Project Name: EVALUATION OF PUBLIC TRANSPORTATION SAFETY NEEDS OF SPECIAL POPULATIONS

Final Report

Report Title: **IDENTIFICATION OF CRITICAL ISSUES INVOLVING SCHOOL BUS SAFETY**

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16. Abstract

There are around 8500 annual injuries to students due to crashes or accidents involving school bus transportation. Although school bus transportation is a relatively safe mode of transportation, with occupant fatality rates much lower than passenger cars, renewed attention has addressed safety concerns of this mode of transportation. This is because it involves children, who are a precious resource of our nation's future.

This study was conducted to identify the critical safety concerns involved in school bus transportation so that countermeasures could later be focused on the most important safety concerns. Based on a review of the existing literature, the safety concerns identified were illegal passing of a stopped school bus by other motorists, use of nonconforming vehicles (vans), handrail snagging, school bus driver training, licensing and retention, student discipline and supervision, students with special needs, routing procedures, standees and overcrowding, mechanical and equipment concerns, evacuation drills and emergency exits, and seat belts (lap belts).

A survey was carried out to determine the perceived significance of various safety concerns in school bus transportation from the school bus drivers' perspective. It was decided to survey school bus drivers because there was little available literature to identify safety concerns from the perspective of these frontline participants. The survey was conducted in the Alachua, Orange and Pinellas school districts of Florida.

It was found that school bus drivers' perception of safety concerns closely correlate with findings reported in the existing literature. The study also revealed that school bus drivers perceived illegal passing by other motorists, student misbehavior on board the bus and at stops, and school bus backing up to be the issues of primary concern.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yards	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
VOLUME				
fl oz	fluid ounces	29.57	milliliters	ml
gal	gallons	3.785	liters	l
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
NOTE: Volumes greater than 1000 l shall be shown in m^3.				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams	Mg
TEMPERATURE (exact)				
°F	Fahrenheit temperature	5(F-32)/9 or (F-32)/1.8	Celcius temperature	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	l
fl	foot-Lamberts	3.426	candela/m^2	cd/m^2
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
psi	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	ac
ha	hectares	2.47	acres	mi^2
km^2	square kilometers	0.386	square miles	
VOLUME				
ml	milliliters	0.034	fluid ounces	fl oz
l	liters	0.264	gallons	gal
m^3	cubic meters	35.71	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg	megagrams	1.103	short tons (2000 lb)	T
TEMPERATURE (exact)				
°C	Celcius temperature	1.8C + 32	Fahrenheit temperature	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m^2	candela/m^2	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	psi

* SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.

(Revised August 1992)

ABSTRACT

School bus transportation incidents killed an estimated 169 persons nationwide in the 1995-1996 school year, including 43 pupils and 126 other persons. There are around 8500 annual injuries to students due to crashes or accidents involving school bus transportation. Although school bus transportation is a relatively safe mode of transportation, with occupant fatality rates much lower than passenger cars, renewed attention has addressed safety concerns of this mode of transportation. This is because it involves children, who are a precious resource of our nation's future.

This study was conducted to identify the critical safety concerns involved in school bus transportation so that countermeasures could later be focussed on the most important safety concerns. Based on a review of the existing literature, the safety concerns identified were illegal passing of a stopped school bus by other motorists, use of nonconforming vehicles (vans), handrail snagging, school bus driver training, licensing and retention, student discipline and supervision, students with special needs, routing procedures, standees and overcrowding, mechanical and equipment concerns, evacuation drills and emergency exits, and seat belts (lap belts).

One of the primary participants in school bus safety is the school bus driver. A survey was carried out to determine the perceived significance of various safety concerns in school bus transportation from the school bus drivers' perspective. It was decided to survey school bus drivers because there was little available literature to identify safety concerns from the perspective of these frontline participants. The survey was conducted in the Alachua, Orange and Pinellas school districts of Florida.

It was found that school bus drivers' perception of safety concerns closely correlate with findings reported in the existing literature. The study also revealed that school bus drivers perceived illegal passing by other motorists, student misbehavior on board the bus and at stops, and school bus backing up to be the issues of primary concern.

FOREWORD AND ACKNOWLEDGEMENTS

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The authors acknowledge with thanks the school boards of the Alachua, Orange and Pinellas Counties and their participating drivers, whose cooperation and timely action in conducting and responding to the survey, contributed to a significant portion of this study.

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CHAPTER 1
INTRODUCTION

1.1 General Comments

On average, 55% of the nation's pupils in grades K-12 are transported by school buses [STN98]. Every year, nearly 440,000 public school buses travel around 4.3 billion miles to transport 23.5 million children to and from school and school-related activities. The school bus occupant fatality rate is 0.2 fatalities per 100 million vehicle miles traveled (VMT), compared to the occupant fatality rate of 1.5 per 100 million VMT for passenger cars and 1.3 per 100 million VMT for light trucks and vans [TSF95].

Although school bus transportation is a relatively safe mode of transportation, this degree of safety can and should be improved, especially since it involves children, who are the future of the nation and represent a particularly vulnerable special population group. There has been renewed interest in improving the level of school bus safety and in 1998, with the increase in the highway budget approved by Congress, the National Highway Traffic Safety Administration (NHTSA) has proposed a study that will review occupant protection measures for school buses. The study is part of an overall research program to improve all aspects of school bus transportation [SPC98].

1.2 Problem Statement

School bus safety comprises the areas of bus loading and alighting, occupant protection, related issues involving the school bus driver, and equally important the interactions of other motorists. It is a matter of concern that there is an average of 37 student pedestrian fatalities and nine occupant fatalities per year. Student pedestrian fatalities are largely caused by the school bus itself and by other motorists who illegally pass a stopped school bus. Extrapolated data by the National Safety Council (NSC) indicate an average of 13,000 student injuries per year. NHTSA data indicates that there were about 8,511 annual student injuries during the period 1988-1996. Of the injuries to students, 8,170 (96%) were minor to moderate, requiring some degree of hospitalization. The remaining injuries were considered serious. There were also 1,482 injuries to school bus drivers nationwide [GES97].

One of the most serious safety concerns involves the operation of the bus itself because the majority of the fatalities were due to pedestrians being struck by the school bus. This indicates a lapse on the part of the driver, which may have occurred due either to their own errors or to external sources of distraction. The existing literature does give a statistical basis to quantify the nature of accidents that have occurred, but there is no available literature from the perception of school bus drivers to identify the possible causes that led to the lapses on their part.

1.3 Objectives of the Study

This study is part of the first phase of a study conducted for the Southeastern Transportation Center to identify the critical safety concerns involved in transportation of special populations, which, in this specific case, involves students who use school buses, and related issues. Upon identification of critical safety concerns, the second phase will suggest countermeasures addressed at these safety concerns.

The main objective of this study is to identify the critical safety issues involved in school bus transportation. Another objective is to obtain perceptions of the safety issues in school bus transportation from school bus drivers, since there is little available literature to identify safety concerns from their perspective. School bus drivers have a constant exposure to school bus transportation and they can identify any safety issues of critical importance with a reasonable level of confidence.

1.4 Report Organization

This chapter gave an overview of school bus transportation, the problem statement and the objectives of this study. Chapter 2 contains a review of the literature on school bus transportation and safety-related issues. Chapter 3 contains a description of the methodology involved in conducting the survey of school bus drivers in representative local school districts in Florida. Chapter 4 covers the results of the survey conducted and contains findings of assessments of the school bus safety concerns from the school bus drivers' perception. Chapter 5 presents the conclusions that identify the critical safety concerns in school bus transportation and recommends the areas in which countermeasures should be primarily focussed.

1.5 Limitations of the Study

One limitation of this study was the lack of access to detailed descriptions of accident and incident reports, especially in the cases involving students' misbehavior. The brief accident reports provided by school districts could only be used for quantitative or statistical purposes with no method of drawing qualitative inferences as to the possible causes of accidents and incidents. Another limitation was the inability to measure the benefits and experiences of seat belt use on the school bus from the drivers' perspective since none of the school districts in Florida are required to have seat belts. A third limitation was the inability to assess hazards posed by using vans from the drivers' perception, since the drivers only had experience using conventional school buses in accordance with the policy of the surveyed school districts.

CHAPTER 2
REVIEW OF LITERATURE

2.1 Overview

School bus transportation incidents killed an estimated 169 persons nationwide during the school year 1995-1996, including 43 pupils and 126 other persons. Of the pupils killed, 27 were pedestrians either approaching or leaving a loading zone [NSC96]. About one quarter of the pupil pedestrian victims were struck by the school bus that they were entering or leaving. School bus pedestrian fatalities account for the highest number of school bus related fatalities each year. There is an average of 37 such fatalities per year, about 27 of which involve the school bus itself and about 10 involving illegal passing of the stopped school bus by other vehicles [SBC95]. Table 2.1 is a summary of the types of school bus fatalities for the years 1985-1995 [TSF95].

Table 2.1 Fatalities in School Bus Related Crashes, 1985-95

Year	School Bus Occupants*			Pedestrians			Other Non-Occupants	Occupants of Other Vehicle	Total
	Driver	Passenger	Total	Struck by School Bus*	Struck by Other Vehicle	Total			
1985	2	22	24	28	13	41	4	89	158
1986	2	0	2	31	16	47	6	73	128
1987	8	9	17	32	11	43	5	113	178
1988	2	6	8	19	17	36	6	80	130
1989	4	33	37	25	7	32	1	72	142
1990	4	7	11	32	7	39	1	64	115
1991	2	15	17	21	5	26	5	86	134
1992	1	9	10	21	8	29	2	83	124
1993	1	12	13	32	8	40	2	86	141
1994	2	2	4	28	9	37	2	64	107
1995	0	13	13	23	10	33	4	71	121
Total	*28*	*128*	*156*	*292*	*111*	*403*	*38*	*881*	*1,478*
Avg.	*2.5*	*11.6*	*14.2*	*26.5*	*10*	*36.6*	*3.5*	*80.0*	*134.0*

* Includes conventional school bus and vehicle used as school bus.

Source: [TSF95]

For this 11 years, 1,478 people died in school bus-related crashes, which is an average of 134 fatalities per year. Nearly 60% of those killed were occupants of other vehicles involved. Non-occupants (pedestrians, bicyclists, etc.) accounted for 30% of the fatalities, and school bus occupants accounted for 11% (drivers 2%, passengers 9%). For this same period, there were more than 400 school-aged (less than 19 years old) pedestrian fatalities in school bus-related crashes. Half of all school-aged pedestrians killed in school

bus-related crashes were between the ages of five and seven years. More school-aged pedestrians were killed in the afternoon than in the morning, with 43% of the fatalities occurring in crashes between 3:00 PM and 4:00 PM [TSF95].

Most of these student pedestrian fatalities occurred in the "danger zone," an area of bounded by 10 feet surrounding the bus. This is the blind zone around the bus where the visibility to the driver is poor or non-existent. In this zone, students are also at risk of being struck by illegally passing vehicles that do not have sufficient time to avert the collision. Younger students comprise the majority of the fatalities in the loading and unloading zone. In the issue of loading zone safety, various factors are involved such as violations by the school bus itself, illegal passing by other vehicles, driver training and operation, student behavior and supervision, school bus routing and stops, and vehicle deficiencies. Loading zone safety and its associated components have assumed as much importance as occupant protection.

With regard to occupant protection, school buses are designed to conform to about 35 Federal Motor Vehicle Safety Standards (FMVSS), such as outside mirrors to provide the seated driver with a view in front of and along both sides of the bus; amber and red warning lights when the bus is stopped to load or unload passengers; emergency exits; and fuel system integrity. Four of these standards unique to school buses are,

- School Bus Rollover Protection (FMVSS 220), which specifies the minimum structural strength of buses in rollover-type accidents;
- School Bus Body Joint Strength (FMVSS 221), which specifies the minimum strength of the joints between panels that comprise the bus body and the body structure;
- School Bus Passenger Seating and Crash Protection (FMVSS 222), which establishes requirements for school bus seating systems for all sizes of school buses, provides minimum performance requirements for wheelchair securement and occupant restraint devices, and establishes a requirement that wheelchair locations be forward facing; and
- School Bus Pedestrian Safety Devices (FMVSS 131), which requires school buses to be equipped with an automatic stop signal arm on the left side of the bus to help alert motorists that they should stop their vehicles because children are boarding or leaving the stopped school bus.

The school bus safety requirements apply only to buses built after 1977 that are used to transport pre-primary, primary, or secondary school children. The post-1977 FMVSS standard school buses have a remarkable safety record. In terms of fatalities, school bus occupant fatalities fell from 75 in 1970 to 19 in the 1996-97 school year [KSDE96]. Due to recent enhancements in the highway budget approved by the U.S. Congress, NHSTA is conducting a comprehensive occupant protection study to reevaluate the structural integrity of school bus occupant protection systems and to review the controversial issue of installing seat belts on large school buses.

Based on a preliminary review of existing literature, major safety concerns relative to school bus transportation were identified as follows:

- illegal passing of a stopped school bus by other motorists;
- use of nonconforming vehicles (vans);
- handrail snagging;
- school bus driver training, licensing and retention;
- student discipline and supervision;
- students with special needs;
- routing procedures;
- standees and overcrowding seats;
- mechanical and equipment concerns;
- evacuation drills and emergency exits; and
- seat belts (lap belts).

This categorization served as the basis for the study. We review the literature covering these specific areas in the remaining of this chapter.

2.2 Illegal Passing

For the years 1985-1995, of all pupil fatalities, 63% were killed by school buses, 5% by the vehicles functioning as school buses, and about 32% of pupils were killed by other vehicles that illegally passed a stopped school bus [KSDE96, MRB96]. Two related studies [MRB96, MRB97] were conducted within Florida by the Center for Urban Transportation Research (CUTR) to analyze the issues of illegal passing and motorist comprehension of the school bus stop laws, respectively.

Field studies in Florida revealed that 10,590 vehicles illegally passed 3,427 school buses on a single day. This averages to about three illegal passes per school bus per day. About 80% of the violating vehicles were passenger cars. The vehicles illegally passed a significant portion of wheelchair lift-equipped buses. That could be due to the extra time it takes to load and unload the disabled children. The illegal passing was almost evenly distributed throughout the operating hours of school buses. In the study conducted by CUTR in 1995, Pinellas County ranked fourth among all school districts in Florida in the daily occurrence of illegal passing with a rate of 1.71 incidents per day per bus. Alachua County ranked eighth with a rate of 1.23 incidents per day, and Orange County ranked 21st with a rate of 0.64 incidents per day [MRB96].

