



Project Summary Report O-4286-S

Project O-4286: Operational and Safety Guidelines for Roadway
Facilities around Schools

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Summary of Guidelines for Roadway Facilities around Schools

The state of Texas, particularly in the large urban areas, has recently experienced considerable population growth. This growth has produced new schools on sites near highways originally designed for low volumes and high speeds. Another trend is the higher proportion of children being transported to schools in private vehicles. These realities make it important to consider the design of roadways within and around schools. Equally important is the consideration of the location and design of the school site, preferably during the planning stages, in order to establish safe and efficient operations.

The Texas Department of Transportation (TxDOT) has focused attention on these issues through its Precious Cargo Program. Precious Cargo allows TxDOT to review school site plans and make recommendations prior to construction. TxDOT has assisted independent school districts (ISDs) through application of transportation principles and fundamentals, but its efforts have sometimes been limited by the lack of knowledge of the specific problems associated with school transportation needs and the lack of acceptable guidelines. This research addressed these limitations and provided an opportunity to enhance Precious Cargo by providing TxDOT staff,



Some Schools Use Traffic Cones to Improve Flow and Safety in Loading Zones.

ISD personnel, and the other stakeholders with guidelines and good examples for the design and operation of roadway facilities around schools.

What We Did...

Initially, researchers used a variety of methods to review existing guidelines for transportation-related elements at school sites. This review included guidelines on site layout, parking, bus operations, parent drop-off/pick-up zones, pedestrian and bicycle access, and traffic control devices. Secondly, the research team interviewed architects, consulting engineers, and ISD personnel about current school site planning methods and resources.

Researchers also used surveys to identify current site plan review practices used by TxDOT and local municipalities. Next, the research team performed 14 observational studies at schools to assess different school site designs and to refine data collection methods and procedures.

In the second year of the project, researchers conducted field studies at 20 school sites throughout the state to collect detailed operational and safety data to assess various site designs and loading zone strategies. The research team developed guidelines and good examples for the design and operation of transportation-related elements within and around school sites.



What We Found...

Review of Existing Guidelines

Researchers used published documents, Internet searches, survey instruments, and direct correspondence to gather information on existing guidelines. This effort produced some key findings including:

- Much of the state-of-the-practice was found in state DOT and local ISD Internet sites.
- Several state DOTs (including North and South Carolina) have dedicated units for review of school site plans and have developed guidelines based on experience and study of existing sites.
- The most universally cited guideline was separation of modes (auto, bus, and pedestrian).
- A recently completed Transportation Research Board (TRB) study indicated that school buses are the safest form of transport for getting children to and from school.
- Some existing guidelines conflict (e.g., engineering guideline to provide adequate on-site stacking space vs. architectural practice to place the school building near the front of the site).

Results of Interviews and Surveys

Architects. Architecture firms are normally the lead entity on most school construction projects. In order to gain a better understanding of challenges, issues, and methods used to plan and design educational facilities, researchers conducted interviews with six architecture firms with considerable school design experience. The following list presents three key findings from this effort:

- Most resources did not provide any substantial guidance on transportation-related issues.
- Only 3 of 10 participants indicated an awareness of Precious Cargo; however, half had at least one site plan reviewed by TxDOT prior to construction of a new school campus.
- The majority of participants (70 percent) stated that the most challenging problem with traffic

access and circulation at schools was separating vehicle, bus, and pedestrian traffic.

School District Personnel.

According to data collected by *School Management and Planning* magazine, the state of Texas has led the nation in the development and renovation of school campuses, spending over \$19 billion on construction of K-12 facilities between 1992 and 2000. These data mean that Texas ISDs are building a large number of schools, more and more of which are being located on or near state-maintained roadways. Researchers conducted interviews with eight ISD personnel about transportation-related elements of school projects. The following list presents three key findings from this effort:

- Separation of traffic types (vehicles, buses, and pedestrians) was the highest-rated problem area at all campus types (i.e., elementary, middle/junior, and high schools).
- Slightly more than half (56 percent) were aware of Precious Cargo; 40 percent had at least one site plan reviewed by TxDOT prior to construction of a new school.
- Demographics (i.e., locations of existing and future students) were the most important factor in the selection of future land parcels for development of new school campuses.

Consulting Engineers. Civil or transportation engineers support architects on many projects with traffic-related elements. A member of the research team interviewed two consulting engineers with extensive experience in school projects regarding coordination issues with architects and the design principles they commonly use. The following list presents two key findings from this effort:

- The integration of traffic circulation with the school building's location was important, but consulting engineers were typically brought in late in the process and in some cases were called upon after construction to devise solutions to access and circulation problems.

- Design guidelines for parent zones were sketches or in-house sources (no written guidelines).

TxDOT and Municipal Engineers.

