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Highway Accident Report - B and J Trucking Company Truck Tractor/Coachella Valley Unified School District Schoolbus Collision, State Route 86, Near Coachella, CA, April 23, 1980

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

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16. Abstract

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The National Transportation Safety Board determines that the probable cause of this accident was the failure of the truck company to properly maintain its vehicle which resulted in a blow-out of the left front tractor tire, causing the truckdriver to lose control of his vehicle. Contributing to the accident was the lack of a truck company preventive maintenance program and an inadequate California Highway Patrol inspection that should have detected the deteriorated condition of the tire before it blew out.

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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C. 20594

HIGHWAY ACCIDENT REPORT

Adopted September 29, 1980

B & J TRUCKING COMPANY TRUCK TRACTOR/ COACHELLA VALLEY UNIFIED SCHOOL DISTRICT SCHOOLBUS COLLISION, STATE ROUTE 86 NEAR COACHELLA, CALIFORNIA APRIL 23, 1980

SYNOPSIS

About 3:25 p.m., Pacific standard time, on April 23, 1980, a truck tractor was traveling north on California State Route 86, a two-lane rural highway, when its left front tire blew out. The tractor swerved to the left, crossed the centerline, and collided head-on with a southbound schoolbus transporting nine teenaged students home from school. The busdriver and three students were killed; the truckdriver and six students were injured.

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the truck company to properly maintain its vehicle which resulted in a blow-out of the left front tractor tire, causing the truckdriver to lose control of his vehicle. Contributing to the accident were the lack of a truck company preventive maintenance program and an inadequate California Highway Patrol inspection that should have detected the deteriorated condition of the tire before it blew out.

INVESTIGATION

The Accident

About 3:25 p.m., P.s.t., on April 23, 1980, a truck tractor was traveling north on California State Route 86, a two-lane rural highway in southern California. A schoolbus and two automobiles were traveling south. The driver of the second automobile estimated that the schoolbus was traveling between 50 to 55 mph, and he did not notice anything abnormal about the tractor's speed. The tractor had just crossed a 75-foot-long bridge and was about 400 feet from the end of a long, slight curve to the right when witnesses in the southbound vehicles saw and heard the left front tire blow out. A series of scalloped tire scuff marks, typically produced by a rolling flat tire, began at the point where the tire blew out. (See figure 1.) The tractor swerved to the left, crossed the centerline at about a 7° angle, and collided head-on with the schoolbus. (See figure 2.)

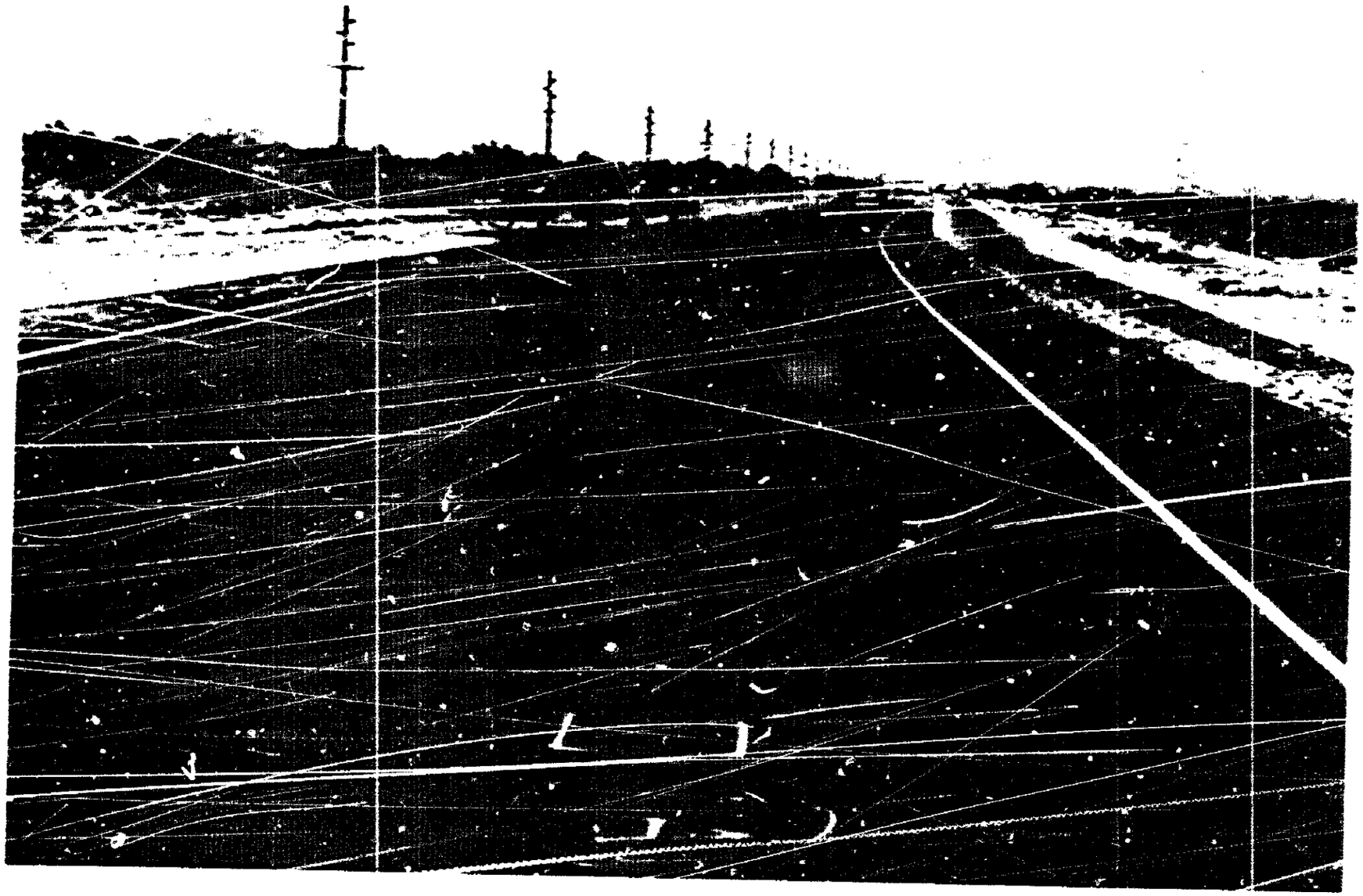


Figure 1.--Scalloped tire scuff mark.

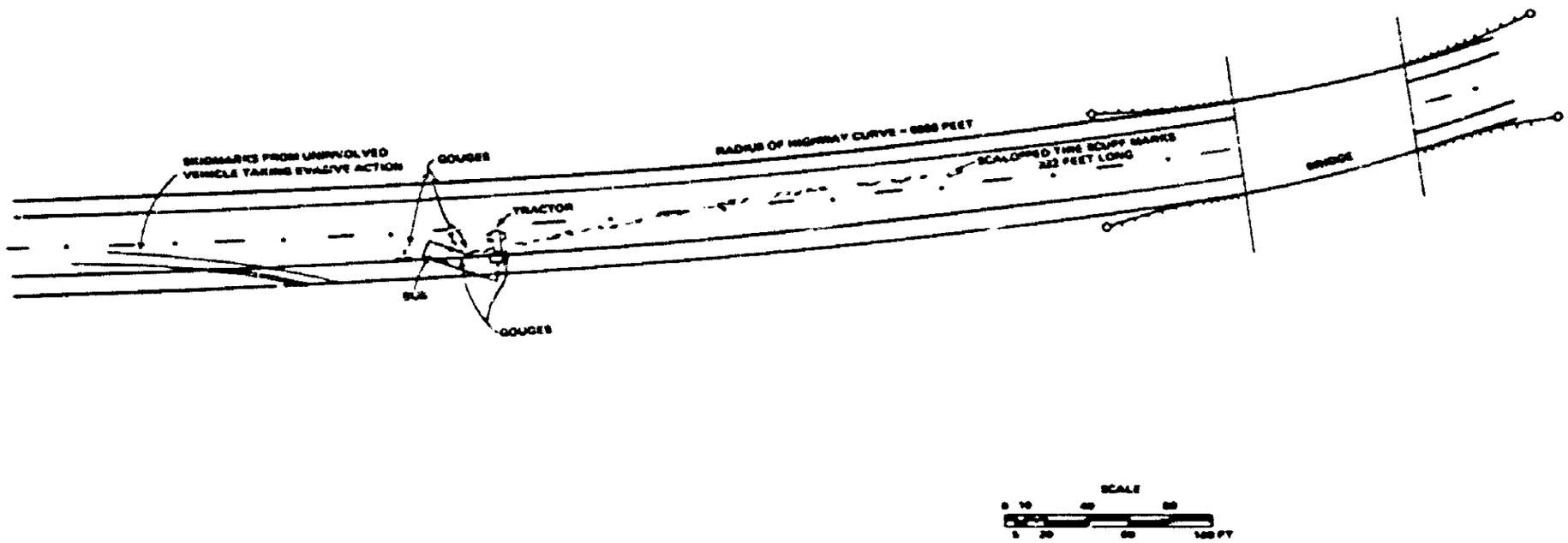


Figure 2.--Accident site.

The second automobile driver did not see any schoolbus brake lights illuminate or the schoolbus turn before impact. After impact, the tractor and schoolbus came to rest straddling the edgeline between the southbound lane and shoulder. (See figure 3.) The two automobiles were able to stop in time to avoid the wreckage.

At 2:30 p.m., the reported temperature was 65° F, with overcast skies. No witnesses reported rain or wet highways at the accident site.

Injuries to Persons

Injuries	Drivers		Passengers		
	Truck	Schoolbus	Truck	Schoolbus	Totals
Fatal	0	1	0	3	4
Nonfatal	1	0	0	6	7
Minor/None	0	0	0	0	0
Totals	1	1	0	9	11

Vehicle Information

The 2-axle, 1970 Mack, cab-over-engine tractor, VIN FS773 LT 7689, was manufactured in September 1970. It was bought by the B&J Trucking Company on December 6, 1979, about 4 1/2 months before the accident, and was driven about 12,000 miles during that time. It was equipped with a 318-hp Detroit diesel engine, a Fuller 13-speed transmission, air-mechanical drum brakes on the front and rear axles, and a ball-type hitch for towing large mobile homes. It was not equipped with power steering. Its designed maximum in-gear road speed was 66.7 mph, and it weighed 12,430 lbs.

