ☑ Define a drop-off/pick-up site
- ☑ Designate access points for bus drivers, school staff, and parent drivers that are separated from pedestrians and bicyclists
- ☑ Vary dismissal time or location by mode or grade to reduce the number of students arriving at or leaving school simultaneously
- ☑ Reroute or restrict automobile access during key times in the day when conflicts occur
- ☑ Define zones within the school campus (student drop-off/pick-up, short-term parking, bus waiting area, etc.) and identify student and parent rules in each zone
- ☑ Use a platooning drop-off/pick-up system in which all vehicles unload/load simultaneously. The platoon would enter, load or unload, then exit in a platoon as the front vehicles start to exit.
- ☑ Require pedestrians to use the crosswalks
- ☑ Require students to enter and exit the vehicle on the same side of the street as the school
- ☑ Utilize one-way traffic flows along streets during drop-off and pick-up

Conflicts between pedestrians and/or bicyclists and motor vehicles on the school grounds can be caused by an undesirable school campus layout, which may require students walking or bicycling to cross the school driveway or parking lot. This problem can be addressed by developing, clarifying, or improving walking and bicycling routes through the school grounds. If possible, drop-off/pick-up areas should be separated from walking and bicycling routes.

Poor motorist behavior can be due to parent drivers ignoring or disobeying traffic controls. Clarifying and enforcing traffic controls should discourage parents from engaging in unsafe behaviors. However, poor motorist behavior could be the result

of improper traffic control devices, overcapacity conditions, or too many conflict points in too close of an area. Factors such as these could be identified through a traffic engineering study.

Potential solutions to poor motorist behavior include:

- ☑ Upgrade existing traffic control devices—repaint or provide crosswalks, post speed limit signs, signalize pedestrian crossings, clarify and simplify traffic control, as appropriate
- ☑ Redesign circulation by designating one-way flow and pull-through lanes, or by realigning or constricting automobile access
- ☑ Discourage use of cell phones in the school parking lot and in pick-up and drop-off lines, and minimize other distractions so that parents can focus on their surroundings
- ☑ Educate school bus drivers about pedestrian and bicyclist safety issues, including maintaining slow speeds on streets surrounding the school
- ☑ Provide safety vests to crossing guards/student valets to reinforce authority
- ☑ Employ targeted police enforcement

Poor student behavior may be due to a lack of awareness of “rules of the road,” distractions, lack of student discipline, and unwillingness to travel out-of-direction. Potential solutions to poor student behavior include:

- ☑ Provide supervision during arrival and release
- ☑ Move the crosswalk to a location where students prefer to cross, provided it is a logical location with respect to other traffic control devices
- ☑ Improve crosswalk visibility/repaint crosswalks; use signs, plantings, and other barriers to direct pedestrians to use the crosswalk; use raised crosswalks if appropriate for that location
- ☑ Evaluate pedestrian signal timing to provide sufficient time for pedestrians to cross and to minimize pedestrian wait time
- ☑ Educate students in proper walking and bicycling rules of the road; implement an ongoing educational program based on grade levels to continuously reinforce the ideas
- ☑ Install fences to prohibit students from crossing at inappropriate locations

## School Site Design

A well-designed school site should support the safe arrival and departure of pedestrians and bicyclists. The physical routes provided for the various travel modes (buses, cars, pedestrians, bicycles, and delivery vehicles) should be separated as much as possible to provide safe and efficient access. Physical separation of the modes is both a design issue (for example, layout of separate driveways, loading areas) and an operations issue (for example, enforcement of bus-only zones or supervision of crosswalks). Enforcement may be needed to ensure that separation is maintained between the modes, such as not permitting parent cars to use the bus-only areas.

To encourage bicycling, bicycle access and storage are needed at school sites, including bicycle lanes, shared lanes (produced by providing a wider lane for the inside travel lane), and in some cases trails on separate right of way. In addition, access needs to be provided between the roadway or trail and the bike parking racks at the school. Guidance on bicycle parking is available in the Association of Pedestrian and Bicycle Professionals Bicycle Parking Guidelines (<http://www.apbp.org/?page=Publications>).

