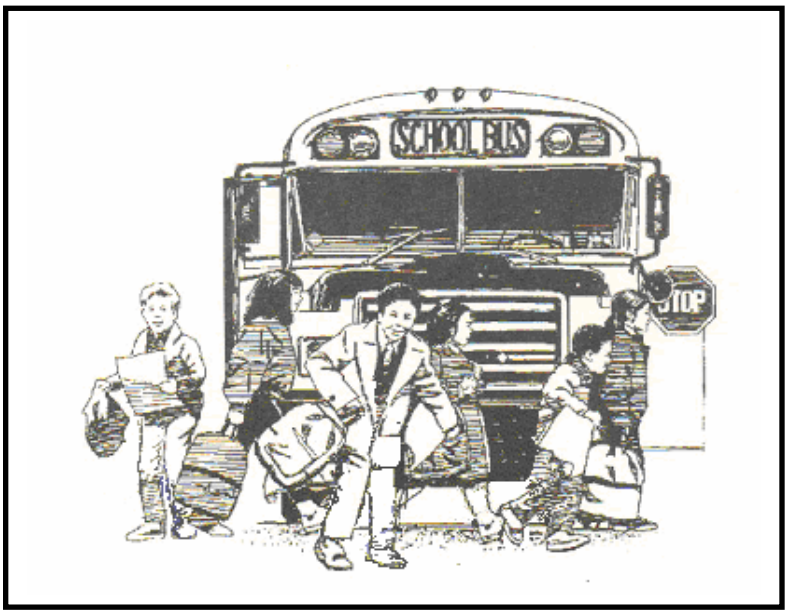
Arizona Department of Transportation

Traffic Safety for School Areas Guidelines
2006



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Arizona Department of Transportation

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Section 1
FOREWORD

In 1950, Arizona safety officials (police and engineers), in conjunction with parents and school officials, created a unique traffic control concept that would slow motorists to 15 mph at school crosswalks for the purpose of providing safe and efficient conditions near schools. This concept was approved and endorsed by the Arizona State Legislature (ARS 28-797). Shortly after implementation, it became apparent that compliance would improve and safer conditions would result if guidelines were prepared. These guidelines would pinpoint the key components that would promote uniformity throughout Arizona. Throughout this document, any reference to "School Crossing" means the school crosswalk marked in yellow (except as noted in 28-797 F.1), accompanied by NO PASSING 15 MPH SCHOOL IN SESSION and STOP WHEN CHILDREN IN CROSSWALK portable signs.

These guidelines were first published in 1953 and this is the ninth known edition. The guidelines are published by the Arizona Department of Transportation (ADOT) and apply to the entire Arizona Highway System. Since the majority of School Crossings are not on the state highway system, but instead within local jurisdictions, ADOT has made it a practice to solicit and incorporate input from local jurisdictions each time these guidelines are revised.

Purpose and Applicability of ADOT Guidelines

The purpose of these guidelines is to summarize the most successful ways of implementing ARS 28-797 in order to effectively achieve school safety throughout Arizona. The guidance provided is fully consistent with the *Manual on Uniform Traffic Control Devices* and its companion *Arizona Supplement*.

These guidelines are applicable to school officials (public and private), school planners, traffic engineers, police, and other public safety personnel throughout Arizona. Engineering judgment is key to achieving operational safety and efficiency around schools, carefully taking into consideration the particular conditions that exist at each site. Engineers familiar with local conditions are in the best position to assess and make engineering judgments regarding what will work best in a specific situation.

These guidelines are intended to promote community safety by harmonizing the efforts and responsibilities of all involved. They are not intended to impose new or additional duties upon parents, schools, or jurisdictions operating streets and highways. Rather, the guidelines are intended to encourage all stakeholders to work together to make a difference in safety. Nationally, there has been a pattern of increased propensity for tort liability litigation. This has unfortunately resulted in some schools and jurisdictions becoming increasingly reluctant to act beyond minimal efforts to help create the safest practical school environment. This is not the intent or desire in Arizona. Each party involved in school safety starts out with their own clear legal duties regarding traffic safety as follows:

- Parents are primarily and personally responsible for their own children's safety, health, and welfare. This includes teaching children about crossing streets and driveways safely, riding bikes safely, and other necessary precautions to take when traveling to and from school. Parents should know their children's vulnerabilities.

- Schools are responsible for traffic safety on-site, much the same as operators of a movie theater, restaurant, or retail store. These duties can be extended if schools provide or contract to provide portal to portal transportation, such as busing. In this case, schools accept the duty for providing reasonable and safe transportation for children whom are provided busing. Duties can also be extended when a school operates a School Crossing. Operation of a School Crossing requires the school to sign a written Operating Agreement consistent with the intent of ARS 28-797 and these guidelines. The written Operating Agreement specifies times of operation and whether adult crossing guards are required.

- State, county, and local jurisdictions have the ongoing duty to maintain a safe and efficient street system. Doing so requires jurisdictions to rely upon all road users to make reasonable, prudent, and lawful use of that street system. No traffic control device or particular street design can compensate for illegal or imprudent use of the street by road users.

Five decades of experience has proven that safety can be improved by each party complementing the efforts of others. These guidelines recommend and encourage parents, schools, and jurisdictions to not just take responsibility for their own duties, but also to help one another. Depending on situations, budgets, priorities, and constraints:

- Parents can help by providing safety guidance for their own children and others as well. They can notify other parents, school officials, or jurisdiction officials of any safety concerns observed. Parents and PTA groups can also provide additional adult oversight on routes to and from schools, apply adult judgment, pick appropriate gaps in traffic, make eye contact with motorists before crossing a street, and help teach students to do the same.

- Schools can help promote safety education by sponsoring on-site presentations focusing on safety. School officials can provide additional adult supervision on the busiest routes to and from schools. Adult crossing guards at designated crosswalks are to apply adult judgment when picking gaps in traffic, watch for motorists to follow the "rules of the road", and act as role models when stepping into the street first as a responsible pedestrian when guiding school children across the crosswalk.

- State, county, and local jurisdictions can help by sharing their expertise in traffic control safety, making educational videos and presentations, and helping to train adult crossing guards.

School Safety: Perception Versus Reality

Traffic control in school areas is a highly sensitive subject, creating a diverse range of opinions about the best potential applications. If all requests from citizens and parents were accommodated (additional police officers, adult guards, signals, flashing lights, signs, and markings), Arizona's street and highway system would be non-functioning and not conducive to safety. In addition, such demands are seldom in line with actual needs and can create disrespect for warranted traffic controls, if implemented. Experience has shown that while doing more certainly costs more, it may not always result in safer conditions and often can be counter-productive.

It is important to stress that regardless of the school location, the safest and most effective traffic control is achieved by the uniform application of realistic policies, practices, and standards based on sound engineering principles and engineering judgment. It is also important to keep in mind that traffic control devices alone (signs, crosswalks, etc.) are powerless to overcome the root cause of most school related crashes. Most crashes result from the failure of the road users, both motorists and pedestrians, to comply with the rules of the road and properly share the road space.

Section 2
Arizona's School Crossing History

In 1950, the Arizona State Legislature at the urging of traffic engineers, police, school officials, and parents passed legislation authorizing the use of the School Crossing concept on Arizona streets and highways (ARS 28-797). The concept called for marking School Crossings in a different manner than normal crosswalks by using yellow markings instead of standard white markings at pedestrian crossings and prohibiting passing on the approaches to the School Crossing. Additionally, the concept is predicated on placing 15 mph portable speed limit signs in the roadway in advance of the crosswalk and STOP WHEN CHILDREN IN CROSSWALK portable signs at the crosswalk during the specific hours that each School Crossing is in effect and adult crossing guards were to provide supervision in many cases.

- This concept recognized the following precepts:
- Aggressive enforcement is required to gain compliance of the 15 mph speed limit.
- School Crossings need to be limited in number, duration, and only used where truly needed. If used indiscriminately, motorists would ignore them and police could not adequately enforce them.
- Schools will operate School Crossings by placing, removing, and re-setting portable signs when knocked down.
- Schools will provide and train crossing guards.
- Adult Crossing Guards will help children learn to cross streets in a safe manner.

On March 25, 1953, the creators of the School Crossing concept regrouped, having learned the importance of standardizing practices. Their goal was to write a statewide guideline based on the successes and failures of the concept. Experience showed that School Crossings should:

Not be used at high schools: The 15 mph legislation originally addressed all schools. However, the concept was not successful at high schools. There was consensus that continued use of School Crossings at high schools threatened their effectiveness at elementary schools, where they were most needed. Not only did using School Crossings at high schools increase the number of School Crossings, but older students failed to obey crossing guards, antagonized motorists, and in general, created substantial disrespect for the concept. Recognizing that high school students are generally old enough know how to behave as responsible pedestrians and to even drive vehicles themselves, a conscious decision was made to treat high school students as other states do using traditional methods prescribed in Parts II, III and VII of the *Manual on Uniform Traffic Control Devices.*

Not be used within 600 feet of a STOP sign, traffic signal, or another School Crossing on the same street: This outcome resulted from firsthand experience showing that motorist compliance with traffic control was substantially reduced whenever a School Crossing was located too close to a STOP sign, traffic signal, or another School Crossing on the same street. Observations found that motorists obeyed the first traffic control device, but consistently paid less attention to a second set of traffic controls unless they were separated by at least 600 feet. If another traffic control device exists that is close to a proposed crossing location, it is best to either route the students to the other location, or alternatively, consider removing it so that an effective School Crossing can be employed nearby.

Not be used in conjunction with STOP signs or traffic signals: These devices were all found to be mutually exclusive traffic control devices, for the above reasons.

ARS 28-797 has been modified three times. Changes were made for the purpose of:

- Delegating authority to approve School Crossings from ADOT to local jurisdictions.
- Allowing School Crossings on unpaved roadways.
- Allowing use of School Crossings at signals, except at signals on state highways.

The latter two practices, while authorized by law under rare circumstances, are highly discouraged by practitioners based on both experience and safety ramifications. For example, if a School Crossing is installed on a dirt road, the crosswalk foregoes the recognition offered by the unique yellow pavement markings. Mixing traffic signals with the School Crossing is discouraged for the following reasons:

- Signals work at conflicting purposes with School Crossings. The purpose of the traffic signal is to establish the right-of-way and provide orderly traffic progression at speeds consistent with the roadway design. However, the purpose of the School Crossing is to slow traffic, allowing motorists sufficient reaction time to stop for pedestrians at locations that do not offer the benefit of either a STOP sign or a traffic signal.
- Red light violations may increase.
- Greater speed differential may occur through the School Crossing at a signal
- Added delay may promote risk-taking.
- Traffic may divert onto parallel residential streets as a by-product of motorists avoiding congestion.
- The NO PASSING regulation creates confusion when motorists observe a green light.
- Portable signs at intersections with traffic volumes sufficient to warrant signals pose a direct hazard to both pedestrians and motorists. Motorists looking up at signals may not expect metal objects near where they may turn. Additionally, crossing guards may be at risk when placing and removing signs at busy signalized intersections.
- The portable STOP WHEN CHILDREN IN CROSSWALK sign conflicts directly with the green signal which tells the motorist to go. Students or even adult crossing guards may feel they can enter the street against the DON'T WALK because of the priority to pedestrians created by a School Crossing.

School Safety in Arizona Today

A key ingredient to Arizona's success in school safety has been the early recognition of the dramatic differences in maturity levels of younger students (grades K-8) versus high school students. Experience has shown that older students are best treated using the standard pedestrian traffic control prescribed in Parts II and III of the *Manual on Uniform Traffic Control Devices (MUTCD)*, augmented by notification of the school grounds as prescribed in Part VII. High school students are at or near the age required to acquire a Driver License, so it is not surprising that success has resulted from Arizona's assumptions that high school students should be fully capable of crossing streets using the basic "Rules of the Road" and the standard traffic control provided. Younger children, on the other hand, have proven to benefit from the unique School Crossing/adult crossing guard concept described in these guidelines.

The second key to achieving school safety in Arizona has been the recognition that optimum results are achieved by the application of engineering judgment by trained, accountable traffic officials familiar with local conditions. The traffic control device used must relate to the volume and speed of traffic, street width, age (maturity level) of students, and the number of children crossing. For this

reason, the same traffic control application needed in a school area located directly on a major highway may be inappropriate on a residential street with low traffic volumes.

Students of any age are expected to learn safe crossing procedures from their parents, who are responsible for their behavior and progress. Good parenting, combined with schools providing effective safety awareness opportunities and jurisdictions providing effective school traffic control, can enhance overall operations. Neither school children nor motorists can be expected to move safely in school areas unless they obey the laws and respect the need for these controls. Reasonable, prudent, and lawful behavior is required by drivers and pedestrians alike to achieve a safe environment. Traffic control devices alone cannot compensate for unsafe behavior or decisions.

It is important that traffic control in school areas be uniform throughout the state. Use of non-uniform procedures or devices can confuse pedestrians and motorists, which in turn can lead to an increased tendency for collisions. To promote uniformity, care needs to be taken before using some of the many optional traffic control devices contained in the MUTCD. While the MUTCD lists an abundance of optional traffic control devices that "may" be used where justified by engineering assessments, many have shown little or no effect on traffic behavior near schools on Arizona streets and highways. Examples of these devices include posting unreasonably low speed limits, reduced speed limits with flashing lights, flashing warning lights, in-pavement lights outlining crosswalks, driver feedback signs, etc. Using these devices may work against uniformity in school areas, so should only be used where unusual conditions exist warranting such devices. The use of additional devices is discouraged because engineering assessments by Arizona jurisdictions have found a majority of them to be ineffective in influencing speeds or crash rates[1, 2]. On a national scale, research has concluded that an adverse consequence associated with using some of the devices is the increase in speed variances, which can negatively impact safety.

In summary, ARS 28-797 and the Arizona Supplement to the MUTCD together empower jurisdictions to team with schools to use the highly successful School Crossing concept for children. The Arizona Supplement to the MUTCD additionally mandates that traffic control used for K-8 schools comply with these guidelines.

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1 «Pedestrian Warning Flashers in an Urban Environment, Do They Help?» ITE Journal, January 1990

2 «School Zone Flashers- Do They Really Slow Traffic?» ITE Journal, January 1990

Section 3
Site Selection

Effective site selection will enhance the safe and efficient movement of vehicular and pedestrian traffic. School sites and access to the sites should be tailored to fit local conditions. Planners should consider many factors including: buses, parents, faculty, visitors, service and student vehicles, bicycles, pedestrians, ADA requirements, and emergency vehicles. A traffic engineer should be consulted before school layout plans are finalized and ideally before a site is even chosen.

Traffic control and circulation around a potential school site are some of the most important factors to be considered when selecting and designing a school site plan. With proper site selection, potential traffic problems can be eliminated or treated at the design stage. The suggestions in this guide need not be considered exhaustive, since no guidelines can address all situations.

This chapter is intended for all personnel involved in locating, designing, and operating new school facilities or in renovating and reconstructing existing facilities. The guidelines can be applied to all school sites as part of a regular review to ensure that existing facilities are as safe as possible. Persons involved in school site planning and design should consult with local government and safety agencies for assistance. State and local officials should be consulted regarding standards, codes, ordinances, and permits.

The following design and traffic control principles are important and should be given the highest possible priority when evaluating new sites, expanding current sites, or reviewing existing school operations.

The present and future land use surrounding the school area should be considered. For undeveloped areas, determine whether future development in the area would complement a new school. Property zoned for residential use is a good example of land use complementing a school area. In developed areas, a land use review would aid in determining appropriate locations for school driveways. Estimate future traffic volumes on abutting streets, review the need for traffic control devices, and consider the need for pedestrian control prior to the design.

The school district should establish the following design parameters before site selection and school design:

A. Current, projected, and maximum school population

B. Grades served (elementary, middle school, and high school)

C. Size of the school structures (including projections for growth)

D. Scope of extracurricular activities – playground area, athletic fields, auditorium facilities, community rooms, etc.

E. Current transportation policies in the school district and public transit service availability

F. Size and shape of the school grounds

G. Abutting and on-site roadway systems including parking, loading zones, and accessibility

H. Proximity to high speed highways or arterial streets that would require crossing by school children

Once these elements are identified, the land area needed for the school site can be calculated by the school architect and planner. Available sites are usually limited and, too often, the final selection is based primarily on initial cost with only secondary consideration given to the parameters cited above. Such a selection, based on cost alone, is shortsighted and can prove costly in future years if the site does not have sufficient access for pedestrians or motor vehicles, sufficient area to accommodate parent parking, future building and related facilities, and essential transportation facilities.

During initial stages, local authorities should be contacted to determine present and planned zoning and provide advice on how the site can best function.

The actual site location should depend on consideration of the following factors:

A. Amount of land and building space needed

B. Zoning or land use

C. Evaluation of land presently owned by the school district

D. Funds available for land acquisition

E. Access to and impact upon street system

F. Classification of adjacent streets (local, collector, arterial, state highway, county primary, etc.)

G. Relationship to other facilities

H. Availability of utilities

I. Compatibility and partnering with adjacent land owners

J. Future plans for expansion

School sites should be selected to maximize the potential for walking and bicycling and minimize the need for motor vehicle transportation.

Donated land and buildings or land presently owned by the school district are not always suitable for a new school site. Increased travel times, busing needs, accessibility, and land use problems will often more than offset the initial dollar savings. A new school is a long-term investment and should be analyzed from that point of view.

Traffic congestion and potentially hazardous conflicts may develop if the site is not readily accessible from an adequate sidewalk and street network. Further, if the site is not adequate in size, it cannot efficiently accommodate all facilities necessary for effective and safe school operations. The site size should be sufficient to address all design considerations.

Transportation elements that need attention during the site selection and design phase include providing:

A. Separate unloading/loading areas for students transported by

   1. Parents.

   2. School bus.

   3. Public transit.

B. Separated parking facilities for

   1. Faculty and staff.

   2. Visitors.

   3. Students (high schools only).

C. Access for

   1. Emergency vehicles.

   2. Service vehicles.

   3. Disabled persons.

D. Sufficient roadways to avoid traffic congestion and the concentration of activities at any one location.

E. Analyses of playgrounds/athletic field locations relative to streets.

F. Adequate pedestrian and bicycle routes.

G. Bicycle racks.

School access is improved when the school is bounded by two or more streets. This allows for sufficient curb space to permit parent parking and/or bus loading. Providing sufficient access benefits both vehicles and pedestrians. Smaller schools generally experience a higher percentage of students walking or bicycling to school, as opposed to a larger school campus where more students travel longer distances. Typically, smaller schools pose lesser traffic and parking impacts on adjacent neighborhoods, especially during special events.

