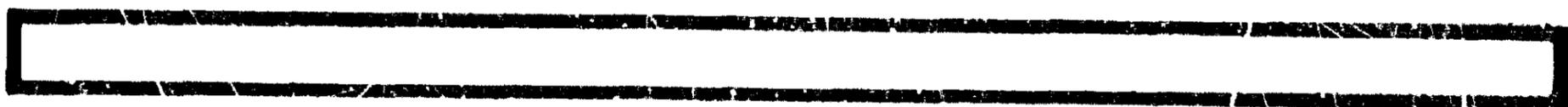
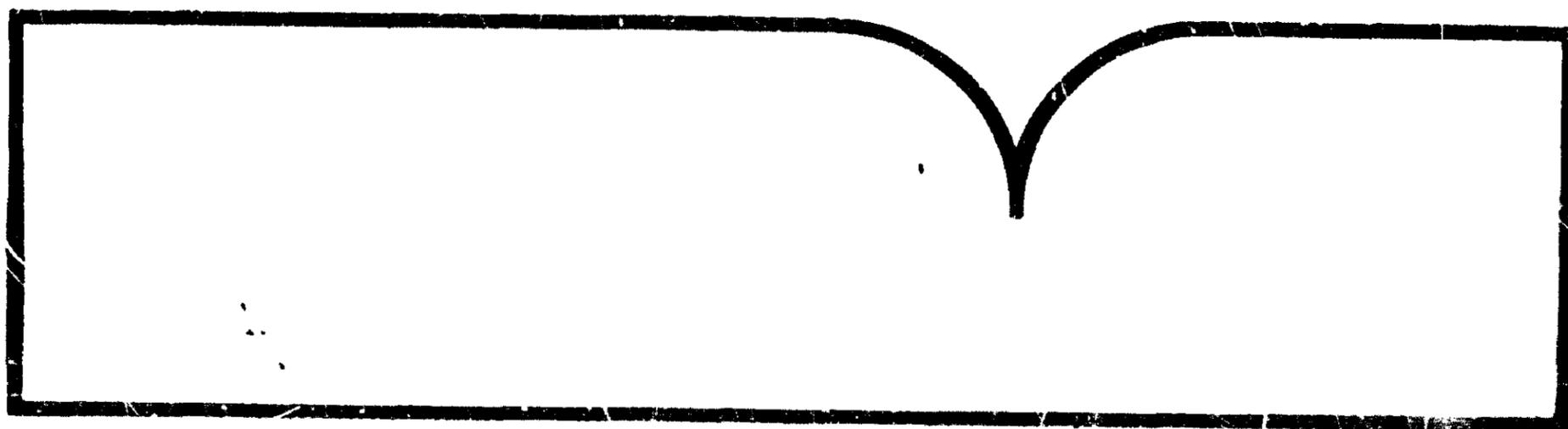


PB83-916202

Highway Accident Report - J. C. Sales, Inc.  
Tractor-Semitrailer, Calvary Baptist Church  
Van Collision, State Route 198 at 19th Avenue  
Near Lemoore, California, October 8, 1982

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

3 May 83



U.S. Department of Commerce  
National Technical Information Service

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16. Abstract About 7:50 a.m., on October 8, 1982, the driver of a tractor-semitrailer swerved his vehicle left and applied the brakes to avoid striking an automobile that had stalled on State Route (SR) 198 near Lemoore, California, while crossing the roadway at an intersection and was blocking the westbound curb lane in which the truck was approaching. The truck traveled to the left of the center of the highway, through the intersection, and into the eastbound curb lane where it collided head-on with an eastbound van. Nine of the van's 11 occupants were killed in the collision, 1 passenger died 3 days later, and 1 passenger received minor injuries. The truckdriver received serious injuries.  The National Transportation Safety Board determines that the probable cause of this accident was the failure of the truckdriver to slow his vehicle while approaching an automobile that was stalled in an intersection and his subsequent failure to control his vehicle while making an avoidance maneuver. Contributing to the cause of the accident was the automobile driver's poor judgment in moving farther into the intersection after he restarted the automobile's engine.			
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**NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C. 20594**

**HIGHWAY ACCIDENT REPORT**

**Adopted: May 3, 1983**

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**J. C. SALES, INC., TRACTOR-SEMITRAILER  
CALVARY BAPTIST CHURCH VAN  
COLLETON  
STATE ROUTE 198 AT 19TH AVENUE  
NEAR LEMOORE, CALIFORNIA  
OCTOBER 8, 1982**

**SYNOPSIS**

About 7:50 a.m., p.d.t., on October 8, 1982, an automobile stopped in compliance with a stop sign at the stop line in the southbound lane of 19th Avenue at its intersection with State Route (SR) 198 near Lemoore, California. After waiting for traffic to clear, the driver accelerated the automobile into the intersection. The automobile's engine stalled, and the vehicle came to a stop, blocking the westbound curb lane on SR 198 in which a westbound tractor-semitrailer was approaching the intersection. While the automobile driver was attempting to restart his vehicle's engine, the tractor-semitrailer continued toward the intersection with no apparent lessening of speed. The driver started the automobile engine and moved the vehicle forward to a position which partially blocked the westbound curb lane and also partially obstructed the westbound median lane. However, the driver stopped the automobile before clearing the intersection when he saw that the truck was close to his automobile. The truckdriver swerved his vehicle left and applied the brakes to avoid striking the automobile. The truck traveled to the left of the center of the highway, through the intersection, and into the eastbound curb lane where it collided head-on with an eastbound van. Nine of the van's 11 occupants were killed in the collision, 1 passenger died 3 days later, and 1 passenger received minor injuries. The truckdriver received serious injuries.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the truckdriver to slow his vehicle while approaching an automobile that was stalled in an intersection and his subsequent failure to control his vehicle while making an avoidance maneuver. Contributing to the cause of the accident was the automobile driver's poor judgment in moving farther into the intersection after he restarted the automobile's engine.

**INVESTIGATION**

**The Accident**

About 7:30 a.m. on October 8, 1982, an automobile driver left his residence and drove about 1.5 miles to the intersection of 19th Avenue and State Route (SR) 198 near Lemoore, California, where he stopped in compliance with a stop sign at the stop line in the southbound lane on 19th Avenue and waited for traffic on SR 198 to clear. The automobile driver stated that after the traffic had cleared and after judging that approaching westbound traffic was about one-half mile away, he accelerated into the intersection intending to make a left turn. After moving several feet, the automobile's engine stalled and the vehicle came to a stop, blocking the westbound curb lane on SR 198

in which a westbound tractor-semitrailer was approaching the intersection. The driver said he decided to restart the engine and move the vehicle forward to clear the intersection. After several attempts, the driver restarted the engine and moved the vehicle forward, to a position which partially blocked the westbound curb lane and also partially obstructed the westbound median lane. However, the driver stopped the automobile before clearing the intersection when he saw that the truck was close. The driver later said that he thought about moving his vehicle rearward out of the intersection, but did not attempt to do so.

A witness in a vehicle which was in front of the truck in the westbound curb lane said that he saw the automobile ahead blocking the lane and that he had more than ample distance to stop his vehicle. He said that the truck moved into the westbound median lane and continued toward the intersection at an estimated 55 to 60 mph, with no perceptible decrease in speed. The witness then saw the automobile move forward, the truck swerve to the left, and that the truck's brakes were being applied.

The truckdriver successfully avoided striking the automobile in the intersection; the automobile driver estimated that the right side of the truck passed about 1 foot from the front of his vehicle. After crossing the intersection, however, the truck's right wheels overrode the east end of the 4-inch-high concrete curb in the raised median at the west side of the intersection. The truck tractor then traveled in an arc to the truckdriver's right, westward in the eastbound travel lanes, and when the truck tractor was nearly aligned with the roadway, the tractor and an eastbound van, occupied by 11 persons, traveling in the eastbound curb lane of SR 198 collided head-on. (See figure 1.)

After impact, the van moved rearward while rotating counterclockwise about 190 to 200 degrees and came to rest facing west-southwest partially on the south edge of the pavement. The truck swerved sharply to the driver's left and off the road. The tractor penetrated a fence and stopped in a field with the semitrailer's wheels resting on the south edge of the pavement. (See figure 2.) The driver and eight of the van passengers were ejected and killed, one passenger died 3 days later, and one passenger received minor injuries. The truckdriver received serious injuries.

