P390-916202

Highway Accident Report - Collision between Mission Consolidated Independent School District School Bus and Valley Coca-Cola Bottling Company, Inc. Tractor-Semitrailer Intersection of Bryan Road and Texas Farm-to-Market Road 676 Alton, Texas, September 21, 1989

(U.S.) National Transportation Safety Board, Washington, DC

17 Jul 90

U.S. Department of Commerce
National Technical Information Service
NTIS

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. NTSB/HAR-90/02	2. Government Accession No. PB90-916202	3. Recipient's Cataiog No.
4. Title and Subtitle Highway Accident Report--Collision Between Mission Consolidated Independent School District School Bus and Valley Coca-Cola Bottling Company, Inc. Tractor-Semitrailer, Intersection of Bryan Road and Texas Farm-to-Market Road 676, Alton, Texas, September 21, 1989		5. Report Date July 17, 1990
		6. Performing Organization Code
7. Author(s)		8. Performing Organization Report No.
9. Performing Organization Name and Address National Transportation Safety Board Bureau of Surface Transportation Safety Washington, D C 20594		10. Work Unit No. 5203A
		11. Contract or Grant No.
12. Sponsoring Agency Name and Address NATIONAL TRANSPORTATION SAFETY BOARD Washington, D.C 20594		13. Type of Report and Period Covered Highway Accident Report September 21, 1989
		14. Sponsoring Agency Code
15. Supplementary Notes		

16. Abstract

This report explains the collision between a school bus and a tractor-semitrailer in Alton, Texas, on September 21, 1989 The safety issues discussed in the report are the adequacy of school bus egress guidelines, State and local emergency response planning for mass casualty accidents, adequacy of school bus driver medical examination report reviews, training of public safety personnel regarding emergency complaints, Valley Coca-Cola Bottling Company maintenance procedures, adequacy of Valley Coca-Cola Bottling Company driver training, and crashworthiness of large school buses. Safety Recommendations addressing these issues were made to the National Highway Traffic Safety Administration, the Texas Department of Public Safety, Hildalgo County, City of Alton, Texas, the Valley Coca-Cola Bottling Company, Inc , and the National Association of State Directors of Pupil Transportation Services

17. Key Words		18. Distribution Statement This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161	
19. Security Classification (of this report) UNCLASSIFIED	20. Security Classification (of this page) UNCLASSIFIED	21. No. of Pages 96	22. Price A05

NTSB Form 1765.2 (Rev. 5/88)

CONTENTS

EXECUTIVE SUMMARY

About 7:34 a.m., central daylight time, on Thursday, September 21, 1989, a westbound school bus with 81 students operated by the Mission Consolidated Independent School District, Mission, Texas, and a northbound delivery truck operated by the Valley Coca-Cola Bottling Company, McAllen, Texas, collided at Bryan Road and Farm to Market Road Number 676 (FM 676) in Alton, Texas.

After the collision, the truck came to rest facing west on the right shoulder of FM 676. The school bus continued in a northwest direction and dropped approximately 24 feet into a caliche pit (excavation pit) partially filled with water, located in the northwest corner of the intersection. The bus came to rest on its left side facing southeast, totally submerged in approximately 10 feet of water, approximately 35 feet from the nearest shoreline. The bus front boarding door was jammed shut, but the rear emergency exit door was operable. No other emergency exits were on the bus.

Nineteen students died at the accident scene, and two died later in the hospital. The 21 fatalities were the result of drowning or complications related to the submersion. Furthermore, 3 students sustained serious injuries, 46 others sustained minor injuries, and 11 students were not injured.

The National Transportation Safety Board determines that the probable cause of the accident was the truckdriver's inattention and subsequent failure to maintain sufficient control of his vehicle to stop at the stop sign. Contributing to the severity of the accident was the lack of a sufficient number of emergency exits on the school bus to accommodate the rapid egress of all 81 students.

The safety issues discussed in this report include:

- o Adequacy of school bus egress guidelines.
- o State and local emergency response planning for mass casualty accidents.
- o Adequacy of school busdriver medical examination report reviews.
- o Training of public safety personnel regarding calls for emergency assistance.
- o Vehicle maintenance procedures of Valley Coca-Cola Bottling Company.
- o Adequacy of Valley Coca-Cola Bottling Company driver training.
- o Crashworthiness of large school buses.

Safety recommendations addressing these issues were made to the National Highway Traffic Safety Administration; Texas Department of Public Safety; Texas Education Agency; Hidalgo County; City of Alton, Texas; Mission Consolidated Independent School District; Coca-Cola Enterprise, Inc.; Valley Coca-Cola Bottling Company, Inc.; and the National Association of State Directors of Pupil Transportation Services.

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

HIGHWAY ACCIDENT REPORT

COLLISION BETWEEN MISSION CONSOLIDATED INDEPENDENT SCHOOL DISTRICT SCHOOL BUS AND VALLEY COCA-COLA BOTTLING COMPANY, INC., TRACTOR-SEMITRAILER, INTERSECTION OF BRYAN ROAD AND TEXAS FARM-TO-MARKET ROAD 676, IN ALTON, TEXAS SEPTEMBER 21, 1989

INVESTIGATION

The Accident

About 6:45 a.m. central daylight time on September 21, 1989, a school busdriver arrived at the Mission Consolidated Independent School District (Mission School District) transportation compound in Mission, Texas. (See figure 1.) He reported that he completed a pretrip inspection of his regularly-assigned school bus, found no defects, and left the compound shortly before 7:00 a.m., driving his scheduled route.

The pick-up point on the first part of his route was about a mile from the compound where about 70 prekindergarten and elementary school students boarded the bus. These students were then transported directly to Bryan Elementary School, one block north of Business Highway 83 on Bryan Road in Mission.

The busdriver then began the second part of his morning route, picking up students for the Mission junior and senior high schools at pick-up points along Bryan Road and Texas State Farm-to-Market Road number 676 (FM 676)[1]. The last pick-up point was on westbound FM 676 about 785 feet east of the Bryan Road intersection. After the last pick-up, the bus was loaded with 39 junior and 42 senior high school students ranging from 12 to 19 years of age.

Meanwhile, the truckdriver reported for work at the Valley Coca-Cola Bottling Company, Inc. (Valley Bottling Company), in McAllen, Texas, about 6:10 a.m. He departed with a helper about 6:30 to 6:40 a.m. and began

---

[1] FM 676 is also known as Mile 5 Road or Line and 5 Mile Road or Line.

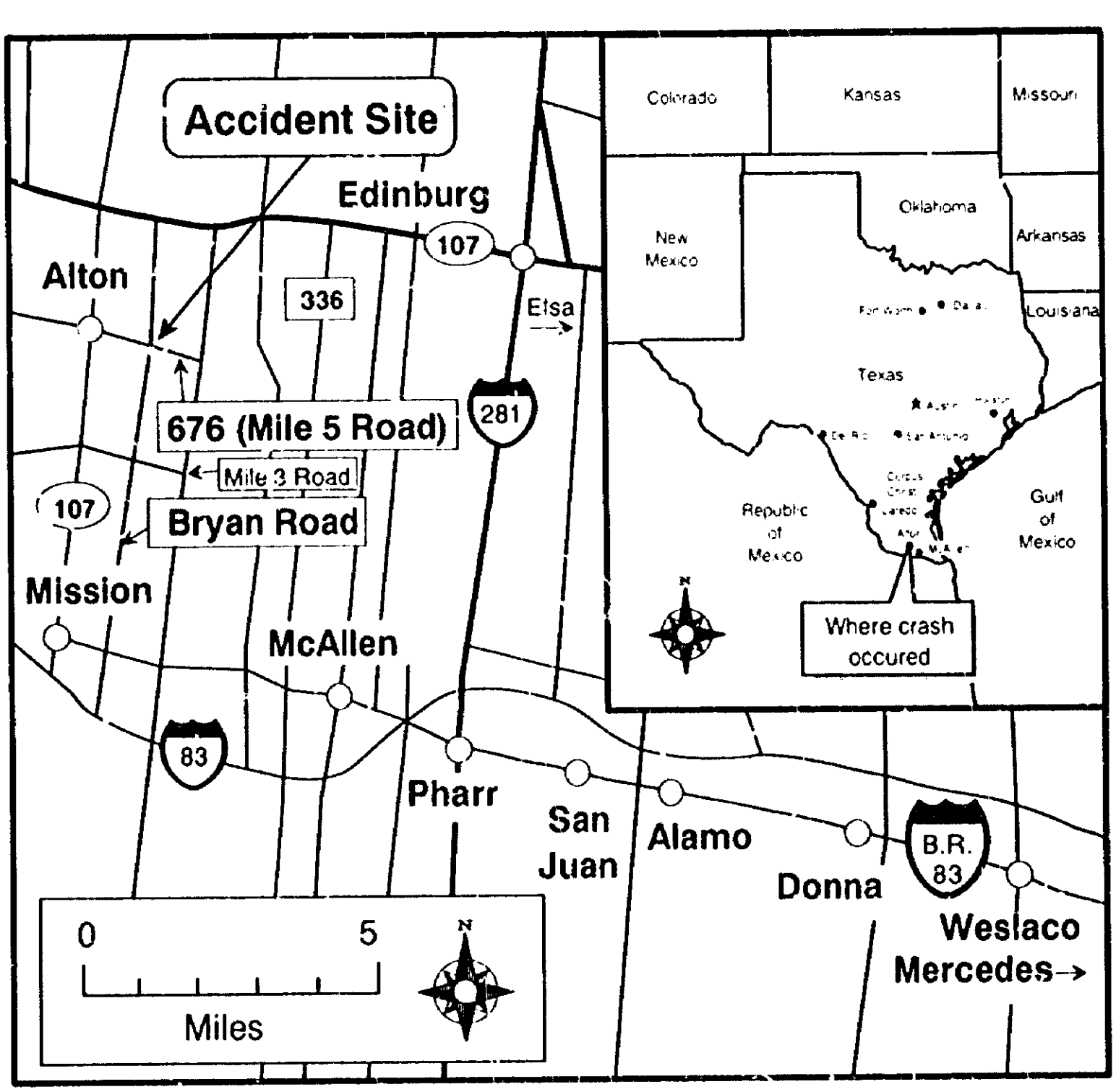


Figure 1.--Map of accident location.

driving his tractor-semitrailer on his scheduled Thursday route, delivering soft drinks to area stores.

According to a clerk at the truckdriver's first delivery point, the Circle K convenience store at the intersection of Bryan Road and Business Highway 83 in Mission, the truck arrived about 6:45 a.m. About 7:20 a.m. tne truckdriver and his helper left the Circle K and drove north on Bryan road toward FM 676 in Alton, Texas.

The helper reported that the truck was traveling north on Bryan Road, a two-lane, two-way asphalt roadway, at approximately 45 mph. About 300 feet south of the intersection with FM 676, a two-lane, two-way east/west asphalt road, he realized that the truckdriver was not slowing for the stop sign at tne intersection. The helper said that he warned the truckdriver of the stop sign. The truckdriver then applied the vehicle's brakes using the foot brake valve, then applied the semitrailer's hand brake valve, and finally down-shifted the tractor's manual transmission from fifth to fourth gear.

On June 15, 1990, the truckdriver submitted a prepared statement as follows:

> My Dr. Pepper trailer was fully loaded. That morning, I made stops for stop signs and traffic before reaching the intersection where the accident happened. That was the first time I drove this far north on Bryan Road on my route. After 3 Mile Line I drove northbound on Bryan Road at the speed limit of 45 miles per hour toward 5 Mile Line. I did not notice the stop ahead sign, which I later learned was bent when I went by it. About the time I passed the mail box on my right, my helper Ruben Pena warned me about a stop sign. I could see a pole ahead but not the red stop sign because of the tree's leaves and branches. I immediately applied my foot brakes. I have been told this mail box is about 425 feet from the intersection. The brakes failed. I kept applying the foot brake like I learned from the other Coca-Cola drivers but I did not feel the brakes catching. About this time, my helper indicated there was a stop ahead. I downshifted to fourth gear, which slowed the tractor-trailer some. Then I applied the trailer brakes with the hand lever. The truck slowed some more, but not enough to stop before going into the intersection and being hit by the school bus.

A witness following the truck on Bryan Road and another witness traveling eastbound on FM 676 reported that the truck did not stop at the stop sign at FM 676. Several students on board the bus reported that they noticed the truck approaching from the left and shouted a warning to the busdriver. The busdriver reported that when he saw the truck, he applied his brakes and attempted to steer to the right. The left front of the bus struck the right front of the truck in the northwest quadrant of the intersection. The busdriver stated that the initial impact with the truck was hard, that he hit his head "by the window," and that he then lost

control of the bus. The busdriver also stated that following the collision, he attempted to steer the bus but was unsuccessful.

After the tractor's initial impact the semitrailer then collided with the left side of the bus, aft of the driver position. The truck rotated 90 degrees counterclockwise and came to rest upright facing west approximately 8 feet north of the edge of the paved shoulder of FM 676. The bus traveled northwest, struck a stop sign at the northwest corner of the intersection, overrode a mound of earth about 2 feet high, and plunged downward approximately 24 feet into a caliche pit[2] in which stagnant water from rain storm runoff had collected. (See figure 2.) A witness and several students stated that before coming to final rest the school bus tilted onto its left wheels and "bobbed up" before it completely sank into the water. The bus came to final rest facing southeast, left side down, submerged in about 10 feet of water. The right side of the bus was about 18 inches below the water surface, and the bus was about 52 feet from the top of the bank where it began to plunge into the caliche pit. (See figure 2.) The caliche pit was 385 feet wide by 610 feet long and 30 feet deep at its deepest point.

As a result of the accident, 21 students died, 3 sustained serious injuries, 46 sustained minor injuries, and 11 were uninjured.[3] The busdriver and the truckdriver and his helper sustained minor injuries. Additionally, one rescuer sustained minor injuries while attempting to rescue students from the submerged school bus.

Survival Factors

Following the accident Safety Board investigators, in cooperation with the Texas Department of Public Safety (DPS) officials and Mission School District officials, interviewed 55 of the 60 surviving students. According to the students, the busdriver had just picked up his last passenger on FM 676 (east of the intersection) and was proceeding at approximately 25 to 35 mph toward the Bryan Road intersection. They said that it was quiet on the bus with the students engaged in normal conversations. Three seating positions were empty and one student was standing in the aisle near the rear of the bus. Several students reported that, although most of the windows were closed the morning of the accident because it was cool, two windows on each side toward the front of the school bus may have been partially open.

A few of the students who saw the truck stated that it was coming "fast" toward the intersection. Speed estimates ranged from 30 to 55 mph. Most of the students, however, could not estimate the speed of the truck. The majority of students stated that the busdriver blew the horn, applied the brakes, and attempted to steer the bus to the right to avoid the truck.

---

[2]Caliche is a hard soil layer cemented by calcium carbonate that is used as a subbase for road construction.

[3]Classification according to the International Civil Aviation Organization (ICAO). The ICAO classification is used in the text of this report.

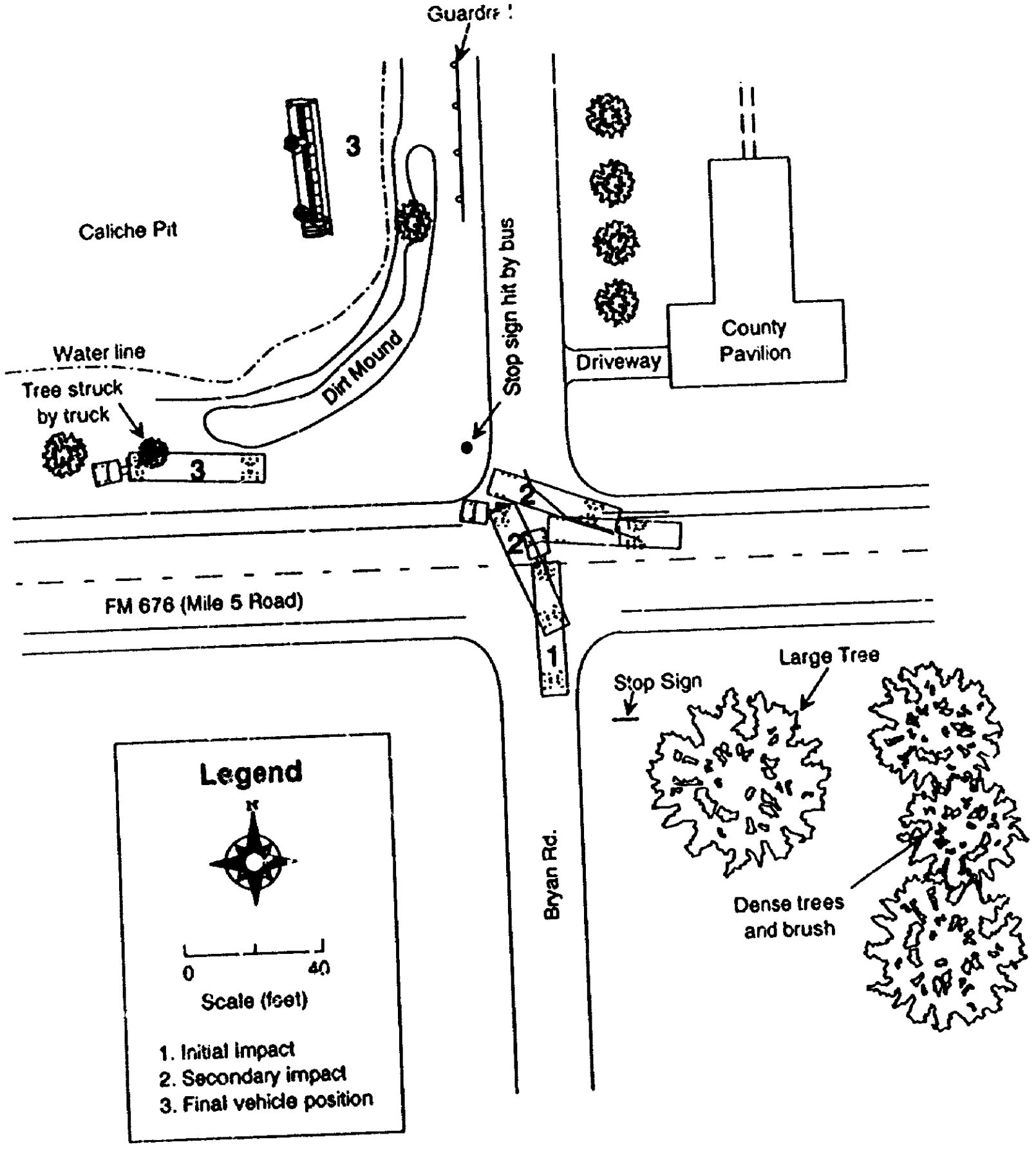


Figure 2.--Plan view of accident scene.

Some students stated that during the initial impact with the truck and subsequent impact with the water in the pit, they were thrown out of their seats toward the front of the bus. Several students said that as the bus left the road, they stood up at their seats and were then propelled toward the front of the bus when it impacted the water. Some students also reported that the impact with the water was "not hard."

According to the students, water quickly rushed into the bus through the dislodged windshield and window openings, filling the interior in 1 to 2 minutes. Further, the survivors reported considerable panic with students attempting to get to and open the windows on the right side of the bus after it fell into the water. One student said that as soon as the bus contacted the water, he immediately opened the window next to him and was half way out when he felt water up to his waist. The students said it was practically impossible for them to see in the dark murky water and that they had difficulty operating the side window latches. In the water filled bus the students pushed and shoved each other through the windows they had opened.

A postaccident examination of the school bus indicated that the boarding door at the right front of the school bus was jammed shut because of impact damage. The rear emergency door was the only designated emergency exit on the bus, and information obtained from student interviews indicated that at least three students exited from the bus through the emergency door. One student said that she tried to get out through the rear emergency door but that it closed on her after three other students had used it to escape.[4] After that, she escaped through the right side windows where a friend pulled her out. Other students reported that they escaped through the windows on the right side of the bus. (See figure 3.) The busdriver could not recall whether he escaped through the windshield area or a side window.

After escaping, the busdriver and some students stood in 18 inches of water on the right outside of the school bus and tried to rescue students still inside. They reported that they were unsuccessful in attempting to break the side windows.

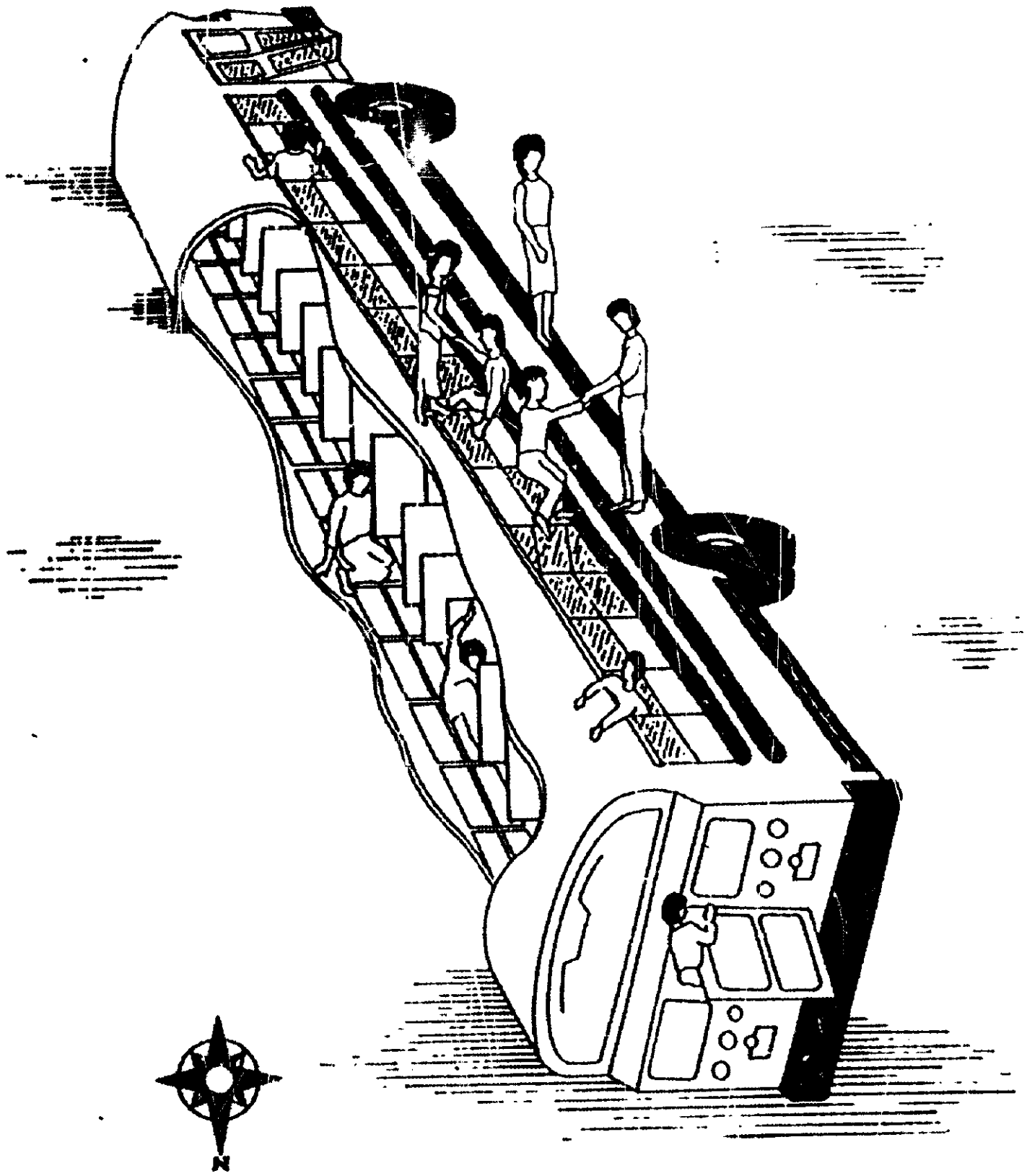
Additionally, the larger students had difficulty getting out of the open bus windows. One student became stuck in a window opening because he was wearing a backpack; however, he was rescued by two other students who removed the bulky pack and pulled him through the window.

