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Highway Accident Report - Pattison Head Start Center School Van Run-off Bridge and Fire Near Hermanville, Mississippi, December 17, 1981

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16. Abstract

About 7:25 a.m., on December 17, 1981, the driver of a 16-passenger Head Start school van, traveling southbound on a two-lane dirt road near Hermanville, Mississippi, lost control of the vehicle and ran off the right side of a one-lane wooden bridge. The roadway condition on the approach to the bridge was muddy as a result of rain, and there was a light rain at the time of the accident. The van fell about 9 1/2 feet onto a creek embankment and came to rest on its right side. A fire developed in the front engine compartment and, after burning for 11 to 13 minutes, spread through the interior of the van. Five of the 32 occupants of the van were killed and 11 persons were injured.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the driver to stop and align the van with the bridge in the presence of adverse road conditions and an exaggerated steering maneuver that was further aggravated by the van tires striking the sides of the bridge running boards. Contributing to the accident was the lack of guardrails on the bridge. Possibly contributing to the loss of life were the lack of precise Head Start occupant capacity guidelines which permitted an excessive number of passengers in the van, a lack of driver emergency training, and the limited availability of exits.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

HIGHWAY ACCIDENT REPORT

Adopted: September 22, 1982

PATTISON HEAD START CENTER SCHOOL VAN RUN-OFF BRIDGE AND FIRE NEAR HERMANVILLE, MISSISSIPPI DECEMBER 17, 1981

SYNOPSIS

About 7:25 a.m., on December 17, 1981, the driver of a 16-passenger Head Start school van, traveling southbound on a two-lane dirt road near Hermanville, Mississippi, lost control of the vehicle and ran off the right side of a one-lane wooden bridge. The roadway condition on the approach to the bridge was muddy as a result of rain, and there was a light rain at the time of the accident. The van fell about 9 1/2 feet onto a creek embankment and came to rest on its right side. A fire developed in the front engine compartment and, after burning for 11 to 13 minutes, spread through the interior of the van. Five of the 32 occupants of the van were killed and 11 persons were injured.

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INVESTIGATION

The Accident

About 7:25 a.m., on December 17, 1981, a 16-passenger Head Start school van, occupied by a driver, 2 other adult passengers, and 29 preschool-age children (3 to 5 years old), was traveling southbound on Peach Grove Road, a two-lane dirt road near Hermanville, Mississippi. The van was en route to pick up two more children before traveling to a Head Start Center, a preschool educational facility, located in Pattison, Mississippi, about 8 miles away.

The driver reported that the road was "real muddy" and there was a "light drizzle" of rain, although not enough rain to require using the windshield wipers. The driver said that as the van approached a one-lane wooden bridge over a creek, she slowed the vehicle and came to a complete stop about 5 feet before the bridge. She said she always stopped when entering the bridge to avoid a "bump" created by a dip in the roadway where it meets the bridge. She said that as she started onto the bridge, she thought the van tires were on the bridge "running boards," 3-foot-wide planking over which standard vehicle tires were to travel. (See figure 1.) She said that the van "started shaking and was rough" as soon as the front wheels were on the bridge, and the van was "pulling to the left" and "started to go off the bridge to the left." The driver said that she did not remember

Figure 1.--Eastbound approach to wooden bridge on Peach Grove Road, near Hermanville, Mississippi. Note the "running boards" (a) for vehicles to travel on when crossing the bridge and the "curb boards" (b) along the side edges of the bridge.

braking, just "wrestling with the steering." The van then moved to the right and ran off the bridge. An adult passenger said that the driver had "slowed and was driving real slow" approaching the bridge and that the van started "sliding to the left, then slid back to the right, and then off the bridge."

According to the physical evidence, the van traveled about halfway across the length of the bridge, went off the right side, and fell about 9 1/2 feet onto the creek embankment. After the left-front corner of the van struck the embankment, the van rotated about 130° counterclockwise horizontally and came to rest on its right side at the bottom of the embankment. (See figure 2.) A fire started almost immediately in the engine compartment.

The driver tried to open the driver's door but it would not open, so she pulled herself through the driver's door window and onto the side of the van. She stayed on the side of the van and began to lift passengers up through the driver's window. She did not attempt to turn off the ignition, and the engine remained running. A man who had been working at a garage about 200 yards from the bridge heard the crash and drove down to the bridge, arriving about 1 to 2 minutes after the crash. He saw that the front of the van was on fire and that the driver and an adult passenger were climbing out of the van. He radioed to his mechanic back at the garage to call for help and went down to assist in the rescue.

The man said that his ability to assist in the rescue effort was hampered due to three recent abdominal operations. Also, he initially thought that the van had only six to eight children inside. Therefore, he concentrated on aiding the driver's rescue efforts rather than trying to fight the fire or breaking out the windshield. For the next 4 to 5 minutes, the driver continued to lift passengers through the driver's window, the man

