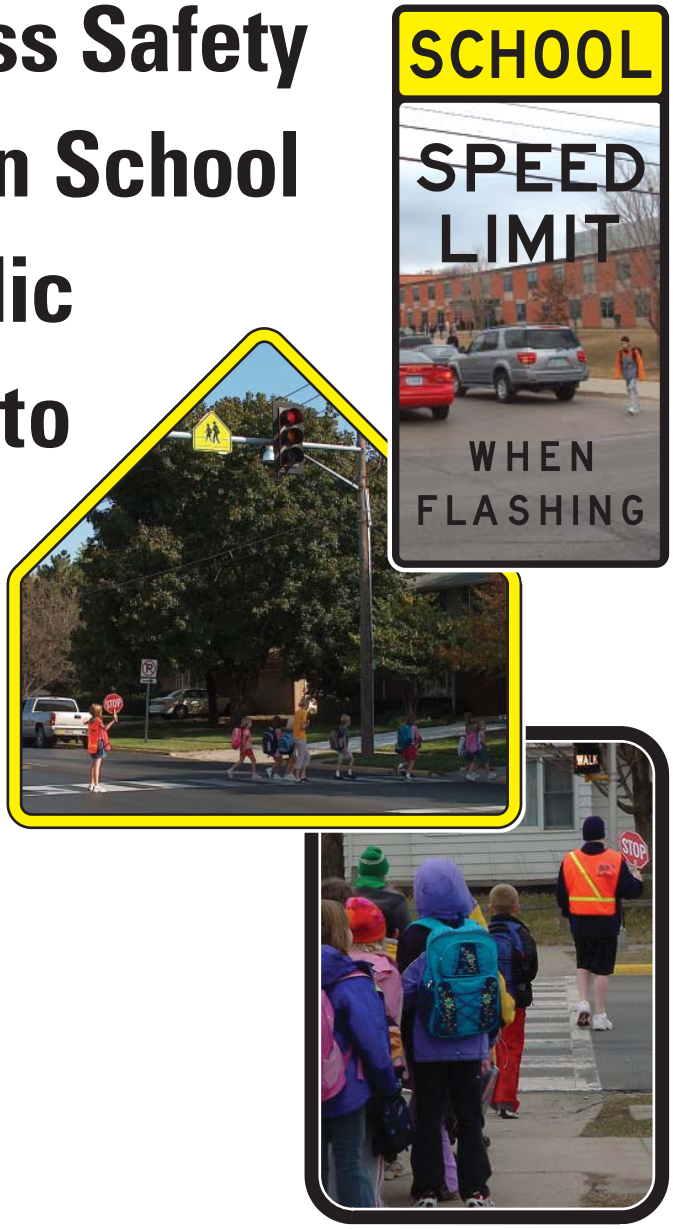
Toolbox to Address Safety and Operations on School Grounds and Public Streets Adjacent to Elementary and Middle Schools in Iowa



Final Report, August 2006

Iowa Department of Transportation

Iowa Department of Transportation
Office of Traffic and Safety

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Final Report, August 2006

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Foreword

This study identified transportation safety issues at existing Iowa school sites through on-site observations, traffic data collection, and through interviews with schools, law enforcement, and traffic engineers. Frequently observed problems, such as crossing at unmarked crosswalks, unloading and loading students on the street side, inattentive student safety patrols, and illegal parking, were documented and solutions were recommended for implementation. The results of the study also conclude that regular communications between school officials, traffic engineers, law enforcement, parents, and school transportation personnel are all critical to promoting safe operations within school zones.

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Chapter 1

Introduction

Transportation modes to and from public schools have changed significantly in the last few decades. In the past, most trips to neighborhood schools in urban areas were by school bus, walking, or biking. In 1969, 49% of elementary school children walked or biked to school, 36% rode the school bus, and only 12% traveled by passenger vehicle (FHWA 1972). By 2001, the number of students that walked or rode bikes had dropped to around 16% according to an estimate by the U.S. Environmental Protection Agency (USEPA 2003), while a study by the Center for Disease Control estimates around 14% walk or bike (CDC 2002). Private passenger vehicles have become the dominant mode for students, with the percentage of private vehicle trips averaging from 51% (CDC 2005) to 59% (TRB 2002).

A large number of students are now picked up and dropped off by private vehicles. Existing school driveways and parking lots were not designed to handle large numbers of vehicles picking up and dropping off students either in terms of circulation or parking. Additionally, increases in the number of trips to and from schools affect traffic on adjacent streets. In fact, 20% to 25% of morning congestion is due to parents driving their children to school, according to National Highway Transportation Safety Administration (2002). Parisi and Associates (2005) estimate that 26% of congestion is due to school traffic. As a result, traffic operations often break down near school zones during peak pick-up and drop-off times, resulting in queuing and other operational problems.

Figure 1.1. Transportation modes interacting within a school zone (walking, schools bus, and private vehicle)

The changing transportation modes at existing elementary schools have safety impacts within school zones. The shift from walking and busing students to parents driving their children to school has created traffic and safety concerns at many schools across Iowa. Children who do walk or ride their bikes to school are forced to negotiate streets and school parking lots that are increasingly busy. In some cases, there is a lack of sufficient traffic control on streets adjacent to schools. School parking lots also lack adequate traffic control, either in the form of pavement marking and signing, adult monitors, or other positive guidance and enforcement, leaving drivers and young pedestrians to use their own judgment in entering, leaving, and crossing parking lot facilities. Unsafe conditions result when children are dropped off randomly or walk to school and are forced to negotiate the same space as vehicles that are involved in a number of different types of movements in the same location.

In other cases, children ignore traffic control and cross streets and parking lots wherever it is convenient. Children walking or biking to school often cross midblock and, in many cases, do so without checking for an appropriate gap. They also cross at intersections without waiting for the right of way.

Even when parents drop their children off, parents themselves often engage in unsafe behavior around school zones and in some cases enable unsafe activities to occur. Parents double-park, stop in crosswalks, speed, park in NO PARKING areas or fire lanes, and ignore turn restrictions. In many cases, parents drop off children midblock on the side of the street opposite to the school and drive away leaving the child to cross several lanes of traffic. Parents parking on the street also beckon children to cross outside of designated crossing areas and allow their children to enter and exit the vehicle directly in the path of oncoming traffic. Parents were also observed dropping children off in the middle of busy streets, so they would not have to pull over or enter the parking lot.

The U.S. Department of Transportation (USDOT) and National Highway Transportation Safety Administration (NHTSA) have published and sponsored research related to school zone safety in hopes to improve awareness at all levels (i.e., children, parents, school officials, and the community). Some sobering statistics from these studies show that 46% of traffic crashes involving young pedestrians occur when children run out into the street; 50% of children that are hit by vehicles near schools are hit by vehicles driven by parents of other children (NHTSA 2002).

To address these challenges within Iowa, it is critical to specifically identify the transportation safety related issues at school sites and provide clear guidance for school administrators, law enforcement personnel, parents, children, and others living in the adjacent neighborhoods to deal with these issues and improve safety in school zones. According to the Des Moines, IA, Traffic Safety Committee (1997), unless school children and drivers are educated about school zone safety and understand the traffic control around schools, they can not be expected to carry out safe behavior in school zones.

1.1 Need for Research

On April 3, 2003, a Traffic Safety Research Forum was held at the Iowa State University Center for Transportation Research and Education (CTRE). Many of the leading transportation professionals in the state were present and participated in identifying research interest areas. From that effort, one interest area seemed to rise above the others developing a toolbox to address safety and operations around elementary schools in Iowa for traffic control on and around school sites to assist school districts with mitigating traffic problems such as vehicle circulation, parking issues, student drop-off and pick-up issues, and general safety.

School zones pose significant challenges related to student safety and traffic operations. The shift in the transportation mode dynamics at schools has elevated traffic safety concerns in school zones and increased the number of vehicles competing for space with buses, bicycles, and pedestrians. Additionally, poorly supervised loading and unloading zones and lack of structured arrival and dismissal procedures are common trends observed at elementary schools across Iowa that contribute to unsafe school zones.

1.2 Project Scope and Objectives

This study identifies transportation safety and operational issues at existing elementary and middle school sites in Iowa. The study team made site visits, collected data, and interviewed schools, law enforcement, and traffic engineers. The study identified common problems and solutions to address these issues. This toolbox was written and designed for technical and non-technical users, including traffic engineers, school officials, law enforcement, parents, teaching organizations, and others who are involved in managing traffic operations and safety around school zones. This research primarily focuses on the traffic safety and operation strategies for existing urban elementary and middle schools, but many of the solutions are appropriate for consideration in planning for high schools.

1.3 Report Organization

The Toolbox to Address Safety and Operations on School Grounds and Public Streets Adjacent to Elementary and Middle Schools in Iowa was developed from the literature and observations, interviews, and data collected from elementary and middle schools in Iowa. Each chapter of the toolbox is presented in a user-friendly format that includes many photos to illustrate both problems and solutions to transportation safety and operation issues that exist at the schools in Iowa. The visuals within the handbook include photos and sample data forms that are useful for schools and traffic safety steering committees and traffic professionals. Important industry-recognized documents are also referenced throughout the chapters to ensure that the schools are aware of the available guidelines and standards.

This document is organized into 6 main chapters:

- Chapter 2 provides background and data collection techniques
- Chapter 3 provides a summary of the case study schools
- Chapter 4 discusses the common transportation safety issues and solutions on school grounds
- Chapter 5 discusses the common transportation safety issues and solutions on the streets adjacent to the schools
- Chapter 6 provides guidelines and additional resources for the schools to address transportation safety
- A glossary, index, and references are also provided.

1.4 Disclaimers

This work was funded by the Iowa Department of Transportation (Iowa DOT). The work contained in this toolbox reflects the views and opinions of the research team and not necessarily those of the Iowa DOT.

The toolbox provides solutions aimed toward school officials, traffic engineers, and law enforcement. The authors do not intend to imply that these professionals are solely responsible for child safety to and from school. Parents or other custodial adults bear a large portion of the responsibility to ensure that their children make a safe journey to school. Additionally, parents are often the cause of many operational and safety problems around schools. Parents and all drivers bear responsibility for safe driving behavior in and around school zones.

This study frequently refers to parents. The authors acknowledge that in many cases the primary caregiver or person responsible for getting a child to and from school maybe a grandparent, foster parent, custodian, or other authorized person. We use this term for simplicity in writing the toolbox. It is not our intent to marginalize the role of other dedicated caregivers.

Additionally, the information in this toolbox provides a range of solutions but should not take the place of good engineering judgment. It also should not be interpreted to supersede any local codes, state laws, policies, or practices.

Chapter 2

Description of Data Collection

Common traffic operation and safety problems that occur both on school sites and on streets around school zones were identified through a series of site case studies of various elementary and middle/junior high schools in Iowa. High schools were not specifically addressed, but many of the solutions apply to high schools as well.

2.1 Site Visits

Site visits typically included detailing the schools layout and observing on-site traffic patterns and parking and access patterns, identifying on-site safety and operational problems, recording off-site traffic control on adjacent streets, identifying safety and operational problems on adjacent streets, and collecting driveway count data. On-site refers to activities that occur on the school campus, including sidewalks, parking lots, and other property owned by the school. On-street or off-site refers to activity that occurs on the public streets and sidewalks adjacent to and around the school site. When studies were conducted on site, the school principal was contacted to gather information such as arrival and dismissal times, procedures, and common problems from the schools perspective. Approval from the school district administration was sought before on-site visits, when needed. The same information was not always obtained for each school. In some cases, off-site visits were made to observe on-street traffic problems. On-site visits were made to a number of schools and in some cases, both on-street and on-site visits were made.

Twenty schools in 11 Iowa school districts were visited during the study. The study focused on elementary (16) and middle schools (4) in Iowa. The elementary school student enrollment ranged from 260 to 575, and the middle/junior high school enrollment ranged from 400 to 983 students. Each school was assigned a case study number that identifies the school throughout the report. The names of individual schools are not provided for confidentiality reasons. Table 2.1 provides a list of the schools, their case study number, and approximate student enrollments for the 2004–2005 school year.

The schools included in this study represented both urban neighborhood schools and suburban schools. The schools that were constructed before about 1980 are described as typical neighborhood schools. The suburban schools were typically located in developing areas where new construction was occurring and had on average 150 more students per school than urban schools.

The field visits at the schools sites were conducted during September and October 2004 and during March, April, and May 2005. Observations were made both during the morning drop-off and afternoon pick-up periods, when possible. Approximately one-third of the schools were observed more than one day. Early dismissal days and days with special activities scheduled at the school were avoided to eliminate changes in typical traffic and pedestrian behavior. Data was, therefore, collected under “normal” traffic conditions.

The study team notified the schools in advance of the site visits; however, the team attempted not to skew the data by "being obvious" while documenting the activity around the schools. Observations of vehicle and pedestrian traffic were recorded, and photos were taken to document the activities. Roadway and driveway characteristics were also recorded.

Table 2.1. Characteristics of case study schools

Case Study	County	Type	Location	Number of Students	Number of Employees
1	Story	Elementary	Urban	430	35
2	Story	Elementary	Urban	395	31
3	Polk	Elementary	Suburban	565	38
4	Polk	Elementary	Urban	513	23
5	Johnson	Elementary	Urban	430	26
6	Johnson	Elementary	Suburban	496	26
7	Linn	Elementary	Suburban	460	25
8	Linn	Elementary	Urban	363	19
9	Union	Elementary/Middle	Suburban	800	100
10	Linn	Elementary	Urban	475	31
11	Linn	Elementary	Suburban	432	33
12	Linn	Elementary	Urban	400	29
13	Linn	Elementary	Suburban	463	32
14	Marshall	Elementary	Urban	337	24
15	Marshall	Elementary	Urban	370	25
16	Polk	Elementary	Suburban	260	16
17	Woodbury	Elementary	Urban	270	13
18	Woodbury	Middle	Suburban	983	66
19	Polk	Junior High	Urban	750	49
20	Polk	Middle	Urban	1000	60

2.2 Driveway Counts

Traditionally, school trips occur during a very compressed time during the morning arrival and afternoon dismissal period. Schools typically have two periods during the day—arrival and dismissal—where traffic is congested and conflicts occur. The morning drop-off and afternoon pick-up traffic characteristics and operations are very different. The morning drop off usually occurs during a 30- to 45-minute period with a peak 15-minute period prior to the bell. The morning arrival period coincides with the typical morning traffic peak when people are going to work and the street system is already congested. It is suspected that this is why the number of passenger vehicles dropping off students in the morning is on average 1.7 times higher than the number of vehicles in the afternoon peak-hour period, as was found in this study.

Most schools provide bussing for at least some students, and a number of students walk or bike to school. Over 50%, however, typically arrive in private vehicles. Walking,

biking, and private vehicle trips tend to occur very close to the school start time. As a result, there are a large number of vehicles, pedestrians, and bikes arriving over a short period of time. The advantage for the morning arrival period is that when private vehicles arrive, they are usually able to immediately drop children off and then leave. As a result, they spend less time on the school site or on the surrounding street system. Therefore, the drop-off/pick-up location is used more efficiently in the morning than in the afternoon, provided there is a long enough drop-off area. The majority of evaluated schools had start times around 8:00 a.m.

Conversely, the traffic associated with the pick-up period in the afternoon begins about 30 to 60 minutes prior to dismissal, with the peak timeframe occurring 10 minutes before the bell rings as parents arrive and continuing for about 15 minutes after dismissal. The study team was surprised to find that at a number of schools parents were arriving and parking up to an hour before school was dismissed to get close to the front of the building. The same parents do this on a regular basis. Similarly, a study by Sear-Brown (2003) also found vehicles arriving up to half hour before school got out. Space in pick-up locations is often used inefficiently since parents occupy the space from the time they arrive until their child leaves the school and loads into the vehicle. The first vehicle queued up and waiting in line may not be the first one to leave, depending on when their children exit the building. As a result, space is often used inefficiently, resulting in congestion and queuing both on and off site. In fact, when on-street spillover and queuing occurred at study locations, it was more likely to be in the afternoon.

In order to better understand the magnitude of trip making, driveway counts were conducted at seven of the elementary case study schools to reevaluate trip-making characteristics around schools. The number of private vehicle trips entering and exiting schools were recorded by 5-minute intervals and were typically collected for an hour or more around school arrival and dismissal times. The temporal distribution of trips was evaluated for five of the schools observed. Figure 2.1 shows the distribution of entering trips at schools during the morning arrival time. Schools typically started between 8:00 and 8:30 a.m. Trips were normalized to school start time for comparison purposes. Time period "0" indicates the time school starts. The value "-45" minutes is the 5-minute period from 45 to 40 minutes before the school start time. As illustrated, the bulk of trip making for the morning arrival period occurs within a 30- to 45-minute period, with a peak 15-minute period prior to the bell. This activity frequently coincides with the regular morning peak period since a number of schools had start times around 8:00 a.m.

Figure 2.2 provides the same information for trips made during the afternoon dismissal period. Most schools were dismissed between 2:50 p.m and 3:30 p.m. Distribution of trips by 5-minute intervals before and after the scheduled dismissal time is shown for vehicle trips entering the school. As shown, moderate activity around the school occurs approximately 40 minutes before the scheduled dismissal time and continues for 20 to 25 minutes after. The peak period occurs around 10 minutes before the bell rings, as parents arrive, and continues for about 15 minutes after dismissal. As discussed, parents in some cases start queuing up to an hour before school dismisses, so trips generated to schools start earlier and last longer than has typically been expected. Although fewer trips are typically made during the afternoon dismissal period than for the morning arrival period, it takes parents more time to pick up than to drop off, so vehicles are on site for longer periods of time. Cooner (2005) conducted a study of Texas schools and also reported that the average amount of time picking up in the afternoon was more variable than for the morning period.

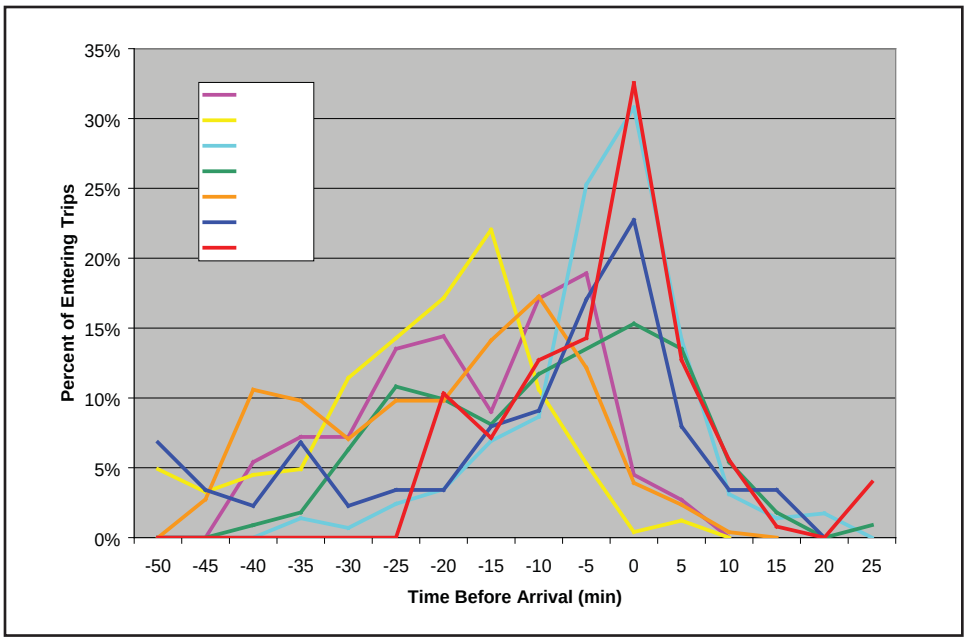


Figure 2.1. Distribution of private vehicle trips entering elementary schools by arrival time

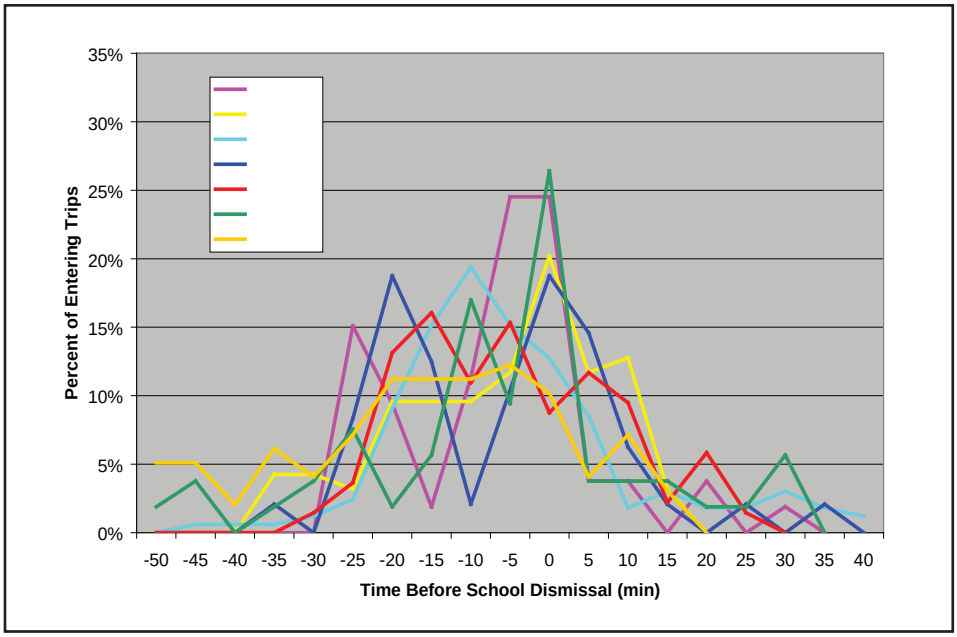


Figure 2.2. Distribution of private vehicle trips entering elementary schools by dismissal time

2.3 Conflict Studies

Conflict studies were performed to record operational and safety problems at schools. Conflict studies recorded activities by pedestrians, bicyclists, and private vehicles that either could result in obstructions to traffic flow or an accident or harm to pedestrian or bicyclist. Sample conflict forms, which can be reproduced for use, are provided in the Appendix.

2.4 Summary of Safety and Operational Problems at Schools

As expected, no two schools had exactly the same traffic characteristics or arrival and dismissal procedures, which made each school observation unique. School zone traffic and safety problems were identified at each school. A description of each case study school is provided in Chapter 3. Commonly observed traffic and safety problems at the case study schools include the following:

- Pedestrian/vehicle conflicts both on site and off site on surrounding public streets
- Parking in crosswalks
- Parking (and left unattended) in non-designated areas, such as NO PARKING areas, fire zones, handicapped spaces, and in front of fire hydrants
- Double-parking and blocking access to other vehicles
- Loading or unloading children in the middle of a street, leaving children to weave through traffic
- Dropping a child off in the middle of a street
- Loading or unloading children on the street side or in parking lots rather than curbside
- Parents blatantly ignoring adult monitors and requests by schools to engage in safe actions
- No adult monitors
- On-site safety is managed completely by 5th grade safety patrol members, including a street crossing near the school
- Violating NO LEFT TURN signs
- Children dashing across four-lane arterials
- Children weaving between moving traffic on the street and school grounds

Chapter 3

Case Studies

Twenty schools were observed during the study. Each school was evaluated by the study team. The observation times at each of the schools varied. They ranged from 2 hours to 6 hours and were conducted by one to four people. Driveway traffic counts were also taken at some of the schools and are provided if applicable. Each of the case study schools are discussed below in terms of general observations, typical problems, good practices, and possible changes, solutions, and enhancements.

It is recommended that all schools and/or school districts create a School Transportation Safety Committee to address safety concerns before and after school both on site and on street. The School Transportation Safety Committee might include the school district superintendent, city traffic engineer, police officer, school district transportation director, school district maintenance representative, school principal, parents, teachers, and students. More information about establishing a School Transportation Safety Committee and the focus of the committee can be found in Section 6.1.

Another critical component of school zone safety is communication with the parents about the schools expectations for arrival and dismissal periods (i.e., convey meaning/ interpretation of traffic signing and pavement marking, locations of preferred entrance and exit doors by transportation modes). Monitored and structured arrival and dismissal procedures allow for a safe and consistent arrival and dismissal periods.

Two case study schools implemented some of the study recommendations that were made. The changes implemented at these two schools are included in the case study summaries below. When the principals at these two schools were asked if the study assisted them with making safety changes, one responded,

> "Processing the transportation issues with other professionals in the community has empowered me to hold adults accountable for their actions. I needed help gathering data to use to convince people that this was a significant issue that deserves attention."

Case Study School #1

Type: Elementary (K to 5)
Enrollment (approximately): 430
Location: Urban
Passenger vehicle trips during AM peak: 146 entering driveway, 20 drop off on street
Passenger vehicle trips during PM peak: 82 entering driveway, 38 pick up on street
Traffic control: Pedestrian traffic signal, safety patrols (3 locations), adult monitors, separate bus loading zone, on-street SCHOOL ZONE X-ING pavement marking, marked crosswalks.

Case study school #1 was one of the two schools who implemented safety improvements during the study.

Figure 3.1. AM peak queuing

Background and General Observations

Case study school #1 was selected as a study school after discussions with the school district, public works department, and the police department. The study team made observations and counted traffic on multiple occasions (September, March, and May) during the 2004–2005 school year. This school recently reconfigured the driveways and parking to alleviate congestion in the adjacent neighborhood. The primary access was moved to the wide 2-lane collector street where queues would not block through traffic, as shown in Figure 3.1. A before and after aerial photos of the school site are shown in Figure 3.2. The school reported problems with repeat parking offenders in front of the school. Parents were also reported to be hostile to school staff when asked to abide by the rules.

Before access changes (Source: Story County, IA)

After access changes (Source: GoogleEarth)

Figure 3.2. Case study #1 driveway and parking lot reconfiguration

Typical Problems

- Students exiting and entering vehicles on driver's side near live traffic
- Drivers accelerating through the driveway
- Drivers backing in driveway to get around parked vehicles
- Students (and parents) not using the designated crosswalks and pedestrian traffic signal
- Drivers parking in crosswalk (see Figure 3.3)
- Drivers leaving vehicles unattended in NO PARKING zones
- Drivers violating RIGHT TURN ONLY, DURING SCHOOL HOURS sign at exit
- Student safety patrol crossing protocol varies by student
- Drivers not putting vehicles in park when picking up and dropping off students
- Drivers leaving their vehicles unattended
- Student safety patrol in driveway
- NO LEFT TURN sign is not obeyed
- Intersection at the exit of school driveway does not have a four-way stop
- Student safety patrol in the street or parking lot
- Drivers parking in a fire lane

Figure 3.3. Parked in crosswalk

Good Practices

- Adult monitors
- Use of signalized pedestrian crossing (see Figure 3.4)
- Driveway was recently realigned
- Schools desire to make the loading and unloading safer
- On-going communication with school resource officer
- Had permission to report habitual parking offenders in the parking lot to the local police department

Possible Changes, Solutions, and Enhancements to Consider

- Improved and enforced traffic signing and pavement marking
- Speed limit signs
- Staggered dismissal for walkers/bikers, bus riders, and vehicle pick up
- Designated exit doors
- Escort students out of the building at dismissal and line up in front of the school for pick up
- Student safety patrol refresher course every semester and consistent monitoring
- Request that the city repaint crosswalks and SCHOOL ZONE X-ING marking near school every year
- Re-time the walk and don't walk phases of the pedestrian signal and make sure that the safety patrol knows when it is safe for students to cross
- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures
- Adjust the pavement marking and signing for the fire lane so that inside lane can be used as a loading and unloading zone

Figure 3.4. Signalized pedestrian crossing

Implementation

- Removed RIGHT TURN ONLY, During School Hours sign that was no longer needed or obeyed
- Had discussion with the city public works department to request a STOP sign near the school and new pavement marking within the school zone. (The STOP sign was installed.)
- Included before and after school procedures as part of the new Student Accountability Program, which addresses everyday school activities and behaviors with the themes "We're Safe," "We Learn," and "We're Proud." Each theme contained a list of expected behaviors during different activities, including riding the bus, behaving in the classroom, using the bathroom/hallway, using the lunch room, playing on the playground or indoor recess, attending assemblies, and arriving and leaving school.
- Considered reducing the number of the student safety patrols
- Continued to include traffic safety information in the school newsletters
- Included information about the school transportation policies in the registration packets
- Mentioned the transportation safety effort at first week of school ice cream social

Case Study School #2

Type: Elementary (K to 5)
Enrollment (approximately): 275
Location: Urban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: On-street SCHOOL ZONE X-ING pavement marking, marked crosswalks, student safety patrol (2 locations), separate bus loading zone, adult monitors

Figure 3.5. Vehicles parked in front of a fire hydrant

Background and General Observations

Case study school #2 was selected as a study school after discussions with the school district, public works department, and the police department. The study team made observations and counted traffic on two occasions (September and October) during the 2004–2005 school year. This school is tucked into an old neighborhood with narrow streets and has a limited number of parking spaces that are almost all occupied by staff. Recently, the school added a new staff parking lot to remove staff parking from the neighborhood streets. The school also added a loading zone in front of the school. Both are shown in Figure 3.6 below. Although this improved staff parking, this allowed parents to park on the far side of the street, letting students cross a narrow, vehicle-packed street. Before and after school, the two streets that border the school property have only enough room for one vehicle to pass through, therefore, operating as one-way streets. The student safety patrols are located at an all-way stop-controlled intersection and at a parking lot entrance.