Secure and effective bike parking is a crucial factor in encouraging children to cycle to and from school. Bike racks should be able to secure both wheels of a bike. Covered shelters should be considered to protect bikes from the elements. All bike parking areas should be easily monitored and in well-lit areas, as well as have convenient access to school building entrances.

It is advantageous to provide secure bike parking on two sides of the school so that bicyclists do not have to go across campus to a bike rack.

Building entrances should be located with consideration for pedestrian “desire lines.” This entails determining the directions and points from which pedestrians are likely to approach the building and then identifying whether the design has inadvertently placed any unacceptable traffic conflicts or obstacles in the pedestrians’ routes. An example of such an undesirable conflict is a school entrance that leads students to a busy vehicular driveway or an uncontrolled midblock crosswalk location. Pedestrians generally prefer the shortest crossing distance and typically will not walk more than 100 feet to cross at an uncontrolled crossing. The location of school entrances should be adjusted to direct pedestrians to the location of the preferred crossings and avoid unnecessary driveway crossings.

**Bus-Related Design.** The subjects of bus operations, safety planning, and facilities design have all received considerable research. Guidelines include:

- ☑ Provide two outbound lanes if possible: one for left-turning and one for right-turning buses
- ☑ Drop-off area design should not require backward movement by buses
- ☑ Bus drop-off areas should be one-way in a counterclockwise direction to ensure that the loading/unloading of students occurs from the right-hand side of the vehicle adjacent to the building
- ☑ The design of the bus drop-off areas should not require children to walk between buses
- ☑ The bus-loading zone should not straddle a pedestrian crossing
- ☑ For efficiency, bus traffic should not share a common driveway with parent traffic
- ☑ Crosswalks in the bus area should have proper sight distance, without sight distance blockages from parked buses

**Drop-Off and Pick-Up Zone.** Well-designed drop-off and pick-up zones can minimize illegal standing or parking near schools and help prevent problems such as blocking bus driveways and flow on adjacent roadways. Guidelines include:

- ☑ Drop-off/pick-up zones should be one-way in a counterclockwise direction so that students are loaded and unloaded directly to the curb/sidewalk. This practice will minimize pedestrian/vehicle conflicts in the drop-off/pick-up zone because students will not be exposed to traffic.
- ☑ Maximize the available curb space at the loading zone by locating the loading/unloading area at the far end of the zone
- ☑ Provide an adequate driveway length for queuing cars on site. The length of the car pick-up zone should be determined as a function of the expected number of cars. SDDCTEA conducted an informal study of school pick-up and drop-off efficiency, and observed an average processing rate of 6.2 vehicles per minute for drop-offs in the morning, and 5.2 vehicles per minute for pick-ups in the evening. These rates, along with the number of students riding to school with parents can be used for queue estimation.
- ☑ Drop-off area design should not require backward movement by vehicles
- ☑ Do not load or unload students where they have to cross a vehicular path before entering the building
- ☑ Student safety patrols and loading supervisors should be well trained and wear highly visible reflective safety vests
- ☑ Provide maps and instructions to parents to describe the location and operation of the loading zone
- ☑ Due to increased dwell time, the space requirements for pick-up can be much longer than for drop-off. Separate policies for pick-up and drop-off may be necessary.
- ☑ Provide proper pavement markings for drop-off spaces (4-inch white lines)
- ☑ Provide a bypass lane so vehicles can depart without needing to wait for other vehicles

- ☑ Consider providing separate parking for short-term parking areas for parents who may require extra time to pick up or drop off their students

Student loading should occur in designated zones to minimize pedestrian/vehicle conflicts. Research has shown that school type is related to the number and type of conflicts. Elementary school sites, which typically have additional supervision and good parental drop-off/pick-up behaviors, such as not dropping off children in parking lots or on the road, tend to have few conflicts. Middle schools typically have less staff supervision and parents who are willing to drop off or pick up children away from the designated student loading zones. When the parking layout is conducive, parents may use it to bypass the drop-off/pick-up queue. This type of loading is undesirable because children can be difficult to see when they emerge from rows of parked vehicles. Loading on an adjacent street can also be undesirable, such as when the vehicle blocks through traffic, when parents and students jaywalk across the street, or when the vehicle is parked in a no-parking zone. When the vehicle is parked on the opposite side of the street, students may need to cross vehicular paths, which is also undesirable. Student drop-off in the neighborhood can also result in complaints from neighbors living adjacent to the school.