The left front half of the tractor engaged the left front half of the schoolbus at initial impact. Major tractor frame and front axle damage was on the left side, and the cab was separated from the chassis. (See figures 4 and 5.)

All components associated with the tractor's front suspension, steering system, and front brakes appeared to be normal except for accident-induced damage. The rear brake linings were about 1/2-inch thick; linings that are worn to within 1/64 inch of the bolts, rivets, or fasteners are unacceptable under State of California inspection criteria. Under a test pressure of 100 psi, the left and right rear push rod travel was 1 1/2 inch and 1 5/8 inch, respectively, for the type-30 clamp-type brake chambers; the maximum push rod travel at which this type of brake should be readjusted under California criteria was 2 inches. The adjustment screw on the left rear brake slack adjustor was frozen, and the nuts which secured the right rear brake chamber to its mounting bracket were backed out about 1/4 inch.

The air compressor drivebelt was loose. The air line hose between the service air tank and the foot brake treadle valve had failed and had been improperly repaired at least 3 years before the accident. A copper tube had been inserted into the air line hose to span the failure point, and hose clamps were used to secure the hose to the tube. To properly repair the line, the hose should have

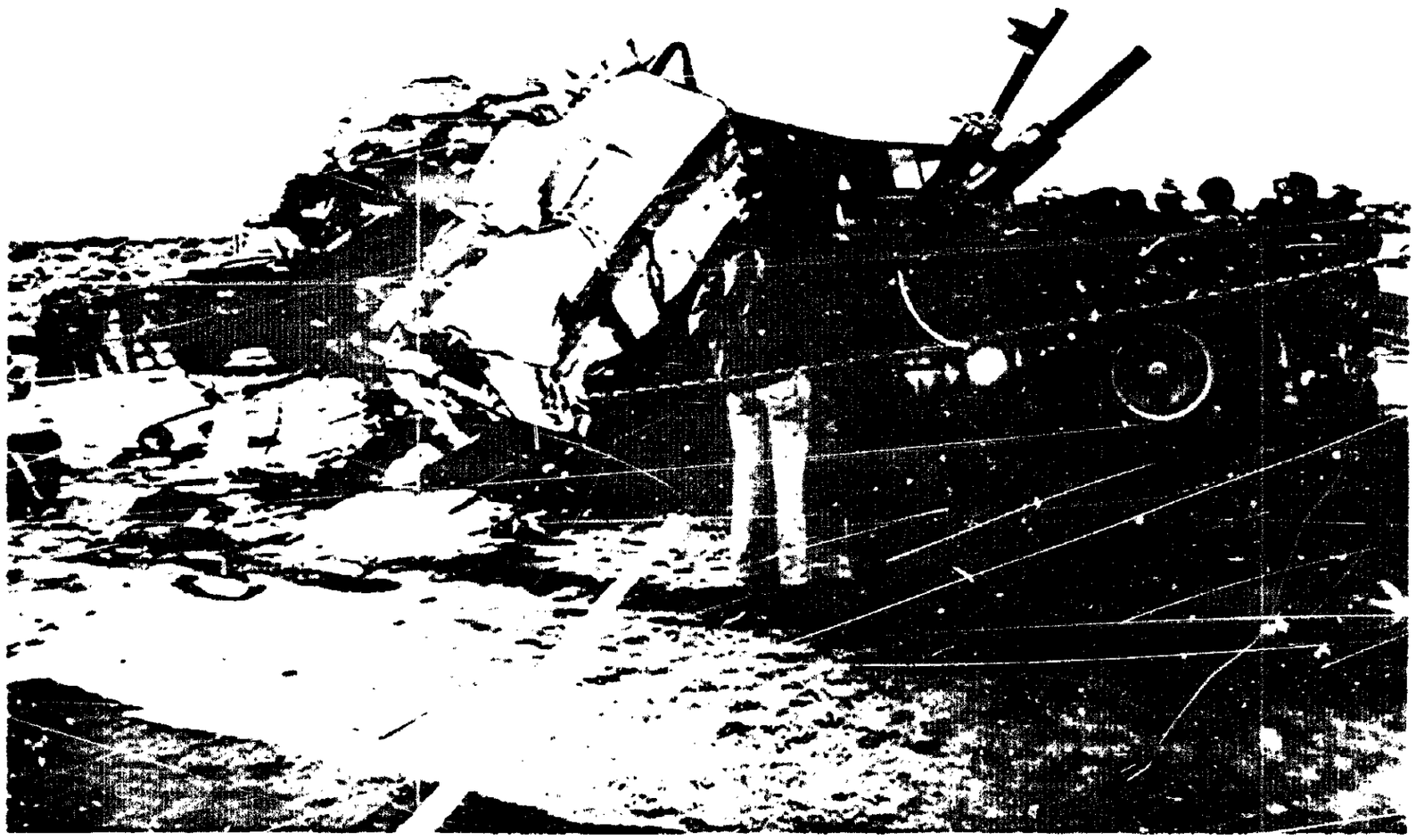


Figure 3.--Final resting position of bus and truck.

Figure 4.--Truck tractor chassis.

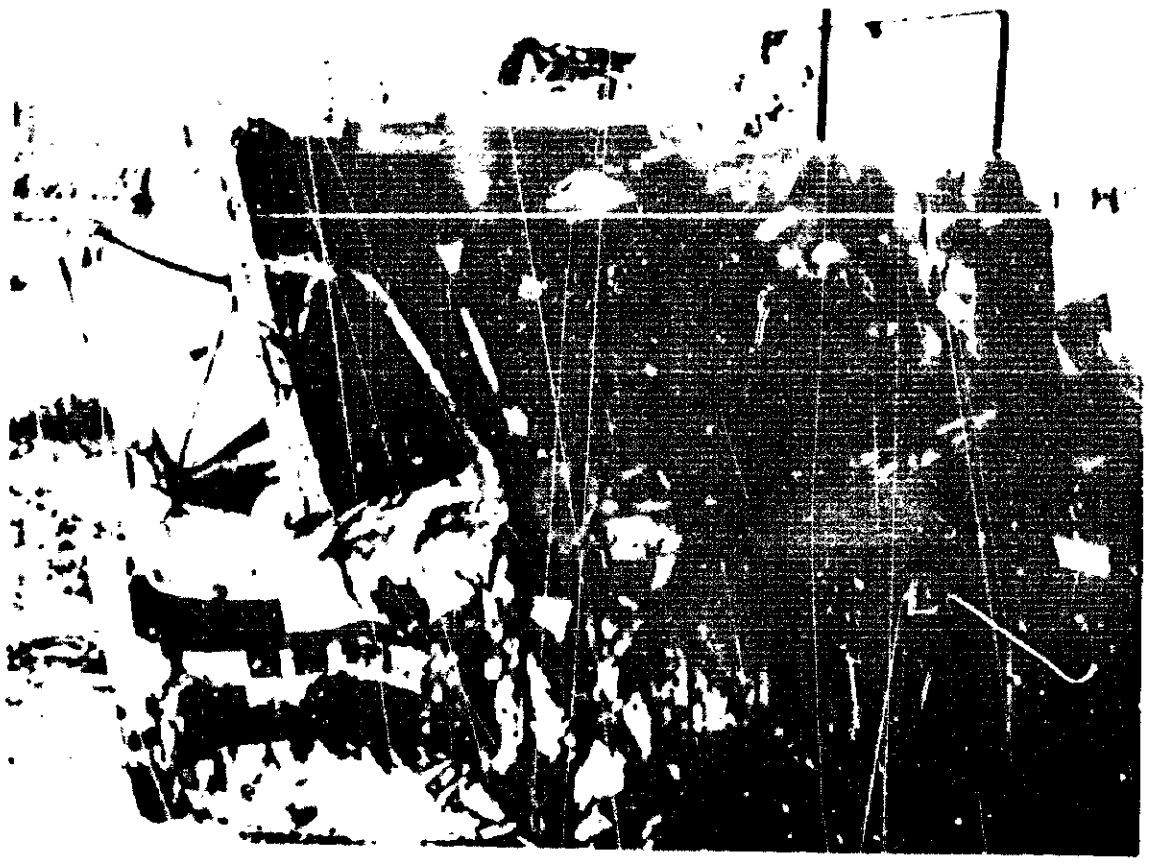


Figure 5.--Truck tractor cab.

been replaced. About 1 1/2 pints of emulsified oil and water were found in the air wet tank. The front suspension and right rear external brake components were covered with a significant amount of oil.

The right front tire of the tractor had an inflation pressure reading of 70 psi and had 10/32 inch of tread depth remaining. The four rear tires had inflation pressure readings between 70 to 82 psi, and all four tires were bald in the center area of the tread. The left rear outside tire also had a 1 1/4-inch-wide by 7/32-inch-deep groove around its circumference which had apparently been produced by a rubbing mud flap mounting bracket before the accident. (See figure 6.) The groove was not deep enough to reach and expose the tire body cords.

The schoolbus was a 1963 Crown Supercoach, 91-passenger, 3-axle bus, serial No. 34691. It was bought used by the Coachella Valley School District and was equipped with a 220-hp Cummins diesel engine, a Fuller 5-speed transmission, and air-mechanical brakes on the front and two rear axles. A hinged rear window and a left-side door at seat row 7 served as emergency exits. The maximum in-gear road speed was 53 mph, and it weighed about 24,000 lbs. The front of the schoolbus was crushed rearward about 9 feet on the driver's left side and about 6 feet on the right side. (See figure 7.) The floor, roof, and side panels of the bus were buckled and displaced an additional 6 1/2 feet on the left side and 8 1/2 feet on the right side of the bus. (See figure 8.) The driver's seat and the first four rows of passenger seats were within these damage zones and formed a "wall" of debris forward of the fifth row of seats. (See figure 9.) Seats to the rear of the two damage zones remained relatively in place with major damage to the seat backs in areas where students were seated before the collision. (See figure 10.)

No precrash deficiencies or unusual conditions were noted for any mechanical system on the schoolbus.