The van, occupied by the 33-year-old driver and her three children, ages 2, 3, and 4, had departed the driver's residence in Avenal, California, about 6:45 a.m. The driver picked up five passengers (ages 4 to 16) in the Avenal area and drove to Lemoore Naval Air Station where she picked up two more passengers (ages 7 and 9). The van was en route to a parochial school in Visalia, California, about 60 miles from Avenal.

The truckdriver's logbook indicated that he came on duty at 1 a.m. on October 8, 1982, at Santa Fe Springs, California, about 95 miles from Lemoore. An invoice in the logbook folder showed that the truckdriver had made a delivery in Tulare, California, on October 8. The truckdriver said that he saw the automobile pull into the intersection and stop and that he then moved into the westbound median lane and honked his horn.

#### Injuries to Persons

<u>Injuries</u>	<u>Driver</u>		<u>Passengers</u>		<u>Total</u>
	<u>Van</u>	<u>Truck</u>	<u>Van</u>	<u>Truck</u>	
Fatal	1	0	9	0	10
Serious	0	1	0	0	1
Minor/None	0	0	1	0	1
Total	1	1	10	0	12

**LEGEND:**

- 1a. Tractor-Semitrailer as it passed the Automobile
- 1b. Tractor-Semitrailer at impact
- 1c. Tractor-Semitrailer at final rest
- 2a. Van preimpact
- 2b. Van at impact
- 2c. Van at final rest
- 3a. Automobile stopped behind stop bar
- 3b. Automobile in position where it stalled
- 3c. Automobile in second stopped position

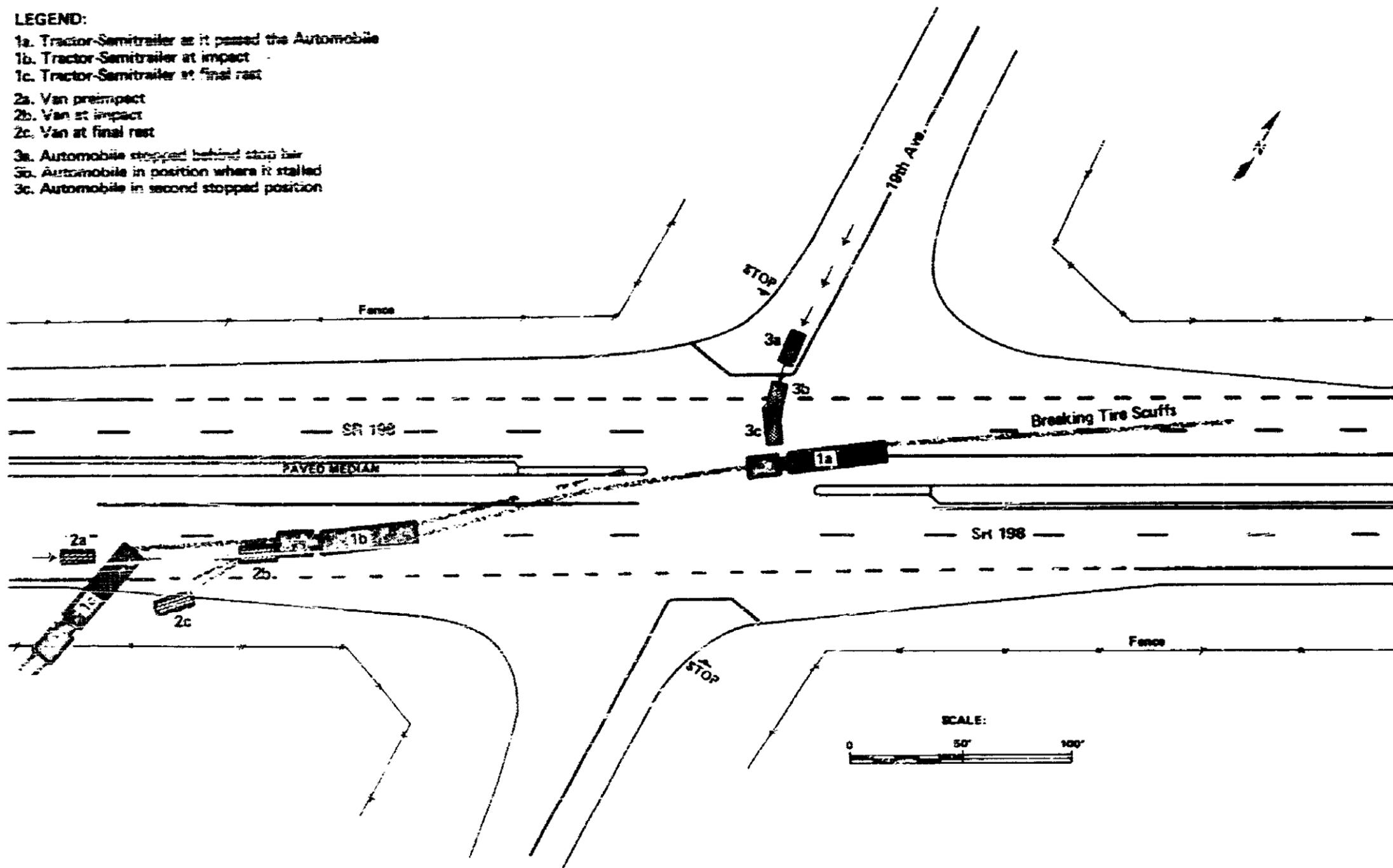


Figure 1.--Plan view of accident site.



Figure 2.--Truck and van at rest positions.

### Vehicle Information

The tractor and semitrailer were owned by J. C. Sales, Inc., of Santa Fe Springs, California. The truck tractor was a 1980 Kenworth, Model K-100C, three-axle tractor, VIN: 287189J. The vehicle's tachograph registered 221,411.8 miles; there was no chart in the tachograph. The cab-over-engine tractor was equipped with an 8-cylinder diesel engine and a Fuller Road Ranger transmission and airbrakes. The tractor had a seatbelt for the right seat, but there was no seatbelt for the driver's seat. Since a driver seatbelt was standard equipment for the tractor, the seatbelt apparently was removed after the tractor was manufactured. The tractor was equipped with four 100-gallon fuel tanks—two mounted on each side of the chassis—and a Merritt dromedary freight box <sup>1</sup>/ <sub>mounted to the chassis directly behind the cab.</sub>

All equipment and mechanical subsystems on the tractor were inspected. The steering axle (No. 1) was equipped with type-20 brake chambers. Collision damage precluded using air to test the brakes, but the slack adjusters were manually checked and found to be within the 1 inch maximum stroke suggested by the manufacturer. The type-30 brake chambers on the No. 2 axle were checked by applying 80-psig air. Slack adjuster travel was 2 1/8 inches on each side; manufacturer-suggested maximum travel for type-30 brake chambers is 2 inches. A tow truck operator had "backed off" both brake chambers on the No. 3 axle to facilitate towing the vehicle after the accident, so that the adjustment of the brakes before the accident could not be determined.

The 42 5-foot-long, 1976 Utility, Model R-200-T, closed box, refrigerated semitrailer was loaded with 30,525 pounds of lard, shortening, and soybean oil. The combined vehicle gross weight was about 65,900 pounds. The mechanical subsystems on the semitrailer had no defects except that the brake slack adjuster travel was marginal and the spring brakes on the No. 5 axle had been "caged" or locked out. Caging these springs meant that in case of a loss of air, the No. 5 axle spring brakes would not activate. This would not have affected adversely the performance of the service brakes.

The semitrailer was equipped with Berg/Mechanex computerized, Federal Motor Vehicle Safety Standard (FMVSS) 121, antilock brakes on both the No. 4 and No. 5 axles. Both axles were equipped with Anchor Lock 30 + 30 brake chambers. The antilock brake computer boxes were mounted—one on each of the semitrailer chassis rails—directly above the No. 4 axle. Measurements of slack adjuster travel were taken; the results were:

<u>Position</u>	<u>Push Rod Stroke</u>
Left No. 4	2 inches
Right No. 4	2 inches
Left No. 5	1 7/8 inches
Right No. 5	1 5/8 inches

Slack adjuster travel on the No. 4 axle was at the manufacturer's recommended maximum stroke of 2 inches.