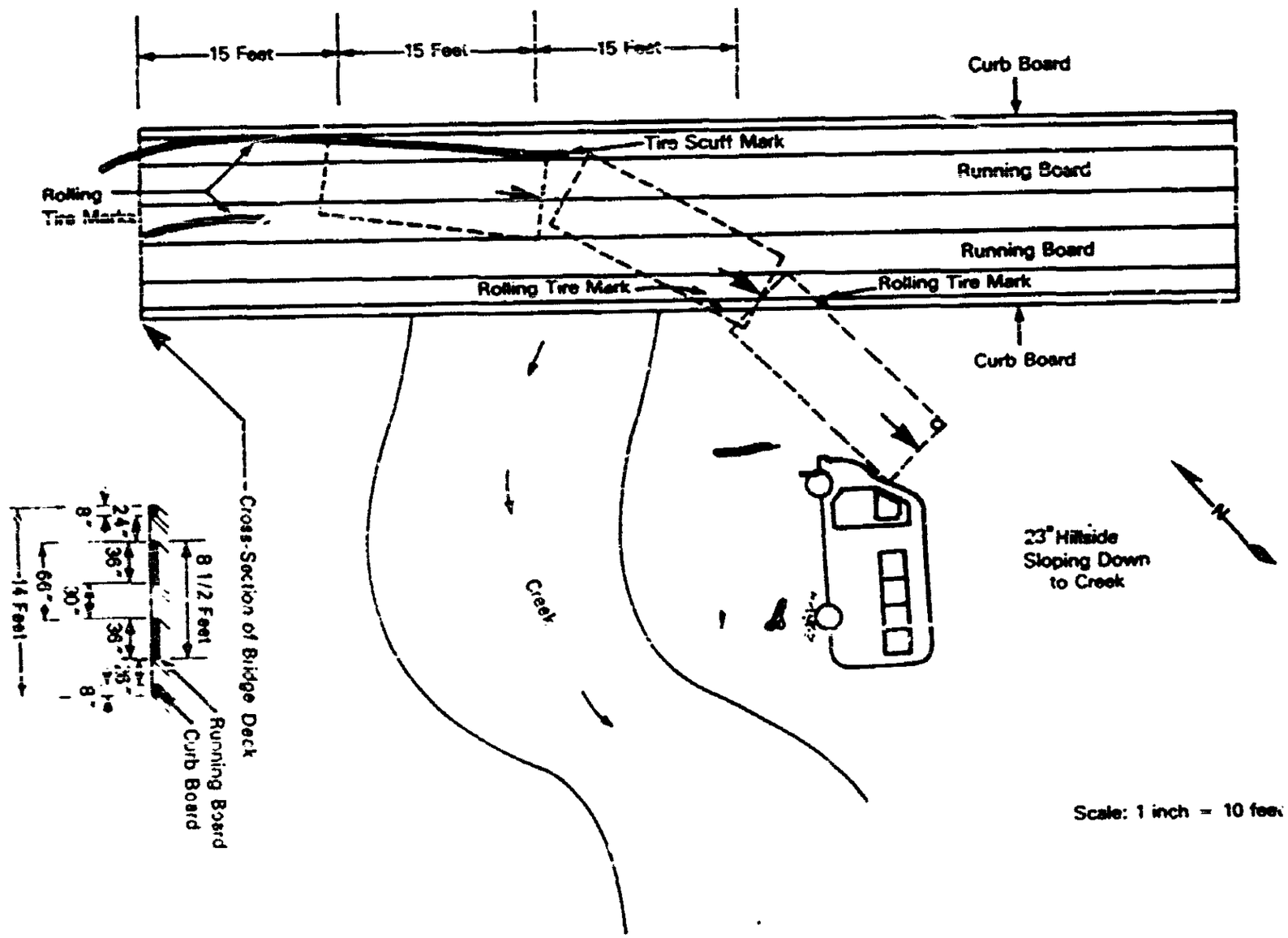

Figure 2.—Plan view of accident site.

assisted them off the side of the van, and one of the adult passengers helped them up the embankment and away from the van until seven children and one adult remained inside. According to the driver, the interior of the van began to burn while she was evacuating passengers. While the driver and the man were struggling to pull the second adult passenger, a heavy, elderly woman, through the driver's window, the fire increased to such an intensity that they had to release her and retreat from the front of the van. They went to the rear doors of the van and tried to open them, but the doors could not be opened.

As the driver and the man were attempting to open the rear doors, the mechanic arrived on the scene with two fire extinguishers. The mechanic tried to extinguish the fire while the other man went back to his truck for a crowbar to use in trying to open the rear doors. According to the mechanic, one extinguisher was not working, and a small hand extinguisher only permitted the fire to be controlled for a "second or two" before it was depleted. The mechanic tried to pry open the back doors with the crowbar, and then smashed the rear door windows with the fire extinguisher. The mechanic reported that when the back windows were broken, the fire began to spread rapidly from the front to the rear. The mechanic and the driver called for those still inside the van to come to the rear of the van and two children came out. The mechanic saw a third child with her coat on fire, entered the van through the rear door window up to his waist, pulled her out, and dunked her into the creek to extinguish the fire. No signs of life from the five passengers remaining in the van were observed after this, and, less than a minute later, a loud "swish" noise was heard and the entire interior was in flames.

About 5 minutes elapsed from the time the mechanic arrived on the scene until the entire interior of the van was in flames. The firetruck arrived 5 minutes later, and it took about 5 minutes to extinguish the fire. The firefighter reported that the fire kept flaring up because the rubber portion of the gasoline fuel line was burned through at the engine compartment, and gasoline was draining onto a smoldering tire. After the metal part of the fuel line near the gas tank was crimped with pliers, the fire remained out. Table 1 summarizes the timing of key events related to the fire and rescue.

Table 1.--Timing of key events related to the fire and rescue.

Elapsed time (minutes)	Key events
0	Van comes to rest after crash, and fire begins in engine compartment.
1-2	Driver and one adult passenger climb out of van; man who heard crash arrives and radios for help.
5-7	Driver and adult who escaped from van evacuate 22 children; fire inside and outside of van.
6-8	Fire increases in intensity; driver and garage man try to open rear doors; mechanic arrives.
9-11	Mechanic fights fire while garage man returns to truck for crowbar.
11-13	Mechanic tries but cannot open rear doors, breaks rear door windows, and rescues three more children.
11-13+	Entire interior of van in flames.
16-18	Firetruck arrives.
21-23	Fire extinguished.

Injuries to Persons

Injuries	Driver	Passengers	Total
Fatal	0	5*	5*
Nonfatal	1	10	11
None	0	16	16
Total	1	31	32

* The 5 fatalities include 4 children and 1 adult.

Vehicle Information

The school van was a 1977 Chevrolet chassis with a Superior body; its gross vehicle weight rating was 7,900 pounds. The van was bought new by the headquarters office of Mississippi Action for Progress (MAP), a group which directs 20 countywide, federally funded, Head Start preschool programs for the education and social development of economically and otherwise disadvantaged children in Mississippi. The van was operated and maintained by the local Claiborne County MAP program. The van was painted yellow and black, and was equipped with conventional schoolbus overhead flashing red lights, a manually operated stop sign arm mounted on the driver's side, a lever-actuated passenger door, a driver's door, and a conventional van double rear door. According to the van's drivers, the driver's door and the double rear doors could be locked with a key. The latching arrangement for the rear doors required the right-rear door to be opened before the left-rear door could be opened.

The van was equipped with an automatic transmission and power brakes and steering. There were four, 30-inch-wide, two-passenger seats on each side of the van for an adult passenger seating capacity of 16. The driver's seat was equipped with a seatbelt. The van was manufactured on March 18, 1977, 2 weeks before Federal Motor Vehicle Safety Standards required all vans of this type to be equipped with seatbelts for all passenger seats. However, seatbelts for all passenger seats were ordered by MAP headquarters when the vehicle was purchased new and were installed by the manufacturer. Van drivers and other witnesses could not agree as to whether or not the passenger seats were equipped with seatbelts at the time of the accident. Remnants of only one seatbelt were found near the driver's seat after the accident. Witnesses reported that no one was wearing a seatbelt at the time of the accident. The van was supposed to have two fire extinguishers on board, according to the van's owner, but none was found or accounted for by witnesses.

Tires, brakes, steering, and other mechanical systems on the van were in good to excellent condition. Tire treads were mud-packed, and the right-front outside and left-front inside tire sidewalls were scuffmarked. The distance between the outside sidewall of the right-front tire and the inside sidewall of the left-front tire was 67 inches, which was almost equal to the 66-inch distance between the left-side edges of the running boards. (See figure 2.) These dimensions indicate that both front tires would have simultaneously contacted the side edges of the running boards. Outside tire track width--the distance between the outside edges of the tires on the same axle--was 75 inches (6 1/4 feet). The distance between the outside edges of the two running boards was 8 1/2 feet.

The left-front corner of the van was deformed rearward about 11 inches in the area between the bottom of the windshield and the bumper. The driver's door frame was distorted and the door was jammed in a closed position by this damage. Minor dents and sheet metal buckling were noted along the right and left sides of the van. (See figure 3.)