Emergency Response and Recovery Operations

A resident of the house located at the southwest corner of the accident intersection reported that he "heard a loud impact" from the direction of the intersection. As he entered his living room to look out the window he noticed that his television clock showed 7:34 a.m. Looking out the window,

---

[4]Federal Motor Vehicle Safety Standard 217 requires, among other things, that a school bus rear emergency door be hinged on the right side (when viewed from the outside).



☐ Water

Figure 3.--Illustration representing how some of the students reported escaping from the submerged school bus. The illustration is based on the condition of the bus when it was examined by the Safety Board. Only a few students are shown for illustrative purposes.

he saw the accident truck on the right shoulder of FM 676, but saw no other vehicles.

The resident telephoned the Alton Police Department and reported, "There has been an accident. get over here quick. Call whomever you need to call." He then ran outside to the accident scene, met some passersby who had stopped to help, and then realized that a bus was submerged in the pit. The resident stated that he could see the outline of the bus below the water's surface with several students on or around the school bus "screaming for help."

About 7:40 a.m. the Alton police officer who had received the telephone notification arrived on the scene. At 7:47 a.m. he radioed the Hidalgo County Sheriff's Communications Center for assistance and reported, "I need crowd control, traffic control, and a marked unit to get out here." However, at that time, he had not determined that the accident also involved a submerged school bus with occupants. The Alton police officer made no further requests for the assistance of rescue personnel.

An Alton volunteer firefighter arrived on scene about the same time. After seeing the submerged bus, the firefighter jumped approximately 24 feet into the pit from the southeast rim and swam to the bus. He was the first person to reach the bus. Shortly thereafter, a witness to the accident also jumped into the water and assisted in rescuing students. The firefighter reported that he tried to break the right-side windows with his foot, but he could not hit the windows hard enough through the water. He unsuccessfully tried to open the front boarding door and the rear emergency exit door. The firefighter eventually pulled out four students from inside the bus by reaching in through the windows on the right side near the front and the center sections. He administered cardiopulmonary resuscitation (CPR) to those he had rescued and successfully resuscitated all four victims.

The Hidalgo County deputy sheriff responding to the Alton Police Department's request for assistance arrived at approximately 7:48 a.m. and radioed the Hidalgo County sheriff's dispatcher that a school bus with students was in the water and that ambulances and rescue assistance was needed. The sheriff's dispatcher notified ambulance and rescue squads at Mission, Edinburg, Pharr, Donna, and Elsa, as well as the Texas DPS at McAllen, and requested assistance at the accident scene.

The deputy sheriff then helped firefighters from Mission lower a ladder into the pit. Two other Alton firefighters and the acting Alton Police Chief climbed down the ladder, swam to the bus, and assisted the Alton firefighter in rescue efforts and the administration of CPR. The 4 Alton public safety officials removed 11 drowned students from the center section of the bus prior to the arrival of divers. The remaining fatalities were later removed from the bus by divers.

Following their escape from the submerged bus, the surviving students either floated on life preservers thrown into the pit by rescuers or swam approximately 35 feet to the southeast edge of the pit. The life preservers were then thrown back to the submerged bus for use by the other students.

After the students reached the edge of the pit they climbed out of it on ladders. Firefighters from Mission and Edinburg assisted the students (See figure 4.) and performed triage when they reached the top of the pit.

Firefighters from McAllen, Edinburg, and Mission also arrived on-scene. After they conferred with the Mission Chief and the McAllen Assistant Chief, the Edinburg Chief took charge of providing medical aid and transportation for the injured. The Mission Chief took charge of rescue and recovery operations at the bus.

An off-duty U.S. Border Patrol agent, an experienced diver with 18 years experience as a volunteer firefighter and as an emergency medical technician, heard about the accident via a commercial radio station request for assistance. He arrived at the accident scene about 8:15 a.m.

The off-duty Border Patrol agent conferred with the Mission Chief and determined that no rescuers had entered the bus. He borrowed a firefighters positive pressure self-contained breathing apparatus (SCBA), descended the ladder and swam to the school bus. He entered the bus through the first window behind the front boarding door and began to search the interior of the bus. His efforts were hampered by limited visibility and the SCBA which only provided air for about 5 minutes diving time. He made two attempts to find bus occupants but was unsuccessful. After his second attempt, about 8:20 a.m., he was joined by an off-duty McAllen firefighter and four other off-duty Border Patrol agents, also experienced divers; however, they did not have underwater breathing equipment. After obtaining a "hand light" the first Border Patrol agent on the scene resumed his search, and a firefighter assisted him in tying open the rear emergency exit door.

About 8:10 a.m. the Edinburg Volunteer Fire Department dispatcher requested the Alamo Volunteer Fire Department to send an ambulance and a boat to the scene. The ambulance and boat arrived on-scene between 8:30 and 8:40 a.m. The boat was launched from the northwest corner of the pit and was used as a recovery platform. A complete interior search of the bus resulted in the location of additional students. These students were removed from the bus via the emergency door, and CPR was begun as soon as they reached the surface. Then, they were transported by the Alamo Volunteer Fire Department boat and other boats that by then had arrived on-scene to a triage area established at the northwest corner of the pit. A neighborhood physician and firefighters at the triage site attempted to resuscitate the accident victims. One of the 10 students recovered by divers was resuscitated; however, she died of complications on September 29th. The physician pronounced 16 of the students dead at the northwest triage area. Three other students who had drowned had been taken to the southeast corner of the pit. The fatalities were transported to the Hidalgo County Veteran's Pavilion building in Mission for identification.[5]

---

[5]See appendix B for description of drowned students.

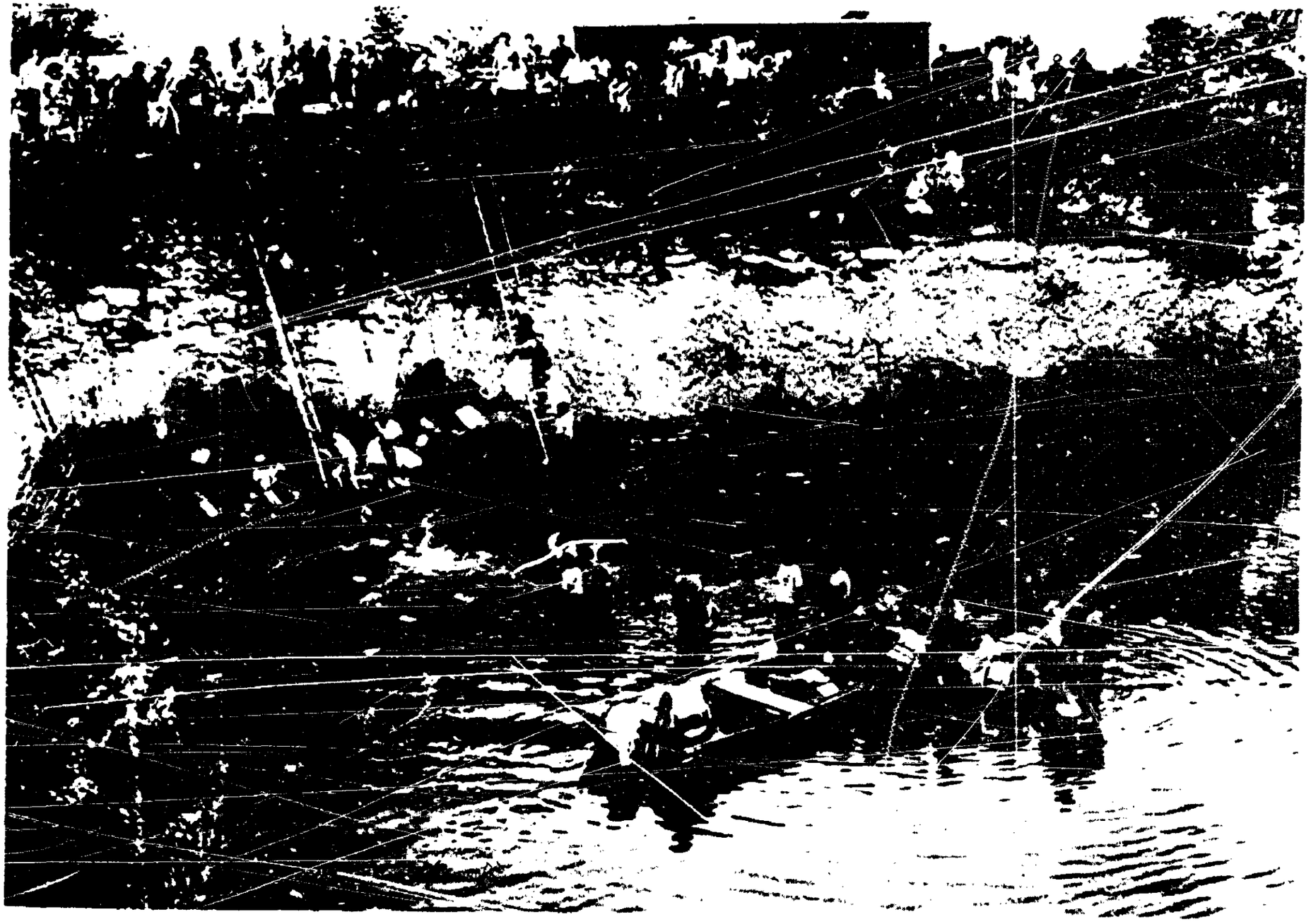


Figure 4.--View of the south side of the caliche pit showing students being removed from submerged school bus and being assisted up ladders. Photograph courtesy of Larry Club, The Monitor News, McAllen, Texas.

Injuries[6]

	Drivers	Passengers	Others	Total
Fatal	0	21	0	21
Serious	0	3	0	3
Minor	2	47*	1**	50
None	0	11	0	11
Total	2	82	1	85

* Includes injured truckdriver's helper.
** Injured rescuer.

Medical and Pathological Information

Nineteen students died on the day of the accident. The cause of their deaths was determined to have been asphyxia by drowning. Two additional students died within 8 days after the accident because of complications associated with asphyxia from near drowning.

Three students sustained serious injuries. Forty-six others sustained minor injuries consisting mostly of lacerations and contusions. Three of these students were hospitalized for observation and treatment. Ten students were examined and released. One student did not go to a hospital.

School Busdriver Information

General.--The 46-year-old busdriver was married and lived with his wife, her two children, and his teenage daughter from a previous marriage. He stated that he smoked cigarettes but did not drink alcohol or use any illicit substances.

License and driving violation conviction record.--The busdriver held a valid Texas Class A license issued in August 1988 with no restrictions, which permitted him to operate all truck combinations, all types of buses including school buses, and any vehicle for hire. A review of the National Drivers Register (NDR) and a 50 State check of drivers licenses showed no evidence that the busdriver had a drivers license or a driving conviction record in another State.

The busdriver's Texas driving record contained three driving violation convictions. The first violation resulted from an accident in his personal vehicle in McAllen on April 1, 1980, when he was cited for failure to yield at an intersection. His second offense occurred in McAllen on December 19, 1983, when he was cited for speeding. The record did not indicate whether this violation took place in his personal vehicle or in a school bus. The

---

[6]Injuries classified in accordance with the Abbreviated Injury Scale (AIS) the Association for the Advancement of Automotive Medicine, revised in 1985, are listed in appendix C. Because of differences in these classification systems, neither the number nor the type of injury can be compared.

third offense occurred while operating his personal vehicle in McAllen on March 11, 1988, when he failed to stop at a red light.

Employment history.--In June 1969 the busdriver was hired by the McAllen Independent School District. After receiving training, he was certified by the Texas Education Agency (TEA)[7] as a school busdriver. He held this position until August 1980, when he quit over a pay dispute.

From September 1980 to January 1985, he worked as a janitor for two area retail stores and as a part-time truckdriver for the City of McAllen. In January 1985 he was hired as a busdriver by the Pharr-San Juan-Alamo Independent School District and was recertified by the TEA. He worked there until August 1985, when he obtained his busdrivers position with the Mission School District.

The busdriver's Mission School District application was for general employment covering all school positions. The application did not request information concerning school bus driving skills or experience, licenses held, class/type of vehicular equipment previously operated, accident/violation history, or prior traffic law convictions. When he was hired by the Mission School District the busdriver held a current TEA certificate qualifying him to operate a public school bus in the State, and at the time of the accident he held a valid TEA certificate with a May 18, 1991 expiration date. His last school busdriver training was in April 1988, when he successfully completed a TEA 8-hour refresher course.

No record of any disciplinary action involving the busdriver was found. School officials stated that no parent or student complaints had been received concerning the busdriver. The busdriver was described by his supervisors and coworkers as a quiet, hard-working, even-tempered person who enjoyed driving school buses. No recent personality or behavior changes were reported. He had driven the same route with the same bus since he was hired in August 1985.

Medical.--Texas State law requires a school busdriver to submit to an annual physical examination. In 1985 and 1986 the examining physicians reported that the busdriver had uncorrected vision of 20/20 in both eyes and that he was qualified to operate school buses without any restrictions. However, the busdriver's 1987 physical examination indicated uncorrected eyesight of 20/50 in the right eye and 20/40 in the left eye. No corrected vision measurement was recorded. The physician wrote on the comment section of the form, "Needs glasses (reading)." He also indicated that the busdriver was "qualified only while wearing glasses." Further, in 1988 the examining physician indicated that the busdriver was qualified to drive school buses only while he was wearing glasses. In this examination his corrected eyesight was measured at 20/25 in both eyes. No uncorrected eyesight measurements were recorded.

---

[7]The TEA is a State agency involved with school busdriver certification and other programs.

The busdriver's most recent physical examination was completed on August 21, 1989. The examining physician reported no significant chronic or acute ailments or illnesses and took no exception to the busdriver's general health. His corrected vision was reported as 20/40 in both eyes, and the physician indicated on the busdriver's medical certificate that he was "qualified only while wearing glasses." The busdriver's uncorrected eyesight measurements were not reported on his last physical examination record.

The busdriver reported to the Safety Board that he never wore or needed corrective lenses. He also stated that he was not wearing corrective lenses at the time of the accident. His wife, supervisor, and other coworkers also indicated that the busdriver did not wear corrective lenses. When asked about the physical examinations in 1988 and 1989 that indicated he needed reading glasses and was wearing corrective lenses when he took the eye examinations, the busdriver responded that the reports were in error.

Preaccident activities.--The busdriver provided the Safety Board with information concerning his whereabouts and activities during the 72-hour period preceding the accident. Additional information was supplied by his wife, coworkers, and other witnesses. On Monday, September 18, 1989, the busdriver awoke at 5:30 a.m., showered, dressed, and ate breakfast. His wife drove him approximately 4 blocks from his home to the Mission School District bus compound. This was his usual daily routine through the week of the accident. The busdriver arrived at the compound at approximately 6:45 a.m., conducted a 5- to 10-minute pretrip vehicle inspection, and began his morning route. He completed the route and returned the bus to the compound at 7:45 a.m. He then cleaned the bus and performed various maintenance related duties before returning home at 12:30 p.m. for lunch. He returned to the compound at 2:00 p.m. to begin his afternoon route, which he completed at approximately 3:30 p.m., signed off duty, and returned home. The busdriver stated that he remained at home that evening, ate dinner, and was in bed before 10 p.m.

The busdriver stated that his work schedule was the same on Tuesday, September 19, and Wednesday, September 20, 1989. On Tuesday evening he went to bed at midnight, and on Wednesday he went to bed at 11:00 p.m.

On the morning of the accident the busdriver's routine was the same as the previous days. Several Mission School District employees saw and spoke with the busdriver that morning and none of them noticed anything unusual about his behavior or personality.

Truckdriver Information

General.--According to his supervisor and coworkers at Valley Bottling Company, the 26-year-old truckdriver was single and lived with his parents and siblings. He did not smoke cigarettes and did not use alcohol regularly.

License and driving violation conviction record.--The truckdriver held a valid unrestricted Texas Class A license issued originally on May 27, 1982, which permitted him to drive all truck combinations, all types of buses

including school buses, and any vehicle for hire. Fifty State license checks and a review of the NDR showed no evidence that the truckdriver had a driver license or driving violation conviction record in another State.

The truckdriver's first Texas driving violation conviction was for speeding in Hidalgo County on April 16, 1984. The next entry in his driving record involved a property damage accident in Pharr, Texas, on February 5, 1987. According to the police report, he was operating a Valley Bottling Company truck when he "failed to control speed" on a wet divided highway and struck the side of another vehicle. He did not receive a citation for this accident. His next offense was in McAllen when he was cited for speeding in his personal automobile on July 10, 1987, and for not having liability insurance. He was also charged with a violation for not appearing in court concerning his lack of liability insurance. The truckdriver was also issued a citation for not having liability insurance on January 31, 1988, when he was stopped at a driver license check point.

Employment history.--According to Valley Bottling Company records, before working for Valley Bottling Company, the truckdriver held various jobs including hospital orderly, furniture delivery laborer, and chef at a local cafeteria. He quit his last job, and there is no documentation concerning his employment from July 1982 until he was hired by Valley Bottling Company in August 1984.

The truckdriver was initially hired as a loader in production at Valley Bottling on August 20, 1984. On September 21, 1984, he was laid-off because business slowed. On October 23, 1984, he was rehired as a loader. On October 25, 1984, he was transferred from loader to bottler and on December 24, 1984, he completed his 90-day probation period. On September 10, 1985, he was transferred from bottler to helper on trucks in the sales department. Although no formal promotion record could be located, he also served in the position of driver. No documentation could be located showing the date of the position change to driver.

On the day following the February 5, 1987 accident, he was removed from the drivers list and demoted back to helper. On May 11, 1989, he was eligible for promotion to driver, but the promotion was withheld because a motor vehicle drivers license check made on May 5, 1989, by Valley Bottling Company showed a license suspension for no liability insurance and for failure to appear in court. The truckdriver informed Valley Bottling Company that his license suspension was the result of a clerical error, and he was given a day off to rectify the situation. He returned that same afternoon with a letter from a Justice of the Peace clearing his record of the suspension charge. On July 25, 1989, he was promoted to driver trainee.

The truckdriver's training supervisor at Valley Bottling Company stated that the truckdriver never had any formal truck driving training. Although the truckdriver was already in possession of his Texas Class A drivers license, the supervisor stated they began at "ground zero" when he entered his informal truckdriver training at Valley Bottling Company. The supervisor reported that the truckdriver's father was also a truckdriver, and the father provided supplementary truck driving instruction to his son. The

training supervisor stated that the truckdriver received approximately 6 hours of classroom instruction, mainly consisting of safety movies and completing workbook assignments.

The training supervisor initially stated to the Safety Board that he did not ride with the truckdriver or provide any behind-the-wheel instruction. The training supervisor recalled that over a period of several weeks, the truckdriver received approximately 10 hours of behind-the-wheel training under the supervision of other company regular full-time drivers. However, during a later interview with the Safety Board, the training supervisor recalled that he also provided training to the truckdriver on several occasions after regular working hours. He said that the truckdriver requested these training trips to practice his driving skills. He was promoted to full-time driver on August 27, 1989. No record could be found indicating that the truckdriver took any type of road test under the direction of any Valley Bottling Company supervisor.

According to Valley Bottling Company officials, the truckdriver was familiar with the truck and the locations of his delivery points because they had been assigned to him since his promotion to driver in August 1989. The number of times the truckdriver traveled north beyond 3 mile line on Bryan Road could not be confirmed. The truckdriver was described by his supervisors and coworkers as a reliable, enthusiastic employee who was a safe, careful driver. They stated they had not noticed any recent changes in the truckdriver's personality and were not aware of any significant events in his life. One coworker described the truckdriver as being overconfident. The truckdriver's personnel file indicated that he had received a verbal warning in March 1986 for using abusive language toward the owner of a grocery store. There was no record of other infractions or disciplinary actions.

Medical.--Valley Bottling Company did not require the truckdriver to take a physical examination before or after being hired, and his personnel file showed no record of any physical examinations. The truckdriver indicated on his Valley Bottling Company employment application that he was in good health and would be willing to be examined by a physician. His supervisors and coworkers were not aware of any significant chronic or acute ailments or illnesses.

Preaccident activities.--The truckdriver and members of his immediate family refused to be interviewed by the Safety Board. However, the Safety Board was able to obtain some information about the truckdriver's 72-hour history from Valley Bottling Company records and statements of supervisors and coworkers.

On Monday, September 18, 1989, the truckdriver reported for duty at the Valley Bottling Company plant at McAllen at 6:11 a.m. He completed his pretrip vehicle inspection at 6:35 a.m., reported no defects, and began his regular delivery route. He made 12 deliveries, returned to the plant at 3:09 p.m., finished paperwork, and went off-duty at 3:45 p.m.

On Tuesday, September 19, 1989, the truckdriver reported for duty at 6:06 a.m. He completed his pretrip vehicle inspection at 6:35 a.m., reported no defects, and started his route. He made 19 deliveries, returned to the plant at 2:25 p.m., and worked on paperwork until 3:13 p.m.

On Wednesday, September 20, 1989, he arrived for duty at 6:06 a.m., completed his pretrip vehicle inspection at 6:35 a.m., reported no defects, and departed on his route. After making 11 deliveries, the truckdriver returned at 1:04 p.m. and signed off-duty at 1:30 p.m.

On the morning of the accident, Thursday, September 21, 1989, the truckdriver reported for duty at 6:10 a.m. Before departing on his route, the truckdriver had a routine work-related discussion with his supervisor and did not mention any mechanical problems with his truck. The supervisor stated that the truckdriver appeared to be alert and ready for duty.

The truckdriver and his helper departed the Valley Bottling Company at approximately 6:30 to 6:40 a.m. for their first delivery at the Circle K convenience store about 4 miles away. According to the store clerk, the truck arrived at approximately 6:45 a.m. and left about a half hour later. Both the store clerk and the store manager were familiar with the truckdriver from previous deliveries and noted that "everything was normal" with him. They also indicated that the truckdriver and his helper appeared to be working well together. The truck departed the convenience store and proceeded north on Bryan Road.

The helper stated that shortly after they departed their first stop, the truckdriver commented that he could not decide which store to go to for his next delivery. The helper told the truckdriver that as the driver he could go to whichever store he wanted. The helper also reported that the truck radio was off and that no distractions in the truck cab were recalled.