The van was a 1969 Chevrolet Sportvan 108 Deluxe, VIN: GE169P745177, and was owned by the Calvary Baptist Church, Avenal, California. Collision damage had distorted the van's odometer, but the mileage reading was probably either 72,705 or 83,705 miles.

<sup>1</sup>/ <sub>An 8-foot-long steel bed with a vertical front plate.</sub>

The van was equipped with an 8-cylinder engine, manual transmission, nonpower-assisted steering, nonpower-assisted drum brakes, and a driver's seat, a right-front passenger seat, two rear-facing bucket seats attached to the floor and to the backrests of the driver's and right-front passenger's seats, and two bench seats. The bucket seats had been installed after the van was manufactured.

The seating capacity of the van was 12 adults, including the driver. Because of the seating capacity and because the van was transporting students to a school (public or private), the van was subject to a California State law that required that the van be operated as a schoolbus subject to all attendant requirements for equipment and operation. (See appendix B.)

The van was equipped with two seatbelts at the driver's seat and the right-front passenger's seat. Federal Motor Vehicle Safety Standards (FMVSS) Nos. 209 and 222 require that vans of the type involved in this accident (and any "schoolbus" with a gross vehicle weight rating of 10,000 pounds or less) have passenger restraint systems if the vehicle was manufactured on or after April 1, 1977, and Highway Safety Program Standard (HSPS) No. 17, Pupil Transportation Safety, states that passengers in vans of this type (having a capacity of 16 passengers or less) must use the restraints whenever the vehicle is in motion. The regulations did not apply to the van in this accident since it was manufactured in 1969. Retrofitting of restraints in older vans such as this one is not required, and the effectiveness of such installation would depend on whether the van's floor and structure were strong enough to support restraints effectively.

The van reportedly had been donated to the Calvary Baptist Church by a member of the congregation. Few records pertaining to the vehicle could be found. About 1 month before this accident, the church began to transport students daily to the parochial school in Visalia. The pastor of the Calvary Baptist Church said that the van was used most of the time, but that the pastor's personal van and a station wagon belonging to another member of the congregation were used occasionally to transport the students to and from the school. The pastor said that he was not familiar with the California State law that required the van to be operated in compliance with the requirements for a school bus.

All mechanical systems and elements of the van were inspected, and no defects were found except for the brakes and tire inflation. Inspection showed that brake fluid had been leaking from the right-rear wheel cylinder and had contaminated both brake linings and the drum. An uneven wear pattern on the right-rear brake linings indicated that the brakeshoes were not aligned properly with the brake drum face. New brake linings reportedly had been installed recently on all four wheels. The right-rear tire was underinflated since it had only 21 psig inflation. Neither of these defects contributed to the accident. Tests showed that the van's headlights were on at the time of the collision.

The automobile, a 1978 Mercury Zephyr 2-door sedan, VIN: 8K35F-526053, was equipped with an 8-cylinder engine and an automatic transmission. The odometer showed 58,172.7 miles when the vehicle was inspected. Safety Board investigators tested the automobile to attempt to duplicate the amount of warm-up time, driving distance, and heater control settings. Investigators noted that the fast idle cam would back off, allowing a normal, but rough, idle. Repeated tests demonstrated that, when cold, the engine would stall when it was accelerated from a stop. No engine stalling was noted when sufficient time was given to allow the engine to warm up fully.

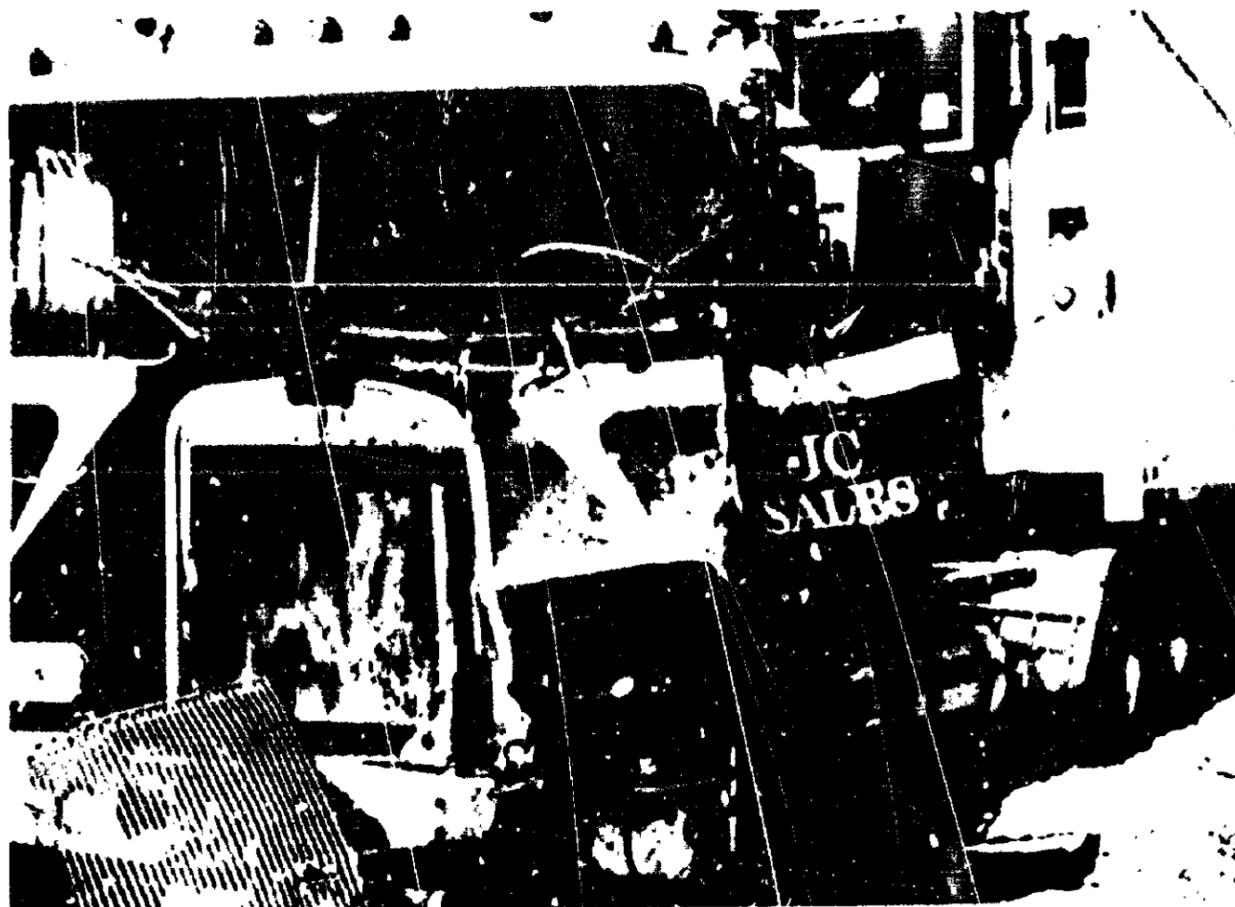


Figure 3.--Damage to front of truck tractor.

### Vehicle Damage

The left front of the truck tractor overlapped the left front of the van by about 4 feet at impact, and the angle between the closing vectors was about 176 to 178 degrees. There was extensive damage to the left front of the tractor. (See figure 3.) In addition to bumper and exterior sheet metal damage, the steering column was separated, and the steering gear box was torn from its mounting on the left chassis rail. The left-front axle leaf springs and shackles were separated, as were the engine and transmission frame mounts. The engine and transmission were displaced rearward, and skewed to the left. The left side of the cab was displaced rearward, damaging the left forward fuel tank and collapsing the air filter. The bottom-left cab rail was separated and displaced rearward, puncturing the forward vertical face of the dromedary. There was about a 16.4-inch difference between the dynamic thrust and the postcrash static position of the cab rail. Interior damage was limited to minor damage to the instrument panel, steering wheel and column, and the driver's seat. The left windshield was broken out. The semitrailer was not damaged.

