

## Summary Report

# HSIS

HIGHWAY SAFETY INFORMATION SYSTEM

The Highway Safety Information Systems (HSIS) is a multi-State safety data base that contains accident, roadway inventory, and traffic volume data for a select group of States. The participating States, Illinois, Maine, Michigan, Minnesota, and Utah, were selected based on the quality of their data, the range of data available, and their ability to merge data from the various files. The HSIS is used by FHWA staff, contractors, university researchers and others to study current highway safety issues, direct research efforts, and evaluate the effectiveness of accident countermeasures.



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## ANALYSIS OF COMMERCIAL BUS CRASHES

Motor vehicle crashes involving buses represent a serious safety problem in the United States that has not been properly recognized or addressed. In 1989, for example, 57,000 buses were involved in accidents, resulting in 15,000 bus occupant injuries and 50 bus occupant fatalities. In addition, these accidents resulted in 205 occupant fatalities in other vehicles and 111 non-occupant fatalities. This investigation was undertaken to determine the capability of the Highway Safety Information System (HSIS) data base to provide detailed information on the causes and characteristics of transit bus crashes.

### Analysis Methods

The first step in this investigation was the review of accident file formats to determine which State code transit buses separately from school buses as a vehicle type involved in a crash. Because each of the five HSIS States had separate designations for school buses, the number of crashes involving commercial buses could be determined. The HSIS data bases were reviewed with regard to variables pertaining to crash severity, contributing circumstances, type of crashes, driver features, and roadway conditions.

Based on this preliminary investigation of the HSIS data bases, a detailed analysis was conducted of bus crashes, as funded by the University Transportation Center (UTC) program. The analysis first involved an investigation of 2 years (1988-1989) of crashes from Illinois, totaling more than 621,000 vehicle involvements. The purpose of this analysis was to compare crash characteristics of commercial buses to those of cars and pickups, trucks, and school buses. Next, the 8,897 crashes (1985-1989) involving commercial buses were analyzed from the 5 States. This included 3,825 bus accidents from Illinois (43.0 percent), 2,160 from Michigan (24.3 percent), 2,014 from Minnesota (22.6 percent), 526 from Utah (5.9 percent), and 372 from Maine (4.2 percent). In addition to analyses conducted on overall bus accidents, separate analyses were conducted on a subset of the urban bus crashes. Accident characteristics were summarized, and potential countermeasures were recommended relating to the bus driver, bus design/operation, and the roadway.

### Results

Bus crashes are most frequent in the cold weather months of January and February and least frequent during July and August. As expected, bus accidents occur most often during weekdays than weekend days, due to higher weekday bus exposure and

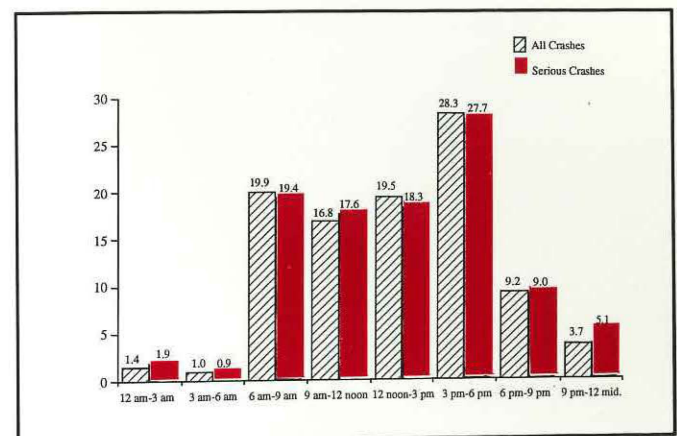


Figure 1. Bus Crashes by time of day using HSIS data base (1985-1989).

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ridership. Bus crashes peak during the more congested afternoon rush period of 3:00 to 6:00 p.m. (see figure 1). Evening and nighttime bus crashes are less frequent but are more severe than those occurring during other periods.