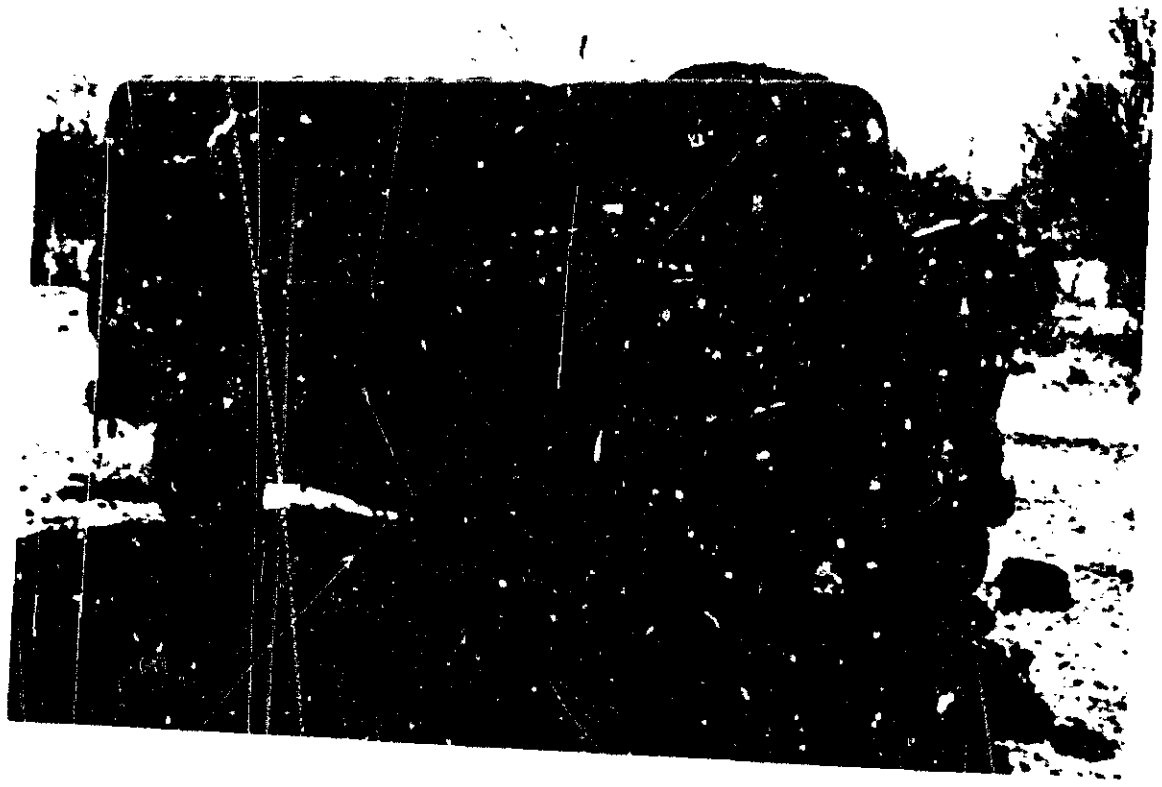

Figure 3.--Front and right-side view of accident vehicle. Note the damage to the left front and right side of the van, and the overlapping, two-piece, passenger-seat side windows.

Both seatbacks of the first passenger seats behind the driver's seat were deformed slightly forward, and the second seatback on the left side was bent forward about 10 1/2 inches. The seat leg-to-floor attachment of the third seat on the left side failed because the floor screws had pulled loose, and the seat was rotated counterclockwise. The engine "dog house" or interior engine cover was loose on the left side; it could not be determined whether this had occurred before or as a result of this accident.

The two rear doors could not be opened because either the right-rear door latching jaws were jammed closed around the latching loop or the doors were locked. (See figure 4.) When the right-rear door was opened by unscrewing the latching loop, the left-rear door was easily unlatched and opened. The right-rear door lock and other parts of the door latching mechanism were melted or missing, which prevented further assessment of why they could not be opened based on physical evidence. The driver and other persons familiar with the van said that they did not know if, before the accident, the doors could be opened or whether they were jammed or locked with a key.

The driver's door window through which occupants escaped was 18 inches by 19 inches. The two rear-door, nonopening windows were each 22 inches by 17 inches. The passenger-seat side windows were overlapping, two-piece windows that opened from the inside and provided an opening of 24 inches by 9 1/2 inches. (See figure 3.)

All combustible and low melting point materials inside the van were consumed by fire. Fire damage was not as significant on the outside of the vehicle. The fuel tank still contained gasoline when the van was examined by the Safety Board after the accident. And, when the van was tipped onto its right side again by Safety Board investigators, engine and transmission oils flowed out of the "dipstick" tubes and down onto the battery. The brake master cylinder fluid reservoir chamber was empty; evidence indicated that this fluid probably also drained out while the van was on its side after the crash.

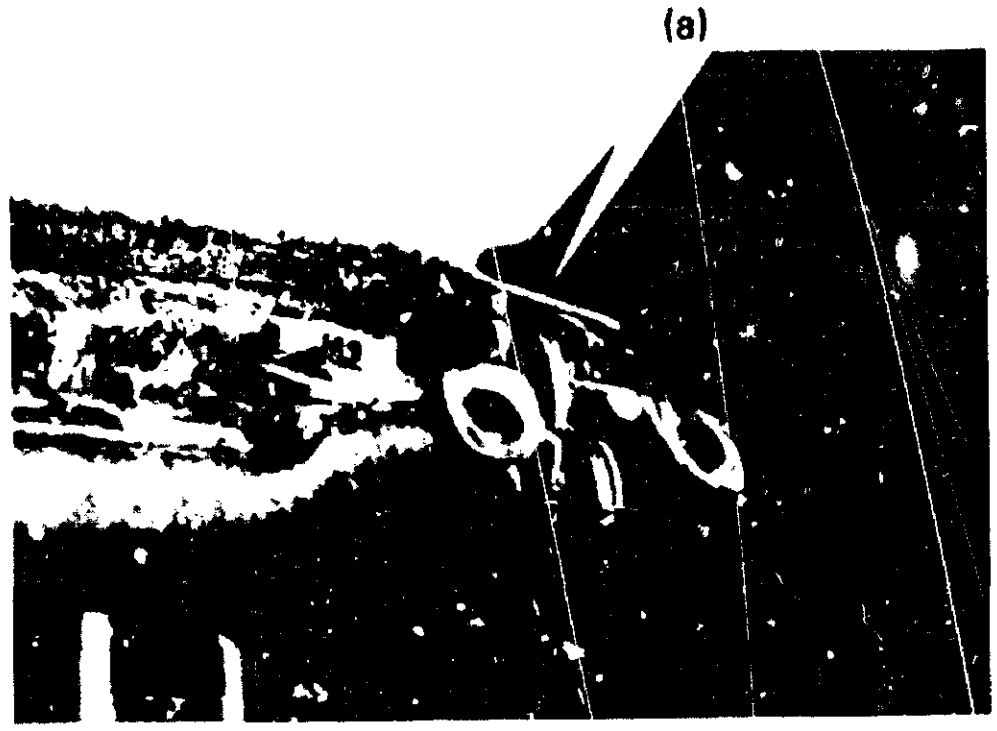

Figure 4.--Latching jaws and loop at the top of the van's right-rear door. Loop was unscrewed from the upper doorframe by investigators. The bending of door sheet metal (a) appeared to be from efforts to pry open the door.

Driver Information

The 27-year-old school van driver had a valid Mississippi driver's license with no operating restrictions. She did not have nor did State law or Head Start regulations require her to have a special driver's license. She was a teacher at the Head Start school and began driving the van when the regular driver quit. She had 10 years of driving experience and had driven automobiles, pickup trucks, and vans. She had driven the van 5 days a week, every other week since October 1981, for a total of about 5 weeks driving experience or 25 round-trips across the bridge. She had driven across the bridge in the past when it was wet. She said that there was another route that could have been taken to avoid the bridge, but that the route would have required backtracking, adding to travel time, and would not have permitted all of the children to be picked up in one trip. She had not driven any other schoolbus or school van, and none of the adults aboard had any formal schoolbus driver, emergency evacuation, or firefighting training.

The driver stated that she was not physically or medically impaired in any way and had not consumed alcohol, drugs, or any medication on the day of the accident. No evidence of impairment was observed by witnesses or police.

