

School Bus Crash Investigation
Dynamic Science, Inc.
Case DS99012
Contract DTNH22-94-D27058
Task 131
Iowa
April, 1999

This research was supported by the National Highway Traffic Safety Administration (NHTSA), U.S. Department of Transportation. The opinions, findings, and recommendations contained herein are those of the authors, and do not necessarily represent those of NHTSA.

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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Background

This crash involved a 1990 Chevrolet 60 School Bus with a Wayne body (Vehicle 1) involved in a right angle collision with a 1971 International 1600 truck (Vehicle 2). The school bus was heading in a southerly direction as it entered an intersection. It was struck on the left side by the frontal plane of Vehicle 2 which was traveling westbound. The school bus suffered subsequent impacts with the box portion of the truck, and a utility pole. The crash was selected for an additional follow-up investigation due to the fatal injuries received by one child. A remote-style investigation was conducted during which information was sought from the investigating police jurisdiction and the bus owners (the school district).

Summary

The crash occurred during the late afternoon of a spring weekday in a rural area. There were no viewing restrictions, and driver inattention on the part of both drivers was cited as a factor in the crash. The weather was clear, and the gravel road surface was described as damp since there was no dust. The crash occurred when Vehicle 2 struck the left front corner of Vehicle 1 at the intersection of two gravel roads.

Vehicle 1 was a 1990 Chevrolet 60 passenger school bus with a Wayne body. It was configured to hold 65 passengers. The bus was driven at approximately 72 kph (45 mph) by a 45 year old male, and was reported to be in good condition prior to the crash. The driver was wearing the available lap belt. There were 5 student occupants ranging in age from 8 to 13 years old. None of the students were restrained. The bus was traveling on a flat gravel county road and was entering an uncontrolled intersection, continuing in a southbound direction of travel.

Vehicle 2, a 1971 International truck driven by a 69 year old male, was traveling westbound at approximately 72-81 kph (45-50 mph) and was entering the intersection. The driver was wearing the available lap belt. The collision occurred in the middle of the intersection when the frontal plane of Vehicle 2 struck the left side of the school bus, forward of the driver's area.

Following the initial impact, Vehicle 1 rotated slightly in a clockwise direction and Vehicle 2 rotated in a counterclockwise direction, moving in a side-by side configuration. During this movement, the box portion of the truck which was heavily laden with dead livestock, broke away, and the box impacted the mid-section of the passenger compartment on the left side of the bus in a sideslap type configuration. The vehicles continued in a southwesterly direction, and the right side of the bus impacted and cracked a utility pole, and sheared an underground utility box. Both vehicles came to their final rest positions in a ditch on the southwest corner of the intersection.

The box of the truck, with the frame attached, was resting on the roof of the school bus.

Damage to Vehicle 1 is shown on the police report sketch as including the left front fender, and extensive damage along the left side of the bus including the roof area. There was extensive intrusion on the left side from the impact with the truck box. In addition, there is severe damage noted to the right side door area, and crush extending along the frame rail area to the rear wheels. Undercarriage damage was also noted, and the right front tire was apparently restricted by the front bumper. The windshield was shattered.

Damage to Vehicle 2 was catastrophic. The cab portion was torn from the frame and opened up. The engine, front axle, radiator and shell, fenders and wheel wells were also torn away. They were described as scattered around at the final rest position. As noted previously the box section separated from the rest of the truck following the initial impact. It remained engaged, with the left side of the bus, with the frame attached and the rear axle in the air. In the interior, police noted that knobs on the right front section of the instrument panel were bent to the right, and the steering wheel was bent forward from occupant loading.

The school bus was carrying five child passengers. Only the driver was restrained by a seat belt. Their seating positions are depicted on figure 1. The injuries sustained by the occupants are listed below, and shown on diagrams included in the appendices.

Vehicle 1

<u>Seat Position</u>	<u>Age</u>	<u>Gender</u>	<u>Height</u>	<u>Weight</u>
Driver	45	Male	183 cm. (72 inches)	84 kg (185 lbs.)
Occupant 1				
Front seat, left side	13	Female	160 cm. (63 inches)	54 kg. (120 lbs.)
Occupant 2				
Front seat, right side	8	Female	117 cm. (46 inches)	36 kg. (80 lbs.)
Occupant 3				
Third seat (or fourth) seat, left side	9	Male	142 cm. (56 inches)	45 kg. (100 lbs.)

Vehicle 1 (continued)

<u>Seat Position</u>	<u>Age</u>	<u>Gender</u>	<u>Height</u>	<u>Weight</u>
Occupant 4				
sixth seat, left side	12	Male	159 cm. (62.5 inches)	45 kg. (100 lbs.)

Occupant 5				
sixth seat, right side	11	Male	158 cm. (62 inches)	52 kg. (115 lbs.)

Vehicle 2

<u>Seat Position</u>	<u>Age</u>	<u>Gender</u>	<u>Height</u>	<u>Weight</u>
Driver	69	Male	180 cm. (71 inches)	73 kg. (160 lbs.)

Vehicle 1

Injury Description

<u>Occupant Number</u>	<u>Injury Description</u>	<u>AIS/OIC</u>	<u>ICD9</u>
Driver	Head laceration	190600.1,9	873.8
	Bruise on right arm	790402.1,1	923.03
	Bruise on left elbow	790402.1,2	923.11
	Bruises on abdomen	590402.1,9	922.2
	Bruise on left thigh	890402.1,2	924.00
	Bruise on right calf	890402.1,1	924.10
Occupant 1	Abrasions to face	290202.1,9	910.0
	Bruise, left shoulder, rear	790402.1,2	923.00
	Abrasions, both hands	790202.1,3	914.0

Vehicle 1 (continued)

Occupant 2	Laceration, forehead	290600.1,7	873.42
	Bruise, left shoulder, front	790402.1,2	923.00
	Bruise, right hip	890402.1,1	922.2
	Abrasion, right knee	890202.1,1	916.0
	Laceration, left knee	890600.1,2	891.0

Injury Description

<u>Occupant Number</u>	<u>Injury Description</u>	<u>AIS/OIC</u>	<u>ICD9</u>
Occupant 3	Abrasion, back of neck	390202.1,6	910.0
	Bruises, back	490402.1,9	922.31
Occupant 4	Multiple skull fractures	150400.3,9	800.0
	Temperoparietal bone fractures	150400.3,9	800.0
	Dislocated eye globe, left		
	Facial abrasions, lacerations and contusions	290202.1,9 290600.1,9 290402.1,9	910.0 873.40 920
Occupant 5	Abrasion to forehead	290202.1,7	910.0
	Laceration to crown of head	190600.1,9	873.0
	Bruise, left knee	890402.1,2	924.11

Vehicle 2

Injury Description

<u>Occupant Number</u>	<u>Injury Description</u>	<u>AIS/OIC</u>	<u>ICD9</u>
Driver	Three fractured ribs on right side	450220.2,1	807.03
	Fractured collarbone	752200.2,9	810.00
	Possible punctured lung	441414.3,9	861.22

The passengers, and the drivers of both vehicles were transported to an area hospital by ambulances. The 12 year old male expired from massive head injuries.

According to the statement of the bus driver, he saw in his mirror, the 13 year old female walking from the back to the left side, front seat of the bus. The right side, front seat passenger was lying in the seat. The driver turned to find her, and asked her to sit up, just as he was entering the intersection. The driver did not see the approach of Vehicle 2. Following the initial impact (frontal plane of Vehicle 2 into the left front fender of Vehicle 1), the driver of Vehicle 1 reported that, "it was like in a tornado with the debris flying around."

After coming to a final rest position, the driver instructed the children to get off the bus and sit in the field. One of the passengers notified the driver that the 12 year old male was still on the bus. The driver found the passenger lying on his left side on the seat with his head toward the window. The driver noted the massive head injury and did not see any signs of breathing. He returned to the children who were outside. After hearing some moans, the driver returned to monitor the passenger still on the bus. He realized that the sounds were not coming from the child, but from the driver of Vehicle 2 who was belted, and leaning to his right. The driver of Vehicle 2 was entrapped. One of the children was sent home to call for help. Rescue personnel arrived approximately 20 minutes post-crash.

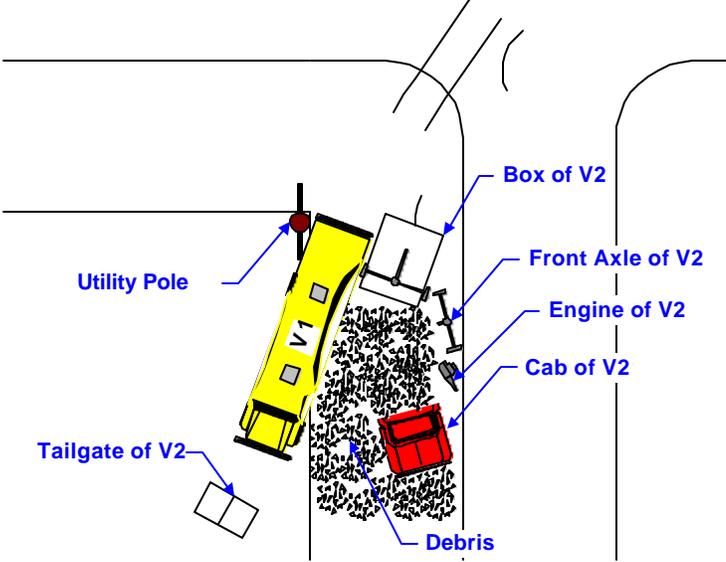
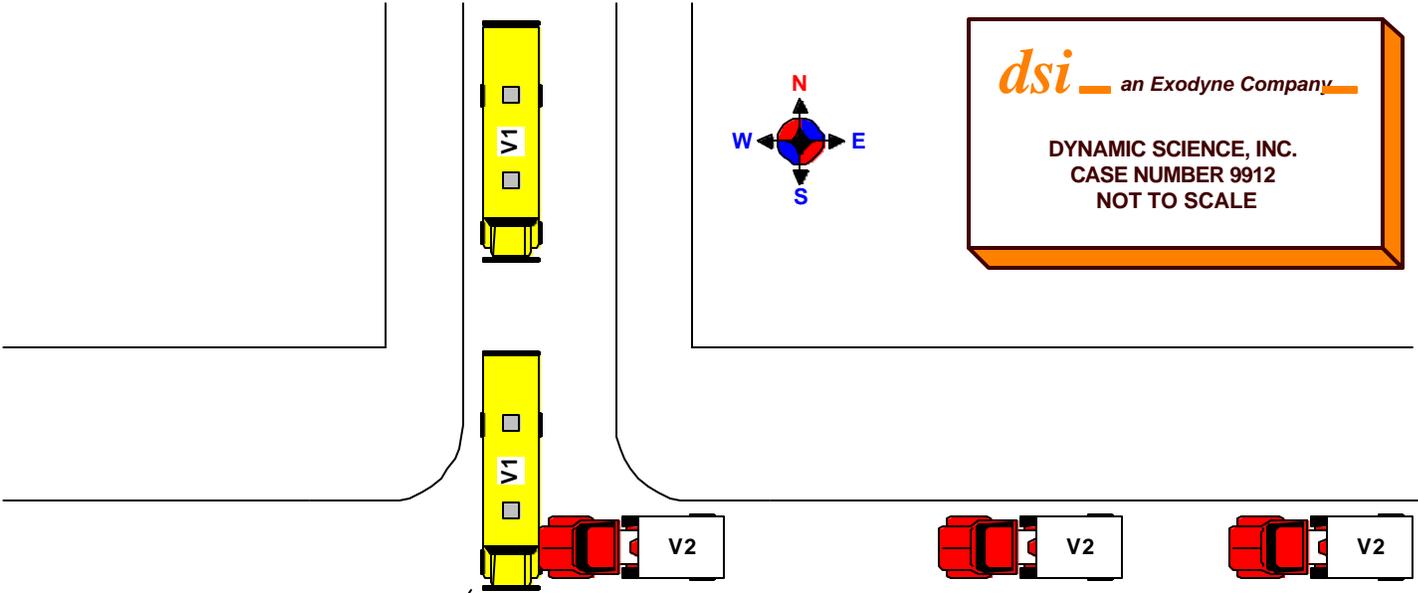
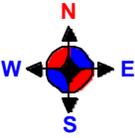
Emergency personnel removed the 12 year old male via the rear emergency exit. He was placed on a backboard and he was breathing with great difficulty. He was admitted to the local hospital, and later transferred by helicopter to a major hospital. The patient expired from his injuries approximately 25 hours after the crash.

Both vehicles were towed from the scene due to damage and were declared total losses. Repair estimates for Vehicle 1 were listed by the police as \$30,000, and for Vehicle 2 were estimated as \$10,000.

Driver AIS1			<table border="1" style="width: 100%; height: 40px;"> <tr> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> <td style="width: 25%;"></td> </tr> </table>						
Occ 1 AIS1		Occ 2 AIS1							
Row 1		Row 1							
Row 2		Row 2							
Row 3		Row 3							
Occ 3 AIS1									
Row 4		Row 4							
Row 5		Row 5							
Occ 4 AIS3		Occ 5 AIS1							
Row 6		Row 6							
Row 7		Row 7							
Row 8		Row 8							
Row 9		Row 9							
Row 10		Row 10							
Row 11		Row 11							
Row 12		Row 12							

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DYNAMIC SCIENCE, INC.
CASE NUMBER 9912
NOT TO SCALE



V1 1990 CHEVROLET 60 SCHOOL BUS

V2 1971 INTERNATIONAL TRUCK