After the accident, the truckdriver provided a written statement to a Texas DPS officer indicating that he performed a pretrip inspection of his vehicle the morning of the accident before he left on his route and found no vehicle defects ("everything was OK perfect to go on the roads"). He also indicated that while driving the vehicle on "Expressway 83," he checked the brakes and "everything was good." (There are two intersections on Bryan Road requiring a stop between the Circle K store and the accident intersection.) Then he reported,

> Suddenly I felt like my brakes didn't work, I shift gears to the fourth gear and shift the back trailer o lower the handle brake...I [unintelligible word] looking somewhere to hit or to land the trailer to stop but there was no way to landed. My helper, we both turn the wheel trying not to hit the bus -- so the bus went to one side, I just went to another side.

Texas School Bus Operations

School busdriver certification.--In Texas the school busdriver training and certification process is coordinated by the TEA. The TEA administers the school busdriver certification program through 20 regional education service centers, maintains a master file of certified school busdrivers, and provides copies of the appropriate files to the respective school districts. All drivers are trained and certified after they have been hired. When a busdriver is trained and certified, the certificate is valid in any school district throughout the State. The certificate of training does not list any restrictions as a result of the driver's physical examination, or restrictions imposed by the State driver licensing agency. An annual physical examination, a driver license citation check, and an accident history are required. The TEA also approves scheduled routes driven by busdrivers for the school districts.

The TEA-required school busdriver training program requires completion of 20 hours of classroom and operating instruction to obtain full certification and an 8-hour triannual recertification course. Written and practical examinations are administered for both courses. For renewal the recertification course must be completed within 1 calendar year following the previous certification expiration date. If more than 12 months have lapsed since the expiration of the driver certification, the full 20-hour initial driver training course is required for certificate renewal.

Mission School District.--The Mission Independent School District was chartered on July 10, 1910, as part of the Texas Public School System. It became the Mission Consolidated Independent School District on January 27, 1975, when the Mission Independent School District and the Alton Independent School District consolidated. The Mission School District includes the cities of Mission and Alton, Texas.

At the time of the accident, the Mission School District employed 24 busdrivers, used 23 buses on 21 TEA-approved regularly-scheduled routes, and employed 2 mechanics and 1 helper at its transportation compound in Mission. The Supervisor of Student Support was responsible for bus maintenance operations and the retention of copies of busdriver records supplied by the TEA. According to Mission School District officials, until this accident, no bus accidents involving serious injuries or death had occurred.

Mission School District officials indicated that all drivers of Mission School District vehicles are required to adhere to the school district policy requiring seat belt usage.

Valley Bottling Company Operations

Driver qualifications.--According to company officials, before April 1989, Valley Bottling Company had an informal truckdriver training and qualification program conducted by a supervisor during slack time periods. Potential truckdrivers were selected from employees who applied for the position and held a valid Texas Class A driver license. This informal training consisted of the supervisor showing safety movies and asking

questions about them, and student workbook assignments. Behind-the-wheel training consisted of the trainer riding in a truck with each trainee to ensure that the student could handle the unit. Behind-the-wheel training was tailored for each student and lasted until the training supervisor was satisfied with the student's driving performance. Following this training the student was promoted to trainee and authorized to drive a truck as a relief driver on various routes. No formal training certificate was issued, but an interoffice document was used to indicate the person's promotion to trainee. A trainee was promoted to driver upon assignment to a permanent route.

After April 1989 Valley Bottling Company began a process of certifying all drivers and trainees in the Texas district according to the Federal Motor Carrier Safety Regulations (FMCSR). Although, at the time of the accident Valley Bottling Company was not subject to the FMCSR because the business is an intrastate operation, it used them as guidelines to certify drivers. Therefore, when completed, all driver files should contain a physical examination, record of driving violations history, and written and road test results. In addition, all drivers should have completed a formal training program consisting of scheduled classroom sessions and behind-the-wheel experience.

Motor carrier.--In August 1987, Coca-Cola Enterprises, Inc., of Atlanta, Georgia, purchased the privately owned/operated McAllen Bottling Company and began operating it under its Texas district authority as Valley Coca-Cola Bottling Company, Inc. This company is a private carrier that markets soft drinks in bottles, cans, and carbonated dispenser units. It operates out of two locations at McAllen and San Benito, Texas. At the time of the accident the company owned 326 vehicles, 269 were in service. The others were reserve and surplus units. One hundred and sixty two units, including the vehicle involved in the accident, and three mechanics were assigned to the McAllen plant. One hundred and seven units, two mechanics, and one helper were assigned to San Benito. Valley Bottling Company owned approximately 58 units similar to the accident unit, 36 assigned to the McAllen plant. Valley Bottling Company employed 66 drivers, 44 assigned to handle 36 routes out of the McAllen facility. The routes were considered to be local because the majority were within a 25 mile radius of the facilities.

Coca-Cola Enterprises, Inc., employs a safety director located at its district headquarters in Houston, Texas. He reports directly to the vice president of human resources of South Texas. The safety director also has access to the president of the South Texas operations. According to company officials, there had been no serious accidents involving Valley Bottling Company vehicles causing injuries, fatalities, or damage exceeding $4,000 before this accident.

Company officials reported that company policy requires truckdrivers to perform a pretrip inspection of their assigned vehicles before beginning deliveries and that any defects found were to have been reported to the maintenance department and corrected before leaving the plant. The accident truckdriver did not report any defects before he left the Valley Bottling Company facility the morning of the accident.

Valley Bottling Company policy concerning seat belt usage by its employees complied with the Texas law that required all persons 15 years or older driving or riding in the front seat of vehicles weighing under 3/4 tons and equipped with seat belts use them. Drivers and passengers in vehicles weighing 3/4 tons and over were not required to use seat belts. However, Valley Bottling Company encouraged seat belt usage in these heavier vehicles.

Toxicological Information

Shortly after the accident, the Texas DPS collected samples of blood and urine from the school busdriver and the truckdriver. The DPS analyzed these samples in its field crime laboratory in McAllen and in its Austin laboratory. The DPS also supplied samples to the Safety Board. These samples were analyzed by the Center for Human Toxicology. All tests for both drivers were negative for alcohol and other drugs.

School Bus Information

General.--The Blue Bird Body Company manufactured the 1985 transit-style school bus body and chassis. The 83-passenger bus was an "All American" series model with a 210 horsepower diesel engine located in the front, a 4-speed automatic transmission, air-mechanical "S" cam service brakes, and power steering. The estimated gross weight of the 2-axle school bus, including passengers, was about 32,285 pounds at the time of the accident. The school bus was equipped with a pedestal-mounted driver seat with a lap belt. After the accident, the lap belt was found in its storage retractor and, when tested, it latched properly.

Passenger seats.--Padded restraining barriers were in front of the first row passenger seat on each side of the center aisle. The minimum width of the center aisle between seat cushions was 14 inches. The first seat behind the driver was a two-passenger seat, and all the remaining seats were three-passenger seats. Fourteen rows of passenger seats were installed on each side of the school bus aft of the barriers. Each right-side seat was installed 12 inches to the rear of its corresponding left-side seat.

Windshield.--The bus windshield consisted of two laminated safety glass panels measuring about 42 inches wide by 30 inches high. The bus manufacturer reported that the windshield sections were not designed as "push-out" emergency exits.

Side windows.--Fifteen passenger windows were on each side of the bus. Because of the staggered seat rows, each right-side window was between the seat backs of each row, while on the left side the seat backs were at the center of the window; however, the top of the seat back extended approximately 7 1/2 inches above the window sill, but it did not block the upper window sash.

Each passenger window had a dual-sash assembly with an aluminum frame and tempered glass panes. The overall dimension of each side window

assembly was 28 inches wide by 31 inches high. Each window assembly was mounted from the inside and fastened with four metal screws.

The lower sash of each side window is a fixed sash. The upper sash is moveable and in its highest position fully closed the window. When fully lowered the upper sash created an opening 24 inches wide by 9 inches high. The upper sash of each side window contained two latches located in a 2 5/8-inch-wide by 3/4-inch-high slot at the top of the frame. The latches were 13 3/8 inches apart. The upper window sash could be opened by simultaneously moving the latches toward each other by placing a finger from each hand in grooves in the latches. With the latches depressed, downward pressure would lower and open the window.

Constant pressure on the latches was required to lower and fully open each side window from a closed position. The spring-loaded latches had five stops in the side frame allowing the window to be opened in various increments up to the maximum of 9 inches. No instructions were posted on how to open or close the side windows. (See figure 5 for photograph of typical window.)

Emergency door and rear windows.--The rear door emergency exit measured 38 inches wide by 52 inches high and was hinged on the right side. The rear emergency door opened from inside or outside the school bus by rotating the door handle upward which released the latch mechanism.

A 20-inch by 20-inch window that was not designed to be opened was on each side of the rear emergency door. The seatback of the rearmost row of seats on either side of the school bus next to these rear windows extended up 11 1/2 inches over the bottom section of each window.

Accident bus damage.--Following the accident, both windshield panels were missing. Divers later located one windshield panel at the bottom of the caliche pit near where the bus came to rest. The other windshield panel was found in a pile of debris in the rear of the bus. After rescue operations were completed, chains were attached to the bus front axle, and a large crane lifted the bus front-first from the pit. This method of hoist recovery from the caliche pit allowed debris inside the bus to wash to the rear of the bus.

After recovery, measurements indicated that above the driver seat the roof was displaced 14 inches down and 24 inches aft from its preaccident position. The roof was also displaced downward at the rear, but some of this displacement may have occurred during recovery operations because the bus was loaded on its roof on a flatbed semitrailer for removal from the scene.

The left end of the front bumper was displaced 12 inches aft and the left-front body corner panel was displaced 4 inches inward and 12 inches aft. The lenses of the left dual headlamps and the turn signal were broken. The cowling under the windshield panels was displaced 2 inches rearward from the right windshield wiper across to the area of the steering wheel. The

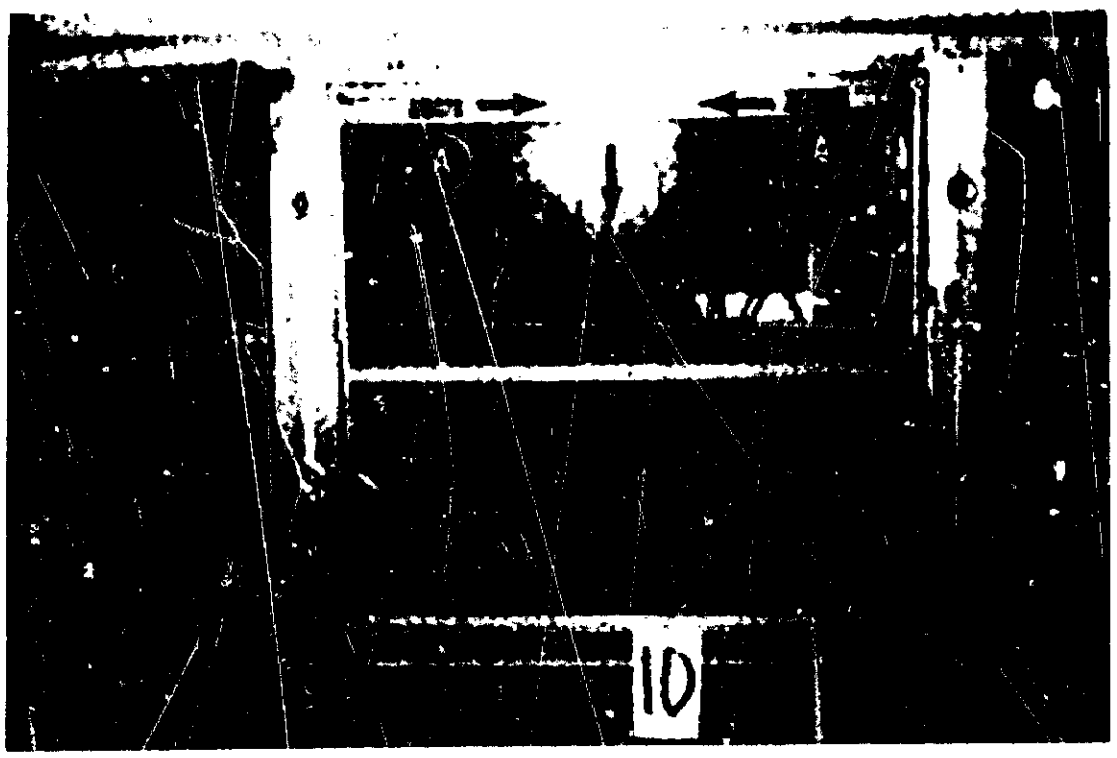


Figure 5.--Inside view of window #10 on right side of school bus. Arrows at A indicate the direction of pressure required to move window latches. (The direction of vertical travel to open the top window is indicated by the arrow on the top window.)

right end of the front bumper was displaced 12 inches aft, and the corner panel was displaced 13 inches aft into the jammed-closed boarding door. (See figure 6.) Three of the four glass panes in this door were missing.

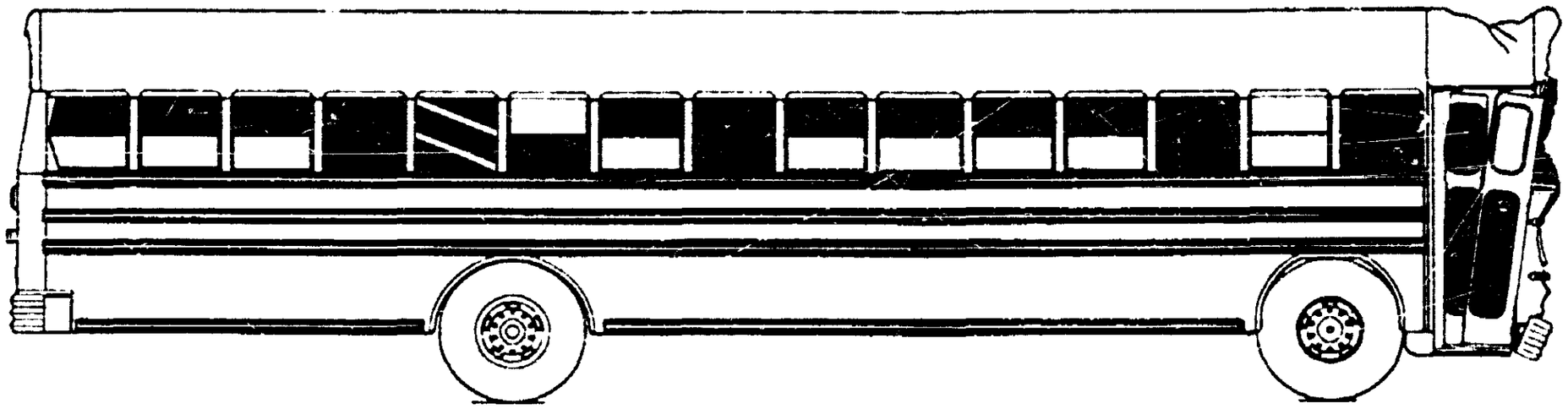
The entire frame and the glass from the first window aft of the boarding door on the right side were missing. The second window was closed. The frames for the 3rd, 8th, and 12th windows were in place, but both the bottom and top panes of glass as well as portions of both the upper and lower sash were missing. Both panes of glass were also missing from the 11th window, and the sash for the forward portion of the upper pane was bent downward, partially blocking the window. The top pane was up (closed), but the bottom pane was missing from the 10th window. The top panes of the remaining windows were lowered to their fully open position. (See figure 7 for illustration of bus windows and appendix D for description of window damage on the right side of the bus.)

The rear emergency door operated properly after the accident. The two windows on each side of the door were undamaged. (See figure 8.)

Figure 6.--View of front of school bus.

Postaccident brake inspection.--A functional test of the bus brake system's air compressor was not performed because the engine had been submerged. A 120 psig air supply was connected to the bus, and a functional brake test was performed. No functional defects were noted. The brake linings on the front axle measured 2/32 inch over the fastener and on the rear axle measured 4/32 inch over the fastener. These were free from any contaminants.

The measured push rod stroke of the service brakes on the front axle was 1 1/8 inch on the left brake and 1 3/8 inch on the right brake. According to manufacturer's standards, the stroke at which these brakes should be readjusted was 1 3/4 inch. The measured stroke of the service brakes on the rear axle was 2 inches on the left brake and 2 1/8 inches on the right brake. The stroke at which these brakes should be readjusted was 2 inches. The parking brake system on the rear axle was intact and functioned properly when tested.



Open window or window with no glass
Closed window with glass in place
Dislodged window frames

Figure 7.--Illustration of open and closed windows on right side of school bus following the accident. The illustration is based on the condition of the bus when it was examined by the Safety Board.

Figure 8.--View of rear of school bus
with emergency door open.

Tractor-Semitrailer Information

General.--Navistar International Transportation Corp. manufactured the two-axle tractor in July 1984. It had a diesel engine, a five-speed manual transmission with a two-speed rear axle, and power steering. The tractor was equipped with a three-passenger bench seat with lap belts installed at each seating position. After the accident, half of the lap belt at the driver position was found wrapped around an electrical junction box behind the driver seat. The buckle for the driver lap belt was attached to the latch fitting for the center seat occupant. The remaining lap belts, greasy and dirty, were found under the seat.

The semitrailer was a 1984 Mickey single-axle beverage delivery van. The vehicle combination was equipped with air/mechanical "S" cam drum brakes. The total gross weight for the combination without the driver and helper was approximately 44,100 pounds.

Accident truck damage.--The semitrailer, which had yellow and black paint transfers on its right front corner, did not sustain any major damage in the accident. Following the accident, the tractor transmission was found in the fourth gear position, and the two-speed axle switch was found in the high range position. The Safety Board could not determine its position at

the time of the accident. The major impact area on the tractor was located on the right front side. The chassis and cab of the tractor, forward of the fifth wheel, was displaced about 32 inches to the left of its preaccident configuration. The edge of the right front fender at the steering axle wheel-well opening had yellow paint transfers. The fiberglass along the top of this opening was fractured. The impact damage area continued up through the cowl, door jam and forward door frame, and windshield "A" pillar. No damage was observed to the rear of the tractor. Other than the displacement of the chassis and cab, no damage was noted on the left side of the tractor.

Postaccident brake inspection.--The tractor compressor system was not tested because of accident damage. However, functional tests of the tractor and semitrailer brake systems were performed using compressed air at 80 to 90 psig supplied by the recovery wrecker. The right front brake line fitting on the tractor was fractured. The fitting was covered with dirt; however, the fractured area was clean. The line was plugged to perform the tests.

During the first functional test, an air leak was noted in the tractor left front wheel brake chamber. The leak became greater with each successive brake application. After the stroke was measured for the brake, the line was plugged. The air hose from the left front brake was moved to the right front brake to make the brake functional. The testing was continued, no other air leaks were detected, and no other system defects were noted during the functional testing.

The measured stroke of the left brake on the tractor rear axle was 1 7/8 inch, and the stroke of the right brake was 2 3/8 inches. According to industry standards, the stroke at which these brakes should be readjusted was 2 inches. After the brake system was functionally tested, disassembly of the left front brake chamber disclosed that the brake diaphragm in the chamber had a triangular-shaped tear with an apparent point of origin in the fold, the area of the diaphragm that flexes and folds with each brake application. The pressure surface of the diaphragm was contaminated with oil and water deposits. The nonpressure surface of the diaphragm in the fold area displayed deterioration in the form of a series of cracks running the full circumference of the fold. The nonpressure surface was dry and free of contaminants.

For testing purposes the semitrailer was connected to the tractor as it was at the time of the accident. With the brakes applied at 50 psig (because of the air leak in the diaphragm), the measured stroke of the tractor left brake on the front axle was 1 1/4 inch, and the stroke of the right brake on the same axle was 1 3/8 inch. According to industry standards, the stroke at which these brakes should be readjusted was 1 3/4 inch.

The front axle brake linings and drums were inspected after the drums were removed The rear axle units were inspected through the dust cover openings. All brake drums were free of cracks, and the friction surfaces of the drums were free of contaminants. The tractor front brake drums had

medium heat checking[8] and the rear drums had heavy heat checking. The semitrailer brake drums and linings were inspected through the dust cover openings. The friction surfaces of the drums were free of contaminants, and no cracks were noted. The drums displayed medium heat checking and had about a 2/32-inch wear lip on the outer edge, next to where the linings contact the friction surface of the brake drums. The measured push rod stroke for both brakes on the semitrailer axle was 2 1/4 inches. According to industry standards, the stroke at which the brakes should be readjusted is 2 inches.

The braking air reservoirs were constructed as a three-compartment single tank. The forward compartment was the supply (wet tank) reservoir, the center compartment (secondary system) was the reservoir for the steering axle brakes, and the rear compartment (primary system) was the reservoir for the tractor rear axle and the semitrailer brakes. Each compartment had a drain valve to empty any condensation or other contaminants. The rear compartment was equipped with a remotely operated drain valve.

Safety Board investigators removed the air reservoir tank, drained each of its three compartments, and measured the contents. The forward tank contained about one pint of water mixed with a thick oil sludge. The center tank contained about two quarts of water mixed with an oil emulsion. The rear compartment was dry.

Texas State Vehicle Inspection Program

Texas State law requires that all State-licensed vehicles pass an annual mechanical inspection conducted by Texas officials or a State-certified representative. This program is administered by the Texas DPS, Motor Vehicle Inspection Service.

The Valley Bottling Company fleet manager and maintenance supervisor were certified designated vehicle inspectors authorized to perform the required annual inspections. The tractor passed its annual inspection on August 30, 1989, and the semitrailer passed inspection on February 1, 1989. The inspection included an examination of the brakes, tires, lighting system, and other safety items.

None of the Mission School District mechanics were authorized to perform the State vehicle inspections. Required inspections were performed at various State-certified vehicle inspection facilities. The school bus passed the Texas annual inspection on July 1, 1989.

Federal Motor Carrier Safety Regulations

The State of Texas adopted the FMCSR under Texas House Bill No. 908 that gave the Texas DPS the authority to implement the regulations. The DPS established a tentative date of January 1988 to begin implementing the FMCSR. However, in January 1988 the DPS postponed implementation until October 1989

---

[8]Heat checking is minor surface cracking frequently found on the brake drums of heavy vehicles as the result of heating during braking.

after several members of the legislature brought it to its attention that certain groups of the trucking industry were not aware of the impact of those regulations on their operation.

On September 1, 1989, the Texas legislature gave the DPS the authority to adopt the FMCSR. Parts 390 through 397 of the FMCSR became effective on October 1, 1989. Part 394, accident reporting, has been excluded because the DPS believes that its present accident reporting procedures are more effective than Part 394. Also, Part 393 that covers safety equipment items such as service brakes is included. The adopted FMCSR covered interstate vehicles weighing 10,000 pounds GVW and intrastate vehicles weighing 26,000 pounds GVW, and interstate and intrastate operations involving the transportation of 15 or more occupants (including the driver).

At the time of the accident neither the Valley Bottling Company (a private intrastate carrier) nor the Mission School District were subject to the requirements of the FMCSR or the out-of-service criteria specified for vehicle safety items.

Highway Information

FM 676 (Mile 5 Road).--Texas FM 676 in the area of the accident site is an east-west roadway with a 12-foot-wide lane in each direction and an 8-foot-wide paved shoulder on each side. The road is straight and level at the accident site, with a 55 mph speed limit. FM 676 near the accident site was improved between August 27, 1988, and May 12, 1989. The improvement project included resurfacing the road and shoulders, drainage work, and replacing existing stop signs with new 30-inch by 30-inch signs for vehicles entering or crossing FM 676 from Bryan Road. The signs were in place at the time of the accident. New pavement markings were placed on the road on May 10, 1989. The markings included solid white edgelines and 10-foot-long dashed yellow centerlines with 30-foot separations.

