

# Evaluation of fatal school bus related crashes and near-term crash mitigation strategies



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## ABSTRACT

School bus crashes are rare in comparison to other crash types, but considering all crashes that occur in and around school buses, they begin to become a noticeable problem and one that tends to attract national attention. As defined by the Fatality Analysis Reporting System (FARS), a school bus related crash is a crash that either involves a school bus or a crash where the presence of a school bus is considered as a major contributing factor. Ten years of data indicate that the number of fatal school bus related crashes has remained nearly stagnant despite an increase in the number vehicle safety systems available on the market. The findings also highlight the importance of protecting the non-bus occupants since they are the most likely to incur a serious or fatal injury in the event of a crash. As the most vulnerable user group, pedestrians (typically school-aged children) are especially at risk when crossing the road while boarding or exiting a school bus. Until new technologies for reducing school bus related crashes are designed and implemented, school transportation safety can be improved by increasing awareness of school bus stop laws and by implementing existing transportation safety initiatives at school bus stop locations.

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## 1. Introduction

Students around the world use buses to travel to and from school. In the U.S. alone, 450,000 public school buses travel approximately 4.3 billion miles to transport 23.5 million students to and from school and school related activities each year [7]. Data from the 2000 Census Report estimates that school-aged children make 23.5 billion trips each year regardless of mode-choice (9.7 billion trips in the morning and 13.8 billion trips in the afternoon) and more than half of the total trips occur on rural roads (58.6 billion miles annually) compared to urban roads (54.7 billion miles annually) [4]. Assuming the general rural/urban trip distribution can be applied to school bus transportation, rural trips account for 2.2 billion miles of travel and urban trips account for 2.1 billion miles of travel.

School bus transportation is often considered one of the safest modes of travel [4,7,8,10,13,17] since it only accounts for 2% of the total number of motor vehicle fatalities of school-aged children [8]; however, if one considers all of the vehicles involved in school bus related crashes, such as an injury or fatality in a passenger vehicle that collided with a school bus, there are approximately 140 school-aged fatalities and 85,000 injuries each year due to school bus related crashes

[1]. By studying and understanding the characteristics of these crashes, school transportation professionals, in combination with researchers and engineers, can develop methods and technologies to reduce school bus related crashes of all severity levels.

## 2. Identifying the Problem

Although research surrounding school bus related crashes is limited, a handful of researchers have identified areas of concern surrounding school bus transportation. These problems generally related to the students' awareness of their own safety and other motorists' regard for school bus loading and unloading laws.

### 2.1. Lack of awareness of students as pedestrians

As students exit the bus, they often have to cross the street by walking in front of or behind the bus. In this process, young children sometimes become the victims in school bus related crashes in the loading and unloading zone [1]. There are two common cases where students could find themselves involved in this type of crash:

1. Students may dart in front of the bus, unaware of the bus driver's restricted visibility within the ten foot area surrounding the bus. Due to its nature, this area is often referred to as the "danger zone" [5].
2. If motorists are unaware of the law to stop while buses are stopped, they may illegally pass a bus and collide with a child attempting to cross the road.

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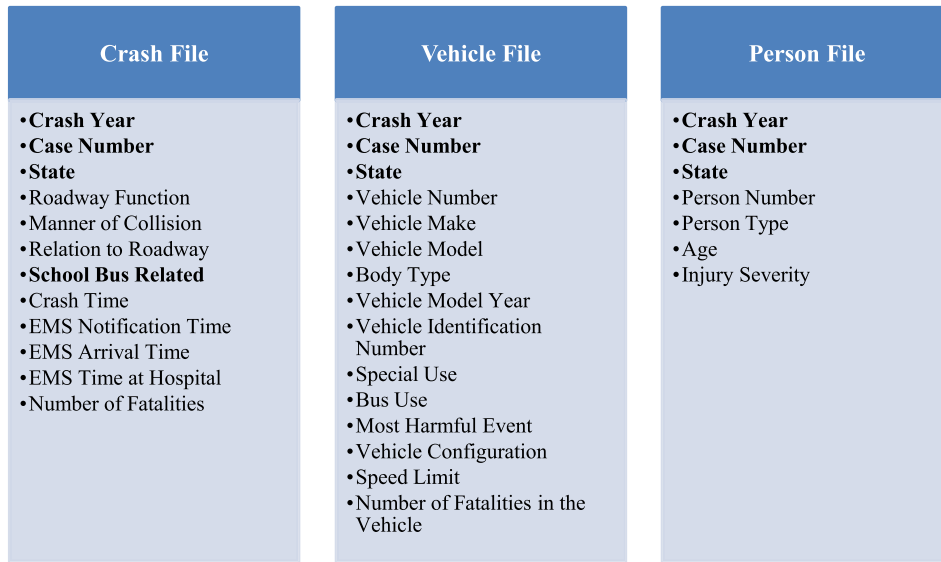