Highway/Bridge Information

Peach Grove Road is a north-south, clay-dirt, county road through a sparsely populated rural farm and ranch area in southwestern Mississippi. At the time of the accident, the clay-dirt road was wet and slippery. Traffic volume was less than

50 vehicles per day, including the Head Start van and a large public schoolbus. There was no posted speed limit; traffic operated about 30 to 40 mph on open sections of the road. There were no traffic signs within 1/2 mile of the bridge where the accident occurred. There were several other similar one-lane bridges on this road and in the area. According to the Claiborne County Sheriff, no other accidents had occurred at this bridge. Clairborne county roads are constructed and maintained by the County Board of Supervisors who usually contract with private engineering consultants and construction companies for major road projects.

Road width varied over the last 200 feet of the southbound approach to the bridge. Traffic followed an S-shaped route on this final approach to the bridge, through a 30° left-hand curve for about 100 feet, and then a 27° right-hand curve ending at the bridge. Traffic could operate comfortably around this type of curve at speeds of about 20 to 25 mph. The road was slightly banked in the wrong direction (0.01 to 0.02 foot per foot) over the last 50 feet of the approach. There was a 3-percent downgrade leading to the bridge, which abruptly changed to a slight upgrade on the bridge. There was also some slight rutting on the approach, and the right-side bridge running board was 2 to 3 inches higher than the dirt road leading to it. These three factors could have caused a vehicle to "bump" when entering the bridge.

The bridge was over 50 years old; it was 81 feet long and 14 feet wide. The bridge had been replaced in sections over the years as various parts deteriorated. The last repair involved replacing piling supports and about 25 feet of the bridge deck on the north end of the bridge about 3 months before the accident.

Lateral bridge deck planks were 3 inches deep by 8 inches wide. There were no significant changes in height between these planks, and a vehicle could be driven across these planks and between the running boards at about 10 mph without any significant detrimental effect on steering. Each bridge running board consisted of three longitudinal, 3-inch-deep by 12-inch-wide planks, providing a width of 3 feet for each running board. (See figure 2.) The distance between these running boards was about 2 1/2 feet, resulting in an effective defined lane width of 8 1/2 feet for vehicles operating on the running boards.

"Curb" boards that were 3 inches deep by 8 inches wide were placed along each side edge of the bridge. There were no bridge rails, reportedly because the bridge was used by wide farm equipment with limited ground clearance, such as farm combines with 24-foot-wide heads and a 33-inch ground clearance and a 17-foot-wide, 3-point hookup chisel with an 8 1/2-inch ground clearance. This latter item would prevent the use of any type of conventional guardrail system since the bridge was 14 feet wide and these guardrail systems are at least 27 inches high. After this school van accident, the bridge was replaced by a 26 1/2-foot-wide concrete bridge with a 30-inch-high combination of curb and guardrail.

The Claiborne County sheriff's investigating officer reported that rolling, muddy tire marks were found about 1 foot to the left of the beginning of the bridge running boards. These marks curved slightly to the left, almost contacted the left curb board, and then curved to the right. The track width of these marks was equivalent to the track width of the van. Tire scuffmarks about 3 feet long were found along the left-side edges of the running boards, about 30 feet from the beginning of the bridge. Two rolling, muddy tire prints were found across the top of the right curb board, at a 30° angle with respect to the bridge and about 43 feet and 50 feet from the beginning of the bridge. (See figure 2.)

A gouge mark was found in the creek embankment about 9 1/2 feet below the bridge deck and 11 3/4 feet out from the edge of the bridge in the direction the van was traveling. This gouge mark was similar in size to the damaged left-front corner of the van.

Medical and Pathological Information

No autopsies were performed on the five accident victims. According to death certificates, cause of death was "burns, third degree." Three survivors received first-degree burns on the forehead, hands, lower leg; one received second-degree burns on the forehead; six were treated for abrasions, bruises, and small cuts; two were treated for smoke inhalation. Those killed had been seated in various seats in the front, rear, and on each side of the bus before the crash; they were found at the front of the van after the crash. (See figure 5.)

Other Information

Mississippi Action for Progress (MAP) is a private, nonprofit agency that operates Head Start programs in 20 Mississippi counties. The programs are 80-percent federally funded, and remaining funds are raised or provided by the local area. The State of Mississippi, county, or municipal governments have no direct control or management function in these programs, and these programs are independent of the public school system.

The Claiborne County MAP program operates two Head Start Center schools (Pattison and Port Gibson), and has 7 school vans to transport 234 students. MAP owns two vans, and the others are provided by private contractors. A statewide transportation director for MAP is located in Jackson, Mississippi, and visits each center about three or four times over an 8-month school year to check the transportation system. There is no schoolbus driver training program; a valid driver's license is the only requirement for operating a vehicle. Local MAP programs hire drivers or contractors.

The Head Start program in Claiborne County had problems in keeping drivers for the MAP vans because the drivers were being paid for 4 hours per day, part-time, and had to provide their own transportation to and from the program office where the vans were parked, or had to reimburse the program for using the vans for "personal" transportation. At times, drivers from a rural area would have to pay more for reimbursement than they could earn. Because of this inability to keep drivers for the vans, teachers or other employees had to drive to keep the program going. The Claiborne County program encouraged the use of private contractors to avoid such problems as vehicle maintenance and finding and keeping drivers. There were no training requirements for contractor drivers imposed by the MAP program or State law.

No national pupil transportation standards have been issued by the Administration for Children, Youth and Families, the Federal agency within the U.S. Department of Health and Human Services that administers the Head Start program. Operating guidelines and vehicle checklists are provided to each Head Start county program by MAP. (See appendix B.) MAP operating guidelines regarding passenger capacity state:

> 3. Be sure that all children are seated in bus. No one is to sit in the other person's lap or stand up.
>
> * * *
>
> 9. Check the number of children they transport daily.