The forward half of the van was virtually destroyed. All front-end components were either stripped from the vehicle or were distorted so that the front of the vehicle was open. The van's entire left side was separated back to the left D-pillar and hinged at the D-pillar so that at final rest the left side was aligned at about a 40- to 60-degree angle to the longitudinal axis of the vehicle. (See figure 4.) The van's roof was crushed downward with the front displaced to the left. The van's front panel contained circular imprints associated with the truck tractor's left headlights and a puncture from the left tilt-cab



Figure 4.--Damage to front of van.

hinge on the tractor. The van's steering, front suspension, forward chassis, and wheels were destroyed; the fuel tank was stripped from the vehicle. The engine and transmission were displaced rearward and upward, intruding into the passenger compartment. Interior damage was also extensive. The padded instrument panel was severely buckled and showed evidence of occupant contact. The driver's seat was buckled and torn from the vehicle; the right-front seat was buckled, but in place. Both bucket seats were torn loose. The first bench seat had broken loose from its floor mounting brackets and the right end was displaced forward and its left end displaced rearward, so that the seat was at an angle laterally in the van. The seat backrest evidenced occupant contact and loading from the rear. The rear bench seat, mounted over the rear axle, was still attached to the floor mounting brackets; it evidenced slightly rearward distortion of its left end.

#### Carrier Information

J. C. Sales, Inc., is owned by the truckdriver's father. The company operates five truck tractors and nine trailers in interstate commerce, primarily in California and Arizona.

Following this accident, the Bureau of Motor Carrier Safety (BMCS) of the Federal Highway Administration (FHWA) conducted a Safety Compliance Survey of J. C. Sales, Inc. Numerous violations of the Federal Motor Carrier Safety Regulations (FMCSR) were found, and the company was given an overall safety compliance evaluation of "unsatisfactory." It was noted that the owner was not aware of the applicability of the FMCSR's. The FMCSR's were explained to him, and he committed himself to future compliance. The BMCS planned to resurvey the company in 6 months.

#### Driver Information

The 20-year-old truckdriver held a valid California Class 1 operator's license which had no restrictions and which was valid for the type of vehicle being driven. Since he was less than 21 years old, the FMCSR's prohibited his driving interstate. Logbooks found in the tractor showed that the driver had made several trips to Arizona. Between November 23, 1979, and April 29, 1982, the truckdriver's driving record showed: one previous accident; six speeding violations (five in California and one in Arizona); one red light violation; and multiple truck weight, registration, and equipment violations. Investigation also revealed several instances in which the truckdriver had falsified his driving logs.

The 33-year-old van driver held a valid California Class 3 operator's license with no restrictions. Her license was valid for operation of the van at all times except when it was being operated as a schoolbus. The van driver was neither properly licensed nor certificated to drive a schoolbus. Her California driving record showed no previous accidents or convictions for violations.

The 19-year-old automobile driver held a valid California operator's license which had no restrictions and which was valid for the type of vehicle being driven. His California driving record showed no previous accidents or convictions for violations. He had completed driver's education in high school and a defensive driving course during military service.

### Highway Information

State Route (SR) 198 is an east/west arterial highway. At the accident site, it is a 4-lane divided expressway. SR 198 has both at-grade intersections and full interchanges. The highway, which was built in 1965, consists of nominal 12-foot-wide travel lanes and sand shoulders. Opposing lanes are separated by a 22-foot-wide depressed median. The speed limit on SR 198 is 55 mph. At the 19th Avenue at grade intersection, there are left turn lanes, and the pavement has been widened to facilitate right turns off of and onto SR 198. Five-foot-wide raised medians with 4-inch-high concrete slanting curbs (semimountable) separate the opposing lanes at the left turn lanes. Pavement markings consist of edge lines (all edges), lane lines, and directional arrows. Appropriate intersection warning and control signs are posted on both approaches. All pavement markings and signing conform to the U.S. Department of Transportation Manual on Uniform Traffic Control Devices (MUTCD) and/or FHWA guidelines. SR 198 has a 2-percent crown and a 0.17-percent grade positive to the west at the intersection area. Traffic volume counts taken in 1981 show annual average daily traffic (AADT) of 6,800 vehicles.

Nineteenth Avenue intersects SR 198 at about 61 degrees in the northeast quadrant and is a 2-lane, two-way roadway. Each approach to SR 198 is controlled by a stop sign with accompanying stop lines painted on the pavement. All signs and pavement markings conform to the MUTCD.

From January 1, 1979, to December 31, 1981, only two accidents were unreported near the intersection of 19th Avenue and SR 198. Both were single-vehicle accidents in which there were no injuries. One occurred 0.04 mile west, and the other 0.17 mile east, of the intersection.

### Meteorological Information

Data received from the Lemoore Naval Air Station, approximately 10 miles from the accident site, show that at 7:50 a.m. on the morning of the accident it was daylight and there was a clear sky with 15 miles visibility. The temperature was 49° F and the dewpoint was 35° F. Wind was out of the west-northwest (280 degrees) at 3 mph.

The sun was above the eastern horizon and at an angle to the right front of the van driver. Observations of the sun angle and azimuth made at 7:50 a.m., 2 days following the accident indicated that sun glare was not a factor to impede the vision of either the automobile driver or the van driver.

### Medical and Pathological Information

There was no evidence that the physical condition of any of the three involved drivers could have affected the safe operation of a vehicle.

The 10 fatalities received extensive cranial, facial, cervical spine, and thoracic injuries. The sole survivor (age 4) from the van received minor lacerations, contusions, and abrasions. She was treated at a local hospital and released. The truckdriver received severe abdominal and leg injuries which required about 3 days' hospitalization.

### Survival Aspects

There was no seatbelt available for the truckdriver. Due to extensive vehicle damage, it could not be determined if the driver of the van and the passenger in the right-front seat were wearing their available seatbelts. Because the seating positions of the van passengers could not be determined, it could not be determined which passenger was riding in the right-front seat and had a seatbelt available.

Although there was insufficient physical evidence to permit accurate speed computations, investigators believe that the closing rate between the van and the truck exceeded 70 mph at the time of impact. Investigators estimated that the van was traveling at 45 to 55 mph at the time of impact. The van's entire forward momentum was instantaneously arrested, and the van's speed was accelerated as its direction of travel was reversed. The impact, therefore, resulted in an instantaneous change in the van's speed due to impact forces ( $\Delta V$ ) on it in excess of 60 mph. Moreover, the penetration of the truck tractor into the van and the van's collapsing components exposed the van's unrestrained occupants to severe collisions with truck and van components. Some of the injuries may have resulted from the passengers striking each other. Damage to the van also permitted ejection of 9 of the van's 11 occupants. Because of the greater momentum of the truck, the  $\Delta V$  of the truck was not as great as that imparted to the van.

A California State Traffic Officer happened onto the accident scene within 1 to 2 minutes after the collision. The first ambulance arrived at the scene about 19 minutes after the collision.

### Tests and Research

Dual wheel tire marks from the semitrailer began about 194 feet east of the intersection and a short distance north of the lane line, in the westbound curb lane. The marks angled southward and were intermittent to within the intersection. Dual tire marks from the left side of the semitrailer began near the east side of the intersection and were continuous beyond the point of impact. (See figure 5.) The semitrailer's right-side dual tire marks began near the east of the raised median on the west side of the intersection and, likewise, continued beyond the point of impact. (See figure 6.) As the tractor left the pavement, its tires left continuous deep furrows to their respective rest positions.

The semitrailer's antilock brakes were tested in an effort to explain the irregular tire mark pattern found at the accident site. The semitrailer was inspected by a Safety Board investigator accompanied by two engineers for Berg/Mechanex Company, the manufacturer of the antiskid hardware. A test of the electrical power supply, electrical continuity, service brake operation, and valve function showed the antiskid system to be functioning properly.

