Safe Routes to School Briefing Sheets

School On-site Design

INTRODUCTION

A well-designed school site should support the safe arrival and departure of pedestrians and bicyclists. From a traffic operations perspective, increased walking and bicycling to school has the added benefit of potentially decreasing the need to accommodate long parent queues at drop-off and pick-up times. It is best for elementary and middle schools to be located within the community they serve, with pedestrian and bicycle access on all sides of the campus. This briefing sheet provides information on key elements to design or redesign a well-functioning school site.

SEPARATION OF PEDESTRIANS, BICYCLES, PARENT VEHICLES, AND BUSES

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

BICYCLE ACCESS AND STORAGE

To encourage bicycling, bicycle access and storage are needed at school sites, including bicycle lanes, shared lanes (produced by providing a wider lane for the inside travel lane), and in some cases trails on separate right of way. In addition, access needs to be provided between the roadway or trail and the bike parking racks at the school. Guidance on bicycle parking is available in the Association of Pedestrian and Bicycle Professionals *Bicycle Parking Guidelines*.[1]

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

Figure 1. Elementary school bicycle facilities in Beaumont. TX, USA.
Source: Michael J. Cynecki

It is advantageous to provide secure bike parking on two sides of the school so that bicyclists do not have to go across campus to a bike rack. Bike safety helmet use should be required or strongly encouraged.

LOCATION OF SCHOOL ENTRANCES

Building entrances should be located with consideration for pedestrian "desire lines." This entails determining the directions and points from which pedestrians are likely to approach the building and then identifying whether the design has inadvertently placed any unacceptable traffic conflicts or obstacles in the pedestrians' routes. An example of such an undesirable conflict is a school entrance that funnels pedestrians toward an uncontrolled midblock location or across a busy driveway. Pedestrians generally prefer the shortest crossing distance and may not walk as few as 100 ft. to cross at a controlled crossing. The location of school entrances should be adjusted to direct pedestrians to the location of the preferred crossings and avoid unnecessary driveway crossings.

BUS-RELATED DESIGN AND OPERATIONS

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

- Single-file right wheel to the curb is the preferred staging method for buses;
- Provide two outbound lanes if possible: one for left-turning and one for right-turning buses;
- Drop-off area design should not require backward movement by buses;
- Bus drop-off areas should be one-way in a counterclockwise direction to ensure that the loading/unloading of students occurs from the right-hand side of the vehicle adjacent to the building;
- The design of the bus drop-off areas should not require children to walk between buses;
- The bus-loading zone should not straddle a pedestrian crossing; and
- For efficiency, bus traffic should not share a common driveway with parent traffic.

DESIGN AND OPERATION OF DROP-OFF AND PICK-UP ZONE

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

- Drop-off/pick-up zones should be one-way in a counterclockwise direction so that students are loaded and unloaded directly to the curb/sidewalk. This practice will minimize pedestrian/vehicle conflicts in the drop-off/pick-up zone because students will not be exposed to traffic;
- Maximize fronting curb space at the loading zone by locating the loading/unloading area at the far end of the zone;
- Provide an adequate driveway length for queuing cars on site. The length of the car pick-up zone should be determined as a function of the expected number of cars;
- Drop-off area design should not require backward movement by vehicles;
- Do not load or unload students where they have to cross a vehicular path before entering the building;
- Student safety patrols and loading supervisors should be well trained and wear highly visible reflective safety vests. Safety vests should be replaced if they are worn or faded;
- Provide maps and instructions to parents on the school Web sites and in newsletters to describe the location and operation of the loading zone; and
- Due to increased dwell time, the space requirements for pick-up can be much longer than for drop-off. Separate policies for pick-up and drop-off may be necessary.

Improvements in pick-up/drop-off zones could result in increased speed on adjacent streets because congestion has been relieved. They could also discourage walking, biking, or bus use because the process is so convenient. The school may need to consider other measures, such as enforcement, to have appropriate speeds on the adjacent street, and incentive programs to encourage walking, biking, or bus use.

Student loading should occur in designated zones to minimize pedestrian/vehicle conflicts. Research[2] has shown that school type is related to the number and type of conflicts. Elementary school sites, which typically have additional supervision and good parental drop-off/pick-up behaviors, such as not dropping off children in parking lots or on the road, tend to have few conflicts. Middle schools typically have less staff supervision and parents who are willing to drop off or pick up children away from the designated student loading zones. When the parking layout is conducive, parents may use it to bypass the drop-off/pick-up queue. This type of loading is undesirable because children can be difficult to see when they emerge from rows of parked vehicles. Loading on an adjacent street can also be undesirable, such as when the vehicle blocks through traffic, when parents and students jaywalk across the street, or when the vehicle is parked in a no-parking zone. When the vehicle is parked on the opposite side of the street, students may need to cross vehicular paths, which is undesirable. Student drop-off in the neighborhood can also result in complaints from neighbors living adjacent to the school. A potential approach is to use remote student loading locations in nearby city parks, community centers, and churches to help eliminate some of the traffic from the campus.