Bryan Road.--According to Hidalgo County officials Bryan Road was built in the early 1920's and in 1979 was extended north of FM 676. South of the intersection with FM 676, Bryan Road was overlayed with an asphalt surface. Approaching the intersection with FM 676, Bryan Road is straight with a 1 percent upgrade beginning 60 feet south of its intersection with FM 676. The road approaching the intersection is 21.8 feet wide, and no pavement markings separate the northbound and southbound lanes.

No speed limit signs were found for northbound vehicles approaching the accident intersection. The speed limit for southbound vehicles leaving the intersection was posted at 45 mph. The DPS accident report listed the speed limit on Bryan Road as 45 mph. According to Texas law, if a speed limit sign is not posted outside an urban district, the speed limit is assumed to be 55 mph. In an urban district the unposted speed limit is 30 mph. While the road appeared to be rural, it was within the city limits of Alton. Texas law also dictates that the last posted speed limit sign establishes the speed limit until it is changed by another speed limit sign. A 30 mph speed limit sign was posted 4 1/2 miles before the accident intersection.

When Safety Board investigators arrived on-scene, an advance "Stop Ahead" sign for northbound vehicles, located 625 feet south of the intersection, was skewed about a 60-degree angle. A Hidalgo County highway employee responding to the accident scene said that he initially did not notice that the sign was skewed but that he later observed that the sign was skewed. Workers at a construction site across from the sign as well as residents next door to the sign stated that the sign had been "bent" as long as a month before the accident.

Although unposted, Bryan Road was restricted with respect to vehicular weight. The Hidalgo County Commissioners' Court adopted the first resolution to place a 40,000-pound gross weight restriction for vehicles using Bryan Road near the intersection on May 17, 1980. On May 15, 1989, the Commissioners' Court lowered the gross weight limit to 20,000 pounds. Hidalgo County officials reported that the weight restriction on Bryan Road was adopted to preclude the use of another pit along the road as a landfill. The school bus with its passengers weighed approximately 32,285 pounds when it was on Bryan Road the morning of the accident. The truck weighed approximately 44,100 pounds loaded.

On-scene measurements.--The accident vehicles had been removed before Safety Board investigators arrived at the scene. Any tire imprints made by the accident vehicles in the dirt northwest of the intersection had been obliterated. Neither vehicle made preimpact tire marks on the road. Based on measurement of post impact tire marks in the intersection, the truck traveled about 125 feet northwest from the initial impact area to its final rest position. The bus traveled about 80 feet from the initial impact area to its plunge into the pit. The tire marks observed for both vehicles after initial impact did not appear to be skidmarks (tire marks made during locked wheel braking). The edge of the caliche pit was about 52 feet from the paved edge of the intersection in the direction the bus traveled after the collision. In the path followed by the bus, no protective barrier was in front of the caliche pit. The edge of the pit was about 52 feet from the centerline of FM 676 and about 35 feet from the centerline of Bryan Road. (See figure 2.) Measurements indicated that the vertical distance was 24 feet from the top of the pit bank to the water surface.

Divers explored the bottom of the pit to locate evidence from the bus. A windshield panel, amber lens, black plastic, a large and small rubber gasket from the right front entrance/exit door, additional glass, notebooks, and a window frame were located along with an indentation in the mud. The window frame was from window 1 on the right side of the school bus. These items were used to position the bus in the pit and for speed calculations.

About a year before the accident, Hidalgo County placed a guardrail on the northwest corner of the intersection parallel to Bryan Road along the edge of the pit. Alton City officials requested this because of concern that persons exiting the Hidalgo County Recreation Pavilion parking lot, located approximately 280 feet from the northeast corner of the intersection, might drive into the pit. The W-beam guardrail was constructed from 8-inch-diameter wooden posts placed 3 to 3 1/2 feet into the surface at 12 1/2-foot intervals. The guardrail ranged from 23 to 29 inches high. Caliche pits and

other similar excavations in Hidalgo County were neither routinely marked by highway signs nor provided with protective devices.

Accident history.--According to available records, two right-angle accidents had occurred at the intersection. In 1987 a daylight right-angle collision occurred involving a passenger automobile and a truck that failed to yield the right-of-way. This accident resulted in three personal injuries. In 1988 another daylight right-angle collision involved a truck and passenger car that failed to yield the right-of-way. This accident resulted in one personal injury.

Meteorological Information

At 6:45 a.m. on the day of the accident, at the Miller International Airport about 10 miles south of the accident site, the weather was reported as 80° F, with scattered clouds, visibility of 10 miles, and wind direction of 030° at 6 knots. The dew point was 75 percent.

School Bus Evacuation Drill Guidelines

The National Conference on School Transportation (National Conference) is comprised of representatives from the State departments of education, local school districts, and contract operations and advisers from various professional organizations and groups. They meet every 5 years to formulate recommendations of standards for school buses and their operations and to produce various recommendations for standards for school bus design and their operation. The standards are widely recognized but compliance is voluntary.

In May 1990 the National Conference approved standards for school bus chassis and body, special education, and operational procedures for inclusion in its 1990 Revised Edition of Standards for School Buses and Operations, (These standards are subject to final changes of the editorial committee and will be forwarded to the National Highway Traffic Safety Administration [NHTSA] for consideration for inclusion in its vehicle standards and safety programs guidelines.) Instructions for conducting emergency exit drills (See appendixes E,F,G, and H.), emergency exit specifications (See appendix I.), and standards for side windows are also included. This emergency exit information addresses reasons for conducting evacuation drills such as: fire or danger of fire; unsafe position when a bus is in an accident or stopped because of hazardous road conditions; and the bus is on or near train tracks, water or a cliff. It also provides instruction for three basic exit drills but does not detail how a passenger should exit a school bus under various emergency conditions. Nor does it describe how to develop a personal emergency escape plan, how to use available exits, or how to use alternate exits to escape.

The 1990 Revised Edition of Standards for School Buses and Operations, under school bus body standards, specifies:

1. Each full side window shall provide unobstructed emergency opening at least 9 inches high and 22 inches wide, obtained by lowering window.

2. Push-out type, split-sash windows may be used.

On May 17, 1990, the NHTSA published a request in the Federal Register for comments on proposed revisions to Highway Safety Program Guideline No. 17, Pupil Transportation Safety, with comments due on July 2, 1990. (See appendix J.) Section E, Other Aspects of Pupil Transportation Safety, of the guideline pertains to emergency evacuation, and proposes that:

1. At least once during each school semester, each pupil transported in a school vehicle should be instructed in safe riding practices, proper loading and unloading techniques, proper street crossing to and from school bus stops and participate in supervised emergency evacuation drills.

School busdrivers in the State of Texas are required to be instructed in the proper procedures for student evacuation from the bus. The State of Texas also has guidelines for the use of student assistants in evacuations.[9] (See appendix K.) However, the State of Texas and the Mission School District do not require evacuation drills.

Federal Motor Vehicle Safety Standards

The NHTSA was directed by Congress in 1974 to address school bus safety standards involving emergency exits, interior occupant protection, floor strength, seating systems, body and frame crashworthiness, vehicle operating systems, windshields and windows, and fuel systems. In 1977 the NHTSA responded to this mandate; however, some Federal Motor Vehicle Safety Standards (FMVSS) were issued earlier.

Certain FMVSS pertain to the accident school bus. FMVSS 217, Bus Window Retention and Release, and FMVSS 220, School Bus Rollover Protection, are particularly relevant from the emergency exit perspective.

Basically, FMVSS 217 deals with requirements for the retention of windows other than windshields in buses and establishes operating forces, opening dimensions, and markings for pushout bus windows and other emergency exits.

---

[9]Course Guide for School Bus Driver Training in Texas, Texas Education Agency, Revised 1987.

For emergency exit, FMVSS 217 requires that all large school buses with a gross vehicle weight rating of more than 10,000 pounds comply with either one of the following emergency exit provisions:

a) One rear emergency door that opens outward and is hinged on the right side, or

b) One emergency door in the rear half of the passenger compartment on the vehicle's left side and is hinged on its forward side and a pushout rear window that provides a minimum opening clearance 16 inches high and 48 inches wide.[10]

FMVSS 220 establishes performance requirements for school bus rollover protection. It requires that when the roof of the school bus is subjected to a force equal to 1 1/2 times the unloaded vehicle weight through a force application plate, the downward vertical movement of the roof at any point on the application plate shall not exceed 5 1/8 inches. Each emergency exit of the vehicle as required by FMVSS 217 shall be capable of opening during the full application of the force and after release of the force.

Texas School Bus Emergency Exit Specifications

The bus in this accident was built according to the 1984 specifications No. 070-B-01 as established by the State of Texas. According to these specifications, buses with front-mounted engines required a rear emergency exit hinged on the right side (looking forward). Fixed rear windows were required on each side of the rear emergency exit door. The front boarding door required a minimum horizontal opening of 24 inches and a minimum vertical opening of 68 inches. Passenger side windows were to be of the split-sash type and provide an unobstructed opening 22 inches wide and at least 9 inches high.

Mission School District officials stated that they may specify additional emergency exits or equipment on their buses, but had not done so before or after the Alton accident.

Emergency Preparedness

The accident occurred in the jurisdiction of the City of Alton. Alton has a population of approximately 2,700; encompasses an area of approximately 1.95 square miles; and is located about 5 miles north of U.S. 83 on S.H. 107. (See figure 1.)

---

[10] Texas school bus specifications require a) for buses with engine in front and b) for buses with engine in rear. Specifications, State of Texas, School Buses, No. 070-B-01, Effective January 1, 1984. Prepared jointly by State Purchasing and General Services Commission, Texas Education Agency, Department of Public Safety.

Alton had a five member police department, comprised of an acting chief (a lieutenant), a sergeant, and three officers. Officers received basic law enforcement training through the Hidalgo County Sheriff's Academy. The lieutenant stated that the Alton police department did not have written guidelines or policies regarding police operations. He indicated that they operate by the chain of command and standard operating procedures. If they have a major incident, the Hidalgo County Sheriff's office would be contacted to provide appropriate assistance.

The Alton volunteer fire department had a volunteer chief and approximately 18 volunteer firefighters. The fire station was located in Alton, approximately 3/4 mile west of the accident scene.

Alton does not have an office of emergency planning; however, Hidalgo County has an Office of Emergency Management, staffed by the county coordinator and a secretary. The coordinator had served in this position since 1985. He primarily served as the superintendent of buildings and grounds and collaterally as the emergency management coordinator. The coordinator provided the Safety Board with a copy of an "Emergency Operations Plan" developed in 1975. The Safety Board also obtained a copy of the 1985 "Emergency Operations Plan" developed in accordance with the Texas DPS Division of Emergency Management (DPSDEM) and Federal Emergency Management Agency (FEMA) requirements. Although the latter plan indicates that it was approved by the Hidalgo County Commissioners' Court on August 12, 1985, it had never been submitted to the court or to the Texas DPSDEM in accordance with State requirements.

On May 20, 1987, 61 individuals, representing various Hidalgo County jurisdictions, held a meeting to consider among other things the emergency management operations plan update, the interagency and the interdepartmental coordination status update, and the weather service presentation. Several participants indicated to the Safety Board that the meeting did not resolve any coordination and communication problems. The county coordinator had not convened any subsequent planning meetings.

The Texas DPSDEM is the State agency responsible for emergency and disaster preparedness. The agency is staffed with a coordinator and approximately 62 employees responsible for coordinating the planning and funding for emergency management planning among the 254 counties and 1,000 political subdivisions in the State. Texas received $2,542,475 for FY 1988 and $2,933,670 for FY 89 in emergency management planning funds from FEMA.

The Texas Disaster Act of 1975 requires counties and local or interjurisdictional entities to have disaster plans and other activities related to disaster prevention, preparedness, response, and recovery. The last documented State oversight for Hidalgo County was a letter from the Texas DPSDEM dated July 26, 1985. The form letter cited the State disaster act and executive order, and provided information to jurisdictions on how to develop local emergency management plans. FEMA funding for emergency planning is supplied to the Texas DPSDEM which then funds county and city disaster planning. Two cities in Hidalgo County, McAllen and Mission, received FY 1989 funds for emergency planning. Nineteen jurisdictions in

Hidalgo County indicated to the Texas DPSDEM that they have an emergency coordinator or person providing a similar function.

Previous Safety Board Findings and Recommendations

School bus emergency exit.--On May 14, 1988, a pickup truck driven by a drunk driver traveling the wrong way on Interstate 70 collided head-on with a former school bus being used as a church activity bus near Carrollton, Kentucky. The bus fuel tank was punctured during the collision sequence, and a fire broke out in the front of the bus and rapidly spread rearward. The busdriver and 26 bus passengers died in the fire, and 34 bus passengers sustained minor to serious injuries.[11]

Smoke, flames, and other passengers pushing and shoving hampered the bus passengers from exiting. Witnesses stated that two or three bus passengers climbed out through windows and that most survivors exited through the rear emergency door. The front boarding door was obstructed, and the only other designated exit was the rear emergency exit door.

The church had not conducted emergency exit drills from the bus. Most of the passengers had experienced school bus emergency evacuation drills conducted by their schools. However, based on their experience in this accident, they said the emergency drills were not realistic.

As a result of its investigation of this accident, on June 5, 1989, the Safety Board recommended that the NHTSA:

> H-89-5
> Revise Federal Motor Vehicle Safety Standard 217 to require that school bus egress be based on vehicle occupant capacity and be no lower than those currently required for nonschool buses.

The NHTSA responded to Safety Recommendation H-89-5 by pointing out that an advance notice of proposed rulemaking (ANPRM) had been published in the Federal Register on November 4, 1988, requesting comments on the NHTSA proposal to amend FMVSS 217, Bus Window Retention and Release. On October 18, 1989, the Safety Board classified the safety recommendation as "Open--Acceptable Action," pending completion of the NHTSA efforts to modify FMVSS 217.

The Safety Board addressed replies to selected questions in the NHTSA November 4, 1988, ANPRM to amend FMVSS 217 by indicating that most bus passenger injuries reported in connection with accidents were the result of crash trauma, not as a result of the evacuation. The Safety Board, however, stressed that improvements in emergency exits are needed and should not be overlooked. It also stated that in its study involving smaller buses, in about half of the cases, at least one exit was not operable.

---

[11]Highway Accident Report--"Pickup Truck/Church Activity Bus Head-On Collision and Fire, near Carrollton, Kentucky, May 14, 1988." (NTSB/HAR-89/01.)

In July 1990 the Safety Board contacted the NHTSA concerning the status of rulemaking activity to amend the school bus emergency exit requirements of FMVSS No. 217. A NHTSA spokesperson indicated that a Notice of Proposed Rulemaking concerning FMVSS 217 which includes a requirement that school bus egress be based on vehicle occupant capacity has been prepared and forwarded to the Office of Management and Budget for its review before publication in the Federal Register.

At the time of the accident NHTSA requirements in FMVSS 217 stated that the emergency exits for nonschool buses be established in accordance with the following formula:

> Buses other than school buses shall provide for unobstructed openings for emergency exits which collectively amount, in total square inches, to at least 67 times the number of designated seating positions on the bus. At least 40 percent of the total required area of unobstructed openings, computed in the above manner, shall be provided on each side of a bus. However, in determining the total unobstructed openings provided by a bus, no emergency exit, regardless of its area, shall be credited with more than 536 square inches of the total area requirement.[12]

An application of the formula for an 83 passenger nonschool bus yields a requirement for 11 emergency exits. They include the boarding door and the rear emergency exit door, four exits on each side of the bus, and (depending on bus configuration) one exit that may be a roof hatch or may be located on either side of the bus. The 1990 National Conference adopted a standard that school buses should meet emergency exit requirements in terms of the number of passengers on board. It further passed a resolution on emergency doors requiring that they remain open during student egress.[13]

Roadside hazards.--The Safety Board examined the caliche pit as a road side hazard. In its report of the Jesus Ayala School Bus-Type Bus Run-Off Roadway/Drainage Ditch Submergence accident in Blythe, California, in January 1974, the Safety Board cited the National Cooperative Highway Research Program (NCHRP) report number 118 and stated in the Safety Board report "that nontraversable hazards, including permanent bodies of water with

---

[12]See appendix L for an example of how the preceding formula would be applied to an 83-passenger nonschool bus.

[13]See appendix I.

depths greater than 2 ft., located within 30 ft. of the traveled way,[14] warrant a longitudinal traffic barrier."[15]

Accident Statistics

Data from the NHTSA Fatal Accident Reporting System (FARS) indicated that from 1979 to 1989, only one school bus accident[16] that resulted in school bus passenger fatalities involved submersion: the 1989 Alton accident. In terms of onboard student fatalities in school bus accidents, FAR data indicate that 2 school bus occupants were killed in 101 fatal accidents in 1986, that 14 were killed in 132 fatal accidents in 1987, and that 38 were killed in 102 fatal accidents in 1988. The 38 fatalities in 1988 include the 27 occupants of the Carrollton, Kentucky, church activity bus accident. FARS data for 1989 are incomplete, but as of the date of this report there were 34 fatalities in 106 fatal accidents, including the 21 fatalities in the Alton accident.

National Academy of Sciences Findings Conclusions

A provision in the Surface Transportation and Uniform Relocation Assistance Act of 1987 requested that the National Academy of Sciences (NAS) investigate:

> the principal causes of fatalities and injuries to school children riding in school buses and of the use of seat belts in school buses and other measures that may improve the safety of school bus transportation...to determine those safety measures that are most effective in protecting the safety of school children while boarding, leaving, and riding in school buses.

In 1989 the Transportation Research Board of the NAS issued Special Report 222, Improving School Bus Safety. The report discussed both crash-phase and postcrash-phase measures to enhance school bus passenger safety along with measured to prevent school bus pedestrian accidents. The report concluded that NHTSA should reconsider the minimum number of emergency exits required on school buses by FMVSS 217 and that school buses with greater seating capacities should have more emergency exits. It also recommended that States and local school districts conduct emergency school bus

---

[14]Traveled way - the portion of the road for the movement of vehicles, exclusive of shoulders and auxiliary lanes.

[15]J. D. Mickie and H. E. Bronstad, Location, Selection, and Maintenance of Highway Traffic Barriers, National Cooperative Highway Research Program Report, No. 118 (Washington, D.C.: Highway Research Board, 1971), pp. 1-5.

[16]Fars data were searched for fatal accidents involving a school bus body type vehicle. The bus may have been used to transport passengers to school or to school activities. Also, the bus may have been used to transport senior citizens or church groups.

evacuation drills twice each year and that NHTSA should prohibit the installation of seats that obstruct emergency exit doors.

Tests and Research

Road coefficients of friction.--Tests were performed with a drag sled at the accident scene to measure the coefficients of friction of the road surfaces. The pull necessary to pull the 43.5 pound sled across the road surfaces and the calculated friction values were as follows:

Location	Force to Pull 43.5 Pound Sled	Friction Coefficient
FM 676 at 50' east	37 lbs.	0.85
Path in dirt for bus	23 lbs.	0.53
Path in dirt for truck	23 lbs.	0.53
Bryan Road at 100' south	33 lbs.	0.76

Visibility.--Visibility tests were conducted at the accident site at approximately the same time day of day that the accident occurred. A similar tractor attached to the accident semitrailer and a similar bus used to replicate the maneuvers of the accident vehicles. The headlights of both vehicles were illuminated during the tests because the accident busdriver had indicated that his lights were on and because of the low ambient light at the time of the test. Based on the departure angle of the bus after impact and the relative weights of the vehicles, the speed of the truck at impact was estimated to have been between the same speed and about 50 percent of the speed of the school bus.

To explore the visibility under these speed conditions, the visibility tests were conducted in two phases. Both phases involved positioning the vehicles at a certain distance from the intersection, moving them forward in measured increments, and making observations. The vehicles were moved toward the accident intersection to simulate the drivers' actions and to determine their ability to perceive each other's vehicle. The first tests involved placing both vehicles approximately 600 feet from the intersection and moving them forward in 25 foot increments until visual contact was made, and then movement was made in smaller increments. This simulated both vehicles moving at the same speed toward the intersection. The test bus driver was not able to clearly see the test truck because of the trees and shrubs until the truck was approximately 150 feet from the intersection and the school bus was 170 to 160 feet from the intersection. The visibility of both drivers was completely obscured by a line of trees and brush parallel to an irrigation ditch about 75 feet east of the edge of Bryan Road. In addition, a large tree in the southeast quadrant, 38 feet from FM 676 and 42 feet from Bryan Road, partially obscured their visibility. (See figure 2.)

In a second series of tests, the school bus was started at 400 feet, and the truck started at 200 feet from the intersection. The truck moved forward at 25 foot increments, and the bus moved at 50 foot increments. This simulated that the truck was approaching the intersection at a speed of half that of the bus. These tests indicated that the bus was 200 feet from the intersection when its driver was first able to observe the truck that was 100 feet from the intersection. The position of the sun was such that glare or a sun ball were not factors. The truckdriver could have observed the stop sign at least 400 feet before the intersection.[17]

Truck braking.--Truck braking tests were conducted using a similar tractor and the accident semitrailer with its original load and brake adjustments. In braking test one, the truck combination unit established a speed of 20 mph (according to Texas DPS radar). At an arbitrarily designated point on the road, approximately 163 feet before the point of impact, the clutch was released, and the trailer hand valve that activated only the semitrailer brakes was applied. The unit came to a full stop in 65 feet.

Braking test two was conducted at a speed of 30 mph with the clutch engaged. The semitrailer brakes were applied at the same location as the previous test. The unit came to a full a stop in 159 feet. In both tests, the semitrailer brakes performed without failure.

School bus acceleration.--Acceleration tests were conducted with a similar bus loaded with 42 persons to obtain a range of speeds and acceleration rates. The gross vehicle weight of the test bus was 29,627 pounds, which was about 2,700 pounds less than the estimated gross weight of the accident school bus.

The last student was picked up before the accident approximately 785 feet east of the point of impact. During the first test, the test driver was instructed to accelerate the bus normally. However, the test bus appeared to have accelerated somewhat slowly and only reached a speed of 24 mph when it passed the point of impact, 38 seconds after the test began. In the second test, the test driver was instructed to use maximum acceleration. The test bus passed the point of impact at 36 mph, in 22 seconds.

ANALYSIS

The Accident

General.--Neither the condition of the highway nor the weather contributed to the accident. Both accident vehicle operators were familiar with their vehicles and their routes driven at the time of the accident, and neither was under the influence of alcohol or illicit drugs.

---

[17]See appendix M for a detailed description of the visibility tests.

The 21 student fatalities were the result of drowning or complications associated with being submerged in the caliche pit. The medical examiner autopsy reports of the deceased students revealed that they had not sustained debilitating crash trauma injuries which would have prevented them from escaping from the school bus.

Accident dynamics.--Following the accident, the Safety Board performed conservation of momentum calculations and time-distance analyses for both accident vehicles. These calculations and analyses were performed to determine vehicle speeds and the sequence of accident events. The calculations indicated that the northbound truck was traveling 42 to 48 mph as it approached the intersection. Moreover, the truckdriver also indicated that his speed was 45 mph. As the truck came within approximately 300 feet of the stop sign at the intersection with FM 676, the truckdriver helper warned the driver of the approaching stop sign. In response to this warning, the driver said he applied the tractor's service brakes causing the truck to decelerate to a speed between 19 and 25 mph. The Safety Board concludes that the truckdriver then applied the semitrailer brake hand valve and released the service brakes as he downshifted the transmission to fourth gear. The speed of the truck at impact with the school bus was estimated to have been 9 to 14 mph. It is likely that the truckdriver reapplied the service brakes after completing the downshift, just before impact. As a result of this series of braking maneuvers, the driver was unable to stop the truck before passing into the intersection.