**Driveways and Internal Roadway Network.** School driveways should conform to local design and access management guidelines for number, spacing, location, and layout. Suggestions specific to schools include:

- ☑ Use separate driveways for parent traffic and bus traffic at elementary and middle schools. Additional driveways may be needed at a high school, depending on the student population.
- ☑ Have space between driveways to accommodate the installation of a properly designed left-turn lane that can handle the anticipated queue length for drop-off and pick-up times
- ☑ Locate the bus area so that buses exit upstream of automobiles and gain priority, thereby reducing delay
- ☑ When selecting the location of driveways, consider the predominant direction of traffic and student origins so most drivers turn right when exiting the school
- ☑ Students should not be required to cross busy driveways to access the school building
- ☑ Ensure that roads within the school site have a maximum grade of 5 percent to avoid configurations that could impair a motorist's vision
- ☑ Locate buildings, landscaping, fences, block walls, and school signs to permit adequate sight distances for drivers and pedestrians
- ☑ Locate driveways to avoid interlocking left turns with other streets or bus driveways

**Gates.** Based on school location, it may be necessary for schoolchildren to use a pedestrian gate while walking to or from school. A school located off-base may serve an on-base population, and a school located on-base may serve an off-base population. In these cases, if children walking to school will pass through a gate, the pedestrian gate must be sized for the peak arrival volumes. See SDDCTEA Pamphlet 55-15 for additional discussion on pedestrian gate requirements.

**Pick-up Procedures.** The pick-up period in the afternoon can be much less efficient due to the need for students and parents to find each other. Following are suggestions to increase the efficiency of the pick-up period:

- ☑ Have children wait in an organized fashion in the loading area or adjacent to it. Organization allows for children to pay attention and hear their name or number called. This helps to expedite the loading process by getting children to their vehicles quicker. It also helps the carpool time to be safe, as children will not be left to run around unsupervised.
- ☑ Implement an Advanced Passenger Identification system using numbers or name cards placed in the windshield of the vehicle waiting in the carpool. This will require at least two people. The first person should stand five or six cars before the loading area and call out the names of the children over a two-way radio to the second person. The second staff member should be standing in the loading area itself relaying the names or numbers with a speaker system and directing students to the appropriate bay.

A traffic study can be used to assess existing queuing or potential queuing with proposed designs.

# Traffic Control for School Areas

All signs and markings within and around school sites must comply with the MUTCD or with a state MUTCD supplement as applicable. Examples of common violations and other problems related to signs and pavement markings at school sites include:

- ☑ Use of yellow paint for non-centerline applications such as directional arrows. Exceptions: yellow pavement markings are required in California for school traffic control and are required in Arizona for 15-mph zone crosswalks.
- ☑ Signs mounted below standard heights
- ☑ Signs with inconsistent text color
- ☑ Nonstandard signs
- ☑ Leaning posts and bent signs
- ☑ Faded or defaced signs or those that are no longer reflective
- ☑ Too much text or too many messages on a sign

Common considerations regarding traffic control devices in school areas include signs, pavement markings, beacons, and traffic signals.