Tractor Left Front Tire Examination.--The Safety Board retained an independent tire consulting firm to evaluate the blown-out left front tractor tire. The left front tire was a 10:00 by 22 General GQT bias-ply, tube-type tire. To identify positions on the left front tire, the side of the tire with the manufacturer's serial number was considered to be the face of a clock with the serial number serving as the 12 o'clock position. (See figure 11.) At the 11:30 o'clock position, there was an x-shaped blow-out break completely through the tire at the serial number edge of the tread or shoulder area of the tire. (See figure 12.) Tread was missing from the 9:30 o'clock position through the blow-out break at the 11:30 o'clock position to the 2:30 o'clock position. Some pieces of the missing tread were found at the accident scene.

A nearly bald spot at the 4:30 o'clock position was about 5 inches in diameter; other areas of the tire had between 4/32 and 5/32 inch of tread depth remaining. The bald spot was along the same edge of the tread or shoulder area as that at which the x-shaped break occurred. The tread of the tire was separated at the bald spot (see figure 13), and there were two small slits through the separated tread. (See figure 14.) A 3-inch by 4-inch "balance pad" was glued to the inside of the tire, directly under the bald spot and the tread separation. A label on the balance pad read: "This tire has been factory balanced to deliver better ride and performance."

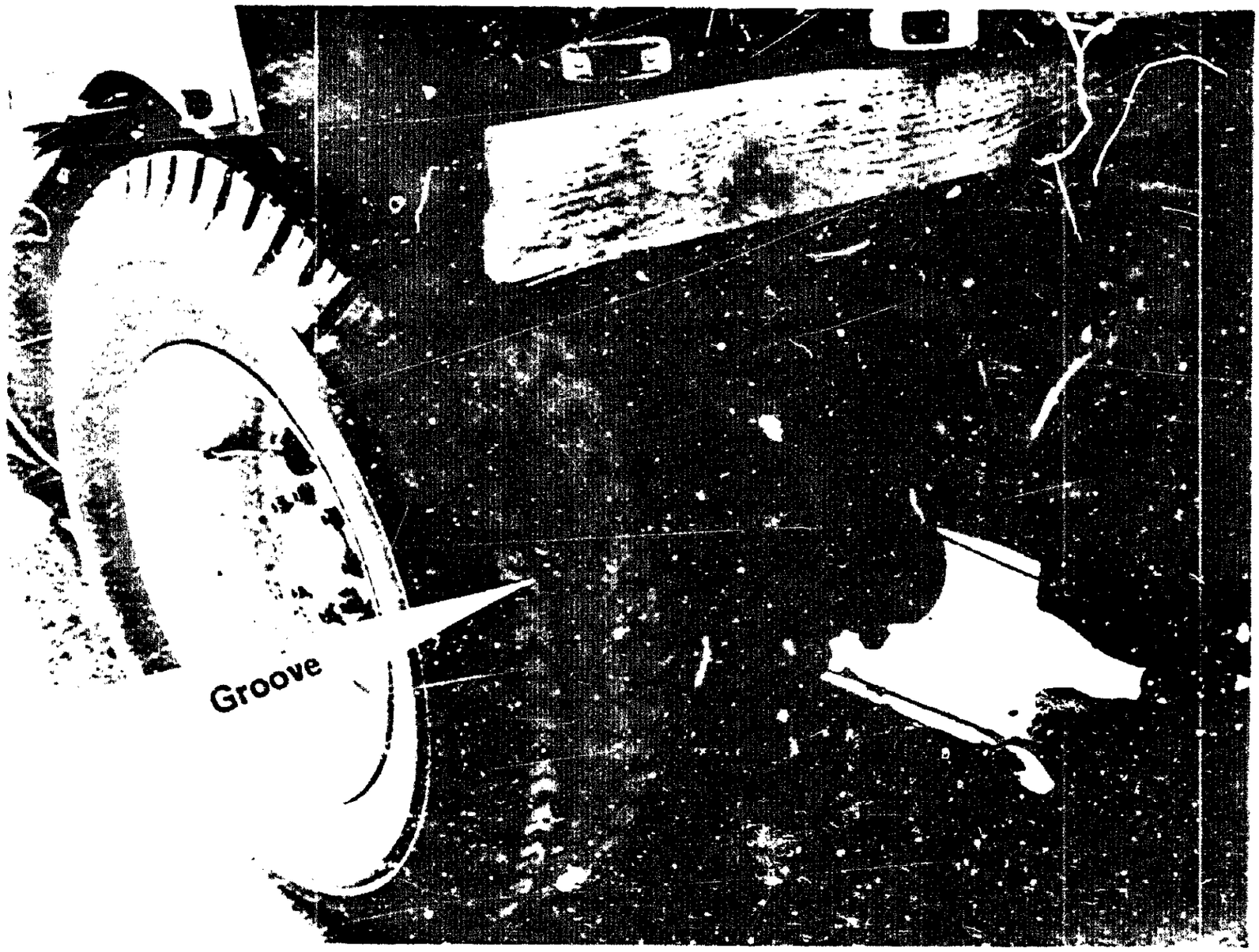


Figure 6.--Groove in left rear outside tire.

Figure 7.--Damage to schoolbus.

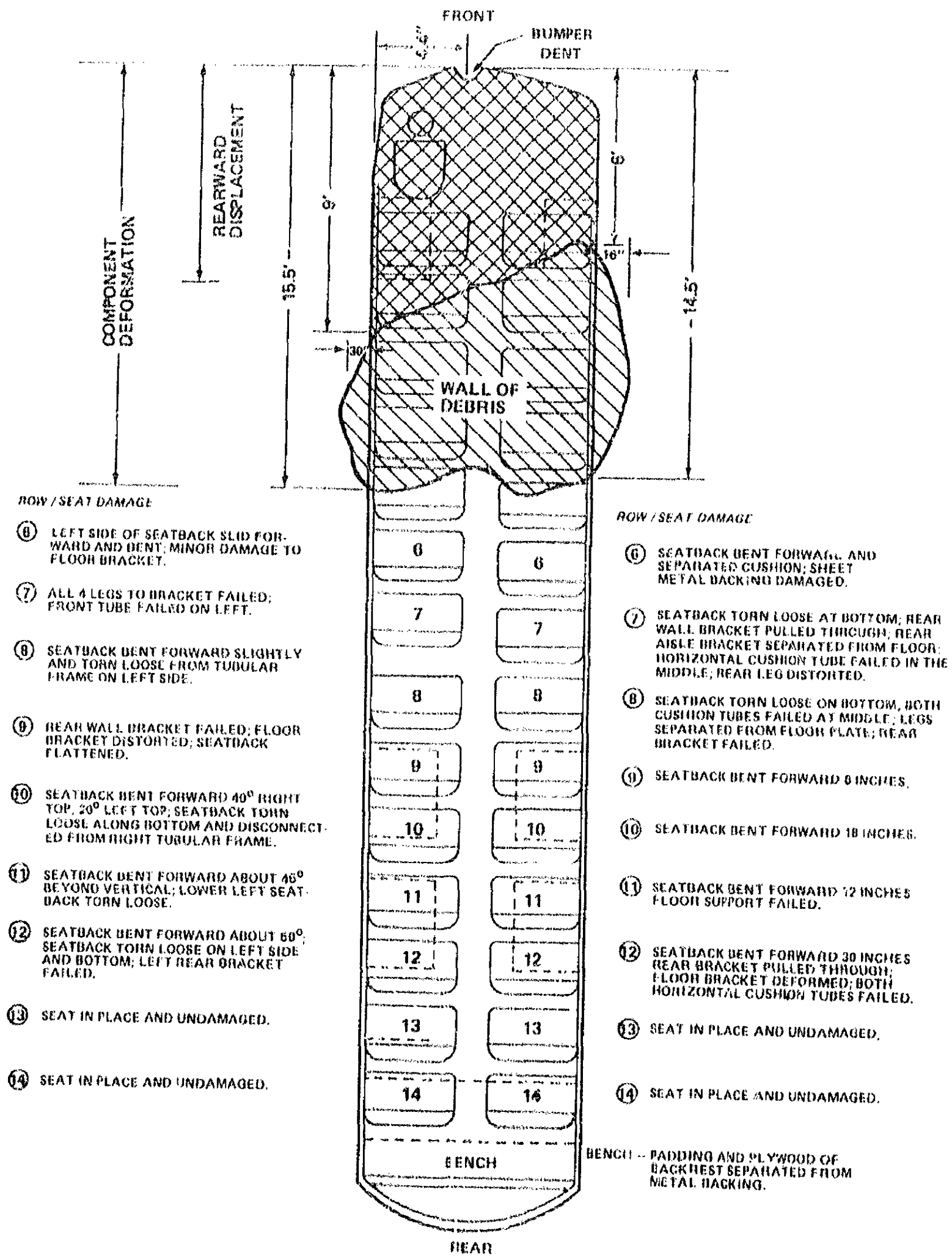


Figure 8.--Schoolbus crash damage patterns.

Figure 9.--Damage to forward area of schoolbus.