Tests were performed on the wheel sensors on all wheels by rapidly spinning and stopping the exciter ring. This action should cause the air valves to cycle. In the tests, the valves on all wheels cycled except the valve on the right No. 5 axle wheel. An inspection revealed metal shavings in the exciter ring on the right No. 5 axle wheel and a .030-inch gap between the electromagnetic pickup and the exciter ring. The manufacturer recommends a .020-inch gap. The electromagnetic pickup was facing at a 6 o'clock position within the exciter ring. Figure 6 of the manufacturer's data book shows all electromagnetic pickups in the 6 o'clock position. However, the manufacturer's engineers who participated in the tests recommended that the sensor unit be placed in the

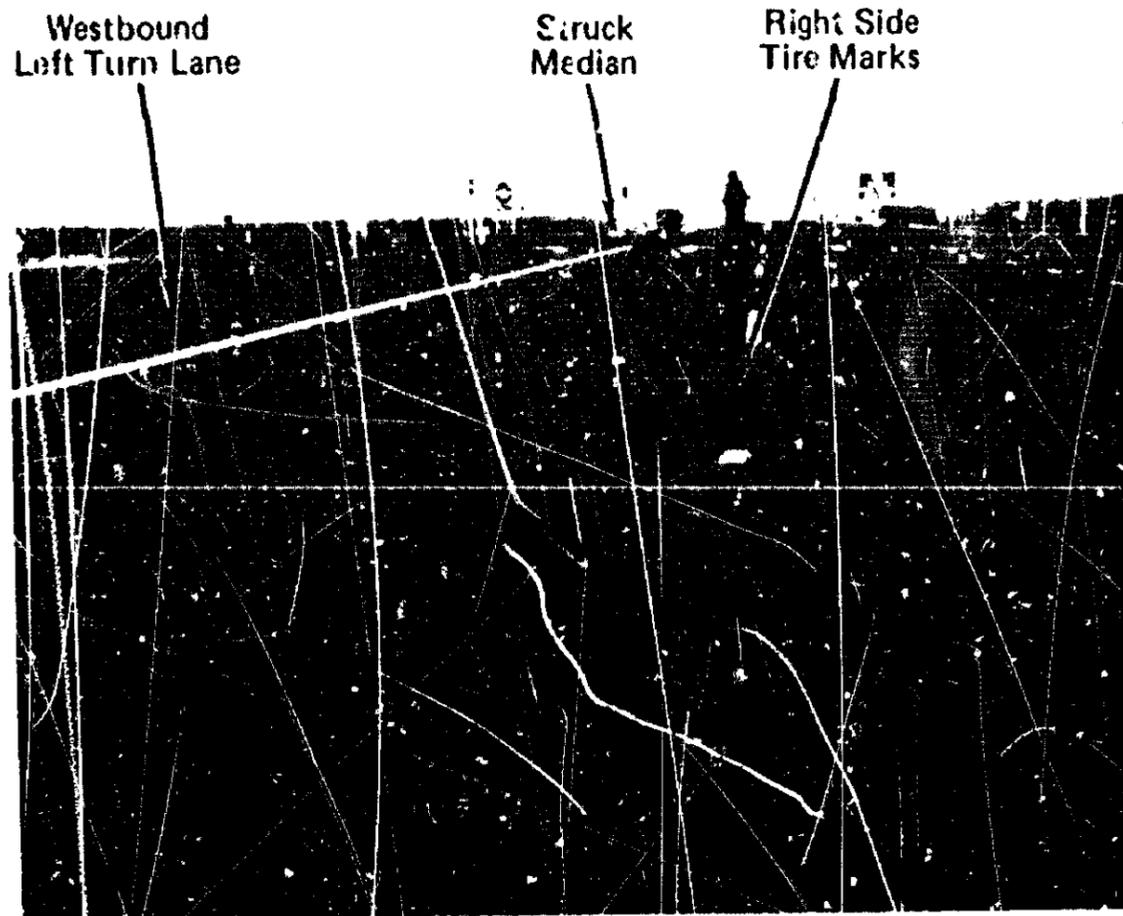


Figure 5.--View west from east of the intersection in the westbound lanes.

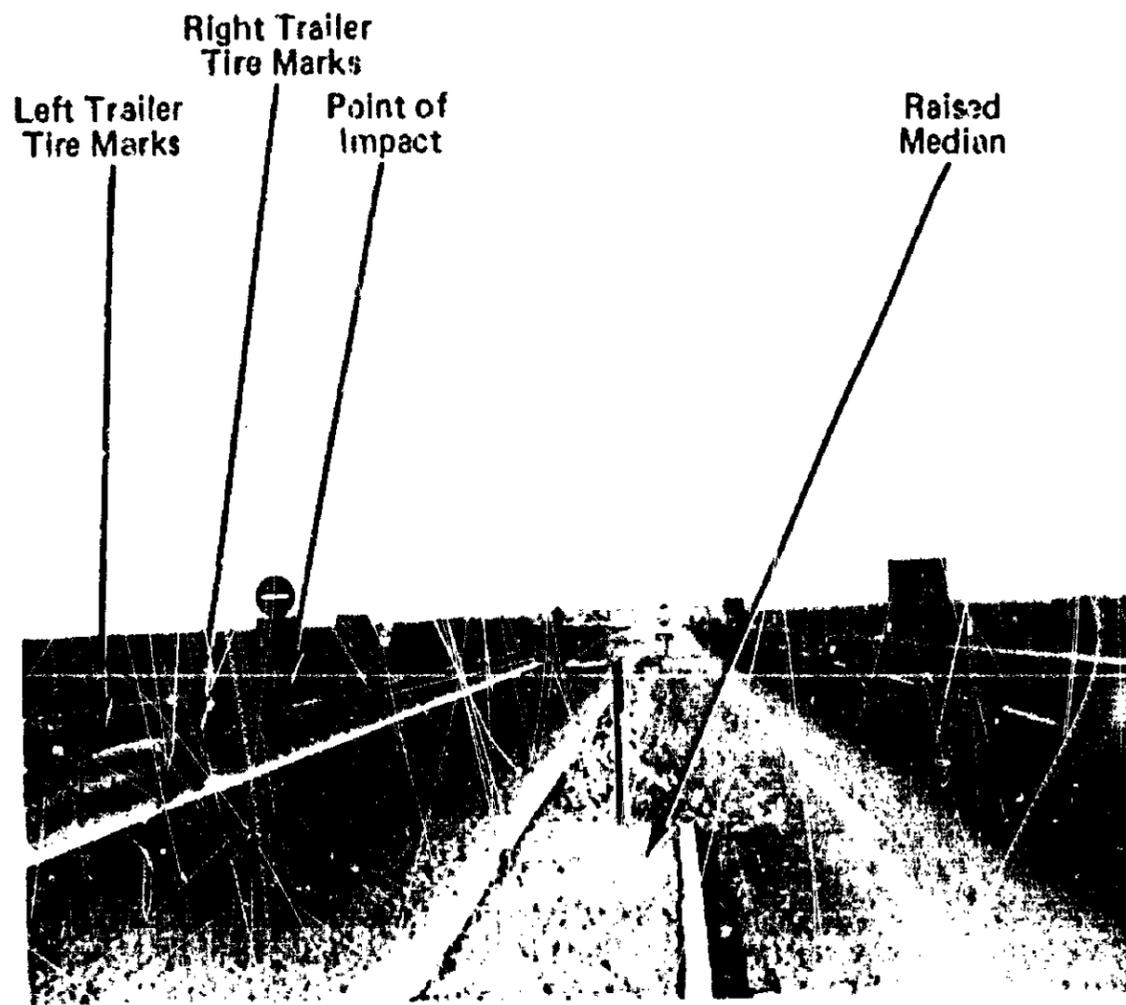


Figure 6.--View west of the intersection from the raised median.

exciter ring with the pickup in the 12 o'clock position. The rubber grommet located on the sensor end of the wheel sensor cables of the right side of axle No. 5 was loose and failed to fit properly. The rubber had hardened and no longer provided a seal. The magnetic pickup of the sensor unit was found to be damaged. Portions of the pickup sensor were chewed away and were no longer in close contact with the exciter rings. No other defects were noted.

Two dynamic skid tests were performed using a conventional, but similar, tractor and the empty accident-involved semitrailer to determine if the electronic brake system was properly functioning. Both tests were run at 20 to 25 mph, and the brakes were applied by use of the hand valve only. The first test was with the antilock mechanism functioning and resulted in a skip-skid pattern; each side was of equal length, but the right side was faint and less distinct, while the left side left well-defined skip-skid marks. The second test was run with the antilock system deactivated. It resulted in two sets of solid dual tire skidmarks of equal length.

A driver would not know whether the antilock system was active or deactivated unless he crawled under the trailer to read the indicator lights in the computer boxes. The system is designed so that if the antilock mechanism is deactivated, the trailer brakes revert to the conventional service brake system. When the circuit is broken, it must be reset using the latching relay reset button. This requires crawling under the semitrailer to check the indicator light on the frame-mounted computer units and resetting if the light is not illuminated. Once the circuit is reset, it will remain so unless it is short circuited, which causes the latching relay and the indicator lights to go out. The light only indicates the flow of electricity to the computer box.