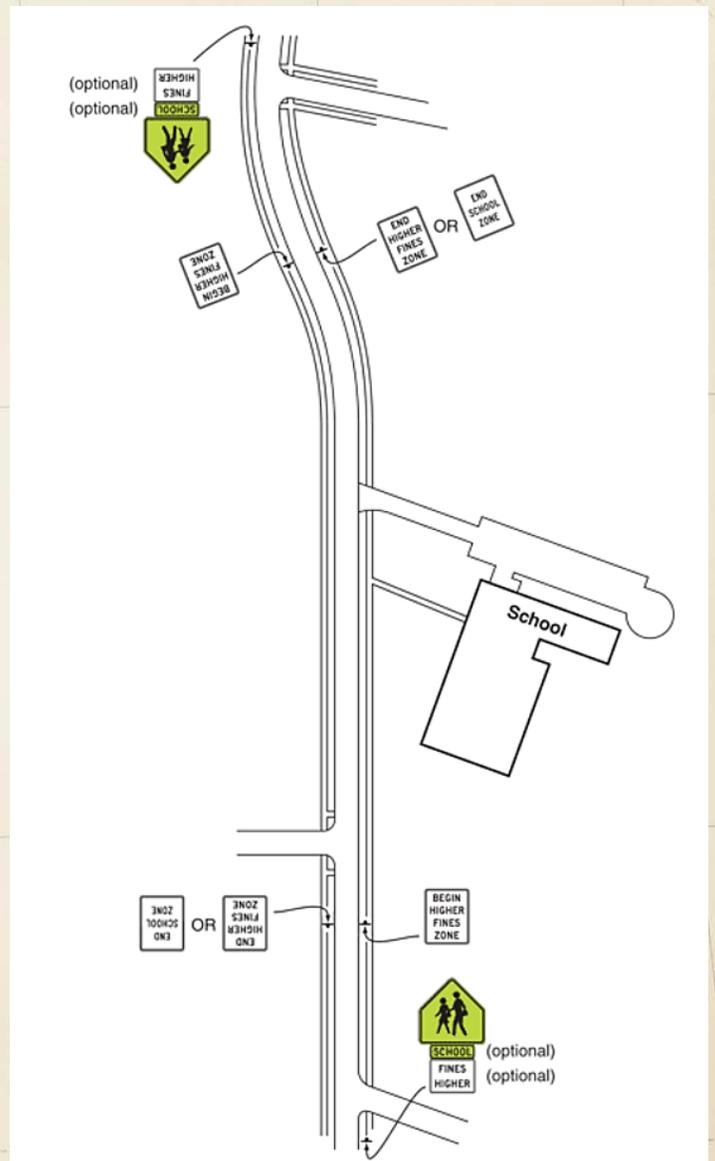
**Signs.** The School Crossing (S1-1) sign is a basic sign used in school areas. It has the following applications:

- ☑ To warn road users that they are approaching a school, a school crossing, or school-related facility adjacent to the highway
- ☑ To identify the beginning of a school zone (some jurisdictions officially designate school zones and grant them special standing in law, such as increased fines imposed for speeding)
- ☑ When combined with an AHEAD (W16-9P) or distance plaque (W16-2P or W16-2aP), to warn road users that they are approaching a school crossing
- ☑ When combined with a diagonal downward-pointing arrow plaque (W16-7P), to indicate the location of a school crossing

The School Crossing (S1-1) sign, as well as all supplemental plaques used for a warning sign assembly are required to use a fluorescent yellow-green background color. See figure 5 for examples of the school crossing sign.

The MUTCD allows a changeable message sign (CMS) to be used in lieu of a static sign to display a reduced speed limit within a school zone. When illuminated, the CMS must conform to the basic shape, message, layout, and color of the static assembly, including the display of the SCHOOL message in fluorescent yellow-green pixels and the other messages in white pixels on a black background.

FIGURE 5: School Area Signing



Driver feedback displays or signs are used to advise approaching motorists of the actual speeds at which they are traveling. These signs must display a yellow YOUR SPEED XX MPH or similar legend on a black background or the reverse of these colors. Experience has shown that driver feedback displays are more effective when used in conjunction with a speed limit sign and should be in use only during active school zone periods.

Many highway agencies are using the In-Street Pedestrian Crossing (R1-6 or R1-6a) sign on the road at marked midblock crosswalks on low-speed roadways (Figure 6). These double-sided signs may be placed on the road within several feet of a marked crosswalk to create an “in-your-face” reminder to drivers that there may be pedestrians in the crosswalk, and that drivers are required to yield to or stop for these pedestrians. The signs also tend to slow the traffic because they reduce the lane width and are in close proximity to vehicles.

Depending upon the state vehicle code, states will generally allow either the R1-6 sign or the R1-6a sign. If military installations are not sure of the specific state requirements, someone should review the matter with the state Department of Transportation (DOT). Installations are also encouraged to ask the DOT if they have a list of approved devices that need to be used.