Around 56% of the illegal passing occurred on two-lane roadways. Vehicles travelling in the opposite direction of the school bus constituted about 66% of the passing. About 24% of illegal passing occurred on four-lane roadways with a center two-way left turn lane [MRB97]. A disturbing finding was that illegal passing frequently occurred on the right (loading side) of the stopped school bus. The amount of time taken by students to board and alight from bus is a factor that could influence the decision of passing motorists; these motorists may grow impatient when there is a larger number of students boarding or alighting from the bus [MRB96].

The problem has also been attributed to inadequate law enforcement. Motorists may be complacent in the knowledge that they will not be drawing attention from law enforcement authorities as they would in the case of speeding and other infractions. Also, some motorists surveyed in the CUTR study were oblivious to the fact that the school bus had stopped [MRB96]. Another factor was poor motorist comprehension of school bus stop laws and school bus stop signalization devices. The other CUTR study [MRB97] revealed that 80% of the school buses that were illegally passed had their strobe lights and flashers activated indicating that they had stopped.

Transportation Research Board (TRB) Special Report 222 [TRB89] concluded that stop signal arms are an effective means of stopping traffic and would help reduce fatalities and injuries in the loading and unloading zone. Also, better law enforcement, periodic public awareness campaigns and driver education would definitely be beneficial. Some states have empowered school bus drivers to record the tag number and other details of the offending vehicle so that the law enforcement authorities can later issue a citation [MRB96].

2.3 Use of Nonconforming Vehicles (Vans and Transit Buses)

The use of passenger vans with capacities of more than 10 passengers to transport children to and from school and school-related activities has become an issue. In an effort to save money, some school districts have purchased or leased passenger vans to transport students. NHTSA defines a "school bus" as a motor vehicle designed for carrying 11 or more persons, including a driver, and sold or leased for transporting students to and from school or school-related events [PJR91]. Under federal law, a 12-15 passenger van is considered a school bus if its intended use is to transport school children.

Federal law prohibits dealers from selling or leasing a motor vehicle with a capacity of more than 10 persons for transporting students to and from school or a school-related activity, unless the vehicle complies with the applicable Federal Motor Vehicle Safety Standards for school buses. This law applies only to the manufacture and sale or lease of a new vehicles; thus a school may use any other vehicle, which do not fall under this law. Federal agencies like NHTSA do not have the authority to prevent a school from using such vehicles; however, state or local agencies can impose such laws. More than 20 states allow the use of vans as "school buses" for transportation of students [PRR95].

Passenger vans are not manufactured to the same stringent federal motor vehicle safety standards as regular school buses. The sale of vans for student transportation poses a risk to school children because vans are not required to have the same protective seats, emergency exits, special mirrors, vehicle structure, and fuel systems as school buses. Vans are also not required to have traffic control devices such as flashing lights and stop arms, which are important warning devices with proven safety benefits [PRR95]. As a result, these vehicles do not provide the same degree of occupant protection to passengers that school buses do. Vans are also not required to have the conventional yellow color with markings; thus the probability of a student pedestrian being struck by a passing vehicle is increased, since these vans are not as recognizable as conventional school buses [HND96].

A school bus has more emergency exits than a large van. In a van accident, the back seat usually blocks access to the rear door [PJR91].

The law specifies that a trained, professional driver who has valid commercial driver's license (CDL) can drive "school buses" that transport 16 or more passengers. Using this loophole, since a van carries 10-15 passengers, school districts often employ people with only a regular driver's license to drive the van thus saving on training expenses for the driver to obtain a CDL [HND96]. Almost 50% of the 19 student pedestrians killed in 1996 were associated with school buses that fell in the "other" category, of which vans constitute the largest proportion [KSDE96].

2.4 Handrail Snagging

This issue focuses on the snagging of children's clothing or backpack straps on stairway handrails, as well as the related issues of driver training and clothing design. From April 1991 to 1996, five children were killed and 17 were severely injured when snagging was involved. The handrail snagging problem has three key components [HND96]:

- The major reason for injury and death due to handrail snagging incidents is driver inattention to students getting off the bus and negligently moving the bus without realizing the student's clothing may be snagged. In two of the deaths, the children were dragged over 1000 feet. The driver's attention may be diverted to other issues such as meeting schedules, driving, and on-board pupil behavior. The unpredictable occurrence of such incidents, which also involves the other factors described below, could account for complacency on the driver's part toward this problem. Almost all these incidents occurred during the afternoon when the students were being dropped off at stops near their residences.
- Second the design of students clothing, bags and accessories that have drawstring ends and straps. Long drawstrings and baggy clothing have an increased risk of getting snagged and catching the student unaware.
- Third is the design of the bus handrail that often has too much space at its base, allowing drawstring ends to be snagged and catching the student unaware until he/she exits the bus door.

Most states have instituted handrail inspection procedures and have conducted recalls on buses with defective handrails to correct the problem. However, 15 states, including Arizona, Georgia, Hawaii, Illinois, Louisiana, Maine, Minnesota, Mississippi, Montana, Nebraska, Nevada, North Dakota, Oklahoma, Texas, Wyoming and Washington D.C., do not recall buses with defective handrails.

This problem is relatively easy to detect using the simple "string–nut test." This involves taking a nut attached to a drawstring and dropping the nut over the gap in the stairway handrail and dragging the string to observe whether the nut passes through freely or

gets trapped. This test simulates the actions that would occur on the stairway handrail gap to backpack straps or drawstrings of the exiting students [HND96].

The solution to this problem is the installation of a rubber washer to close the handrail gap. This solution is very inexpensive with estimates of about $2 per bus excluding labor costs [HND96]. Another part of the solution is to make school bus drivers more aware of the potential hazard and benefit of the simple action of their visually checking the doors at every stop.

2.5 School Bus Driver Training, Licensing and Retention

It is mandatory that all states hire (regular) school bus drivers who possess a valid Commercial Driver's License (CDL). This CDL program is administered by the Federal Highway Administration (FHWA). The CDL is a generic license to drive all buses and is not school bus-specific. Most states require additional training to orient school bus drivers to the special needs of school bus transportation. This training is not standardized, however, and the requirements for school bus driver selection, licensing and training vary greatly from state to state. Most states (including Florida, Georgia, etc.) also have state-wide pre-service training while other states have specific local pre-service training and periodic in-service training [TRB89].

Another concern is school bus drivers who obtain a CDL then leave the school district to obtain higher paying jobs in the regular bus sector. Some districts have a turnover of as much as 20% due to this problem [HND96]. A contributing factor to this exodus of drivers is the increasing stress due to student misbehavior.

TRB Special Report 222 [TRB89] has recommended that all states establish minimum criteria for driver training. These should focus on the driver responsibilities in ensuring the safety of children in the loading and unloading zones and also on board the bus. It would be beneficial for school districts to have a standardized procedure for driver education programs and in-service training, perform background checks on their drivers and have a regular drug-testing program [HND96].

2.6 Student Discipline and Supervision

Improper riding practices and student misbehavior on board the bus contribute to school bus-related crashes. For example, in an accident that occurred in Miami in 1983, the driver of a privately owned school bus was distracted by the behavior of an unruly student and veered off the road. The bus driver and 30 students received minor to moderate injuries [SBC85]. There have been various safety programs created by agencies like NHTSA, the National Safety Council (NSC), professional bus transportation agencies and school bus builders like Navistar and Ryder that describe safe practices to be followed by the students on all parts of the school bus trip. These programs teach students how to safely ride on the bus, walk to and from the school bus stop, and safely board and exit the bus [WRW95].

These programs consist of illustrated booklets and videos for the students, with supplementary instructional guides for teachers, parents and school bus drivers to administer the programs effectively.

Another issue is the feasibility of providing on-board adult monitors. Adult supervision by a monitor (other than the driver) on school buses would focus on making certain that passengers stay properly seated, use seat belts when available, and keep arms and heads inside the windows; assisting in handling emergencies; assisting passengers with special needs; and escorting children across busy roadways. They would also help to manage pupil behavior, thus allowing the drivers to remain focussed on their most important task—driving. A study in California showed that pupil fatalities were reduced when a monitor (in this case, the driver), escorted them across busy roadways [TRB89].

In the era of declining budgets this would be an expensive solution. The school districts would have to determine the cost implications and decide whether there would be any significant improvement over the already relatively good safety record of school bus transportation. TRB Special Report 222 [TRB89] concluded that this measure would not be recommended due to the prohibitive cost and other safety programs and devices could achieve the same or increased beneficial effect.

2.7 Students with Special Needs

Students with special needs include those with mental retardation, hearing impairments, speech or language impairments, visual impairments, ambulatory impairments, specific learning disabilities, and other physical and mental health impairments. Many children with special needs use wheelchairs. Wheelchair securement systems are not currently subjected to any crash-testing requirements. More attention needs to be focussed on the restraining systems for these wheelchairs on board the bus to ensure they are being used in the correct manner [AAP97].

An unoccupied wheelchair also should be secured adequately in the vehicle to prevent it from becoming a hazard in the event of a sudden stop or crash [TRB89]. Other safety concerns include special behavior management for these students and timely attention to their impairments [IAS97].

2.8 Routing Procedures

A majority of the student fatalities occurred during the afternoon drop-off after school [KSDE96]. It has been recommended that school bus routes and stops should be located so that the potential for pedestrian accidents in loading and unloading zones is reduced. The route planning has to be locally planned in coordination with the educational, engineering, enforcement, and parent-teachers and other city organizations. When possible, loading and unloading zones should be located off the main traveled part of highways [ITE84]. The established principles according to TRB Special Report 222 [TRB89] are as follows:

- School buses should not be required to back up on their routes. There should be sufficient space to allow for a safe bus turn-around.
- Stops should be located to minimize the need for children to cross the street to board or leave the bus. This should be especially borne in mind for busy highways.
- Stops should be located so that traffic disruptions are minimized and to enable the driver to have a good view in front of, and behind, the bus. Mid-block stops and stops requiring students to cross wide busy roads, especially those with no pedestrian refuge (medians, islands), present special hazards.

Also stops should take into account conditions such as [ITE84],

- age, number, behavior and deficiencies of the children using the route;
- availability of traffic control devices and crossing guards.
- speed, volume, peak hour volume, available safe gaps in the vehicle stream; and
- geometric considerations, such as the number of lanes at the crossing, existence of sidewalks, sight distance, steep downgrades, areas of significant speed differential between vehicles, insufficient clearances at underpasses, and hazards at rail grade crossings.

For the years 1975-1997, available data from the Federal Railroad Administration (FRA) indicate that there were 141 train-school bus collisions. Nearly 66% of these collisions resulted in no fatalities and no injuries. About 5% of these train-school bus collisions resulted in fatalities and 386 school bus passengers or train crewmen were injured [STN98].

One of the major crashes occurred in 1995 at Fox River Grove, Illinois, and was the focus of a study for railroad hazards for school buses. In this crash alone, seven students were killed and the school bus driver and 24 other students were injured. The school bus driver had taken the recommended precautions prior to crossing the railroad tracks, but unknowingly failed to completely clear the railway track while the school bus was stopped at a traffic signal, and was struck by a commuter train. This crash was due to inadequate storage space at the railroad crossing and the fact that the driver was a substitute for the regular driver. At the conclusion of its investigation of this crash, the National Transportation Safety Board (NTSB) identified one of the factors contributing to the crash was an inadequate school district routing and hazard identification and notification system [RHS98].

Subsequently, the United States Department of Transportation (U.S.DOT) released guidelines to deal with planning and developing a safe and efficient school transportation routing system [PBS97]. Recently, with support from a grant by NHTSA, the National Association of State Directors of Pupil Transportation Services (NASDPTS) completed a report [RHS98] that deals with developing a system and provides guidelines for identifying school bus route hazards. The NTSB has released a comprehensive report analyzing the issue of safety at railroad grade crossings. This report [SRG98] also includes an analysis of railroad grade crossing incidents involving school buses.

2.9 Standees and Overcrowding Seats

NHTSA and FMVSS standards and safety measures [SBB67] were designed making the assumption that all passengers would be properly seated. Standees and other pupils who are not seated properly may face a greater risk of injury during crashes. During a collision, they may be thrown around the bus passenger compartment, striking and injuring other individuals who may be properly seated. Thus, they are a hazard not only to themselves but also to the rest of the pupils [TRB89].

The standee's chances of injury during a collision greatly exceed those of seated passengers. Standees thrown to the front of the bus may block the exit with injured greatly increasing the evacuation time for those able to move. Laws regarding standing on school buses vary widely from state to state. Some states have banned standees in school buses while, at the other extreme, some states permit standees when the school bus seating capacity is exceeded [TRB89].

2.10 Mechanical and Equipment Concerns

The 35 Federal Motor Vehicle Safety Standards cover almost the complete spectrum of areas from occupant protection and pedestrian safety devices to specific mechanical and equipment concerns, including braking systems, fuel system integrity, tires, lighting systems, steering and transmission systems. Due to the continuous review by NHTSA [RCH97], school districts conduct recalls to correct deficiencies in areas such as,

- fuel system integrity, which could prove serious in the event of a crash (some fuel tanks of buses have been punctured during compliance testing, which indicate a failure to meet the requirements of the applicable Federal Motor Vehicle Safety Standards),
- braking systems that involves correcting defective anti lock braking systems and brake fluid leaks,
- steering problems that includes power steering losses,
- accelerator systems that may cause the accelerator pedal to remain stuck and prevent it from returning to the idle position,
- door release and warning systems,
- defective handrails, and
- wheelchair securement systems.

2.11 Evacuation Drills and Emergency Exits

The orderly exiting of many people under emergency conditions poses a problem requiring special measures [FTA96]. This is even more applicable in the case of school children. TRB Special Report 222 [TRB89] recommends a review of the NHTSA requirements and states that use buses with greater seating capacities should have more

emergency exits. In addition to evolving more emergency exits for school buses, studies are needed for safe and practical emergency escape systems. Practice emergency exit demonstrations would help younger passengers to manage their own escape during an accident that incapacitates the driver. The ever-present hazard of post-crash fire necessitates prompt and orderly evacuation by all able passengers in order to improve the chances of rescuing those unable to help themselves [TRB89].

Standardization of bus designs would enhance rescue training and effectiveness. The federal agencies should take steps to ensure that all bus manufacturers have standardized safety devices with respect to method of operation, location and general appearance. This would ensure that fire fighters and other rescue agencies are familiar with the devices, and valuable time would not be lost by rescuers trying to familiarize themselves with the safety features [FTA96].