During the collision the tractor rotated approximately 60 degrees counterclockwise, and the semitrailer continued forward and to the left following the initial collision. The right front of the semitrailer then struck the left side of the school bus. This impact forced the tractor to rotate counterclockwise an additional 20 to 30 degrees. The helper stated that after the initial impact the truckdriver was jarred from behind-the-wheel, was laying across the helper, and lost contact with the brake pedals and steering wheel. Because there was no evidence of truck braking following the collision, the truck probably lost little or no speed and left the impact area traveling between 8 and 14 mph in a west northwest direction before it came to rest.

The busdriver reacted to the impending collision by steering the bus to the right and braking. Tire marks indicated that the right side of the bus was approximately 4 feet to the right of the right edgeline on FM 676 just prior to the collision in the intersection.

Based on the acceleration tests of the similar school bus, 36 mph was used as an upper speed boundary in the equations for the bus speed. The calculations and the lack of skid marks after impact indicated that the bus brakes were not applied after the impact. The results of the calculations also indicated that the speed of the bus prior to impact was 25 to 30 mph.

Tire marks and vehicle damage indicated that the bus rotated clockwise approximately 20 degrees after impact, and the right front of the semitrailer then struck the left side of the bus causing it to rotate clockwise again about 20 degrees. The bus continued forward after the

second impact with the semitrailer at a speed of 19 to 21 mph and continued toward the edge of the caliche pit. The bus continued approximately 60 feet in a northwest direction, striking the southbound stop sign on Bryan Road, and traversing an 2-foot-high mound of dirt at the edge of the pit. The right front wheel reached the edge of the mound just before the left front wheel. At this point the bus began its plunge into the pit. However, the right side dropped onto and rubbed the mound of dirt on the rim of the pit. As the right side of the bus rubbed along the mound of dirt, it began a clockwise rotation during which the front of the bus dropped toward the water in the caliche pit.

Based on vehicle damage to the right front bumper and the body panel below the windshield near the door, the front of the bus apparently struck the bottom of the caliche pit in about 4 feet of water. At that point the bus pivoted clockwise, and the rear of the school bus continued in a southwest direction. The grille and front roof section scraped along the bottom of the pit as the bus continued to rotate clockwise. The school bus settled onto its left wheels with its right side out of the water facing southwest and then quickly filled with water and sank.

Based upon the position of the bus parts the divers located in the pit, the Safety Board was able to estimate that the speed of the bus was between 11 and 16 mph when it left the top of the pit. Further, as the bus began to fall into the caliche pit, it accelerated in the downward direction due to gravity between 29 and 31 mph before entering the water.

Accident Occurrence Reasons

Apparently, the truckdriver was inattentive on his approach to the intersection. He may have been distracted because he was trying to decide which store he would choose to make his next delivery. After the prompting by his helper, the truckdriver realized that he needed to make a stop at the intersection and initially applied his foot brake. However, after he applied his foot brake, the truckdriver may not have perceived a hazard and, therefore, started to downshift. When he saw the bus, the truckdriver probably applied the foot brake fully. Although he began a leftward steering maneuver as he entered the intersection, the truckdriver was unable to stop or to avoid the collision with the bus. Consequently, the Safety Board concludes that the truckdriver's inattention while he was approaching the intersection resulted in his failure to stop his truck before reaching the intersection and in his failure avoid the collision with the school bus.

Although the truck brakes were out of adjustment, the collision may have been avoided if the truckdriver had maintained a full service brake application until the truck stopped. If the truck had been traveling at 42 to 48 mph, the driver could have stopped prior to the intersection if he had reacted to the helper's warning within 1 second. This assumes that the helper's estimate of the 300 feet was accurate. The Safety Board believes that the 300-foot estimate is correct based on stop sign visibility constraints, normal reaction time by the driver, and the time distance calculations. Further, based on the truckdriver's estimate that he first applied his brakes 425 feet from the intersection, the Safety Board

calculated that if he had maintained full brake application on the tractor brakes at this distance the truck would have been able to stop prior to the intersection.

The Safety Board studied various braking situations with a sensitivity to speed, friction coefficients, reaction time, and whether the full service or just the semitrailer braking systems were used. For example, if the tractor semitrailer, with its brakes out of adjustment, was traveling in excess of 50 mph, it could not have been stopped before the intersection even if the service brakes were applied the full time after responding to the warning the helper made about 300 feet before the collision.

Further, assuming a truck speed of 42 to 48 mph, the truckdriver would had to have fully applied his service brakes within about one second of the helper's warning in order to stop the truck and avoid the collision, if the friction coefficient was 0.30.[18] If the friction coefficient was 0.40, the truckdriver would had to have fully applied his service brakes within 2 seconds of the helper's warning. If the brakes were optimally adjusted, the truckdriver would have had 2.9 seconds after the warning to react and avoid the collision. Thus, the lack of optimally-adjusted brakes greatly reduced the available time the driver had to respond to the helper's warning about the stop sign. In any of these situations, however, the truckdriver still had the capability to stop the truck and avoid the collision by fully applying and maintaining a full service brake application.

Moreover, even if the truckdriver had reacted later than 1 second, his impact speed with the bus would have been much lower had he maintained full brake application. Further, the Safety Board could not determine whether the truck would have stopped prior to the intersection if the truckdriver had performed the braking maneuvers as he did during the accident sequence, with the brakes fully adjusted. Therefore, a collision still may have occurred, but at a lower speed. However, the severity of the accident may not have reduced. It is likely that the truck at a lower speed would have collided with the left side of the bus rather than being struck by the bus. As a result, the bus speed would likely have been higher following the collision allowing the busdriver even less time to steer or to brake prior to entering the caliche pit.

The Safety Board calculated that the truckdriver's view of the approaching bus was partially obscured by a large tree until the truckdriver was about 80 feet from the point of impact. Based on his established speed approaching the accident intersection, the Safety Board calculated that the truckdriver applied his full brakes about 1.6 seconds before the impact occurred. Although he steered to the left and probably had all brakes applied at the time of the accident, neither action was sufficient to avoid the collision.

---

[18]The coefficient of the friction level obtained on Bryan Road (0.76) with a drag sled was reduced to 0.30 to 0.40 to account for a reduction of friction for truck tires and the reduced braking efficiency of the truck. This adjustment was made based upon Safety Board investigative experience.

Based on its time-distance analysis, the Safety Board believes that the maximum perception time for both drivers to see each other was 3.1 to 3.6 seconds before impact after the vehicles cleared the line of trees and bushes. However, it was more likely that they did not perceive each other until 2.2 to 2.7 seconds before impact, when the truck was no longer obscured by the large tree. Based upon the latter perception time, the Safety Board concludes that the busdriver detected the truck and took appropriate actions in a timely manner.

Additionally, the Safety Board calculated that if the busdriver had been able to fully apply his brakes following the collision with the truck, he could have stopped the bus before the caliche pit. However, the busdriver was injured during the collision with the truck and the Safety Board could not determine if the driver was capable of applying the brakes following the impact.

Survival Factors

The fatalities resulted after the school bus became submerged in the pit. The students who perished were unable to make a timely escape from the bus through the rear emergency door, the jammed front boarding door, the displaced windshield area, or the available window openings along the right side of the bus. None of the students who died received injuries during the various impact sequences that would have disabled them and prevented their escape from the bus. The Safety Board concludes that this was a survivable accident because impact forces were not great enough to cause ..bilitating injuries and the structural integrity of both vehicles was maintained during the collision. The occupants had adequate survival space.

Emergency egress.--Because the bus filled quickly with water through the large opening in the displaced windshield, the front boarding door, and the partially open side windows, no "air pocket" existed to allow sufficient time for students to plan their escape from the bus. The submerged students reported difficulty finding, opening, and getting out of the bus windows. This was complicated by the murky water that filled the inside of the overturned school bus. However, some students were still able to help each other escape from the bus.

Furthermore, this dark murky water prevented many of the students from recognizing that the rear emergency exit door and the large front windshield openings were available to escape from the bus. Following the accident, most of the fatally injured students were found in the center section of the bus at the farthest point from emergency exits.

At least 55 students exited the submerged bus through some of the 15 windows on the right side. (See figure 3.) Three to five students exited through the rear emergency exit door. The door closed on at least one student and prevented her escape; however, she eventually exited through a window. Rescuers also had difficulty keeping the door open, until they tied it back during postaccident activities. Therefore, the Safety Board believes that floor level emergency exits should be designed so that once opened they remain open during emergencies and school bus evacuations.

The Safety Board believes that the impact with the water or with the bottom of the pit may have displaced the windshield and glass panes in the front boarding door and that this, along with the partially opened side windows, may have caused the bus to completely submerge and fill with water in 30 to 60 seconds, faster than the 1 to 2 minutes estimated by the students.

The Safety Board concludes that the estimated 30 to 60 seconds was inadequate time for 81 desperate students to escape through the available window openings and the rear emergency door that did not remain open before they were trapped underwater. Escape was further complicated by: dark murky water which obscured vision; several large students who became stuck in the windows; the small size of window openings; and several students trying to exit the same window simultaneously. The 62 students and the busdriver were able to survive because: they were among the first to escape, and they fit physically through the side windows. The 21 students who perished did not have enough time to escape from the bus.

The students could not identify the specific window they used to escape from the bus. They were, nevertheless, limited to using a window with the moveable frame in the full down position (a 9-inch by 24-inch opening) or using an opening (approximately 25 inches by 23 inches) where the window frames were missing. The Safety Board could not establish if the window frames were knocked out during the rescue/recovery operations or if students had actually escaped through the larger openings.

The side windows on this school bus were not designed nor intended to be used as emergency exits. They were standard side windows, meant to provide light and ventilation. However, this accident and previous Safety Board investigations indicate that emergency exits may frequently be blocked or disabled during school bus accidents.[19] The Safety Board believes that current Federal Standards do not require a sufficient number of school bus emergency exits. In an emergency, passengers will try to use any opening to escape from danger and to save their lives. In this accident, most of the students attempted to escape through the windows on the right side of the bus. (See figure 3.)

If the regular escape exits are blocked or inoperable, school bus passengers should be able to use the side windows as a means of egress. The 24-inch by 9-inch openings in standard school bus side windows do not have the vertical height (9 inches) to allow some larger students to make an emergency exit. Most school bus manufacturers offer as an option, a 24-inch-wide window with a 12-inch-vertical opening. If these windows were installed in school buses, the window size of 12 inches by 24 inches (a 33-percent increase of exit area per window) would improve escape opportunities.

---

[19]For more information see: Highway Accident Report--"Pickup Truck/Church Activity Bus Head-on Collision and Fire Near Carrollton, Kentucky, May 14, 1988" (NTSB/HAR-89/01); and Safety Study--"Crashworthiness of Small Poststanderd School Buses" (NTSB/SS-89/02).

The Safety Board recognizes that larger window openings may provide an easier means of passenger ejection, but larger windows would have improved passenger egress in the accident bus. The Safety Board also recognizes that side windows are not intended to be a substitute for designated emergency exits. However, larger windows with standardized opening devices are available, and emergency exit training programs can address their proper use. Therefore, the Safety Board believes provision for side window egress in an emergency needs to be evaluated.

Manufacturers offer a variety of emergency escape features such as push-out windows, side emergency doors, and roof hatches. For example, in a rollover situation, if the bus comes to rest on its side a roof hatch would provide a means of egress. The Safety Board concludes that a combination of these features is necessary to provide for alternate means of egress.

Moreover, the Safety Board believes that the number of emergency exits in buses should be commensurate with the number of passengers. A previous safety recommendation was made to the NHTSA to address this issue as a result of the Carrollton, Kentucky, church activity bus accident. Therefore, the Safety Board concludes that the limited number of emergency exits adversely affected the students' ability to escape from the submerged bus and that this contributed to the severity of the accident.

Emergency response.--A local resident made the initial telephone notification in a timely manner. However, the resident did not know that in addition to the truck, a school bus was involved in the accident and was completely submerged in the caliche pit. The Safety Board concludes that based on commonly accepted police procedures the Alton police officer who received this call should have immediately requested the Hidalgo County Sheriff's communications center to dispatch emergency units. Upon his arrival at the accident scene, he should have established a command post to coordinate the resources as they arrived.

The firefighters first reaction was to get to the students in the bus as quickly as possible. In doing so, they did not take an appropriate tool to force entry into the bus.

Two positive pressure SCBA units were on the Alton volunteer pumper. This type of equipment is not normally used for underwater rescue. However, an off-duty U.S. Border Patrol agent used the SCBA to enter the submerged bus. This was about 8:15 a.m., and any students still inside the bus probably would have perished by that time.

As the various police and rescue units arrived on the scene, they initially functioned independently of each other in a reasonably efficient

manner, rather than in a typical on-scene incident command situation.[20] The initial lack of coordination between police and rescue units may have contributed to early problems with crowd and traffic control.

Human Performance Considerations

School busdriver.--The busdriver was properiy licensed by the DPS to operate the school bus. There was nothing in his 72-hour history to suggest that the busdriver may have experienced physical or mental fatigue while on duty. The busdriver was an experienced school busdriver. He was also familiar with his vehicle as well as his route on the day of the accident, and he had been driving the same bus on the same route since July 1985.

The busdriver's August 21, 1989, TEA Medical Examination Report indicated that he was "qualified only while wearing glasses." However, he was not wearing glasses at the time of the accident. Although the busdriver's last three physical examinations indicated that he should wear glasses while driving a school bus, the school officials did not require him to comply with this restriction. The Mission School District director for special services indicated that he missed these notations when he checked the driver's medical forms. The director for special services also indicated that he was not alerted to any possible vision problems because the busdriver held a driver license without restrictions and had never displayed any noticeable signs of visual deficiency. The busdriver denied having a vision problem and stated that he did not wear glasses when he took his eye examinations in 1988 and 1989.

Although an accurate measurement of the busdriver's uncorrected vision at the time of the accident is unavailable, the effect of his failure to wear corrective lenses on his ability to perceive the approaching truck appears to be minimal and did not contribute to the accident. The evidence suggests that he detected the presence of the approaching truck within a reasonable time frame and that he reacted appropriately by attempting to maneuver to avoid the collision. A medical advisor to the Safety Board confirmed that because of the busdriver's recorded eye test results, it is likely that the degradation of his visual acuity affected to a greater extent his near vision (his ability to read and to discriminate fine detail) and had little bearing on his distant vision (ability to perceive large moving objects, such as other vehicles). Further, it is unlikely that the busdriver's reported corrected eyesight was indicative of a visual acuity deficiency that would have prevented him from detecting a large moving object during uncorrected viewing and, thus, did not contribute to the accident.

However, the Safety Board is concerned that a busdriver with restricted certificates could have slipped through the screening process at the local

---

[20] In this system the incident commander divides duties into distinct, manageable activities and designates the management of those activities to a qualified officer or other person. The incident commander then obtains needed information and directs actions to be implemented through his appointed personnel.

level for 3 consecutive years. The Safety Board believes that a more conscientious review of the examination forms by the school official would have disclosed the busdriver's eyesight restriction.

Also, the school bus was not equipped with a lap shoulder belt for the driver. The Safety Board is unable to determine if this type of restraint system, because of the low speed of the collision, would have prevented the minor injury sustained by the driver. However, the Safety Board believes that lap shoulder seat belts are beneficial to drivers in higher speed accidents, and, therefore, school buses should be equipped with lap shoulder belts at the driver position.

Truckdriver.--The truckdriver was properly licensed to operate the vehicle he was driving at the time of the accident. There were no restrictions on his driver license. Although the truckdriver declined to be interviewed by the Safety Board, it believes, based upon interviews with friends and coworkers, that the truckdriver did not have any physical or emotional problems that would have contributed to the accident. The helper stated that the truckdriver appeared to have been alert. Aside from the truckdriver's quandary about his next delivery stop, which may have preoccupied him, the Safety Board was unable to determine why the truckdriver was inattentive.

The Safety Board believes that although in April 1989, the Valley Bottling Company started to use the FMCSR as guidelines to certify its drivers and trainees, it still needs to develop a formal driver training program. The training program should be taught by qualified instructors and conducted with classroom and behind-the-wheel exercises. Emphasis should be placed on seat belt usage and compliance with traffic regulations. Valley Bottling should also maintain driver records and documentation concerning driver examinations and road test results.

School Bus Examination

The Safety Board examination of the bus did not disclose any evidence of a mechanical subsystem failure. The Safety Board inspection of the bus disclosed that the brake system was in good working condition, and no broken hardware or malfunctions were noted. One brake adjustment was 1/8 inch beyond recommended stroke limit, and one was at the limit for readjustment; however, this would not have significantly affected the bus's stopping capability. Thus, the Safety Board concludes that the condition of the service brakes on the bus was not a factor in this accident.

School Bus Crashworthiness

Based on the accident dynamics, damage to the bus occurred in six separate, but related, events. The first event was the impact with the tractor. The second was the semitrailer striking the left side of the bus. The third was the impact with the stop sign. The fourth was contact with the dirt mound on the rim of the pit. The fifth was the impact with the water. The sixth was the impact with the pit bottom. The first event damaged the left front corner (outboard of the left frame rail). The second damaged

the left side of the bus near the fourth row seat window. The third damaged the front of the bus. The fourth damaged the right side in front of the rear wheel well. The fifth may have displaced the windshield. The sixth damaged the right front corner and the boarding door and may have dislodged the windshields.

Based on the crash dynamics, impact damage, and lack of disabling injuries to the students, the Safety Board believes that the bus generally exhibited good crashworthiness. The left front bumper was in the impact zone with the right front of the truck. The Safety Board could not determine if the windshield sections were dislodged upon contact with the water or upon contact with the bottom of the pit. However, the Safety Board concludes that the front boarding door was jammed closed because it was in the impact zone when the bus struck the bottom of the pit. All other damage to the bus was minor.

Tractor-Semitrailer Examination

The Safety Board examination of the tractor-semitrailer did not disclose a mechanical subsystem failure. The brake system examination did not reveal any total system failure. However, three push rod stroke measurements (one on the tractor and two on the trailer) exceeded the manufacturer recommended operational limits. In this condition brakes that are out of adjustment increase the stopping distance of the truck. Therefore, the Safety Board believes that Valley Bottling Company should establish a procedure to ensure that truck air brakes are maintained at the manufacturer recommended operational limits. A leaking brake chamber diaphragm was detected on the left front brake unit of the tractor. The leak increased in intensity with each brake application during the Safety Board tests. This indicated that the diaphragm was rupturing as it was being tested and that the initial rupture probably began during full application of the brakes just before impact. If the brake chamber diaphragm had ruptured sometime before the accident, there should have been evidence of dirt and other contaminants on the pressure side of the diaphragm. Since no evidence of these contaminants was observed during the chamber diaphragm inspection, the Safety Board concludes that the diaphragm failure occurred just before impact.

The air line fitting attached to the chassis at the right front wheel brake chamber was fractured. The brass fitting had a stress-type fracture, and all surfaces in the fracture had a bright clean finish. The Safety Board concludes that the fracture probably occurred during the collision sequence when the front bumper and fender of the truck struck a bush as the truck came to rest.

A review of the maintenance records from 1986 to present and driver pretrip vehicle inspection reports from July 1989 did not disclose any complaints about any air leaks or low air pressure gauge readings on the service brakes. In July 1989 Valley Bottling Company instituted a formal pretrip inspection program following guidelines in the FMCSR.

The braking air reservoirs for the supply and secondary systems had accumulated approximately a half gallon of water and oil emulsion. The primary reservoir (rear) was dry. The remotely operated drain valve had been installed on this reservoir at the rear of the tank assembly. Such a location would be normal if the tank was a single reservoir. However, this tank was a three-compartment (reservoir) single unit, and the remotely operated drain valve should have been placed on the supply (wet) reservoir that is located in the front section of the unit. If the remote valve had been properly installed in the wet reservoir, little or no condensation would have accumulated in the air reservoirs. The fact that the primary tank was dry suggests that the pretrip vehicle maintenance was performed. The recommended maintenance for the supply air reservoir is to drain it daily before beginning operation.

The condensation and sludge found in the air reservoirs reduced the volume of air supply. This condition did not affect the application of the brakes, but could have reduced the number of brake applications that were available to the truckdriver over a period of time.

Inspection procedures contained in the State of Texas "Inspection of Air Brakes on Commercial Vehicles and Trailers" require that inspectors open drain cocks in each reservoir in the air system and close the drain cocks with the air system at zero gauge pressure. The amount of condensation and sludge found in the accident truck air reservoirs indicates that they were not drained on the day of the accident or for several days before the accident. Because of variations in humidity and wet weather, the Safety Board cannot determine whether the amount of condensation is an indication that the tanks were not properly drained when the tractor was inspected on August 30, 1989.

Nevertheless, the Safety Board believes that Valley Bottling Company failed to use a sufficient number of mechanics or have adequate procedures to ensure that proper vehicle maintenance was performed in accordance with manufacturer specifications.

Tractor-Semitrailer Crashworthiness

Damage to the truck came from two sources, impact with the bus and contact with a tree at the final rest position. The first impact was to the right side of the truck and caused the major damage to the vehicle. The second impact was near the same area as the major damage, but resulted in considerably less damage.

Valley Bottling Company maintenance practices.--The Safety Board believes that the maintenance performed on the accident truck was marginal. The postaccident examination revealed that the accident truck had at least three improperly adjusted service brakes and an accumulation of oil and water emulsion in the service brakes air reservoir tank.

The marginal mechanical condition may be because of the relatively high ratio of vehicles to mechanics at the Valley Bottling Company facilities. At the McAllen facility 3 mechanics service 162 vehicles, (a 54 to 1 ratio), and

at the San Benito facility 2 mechanics and 1 helper serviced 111 vehicles (a 44 to 1 ratio). The vehicle maintenance staff was responsible for general repairs identified as a result of driver pretrip inspections, normal periodic vehicle maintenance, and an annual vehicle inspection program for the 273 vehicles. Therefore, it is unlikely that this small staff was able to effectively detect and correct the majority of mechanical discrepancies. The Safety Board believes that additional maintenance resources are needed for the company to properly maintain its vehicle fleet.

Highway

General.--The signs and markings at the intersection were in compliance with the Manual on Uniform Traffic Control Devices. The speed limit sign for northbound traffic on Bryan Road south of the accident location was not found. The Safety Board searched Hidalgo County records and could not find the speed limit regulation that would have warranted posting of the speed limit. Based upon the available information, the Safety Board cannot determine whether the northbound speed limit on Bryan Road approaching the accident site was 30, 45, or 55 mph. The search for these records proved difficult because county records were not automated to permit a search for road control devices and regulations. The Safety Board believes that a traffic/regulation inventory system would increase the efficiency of obtaining pertinent information and aid Hidalgo County safety officials in their maintenance of highway traffic signing.

Even though the advance "Stop Ahead" sign on the approach to the intersection was skewed away from the road, it was not a factor in the accident. This is because driver visibility of the stop sign was greater than the distance the "Stop Ahead" sign needed to be to warrant posting, according to the Manual on Uniform Traffic Control Devices. In May 1990, the Safety Board observed that the "Stop Ahead" sign had been straightened.