Fig. 1. Variables utilized in the crash analysis. The three databases were linked together through the crash year, case number, and state. Additionally, only crashes indicated as being “school bus related” were kept.

2.1.1. Illegal passing of stopped school buses

In a survey of school bus drivers in three Florida counties, drivers perceived illegal passing by other motorists as the biggest safety problem that faces school transportation vehicles [1]. This claim is substantiated by a field study in Florida which identified 10,590 instances of vehicles illegally passing 3427 school buses on a single day. In that study fifty-six percent of the illegal passing maneuvers occurred on 2-lane roads and more than half of those (66%) were by vehicles traveling in the opposing lane. On average, there were 5.9 incidents per bus per day on routes that utilized primarily main roads, whereas mostly minor-road routes with light traffic averaged 3.1 incidents per bus [1].

Although injuries caused by illegally passing vehicles are rare, reported injuries generally involved a pedestrian with serious head injuries and a variety of bone fractures. Sometimes, illegal passing also resulted in sideswipe crashes that caused cosmetic damage to the bus, but few occupant injuries or fatalities were reported as a result of those crashes [1].

2.2. Knowledge gaps and unique research contributions

Previous research on school bus crashes are limited to injury and fatality data of school bus occupants or provide limited information on

the occupants of other vehicles involved [8,10]. The remainder of this paper considers the previously mentioned issues in addition to parsing out information on where and under what circumstances school bus related fatal crashes are occurring. Although all the raw data in this paper is publically available, the authors are articulating it in manner that has not been done before. Doing so provides a more complete understanding of the problem which could encourage the development and implementation of technologies to improve school transportation safety.

3. Data analysis

The data for this paper was collected through the National Highway Traffic Safety Administration's (NHTSA's) Fatality Analysis Reporting System (FARS). The FARS database contains the police-reported information on all fatal crashes in the United States. It is important to note that since FARS only contains data from fatal crashes, less severe crashes are underrepresented in the data.

3.1. Data collection method

The data in the following sections presents ten years of fatal school bus related crash data. The timespan (2002–2011) was chosen to ensure

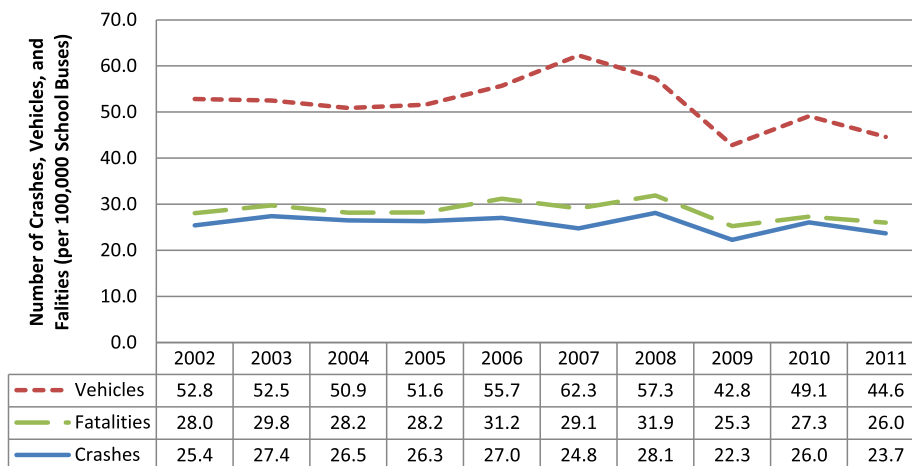


Fig. 2. Number of school bus related crashes, fatalities, and vehicles involved in fatal crashes (per 100,000 school buses).

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