General recommendations include the following:

- ☑ Use these signs only on roadways with a speed limit of 35 mph or less, and with lanes at least 10 feet wide
- ☑ Use only at marked midblock crosswalks
- ☑ Use the appropriate sign to correspond to the requirements of the applicable state vehicle code
- ☑ Place the sign near the crosswalk, either on the center line, on a lane line, or on a median island
- ☑ Only place the R1-6 and R1-6a signs on weighted bases. Never install on sign posts

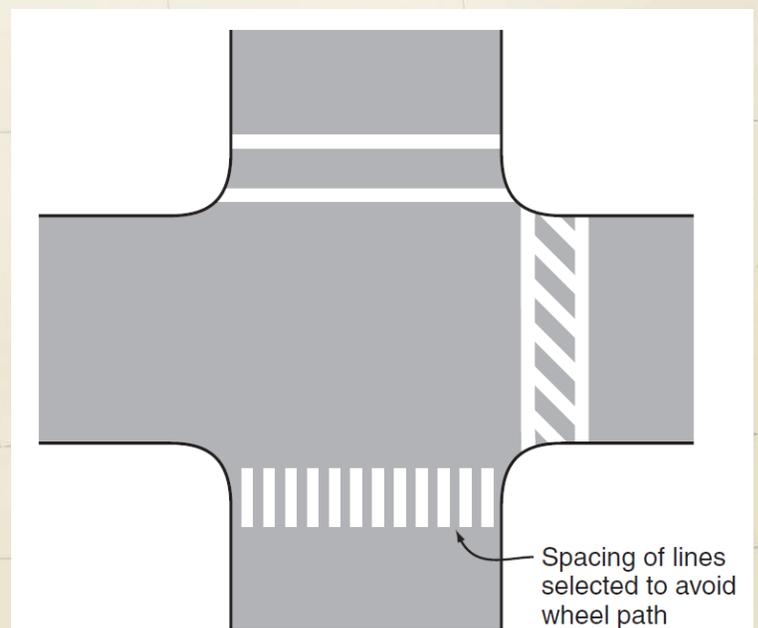
**Crosswalks.** Crosswalks should be marked in accordance with the MUTCD and the 2016 version of SDDCTEA Pamphlet 55-17 (figure 7). Crosswalks in the area of schools should be located at controlled intersections, particularly those controlled by signals or stop signs. SDDCTEA Pamphlet 55-17 discusses appropriate locations for midblock crossings, signing and marking requirements for crosswalks, enhancements such as signing and hybrid beacons that could be used to draw better attention to crosswalks, as well as requirements to restrict parking within 30 feet of a crosswalk.

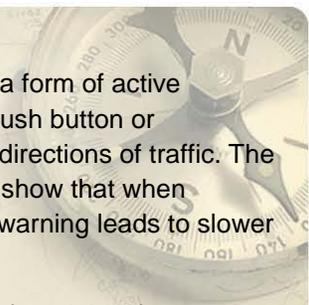
The crosswalk markings should be retroreflective for visibility during nighttime hours.

FIGURE 6: In-Street Pedestrian Crossing Signs



FIGURE 7: MUTCD Crosswalk Designs





**In-Roadway Warning Lights.** In-roadway warning lights can be used at uncontrolled crosswalks as a form of active warning devices. These have high-intensity, bi-directional in-pavement lights that are activated by a push button or microwave sensor at either curb. Once activated, the lights emit a rapidly flashing yellow light in both directions of traffic. The advantage to using these is that they only are activated when a pedestrian is in the crossing. Studies show that when flashing crosswalks are used, drivers tend to yield to pedestrians more frequently, and the advanced warning leads to slower approach speeds.

Currently, there are no “warrants” in the MUTCD regarding the use of in-roadway warning lights; therefore, it is left to engineering judgment as to where these devices should be considered, provided they are used in accordance with MUTCD. Additionally, be sure to check with your state DOT to verify that these are acceptable for use in your state.

## School Zone Speed Limits

Slower speed limits are often associated with less severe pedestrian crashes. As a result, lower school zone speed limits are often utilized in the interest of safety near schools, and sometimes in the area of school crosswalks. Simply setting a reduced speed limit in a school zone is not likely to produce the entire desired speed reduction on its own. Tools used to assist in reducing vehicle speeds in school zones include police enforcement (for example, conventional, automated speed cameras, double fines), public awareness campaigns, and engineering countermeasures such as traffic calming.