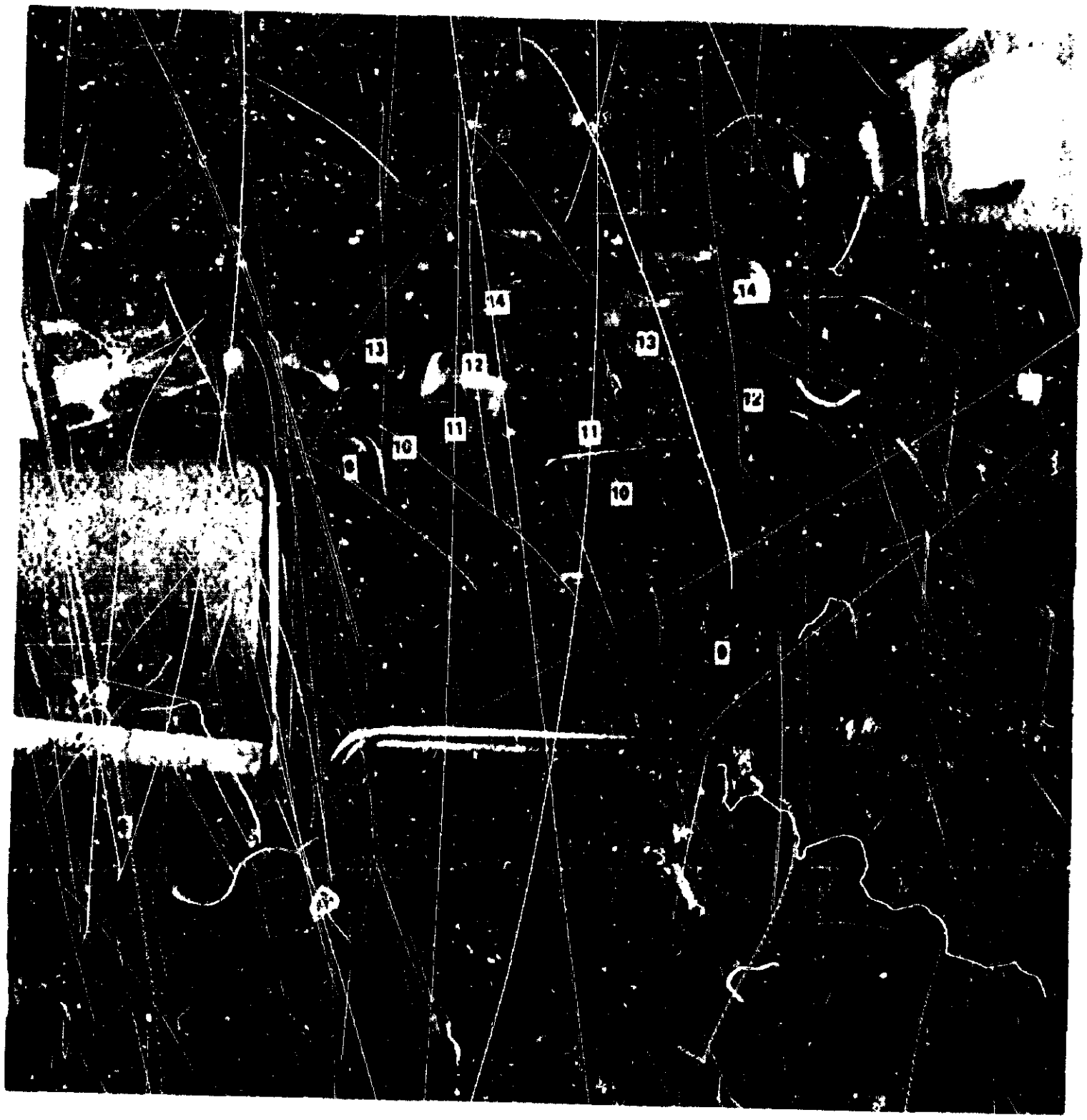


Figure 10.--Damage to rear area of schoolbus.

Figure 11. --Serial side view of left front tire.

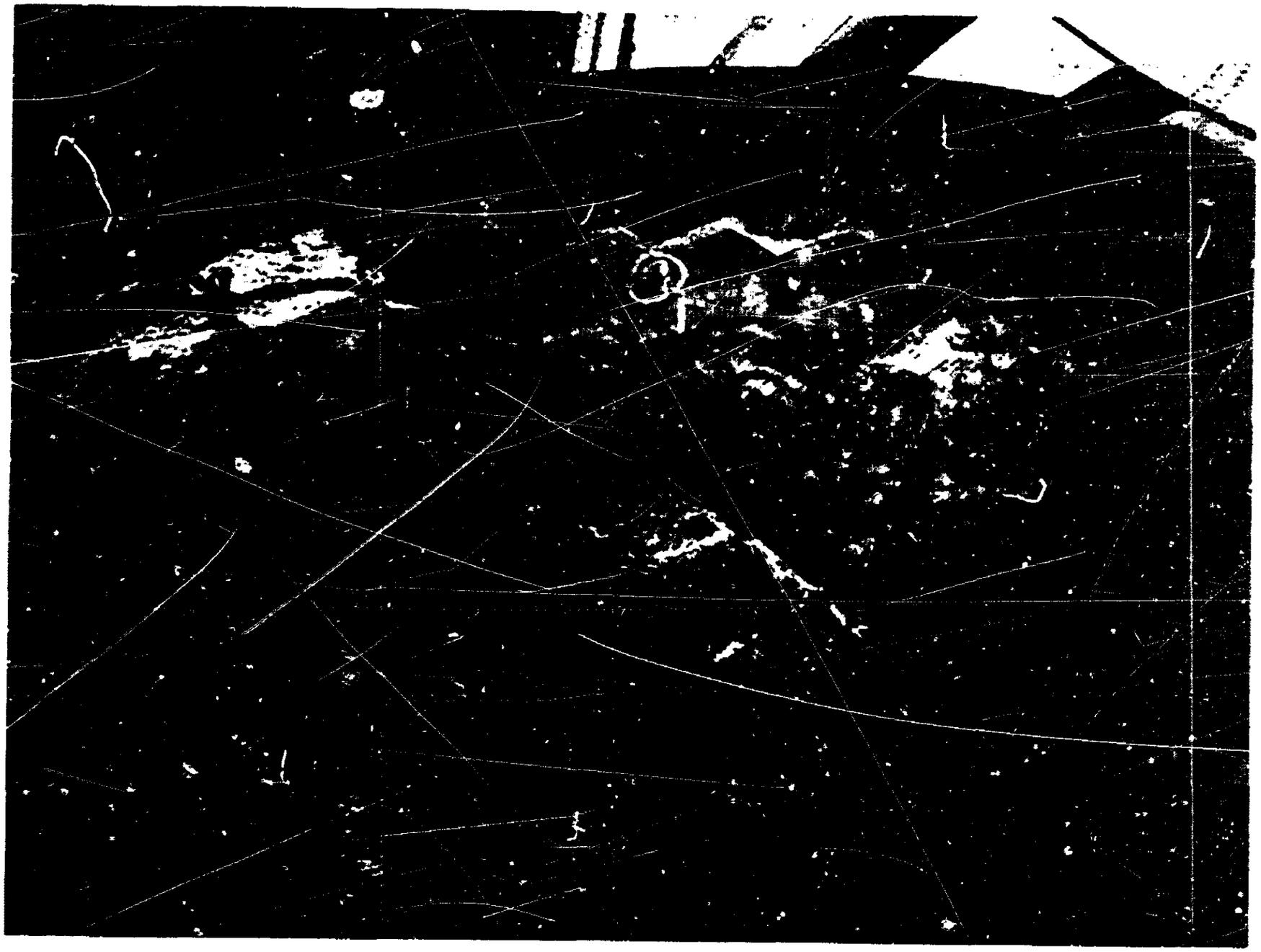


Figure 12.--X-shaped blow-out break in left front tire.

Figure 13.--Tread separation on left front tire at bald spot.

Figure 14.--Two slits through separated tread at balance pad.

There were two ring-split marks on the bead of the tire. A ring-split mark is produced by the steel side ring which holds the tire on the rim. Unless a tire is remounted in exactly the same position with respect to the steel side ring, each time the tire is mounted, a new ring-split mark will be produced. One prominent ring-split mark was found at the 3:45 o'clock position on the serial number side of the tire. The tire was mounted on the tractor with the serial number side out. Another relatively faint ring-split mark was found at the 9 o'clock position on the side of the tire opposite the serial number, indicating by its faint intensity that the tire was probably remounted while it was relatively new. No evidence of a recent remounting was found.

The inner tube was manufactured by Carlisle Tire and Rubber Company. The location of the blow-out in the inner tube matched that in the tire. The valve stem was back pressure tested, and it did not leak.

No defects in workmanship or materials were found in the tire or inner tube. An examination of the tire at the blow-out area and the pieces of missing tread found at the accident scene indicated that the tire had suffered some type of earlier impact injury--e.g., a severe impact on a rock, pothole, or debris in the road--at the 11:30-o'clock position. The previous impact had broken some of the tire cords under the tread which put additional strain on adjacent cords. The tire continued to be used for several hundred or perhaps even a thousand miles after the injury, and tread began to separate at the point of injury and eventually spread to the 9:30 o'clock position on the tire. This was supported by the fact that most of the eight layers of tire cord were eroded and abraded at the point of injury, whereas only the outer layer of tire cords was abraded and torn from the point of injury to the 9:30 o'clock position. Fresh tread tearing was noted from the point of injury to the 2:30 o'clock position on the tire, and no cord abrasion was noted, indicating that the missing tread in this area was torn off when the tire blew out. The tire cords at the point of injury continued to erode and abrade until tire strength was reduced to the point where the remaining cords could no longer contain the inflation pressure, and the tire blew out.

There was no continuous tread separation between the point of injury and the balance pad, indicating that the two tread separations were separate incidents. Both the tread separation at the point of injury and the tread separation at the balance pad would have produced a bulge in the tire that would have allowed the tire tread to more rapidly wear in those areas. Since there was more tread wear at the balance pad than at the point of injury, the tread separation at the balance pad probably developed first.

High operating temperatures probably caused the tread separation to develop at the balance pad. Generally abusive operating conditions, such as overload, underinflation, high speeds, and hot desert environments, either singly or in combination, were necessary to generate such high operating temperatures. The extra thickness of the balance pad would have served to increase further the temperature in the area of the balance pad, thereby providing a possible reason for the tread to begin to separate in that particular area of the tire. However, the decidedly primary reason for any tread to begin to separate was generally abusive operating conditions.

The two small holes through the separated tread at the balance pad may have relieved some of the bulge by venting any air trapped in that tread separation. However, the bulge had to be present for a significant period of time to allow the tread to wear and the bald spot to develop.

The separation at the balance pad would have at least produced a rhythmic "slapping" sound as the vehicle was driven, which should have been cause for inspecting the tire. Further, the bulge and the bald spot at the balance pad were additional visual clues that there was a problem with the tire. The tread separation that later developed at the point of injury also would have produced a bulge with a rhythmic "slapping" sound. It is possible that the bulges from the tread separations eventually unbalanced the left front wheel assembly to the point that vibration was felt through the steering system. In summary, there were a series of increasingly obvious clues that the tire was inadequate and failing before the blow-out.