There were no preimpact tire marks left by the van. The impact area showed several tire scuffs and pavement gouges. Tire scuffs led from the impact area to the van's rest position.

#### Other Information

Currently, there are no universally recognized commercial driver training standards. The FMCSR's provide that a motor carrier driver may qualify "by reason of experience or training, or both." <sup>2/</sup> The lack of specific qualification criteria results in a broad spectrum of training standards and driver qualifications. A 1982 DOT report to Congress <sup>3/</sup> revealed that: (1) 85 percent of drivers involved in commercial vehicle accidents have had no formal commercial driver training, (2) drivers with less than 2 years' experience are involved in 49 percent of the large truck accidents, and (3) drivers of large trucks who are younger than 25 are involved in more accidents than are drivers of passenger cars who are younger than 25.

The National Highway Traffic Safety Administration (NHTSA) is currently sponsoring research in the development of improved license examinations for operators of heavy vehicles. The research is being conducted by the National Public Services Research Institute (NPSRI). The primary objective of the research is to develop a more effective standardized heavy vehicle licensing test to be used by the States. It will include an on-road examination, a driving range examination, a pretrip inspection examination, and a knowledge examination based on a driver's manual to be developed. The research is expected to be completed in 1984.

<sup>2/</sup> See 49 Code of Federal Regulations, Section 391.11(3) and (4).

<sup>3/</sup> U.S. Department of Transportation, National Highway Traffic Safety Administration, "A Report to the Congress on Large-Truck Accident Causation," July 1982.

The BMCS has conducted a study entitled "Control of Large Commercial Vehicle Accidents Caused by Front Tire Failure" (DOT FH-11-8562). In 1975, as a result of the study, the BMCS indicated that it intended to develop and test tractor-trailer driver training standards and course curricula for the training of commercial vehicle drivers. The purpose of the course was to improve the training programs which did not address emergency driving problems and their solutions.

On May 30, 1975, following its investigation of a truck and bus accident in Bordentown, New Jersey, <sup>4/</sup> the Safety Board issued Safety Recommendation H-75-9 to the BMCS, urging that:

Upon the completion of the research dealing with the development of the tractor-trailer driver training standards, distribute such training course information to all professional commercial driver training schools.

On June 12, 1975, the BMCS replied that when the course curricula are completed and tested, it intends to issue them as "recommended practices" for training standards. These practices would enable motor carriers and existing and prospective commercial driver training schools to upgrade their curricula to insure uniform quality of training. This recommendation remains in an "Open-Acceptable Action" status, but the BMCS has yet to issue any training standards.

Both the NHTSA and the BMCS are monitoring the other agency's work in this area. While the research is similar, the objectives differ. The BMCS is developing a comprehensive truckdriver training syllabus and a comprehensive final examination to assure that the trainee has learned and retained what was taught. The NHTSA research is oriented toward developing a commercial vehicle oriented test to be used by State driver's license examiners in testing commercial driver's license applicants.

## ANALYSIS

### The Accident

The facts developed during the investigation of this accident indicated that the driver of the stalled automobile was not in violation of the State of California's right-of-way law because, at the time the automobile entered the intersection, there were no other vehicles on SR 198 "... approaching so closely ... as to constitute an immediate hazard" (Cal. Veh. Code Section 21802(a)). Once the automobile entered the intersection, the truckdriver had the responsibility to "... yield the right of way to the vehicle entering or crossing the intersection" (Cal. Veh. Code Section 21802(b)). The truckdriver's continuing toward the intersection without lessening his vehicle's speed while the intersection was occupied by a stalled vehicle was not in compliance with the California right-of-way law.

When the automobile's engine stalled, the driver decided to restart the engine and move the vehicle forward to clear the intersection. Even though the driver said he thought about moving his vehicle rearward out of the intersection, the driver did not change his decision to move his vehicle forward. The driver had completed both driver education and defensive driving courses. A review of textbooks commonly used in such

<sup>4/</sup> Highway Accident Report--"George Wollman Meats, Inc., Truck/Auto/Greyhound Bus Collision and Fires, New Jersey Turnpike, Bordentown, New Jersey, October 19, 1973" (NTSB-HAR-75-3).

education courses and of defensive driving course instructor materials shows that both advise drivers to monitor and evaluate the changing, dynamic traffic situation and to alter decisions based on the changing needs of the traffic situation. Because of the developing traffic situation, the driver should have moved rearward or remained stationary when his automobile stalled. His action in moving forward probably resulted in the truckdriver's increasing his degree of evasive action. However, as earlier noted, the automobile driver had the right of way in the intersection, and his action was not improper according to California law.

The witness in the vehicle ahead of the truck said that when the automobile was driven into the intersection and stalled, he had ample distance to stop his vehicle before the intersection. The Safety Board concludes that the truckdriver could have brought his truck to a safe stop in the westbound lanes without conflict with the automobile if the truckdriver had immediately applied the truck brakes. The truckdriver said that he saw the automobile pull into the intersection and stop. The witness said that the truckdriver did not slow the speed of his truck from its estimated speed of 55 to 60 mph. It appears that the truckdriver assumed that the automobile would remain stationary and that he could move into the median lane and pass by the automobile without slowing or stopping. Once the automobile moved forward, the truck had to be driven farther to the left to avoid the automobile.

Evaluation of the drivers' statements, witness statement, and time-distance computations indicate that the truck was about 15 seconds and 1,300 to 1,400 feet west of the intersection at the time the automobile entered the intersection and stalled. The automobile driver had to stop the car, shift the gear selector into "park," crank the starter, turn the ignition to "off," then recrank the starter before he could start the engine again. He then revved the engine, shifted into a drive gear, moved forward a few feet, and stopped a second time before the truck passed by the automobile. The automobile driver's actions would have taken about 15 to 20 seconds to accomplish.

The truckdriver's statement, witness statement, and computations all indicate that the travel speed of the truck was very near 60 mph (88 feet per second). At a constant speed of 60 mph, the truck would have traveled 1,320 feet in 15 seconds and 1,760 feet in 20 seconds. If the truckdriver had reacted by slowing his vehicle when he saw the automobile pull into the intersection and stop, he could have brought the truck to a safe, smooth stop in about one-half the available distance. For example: allowing 1.5 seconds for perception/decision/reaction time (132 feet of travel at 60 mph) and applying a nominal braking coefficient of 0.20 to 0.25, the truck could have been brought to a stop in 612 to 732 feet. Moreover, the reduction of the truck's speed would have increased the travel time to the intersection, thus giving the automobile driver more time to start his vehicle's engine and clear the intersection.

Examination of the known data leads the Safety Board to conclude that this accident resulted from the actions of both the truckdriver and the automobile driver. Neither driver could have known what the other was thinking or intending to do. Therefore, it rested with each driver to quickly evaluate the situation and take the most prudent action. Neither driver did that. The Safety Board concludes that the accident resulted from the truckdriver's failure to slow or stop his vehicle when approaching the stalled automobile, and that the actions of the automobile driver in moving forward so that his vehicle partially obstructed both westbound travel lanes contributed to the accident. The fact that the truckdriver was not restrained may have contributed to the loss of control when the truck bounced over the median curbing. He may have been jostled from his seat behind the steering wheel.

Assuming that the van driver's initial perception of danger began about the time that the truck struck the median, her time to react would have been 2 to 3 seconds. Given the elements of surprise or disbelief which may have existed, the 2 to 3 second time was insufficient to process the information presented by the precrash truck dynamics and react to avoid the collision.

### Commercial Driver Training

The events of this accident, which caused the loss of 10 lives, clearly demonstrate that the truckdriver was incapable of safely operating the vehicle he was driving during a situation that is not uncommon for a driver to encounter. The Safety Board has investigated several other accidents in which drivers of large motor vehicles have similarly demonstrated a lack of ability to safely operate their vehicles. (See appendix C.) Many trades and professions require years of training coupled with extensive testing before a trainee receives a license. Considering the loss of life each year in accidents involving large vehicles, the Safety Board believes that standards should be established for the training of professional drivers of large motor vehicles and that they should be adequately trained and required to demonstrate through a comprehensive examination their ability to operate large motor vehicles under normal and adverse conditions before being licensed to drive.