The first step is to evaluate whether the speed limit should be reduced near a school. The evaluation process needs to measure existing speeds on the street in question during school hours and determine whether speeds are higher than desired. The evaluation process should consider whether other actions might bring about the desired results more effectively.

A school speed limit zone typically is considered when children are crossing a roadway going to and from school. The zone may be considered on any street along the school frontage.

In some regions, school speed limit zones are generally not used when signalized or stop-controlled intersections are present at school crossings, because their traffic control creates gaps that children can use to cross a roadway. A school speed limit zone may be installed or retained at a roundabout, at a signalized or stop-controlled intersection (for example, as a mitigation measure for concerns related to sight distance), or in other situations as determined by an engineering study. Young children may be benefited more with reduced speed limits versus older children due to abilities not being as developed at early ages. Therefore, with similar traffic conditions a reduced speed limit may be desired for elementary schools and not high schools.

When school zone speed limits are used, follow state statute for the speed limit within a school zone. Some states set a constant speed limit such as 15 or 25 mph in school zones statewide. Other states use different speeds that vary as the regular speed limit varies. Other states have no set value; they are established on a case-by-case basis.

State practice also should be used to determine the length of the reduced speed zone. States may have statute specifying a constant, minimum, or maximum length. In the absence of state requirements, the MUTCD recommends that the beginning point of a reduced school speed limit zone should be at least 200 feet in advance of the school grounds, a school crossing, or other school-related activities. This 200-foot distance should be increased, however, if the reduced school speed limit is 30 mph or higher. The location of the beginning and end of a school speed limit zone should be based on engineering judgment rather than the exact location of the school property line or fence. The school speed limit zone should be centered at the location(s) where children cross the roadway.

The reduced school speed limit zones should be in effect only during specified intervals such as at the start and end of a school day. Close cooperation is needed between school officials and DPW staff. If the school start or dismissal times are changed year to year, signs indicating the times of a reduced speed limit must be changed.

There are different types of school speed limit signing, as shown in figures 9 and 10. Where allowed by state practice, use a sign with a clear message as to when it applies or a beacon to reinforce when the speed limit is in effect. The message “When Children are Present” is overly subjective—it could refer to children present in the vicinity of the roadway or children present in the school building.

Traffic calming measures as discussed in SDDCTEA Pamphlet 55-17 Chapter 16, can be considered to help to lower speeds either in conjunction with or without a school zone speed limit. There are no applications for traffic calming that are exclusive to school zones; the measures used should be appropriate for the location and roadway characteristics under consideration. Traffic calming measures can include the following:

- Curb extensions
- Chicanes or lateral shifts
- Speed humps
- Speed tables or raised crosswalks
- Raised intersections
- Roundabouts
- Half-street closures
- Median islands
- Forced-turn islands

FIGURE 9: School Zone Speed Limit Signing

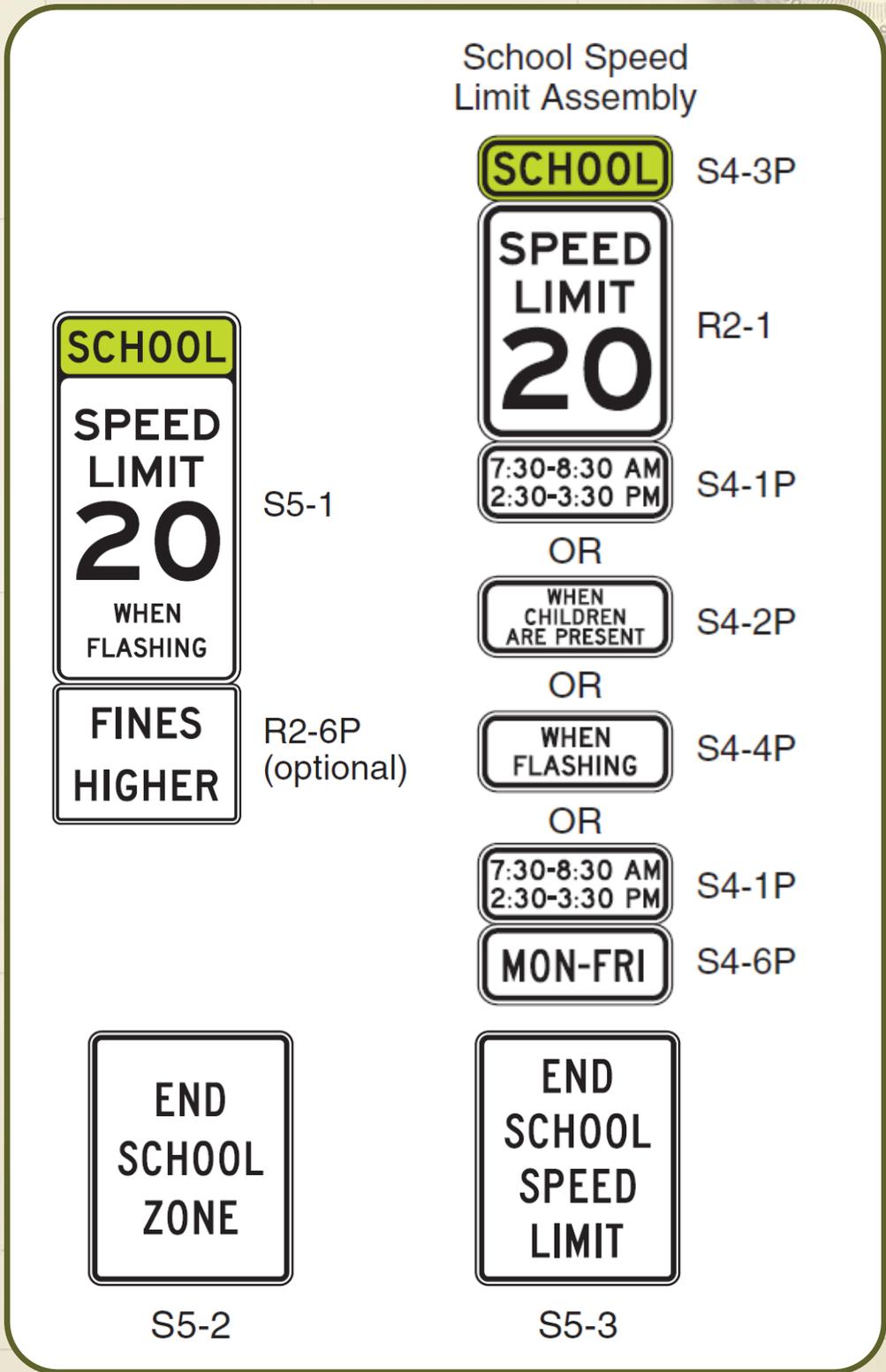
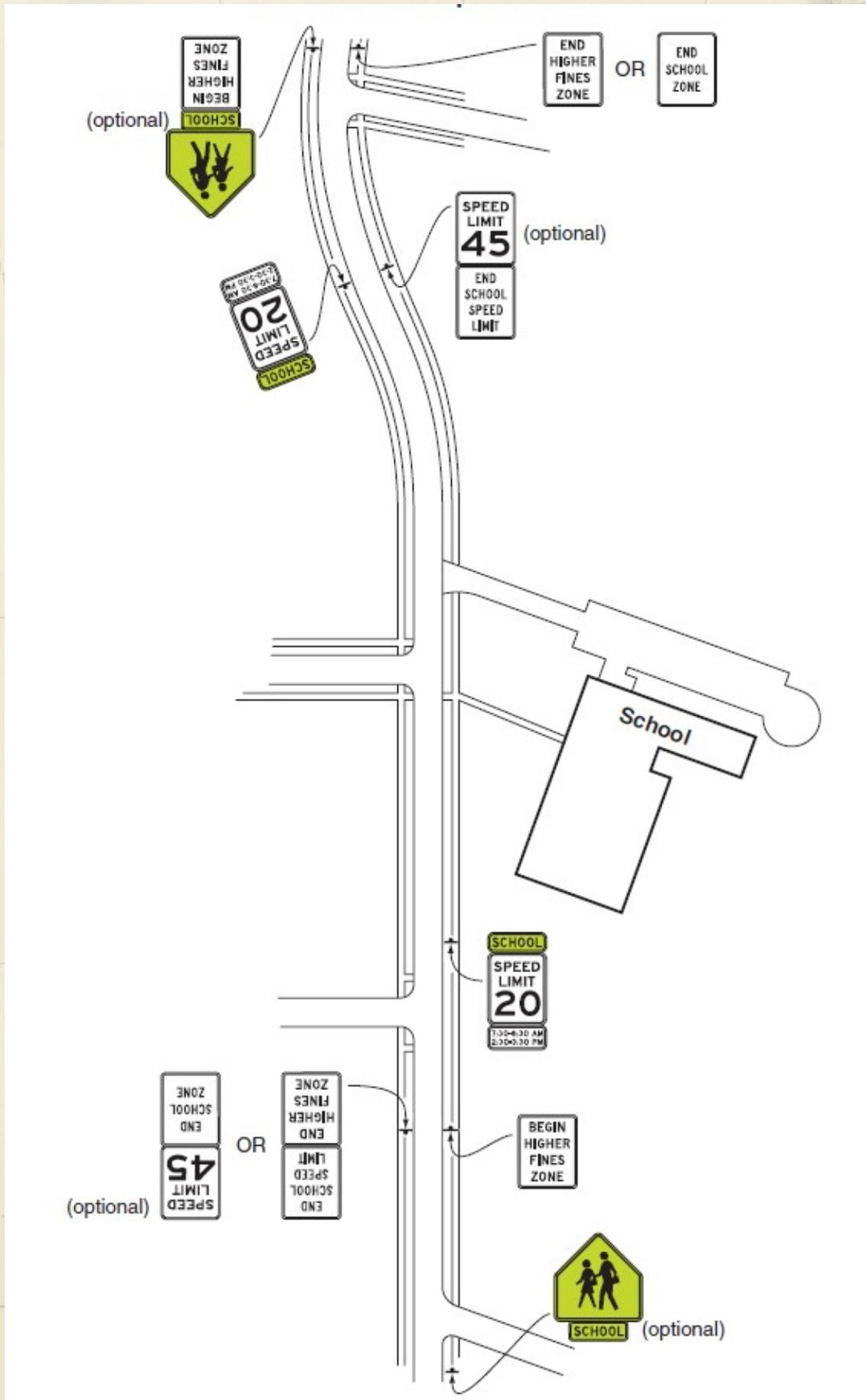


FIGURE 10: Example of Higher Fines School Zone Speed Limit Signing



Mr. Bruce A. Busler, SES  
Director, Transportation Engineering Agency

## Contact Us

### MILITARY SURFACE DEPLOYMENT AND DISTRIBUTION COMMAND TRANSPORTATION ENGINEERING AGENCY (SDDCTEA)

1 Soldier Way  
Scott Air Force Base, Illinois  
62225-5006

**DSN:** 770-5218

**FAX:** 618-220-5125

**EMAIL:** [army.sddc.safb.traffic@mail.mil](mailto:army.sddc.safb.traffic@mail.mil)

**WEBSITE:** <http://www.sddc.army.mil/sites/tea> for pamphlets,  
bulletins and studies

## Reference List

- ☑ TEA Home: <http://www.sddc.army.mil/sites/tea>
- ☑ SDDCTEA Pamphlet 55-15 - *Traffic and Safety Engineering for Better Entry Control Facilities* – 2014 and SDDCTEA Pamphlet 55-17: *Better Military Traffic Engineering*, 2016 (<https://www.sddc.army.mil/sites/TEA/Functions/SpecialAssistant/TrafficEngineeringBranch/Pages/pamphlets.aspx>)
- ☑ U.S. Department of Transportation, Federal Highway Administration. *Manual on Uniform Traffic Control Devices*, 2009 (<http://mutcd.fhwa.dot.gov/>).
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- ☑ Pedestrian and Bicycle Information Center Website (<http://www.pedbikeinfo.org>)
- ☑ State by State Contact Info ([www.pedbikeinfo.org/data/state.cfm](http://www.pedbikeinfo.org/data/state.cfm))
- ☑ National Center for Safe Routes to School Website (<http://saferoutesinfo.org>)
- ☑ Association of Pedestrian and Bicycle Professionals Bicycle Parking Guidelines (<http://www.apbp.org/?page=Publications>)
- ☑ Architectural Barriers Act (ABA) (<https://www.access-board.gov/the-board/laws/architectural-barriers-act-aba>)