DRIVEWAYS AND INTERNAL ROADWAY NETWORK

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

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

Adequate on-site queue storage length to accommodate parent vehicles during drop-off and pick-up operations is important. Tools such as the school calculator available from the North Carolina Department of Transportation[2] and a recent study in Texas[3] provide guidance regarding queue storage length. It is good practice to use the afternoon pick-up data to predict the maximum queue of vehicles. Another study in Texas[4] found that the on-site elementary school queue design length in number of vehicles is approximately 6 percent of the total enrollment in students; however, this may increase if the school campus and placement are not well designed for walking and bicycling.

PARKING

Many school districts utilize local requirements, typically from a municipality, for the parking requirements at schools. The local requirements for total number of spaces often vary based on school type (high, middle, or elementary schools). Most school architects also use standard graphics software packages for the design of lots or parking spaces (angled, parallel, or conventional). General guidance for schools is to separate parking areas (student, staff, visitors, and buses) from student loading/unloading areas and delivery loading zones and to separate student pedestrians and bicyclists from both. Also, avoid driveways that allow parents to take shortcuts through parking lots to drop off or pick up students; this type of parking layout encourages students to cross vehicular paths.

Short-term parking spaces should be identified beyond the student loading area and near the building entrance. These spaces can be used by parents requiring an extended time to load or unload. The availability of short-term parking keeps the loading area clear of parked vehicles and can result in safer and more efficient operations.

SUPPLEMENTAL DEVICES TO MINIMIZE PEDESTRIAN/VEHICLE CONFLICTS

The design of the school grounds plays a large role in dictating traffic circulation at the site. In addition to physical layout and geometric elements (for example, driveway width or number of lanes), schools can use traffic cones and other channelizing devices to control on-site traffic patterns. Examples of practices include:

- Place traffic cones for traffic control or access restriction. More lanes in the parent zone are associated with increased pedestrian/vehicle conflicts. Cones can be used to create a single-lane queue in the drop-off/pick-up zone. This practice is desirable because it minimizes the potential for pedestrian/vehicle conflicts; however, it can be used only if there is enough capacity to process the queue efficiently using only one through lane;
- Place cones or a traffic gate to restrict vehicles, typically parent vehicles, from accessing a zone designated for other uses (for example, parking, bus loading, pedestrian/bicycle zone); and
- Replace discolored traffic cones with new orange cones.

TRAFFIC CONTROL DEVICES

All signs and markings within school sites should comply with the 2009 *Manual on Uniform Traffic Control Devices* (MUTCD)[5] or with state documents if the state has its own manual or state supplement to the 2009 MUTCD. The MUTCD is the definitive source for guidance on signing, pavement marking, and traffic control. If traffic control devices, signs, and pavement markings within school sites comply with the MUTCD, drivers, pedestrians, and bicyclists are more likely to operate in a uniform manner consistent with off-site operations. Examples of common violations and other problems related to signs and pavement markings at school sites include:

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

It is best for local agencies to create an inventory of signs and pavement markings in the right of way for each school and to inspect these signs/markings annually. School officials can do the same for the signs and pavement marking placed on their campus.

Additional information on traffic control devices for schools is available in the ITE Briefing Sheet—*School Area Traffic Controls*.

REFERENCES

1. Association of Pedestrian and Bicycle Professionals (APBP). *Bicycle Parking Guidelines*, 2nd Edition. Washington, DC, USA: APBP, 2010.
2. http://ncdot.org/doh/PRECONSTRUCT/traffic/congestion/cm/msta/schools.html.
3. Cooner, S.A., K. Fitzpatrick, M.D. Wooldridge, G.L. Ford. *Traffic Operations and Safety at Schools: Recommended Guidelines*. Report No. 0-4286-2, College Station, TX, USA: Texas Transportation Institute, 2004.
4. Qualls, D. *Strategies for the Greening of Student Pick-Ups at School Dismissal*. Washington, DC, USA: Institute of Transportation Engineers, 2010.
5. Federal Highway Administration (FHWA). *Manual on Uniform Traffic Control Devices*. Washington, DC, USA: FHWA, 2009.