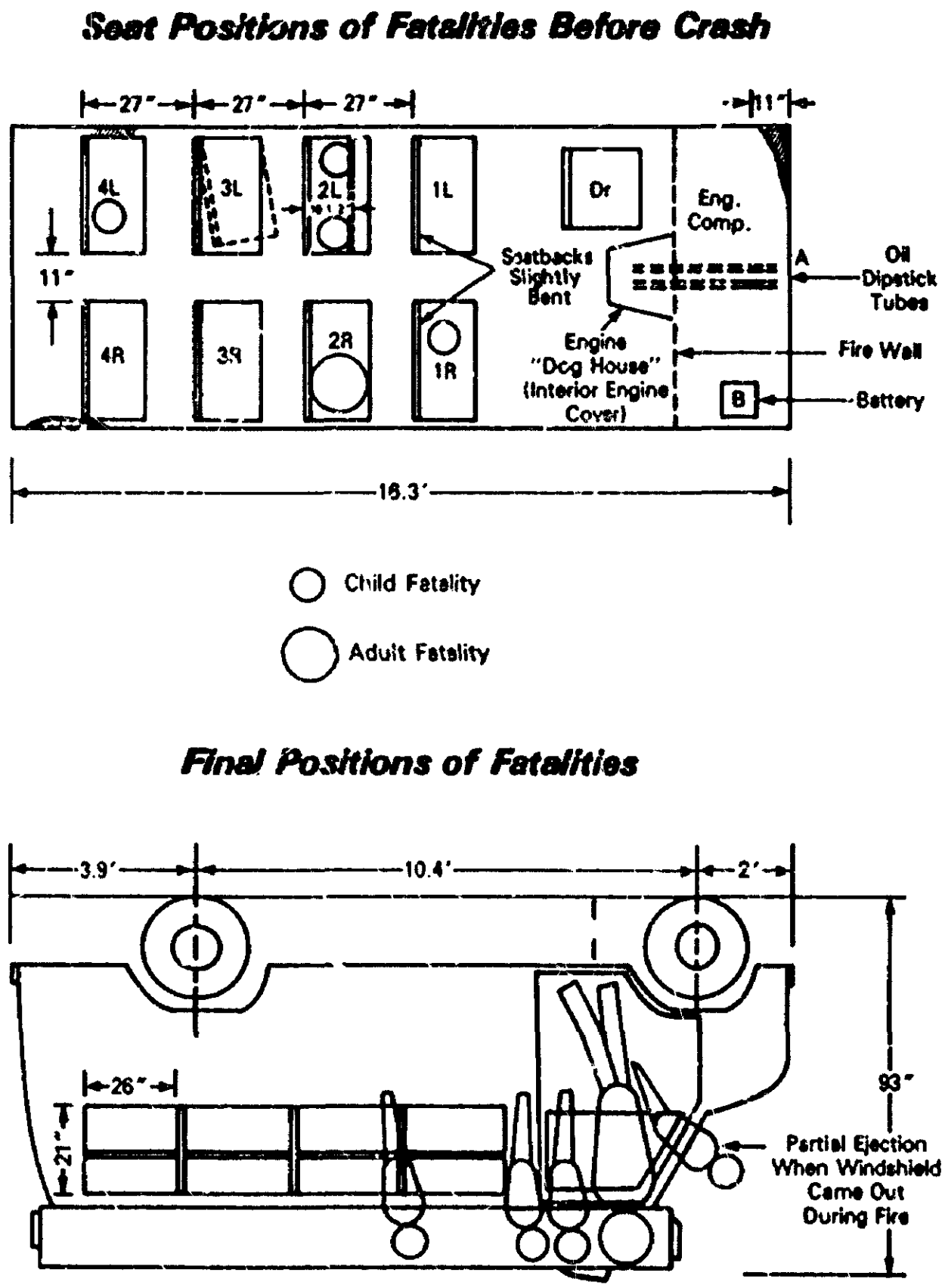

Figure 5.—Seat positions of fatalities before and after crash.

10. Don't overload vehicles.

* * *

12. All MAP buses should pick up 21 children or more if (2) trips are necessary.

The statewide transportation director for MAP reported that insurance regulations for school vans such as the one involved in this accident allow more riders than the seating capacity as long as none stand or sit on the floor. The school van driver and adult passenger reported that none of the 32 occupants was standing or sitting on the floor of the accident van. The executive director of MAP reported that MAP policy is to transport three children in a seat designed for two adults.

In 1974, a Pupil Transportation Safety Standard 1/ was developed by the National Highway Traffic Safety Administration (NHTSA) of the U.S. Department of Transportation. The purpose of this standard is to improve public and private pupil transportation safety, and it provides minimum requirements for the identification, operation, and maintenance of schoolbuses; training of personnel; and administration. Regarding passenger capacity, this standard calls for at least 12.3 inches of seat width for each school vehicle occupant.

A MAP daily vehicle checklist was prescribed for use in assessing the condition of various mechanical systems; there was no checklist for emergency equipment, doors, or other safety equipment. There apparently was no requirement to complete the mechanical system checklist, and the driver in this accident had not submitted any lists since she began driving. The program manual for the Pupil Transportation Safety Standard calls for a daily check of mechanical systems and the following emergency equipment:

First Aid	Fire Extinguisher
Ax	Fuses and Flares
Chains	Emergency door and buzzer and service door

The program manual also notes that if a defect is discovered, it should be corrected before the bus transports children, or written approval should be obtained from a competent mechanic or the fleet supervisor that the defect will not create a hazard.

There are no MAP guidelines for bus or van route selection, emergency evacuation, or firefighting training. The program manual for the Pupil Transporation Safety Standard either directly provides such guidelines or refers to agencies and reports that can provide such guidelines.

ANALYSIS

Precrash Sequence of Events

Speed calculations 2/ indicated that the van was traveling at least 10 mph when it went off the middle of the right side of the bridge. If the driver had come to a complete

1/ Highway Safety Standard and Highway Safety Program Manual No. 17, "Pupil Transportation Safety," February 1974, U.S. Department of Transportation, National Highway Traffic Safety Administration.
2/ Calculations were based on the distances the van vaulted out from (11 3/4 feet) and below (9 1/2 feet) the bridge as it traveled off the bridge.

stop just before the bridge, as she stated, it is unlikely that she would have accelerated up to 10 mph on the bridge while the van was initially heading toward and off the left side as it entered the bridge. Therefore, the driver probably did not come to a complete stop just before the bridge, but rather slowed the van and it slid to the left as the surviving adult passenger reported.

On the muddy, slippery, clay roadway on the approach to the bridge, even a light brake application to slow the van could have locked the wheels, preventing them from rotating. The driver could have turned the steering wheel and thereby turned the front tires, but tire rotation would not have been available, and such rotation is necessary for tires to grip and develop the side forces necessary to turn a vehicle. Locked wheels, no steering capability, and the slight banking of the roadway to the left would have caused the van to skid and slide slightly to the left. This would have resulted in the van sliding to the outside of the right-hand curve leading to the bridge and to the left of the bridge running boards; this was the van's position and trajectory as it entered the bridge according to the physical evidence. Since the van would have lost some speed while sliding on the approach to the bridge, the van probably approached the bridge traveling faster than 10 mph just before the driver braked. Even 10 mph was probably too high an approach speed for the muddy road and difficult maneuvering conditions.

Based on this evidence, the most likely approach sequence is that the driver braked too close to the bridge, perhaps to reduce the effect of the "bump" but more probably to reduce the overall approach speed on the downgrade, while she was also attempting to steer through the curve and onto the bridge running boards. Braking too close to the bridge did not allow any space for the driver to adjust for any departure from her intended path due to braking, and the van could not be simultaneously braked and steered because the wheels locked on the muddy, slippery surface. As a result, as the van slid to the left, its wheels were not aligned with the running boards or the bridge, so that the van headed toward the left side of the bridge as the driver released the brakes but before she could regain steering capability.

The rolling van tire marks that initially curved to the left on the bridge do not necessarily indicate that the van was "pulling to the left" as the driver claimed. The deck planks could be ridden across at low speed without any significant detrimental effect on steering. The tire marks were more likely a continuation of the van's trajectory after the driver stopped braking, missed aligning the van, and continued onto the bridge while attempting to regain steering control. If the driver had not steered for so long to the right, as the later tire marks to the right indicate, she would have been able to travel across the bridge between the running boards. However, the van was so close to going off the left side of the bridge that she probably was more concerned about steering away from the edge of the bridge than establishing a path between the running boards.

The later tire marks to the right also indicate that the van turned more sharply to its right after both front tires simultaneously contacted the left side edges of the running boards. The scuffmarks on the van tire sidewalls and left side edges of the running boards indicate that the side edges of the running boards initially provided some resistance against the right turning maneuver. However, once that initial resistance was overcome, the van tires "popped" up and onto the running boards at a sharper right steering angle, and the van was off the bridge in about 1 second at 10 mph. This sudden reaction to the driver's emergency right steering maneuver did not leave enough time for the driver to regain steering control to the left and prevent the van from going off the bridge.

Influence of Bridge Elements in the Accident

The running boards on the bridge were narrow, and the effective lane width of 8 1/2 feet provided by these boards allowed for only a small margin of driver error in maneuvering the van which had a 6 1/4-foot outside-to-outside tire track width. Such a running board-to-vehicle track width matchup means that van drivers would be riding on the edges of the running boards if they missed the ideal center path of the boards by more than 1 foot or 1 1/2 tire widths. However, in this accident, the van driver not only missed the ideal path of the running boards by 2 feet, but the van's tire marks indicated that the van was in the process of missing the bridge. No other accidents of this type had occurred at this bridge, and the school van driver was familiar with the bridge. Therefore, while the running boards, the grade, the curve, and the expected bump contributed to the difficulty in maneuvering the van and contributed to the accident, the most significant factors were the muddy, slippery approach conditions and the timing of the driver's maneuvers. The driver should have stopped or slowed at a point(s) that would have allowed her to adjust for any departure from her intended path on the slippery approach, and proceeded as slowly as possible to maneuver onto the bridge.

Because of the driver's failure to align the van with the bridge and the consequences of her later emergency steering maneuver, guardrails or similar barriers would have been necessary to contain the van on the bridge. An accident would not have been prevented because the guardrails would have been struck, but the severity of the accident probably would have been reduced because impact speed would have been low (10 mph) and the guardrails would have contained the van on the bridge. Accident severity may have been so low that it might not have been necessary to report the accident to the police. However, the bridge did not have guardrails because the narrow bridge was used to transport wide farm equipment with limited ground clearance.

Schoolbus operators should avoid using hazardous bridges and other roadways of this type with poor maneuvering conditions and no guardrails, especially during inclement weather conditions that could make driving conditions even worse along these routes. The Pupil Transportation Safety Standard calls for schoolbus routes to be "planned to improve program efficiency, operational economy and pupil safety on a system-wide basis" and specifically points out the need for highway departments to "assist schools in the establishment of safe school bus routes and loading areas" and to "periodically check the condition of bridges used by school buses."

The busdriver reported that there was another route that could have been taken to avoid the bridge, but that the route would have required backtracking, adding to travel time, and would not have permitted all of the children to be picked up in one trip. The Safety Board concludes that such alternate routes should be thoroughly investigated with safety considerations taking priority over efficiency.

The Crash and Fire

Vehicle damage and survivors' injuries were of a low level and appeared to be typical of what would be expected from a 10-mph collision. Even though she was not wearing her seatbelt, the driver was not incapacitated; that might not have been the case in a higher speed impact. The Pupil Transportation Safety Standard states that when the school vehicle is equipped with seatbelts for drivers, schoolbus drivers should be required to wear them. Although no autopsies were performed, the low collision speed and low level of survivor injuries indicates that some of those who were killed did not die from crash forces. Those killed were seated in all areas of the van before the crash, yet they apparently were at the front of the vehicle awaiting rescue after the crash. (See

figure 5.) The adult passenger who died was alive during the early rescue efforts. These factors indicate that at least some of the fatalities were more likely a result of the fire and not of the crash.

The van's engine remained running after the accident, indicating that the fuel system substantially retained its integrity during the crash and probably was not leaking. The initially slow-burning rate of the fire further indicates that the fire probably was not fueled by gasoline, especially during the early stages of the fire. Brake fluid, engine oil, and transmission oil that drained out while the van was on its side were more likely the early fuel sources for the fire.

Model year 1977 vans such as the one involved in this accident were required to meet the National Highway Traffic Safety Administration's Federal Motor Vehicle Safety Standard No. 301. This standard requires no leaks in the fuel system greater than 1 ounce per minute after a frontal impact into a barrier at a speed of 30 mph (effective September 1, 1976). A later provision of the standard (effective September 1, 1977) requires the same level of integrity when the vehicle is rolled up to 360° after a 30 mph, frontal barrier impact test. The fuel system of the van in this accident apparently met both provisions of the standard. Thus, the early intensity of the fire was reduced. This indicates the appropriateness of having such a standard.

The Safety Board was not able to establish precisely the source of the fire. Operating and shorted electrical systems and hot engine components were all possible ignition sources. Since the fire started almost immediately after the crash, the driver may not have had time to turn off the van's ignition. Drivers should make an effort to turn off the ignition after a crash to eliminate this potential source of fire ignition. Removing the keys also would make them available to open any locked doors or compartments.

At some point in the fire, the gasoline fuel line was burned through. This may have caused the fire that occurred near the front of the vehicle to increase in intensity about 6 to 8 minutes after the crash occurred. Even with an increase in intensity, the fire continued to remain relatively confined to the front of the van. After the rear door windows were broken out, however, the fire apparently spread more rapidly through the bus interior. The interior fire was not directly fueled by oils, fluids, or gasoline; the gasoline tank did not explode and still contained gasoline after the fire was extinguished. The more rapid spread of the interior fire may have been aided by the draft created when the rear door windows were broken out. The loud "swish" noise heard by witnesses may have been the ignition of accumulated flammable vapors in the rear of the vehicle. Such vapors could form from materials that initially were only partially burned.

The Safety Board is concerned about any fuel source feeding a vehicle fire. In this accident, the fire was fed by the oil and brake fluid early in the fire sequence and the burned-through gasoline fuel line later in the fire sequence. However, at least 6 to 8 minutes elapsed before the fire increased in intensity and seriously invaded the van interior. This would normally be a sufficient amount of time for a systematic evacuation of the van. Therefore, the Safety Board concludes that no recommendations are appropriate regarding these fuel sources at this time.

Postcrash Factors

The most significant factors that may have influenced the severity of the accident and loss of life after the crash were the lack of precise Head Start occupant capacity guidelines which permitted an excessive number of passengers in the van, a lack of driver emergency training, and a limited availability of exits. Even with all of the other

compounding factors, not as many might have died in this accident if there had been fewer occupants.

Passenger capacity guidelines issued by MAP did not appear to be precise or consistently interpreted. For example, MAP guideline No. 12 states, "All MAP buses should pick up 21 children or more if (2) trips are necessary." The executive director for MAP apparently interpreted this guideline to mean that three children would be transported in a seat designed for two adults. According to this interpretation, one passenger seat in the van involved in this accident would have been occupied by two adults, six seats would have been occupied by three children each, and one seat would have been occupied by one child with two spaces available for the two children remaining to be picked up. In summary, 2 adults and 19 children would have been passengers in the van at the time of the accident. However, MAP guideline No. 12 also could be interpreted to mean that if there are less than 42 children to be picked up, they should be transported in one trip.

In order to provide 12.3 inches of seat width per occupant, called for in the Pupil Transportation Safety Standard, only two children would be allowed to sit in each of the van's 30-inch-wide seats. Three children to a seat would only be permitted for the 37-inch-wide seats found on large schoolbuses. Therefore, under this standard, the total capacity of the van was 16 passengers, irrespective of occupant size, and the driver and 14 passengers would have been on the van while it was en route to pick up 2 more children. Since 27 people were evacuated and some of the fatalities appeared to have survived the crash, fewer fatalities might have occurred in this accident if the Pupil Transportation Safety Standard capacity guidelines had been followed.

None of the adults aboard the van had had any schoolbus driver, emergency evacuation, or firefighting training, and no training of this type was required by MAP guidelines or State law. Although the Pupil Transportation Safety Standard does not directly call for training in firefighting techniques for schoolbus drivers, it does refer to courses that provide such training. It also requires training in emergency evacuation and periodic evacuation drills, and it emphasizes the need to check doors, emergency fire extinguishers, and other safety equipment. Perhaps following this standard would have alerted officials of the Head Start program to the difficulties in evacuating a large number of people from the van, which may have led to less people being in the van and a safer route selection. The driver also may have realized the need for insuring the availability of extinguishers, for all exits such as the rear doors to be operational, and for a more systematic rescue procedure.

By witness accounts, the fire initially may have been small enough to control, but apparently there were no extinguishers available on the van. Some training in minor firefighting techniques might have made the driver aware of the need for extinguishers and their proper use. The first person to arrive at the scene apparently thought there were only six to eight children inside; he said that he might have taken some other action like breaking out the windshield or trying to control the fire if he had known initially how many people were inside the van. Once he committed to the evacuation effort being performed by the driver, there was no time to evaluate alternative courses of action until an impasse like the increased intensity of the fire and the difficulty in evacuating the heavy, elderly passenger was reached.

The driver probably took the best initial course of action by evacuating passengers through the driver's window, a known usable exit. The driver and the two men risked their lives and made a heroic effort to evacuate the van passengers. However, the continued use of this single method of evacuation during the early stages of the slow-developing fire did not maximize chances for total evacuation and survival. When the first man arrived

to help, the driver's best course of action would have been to direct him to either provide additional exit points or to contain the fire, since she knew the large number of occupants to be evacuated. Such quick and orderly thinking could be fostered through emergency evacuation training, a reason why such training is called for by the Pupil Transportation Safety Standard. Evacuation training should discuss or use "worst case" conditions like this accident so that drivers and passengers are made aware of all potential problems and of options available to them.

There was a limited availability of exits in this accident. Windows other than the driver's door window were not accessible or easy to adapt as escape areas. The right-front passenger door was blocked because the van came to rest on its right side, and the driver's door was jammed because of accident damage. After the accident, the rear doors of the van could not be opened. Because of limited evidence, it could not be established whether these rear doors were not functional before the accident or as a result of crash forces. However, the important fact from a safety standpoint is that they were not functional for unknown reasons, and further study and action are therefore necessary.

The National Highway Traffic Safety Administration (NHTSA) is the Federal agency with responsibility for testing and establishing standards for the crash performance of vans and other vehicles. Therefore, the Safety Board believes that NHTSA should examine the crash performance of vans in rollovers and all accident types, through its crash testing and accident investigation programs, and determine if there is any tendency for doors and other escape areas to unnecessarily jam or be blocked in low-speed crashes. These actions would provide necessary data to determine if performance standards need to be established for van doors and other escape areas, especially on vehicles used in public transportation. If Head Start schools were to follow the Pupil Transportation Safety Standard by checking all doors to be certain they are functional before transporting children, the remaining possibilities for doors not functioning in an accident would be addressed.

Because rescuers elected to use only the driver's window during the early evacuation efforts and because the precise time when the fatalities occurred is unknown, the Safety Board is not entirely certain that a limited availability of exits contributed to the loss of life in this accident. However, the limited availability of exits did delay final rescue efforts, which had some potential to contribute to the loss of life in this accident, and could contribute to a loss of life in future accidents.

The transportation guidelines that were developed and used by the statewide and local Head Start programs involved in this accident provided no real assistance in preventing or reducing the severity of this accident. The Administration for Children, Youth and Families of the U.S. Department of Health and Human Services should adopt and disseminate Highway Safety Program Standard Number 17, the Pupil Transportation Safety Standard, to all Head Start programs as a first step toward establishing a safer Head Start pupil transportation system.

Occupant Restraints

The Safety Board is concerned that the local Head Start program involved in this accident made no effort to require use of seatbelts and other child restraint devices. Seatbelts were specially ordered for the van by MAP headquarters, but they were not used by the local program. In fact, since no passenger seatbelts were found by Safety Board investigators, and witnesses could not agree that seatbelts were available, the seatbelts may even have been removed from the van before the accident.

In this country, motor vehicle crashes are the leading crippler of children after the first critical months of life, yet the majority of crash fatalities and injuries to children could be prevented by the proper use of restraint systems such as seatbelts or a combination of seatbelts and child safety seats. Head Start programs should pay particular attention to the potential need for combinations of seatbelts and child safety seats, given the young ages and small sizes of children who are being transported.

Since April 1, 1977, Federal Motor Vehicle Safety Standards have required manufacturers to provide seatbelts for passengers in all vans and schoolbuses under 10,000 pounds, and the Pupil Transportation Safety Standard requires their use whenever the vehicle is in motion. However, there are no laws or regulations to prevent the owner of a vehicle that is used for school transportation from removing the seatbelts. The Safety Board is not aware of any other instances where seatbelts may have been removed from a school bus vehicle, but users of the Pupil Transportation Safety Standard may wish to consider adding a regulation to prohibit their removal.

In this accident, limited data regarding fatal injury details, occupant crash trajectories, and objects struck by occupants made it impossible to determine what effect, if any, seatbelts might have had on the outcome. In the past, concerns have been raised about potential entrapment of restrained children in a burning or submerged vehicle. However, recent investigations by the Safety Board have shown that even young children can be quickly and easily taught both to fasten themselves properly into seatbelts and to release themselves in a post-crash situation. Of course, children who have been protected from injury by properly used restraints have a much better chance of evacuating or being evacuated safely.

In one crash investigated by the Safety Board, for example, all the small passengers (5 to 7 years old) and the driver of a van-type school bus were seatbelted. All escaped injury and the children were able to release their own belts and leave the van without assistance -- even the three children hanging, uninjured, from their seatbelts on the "high side" of the overturned van. The driver told the Safety Board investigators that it had taken "just a few days" to teach the children to use their seatbelts.

The Safety Board believes that the minimal risk of entrapment can be effectively reduced by teaching children proper restraint manipulation and that, in any case, this risk is far outweighed by the more serious risk of fatal or incapacitating injuries to unrestrained child occupants. Restraint usage training could be conducted separately or as part of the emergency and evacuation training called for by the Pupil Transportation Safety Standard.

CONCLUSIONS

Findings

1. Speed calculations based on physical evidence indicated that the school van was traveling at least 10 mph when it went off the middle of the right side of the bridge.

2. If the van driver had stopped just before the bridge, as she stated, it is unlikely that she would have accelerated the van to 10 mph on the bridge since the van was headed toward the left edge as it entered the bridge.

3. The driver probably did not stop the van just before the bridge, as she stated, but rather braked to slow the van so that it slid to the left, as an adult passenger reported.

4. The van driver probably approached the bridge at too high a speed for the approach and maneuvering conditions, braked too close to the bridge, and the van slid on the muddy, slippery approach and missed mounting the running boards or even aligning with the bridge before the driver could regain steering control.

5. The driver missed the ideal center path of the running boards by 2 feet, entered the bridge heading toward the left side and off of the bridge, emergency steered right to avoid going off the left side, and ended up going off the right side of the bridge.

6. The driver's emergency steering maneuver was disrupted by the van contacting the sides of the bridge running boards. The van turned more sharply to the right after this contact, and the driver had no time to regain control before the van went off the bridge.

7. Although a grade, curve, "bump," and an effective 8 1/2-foot-wide running board lane width, which was not fully compatible with the van, contributed to the difficulty in maneuvering the van and the accident, the most significant factors were the muddy, slippery approach conditions and the timing of driver maneuvers.

8. Because of the driver's miss in aligning with the bridge and the consequences of her later emergency steering maneuver, guardrails or a similar type of barrier would have been necessary to contain the van on the bridge and reduce the severity of the accident; no guardrails were present because the narrow bridge was used to transport wide farm equipment with limited ground clearance.

9. Available evidence indicated that some of the fatalities were the direct result of the fire that developed in the front engine compartment after the crash.

10. Brake fluid, engine oil, and transmission oil that drained out while the van was on its side were more likely the early fuel sources for the fire.

11. The early intensity of the fire was reduced because the van's fuel system apparently met the impact and rollover provisions of Federal Motor Vehicle Safety Standard No. 301, which indicates the appropriateness of having such a standard.

12. The main gasoline fuel line was burned through during the fire, and this may have contributed to the fire increasing in intensity about 6 to 8 minutes after the crash occurred.

13. Even with an increase in intensity, the fire continued to remain relatively confined to the front of the van for an additional 5 minutes until the rear door windows were broken out, and then the fire spread more rapidly through the interior.

14. The interior fire was not directly fueled by oils, fluids, or gasoline, and the gasoline tank did not explode. The late, more rapid spread of the interior fire may have been the result of the draft created when the rear door windows were broken out.

15. The most significant factors that influenced the severity of the accident and loss of life after the crash were the lack of precise Head Start occupant capacity guidelines which permitted an excessive number of passengers in the van, a lack of driver emergency training, and a limited availability of exits.

16. The Administration for Children, Youth and Families has not adopted any national pupil transportation safety standards for the Head Start programs it administers, and the "transportation guidelines" that were developed and used by the Head Start program involved in this accident provided no real assistance in preventing or reducing the severity of this accident.

17. The National Highway Traffic Safety Administration has developed a Pupil Transportation Safety Standard that has policies, guidelines, and references that could have been useful in preventing or reducing the severity of this accident.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the driver to stop and align the van with the bridge in the presence of adverse road conditions and an exaggerated steering maneuver that was further aggravated by the van tires striking the sides of the bridge running boards. Contributing to the accident was the lack of guardrails on the bridge. Possibly contributing to the loss of life were the lack of precise Head Start occupant capacity guidelines which permitted an excessive number of passengers in the van, a lack of driver emergency training, and the limited availability of exits.

RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board recommended that:

—the Administration for Children, Youth and Families of the U.S. Department of Health and Human Services:

> Advise all Head Start grantees and delegate agencies of the circumstances of this accident and adopt and emphasize the need for adherence to the policies and guidelines provided by the Pupil Transportation Safety Standard, Highway Safety Program Standard Number 17. (Class II, Priority Action) (H-82-37)

—the National Highway Traffic Safety Administration:

> Examine the crash performance of vans in rollovers and all accident types, through its crash testing and accident investigation programs, to determine if there is any tendency for doors and other escape areas to unnecessarily jam or be blocked in low-speed crashes. If necessary, establish additional crash performance standards for van escape areas, especially those used for public transportation. (Class II, Priority Action) (H-82-38)

—the Claiborne County, Mississippi, Board of Supervisors:

Provide engineering assistance to all public and private schools in the county in planning schoolbus routes and transportation policies for inclement weather that would avoid, to the extent possible, hazardous or substandard routes. (Class II, Priority Action) (H-82-39)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ PATRICIA A. GOLDMAN
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ G. H. PATRICK BURSLEY
Member

/s/ DONALD D. ENGEN
Member

JIM BURNETT, Chairman, did not participate.

September 22, 1982

APPENDIXES

APPENDIX A

INVESTIGATION

1. Investigation

The National Transportation Safety Board was notified of the accident at 12:15 p.m., on December 17, 1981. Investigators were dispatched from the Washington, D.C., headquarters and the Kansas City field office and arrived at the scene at 3 p.m., on December 18, 1981. The Safety Board was assisted by representatives of the Claiborne County Sheriff's Department.

2. Depositions/Hearings

Depositions were not taken and a hearing was not held in connection with this investigation.

APPENDIX B

VEHICLE GUIDELINES AND CHECKLISTS FOR MAP HEAD START PROGRAMS

TRANSPORTING CHILDREN IN MAP VEHICLES

In some areas when transporters are not available MAP, Inc. may be able to furnish vehicles for transportation of children. In these cases the following will apply:

1. The County and Center Transportation Committee must notify the Transportation Department of the need for transportation.

2. The County and Center Transportation Committees must find a qualified driver for the vehicle by:

   a. Using the maintenance person, who will be put on an 8 hour day to drive the vehicle.

   b. Advertise for a part-time driver to drive the vehicle.

3. The Transportation Department will be the final approving authority on the driver, and then furnish a vehicle for use.

4. A repair place and gas station should be selected where MAP, Inc. can open a charge account for the up-keep of the vehicle.

5. When the drivers of vehicles are set up the following procedures will apply:

   a. MAP Form 15 (a mileage log) will be kept in the vehicle. This form will show all use and cost on the vehicle.

   b. MAP Form 12 (Travel Authorization) will be completed by the Head Teacher or Area Director every 2 weeks and sent to the Transportation Department with the MAP Form 15 and all bills.

   c. When a part-time driver is used, a MAP Form 11 worksheet will be completed and sent to the Department every 2 weeks.

MAP OWNED BUSES

1. Drivers must keep their vehicles clean.

2. Check oil and gas regularly. Change oil and filter every 2,000 miles.

3. Be sure that all children are seated in bus. No one is to sit in the other person's lap or stand up.

4. The driver must have someone to ride with him/her to see that the children get safely across the street.

5. The MAP owned buses should not be used by the driver for anything other than hauling children to school and back home.

6. The driver should not use this Bus or Truck for: (1) to go get lunch (2) go shopping and (3) by no means personal business.

7. The bus must be parked in a safe place night and weekends.

8. In case of a breakdown, contact your head teacher or the Area Director's Office and they will check with the transportation department or controller before any maintenance work can be done.

9. Check the number of children they transport daily.

10. Don't overload vehicles.

11. All buses should be left at school after delivering children.

12. All MAP buses should pick up 21 children or more if (2) trips are necessary.

13. A set number of miles will be set for each bus per day.

14. After the route is run no busdriver will exceed the number of miles of said route. If so, the driver or area will be charged for the extra miles if prior approval is made.

15. All buses will be ordered to be brought to Central Office after the 16th of May (with the exception of three (3)).

16. Area Director will advance travel for contractual drivers now, and no bus will be lent until this is done.

MAP, INCORPORATED
TRANSPORTATION CHECKLIST

PERIOD OF: _____ TO _____

Vehicle #: _____ Location: _____

Model/Make: _____ Beginning Speedometer Reading: _____

DAILY CHECKLIST

	FIRST WEEK					SECOND WEEK				
	M	T	W	TH	F	M	T	W	TH	F
Oil & Water Leaks										
Lights										
Tires										
Brake Pedal Travel										
Transmission Level										
Radiator Level										
Steering Gear Fluid Level										
Engine Oil Level										
Master Cylinder Level										

Oil & Filter Change: ☐ _____ DATE _____ SPEEDOMETER READING

Carburator Filter Change: ☐ _____ DATE _____ SPEEDOMETER READING

Fuel Line Filter Change: ☐ _____ DATE _____ SPEEDOMETER READING

COMMENTS: _____

_____

I certify that the above described vehicle has been checked and any maintenance discrepancies noted:

_____ BUS DRIVER _____ EMPLOYEE NUMBER _____ DATE

_____ CENTER HEAD _____ EMPLOYEE NUMBER _____ DATE

_____ AREA DIRECTOR _____ EMPLOYEE NUMBER _____ DATE

TO BE SUBMITTED TO CENTRAL OFFICE BI-WEEKLY.

* U. S. GOVERNMENT PRINTING OFFICE : 1983 381-[illegible]