Elementary School Sites

School sites which serve younger children should be located as close as possible to the center of the area in which the students reside. This minimizes walking distances and reduces traffic congestion.

Elementary school access is not compatible with locations adjacent to arterial streets. The school should be located on “collector” type roadways internal to neighborhoods, so as to minimize the need for young children to cross a major street on their way to school. The ideal neighborhood school site will also be in the center of the attendance boundary with good walking access in all directions from the school.

Streets adjacent to schools should be wide enough for safe traffic flow. Curb parking should be prohibited in advance of pedestrian crossings, at driveway areas, and at building entrances. These parking restrictions maximize visibility of school pedestrians and provide safer vehicle access. Elementary schools also tend to generate the greatest number of driving parents, so special consideration should be given to provide ample onsite queuing for parents picking up and dropping off students.

Middle Schools and Junior High School Sites

Sites for middle and junior high schools typically have greater capacities and attendance boundaries than elementary schools which often results in greater parking needs. This can make middle and junior high schools more difficult to accommodate within neighborhoods. It is preferable that these schools be located on “collector” roadways inside neighborhoods rather than on arterials streets. They should also have walking access on all sides of the school campus.
Middle school and junior high school sites should be readily accessible from a street system capable of handling school generated traffic (buses, service vehicles, delivery trucks, and automobile traffic created by faculty, staff, and parents). The use of local

residential streets for primary access to these schools should be avoided.

High School Sites

High school sites require special consideration for their transportation needs, especially vehicular access to the site. High school sites are typically much larger than elementary school sites. Because of size, associated traffic volumes, and the incompatibility with residential land use, high schools are typically best located on arterial streets.

A good high school site design needs adequate arterial street access and on-site provisions for bus and student loading. Student parking and associated driveways should be separated from loading and unloading areas. Primary vehicle access to the school from local residential streets should be minimized.

School Crossings should not be used for high school students. Instead, provisions outlined in Parts II, III, and VII of the MUTCD have proven to successfully accommodate high school students. It is important to preserve the integrity of the School Crossing so it can continue to provide its intended protection for younger students.

School administrators need to carefully evaluate the merits of an open campus. Allowing students to leave the campus during the school day for lunch or break periods may unnecessarily expose students to safety risks linked with inexperienced drivers in a hurry to leave or return to campus.

Charter School Sites

Charter schools create unique traffic control and pedestrian issues that should be addressed by school operators. Many of these schools are located in buildings or on sites that were not originally intended or designed for school operations. Often, charter schools have few walking students, so School Crossings may not be appropriate. However, if a sufficient number of walking students exist and the school requests a School Crossing, assessments should be made in the same manner as at a traditional public school. The assessment would take into consideration the age and number of pedestrians, conditions that exist, and a willingness by the charter school to provide an adult crossing guard, where required.

Typically, most students arrive by car, meaning charter schools need to focus on providing adequate student drop-off and pick-up facilities in an area where the students do not need to cross streets. If public transit is used for student transportation, then the school may need to establish an adult guard system to oversee and assist the students. If standard (white) crosswalks are to be considered, their installation should be predicated on the responsible jurisdiction's normal criteria for crosswalk installation.

It is important that space be provided for buildings, recreation and athletic facilities, faculty and staff parking, visitor parking, student parking, bus loading and student staging areas, bicycle racks, interior roadways, etc.

All School Sites

All schools are urged to consider future parking needs, especially student parking at high schools. It is best to evaluate the potential number of student vehicles and provide adequate on-site space for them. Doing so may eliminate future problems in adjacent neighborhoods. Inadequate on-site parking results in parking intrusion onto adjacent residential streets. This in turn can lead to congestion and safety concerns, as well as complaints from nearby residents. Residents near schools often request parking restrictions, which reduce the availability of off-campus parking. Schools should not rely on parking that requires students to cross busy streets near the school.

Overall, when all of these elements are considered, the final selection of a school site may have to be made on the basis of compromise. Of the sites considered, one may have adequate area, but limited access; another may be accessible, but not provide sufficient area for the desired facilities; still another may have many shortcomings, but be priced so attractively that it is given a preferential rating. In the last case, it should be remembered that the long-term problems that could result may well outweigh the short-term price advantage. It is important for school authorities to resolve these issues before a site is selected.

Section 4
On-Site Safety

Schools have specific start and dismissal times, faculty and students typically arrive and depart at approximately the same times. This creates the need for efficient parking and drop-off/pick-up provisions. It is important to provide adequate and separate provisions for some functions, such as bus loading and student drop-off/pick-up used by parents

There has been an increasing tendency for school designs to over-emphasize security concerns to the extent that it impairs traffic safety. Both concerns are very important, but a balance must be achieved to have both a safe and a secure school. Over-emphasis on security has a tendency to concentrate all access to just a few points, which in turn creates both safety and traffic congestion issues that could easily be eliminated if those activities were spread out either in time or in space.

Good school site planning and design stresses the maximum feasible separation of these basic modes of transportation:

A. Buses

B. Other motor vehicles

C. Pedestrians

D. Bicyclists

In addition, there are many more requirements that should be considered in the planning stages of developing a school site.

The following safety principles should be considered:

A. Adequate space should be provided for all modes of transportation envisioned in the future.

B. Routes provided for the basic school modes of transportation should be separated as much as possible from each other.

Adherence to these two basic principles can improve the safety of all persons using the school site.

Another on-site consideration is the location of school driveways and pedestrian crossings with respect to the street layout on all sides of the school. Site planners should provide information regarding these items and the layout of homes/streets within the anticipated walking attendance boundary of the school site. This will help determine the location of pedestrian sidewalks, possible School Crossings, loading areas, and building entrances.

School Bus Areas

School bus operations function best when they are separated from all other transportation activities. An estimate should be made of the number of buses that are expected to be within the bus loading and unloading area at any given period of time. The estimate should include the total number of buses used at the school, and the length of the buses to be used at the location. These facts will dictate the required dimensions for the school bus loading area.

Depending on the number of buses and where the bus loading and unloading driveway re-enters the street system, consideration should be given to providing two exit lanes; one for right-turning buses and one for left-turning buses. Consideration should also be given to the length of storage available from the street exit back to the point where buses are lined up against the curb for loading and unloading.

The bus loading areas should be designed for one-way counter-clockwise circulation so the passenger door will be on the building or curb side. Clockwise circulation functions well only when the school bus driveway encircles the school.

Recommended school bus loading patterns are shown in Figures 4-1 and 4-2. The dimensions of these areas will vary depending on the number of buses delivering or picking up students at any given time. Staggered dismissal times may allow for a shorter bus loading area. Bus loading areas should be designed for future projected use and possible expansion.

Bus loading areas should include a designated student staging area set back from where buses pull up to the curb. Large groups of students may make bus loading areas congested. Stand-back lines will keep children away from the edge of sidewalks where buses may overhang curbs and provide a buffer area between the buses and students. Designated waiting areas should be provided to safely accommodate large groups of waiting children.

Schools establishing school bus loading areas shall do so in accordance with The Arizona Department of Administration Minimum Standards for School Buses and School Bus Drivers Section R17-9-104.

Student Drop-Off/Pick-Up Areas

Student drop-off/pick-up areas are often overlooked in school design, but are very important. Students require a safe space to be dropped off and picked up. Providing adequate drop-off/pick-up areas can minimize illegal vehicular standing and parking near schools and helps prevent problems such as blocking school buses and driveways.

As in the bus loading area, traffic movement works best as a one-way, counterclockwise direction. Passenger vehicles should be lined up parallel to the pick-up area so there is no need to back-up. This counterclockwise flow allows the students to leave the vehicle and step immediately upon the sidewalk. Student drop-off/pick-up areas are to be separated from the bus loading area, and preferably should be separate from other parking lots. An estimate of the total number of cars that may be in the drop-off/pick-up area at any one time should be made to establish a drop-off/pick-up area that is long enough to avoid congestion and backing onto the adjacent public street. However, backing onto a residential or collector street may sometimes be accommodated, if necessary.

FIGURE 4-1
Suggested Style of Off-Street School Bus Loading/Unloading Area

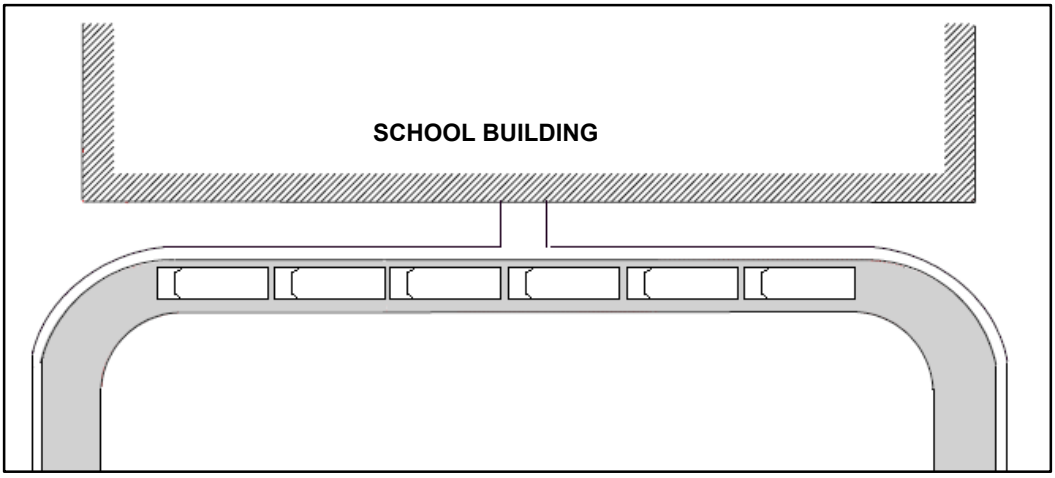


FIGURE 4-1 shows the most common and preferred "bumper to bumper" practice of loading and unloading students. The inherent shortcoming to this practice is that only the front and rear buses can move should an emergency or break-down occur. It is recommended that the lane be wide enough to allow two vehicles side by side. This system, however, provides maximum safety for students during loading and unloading operations by preventing students from walking between buses.

FIGURE 4-2
Suggested Style of On-Street School Bus Loading/Unloading Area

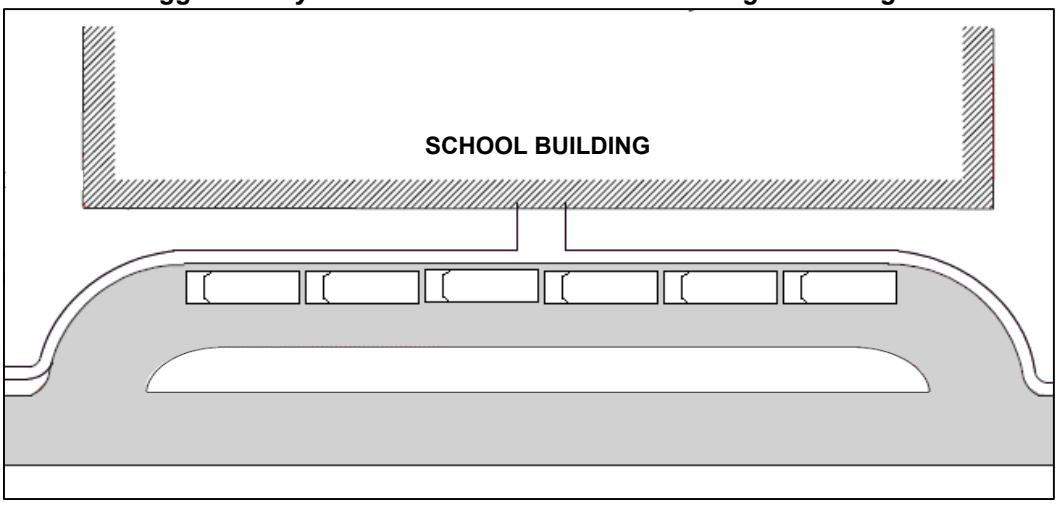


FIGURE 4-2 shows how an on-street bus loading area may be established. It is best to provide a wider sidewalk immediately adjacent to the bus loading area. It is very important that traffic controls be installed to keep motorists out of the bus loading area. Buses should be parked in such a manner that students do not tend to walk between buses, yet allows the rear emergency door to open.

Streets near schools may benefit from parking restrictions to control parent parking behavior near crosswalks, driveways, in neighborhoods, and at other locations. Parking restrictions may be installed across the street from a school property to discourage parents from dropping-off or picking-up their children in violation of ARS 28-901 and to discourage children from darting across the street. Most parking restrictions near schools should be limited to school hours (e.g. 7 a.m. - 4 p.m.) and school days to provide additional parking for evening and weekend events at the school.

Faculty, Student, and Visitor Parking

Schools should provide separate parking facilities for faculty, student, and visitor parking. Visitor parking may be combined with faculty parking, but should not be mixed with a bus loading area or the student pick-up area. The visitor parking area should be located close to the school administrative offices.

There should be at least one parking space for each staff member (full time, part time, and volunteer) and an additional 10 percent of that for visitor parking. Experience has shown that insufficient on-site visitor parking can impact the smooth traffic operation of a school site, especially at arrival and dismissal times and during special events. When sufficient on-site parking is not provided, area residential streets tend to be used for school related parking.

Any school policy on students driving to school should be considered during the design of the student parking lots. These parking lots should be laid out with enough capacity and sufficient access points to minimize the impacts on surrounding streets and residential areas. Typical parking lot arrangements are shown in Section 6.

On-site school traffic congestion and off-site parking impacts can be minimized through proper design of school parking lots and by providing an adequate number of parking spaces.

Pedestrian and Bicycle Routes

Sidewalks along and on the school campus must be provided for students who walk or ride bicycles to school. Where possible, sidewalk connections to the school building should eliminate or minimize the number of driveways that are crossed, especially busy driveways. Adult monitors should be considered where students have to cross busy driveways. Wider sidewalks (eight to ten feet wide) adjacent to and on the school site are helpful to accommodate the higher concentrations of pedestrians and bicycle traffic at the school. Where feasible, student walking and bicycle routes to the school building should be separated from the bus and student drop-off/pick-up areas.

Some schools and school districts require bicycle training, bike helmet use, and a minimum age level before a student is allowed to ride a bike to school. School officials also have found it helpful to require bicyclists to walk bikes while on campus to eliminate collisions with pedestrians. Secured bike racks should be located to minimize conflicts between walking students and bicyclists. It may be desirable to have more than one bike rack location to minimize the concentration of bicyclists from any one point on the school campus. The use of roller skates, roller blades, scooters, or other similar devices are not recommended for children going to or from school, especially when on campus.

Playground Area and Fencing

Playground facilities should be located so that students walking between school buildings and the playground need not cross streets, roadways, or driveways. Fences should be used where students may be tempted to wander from the playground area, as they minimize potential collisions which may result from children chasing balls that have rolled into streets and driveways. Fences can help and may even be necessary to separate students on the school grounds from vehicles. Fencing can also be used to channel crossing patterns and to maintain security on the school campus.

Service Roads

On-site parking for service and delivery vehicles should be provided. Delivery and maintenance vehicles should not park along public streets (see Emergency Vehicle Access below). Service and delivery turn-offs connecting to main driveways are appropriate ways to accommodate service vehicles.

Driveway & Roadway Design Criteria

Most local agencies have their own driveway design standards. However, in the absence of local standards, the following may be considered as a minimum standard:

A. At school driveways along streets, the entry and exit radii should be built large enough to allow bus access, yet narrow enough to reduce speeds and not pose problems for pedestrians.

B. The driveway width at the curb return should be at least 30 feet, but preferably 40 feet.

C. At ingress and egress points, a relatively flat grade is desirable (no greater than 2%) for at least 100 feet from the street. This flat grade will provide better operation during adverse weather conditions.

D. A maximum grade of 5% is recommended on internal school bus driveways.

E. Internal two-way roadways or two-lane one-way roadways should have a minimum width of 26 feet curb face-to-curb face for roadways with curbs, or 24 feet pavement edge-to-edge for roadways without curbs. Wider pavement widths may be needed when roadways are curvilinear.

Minimum turning paths for passenger cars, single unit trucks, and school buses are available in the American Association of State Highway and Transportation Officials (AASHTO) publication entitled "A Policy on Geometric Design of Highways and Streets." These design criteria should be used when designing curves on internal roadways. Curbs are desirable on all driveways and roadways to provide good drainage flow, provide additional parking controls, and better define roadways. The location of driveways, structures, and landscaping shall allow adequate sight distances for both drivers and pedestrians. Safe stopping sight distance values are also listed in the AASHTO policy.

Emergency Vehicle Access

Where driveways or parking lots are not contiguous to the school buildings, consideration should be given to using high strength sidewalks, 15 feet wide with radii at turns which would be sufficient to permit turning a large emergency vehicle. Access to these structural sidewalks can be provided via mountable curbs. Through the use of such features, emergency vehicles can gain access to all sides of a school building, even if a street, driveway, or aisle does not run close to the building. It is recommended that all roadways on school properties, with the exception of bus loading and students drop-off/pick-up areas, be signed as fire lanes. Fire lanes may be usable for bus loading or student drop-off/pick-up areas as long as vehicles are never left unattended and drivers remain in their vehicles. This caveat is important in case the fire lane is needed for emergencies and must be evacuated promptly. Assistance in developing traffic control restrictions can be obtained from local or state enforcement agencies.

Traffic Control Devices

All traffic control devices (signs, signals, and pavement markings) are to conform to the latest edition of the Manual on Uniform Traffic Control Devices (MUTCD), as adopted and amended by the State of Arizona. Additionally, traffic control associated with ARS 28-797 should conform to the guidance presented here-in. Within the school site, the responsibility for traffic controls and their enforcement belongs with the school.

A review of all traffic controls should be conducted to ensure clarity to motorists. Traffic signs should never be hidden by buildings, trees, shrubs, etc. Pavement markings should be routinely maintained and checked each school year.