Driver Information

The 29-year-old truckdriver held a valid Class I California driver's license for operating trucks of this size with no operating restrictions. He had driven trucks for about 10 years mostly involving interstate travel. He had received three traffic citations since 1977--on August 12, 1977, for an improper driver's license; on April 11, 1979, for an equipment violation; and on February 7, 1980, for an equipment violation. He was also involved in two motor vehicle accidents. In 1978, he struck a car that did not stop for a stop sign and in 1979, he hit a large pothole that was filled with water. These violations and accidents did not involve the tractor or company involved in the Coachella schoolbus accident.

He began working for the B & J Trucking Company, a two-tractor company, about 6 weeks before the accident. He normally drove the tractor involved in this accident and performed some of the general repairs. He reported that the tractor had been taken into a shop for some repairs about a month before the accident. About a week before the accident, he noticed a slight vibration at the front axle and discussed the problem with the owner. His prior experience with problems of this type indicated that there might be a problem in the steering system, that the wheel(s) might not be balanced, or that tire tread might be separated. He said that he examined the steering system and tires but did not notice anything unusual.

Six days before the accident, he was riding as a passenger in the tractor when it was inspected by California Highway Patrol Commercial Vehicle Inspection Specialists. The inspection was performed at the Banning, California, Truck Scale which was located about 70 miles northwest of the accident site. The tractor was inspected after State inspectors noticed that the brake lights were not working on a tractor being towed by the tractor involved in the accident. The truckdriver repaired the brake lights, and a "fix-it" ticket was issued by the State inspectors to have a damaged front headlight repaired. This type of ticket permitted the tractor to be moved and repaired within 2 weeks from the date the ticket was issued. If the repair was made, no fine would be levied. No other mechanical problems were noted on the inspection record.

The truckdriver did not advise the State inspectors of any mechanical problems he was experiencing. In the truckdriver's opinion, since neither he nor the State inspectors found anything exceptional or unusual, he thought it would be reasonable to wait until he had a convenient time to have a tire dealer look into the vibration problem.

The truckdriver reported that he had 8 hours of sleep the night before the accident. He began driving at 6:30 a.m., stopped for lunch at 2 p.m., and did not feel drowsy or fatigued at the time of the accident. He did not recall any details about the accident. Blood tests indicated no alcohol or drug use.

The 57-year-old schoolbus driver held a valid Class II California driver's license for operating a schoolbus with no operating restrictions. He received one ticket for speeding above the national 55-mph speed limit in 1978 and had no accident record. He had no medical problems, had driven the accident bus for 5 months, and was familiar with the bus route.

Truck Maintenance

The B & J Trucking Company was a two-man partnership formed about 2 years before the accident; however, one partner withdrew about a year before the accident. The current owner had been driving trucks for about 6 months before entering the partnership and had no significant experience in trucking before that. He had no personal maintenance and garage facilities and, therefore, parked his two tractors in front of his house and used independent shops for equipment repair. His business was intrastate and, therefore, subject only to the State of California's motor carrier rules and regulations.

Title 13, Section 1232A, of the California Administrative Code requires that such a company have an organized preventive maintenance program. The regulation requires that all motor carriers insure that all vehicles subject to their control and all accessories on the vehicles are regularly and systematically inspected, maintained, and lubricated to insure they are in safe and proper operating condition. Motor carriers shall also have a means of indicating the types of inspection, maintenance, and lubrication operations to be performed on each vehicle and the rate of mileage when these operations are due.

Section 1215(b) of the California Code requires a driver to inspect lights, brakes, tires, and accessories and submit a written report of all defects and deficiencies that might affect safe operation or cause mechanical breakdown of the vehicle as part of his trip report to the company.

After this accident, the California Highway Patrol inspected the B & J Trucking Company operation and determined that it did not have an organized preventive maintenance program or record system to insure that its equipment was maintained in safe operating condition. According to the repair shop that made some repairs on the company's equipment, only service requested by the owner was performed. The last requested repair service, performed about a month before the accident, included: Tuned up engine, checked for water leaks, checked for

oil leaks, repaired cab jack, repaired "spring handle" in truck, adjusted brakes, and replaced belt on air conditioner. According to a spokesman for the repair shop, when the driver involved in the accident came for the tractor, he was told that the rear brakes could not be adjusted because of a frozen slack adjustor screw and that about 2 days' effort would be required to repair the engine oil leaks. The driver told the repairman that the owner could not afford such repairs at that time. Upon questioning by the Safety Board, the owner denied any knowledge of the exchange between the driver and the repairman. The repair shop estimated that about 40 hours' labor would have been required to make the tractor fully roadworthy.

The repair shop had an unwritten policy to advise equipment owners of any other unsafe conditions it might discover while performing requested repairs. No particular attention was paid to the front tires or air lines of the tractor, and repairmen could not recall anything unusual about their condition. One mechanic thought he remembered that the tires had some tread left.

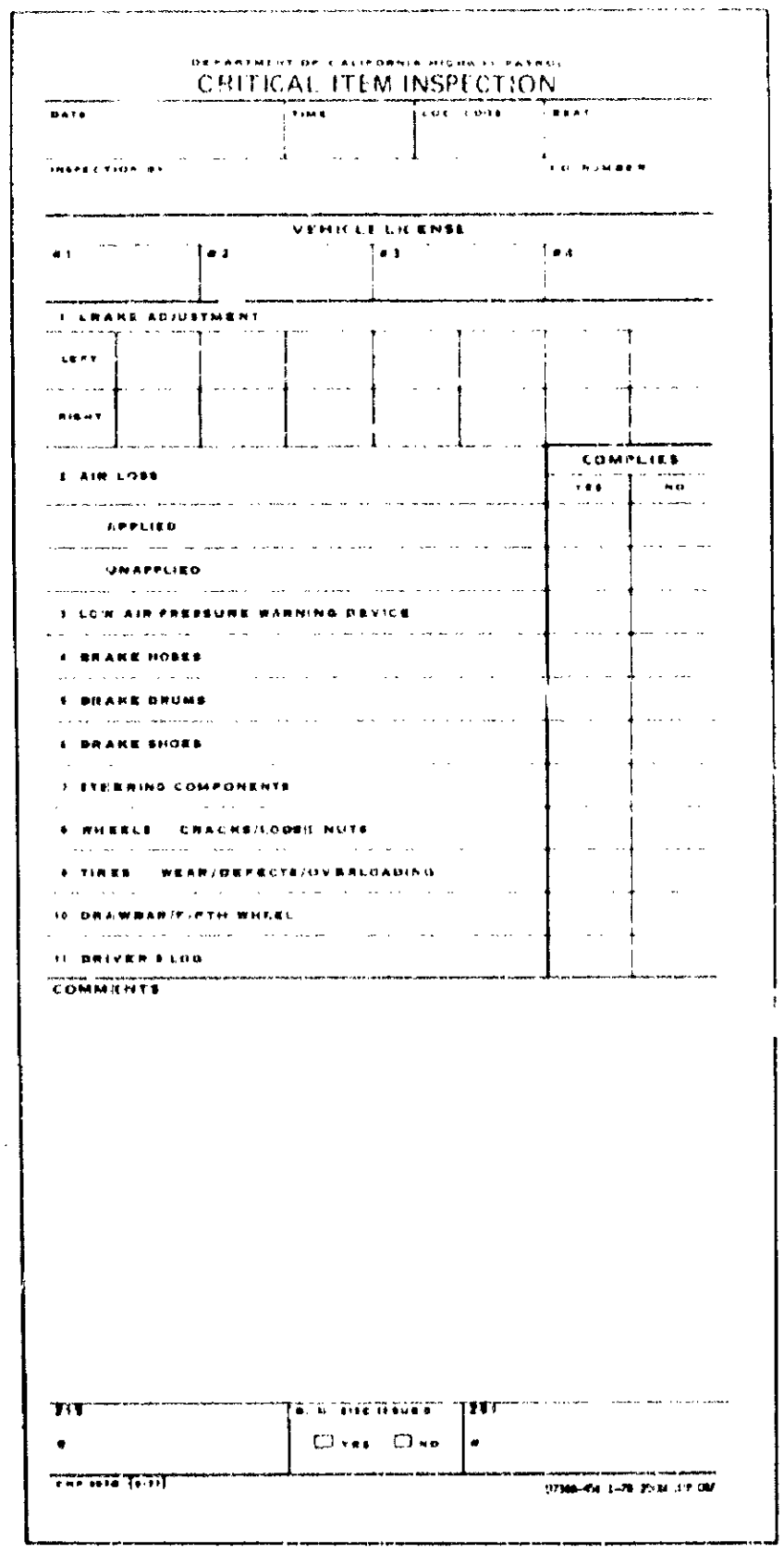
The tractor owner recalled that he had what he thought was the left front tire of the tractor repaired about 6 weeks before the accident. He took only the tire, wheel, and rim assembly to a repair shop, where the inner tube was patched and replaced. After the accident, the tire repairmen did not recognize the left front tire or recall any balance pad inside the tire. They did recall patching a tube with a small tube patch and replacing the tube in the tire. Such a patch was found on the right front inner tube when that tire was examined.

California Commercial Vehicle Inspection Procedures

The State of California employed a "Critical Item Inspection" when it inspected the tractor at the Banning truck scale 6 days before the accident. This type of inspection examined driver's logs and those vehicle systems and their components that have "a critical effect on safety." 1/ The California Highway Patrol had conducted a detailed study of over 3,000 truck accidents to determine which mechanical defects were most frequently identified as a cause or contributing factor in these accidents, and components with these defects became the focus of the critical items inspection. (See figure 15.) Since fewer items per truck had to be examined, this approach permitted the State to examine more trucks, while insuring that the most critical safety items were being examined.

A preliminary study of truck accident data by the California Highway Patrol indicated that the Critical Item Inspection program may have had some influence in reducing the number of "truck-at-fault" accidents. In 1979, for the first time in years, these accidents did not increase but were reduced by one-half of 1 percent while truck travel increased by 13 percent. 2/

1/ "California Highway Patrol, Critical Item Truck Inspection Guide, A Supplement to Preventive Maintenance," made available by the AAA Foundation for Traffic Safety, Falls Church, Virginia.
2/ Memorandum from the Commissioner, California Highway Patrol to the Secretary, Business and Transportation Agency, on the subject of Traffic Accident Reduction Summary, June 4, 1980.



DEPARTMENT OF CALIFORNIA HIGHWAY PATROL

CRITICAL ITEM INSPECTION

DATE | TIME | LOC CODE | BEAT

INSPECTION BY | I.D. NUMBER

VEHICLE LICENSE

#1 | #2 | #3 | #4

1 BRAKE ADJUSTMENT

LEFT						
RIGHT						

	COMPLIES YES	COMPLIES NO
2 AIR LOSS		
APPLIED		
UNAPPLIED		
3 LOW AIR PRESSURE WARNING DEVICE		
4 BRAKE HOSES		
5 BRAKE DRUMS		
6 BRAKE SHOES		
7 STEERING COMPONENTS		
8 WHEELS CRACKS/LOOSE NUTS		
9 TIRES WEAR/DEFECTS/OVERLOADING		
10 DRAWBAR/FIFTH WHEEL		
11 DRIVER'S LOG		

COMMENTS

SIGN | ☐ YES ☐ NO | SIGN

Figure 15.—Critical Item Inspection form.

Tire condition was one of the critical items to be checked. The California inspection procedures for tires, wheels, and rims contain an explanation of the functions of these items and their major components and set forth an inspection procedure for examining these items. In the procedures under tire-wear problems and cures, it is noted that bald spots on tires are normally caused by an unbalanced wheel. Inspection procedures note that a tire mounted on the steering axle of a commercial truck must have at least 2/32 inch (1.6 mm) tread depth at all points in all major grooves. There are no minimum tread depth requirements for tires mounted on any other axle of a commercial truck. Federal Motor Carrier Safety Regulations (FMCSR) Section 343.75(b) and (c) require, for trucks operating interstate, 4/32 inch of tread depth for tires mounted on the steering axle and 2/32 inch of tread depth for tires mounted on any other axle of a commercial truck.

California inspection procedures do require that tires having any of the following defects shall not be used on a truck:

- Repairs utilizing a blow-out patch or boot;
- Unrepaired fabric breaks;
- Bumps, bulges, or knots related to ply or tread separation;
- Exposed or damaged body cords;
- Cuts extending more than 1 inch in any direction and deep enough to reach the body cord; and
- Cracks in valve stem rubber.

When a defective vehicle condition is found, three options are available to the California inspector. He can issue a "fix-it" ticket, a traffic citation, or place the vehicle "out of service." For the latter, either repairs have to be made on the spot or the vehicle has to be towed to a repair facility. The inspector who led the inspection of the tractor involved in this accident said that checking the air lines was one of the elements of the critical item safety checks, and he did not recall any improperly repaired air lines.

He thought he remembered one of the front tires "being kind of worn," but not enough to warrant any action. After examining the blown left front tire, he acknowledged that the bald spot was in violation of the law. He explained, however, that if the tire were on the tractor at the time of inspection, the bald spot may have been in contact with the ground and would not have been visible. He further allowed that, if the bald spot had been detected, he might have issued a "fix-it" ticket rather than placed the vehicle "out of service," primarily because no bulge may have been present because of the holes through the outer layer of the tire at the bald spot.

Highway Information

California State Route 86 was a north-south roadway near the U.S.-Mexican border in southern California and was classified as a Federal-aid primary route. The accident site is in a desert-agricultural area, about midway between the cities of Coachella and Westmorland, California. State Route 86 is a two-lane asphalt roadway over the 58 miles between these cities, with some four-lane divided

sections to the north and south of this 58-mile segment. Average daily traffic is about 2,600 vehicles, about 20 percent of which is large trucks. Recently, the State's main focus had been to upgrade State Route 86, with emphasis on replacing or eliminating about 80 narrow and structurally deficient bridges.

The collision occurred on a 3.9-mile segment where the road and bridges had been reconstructed in 1979. No bumps, holes, or other pavement irregularities were found along the path the truck was traveling before the tire blew out. No damage-causing debris was seen on the highway. The white pavement edgelines and dashed centerline were in good condition. The grade was about 1 percent downhill for the truck, and the superelevation was appropriate for the degree of curve. The unposted speed limit was 55 mph, and the curve could be easily negotiated at that speed.

Since 1977, the following accidents have occurred within 1/2 mile of the accident site:

> February 2, 1977 -- A northbound automobile crossed the centerline at a bridge and struck a southbound Border Patrol bus. The automobile driver had been drinking; one person was injured.
>
> February 15, 1977 -- A southbound automobile crossed the centerline and struck a bridge approach guardrail. Several opened and unopened beer cans were found in the vehicle; alcohol impairment was reported to be unknown. One person was killed and four were injured.
>
> March 10, 1977 -- A southbound truckdriver apparently fell asleep, drifted off the right side of the road, and struck a guardrail, a bridgerail, and a powerline pole; one person was injured.
>
> July 8, 1977 -- A southbound crane truck drifted off the right side of the road and struck a sign and a bridge approach guardrail. The truckdriver was found to be under the influence of alcohol; no one was injured.
>
> June 14, 1978 -- A northbound truck/trailer combination had a tire blow-out and ran off the right side of the road; one person was injured.

Between 1977 and 1979, the overall average Statewide accident rate for highways similar to State Route 86 was 1.73 accidents per 1 million vehicle miles traveled. Between 1977 and 1979, the overall accident rate for the 58-mile segment of State Route 86 was 1.90 accidents per 1 million vehicle miles traveled, only slightly higher than expected. However, the fatal accident rate for State Route 86 was more than twice the Statewide average for similar highways (0.106 versus 0.051 fatal accidents per 1 million vehicle miles traveled). And, in the first 5 months of 1980, the fatal accident rate was about 6 times the Statewide average

for similar highways (0.305 versus 0.051 fatal accidents per 1 million vehicle miles traveled). Such high rates have been of concern to the State and local communities along State Route 86. Of the 433 (23 fatal) accidents, 40 percent involved large trucks; 10 percent involved bridgerails or guardrails; 20 percent involved vehicles traveling in opposite directions; and 7 percent involved vehicles passing and colliding with vehicles in the same direction. Of the 23 fatal accidents, 67 percent involved drivers known to be intoxicated by alcohol; 13 percent involved drivers known not to have been drinking; and 20 percent involved drivers whose alcohol impairment was unknown.

Medical and Pathological Information

Autopsies performed by the Imperial County Sheriff Coroner's Office revealed that the schoolbus driver died of massive, severe head and internal injuries. The two passengers who were sitting together in the 5th row, right side of the schoolbus, died of massive, severe internal injuries. The passenger who was sitting in the 10th row, left side of the schoolbus, died because blood from facial wounds was drawn into her lungs, resulting in suffocation. Medical experts believe that this death occurred between 1 and 5 minutes after the collision.

Survival Aspects

Passersby assisted in evacuating the survivors from the bus. The passenger who was sitting in the 11th row, left side of the bus, was the only passenger who left the bus unassisted, apparently by jumping out a window. Witnesses characterized the evacuation as hurried, with concern about the possibility of fire. Evacuation was through the rear window emergency exit; passengers were assisted one at a time, beginning with those at the rear of the bus. No details were available about what attention was given to those killed. The California Highway Patrol was notified of the accident about 12 minutes after it occurred, and official units began to arrive about 15 minutes after notification. Figure 16 contains the seating position, AIS injury level, 3/ and probable crash trajectory of the bus occupants.

ANALYSIS

Tire Blow-Out and Loss of Control

Witness statements, the flat tire scuff mark at the accident scene, and the tire examination, all indicate that the left front tire of the tractor blew out before the collision. Witness statements, calculations based on the physical evidence at the accident site, and the known maximum speed capabilities of the two vehicles indicated that the schoolbus was travelling about 50 mph and the tractor was traveling about 60 mph when the tire blew out. Therefore, the tire blew out about 222 feet or about 2 1/2 seconds before impact.

3/ Abbreviated Injury Scale, developed by a joint committee of the American Medical Association, the Society of Automotive Engineers, and the American Association for Automotive Medicine to characterize the degree of highway accident injury. For details see "Abbreviated Injury Scale, 1980 Revision, American Association for Automotive Medicine, Morton Grove, Illinois."

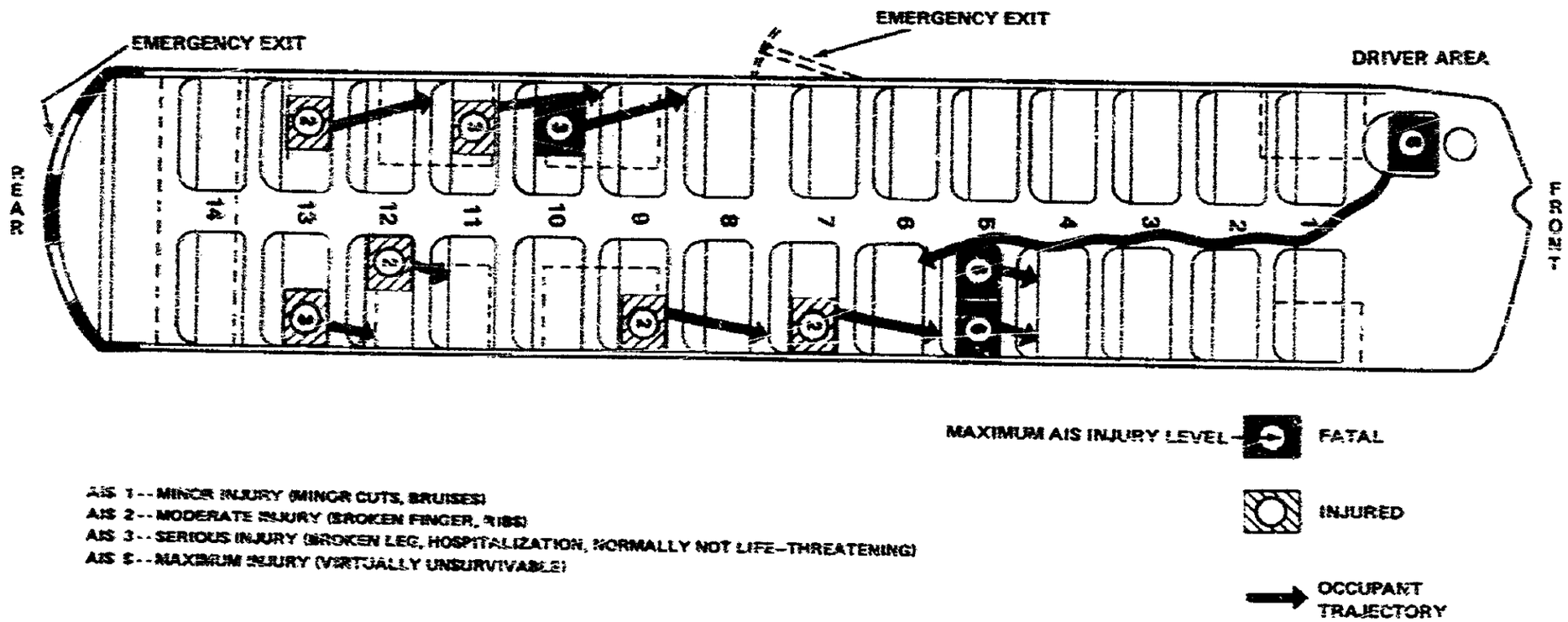


Figure 16.--Schoolbus seating chart showing occupant AIS injury level and crash trajectory.

When the tire blew out, the tractor wheel, rim, and remaining tire material dropped about 8 inches as the tire collapsed onto the road surface, creating a large and immediate drag on the left side of the tractor which caused the tractor to turn to the left. The logical corrective action available to the driver was to attempt to regain and maintain directional steering control of the tractor and slow it down. However, some drivers cannot predictably apply enough hand force to physically turn the steering wheel, and the tires cannot generate enough cornering force to overcome the drag produced by a blow-out, especially on large trucks traveling around a curve. If the tire to the outside of the curve fails, as in this accident, the cornering force necessary to regain control must be assumed by the inside tire. A large steering hand force and a large steering wheel rotation are required to transfer cornering force capability to the inside tire. Even if this can be accomplished, the cornering force that can be generated by the inside tire may not be sufficient for the driver to regain control. And, with the short time span between blow-out and collision, there was not significant time for the truckdriver to react and regain steering control.

There were no skidmarks made by the truck before the point of impact, which indicated that the truckdriver did not lock the wheels. Even if he had reacted within a normal reaction time of about 1 1/2 seconds and applied the brakes to lock the wheels, with about 1/2 second for the brakes to lock the wheels, he would have had only enough time to slow the truck about 5 to 10 mph before impact. If the busdriver did not see or hear the blow-out immediately, there was only about 1 second to react after the tractor reached the centerline -- insufficient time to take effective evasive action.

Preventive Maintenance and Inspections

An organized preventive maintenance program, which the B & J Trucking Company did not have, should have prevented this accident. The required trip and periodic inspections should have made it possible to detect the unsafe tire and remove it from service. The amount of extra tread wear at the bald spot and the truckdriver's statement regarding the vibration problem were obvious clues that the tire was inadequate; these clues of failure were probably present for weeks rather than days before the accident. Given the relatively long-term deterioration of the tire, the increasing series of obvious clues that the tire was failing, and the number of opportunities for the company to have inspected the tire or to have sought more professional advice, there was no reason for the tire to have remained in service. The Safety Board, therefore, concludes that the trucking company failed to maintain the vehicle properly and that this failure resulted in the blow-out and subsequent collision.

Except for a lenient standard relative to the minimum tread depth allowed on truck tires, California's written inspection proceddres and standards for tires, wheels, and rims seemed adequate. With regard to tread depth standards, current research indicates that a minimum of 2/32 inch of tread depth should be required

on all truck tires to insure adequate traction in wet weather. 4/ The FMCSR that requires 4/32 inch of tread depth for tires mounted on the steering axle guarantees that truck tires which have exceeded 75 percent of their maximum service life and are more likely to have suffered abuse or injury and, therefore, more likely to blow out, will not be placed on a steering axle where a blow-out is extremely difficult to control. California should revise its minimum tread depth requirements to those required by the FMCSR. In revising its tire inspection procedures and standards, California should consider incorporating some additional guidance about tire wear patterns that might be symptomatic of tread or ply separation problems. Further, it should emphasize the need to examine for tire defects and overloading regardless of tread depth.

The inspectors at the Banning truck scale either did not detect or did not react to the loose right rear brake chamber, the improperly repaired air line hose, the excessive amount of oil leakage, or the unsafe tire--areas that were to be examined during a critical items inspection. Such inadequate inspections should be avoided by the California Highway Patrol and it should take action to insure that such inadequate inspections are not repeated and affect the apparent general success of the Critical Items Inspection program. As part of any action taken, the Safety Board recommends that the State of California circulate the Coachella accident report, with its finding of the inadequate inspection of the truck, among California commercial vehicle inspectors.

Crash Severity Reduction

In 1977, the Safety Board investigated an accident involving a stopped schoolbus that was struck in the rear by a tractor-semitrailer. Of the three children who died, two were sitting in the last row of seats in the bus and one was sitting in the first row of seats. In its 1978 report on this accident, the Safety Board recommended that the National Highway Traffic Safety Administration (NHTSA) revise its pupil transportation safety standard to provide that no passengers occupy seats in either the foremost or rearmost rows until all other seats have been occupied. 5/ An examination of the crash damage to the schoolbus in this Coachella, California, accident and the seat positions of occupants who died and survived supported this recommendation. (See figure 17).

Except for the passenger in the 10th row who suffocated as a result of moderate injuries, only the driver and the two passengers who were sitting in the major damage zones near the front of the bus died. The Safety Board's seating recommendation would not have prevented the fatalities which did occur, since the two passengers who sat in the 5th row could have sat there under the Safety Board's seating recommendation. However, if more passengers had been sitting in the major damage zones, or more particularly, at the front of the bus, more serious or fatal injuries would have occurred.

4/ "Influence of Tread Depth on Wet Skid Resistance of Tires," Albert Dijks, Delft University of Technology, presented at the Second International Skid Prevention Congress, 1977, and published in Transportation Research Record 621 of the Transportation Research Board.

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

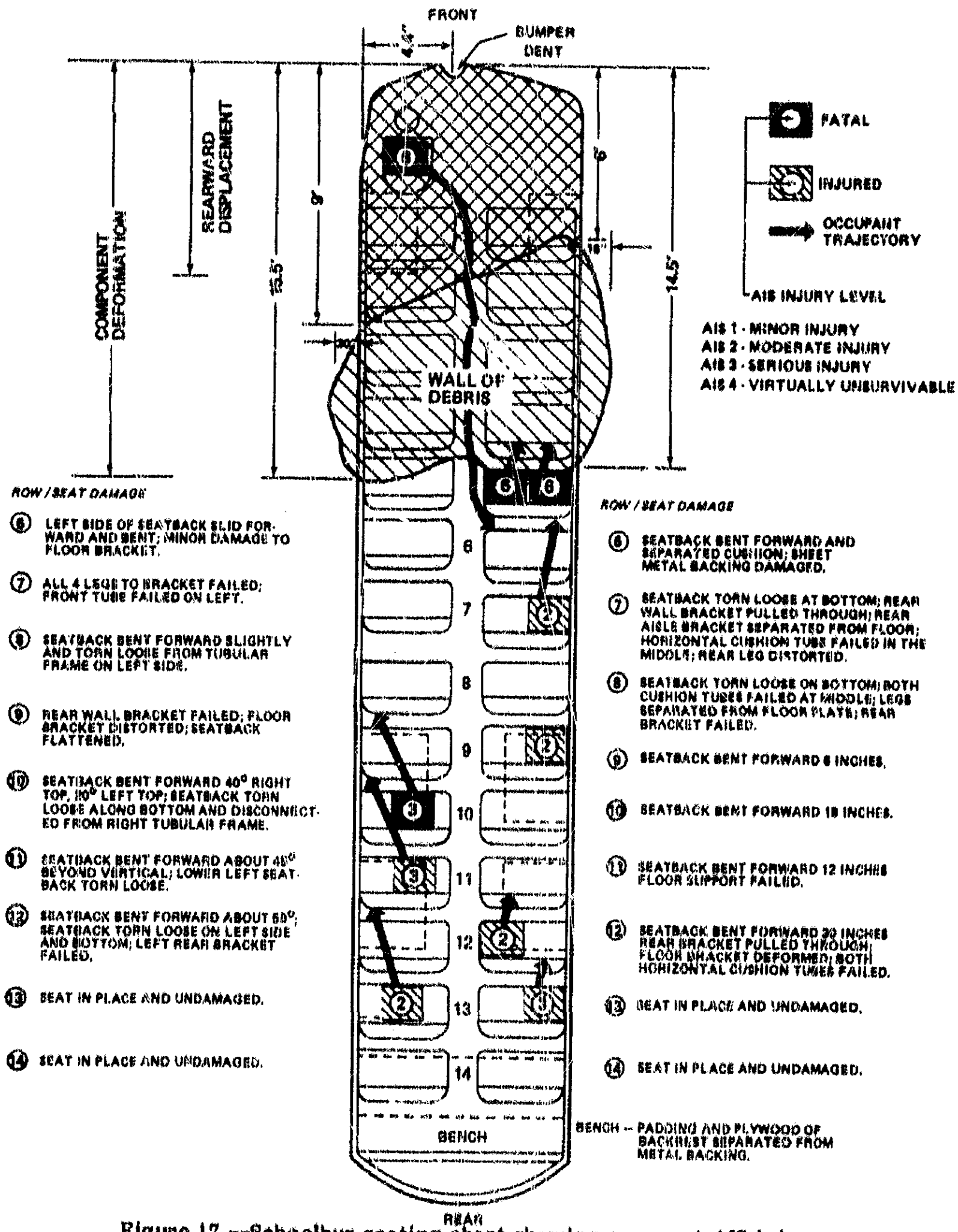


Figure 17.--Schoolbus seating chart showing occupant AIS injury level, crash trajectory, and damage patterns.

In responding to the Safety Board's recommendation, the NHTSA noted that of the 45 schoolbus occupants who died in highway accidents that occurred between 1975 and 1978, 22 (49 percent) died in front or rear-end collisions. Also there was "scant information to indicate whether the occupant's seating location contributed to their deaths in any of these cases." The National School Transportation Association reported that of 150 serious accidents reported to them in the past year, about 60 percent involved collisions with the front or rear of the bus. Rollover and side impact accidents were the other major accident types, but no information was available to indicate percentages for these accident types or whether the forward, middle or rear areas were struck in side impacts.

Although the NHTSA was "doubtful that many lives would be saved by a front-and-rear-seats-last policy," the NHTSA believed that "such a policy has the virtues of simplicity and low cost and might in some cases reduce the chances of injury or fatality." The NHTSA, therefore, planned "to urge States to adopt the Safety Board's recommendation by revising its pupil transportation safety manuals to include this policy." However, the NHTSA had taken no action in this regard as of the date of this Coachella accident report, and the seating arrangement in this accident was, therefore, strictly by chance.

The Safety Board is concerned about the lack of statistical data to support its schoolbus seating recommendation. However, the concept of limiting occupant exposure at or near the most likely impact zones does appear to have theoretical merit, and available data indicate that front and rear impacts are the most likely to occur. Therefore, the Safety Board believes that the NHTSA should take immediate action to fulfill its commitment to urge the States to adopt a schoolbus seating policy that front and rear seats be left vacant when feasible and to revise its pupil transportation safety manuals to include this policy. The Safety Board also believes that the National School Transportation Association could also aid in informing schoolbus owners and operators about the Safety Board's seating recommendation.

Highway Safety Factors

Although the highway was not a causal factor in this accident, the Safety Board is concerned by the significantly high fatal accident rate on State Route 86. The recent high number of fatal accidents in the first 5 months of 1980 increased the fatal accident rate to about 6 times the average rate for similar State highways. Before the rapid increase in fatal accidents, California had begun a detailed study to determine the most cost-effective major highway construction improvements that could be made to the route, including the construction of a four-lane freeway. 6/ California is currently considering these major construction improvements.

6/ "Project Development Feasibility Report, Route 86 Transportation Corridor between Brawley & Indio, CALTRANS, California Department of Transportation, April, 1980.

The Safety Board conducted a preliminary analysis of accident statistics to determine if safety improvements more limited than major highway construction were feasible for State Route 86. The analysis showed that the State Route 86 bridge replacement program has the potential to eliminate or reduce the severity of about 10 percent of the accidents that occur annually on this highway.

Accident statistics revealed a high rate of alcohol involvement in the fatal accidents that occurred on this highway. At least two out of every three drivers were known to be under the influence of alcohol. This rate is even higher than the already alarming national rate of 50-percent alcohol involvement in fatal accidents.

Another limited improvement might involve asking motorists to turn their vehicle headlights on in the daytime to enhance their vehicle's conspicuity, particularly during passing and turning maneuvers. The Safety Board noted that about 25 percent of the serious-injury accidents occurred in daylight and that about 40 percent of these accidents involved a passing or turning maneuver. At night, about 20 percent of the serious injury accidents involved a passing or turning maneuver, indicating that increased vehicle conspicuity in the daytime may be of benefit. California has two test areas where the use of headlights is encouraged and should consider State Route 86 for test purposes.

The State of California should do further analysis of the State Route 86 accident data to determine if there are other limited improvements that could be made along the route. For example, California should examine why large trucks are involved in about 40 percent of all accidents while these trucks are only about 20 percent of the daily traffic volume. Such improvements could at least be used as an interim measure while longer term, major projects are under consideration.

CONCLUSIONS

Findings

1. Witness statements, a flat tire scuff mark at the accident scene, and examination of the left front tire indicated that the left front tire of the tractor blew out before the collision and caused the truckdriver to lose control of his vehicle.

2. The left front tire of the tractor blew out because an earlier impact injury damaged the tire cords and caused the tread to separate. Separation continued to erode and abrade the tire cords until the tire failed.

3. The left front tire had another tread separation area which developed at a balance pad that had been placed inside the tire by the tire manufacturer, but the tire did not fail at this tread separation.

4. Since there was more tread wear at the left front tire balance pad separation than at the injury separation, the balance pad separation probably developed first.

5. High operating temperatures, produced by generally abusive operating conditions, such as tire underinflation, and concentrated by the extra thickness of the balance pad, probably caused the tread to separate at the balance pad.

6. Bulges in the tire at the tread separations, rhythmic "slapping" sounds from these bulges, a bald spot produced by abnormal tread wear at the separation at the balance pad and possible vibrations through the steering system were obvious clues that the tire was inadequate and failing before the blow-out.

7. Given the amount of tread wear at the bald spot and the truckdriver's comments regarding the onset of the vibration problem, the clues that the tire was inadequate and failing were probably present for a period of weeks rather than days before the accident.

8. Since the schoolbus was traveling about 50 mph, the tractor was traveling about 60 mph, and the tire blew out about 222 feet from impact, the drivers had only about 2 1/2 seconds to react and take emergency action.

9. The large drag force, which was created by the blow-out and which turned the tractor to the left, and the limited time between the blow-out and collision would have prevented the truckdriver from regaining control through steering.

10. Had the truckdriver applied the brakes and locked the wheels, he would only have had time to slow the tractor about 5 to 10 mph before the collision.

11. If the busdriver did not see or hear the blow-out immediately, there was only about 1 second to react after the tractor reached the centerline--insufficient time to take effective evasive action.

12. An organized preventive maintenance program, as required by law, should have prevented this accident.

13. Given the long-term deterioration of the tire, the series of increasingly obvious clues that the tire was failing, and the high number of opportunities for the truck company to have inspected the tire through daily and periodic inspections or to have sought more professional advice, there was no reason for the tire to have remained in service.

14. Six days before the accident, the tractor was inspected by California Commercial Vehicle Inspection specialists during a random inspection of commercial vehicles at a truck scale, but the unsafe tire was not detected.

15. Except for a lenient standard relative to the minimum tread depth allowed on truck tires -- 2/32 inch on the steering axle and no requirement for other axles -- California's written inspection procedures for tires, wheels, and rims seem adequate.

16. The truck scale inspectors either did not detect or did not react to the truck's loose right rear brake chamber, an improperly repaired brake air line hose, an excessive amount of oil leakage, or the unsafe tire -- areas that were to be examined during inspection.

17. A 1978 Safety Board recommendation to load schoolbuses so that no passenger sits in the foremost or rearmost rows of the bus until all other seats of the bus have been occupied was reinforced by this accident.

18. A Safety Board analysis of the accident history of this highway indicated that there is a potential for developing a number of limited safety improvements that might at least serve to reduce the accident rate until longer term, major projects can be funded.

Probable Cause

The National Transportation Safety Board determines that the probable cause of this accident was the failure of the truck company to properly maintain its vehicle which resulted in a blow-out of the left front tractor tire, causing the truckdriver to lose control of his vehicle. Contributing to the accident were the lack of a truck company preventive maintenance program and an inadequate California Highway Patrol inspection that should have detected the deteriorated condition of the tire before it blew out.

RECOMMENDATIONS

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

-- to the State of California:

Revise Section 1088 of the California Administrative Code to match the minimum tread depth requirements of the Federal Motor Carrier Safety Regulations, Section 343.75(b) and (c), which are more in keeping with tire standards recommended by current research. (Class II, Priority Action) (H-80-70)

Circulate the Coachella accident report, with its finding of the inadequate inspection of the truck, among California Commercial Vehicle Inspectors. (Class I, Urgent Action) (H-80-71)

Investigate the potential for limited improvements along California State Route 86 between Coachella and Westmorland, California, that will at least serve as interim safety improvements while longer term improvements are under consideration. (Class I, Urgent Action) (H-80-72)

— to the National Highway Traffic Safety Administration:

Take immediate action to fulfill its commitment to urge the States to adopt a schoolbus seating policy that front and rear seats be left vacant when feasible and to revise NHTSA pupil transportation safety manuals to include this policy. (Class I, Urgent Action) (H-80-73)

— to the National School Transportation Association:

Inform its members of the National Transportation Safety Board recommendation that front and rear seats of schoolbuses be left vacant when feasible. (Class I, Urgent Action) (H-80-74)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD:

/s/ JAMES B. KING
Chairman

/s/ ELWOOD T. DRIVER
Vice Chairman

/s/ FRANCIS H. McADAMS
Member

/s/ PATRICIA A. GOLDMAN
Member

G.H. PATRICK BURSLEY, Member, did not participate.

Member GOLDMAN, concurring and dissenting:

I concur in the analysis, conclusions, probable cause, and recommendations in this report with the following exceptions:

I do not concur with the recommendation to the State of California to "Investigate the potential for limited improvements along California State Route 86 between Coachella and Westmorland, California, that will at least serve as interim safety improvements while longer-term improvements are under construction." First of all, the highway was not a causal factor in this accident. Secondly, California is already considering major construction improvements

along this route. Finally, I do not believe it is appropriate to second-guess the State of California based on the limited "preliminary analysis of the accident statistics." Therefore, even though the recommendation is rather innocuous, I do not believe it is justified.

Also, I do not concur with the "urgent" recommendation to the National Highway Traffic Safety Administration. First of all, there is "scant information" available in the accident history of schoolbuses to indicate that one is actually safer if seated in the middle of the bus. Secondly, I believe it is highly impractical to believe that a "middle-seats-first policy" could be effectively enforced. Therefore, even though the recommendation has the "virtues of simplicity and low cost," I do not believe it is justified.

PATRICIA A. GOLDMAN
Member

September 29, 1980

APPENDIX

INVESTIGATION

1. Investigation

The National Transportation Safety Board was notified of the accident at 7:30 p.m. on April 23, 1980, by the California Highway Patrol. An investigative team from Washington, D.C., arrived at the accident scene at 7 p.m. on April 24, 1980. Representatives of CALTRANS, the California Multidisciplinary Accident Investigation Team, the California Highway Patrol, and Smithers Scientific Services, Inc., participated in the investigation.

2. Deposition/Hearing

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