In terms of environmental features, bus accidents are less frequent but more severe at night (on roads where street lights are present) than during other light conditions. Wet roads are associated with higher crash severities than dry or icy pavements. The most common accident types involving commercial buses are sideswipe same direction (24.0 percent), turning (23.1 percent), and rear-end one vehicle stopped (23.3 percent), as shown in figure 2. Rear-end both moving accidents are less frequent for commercial buses (8.6 percent) than for trucks (12.5 percent) or cars and pickups (12.9 percent). These accident trends are consistent with the types of operation commonly associated with buses in urban areas, such as frequent stops, turns, and lane changes.

In terms of bus driver characteristics, while drivers between the ages of 36 and 45 were involved in many more reported crashes than other ages, driver age was not related to accident involvement based on their relative population in the traffic stream (based on induced exposure analyses). While 79 percent of crash-involved bus drivers were male, gender was not related to crash involvement (based on their exposure) or accident severity. In terms of bus features, older buses were over-involved in reported accidents and also in injury and fatal crashes.

A number of recommendations were made to reduce the frequency and/or severity of bus crashes. Roadway design improvements for bus routes include use of wider lanes and intersection turning radii, adding turn lanes, elimination of on-street parking, traffic signal improvements

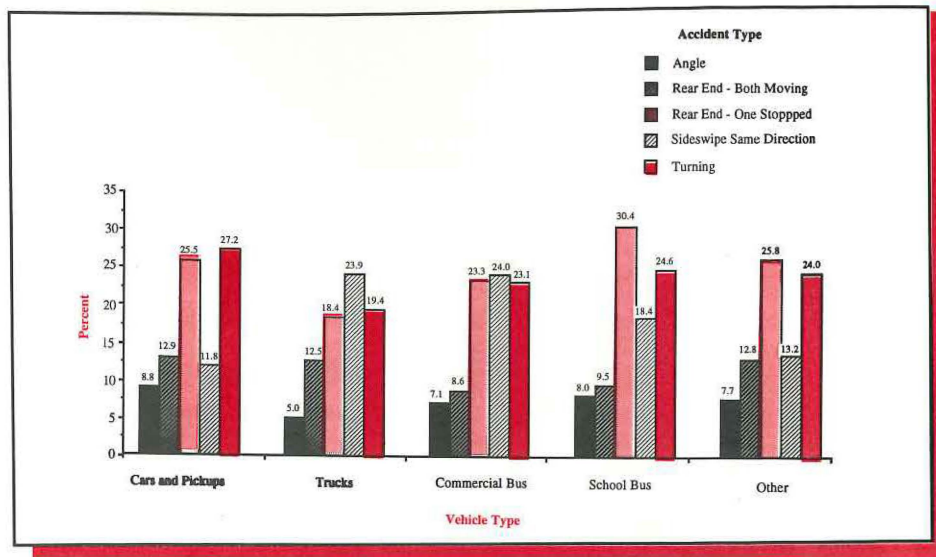


Figure 2. Summary of Accident Type by vehicle type— Illinois (1988 and 1989) motor vehicle crashes.

(e.g., providing separate left-turns phasing), providing adequate nighttime lighting, safer roadside design (e.g., flatter slopes and better clear zones), use of wide paved shoulders or exclusive bus lanes in rural areas, and improved snow and ice removal. Other potential improvements include locating bus stops on the far side of intersections, improved bus designs and operation to reduce passenger injuries, bus driver screening and education, improved bus safety and security reporting systems, and other improved transit agency policies.

## State Data Bases Used

For each of the five HSIS States, it was possible to conduct an analysis of commercial buses. A review of the variables relating to crash severity, contributing circumstances, driver characteristics, bus age, type of crashes, and other factors revealed that each of the HSIS States has sufficient data detail for a meaningful analysis of bus crash causes and characteristics.

## Study Implications

The availability of HSIS accident data allowed for an indepth, multi-State analysis of commercial bus crashes. This was one of the few bus accident studies that has ever been conducted on a large-scale basis in the United States. Results from this analysis are being submitted to the Federal Transit Administration for use by highway designers and engineers and also transit agency representatives.

## For More Information

This research was conducted under the direction of Charles V. Zeegar at the University of North Carolina Highway Safety Research Center through a grant from the U.S. Department of Transportation, University Transportation Centers Program. The final report titled "Characteristics and Solutions Related to Bus Transit Accidents" is in publication. For more information contact, Jeffrey F. Paniati, HSIS Program Manager, HSR-30, (703) 285-2568.