Before the accident in the area of the intersection of Bryan Road and FM 676, no barrier existed that would have prevented motor vehicles from falling into the caliche pit. AASHTO standard guardrails are designed to restrain 4,500-pound automobiles striking the rail at an angle of 25 degrees or less at 60 mph. If an AASHTO guardrail had been in place at the caliche pit before the accident, the 32,285-pound school bus would have struck it at about a 45-degree angle. The school bus probably would have overridden the guardrail with little or no change in speed or direction. The guardrail height would not have been sufficient to retain a large vehicle with a high center of gravity, and the support posts would have been pushed down and overridden. Furthermore, according to the FHWA, guardrails attributed to 1,384 highway accident fatalities in 1988.

After the accident the City of Alton requested the Texas Department of Highways and Public Transportation to place a guardrail along FM 676 parallel to the pit. In May 1990 the Safety Board observed an installed system that consisted of two and three rows of guardrails, a mound of compacted caliche, and a chain link fence. (Guardrails had also been installed adjacent to other pits in the vicinity.) Although the current warrants of the AASHTO Roadside Design Guide did not require the placement of this system, the

Safety Board believes that this action will prevent other vehicles from falling into the pit at the intersection.

School Bus Evacuation Drill Guidelines

Some school and activity buses can transport in excess of 50 passengers at a time. School bus and activity bus accidents involving large loss of life are, fortunately, rare. Accidents resulting in occupant fatalities from fire or submersion are also rare. However, the Carrollton, Kentucky, activity bus accident involving fire and the Alton school bus accident involving water proved that these forms of accidents must be anticipated. These types of accidents required rapid, organized egress from the bus. The students in these accidents had not received training in emergency bus evacuation. The Safety Board concludes that school bus emergency evacuation drills would have improved the occupants' chances to escape. Therefore, countermeasures must be considered in the design of the school buses and in planning comprehensive emergency exit training guidelines.

Because of time constraints, students will often be responsible for rescuing themselves and fellow passengers before help arrives from bystanders and public safety officials. Therefore, comprehensive guidance is needed to train school bus passengers to develop a personal escape plan and to train school busdrivers and public safety officials in emergency egress and the performance of rescues from a school bus. The final product should be a comprehensive guide that pupil transportation officials and emergency responders can use to implement training and drills.

As a minimum the guide should include specific objectives for pupil transportation officials to train passengers in making an emergency exit from a school bus that has been involved in an accident resulting from any of the following situations: the school bus remains on its wheels or is on its side or roof; all emergency exit doors may be used for evacuation or only some of the emergency exits may be used; fire, smoke, or toxic fumes are present; and the school bus is completely submerged on its side or roof or upright. Also, passengers should be trained to use each type of emergency exit. Alternate means of escape should also be considered in case any of the designated emergency exits are blocked or disabled. A key component in this guide should be a section dealing with training each passenger to develop a personal escape plan for use on a school bus.

The guide should also contain information for emergency responders, including police and rescue personnel, to deal with the school bus accident situations mentioned above. These responders should have a rescue plan to deal with each type of school bus normally used by the various school systems in their jurisdiction. They should be familiar with all emergency exits as well as means of assisting passengers from the school bus if the emergency exits are not functioning. Also, they should be trained in getting to school bus wreckage under any difficult situations that would be found in their response area, for example, a bus route along waterways, bridges, or a ravine. Their participation in planning the guide is essential. The guide should also include recommendations for the frequency of providing periodic passenger exit drills and training for emergency responders to ensure that

they are kept current on the appropriate escape and rescue procedures.

Further. the guide should reflect any updated information concerning emergency egress. It should involve contributions from students, pupil transportation officials, and school bus manufacturers. This guide should be developed and distributed nationally to public and private schools as well as to the private sectors that use school bus type vehicles to transport children to and from school and to and from other activities.

The Safety Board believes that because of its familiarity with pupil transportation, the National Association of State Directors of Pupil Transportation Services (NASDPTS) is in a position to provide key leadership in developing and distributing the guide. Further, the Safety Board believes that NASDPTS should convene a national task force in cooperation with the NHTSA to prepare the comprehensive school bus emergency evacuation-rescue guide. The task force should be comprised of representatives from schools, State education-pupil transportation agencies, police, fire, and rescue departments. The Safety Board believes that representatives from the Parent Teachers Association, NASDPTS, the International Association of Chiefs of Police, the National Sheriffs Association, the National Association of State Emergency Medical Service Directors, the National Council of State Emergency Medical Service Coordinators, the NHTSA, and the International Association of Fire Chiefs should be involved with the task force. Among the items the task force should consider would be the final publication and distribution of the guide.

Although the 1990 Revised Edition of Standards for School Buses and Operations contains various information concerning emergency exit from a school bus, it does not contain all of the information necessary for the various agencies. However, the material could be used as a resource in the development of the guideline.

Emergency Preparedness

The accident occurred in the City of Alton, a community with a small police department and volunteer fire department. Although Hidalgo County provided communications support, the primary emergency responsibilities were with the City of Alton. No written policies or guidelines dealt with emergencies or disasters. For example, no standard telephone procedures were used by the Alton police sergeant who received the initial accident notification. The Safety Board believes that the City of Alton should direct its police department to prepare written guidelines and policies concerning police operations, especially standard operating procedures for handling calls for emergency assistance and responding to community-wide emergencies and disasters. The volunteer fire department and the other communities should be part of this planning effort.

The City of Alton does not have an office of emergency planning and does not have an emergency operations plan as required by the State of Texas Disaster Act of 1975. Additionally, it does not have a specific emergency operations plan dealing with mass casualties. The State of Texas DPSDEM has apparently not given smaller localities a high priority in seeing that they

establish emergency operation plans required by the Texas Disaster Act of 1975. The Texas DPSDEM also does not have a specific emergency operation plan dealing with mass casualty accidents. The Safety Board believes that the Texas DPSDEM should ensure that all localities and counties are in compliance with the Texas Disaster Act of 1975. If not, the Texas DPSDEM should provide assistance in the preparation or update of appropriate plans. Also the State of Texas DPSDEM should develop a statewide plan to provide assistance for mass casualties.

Federal Highway Safety Program Guidelines

The NHTSA is in the process of revising its Pupil Transportation Safety Guideline, No. 17. The proposed revisions, however, do not contain sufficient detail to be useful for State and local officials to plan a comprehensive school bus emergency evacuation-rescue guide. (See appendix J.) The Safety Board believes that the information contained in the 1990 Revised Edition of Standards for School Buses and Operations, issued by the National Conference on School Transportation and sponsored by NASDPTS, forms the basis for the timely development of the comprehensive school bus emergency evacuation-rescue guide. Therefore, the Safety Board believes that the NASDPTS is the appropriate group to coordinate the preparation of the comprehensive school bus emergency evacuation-rescue guide. The Safety Board has responded to the NHTSA request for comments concerning other provisions in the guideline.

CONCLUSIONS

Findings

1. The weather and road conditions did not contribute to the accident.

2. Neither driver was under the influence of alcohol or illicit drugs at the time of the accident.

3. The busdriver was familiar with his vehicle and the route he was traveling. The truckdriver was also familiar with his vehicle and locations of his delivery points.

4. None of the fatally injured students received crash-related injuries that would have prevented them from escaping from the school bus.

5. The truck was traveling 42 to 48 mph before the driver applied the service brakes.

6. The speed of the school bus at impact was 25 to 30 mph, and the truck was traveling 9 to 14 mph.

7. The speed of the school bus as it entered the water was 29 to 31 mph.

8. The truckdriver's inattention resulted in his failure to stop his truck before reaching the intersection.

9. If the truckdriver had fully applied his service brakes the entire time, rather than downshifting and applying his trailer brakes, he may have been able to stop before impact.

10. The school bus impact with the water or bottom of the pit displaced the windshield and glass panes in the front boarding door which, along with the partially-opened side windows, caused the school bus to fill with water in 30 to 60 seconds.

11. Thirty to 60 seconds was not adequate time for 81 students to escape through the available window openings and the rear emergency door.

12. The students had difficulty finding and operating the windows and keeping the rear emergency door open to get out of the school bus.

13. Larger vertical openings of the side windows would have improved the occupants' opportunity to escape.

14. The students' difficulty in escaping from the submerged school bus contributed to the severity of this accident.

15. A combination of emergency exits is needed in school buses to provide for alternate means of passenger egress.

16. While on scene the Alton police officer failed to recognize the actual nature of the emergency.

17. The on-scene incident command concept was not used. Rather, the various public safety agencies initially functioned semi-independently in a reasonably efficient manner.

18. Although the school busdriver was required by the Texas Education Agency to wear glasses, his failure to wear glasses to correct near vision deficiencies did not contribute to the accident.

19. The Mission Consolidated Independent School District official was not diligent in checking the busdriver's forms and was not aware that the school busdriver was "qualified only while wearing glasses."

20. The school busdriver's and truckdriver's 72-hour history did not indicate nor suggest mental or physical fatigue.

21. The condition of the service brakes on the school bus was not a factor in this accident.

22. It is likely that the failure of the truck's left front brake diaphragm occurred just before impact and did not affect the outcome of the accident.

23. The fracture of the truck's right front wheel brake chamber air line fitting probably occurred during the collision sequence and did not affect the outcome of the accident.

24. None of the preexisting truck brake system discrepancies would have prevented the truckdriver's ability to stop the truck.

25. The preexisting truck brake system discrepancies increased the distance necessary to stop the truck.

26. Because impact forces were not great enough to have caused debilitating injuries and the structural integrity of both vehicles was maintained during the collision, the accident would have been survivable if the school bus had not fallen into the caliche pit.

27. The Valley Bottling Company did not have sufficient staff to properly maintain the accident vehicle.

28. The signing and marking at the intersection conformed with the Manual on Uniform Traffic Control Devices.

29. School bus emergency evacuation drills would have improved the occupants' chances to escape.

30. No nationwide comprehensive instruction is available for conducting school bus emergency evacuation drills.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the truckdriver's inattention and subsequent failure to maintain sufficient control of his vehicle to stop at the stop sign. Contributing to the severity of the accident was the lack of a sufficient number of emergency exits on the school bus to accommodate the rapid egress of all 81 students.

RECOMMENDATIONS

As a result of its investigation, the National Transportation Safety Board made the following recommendations:

-- to the National Highway Traffic Safety Administration:

Revise Federal Motor Vehicle Safety Standard 217, Bus Window Retention and Release, to include a requirement that floor level emergency exits should be designed so that once opened they remain open during emergencies and

school bus evacuations. (Class II, Priority Action) (H-90-74)

Revise Federal Motor Vehicle Safety Standard 208, Occupant Crash Protection, to include a requirement that lap shoulder belt systems for the driver position be installed in all newly manufactured buses, including city, intercity, small, and large. (Class II, Priority Action) (H-90-75)

Cooperate with the National Association of State Directors of Pupil Transportation Services to prepare a comprehensive school bus emergency evacuation - rescue guide. (Class II, Priority Action) (H-90-76)

Conduct research to determine the safety benefits and disadvantages of larger school bus side windows. (Class II, Priority Action) (H-90-77)

Revise Federal Motor Vehicle Safety Standard 217, Bus Window Retention and Release, to include a requirement for larger side windows in school buses if research proves that larger windows are more beneficial to school bus occupant safety. (Class II, Priority Action) (H-90-78)

--to the Texas Department of Public Safety

Examine the status of emergency management response plans statewide and work in coordination with and provide guidance to county and local governments in complying with the Department of Public Safety Division of Emergency Management emergency response plans requirements. (Class II, Priority Action) (H-90-79)

Evaluate in cooperation with Hidalgo County its compliance with the Texas Disaster Act of 1975. (Class II, Priority Action) (H-90-80)

--to the Texas Education Agency:

Coordinate the modification of school bus specifications prepared jointly with the State Purchasing and General Services Administration and the Texas Department of Public Safety, to include a requirement that lap shoulder belt systems for the driver position be installed in all newly manufactured buses including city, intercity, small, and large. (Class II, Priority Action) (H-90-81)

--to the Hidalgo County:

Develop a system to identify all traffic regulations and traffic control devices in the county and other appropriate jurisdictions within Hidalgo County. (Class II, Priority Action) (H-90-82)

Review emergency response plans in coordination with the Texas Department of Public Safety and update and enforce these plans to be in compliance with the Texas Disaster Act of 1975 and the Department of Public Safety Division of Emergency Management requirements. (Class II, Priority Action) (H-90-83)

--to the City of Alton:

Provide public safety personnel assigned to telephone duties with training in techniques of handling calls for emergency assistance. (Class II, Priority Action) (H-90-84)

Provide public safety personnel with guidance in handling emergency response, command, and on-scene control of community-wide emergencies and disaster. (Class II, Priority Action) (H-90-85)

--to the Mission Consolidated Independent School District:

Institute procedures that will ensure accurate review of the school busdriver medical examination report form and related documents and enforcement of any limitations. (Class II, Priority Action) (H-90-86)

--to the Coca-Cola Enterprises, Inc.:

Conduct a review and evaluate the number of mechanics and the provided resources in each of its operations to ensure that proper vehicle maintenance is performed in accordance with manufacturer specifications. (Class II, Priority Action) (H-90-87)

--to the Valley Coca-Cola Bottling Co., Inc.:

Develop and implement a formal truck driving training program including classroom and behind-the-wheel instruction with emphasis on driving articulated vehicles, using seatbelts, and complying with traffic regulations. The program should include maintaining adequate records and other documentation of driver examinations, including road test results. The training should be performed by qualified instructor(s). (Class II, Priority Action) (H-90-88)

Establish procedures and provide adequate resources to ensure that proper vehicle maintenance is performed in accordance with manufacturer specifications. (Class II, Priority Action) (H-90-89)

--to the National Association of State Directors of Pupil Transportation Services:

Cooperate with the National Highway Traffic Safety Administration to convene a national task force to prepare a comprehensive school bus emergency evacuation-rescue guide. (Class II, Priority Action) (H-90-90)

Also, the Safety Board reiterated Safety Recommendation H-89-5 to the National Highway Traffic Safety Administration:

Revise Federal Motor Vehicle Safety Standard 217, Bus Window Retention and Release, to require that school bus egress be based on vehicle occupant capacity and be no lower than those currently required for nonschool buses. (Class II, Priority Action) (H-89-5)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ James L. Kolstad
Chairman

/s/ Susan Coughlin
Vice Chairman

/s/ John K. Lauber
Member

Jim Burnett, Member, filed the following concurring and dissenting statement:

I concur with the probable cause as adopted, but would have added that, "contributing to the severity of the accident was the deficient condition of the truck's brakes."

I voted not to adopt the report because the report deals inadequately with the issue of the performance of the brakes on the Coca Cola truck and its effect on the accident scenario.

July 17, 1990

APPENDIXES

APPENDIX A

INVESTIGATION AND HEARING

Investigation

The National Transportation Safety Board was notified of this accident via a news report about 10 a.m. on September 21, 1989. A Board Member and highway accident investigators were dispatched from Safety Board headquarters in Washington, D.C. Safety Board investigators from its Denver, Colorado; Fort Worth, Texas; and Seattle, Washington regional offices were also assigned to assist with the investigation. The Safety Board team arrived at the accident scene at about 7:30 p.m. on September 21, 1989. Participating in the investigation were representatives of the Federal Highway Administration, San Antonio, Texas; Texas Department of Public Safety; Texas Education Agency; Texas State Department of Highways and Public Transportation; Hidalgo County; the City of Alton, Texas; Navistar International Transportation Corporation; Valley Coca-Cola Bottling Co., Inc.; Blue Bird Body Co., Inc.; and Mission Consolidated Independent School District.

Hearing

No public hearing or deposition was held in conjunction with this investigation.

APPENDIX B

Description of Drowned Students

Sex	Age	Height	Weight (lbs.)	Evidence of Injury*
M	18	70"	170-175	Minor
M	12	58"	70-80	None
F	15	63"	100-110	None
F	17	64.5"	180-200	None
F	16	61"	100-105	Minor
M	14	68"	180-190	None
M	14	64"	150-160	Minor
F	14	66"	90-100	None
F	13	60"	90-100	Minor
M	14	68"	165-170	Minor
M	13	59.5"	80	None
M	15	64"	200-220	Minor
F	12	61"	90-100	Minor
M	14	68.5"	180-190	Minor
F	13	65"	90-100	None
F	13	59"	100-110	None
F	12	59"	100-110	None
F	12	60"	90-100	None
M	12	61"	90-100	Minor
F	15	N/A	N/A	None
F	15	67.5"	130	None

*The evidence of injury category as used in this table describes the general nature of the injuries and is not an injury classification per se.

APPENDIX C

Abbreviated Injury Scale[21]

	Drivers	Passengers	Others*	Total
Unsurvivable (AIS-6)	0	0	0	0
Critical (AIS-5)	0	0	0	0
Severe (AIS-4)	0	0	0	0
Serious (AIS-3)	0	0	0	0
Moderate (AIS-2)	2	3	0	5
Minor (AIS-1)	0	68**	1*	69
None (AIS-0)	0	6	0	6
Unknown (AIS-9)	0	5	0	5
Total	2	82	1	85

*"Others" includes a fireman injured during rescue operations.

** Includes 21 deceased bus passengers, 46 surviving students with minor injuries, in addition to the truck helper. Drowning is not considered an injury under the Abbreviated Injury Scale system.

[21]Abbreviated Injury Scale (AIS) refers to the abbreviated injury scale (1985) of the American Association for the Advancement of Automotive Medicine.

APPENDIX D

Description of Damage to Windows on Right Side of School Bus

Window 1, the main frame and both windows were missing. This window was later recovered by divers from the caliche pit. The opening in the side wall was 25 inches wide by 23 inches high. The top window sash and glass were in place in the main frame and were operable. The bottom glass pane was missing. Both sides of the frame were deformed outboard at the top, about 8 to 10 inches of the frame.

Window 2, the top window was closed and operable. No damage was observed.

Window 3, the frame was in place and the top and bottom sash were missing. The opening was 24 3/4 inches wide and 22 inches high.

Windows 4-7, the top window was open 9 inches and was operable. No damage was observed.

Window 8, the main frame was in place, and the top and bottom sash were missing. The opening was 23 3/4 inches wide and 22 inches high.

Window 9, the top sash was open 9 inches and operable. The exterior rain shield was bent upward 1 1/2 inches over the rear 7 inches of the top sash.

Window 10, the top sash was closed and operable. The bottom glass pane was missing.

Window 11, the glass from each sash was missing. The forward edge of the top sash was displaced downward 5 inches and was found loose in the main frame.

Window 12, the main frame was in place and was distorted 4 inches rearward at the center front side and distorted 1/2 inch at the center rear side. Both glass panes were missing.

Windows 13-14, the top sash was down and operable. No damage was observed.

Window 15, the top sash was open and operable. The glass in the top sash was cracked from the middle of the pane rearward.

APPENDIX E

1990 Revised Edition of Standards for School Buses and Operations, Appendix D, Instructions for Conducting Emergency Exit Drills

APPENDIX D
INSTRUCTIONS FOR CONDUCTING EMERGENCY EXIT DRILLS

There is an urgent need, due to the increased number of pupils being transported and the ever-increasing number of accidents on the highways, to instruct pupils on how to properly vacate a school bus in case of an emergency. It is possible for pupils to block the emergency door if all are trying to get out at the same time. There is also a possibility of danger when pupils jump from the rear emergency door exit. To avoid these situations, schools should organize and conduct emergency exit drills for all pupils who ride the school bus even occasionally.
Reasons for actual emergency evacuations:

1. Fire or danger of fire. Being near an existing fire and unable to move the bus, or being near the presence of gasoline or other combustible material is considered danger of fire and pupils should be evacuated. The bus should be stopped and evacuated immediately if the engine or any portion of the bus is on fire. Pupils should be moved to a safe place 100 feet or more from the bus and instructed to remain there until the driver has determined that the danger has passed.

2. Unsafe position. When the bus is stopped because of an accident, mechanical failure, road conditions, or human failure, the driver must determine immediately whether it is safer for pupils to remain on or evacuate the bus.

3. Mandatory evacuations. The driver must evacuate the bus when:

   a. The final stopping point is in the path of a train or adjacent to railroad tracks.

   b. The stopped position of the bus may change and increase the danger (e.g., a bus comes to rest near a body of water or at a precipice where it could still move and go into the water or over a cliff). The driver should be certain that the evacuation is carried out in a manner which affords maximum safety for the pupils.

   c. The stopped position of the bus is such that there is danger of collision.

4. Sight distance. In normal traffic conditions, the bus should be visible for a distance of 300 feet or more. A position over a hill or around a curve where such visibility does not exist should be considered reason for evacuation.

APPENDIX E

Important factors pertaining to school bus evacuation drills:

1. Safety of pupils is of the utmost importance and must be first considered.

2. All drills should be supervised by the principal or by persons assigned to act in a supervisory capacity.

3. The bus driver is responsible for the safety of the pupils. When the driver is incapacitated and unable to direct the evacuation, school patrol members, appointed pupils or adult monitors should be authorized to direct these drills. It is important to have regular substitutes available.
   Pupils appointed to direct evacuation drills should possess the following qualifications:

   a. Maturity.

   b. Good citizenship.

   c. Live near end of bus route.

   Appointed pupils should know how to:

   a. Turn off ignition switch/shut down engine.

   b. Set emergency brake.

   c. Summon help when and where needed.

   d. Use kick out windows or emergency escape exits.

   e. Set warning devices.

   f. Open and close doors, and account for all pupils passing his station.

   g. Help small pupils off bus.

   h. Perform other assignments.

   i. Use of two-way radio to summon help.

4. Drills should be scheduled in a manner similar to fire drills held regularly in schools. They should be held more often during fall and spring months and conducted when the bus arrives at the school building with the pupils.

5. Drills should be restricted to school property and conducted under the supervision of school officials.

6. Types of drills should be varied.

7. Driver should stay in bus during evacuation drill. He/she must set the parking brake, turn the engine off and place the manual transmission in gear.

8. Pupils should not be permitted to take lunch boxes, books, etc. with them when they leave the bus. The objectives are to get pupils off safely in the shortest time possible ;and in an orderly fashion.

9. Pupils should travel a distance of at least 100 feet from the bus in an emergency drill and remain there until given further directions.

10. All pupils should participate in the drill, including those who ride only on special trips.

11. Each pupil should be instructed in proper safety precautions.

12. Pupils should be instructed in how and where to obtain assistance in emergencies. Written instructions and telephone numbers should be posted in the bus.