Ongoing BMCS studies of commercial vehicle driver training are progressing on schedule. However, the BMCS has stated that it intends to use the data developed through these studies to establish recommended practices for the trucking industry. The Safety Board believes that practices that are critical to the prevention of accidents in large commercial motor vehicles should be required rather than merely recommended. Therefore, the Safety Board concludes that the BMCS should expeditiously complete its work in developing and testing Tractor-Trailer Driver Training Standards and, upon completion, add those standards to Part 391 of the FMCSR's. Furthermore, the Safety Board concludes that the NHTSA should expedite its ongoing research to develop large motor vehicle driver licensing examination criteria and examination procedures and standards and, after testing them, expeditiously disseminate the procedures and standards and urge their adoption and use by the States. With the advent of the Surface Transportation Assistance Act of 1982 and the longer, wider truck combinations and double bottoms, this training now is more important than ever.

The Department of Motor Vehicles of the State of California is reviewing its truckdriver testing program to determine if there is a need for legislation that would require a comprehensive truck-related testing procedure. The State is also cooperating with the NHTSA in field testing the driver tests being developed in NHTSA-sponsored research. Moreover, legislation is pending in California to make truckdrivers violation records more available and to require that these records include the type of vehicle being driven and the type of load being carried when the violation occurred. Other legislation which would impose additional licensing requirements on California drivers of hazardous materials vehicles also is pending. The Safety Board supports these ongoing efforts to improve highway safety in California.

### Survival Aspects

The high closing rate, the much greater momentum of the truck, and the high  $\Delta V$  imparted to the van made the accident nonsurvivable for the unrestrained, and probably most of any restrained, occupants of the van. It is not known whether either the driver or right-front passenger was using available restraints. However, the truck's penetration

into the van makes it unlikely that they could have survived. Even if every occupant in the van had been using restraints, the penetration of the truck coupled with the collapse of the roof and front-end components makes it unlikely that the occupants of the front seats and bucket seats could have survived even if using restraints. Survival of the occupants in the forward bench seat would have been questionable, and survival of the occupants of the rear bench seat would have been possible. The Safety Board believes that, even though collision forces were severe, the use of properly installed safety belts and child safety seats may have saved the lives of the van's rear seat passengers.

#### Antiskid Brakes on the Semitrailer

The dynamic skid tests performed on the semitrailer indicate that the brake antilock device was activated early in the truck's approach to the intersection where the intermittent skidmarks were found. When the truck tractor struck the median, the electrical power flow to the antiskid computers could have been disrupted, causing a shutdown of the antilock device and reversion to conventional braking. This action would have permitted the wheels to lock and would have caused the solid skidmarks past the median and through the impact area. If the antilock system had not been working at any time, solid skidmarks from the semitrailer's tires would have resulted from the beginning of the brake application.

Slack adjuster adjustment on the tractor's No. 2 axle coupled with the weight on that axle may have prevented full lockup of those tires initially, and jouncing caused by the vehicle striking the raised median may have caused the truckdriver to lose foot contact with the service brake pedal. Even though the slack adjuster travel was marginally beyond acceptable tolerances, there still should have been adequate braking effort to the No. 2 axle wheels. While there is not sufficient information to conclude exactly what was happening during the truck's preimpact braking, there is sufficient information which enables the Safety Board to conclude that there were no brake defects which contributed to, or materially affected the severity of, this accident.

#### Schoolbus Operation

The Safety Board concludes that the fact that the van was not operated as a schoolbus did not contribute to this accident. However, since the more than 5 million students attending private schools represent about 11 percent of the total student population in the United States, the Safety Board is concerned that these students may not be the beneficiaries of certain safeguards extended to their public school counterparts. HSPS No. 17 is intended to enhance the safe transportation of students both to public schools and private schools. However, the lack of structured organization for pupil transportation in most private schools makes it difficult to apply the requirements of HSPS No. 17 and to enforce State laws pertaining to pupil transportation. Most private school students are transported to and from school via schoolbuses, vans, and cars.

There is a lack of information on exposure data and accident statistics involving the transportation of students to private schools. The Safety Board believes this area of student transportation merits more study.

## CONCLUSIONS

### Findings

1. When the automobile entered the intersection, it had the right of way, and California State law required the truckdriver to yield the right of way to the automobile.
2. The truckdriver saw the automobile move into the intersection, but failed to slow his vehicle.
3. The truckdriver did not properly control his vehicle in taking action to avoid striking the automobile, and lost control of his vehicle when it struck and overrode the curb of the raised median.
4. The truckdriver's not being restrained by a seatbelt may have contributed to his inability to regain control of his vehicle.
5. The van driver did not have sufficient perception and reaction time to take avoidance action.
6. California law required that the van be operated as a schoolbus with all the requirements pertaining to ownership, maintenance, equipment, and operation of a schoolbus; however, the failure to operate the van as a schoolbus did not contribute to the cause or severity of this accident.
7. The van used to transport the students did not, nor was it required to, conform to FMVSS Nos. 209 and 222 and HSPS No. 17.
8. Use of seatbelts and child safety seats may have reduced the severity of injuries to a limited number of the van occupants.
9. There were no mechanical vehicle defects pertaining to the truck or van which contributed to the cause, or materially affected the severity of, this accident.
10. There were no highway, environmental, or sun glare factors which contributed to this accident.

### Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the truckdriver to slow his vehicle while approaching an automobile that was stalled in an intersection and his subsequent failure to control his vehicle while making an avoidance maneuver. Contributing to the cause of the accident was the automobile driver's poor judgment in moving farther into the intersection after he restarted the automobile's engine.

### RECOMMENDATIONS

As a result of its investigation of this accident, the National Transportation Safety Board reiterates the following recommendation, made to the Bureau of Motor Carrier Safety on May 30, 1975:

Upon the completion of the research dealing with the development of the tractor-trailer driver training standards, distribute such training course information to all professional commercial driver training schools. (H-75-9)

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

Upon completion of the testing of the Tractor-Trailer Driver Training Standards, the Sample Model Curriculum, and final examination criteria, amend Part 391, "Qualifications of Drivers," of the Federal Motor Carrier Safety Regulations to include criteria and standards for the training of tractor-trailer drivers. (Class II, Priority Action) (H-83-21)

### BY THE NATIONAL TRANSPORTATION SAFETY BOARD

/s/ JIM BURNETT  
Chairman

/s/ PATRICIA A. GOLDMAN  
Vice Chairman

/s/ FRANCIS H. McADAMS  
Member

/s/ G. H. PATRICK BURSLEY  
Member

/s/ DONALD D. ENGEN  
Member

May 3, 1983

**APPENDIX A**  
**INVESTIGATION**

1. Investigation

The National Transportation Safety Board was notified of the accident via news media on October 8, 1982. An investigation team composed of investigators from Washington, D.C., the Kansas City Field Office, and the Los Angeles Field Office arrived at the scene about 8:13 p.m., on October 9 1982. Parties to the investigation were the California Department of Transportation, the Bureau of Motor Carrier Safety, Kenworth Truck Company, and Berg/Mechanex.

2. Deposition/Hearing

There were no depositions or hearings held in connection with this investigation.

**APPENDIX B**

**STATE OF CALIFORNIA  
DRIVER AND EQUIPMENT REQUIREMENTS  
FOR A "SCHOOL BUS"**

The following definitions and list of violations pertaining to the Calvary Baptist Church van are excerpted from the California Highway Patrol Multidisciplinary Accident Investigation Team (MAIT) report of the Lemoore, California accident:

Section 545 of the California Vehicle Code [CVC] states, "A school bus is any motor vehicle designed, used, or maintained for the transportation of any school pupil at or below the twelfth grade level, to or from a public or private school, or to or from a public or private school activity, except the following:

Section 545(b) California Vehicle Code, a motor truck transporting pupils who are seated only in the passenger compartment and a passenger vehicle designed for and when actually carrying not more than 10 persons, including the driver, etc." Under this Section of the Vehicle Code, while the driver of this 12 passenger vehicle is transporting 11 people, including the driver, on a regular basis of to and from school, the bus then comes under the legal definition of a "school bus".

Under this definition, the school bus is required to have the following:

Section 12517 CVC, No person shall operate a school bus in the transportation of pupils to or from a private school unless such person holds a valid driver's license and a school bus driver certificate issued by the Department under the same standards and requirements as are applied to public school bus drivers at the time of issuance of the certificate.