2.12 Safety Belts (Lap Belts)

The use of lap belts on school buses is a controversial issue that has received renewed media and public attention. Recently the chairman of the NTSB also recommended a review of whether seat belts should be installed on school buses. The federal government has been debating the issue of seat belts on large school buses for three decades. Seat belts for use on school buses specifically refer to lap belts on large school buses with a gross vehicle weight of more than 10,000 lb. For small school buses, those with a gross vehicle weight rating less than 10,000 lb., the federal standard currently requires either lap belts or lap and shoulder belts at all designated seating positions [TRB89].

In 1967, the pioneering study of occupant protection on school buses titled "School Bus Passenger Protection" [SBB67] was conducted by the Institute of Transportation and Traffic Engineering of the University of California, Los Angeles (UCLA). This study reports on a series of school bus crash tests. Based on the recommendations of this study the safety of school buses has been greatly enhanced. This study recommended compartmentalization, higher and completely padded seat backs, prohibition of standees and aisle seating, and lamination of windshields.

This study also strongly recommended seatbelts, stating that properly designed restraining devices can be effective in head-on collisions where forces are more likely to produce injuries. According to this study the greatest contribution to school bus passenger collision safety is the high strength, high back safety seat. Next in importance is the use of a three-point belt, a lap belt or other form of effective restraint [SBB67].

NHTSA has only adopted standards for the first recommendation of compartmentalization. Compartmentalization is an engineering design concept that provides passengers with a safe environment by creating a protective envelope consisting of strong, closely-spaced seats that have energy-absorbing seat backs. NHTSA has recommended a 20 inch seat back height as compared to the UCLA recommendation of 28 inches.

TRB Special Report 222 [TRB89] concluded that the seat back height could be raised to 24 inches at little extra cost. This TRB report also concluded that the overall potential benefits of requiring seat belts on large school buses are insufficient to justify mandatory installation [TRB89].

In another study [STC85] by Transport Canada, crash tests of three school buses were conducted to determine the adequacy of existing school bus occupant protection standards in preventing death and injury, and to determine the effect of seat belts on the level of occupant protection. The study concluded that in a frontal collision, school bus occupants with lap belts are likely to suffer more serious injury than those occupants with no safety belts. It is to be noted that this study was conducted using lap belts and this has gained criticism by pro seat belt organizations like the National Coalition for Seatbelts on School Buses (NCSSB), who recommend three-point seat belts rather than lap belts.

Most professional school transportation organizations like the NASDPTS and school bus builders have concerns about seat belts. They state that seat belts would be ineffective in most collisions involving school buses since NHTSA data show that most school bus related fatalities and injuries occur to occupants of other vehicles (56%) and pedestrians (30%), with a very small number occurring to student occupants of school buses. They also state that it would not be possible for the bus driver to supervise the proper fastening and adjustment of seat belts, and improperly adjusted belts could prove hazardous. These organizations have voiced concerns about possible liability problems in the event of a crash in which the students did not properly use the seat belt and the risk of students vandalizing seat belts in the absence of proper supervision. They feel that it will be essential to have a mandatory seat belt policy enforced by adult monitors or designated student monitors.

Some medical and biomechanics experts feel that lap belts alone could actually cause injuries to young children in the event of a collision. Since the hip-bone of young children is not sufficiently developed, as compared to an adult; in a collision the lap belt could ride up to the abdominal region and crush abdominal organs. This implies that the seat belts would have to be of the three-point type, which would involve significant redesign and cost [KSS98]. Most professional transportation organizations feel that the costs do not justify the benefits and the funds could be better utilized to provide more productive countermeasures. In the study conducted by the TRB [TRB89], nine countermeasures were evaluated to find the annual reduction in fatalities and injuries that could be achieved by the annual expenditure of $1,000,000 per countermeasure. Table 2.2 indicates the evaluation results of the TRB study.

Table 2.2 Reduction in Fatalities and Injuries from an Annual Investment of $1,000,000 per Safety Measure

Safety Measure	Effectiveness in Fatality Reduction %	Lives Saved per Year	Injuries Prevented per Year		
			Incapacitating	Non-incapacitating	Possible
Higher seat backs	0 - 20	0 - 0.426	0 - 16.9	0 - 84.3	0 - 236.0
Stop signal arms	0 - 30	0 - 0.299	0 - 2.8	0 - 4.2	0 - 6.9
Crossing control arms	5 - 25	0.052 - 0.261	0.1 - 0.6	0.2 - 0.9	0.3 - 1.6
External loud speaker systems	0 - 20	0 - 0.210	0 - 1.8	0 - 2.8	0 - 4.6
Electronic sensors	10 - 50	0.026 - 0.131	0.1 - 0.3	0.1 - 0.5	0.2 - 0.8
Mechanical sensors	10 - 50	0.018 - 0.092	0 - 0.2	0.1 - 0.3	0.1 - 0.5
Pupil education programs	0 - 20	0 - 0.0459	0 - 2.1	0 - 3.1	0 - 5.1
Seat belts*	0 - 20	0 - 0.023	0 - 1.1	0 - 5.6	0 - 15.6
School bus monitors	25 - 75	0.007 - 0.020	0.1 - 0.3	0.3 - 1.0	0.9 - 2.8

* Assuming a 50% usage rate.

Source : [TRB89]

On the other hand, pro-seat belt organizations like the NCSSB, parent-teacher organizations, and various professional medical organizations like the American Association of Pediatrics advocate the installation of seat belts on school buses. Their arguments are that, in the unfortunate event of a crash, the use of seat belts will reduce the probability of serious injuries or death to children properly seated in post-standard 1977 buses. They state that seat belts would offer restraint and protection against injuries in rollover or side impact crashes. They also feel that the use of seat belts would reduce bus driver distractions, since it would improve student behavior. It also would have the added benefit of the "carryover effect" that would train children to use seat belts when riding in other vehicles. They also dispute the cost comparisons of the anti-seat belt lobby.

CHAPTER 3
SURVEY METHODOLOGY

3.1 Design of Survey Questions

To supplement the literature review on school bus safety, a survey of school bus drivers was conducted to obtain their perceptions of the safety issues involved in school bus transportation and more importantly to identify any new or existing safety issues of critical importance. The decision to survey school bus drivers was based on the fact that they have continuous exposure to the safety issues in school bus transportation and their perceptions of the hazards posed by these safety issues are expected to be reasonably accurate. Due to their experience, school bus drivers should be able to enumerate factors that constitute these safety issues, which ordinarily cannot be obtained from analysis of the available accident reports. Due to their contemporary exposure, any new or existing safety issues of critical importance would be expected to be identified with a reasonable level of confidence.

Based on the literature review, a survey form (included in appendix A) was designed incorporating the following safety concerns:

- effect of student behavior on the drivers' attention to driving the bus safely,
- students with special needs and their safety relative to regular students,
- perception of hazards involving to children around the danger zone of the bus,
- illegal passing,
- handrail snagging,
- satisfaction with the amount of training the drivers have been provided, and
- other safety concerns that had not been listed in the survey.

No questions were asked about seat belts, since the drivers surveyed had no exposure to this issue. Also, no questions were asked about the use of nonconforming transportation (vans and transit buses) due to the fact that vans were not used by the districts in school transportation. The school districts reported that they do not allow standees on their buses, and hence this item was also excluded from the survey form. Since equipment maintenance was handled by the vehicle maintenance garages, this too was excluded, since it fell outside the drivers' purview.

There was no available evidence or studies to determine whether student misbehavior on board the school bus sufficiently affected the drivers' attention to adversely influence safety. There was no access to the drivers' actual written reports of incidents or accidents involving student misbehavior on the school bus from the district offices, since reservations were expressed that most reports had the students' name on it and this would involve a violation of student privacy rights. Accordingly, questions about student misbehavior and related incidents were incorporated into our survey.

3.2 Administration of the Survey

Data was sampled from small, medium, and large-sized school districts in the state of Florida. This strategy was used to determine if there would be any significant variation in the safety concerns that could be influenced by the size of the school district. Several school districts in Florida were contacted, and from those that sent a positive response, the survey was conducted in the Alachua, Orange and Pinellas County school districts of Florida.

Survey forms were sent to the school districts and distributed to the drivers by the local offices in the school districts. Drivers were given the option of either completing the form on site or taking it home and returning it on their next visit to the office. It took approximately one month for each district to complete and return their survey forms.

3.3 School Districts Surveyed

The Alachua County School District is a relatively small-sized school district with around 182 buses serving 42 schools. Over 14,000 students are transported daily and about 22,656 miles are traveled daily by the school buses of this district [ASB98]. There are about 206 school bus drivers and 41 ESE (Exceptional Student Education) bus attendants. ESE is the program for physically impaired and cognitively-impaired students. Around 20% of the fleet is used primarily for the transportation of students with special needs [FDE96].

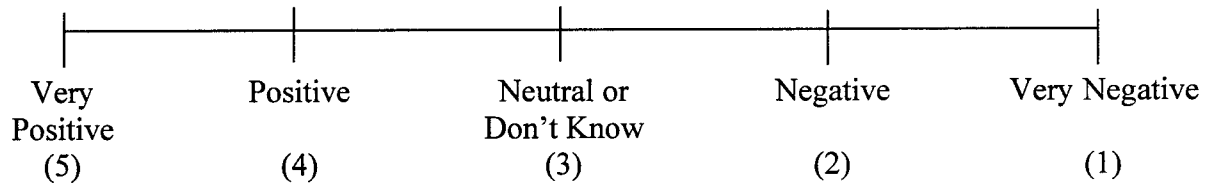
The Pinellas County School District is a medium-sized school district with around 570 buses serving 134 schools in the district. Over 43,000 students are transported daily by the buses of this district. There are about 600 school bus drivers and 235 ESE bus attendants. About 35% of the fleet is used primarily for the transportation of students with special needs [FDE96].

The Orange County School District is a large school district with about 820 buses serving over 141 schools. Over 54,000 students are transported daily by the buses of this district. There are about 886 school bus drivers and 187 ESE bus attendants. Around 30% of the fleet is used primarily for the transportation of students with special needs [FDE96].

Appendix B contains the information of the personnel contacted in the three school districts for authorizing and conducting the survey.

3.4 Analysis of Responses

Responses to almost all questions were analyzed on a scale in the following format:



This scale was chosen based on literature [MRR95] that recommended this scheme as a more accurate method of determining perceptions than a conventional numeric scale. The responses were scaled with 3 as the neutral point, 1 and 2 for degrees of negative responses and 4 and 5 for the degrees of positive responses. The surveyed districts were first analyzed using the Single-factor Analysis of Variance (ANOVA) to check if there were statistically significant differences at the 95% confidence level in responses received from the surveyed districts. Responses that showed no statistically significant differences among the surveyed districts were combined. Questions that received negative responses were analyzed.

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CHAPTER 4
SURVEY RESULTS

4.1 Sample Description

The following sections present the responses received from the surveyed districts and a general description of the respondents.

4.1.1 Response Rates

The total response rate for all the surveyed districts was 53.9%. Table 4.1 summarized the responses received.

Table 4.1 Response Rates.

District	Forms Distributed	Forms Received	Response Rate (%)
Alachua	114	53	46.5
Orange	500	342	68.4
Pinellas	640	281	43.9
Total	1254	676	53.9

4.1.2 Background of Drivers

The drivers surveyed had an average age of 46.2 years and an average of 6.6 years of school bus driving experience. About 94.6% of the respondents drove full time and 56.9% of the respondents were male. Tables 4.2 and 4.3 present the demographic information of the three school districts surveyed.

Table 4.2 Average Driver Age and Experience.

District	N	Average Age	Average Experience
Alachua	51	44	8.5
Orange	335	45	5.6
Pinellas	273	48	7.5
Total	659	46.2	6.6

Table 4.3 Driver Gender and Employment Type.

District	N	Male (%)	Female (%)	Part Time (%)	Full Time (%)
Alachua	51	25	75	9.8	90.2
Orange	335	60.8	45.3	5.1	94.9
Pinellas	273	53.1	46.9	5.1	94.9
Total	659	56.9	43.1	5.4	94.6

4.2 Analysis of School Bus Drivers' Perspective of Selected Safety Issues

The following sections provide an analysis of selected safety issues based on the perspectives of the surveyed school bus drivers.

4.2.1 Effect of Student Misbehavior on Drivers' Attention while Driving

The drivers were asked whether the behavior of students on board the school bus distracts them significantly enough to affect their attention to driving the bus safely. The drivers were asked to mark their responses on the following scale:

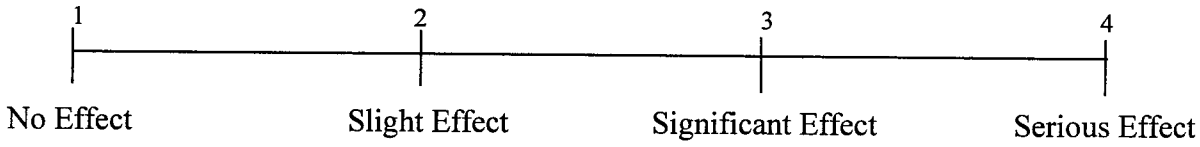


Table 4.4 indicates that the average response for all districts was around 2, which implies the drivers felt that student misbehavior had a slight effect on the drivers' attention to driving the bus safely.

Table 4.4 Perceived Effect of Student Behavior on the Drivers' Attention.

District	N	Mean	Variance	Median
Alachua	49	2.24	0.77	2*
Orange	318	2.05	0.81	2*
Pinellas	270	2.33	0.91	2*

*-"Slight Effect"

The ANOVA analysis of table 4.5 shows that there are statistically significant differences between the means of the three school districts at the 95% confidence level. Figure 4.1 shows the distribution of the respondents' perspectives.

Table 4.5 One-way ANOVA of Population Mean Responses to the Effect of Student Misbehavior on Driver Attention.

One-way ANOVA	$\alpha = 0.05$					
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	11.039	2	5.519	6.499	0.002	3.010
Within Groups	538.471	634	0.849			
Total	549.510	636				

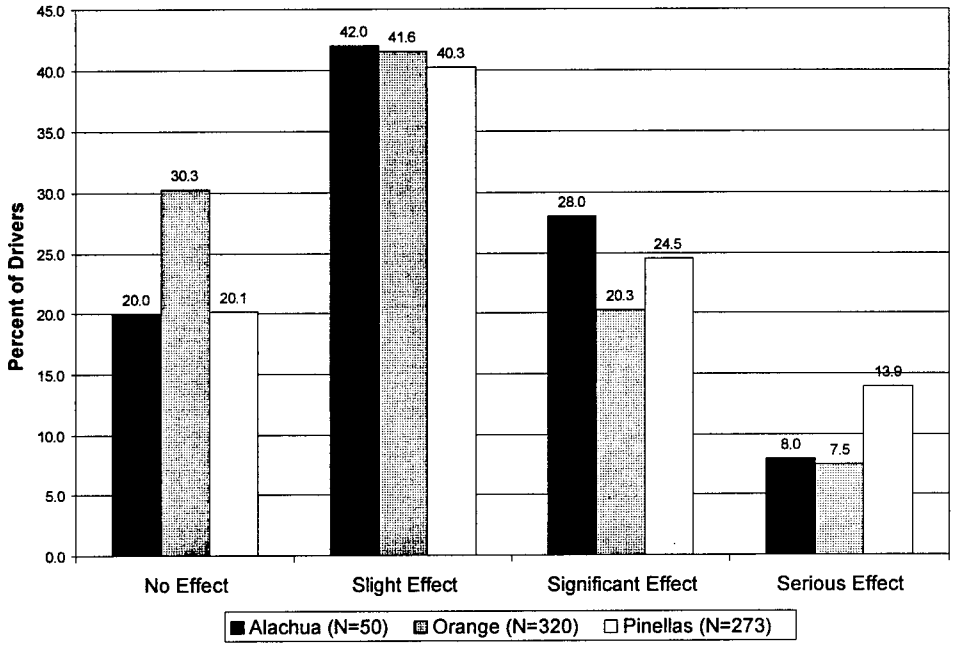


Figure 4.1 Perceived Effect of Student Behavior on the Drivers' Attention to Driving the Bus Safely.

Although the average driver's response indicated that student behavior had a slight effect on their attention while driving, it is noted that about 30% of respondents in all districts surveyed stated that student misbehavior had a significant to serious effect on their attention while driving. There were numerous comments, as detailed later, that suggest that this is a critical concern.

The drivers were asked to specify who monitored behavior of students on the school bus, the common types of student misbehavior that they believed affects the safety of school bus trips, and the nature of injuries to students due to student misbehavior on the school bus.

4.2.1.1 Monitoring of Student Behavior On Board the School Bus. On most regular buses only the driver monitored the behavior of students. On-board adult monitors were

present on the buses that served the students with special needs. A few bus drivers noted that they had designated student patrol. All buses in the Alachua County School District were equipped with video cameras to document student behavior. Due to budgetary restrictions and the large number of buses in Orange and Pinellas Counties, video cameras were mounted mainly on buses where there were reported problems of student misbehavior.

Video camera monitoring is an effective way to document the actions of errant students and this was also used as evidence to support decisions by school principals to suspend the riding privileges of these students. Researchers from the TRC interviewed concerned officials in the surveyed school districts, and they expressed satisfaction with the benefits of these cameras expressing that cameras contributed to reducing incidents of student misbehavior.

Unfortunately, there was no way to quantify the reduction in incidents of student misbehavior on board the bus after the installation of video cameras. Due to objections from the school district offices, there was no access to actual written driver reports of incidents involving the school bus, since these reports contained the names of students, as there would be privacy violations of the involved students. Permission to view the actual driver description reports would have to be obtained from the respective schools and due to the large number of schools in the surveyed districts, it was decided not to pursue this.

4.2.1.2 Types of Student Misbehavior. The most common type of student misbehavior was fighting on a moving bus. This was reported in all the surveyed districts. Students were involved in fights of varying severity from throwing punches to the face to causing bloody noses and even stabbing each other with pencils. Drivers complained that they also were sometimes injured in these fights. Several drivers said they were assaulted by students.

Another common form of misbehavior was throwing objects such as books, backpacks, scissors, pens, etc., and in some cases these objects even hit the driver, causing minor injuries. Some drivers expressed concerns about having no partition to protect them while driving since they were often hit by flying objects. Other forms of misbehavior included running about the moving bus and changing seats, and sometimes heckling the driver. A driver in Pinellas County responded that he was so distracted by this heckling that he had a rear-end crash with a car, resulting in minor injuries. Some drivers reported that students distract drivers when they look in the rearview mirrors.

Due to noisy student behavior, in heavy traffic the driver could not hear emergency vehicles until they drew close. A driver in Alachua County responded that this distraction caused his bus to run into a parked car. Unruly students did not follow bus rules, and some students jump out of the back doors into traffic. Drivers also reported that at stops, some students rushed towards the moving bus while fighting off other students in an attempt to board the bus first.

Drivers also reported that some students brought weapons on board some buses. A driver in Alachua County reported that a student had boarded the bus with a 357 Magnum

pistol. Drivers expressed concerns about their safety as well as the safety of other occupants on the bus. Some drivers noted that objects such as scissors should not be allowed on the bus since students tend to misuse them by injuring other students and by vandalizing the bus seats, etc. Some drivers also expressed concerns about leaving the driver's area of the bus exposed when they were attending to a student.

4.2.1.3 Nature of Injuries. From the drivers' responses, the nature of injuries to students due to misbehavior on the bus was mostly minor, but some did require varying amounts of hospitalization. Table 4.6 indicates the proportion of drivers who reported injuries to students due to student misbehavior. Most fights resulted in injuries such as a bloody lip and in some cases even a broken nose. More serious fights such as pencil stabbing resulted in eye injuries that required hospitalization. Often the students injured were those not directly involved in the incident. In a few cases even the driver sustained minor injuries such as cuts, bruises, etc.

Other injuries occurred due to improper riding practices such as running about the moving bus. The students fell and some sustained fractured arms. In most cases, actions of unruly behavior were reported on a moving bus. Some students also sustained injuries due to illegal passing by other motorists. The details are covered in the section on illegal passing.

Table 4.6 Proportion of Drivers who Reported Injuries to Students Due to Student Misbehavior.

District	N	Reported Injury to Student (%)
Alachua	51	25.5
Orange	333	8.7
Pinellas	276	11.6
Total	660	10.9

4.2.2 Students with Special Needs

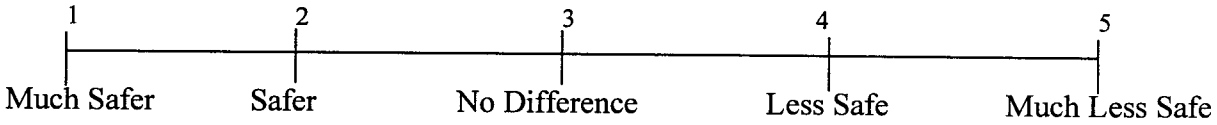
About 26.3% of the respondents predominantly transported students with special needs. Table 4.7 indicates the proportion of types of students transported by the respondents. Most adult monitors were provided on buses that predominantly transported students with mental impairments. The predominant types of students with special needs transported in the surveyed districts are as follows:

1. Students who are cognitively impaired.
2. Students with ambulatory difficulties but not requiring a wheelchair.
3. Students with ambulatory difficulties requiring a wheelchair.
4. Students who are visually impaired.
5. Students who are hearing impaired.
6. Other which included students with speech impairments, autism and behavioral disorders.

Table 4.7 Type of Students Transported by Drivers.

District	N	Regular (%)	Special Needs (%)	Both (%)
Alachua	51	76.5	9.8	13.7
Orange	335	55.2	40.9	3.9
Pinellas	271	80.8	11.4	7.7
Total	657	67.4	26.3	6.2

The drivers were asked to compare the safety of students with special needs to regular students in school bus transportation. The drivers were asked to mark their responses on the following scale:



The ANOVA analysis in table 4.8 shows that there are no statistically significant differences between the means of the three school districts at the 95% confidence level. Hence, the responses of the surveyed districts were combined. Table 4.9 indicates that the average response for all districts was around 2, which implies the drivers felt that transportation involving students with special needs was safer than that involving regular students. Figure 4.2 shows this graphically for the combined samples.

Table 4.8 One-way ANOVA of Population Mean Responses to Perceived Safety of Students with Special Needs Compared to Regular Students.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.619	2	0.309	0.357	0.700	3.033
Within Groups	213.462	246	0.868			
Total	214.080	248				

Table 4.9 Perceived Safety of Students with Special Needs Compared to Regular Students.

District	N	Mean	Variance	Median
Alachua	16	2.1	1.00	2*
Orange	149	2.2	0.91	2
Pinellas	84	2.1	0.78	2*
Total	249	2.1	0.86	2*

* "Safer"

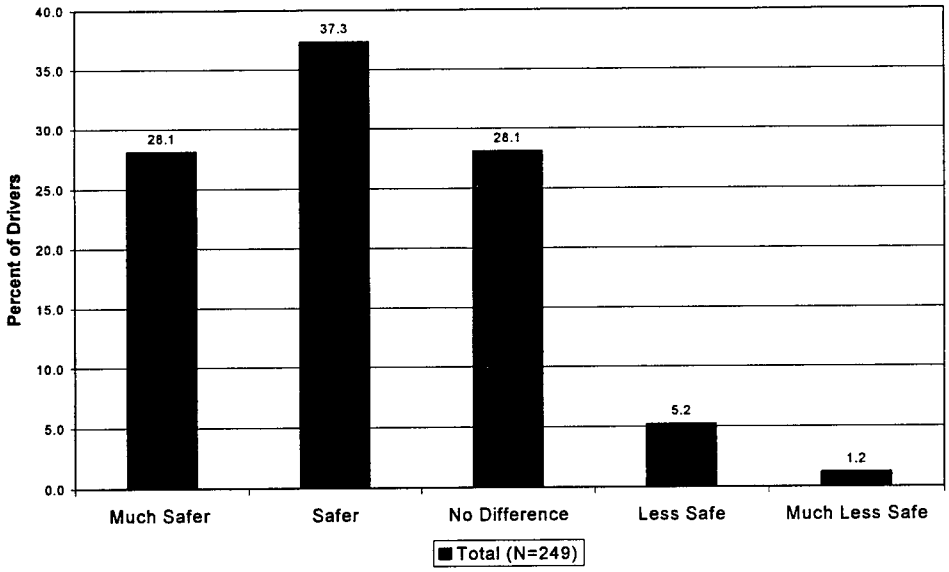


Figure 4.2 Perceived Safety of Students with Special Needs on the School Bus Compared to the Safety of Regular Students.

Drivers felt that driving a smaller and relatively less populated ESE (Exceptional Student Education) bus generally has fewer problems than driving the larger buses. They also believe that the relative safety of students with special needs using the school bus was better than that for regular students.

Comments received indicated that a majority of students with special needs were usually picked up and dropped off almost always at closer stops to their origin/destination zone. Table 4.10 shows the type of stops made for students with special needs. Adult monitors supervised most pick-ups and drop-offs. Parents, too, were involved in pick-ups and drop-offs at stops. A serious concern reported was that while the buses were loading students with special needs on wheelchair lifts there were many instances of illegal passing of the school buses by other motorists and these occurred almost every day.

Table 4.10 Type of Stops Made by Drivers for Students with Special Needs.

District	N	Regular Stops (%)	Closer Stops (%)	Both (%)
Alachua	16	12.5	87.5	0.0
Orange	154	7.1	85.7	7.1
Pinellas	81	11.1	85.2	3.7
Total	251	8.8	85.7	5.6

Another concern expressed by respondents was that not all the ESE buses were equipped with air conditioners, and this could lead to "blackouts" both by drivers and

students due to heat exhaustion. (Note: new federal requirements specify that air conditioners must be provided to all ESE buses [ASB98]).

In all districts surveyed, drivers indicated that they need more assistance handling students who experience seizures. The concern was that if some students with special needs had seizures, choking and other motor-skill problems, the driver or the on-board adult monitor were not fully prepared or knowledgeable enough to handle the situations. Some buses transported both regular and students with special needs, and drivers indicated that regular students sometimes harassed students with special needs.

Several drivers indicated that students with ambulatory difficulties found it difficult to board the bus since the steps were too high. Further, students with mental impairments and behavioral disorders were difficult to handle when they became angry and some of these students were unable to comprehend the drivers' instructions.

With regard to wheelchair lifts, about 18.1% of the respondents drove buses equipped with these lifts. Table 4.11 indicates the proportion of respondents who drove buses equipped with wheelchair lifts.

The ANOVA analysis in table 4.12 shows that there are statistically significant differences between the means of the three school districts at the 95% confidence level.

Table 4.11 Proportion of Drivers who Drove Buses Equipped with Wheelchair Lifts.

District	N	Equipped with Wheelchair Lift (%)
Alachua	51	17.6
Orange	335	21.8
Pinellas	271	13.7
Total	657	18.1

Table 4.12 One-way ANOVA of Population Mean Responses to Perceived Safety of Loading/Unloading Devices (Wheelchair Lifts).

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2.291	2	1.146	3.114	0.048	3.062
Within Groups	50.394	137	0.368			
Total	52.686	139				

Table 4.13 indicates that the average response for perceived safety was around 1.8 which implies the drivers felt that the loading/unloading devices (wheelchair lifts) were safe.

Figure 4.3 shows the distribution of the respondents' perspective. Over 80% of respondents felt the loading/unloading devices (wheelchair lifts) were safe. Although the operation of these lifts was safe, the main perceived hazard was due to the rampant occurrence of illegal passing by other motorists while these lifts were in operation.

Table 4.13 Perceived Safety of Loading/Unloading Devices (Wheelchair Lifts).

District	N	Mean	Variance	Median
Alachua	10	1.8	0.18	2*
Orange	87	1.5	0.37	1#
Pinellas	43	1.8	0.41	2*

-"Very Safe" *- "Safe"

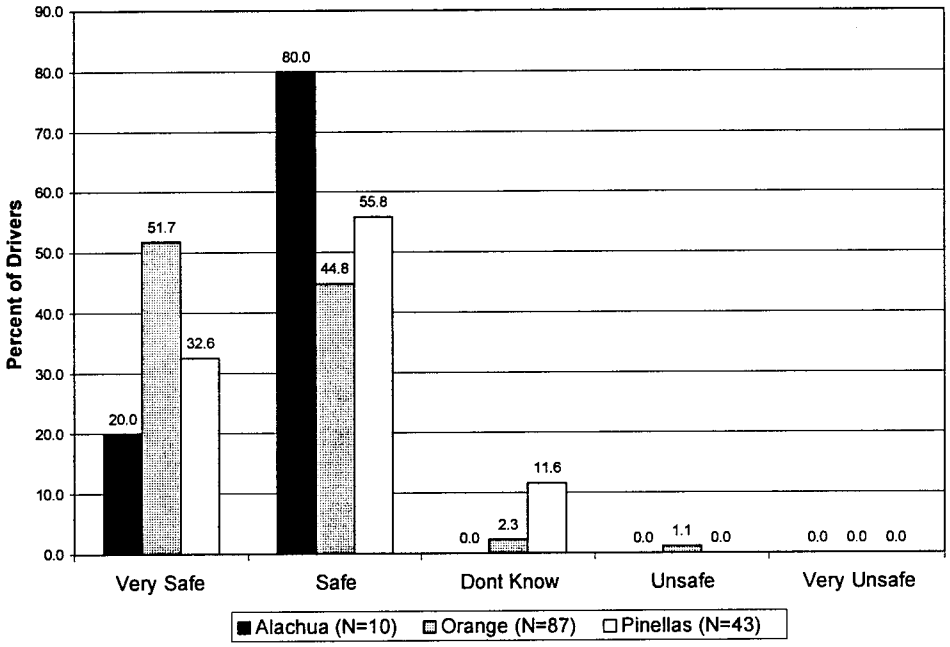


Figure 4.3 Perceived Safety of Loading/Unloading Devices (Wheelchair Lifts).

For wheelchair locking devices, the ANOVA analysis in table 4.14 shows that there are no statistically significant differences between the means of the three school districts at the 95% confidence level. Hence the responses of the surveyed districts were combined.

Table 4.15 indicates that the average response for the districts was around 1.8, which implies the drivers felt the wheelchair locking devices were safe. Figure 4.4 shows the distribution of the respondents' perspective. Around 90% of respondents felt the wheelchair locking devices were safe or very safe.

Table 4.14 One-way ANOVA of Population Mean Responses to Perceived Safety of Wheelchair Locking Devices.

One-way ANOVA	$\alpha = 0.05$					
Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2.936	2	1.468	2.394	0.095	3.063
Within Groups	83.423	136	0.613			
Total	86.360	138				

Table 4.15 Perceived Safety of Wheelchair Locking Devices.

District	N	Mean	Variance	Median
Alachua	10	1.9	0.10	2*
Orange	86	1.7	0.71	2*
Pinellas	43	2.0	0.52	2*
Total	139	1.8	0.63	2*

*-"Safe"

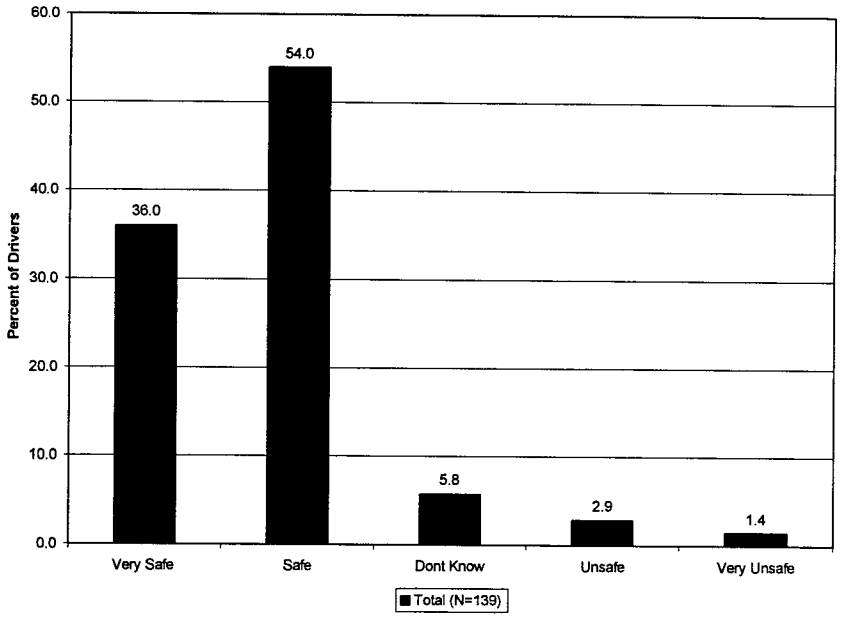


Figure 4.4 Perceived Safety of Wheelchair Locking Devices.

The type of wheelchair locking devices varied between the buses. Some drivers rated wheelchair securement devices as safe while others mentioned that the wheelchair locking straps of some models could come undone or were not strong enough. There was no uniform design for these devices. Some drivers requested more assistance and training to deal with these problems. Drivers also expressed concerns that it could be difficult to speedily evacuate restrained students in the event of an accident.

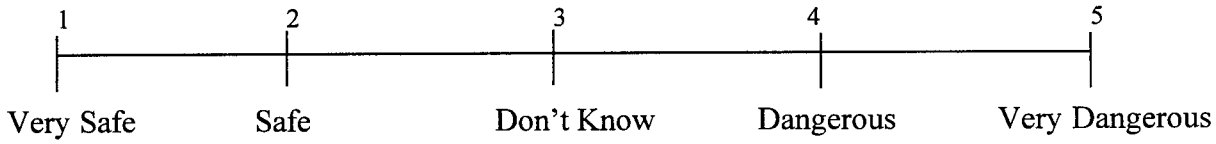
Table 4.16 shows the proportion of drivers who reported injuries to disabled students. The injuries were mostly minor and in Orange County this occurred because the monitor did not properly lock the wheelchair. This caused the wheelchair to roll and topple with the student in it. No details were received for the other reported incidents.

Table 4.16 Proportion of Drivers who Reported Injuries to Students with Special Needs.

District	N	Reported Injury to Student (%)
Alachua	10	0.0
Orange	95	4.2
Pinellas	40	5.0
Total	145	4.1

4.2.3 Danger Posed by the Bus Itself

Drivers were asked to rate the danger posed to students outside the bus by backing up of the school bus. The drivers were asked to give their responses on the following scale:



The ANOVA analysis in table 4.17 shows that there are no statistically significant differences between the means of the three school districts at the 95% confidence level; hence the responses of the surveyed districts were combined. Table 4.18 indicates that the average response for the districts was around 4 which implies the drivers felt the backing up of the school bus was dangerous to the students outside. Figure 4.5 shows the distribution of the respondents' perspectives. Over 75% of respondents felt that backing up of the school bus was dangerous or very dangerous.

Table 4.17 One-way ANOVA of Population Mean Responses to Perceived Danger Posed to Students Outside by Backing Up of the School Bus.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	7.527	2	3.763	2.289	0.102	3.010
Within Groups	1032.635	628	1.644			
Total	1040.162	630				

Table 4.18 Perceived Danger Posed to Students Outside by Backing Up of the School Bus.

District	N	Mean	Variance	Median
Alachua	49	3.6	2.24	4*
Orange	316	4.0	1.55	4*
Pinellas	266	3.9	1.65	4*
Total	631	4.0	1.65	4*

*- "Dangerous"

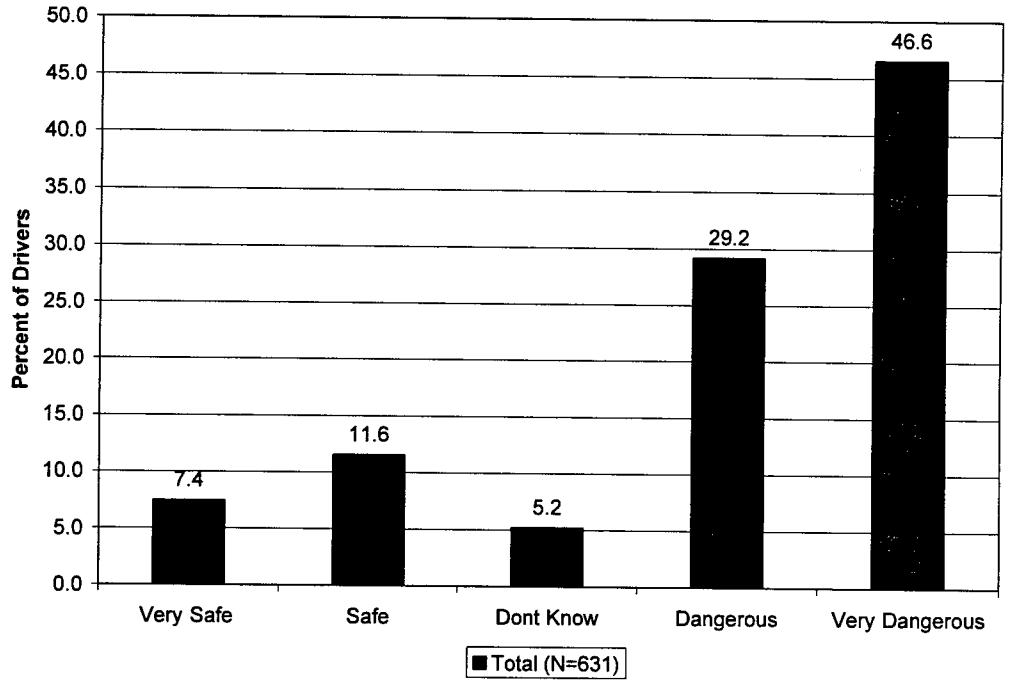


Figure 4.5 Perceived Danger Posed to Students Outside by Backing Up of the School Bus.

The second question was to rate the danger posed to students who cross in front of the bus to board or leave the bus. The ANOVA analysis in table 4.19 shows that there are statistically significant differences between the means of the three school districts at the 95% confidence level. Table 4.20 indicates that the average response for the districts was around 3 which implies the drivers were not sure or didn't know about the hazard posed to students who cross in front of the bus. Around 40% of respondents in all districts reported that it was safe for students who crossed in front of the stopped bus while another 40% of respondents in all districts reported that it was dangerous for students. Figure 4.6 shows the distribution of the respondents' perceptions. Respondents reported that the students were in no danger from the bus itself; however, the rampant occurrence of illegal passing by other vehicles posed a definite danger to students. Some drivers had reported serious injuries to students due to illegal passing by other vehicles and in Pinellas County drivers reported instances of fatalities.

Table 4.19 One-way ANOVA of Population Mean Responses to Perceived Danger Posed to Students who Cross in Front of the Bus to Board or Leave.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	20.368	3.000	6.789	3.998	0.008	2.612
Within Groups	2180.477	1284.000	1.698			
Total	2200.845	1287.000				

Table 4.20 Perceived Danger Posed to Students who Cross in Front of the Bus to Board or Leave.

District	N	Mean	Variance	Median
Alachua	50	2.9	1.59	3*
Orange	319	3.3	1.86	4#
Pinellas	275	2.9	1.50	2+

+ "Safe" * "Don't Know" # "Dangerous"

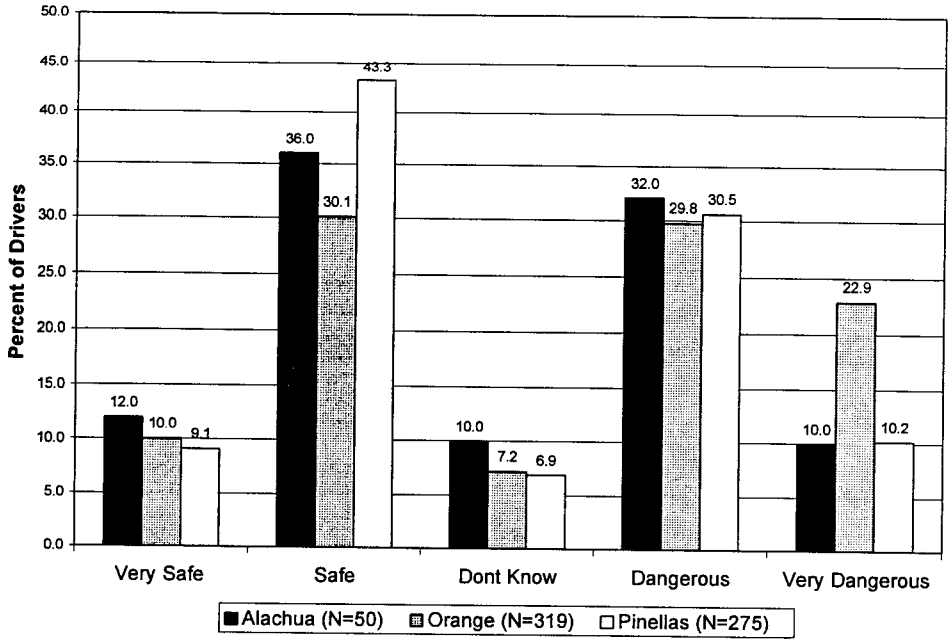


Figure 4.6 Perceived Danger Posed to Students who Cross in Front of the Bus to Board or Leave.

Although 75% of the respondents reported that backing up of the school bus was a dangerous or very dangerous maneuver, very few reported that this maneuver had caused any accident or injury to students. Table 4.21 indicates the proportion of drivers who reported injuries to students. This could be an indication that the students follow safe riding practices in the zone outside of the bus. Drivers have reported that during backing up, they have had minor accidents such as backing up into utility poles, mailboxes and traffic control signs. Some drivers have also reported backing up into cars with minor damage to the vehicles, but no injuries to anybody involved.

Table 4.21 Proportion of Drivers who Reported Injuries to Students Due to Backing Up or Crossing in Front of the School Bus.

District	N	Reported Injury to Student (%)
Alachua	10	0.0
Orange	95	4.2
Pinellas	40	5.0
Total	145	4.1

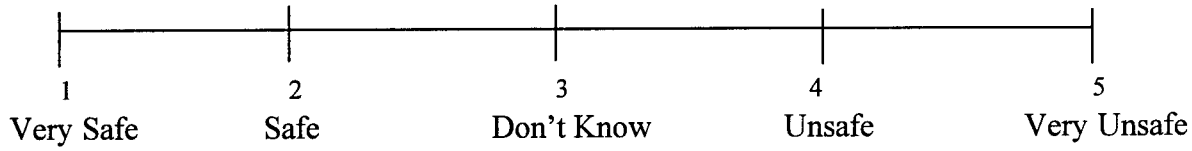
4.2.4 Location of Stops and Stop Safety

Drivers were asked to list the predominant location of stops along their route. Table 4.22 indicates the predominant locations of stops made by the driver. In all districts, a majority of the stops were made on major roads with heavy traffic followed by neighborhood streets.

Table 4.22 Predominant Location of Stops Made by Driver.

District	N	Main Roads Heavy Traffic (%)	Minor Roads Heavy Traffic (%)	Minor Roads Light Traffic (%)	Neighborhood Streets (%)	Other Roads (%)
Alachua	50	46.0	8.0	10.0	28.0	8.0
Orange	317	36.6	16.1	12.6	34.1	0.6
Pinellas	265	37.0	9.1	14.7	34.0	5.3
Total	632	37.5	12.5	13.3	33.5	3.2

Drivers were also asked to rate the safety of the location of stops along their route. The drivers were asked to mark their responses on the following scale:



The ANOVA analysis in table 4.23 shows that there are no statistically significant differences between the means of the three school districts at the 95% confidence level; hence the responses of the surveyed districts were combined. Table 4.24 indicates that the average response for the districts was around 2.3 which implies the drivers felt the location of their stops was safe. Figure 4.7 shows the distribution of the respondents' perception. Over 75% of respondents felt that the location of stops was safe or very safe.

Table 4.23 One-way ANOVA of Population Mean Responses to Driver Perceived Safety of the Location of Stops Along Their Route.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	2.111	2	1.055	1.244	0.289	3.010
Within Groups	539.382	636	0.848			
Total	541.493	638				

Table 4.24 Driver Perceived Safety of the Location of Stops Along Their Route.

District	N	Mean	Variance	Median
Alachua	50	2.2	0.68	2*
Orange	320	2.4	1.04	2*
Pinellas	269	2.2	0.65	2*
Total	639	2.3	0.85	2*

* - "Safe"

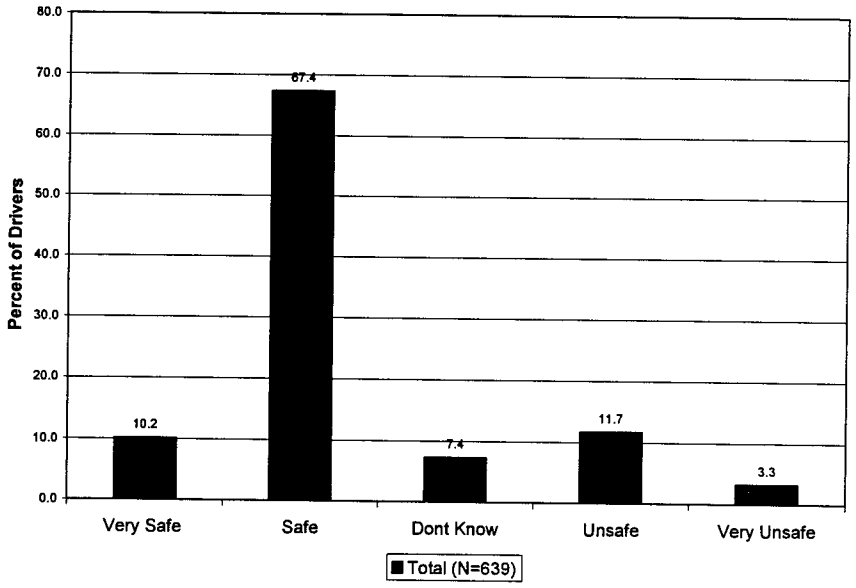


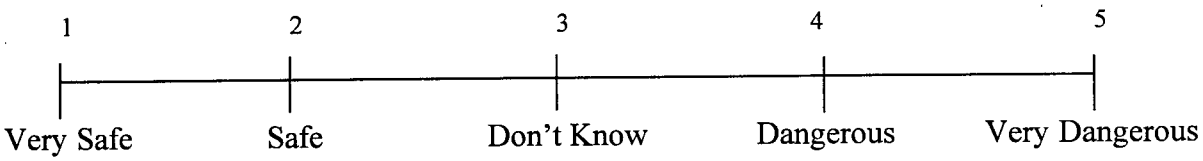
Figure 4.7 Driver Perceived Safety of the Location of Stops Along Their Route.

4.2.5 Illegal Passing by Other Vehicles

Drivers were asked to rate the danger posed by illegal passing of a stopped school bus by other motorists in three categories of illegal passing as follows:

- in the same direction on an undivided road,
- in the opposite direction on an undivided road, and
- in the same direction on a divided road.

The responses for perceived danger posed were rated on the following scale:



The ANOVA analysis for all three categories shows that there are no statistically significant differences between the means of the three school districts at the 95% confidence level. Hence the responses of the surveyed districts were combined.

Tables 4.25, 4.26 and 4.27 indicate the ANOVA analysis for the three categories. For illegal passing on an undivided road, the respondents rated illegal passing in both directions as equally hazardous. Tables 4.28 and 4.29 indicate that the average response for the districts was around 4 which implies the drivers felt the illegal passing on an undivided road either in the same or opposite direction was equally dangerous. The perceived hazard was slightly lower at 3.6 for illegal passing in the same direction on a divided road and this is indicated in table 4.30.

Table 4.25 One-way ANOVA of Population Mean Responses to Perceived Danger to Students by Illegal Passing by Other Vehicles in the Same Direction—Undivided Road.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.791	2	0.396	0.282	0.755	3.010
Within Groups	889.515	633	1.405			
Total	890.307	635				

Table 4.26 One-way ANOVA of Population Mean Responses to Perceived Danger to Students by Illegal Passing by Other Vehicles In the Opposite Direction—Undivided Road.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	0.133	2	0.066	0.052	0.949	3.010
Within Groups	789.861	621	1.272			
Total	789.994	623				

Table 4.27 One-way ANOVA of Population Mean Responses to Perceived Danger to Students by Illegal Passing by Other Vehicles in the Same Direction—Divided Road.

One-way ANOVA	$\alpha = 0.05$					
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1.136	2	0.568	0.407	0.666	3.010
Within Groups	857.669	615	1.395			
Total	858.804	617				

Table 4.28 Perceived Danger to Students by Illegal Passing by Other Vehicles in the Same Direction—Undivided Road.

District	N	Mean	Variance	Median
Alachua	51	4.0	1.56	4#
Orange	315	4.0	1.40	4#
Pinellas	270	3.9	1.38	4#
Total	636	4.0	1.4	4#

- "Dangerous"

Table 4.29 Perceived Danger to Students by Illegal Passing by Other Vehicles in the Opposite Direction—Undivided Road.

District	N	Mean	Variance	Median
Alachua	51	4.0	1.24	4#
Orange	303	3.9	1.24	4#
Pinellas	270	3.9	1.31	4#
Total	624	3.9	1.27	4#

- "Dangerous"

Table 4.30 Perceived Danger to Students by Illegal Passing by Other Vehicles in the Same Direction—Divided Road.

District	N	Mean	Variance	Median
Alachua	51	3.5	1.61	4#
Orange	301	3.7	1.41	4#
Pinellas	266	3.7	1.33	4#
Total	618	3.6	1.39	4#

- "Dangerous"

Figure 4.8 indicates the relative hazard for all three cases. Figure 4.9 indicates the distribution of the respondents' perceptions for all three cases. Over 70% of respondents felt that illegal passing in both the same and opposite directions was dangerous or very dangerous on an undivided road. Over 60% felt it was dangerous or very dangerous for the same direction on a divided road.

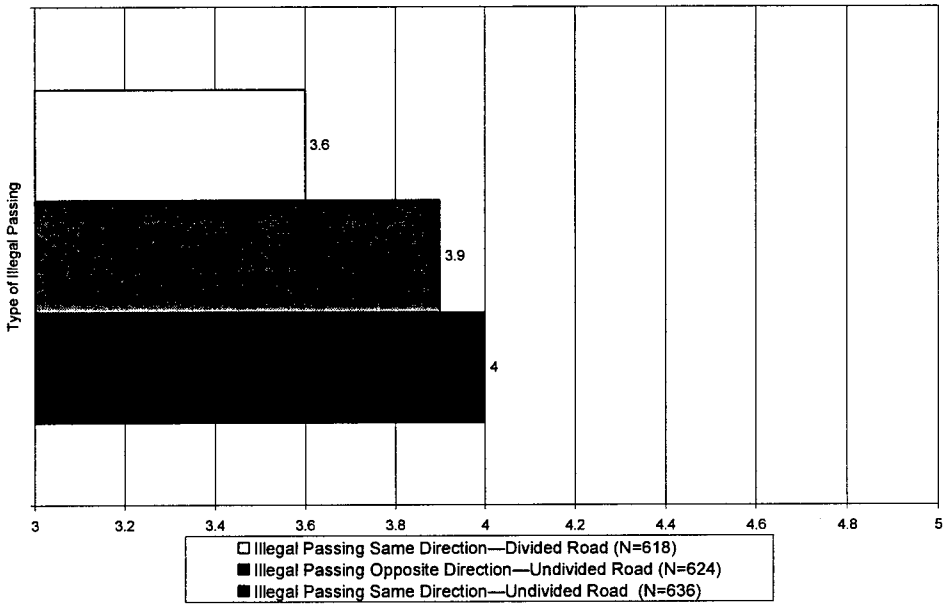


Figure 4.8 Perceived Danger of Illegal Passing According to Type of Incident.

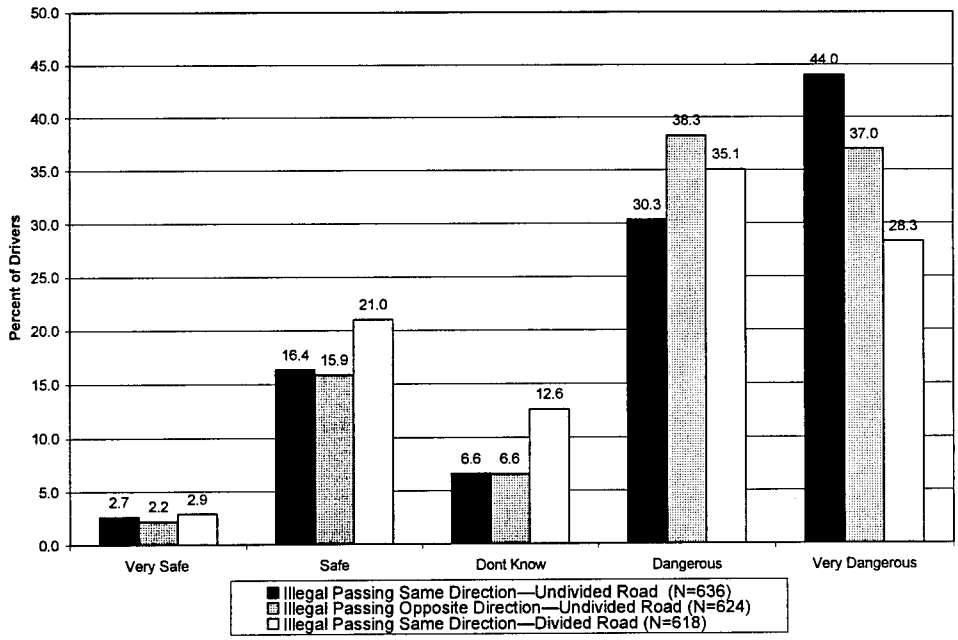


Figure 4.9 Distribution of Perceived Hazard of Illegal Passing According to Type of Incident.

For the average daily number illegal passing incidents per bus, the ANOVA analysis in table 4.31 for all the surveyed districts shows that there are no statistically significant differences between the means of the three school districts at the 95% confidence level. The responses for the average daily number of illegal passing incidents per bus were similar for all districts and hence the responses of the surveyed districts were combined. Table 4.32 shows the average daily number of illegal passing incidents per bus. Figure 4.10 shows the distribution of the reported driver responses of average daily number of illegal passing incidents.

Table 4.31 One-way ANOVA of Population Mean Responses to Average Number of Illegal Passing Incidents per Day Reported by Driver.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	5.460	2	2.730	0.150	0.860	3.010
Within Groups	11748.215	647	18.158			
Total	11753.675	649				

The survey found that the drivers reported an average of 4.3 incidents of illegal passing per day. Drivers who drove predominantly along routes located on main roads reported the highest incidents of illegal passing with an average of 5.9 incidents per day. A significant finding was that on routes predominantly located along minor roads with light traffic an average of 3.1 daily incidents of illegal passing were recorded. This could be attributed to motorist complacence about poor enforcement along these roads. Routes predominantly located along neighborhood residential streets with light traffic reported the lowest rate of 2.8 daily incidents of illegal passing.

Table 4.32 Average Number of Illegal Passing Incidents per Day Reported by Driver.

District	N	Average Reported Incidents of Illegal Passing per Day	Average Reported Incidents of Illegal Passing per Day According to Predominant Location of Stops				
			Main Roads Heavy Traffic	Minor Roads Heavy Traffic	Minor Roads Light Traffic	Neighborhood Streets	All Roads
Alachua	50	3.5	4.5	2.8	3.2	2.1	4.0
Orange	317	4.3	6.1	4.2	3.2	2.7	4.5
Pinellas	265	4.4	6.1	3.8	3.0	3.0	6.2
Total	632	4.3	5.9	4.0	3.1	2.8	5.6

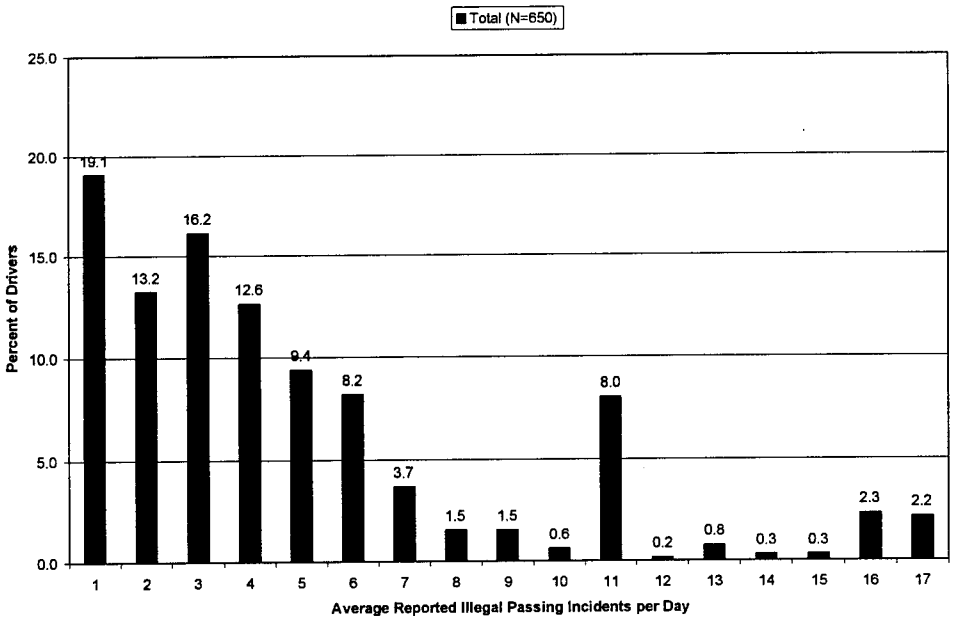


Figure 4.10 Distribution of Average Number of Illegal Passing Incidents per Day.

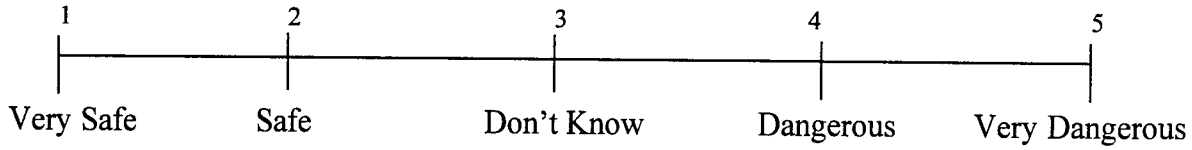
Table 4.33 indicates the fatalities and injuries to students reported by drivers due to incidents of illegal passing. The proportion of drivers reporting injuries is quite low and the sole fatality was reported from Pinellas County. The nature of injuries was usually serious and resulted in fractures and head injuries requiring hospitalization. Some drivers reported damage to stopped buses due to sideswiping by illegally passing cars. In a few cases the buses were illegally passed on the right (loading) side. Drivers also reported that other motorists were unaware of the laws and a motorist who struck a student was unaware that he had to stop behind a stopped school bus that was loading. In some cases the students were struck as they darted in front of the bus.

Table 4.33 Proportion of Drivers who Reported Injuries to Students Due to Incidents of Illegal Passing.

District	N	Reported Death to Student (%)	Reported Injury to Student (%)	Reported No Injury (%)
Alachua	10	0.0	0.0	100.0
Orange	95	0.0	0.9	99.1
Pinellas	40	1.1	2.6	96.3
Total	145	0.5	1.5	98.0

4.2.6 Handrail Snagging

Drivers were also asked to rate the perceived danger posed to students by handrail snagging. The drivers were asked to mark their responses on the following scale:



The ANOVA analysis in table 4.34 shows that there are statistically significant differences between the means of the three school districts at the 95% confidence level. Table 4.35 indicates that the average response for the districts was around 2.7, which implies that drivers were not sure, or don't know, about the hazard posed to students due to incidents of handrail snagging.

Table 4.34 One-way ANOVA of Population Mean Responses to Driver Perceived Danger Posed to Students by Handrail Snagging.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*Df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	12.028	2	6.014	4.722	0.009	3.010
Within Groups	803.593	631	1.274			
Total	815.621	633				

Table 4.35 Perceived Danger Posed to Students by Handrail Snagging.

District	N	Mean	Variance	Median
Alachua	49	2.6	1.29	2*
Orange	315	2.9	1.50	3#
Pinellas	270	2.6	1.00	2*

* "Safe" # "Don't Know"

The responses to this question could be biased since this problem had been rectified in the school bus fleet by the school districts two years ago. Most drivers rated this issue as safe and reported no incidents of handrail snagging. Figure 4.11 shows the distribution of the respondents' perception.

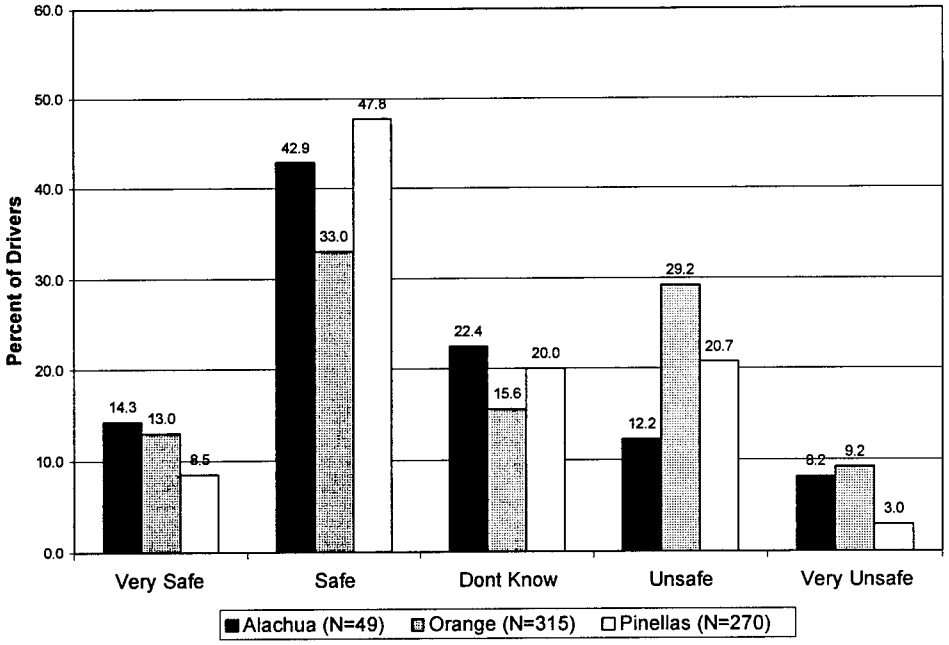


Figure 4.11 Perceived Danger Posed to Students by Handrail Snagging.

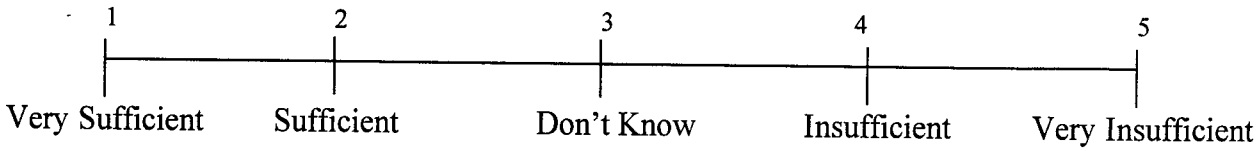
Only 2% of the respondents reported incidents of students falling due to handrail snagging and these were minor, since the driver had noticed the incident. Table 4.36 indicates the proportion of drivers who reported injuries to students due to handrail snagging. In most cases the backpack got snagged, leading to the student falling and sustaining minor injuries.

Table 4.36 Proportion of Drivers who Reported Injuries to Students Due to Handrail Snagging.

District	N	Reported Injury to Student (%)
Alachua	50	4.0
Orange	319	1.6
Pinellas	269	1.9
Total	638	1.9

4.2.7 Driver Satisfaction of Training Received

Drivers were asked to rate whether the pre-service and in-service training received was sufficient, and therefore if they felt comfortable to handle most problems on the job. The responses were rated on the following scale:



The ANOVA analysis for both categories shows that there are statistically significant differences between the means of the three school districts at the 95% confidence level. Tables 4.37 and 4.38 indicate the ANOVA analysis for both categories. Table 4.39 and table 4.40 indicates that the average response for the districts was around 2 which implies the drivers felt the pre-service training and in-service training provided to them was adequate.

About 90% of the respondents in all surveyed districts were satisfied by both the pre-service and in-service training provided by the school districts and felt that it was sufficient to make them comfortable and prepared to tackle most problems encountered on the job. Figures 4.12 and 4.13 show the distributions of the responses for driver perceived adequacy of pre-service training and in-service training respectively. The training conforms to state board regulations, which specify that new drivers must be provided with 40 hours of pre-service training and all drivers have an annual requirement to undergo eight hours of in-service training.

Table 4.37 One-way ANOVA of Population Mean Responses to Perceived Adequacy of Pre-Service Training.

One-way ANOVA $\alpha = 0.05$

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	5.297	2	2.649	3.413	0.034	3.010
Within Groups	497.417	641	0.776			
Total	502.714	643				

Table 4.38 One-way ANOVA of Population Mean Responses to Perceived Adequacy of In-Service Training.

One-way ANOVA	$\alpha = 0.05$					
Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	4.913	2	2.457	3.337	0.036	3.010
Within Groups	466.043	633	0.736			
Total	470.956	635				

Table 4.39 Driver Perceived Adequacy of Pre-Service Training.

District	N	Mean	Variance	Median
Alachua	50	2.1	0.80	2#
Orange	321	2.0	0.75	2#
Pinellas	273	2.2	0.80	2#

- "Sufficient"

Table 4.40 Driver Perceived Adequacy of In-Service Training.

District	N	Mean	Variance	Median
Alachua	48	2.1	0.81	2#
Orange	317	2.0	0.73	2#
Pinellas	271	2.2	0.73	2#

- "Sufficient"

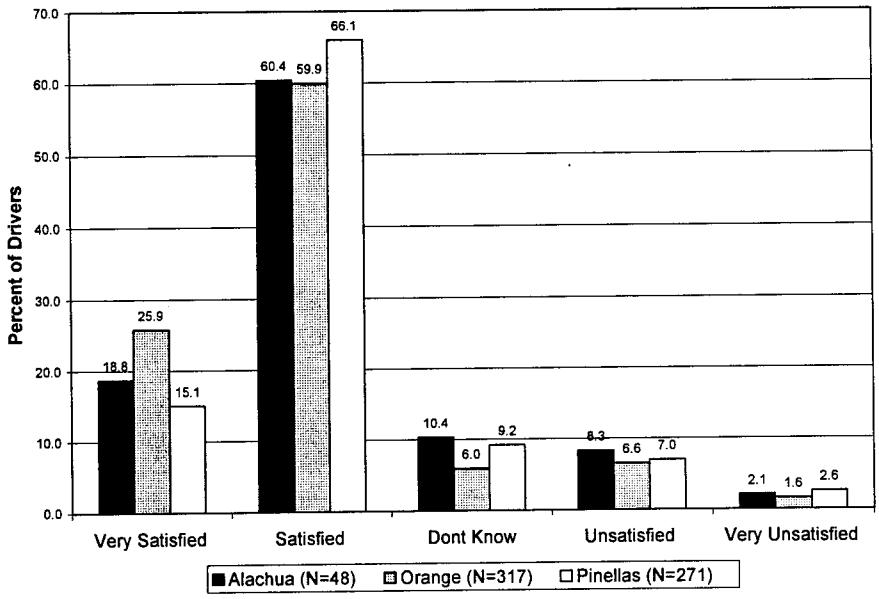


Figure 4.12 Driver Perceived Adequacy of Pre-Service Training.

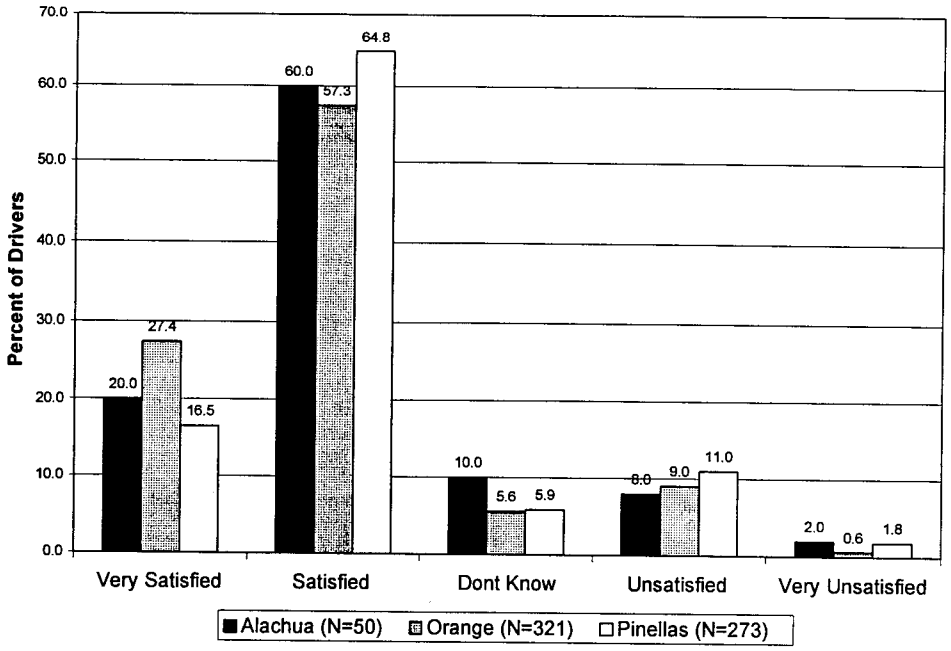


Figure 4.13 Driver Perceived Adequacy of In-Service Training.

4.2.8 Other Comments Received

Many drivers claimed lack of support from school districts and expressed frustration at their inability to control student misbehavior and prevent regularly disobedient students from riding on the bus. This responsibility only rested with the principals of the respective schools. Also several drivers reported that student referrals were not given prompt attention. This seemed to be a consistent concern and drivers felt that this accounted for the rising incidents of student misbehavior on board the bus. The drivers indicated that school systems are reluctant to remove unruly students in a timely manner due to the threats of lawsuits and harassment from parents. Before the installation of video cameras monitors the onus of proof of student misbehavior rested with the drivers who were frequently subjected to scorn and harassment by the parents of the implicated students. In the larger districts of Pinellas and Orange, drivers complained that there were insufficient video cameras available to document reported incidents to student misbehavior.

Another concern stated by drivers was that sometimes due to the extremely hot summer temperatures, especially in southern states like Florida, the drivers and some students suffered from heat exhaustion. They expressed fears of blackouts among students and drivers and requested air conditioners on all buses. Some drivers also expressed concerns about posting new and inexperienced drivers on the busiest routes. Some drivers expressed concerns about transporting students with special needs and regular student

on the same bus since this sometimes led to regular students harassing the students with special needs.

Drivers also expressed concerns about being rear ended by vehicles as they made frequent stops. Drivers in Orange County were concerned at being rear ended at railroad crossings. School buses are required to stop at all railroad crossings and many following motorists are unaware of this and there have been instances on rear ending. Pinellas County had limited this problem by installing a sign behind the buses warning motorists that the bus stops at all railroad crossings.

Some drivers, especially those who drove on out of town routes, expressed some annoyance regarding the speed governor on their bus being set to the old speed limit of 55 mph. The routes they drove on were sometimes two-lane highways and they found it difficult to pass other slower vehicles due to the limited speed of the bus. They noted that this caused a delay in their schedule. This seems to be a minor annoyance.

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CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

For most safety concerns identified by school bus drivers there were no significant variations in the responses of the three school districts. The drivers cited several safety issues.

Illegal passing of stopped school buses seems to be the dominant safety concern. The majority of surveyed bus drivers reported such occurrences on a daily basis. These reports imply a rise in the number of incidents of illegal passing, as compared with previous studies. Traffic growth, poor adherence to proper driving practices, and insufficient enforcement of existing laws appear to be the main causes of the increasing number of illegal passing infractions.

This study also revealed another important safety issue that is not explicitly related to surrounding traffic or vehicle features. Student misbehavior was a general concern for most of the surveyed drivers. School bus drivers reported that they are distracted by student misconduct inside the bus, and such incidents could be contributing factors in accidents. Comments received indicate that schools do not adequately handle discipline of students on school buses, and that it is becoming increasingly hard to control students, who are often defiant on board the buses. This appears to be a source of frustration for school bus drivers, and increases the potential of accidents. Improper riding practices by students, such as not remaining properly seated on a moving bus, may result in serious injuries or even fatalities to these students if there is a severe maneuver or a collision. Most of the safety features incorporated in the interior school bus design involve the concept of compartmentalization, which assumes that students are properly seated in the bus at all times.

The third most critical safety concern identified by this study is the danger posed to students outside the vehicle by the school bus backing up. Over 75% of respondents felt that backing the bus was a dangerous operation. As for the danger posed to students who cross in front of the bus to board or leave the vehicle, even though there were statistically significant differences among the surveyed districts, most respondents reported that the students are in no danger from the bus itself, but rather more so from surrounding traffic, due to the occurrence of illegal passing.

Another widespread concern expressed by the bus drivers is heat exhaustion. School bus drivers' blackouts due to improper ventilation of the vehicle could lead to serious accidents.

There is also a renewed interest in the issue of safety belts in school buses. Most existing research indicates that safety belts would be of limited value compared to existing occupant protection methods employed in school buses.

5.2 Recommendations

More attention needs to be focused on addressing the safety concerns identified in this study. Better ways to reduce illegal passing should be considered for implementation. Countermeasures should encompass a wide spectrum of engineering improvements for bus visibility, increased and effective enforcement policies, and methods of educating other motorists about the laws involving school buses.

Student discipline is also an area of widespread concern and therefore further research is needed to quantify the influence this problem has on safety. Once the magnitude of this issue is determined, proper and cost-effective countermeasures can be assessed. In any case, educating students about safe and proper bus riding and pedestrian practices is critical to school bus safety.

Drivers in all the surveyed districts reported concerns about blackouts due to heat exhaustion. Hence, further attention should be paid towards this concern. Attempts should be made to post drivers particularly sensitive to heat on buses equipped with air conditioners, and to expand the number of air-conditioned buses.

Due to the absence of available data in states that have employed safety belts, their potential benefit has still not been adequately measured. Data should be gathered over a period of time in these states to measure the effectiveness of safety belt installation. A comprehensive study planned by NHTSA should throw new light on this subject.

5.3 Closing Comment

Georgia and Florida recently introduced legislation requiring seatbelts in school buses. The Florida bill was endorsed by both the House and Senate and will probably be signed by the Governor. It calls for school buses purchased after December 31, 2000, to have safety belts or other restraint systems installed. The experience of these states, and others that may require seatbelts on school buses, should be carefully monitored.

Appendix A

Survey Form

SCHOOL BUS SAFETY

The Transportation Research Center (TRC) at the University of Florida is conducting a study for the U.S. DOT to assess the safety of students who use school buses. We are in need of your help to complete this form to help identify safety problems. This form should take about 15 to 20 minutes to complete. After you have filled out this form, **please return to the person who handed out this form to you**. Thank you so much for taking the time to give us this information.

---

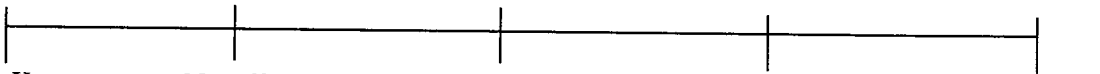
1. Please give your age_____ and gender (F/M)_____

2. How long have you driven a school bus? [ ] years

3. Are you currently a full or part-time driver? [ ] part-time [ ] full-time

4. Please indicate the predominant type of students you transport: [ ] regular [ ] disabled

5. Does the behavior of students on board the school bus distract you seriously enough that it affects your attention to driving? (*For this question and others that use rating scales, please place an **X** closest to the rating that matches your opinion.*)



Don't Know | No Effect | Slight Effect | Significant Effect | Serious Effect

6. How is the behavior of students on the school bus monitored (*check all that apply*)?

   [ ] Driver [ ] On-board adult monitor [ ] No monitoring [ ] Other (*please specify*)_____

7. Have any students been injured in accidents that occurred due to student misbehavior?

   [ ] Yes [ ] No

   If you answered "yes," please specify type of misbehavior, type of accident and seriousness of injury.

   _____

   _____

8. Do you pick up disabled students along your route? [ ] Yes [ ] No (*skip to Question 10*)

   If you answered "yes," please reply to the following questions:

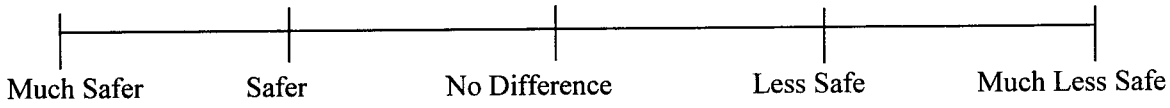
   a. Please rank the kind of disability of most students you transport, starting with "1" for the most common disability.

      [ ] wheelchair
      [ ] ambulatory difficulties not requiring wheelchair
      [ ] vision impaired
      [ ] hearing impaired
      [ ] mentally impaired
      [ ] other (*please specify*)_____

b. Disabled students are picked up and dropped off at:

[ ] school bus stops for regular students [ ] stops closer to their origin/destination

c. How does the safety of disabled students on the school bus compare to the safety of regular students?



d. Please list any hazardous conditions that specially apply to disabled students.

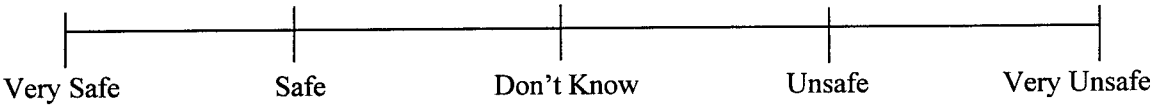
_____

_____

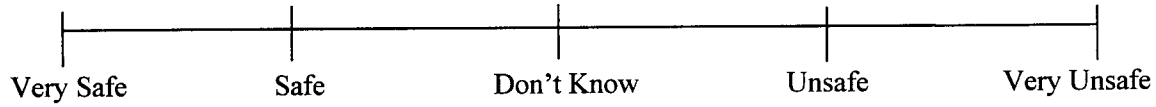
9. Is your school bus equipped with a wheelchair lift? [ ] Yes [ ] No

If you answered "yes," please reply to the following questions:

a. How would you rate the safety of the loading/unloading devices (wheelchair lifts)?



b. How would you rate the safety of wheelchair locking devices on board the bus?



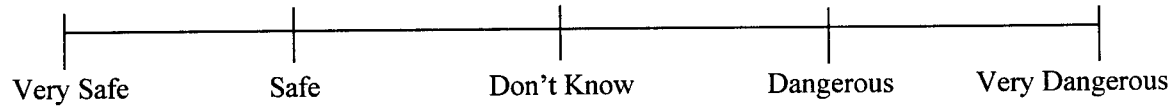
c. Have any students been injured in accidents that occurred due to wheelchair lifts or wheelchair locking devices? [ ] Yes [ ] No

If you answered "yes," please specify type of accident and seriousness of injury.

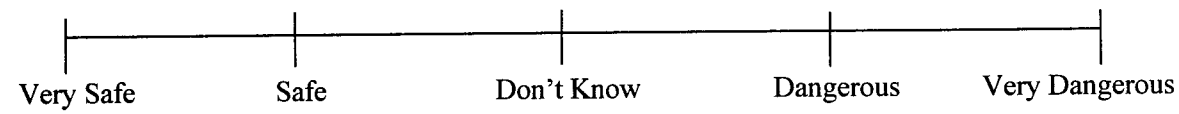
_____

_____

10. Please rate the danger posed to students outside the bus by backing up the school bus.



11. Please rate the danger posed to students who cross in front of the bus to board or leave the bus.



12. Have any students been injured in accidents that occurred due to backing up the school bus or when the student crossed in front of the school bus? [ ] Yes [ ] No

If you answered "yes," please specify type of accident and seriousness of injury.

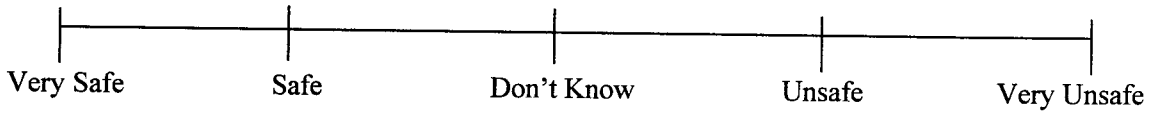
_____

_____

13. Bus stops along my route are mostly on:

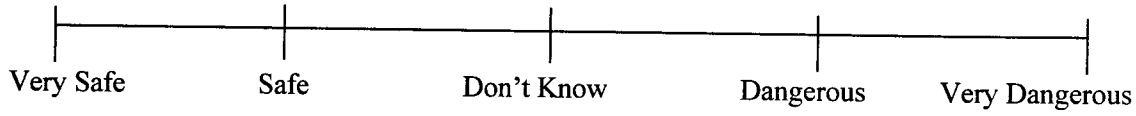
[ ] main roads with heavy traffic
[ ] minor roads with heavy traffic
[ ] minor roads with light traffic
[ ] neighborhood streets or roads with light traffic
[ ] other (*please specify*)_____

14. How would you rate the safety of the location of the stops along your route?

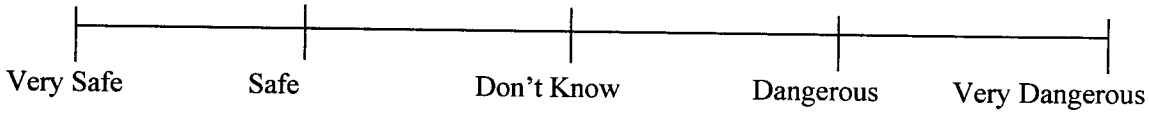


15. Please rate the danger posed to students from illegal passing by other vehicles when the school bus has stopped.

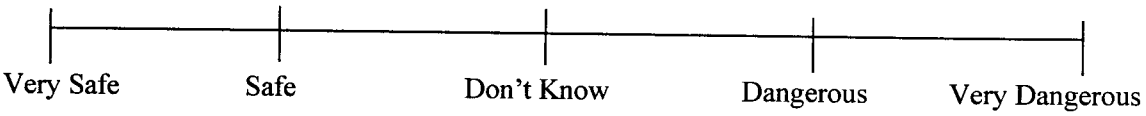
a. Passing in the same direction on an undivided road:



b. Passing in the opposite direction on an undivided road:



c. Passing in the same direction on a divided road:



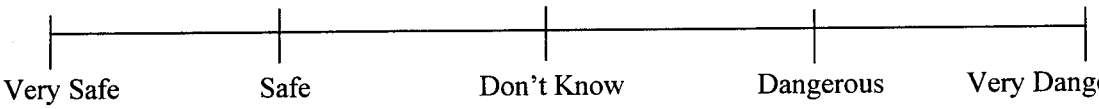
16. On a typical day, how many illegal passes by other vehicles do you encounter? [ ]

17. Have any students been injured in accidents that occurred due to illegal passing by other vehicles?
[ ] Yes [ ] No

If you answered "yes," please specify type of accident and seriousness of injury.

_____

18. Please rate the danger posed by students' clothing/backpack getting trapped in the staircase handrail while entering or exiting the bus.



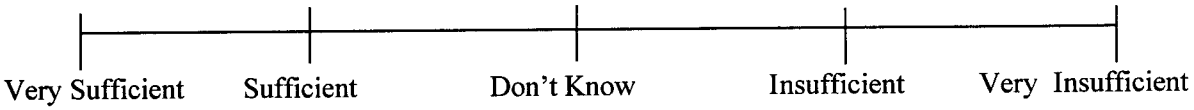
19. Have any students been injured due to clothing/backpack getting trapped in the staircase handrail while entering or exiting the bus? [ ] Yes [ ] No

If you answered "yes," please specify type of accident and seriousness of injury.

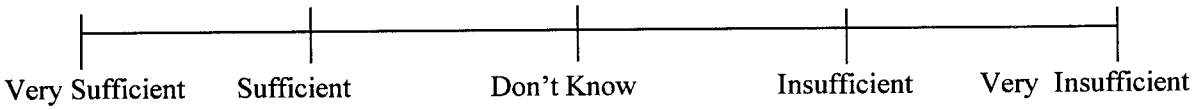
_____

_____

20. Please indicate if the pre-service training was sufficient to make you feel comfortable and prepared to tackle most problems encountered on the job.



21. Please indicate if the in-service training was sufficient to make you feel comfortable and prepared to tackle most problems encountered on the job.



22. Please list any other school bus safety problems that you are aware of, but have not been mentioned in this form.

_____

_____

_____

_____

_____

_____

_____

_____

Thank you!

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Appendix B

School Districts Surveyed

SCHOOL DISTRICTS SURVEYED

Alachua District School Board

Mr. Jack Shelton, Transportation Director

1800 SE Hawthorne Road, Gainesville, FL 32641

E-mail : sheltonjg@sbac.edu

Contact : Ms Sandy Williams, Secretary to Transportation Director

Phone : 352-955-7762

Fax : 352-955-7434

Orange District School Board

Mr. Rye Merriam, Director of Transportation

6721 Hanging Moss Road, Orlando, FL 32807

E-mail : merriar@ocps.k12.fl.us

Contact : Ms Linda Henderson, Secretary to Director of Transportation

E-mail : henderl@ocps.k12.fl.us

Phone : 407-317-3801

Fax : 407-317-3850

Pinellas District School Board

Contact : Mr. George Francey

Driver Training and Safety Specialist, Department of Transportation

11111 S Belcher Road, Largo, FL 33773

E-mail : franceyg@pinellas.k12.fl.us

Phone : 727-547-7208

Fax : 813-547-7244

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