There are several different drills:

1. Everyone exits through the front entrance door(s).

2. Everyone exits through the rear-most emergency door(s).

3. Front half exits through the front door and rear half exits through the rear-most door.

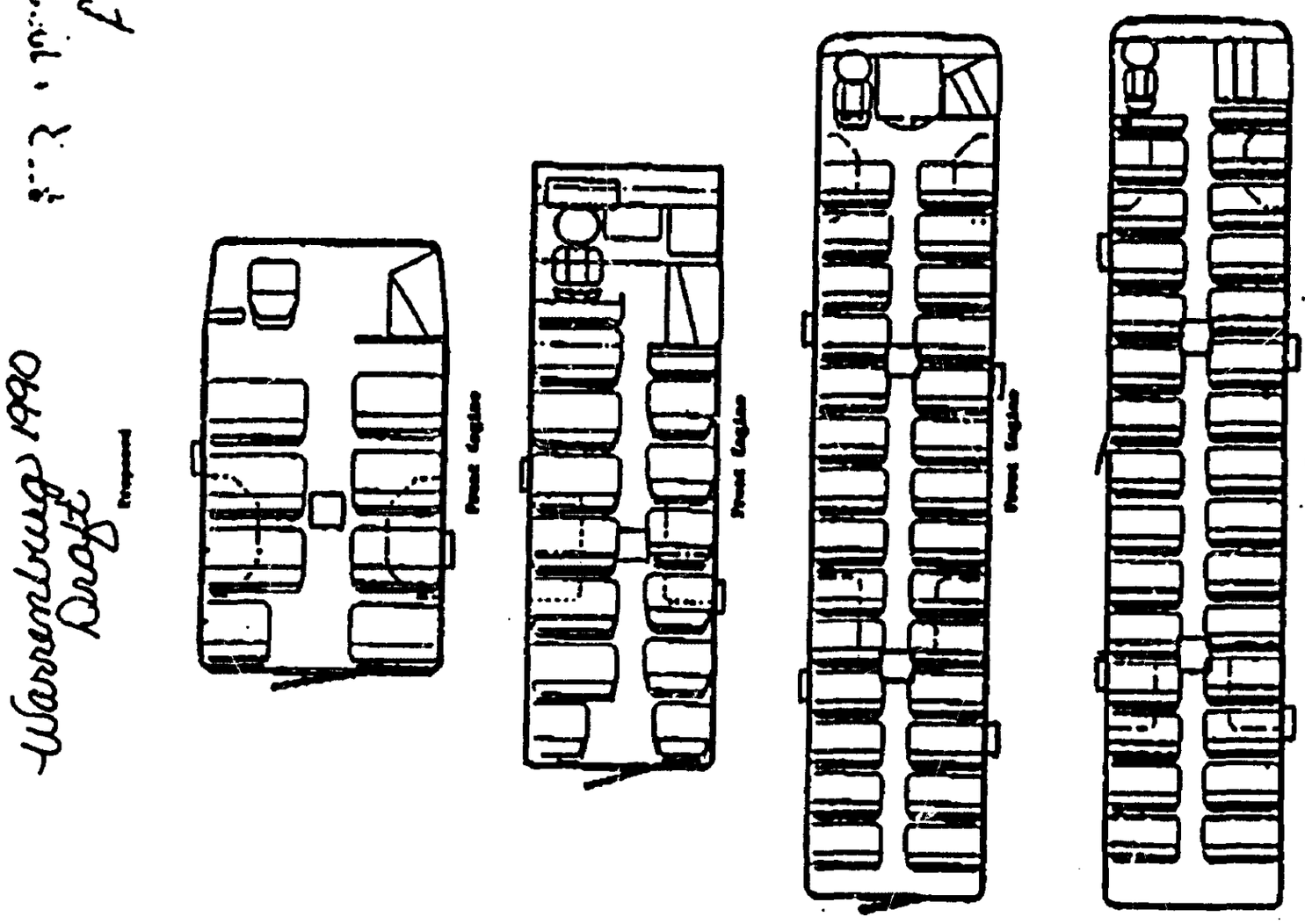
4. All rear engine buses are equipped with a left side emergency door in lieu of a rear emergency door (see diagram).

5. Some states also require side emergency doors in addition to rear emergency doors.

6. Students should be familiar with the operation of emergency windows, both side and rear, and roof hatches. All exits should be opened by students during evacuation drills to ensure their ability to operate such devices.

7. Every school bus driver shall ensure the students assigned to their bus are familiar with the emergency exit configuration of their assigned bus.

8. Identification of seat rows and positions similar to airline seating is recommended, i.e., left front seat 1, a, b, c, right front seat 1, d, e, f, etc. (See Diagram)



APPENDIX E

APPENDIX F

1990 Revised Edition of Standards for School Buses and Operations, Appendix O, Guidelines for Enroute Emergency Bus Evacuation Procedures (For Special Education)

APPENDIX O

GUIDELINES FOR ENROUTE EMERGENCY BUS EVACUATION PROCEDURES

The intent of this procedure is to provide guidelines for evacuating a bus only when absolutely necessary for the safety of students and staff in an emergency situation.

PREPARING AN EMERGENCY EVACUATION PLAN:

Bus staff should have an emergency evacuation plan which considers the individual capabilities and needs of each student, the type of behavior which might be exhibited during an emergency evacuation, and the type of wheelchair or support equipment being used for students. Some issues to consider in establishing an evacuation plan are:

1. Which students could help, and to what extent.

2. How to deal with individual emergencies during the evacuation process, such as seizures.

3. Whether students should be evacuated in their wheelchairs, or removed from their wheelchairs before evacuation.

4. How to disconnect or cut wheelchair securement and occupant protection equipment, including belts, trays, and other support equipment.

5. Identify which students might run after evacuation so they could be evacuated last.

6. Know the length of time a student requiring life support equipment or medical care procedures can survive if such service is interrupted or delayed during the evacuation process.

Every driver and/or attendant should be able to physically carry-out their emergency evacuation plan upon request without hesitation. Many emergencies only allow 3 to 5 minutes to complete an evacuation before possible serious injury to students might occur.

APPENDIX F

ASSESSING THE NEED TO EVACUATE:

Student safety and control is best maintained by keeping students on the bus during an emergency and/or impending crisis situation if doing so does not expose them to unnecessary risk or injury. A decision to evacuate should include consideration of the following conditions:

1. Is there a fire involved?

2. Is there a smell of raw or leaking fuel?

3. Does the possibility exist that the bus will roll/tip causing further threat to safety?

4. Is the bus likely to be hit by other vehicles?

5. Is the bus in direct path of a sighted tornado?

6. Would removing students expose them to speeding traffic, severe weather, or a dangerous environment?

GENERAL PROCEDURES TO FOLLOW FOR EMERGENCY EVACUATION:

1. Keep the situation as orderly and low key as possible.

2. If time and conditions permit, bus driver should use their communication system to advise their office:

   A. Their exact location, including nearest intersecting road or familiar landmark.

   B. The condition creating their emergency.

   C. The type of assistance needed (police-fire-ambulance)

   D. Notification that the bus is being evacuated.

3. Analyze conditions to determine safest exit from bus.

4. During evacuation, monitor conditions and adjust procedures to meet unexpected circumstances.

5. Move evacuated students to the nearest safe location at least 100 feet from the bus.

6. Be prepared to give information to emergency medical personnel regarding individual students medical or physical requirements.

APPENDIX G

1990 Revised Edition of Standards for School Buses and Operations, Appendix F, Evacuation Procedures for Activity Trips and Field Trips

APPENDIX N

EVACUATION PROCEDURES

for

ACTIVITY TRIPS AND FIELD TRIPS

In order to ensure the safety of school bus passengers in an actual emergency, every school bus driver assigned to transport students on activity trips or field trips, shall assign an evacuation team prior to each trip. The team may consist of teachers, coaches, students or any other passenger.

Passengers assigned to evacuation teams must be seated where they can effectively carry out their responsibilities in an emergency.

Each Evacuation Team will consist of at least the following:

1. A passenger assigned to set the parking brake, turn off the engine, turn on overhead flashers and to call in on the radio or other means, and report the incident to the Transportation Department, in case the driver is unable to do so.

2. A passenger assigned to lead passengers to a safe location at least 100 feet from the bus and for taking the first aid kit off the bus.

3. Two passengers assigned to stand outside the bus, next to the front door to help students exit the bus and for taking the fire extinguisher.

4. Two passengers assigned to stand outside the bus next to the rear door, to help students exit the bus.

APPENDIX G

In addition to assigning an evacuation team, the following information shall be discussed and/or demonstrated prior to each activity trip or field trip:

1. Location and use of the fire extinguisher.
2. Location of the first aid kit.
3. Location of the warning reflectors.
4. Location and use of all emergency exits.
5. How to shut off the engine and set the parking brake.
6. How to open the service door, to include, safety releases on manual, air or vacuum doors, if so equipped.
7. Instruct passengers to keep aisles clear at all times and not to block emergency exists.

THE DRIVER OF THIS TRIP DID ASSIGN AN EVACUATION TEAM AND EXPLAINED THE EMERGENCY PROCEDURES TO OUR GROUP.

_____

Sponsor

APPENDIX H

1990 Revised Edition of Standards for School Buses and Operations, Transportation other than to and from school

IX. TRANSPORTATION OTHER THAN TO AND FROM SCHOOL

A. School-Related Activity Operations

Each school system providing activity bus operations shall have comprehensive policies and guidelines for this type of transportation which delegate responsibility for this function to the supervisor of pupil transportation. To provide safe and efficient activity transportation, lines of responsibility and authority need to be defined and personnel involved must have an understanding of their respective responsibility.

In the interest of providing the safest means of transportation available, students should be transported to school-sponsored activities in school buses which meet state and federal standards.

These school-related activity trips may include: field trips which are extensions of the instructional program, athletic trips, vocational and/or trade training, volunteer activities and recreational outings such as dances, picnics and overnight camping trips. These trips range from a few miles to those extending over several days and covering large distances.

The following items need to be considered when developing criteria for activity trip transportation:

1. Policies and guidelines:
   a. Purpose of trip (instructional, athletic, pupil/spectator's recreation, etc.)
   b. Funding source (district or individual school funds, individual charge, parent group, etc.).
   c. Administrative approval:
      1. Person who has authority to approve trip.
      2. A priority guideline should be developed for trip scheduling if all requests cannot be accommodated.

d. Advance notification (Allow adequate time for approval process and for making driver and vehicle arrangements.)

e. Methods of travel (may include district owned or contracted bus, commercial carrier or local transit equipment, air, boat, rail or combination of the above, private or school passenger automobile), when required by special or unique needs.

f. Trip Request Form (should include all necessary information from trip arrangements, payroll, reimbursement and other local needs.). (See Appendix M)

g. Chaperones (An adult chaperone should be required on all activity trips. Responsibilities include passenger control with drivers maintaining final authority.)

h. Discipline and emergency medical procedures (A trip release to be signed by parents should include procedures concerning difficult of severe behavioral and medical problems and emergency policies.)

i. Communication (drivers, pupils, chaperons and parents should be made aware of applicable rules and regulations. Parents should have destination information, mode of transportation, chaperons, departure and return times, appropriate dress and what the pupils should bring with them. A signed note from the parent or guardian is important. A detailed itinerary for all persons involved may be advisable. Identification of special medical problems in the event of an emergency enroute is necessary.)

j. Luggage (A procedure for transporting luggage or equipment prohibited in the passenger compartment by state law and/or local regulations is necessary.

Loose luggage or equipment which could cause injury or block passageways in the event of an accident or sudden maneuver should never be transported in the passenger compartment.)

k. Out-of-state trips (Policies should detail whether out-of-state trips are permitted and any applicable restrictions. Regulations for states to be visited should be reviewed prior to the trip.)

l. Insurance policies (Policies should be reviewed or agents contacted to determine adequacy of coverage. This is an absolute necessity for trips scheduled to another state or country. If vehicles other than district-owned are used, the board of education should determine the minimum insurance coverage to be carried. A current copy of the contract or commercial carrier's insurance should be on file with the school district.)

m. Road and weather check (A person responsible for checking road conditions should be designated. School transportation personnel from other districts, state patrols, highway divisions and auto clubs are generally cooperative in supplying road information. If warranted, the weather bureau should also be contacted. A planned route and any contingent route for trips should be determined prior to initiation of the trip.)

n. Contingency plans (Policies should detail who has authority to make decisions if the unexpected happens during a trip. Impassable roads, accidents or mechanical breakdowns are examples. Drivers and chaperons should have access to that authority's phone number. It is also advisable to obtain phone numbers of transportation personnel in various communities and school districts where activity

vehicles regularly travel. Provisions should include plans for staying overnight if conditions do not permit a safe trip home. It is advisable to develop a mutual aid directory for contact within athletic league boundaries which could provide assistance in the event of mechanical emergencies. Drivers should be trained in procedures and regulations relating to trip accidents.)

o. Driving hours (School districts should have regulations based on a common sense application of the Bureau of Motor Carriers Safety Manual: 15 hours of duty of which 10 hours are driving time; 8 hours continuous off-duty prior to a long trip; no more than 60 hours driving in a week.)

p. Driver selection (Criteria for driver assignments are necessary to avoid conflict and confusion. The criteria should include a driver's knowledge, skill, experience and familiarity with activity trip vehicles. The area to be traveled should also be a consideration. Drivers should be notified at least 3 days in advance of trip date. Drivers who only drive trips occasionally should be periodically tested for driving ability and vehicle familiarity. They shall hold the same license and certification as regular school bus drivers.)

q. A list of all students and passengers being transported should be kept by the driver and left with proper authorities at the school or institution.

r. An emergency evacuation drill or at least a talk through should be given by the driver before each trip. (See Appendix N.)

Vehicle and equipment:

APPENDIX I

1990 Revised Edition of Standards for School Buses and Operations, Emergency Exits

EMERGENCY EXITS

1. Emergency Door:

   A. Emergency door shall be hinged on right side if in rear end of bus and on front side if on left or right side of bus. It shall open outward and be labeled inside to indicate how it is to be opened. If double emergency doors are used on Type A vehicles, they shall be hinged on the outside edge and shall have a 3-point fastening device. A device shall be used that holds the door open to prevent the emergency door from closing during emergencies and school bus evacuation drills.

B. Upper portion of emergency door shall be equipped with approved safety glazing, exposed area of which shall not less than 400 square inches. The lower portion of the rear emergency door on Type B, C, and D vehicles shall be equipped with a minimum of 350 square inches of approved safety glazing.

C. There shall be no steps leading to emergency door.

D. Words "EMERGENCY DOOR," both inside and outside in letters at least 2 inches high, shall be placed at top of or directly above the emergency door or on the door in the metal panel above the top glass.

E. The emergency door shall be equipped with padding at top edge of each door opening. Pad shall be at least 3 inches wide and 1 inch thick, and extend the full width of the door opening.

F. The side emergency door, if installed, must meet the requirements as set forth in FMVSS 217, S 5.4.2.1,(b), regardless of its use with any other combination of emergency exits. (See Appendix)

G. There shall be no obstruction higher than 1/4 inch across the bottom of any emergency door opening.

2. Emergency Exits

A. Type A, B, C, and D vehicles shall be equipped with emergency exits in the following capacity vehicles.

(0) to (22) Passenger = (1) emergency exit per side and 1 roof hatch

(23) to (65) Passenger = (1) emergency exits per side and 2 roof hatches

(66 and above) = (2) emergency exits per side and 2 roof hatches

Each emergency exit shall comply with FMVSS 217. These emergency exits are in addition to the rear emergency door or exit.

In addition to side and rear emergency exits, doors, or windows, one or more roof hatch(s) may be installed provided they meet all requirements specified in FMVSS 217.

In addition to the audible warning required on emergency doors by FMVSS 217 additional emergency exits may be likewise protected.

APPENDIX J

PROPOSED NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION, HIGHWAY SAFETY PROGRAM GUIDELINE 17, CHAPTER IV

In consideration of the foregoing, NHTSA proposes to amend 23 CFR part 1204 as follows:

PART 1204—[AMENDED]

1. The authority citation for part 1204 would continue to read as follows:

Authority: 23 U.S.C. 402; delegations of authority at 49 CFR 1.48 and 1.50.

§ 1204.4 [Amended]

2. Highway Safety Program Guideline No. 17, Pupil Transportation Safety, would be revised to read as follows:

Highway Program Guideline No. 17—Pupil Transportation Safety

I. *Scope.* This guideline establishes minimum recommendations for a State highway safety program for pupil transportation safety including the identification, operation, and maintenance of vehicles used for carrying students, training of passengers, pedestrians, and bicycle riders, and administration.

II. *Purpose.* The purpose of this guideline is to minimize, to the greatest extent possible, the danger of death or injury to school children while they are traveling to and from school and school-related events.

III. *Definitions.*

"Bus" is a motor vehicle designed for carrying more than 10 persons (including the driver).

"Federal Motor Carrier Safety Regulations (FMCSR)" are the regulations of the Federal Highway Administration (FHWA) for commercial motor vehicles in interstate commerce, including buses with a gross vehicle weight rating (GVWR) greater than 10,000 pounds or designed to carry 16 or more persons (including the driver), other than buses used to transport school children from home to school and from school to home. (The FMCSR are set forth in 49 CFR parts 355, 380–399.)

"School-chartered vehicle" is a motor vehicle that is operated under a short-term contract with State or school authorities who have acquired the exclusive use of the vehicle at a fixed charge to provide transportation for a group of students to a special school-related event.

"School bus" is a "bus" that is used for purposes that include carrying students to and from school or related events on a regular basis, but does not include a transit bus operated under contract with State or local authorities to provide transportation for these purposes or a school-chartered vehicle.

"School vehicle" is any vehicle that is a "school bus," a transit bus operated under contract with State or local authorities to transport students to and from school or related events on a regular basis, or a passenger van (a passenger vehicle constructed on a truck chassis) that is owned by, or operated under contract with, school officials or with State or local authorities for that purpose, but does not include a school-chartered vehicle.

IV. *Pupil Transportation Safety Program Administration and Operations.*

Recommendation. Each State, in cooperation with its school districts and other political subdivisions, should have a comprehensive pupil transportation safety program to assure that school vehicles and school-chartered vehicles are operated and maintained so as to achieve the highest possible level of safety.

A. *Administration*

1. There should be a single State agency having primary administrative responsibility for pupil transportation, and employing at least one full-time professional to carry out these responsibilities.

2. The responsible State agency should develop an operating system for collecting and reporting information needed to improve the safety of operating school vehicles and school-chartered vehicles. This includes the collection and evaluation of uniform crash data consistent with the criteria set forth in Highway Safety Program Guidelines No. 10 "Traffic Records" and No. 18, "Accident Investigation and Reporting."

B. *Identification and equipment of school vehicles.* Each State should establish procedures to meet the following recommendations for identification and equipment of school vehicles.

1. All school vehicles other than a transit bus operated under contract with State or local authorities to provide pupil transportation should:

a. Be identified with the words "School Bus" printed in letters not less than eight inches high, located between the warning signal lamps as high as possible without impairing visibility of the lettering from both front and rear, and have no other lettering on the front or rear of the vehicle.

b. Be painted National School Bus Glossy Yellow, in accordance with the colorimetric specification of National Institute of Standards and Technology (NIST) Federal Standard No. 595a, Color 13432, except that the hood should be either that color or lusterless black, matching NIST Federal Standard No. 595a, Color 37038.

c. Have bumpers of glossy black, matching NIST Federal Standard No. 595a, Color 17038, unless, for increased night visibility, they are covered with a reflective material.

d. Be equipped with safety equipment for use in an emergency, including a charged fire extinguisher, that is properly mounted near the driver's seat, with signs indicating the location of such equipment.

e. Be equipped with device(s) demonstrated to enhance the safe operation of school vehicles, such as a stop signal arm.

2. In addition to meeting the recommendations specified under section IV.B.1, all school buses should:

a. Be equipped with a system of signal lamps that conforms to the school bus requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 108, 49 CFR 571.108.

b. Have a system of mirrors that conforms to the school bus requirements of FMVSS No. 111, 49 CFR 571.111, and provides the seated driver a view to the rear along both sides of the bus and a view of the front bumper and the area in front of the bus. Mirrors should be positioned and adjusted such that when a rod, 30 inches long, is placed upright on the ground at any point along a traverse line 1 foot forward of the forward-most point of a school bus, at least 7½ inches of the length of the rod should be visible to the driver either by direct view or by the system of mirrors.

3. Transit buses operated under contract with State or local authorities to provide pupil transportation should:

a. Be equipped with safety equipment for use in an emergency, including a charged fire extinguisher, that is properly mounted near the driver's seat, with signs indicating the location of such equipment.

b. While transporting children to and from school, be equipped with temporary signs located conspicuously on the front and back of the vehicle. The sign on the front should have the words "School Bus" printed in black letters not less than 6 inches high, on a background of National School Bus Glossy Yellow, as specified in section 1.b. The sign on the rear should be at least 10 square feet in size and should be painted National School Bus Glossy Yellow as specified in section 1.b and have the words "School Bus" printed in black letters not less than 8 inches high. Both the 6-inch and 8-inch letters should be Series "D" as specified in the Standard Alphabet for Highway Signs, FHWA, D.O.T., 1966.

4. Any school vehicle meeting the identification recommendations of sections 1.a–e or 2.a–b above that is permanently converted for use wholly for purposes other than transporting children to and from school or school-related events should be painted a color other than National School Bus Glossy Yellow, and should have the stop arms and school bus signal lamps described by §§ 1.e and 2.a removed.

5. School vehicles, while being operated on a public highway and transporting primarily passengers other than school children, should have the words "School Bus" covered, removed, or otherwise concealed, and the stop arm and signal lamps described by §§ 1.e and 2.a should not be operable through the usual controls.

C. *Operations.* Each State should establish procedures to meet the following recommendations for operating school vehicles and school-chartered vehicles.

1. *Personnel.* a. Each State should develop a plan for selecting, training, and supervising persons whose primary duties involve transporting school children in order to assure that such persons will attain a high degree of competence in, and knowledge of, their duties.

b. Every person who drives a school vehicle or school-chartered vehicle occupied by school children should, as a minimum:

(1) Have a valid State driver's license to operate such a vehicle. All drivers who operate a vehicle designed to carry 16 or more persons (including the driver) are required by FHWA's Commercial Driver's License Standards (49 CFR part 383) to have a valid commercial driver's license.

(2) Meet all physical, mental, and moral requirements established by the State agency having primary responsibility for pupil transportation.

(3) Have a traffic record free from arrests, convictions, and crashes for at least three years and provide clear documentation that there is no evidence of drug and/or alcohol misuse or abuse.

APPENDIX J

(4) Be qualified as a driver under the Federal Motor Carrier Safety Regulations of the FHWA, 49 CFR part 391, if the driver's employer is subject to those regulations.

2. *Vehicles.* a. Each State should enact legislation that provides for uniform procedures regarding school vehicles stopping on public highways for loading and discharge of children. Public information campaigns should be conducted on a regular basis to ensure that the driving public fully understands the implications of school bus warning signals and requirements to stop for school vehicles that are loading or discharging school children.

b. Each State should develop plans for minimizing highway use hazards to school vehicle and school-chartered vehicle occupants, other highway users, pedestrians, bicycle riders and property. They should include, but not be limited to:

(1) Careful planning and annual review of routes for safety hazards.

(2) Planning routes to assure maximum use of school vehicles and school-chartered vehicles, and avoid passengers standing while these vehicles are in operation.

(3) Providing loading and unloading zones off the main traveled part of highways, whenever it is practical to do so.

(4) Establishing restricted loading and unloading areas for school vehicles and school-chartered vehicles at or near schools.

(5) Ensuring that school bus operators, when stopping on a highway to take on or discharge children, adhere to State regulations for loading and discharging including the use of signal lamps as specified in section 2.a.

(6) Prohibiting, by legislation or regulation, operation of any school vehicle unless it meets the equipment and identification recommendations of this guideline.