Section 12804(b)(2) CVC, A Class 2 driver's license if required to drive any bus.

Section 12804(c) CVC, Medical certificate required with a driver's license. Class 2 licenses are valid only when a medical certificate approved by the Department is in the licensee's possession, which has been issued within 2 years of the date of operation of such vehicle.

Section 34500 CVC, Under Division 14.8 of the California Vehicle Code, and specifically under Section 34500, it states, "The Department of the California Highway Patrol shall regulate the safe operation [of] the following vehicles: Section C, buses and school buses. ["

Section 22257 CVC, Every school bus when operated for the transportation of school pupils shall be equipped with a flashing red light system.

Section 34508 CVC states that the Department of the California Highway Patrol shall adopt and enforce rules and regulations relating to the equipment, maintenance, construction, design, color, and operation of school buses.

Title 13 of the California Administrative Code (CAC) Subchapter 6.5, Motor Carrier Safety, Article 1, Definitions and general provisions, Section 1200 CAC, Scope; these regulations implement and supplement applicable provisions of the Vehicle Code. Unless otherwise indicated within a specific Section, the provisions of this subchapter shall apply to the following vehicles: buses and school buses.

Section 1202(c) CAC, application to private school buses. The provisions of this subchapter shall apply equally to private school buses and to private school officials and agencies, unless the context clearly indicates that no such application may reasonably be made.

Section 1203.1 CAC, special driver certificates. In addition to a valid drivers license of the appropriate class, the driver shall possess a current California special driver's certificate, valid for driving the specific vehicle listed herein.

Section 1203.1(a) CAC, a school bus, when used for pupil transportation.

Section 1215 CAC, daily vehicle condition report required.

Section 1231 CAC, vehicle inspection certificate required.

Section 1232(a) CAC, preventative maintenance program required. Carrier to have preventative maintenance program including a means of indicating the type of inspection, maintenance, and lubrication to be performed, by date or mileage, when due.

Section 1232(b) CAC, school buses required to be inspected at least every 3,000 miles or 45 calendar days (minimum list of 6 items).

Section 1234 CAC, required records of Motor Carriers (school bus operator).

- B. List of authorized drivers of school buses.
- C. Driver's records, expiration dates of all licenses and certificates, as well as hours of training.
- E. Daily vehicle inspection reports.
- F. Inspection, maintenance, lubrication, and repair records.

Article 8, General Equipment Requirements.

Section 1242(c) CAC, an 8 BC fire extinguisher required.

Section 1243(b) CAC, a 16 unit first aid kit required in the bus.

Section 1256(b)(1) CAC, school bus body and trim colors: Exteriors shall be national school bus yellow.

Section 1256(b)(2) CAC, requires school bus signs and numbers. Signs "school bus" on the front and rear of the bus. "Stop When Red Light Flash" on rear of vehicle. Name of private school on sides. Number of unit on four corners.

Section 1258 CAC, mirrors on school buses.

- A. Size of the rearview mirrors.
- B. Size of the crossview mirrors.

Section 1292 CAC, emergency reflector kit required as in Section 25300 of the California Vehicle Code.

Inspection of [van] disclosed that the driver was in violation of the following:

1. Section 12517 of the California Vehicle Code, operating a school bus without a valid Class 2 driver's license and no school bus driver's certificate.
2. Section 12804(b)(2) of the California Vehicle Code, driving out of classification. Operating a Class 2 school bus on a Class 3 driver's license.

Inspection of [van] disclosed the vehicle was not equipped as required by Code for the following:

1. Section 22257 of the California Vehicle Code, failure to have a flashing red light signal system on a school bus.
2. Section 1232(a) California Administrative Code, failure to have an adequate preventative maintenance program.
3. Section 1242 CAC, operation of a school bus without an 8 BC fire extinguisher.
4. Section 1243(b) CAC, no first aid kit on school bus.
5. Section 1256(b)(1) CAC, operating a school bus not painted school bus yellow.
6. Section 1256(b)(2) CAC, failure to have the required signs on a school bus.
7. Section 1258 CAC, failure to have required mirrors on a school bus.
8. Section 1292 CAC, failure to carry the required emergency reflector kit on a school bus.
9. Section 26453 of the California Vehicle Code, failure to maintain brakes in good working order. The right rear brake shoes contaminated with brake fluid.

Inspection disclosed that the motor carrier or the operator of this school bus failed to comply with the following:

1. Section 1215(b) CAC, failure of the motor carrier to require daily vehicle condition reports, in writing, from the driver of a school bus.
2. Section 1231 CAC, operation of a school bus, with pupils, without an approved inspection certificate for the vehicle.
3. Section 1232(a) CAC, failure to have an adequate preventative maintenance program for a school bus, and keep records of same.
4. Section 1234(b) CAC, failure of the motor carrier to maintain a list of authorized drivers for the school bus.
5. Section 1234(c) CAC, failure to maintain records of the drivers expiration dates for driver's licenses and certificates.
6. Section 1234(e) CAC, failure to maintain copies of the driver's daily inspection reports.
7. Section 1234(f) CAC, failure to maintain adequate inspection, maintenance, lubrication, and all repair records on a school bus.

APPENDIX C

**SAFETY BOARD INVESTIGATIONS  
INVOLVING DRIVER CONTROL OF LARGE MOTOR VEHICLES**

The following is a limited bibliography of past major investigations by the Safety Board where drivers of large vehicles have shown a lack of ability to safely operate their vehicles under normal and unexpected situations:

Surtigas, S.A., Tank-Semitrailer Overturn, Explosion, and Fire, near Eagle Pass, Texas, April 29, 1975 (NTSB-HAR-76-4).

Student Transportation Lines, Inc., Charter Bus Climbing of Bridge Rail and Overturn, near Martinez, California, May 21, 1976 (NTSB-HAR-77-2).

Tractor-Semitrailer/Schoolbus Collision and Overturn, Rustburg, Virginia, March 8, 1977 (NTSB-HAR-78-1).

Osterkamp Trucking, Inc., Truck/Full Trailer and Dodge Van Collision, U.S. 91 near Scipio, Utah, August 26, 1977 (NTSB-HAR-79-1).

Gateway Transportation Co., Inc., Tractor-Semitrailer Penetration of Median Barrier and Collision with Automobile, I-70, St. Louis, Missouri, September 25, 1977 (NTSB-HAR-79-3).

Overturn of a Ypsilanti, Michigan, Boy's Club Bus, on I-75 near Tifton, Georgia, April 11, 1978 (NTSB-HAR-79-2).

B&J Trucking Company Truck Tractor/Coachella Valley Unified School District Schoolbus Collision, State Route 86 near Coachella, California, April 23, 1980 (NTSB-HAR-80-6).

Central Texas Bus Lines, Inc., Charter Bus, State Route 7 near Jasper, Arkansas, June 5, 1980 (NTSB-HAR-81-1).

East Side Church of Christ Bus Skid and Overturn, U.S. Route 183, near Luling, Texas, November 16, 1980 (NTSB-HAR-81-4).

Illinois Central Gulf Railroad Freight Train and Mobil Oil Company Tractor/Cargo-Tank Semitrailer Collision and Fire, Kenner, Louisiana, November 25, 1980 (NTSB-RHR-81-1).

Continental Trailways, Inc., Scheduled Intercity Bus/Multiple-Vehicle Collision and Fire, Interstate Route 95 near Beltsville, Maryland, April 20, 1981 (NTSB-HAR-81-5).

ARA Services, Inc., Tour Bus, Denali National Park and Preserve (Mt. McKinley National Park), Alaska, June 15, 1981 (NTSB-HAR-81-7).

Miller Transporters, Inc., Tractor Cargo Tank Semitrailer/Southern Railway System Freight Train Collision and Fire, Huntsville, Alabama, September 15, 1981 (NTSB-TSR-RHR-82-1).

Herman Duvall Tractor-Pole Semitrailer/SL & B Academy, Inc., Schoolbus Collision, U.S. Route 45 near Waynesboro, Mississippi, October 12, 1981 (NTSB-HAR-82-2).

Pacific Intermountain Express Tractor Cargo Tank Semitrailer, Eagle/F.B. Truck Lines, Inc., Tractor Lowboy Semitrailer Collision and Fire, U.S. Route 50, near Canon City, Colorado, November 14, 1981 (NTSB-HAR-82-3).