Researchers mailed a survey to each TxDOT district and most of the major municipalities in Texas. The survey gathered information on how school site plans were reviewed and also identified good (and not-so-good) examples for design and operation of transportation facilities at schools. The following list presents three key findings from this effort:

- TxDOT and cities preferred to be involved very early in the school site planning process.
- When reviewing a school site plan, TxDOT and cities were overwhelmingly using the *Manual on Uniform Traffic Control Devices* (MUTCD) and engineering judgment. TxDOT staff also used the *Roadway Design Manual*, and cities used local guidelines.
- TxDOT has no requirement in place for school sites to have a traffic impact analysis (TIA); however, four of the nine city respondents required a TIA.

Observational Case Studies

In the first year of the project, researchers performed observational case studies at seven elementary, five middle, and two high schools. Some key findings from this effort included:

- The average amount of time spent dropping off or picking up was significantly more variable in the afternoon as opposed to the morning.
- There was a wide variety of design, operational, and traffic control practices (lack of uniformity).
- Some schools used innovative practices such as placement of traffic cones and use of students and staff for on-site traffic control to improve safety and traffic flow.

Researchers also observed several typical problems. Some examples of these problems included:

- lack of sufficient on-site stacking length, which caused the queue of vehicles trying to access the school



site to spill back onto adjacent roadways;

- undesirable behaviors such as circumvention of traffic control (e.g., DO NOT ENTER and turn restriction signs) and use of non-designated areas for loading (e.g., parking lots);
- signs and pavement markings that were not consistent with accepted MUTCD standards;
- lack of supervision of on-site loading zones, particularly during morning drop-off; and
- at many sites, a low proportion of students arriving by bus and/or walking, which contributed to the high volume of vehicles vying for access to the campus.

Field Studies

The team conducted in-depth field studies at 20 schools and focused on elementary schools and parent drop-off/pick-up zones. Researchers concentrated on collecting data at elementary sites because they are the most prevalent type of school (almost 60 percent of public schools in Texas) and are frequently cited for having problems. Some of the key field study findings for elementary sites included:

- Student enrollments ranged from a low of 400 students to a high of 1087 students, and many schools were over their design capacities.
- The percentage of students arriving at school by private vehicle ranged from a low of 34 percent to a high of 92 percent, with an average of approximately 60 percent.
- The percentage of students arriving at school by bus or day care vans ranged from a low of 1 percent to a high of 55 percent, with an average of approximately 33 percent.
- The percentage of students arriving at school by walking or cycling ranged from a low of 0 percent to a high of 21 percent, with an average of approximately 7 percent.
- On average, almost twice as many vehicles arrived in the morning than in the afternoon; however, maximum queues were twice as long in the afternoon because departure times were less variable.



Queue Spillback Was a Common Problem at School Sites.

Some general findings based on the pedestrian/vehicle conflict data collection included:

- Elementary sites experienced a relatively low rate of conflicts primarily because of good on-site supervision by staff members.
- Sites with two or more lanes for loading and unloading of students had more conflicts than those with single-file queue lanes.
- Middle school sites had significantly more conflicts compared to elementary sites, which was attributed to less supervision in the loading zone.

Guidelines and Good Examples

Based on the findings and lessons learned during the project activities, the research team developed recommended guidelines for the design and operation of transportation-related elements within and around schools. Researchers organized the guidelines into nine different categories including:

- site selection criteria;
- general site requirements and design;
- bus operations;
- parent drop-off/pick-up zones;
- bicycle/pedestrian access;
- driveways;
- turn lanes;

- traffic control, signing, and pavement markings; and
- parking requirements and design.

These guidelines are provided in detail in Report 0-4286-2. This document also contains best practices and good examples of school site design and operations.

The Researchers Recommend...

Based on the findings of this project, researchers recommend:

- Increased promotion of the TxDOT Precious Cargo Program to school districts and architecture firms to increase awareness and usage. This promotion can be accomplished by coordination with professional organizations such as the Council of Educational Facility Planners International (CEFPI) and the American Institute of Architects (AIA).
- TxDOT district staff use the guidelines, good examples, and review checklist produced during the project to ensure a uniform approach to review of school site plans.
- Further research on topics regarding development of methods and techniques to increase the proportion of students getting to school by bus, walking, and biking versus private vehicles.



For More Details . . .

The research results, conclusions, and recommendations are documented in:

[Report 4286-1, *Traffic Operations and Safety around Schools: Review of Existing Guidelines*](#)

[Report 0-4286-2, *Traffic Operations and Safety around Schools: Recommended Guidelines and Best Practices*](#)

[Report 0-4286-3, *Operations and Safety around Schools: Overview of Project Activities and Findings*](#)

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TxDOT Implementation Status—January 2004

The objective of this research project was to develop safety guidelines and good examples of design and operation of transportation modes in and around school sites. One product was required for this project: recommended guidelines for traffic operations and safety at schools. These guidelines and procedures were submitted as Research Report 0-4286-2. It is recommended that these guidelines and procedures be implemented on a case-by-case basis, contingent on the approval of public school and local government officials, as well as TxDOT, when a school site is located near a state-maintained roadway.

For more information, contact Mr. Wade Odell, P.E., RTI Research Engineer, at (512) 465-7403 or e-mail wodell@dot.state.tx.us.

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