"Special" signs should be avoided. The MUTCD addresses most traffic control needs and contains uniform controls designed to meet these needs. Conformance to the MUTCD will improve traffic flow, safety, and enforcement of traffic regulations. At no time can school personnel direct traffic in the public right-of-way onto or off of the school campus. Only uniformed officers can direct traffic in the right-of-way. Additionally, school authorities may not install signs of any kind in the right-of-way, nor may they use or install traffic control devices in the right-of-way, except as approved by the local traffic authority.

Requirements to Accommodate the Disabled

Wheelchair access for pedestrians onto and throughout the campus is required. Existing school facilities must be made accessible to provide full access to disabled students, teachers, parents, and others who come to the campus. Safety and building specifications must conform to the requirements of the 1990 Americans with Disabilities Act and the most recent changes.

Section 5
Off-Site Safety

Community responsibility for developing an effective school pedestrian safety program should be a combined effort of the school, the parents, and the State and local authority.

Studies of walking routes to and from schools reveal that students frequently cross streets at inappropriate locations in an effort to take the shortest route to minimize their walking distance. This problem is often compounded when parents pick-up and drop-off students on the surrounding streets near the school. Examples of inappropriate crossing locations include those that are close to existing crosswalks, where students must cross busy school driveways, or walk through parking lots and bus loading areas. Parents and school officials often ask for marked crosswalks at inappropriate crossing locations because they perceive it will make the crossing safe. Installation of a School Crossing at an inappropriate location may compromise safety for convenience. Students should be directed to use crossings that will optimize safety and promote better traffic conditions. Traffic control devices cannot make any condition or location 'safe'. Only the reasonable and prudent behavior of the pedestrian and driver can provide a safe condition.

It is vitally important that consideration is given to locating logical walking routes for each school where the maximum number of school-age pedestrians can benefit from their use. The routes should minimize potential conflict points, such as crossing busy school driveways. Further, a primary goal of these school walking routes should be the concentration of pedestrian crossings at selected points on collector or major streets. Creating a comprehensive walking plan for a school is the best way to determine the optimal crossing locations. These routes are also useful for determining when and where to place adult crossing guards or other traffic controls, such as signs, traffic signals, and pavement markings and may reduce requests for inappropriate crosswalks.

Bicycle Safety

Parents or school officials should provide training for students who choose to ride their bikes to school, especially younger children. It is important that bicyclists are made aware of school policy, local ordinances, and state law requirements governing bicycle operation, including the fact that bicyclists are required to ride with traffic when in the street.

Elementary age children should not ride bicycles in arterial streets or busy collector streets. Young cyclists should be encouraged by school officials and parents to walk their bikes while in crosswalks to preserve their rights as pedestrians, to give motorists more time to react, and to avoid conflicts with other children walking in the crosswalk. Some elementary schools have established minimum age requirements and require passage of a bike safety course before students are allowed to ride to school. Bicycle rodeos are a popular and successful way to educate students on how to ride safely and to properly maintain their bikes. Cyclists should be strongly encouraged to wear a safety helmet while riding and shall wear a helmet where required by law.

School Responsibilities

School district responsibilities, under the school superintendent or an assigned staff member, should include:

A. Developing a suggested "Route to School" walking plan for each school (see Appendix E). Such a plan should consist of a street map showing the walking attendance boundary and location of the school, as well as the suggested routes to be used by the students en-route to and from the school. The plan should be designed to take advantage of existing traffic controls, crosswalks, adult crossing guards, and pedestrian facilities. Children may be required to walk somewhat longer distances in order to take advantage of existing crossing aids. The shortest route is not necessarily the safest route.

B. Instructing students and parents on the use and purpose of the suggested "Route to School" walking plan.

C. Making periodic field reviews of the plan to ensure that the suggested routes are being used. Special attention should be given to unsafe activities of school children. The need for traffic control, trimming of overgrown or low hanging vegetation, or other maintenance needs should be directed to the attention of the appropriate agency.

D. Providing and maintaining access to the school campus consistent with the suggested "Route to School" walking plan.

E. Making an annual review of the suggested "Route to School" walking plan to determine the need for revisions.

F. Training and supervising adult crossing guards.

G. Establishing and reviewing the location of school bus stops.

Parental responsibilities

Parental responsibilities, through local Parent Teacher Organizations in cooperation with school administrators should include:

A. Instructing their children on crossing streets safely, including travel to and from special school programs.

B. Ensuring that their child uses the suggested "Route to School" walking plan.

C. Directing any safety concerns that may develop during the school year to the attention of the school administrators.

D. Teaching their children about bicycle safety and wearing bicycle safety helmets, verifying that their children are following safety rules, and ensuring that their children have properly fitting bikes and are wearing properly fitting helmets. As a part of this training, parents need to ensure that their children know and understand the local ordinances and state laws governing bicycle operation.

Parents who register their children in a private, charter, or a public school outside their normal public school attendance boundary are responsible for transporting their children to and from school. Parents must obtain a variance for their children and sign an agreement accepting responsibility for student transportation if they enroll their children in a school outside the normal public school attendance boundary.

Local Authority Responsibilities

Local authorities' responsibilities should include:

A. Working with willing school authorities and parent groups in developing a suggested "Route to School" walking plan as requested.

B. Installing and maintaining permanent traffic control devices adjacent to the school and along the walking routes.

C. Administering the Application and Operating Agreements for School Crossing and ensuring compliance with those agreements.

D. Periodically reviewing traffic control along the school walking route at the request of school officials.

All groups may come together to educate students on bicycle and pedestrian safety.

Section 6
Safety at Existing School Sites

On existing, fully developed school sites, traffic conflicts may exist or be created by changing population patterns, school attendance boundaries, curriculums, and busing policies. For example, an elementary school with no busing may start to provide busing because of a change in policy. In this situation, there would be a change in the number of parents driving students to and from school and a change in pedestrian walking patterns. However, most critical of all, a bus loading area would be needed. Another example is an elementary school changing dismissal times from two dismissals (one for grades 1-3 and another for grades 4-6) to one common dismissal for all grade levels. Such a change may have a significant impact on the number of parent vehicles and buses arriving at the school during dismissal times.

This section shows how existing school sites may be effectively and economically modified to adapt to traffic operational changes and reduce the impact of newly created traffic concerns.

The following examples illustrate just a few of the ways that the basic principles discussed in the previous sections may be applied to existing school sites.

As with new sites, each existing site presents a unique situation which must be evaluated on an individual basis. There is no single, simple solution which will improve all situations. Each of the basic principles must be considered in the analysis of an existing site.

FIGURE 6-1
Example School Site

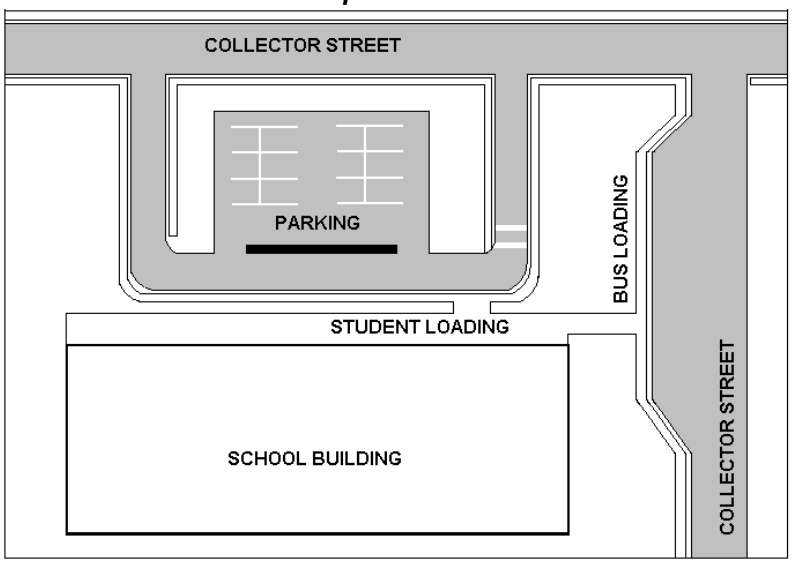


FIGURE 6-1 is a example of a school site that has separate bus loading/unloading and student drop-off and pick-up areas with sufficient curb space for parent vehicle queuing. No major changes would need to be made for traffic to function safely and efficiently.

FIGURE 6-2
Single Shared Horseshoe Driveway

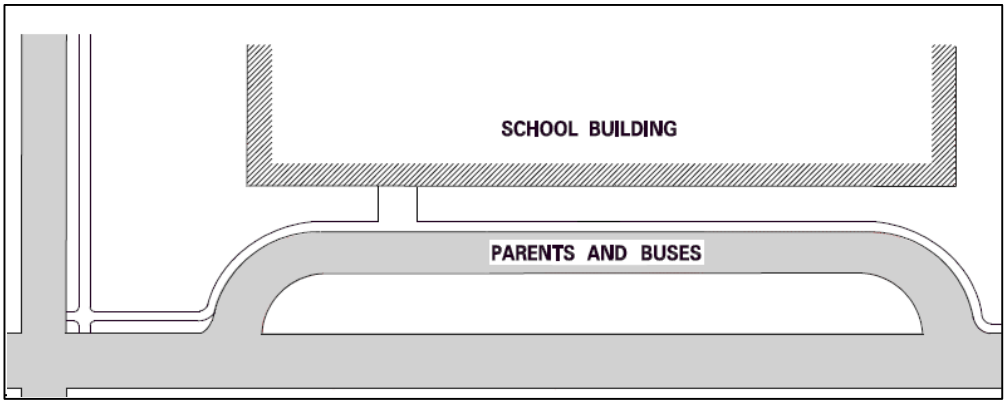


FIGURE 6-2 is an example of an existing school with a horseshoe driveway in front of the building used for both buses and parent vehicles. These two uses should not be mixed, as buses may be blocked by parents' vehicles and students may walk between vehicles to meet their parents.

FIGURE 6-3
Separated Horseshoe Driveways

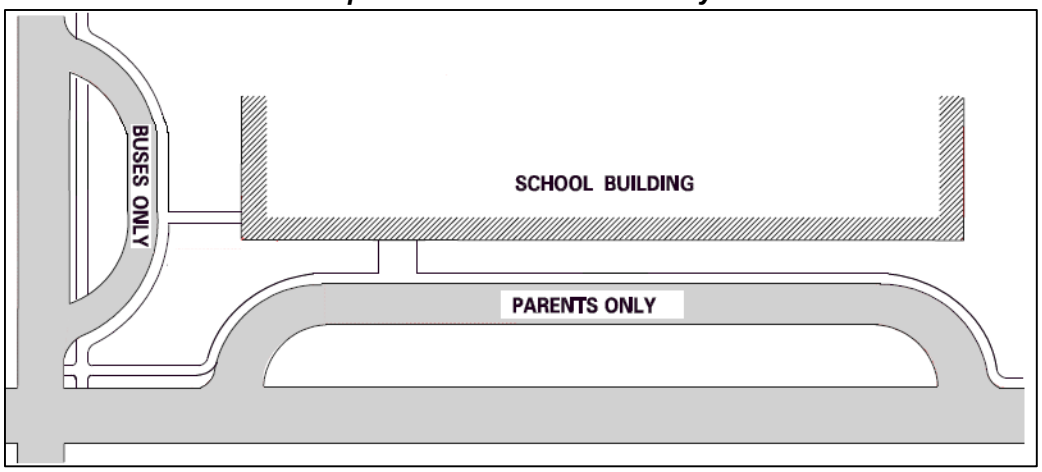


FIGURE 6-3 shows a separate loading area for buses. The larger loading area should usually be reserved for the student loading area to be used by parents. Also, if the loading area used by parents were to be fully occupied, additional vehicles in the queue could back up along the curb on the street. The one-way counterclockwise pattern is used in both zones.

FIGURE 6-4
Single Shared Parking Lot

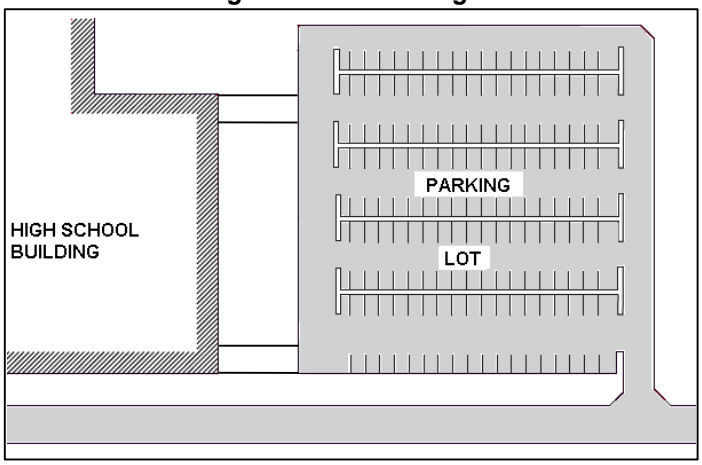


FIGURE 6-4 is an example of a high school with a large adjacent parking lot. Currently, visitors, staff, and students may park anywhere in this lot. These parking areas should be separated, if possible, by signing and pavement markings. Adding concrete curbs and/or fencing may also be helpful.

FIGURE 6-5
Single Separated Parking Lot

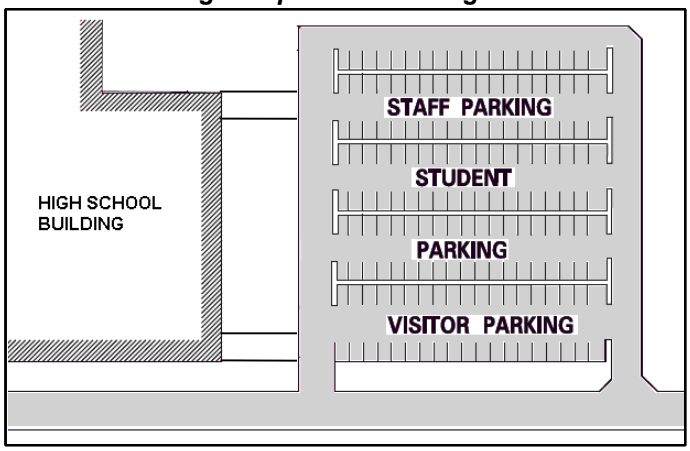


FIGURE 6-5 is an example of a parking lot that has been divided to provide designated staff and student parking areas as well as “reserved” parking close to the main entrance for visitors.

FIGURE 6-6
Uninterrupted Perimeter Road

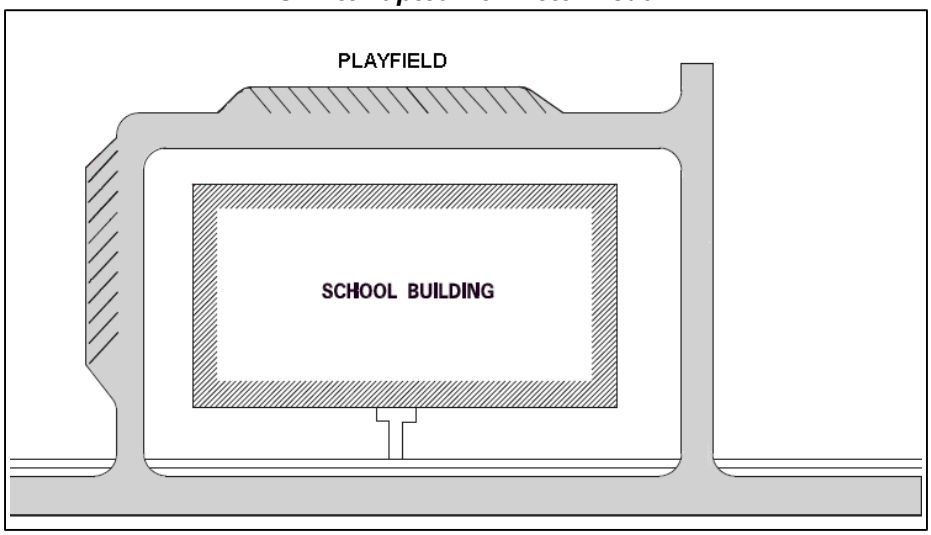


FIGURE 6-6 is an example of an elementary school building that is surrounded by either streets or driveways. The school has limited sidewalk access along one street and students may be exposed to vehicular traffic onsite in order to get to the playfield.

FIGURE 6-7
Interrupted Perimeter Access

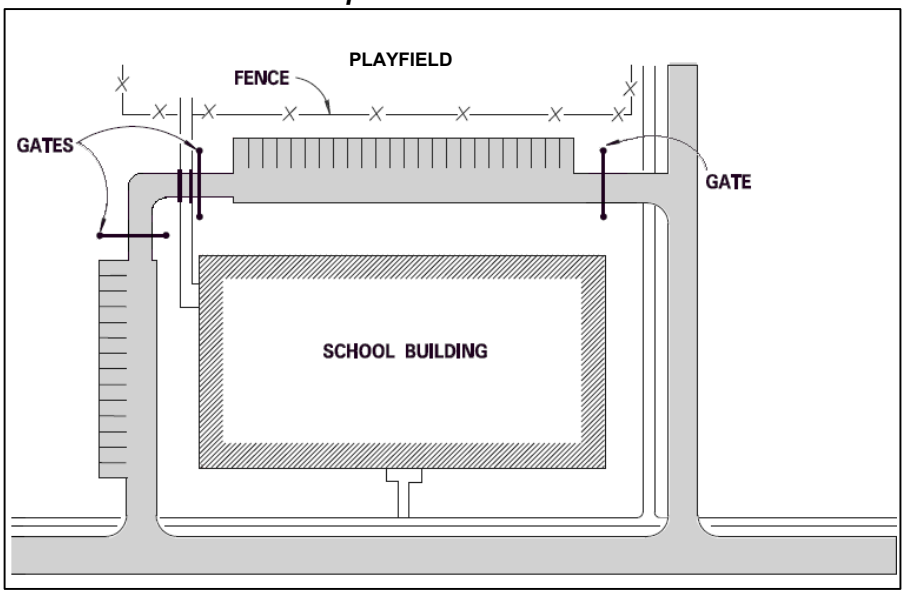


FIGURE 6-7 shows where sidewalks have been provided for walkways and bikeways along all streets adjacent to the property. In addition, the driveway is interrupted by gates, the playfield is fenced, and a walkway is provided from the school to the playfield. This may be accomplished fairly inexpensively and eliminates many potential conflicts between vehicles and students.

FIGURE 6-8
Parking Between Playfield and School

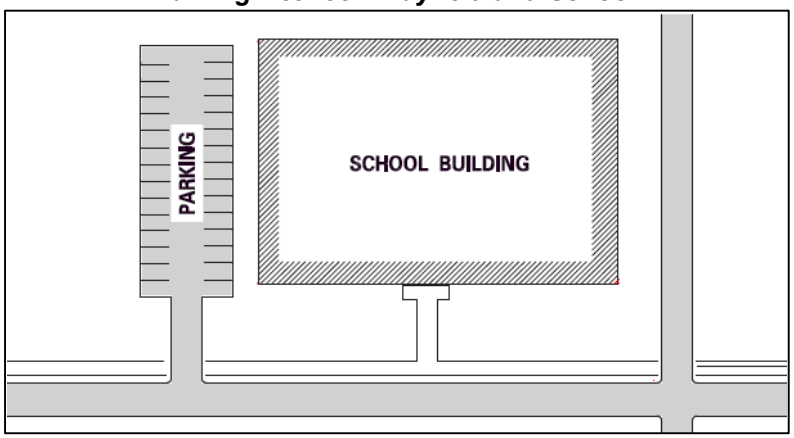


Figure 6-8 is an example of a school built with a parking lot and playfield which allows students to cross the parking lot to access the playfield. Students are exposed to vehicular traffic in the parking lot as they walk to the playfield.

FIGURE 6-9
Parking Separated from Student Access

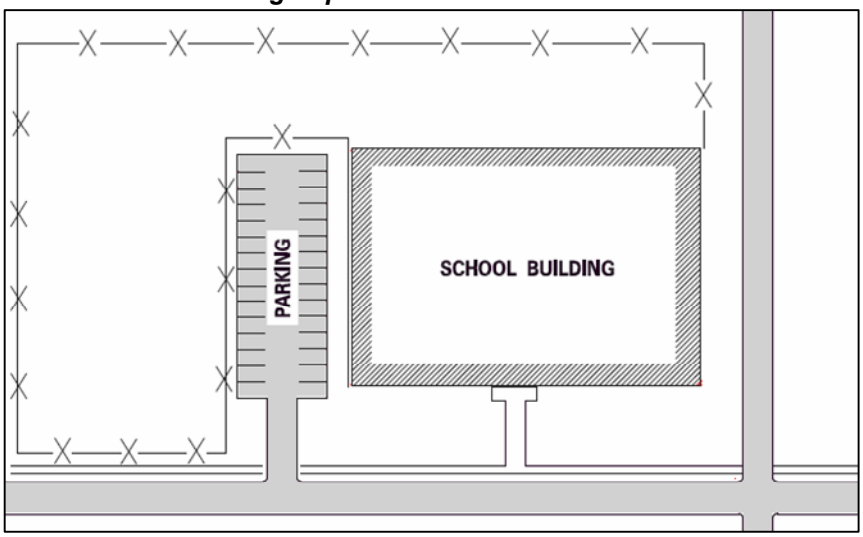


FIGURE 6-9 shows a fence that has been built around the playfield to confine the students to the playfield area. The fencing also provides a barrier to prevent balls from rolling off the playfield into the streets or parking lot.

FIGURE 6-10
Elementary School with Arterial Access

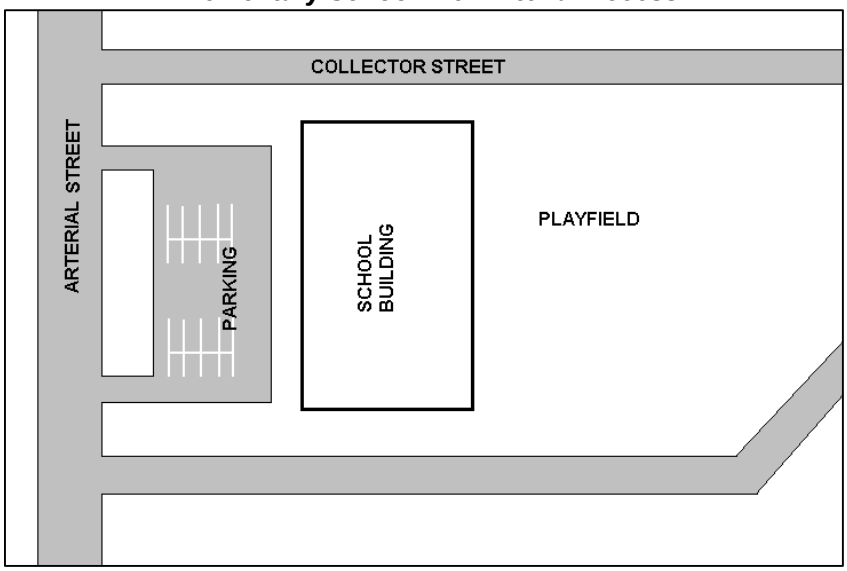


FIGURE 6-10 is an example of an elementary school that was built having all access from an arterial street. Motorists entering and exiting the school must find a gap in traffic on the heavily traveled, high speed arterial street. The driveway locations will never be suitable for traffic signals.

FIGURE 6-11
Elementary School with Collector Access

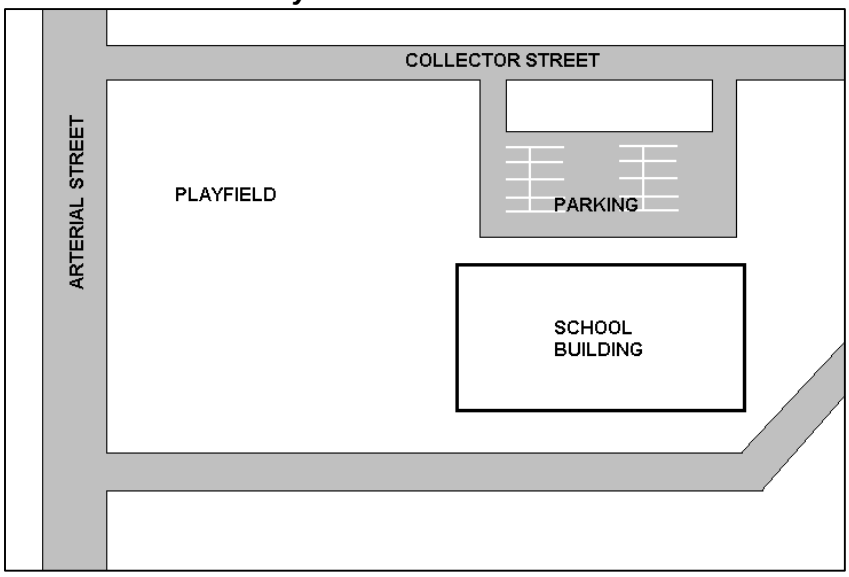


FIGURE 6-11 shows the same site following a rebuild of the school. Access to the site was relocated from the arterial street to the collector street, into the interior of the neighborhood while the playfield was relocated closer to the arterial street. Motorists entering this site can now do so from the lower volume, lower speed collector street.

Section 7
Arizona School Crossing Controls

Throughout this document, any reference to "School Crossing" means the school crosswalk marked in yellow (except as noted in 28-797 F.1), accompanied by NO PASSING 15 MPH SCHOOL IN SESSION and STOP WHEN CHILDREN IN CROSSWALK portable signs. This section sets forth procedures and requirements for the establishment of school crossings in Arizona.

School crossings shall be established in compliance with the Arizona Revised Statutes article 10 section 28-797 (see Appendix C), and the decision to establish a crosswalk at a particular location shall be made on the basis of an engineering assessment of the location.

The Arizona Department of Transportation (ADOT) uses a warrant procedure based on points (see Appendix B) for making crossing assessments on State Highways. Some local jurisdictions have adopted the ADOT warrant procedure. However, this specific warrant procedure is not required for the installation of a School Crossing nor is it intended to be a substitute for engineering judgment of trained, accountable traffic officials familiar with local conditions.

The following sections of the Arizona Revised Statutes (A.R.S.) are relevant to the establishment of School Crossings. Each is discussed briefly following the text of the A.R.S.

Abutting School Crossings
A.R.S. Section 28-797.A.

"The director, with respect to state highways, or the officer, board or commission of the appropriate jurisdiction, with respect to county highways or city or town streets, by and with the advice of the school district governing board or county school superintendent may mark or cause to be marked by the department or local authorities crosswalks in front of each school building or school grounds abutting the crosswalks where children are required to cross the highway or street."

Guidelines for implementing 28-797.A.:

A. This section of the law places the responsibility for the location of all abutting School Crossings on the state highway system with the Director of the Department of Transportation, and for the county highways or city or town streets with the appropriate local authorities.

   Requests for School Crossings on roads off the state highway system should be addressed directly to the authority having jurisdiction over those roads.

B. School authorities are responsible for the proper operation of School Crossings. No School Crossing evaluation on the state highway system may be undertaken without a written request signed by the school district governing board or superintendent of schools for that district or the superintendent of a charter, private, or parochial school. The request should be addressed to the appropriate Regional Traffic Engineering office, Arizona Department of Transportation.

   Requests for School Crossings outside the state highway system should be directed to the local authority.

C. Upon receipt of request for a School Crossing, a traffic operations investigator, together with an official of the school (if the school so desires), will make an inspection of the location. This inspection will consider, but not necessarily be limited to the following factors:

   1. Physical conditions of the area

   2. Number of lanes, vehicular volume, speed and other conditions pertaining to traffic

   3. Number and age of children who will or are using the proposed School Crossing area

   4. Proposed method of operation of the School Crossing by school authorities and the willingness of the school and school district to provide the necessary adult crossing guard(s)

D. Upon consideration of the above information using the report and/or recommendations of the investigator, the Director or local authority may exercise engineering judgment to either approve or deny the School Crossing. If a School Crossing is approved, an Operating Agreement shall be signed by the Director of State Highways or the local authority to authorize the School Crossing. The Operating Agreement shall indicate the location of the crosswalk and may indicate the location of the associated signs. A sample Application and Operating Agreement for School Crossing is shown in Appendix D. The school authority shall sign the agreement indicating acceptance of the responsibility for operating the School Crossing in accordance with state law, this guide, and other requirements included in the agreement.

E. If for any reason the investigator recommends denial of a request for a School Crossing, the applicant may request a review by the Director or local authority.

Non-Abutting School Crossings
A.R.S. Section 28-797.B.

"The department or local authorities may approve additional crossings across highways not abutting on school grounds on application of school authorities and with written satisfactory assurance given the department or local authorities that guards will be maintained by the school district at the crossings to enforce the proper use of the crossing by school children."

Guidelines for implementing 28-797.B.:

A. The same procedure should be followed as outlined above for implementing abutting School Crossings.

B. For non-abutting School Crossings, the Operating Agreement shall include a requirement that an adult crossing guard will be provided by the school district during the operational times of the School Crossing to enforce the proper use of the School Crossing by school children and to monitor and maintain the portable signs while in the street.

C. Non-abutting School Crossings should be in operation only while children are going to or leaving school during arrival or dismissal times.

School Crossings On Unpaved Highways or Streets
A.R.S. Section 28-797.F.1.

"An agency of appropriate jurisdiction may establish a school crossing on an unpaved highway or street adjacent to a school when the agency determines the need for the school crossing on the basis of a traffic study. School crossings on unpaved highways and streets shall be marked by the use of signs as prescribed in the manual prescribed in section 28-641."

Guidelines for implementing 28-797.F.1.:

A. The same procedure should be followed as outlined above for implementing abutting School Crossings.

B. A School Crossing on an unpaved highway shall be signed as shown in Figure A-6.

Restrictions on Establishing School Crossings

A. At no time shall a School Crossing be used as a device to control vehicular speed, except as stated in A.R.S. 28-797 at a bona-fide installation where children are required to cross the street or highway.

C. School Crossings normally should not be installed between intersections on major streets. Mid-block crossing locations can present the driver with an unexpected situation for which they are not prepared. However, there are a few isolated circumstances when engineering judgment may result in mid-block crossings being advantageous if, for example, it eliminates conflicts involved with drivers from other streets turning across the crosswalk.

C. School Crossings shall not be established at a signalized intersection on any State highway. School Crossings are discouraged by safety officials at signalized intersections under local jurisdictional control. However, ARS 28-797.F.2 allows School Crossings at a signalized intersection if the local authority determines the need on the basis of a traffic study.

The establishment of a School Crossing at a signalized intersection can be counter-productive. The School Crossing and a traffic signal are two mutually exclusive types of control and should not to be used together. A signalized intersection, in conjunction with an adult guard, provides the safest, most controlled environment for locations where students must cross. Adding a School Crossing to a signalized intersection has been found to:

1. Create confusion for both drivers and pedestrians. This confusion is a result of the mixed conflicting information provided by the "go" signal indication and the required STOP WHEN CHILDREN IN CROSSWALK portable sign.

2. Increase speed differential at the intersection.

3. Increase the potential for red light violations due to impatience with added delay.

4. Create violations as motorists in the thru lanes "pass" left turning vehicles when the signal is green.

5. Create congestion and increase delay, which may encourage motorists to divert to local residential streets, cutting-through adjacent neighborhoods.

If additional controls are requested at a signalized intersection, first consideration should be given to providing additional adult crossing guards or additional training for existing crossing guards to ensure that children cross only at the proper times. The location should also be reviewed to verify that students have enough space at the crossing to stand away from the roadway while waiting to cross. Often, a 'stand-back' line can help the crossing guard to define this distance.

If a School Crossing on a state highway is subsequently signalized, the School Crossing Agreement shall be cancelled, the School Crossing signs removed, and the yellow crosswalk markings removed or reinstalled as standard white markings. If a School Crossing under local jurisdiction is subsequently signalized, the School Crossing Agreement should be cancelled, the School Crossing signs removed, and the yellow crosswalk markings removed or reinstalled as standard white markings. If the new signal remains a primary crossing location, the school district should consider keeping an adult crossing guard at the signal.

D. School Crossing shall not be established on approaches where traffic is controlled by a STOP sign. A STOP sign is the least violated of all regulatory traffic controls. The establishment of a School Crossing where traffic is already required to stop could create confusion, encourage violations of the STOP sign, and be counter to the normal expectations a driver. Most importantly, no additional safety benefits could be anticipated as a result of adding a School Crossing where a STOP sign already exists. This does not prohibit an adult guard from being located at a STOP controlled intersection. An adult guard at a STOP controlled intersection can help increase supervision along the suggested "Route to School".

E. A School Crossing typically should not be established within 600 feet of a STOP sign, traffic signal or another School Crossing on the same street. Since an Arizona School Crossing is the most restrictive control on Arizona's streets and highways, it is critical that it be viewed as "reasonable" by motorists, thereby encouraging a high level of voluntary compliance. Where two School Crossings are established closer than 600 feet, research has shown that the second crossing in either direction is routinely violated by drivers. This same poor compliance also results where School Crossings are located too close to signalized or STOP controlled intersections.

F. A School Crossing typically should not be established within 600 feet of a railroad crossing. Care must be taken to minimize the possibility of traffic queuing across the railroad tracks.

G. A School Crossing shall not be established at locations with inadequate sight distance.

H. A School Crossing should not be established on roadways less than 20 feet in width.

I. School Crossings should not be established at high schools or for students of high school age. Most high school students are mature enough in the eyes of Arizona to be issued a Driver License, and have acquired sufficient judgment and maturity to choose adequate gaps in traffic.

J. School Crossings shall not be established at any school that has no walking students, or to create a drop-off/pick-up area on the opposite side of the roadway for the purpose of crossing children.

K. School Crossings shall not be installed for adult education schools or universities.

Methods of Operation
A.R.S. Section 28-797.D.

"When the school crossings are established, school authorities shall place within the highway the portable signs indicating that school is in session. This placement shall be not more than three hundred feet from each side of the school crossing. In addition, portable "stop when children are in crosswalk" signs shall be placed at school crossings. School authorities shall maintain these signs when school is in session and shall cause them to be removed immediately when school is not in session."

Guidelines for implementing 28-797.D.:

A. School authorities shall not delegate the responsibility for placing, furnishing, maintaining or removing the portable signs to any person who is not in the service of the school or school district.

B. Portable signs should not normally be placed in the highway during the hours of darkness; however, if the school arrival or dismissal hours occur during the hours of darkness, portable signs shall be placed in the highway and the signs shall be retroreflective as required by Sections 2A.08 and 7B.02 of the MUTCD.

C. School authorities shall replace any portable signs when deterioration of the message or excessive damage to the signs is evident. It is extremely important that all traffic signs command the continued respect of the motoring public.

D. No portable signs shall be within the highway or roadway unless all required signs are in place, except when placing or removing the signs.

E. Portable signs shall be removed from the street or highway when a required adult crossing guard is not on duty at the non-abutting School Crossing.

F. School authorities should provide adult crossing guards at abutting School Crossings wherever roadway and traffic conditions are such that adult supervision would improve safe operation of the School Crossing. Adult crossing guards should be employees of the school district or trained volunteers for whom the school district agrees to provide back-

up support to ensure reliable operation of the School Crossing. Using students in place of adult guards is not recommended as it does not provide the adult supervision needed. Students may assist an adult crossing guard by helping control students on the sidewalk, but at no time should a student assistant enter the street nor determine when students are to cross.

G. School authorities shall provide adult crossing guards at non-abutting School Crossings at any time the portable signs are in the street.

H. The function of the adult crossing guard is to choose adequate gaps in traffic, concentrate attention on controlling the school children, and guide the proper use of the crossing by the school children. Crossing guards shall not direct traffic. Adult crossing guards should be trained and must wear a retroreflective safety vest, as prescribed in Section 7E.04 of the MUTCD, over their clothing while in the street. Adult crossing guards should use hand held STOP signs to increase conspicuity, as prescribed in Section 7E.05 of the MUTCD. Annual refresher training is recommended.

Times of Operation
A.R.S. Section 28-797.H.

"For the purposes of this section, "school in session," when used either in reference to the period of time or to signs, means during school hours or while children are going to or leaving school during opening or closing hours."

Guidelines for implementing 28-797.H.:

A. Time limitation on placement and removal of School Crossing portable signs shall depend on the opening and closing hours for the individual school as follows:

   1. Signs should not be placed more than 45 minutes before the beginning of the first class unless engineering judgment has determined that the walking time from the School Crossing to the school is sufficient to justify additional time.

   2. Signs should be removed within 30 minutes after dismissal of the last class unless engineering judgment has determined that the walking time from the school to the School Crossing is sufficient to justify additional time.

   3. Where additional traffic control or School Crossing use is necessary during times other than normal school operating hours, a written request for permission must be submitted to the local authority and written permission given before the crosswalk or other traffic control may be employed during other than normal school hours.

Restrictions on Operating School Crossings

A. Portable School Crossing signs shall not be placed in the street or highway on Saturdays, Sundays, school holidays or during hours beyond the normal school day for extracurricular school activities, unless permission is obtained from the regulating authority.

B. Portable School Crossing signs shall not be installed as a permanent installation at the side of the road.

C. Revision of school attendance boundaries, adult supervision, or busing in lieu of School Crossings should be used where children must cross high speed highways. Consideration must be given to overall safety.

D. When not in use, all School Crossing portable signs shall be placed out of the roadway in a location or position such that the sign will not face approaching traffic.

E. School Crossings shall not be installed so as to encourage unlawful drop-off or pick-up of students.

F. Arizona School Crossing signs (S2-2, S4-5) shall not be used along with MUTCD school speed limit assemblies (S4-1, S4-2, S4-3, S4-4, S4-6, S5-1).

Traffic Control Devices for School Crossings
A.R.S. Section 28-797.C.

"The manual prescribed in section 28-641 shall provide for yellow marking of the school crossing, yellow marking of the centerline of the roadway and the erection of portable signs indicating that vehicles must stop when persons are in the crossing. The manual shall also provide the type and wording of portable signs indicating that school is in session and permanent signs that warn of the approach to school crossings."

Guidelines for implementing 28-797.C.:

A. Markings

   1. School Crossing crosswalk markings shall be standard highway yellow.

   2. Crosswalk lines shall be a minimum of 10 inches wide and should not be spaced less than 6 feet apart.

   3. The centerline and/or lane lines shall be as prescribed by the Manual of Uniform Traffic

Control Devices (MUTCD), as amended by the State of Arizona (See Appendix A).

4. A solid yellow circle approximately 10-18 inches in diameter should be painted to mark the appropriate location for the portable signs (S4-5 or S2-2) to be placed.

B. Signs

1. All signs shall conform to the Manual on Uniform Traffic Control Devices (MUTCD), as amended by the State of Arizona (Appendix A).

2. The following signs shall be used at School Crossings only as indicated in this guide:

   a. School Advance Warning Sign (S1-1)

   c. School Crossing Warning Sign Assembly (S1-1 and W16-7p) (optional)

   d. STOP WHEN CHILDREN IN CROSSWALK portable sign (Arizona School Crossing Sign S2-2)

   e. NO PASSING 15 MPH SCHOOL IN SESSION Portable Sign (Arizona School Crossing Sign S4-5)

   f. NO PARKING Sign

   g. END OF SCHOOL ZONE Sign (S5-2), at discretion of local authority.

3. The School Advance Warning Sign (S1-1) is used in advance of the School Crossing. The sign should be permanently mounted on a post at the side of the street or highway in advance of the NO PASSING 15 MPH SCHOOL IN SESSION portable. The School Advance Warning Sign should be positioned using engineering judgment, typically 150' – 700' in advance of the School Crossing.

4. The optional School Crossing Warning Sign Assembly (S1-1 and W16-7p), when used, shall be permanently mounted on a post at the side of the street or highway and placed at the school crosswalk. This sign assembly shall not be used at a traffic signal.

5. The STOP WHEN CHILDREN IN CROSSWALK sign (S2-2) should be mounted on a portable standard not less than 24 inches nor more than 30 inches from the bottom of the sign to the roadway. Under normal circumstances on local or most collector streets, two STOP WHEN CHILDREN IN CROSSWALK signs can be mounted back-to-back and placed at the crosswalk on the centerline of the highway. On one-way, multiple lane streets, one or more STOP WHEN CHILDREN IN CROSSWALK signs should be mounted on separate portable standards and placed at the crosswalk.

6. The NO PASSING 15 MPH SCHOOL IN SESSION sign (Arizona School Crossing sign S4-5) should be mounted on a portable standard not less than 24 inches or more than 30 inches from the bottom of the sign to the roadway. On four-lane, two-way roadways, the NO PASSING 15 MPH SCHOOL IN SESSION sign should be placed on the lane line. On one-way, multiple lane streets, each lane should have a NO PASSING 15 MPH SCHOOL IN SESSION sign either to the right or left. The NO PASSING 15 MPH SCHOOL IN SESSION signs should be located in advance of the yellow marked crosswalk as follows:

   a. 75 to 125 feet when the posted regular speed limit is 30 mph or less

   b. 125 to 300 feet when the posted regular speed limit is 35 to 45 mph

   The location of the portable NO PASSING 15 MPH SCHOOL IN SESSION signs should be determined by the investigator after reviewing existing conditions. The location of the NO PASSING 15 MPH SCHOOL IN SESSION signs is measured from the near side of the yellow marked crosswalk.

7. On multi-lane roadways, additional Arizona School Crossing portable signs (S2-2 and S4-5) may be used when a traffic engineering investigation indicates they are needed. It is desirable for the portable signs to be adjacent to at least one side of every through traffic lane. When lanes are narrow, it is desirable to stagger portable signs so that signs do not intrude on both sides of a thru lane.

8. All on-street parking shall be eliminated on the approach between the NO PASSING 15 MPH SCHOOL IN SESSION sign and the crosswalk during the hours the crosswalk is in effect (See Appendix A). On-street parking should also be eliminated on the departure side of the School Crossing between the marked crosswalk and the NO PASSING 15 MPH SCHOOL IN SESSION sign for the opposing direction of traffic. NO PARKING signs are to be installed under provisions of A.R.S. 28-873 and in conformance with the MUTCD.

9. Typical examples of signing and markings for School Crossings are shown in Appendix A.

Responsibility for Signs and Markings

The responsibility for furnishing or replacing signs, sign posts, portable sign standards and pavement markings is as follows:

A. Permanent signs

1. Department of Transportation, on state highways

2. County authority on county roads

3. City or town authority on city or town streets

B. Portable signs

The School district, charter, private or parochial school for which the School Crossing is authorized

C. Pavement markings

1. Department of Transportation, on state highways

2. County authority on county roads

3. City of town on city or town streets

D. Adult guard equipment (safety vest, STOP paddle)

School district, charter, private or parochial school for which the School Crossing is authorized

Section 8
Pedestrian Traffic Signals

Pedestrian signals are special types of traffic signal indications installed for the exclusive purpose of controlling pedestrian traffic. They are frequently installed at signalized intersections when engineering analysis shows that the vehicular indications cannot adequately accommodate the pedestrians using the intersection. Unfortunately, there are some common misconceptions about how pedestrian signals function.

The following discussion is intended to clarify when pedestrian signals are normally installed, how they function, and what the WALK, flashing DON'T WALK and steady DON'T WALK signal indications mean.

When Pedestrian Signals Are Used

Pedestrian signals may be installed for a variety of reasons. Frequently they are installed at traffic signal-controlled intersections where:

A. The layout of an intersection is such that vehicular indications are not visible to pedestrians.

B. Pedestrian volumes are high, as in a central business district.

C. Traffic movements are complex and special efforts are necessary to communicate with pedestrians. For example, pedestrian signals are typically needed when left turn arrows exist.

D. A special pedestrian path has to be defined across a complex intersection.

E. Unusual conditions exist where pedestrians are given exclusive use of an intersection (all conflicting vehicular movements stopped in the interest of safety).

F. The traffic signal is on the suggested "Route to School" walking plan.

G. Pedestrians crossing a wide street would benefit from knowing when their specific clearance interval begins.

How Pedestrian Signals Function

There are two types of pedestrian signals: those with pedestrian detectors ("Push to Walk" buttons) and those without detection (i.e. fixed-time signals). Pedestrian detectors are normally installed at signalized intersections that are actuated or semi-actuated. Pedestrian actuated signals are desirable when:

A. Arrival rates of side street vehicles are relatively infrequent and erratic.

B. Vehicular green lights are too short to allow for a pedestrian to safely cross a wide street. In these instances the pedestrian push button causes the signal controller to extend the green time for both vehicles and pedestrians.

C. Pedestrians may need to cross half the street at a time with a pedestrian push button in the median island.

What the Pedestrian Signal Indications Mean

Pedestrian signals consist of the illuminated walking person/upraised hand symbol or the WALK/DON'T WALK word messages. The meanings of the indications are as follows:

A. A steady, illuminated walking person symbol or WALK display means that a pedestrian may enter the roadway and proceed in the direction of the indication. While drivers are required to yield the right of way to pedestrians in the crosswalk, pedestrians must still be alert for turning vehicles and motorists who may run the red light.

B. A flashing, illuminated upraised hand symbol or flashing DON'T WALK display means that a pedestrian may not start to cross the roadway, but any pedestrian who has already started crossing during the WALK indication will have sufficient time to complete the crossing.

C. A steady, illuminated upraised hand or steady DON'T WALK display means that a pedestrian cannot legally enter the roadway.

Common Misconceptions

Common misconceptions about pedestrian signals harbored by pedestrians include:

A. The erroneous belief that the walking person or WALK indication is displayed for the entire time required to cross the street. Instead, sufficient time must be provided for pedestrians that have lawfully entered the street to complete their crossing at a normal walking speed before conflicting traffic is released. Essentially the WALK indication informs pedestrians that they may begin to cross, and the flashing DON'T WALK provides sufficient time to complete their crossing.

B. Not recognizing that a pedestrian must push the button (if one exists) to notify the signal he/she intends to cross and needs time to do so. If the button is not pushed, the WALK signal will not come on (it remains steady DON'T WALK) and the vehicular green signal will only remain displayed as long as vehicles trigger the vehicular detection. Since vehicles move faster than pedestrians, the green vehicular signal will not remain green a sufficient time to let pedestrians cross the street. When pedestrians cross under these conditions, they are not only disregarding their signal (A.R.S. 28-646), but are jeopardizing their safety.

C. The misconception that pedestrian signals automatically increase safety and should be installed at all signalized intersections. Every signalized intersection has to be evaluated independently. If the combination of signal timing, intersection layout, pedestrian volumes, and vehicular volumes are such that pedestrian signals and push buttons are not needed, then they should not be installed.

Parent, Pedestrian, and School Responsibilities

Parents and school officials need to teach children how to properly use pedestrian signals. Pedestrian signals are assistance devices that assign right-of-way to pedestrians, but depend fully on compliance by motorists. They provide no guarantee of safety and pedestrians must still exercise sound judgment when crossing a roadway. Pushing the pedestrian push button when the vehicular signal is already green will not cause the WALK signal to illuminate or the green time to be extended during that particular green interval. Instead, pushing the button will only call the WALK signal in the next cycle. The following suggestions are offered in the interest of safety when crossing any signalized intersection:

A. Always push the pedestrian push button, if one is present. This will provide adequate crossing time. Push the button and start crossing only on the WALK signal. Before crossing, always watch for turning vehicles and motorists who may run the red light. Do not panic when the indication turns to flashing DON'T WALK: there is still adequate time to cross or return to the corner before opposing traffic is released.

B. If no pedestrian signal is present, begin crossing as soon as the vehicular signal turns green to ensure that the maximum crossing time will be available. While crossing, remain attentive, always watching for turning vehicles and red light violators. If the green signal has been on for any length of time prior to your arrival, be very cautious about entering the roadway. The vehicular signal may quickly turn yellow, then red, and pedestrians could still be in the roadway when it changes. Instead, wait for a "fresh" green vehicular signal.

C. When crossing, regardless of the presence or absence of pedestrian controls, minimize the time spent in the roadway. Walk quickly, but do not run or play while crossing.

D. Always be attentive and make eye contact with drivers turning across the crossing path to ensure they intend to yield for pedestrians. By law, motorists are obligated to yield to pedestrians lawfully within the crosswalk. However, in any physical contest of right-of-way between pedestrians and vehicles, the pedestrian always loses.

Section 9
Pedestrian Overpasses and Underpasses

Periodically, requests are received from concerned communities for pedestrian overpasses or underpasses across major streets or highways near schools. While creating non-conflicting paths (over or under) seems to offer the ultimate safety, such structures are extremely costly and typically are not an appropriate option. More practical and economical solutions are often available to remedy school-age pedestrian conflicts with vehicular traffic.

A pedestrian overpass is frequently perceived as a perfect solution, with little thought given to whether or not the great expenditure of public funds is economically justifiable. Quite often, community requests for overpasses are emotional responses to symptoms, rather than attempts to solve underlying problems. For example, in areas where concerned parents are requesting an overpass, a traffic investigation may reveal that:

A. A suggested "Route to School" walking plan does not exist.

B. Pedestrian safety programs in the schools are either ineffective or do not exist.

C. Some students choose an inappropriate walking route that does not take advantage of existing traffic controls.

D. Some parents seem to abdicate their responsibility by placing the entire burden for pedestrian safety on the local government or school officials.

E. One or more adult crossing guards or other traffic control measures may be needed.

F. School attendance or busing boundaries may not be set appropriately to prevent students from crossing a busy arterial street or intersection.

Aside from the enormous cost associated with overpasses or underpasses, several challenges make them difficult to function in an urban setting.

A. Limited right-of-way often does not allow sufficient space for the large required landings and stairs on both ends of the street.

B. Excessive walking distances up and down ramps makes it necessary to post adult guards to require pedestrian usage and discourage short-cut crossings on the street surface. Only in controlled access environments where walls and fences exist to channel and force usage will pedestrians typically accept the long walks.

C. Pedestrians elevated to cross roadways may be able to look into back yards over walls, creating privacy concerns. Additionally, some residents and motorists consider overpasses to be visually unappealing or intrusive.

APPENDIX A

SCHOOL CROSSING SIGNS AND MARKINGS

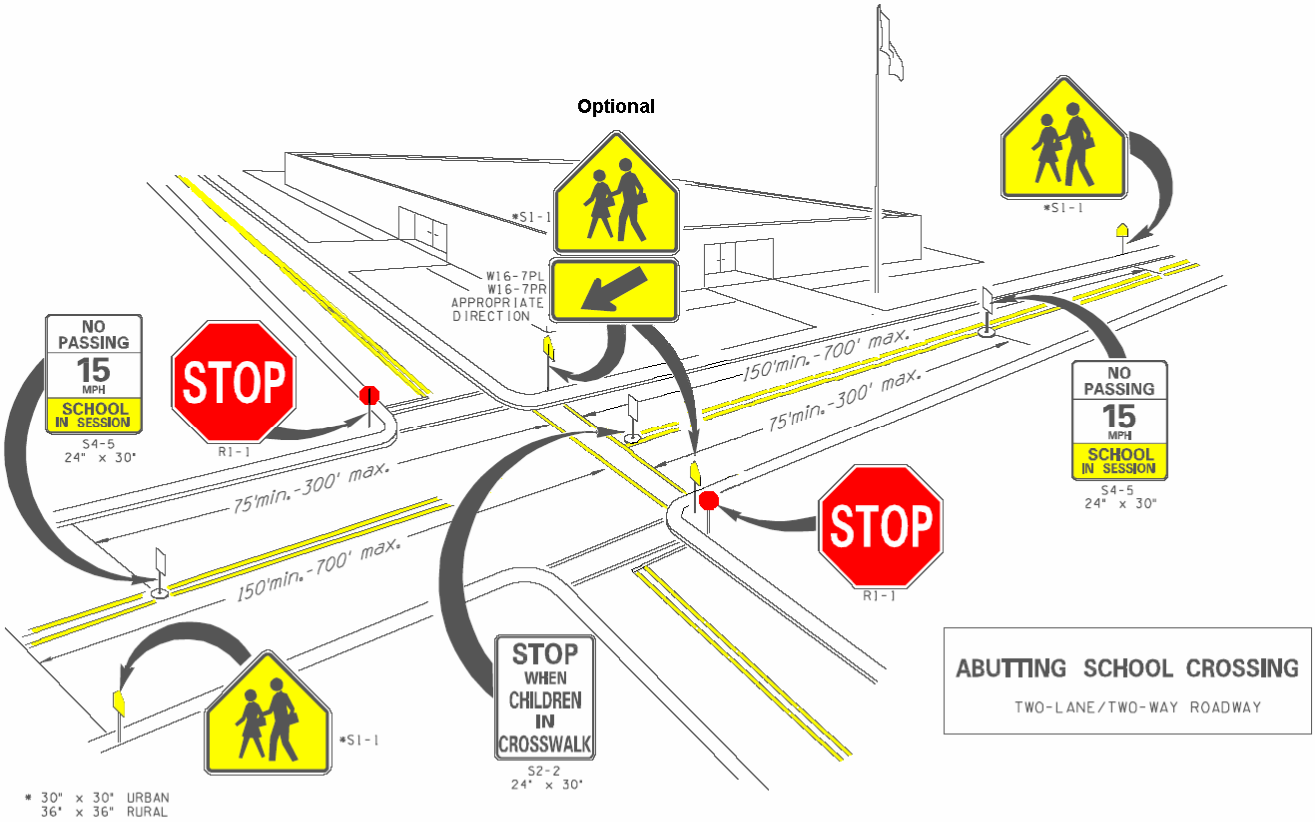


Figure A–1

NOTES:

- NO PARKING BETWEEN S4-5 SIGNS DURING SCHOOL HOURS.
- NO SCHOOL CROSSINGS PERMITTED AT CROSSWALKS CONTROLLED BY STOP SIGNS.
- PORTABLE SCHOOL CROSSING SIGNS (S2-2 AND S4-5) MAY BE REDUCED IN WIDTH TO 20" WHEN USED ON URBAN STREETS.
- LANE LINES IN ADVANCE OF MARKED CROSSWALKS OF ANY TYPE MAY BE MADE SOLID AND SLIGHTLY WIDER THAN TYPICAL TO DISCOURAGE PASSING AND TO PROVIDE AN ADDITIONAL ALERT THAT A CROSSWALK MAY EXIST AHEAD. ON TWO LANE URBAN STREETS, A SKIP YELLOW CENTERLINE MAY BE EITHER ADDED OR MADE SOLID AS WELL FOR THE SAME REASONS.

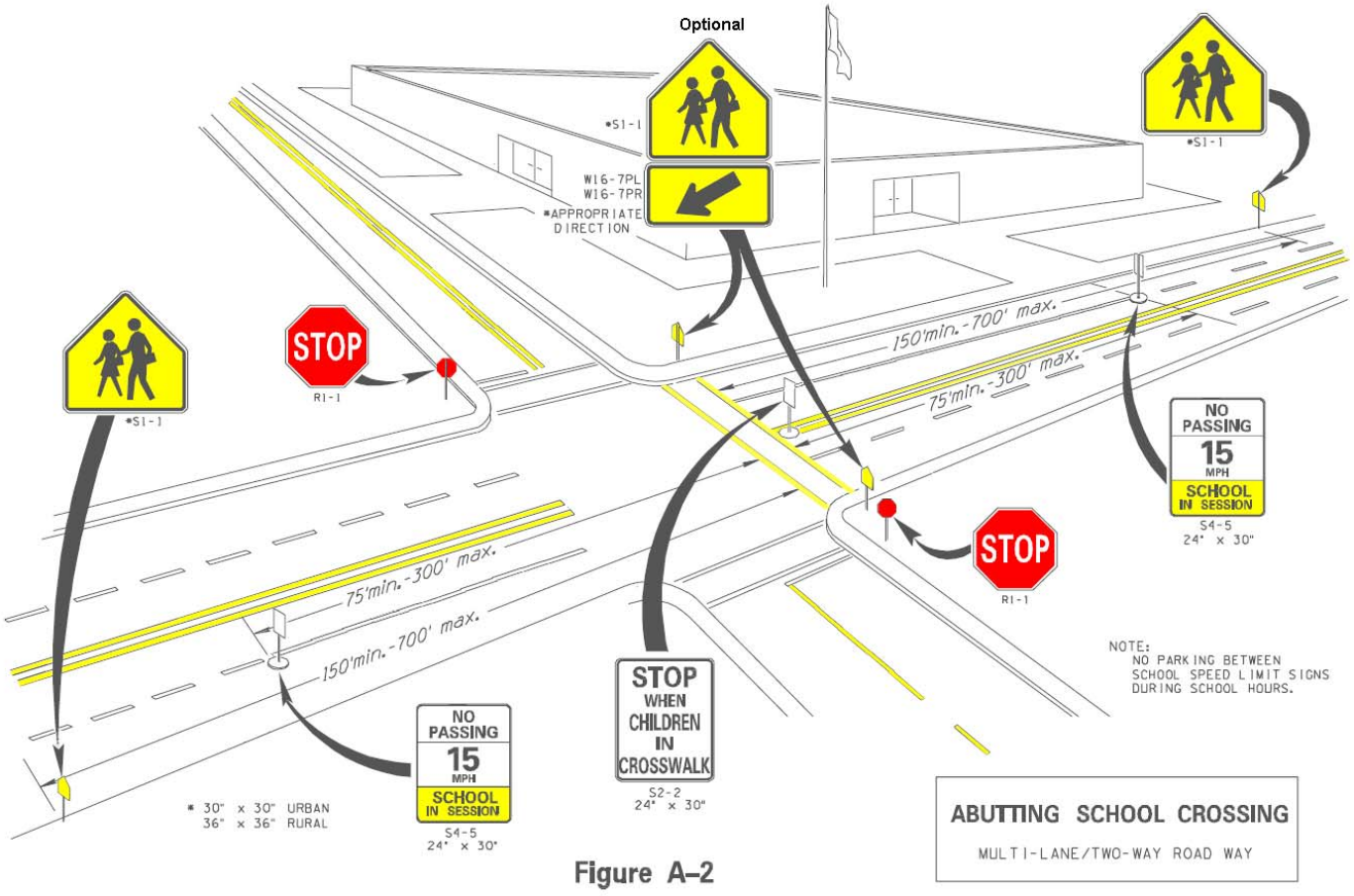


Figure A–2

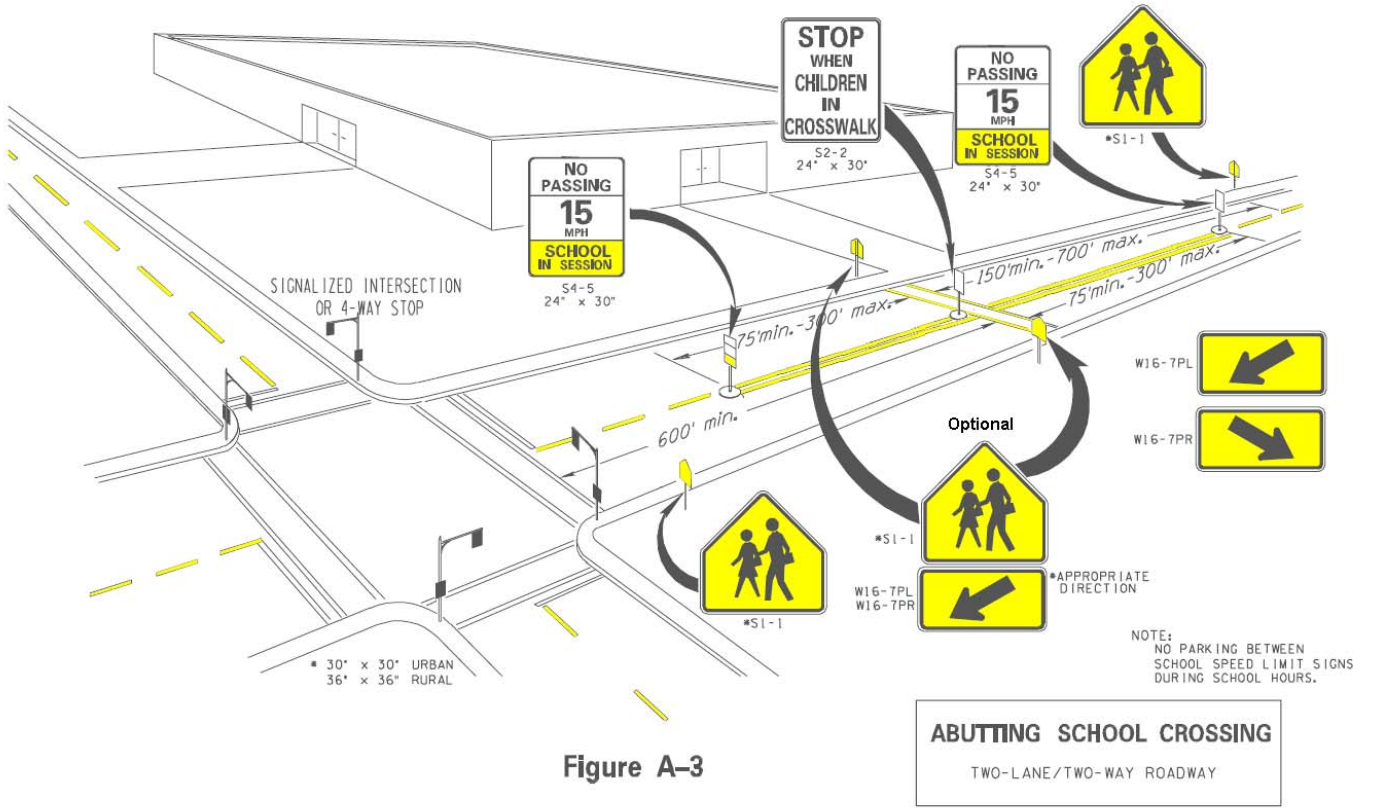


Figure A–3

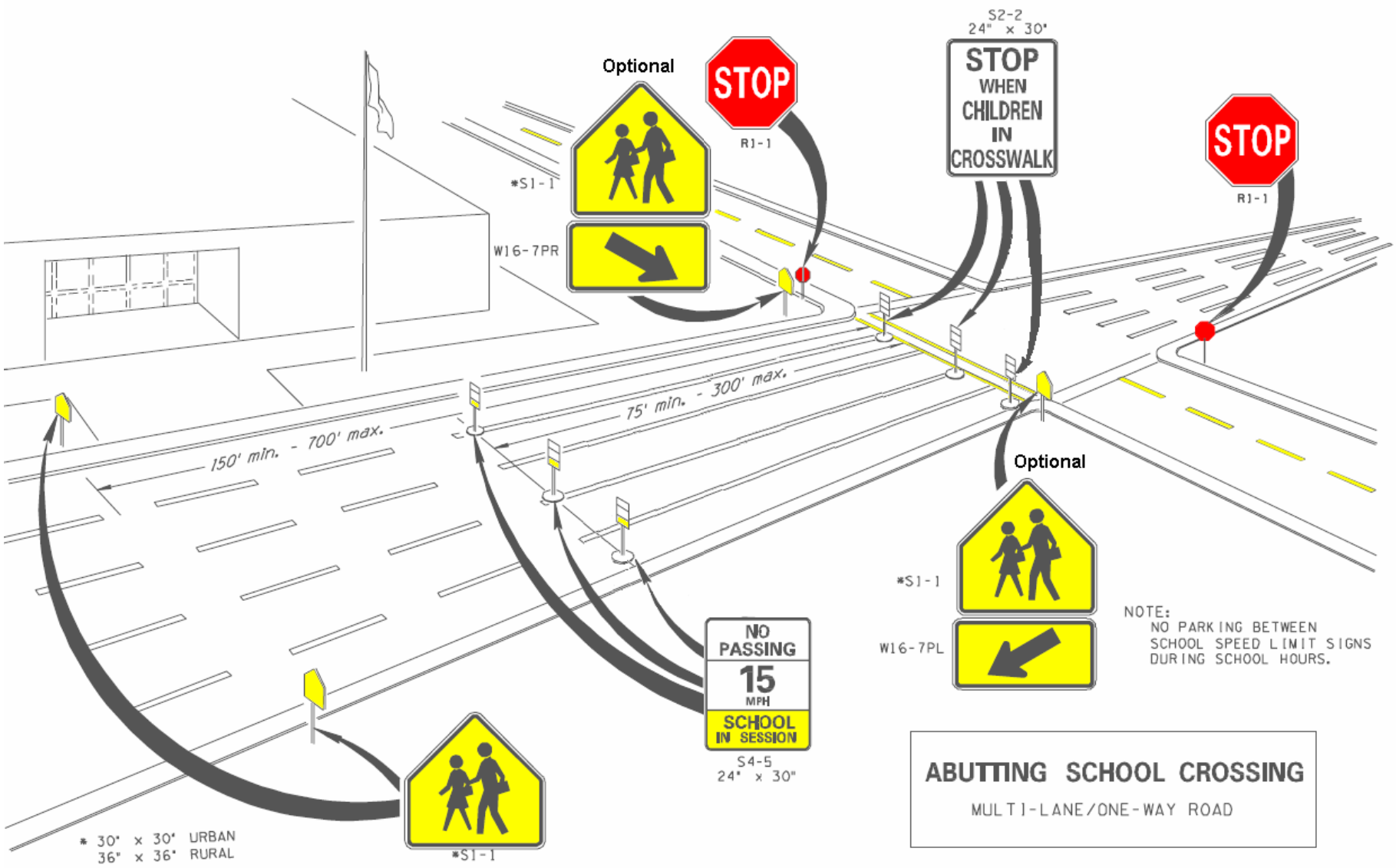
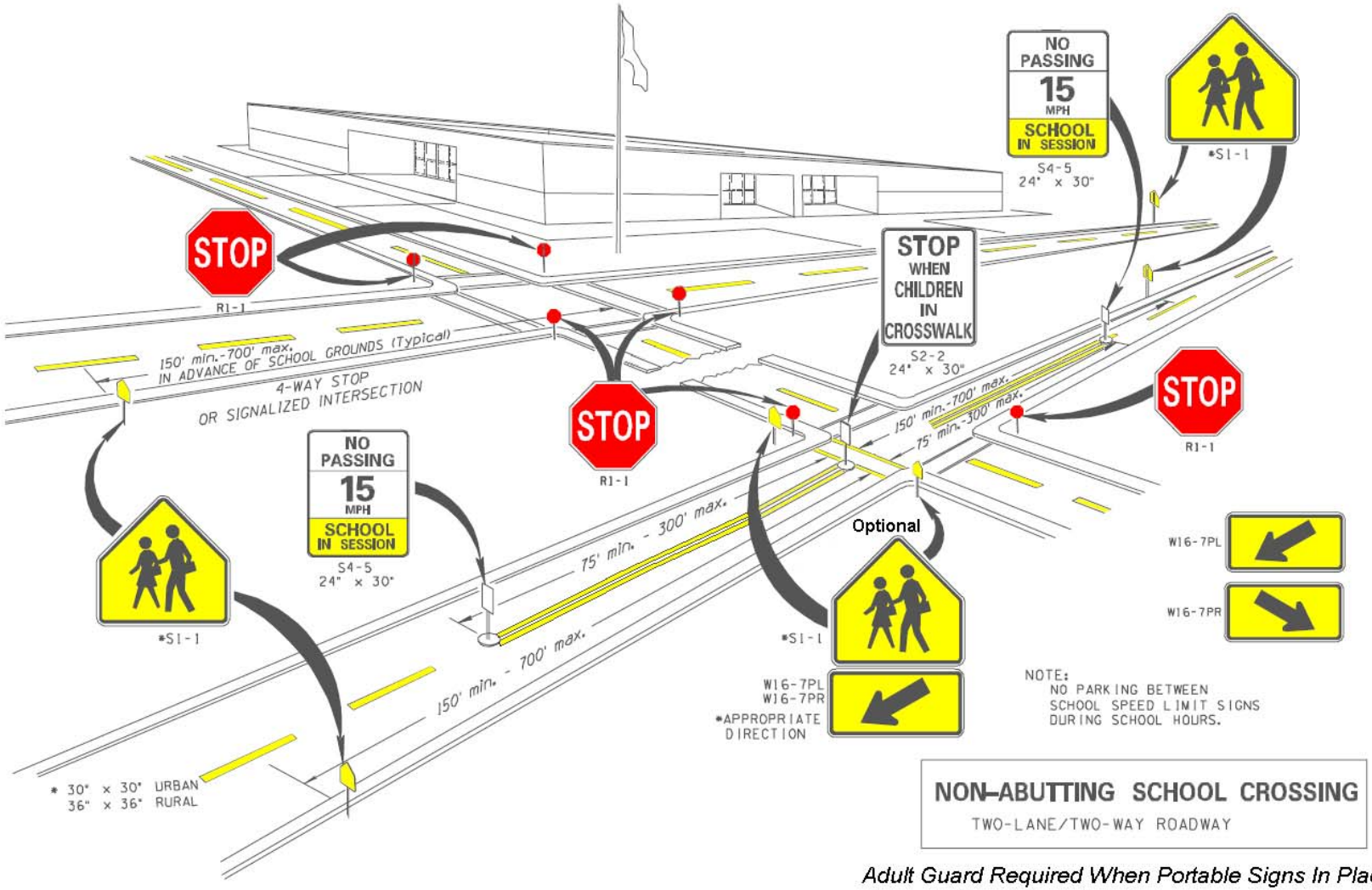

Optional
STOP
R1-1
S2-2
24" x 30"
STOP
WHEN
CHILDREN
IN
CROSSWALK
STOP
R1-1
*S1-1
W16-7PR
75' min. - 300' max.
150' min. - 700' max.
Optional
*S1-1
W16-7PL
NOTE:
NO PARKING BETWEEN
SCHOOL SPEED LIMIT SIGNS
DURING SCHOOL HOURS.
NO
PASSING
15
MPH
SCHOOL
IN SESSION
S4-5
24" x 30"
ABUTTING SCHOOL CROSSING
MULTI-LANE/ONE-WAY ROAD
* 30" x 30" URBAN
36" x 36" RURAL
*S1-1

Figure A–4



Adult Guard Required When Portable Signs In Place at non-abutting School Crossings

Figure A–5

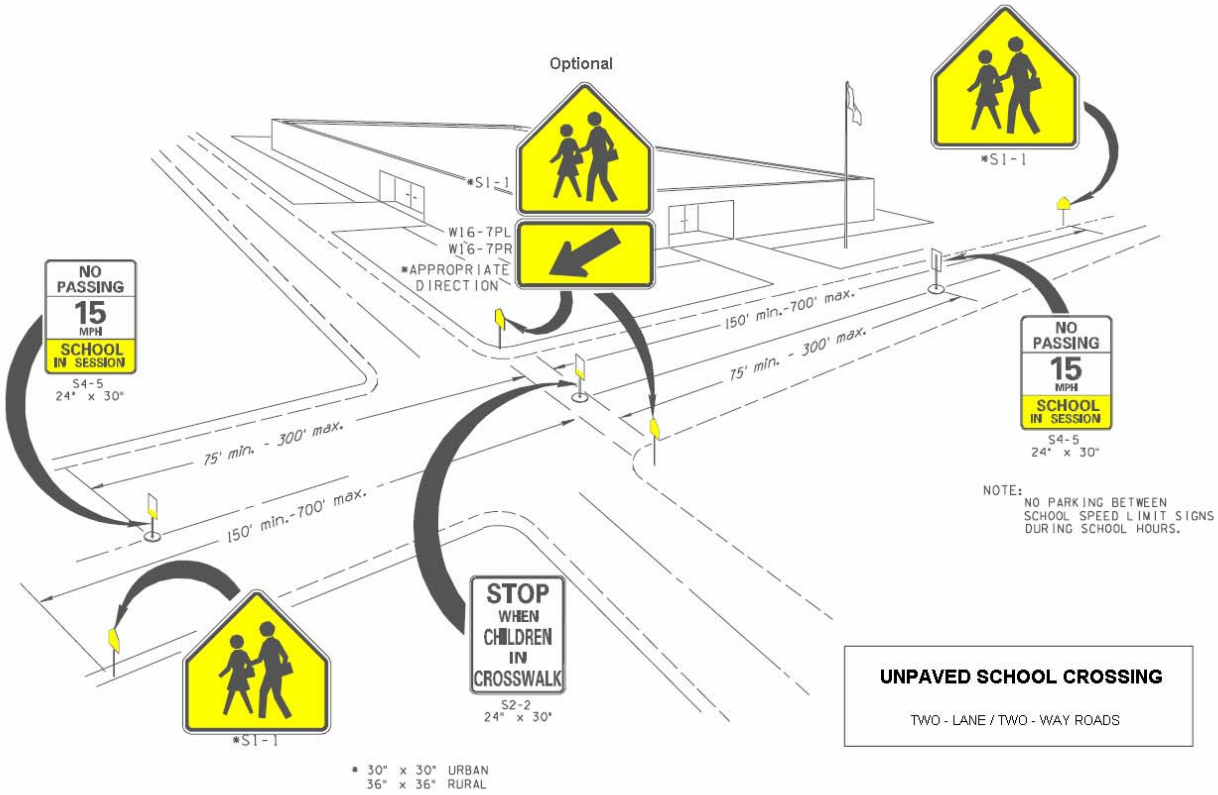


Figure A–6

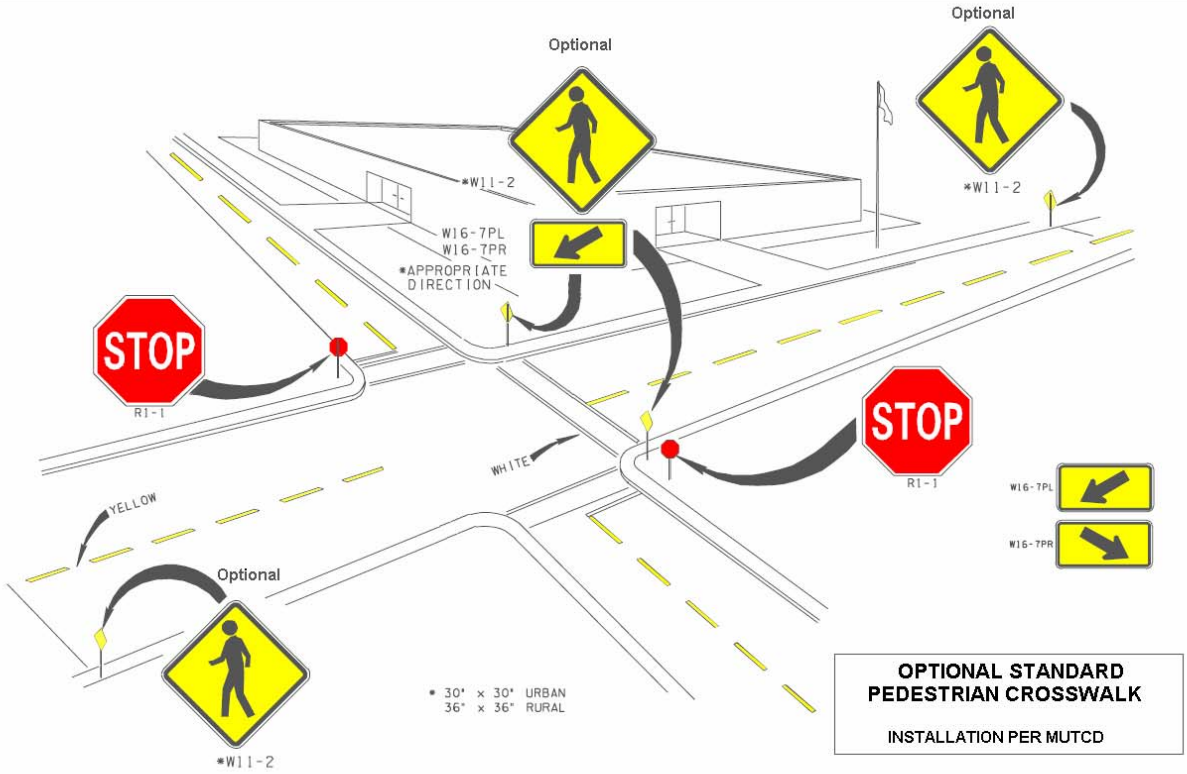
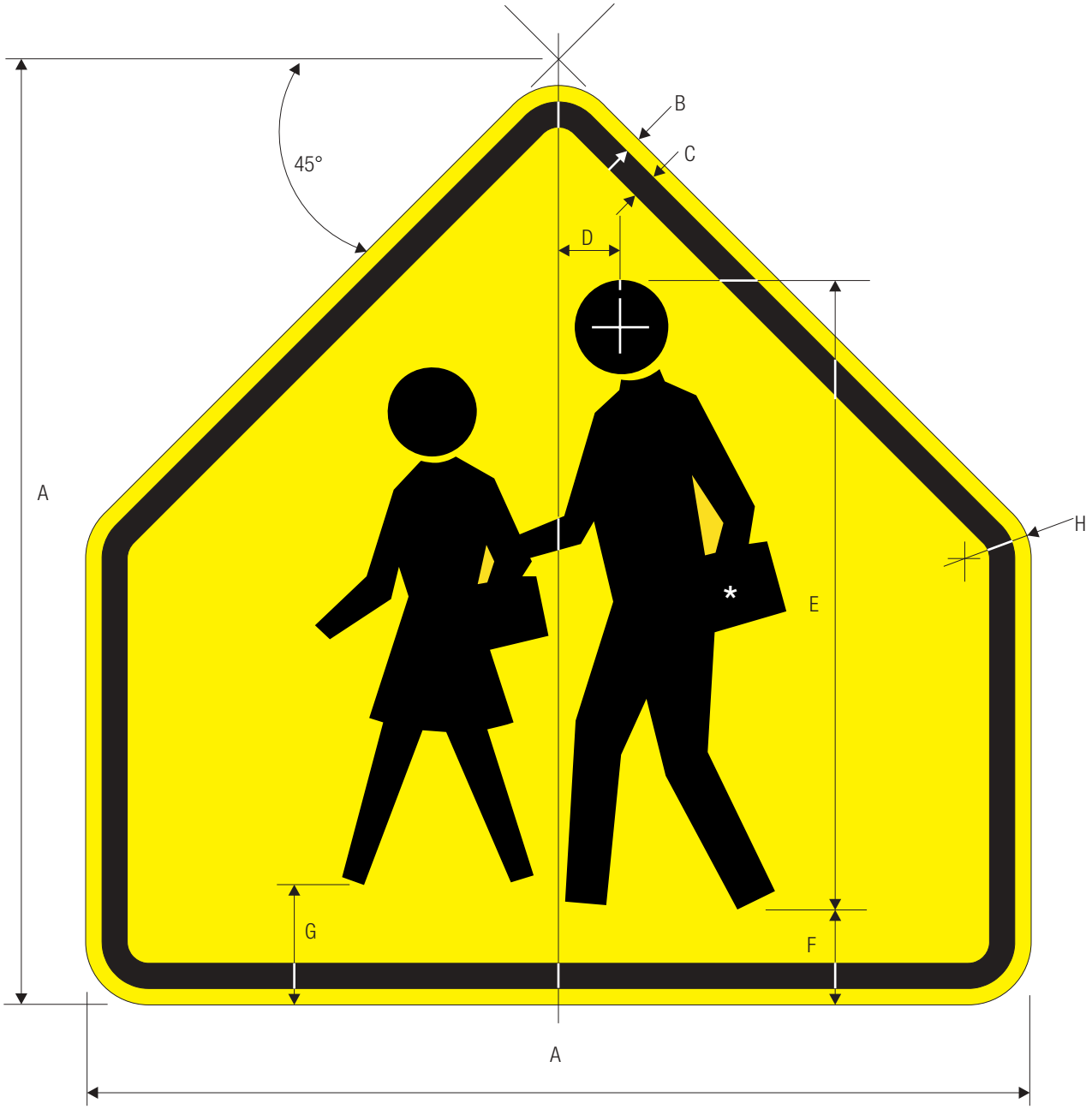


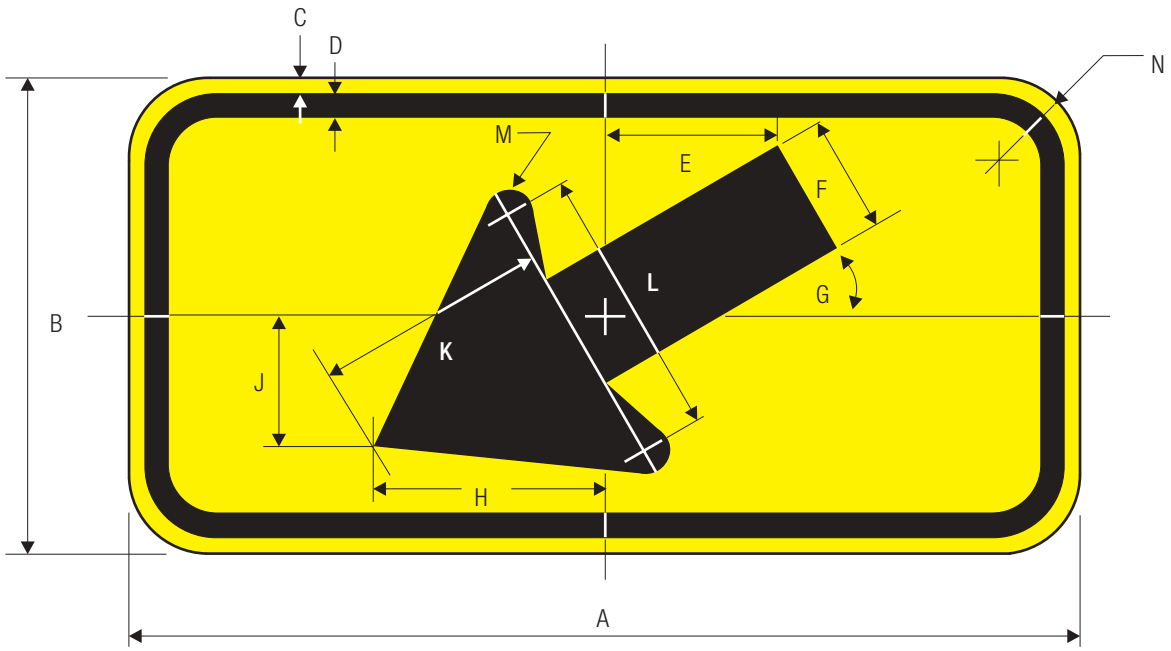
Figure A–7



S1-1

A	B	C	D	E	F	G	H
30	.5	.75	2	20	3	3.75	1.875
36	.625	.875	2.5	24	3.5	4.5	2.25
48	.75	1.25	3.25	32	5	6	3

COLORS: LEGEND — BLACK
BACKGROUND — YELLOW (RETROREFLECTIVE)

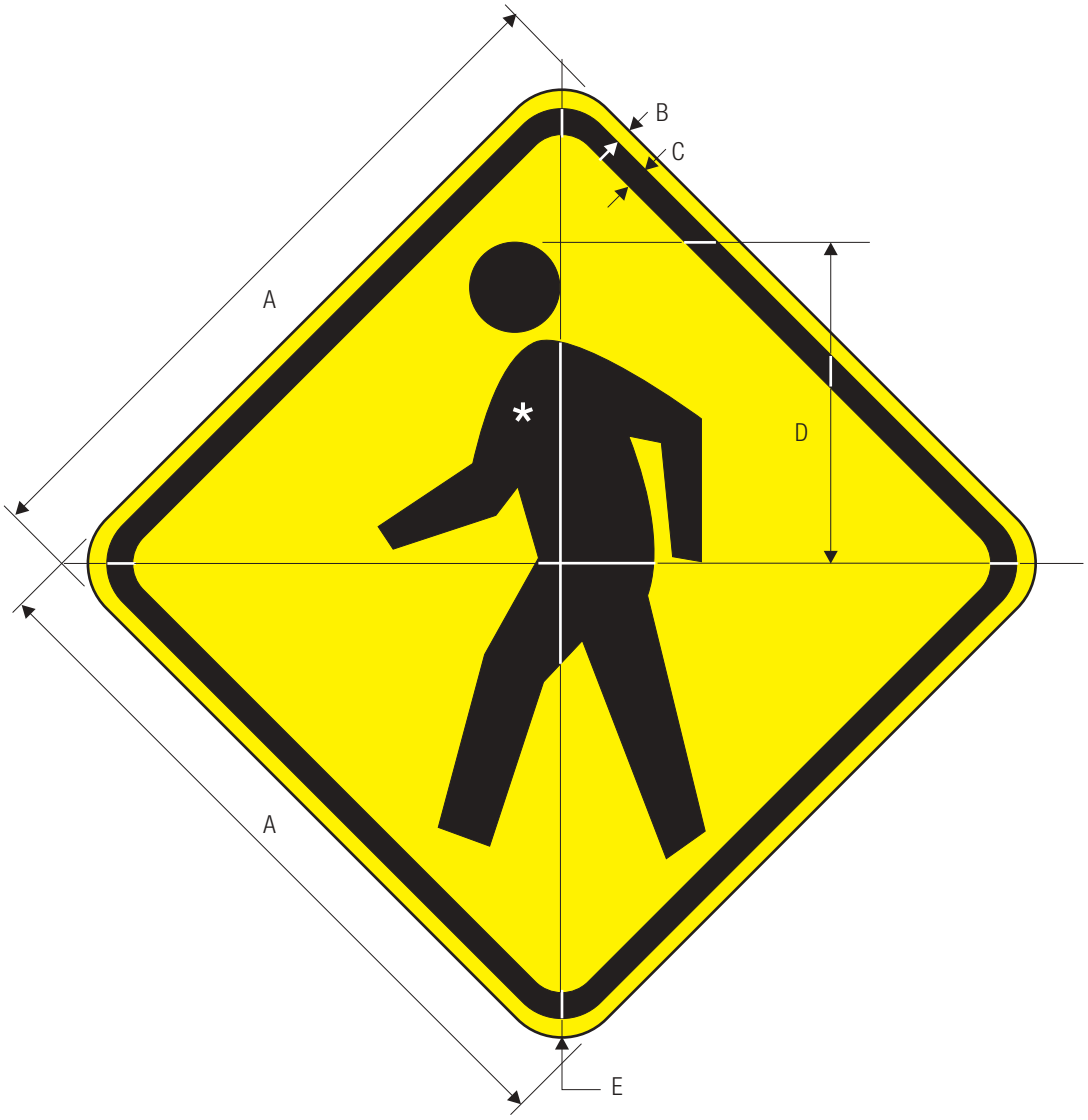


W16-7pL

A	B	C	D	E	F	G	H	J	K	L	M	N
24	12	.375	.625	4.323	3	30°	5.844	3.282	5.884	6.925	.600	1.5
30	18	.5	.75	6.524	4.5	30°	8.766	4.923	8.846	10.407	.920	1.875

W16-7pR

COLORS: LEGEND — BLACK
BACKGROUND — YELLOW (RETROREFLECTIVE)



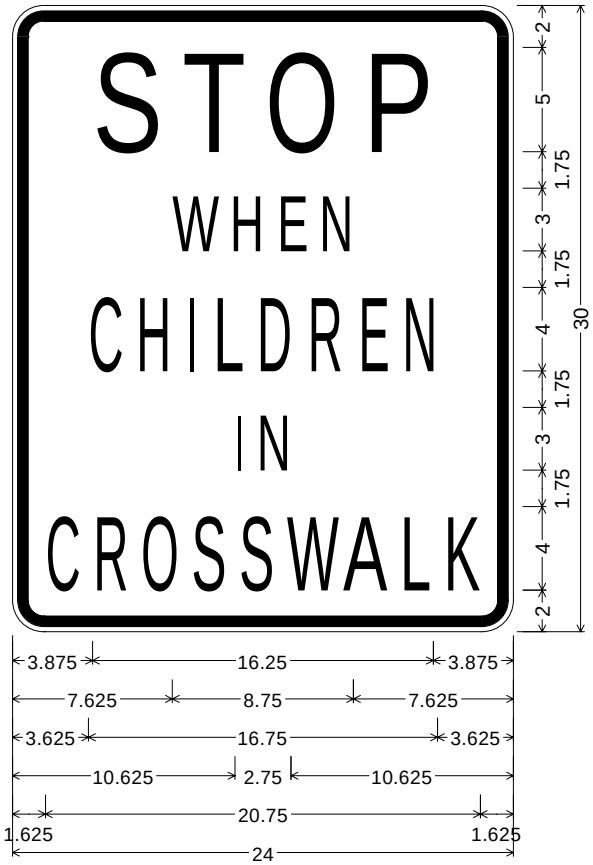
W11-2

A	B	C	D	E
24	.375	.625	11	1.5
30	.5	.75	13.5	1.875
36	.625	.875	16	2.25
48	.75	1.25	22	3

COLORS: SYMBOL — BLACK
BACKGROUND — YELLOW (RETROREFLECTIVE)

CODE: S2-2

SIZE: 24" x 30"
STANDARD



S02-02(24x30-STD)WHT;

1.500" Radius, 0.500" Border, 0.250" Indent, Black on White;

"STOP" D; "WHEN" C; "CHILDREN" B; "IN" C;

"CROSSWALK" B;

Table of letter and object lefts.

S	T	O	P
3.875	8.125	12.125	16.750

W	H	E	N
7.625	10.375	12.750	14.750

C	H	I	L	D	R	E	N
3.625	5.875	8.375	9.625	11.750	14.125	16.625	18.625

I	N
10.625	11.750

C	R	O	S	S	W	A	L	K
1.625	3.875	6.125	8.625	10.875	13.125	15.875	18.625	20.625

ALL DIMENSIONS ARE IN INCHES

COLORS:

LEGEND & BORDER - BLACK (NON-REFL)

BACKGROUND - WHITE (REFL)

ARIZONA DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING GROUP

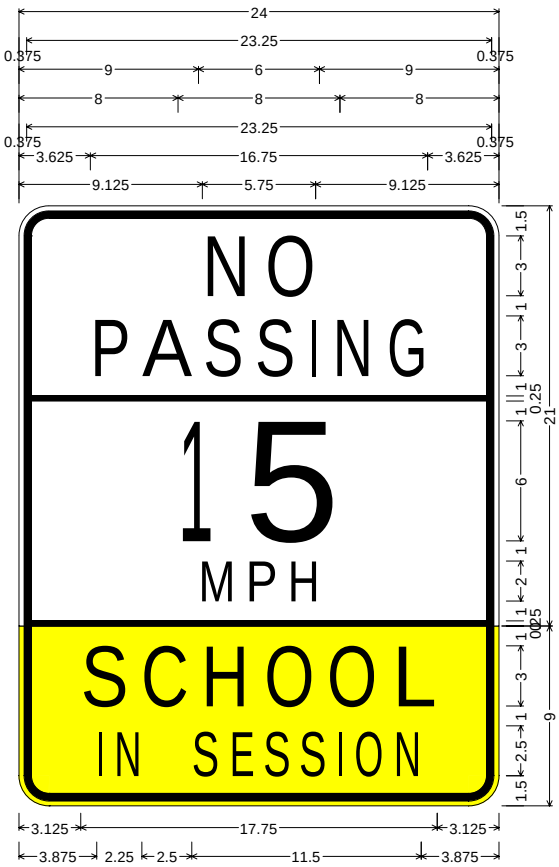
DRAWN	DATE
L. LOPEZ	4/03

APPROVED

SIGNATURE ON FILE

CODE: S4-5

SIZE: 24" x 30"
STANDARD



S04-05(24x30-STD)WHT-YEL;
1.500" Radius, 0.375" Border, 0.250" Indent, Black on White;
"NO" E Mod; "PASSING" D; "15" E Mod; "MPH" E Mod;
1.500" Radius, 0.375" Border, 0.250" Indent, Black on Yellow;
"SCHOOL" E Mod; "IN SESSION" C;
Table of letter and object lefts.

N 9.125	O 12.375

P 3.625	A 6.125	S 9.250	S 11.750	I 14.500	N 15.750	G 18.375

— 0.375

I 8.000	5 11.250

M 9.000	P 11.375	H 13.375

— 0.375

S 3.125	C 6.125	H 9.125	O 12.250	O 15.375	L 18.625

I 3.875	N 4.750	S 8.625	E 10.500	S 12.250	S 14.000	I 15.875	O 16.750	N 18.750

ALL DIMENSIONS ARE IN INCHES

COLORS:

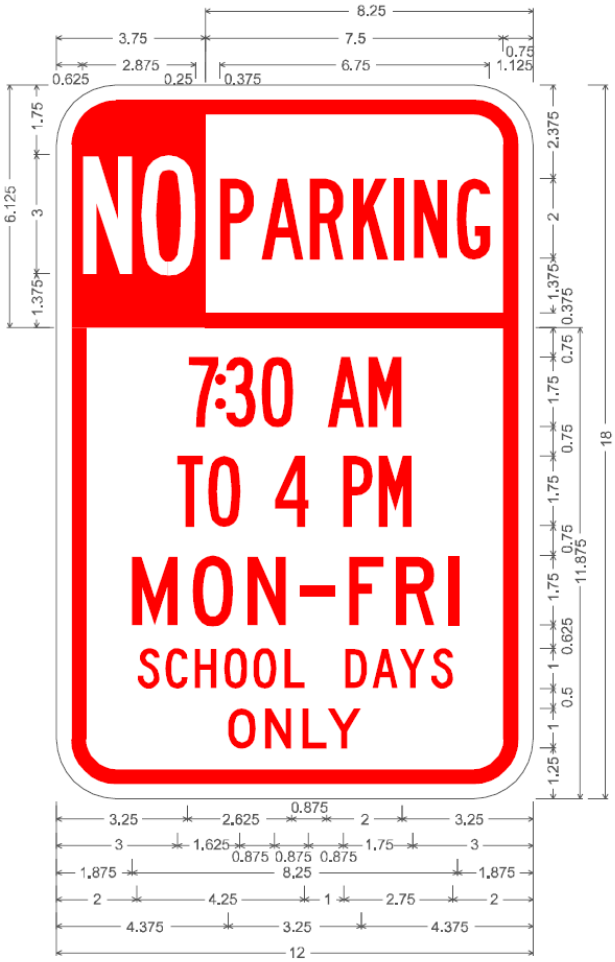
LEGEND & BORDER - BLACK (NON-REFL)
TOP BACKGROUND - WHITE (REFL)
BOTTOM BACKGROUND - YELLOW (REFL)

ARIZONA DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING GROUP

DRAWN	DATE
L. LOPEZ	4/03

APPROVED
SIGNATURE ON FILE

CODE R7-13
STANDARD



R07-13(12x18-STD)WHT-RED;
1.500" Radius, 0.375" Border, White on Red;
[NO] B 40% spacing;
1.500" Radius, 0.375" Border, 0.375" Indent, Red on White;
[PARKING] B 60% spacing;
1.500" Radius, 0.375" Border, 0.375" Indent, Red on White;
[7:30 AM] B 50% spacing; [TO 4 PM] B 50% spacing;
[MON-FRI] C; [SCHOOL DAYS] C; [ONLY] D;
Table of letter and object lefts.

N 0.625	O 2.125									
P 4.125	A 5.125	R 6.375	K 7.500	I 8.500	N 9.000	G 10.000				
— 3.750										
7 3.250	: 4.000	3 4.250	0 5.125	A 6.750	M 7.875					
T 3.000	O 3.875	4 5.500	P 7.250	M 8.125						
M 1.875	O 3.375	N 4.750	- 6.125	F 7.375	R 8.500	I 9.875				
S 2.000	C 2.750	H 3.500	O 4.250	O 5.000	L 5.750	D 7.250	A 8.000	Y 8.625	S 9.375	
O 4.375	N 5.250	L 6.125	Y 6.875							

ALL DIMENSIONS ARE IN INCHES

COLORS

LEGEND - RED & WHITE (REFL)
BORDER & BACKGROUND - WHITE (REFL)

ARIZONA DEPARTMENT OF TRANSPORTATION
TRAFFIC ENGINEERING GROUP

DRAWN	DATE
L. LOPEZ	4/03

APPROVED
SIGNATURE ON FILE

Appendix B
ADOT School Crossing Warrants

A. Average Time Between Gaps Warrant		Maximum 10 Points
B. School Age Pedestrian Volume Warrant		Maximum 10 Points
C. 85th Percentile Approach Speed Warrant		Maximum 5 Points
D. Average Demand Per Gap Warrant		Maximum 8 Points
	Maximum Total Points	33 Points

The minimum warrant for the installation of a marked School Crossing is satisfied when a location rates at least two points for school age pedestrian volumes and has an overall total of at least 16 points in an urban area or 12 points in an isolated community under 10,000 population (rural).

POINT ASSIGNMENT

A. Average Time Between Gaps

Point assignment is based on gap measurements taken during the evaluation period.

Average Minutes Between Usable Gaps in Traffic		Points
less than 1		0
1.01-1.25		2
1.26-1.67		4
1.68-2.50		6
2.51-5.00		8
over 5		10
	Maximum	10

B. School Age Pedestrian Volume Warrant

Points are assigned in accordance with the total number of school age pedestrians crossing at the study location on the way to or from school during the evaluation period. A School Crossing shall not be installed where the school age pedestrian volume is 10 or fewer.

School Age Pedestrian Volume

Urban	Rural		Points
10 or fewer	10 or fewer		0
11-30	11-20		2
31-50	21-35		4
51-70	36-50		6
71-90	51-65		8
over 90	over 65		10
		Maximum	10

C. 85th Percentile Approach Speed Warrant

Points are assigned in accordance with the vehicular approach speed from both directions of travel as determined through engineering speed studies. No School Crossings shall be installed on state highways having 85th percentile operating speeds in excess of 45 mph.

Approach Speed Mph	Points
under 20	0
20-25	1
26-30	2
31-35	3
36-40	4
41-45	5
Maximum	5

D. Average Demand Per Gap Warrant

Points are assigned in accordance with the average number of demands per gap during the evaluation period. Since school children frequently walk in groups, the arrival of each individual, or group, at the crossing location should be construed as one demand, e.g., the arrival of a group of three, one individual, a group of two, and another individual constitute four demands.

Average Demand Per Gap	Points
1 or less	0
1.01-1.67	2
1.68-2.33	4
2.34-3.00	6
over 3.00	8
Maximum	8

FORMULAS

1. School Age Pedestrian Crossing Time = $\frac{W}{3.5} + 3 + 2(N - 1)$

   W
   3.5 = crossing time in seconds: critical width in feet of the pavement to be crossed (roadway width, curb extension to curb extension, divided by the assumed juvenile pedestrian walking speed of 3.5 feet per second).

   All roadways having a raised, painted or earthen median at least 6 feet in width for curbed sections and 10 feet in width for uncurbed sections, may be considered two separate roadways. Roadways having two-way left turn lanes may be considered as two separate roadways, when in the judgment of the engineer, it is appropriate.

   3 = pedestrian perception and reaction time (the number of seconds required for a child to look both ways, make a decision, and commence to walk across the roadway).

   2 (N - 1) = pedestrian clearance time (additional seconds of time required to clear the largest observed group of children from the roadway). The children are assumed to cross the roadway in rows of five with two-second time intervals between each row. The clearance time interval is equal to 2 (N - 1) where N is the number of rows, 1 represents the first row, and 2 the time interval between rows.

2. Trial Usable Gap = W + 3

3. Average Minutes Between Gaps = $\frac{\text{Length of Evaluation Period in Minutes}}{\text{Number of Usable Gaps}}$

4. Average Number of Demands Per Gap = $\frac{\text{Total Demands During Evaluation Period}}{\text{Number of Usable Gaps}}$

SURVEY METHODS

A. Personnel Requirements: One person.

B. Duration of Survey: Forty-five minutes before school starts to 15 minutes after school starts in the morning and 30 minutes before school ends to 30 minutes after school ends in the afternoon.

C. Equipment: Stop watch and field data forms.

D. Type of Survey:

1. School age pedestrian count within the proposed School Crossing area during the evaluation period.

2. Usable gap time count during the same evaluation period.

   a. Children may cross roadways in groups and additional seconds of time are required to clear the largest observed group of children from the roadway. Since the size of the groups is unknown until the field data collection is completed, a trial usable gap should be used for field data collection.

   b. The trial usable gap is the width of the roadway, in feet, plus 3. This ensures that the usable gaps measured in the field will include as a subset all of the actual usable gaps since a group size of no more than one row is assumed.

   c. During the evaluation period, the length of each gap that is equal to or exceeds the calculated trial usable gap time is entered on the field data form in seconds.

3. Speed samples should be obtained.

USE OF THE CROSSWALK WARRANT FIELD FORMS

A. Fill out the location information on the heading of the Warrant Evaluation form, sketch the area on the bottom of the form, compute the trial usable gap, and enter the figure (in seconds) in the appropriate space on the Warrant Evaluation form.

B. For the duration of the survey, enter on the field data sheet the length (in seconds) of those gap times equal to or exceeding the calculated trial usable gap time. During this period also note the time at which the gaps occurred in the TIME column (this will be used to determine the gaps which occurred in the evaluation period at the end of the survey).

C. For the duration of the survey also record the school age pedestrian volume by five-minute intervals. Individual pedestrians may be recorded by tally marks. Groups should be indicated by size (e.g., 7 for a group of seven pedestrians).

D. After the field data is collected, the school age pedestrian crossing time (actual usable gap time) is calculated by determining the size of the largest group observed in the evaluation

period and dividing by five to determine the number of rows N. Any remainder counts as one row, i.e., for a largest group size of eight pedestrians there would be 1.6 rows which would be rounded up to two rows of pedestrians. The school age pedestrian crossing time equals W/3.5 + 3 + 2(N-1).

E. Determine the evaluation period (in minutes) by finding, from the pedestrian count data, the time period during which 80% of the pedestrians crossed.

F. The field data for the evaluation period is reviewed, and all recorded gaps that are shorter than the actual usable gap time are deleted from the data.

G. To obtain average minutes between gaps, divide the evaluation period (minutes) by the number of usable gaps in the period.

H. To obtain the average number of demands per gap, divide the number of demands during the evaluation period by the number of usable gaps.

I. Record the average minutes between gaps, the school age pedestrian volume, the approach speed, and the average number of demands per gap on the Warrant Evaluation form.

J. Evaluate the individual warrants, assign points as merited, and tabulate to determine if a marked School Crossing installation is justified.

The location and marking of School Crossings on state highways shall be approved by the Regional Traffic Engineer.

ARIZONA DEPARTMENT OF TRANSPORTATION

INTERMODAL DIVISION TSS NO _____

TRAFFIC STUDIES SECTION

SCHOOL CROSSWALK WARRANT EVALUATION

ROUTE:_____ M.P. _____ INTERSECTION:_____ COMMUNITY:_____

DATE:_____ TIME:_____WEATHER:_____

DISTRICT:_____ COUNTY: _____ INVESTIGATOR:_____

TRIAL USABLE GAP	PEDESTRIAN CROSSING TIME
W + 3 =	$\frac{W}{3.5}$ + 3 + 2(N-1) = ___ + 3 + 2( ) =
MAXIMUM NO. OF USABLE GAPS	AVERAGE MINUTES BETWEEN GAPS
$\frac{\text{TOTAL USABLE GAP TIMES DURING E.P.*}}{\text{PEDESTRIAN CROSSING TIME}}$ = _____ =	$\frac{\text{TIME INTERVAL (MINUTES) DURING E.P.*}}{\text{NO. OF USABLE GAPS}}$ = _____ =
AVERAGE NO. OF DEMANDS PER GAP	
$\frac{\text{TOTAL DEMANDS DURING E.P*}}{\text{NO. OF USABLE GAPS}}$ = _____ =	

* EVALUATION PERIOD (E.P.) = THE PERIOD WHEN 80% OF THE SCHOOL AGE CROSSING ACTIVITY OCCURS.

EVALUATION: URBAN CONDITIONS – 16 POINTS ☐

RURAL CONDITIONS – 12 POINTS ☐

WARRANTS	FIELD DATA	ASSIGNED POINTS	MAXIMUM POINTS
1. AVERAGE TIME BETWEEN GAPS (MINUTES)			10
2. SCHOOL AGE PEDESTRIAN VOLUME (NO.)			10
3. 85TH PERCENTILE APPROACH SPEED (KM/HR)			5
4. AVERAGE DEMAND PER GAP (NO.)			8
TOTAL			33

SKETCH

Appendix C
Arizona Revised Statute 28-797
School Crossings

A. The director, with respect to state highways, or the officer, board or commission of the appropriate jurisdiction, with respect to county highways or city or town streets, by and with the advice of the school district governing board or county school superintendent may mark or cause to be marked by the department or local authorities crosswalks in front of each school building or school grounds abutting the crosswalks where children are required to cross the highway or street.

B. The department or local authorities may approve additional crossings across highways not abutting on school grounds on application of school authorities and with written satisfactory assurance given the department or local authorities that guards will be maintained by the school district at the crossings to enforce the proper use of the crossing by school children.

C. The manual prescribed in section 28-641 shall provide for yellow marking of the school crossing, yellow marking of the centerline of the roadway and the erection of portable signs indicating that vehicles must stop when persons are in the crossing. The manual shall also provide the type and wording of portable signs indicating that school is in session and permanent signs that warn of the approach to school crossings.

D. When the school crossings are established, school authorities shall place within the highway the portable signs indicating that school is in session. This placement shall be not more than three hundred feet from each side of the school crossing. In addition, portable "stop when children are in crosswalk" signs shall be placed at school crossings. School authorities shall maintain these signs when school is in session and shall cause them to be removed immediately when school is not in session.

E. A vehicle approaching the crosswalk shall not proceed at a speed of more than fifteen miles per hour between the portable signs placed on the highway indicating "school in session" and "stop when children are in crosswalk."

F. Notwithstanding any other law:

1. An agency of appropriate jurisdiction may establish a school crossing on an unpaved highway or street adjacent to a school when the agency determines the need for the school crossing on the basis of a traffic study. School crossings on unpaved highways and streets shall be marked by the use of signs as prescribed in the manual prescribed in section 28-641.

2. A local authority may establish a school crossing at an intersection containing a traffic control signal if the local authority determines the need for a school crossing on the basis of a traffic study.

G. When a school authority places and maintains the required portable "school in session" signs and "stop when children are in crosswalk" signs, all vehicles shall come to a complete stop at the school crossing when the crosswalk is occupied by a person.

H. For the purposes of this section, "school in session," when used either in reference to the period of time or to signs, means during school hours or while children are going to or leaving school during opening or closing hours.

Appendix D
Sample Application and Operating Agreement for School Crossing

SCHOOL: _____ **DISTRICT:** _____

ADDRESS: _____

The school is in session (class hours only) from: _____ a.m. to _____ p.m.

In accordance with the provisions of Section 28-797 of the Arizona Revised Statutes, application is made for a school crossing at the location indicated on the following diagram:

TYPE OF APPLICATION:

☐ NEW CROSSWALK
☐ RELOCATION
☐ MODIFY HOURS

LOCATION OF CROSSING:

☐ ABUTTING
☐ NON-ABUTTING

The undersigned school authority agrees to administer all duties as prescribed in Section 28-797 of the Arizona Revised Statutes, to operate the crossing in conformance to the Arizona Department of Transportation's Traffic Safety for School Areas Guidelines, and when required, to provide an adult guard at the crossing while children are going to or leaving school during opening or closing hours.

_____
Signature of School Authority Printed Name Title Date

TO BE COMPLETED BY AUTHORIZING AGENCY

REQUEST:	CROSSING GUARD:	ADDITIONAL CROSSING GUARDS
☐ DENIED	☐ REQUIRED	☐ MORE THAN ONE GUARD REQUIRED
☐ APPROVED	☐ RECOMMENDED	☐ MORE THAN ONE GUARD RECOMMENDED
_____ Crossing Code Number	☐ NOT REQUIRED	☐ MORE THAN ONE GUARD NOT REQUIRED

Approval is granted for the school crossing during the days the school is in session, with the stipulation that portable signs may be placed within the roadway during the following times:

☐ Not prior to _____ a.m., nor later than _____ a.m.
☐ Not prior to _____ a.m., nor later than _____ a.m.
☐ Not prior to _____ a.m., nor later than _____ p.m.
☐ Not prior to _____ p.m., nor later than _____ p.m.
☐ Not prior to _____ p.m., nor later than _____ p.m.

_____
Signature of Authorizing Agency Date

_____
Title

_____
Authorizing Agency

Appendix E
Sample Suggested Route to School Walking Plan