(7) Replacing, consistent with the economic realities which typically face school districts, those school buses which are not manufactured to meet the April 1, 1977 Federal Motor Vehicle Safety Standards for School Buses, with those manufactured to meet the stricter school bus standards.

c. Use of amber signal lamps while loading or unloading children is at the option of the State. Use of red warning signal lamps as specified in § 2.a above for any purpose or at any time other than when the school bus is stopped to load or discharge passengers should be prohibited.

d. When school vehicles are equipped with stop arms, such devices should be operated only in conjunction with red warning signal lamps, when vehicles are stopped.

e. Seating. (1) Standing while school vehicles and school-chartered vehicles are in motion should not be permitted. Routing and seating plans should be coordinated so as to eliminate passengers standing when a school vehicle or school-chartered vehicle is in motion.

(2) Seating should be provided that will permit each occupant to sit in a seat intended by the vehicle's manufacturer to provide accommodation for a person at least as large as a 5th percentile adult female, as defined in 49 CFR 571.208.

(3) There should be no auxiliary seating accommodations such as temporary or folding jump seats in school vehicles.

(4) Drivers of school vehicles and school-chartered vehicles should be required to wear occupant restraints whenever the vehicle is in motion.

(5) Passengers in school vehicles and school-chartered vehicles with a gross vehicle weight rating (GVWR) of 10,000 pounds or less should be required to wear occupant restraints (where provided) whenever the vehicle is in motion.

f. Emergency exit access. Baggage and other items transported in the passenger compartment should be stored so that the aisles are kept clear and the door(s) and emergency exit(s) remain unobstructed at all times.

D. *Vehicle maintenance.* Each State should establish procedures to meet the following recommendations for maintaining vehicles used to carry school children:

1. School vehicles should be maintained in safe operating condition through a systematic preventive maintenance program.

2. All school vehicles should be inspected at least semiannually. In addition, school vehicles and school-chartered vehicles subject to the Federal Motor Carrier Safety Regulations of FHWA should be inspected and maintained in accordance with those regulations (49 CFR parts 393 and 396).

3. School vehicle drivers should be required to perform daily pre-trip inspections of their vehicles, and the safety equipment thereon (especially fire extinguishers), and to report promptly and in writing any problems discovered that may affect the safety of the vehicle's operation or result in its mechanical breakdown. Pre-trip inspection and condition reports for school vehicles and school-chartered vehicles subject to the Federal Motor Carrier Safety Regulations of FHWA should be performed in accordance with those regulations (40 CFR 392.7, 392.8, and 396).

E. *Other Aspects of Pupil Transportation Safety.*

1. At least once during each school semester, each pupil transported in a school vehicle should be instructed in safe riding practices, proper loading and unloading techniques, proper street crossing to and from school bus stops and participate in supervised emergency evacuation drills.

2. Parents and school officials should work together to select and designate the most safe pedestrian and bicycle routes for the use of school children.

3. All school children should be instructed in safe transportation practices for walking to and from school. For those children who routinely walk to school, training should include preselected routes and the importance of adhering to those routes.

4. Children riding bicycles to and from school should receive bicycle safety education, wear bicycle safety helmets, and not deviate from preselected routes.

5. Local school officials and law enforcement personnel should work together to establish crossing guard programs.

6. Local school officials should investigate programs which incorporate the practice of escorting students across streets and highways when they leave school vehicles. These programs may include the use of school safety patrols or adult monitors.

7. Local school officials should establish passenger vehicle loading and unloading points at schools that are separate from the school vehicle loading zones.

V. *Program evaluation.* The pupil transportation safety program should be evaluated at least annually by the State agency having primary administrative responsibility for pupil transportation.

Issued on May 11, 1990.

Howard M. Smolkin,

Executive Director, National Highway Traffic Safety Administration.

Thomas D. Larson,

Federal Highway Administration.

[FR Doc. 90-11426 Filed 5-11-90; 4:59 pm]

BILLING CODE 4910-59-M

Coast Guard

33 CFR Part 117

[CGD1-90-040]

Drawbridge Operation Regulations; Newtown Creek (East Branch), East River, and Dutch Kills, NY

AGENCY: Coast Guard, DOT.

ACTION: Proposed rule.

SUMMARY: At the request of the New York City Department of Transportation (NYCDOT), the Coast Guard is considering a change to the regulations governing the Grand Street/Avenue drawbridge over East Branch of New town creek, at mile 3.1 between the boroughs of Brooklyn and Queens, New York the Roosevelt Island drawbridge over the East River, at mile 6.4 between Roosevelt Island and Queens, New York, and the Borden Avenue and Hunters Point Avenue drawbridges over Dutch Kills, at miles 1.2 and 1.4, respectively in Queens, New York by permitting these NYC moveable highway bridges to be manned and operated on an advance notice basis with a roving team normally based at the Borden Avenue bridge across Dutch Kills. This proposal is being made because of the relatively close proximity and limited openings of these bridges, as well as desire to provide timely openings and efficient utilization of manpower. This action should relieve the bridge owner of the burden of having a person constantly available to open the draw of the Grand Street/Avenue bridge and should still provide for the reasonable needs of navigation.

DATES: Comments must be received on or before July 2, 1990.

ADDRESSES: Comments should be mailed to Commander (obr), First Coast Guard District, Bldg. 135A, Governors Island, NY 10004-5073. The comments

APPENDIX K

COURSE GUIDE FOR SCHOOL BUS DRIVER TRAINING IN TEXAS, TEXAS EDUCATION AGENCY, REVISED 1987, SELECTED SECTIONS FROM UNIT 6, SAFETY AND EMERGENCY PROCEDURES

UNIT SIX: SAFETY AND EMERGENCY PROCEDURES

1. OVERVIEW

The driver is responsible for the safety and well-being of the passengers being transported as well as for the safe operation of the vehicle. The driver is in full charge of the bus at all times. Knowledge of proper emergency procedures and accident scene procedures is a must! These areas of responsibility deal directly with the safety and care of passengers in the event of an accident, as well as other emergency situations which may arise.

2. CONCEPTS

a. In emergency situations, expeditious and orderly movement of people contributes to safety.

b. Expeditious and orderly movement of people can be accomplished by understanding and practicing recommended evacuation procedures

c. In any emergency situation, the safety of bus passengers should be the first consideration of the driver.

3 INTENDED LEARNING OUTCOMES

a. Identify and demonstrate the use of required emergency equipment on the school bus

b. Identify the recommended procedures to be followed when a school bus is involved in an accident and/or becomes disabled

c. Demonstrate the recommended procedures for front door and rear door emergency evacuation of a school bus

4 CONTENT

a. Description and use of emergency equipment on the bus

(1) Red reflectors as warning devices

(a) Three red reflectors are located in the driver's compartment

(b) Reflectors may be used either day or night

(c) Warning reflectors should be properly placed.

- Place the first reflector at the side of bus nearest the roadway, approximately 10 feet to the rear of the bus
- Place second reflector approximately 40 paces or 100 feet to the rear of the bus
- Place third reflector 40 paces or 100 feet to the front of the bus on the roadway side.
- Place reflectors at greater distances if conditions warrant.

(2) Emergency hazard flashers. These flashers should be used as a warning device. They should be activated when a need exists to draw other drivers' attention to the bus. For example,

should be used in case of mechanical failure on the highway when the driver is aring to stop at a railroad crossing.

(3) Fire extinguisher. One five-pound or larger dry chemical type fire extinguisher shall be located in driver's compartment. A five-pound extinguisher has approximately 60 seconds of use.

(a) Use of dry chemical fire extinguishers

- Remove extinguisher from mounting bracket
- Hold extinguisher in vertical position
- Release safety device
- Squeeze handle to discharge chemicals
- Direct chemical discharge at the base of the flame

(b) Recharge fire extinguisher after each use, and check periodically for proper operating pressure.

(4) First aid kit. Each bus shall have a removable metal first aid kit container mounted in an accessible place within driver's compartment. Replace any item used from emergency equipment supplies as soon as possible.

b. Emergency procedures for mechanical breakdown

(1) If possible, move bus off roadway to prevent accidents.

(2) Turn off ignition switch and remove key.

(3) Set hand brake.

(4) Activate emergency hazard flashers, and place reflectors in recommended positions if conditions warrant.

(5) If possible, request two different passing motorists to notify school officials of bus location and suspected mechanical failure. The driver should provide the assisting motorists with the proper number to call. The driver should remain with the bus.

(6) Keep pupils on the bus, in most cases. Pupil safety is the highest priority. Safety conditions may warrant evacuation of bus. If students are evacuated, the driver should give precise instructions as to where students should relocate and how they should do it.

(7) Upon arrival, the relief bus should stop in line with and as close as possible to the rear of the disabled bus.

(8) Drivers of both buses shall activate the alternating red flasher lights prior to transferring students from one bus to the other.

(9) The driver of the disabled bus shall open the door, get out of the bus, and stand to the left of the door.

(10) The driver of the relief bus should open the door, get out of the bus, and stand to the right of the door of the relief bus.

(11) The driver of the disabled bus shall instruct pupils to change buses in an orderly manner staying in single file.

(12) The alternating red flasher lights on each bus shall be deactivated as soon as all students are on the relief bus.

(13) After all pupils have been loaded on the relief bus, the regular driver should complete the route.

(14) The driver of the relief bus should assist in getting the loaded bus back [illegible] roadway.

(15) The driver of the relief bus should [illegible] the disabled bus with [illegible]

c. Accident procedures If an accident results [illegible] on a main lane, ramp, shoulder, median, or [illegible] and each vehicle involved can be safely driven, each driver should move [illegible] a designated accident investigation area, if available, or other [illegible] interference with other freeway traffic and the possibility of additional [illegible]

If injuries are involved and one or both of the involved vehicles are [illegible] procedures shall be followed

(1) Turn off ignition switch and remove keys.

(2) Set hand brake

(3) Remain calm and reassure students

(4) Account for all students as a check is made for injury of students. If students are injured, follow recommended first aid procedures

(5) Students should be kept on bus unless safety hazards warrant evacuation. Safety of students is the highest priority. If evacuation is deemed necessary, the recommended procedures for evacuation should be followed

(6) Request assistance of passing motorists in notifying state highway patrol or other legal investigating officer, and in notifying local school administrators of the accident and its location.

(7) Protect the accident scene from further damage

(a) Check for fire or possibility of fire.

(b) Activate emergency hazard flashers and place reflectors in designated locations.

(c) Recruit adult assistants to flag approaching vehicles from all directions. Flagmen should take positions and operate approximately 100 yards from the accident.

(d) If the accident occurs at night, direct headlight beams on vehicles involved in the accident.

Have flagmen avoid undue traffic congestion by directing tr. round the accident scene. In some cases, it may be necessary to stop all traffic. a. craffic is stopped, all drivers should be instructed to park at least 100 feet from the accident and to remain in their veh'cles unless requested to do otherwise.

(8) Discuss facts relating to the accident only with investigating officers and school officials.

(9) Follow the requirement that drivers in an accident give their names, addresses, driver's license numbers, and vehicle information to others involved in the accident. The bus driver should also get names and addresses of witnesses to the accident.

(10) Do not continue transportation of students from the accident scene until authorized to do so by school officials.

(11) Complete Accident Report Form ST-2 and forward to the Texas Department of Public Safety within 10 days of an accident involving $250 or more in damages or personal injury. However, if the accident was investigated by a law enforcement officer, the officer's report will fulfill the above requirement.

(12) Prepare and submit to school officials a complete and comprehensive report of the accident within five days

Emergency evacuation of school buses

The need for emergency evacuation procedures

prevailing conditions will warrant the evacuation of students from a school when evacuation is deemed necessary by the driver, it is imperative that procedures be followed in conducting the evacuation. In order to expedite evacuation and eliminate confusion and disorder, the evacuation procedures hereafter described should be utilized.

Use of student assistants

Utilization of student assistants on school buses can promote safety for all students. On each regular route, and on special trips, the driver should request that four mature and responsible students serve as assistants. Parental or guardian written consent should be obtained prior to designating student assistants. A possible source for obtaining student assistants would be the high school student council safety committee.

Student assistants should be instructed as to responsibilities, duties, and procedures. In addition, assistants should know procedures to follow in case the driver is incapacitated.

(a) *Position and duties of rear door assistants*

- One assistant should be positioned on each side of the aisle in the seat nearest the rear door. The third assistant should sit on the next-to-last seat on the right-hand side next to the aisle.
- Assistants should prevent students from touching the emergency door.
- Assistants should open the door on command of the driver or, if the driver is unable to give such a command, open the emergency door when a rear evacuation is necessary.

- Assistants should exit first and assist passengers as they alight from the bus. The third rear door assistant should exit the bus immediately behind the two that were seated on either side of the rear door.
- Assistants should check the bus to make certain all passengers are out of the bus when front door evacuation is utilized.
- In a rear door evacuation, the third rear door assistant should lead passengers to a safe place, and assist in keeping order to maintain safety.

(b) Position and duties of front door assistant

- The front door assistant shall be seated next to the aisle on the front right-hand side of the bus and shall assist the driver in the event he or she is incapacitated.
- In a front door evacuation, depart the bus first and lead the passengers to a place of safety designated by the driver, or one of his or her own choosing if none is designated by the driver.
- Assist in keeping the passengers orderly and together while out of the bus.
- If the driver is incapacitated, make certain all passengers have departed the bus when rear door evacuation procedures are used.

(3) Evacuation procedures

(a) Front door evacuation

- Bus must be stopped, parking brake set, and engine turned off.
- The driver should stand, open the door, face the passengers and get their attention.
- The driver gives the command, "Front door evacuation." If the driver is incapacitated, the front door assistant should give the command. Passengers should be reminded that all books, lunches, etc., should be left on the bus.
- The front door assistant should rise and step out of the bus and lead pupils to a place of safety.
- Standees on the bus should follow the assistant prior to seated passengers assuming a standing position.
- Passengers seated in the front seat of the bus on the right-hand side should rise and leave the bus followed by the passengers occupying the front seat on the left-hand side.
- The evacuation should continue as described, alternating right-hand and left-hand seats, from the front of the bus backward until all passengers are out.
- When the last passenger has apparently departed the bus, the driver should walk to the rear of the bus checking under and between seats to make certain that complete departure has been achieved.
- When the driver is certain that all passengers have departed, the fire extinguisher, first aid kit, flares, and reflectors should be transported from the bus.
- The driver shall check to see that all passengers are in a safe area and behaving in an orderly manner.
- The driver shall place the flares and reflectors in keeping with state statutes.

(b) Rear door evacuation

- The bus must be stopped, parking brake set, and engine turned off.
- The driver should stand, face the pupils, and get their attention.
- The driver gives the command, "Rear door evacuation." Passengers should be reminded that all books, lunches, etc., should be left on the bus.
- The two rear door assistants sitting on the back seats of the bus should open the emergency door, get out of the bus, stand one on each side of the door and provide assistance to passengers in departing the bus.
- The third rear door assistant seated in the rear of the bus should follow the first two helpers out of the bus and lead passengers to an area of safety.
- Standees on the bus should follow the third rear door assistant in departing the bus.
- Passengers on the back seat right-hand side should rise and depart the bus followed by the passengers on the back seat left-hand side.
- The evacuation continues as described, right-hand back and left-hand back seats alternately until the last passenger has departed the bus. The driver should move toward the rear of the bus as the passengers depart, making certain that they all have departed the bus. The driver should check between and under all seats as movement toward the rear of the bus is made. After the bus is evacuated of all students, the two remaining assistants should then follow passengers to an area of safety.
- When the driver is certain that all passengers have departed the bus, the fire extinguisher, first aid kit, flares, and reflectors should be transported from the bus.
- The driver should check to see that all passengers are in a safe area and behaving in an orderly manner.
- The driver shall place the flares and reflectors in keeping with state statutes.

(c) Front and rear door evacuation

- The bus must be stopped, parking brake set, and engine turned off.
- The driver should stand, open the door, face the pupils and get their attention.
- The driver gives the command, "Front and rear door evacuation." Passengers should be reminded that all books, lunches, etc., should be left on the bus.
- Passengers in the front half of the bus exit through the front door and passengers in the rear half of the bus exit through the rear door.
- Procedures for front and rear door evacuation as previously described should be followed.
- When all passengers have apparently departed, the driver should walk to the rear of the bus checking to make certain that all passengers have in fact departed.
- When the driver is certain that all passengers have departed the bus, the fire extinguisher, first aid kit, flares, and reflectors should be transported from the bus.
- The driver should then check to see that all passengers are in a safe area and behaving in an orderly manner.
- The driver shall then place fuses and reflectors in keeping with state laws.

VALUABLE CARGO

APPENDIX K

THINGS TO REMEMBER

Description and Use of Emergency Equipment on Bus

Emergency Procedures for Mechanical Breakdown

Accident Procedures

Emergency Evacuation of School Buses

TEST YOUR UNDERSTANDING

TRUE/FALSE: Read each statement carefully. If the statement is true, place a "T" in the blank to the left. If the statement is false, place an "F" in the blank to the left.

_____ 1. Three red reflectors are required emergency equipment on a bus.

_____ 2. A fire extinguisher is optional on a school bus.

_____ 3. The first aid kit should be used in emergency accident situations only.

_____ 4. In case of mechanical breakdown, the driver should first send two students to get help.

_____ 5. In most cases, it is better to keep the students on a disabled bus.

_____ 6. In any situation, the safety of students is the highest priority.

_____ 7. Facts relating to an accident should be discussed only with investigating officers and school officials.

_____ 8. Utilization of student assistants on school buses is not recommended.

_____ 9. There are three types of bus evacuation procedures that may be used.

_____ 10. Students should take along all personal items when departing the bus in an emergency evacuation.

MULTIPLE CHOICE: Read the questions and each answer carefully. Select the correct answer and place the letter identifying that answer in the blank to the left.

_____ 1. In a front door evacuation procedure, on which side should students depart the bus first:

a. Right side
b. Left side
c. Makes no difference
d. Both at one time

_____ 2. In a mechanical breakdown situation, the first red reflector should be placed:

a. By the rear bumper
b. By the front bumper
c. 20 feet to the rear
d. 10 feet to the rear

_____ 3. When moving riders from a disabled bus to a relief bus, the red alternating flashers should be activated on:

a. Disabled bus only
b. Relief bus only
c. Both buses
d. Neither bus

_____ 4. When four student assistants are used, it is recommended that they be positioned in which of the following ways?

a. Three rear/one front
b. Two rear/two front
c. One front/two middle/one rear
d. It makes no difference

_____ 5 Regardless of the evacuation procedure used, the last thing the driver should do prior to leaving the bus is:

a. Call the roll
b. Ask if everyone is off
c. Have a student check the bus for remaining students
d. Personally check the bus for remaining students

APPENDIX L
National Highway Traffic Safety Administration,
Example of Application of S5.2 for an 83-Passenger Nonschool Bus

Example of application of S5.2 for an 83-passenger non-school bus.

Under S5.2, an 83-passenger non-school bus would require at least 5,561 square inches of ubobstructed emergency egress area (67 x 83 designated seating positions). At least 2,224 square inches of this space (40 percent) would have to be provided on each side of the bus. Since no single emergency exit can be credited with more than 536 square inches of the required emergency exit space, regardless of its actual size, an 83-passenger non-school bus would have to have at least 5 emergency exits on each side (2,224 divided by the maximum 536 square inches attributable to any single emergency exit). Dividing the total amount of emergency exit space required under S5.2 by the 536 square inch credit limitation results in a minimum of 11 unobstructed emergency exits on the bus.

S5.2.1 requires buses with a gross vehicle weight rating of more than 10,000 pcunds to provide at least one rear exit that is also subject to the 536 square inch limitation. S5.2.1 also notes that when a bus configuration (typically a rear-engine bus) precludes installation of an accessible rear emergency exit, a roof exit shall be provided in the rear half of the bus.

S5.2.1.1 allows a bus with a gross vehicle weight rating of greater than 10,000 pounds to satisfy the unobstructed opening requirements of S5.2 by providing at least one side door for each three passenger seating positions in the vehicle. For a 83-passenger non-school bus, this would result in 28 side doors [illegible]

APPENDIX M

Description of Visibility Tests

Phase 1 began at about 7:25 a.m. When the truck and bus were moved from 600 to 500 feet, some of the truck lights and purple color could barely be seen through the trees. As the vehicles were moved from 500 feet to 225 feet, visibility was completely blocked by vegetation along FM 676 and Bryan Road. At 200 feet the busdriver could barely observe the trucks lights through the bushes. When the truck was moved forward to 175 feet and stopped, and the bus was moved forward to 175 feet, the truck was faintly visible, and at 175 feet the busdriver again lost sight of the truck. The truck was then moved forward to 150 feet and stopped. As the bus moved forward to 169 feet, the truck was barely visible. At 158 feet the front of the truck cab was fully visible, and at 150 feet the entire front of the cab became visible. The truck was initially visible to the bus from 150 feet before and up to impact (except at 100 feet when the bus mirror blocked the truck that was at 75 feet) and when the truck was at 50 feet and the bus at 75 feet.

In phase 1 the truckdriver could see the stop sign about 400 feet before the reference point. The truckdriver could see the front of the school bus when both vehicles were about 150 feet from the intersection. When both vehicles were at approximately 125 feet, the truckdriver could only see the bottom half of the school bus because of a large mesquite tree in the southeast quadrant. As both vehicles were moved forward to the 100 foot mark, the truckdriver could intermittently see the bus through the tree as the leaves were moving in a slight breeze. At 75 feet the truckdriver had a full view of the bus. At 50 feet the A-pillar of the truck blocked the truckdriver view of the rear of the bus. In phase 1 the busdriver was not able to clearly see the truck because of the trees and shrubs until the truck was about 150 feet from the reference point, and the bus was 169 to 158 feet from the reference point.

In phase 2 the truck started at 200 feet and the bus started at 400 feet. The bus was moved forward at 50-foot increments, and the truck was moved at 25-foot increments. From the point of the start until the school bus was at 250 feet and the truck at 125 feet, the busdriver did not observe the truck. When the truck was at 100 feet and the bus at 200 feet, the bus could barely be seen by the truckdriver. Based upon comments made on the two-way radio by the investigation team in the truck, it was noted that the observer in the helper position in the truck could see the bus at 250 feet when the truck was at 100 feet. When the truck was at 75 feet and the bus at 150 feet, the trees blocked some of the view of the bus. When the truck was at 50 feet and the bus at 100 feet, it was noted on the two-way radio that the right corner post of the truck blocked the view of the front of the bus.

In phase 2 the truckdriver could not see the bus until the truck was about 100 feet and the school bus about 200 feet from the intersection. From this position the truckdriver could barely see the right front corner of the bumper and headlight of the bus. The truckdriver helper had a slightly better view. Visibility was limited by the leaves. When the truck was at 75

feet and the school bus at 150 feet, the truckdriver view of the front of the bus was blocked by the A-pillar of the truck. However, the rear of the school bus could be seen. At the next observation (truck at 50 feet and bus at 100 feet), the truckdriver could see the bus by looking through the side window. At 25 and 50 feet the truckdriver could see the front of the bus and the side of the bus by looking out the right side window. Phase 2 indicated that the busdriver was barely able to observe the truck at 100 feet when the bus was 200 feet from the intersection. After the vehicles became visible to each other, the view from the bus was intermittently obscured by the large mesquite tree in the southeast quadrant and the side mirror of the bus.

U.S. GOVERNMENT PRINTING OFFICE: