

On-scene Investigation / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS01001
1995 Plymouth Grand Voyager SE
Idaho
December, 2000

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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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16. Abstract <p>The crash occurred in a rural area in the state of Idaho in December, 2000 at 1759 hours. The crash took place at an intersection between local streets and a east/westbound US highway. The speed limit is 105 km/h (65 mph) in both directions. The case vehicle, a 1995 Plymouth Grand Voyager SE minivan driven by an unrestrained 34-year-old female, was traveling westbound approaching the intersection. The driver had never possessed a valid driver's license. The second right seat was occupied by an unrestrained 5-year-old female. Prior to the crash, the driver had moved into the left hand turn lane. The other vehicle, a 1993 Buick LeSabre driven by a 49-year-old male, was traveling westbound. The other vehicle was reported traveling at 114-116 km/h (71-72 mph) just prior to the intersection. As the case vehicle reached the intersection, the driver began a left hand turn. As her vehicle entered the westbound travel lane it was struck head-on by the other vehicle in the case. The case vehicle sustained a longitudinal delta v of -35.5 km/h (-22.0 mph) and a lateral delta v of -12.9 km/h (-8.0 mph). Both frontal air bags deployed at this time. The case vehicle was pushed in a counter clockwise direction and came to rest facing generally north. The other vehicle departed the roadway and came to rest also facing north. Immediately after the crash, the case vehicle was approached by the first police officer at the scene. He indicated that the driver of the case vehicle was able to respond verbally for a short period before going unconscious. The driver was found in the center console area on top of the 5-year-old rear seat occupant by witnesses. The witnesses, with the assistance of someone they believe was a paramedic, moved the unresponsive driver to remove the child. The child was crying but did not have any visible injuries. The driver of the case vehicle was transported from the scene by ground ambulance to a local hospital where she was pronounced dead on arrival. The county coroner examined the driver but did not do an invasive autopsy. He indicated that the driver had sustained a broken neck and he found a large contusion under the driver's chin. He attributed the cause of death to the air bag. The rear occupant did not report any injuries. She was transported from the scene by a private vehicle. The driver of the other vehicle sustained a femur fracture. He was transported to a local hospital by ground ambulance.</p>			
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Dynamic Science, Inc.
Accident Investigation
Case Number: DS01001

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BACKGROUND:

Description: This driver air bag related fatality case was generated in response to a newspaper article in which the deploying air bag was cited as the cause of death. DSI was assigned the case on January 2, 2001. Field work was completed on January 5, 2001.

Investigation Type: On-scene

Crash Location: Idaho
 Crash Date: December, 2000
 Notification Date: January 2, 2001
 Field Work Completed: January 5, 2001

SUMMARY:

The crash occurred in a rural area in the state of Idaho in December, 2000 at 1759 hours. The crash took place at an intersection between local streets and a east/westbound US highway. The eastern leg of the intersection is comprised of a westbound travel lane, a left turn lane, and an eastbound travel lane. The travel lane is separated from the westbound travel lane by solid double yellow lines. The western leg of the intersection is comprised of an eastbound travel lane, a turn lane, and a westbound travel lane. The travel lane is separated from the eastbound travel lane by solid double yellow lines. The roadways are straight and level as they approach the intersection. The speed limit is 105 km/h (65 mph) in both directions.



Figure 1. Case vehicle approach to area of impact



Figure 2. Other vehicle approach to area of impact

The case vehicle, a 1995 Plymouth Grand Voyager SE minivan driven by an unrestrained 34-year-old female, was traveling westbound approaching the intersection. The driver had never possessed a valid driver's license. The second row center seat was occupied by an unrestrained 5-year-old female. Prior to the crash, the driver had moved into the left hand turn lane.

The other vehicle, a 1993 Buick LeSabre driven by a 49-year-old male, was traveling westbound. The other vehicle was reported traveling at 114-116 km/h (71-72 mph) just prior to the intersection. A police vehicle traveling in the opposite direction had clocked that speed on radar and had warned the driver of the LeSabre by turning on his lights. Presumably, the driver slowed to some degree after seeing the police vehicle. As the case vehicle reached the intersection, the driver began a left hand turn. As her vehicle entered the westbound travel lane it was struck head-on by the other vehicle in the case.

The case vehicle sustained a longitudinal delta v of -35.5 km/h (-22.0 mph) and a lateral delta v of -12.9 km/h (-8.0 mph)¹. Both frontal air bags deployed at this time. The case vehicle was pushed in a counter clockwise direction and came to resting facing generally north. The other vehicle departed the roadway and came to rest also facing north.

Immediately after the crash, the case vehicle was approached by the first police officer at the scene. He indicated that the driver of the case vehicle was able to respond verbally for a short period before going unconscious. The driver was found in the center console area on top of the 5-year-old rear seat occupant by witnesses. The witnesses, with the assistance of someone they believe was a paramedic, moved the unresponsive driver to remove the child. The child was crying but did not have any visible injuries.



Figure 3. Case vehicle (1995 Plymouth Grand Voyager)



Figure 4. Other vehicle (1993 Buick LeSabre)

¹Calculated using d0/d1 values for a similar vehicle (Dodge Caravan) calculated from NCAP test 2091

A ground ambulance was dispatched at 1800 hours and arrived 6 minutes later at 1806. The driver of the case vehicle was transported from the scene by ground ambulance to a local hospital where she was pronounced dead on arrival. The county coroner examined the driver but did not do an invasive autopsy. He indicated that the driver had sustained a broken neck and he found a large contusion under the driver's chin. He attributed the cause of death to the air bag.

The rear occupant did not report any injuries. She was transported from the scene by a private vehicle.

The driver of the other vehicle sustained a femur fracture. He was transported to a local hospital by ground ambulance.

It does not appear that the driver of the case vehicle was aware of the other vehicle. There was no braking or steering maneuvers applied. The driver was seated in a normal, upright position in the pedestal seat with her hands on the steering wheel and her right foot on the accelerator as she made the left hand turn. The seat was adjusted to the full back position at the time of the vehicle inspection, but it appears that rescue/tow personnel had moved the seat.

Given the driver's relatively short stature (estimated at 164 cm/64 in. by police officers) and views from the on-scene photos, it appears likely that the seat had been positioned much closer at the time of the crash. At impact, the unrestrained driver of the case vehicle pitched forward and to the right. She engaged the deploying air bag with her face and neck. Her left knee struck the left side of the instrument panel. As the air bag expanded, her head was forced upwards and rearward—essentially hyper-extending the neck and causing the cervical fractures. There was 1.9 cm (0.75 in.) deformation from occupant loading to the top of the steering wheel rim, but no indications of any contact.

The rear seat occupant was not restrained. At impact, she pitched forward and to the right. There was an indication from one of the witnesses that she was found in the front seat of the vehicle, but this has not been verified.

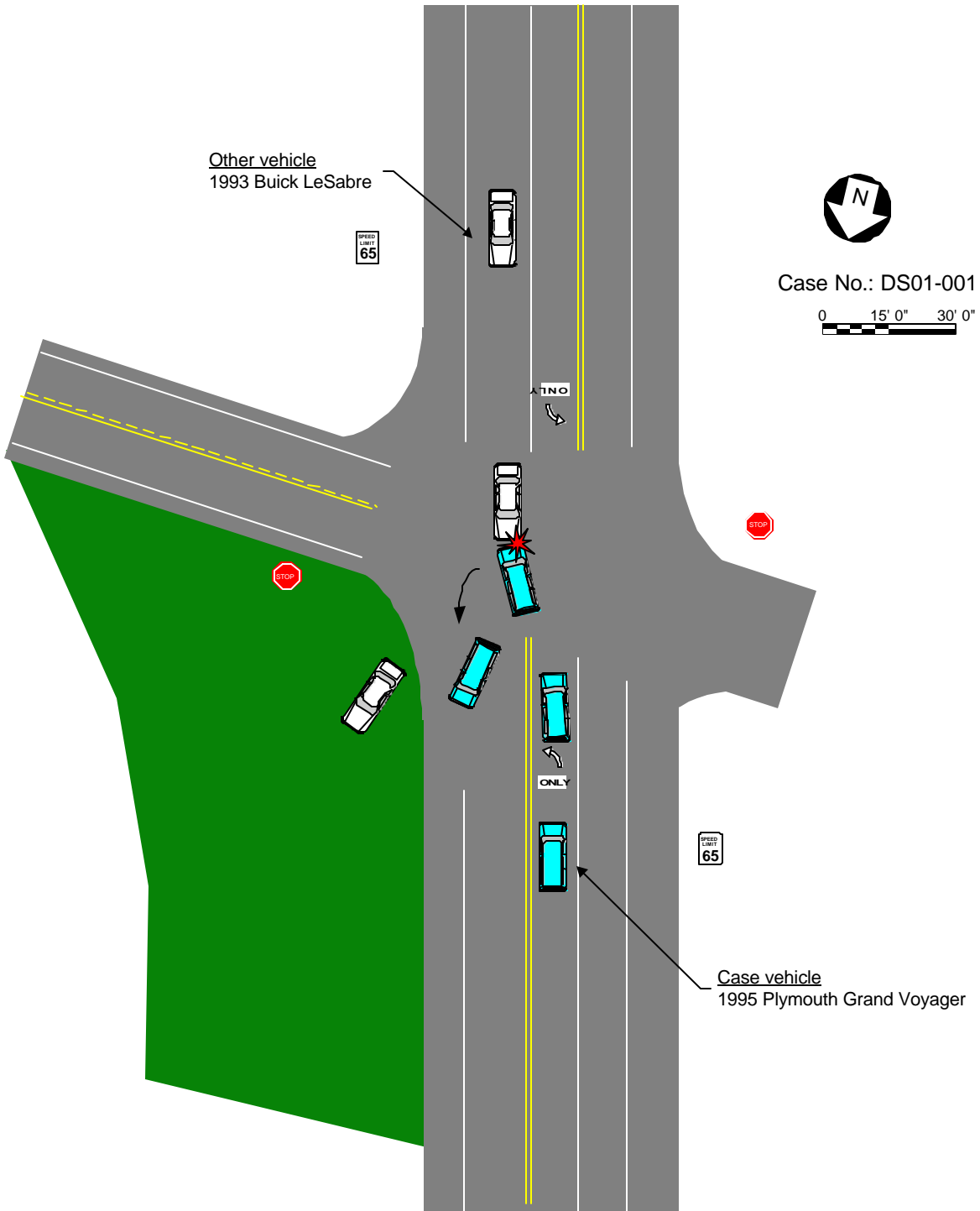


Figure 5. Interior, case vehicle



Figure 6. Interior, other vehicle

Scene Diagram



DETAILED INFORMATION**Vehicles**Case vehicle

Description: 1995 Plymouth Grand Voyager SE minivan

VIN: 1P4GH44RISXxxxxxx

Odometer: 139,150 km (86,466)

Engine: 3.3l V6

Reported Defects: None

Cargo: Child safety seat (installed in the third row left)

Damage Description: Moderate right to left front damage to front bumper, grille, hood, and right fender. Vehicle towed from the scene due to damage. There was 4 cm (1.6 in.) of intrusion through the right front toe pan. Left front side window disintegrated—possibly by driver’s left hand/arm. Police estimated damage at \$8000.

CDC: 01FZEW2

Delta V:

Total	37.7 km/h (23.4 mph)
Longitudinal	-35.4 km/h (-22.0 mph)
Latitudinal	-12.9 km/h (-8.0 mph)
Energy	21,519 joules (15,900 ft-lbs)



Figure 8. Front view, case vehicle

The case vehicle was equipped with a steering wheel mounted driver’s air bag and a top mount right front passenger’s air bag.

The driver’s air bag module cover had an “H” pattern and opened in the proper fashion along the seams. The driver’s air bag was 60 cm (23.6 in.) in diameter. It had two vent holes and was not tethered. There were 8 vertical folds across the face. There was a skin transfer to the upper left quadrant of the face of the air bag.

The front right passenger’s air bag had a single top mount module cover that measured 32 x 13 cm (12.5 x 5.2 in.). The air bag itself measured 73 cm (28.7 in.) high by 45 cm (17.7 in.) wide. The air bag was equipped with two tethers and no vent holes.



Figure 13. Driver's air bag

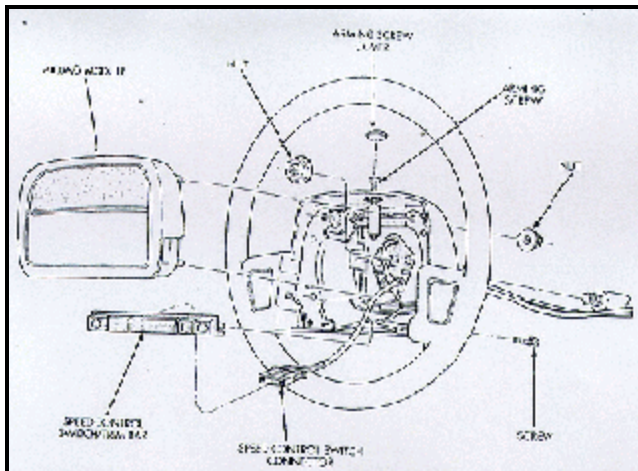


Figure 10. Driver's air bag

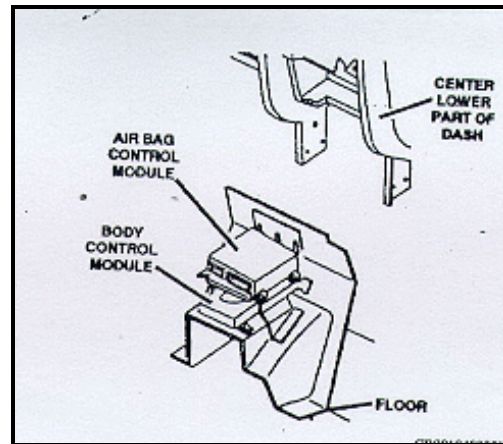


Figure 11. Air bag Control Module location



Figure 12. Front right passenger's air bag

Other vehicle

Description:	1993 Buick LeSabre 4-door sedan	
VIN:	1G4HP53L8PHxxxxxx	
Odometer:	Unknown	
Engine:	3.8 L V6	
Reported Defects:	None	
Cargo:	Unknown	
Damage Description:	Moderate to major frontal damage to bumper, grille, and hood. Towed from the scene due to damage. Police estimated damage at \$8000.	
CDC:	12FDEW2	
Delta V:	Total	35.9 km/h (22.3 mph)
	Longitudinal	-35.8 km/h (-22.2 mph)
	Latitudinal	3.1 km/h (1.9 mph)
	Energy	154,633 joules (114,120 ft-lbs)



Figure 13. Exterior, other vehicle

Occupants

<u>Case vehicle</u>	Occupant 1	Occupant 2
Age/Sex:	34/Female	5/Female
Seated Position:	Front left	Second seat, middle
Seat Type:	Pedestal, fabric covered	Bench with folding back, fabric covered
Height:	163 cm (64 in.), per police	Unknown
Weight:	Unknown	Unknown
Occupation:	Unknown	NA
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	NA
Driving Experience:	Unknown. Driver had never obtained a driving license.	NA
Body Posture:	Normal, upright	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Right foot presumed to be on accelerator, left on floor board	Unknown
Restraint Usage:	Lap and shoulder belt available, not used	Lap and shoulder belt available, not used
Air bag:	Driver's frontal air bag available/deployed	None

Other vehicle

Age/Sex:	49/Male
Seated Position:	Front left
Seat Type:	Unknown
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	Unknown
Alcohol/Drug Involvement:	None
Driving Experience:	Presumed to be greater than 20 years.
Body Posture:	Normal, upright
Hand Position:	Unknown
Foot Position:	Right on accelerator, left on floor board.
Restraint Usage:	Lap and shoulder belt used

Injuries and Injury Mechanisms

Vehicle 1

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	“Broken neck”	650216.2,6 615999.7,6 blunt cervical spine injury, died without further evaluation, no autopsy	805.00	Air bag
	Contusion, beneath chin	390402.1,5	920.0	Air bag

Second row
center occupant: Not injured

Vehicle 2

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Police indicate non- incapacitating injuries, but were not specific			

Occupant Kinematics

The 34-year-old driver of the case vehicle was seated in a normal, upright fashion in the cloth-covered pedestal style seat. She was not restrained. Just prior to the crash she was in the process of beginning a left hand turn. It is likely that her left hand was lower on the steering wheel than the right.

There do not appear to have been any evasive maneuvers so it is likely that she was looking somewhat more to the left toward the intersecting street. The seat was adjusted to the full back position at the time of the vehicle inspection, but it appears that rescue/tow personnel had moved the seat. Given the driver's relatively short stature (estimated at 163 cm/64 in. by police officers) and views from the on-scene photos, it appears likely that the seat had been positioned much closer at the time of the crash. At impact, the unrestrained driver pitched forward and to the right. She engaged the deploying air bag with her face and neck (causing the beneath chin contusion). Her left knee struck the left side of the instrument panel. The lower part of her left leg, or possibly her foot, engaged the left side of the brake pedal. As the air bag expanded, her head was forced upwards and rearward—essentially hyper-extending the neck and causing the cervical fractures. There was 1.9 cm (0.75 in.) deformation to the top of the steering wheel rim, but no indications of any contact.

The 5-year-old rear right seat occupant was not restrained. At impact, she pitched forward and to the right. She likely went into the area between the two front seats and struck the center console. There are no indications that she sustained any injuries.



Figure 14. Driver's air bag

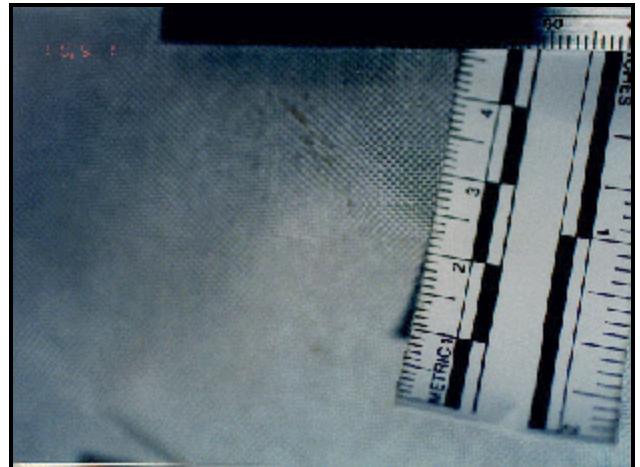


Figure 15. Skin transfer, driver's air bag



Figure 16. Left knee contact/deformed brake pedal 11



Figure 17. Right knee contact