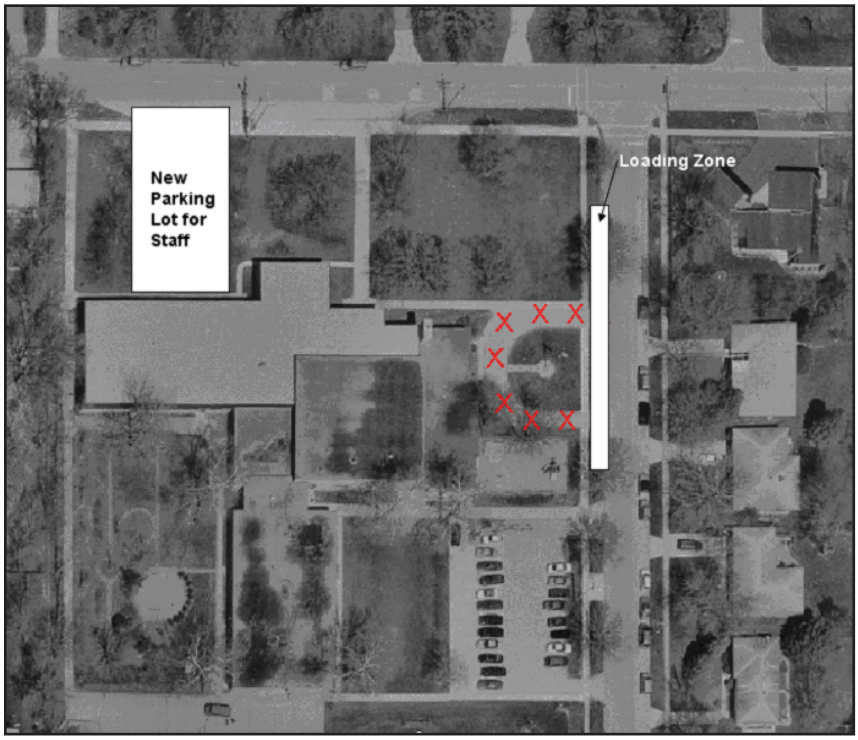


Figure 3.6. Case study school #2 staff parking addition (Source: Story County, IA)

Typical Problems

- Drivers leave vehicles unattended in NO PARKING zones and loading zones (see Figure 3.7)
- Drivers park in front of fire hydrant (see Figure 3.5)
- Students (and parents) do not use the designated, marked crosswalks
- Streets are so congested with parked cars that there is only enough room for one-way traffic
- Parents park on the far side of the street and allow children to cross midblock
- No sidewalk connectivity in neighborhoods
- SCHOOL ZONE X-ING pavement marking is not visible due to wear
- Crosswalk markings lead to "nowhere" (see Figure 3.8)

Figure 3.7. Vehicle parked in bus zone

Good Practices

- Student safety patrol records parking violations
- Adult monitors oversee student safety patrol
- Exit doors are designated for bus and personal vehicle pick up
- On-going communication with school resource officer

Possible Changes, Solutions, and Enhancements to Consider

- Add sidewalk to north side of street to provide connectivity to neighborhood streets
- Request that the city repaints crosswalks and SCHOOL ZONE X-ING markings near school every year
- Enforce student crossing location at traffic-controlled intersection
- Inform parents that the students should not cross the street midblock to enter/exit vehicles
- Student safety patrol refresher course every semester and consistent monitoring
- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures

Figure 3.8. Crosswalk that does not lead to a sidewalk

Case Study School #3

Type: Elementary (K to 5)
Enrollment: 570
Location: Suburban
Passenger vehicle trips during AM peak: 195 entering driveway, 9 drop off on street
Passenger vehicle trips during PM peak: 94 entering driveway, 3 pick up on street
Traffic control: Roll-out STOP signs with student safety patrol, student safety patrol on-site, separate bus loading zone

Figure 3.9. Parents parked across street for pick up

Background and General Observations

The school is located off a 2-lane collector to the south and a 2-lane arterial to the west. The school has problems with parking lot layout and circulation, shown in Figure 3.10, which leads to regular congestion and conflicts. Traffic enters at points B and C and leaves at points A and B. A line of traffic typically queues along Lane 1 (dark blue line) for drop off/pick up. Vehicles arrive and pull up to the curb randomly, which results in inefficient use of space. Vehicles also regularly stop and drop children off in lane 2 (green line), which blocks vehicles behind them as well as vehicles attempting to pull out from parking spaces. A long queue extends onto the street with vehicles waiting to enter the school at Point C (yellow line for eastbound and light blue for westbound, as shown in Figure 3.10). Vehicles entering or exiting (red lines) through Point B cross paths with vehicles moving in Lane 2. Vehicles parked in parking spaces marked in yellow are forced to back into the path of vehicles in Lane 1, who are dropping children off or picking them up. In many cases, vehicles who park in this area are unable to leave until the queue dissipates. Vehicles in the parking spaces marked in pink must back into traffic moving through Lane 2, and vehicles who attempt to enter the parking spaces marked in purple must cross paths with a major pedestrian crossing (black arrow) and one or two lanes of vehicles.

A roll-out STOP sign is placed at a marked crosswalk directly south of the school. The roll-out STOP sign on the east/west street is less than 1 block from the north/south 2-lane arterial. Traffic at the roll-out STOP sign queues back onto the 2-lane arterial.

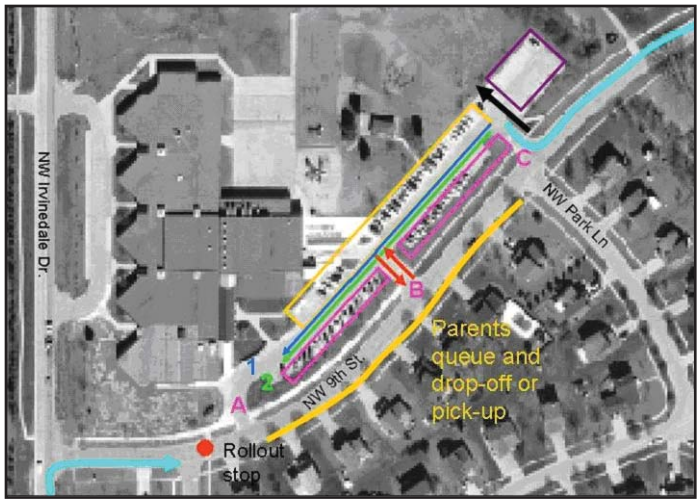


Figure 3.10. Layout for case study school #3

Typical Problems

- Poor parking lot design leads to significant congestion and conflict, difficult to enter and exit parking
- No adult monitors present
- On site, parents drop off in middle of parking lot and children cross moving lanes of traffic
- On street, parents drop off and pick up midblock with children crossing 2 lanes of traffic (see Figure 3.9)
- Roll-out stop creates queuing that spills back onto 2-lane arterial
- Significant on-street queuing (see Figure 3.11)
- SUV nearly drove over a young child who had exited a vehicle and was crossing a parking space. The driver appeared to be aware of the child but was attempting to enter the space before another vehicle could pull up.
- Parents arrive and start queuing up to an hour before school dismisses

Figure 3.11. Vehicles queued in street for pick up

Good Practices

- Student safety patrol monitors sidewalks
- Student safety patrol monitors bus loading and unloading
- Buses and private vehicles are separated

Possible Changes, Solutions, and Enhancements to Consider

- Student safety patrol refresher course every semester and consistent monitoring
- Establish an arrival and dismissal procedure to try to alleviate queuing on adjacent through streets

Case Study School #4

Type: Elementary (K to 5)
Enrollment: 513
Location: Urban
Passenger vehicle trips during AM peak: 255 entering lot, 143 drop off on street
Passenger vehicle trips during PM peak: 137 entering lot, 67 pick up on street
Traffic control: Crossing guard for 4-lane arterial to the south, roll-out STOP sign, student safety patrol at intersection

Figure 3.12. PM queuing on street

Background and General Observations

Case study school #4 is located in a suburban area. The school is located off a minor 2-lane road with 4-lane arterials one block to the west (18,000 vpd) and less than one block to the south (13,900 vpd). A 2-way stop is located at the intersection directly north of the school and controls the north and south approaches, as shown in Figure 3.13. During arrival and dismissal times, a roll-out STOP sign is placed in the center of the intersection for the east and west approaches, resulting in a 4-way stop during those periods. A crossing guard is provided at the signalized intersection directly to the south. The school has a single parking lot with a one-way configuration—with one entering driveway and one exiting driveway.

A queuing study was conducted for the PM dismissal period. Queuing was observed at the intersection north of the school which is converted to a 4-way stop for the PM dismissal period, as shown in Figure 3.13. Queuing locations are shown with the green arrows in Figure 3.13. The number of vehicles in queue was recorded for the southbound traffic on the north approach, westbound traffic on the east approach, eastbound traffic on the west approach, and southbound traffic on the south approach.

The south approach was observed for southbound traffic queued up between the school and the intersection and indicates the number of vehicles queued from the school backwards towards the intersection. Northbound traffic along the south approach was not recorded. School dismisses at 2:50 p.m. On the study day, queuing at the intersection was observed from 2:25 p.m. to 3:05 p.m. and was recorded in one-minute intervals. Queuing by approach is shown in Figure 3.14. As shown, queues of up to 16 vehicles for the south approach and up to 11 vehicles for the east approach were formed. During certain times of the observation period, all four intersection approaches were blocked, which is problematic since all approaches are on 2-lane roadways and there are no opportunities for vehicles to move around queued vehicles without encroaching on the opposing direction of traffic.

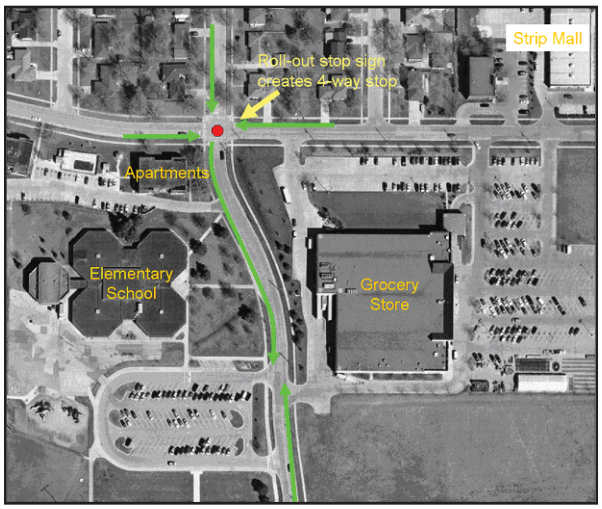


Figure 3.13. Diagram for case study school #4 (Source: Iowa DOT)

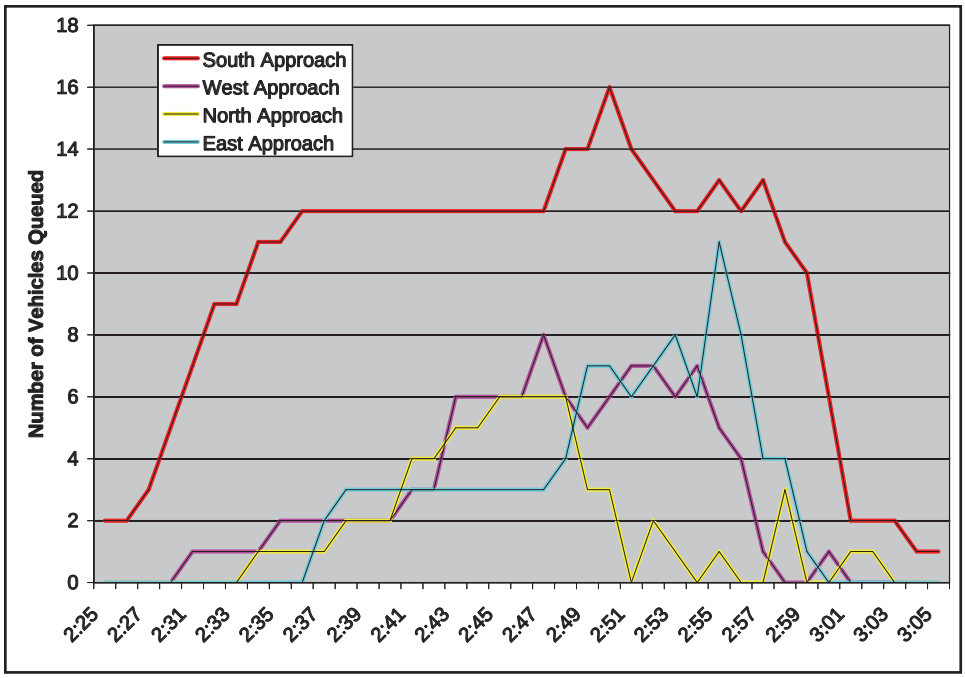


Figure 3.14. Queuing at intersection north of case study school #4 for afternoon dismissal period (recorded in one-minute intervals)

Typical Problems

- Extensive queuing and congestion on street in front of school and on adjacent streets (see Figure 3.12)
- Large number of students crossing midblock at various location
- Students seen dashing across streets midblock
- Buses and private vehicles unloading in the same space
- Children loading or unloading to the right into street rather than curbside
- Safety patrol running across the street
- Parents drop off midblock across the street, leaving children to cross two lanes of traffic
- Parents arrive and start queuing up to an hour before school dismisses (see Figure 3.15)

Figure 3.15. On-street queuing

Good Practices

- One-way driveway configuration facilitates traffic flow and may help reduce pedestrian/vehicle conflicts
- Long driveway around school parking lot has sidewalk which facilitates separation of child pedestrians and vehicles

Possible Changes, Solutions, and Enhancements to Consider

- Student safety patrol refresher course every semester and consistent monitoring
- Establish an arrival and dismissal procedure to try to alleviate queuing on adjacent through streets

Case Study School #5

Type: Elementary (K to 5)
Enrollment: 563
Location: Urban
Passenger vehicle trips during AM peak: 255 entering lot, 143 drop off on street
Passenger vehicle trips during PM peak: 137 entering lot, 67 pick up on street
Traffic control: Crossing guard for four-lane arterial to the south, student safety patrol (multiple locations), adult monitors

Figure 3.16. Safety patrol posted to warn of vehicles approaching around horizontal curve

Background and General Observations

Case study school #5 was selected for the study after discussions with the school district. The school is located in an urban area. The school is older and has limited driveway and parking space. School buses drop off students in front of the school, as shown in Figure 3.17. The area is designated for school buses only. The 2-lane roadway in front of the school is located along a significant curve and slope, which presents sight distance problems. The school posts a child safety patrol member, as shown in Figure 3.16, to warn children of vehicles approaching through the curve. Drop off and pick up are restricted to the driveway on the east side of the school.

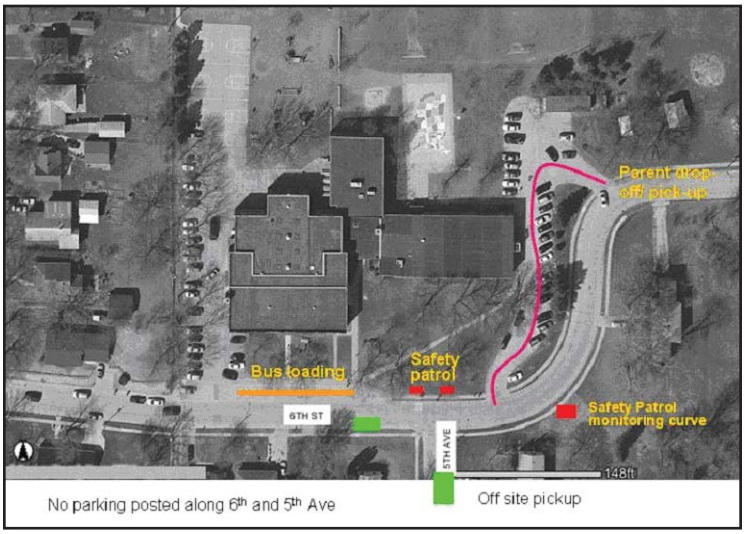


Figure 3.17. Layout for case study school #5 (Source: Iowa DOT)

Typical Problems

- Large number of parents dropping off and picking up in BUS ONLY zone
- Parents drop off midblock across the street, leaving children to cross two lanes of traffic
- Some queuing on street
- Sight distance problems around horizontal curve
- Children crossing midblock
- Parents parked in NO PARKING areas
- Parents double-park
- Children loading or unloading to the left into path of traffic rather than curbside (see Figure 3.18)
- Student safety patrol attire (safety sash) is not visible

Figure 3.18. Unloading on street side

Good Practices

- Student safety patrol posted on horizontal curve to warn students crossing of approaching vehicle (see Figure 3.16)
- Student safety patrol leads groups of students from building to bus area, pick up area, or to street crossing (see Figure 3.19)
- Teachers are posted for drop-off/pick-up duty
- Principal is frequently present during drop off/pick up
- Adult monitors present

Figure 3.19. Safety patrol leading children to pick up location

Possible Changes, Solutions, and Enhancements to Consider

- Student safety patrol refresher course every semester and consistent monitoring
- Establish an arrival and dismissal procedure to try to alleviate traffic violations
- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures
- Student safety patrol should wear a retro-reflective safety vest
- Request that the city repaints crosswalks and SCHOOL ZONE X-ING markings near school every year

Case Study School #6

Type: Elementary (K to 6)
Enrollment: 570
Location: Suburban
Passenger vehicle trips during AM peak: 190 entering vehicles, none on street
Passenger vehicle trips during PM peak: 101 entering vehicles, none on street
Traffic control: Four adult monitors in front of school, marked crosswalks and pavement markings on-site

Figure 3.20. Driveway queuing

Background and General Observations

Case study school #6 was selected for the study after discussions with school district and public works staff. The school is located in a residential/recreational area north of the intersection of a 2-lane major street and 2-lane minor street, which ends at a T-intersection at the school. The school's designated drop off and pick up area on the west side of the parking lot is shown in Figure 3.22. The school does have a significant amount of room on site to store queued vehicles and has a fairly aggressive drop off/pick up plan (see Section 4.1.2.F).

A queuing study was conducted during both the morning arrival and afternoon dismissal periods. Queues up to 14 vehicles on the eastbound approach and 3 vehicles on the westbound approach were observed for the morning drop off period. Queuing for the afternoon dismissal period is shown in Figure 3.23. Vehicles are queued on street for almost 20 minutes during the afternoon dismissal period. Queues up to 14 vehicles were observed on the eastbound approach and up to five vehicles on the westbound approach for the afternoon period. Vehicles along the eastbound approach back up beyond a horizontal curve, which results in sight distance problems. Through vehicles become impatient and begin passing in the westbound approach, as shown in Figure 3.21.

- Significant on-street queuing leading to vehicles passing in opposing lane (see Figure 3.21)

Figure 3.21. Vehicles passing queue of 14 vehicles in opposing lane on 2-lane roadway

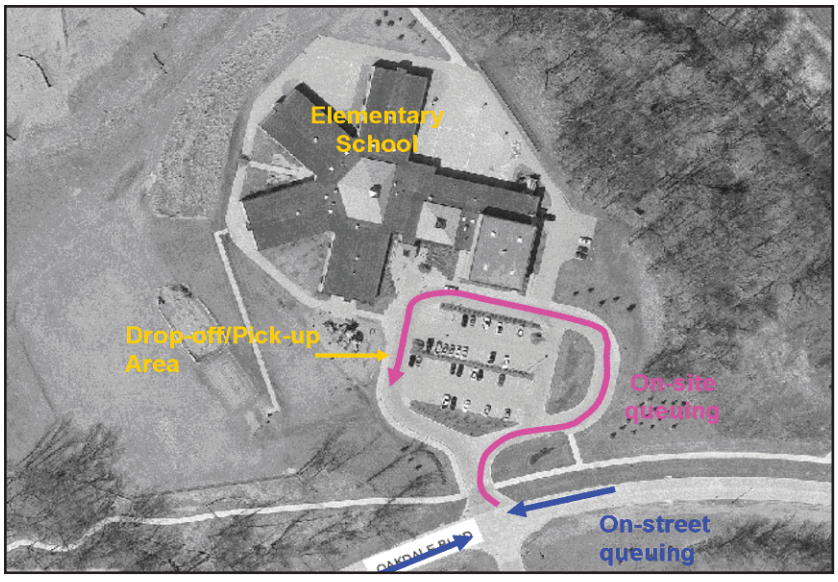


Figure 3.22. Layout for case study school #6 (Source: Iowa DOT)

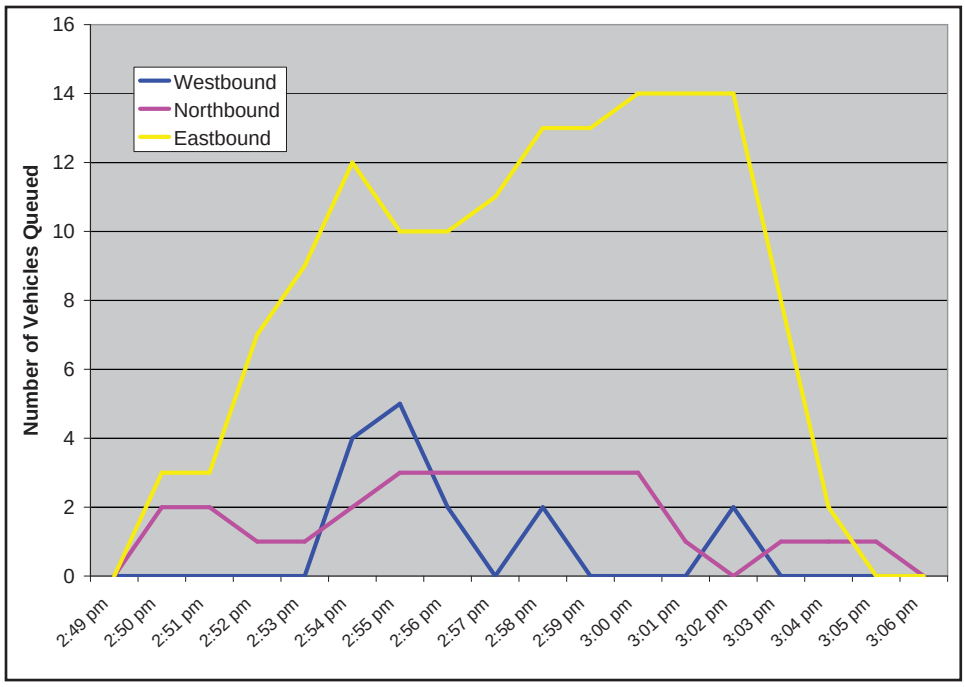


Figure 3.23. Queuing at intersection south of case study school #6 for dismissal

Good Practices

- Buses and private vehicles are separated by having buses pick up first
- Aggressive management of drop off and pick up (see Section 4.1.2.F)
- Designated crosswalks through parking lot
- Pavement markings in parking lot assist with circulation (see Figure 3.20)
- Safety committee
- Letters and reminders sent to parents when needed
- Well designed sidewalks and walking trail around school
- Students prohibited from using wheeled vehicles to access school (no electric scooters and bicyclists must walk bike on school grounds)

Possible Changes, Solutions, and Enhancements to Consider

- Communicate with public works department on possible changes in traffic control on street in front of the school to minimize queuing and illegal passing
- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures

Case Study School #7

Type: Elementary (pre-K to 5)
Enrollment (approximately): 512
Location: Suburban
Passenger vehicle trips during AM peak: 125 entering driveway, 0 on street
Passenger vehicle trips during PM peak: 88 entering driveway, 0 on street
Traffic control: Student ambassadors (safety patrol), adult greeter, adult monitor, traffic cones prohibiting movements

Figure 3.24. Student ambassador assisting traffic as pedestrians cross driveway

Background and General Observations

Case study school #7 was selected for the study based on discussions with the city traffic engineer. The study team made observations and counted traffic at the school in March of the 2004–2005 school year. The school is located in a developing area where much of the land surrounding the school has not been developed yet. Transportation modes are separated and passenger vehicles use the parking lot to queue before loading and unloading children. This protocol is at the request of the school. This school has an active safety committee that deals with traffic safety among other issues.

Typical Problems

- No marked crosswalks
- Children run out of school
- All curb is marked as a fire lane
- Drivers park in handicap spaces
- Drivers park in front of fire hydrant
- Children and parents cut through pick-up queue to get to parking lot (see Figure 3.25)
- Safety patrol is not consistent with SLOW/STOP paddle (SLOW/STOP paddle is typically only used for construction/road work (see Figure 3.24))

Figure 3.25. Children and parents cut through pick-up queue to get to parking lot

Good Practices

- Active safety committee addresses traffic concerns
- Transportation modes are separated
- Principal or monitor present outside during arrival and dismissal
- Student ambassadors help young students in and out of vehicles
- Cones are used to prevent movements in driveway
- Parents queue through parking lot instead of on the street
- Student safety patrol wears visible safety vests

Possible Changes, Solutions, and Enhancements to Consider

- Add pavement marking in on-site crosswalks
- Train student ambassadors for safety patrol duties during safety patrol refresher course every semester
- Consider moving handicap parking in front to side door where additional spots are located
- Needs may change as development is completed in the area and the adjacent street becomes a through street
- Adult monitors should wear safety vests so that both parents and children can easily identify them as authority figures

Case Study School #8

Type: Elementary
Enrollment: 363
Location: Urban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Adult crossing guard at four-lane arterial 2 blocks south of the school, bus loading and unloading zone

Figure 3.26. Designated on-street unloading

Background and General Observations

Case study school #8 was selected for the study based on discussions with the city traffic engineer. The school is an older school in an established neighborhood. Little on-site parking is available so drop off and pick up occur on street. However, the drop-off/pick-up volumes are fairly low. A designated BUS ONLY loading zone is separate from the on-street drop-off/pick-up area.

Typical Problems

- Parents dropping off and picking up in BUS ONLY zone (see Figure 3.27)
- Children observed dashing across 4-lane arterial located 2 blocks south of school
- Children loading or unloading to the right into path of traffic rather than curbside
- Significant on-street parking makes seeing child pedestrians difficult (see Figure 3.26)

Figure 3.27. Vehicle unloading in bus zone

Good Practices

- Principal monitors drop off/pick up
- Bus and private vehicle traffic separated
- Designated crosswalks on street in front of school

Possible Changes, Solutions, and Enhancements to Consider

- Establish an arrival and dismissal procedure to assist with controlling loading and unloading at curb side

Case Study School #9

Type: Elementary and middle school (K to 8)
Enrollment: 800
Location: Suburban/Fringe
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Adult monitors, fencing and gates for bus pick up and drop off, crossing guard and roll-out STOP sign at school entrance

Figure 3.28. On-site crossing

Background and General Observations

Case study school #9 is selected for the study based on interest from the district transportation director. The school was observed in March of the 2004–2005 school year. It is a newer facility that has the middle and elementary schools connected for the entire community. It has a campus atmosphere with long driveways coming from local streets. An access road connects the high school and bus garage to the south, which may encourage cut-through traffic from the high school. The parking lot design facilitates flow. The school has a rather long open driveway, as shown in Figure 3.29. This encourages speeding once a parent has dropped off or picked up children. Over 600 to 750 children are bussed to and from the elementary and middle schools to the neighborhood centers where students are then able to walk home. This school district has many pedestrian signals within its neighborhoods to then assist students with getting home safely. This school also uses gates and fences to load students, as shown in Figure 3.30.

Typical Problems

- Speeding through parking lot and in driveway
- Transportation modes are not separated completely from passenger vehicles
- Many parents pick up students after school in order to get children to after-school activities that begin within 15 minutes of dismissal
- Number of vehicles parked in the aisles of the parking lot
- Significant on-site queuing
- Parking in crosswalk

Figure 3.29. Queuing contained on site due to long driveway

Good Practices

- Busses load first
- Monitors are present before and after school
- Children wait in designated lines to board the bus and wait to enter the building
- Fences with gates were placed along bus loading area so that children are physically separated from buses once they exit the bus or are waiting to board the bus (see Figure 3.30)
- Vehicles are able to make a U-turn within school parking lot
- School parking lot design contains all queuing on site (see Figure 3.29)
- Well-designated crossing locations within parking lot (see Figure 3.28)

Possible Changes, Solutions, and Enhancements to Consider

- Monitors could be used to keep parents from parking in the crosswalks and to assist students in recognizing safe gaps in traffic to cross active driveway
- Eliminate loading and unloading in the parking lot. Curb-side pick up is preferred
- Monitors should wear safety vests so that both parents and teachers can easily identify them as authority figures

Figure 3.30. Fence physically separates children from buses

Case Study School #10

Type: Elementary (K to 5)
Enrollment (approximately): 475
Location: Urban
Passenger vehicle trips during AM peak: 83 entering driveway, 58 drop off on street
Passenger vehicle trips during PM peak: 48 entering driveway, 37 pick up on street
Traffic control: Adult crossing guards (2 locations), sidewalk restrictions, adult monitors, bus loading zone, traffic cones

Figure 3.31. Aerial view (Source: Linn County, IA)

Background and General Observations

Case study school #10 was selected as a study school after discussions with the local police department. The study team made observations and counted traffic at the school in March of the 2004–2005 school year. The school is located on a neighborhood street and just north (300 ft) of a busy two-lane street that carries a high volume of local traffic during peak hours, as shown in Figure 3.31. The intersection of these two streets has all-way stop control and an adult crossing guard is present before and after school. The school entrance sits on the crest of a vertical hill. On-street parking is allowed, except in bus loading and unloading zones. The circular parking lot/driveway is designated as a drop-off and pick-up area for parents, but is quite small. During the afternoon count, approximately 100 students walked home after school and 3 school busses transported students. The school also accommodates a before- and after-school program (6 a.m. to 6 p.m.). This program results in several students arriving early to the school and staying later that would not be accounted for during the peak morning and afternoon hour traffic.

Typical Problems

- Drivers parking in the bus loading and unloading zone
- Parked vehicles on the neighborhood street create problems for vehicles turning in and out of the school driveway (see Figure 3.34)
- Parked vehicles between the major intersection and the school narrow the street in a way that drivers have a difficult time making turning movements
- Children and parents cross midblock despite crossing guard near parked cars
- Tight driveway configuration and vehicles exiting school forces parents to pull across sidewalk to view oncoming traffic, blocking pedestrians
- Students crossing the school driveway after school to walk home

Figure 3.32. Parking in bus zone

Good Practices

- Passenger vehicle and school bus transportation modes are separated
- Pedestrians are not allowed to cross the school driveway when walking/biking to school
- Adult crossing guards are present and wear safety vests (see Figure 3.33)
- Crossing locations and routes are designated in front of the school and at the nearest intersection
- Staff and 5th graders are assisting/escorting students to/from the building before and after school
- Traffic cones are used to keep drivers from parking near the crosswalk in front of the school
- Supplementary signing (fold-up sign, shown above) in loading/unloading area (see Figure 3.32)

Figure 3.33. Adult crossing guard with flashing STOP sign

Possible Changes, Solutions, and Enhancements to Consider

- Post NO STOPPING, STANDING, PARKING signs from intersection to school driveway.
- Do not allow walkers and bikers to cross the school driveway after school. Direct them to walk around along the sidewalk just as they do in the morning. This promotes consistent behavior.
- Hold walkers and bikers in the afternoon until most parents have picked up the students and the queues have cleared.
- Designate specific exit doors for different modes of transportation
- Monitors should wear safety vest to easily identify them as an authority figure
- Request that the city repaint crosswalks and SCHOOL ZONE X-ING markings near school every year

Figure 3.34. On-street parking makes turning movements difficult near intersection

Case Study School #11

Type: Elementary (pre-K to 5)
Enrollment (approximately): 432
Location: Suburban
Passenger vehicle trips during AM peak: 115 entering driveway, 0 on street
Passenger vehicle trips during PM peak: 51 entering driveway, 0 on street
Traffic control: Traffic cones, adult monitors (5 locations)

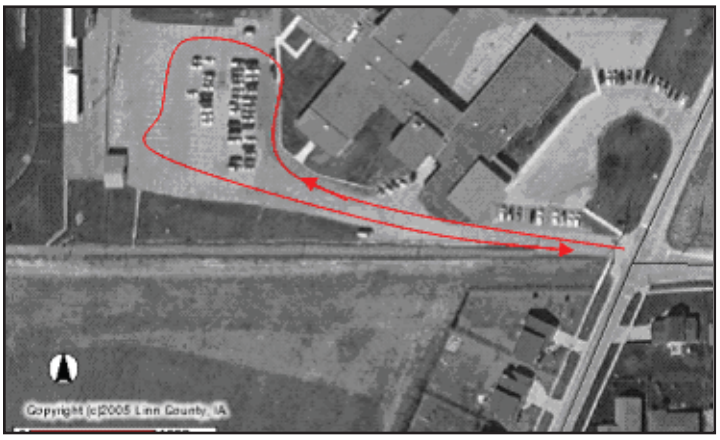


Figure 3.35. Aerial showing flow for drop off and pick up (Source: Linn County, IA)

Background and General Observations

Case study school #11 was selected as a study school after discussions with the local police department. The study team made observations during May of the 2004–2005 school year. Transportation modes are separated with the buses in the front of the school, private vehicle pick up and drop off occurs in the back of the school, and walkers also come in the front door. The vehicle pick-up and drop-off route is shown in Figure 3.35. A structured dismissal procedure is followed. Four staff members are stationed inside and outside the back door monitoring parents who are arriving and loading six to ten vehicles at a time. The staff use walkie-talkies and a megaphone to call students out to the parking lot. Approximately 100 students are loaded after school in 15 minutes with this procedure.

Typical Problems

- None observed

Good Practices

- Transportation modes are separated
- Only six to ten vehicles are loaded at once (see Figure 3.36)
- Staff get to know all the parents with loading procedure
- Students that change modes of transportation and who have multiple people pick them up carry a bright pink piece of paper
- Vehicles parked in the bus loading area are given notice of the violation with a reminder note
- Queued vehicles are allowed to make two lines until they form a single line for pick up
- The driving path through the parking lot is marked to keep parents from cutting through parking spaces
- Parents who walk to get their children are required to wait across the street

Figure 3.36. Three staff members assist with loading six to ten vehicles at a time

Possible Changes, Solutions, and Enhancements to Consider

- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures

Case Study School #12

Type: Elementary (K to 5)
Enrollment (approximately): 400
Location: Urban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Adult monitors

Figure 3.37. Driveway queue backs into street

Background and General Observations

Case study school #12 was selected for the study based on comments from the local police department. It is located along a two-lane collector. The school is at the top of a vertical curve which results in sight distance problems for vehicles entering and exiting the school driveways. The high school is located directly across the street. The school had significant problems with on-street queuing until officers posted and enforced NO PARKING, NO LOADING signs along the two-lane collector. The school tried to encourage parents to park in the high school lot across the street and then walk to get their child. Some parents comply but the majority arrives early for pick up and park in every available spot in the school parking lot, as shown in Figures 3.38 and 3.39. An incident arose when a parent who arrived well before school dismissal time to pick her child up for an after school appointment returned to the parking lot to find she was completely blocked in. School officials had to guide the parent onto the sidewalk so that she could leave the school parking lot. Concern was expressed about what would happen if a fire truck or ambulance needed to access the school in a hurry. This level of congestion on site was a common problem at many schools. Traffic is so congested both on site and on surrounding streets at many of the schools that it would be almost impossible for a fire truck, police officer, or ambulance to access the school site in a timely manner.

Typical Problems

- Double-parking on site
- Parking in locations such as behind dumpster
- On-site congestion
- Parents and children crossing from high school lot cross 4 moving lanes of traffic in parking lot
- Sight distance problems at driveways due to vertical grade
- Parents arrive and start queuing up to an hour before school dismisses (see Figure 3.37)

Figure 3.38. Driveway queue

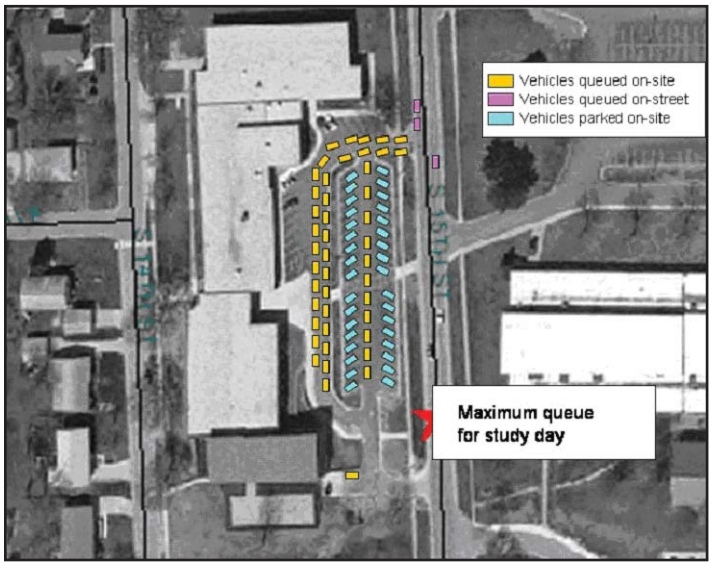


Figure 3.39. On-site queuing

Good Practices

- Adult monitors announce parent's name as they drive-up to facilitate pick up
- Police officers actively patrol and aggressively enforce traffic laws around schools

Possible Changes, Solutions, and Enhancements to Consider

- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures
- School should work with public works department and police department on possible changes to staff parking and loading and unloading procedure to alleviate queuing on street near the crest of vertical curve
- School should designate a crossing location from high school to middle school and reinforce this crossing with pavement marking and signing to alert motorists
- Establish an arrival and dismissal procedure to try to alleviate traffic violations

Case Study School #13

Type: Elementary (K to 5)
Enrollment (approximately): 463
Location: Suburban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Crossing guard at signalized intersection southwest of school, adult monitor to load and unload students, pavement marking within parking lot to designate paths

Figure 3.40. Double stacked queue in parking lot waiting to load and unload at the door

Background and General Observations

Case study school #13 was selected for the study based on comments from the local police department. Observations were made in March of the 2004–2005 school year. This school is located on the fringe of the community and shares a parking lot with a high school. A new middle school is also located about a quarter of a mile north of these two schools. A two-lane collector serves all theses schools. Start and dismissal times are staggered between the schools to monitor traffic. An adult crossing guard is posted at the nearest signalized intersection to assist students crossing the busy roadway. The school has a structured arrival and dismissal procedure that makes for an efficient loading and unloading of students. Queuing on the adjacent street does occur.

Typical Problems

- Parents dropping off behind school
- Vehicles turning at signalized intersection southwest of school while child pedestrians were in crosswalk
- Parents drop children off at signalized intersection southwest of school
- Children running across approach of signalized intersection
- Parents loading and unloading in undesignated areas

Good Practices

- Traffic signal southwest of school has all-red for pedestrians to cross (pedestrian phase)
- Adult monitor loads and unloads all students out of vehicles
- School utilizes parking lot to double-stack vehicles for pick up and drop off, and vehicles alternate to allow students to be loaded by a monitor (see Figure 3.40)
- Pavement marking designates where to walk in parking lot (see Figure 3.41)
- Parents escort children to and from parking lot
- Transportation modes are separated

Figure 3.41. Well-marked crosswalk within a parking lot

Possible Changes, Solutions, and Enhancements to Consider

- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures

Case Study School #14

Type: Elementary (K to 5)
Enrollment (approximately): 370
Location: Urban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Roll-out STOP signs (2 locations), parking restrictions on adjacent streets

Figure 3.42. Congestion on street

Background and General Observations

Case study school #14 was selected for the study based on comments from the school district transportation director. This is an urban school that has limited accommodations for pick up and drop off on site. The school is on a busy two-lane collector that runs through many neighborhoods. Roll-out STOP signs are used on this corridor throughout the day. The location of the roll-out STOP sign is a major crossing and drop-off area for students. Vehicles queue in two directions as students are dropped off.

Typical Problems

- Roll-out STOP sign stays on street all day
- Impatient drivers frequently sound horn and back on streets adjacent to school
- Frequent midblock crossings by both students and parents (see Figures 3.42 and 3.43)
- High school traffic adds to congestion during dismissal (High school and middle school are dismissed only 10 minutes after elementary school dismissal)
- Busses and passenger vehicles share loading space
- Pavement marking is not well maintained at crosswalks
- Congestion is increased with parking allowed on both sides of the street in front of the school (see Figure 3.44)

Figure 3.43. Parent and child crossing midblock

Figure 3.44. Unloading child on curbside

Good Practices

- Adult monitors on sidewalks
- Younger students are escorted out by staff
- Kindergarteners are allowed to come directly into the building in the morning
- Buses transport students to transfer area in neighborhoods where they walk home

Possible Changes, Solutions, and Enhancements to Consider

- Stagger dismissal of high school and middle school further from dismissal of elementary school
- Possibly use church parking lot for overflow parking
- Busses should all leave at the same time
- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures
- Request that the city repaints crosswalks and SCHOOL ZONE X-ING markings near school every year
- Establish an arrival and dismissal procedure to try to alleviate traffic violations
- Enforce the NO PARKING ordinance

Case Study School #15

Type: Elementary (K to 5)
Enrollment (approximately): 340
Location: Urban
Passenger vehicle trips during AM peak: 120 entering driveway, 143 drop off on street
Passenger vehicle trips during PM peak: 60 entering driveway, 30 pick up on street
Traffic control: Adult monitors in front of school, traffic cones

Figure 3.45. Aerial view (Source: Iowa DOT)

Background and General Observations

Case Study School #15 was one of the two schools who implemented safety improvements during the study. Case study school #15 was selected as a study school after the study team was contacted by the school district transportation director. The study team made observations and counted traffic on multiple occasions (March and April) during the 2004–2005 school year. This school is bordered by a wide two-lane collector road and a narrow two-lane collector. A large vertical curve (hill) 500 ft east of the school causes some sight distant issues. The intersection closest to the school is a stop-controlled intersection, and parking is allowed on the wide two-lane corridor.

Typical Problems

- Students exiting and entering vehicles on drivers side of vehicle near live traffic
- Students crossing street near the crest of the hill and sneaking between parked vehicles and live traffic
- Busses and pick-up/drop-off vehicles share the same area
- Students crossing the two school driveways without stopping or looking for traffic
- Drivers accelerating through the driveway
- Drivers backing in driveway and out of driveway to get around parked vehicles
- Students (and parents) not using the designated crosswalks on site
- Drivers parking in NO PARKING zones and leaving vehicles unattended

- Drivers parking in crosswalk and handicap spaces
- Drivers not putting vehicles in PARK when picking up and dropping off students
- Drivers stacking vehicles in the parking lot to wait for students, creating an unsafe location for students to enter and exit the vehicles

Figure 3.46. Vehicle-pedestrian conflicts

Good Practices

- Presence of adult monitors
- Traffic cones are used to prevent vehicles from parking where the busses load (see Figure 3.47)

Figure 3.47. Traffic cones restrict parking reserved for busses

Possible Changes, Solutions, and Enhancements to Consider

- Safety campaign (Raise Awareness, Constantly Remind, Peer/Parent Pressure; Safety is Important, Promote a Sense of Community)
- Have a staff person/safety patrol help students to the vehicle (no running through parking lot or across the street)
- Enforce where students should cross street
- Document violators (both parents and children) and set up some sort of policy that has consequences if you are a repeat offender
- Reflective safety vests for adult volunteers (give authority)
- Restrict the number of entrances and exits for students
- Staggered dismissals with designated doors (walking/biking, vehicle, bus)
- Eliminate all parking on north-south street
- Improved and enforced traffic signing and pavement marking
    - STOP sign at the driveway exit
    - ONE WAY signs
    - DO NOT ENTER signs
    - Enhanced crosswalk pavement marking meeting MUTCD guidelines
    - Curb cuts at the crosswalks
    - Two exit lanes with arrows painted on the pavement and a sign
- Suggest working with city to paint the crosswalks every year before school starts
- Consider impacts of infrastructure improvement on school transportation
- Implement changes at the beginning of school year

Implementation

- Moved bus loading/unloading onto the street to allow more curbside pick up in the short school driveway
- Designated specific street crossings at the controlled intersection for walkers and bikers
- Included information in the registration packets and talked with parents during registration about transportation safety and the efforts that would be implemented at the beginning of the school year

Case Study School #16

Type: Elementary (pre-K to 5)
Enrollment (approximately): 270
Location: Suburban/Fringe
Passenger vehicle trips during AM peak: 74 entering driveway, 0 on street
Passenger vehicle trips during PM peak: 43 entering driveway, 0 on street
Traffic control: Roll-out STOP sign, advanced flashing lights and signing in advance of school zone

Figure 3.48. Aerial view of school in developing area with no sidewalks (Source: Polk County, IA)

Background and General Observations

Case study school #16 was randomly selected to be in the study. Observations were made during October and March of the 2004–2005 school year. This school is in a developing area on the fringe of a small community. It sets off of a two-lane roadway surrounded by new homes and three daycare facilities as shown in Figure 3.38. Sidewalk continuity leading to the school is inconsistent. This school uses a roll-out STOP sign before and after school. There are two entrances to the school parking lot, and it was recently signed to have one-way flow from the east entrance. Busses only use the west entrance and load and unload students at a separate door from students who walk and are dropped off by parents.

Typical Problems

- Compliance with roll-out STOP sign is inconsistent (see Figure 3.49)
- Multiple pedestrian crossings and school crossing signs along corridor do not promote good crossing behavior by pedestrians and may encourage drivers to ignore pedestrians altogether
- Location of roll-out STOP sign in the intersection is poor
- Lack of sidewalks leading to the school
- Two pedestrians crossings within 200 ft of each other
- Advanced school warning signs and flashers are too far away from school based on MUTCD guidelines
- Roll-out STOP sign appears to be used for speed control on corridor in front of school

Figure 3.49. Roll-out STOP sign at west entrance to school

Good Practices

- Most students are escorted by parents to vehicles
- Designated drop-off and pick-up area at curbside in school driveway
- School dismissal is staggered to accommodate the different modes of transportation that the students use. Bus students are let out 5 minutes before students who are walking and being picked up.
- Parking lot is signed as one-way
- Daycare providers pick up students and escort them to daycare facilities across the street

Possible Changes, Solutions, and Enhancements to Consider

- Move roll-out STOP sign to middle of the intersection or eliminate it
- Work with public works department to assess all the warning signs in front of the school and determine primacy
- Work with public to require sidewalks with all new subdivision along corridor
- Adjust location of west advanced warning flasher assembly to comply with the MUTCD
- Combine two crosswalks once sidewalk is placed on north side of road
- Request that the city repaints crosswalks and SCHOOL ZONE X-ING markings near school every year

Case Study School #17

Type: Elementary (K to 5)
Enrollment (approximately): 270
Location: Urban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Student safety patrol (2 locations)

Figure 3.50. One-way street adjacent to school

Background and General Observations

Case study school #17 was selected based on discussions with the city traffic engineer. This school is abutted by three streets, one of which is a dead end, another is one-way street, and the other has a skewed three-legged intersection. All school traffic lines both sides of the streets as shown in Figure 3.50. A lot of midblock crossing occurs on two sides of the streets. Parents also pull up on the sidewalk to wait for children. Kindergarteners use a separate door.

Typical Problems

- Parents dropping off students midblock (see Figure 3.51)
- Parents block the one-way street as dismissal approaches
- All streets surrounding school are congested with parked cars

Figure 3.51. Students crossing midblock

Good Practices

- Student safety patrols report violators (see Figure 3.52)
- Student safety patrol use AAA crossing techniques
- Student safety patrol attire is visible
- Some parents park further away from the school and walk to get their children

Figure 3.52. Student safety patrol using AAA techniques

Possible Changes, Solutions, and Enhancements to Consider

- Add adult monitors
- Monitors should wear safety vests
- Consider reconfiguring staff parking and adding parking in back of school
- Discussions had already begun with city about connecting dead-end street with parallel street on the other side

Case Study School #18

Type: Middle
Enrollment (approximately): 863
Location: Suburban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Significant signing, turning restrictions, one-way segments of on-site road

Figure 3.53. On-site queue

Background and General Observations

Case study school #18 is a middle school on a major collector and was identified by the local public works department. The middle school is adjacent to a high school and has a campus environment. The driveways are long but traffic still queues onto the adjacent collector. During peak times, the length of the turn lane into the school property is insufficient. All transportation modes share the same space, as shown in Figure 3.53. Signing appears to be ineffective and may be an overload with the number of signs and restrictions.

Typical Problems

- Students crossing midblock on major collector (see Figure 3.54)
- Drivers violate one-way and turn restriction signing on-site
- Use of excessive signing may lead to driver overload
- Lack of visible pavement marking in the crosswalks
- Queuing spills back onto the street
- Both school entrances are located near the crest of a hill
- All transportation modes share the same space
- Speeding within the driveway
- Lack of pavement marking

Figure 3.54. Students cross major collector midblock near gas station

Good Practices

- Adult monitors
- Attempt to control traffic with signing

Possible Changes, Solutions, and Enhancements to Consider

- Separate transportation modes and designate doors for each mode (i.e., load and unload busses on west side of building)
- Install pavement marking throughout the driveway and parking lot to designate lanes
- Campus has adequate property, accesses, driveway length, and parking lots; however, circulation is still compromised. A circulation plan should be developed and established to better use the driveways and entrances to the school
- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures

Case Study School #19

Type: Junior High (7 and 8)
Enrollment (approximately): 750
Location: Urban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Left turn restrictions, one-way driveway

Figure 3.55. Aerial view of school on major arterial (Source: Google Earth)

Background and General Observations

Case study school #19 is a junior high in an urban neighborhood. The school has a limited pick-up and drop-off area; therefore, traffic on the adjacent street backs up near a signalized intersection, as shown in Figure 3.55. The school uses multiple doors for students to exit. All bus riders enter/exit at a side door; however, some parents pick up/drop off their children in this area because it is near the music room.

Typical Problems

- On-site queue backs up into the street
- Turning restrictions are not adhered to
- Drivers entering the driveway block other drivers trying to exit the parking lot
- Minimal pavement marking for crossings
- No enforcement of traffic in parking lot and driveway
- One school driveway exits onto a four-lane arterial
- Drivers park across active sidewalks (see Figure 3.56)
- Students cross between vehicles to get to the inside lane of vehicles

Figure 3.56. Vehicle parked across sidewalk

Good Practices

- Busses are separated from a large portion of passenger vehicle pick up
- One-way circulation allows for more storage in driveway

Possible Changes, Solutions, and Enhancements to Consider

- Use adult monitors to assist with traffic violations (i.e., parking on active sidewalk) (Monitors should wear safety vests so that both parents and children can easily identify them as authority figures)
- Enforce left turn movements on to four-lane arterial
- Possibly widen the neck of the driveway (a defacto third lane) to allow exiting traffic from parking lot to turn onto street. This would still allow for two lanes for parents to pick up in the driveway.
- Dismiss walkers and bus riders 5 minutes before students who are being picked up by private vehicles to reduce the number of conflict points with moving vehicles

Case Study School #20

Type: Middle school (6 and 7)
Location: Suburban
Passenger vehicle trips during AM peak: N/A
Passenger vehicle trips during PM peak: N/A
Traffic control: Crossing guard for 4-lane arterial to the south, adult monitor prohibits entry into bus areas at certain times

Figure 3.57. Kids crossing 4-lane arterial

Background and General Observations

Case study school #20 is located along a four-lane arterial to the south (13,900 vpd) and within one block of a 4-lane arterial to the west (18,000 vpd). A crossing guard is provided for the signalized intersection next to the school along the 4-lane arterial.

The school has problems with parking lot layout, which results in vehicle, pedestrian, and bicyclist conflicts. The school grounds are adjacent to a city park and city administrative buildings, which provides a number of access points as shown in Figure 3.58. Buses enter at Point A and exit at Point D. Passenger vehicles enter and exit at points A, C, and D. Traffic accessing Point A form two lanes of traffic indicated as lane 1 (yellow) and lane 2 (dark blue), with buses using only lane 1 (yellow). Lane 2 disappears at Point B with no traffic control, leaving vehicles in lane 2 to face oncoming traffic in lane 3 (pink). Vehicles leaving the parking area along lanes 1, 2, and 3 have to back into moving lanes of traffic in order to exit. Parents drop off children at many locations along lanes 1, 2, and 3, as well as in front of the city offices. Pedestrians and bicyclists also access the school at points A, C, and D. As a result, child pedestrians and bicyclist cross multiple lanes of traffic and cross paths with vehicles that are backing up. In some cases they cross paths with vehicles in both directions. The area shown in light blue allows parking for the recreational facility outside of school hours and is used by buses to pick up and drop off. The space is also utilized by parents dropping off and picking up. Even though parking is restricted during drop-off and pick-up times, parents still park there further contributing to on-site congestion.

Children were observed dashing across both the four-lane arterial adjacent to the school and the four-lane arterial to the west in several locations, even though crossings are clearly designated at intersections and adult crossing guards are present , as shown in Figure 3.57.

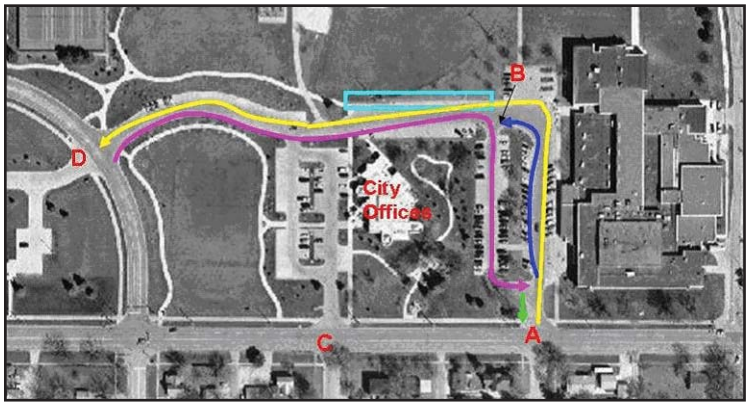


Figure 3.58. Parking lot configuration for case study school #20 (Source: Iowa DOT)

Typical Problems

- Parking lot design creates multiple conflict points between vehicles and pedestrians and bicyclists
- Parents drop children off in the middle of the school parking lot, leaving children to negotiate between moving vehicles
- Buses and private vehicles share same space
- Parents park in NO PARKING areas designated for buses (see Figure 3.59)
- Child pedestrians and bicyclists cross parking lot at multiple locations
- Children cross four-lane arterial to the south of the school midblock even though crossing guards are provided at signal

Figure 3.59. Sign indicates NO PARKING 7:00 to 8:00 a.m. and 2:00 to 4:00 p.m. so that buses can use the area for loading. Image taken 2:30 p.m.

Good Practices

- School controls access into the school during times buses are entering school
- School designates drop-off procedures in school newsletter

Possible Changes, Solutions, and Enhancements to Consider

- Establish an arrival and dismissal procedure to try to alleviate traffic violations
- Communicate school safety expectations to the parents and students
- Safe route to school should be established due to the proximity to a four-lane high-volume road
- Use adult monitors to assist with traffic violations (i.e., parking on active sidewalk)
- Monitors should wear safety vests so that both parents and children can easily identify them as authority figures
- Paint crosswalks within the school parking lot to designate safe areas for students and parents to travel to and from the school

Summary of Case Study Schools

Table 3.1 provides a summary of the case study schools by various characteristics and safety practices.

Table 3.1. Case study schools summary

Suburban	Urban
#3, #4, #6, #7, #9, #11, #13, #16, #18, #20	#1, #2, #5, #8, #10, #12, #14, #15, #17, #19
Sufficient on-site parking and storage	**Limited on-site parking and storage**
#1, #7, #9, #11, #13, #16, #18	#2, #3, #4, #5, #6, #8, #10, #12, #14, #15, #17, #19, #20
On-street queuing	**Minimal or no on-street queuing**
#2, #3, #4, #6, #10, #12, #14, #15, #17, #19	#1, #5, #7, #8, #9, #11, #13, #16, #18, #20
Elementary school	**Middle school/junior high school**
#1, #2, #3, #4, #5, #6, #7, #8, #9, #10, #11, #12, #13, #14, #15, #16, #17	#9, #18, #19, #20
Student safety patrol	**Adult crossing guards**
#1, #2, #3, #4, #5, #7, #17	#4, #5, #8, #9, #10, #13, #20
Arrival and dismissal procedures in place	**No arrival and dismissal procedures**
#6, #7, #9, #10, #11, #13, #16	#1, #2, #3, #4, #5 #8, #12, #14, #15, #17, #18, #19, #20

Chapter 4

School Grounds (On-Site): Common Transportation Safety Issues and Solutions

This chapter describes common safety problems and solutions for transportation of students to and from schools and focuses on activity that occurs on the school grounds. Activity that occurs on the school grounds is typically the responsibility of the school. Activity that occurs on public streets surrounding schools is addressed in Chapter 5 and is typically the responsibility of traffic engineers and local law enforcement. Parents, however, always have the primary responsibility for ensuring their child's safety to and from school.

As discussed, schools are increasingly faced with large numbers of student trips to and from school in private vehicles rather than by bus or walking. Many school driveways were not designed to handle the volume of traffic that accesses schools as parents drop off and pick up children. Additionally, school zones are areas of significant modal activity with buses, private vehicles, bicycles, and pedestrians often competing for the same space. Large traffic volume demand also occurs over a short period in the morning and afternoon. Traffic operations can break down as numerous vehicles and modes converge. Safety also becomes an issue as unescorted walkers and bicyclists regularly cross paths and sometimes even compete for space with distracted drivers.

School transportation problems and solutions can be addressed by focusing on the three main components of school ground transportation:

School grounds Existing school ground layouts, especially the typical neighborhood schools, are not conducive to accommodating all transportation modes simultaneously as they access the driveways and parking lots. Solutions may address separation of vehicle modes and improvements to circulation of vehicles and pedestrians.

Drivers Drivers on school grounds can be broken into three groups: bus drivers, school staff, and parents. Bus and daycare van drivers often have designated access points at the school. Bus drivers usually have and adhere to established rules for operation of school busses in a school zone. Bus drop-off and pick-up locations may need to be reconsidered to improve operations on school grounds. In most cases, bus drivers in the case study schools performed in a professional and safe manner and did not contribute to unsafe conditions by their driving behavior.

In contrast, parent driver behavior was often a major contributor to problems on school grounds. Poor choices and lack of compliance with school ground traffic control and policies by parent drivers appears to be one of the biggest contributors to transportation safety, or lack thereof, on school grounds during arrival and dismissal. Parent driver behavior is particularly problematic because it is difficult to find an effective medium to convey safety information and education to them. Additionally, unlike bus drivers, it is difficult to isolate violators and enforce compliance. Often parent drivers "mean well,"

but become careless and distracted and do not think about their actions. Larger vehicles, such as SUVs and pick-up trucks, also make it more difficult for drivers to see small children. In other cases, parents simply refuse to comply with school ground rules, which can also contribute to the break down of traffic operations at the school.

Traffic generated by school staff was not observed as an issue during the study. Staff arriving and departing from the schools was staggered long enough before and after the peak hour that it was not significant.

Children Children access the school grounds by walking, biking, riding the bus, or being transported by private vehicles. Children often have other things on their mind and frequently are not paying attention to their surroundings. Children also are more prone to have a lack in good judgment due to inexperience, and when their behavior is not monitored, it is common to see students running and biking through parking lots, dashing in front of vehicles, crossing at unsafe locations, pushing and shoving each other into the street or designated vehicle paths on school grounds, ignoring designated crossing locations, etc. This was especially evident after school, as students exited the building running to their after-school transportation.

The remainder of this chapter summarizes transportation safety and operation problems on school grounds at elementary and middle schools across Iowa. Solutions are focused towards elementary and middle/junior high schools, but many of the solutions are appropriate for high schools as well. The problems and solutions are aimed towards schools and school administrators. When administrators assess solutions for their school ground problems, they are encouraged to work with the city traffic engineer and police department in order to take a holistic approach in addressing the problems. Often, on-site problems can affect on-street operations and vice versa.

Solutions to these issues cover a broad spectrum and involve a number of stakeholders: traffic engineers, law enforcement, school district personnel, parent organizations, community organizations (Cooner et al. 2004), parents, and students. A collaborative effort between all of these stakeholders is essential to the success of any solution that may be implemented. Consequently, even positive changes to an existing school zone can create new problems, so it is important to consider all impacts from a physical and behavioral standpoint when a change is implemented and to monitor the results and make modifications, when necessary.

Common transportation safety and operational problems and solutions on school grounds are identified and discussed in the following sections of this chapter. Common problems and solutions are summarized in Table 4.1 as well for easy reference. Refer to the appropriate section for a detailed description.

Table 4.1. Common school ground transportation problems and solutions

Issue	Solutions	
Congestion and queuing during drop off and pick up on school grounds		
Congestion on school grounds	Management plans	(4.1.2.A)
	Provide arrival and dismissal plans	(4.1.2.B)
	Designate drop-off and pick-up locations for private vehicles	(4.1.2.C)
	Redesign or repaint parking lots to facilitate traffic flow	(4.1.2.D)
	Provide adult monitors	(4.1.2.E)
	Control drop off/pick up	(4.1.2.F)
	Stagger after-school activities	(4.1.2.G)
Inefficient use of drop-off/pick-up space	Redesign or repaint parking lots to facilitate traffic flow	(4.1.2.D)
	Provide adult monitors	(4.1.2.E)
	Control drop off/pick up	(4.1.2.F)
Vehicles unattended in NO PARKING areas	Provide adult monitors	(4.1.2.E)
	Control drop off/pick up	(4.1.2.F)
	Consistent and clear use of traffic control	(4.3.2.B)
	Remind parents	(4.3.2.C)
Unloading/loading in parking lots, through lanes, and other non-designated areas	Designate drop-off and pick-up locations for private vehicles	(4.1.2.C)
	Provide adult monitors	(4.1.2.E)
	Control drop off/pick up	(4.1.2.F)
	Remind parents	(4.3.2.C)
Queues spilling onto adjacent public streets	Provide arrival and dismissal plans	(4.1.2.B)
	Designate drop-off and pick-up locations for private vehicles	(4.1.2.C)
	Redesign or repaint parking lots to facilitate traffic flow	(4.1.2.D)
	Provide adult monitors	(4.1.2.E)
	Control drop off/pick up	(4.1.2.F)
	Stagger after-school activities	(4.1.2.G)

Table 4.1. (*continued*)

Issue	Solutions	
Conflicts between vehicles, pedestrians, and bicyclists on school grounds		
Pedestrians crossing between moving vehicles	Designate drop-off/pick-up areas	(4.2.2.A, 4.1.2.C)
	Designate parking lot crossing areas	(4.2.2.B)
	Separate modes	(4.2.2.C)
	Stagger dismissal times	(4.2.2.D)
	Educate children	(4.2.2.E)
	Provide adult monitors	(4.1.2.E)
Conflicts between buses and private vehicles	Designate drop-off/pick-up areas	(4.2.2.A, 4.1.2.C)
	Separate modes	(4.2.2.C)
	Stagger dismissal times	(4.2.2.D)
	Remind parents	(4.3.2.C)
	Provide adult monitors	(4.1.2.E)
	Control drop off/pick up	(4.1.2.F)
Pedestrians crossing through parking lots	Designate drop-off/pick-up areas	(4.2.2.A, 4.1.2.C)
	Designate parking lot crossing areas	(4.2.2.B)
	Educate children	(4.2.2.E)
	Parking lot design and repainting	(4.2.2.F)
Parents unloading in bus zone or parking lot	Separate modes	(4.2.2.C)
	Parking lot design and repainting	(4.2.2.F)
	Provide adult monitors	(4.1.2.E)
	Remind parents	(4.3.2.C)

Table 4.1. (*continued*)

Issue	Solutions	
Disregard for traffic control and school rules on school grounds		
Negative parental behavior	Adult monitors Consistent and clear use of traffic control Remind parents Enforcement Control drop off/pick up	(4.3.2.A, 4.1.2.E) (4.3.2.B) (4.3.2.C) (4.3.2.D) (4.1.2.F)
Parking in NO PARKING spaces **Parking in handicap spaces** **Parking in fire lanes or in front of hydrants**	Adult monitors Consistent and clear use of traffic control Remind parents Control drop off/pick up	(4.3.2.A, 4.1.2.E) (4.3.2.B) (4.3.2.C) (4.1.2.F)
Leaving vehicles unattended	Adult monitors Consistent and clear use of traffic control Remind parents	(4.3.2.A, 4.1.2.E) (4.3.2.B) (4.3.2.C)
Ignoring turn restrictions	Adult monitors Consistent and clear use of traffic control Remind parents Control drop off/pick up	(4.3.2.A, 4.1.2.E) (4.3.2.B) (4.3.2.C) (4.1.2.F)
Aggressive behavior	Adult monitors Consistent and clear use of traffic control Remind parents Enforcement Control drop off/pick up	(4.3.2.A, 4.1.2.E) (4.3.2.B) (4.3.2.C) (4.3.2.D) (4.1.2.F)
Failing to yield right of way	Adult monitors Consistent and clear use of traffic control Remind parents	(4.3.2.A, 4.1.2.E) (4.3.2.B) (4.3.2.C)
General information on working with parents	Parent teacher associations/organizations Communicating effectively with students and parents	(6.1.2) (6.2)

Table 4.1. (*continued*)

Issue	Solutions	
Speeding through drop-off/pick-up locations or through parking lots		
Parents speeding	Control drop off and pick up Traffic control Traffic calming Reconfigure parking and circulation areas	(4.4.2.A, 4.1.2.F) (4.4.2.B) (4.4.2.C) (4.4.2.D)
Cut-through traffic	Traffic control Traffic calming Reconfigure parking and circulation areas Reduce access	(4.4.2.B) (4.4.2.C) (4.4.2.D) (4.4.2.E)
Other issues		
Case studies of Iowa schools	Chapter 3	
Use of roll-out and fold-down STOP signs	Use of temporary traffic control	(5.4.2.C)
Use of student safety patrol	Guidelines for crossing guards and student safety patrol Use of adult crossing guards and student safety patrolon public streets	(6.4) (5.3.2.E)
Adult crossing guards	Guidelines for crossing guards and student safety patrol Use of adult crossing guards	(6.4) (5.3.2.E)
More tips on handling and communicating effectively with parents	Remind parents Control drop off and pick up Parent teacher associations/organizations Communicating effectively with students and parents	(4.3.2.C) (4.1.2.F, 4.4.2.A) (6.1.2) (6.2)
Establishing a school transportation safety committee	Establishing a school transportation safety committee	(6.1)
Communicating traffic safety to students	Communicating effectively with students and parents Educate children	6.2 (4.2.2.E, 5.3.2.D)
Getting support from school teachers and staff	Support from school teachers and staff	(6.3)
School busses	School busses	(6.5)
Traffic and safety studies in school zones	Traffic and safety studies in school zones Conflict Studies	(6.6) (2.3)
Development of a "Safe Route to School Plan"	Development of a "Safe Route to School Plan"	(6.7)

4.1 Congestion and Queuing on School Grounds

Schools typically have two periods during the day—arrival and dismissal—when traffic is congested and conflicts occur. Traffic volumes in the morning arrival period are usually higher. However, less queuing and congestion was observed on school grounds during the morning arrival period than during the afternoon dismissal period. This is likely due to the fact that parents are usually able to drop children off and then leave immediately. As a result, they spend less time on the school site. This tends to use the drop-off/pick-up location more efficiently in the morning than in the afternoon.

Conversely, the traffic associated with the pick-up period in the afternoon begins about 30 to 60 minutes prior to dismissal, with the peak timeframe occurring 10 minutes before the bell rings and until 15 minutes after dismissal.

Causes

- Grounds not designed for significant numbers of private vehicles
- Inefficient use of drop-off/pick-up zones
- Poorly designed and marked parking areas
- Parking in non-designated areas and leaving vehicles unattended
- Double-parking
- Unloading/loading in parking lots, through lanes, and other non-designated areas

Consequences

- Vehicles block fire lanes or other exits and may block emergency access to school
- Child pedestrians may not be visible walking between queued or parked vehicles
- Vehicles block parking spaces
- Emissions increase
- Drivers' frustration may lead to undesirable behavior
- Queuing and congestion spill onto adjacent public streets

Solutions

- Management plans for drop off/pick up
- Designate drop-off/pick-up locations
- Re-mark or redesign parking lots to facilitate traffic flow
- Control drop off/pick up with adult monitors
- Stagger after-school activities
- Educate children and parents

4.1.1 Common Problems

Queuing and congestion are often problems on school grounds during arrival and dismissal times as a significant number of vehicles and modes attempt to use a limited space over a short period of time, as shown in Figures 4.1 and 4.2. Long queues often form on the school grounds for several reasons. The most significant reason is that school parking lots and other drop-off/pick-up locations are not designed to accommodate the significant number of private vehicles that currently access school grounds.

A problem that contributes to queuing and congestion is inefficient use of space and poor design or layout (i.e., number and location of parking spaces) of parking lots. During arrival and dismissal periods, vehicles randomly arrive and stop along designated queuing locations in a haphazard manner, unless arrival and dismissal are controlled. A queuing area designed to handle 20 vehicles may only be handling 12 or 15 since vehicles arrive and park randomly, leading to inefficient use of space. The problem is compounded in the afternoon dismissal period since parents occupy space from the time they arrive until their children leave the school, arrive at the pick-up point, and load into the vehicles. The first parents waiting in line may not be the first ones to have their children exit the building. The study team was surprised to find that at a number of schools, parents were actually arriving and parking up to an hour before school dismissed in order to get the first spots in front of the building. The same parents do this on a regular basis.

Figure 4.1. Congestion at school site

Figure 4.2. Queuing on school grounds

When parents engage in activities that block other vehicles and space, it can also play a role in queuing and congestion problems. In many cases, parents were observed double-parking, which blocks vehicles who are attempting to use through lanes, leading to congestion, as shown in Figure 4.3. In some cases, parents park in drop-off/pick-up areas and leave their vehicles to enter the school. Unattended vehicles use space inefficiently and cannot be moved immediately when conflicts occur. In other cases, parents park in non-designated spaces, including NO PARKING areas, fire zones, in front of fire hydrants, and in handicapped spaces. Parents also often drop off or pick up children in the middle of parking lots, as shown in Figure 4.3 and in designated through lanes. All of these activities lead to blockage of other vehicles, causing queuing and congestion. Drivers who are blocked or caught in congestion often engage in unsafe or erratic actions themselves. Drivers attempting to go around stopped vehicles often block other vehicles. In several cases, drivers were observed backing up to get around stopped vehicles. This can be unsafe since it is difficult to see small children who may be crossing between vehicles.

Figure 4.3. Unloading in parking lot and blocking parked vehicles

4.1.2 Solutions and Case Study Best Practices

This section addresses general solutions to manage on-site traffic during arrival and dismissal periods to avoid congestion. During arrival and dismissal periods, vehicles randomly arrive and stop in designated queuing locations in a haphazard manner, unless arrival and dismissal is controlled. Solutions to more specific problems, such as managing vehicle/pedestrian interactions, are discussed in other sections. Strategies that manage congestion and queuing on site often result in improved traffic operations on adjacent streets as well.

4.1.2.A Management Plans

On-site management plans proactively address vehicle, pedestrian, and bicyclist behavior. Well-organized management plans can alleviate a number of problems around school zones during drop off and pick up. Seven schools had a structured on-site management plan, which included designated drop-off/pick-up locations, effective adult monitors, and on-site traffic control. However, it should be noted that even structured management plans cannot always circumvent poor parental behavior. Structured management plans may range from simple to complex and may include all or several of the components listed in sections 4.1.2.B to 4.1.2.G.

4.1.2.B Provide Arrival and Dismissal Plans

A management plan indicates the following:

- Routes for bicyclists and pedestrians entering the school grounds
- Locations and times where crossing guards or student safety patrol are provided
- Doors where children should enter or exit the school
- Locations where parents should drop off or pick up children
- Locations where parents can park and wait for their children; park and leave the vehicle unattended; and where absolutely no parking, stopping, or standing is allowed
- Prepare an education plan for the parents and students to convey what the school expects from each group
- Prepare an implementation plan for the arrival and dismissal procedures Areas where children should wait to load onto buses or into private vehicles.
- Areas where children should wait to load onto buses or into private vehicles.

Young children traditionally respect teachers as authority figures, so when shown expected drop-off procedures and behaviors, students are likely to listen and take these procedures seriously. It is hoped that the children's desire to obey the teacher may influence the parent's behavior. Parents should also be provided with arrival and dismissal plans so that they are aware of drop-off/pick-up locations and rules. Information can be provided to parents through orientation, parent-teacher conferences, school newsletters, and other correspondence throughout the year.

Case study school #1 recently developed a Student Accountability Program that had three themes: "We're Safe," "We Learn," and "We're Proud." Each theme contained a list of expected behaviors during different activities, including riding the bus, behaving in the classroom, using the bathroom/hallway, using the lunch room, playing on the playground or indoor recess, attending assemblies, and arriving and leaving school.

Schools included in the study that had established arrival and dismissal protocol were observed to have the highest compliance by parents and students, and as a result, the most control over these busy periods during the day. Schools with these procedures are also documented in Table 3.1.

4.1.2.C Designate Drop-off and Pick-up Locations for Private Vehicles

Drop-off or pick-up locations can be designated using pavement or curb markings, positioning adult or child safety monitors at these points, and blocking off or signing locations where access is not desired, as shown in Figure 4.4. One school, for instance, has several designated pick-up/drop-off locations. The expectation is that vehicles will pull up and either drop off or pick up and then, as they leave, several more vehicles will pull into those positions. Parents are expected to stay in queue until they reach one of the designated spots. When this procedure is followed by parents, it keeps the queue moving, uses the space more efficiently, and ensures that children enter and leave vehicles in a controlled location.

When parents need to escort a student to or from the building, they should be guided to park in the parking lot or another location away from the primary pick-up area and use the designated crosswalks to accompany the student to the vehicle or to the building.

Figure 4.4. Restricting movements on school grounds

4.1.2.D Redesign or Repaint Parking Lots to Facilitate Traffic Flow

Queuing and congestion often occur because parking lot configurations do not facilitate smooth flow, space is used inefficiently, or lots are not designed to accommodate large traffic volumes. While expansion of parking lots and loading/unloading areas is not practical, redesigning or repainting existing parking spaces may facilitate better use of available space. When redesigning parking lots, it is recommended to discuss ideas with the city traffic engineer who has experience in parking and traffic flow issues.

4.1.2.E Provide Adult Monitors

The presence of adult monitors indicates that the school takes on-site safety seriously. Parents and children are less likely to disregard traffic control and engage in unsafe actions when an adult is present. It also allows schools to identify and proactively address on-site problems. At several schools, an adult greets students and monitors traffic. At case study schools #7, #10, and #13, the principal greets vehicles and assists students as they get out of the vehicle. This encourages parents to drop off in the appropriate location. The principal reminds them when this does not occur. At case study school #5, all teachers rotate playground and before and after school duty. The principal is often outside greeting students and observing behavior. Student monitors lead the children to and from the building to designated pick-up locations, as shown in Figure 4.5.

It should be noted that at several schools teachers do not provide outside supervision due to other before and after school responsibilities and due to union restrictions. Additionally, in some cases schools feel that having adult monitors to manage arrival and dismissal periods leaves them open to liability if a conflict were to occur on school grounds. If a school is concerned with these issues but would like to pursue these activities, it should consult with the union representation and/or legal counsel in the school district.

Figure 4.5. Student safety patrol leading children to pick-up location

4.1.2.F Control Drop Off/Pick Up

In many instances, schools had attempted to control drop off and pick up but were ignored or even harassed by parents. When the latter occurred, schools contacted law enforcement officials to handle these extreme situations. Although these are extreme cases, two case study schools did get the police department involved in incidents where parents were threatening other parents and monitors. Schools cannot actually control adult behavior, but they can control students until they are picked up. A total of four of the evaluated schools designate pick-up locations and restrict children to a specified area until their parents arrive. This method also facilitates efficient loading and unloading of children.

Case study school #6 provides a long queuing area and designates four drop-off and pick-up spots at the far end. This space is first used by buses since they are unable to provide separate bus access. Children riding in private vehicles are asked to wait on the sidewalk adjacent to the indicated drop-off/pick-up location. Parents in queue have a placard in the front window of their vehicle with their last name. As the first four vehicles pull into the designated spots, an adult monitor calls the names of the children so that they are ready to load as soon as their parents pull up. Once those four vehicles have loaded, the next four pull up, and so forth. Not only does this provide a structured pick up, it also separates transportation modes. The process is shown in Figure 4.6.

Parents have sign with last name in window

Teacher calls last name

Four vehicles pull up to marked spots, children wait behind line

Four vehicles load and leave, followed by another four vehicles

Figure 4.6. Managed drop off/pick up at case study school #6

Several schools use similar procedures and are able to load students six to ten vehicles at a time. Case Study #11 manages drop off and pick up on site by designating pickup at the rear of the school (Point A) rather than at the front of the school (Point B), as shown in Figure 4.7. The school has a large parking lot at the rear of the school with pavement markings to guide flow through the facility. Vehicles are queued up in two lines until they arrive at the pick-up area. The pick-up area has only a single lane of traffic. Children stay in one location and megaphone and walkie-talkies are used to communicate whose parents are next in line, as shown in Figure 4.8. Five monitors are used for this procedure and they are able to load approximately 100 students in less than 15 minutes.

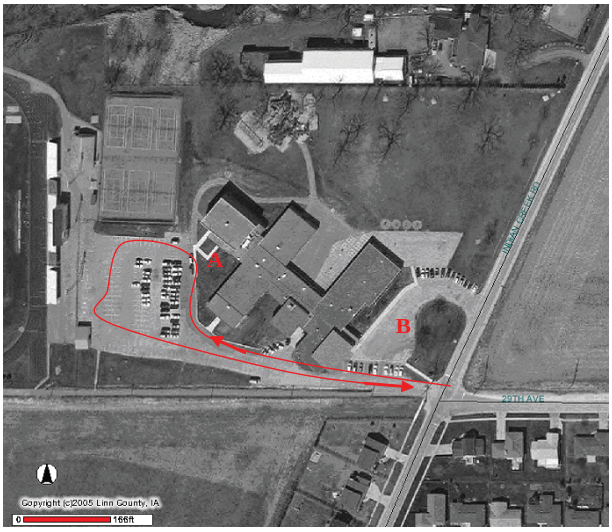


Figure 4.7. Parking lot configuration for case study school #11

Staff monitor traffic

Teachers identify parents who pull up next in line

Staff use walkie-talkies to tell arriving parent's name to teacher inside

Children wait inside until their name is called by teacher using megaphone before leaving building to load

Figure 4.8. Structured loading at case study school #11

4.1.2.G Stagger After-School Activities

On-site congestion during afternoon dismissal can be compounded when parents are in a hurry to pick up children for after-school activities and appointments. One school in a small community worked with a local dance studio to schedule lessons slightly later since lesson start times were close to school dismissal times and a number of parents were rushing to pick up children so they could meet the lesson time. School officials can also work with community leaders to balance scheduled community activities. Parents can be encouraged to schedule doctor or dentist appointments farther from dismissal times.

4.2 Vehicle and Pedestrian/Bicyclist Conflicts on School Grounds

Students may be transported to and from school by private vehicle or by bus (school or transit), or they may also bike or walk. School grounds are overwhelmed with a number of different modes often trying to utilize the same space, which can lead to chaotic and unsafe conditions, particularly for student pedestrians and bicyclists. Student pedestrians and bicyclists often cross paths with buses, private vehicles, and each other, both on school sites and on the surrounding streets, leading to conflicts and potential accidents.

Causes

- Undesignated crossing locations
- Parents drop off in parking lots or other areas and leave children to walk across parking lots and moving traffic
- Children exit to the left of vehicles into moving paths of traffic
- Buses, private vehicles, and pedestrians share the same space
- Parents unload or load in bus zones

Consequences

- Student pedestrians or bicyclists may be struck by vehicles
- Driver frustration may lead to unsafe actions. Accidents may happen between vehicles
- Congestion

Solutions

- Designate drop-off/pick-up areas
- Designate parking lot crossing areas with pavement marking
- Separate modes
- Stagger dismissal times
- Educate children and parents

4.2.1 Common Problems

One common problem observed is children routinely crossing school grounds and vehicle paths haphazardly. They often do not pay attention to vehicles. In many cases, locations for crossing parking lots or vehicle paths are not designated, and children and even adults are to cross wherever it is convenient. Even when crossings and traffic modes are physically separated or crossings are designated, children still ride or walk through parking lots or between queued vehicles to access the school without caution from monitors, as shown in Figures 4.9 and 4.10.

Figure 4.9. Parent crosses several lanes of queued traffic on school grounds

Figure 4.10. Students walking between moving queues of vehicles because sidewalk is blocked

Parents themselves often set bad examples with unsafe behavior on site. At several schools, parents were observed doing the following:

- Walking between moving vehicles, as shown in Figure 4.11
- Dropping off children in the middle of the parking lot and then leaving them to negotiate through parked, queued, and moving vehicles
- Pulling up to the left of a moving drop-off queue and dropping off their children, requiring them run through the moving queue
- Allowing children to exit to the left of the vehicle, placing them directly in the path of moving vehicles, rather than requiring them exit to the right onto the curb or sidewalk.

Figure 4.11. Parent walking through moving queue of vehicles

Conflicts also occur when busses and passenger vehicles share the same loading and unloading area. These two modes of transportation carry almost 85% of the students to and from school. At schools where there is limited curb space in front of the school, busses can take up a significant amount of room if loading of both modes is occurring simultaneously. This can result in congestion and conflicts between passenger vehicles and busses as they cross paths. In other cases, where bus zones were clearly designated and signed, private vehicles still parked in these areas, as shown in Figure 4.12. When busses and private vehicles share the same pick-up and drop-off areas, the potential for crashes increases, and buses might not be able to stay on their route schedule.

Figure 4.12. Parent dropping off child in BUS ONLY zone

Furthermore, students are also often trying to share the same space with the busses and passenger vehicles. Often children are seen running into school or dashing across the driveway, street, or parking lot to meet their ride home. When children are crossing the street or driveway in an undesignated area, buses and vehicles may block the view of children and other drivers, creating a dangerous situation. Figure 4.13 shows two examples where bus, private vehicle, and students are trying to share the same space. These mode conflicts were observed at both urban and suburban schools.

Figure 4.13. Various transportation modes crossing paths

Conflicts also occur between private vehicles. In some cases, vehicles attempting to drop off or pick up children are attempting to use the same space as vehicles parking or backing up from parking spaces. Vehicles attempting to leave the school grounds may cross paths with vehicles queuing for drop off and pick up.

4.2.2 Solutions and Case Study Best Practices

This section discusses solutions to manage vehicle, pedestrian, and bus conflicts on school grounds.

4.2.2.A Designate Drop-off/Pick-up Areas

Drop-off and pick-up locations should be selected to minimize the number of times children cross paths with busses and private vehicles. For safety reasons, it is preferred that children exit and enter vehicles on the right side of the vehicle (curbside). Vehicles can be directed to designated drop-off/pick-up locations with the help of pavement markings, cones, signs, adult monitors, or any combination thereof. This information should be communicated to parents via school newsletters and during orientation, as well as when they are picking up their child. Clearly designating drop-off and pick-up locations guides parents to preferred, monitored, and consistent areas. A study by Sear-Brown (2003) indicated that some schools used traffic cones to keep vehicles queued in a single line.

Additionally, when queuing areas are provided for drop off /pick up and students are loaded under supervision (i.e., adult monitor is watching as students are loading), double queues, as shown in Figure 4.14, may be used to maximize the space available for passenger vehicles. This is only recommended when a designated number of vehicles are loading at one time and is not recommended when there is no assistance or supervision because this forces children to cross between and load near moving vehicles. While drivers may be aware that children are being dropped off, speeding and careless driver behavior are commonplace. Case study schools #11 and #13 provide double lanes for queuing through the drop-off/pick-up area. Drivers are expected to drop off or pick up along the curbside lane and then move into the adjacent lane when leaving, as shown in Figure 4.15. This allows drivers to move around queued vehicles and exit the school property.

Additional information on designating drop-off/pick-up areas is provided under the discussion on school management plans in section 4.1.2.A.

Figure 4.14. Double queue of vehicles waiting their turn to approach the designated pick-up and drop-off location

Figure 4.15. Vehicles load at the curb in the right lane and drive through in the left lane

4.2.2.B Designate Parking Lot Crossing Areas

Parking lots are usually extensive uncontrolled areas. Crossing a parking lot may be the shortest path to a destination for a child pedestrian or bicyclist. Parents also often drop off children or pick them up within the parking lot, rather than using designated curb drop-off areas. School staff, volunteers, and parents also park in the parking lots to enter the school, creating additional pedestrian traffic through parking lots. When possible, locations and sidewalks should be designated where pedestrians and bicyclists are preferred to cross parking lots. Figure 4.16 illustrates a marked crosswalk (left picture) that guides pedestrians to walk in front of the pick-up queue and behind the vehicles that are loading/unloading rather than routing them through a moving queue (right picture) through the area without crosswalk pavement markings. Providing a sidewalk or painted crosswalk from the parking lot designates the safest location for pedestrians to access the school. Figure 4.17 shows two schools that have designated and painted crosswalks through parking lots. Channeling pedestrians to one location also allows drivers to expect pedestrians in that area. However, when crosswalks or other designated crossing locations are provided, children should still be reminded to watch for cars since pedestrians often feel that a marked crosswalk provides a measure of safety and fail to watch for moving vehicles.

Crosswalk and adult monitor guide children and parents to crossing locations

No crosswalk is designated so children and parents cross wherever it is convenient

Figure 4.16. Crossings with and without designated crosswalks

Figure 4.17. Parking lot crossings with designated crosswalks

4.2.2.C Separate Modes

Busses, passenger vehicles, and pedestrians are sharing the same loading and unloading areas at many schools and this introduces a significant number of conflicts. One way to reduce or avoid pedestrian/bicyclist/vehicle/bus conflicts is to separate the different transportation modes. A number of schools in the study load busses at different exits/entrances away from the private vehicles drop off/pick up, as shown in Figure 4.18. Bus loading and unloading is often better located on an adjacent street or side/back door, where students can unload and load at the curb away from other vehicles and have direct access to a sidewalk that leads to the school.

If schools are unable to separate the transportation modes, particularly in the afternoon, they may consider having busses load first before private vehicles are allowed to pick up students. They may also designate specific entrances and exits into and out of the school based on mode, as well as the destination. Schools may consider prohibiting students to play on the playground in order to maintain a structured dismissal. Figure 4.19 illustrates an example of a school that designates doors for specific transportation mode. Students who are walking are asked to leave the school property immediately. When separation of modes involves locating bus loading/unloading or drop off/pick up on public streets, the city traffic engineer should be involved to provide feedback on the impacts to the adjacent street system.

Figure 4.18. Separating transportation modes using different bus drop-off/pick-up areas

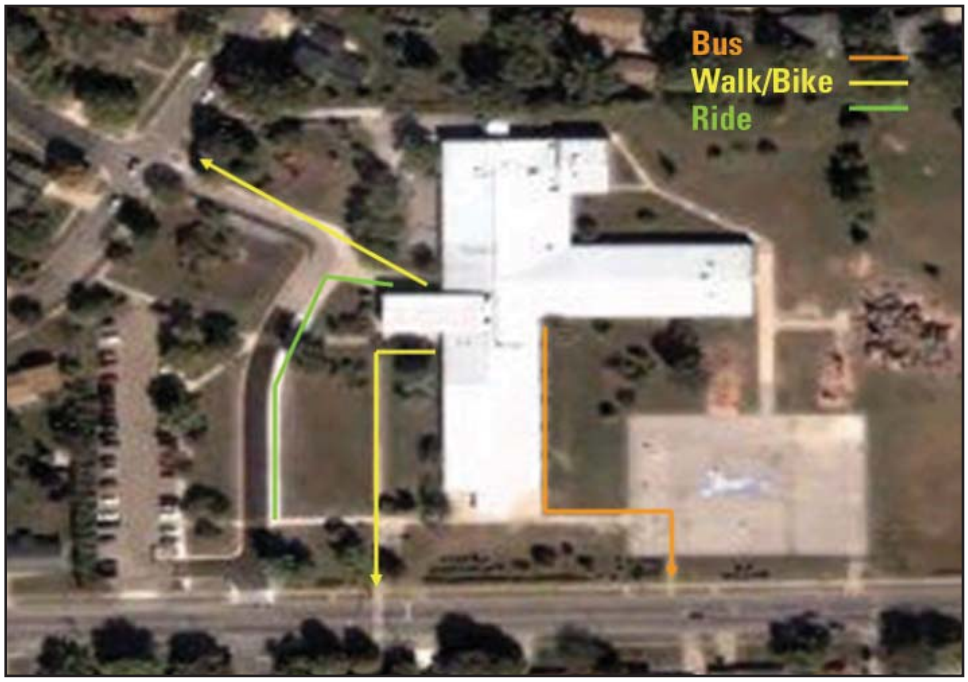


Figure 4.19. School doors designated by transportation mode (Source: GoogleEarth)

Sidewalks can be used to separate pedestrians and bicyclists from vehicles. Case study school #3 has sidewalks that completely surround the perimeter of the school's parking lot, as shown in green in Figure 4.20. This helps encourage children to walk or ride around the parking lot rather than thru it. The school also has a bus unloading/loading area. Children walk to and from the bus in an area completely separated from traffic in the parking lot.

Figure 4.20. Parking configuration at case study school #3 (Source: Iowa DOT)

Other schools used traffic cones to block off areas to separate modes during arrival and dismissal periods. Figure 4.21 illustrates a DO NOT ENTER sign rerouting students to a sidewalk around the parking lot to the side door instead of across the busy driveway. Blocking a sidewalk that crosses a major entrance to the school prevents pedestrian-vehicle conflicts. Figure 4.22 shows the use of traffic cones to prevent vehicles from parking in front of the school where the busses drop off and pick up students.

Figure 4.21. DO NOT ENTER sign to reroute pedestrians away from driveway

Figure 4.22. Use of cones to prevent vehicles from parking in bus drop-off and pick-up areas

4.2.2.D Stagger Dismissal Times

Staggering dismissal times for walkers/bikers, bus riders, and vehicle riders can also be an effective solution to separate transportation modes. By adjusting the dismissal time by 5 minutes, schools with limited space to separate transportation modes can alleviate some of the safety and congestion issues. Staggering the dismissal times slightly for walkers/bikers and/or bus riders may reduce potential conflicts that occur in the driveway and on the adjacent streets with students.

Dismissing walkers and bikers 5 minutes early out of one door and bus riders out of another door, before parents in vehicles are allowed to pick up their children, reduces the number of students crossing the driveways and streets at the same time as vehicles are exiting the school zone. Alternatively, schools may want to hold the walkers until a majority of the students are picked up by their parents.

However, when dismissal times are staggered by mode, consideration should be given to the direction where most vehicles are arriving and leaving the school zone. The success of this solution is dependent on the school location and the destination of the walkers in relationship to traffic. If not considered carefully, this may shift mode conflict problems onto the neighborhood streets.

Carefully orchestrated arrivals and dismissals can potentially improve traffic circulation on site and the adjacent streets. Dismissing walkers and bicyclists first also makes these two modes more attractive and provides an incentive for children to walk, bike, or ride the bus to school. Walkers and bicyclists can also be dismissed through different doors, which can help channel pedestrians or bicyclists away from vehicle traffic.

4.2.2.E Educate Children

Children should also be educated by parents and school programs to cross parking lots and traffic lanes safely. Children should be instructed to

- Cross at designated locations
- Cross at locations with sufficient sight distance when designated crossing are not provided
- Remember to look both ways for moving vehicles at all times
- Avoid crossing lanes of traffic
- Watch for backing vehicles
- Use sidewalks and other pedestrian facilities

4.2.2.F Parking Lot Design and Repainting

Parking lots can be reconfigured and repainted to provide circulation that is more conducive to pedestrians and vehicles sharing space. One source suggests the use of one-way parking lanes, which are simpler for pedestrians to cross because traffic only comes from one direction. They also suggest placing parking spaces at an angle, which provides better sight distance for pedestrians and drivers (Florida DOT 1999). Parking lot design and repainting should also include input from the city traffic engineer who will be able to provide insight into use of space and facilities to improve traffic flow.

4.2.2.G Provide Appropriate Facilities for Drop Off/Pick Up

Designated drop-off and pick-up locations should be evaluated to determine whether adequate facilities are available. Drop-off/pick-up areas should have sidewalks, curbs, large waiting area, and walking space for child pedestrians. They should be located close enough to the school so that children do not have to walk a significant distance by themselves. Parents may be reluctant to use a drop-off/pick-up location if the child exits the vehicle into grass, mud, or walks across an empty lot.

4.2.2.H Encourage Walking and Biking

One of the biggest problems for many of the schools was the number of private vehicles that were picking up and dropping off students daily. For the most part, schools have been unsuccessful in convincing parents to allow their children to walk to school or carpool with other families. New strategies discussed with the schools in the study included creative programs provided in the *Safe Routes to School Handbook* encourage students to walk or bike to school, such as the "frequent rider milers club," "greening the trees" contest, and participating in the international bike or walk to school week (NHTSA 2002). Integrating these programs and contests into school curriculum can be a fun way for students and parents to make lifestyle changes. More information about Safe Routes to School is provided in Chapter 6.

4.3 Disrespect for Traffic Control or School Rules on School Grounds

Traffic control, such as signing and markings, are often used to minimize conflicts between different vehicle modes and provide smoother traffic operation on school grounds. An interesting observation from site visits at many of the case study schools is that parents tend to disregard traffic control on school grounds. Space may be limited for the number of vehicles attempting to access drop-off/pick-up locations, or parents are in a hurry and feel justified in ignoring posted signs and markings. Whatever the cause, the same rules that govern vehicle behavior on the street appear not to apply to parents once they enter school grounds.

Causes

- Parents feel that the rules don't apply to them
- Disregard of traffic control, such as entering wrong way in one-way areas
- Parking in NO PARKING zones, handicap spaces, fire zones, or in front of hydrants
- Leaving vehicles unattended in NO PARKING zones
- Ignoring lane and turning movement restrictions
- Failing to yield right-of-way
- Ignoring adult monitors and failing to use good judgment
- Inconsistent use of signs, pavement marking, and other traffic control send conflicting messages to drivers
- Drivers feel that enforcement is unlikely to occur

Consequences

- Conflicts between pedestrians or bicyclists and vehicles
- Congestion
- Conflicts between vehicles
- Vehicles block fire lanes or other exits and may block emergency access to school
- Vehicles block parking spaces which reduces capacity and turn over of vehicles

Solutions

- Adult monitors
- Clear and consistent use of signing
- Remind parents
- Enforcement
- Educate children and parents

4.3.1 Common Problems

Many parents park in areas where parking is prohibited and double-park, blocking other vehicles. Vehicles were observed parking in NO PARKING areas, fire lanes, and clearly marked BUS ONLY zones, as shown in Figure 4.23. Drivers parked in handicap spots and fire zones without hesitation. This behavior likely would not occur if the drivers were in the central business district of their community. In some cases, vehicles were stopped to drop off or pick up students and drivers remained with their vehicles. In other cases, drivers actually parked in non-designated areas and left their vehicles to enter the school. Many schools report parking in non-designated locations, but they are not sure how to enforce the behavior. At one school, a parking area is used during arrival and dismissal periods as a bus zone. Parking in the indicated spaces is prohibited during arrival and dismissal.

Figure 4.23. Parking in prohibited areas

Parking in fire lanes and in front of fire hydrants, as shown in Figure 4.24 creates a potential safety hazard if an emergency occurs. Emergency vehicles should have access to the schools at all times and fire lanes should be maintained. Even if vehicles are attended by drivers, they may not be able to get out of the way should emergency vehicles need to access the building or site. Allowing drivers to park in fire lanes at certain times during the day provides an inconsistent message. Figure 4.24 (right) shows a driveway that has both curbs painted as a fire lane, yet parents are allowed to park in the right lane before and after school.

Figure 4.24. Vehicles violating emergency vehicle ordinances

Parents often disregard signs and pavement markings indicating one-way lanes and prohibited turning movements, as shown in Figure 4.25. These signs are usually placed to facilitate circulation through the school grounds and/or prevent unsafe maneuvers. When drivers ignore traffic control that restricts certain movements, vehicle conflicts may occur, leading to congestion and unsafe situations. Pedestrians and other drivers who do not expect vehicles to turn left may not pay attention to this movement. They may also fail to check for vehicles driving in the wrong direction.

Figure 4.25. Drivers ignoring one-way markings

Drivers on school grounds also fail to yield the right-of-way to pedestrians in marked crosswalks and sidewalks, as shown in Figure 4.26. As parking lots and school driveways get full, drivers try to squeeze into place and often block sidewalks adjacent to the schools. They may also fail to use good judgment and watch for pedestrians and bicyclists while loading and unloading. In some cases, drivers completely disregarded adult monitors as they engaged in unsafe traffic-related behavior.

Figure 4.26. Vehicles block crosswalks and sidewalks adjacent to schools

4.3.2 Solutions and Case Study Best Practices

On-site traffic control is difficult to enforce since educators have few legal recourses to force parents to comply. The following are solutions used by schools evaluated.

4.3.2.A Adult Monitors

Several schools have adult monitors who remind parents about following traffic rules when infractions occur and report violations to track repeat offenders. Other schools use adult monitors and traffic cones to direct vehicles to the appropriate drop-off and pick-up locations. The presence of adult monitors does not always discourage poor parental behavior but does provide adult supervision during chaotic times before and after school.

4.3.2.B Consistent and Clear Use of Traffic Control

At a number of school sites there was an inconsistent and sometimes unclear use of traffic control devices, specifically signs and pavement markings. A number of schools use NO PARKING signs or yellow pavement markings to control traffic. A NO PARKING sign typically means that drivers can stop in the designated NO PARKING space for a short amount of time but cannot leave their vehicles unattended. In some cases, schools use NO PARKING signs to mark zones where pick up and drop off occur. The schools intend for drivers to stop and wait, but not leave their vehicles unattended. In other cases, the schools intend NO PARKING to mean no parking, stopping, or waiting (standing) regardless of whether or not the vehicle is attended. The school's intention and meaning for the traffic control must be conveyed to the parents for compliance to occur. The meaning should also be consistent with the city codes and state laws. Two examples of signing that provide additional information to the driver are shown in Figure 4.27.

Figure 4.27. Examples of informative parking signs

When signing and pavement markings are not used consistently to convey the same message as drivers expect in others situations, such as on the street, getting parents to comply becomes difficult. Case study school #1 has a one-way, 2-lane driveway in front of the school that is a designated as a fire lane (i.e., red pavement marking and fire lane signing). Both curbs are striped with red pavement marking to indicate a fire lane, as shown in Figure 4.28, and supplemented with a NO PARKING ANYTIME FIRE LANE sign. Despite this, it also serves as the designated drop-off/pick-up location during arrival and dismissal. During arrival and dismissal, the school allows vehicles to park in the right lane to load and unload students and then enter the left lane to exit the school

driveway. This provides an inconsistent message since both sides of the driveway have the same traffic control, but two different actions are expected. Vehicles are expected to drop off/pick up on the right and exit on the left. The image in Figure 4.28 (right) shows yellow pavement marking which sends a different message and would indicate, with the proper signing, that loading and unloading is acceptable. In this case, it was suggested to consider painting the curb side lane with yellow pavement marking and adding NO PARKING signs that would allow parents to stop but not leave their vehicles.

Figure 4.28. Confusing message sent by red fire lane marking (left) and modification to clarify the parking restrictions (right)

Figure 4.29. Storage of roll-out STOP signs obstructs existing STOP sign

Figure 4.29 illustrates two roll-out STOP signs stored with a permanent STOP sign. Drivers may mistakenly believe that this location is used to store roll-out STOP signs and they may disregard the actual STOP sign.

Inconsistent messages sent to drivers tend to affect the compliance with all traffic control on school grounds. Traffic control on school grounds should follow the same conventions used on public streets and parking lots. The message should be consistent and clear.

Traffic engineers use a set of guidelines that call for consistent and uniform use of any traffic control device, including pavement markings and signs. Traffic signs, for instance, should be of uniform size, color, and placed at a specific height. Uniform and consistent traffic control ensures that drivers understand the message and know what the expected action should be.

The *Manual on Uniform Traffic Control Devices* (MUTCD 2003) promotes the uniform placement of traffic signals, signs, and pavement markings on roadways, as well as provides guidance for construction zones, school zones, and bicycle facilities. The MUTCD is predominantly used by traffic engineers, but schools should follow the same conventions used by traffic engineers when placing signs, pavement markings, or other traffic control on school grounds to ensure consistency. According to the 2003 edition of the MUTCD, to be effective, traffic control devices should

1. fulfill a need;
2. command attention;
3. convey a clear, simple meaning;
4. command respect from road users; and
5. give adequate time for proper response.

Section 7 of the MUTCD is exclusively dedicated to traffic control for school areas. More information on the MUTCD can be found in chapter 6. NO PARKING signs, in particular, are misapplied on school grounds. Table 4.2 illustrates different meanings of NO PARKING signs. Many of the regulations and interpretation of these signs and pavement markings are included as part of the city or municipal codes. It is recommended that schools work with their local municipalities to interpret the meaning of these signs and of pavement markings in their area. Parents should be educated about the meaning of the signs and pavement markings.

The use of too much signing should also be avoided. Drivers who are bombarded with too much information or information that is confusing are likely to ignore the information provided. The simplest signing should be used to convey the message.

Table 4.2. Different uses of NO PARKING signs

Sign	Meaning
	Drivers may wait in parked vehicles for a short period of time at this location, but they may not leave the vehicles unattended.
	Drivers should not stop, pullover, or park for any length of time.
 	Drivers may stop and wait while they are loading or unloading passengers, but may not leave vehicles unattended.

4.3.2.C Remind Parents

When parents ignore posted traffic control, some schools document violators (license plates) and record offenses. Case study school #11 places friendly notes, as shown in Figure 4.30, on the windshields of vehicles parked in non-parking locations. Offenders can be sent a letter, or a meeting between the school and parent can be requested, if the behavior persists. Parents can be reminded to follow designated traffic control and access school grounds safely at back-to-school meetings, in newsletters, and during parent-teacher conferences. See Chapter 6 for more information about communicating with parents.

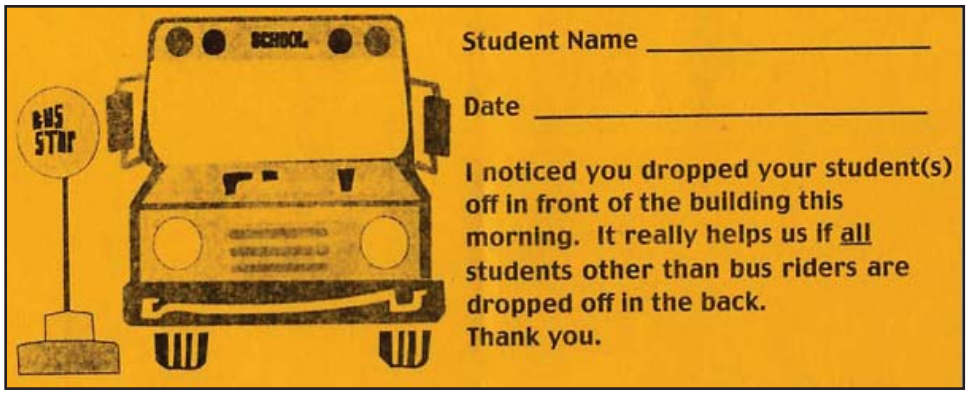


Figure 4.30. Reminder to parents about dropping off in bus zone (Source: Linn County School)

School officials in Sandy City, Utah, developed a Parent Parking Patrol (PPP). Volunteers monitor specific areas of the schools. When they observe traffic violations, volunteers approach offenders in a non-confrontational manner and provide safety-related materials and a warning note. Volunteers record the license plate of habitual offenders and report this information to the local police department. They indicated that traffic violations by motorists and pedestrians at schools that participate are substantially reduced when compared to non-participating schools (NHTSA 2005).

A number of schools have developed educational materials that can be sent home to parents to remind them to observe traffic controls and behave safely in school zones. Appendix illustrates educational materials developed by the city of North Las Vegas and the city of Richmond, British Columbia.

4.3.2.D Enforcement

Although law enforcement officers may not have jurisdiction over traffic control violations on school grounds or the resources to monitor schools, enforcement was used at several schools to encourage parents to comply with school ground traffic control. At case study school #1, the principal first tried having adult monitors remind drivers of the posted notices such as NO PARKING. While a number complied, some did not and the problem became repeatedly worse. After speaking with law enforcement officials, they agreed that adult monitors would write down the license plate numbers of repeat offenders and then the local police would issue a ticket. They hope that those who completely disregarded educators would at least respond to a traffic violation.

In one school district, local law enforcement actively works with the school to identify problems both on and off school grounds. Officers regularly patrol school zones to discourage bad behavior.

4.3.2.E Involve Parents

Parents who repeatedly ignore efforts to improve the operation and safety situation on school grounds may be "sold" on the idea if they actually see the problem for themselves. Involving parents in assessing safety on the school grounds, collecting data, and brainstorming solutions allows them to see for themselves the potential consequences of the actions of those who disregard safety rules. Parents who usually obey school ground rules can also be involved. Parents who observe the consequences of bad behavior may be willing to provide peer pressure to parents who continue disregarding school rules. Peer pressure can be a more powerful motivating factor than school officials or even enforcement personnel chastising offenders.

4.4 Speeding On-Site

Speeding was observed on the school grounds of a number of the evaluated schools. There is a tendency for parents to pick up their child and then speed off to work or back home without considering the other pedestrians and bicyclists in the area. Speeding may also be a result of other drivers using the school grounds as a cut-through area.

Causes

- Parents are in a hurry and speeding through drop-off/pick-up areas or parking lots
- Long open driveways and parking lots are conducive to speeding
- Cut-through traffic

Consequences

- Pedestrian struck at higher speeds are more likely to be injured or killed than at lower speeds

Solutions

- Control drop off and pick up
- Traffic control
- Traffic calming
- Change driveway alignment
- Restrict access

4.4.1 Common Problems

Speeding appeared to be the most pronounced at case study schools which had long driveways in front of the school, large parking lots, and other wide open spaces. When the school is located at the far end of a long driveway or parking lot, parents tend to speed until they reach the drop-off/pick-up point. When the school is located at the beginning of the driveway, they tend to pick up/drop off at that point and then speed away.

Speeding on school grounds can usually be attributed to parents who are in the process of dropping off or picking up children. In some cases, drivers on adjacent streets may use school parking lots and queuing areas as a shortcut. In other cases, high schools are adjacent to middle and elementary schools and the arrangement of driveways facilitates cut-through by high school students arriving or leaving school. The driveway configuration at case study school #9 illustrates this situation, as discussed in Chapter 3.

4.4.2 Solutions and Case Study Best Practices

The following sections discuss solutions to on-site speeding.

4.4.2.A Control Drop Off and Pick Up

The schools who have implemented a procedure where vehicles stay in queue until they reach a designated drop-off/pick-up point appear to have fewer problems with speeding. Forcing vehicles to stay in line to a designated point physically provides less driveway area for vehicles to accelerate and keeps vehicles in queue at a low speed. Additional discussion on controlling drop off and pick up is found in Section 4.1.2.F.

4.4.2.B Traffic Control

Several sites used signs to remind drivers to slow down. Speed limit signs can also be posted for an appropriate speed in the driveway (i.e., 5 mph or 10 mph).

4.4.2.C Traffic Calming

A number of on-street traffic calming devices used by traffic engineers, such as speed tables (which differ significantly from speed bumps), may be appropriate for driveways and queuing areas on school sites. Traffic calming devices either physically force drivers to slow down using horizontal or vertical displacements, or provide visual clues to remind drivers that they are on school grounds and should slow down. Traffic calming devices, such as raised pedestrian crossings, speed tables, bump-outs, and in-street crosswalk signs may be appropriate for on-site application, as shown in Figure 4.31. A traffic engineer should be consulted before selecting or installing calming devices since some devices are only appropriate under certain circumstances.

Intersection bulb-outs

In-pavement pedestrian crossing sign

Figure 4.31. Traffic calming devices

4.4.2.D Reconfigure Parking and Circulation Areas

Long straight open spaces, whether they are streets or drop-off/pick-up areas at schools, may promote speeding since there are no physical or psychological constraints reminding drivers to do otherwise. Changing driveway alignment may be accomplished by physically redesigning on-site parking and queuing facilities. When physically redesigning school parking lots is not practical, the same effect can be achieved by channeling traffic using pavement markings or traffic cones.

4.4.2.E Reduce Access

In some cases, speeding on school grounds is a result of cut-through traffic. When cut-through traffic is suspected, school officials should conduct site studies to verify that this is the case. Cut-through traffic may be discouraged by setting up one-way traffic patterns that are inconvenient to the cut-through. Turn restrictions may also discourage cut-through traffic. In some cases, blocking access to certain entrances or exits may be necessary.

4.5 Summary

Common transportation safety and operation problems on school grounds were discussed in this chapter. Solutions were identified and presented. Common problems and solutions were summarized in Table 4.1 for easy reference.

Gaining control over traffic on school grounds takes the effort of many stakeholders. School administrators, principals, city, law enforcement, parents, and students need to work together to find a unique solution for their school to create a safer and more efficient arrival and dismissal experience.

Chapter 5

School Zone (On-Street): Common Transportation Safety Issues and Solutions

This chapter discusses common operation and safety problems that occur on the street network surrounding schools, referred to as "on-street." Problems that spill onto the adjacent streets from the school driveways are typically handled by traffic engineers and/or law enforcement officials. In some cases, traffic engineering solutions are feasible to implement for surrounding streets. In other cases, traffic engineers must coordinate with school officials to find solutions.

Common transportation safety and operation problems and solutions on public streets adjacent to school grounds are identified and discussed in the following sections of this chapter. They are summarized in Table 5.1, as well for easy reference. Refer to the appropriate section for a detailed description of each.

This toolbox is intended primarily for use in solving congestion and safety problems around existing elementary and middle schools. For more information on addressing congestion and safety problems for new school sites, the Texas Transportation Institute (Cooner et al. 2004) developed a handbook titled *Traffic Operations and Safety at Schools: Recommended Guidelines*.

Table 5.1. Issues and solutions for on-street traffic operational and safety issues

Issue	Solutions	
Queuing and spillback on streets adjacent to schools		
Queues exceed school ground capacity and spill out onto street	**School Ground Solutions**	
	Reconfigure on-site school parking and circulation areas	(5.1.2.A, 4.1.2.D)
	Control on-site drop off and pick up	(5.1.2.B, 4.1.2.F)
	Provide arrival and dismissal plans	(4.1.2.B)
	Designate drop-off and pick-up locations for private vehicles	(4.1.2.C)
	Redesign or repaint parking lots to facilitate traffic flow	(4.1.2.D)
	Provide adult monitors	(4.1.2.E)
	On-street Solutions	
	Move drop-off/pick-up locations to locations better able to handle queuing	(5.1.2.C)
	Prevent turning movements	(5.1.2.D)
	Use of consistent and clear signing and pavement marking	(5.1.2.E)
Speeding		
Speed in school zones	Traffic calming	(5.2.2.A)
	Visible school zone	(5.2.2.B)
	Remind drivers	(5.2.2.C)
	Enforcement	(5.2.2.D)
Drivers not slowing down because they regularly use the facility during non-school hours	Traffic calming	(5.2.2.A)
	Visible school zone	(5.2.2.B)
	Remind drivers	(5.2.2.C)
Traffic calming	Traffic calming	(5.2.2.A)

Table 5.1. (*continued*)

Issue	Solutions	
On-street vehicle/pedestrian/bicyclist conflicts		
Pedestrian/vehicle conflicts	Treat child pedestrians differently	(5.3.2.A)
	Designate pedestrian crossings	(5.3.2.B)
	Visible school zones	(5.3.2.C, 5.2.2.B)
	Educate children	(5.3.2.D)
	Use of adult crossing guards	(5.3.2.E)
	Signing and pavement markings	(5.3.2.F, 5.1.2.E, 4.3.2.B)
Distracted drivers	Visible school zones	(5.3.2.C, 5.2.2.B)
	Use of adult crossing guards	(5.3.2.E)
	Signing and pavement markings	(5.3.2.F, 5.1.2.E, 4.3.2.B)
	Maintenance and sight obstruction	(5.3.2.H)
Crossing locations for pedestrians or bicyclists not designated	Treat child pedestrians differently	(5.3.2.A)
	Designate pedestrian crossings	(5.3.2.B)
	Use of adult crossing guards	(5.3.2.E)
	Educate children	(5.3.2.D)
Pedestrians/bicyclists ignore designated crossing locations	Treat child pedestrians differently	(5.3.2.A)
	Use of adult crossing guards	(5.3.2.E)
	Signing and pavement markings	(5.3.2.F, 5.1.2.E, 4.3.2.B)
	Maintenance and sight obstruction	(5.3.2.H)
Large numbers of teen drivers during arrival and dismissal periods	Stagger high school arrival/dismissal times with elementary and middle schools	(5.3.2.G)
	Visible school zones	(5.3.2.C, 5.2.2.B)
	Use of adult crossing guards	(5.3.2.E)
Sight distance issues	Visible school zones	(5.3.2.C, 5.2.2.B)
	Maintenance and sight obstruction	(5.3.2.H)
Use of student crossing guards	Use of adult crossing guards	(5.3.2.E)

Table 5.1. (*continued*)

Issue	Solutions	
Intersection vehicle/pedestrian/bicyclist conflicts		
Child behavior	Provide marked crosswalks	(5.4.2.A, 5.3.2.B)
	Intersection treatments	(5.4.2.B)
	Use of temporary traffic control	(5.4.2.C)
	Adult crossing guards	(5.4.2.D, 5.3.2.E)
Driver behavior	Provide marked crosswalks	(5.4.2.A)
	Intersection treatments	(5.4.2.B)
	Use of temporary traffic control	(5.4.2.C, 5.5.2.E)
	Adult crossing guards	(5.4.2.D, 5.3.2.E)
	Maintenance and sight obstruction	(5.4.2.E, 5.3.2.H)
Use of temporary traffic control	Use of temporary traffic control	(5.4.2.C)
Intersection treatments	Intersection treatments	(5.4.2.B)
Traffic violations		
Violation of parking restrictions	Consistent use of signing	(5.5.2.B, 5.3.2.F, 5.1.2.E, 4.3.2.B)
	Enforcement	(5.5.2.D)
	Use of temporary traffic control	(5.4.2.C, 5.5.2.E)
Drivers entering crosswalks with pedestrians present	Visible school zones	(5.5.2.A)
	Consistent use of signing	(5.5.2.B)
	Education	(5.5.2.C)
	Enforcement	(5.5.2.D, 5.2.2.D)
	Use of temporary traffic control	(5.4.2.C, 5.5.2.E)
	Adult crossing guards	(5.4.2.D, 5.3.2.E)
Other violations of traffic control	Visible school zones	(5.5.2.A)
	Consistent use of signing	(5.5.2.B)
	Education	(5.5.2.C)
	Enforcement	(5.5.2.D, 5.2.2.D)
	Use of temporary traffic control	(5.4.2.C, 5.5.2.E)
	Adult crossing guards	(5.4.2.D, 5.3.2.E)

Table 5.1. (*continued*)

Issue	Solutions	
Other issues		
Case studies of Iowa schools	Chapter 3	
Use of roll-out and fold-down STOP signs	Use of temporary traffic control	(5.4.2.C, 5.5.2.E)
Use of student safety patrol	Guidelines for crossing guards and student safety patrol Use of adult crossing guards	(6.4) (5.3.2.E)
Adult crossing guards	Guidelines for crossing guards and student safety patrol Use of adult crossing guards	(6.4) (5.3.2.E)
Traffic and safety studies in school zones	Traffic and safety studies in school zones Conflict studies	(6.6) (2.3)
Development of a "Safe Route to School Plan"	Development of a "Safe Route to School Plan"	(6.7)

5.1 Queuing and Spillback on Streets Adjacent to Schools

Traffic around schools is condensed to a short period around the morning drop-off and afternoon pick-up times. Since an increasing number of parents drive their children to and from school, nearly 50%, trips to school and therefore traffic on the surrounding streets are increasing. The morning trips, in particular, coincide with the morning peak hour rush. As a result, vehicles attempting to access the school to drop off or pick up often queue on adjacent streets.

Causes

- Queues exceed school ground capacity and spill onto adjacent streets
- Planned on-street drop off/pick up
- Random on-street drop off/pick up

Consequences

- Congestion around school zones
- Drivers caught in queues may engage in erratic behavior to get around queue
- Site obstructions make it more difficult to see child pedestrians and for child pedestrians to see drivers

Solutions

- Reconfigure on-site school parking and circulation areas
- Control on-site drop off and pick up
- Move on-street pick-up locations
- Prevent turning movements
- Use clear and consistent signing

5.1.1 Common Problems

Traffic queues on adjacent streets for several reasons. First, a number of schools actually designate drop-off/pick-up locations on the streets, as shown in Figure 5.1. Of the schools evaluated for this project, a total of seven schools used adjacent streets as their primary drop-off/pick-up locations. This was more the case for older urban schools built within neighborhoods. In other cases, drop off and pick up occurs on the street because there is no formal designation of drop-off or pick-up locations, so parents park wherever it is the most convenient. On-street parking often occurs even if the school has a designated drop-off/pick-up location.

Figure 5.1. Designated drop off and pick up on public street

Queuing also occurs when the capacity of on-site locations is exceeded or used inefficiently and traffic spills back from the school grounds onto adjacent streets, as shown in Figures 5.2 and 5.3. A study by Sear-Brown (2003) evaluated school zones and found morning drop-off queues up to 13 vehicles long, with an average queue of 9 vehicles, and afternoon pick-up queues up to 46 vehicles long, with an average queue of 34 vehicles. Few schools' ground configurations are equipped to handle afternoon queues of this length without spilling onto adjacent streets.

Figure 5.2. Spillback onto adjacent streets

On-street queuing is often more pronounced for the afternoon pick-up period, even though more private vehicles drop off in the morning. This is likely because in the morning parents can drop off their children immediately, while in the afternoon parents arrive before school is dismissed and wait until children exit the school. A study in North Carolina indicated that 50% of schools experience queuing in afternoon that exceeds on-campus storage space, causing spills onto adjacent streets and disrupting normal traffic patterns (Rhoulac 2005).

Figure 5.3. On-street queuing

On-street queuing from school zones significantly reduces roadway capacity and causes delays and driver frustration. Figure 5.4 shows a street adjacent to a case study school where queuing and drop-off/pick-up activities create significant congestion. Queuing around school zones is somewhat different than queuing at other locations, such as at a traffic signal. Queues at a traffic signal may be significant, but typically clear within a cycle or two. As a result, drivers expect that, once caught in this type of queue, they will be able to clear the queue in a reasonable amount of time. Queuing in school zones is much different. A line of vehicles often forms well before school dismissal time. Then the same vehicles remain queued for a significant length of time blocking the roadway for through vehicles. Drivers caught in this type of queue realize that they will not be able to clear the queue in a reasonable amount of time. This can lead to excessive driver frustration and unsafe behavior, such as passing vehicles in opposing lanes of traffic or cutting through neighborhoods to avoid the queue.

Figure 5.4. On-street congestion

Queuing also obstructs visibility. With a number of vehicles parked at different locations along a roadway, it may be difficult for pedestrians and bicyclists to assess whether or not a vehicle is approaching or speeding. They also may not see vehicles swinging out around queued vehicles. It also makes it more difficult for drivers to see pedestrians and bicyclists and provides more opportunities for children to dart out from between parked cars.

On-street queuing occurred at 70% of the schools evaluated as case studies. Queuing studies were conducted at two of the case study schools, as discussed in Chapter 3, with queues up to 16 vehicles forming regularly on streets adjacent to the schools. Specific examples were provided in case study schools #6 and #18.

5.1.2 Solutions and Case Study Best Practices

Major on-street improvements, such as widening or adding an additional lane to allow vehicles to maneuver around queued vehicles, are rarely cost-effective. Major improvements may also increase on-street speeds (Brown and Harris 2003). On-street queuing is usually a result of conditions and congestion on school grounds, both of which should be addressed when developing on-street solutions.

5.1.2.A Reconfigure On-site School Parking and Circulation Areas

The best solution to on-street queuing, when possible, is to move drop-off/pick-up activities off the street onto the school grounds. Another solution is to construct a curb inset for vehicles to pull out of the through lane. Drop off and pick up on school grounds can be controlled to an extent; whereas, off-site control may only be achieved through aggressive and consistent enforcement. Although major on-site changes are not feasible, on-site parking and circulation areas may be reconfigured to accommodate more vehicles and facilitate better circulation. Reconfiguration of on-site parking and circulation areas is discussed more in Sections 4.1.2.E and 4.4.2.D.

5.1.2.B Control On-site Drop Off and Pick Up

Even when parking lots and on-site drop-off/pick-up locations are designed to meet expected demand and appropriately signed to channel drivers to designated locations, traffic flow can still break down due to driver behavior and inefficient use of space, leading to back-up and queuing on adjacent streets. Inefficiency also results when vehicles randomly arrive and haphazardly park along designated pick-up locations. For example, a queuing area designed to handle 20 vehicles may only be handling 15.

Several schools have addressed this by implementing an on-site management plan. These schools provide adult monitors who channel children to specific drop-off/pick-up locations. At several schools, children wait at a designated location, and, when their parents arrive for pick up, an adult monitor (i.e., teacher, staff, or volunteer) calls out the students' names and they enter their parents' vehicles at a designated location. The arrangement facilitates on-site child safety. It is described more fully in Sections 4.1.2.F and 4.4.2.D.

5.1.2.C Move Drop-off/Pick-up Locations to Locations Better Able to Handle Queuing

Most schools have designated drop-off/pick-up locations on the school site. However, some schools, particularly urban schools, can only accommodate drop off/pick up on the street. One strategy to address on-street congestion and queuing is to move drop-off/pick-up activities to locations better able to handle them. For instance, significant queuing along a busy road may be alleviated by routing traffic to drop off and pick up at another location, such as a minor street or a street with more access points.

Alternatively, queuing may be moved from locations where queuing blocks minor streets to streets better able to handle the queuing. Case study school #1 reconfigured their on-site traffic, as shown in Figure 5.5. Their concern was the large amount of traffic routing through and queuing in an adjacent neighborhood with poor outlets to collector streets. The street adjacent to the school is a wide 2-lane roadway, which is able to handle queuing along the street in front of the school and still accommodate through movements. Traffic through the school grounds was converted to one-way except for access into the parking lot. This moved exiting traffic away from vehicles queued on the street, reducing vehicle conflicts.

Before Access Change (Source: Iowa DOT) After Access Change (Source: GoogleEarth)

Figure 5.5. Queuing moved to wider street at case study school #1

5.1.2.D Restrict Turning Movements

Particular movements, such as only allowing right turns out of or into school properties, more commonly called "right-in, right-out" access, can help alleviate congestion and queuing in some locations. Traffic may back up on both sides of a street entering a school as vehicles attempt to make both right and left turns. Restricting left turns into the school may increase queuing in the opposite direction, but prevents queuing in both directions. Restricting or separating left turns out of school properties can alleviate traffic backing up on school grounds as well, especially when there may be few gaps for vehicles to enter traffic. Prohibiting left turns out of schools also leads to fewer conflict points especially at exits onto busy roadway. Right turns may also be prohibited when the existing street configuration cannot handle that movement into or out of the school. Figure 5.6 shows two examples used at case study schools. It should be noted, however, that simply placing signs may not change driver behavior.

Figure 5.6. Restricting turning movements during school hours

5.1.2.E Use Consistent and Clear Signing and Pavement Marking

Although traffic engineers adhere to guidelines in the *Manual on Uniform Traffic Control Devices* (MUTCD) or other local guidelines, the interpretation of traffic control, including pavement markings and signing, may not be clear in the context of school zones. The MUTCD indicates that pedestrian safety in school zones depends on public understanding of accepted and uniform traffic control devices and policies. Traffic control devices used inconsistently causes confusion for both pedestrians and drivers, results in wrong decisions, and contributes to crashes (FHWA 2003).

The intent of a NO PARKING sign is to prevent vehicles from blocking through lanes and fire access, reducing capacity, or obstructing sight distance. In most cases, this means that drivers should not park and leave their vehicles unattended, but they may stop in the space for a short period of time if their vehicles are attended. In a school zone, however, a number of drivers stop in the NO PARKING areas and wait for a significant amount of time (i.e., 30 to 45 minutes) for school to dismiss. When these vehicles queue in NO PARKING areas, they often block fire lanes, hydrants, sidewalks, and intersections; obstruct flow; and create sight distance problems. Figure 5.7 shows a car parked in a NO PARKING zone where it is blocking the sight distance of a crosswalk (left) and unconventional curb markings on a street inset to indicate unconventional parking restriction. Signing, as shown in Figure 5.8, used to supplement the parking restrictions may be easier to interpret for drivers as it provides more information. In all cases, the MUTCD and local traffic control guidelines and ordinances should be consulted and followed.

Figure 5.7. Vehicle blocking view of crosswalk from a driveway (left); dashed pavement marking to indicate unconventional parking regulations (right)

Figure 5.8. Use of signing to clearly indicate desired action

5.2 Speeding

Speeding in school zones is particularly dangerous due to the presence of unaccompanied child pedestrians and bicyclists, who may have a more difficult time judging oncoming speeds than adults and may be less likely to pay attention. Speeding is also dangerous when vehicles are queued on the street waiting to drop off or pick up children and drivers are unable to see child pedestrians crossing between parked vehicles.

Drivers who are speeding have less time to react and be aware of their surroundings. Figure 5.9 illustrates differences in what a driver is able to perceive as speeds increase from 15 to 40 mph (TGM 1999). As shown, a driver's area of focus is significantly decreased at higher speeds. Higher speeds also increase the likelihood and severity of vehicle/pedestrian crashes. The Oregon DOT reports that a pedestrian struck at 40 mph has an 85% chance of being fatally injured, at 30 mph a pedestrian has a 45% chance, and at 20 mph a pedestrian has a 15% chance of being fatally injured (TGM 1999).

Causes

- Drivers are in a hurry
- Drivers not slowing down because they regularly use the facility during non-school hours and don't notice reduced speeds

Consequences

- Drivers have less time to react
- Pedestrians struck at higher speeds are more likely to be injured or killed than at lower speeds
- More difficult for child pedestrians to judge gaps in traffic at higher speeds

Solutions

- Traffic calming
- Education
- Enforcement

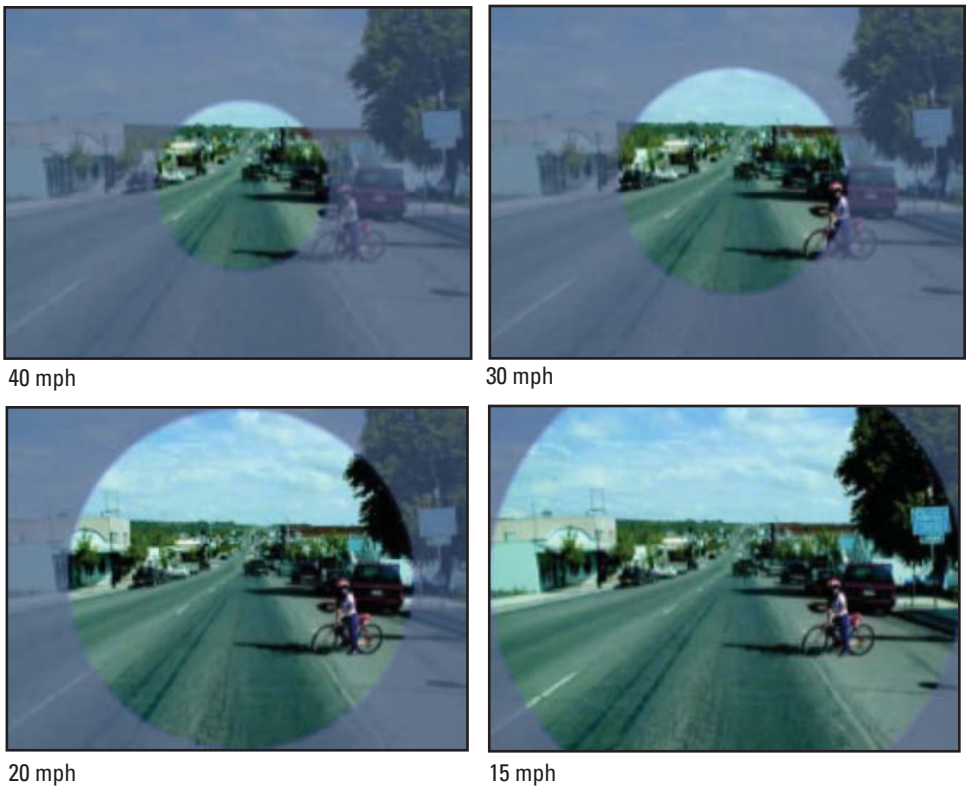


Figure 5.9. Driver focus at different speeds (Source: TGM 1999)

5.2.1 Common Problems

Speeding is common in school zones. Some drivers may ignore posted school zone speed limits, while others may be used to driving the roadway outside of school arrival and dismissal times and simply fail to realize that conditions have changed. A study in Mendocino County, CA, indicated that at the start of each new school year, the county receives complaints that motorists ignore the 25 mph speed limit and fail to yield the right of way to children in crosswalks (Ford 2005).

Lack of redundancy in signing and pavement markings in school zones may contribute to speeding. The pavement markings are visible reminders to drivers to slow down and that pedestrians may be present. Figure 5.10 shows examples of two schools with poor school zone pavement marking maintenance.

Figure 5.10. Obliterated and faded pavement markings

5.2.2 Solutions and Case Study Best Practices

5.2.2.A Traffic Calming

A number of traffic calming measures can be used in school zones. A school safety task force in Phoenix, AZ, suggested use of several traffic calming measures. One measure included placing a horizontal sign SCHOOL on approaches to school crossings on arterial or busy collectors. They also used driver feedback speed monitors which only operate during school times. The city of Milwaukee, OR, used speed humps and a neighborhood speed watch program, which included use of radar guns, advisory letters to speeders, banners, and media coverage (ODOT 2005). Driver feedback signs are being more frequently used in school zones to slow vehicles down. Figure 5.11 shows an example of this traffic calming device.

Figure 5.11. Driver feedback sign in school zone

The city of Eau Claire, WI, installed bump-outs at intersections with marked crosswalk that were designated as part of the "Safe Routes to School" plan for a new elementary school. In-street signs may also make school zones and midblock crossings more visible. Figure 5.12 shows examples of both of these traffic calming measures.

Figure 5.12. Crosswalk bump-outs in a school zone (left) and in-street signing (right)

ITE publishes a list of traffic calming devices by location. Devices appropriate to schools are provided on the following page.

Traffic Calming Tools by Location

Local

1. Curb Extensions
2. Medians
3. Refuge Islands
4. Tree Wells
5. Inset Parking
6. Narrow Lanes
7. Midblock Crossings
8. Curb Radius Reductions
9. Bike Lanes
10. Roundabouts
11. Modified Intersections
12. Median Noses
13 Driveway Modifications
14. Lane Reductions
15. Mini-Circles
16. Speed Tables
17. Raised Intersections
18. Short Medians
19. Medians on Curves
20. Partial Closure
21. Chokers
22. Chicanes
23. Speed Humps

School

1. Curb Extensions
2. Medians
3. Refuge Islands
4. Tree Wells
5. Inset Parking
6. Narrow Lanes
7. Midblock Crossings
8. Curb Radius Reductions
9. Bike Lanes
10. Roundabouts
11. Modified Intersections
12. Median Noses
13 Driveway Modifications
14. Lane Reductions
15. Mini-Circles
16. Speed Tables
17. Raised Intersections
18. Short Medians
19. Medians on Curves
20. Partial Closure
21. Chokers
22. Chicanes
23. Speed Humps

Arterial

1. Curb Extensions
2. Medians
3. Refuge Islands
4. Tree Wells
5. Inset Parking
6. Narrow lanes
7. Midblock Crossings
8. Curb Radius Reductions
9. Bike Lanes
10. Roundabouts
11. Modified Intersections
12. Median Noses
13. Driveway Modifications
14. Lane Reductions

Other types of traffic calming measures that might be appropriate in school zones include the following (NHSTA 2002):

- Narrow lane
- Median islands
- Gateways
- Speed humps or tables
- Raised crosswalks
- Raised intersections
- High-visibility crosswalks
- Chicanes
- One-way streets
- In-street pedestrian signs
- Raised pedestrian crossings, when high volumes warrant (Florida DOT 1999)
- Speed enforcement, such as use of speed signs

5.2.2.B Visible School Zone

Drivers may speed because they are not aware they are in a school zone. Changes in speed limit may not always be noticed by drivers when not accompanied by visible school zone warnings. Visual reminders, such as flashing speed limit signs, speed limit sign with flags, and overhead pedestrian crossing signs, may also serve as supplementary reminders, as shown in Figure 5.13.

Figure 5.13. School zone speed limit signing

A school zone that has features which clearly indicate it as such is more likely to get the attention of motorists and remind them to slow down. A study used red textured pavement in school zones to catch drivers' attention and alert them to watch for children crossing the roadway. An example of textured pavement is illustrated in Figure 5.14 (CWS 2003).

Figure 5.14. Use of textured pavement as a traffic calming measure (Source: CWS 2003)

Signing and pavement markings should be maintained so that they are clearly visible. School zone signing and pavement markings should be checked at the beginning of the school year and periodically thereafter to ensure that signs are in good shape and not blocked by vegetation. Enhanced pedestrian crossing signs with pedestrian activated flashing warning lights, provide additional cues to the drivers that pedestrians will be crossing the roadway. Figures 5.15 and 5.16 show examples of crosswalks near Drake University and well-maintained crosswalk pavement marking in the Des Moines area, respectively.

Figure 5.15. Pedestrian crossing signs with push button activated flashing LED lights

Figure 5.16. Freshly painted crosswalk

5.2.2.C Remind Drivers

Drivers need to be reminded to observe traffic control devices and speed limits in school zones. Drivers may drive through the school zone regularly during non-school hours and, as a result, forget to slow down and watch for pedestrians when school is in session. Drivers may need to be reminded when school starts up again after summer or extended school vacations. Drivers can be educated via television, radio public service announcement, or sent-out driver safety alerts (NHTSA 2002).

5.2.2.D Enforcement

Although enforcement is left up to the discretion of local law enforcement agencies, it can be a powerful tool in reducing speeds around school zones and ensuring compliance with other traffic control. Schools in Phoenix, AZ, began using photo speed enforcement in school zones during school times and established a zero tolerance policy for speeding (Cynecki et al. 2005). The states of Colorado and Maryland both post FINES DOUBLE in school zones, as shown in Figure 5.17. This is a similar strategy that is used in many state construction zones.

Figure 5.17. Fines double in school zone in Colorado and Maryland

Some of the case study schools felt that local law enforcement did not pay attention to their needs. In one case, a police department representative stated that it was not uncommon for officers to avoid school zones during arrival and dismissal periods because of the chaos. The representative was invited to observe traffic at one of the schools within their jurisdiction and they were surprised at all the various safety problems both on the street and on the school grounds. The representative's "eyes were opened" by the experience and changed their attitude about the importance of monitoring safety at schools. This is a good example as to why it is important to involve local law enforcement as these problems are addressed.

Several case study schools are fortunate to have law enforcement officers who work regularly with the school district. Officers patrol school zones and grounds regularly and respond when schools report continuing problems. One case study school district is fortunate to have two police officers assigned to all schools within the district before and after school. The officers rotate around the various schools in order to maintain a presence throughout the school year.

5.3 On-Street Vehicle/Pedestrian/Bicyclist Conflicts

Several different transportation modes converge in school zones. Child pedestrians and bikers often cross paths with buses, private vehicles, and each other on streets surrounding schools. Conflicts between vehicles and pedestrians in school zones can lead to unsafe conditions.

Child pedestrians under 15 have twice the risk of being involved in a pedestrian collision among all pedestrians (Florida DOT 1999).

Causes

- Distracted drivers
- Crossing locations for pedestrians or bicyclists are not designated
- Pedestrians/bicyclists ignore designated crossing locations
- Midblock drop off/pick up
- Large numbers of teen drivers during arrival and dismissal periods
- Sight distance issues

Consequences

- Child pedestrians or bicyclists may be struck by vehicles
- Accidents between vehicles
- Congestion
- Driver frustration, which may lead to unsafe actions

Solutions

- Treat child pedestrians differently
- Designate pedestrian crossings at safest intersections
- Education
- Adult crossing guards
- Clear and consistent use of signing
- Stagger high school arrival/dismissal periods away from lower grades
- Maintenance

5.3.1 Common Problems

In some cases, locations to cross streets are not designated and children and even adults are left to cross wherever it is the most convenient. Additionally, when crossings are not designated and marked, drivers may not be watching out for or expecting pedestrians.

Even when crossing locations are clearly designated, children walking or biking to or from school often ignore indicated crossings and walk, run, and ride into the street or between vehicles. Figure 5.18 shows examples of crosswalks near schools that are not marked and may increase chances of conflicts as pedestrians cross.

Figure 5.18. Poor school zone pavement marking in crosswalk (left) and no designated crosswalk (right)

The increased amount of queued vehicles and drop-off/pick-up activities made it more difficult for pedestrians and bicyclists to see oncoming vehicles or for vehicles to see child pedestrians and bicyclists. Vegetation and other obstructions, such as parked vehicles, also reduce sight distance for drivers and block the view of both pedestrians and drivers.

In some cases, parents enable and even participate in unsafe pedestrian behavior. At several of the case study schools, parents dropped their child off and picked them up on the far side of the street or even stopped in the middle of the street. This forces the child to cross midblock or exit/enter the vehicle on the street side of the road, as shown in Figures 5.19.

Figure 5.19. Children being dropped off and picked up in the street and street side

Some parents at case study school #19, a middle school, park down the street from the school across a major collector street at a gas station. When school is dismissed, students cut through school property and across a busy two-lane street, midblock, to reach their parents' cars, as shown in Figure 5.20.

Figure 5.20. Parents encouraging unsafe behavior

Use of student safety patrols can also cause problems in school zones. Often, drivers do not know the role of the student safety patrol and it causes confusion. The use of student safety patrols to assist younger children in crossing public streets is widespread in Iowa. Many student safety patrols are used to assist other children in crossing at STOP signs, midblock crossings, school driveways, and even crossing at traffic signals. Figure 5.21 shows an example of student safety patrol (right) with their back to uncontrolled traffic (i.e. no STOP signs for traffic on one leg of intersection), and both examples show the student safety patrol using STOP signs to control traffic. Both of these situations are unsafe and not the proper protocol for student safety patrols according to the MUTCD.

The use of student safety patrols in crossing streets is problematic for several reasons. First, student safety patrols are much less visible than adult crossing guards due to their size and have far less experience and judgment.

Figure 5.21. Student safety patrols using stop paddles and standing with back to traffic (right)

Second, student safety patrol should not be directing traffic, which means they cannot stop traffic so that children can cross the street. Their function is to control students and help children select appropriate gaps in traffic. This is problematic because drivers often do not understand the purpose of the student safety patrol in street crossings. As drivers approach a STOP sign or crosswalk with children waiting with a student safety patrol, the average driver expects the student safety patrol to indicate that they are going to take a group of kids across the street and to make the first move. The student safety patrol, on the other hand, has been instructed to wait until drivers formally stop and wave them across. As a result, neither driver or student safety patrol is sure what the other is going

to do and leads to confusion and could result in an even more unsafe condition than leaving children to cross the street alone.

Third, student safety patrols who assist children crossing streets were often observed as being inattentive. On two occasions at signalized intersections, the student safety patrol led children into the intersection after the flashing DON'T WALK had appeared. In one of those instances, the children waiting to cross tried to refuse the safety patrol encouraging them to cross since they recognized that they did not have time to cross. The safety patrol kept motioning for them to cross, which they finally did and then were left in the middle of the crosswalk when the light turned green. At other locations, student safety patrol were often observed running and engaging in horseplay. More information on student safety patrol can be found in Section 6.4.

Another problem that exacerbates conflicts between pedestrians and vehicles is that a large number of teenage drivers, and thus inexperienced drivers, may be present in school zones. Many teenagers drive to high school, and often secondary and elementary schools are centrally located. High school arrival and dismissal periods also frequently coincide with those of middle and elementary schools; however, many school districts make an effort to stagger these times. As a result, high school students are often driving through school zones on their way to and from school. This is problematic since teenage drivers may be more likely to speed and take risks, and they also lack the experience to realize the unpredictability of small children and may not even think to look.

5.3.2 Solutions and Case Study Best Practices

The following solutions address on-street conflicts between child pedestrians or bicyclists and vehicles or between vehicles.

5.3.2.A Treat Child Pedestrians Differently

Many strategies to address pedestrian crossings are based on adult pedestrians. One agency observed that children are not "short adults" and indicated that research has shown that adults as drivers and traffic engineers overestimate a child's ability to deal with traffic, including crossing the street (MARC 1998). They list some common limitations of children ages 5 to 9:

- Eye height is much lower
- Have 1/3 narrower side vision than adults
- Are not as able to determine the direction of sounds
- Have trouble judging speed and distance. Young children only consider how far away a vehicle is, not how fast a vehicle is going, in selecting a gap for crossing
- May be too small to be seen, especially with on-street clutter
- Have short attention spans and will grow impatient if they have to wait too long to cross a street
- Have less experience
- Have difficulty seeing and being seen by vehicles (ODOT 2005)
- Assume that if they can see a vehicle that the vehicle can see them (ODOT 2005)
- Do not understand complicated situations. If one vehicle slows or stops, they may expect other vehicles to do the same (ODOT 2005)

Child pedestrians at different ages have different characteristics as well. MARC (1998) reported the following characteristics of child pedestrians:

Ages 5 to 12

- Poor depth perception
- Increasing independence
- Susceptible to "dart out" or intersection dash behavior
- Crash rates are highest for 5- to 9-year-old males

Ages 13 to 18

- Have sense of vulnerability
- Susceptible to intersection dash behavior

Observations at many of the case study schools indicated that children, particularly middle-school age, cross at the most convenient location or use the shortest path, regardless of what traffic control or barriers exist. At several schools, middle-school age children regularly crossed midblock along high-traffic roads rather than walking to intersections with either crossing guards or pedestrian buttons. An observation of the study team was that middle school students (6th to 9th grade) appeared to exhibit poorer judgment and less caution than elementary school students (K to 5th grade) when crossing streets. Elementary school students may have less experience but often appeared more cautious about interacting with traffic and more observant of traffic rules. Middle school students were often observed dashing into the street, running between vehicles, and in general exhibited less caution in crossing streets and negotiating traffic than elementary school students. They appeared to be the most dangerous group of students in terms of following rules and using caution.

Treating child pedestrians differently entails considering traffic situations from the point of view of child pedestrians. This may include using different walking speeds and gap acceptance. It may also entail considering locating crossings near points of interest for child pedestrians.

5.3.2.B Designate Pedestrian Crossings

Marked pedestrian crossings indicate where child pedestrians and bicyclists should cross, rather than leaving it to chance. Children crossing the street outside of designated crossing locations are less likely to be seen by drivers. Care should be used, however, since children may feel that a marked crosswalk provides a measure of safety, and consequently, use less caution in selecting safe gaps or watching for traffic.

Routes used by child pedestrians to and from school should also have continuous, adequate sidewalks. MARC (1998) suggests clearly marking pedestrian travel zones from other modes using striping, colored or textured pavement, and signing. They also suggest providing frequent well-delineated crossing opportunities. Obstructions that block a driver's view of children or a child pedestrian's view of vehicles should be regularly evaluated and removed. Restriction of turning movements from driveways may also be considered to separate pedestrian crossings and turning vehicles. On-street parking or locations of vehicle queuing around school arrival and dismissal can be moved along pedestrian routes to remove on-street congestion.

When drop off and pick up are located on street, parents should be encouraged to drop off or pick up their children on the side of the street adjacent to the school to avoid midblock drop offs and children dashing across busy streets to their parents' cars. Parents should also be encouraged to drop off or pick up their children on the right side of the vehicle (curbside) so that children do not exit vehicles into the direct path of traffic, as shown in Figure 5.22.

One source also suggests the use of raised pedestrian crossings when pedestrian volumes are high (Florida DOT 1999).

Figure 5.22. Children being dropped off curbside

5.3.2.C Visible School Zones

School zones that are obvious (i.e., well marked with pavement marking and signing) remind drivers to slow down and watch for school children. Creating visible school zones is discussed in Section 5.2.2.B. Maintenance of the signing and pavement marking is very important in school zones. From the site visits, it was evident that the maintenance of these could be improved both on site and on street. Figure 5.23 shows an example of well-marked school zone.

Figure 5.23. Well-marked school zones

5.3.2.D Educate Children

Children should be taught by parents or school curriculum where safe crossing locations are and should be told to cross only at those locations. Children should be taught to stay on the sidewalk and pay attention to their surroundings.

Parents should be reminded that they have the primary responsibility for ensuring that their child arrives and leaves school safely and should be encouraged to point out safe routes and safe street crossing locations to their children. They also should be reminded to practice safe behavior themselves. Parental education can come in the form of newsletters from school or information at school events. Officers and safety patrols can remind parents in school zones when they practice or allow unsafe behavior.

Teen drivers should be taught safe driving practices in school zones as part of driver's training or school curriculum. They should understand that child pedestrians are less visible and may behave unexpectedly.

The Center for Disease Control and Prevention and the National Center for Injury Prevention and Control (CDC 2001) produced a report that addresses child pedestrian safety. They advocated a number of strategies to improve safety for child pedestrians, including the following:

- Develop public awareness about the need to improve safety for child pedestrians by creating coordinated national, state, and local public awareness campaigns
- Modify behavior of both pedestrians and drivers
    - Encourage mutual respect by teaching rules of the road
    - Educate public about the dangers of speeding, including increasing both stopping sight distance and fatal and major risk of injury to pedestrians
    - Encourage public support for enforcement of posted speed limits and other laws, such as those prohibiting passing school buses or requiring traffic to yield to pedestrians
    - Educate parents and drivers about the limitations of children, as pedestrians, and encourage parents to supervise their children in traffic and teach them age-appropriate traffic safety rules
- Develop safe walking programs
    - Safe route to school programs are discussed in more detail in Chapter 6.

5.3.2.E Use of Adult Crossing Guards

Adult crossing guards may be considered for locations where a large number of conflicts occur between pedestrians or bicyclists and vehicles. They are more visible to drivers and provide an authority figure. Many school districts have guidelines on when and where adult crossing guards may be used. Two locations are shown in Figure 5.24. Examples of guidelines for both adult crossing guards and student safety patrols are provided in Section 6.4. The study team recommends that adult crossing guards be used rather than student safety patrols.

Figure 5.24. Adult crossing guards

5.3.2.F Signing and Pavement Markings

Use of clear and consistent signing to convey the appropriate message is discussed in Section 5.1.2.E. Examples of good signing and crosswalk treatment practices that alert drivers and pedestrians to take appropriate actions in school zones are shown in Figure 5.25.

Figure 5.25. Highly visible signing and crosswalk treatments at midblock crossings

5.3.2.G Stagger High School Arrival/Dismissal Times With Elementary and Middle Schools

As discussed, high school students are often driving in elementary, middle, and junior high school zones, since they are often located near one another and school start and dismissal periods often coincide or overlap. High school start and dismissal times may be staggered so that high school students are driving in school zones for lower grade schools after the majority of those children have already made their trip to or from school. Alternatively, the high school can start before lower grades so that high school students arrive or leave school well before peak crossing times for lower grades. Starting after lower grades probably makes more sense since high school students are more likely to linger after school.

5.3.2.H Maintenance and Sight Obstruction

In order to provide proper sight distance and remind drivers that they are in a school zone, regular maintenance should ensure that vegetation is periodically checked so that school crossing signs are visible to drivers.

Other obstructions that block a driver's view of pedestrian crossings and pedestrians, such as parked vehicles, should be noted and parking in these areas should be prohibited at all times. As discussed in Section 5.1.2.E, however, the use of traditional NO PARKING signs to prevent vehicles from sitting and waiting on the street should be considered and the meaning of the sign communicated to the parents.

5.3.2.I Provide Adequate Pedestrian Facilities

Pedestrian facilities around school zones should be evaluated regularly to ensure that they are adequate in meeting the needs of child pedestrians. Continuous sidewalks should be provided for all designated routes to school. Locations where sidewalks end may encourage pedestrians to walk in the street rather than snow or mud. Sidewalks should not end at illogical places and should be maintained for safe access to schools.

5.4 Intersection Vehicle/Pedestrian/Bicyclist Conflicts

Intersections are prime sources of vehicle/pedestrian or vehicle/bicycle conflicts in and around school zones. Drivers often make right turns on red and permitted left turns, even when children are crossing. Children do not always think to look for turning vehicles when they cross.

Causes

- Inattentive child behavior
- Poorly designed intersections from a child pedestrian perspective
- Safety only considered in school zones
- Driver behavior
- Sight distance issues
- STOP signs used as traffic calming
- No parking restrictions near intersections

Consequences

- Conflicts and potential accidents between pedestrians or bicyclists and vehicles
- Interference with intersection operation
- Drivers tend to disregard traffic control when they do not perceive a need for the control

Solutions

- Crosswalks
- Intersection treatments
- Temporary traffic control in school zone
- Adult crossing guards
- Maintenance

5.4.1 Common Problems

At many of the case study schools it was noted that children, overall, exhibit poor judgment in crossing streets, even at intersections. At approaches with no traffic control, children often dash in front of oncoming vehicles, rather than waiting for a gap. At stop-controlled intersections, they also fail to check for oncoming traffic. At signalized intersections, they cross upstream or downstream of the intersection, and cross during the green phase of the traffic signal. Children waiting to cross at intersections also often engage in horseplay. To complicate matters, poor and absent pavement marking can contribute to unsafe crossings, even at controlled intersections (i.e., STOP signs, traffic signals). Figure 5.26 shows an example of the main intersection adjacent to a school with no crosswalk pavement marking (left) and an intersection with worn pavement marking (right).

Figure 5.26. Poor and absent intersection crosswalk pavement marking

In other cases, routes through intersections are not well designated for child pedestrians. For instance, continuous sidewalks are not present, pedestrian push buttons are not available, and space is not provided for the number of students waiting to cross the street. Crossing guards are often used at signalized intersections adjacent to schools, yet higher volume roads just a few streets down do not have crossing guards. Additionally, vegetation, on-street parking, and queuing may interfere with driver and pedestrian sight distance.

5.4.2 Solutions and Case Study Best Practices

The following section provides potential solutions for pedestrian or bicyclist and vehicle conflicts at intersections.

5.4.2.A Provide Marked Crosswalks

Crosswalk at intersections near schools should be clearly marked with stop bars and zebra striping crosswalk treatments, as shown in Figure 5.27 (left). All pavement markings should also be repainted regularly.

5.4.2.B Intersection Treatments

Preferred crossings near schools should be designated by the schools. "Zebra" style pavement marking at crosswalks typically is more visible to drivers as they approach an intersection. The *Manual on Uniform Traffic Control Devices* (MUTCD) provides guidance for typical intersection pavement marking, as shown in Table 5.2. Several school districts paint "stand-back" lines at intersections to indicate where children should stand while waiting for the walk signal or crossing guard to lead them across the street (Cynecki et al. 2005). Two school districts in the study used such lines, as shown in Figure 5.27. This keeps children a safe distance away from the street and traffic until it is safe to cross the street.

Table 5.2. Intersection pavement markings

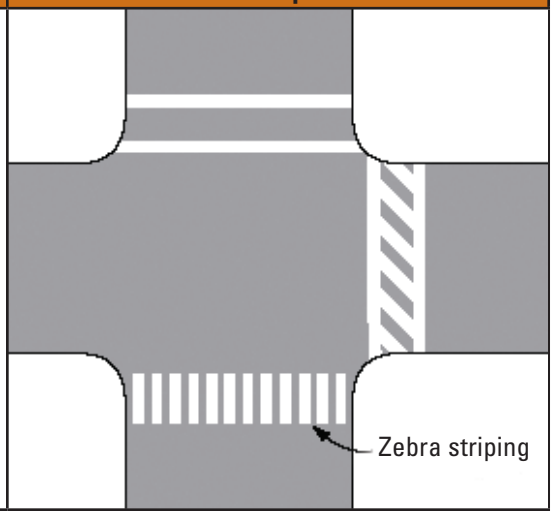
Pavement Marking Type	Color	Example
Crosswalk	White	

Figure 5.27. Stand-back lines and zebra pavement markings at a signalized (left) and unsignalized (right) intersections

One school district recently installed pedestrian signals with countdown timers. Children, as well as many adults, do not always understand the flashing DON'T WALK display and may cross at the wrong time or when there is only a few more seconds to cross. Signals with pedestrian countdown timers are very helpful in communicating how much time one has to cross the street. Schools may even set a protocol that students can only start crossing the street when there are so many seconds remaining in the cycle. Supplemental signing at intersections can also remind drivers to watch for children, especially when making a turn. Figure 5.28 shows an example of a pedestrian countdown timer near a school and an example of supplemental signing.

Figure 5.28. Pedestrian countdown timer (left) and supplemental crossing signage (right)

5.4.2.C Use of Temporary Traffic Control

The use of temporary traffic control in Iowa is quite common within school zones. Outside of Iowa, temporary traffic control has not been seen as a favorable way to handle traffic on roadways. The Handbook of Traffic Engineering for Small Cities published by the State of Missouri states that "roll-out STOP signs can be confusing to motorists and should be avoided." Temporary traffic control devices do not command respect from drivers. A 1978 study by the Iowa Highway Research Board reported that 37% of vehicles observed at temporary stop control devices did not come to a complete stop.

The Iowa State Code (Section 321.249) allows for use of both roll out and fold-down STOP signs. Conversely, the *Manual on Uniform Traffic Control Devices* (MUTCD) states that temporary STOP signs should not be used. In this case, the Iowa Code supersedes the MUTCD. Several of the schools in the study commented that they use roll-out STOP signs to slow down traffic in front of the school. This reasoning also contradicts the MUTCD in that STOP signs are intended to assign right-of-way to vehicles and pedestrians and are not for speed control.

Iowa schools use roll-out STOP signs during arrival and dismissal to create a two-way and four-way stop conditions at locations where only the side streets are stop controlled or there is no control. Two locations use fold-down STOP signs during arrival and dismissal periods. However, temporary traffic control should be used with caution. Drivers who regularly use the route during times when traffic control is not in place are not expecting a STOP sign in a location where there is usually no one. Roll-out STOP signs should be large and visible enough to catch the driver's attention and also be in good condition. Figure 5.29 shows two examples of roll-out STOP signs used in school zones. Four schools in the study used roll-out STOP signs.

Stand-alone roll-out STOP sign

Roll-out STOP sign with supplemental signing

Figure 5.29. Roll-out STOP signs at Iowa schools

Fold-down STOP signs are difficult to see even when an adult crossing guard is present. Figure 5.30 shows a location when the fold-down STOP sign is in use (left) and when it is not in use (right). When temporary traffic control is used, crossing guards and pedestrians should also be taught to always look before crossing the street since drivers may not be expecting to stop. The location for temporary traffic control devices should also be evaluated carefully before they are used. Care should be taken so that they are not placed at locations with limited sight distance, so that drivers who are not expecting them have adequate time to react. Additionally, temporary traffic control devices may cause congestion and unexpected queues, creating problems upstream of the intersection if not used appropriately.

Roll-out STOP signs and other temporary traffic control should not be used as a traffic calming measure. Similarly, STOP signs should fulfill a need and should not be used for traffic calming.

Location with fold-down STOP sign when not in use

Location with fold-down STOP sign when in use

Figure 5.30. Fold-down STOP signs

5.4.2.D Adult Crossing Guards

When practical and warranted, adult crossing guards at intersections can monitor student behavior and assist children in safely crossing intersections, as shown in Figure 5.31. Adult crossing guards are also visible to drivers, may encourage better driver behavior, and can also report driver behavior. Adult crossing guards are discussed in more detail in Section 5.3.2.E. More information on crossing guards can be found in Chapter 6.

As discussed in Section 5.3.2.E, the study team recommends the use of adult crossing guards in assisting children cross public streets rather than using student safety patrols.

Figure 5.31. Adult crossing guards assisting with intersection crossing

5.4.2.E Maintenance and Sight Obstruction

Regular maintenance should be performed to ensure that proper sight distance at intersections is maintained, as discussed in Section 5.3.2.H.

5.5 Traffic Violations

Observations at different case study schools indicate that drivers often disregard traffic control in school zones, even when the message was clear and consistent and the signs or pavement markings were clearly visible.

Causes

- Drivers blatantly ignore posted traffic control
- Drivers may not see or pay attention to posted school times if they travel in that area during other times of the day

Consequences

- Child pedestrians or bicyclists may be struck by vehicles
- Accidents between vehicles
- Congestion
- Driver frustration, which may lead to unsafe actions

Solutions

- Visible traffic control
- Consistent use of signing
- Education
- Enforcement
- Use of temporary traffic control

5.5.1 Common Problems

Figure 5.32 illustrates some of the common traffic violations in school zones at case study schools. In many cases, the violators are parents who are picking up or dropping off their children and somehow feel that the rules do not apply.

Drivers in schools zones at the case study schools were observed violating basic traffic rules that they would not normally violate on typical public streets. Drivers park their vehicles in front of fire hydrants, in fire zones, in handicap parking spaces, and in NO PARKING zones. One reason may be that there are typically no consequences or enforcement at schools for these violations.

To complicate matters, schools often unintentionally use traffic control on school grounds to send a different message than in other situations on the street. For instance, several schools use red pavement markings on the curb in front of the school marking it as a fire lane. During arrival and dismissal, the school intends for that area to be used as a drop-off and pick-up location. On the street, the use of red fire lane markings indicates no stopping for any reason. Another case study school uses handicap parking spaces in front of the school during the day as handicap parking. During arrival and dismissal, they intend parents to use the same handicap parking spaces for drop off and pick up. Parents used to ignoring traffic control on school grounds may also carry this behavior onto the street.

Circumvention of traffic control has been reported in studies conducted in other areas of the country as well. Cooner (2005) reported on behavior around school zones in Texas and indicated that a typical problem around school zones was drivers ignoring traffic control, such as DO NOT ENTER and turn restriction signing.

Vehicles turning left during prohibited left turn hours

Vehicle parked in crosswalk

Vehicle parked in NO PARKING zone

Vehicle parked in handicap parking space

Figure 5.32. Common traffic violations

5.5.2 Solutions and Case Study Best Practices

This section discusses solutions to get drivers to comply with traffic control. Solutions to speeding were presented in the previous section.

5.5.2.A Visible School Zones

Locations around school zones should be regularly monitored to ensure that signs and pavement marking are in good condition and visible. Creating more visible school zones is discussed in Section 5.2.2.B and maintenance of school zones in Sections 5.2.2.B and 5.3.2.C.

5.5.2.B Consistent Use of Signing

Traffic control on school grounds often extends a different meaning than the same traffic control on public streets, as discussed in Section 4.3.2.B. Traffic control on the street should also be consistent and the message that the traffic engineer intends to send should be clear to the driver, as discussed in Section 5.1.2.E.

5.5.2.C Education

Drivers occasionally need to be reminded to follow traffic rules. Schools can send newsletters home to parents or provide information at back-to-school events. One Phoenix, AZ, school district reported using adult safety monitors to identify violators and give them a friendly reminder to follow posted traffic control. They also recorded the license plate numbers of repeat offenders and provided that information to local law enforcement.

5.5.2.D Enforcement

When practical, law enforcement is a useful tool to encourage driver compliance with traffic control devices and traffic laws. One case study school had a regular problem with parents queuing along a narrow two-lane roadway in front of the school. Police officers posted NO STOPPING, STANDING, or PARKING signs along the roadway and regularly patrolled the areas to ensure compliance.

The Newton, MA, public schools transportation website indicates that they have made a commitment to improve the safety of their school zones. The school district has a school traffic safety committee and traffic plans for each school. If traffic violations occur at the schools, fines are given to drivers. The 10 traffic violations that frequently occur in the Newton school zones are listed in Table 5.3.

Additionally, cities may have to implement ordinances to deal with violations around school zones. Law enforcement officials cannot enforce behavior around school zones if ordinances are not in place.

Table 5.3. Traffic violations in the Newton school zones

	Violation	Fine
1	Stopping or parking at school bus stops	$15
2	Stopping or parking in a crosswalk; driving into a pedestrian crossing when a pedestrian is present	$15 to $25
3	Double-parking	$15
4	Parking within 20 feet of an intersection or within 5 feet of a driveway	$15
5	Parking in handicap spots or in front of a fire hydrant	$50, $15
6	U-turns in school zone	$20
7	Failing to stop a motor vehicle when approaching a school bus	$200
8	Failing to stop a motor vehicle at the request of a traffic supervisor or police	$100
9	Failure to wear seatbelt	$25/person
10	Parking a motor vehicle in areas marked LIVE PARKING ONLY, NO PARKING, SCHOOL PICK-UP/DROP-OFF ZONES, or in restricted time zones	$25

5.5.2.E Use of Temporary Traffic Control

Roll-out and fold-down STOP signs are regularly used throughout Iowa. Drivers may violate temporary traffic control since the traffic control violates drivers' expectancy. See Section 5.4.2.C for discussion on use of fold-down and roll-out STOP signs.

5.6 Summary

Common transportation safety and operation problems on public streets adjacent to schools were discussed in this chapter. Solutions were identified and presented. Common problems and solutions were summarized in Table 5.1 for easy reference. Refer to the appropriate section for a detailed description of each.

Several other sources of information are useful for traffic engineers in dealing with safety and traffic operations around school zones. The Oregon DOT defined what is and is not a school zone. They also discuss the basis for setting speed limits in school zones and the use of different school zone traffic control and signing (Oregon DOT 2005).

Chapter 6

Guidance and Additional Resources for Schools

The responsibility to provide a safe school zone and teach and practice safe habits among children is shared by parents, schools, cities, law enforcement, and children. This chapter provides insight and guidance into establishing a school traffic safety committee, communicating policies and procedures with students and parents, conducting traffic and safety studies within a school zone, and implementing a student safety patrol and adult crossing guard program.

According to a 1985 report by the Institute of Transportation Engineers (ITE), there are six steps to a successful school zone program:

1. Organize a traffic safety committee
2. Develop a school route plan
3. Configure the school site to be more accessible
4. Consider other relevant elements (i.e., transportation modes, traffic control)
5. Select mitigation measures
6. Distribute and maintain school route plan

6.1 Establishing a School Transportation Safety Committee

Several different approaches can be taken to establish a school transportation safety committee. This can be done at the school district, school level, or both. Table 6.1 shows the possible members of the committee. The school transportation safety committee at the school district level should include (at minimum) the school district superintendent, city traffic engineer, police officer, school district transportation director, school district maintenance representative, and at least one school principal. For this committee to be effective it is recommended that they meet on a monthly or quarterly basis. It is also important that the committee have a means to communicate back to all the schools in the district regarding the content and decisions discussed at these meetings (i.e., distribute meeting minutes or include in a newsletter/memorandum to the schools). This group should be limited to approximately eight members to promote efficiency.

Similarly, at the school level participants should include (at minimum) the principal, teachers, parents, school district resource officer, school maintenance staff, and a student safety patrol representative, if applicable. Again, it is recommended to meet monthly in the beginning of the school year and then quarterly. Although the school committee does not include standing members from the school district or city, these groups should be notified of the meeting and provided meeting minutes. It is recommended that all school transportation safety committee members keep a transportation safety contact sheet, as shown in Table 6.2.

Traffic and safety issues that should be discussed at the school transportation safety committee include, but are not limited to, complaints, traffic violations, safety concerns, congestion, busing problems, and use of a student safety patrol and crossing guards.

Table 6.1. Possible school transportation safety committee members

District Level	School Level
Superintendent of schools	Principal
Principal (elementary and secondary)	Teacher
City police officer	School resource officer or police officer
City traffic engineer	City traffic engineer
School district transportation director	Parent
Safety patrol or student representative	School Maintenance Staff

Table 6.2. Transportation safety contact sheet

District Level	Phone Number	E-mail	Concern
School - Principal - Traffic safety coordinator			- Student safety patrol - Traffic violation on school grounds - Safety concerns on school grounds
City traffic engineer			- Painting crosswalks - Adding traffic control signing on street - Conducting a traffic study - Traffic violation on street - Safety concerns on street
City police department			- Enforcement - Adult crossing guards
School district transportation director			School busses
Iowa Department of Transportation			Conducting a traffic or safety study

6.1.1 School Resource Officers

Many school districts within Iowa have a school resource officer who is the liaison between the school and police department. The school resource officer is often the first contact a school has with the police department in regards to traffic safety problems within a school zone. Depending on the problem and number of occurrences, the police department may be asked to increase enforcement or assist in addressing an immediate problem.

Larger school districts in Iowa have also assigned one or two officers to patrol the schools before and after school. They maintain a consistent presence within the school zones to help keep traffic violations to a minimum during the peak morning and afternoon hours at schools.

6.1.2 Parent Teacher Associations/Organizations

Parent Teacher Associations (PTAs) and Parent Teacher Organizations (PTOs) are also very valuable and resourceful groups that schools can reach out to for support in dealing with school safety problems. In addition, many PTAs and PTOs have small committees that work with special topics and issues at the school. One school in the study had a PTA/PTO safety committee that handled any safety related issues, one of those being traffic safety. Members of a committee such as this may be good candidates to represent the PTA/PTO on the school transportation safety committee. Other schools utilized their PTAs and PTOs as volunteers before and after school to provide additional supervision in the pick-up and drop-off areas.

6.2 Communicating Effectively with Students and Parents

Physical and procedural changes will only be effective if parents and students are educated, reminded, and held accountable for the changes that schools put in place. Communicating the schools' expectations to the parents and students through face-to-face meetings (i.e., registration, parent-teacher conferences, and classroom discussions) will help reinforce the procedures that have been put into place for the safety of the children.

Students, parents, and drivers need to understand the traffic control devices that are located within a school zone. Educating students and parents about these traffic control devices, as well as having an organized arrival and dismissal procedure, can reinforce safe habits around schools.

At the beginning of the school year, there is often media coverage and communication between the schools and the parents about school openings and how it is important to be alert and watch speeds in school zones. Providing these reminders in school newsletters and curriculum throughout the school year will hopefully promote good habits that become routine instead of an afterthought.

6.2.1 School Children

Providing students with what the school expects of them during arrival and dismissal procedures is essential to having a safe school zone. Along with these expectations the children must be educated about traffic safety. Elementary school children range in age from 4 to 12, so it is also important to constantly practice what is expected of them so students can retain the safety and procedural information.

The Minnesota Department of Transportation shares a useful analogy concerning the similarities between fire and tornado safety procedures and before and after school safety procedures. All schools are required to have fire and tornado evacuation plans, which students practice and are reminded of with postings inside the doors and on the hallway walls. However, most schools do not have a program to educate and practice traffic safety procedures with school children. Fires and tornados are random events, but crossing the street in a school zone and running through a parking lot are daily occurrences that have consequences.

Making school safety a fun activity for students may be the best way to engage them and for them to remember the importance of being safe. The NHTSA's Safe Routes to School Program provides classroom activities for teachers to incorporate into their curriculum to help reinforce the importance of school safety and teach students about basic traffic, pedestrian, and bicycle laws; taking surveys about how students come to school; counting traffic; using maps to find the safest way to school; traffic pollution; and public transit. Guidelines for a Safe Routes to School Program are provided in more detail in Section 5.11.

School children should be directed to cross at the approved roadway and driveway crossings at all times. This may require students to walk a little further to reach their destination; however, it is safer to have all crossings occur at a designated and controlled location. The following information should be communicated to students:

- Students should cross roadways and driveways only at approved crossings
- Students should only get out of the vehicle on the curbside
- Students should not run within the school yard, driveway, or street
- Students should listen to the crossing guard and student safety patrol

Other ways to promote and educate students about school safety is through National Programs. International Walk and Bike to School Day/Week is usually held the first week in October, and other creative programs can be started at a local level. For example, "frequent rider miles" for students who walk, bike, or carpool to school. Students who walk or ride so many miles each year get a T-shirt and their name is put in a raffle for a new bike:

- International Walk and Bike to School Day/Week(www.walktoschool-usa.org/)
- Frequent Rider Miles (www.saferoutestoschools.org/Events/FRMGuidelines2004.htm)

6.2.2 Parents and Guardians

According to the Missouri *School Transportation and Traffic Safety* guidebook, the basic responsibility for the safety of the children is on the parents (MoDOT 1996). The ultimate responsibility lies in the hands of the parents when they drop off and pick up their children. Without parental instruction, guidance, supervision, and cooperation school traffic safety procedures will be inadequate. Parents will not be able to reinforce safe behavior if they do not understand or follow the procedures or traffic control on the streets.

Communication and education for the parents is just as important as for the children. Adults have been observed to be the primary violators in some school zones in Iowa, as shown in Figure 6.1. As was discussed above, parental behavior as drivers and pedestrians is one of the biggest problems for schools. Parents were observed beckoning their children across busy streets, not using crosswalks, parking in crosswalks, speeding through driveways, double-parking, etc.

Figure 6.1. Parents are the primary violators in school zones

The observed and documented parental behaviors at the schools in Iowa were such a concern that their behaviors were discussed with faculty in Iowa State University's Department of Psychology to get insight into the social behavior of people. The study team sought out the answer to one question, "How can schools get through to parents who are violating traffic control and creating an unsafe environment in school zones?" One solution was to designate several levels of awareness for communicating to parents. The four levels of awareness are listed below:

1. Raise awareness
    - School registration
    - Parent–teacher conferences
    - Monthly newsletters
2. Provide constant reminders
    - Effective traffic control
    - Effective pavement marking
    - Adult supervision

- Confront violators by talking immediately or putting a note on their windshield
- Document repeat offenders

3. Apply peer pressure
   - Involve Parent Teacher Associations and Parent Teacher Organizations

4. Enforcement
   - Obtain authority from police department to document violators and turn them in to the police department for them to issue a violation
   - Maintain a presence within school zones on a regular basis

Raising awareness includes talking with parents at registration, parent–teacher conferences, and monthly newsletters. At the beginning of the school year parents should be informed about the on-site and on-street traffic control. Effective traffic control signing and pavement markings mean parents know the difference between NO PARKING and NO STOPPING signs and the difference between red and yellow pavement markings on the curb. Guidance on these traffic control devices can be found in Section 6.5. Many parents are aware of the traffic problems at schools, so schools can also promote carpooling, walking, biking, and bus riding to the parents. Again, the NHTSA's Safe Routes to School Program provides more guidance on this subject.

Constant reminders that schools can rely on are effective traffic control signing and pavement markings, presence of adult supervisors in front of school during arrival and dismissal periods, and talking to violators as the violations occurs or leaving a note on their windshield. Schools are recommended to identify and approach violators and repeat offenders with reminders and keep a running list of the number of violations. Some protocol should be developed on how many violations it takes before a letter is sent home or a phone call is made to the violator.

Peer pressure comes in the form of having the Parent Teacher Association and Parent Teacher Organizations get involved with violators.

Enforcement is the last resort and is most appropriately used when the local police department needs to either administer tickets or provide a presence at the schools. Law enforcement officials can not be at the schools everyday, but making school zones a safety priority before and after school throughout the district may provide the necessary presence needed to keep parents from violating traffic control and creating an unsafe environment.

The city of Richmond in British Columbia, Canada, provides their community with a traffic safety brochure that has reminders to the community regarding safety tips and regulations. Several of the safety problems that they encounter in the city of Richmond were also observed at Iowa schools. A copy of the brochure can be found in the Appendix. The city discusses the following issues in their school zones: no U-turns, no backing-up, avoid driving in parking lots, and prepare for the unexpected. They also provide interpretation of regulatory traffic control along with the legal consequences of not following the regulations.

6.3 Support from School Teachers and Staff

Adult supervision and direction during arrival and dismissal periods reinforces the importance of school zone safety to parents, as well as children; however, this is not possible without the support and cooperation of school teachers and staff. It was observed that the schools with the safest and most efficient arrival and dismissal procedures had very structured procedures for the parents, staff who supported school safety, and teachers and staff who were involved in a process, as shown in Figure 6.2. Many schools have duties required for all teachers and staff before and after school and during recess and lunch. The duties we have described above would all be considered before and after school duties.

Figure 6.2. Adult supervision before and after school

Adults assisting and monitoring the arrival and dismissal procedures should also be recognizable as a person with a safety responsibility. Often, the safety patrol supervisor will be walking in moving traffic. It is important that they wear the appropriate retroreflective safety vest so they are visible to students and parents. Section 6.4 provides more information on retroreflective safety vests.

6.4 Guidelines for Crossing Guards and Student Safety Patrol

In Iowa, both adult crossing guards and student safety patrols are permitted; however, the use of both varies quite a bit from school district to school district. Some schools do not use student safety patrols because they feel it is too dangerous to have students in traffic. According to the *Manual on Uniform Traffic Control Devices* (MUTCD), adult crossing guards are permitted to control both pedestrians and traffic. Conversely, student safety patrol are permitted to only pedestrians.

School crossing guards should be trained for their duties by law enforcement, the department of transportation, or city public works staff. The American Automobile Association (AAA) also has a safety patrol handbook dealing with the responsibilities of these important jobs. Crossing guards and safety patrols should have a refresher training course prior to each school year to familiarize themselves with any changes that may have occurred on the roadways near the school. Figure 6.3 shows examples of a crossing guard and student safety patrol at Iowa schools.

Figure 6.3. Adult crossing guards and student safety patrol

On construction projects, personnel are required (by law) to wear appropriate safety apparel which includes a retroreflective safety vest, as shown in Figure 6.4. Construction workers and inspectors often are on or near the roadway, and it is important that drivers see them. Safety vests draw attention to the workers and alert drivers of their presence. These safety precautions should be no different for the adult crossing guards or student safety patrols that are working on and near active roadways and driveways in school zones.

Figure 6.4. Iowa DOT approved retroreflective vests and shirts

It is recommended that schools encourage children to leave the building and grounds immediately after school to assure they cross the street with the crossing guards in place. The exact times crossing guards should be in place depend on the arrival patterns at each school.

6.4.1 Adult Crossing Guards

The use of adult crossing guards provides crossing supervision for pedestrians and traffic. Most of the crossing guards observed were employed and trained by the local police department. Three schools used adult crossing guards.

The MUTCD presents the following standards and guidance for adult crossing guards:

- Wear high-visibility retroreflective safety apparel (ANSI 107-1999, Class 2).
- Do not direct traffic, but find appropriate gaps in traffic for the students to cross.
- Use a STOP paddle to signal traffic (The STOP paddle should be red with 6-inch white letters, at least 18 inches in size, and retroreflectorized or illuminated).

The Des Moines, IA, *Manual for School Crossing Control* provides additional guidance for adult crossing guards. Some of the guidelines are shown below.

- Crossing must be located in a painted crosswalk.
- A minimum of five lanes of traffic must approach the intersection (four lanes for midblock).
- A minimum volume factor of 1,400 vehicles (based on traffic volume, large vehicles, turning vehicles, children, length of crosswalk); a minimum of 1,000 vehicles if school children are only in grades K-2.

Other important guidance for adult crossing guards is listed below.

- Never turn your back on traffic.
- Do not be distracted by or mingle with other people.
- Record violator vehicle description and license plate number and report to your supervisor.
- Wait until all the students have crossed the street before returning to the sidewalk.
- Be in place at least 15 minutes before the bell rings in the morning and before the bell rings in the afternoon.
- Stay in place until the last bell rings in the morning and at least 15 minutes after the bell rings in the afternoon.
- Use the "stand-back" line to keep students a safe distance from the curb.

6.4.2 Student Safety Patrol

Student safety patrols provide crossing supervision for pedestrians. Most student safety patrols are 5th or 6th graders. The only national formal training identified was the AAA School Safety Patrol Program. Schools with a student safety patrol program should have an adult patrol supervisor that trains and monitors the program and students. If there are multiple students in the safety patrol, it may be appropriate to designate a student patrol captain. These students should exhibit leadership and reliability and have permission from their parents. Five schools used student safety patrols, and some of them are shown in Figure 6.5.

Figure 6.5. Student safety patrols

The MUTCD presents the following standards and guidance for student safety patrols directing and controlling pedestrians:

- Wear high-visibility retroreflective safety apparel (ANSI 107-1999, Class 1).
- Use of a flagging device (NOT a STOP paddle) that is retroreflective or illuminated.
- Crossings should have adequate gaps in traffic occur frequently so gaps do not need to be created.
- Crossings should involve signalized intersections where turning traffic movements are limited.
- Students may assist adult crossing guards in controlling large numbers of pedestrians.

The Des Moines, IA, Manual for School Crossing Control provides additional guidance for student safety patrols. Student safety patrols are allowed to be used at streets that are adjacent to the school property. Some of the guidelines are shown below.

- The student safety patrol will be supervised while performing the duties.
- Students must pass a written and/or oral student safety patrol test.
- Fourth graders that will qualify for the safety patrol the following year will receive a two-week training session at the end of the current school year.
- Safety patrol officers will assist pedestrians during a 15-minute period before and after school.

Other important guidance for student safety patrols is listed below.

- Formal training by law enforcement should be provided.
- Never turn your back on traffic.
- Do not be distracted by or mingle with other people (this includes parents).
- Record violator vehicle and license plate number and report to your supervisor.
- Wait until all the students have crossed the street before returning to the sidewalk.
- Be in place at least 15 minutes before the bell rings in the morning and before the bell rings in the afternoon.
- Stay in place until the last bell rings in the morning and at least 15 minutes after the bell rings in the afternoon.
- Use the "stand-back" line to keep students a safe distance from the curb.

The AAA School Safety Patrol Program and the MUTCD have several discrepancies about the clothing and equipment that should be used by student safety patrol members. The student safety patrol belts that are endorsed by the AAA, as shown in Figure 6.6, do not meet the standard requirements of the retroreflective safety vests in the MUTCD. The belts are small and often covered by the students clothing. These belts also do not draw enough attention to the student safety patrol as they stand next to traffic.

Figure 6.6. AAA student safety patrol belts and use of STOP paddle by a student safety patrol

Another inconsistency with the MUTCD was the use of STOP paddles by student safety patrols, as shown in Figure 6.6. Several of the student safety patrols were using STOP paddles, which are not recognized by the MUTCD. The student safety patrol should not be directing traffic; their role is to supervise students crossing the street. There seemed to be an inconsistent use of paddles by the students, all of which did not appear to be very professional (i.e., twirling the paddle around, not holding the paddle for traffic to see).

Use of student safety patrols for assisting other students in crossing public streets should be carefully considered. As noted in previous sections, the project team noticed on many occasions that student safety patrols are frequently inattentive and in some cases may have created situations that were more dangerous than if younger children had been left to decide on their own when to cross streets. Student safety patrols should be monitored by adult supervisors when used and they should not be expected to take on responsibilities that are above their age and maturity level to perform. More discussion on the use of adult crossing guards rather than student safety patrol is provided in Section 5.3.2.E.

6.5 School Busses

As discussed throughout this document, separating transportation modes is one way to improve the safety around schools. Regular communication with the school bus drivers and school district transportation director are also important. Keeping the busses on schedule can help make dismissals run more efficiently and allow the schools the flexibility of being able to effectively stagger student dismissals by mode of transportation. Students riding the bus may be allowed to be dismissed first before students riding in passenger vehicles to reduce the number of students on the sidewalks and in the streets. In addition, the Iowa Highway Safety Management Toolbox provides a chapter on how to make "School Bus Travel Safer" (IHSMS, 2005).

If there are multiple buses, it is helpful if they are always parked in the same order to ease loading. When possible, it is also recommended that all buses load and leave at the same time. Busses should never have to back up near a school. Many schools park their busses at an angle, so backing is not necessary.

Some schools also rely on public transit busses. These bus drivers should also comply with all of the standards that are expected of school buses. The public busses observed at one school appeared to drive faster through the school campus.

6.6 Traffic and Safety Studies in School Zones

Traffic engineering and safety studies are conducted to assist in the decision making process when considering changes to roadways. Inventory of salient features that impact the school site and adjacent street network should be documented to assist in this process.

The following is a list of possible information that would be needed for an engineering study:

crash history	citizen input
preliminary speed studies	school hours
traffic volumes	list of regularly scheduled events
pedestrian volumes	student demographics
sight distances	school site map
documentation from PTAs	school bus operations/schedules
traffic control devices	pedestrian access ways
roadway geometry (i.e., lane width, sidewalks)	posted speed limits in and around study area
roadway classifications	location map
parking restrictions	appropriate contact persons
walk times to cross streets near school	any other relevant information

Reproducible forms to conduct conflict studies on school grounds and on adjacent streets and intersections were provided in the Appendix. The Iowa DOT maintains a traffic data service (Iowa Traffic Data Service) which can be used to show number and types of crashes around schools.

6.7 Development of a "Safe Route to School Plan"

The National Highway Traffic Safety Administration (NHTSA) developed the "Safe Route to School" toolkit to aid communities in this effort. The program includes activities and outreach for children and the community focusing on safety, mapping the safe routes to school for all modes of transportation, and concludes with classroom lessons dealing with traffic safety, traffic and pedestrian data collection, using geography as they work with maps, and learning about transit and other alternative modes of transportation. The Safe Routes to School Plan is intended to minimize the number of streets that are crossed and maximize the safety of these crossings.

The school traffic safety committee should take the lead to develop a suggested school route plan for schools serving elementary and kindergarten students. Many kinds of existing information may be necessary to develop the plan. The school principal, the PTA/PTO, or any organized citizen group involved in public safety may provide information pertaining to the following items:

- Student walking areas
- Safety patrol and/or crossing guard locations
- Locations of concern
- School hours

The school route plan should include a map that shows the following:

- The school
- Nearby roadways
- Existing traffic control devices
- The suggested school route for children to follow

The following criteria may be considered when developing a school route plan (ITE 1988):

- The school route plan should be designed to provide maximum protection to the children at a minimum cost to the taxpayer.
- School route plans should be designed to take advantage of existing traffic control devices.
- School children should be thoroughly instructed by the schools and parents on the purpose and proper use of the school route plan. Each child should be provided with a copy of the map showing the school route plan.
- Special precautions should be taken in those areas where unusual conditions exist that create problems for school children.

The following factors may be considered when determining the feasibility of requiring children to walk a longer distance to a location with existing traffic control: the availability of adequate, safe sidewalks or off roadway sidewalk areas to and from the location with existing control; number of children using the crossing; age levels of the children using the crossing; and total extra walking distance (FHWA 2003).

The ideal uses and functions of the school route plan map are to (Bismark 1986)

- guide children and avoid roadside and intersection hazards;
- provide for the most effective use of protective measures, such as traffic control signals, STOP signs, pavement markings, and sidewalks;
- minimize the number of crossings on major traffic roadways;
- maximize the use of existing sidewalks and roadways that have wide smooth shoulders;
- choose roadway crossings with adequate sight distance;
- provide a basis for engineering studies of school-related traffic control devices; and
- indicate priorities for sidewalk construction.

Once the school route plan has been developed, it is distributed to users and maintained by school authorities. The school route plan should be transmitted to the agency responsible for traffic control in a given jurisdiction for final approval. Upon approval, the school should post a copy where everybody can view it. Instructions should be given on general pedestrian safety rules and on the use of the plan. A copy of the plan should be sent home with each student so that parents can assist in identifying and explaining the correct route to school for their children.

Regular field checks by school authorities should be undertaken to make sure that students are following recommended routes to school. Lack of compliance with the plan should be investigated to determine if corrective measures or a plan revision is required.

The school route plan is reviewed annually to determine whether revisions are necessary due to changes in school district boundaries, new sidewalk construction, installation of new traffic control devices, or other factors that affect pedestrian and bike safety. Along with changes, necessary revisions should also be made on the map that displays sidewalk location, intersection traffic controls, and school-related traffic controls.

6.8 References and Funding Sources for Schools

In addition to the information within this toolbox, there are other references and funding sources available to schools. This section provides information on several of those sources.

6.8.1 Iowa Department of Transportation

The Iowa DOT's Traffic Engineering Assistance Program (TEAP) provides traffic and safety engineering services for agencies that have traffic safety or operational problems but do not have the funds or the personnel to conduct an appropriate study. The goal of every TEAP study is to efficiently provide brief, unbiased recommendations and identify a clear process to obtain funding and implement improvements. Over 50 communities in Iowa have received a funding for a TEAP study regarding school routes, crossings, and new locations.

Additionally, the Iowa Highway Safety Management System (SMS) members collaborate to develop and maintain a multi-disciplinary approach that provides a "tool box" of strategies and ideas that may be selected and applied to transportation safety issues. Some of the tools involve technical engineering solutions. By contrast, some tools are less tangible and leverage education, aptitude, awareness, attitudes, and other human factors to resolve highway safety issues. Several safety chapters in the toolbox are related to schools, including walking and street crossing, bicycle travel, and school bus travel.

Iowa Department of Transportation Office of Traffic and Safety 800 Lincoln Way Ames, IA 50011 (515) 239-1169 http://www.dot.state.ia.us/traffic/index.htm http://www.iowasms.org/	IOWA HIGHWAY SAFETY MANAGEMENT SYSTEM

6.8.2 American Automobile Association

The American Automobile Association (AAA) provides material to aid schools in educating students and staff about student safety patrols and school safety. The AAA Minnesota/Iowa Centennial Grant Program also provides $100 grants to schools across Minnesota and Iowa for traffic safety activities. Thirty-two schools in Iowa received grants last year and one of those schools was a study school.

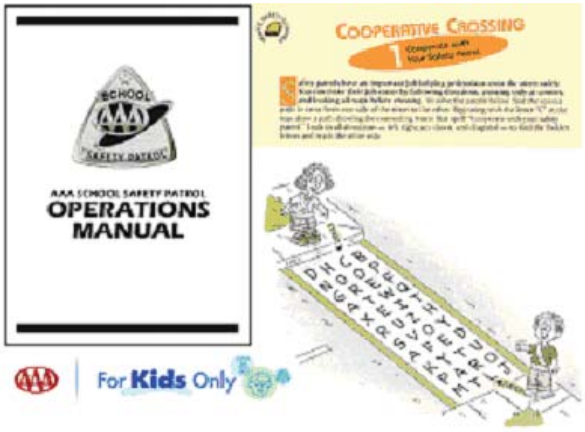
AAA

Safety Patrol Operations Manual and Resources

AAA Minnesota/Iowa
600 West Travelers Trail
Burnsville, MN 55337-2518
(800) 222-1333

http://www.autoclubgroup.com/mnia/kids_only.asp

http://www.aaa.com/aaa/049/PublicAffairs/SSPManual.pdf



6.8.3 National Highway Traffic Safety Administration

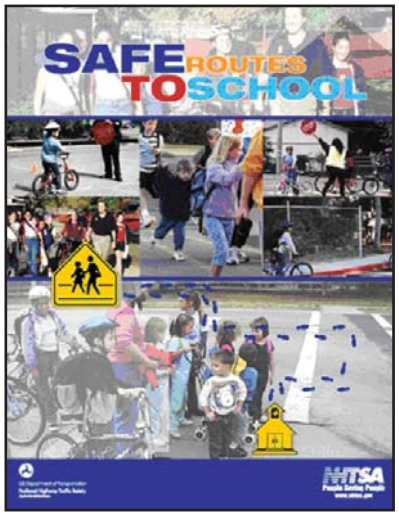
The National Highway Traffic Safety Administration (NHTSA) has published educational material to aid communities in developing Safe Routes to School. The handbook provides guidance on how to establish a Safe Routes to School plan, as well as educational material that can be used in the classroom to assist students in understanding the importance of school zone safety. It also encourages students to practice what they learned.

Safe Routes to School Toolkit

NHTSA Headquarters
400 Seventh Street, SW
Washington, DC 20590
(888) 327-4236

http://www.nhtsa.dot.gov/

http://www.nhtsa.dot.gov/people/injury/pedbimot/bike/Safe-Routes-2002/toc.html



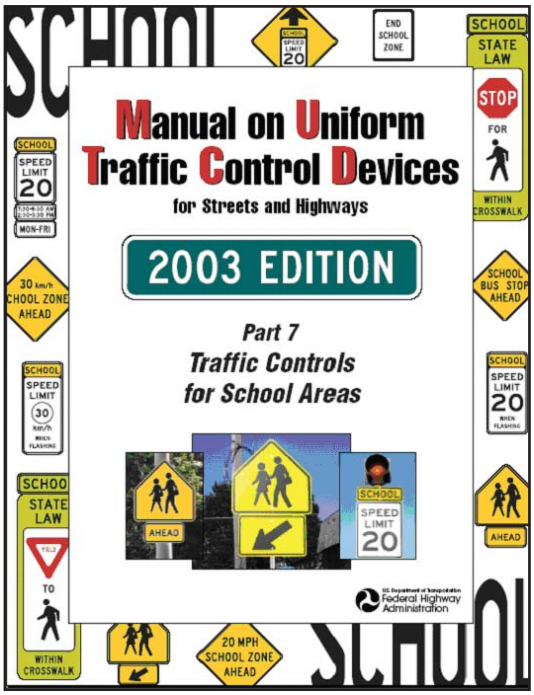
Information about Iowa's Safe Routes to School is found at:
www.dot.state.ia.us/saferoutes

6.8.4 Manual on Uniform Traffic Control Devices

The *Manual on Uniform Traffic Control Devices* (MUTCD) is published by the Federal Highway Administration (FHWA). This document is used nationally to provide consistent traffic control signing, pavement marking, and guidance for highway agencies. Chapter 7 of the manual is dedicated to Traffic Controls for School Areas. Although this manual is primarily used by transportation officials, it may be referenced by the schools to ensure that any signing and pavement marking installed by the schools follows national traffic control standards.

Manual on Uniform Traffic Control Devices (MUTCD), Chapter 7 – Traffic Controls for School Areas

www.mutcd.fhwa.gov



Providing the proper clothing to be worn by student safety patrols and adult crossing guards is very important. The Iowa Department of Transportation requires that all construction workers and inspectors out on the roadway wear high visibility retroreflective safety apparel. According to the MUTCD, all adult crossing guards shall wear safety apparel conforming to ANSI 107-1999 standard performance for Class 2, and student safety patrol shall wear safety apparel conforming to ANSI 107-1999 standard performance Class 1. Several manufactures of this approved safety clothing are shown below.

National Leasing & Investment, Corp	Compliant Clothing	Glowmart
Safety Patrol Division Jim Eldredge PO Box 71544 Clive, IA 50325 515-226-8950 natleasea@aol.com	888-878-2523 www.compliantclothing.com	Ken Kunickis 511 Nelson Street Laurens, IA 50554 866-841-5020 glowmart.com ken@glowmart.com

Glossary of Terms

Term	Definition
Conflict Point	A point of intersection between vehicles and vehicles, vehicles and pedestrians, pedestrian and bicycle, and vehicles and bicycles
Congestion	An excessive amount of traffic that causes a breakdown in normal traffic operations
Loading, Pick up	The act of retrieving a child from school
On-Site	Vehicular and pedestrian activities occurring on school property, including the driveway, parking lot, and sidewalks
On-Street	Vehicular an pedestrian activities occurring on public streets (adjacent to schools and school zones)
Pavement Marking	Colored, reflective paint or tape that helps delineate lane assignments on roadways and designates the type of parking permitted
Pedestrian Countdown Timer	A pedestrian signal that counts down the number of seconds available for pedestrians to cross the street
Queuing	Stopped traffic or people in a line
Retroreflective	Reflective material used on safety vests to enhance visibility when working near live traffic
Signing	Warning (i.e., school crossing) and regulatory signs (i.e., speed limit and STOP signs) posted to help convey a message for drivers and pedestrians
Signalized	Traffic signals for vehicles and pedestrians that assign right of way with green, yellow, and red lights
Sight Distance	The distance or area needed for traffic and pedestrians to detect, recognize, decide, and respond to a potential conflict
Site visit	Observations and data collection at a specific location
Spillback	Traffic within a queue that has extended into an adjacent street
Stand back line	Pavement markings on sidewalks that indicate where pedestrians stand until an acceptable gap or right of way is available
Traffic Operations	The flow patterns of vehicular, bicycle or pedestrian traffic
Traffic Control	Signing (i.e., STOP signs, yield signs), pavement marking (i.e., crosswalks, school x-ing), traffic signals, and geometric layouts (i.e., roundabouts, bump-outs)
Traffic Calming	Traffic control and design techniques to slow traffic down
Transportation Modes	Passenger vehicles, busses, bicycles, and walking are all transportation modes
Unloading, Drop off	The act of releasing a child from a vehicle or bus to school

Acronyms

Acronyms	Definition
AAA	American Automotive Association
AADT	Average Annual Daily Traffic
CDC	Center for Disease Control
DOT	Department of Transportation
FHWA	Federal Highway Administration
ITE	Institute of Transportation Engineers
MUTCD	Manual on Uniform Traffic Control Devices
NHTSA	National Highway Transportation Safety Administration
PTA	Parent Teacher Association
PTO	Parent Teacher Organization
SMS	Iowa Safety Management System
TEAP	Traffic Engineering Assistance Program

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