

CRASH DATA RESEARCH CENTER

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**CALSPAN REMOTE AIR BAG RELATED SERIOUS INJURY
CRASH INVESTIGATION**

CASE NO: 2004-11-200K

VEHICLE: 1996 OLDSMOBILE NINETY-EIGHT

LOCATION: MICHIGAN

CRASH DATE: SEPTEMBER 2004

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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 are 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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**CALSPAN REMOTE ADULT AIR BAG RELATED SERIOUS INJURY
INVESTIGATION
NASS/SCI COMBO CASE NO.: 04-11-200K
LOCATION: MICHIGAN
VEHICLE: 1996 OLDSMOBILE NINETY-EIGHT
CRASH DATE: SEPTEMBER 2004**

BACKGROUND

This remote investigative effort focused on the severity of the crash and the injury sources for an 80-year-old male driver of a 1996 Oldsmobile Ninety-Eight. The Oldsmobile (**Figure 1**) was equipped with frontal air bags for the driver and front right position that deployed as result of this two-vehicle crash. The restrained 80-year-old male driver was operating the Oldsmobile southbound on the two-way north/south roadway. A 56-year-old male driver was operating a 1993 Jeep Grand Cherokee eastbound exiting a private driveway. The driver of the Jeep initiated a left turn from the driveway, across the path of



Figure 1. Subject 1996 Oldsmobile Ninety-Eight.

the Oldsmobile. The front left aspect of the Oldsmobile impacted the left frontal area of the Jeep. As a result of the crash, the frontal air bags deployed in the Oldsmobile. The driver of the Oldsmobile was wearing eyeglasses at the time of the crash. The combination of the air bag deployment and the compression of the eyeglasses against the driver's face resulted in the multiple minor facial abrasions and a facial contusion. The acceleration of the driver's head from the air bag expansion resulted in the 8 mm right cerebrum subfalcine subdural hematoma. The driver was transported to a local trauma center where he was hospitalized for six days. He fully recovered from the closed head injury. The Oldsmobile was also occupied by an 84-year old female seated in the front right seat. This occupant sustained fractures to her right radius and ulna as her arm contacted the interior surface of the instrument panel. She was transported to a local trauma center and was hospitalized for six days.

This crash was initially selected for research by the National Automotive Sampling System (NASS). The crash was identified as an air bag related serious injury crash by the Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA). A remote level investigation was assigned to the Calspan Special Crash Investigations (SCI) team on February 24, 2005. This remote investigation included a review of the NASS case data and the preparation of this summary report.

SUMMARY

Crash Site

This two-vehicle crash occurred during the morning hours in September 2004 in the state of Michigan. At the time of the crash there were no adverse weather conditions and the

asphalt roadway was dry. The north/south roadway consisted of one lane in each direction separated by a center turn lane. The lanes were delineated by solid and broken yellow lane markings separating the center turn lane from the travel lanes. Asphalt shoulders with white fog lines bordered the roadway on both sides. The roadside environment consisted of natural growth and multiple private residences and driveways in a suburban setting. The roadway was straight and level and the posted speed limit was 56 km/h (35 mph). The NASS scene schematic is included as **Figure 9** at the end of this narrative report.

Vehicle Data – 1996 Oldsmobile Ninety-Eight

The 1996 Oldsmobile Ninety-Eight was identified by the Vehicle Identification Number (VIN): 1G3CX52K0T4 (production number omitted). The vehicle’s odometer recorded 99,940 km (62,102 miles) at the time of the NASS inspection. The Oldsmobile was a four-door sedan configured with a 3.8-liter, 6-cylinder engine linked to an automatic transmission. The front-wheel drive vehicle was equipped with 38 cm (15”) steel wheels and Goodyear Regatta-2 P205/70R15 tires. The specific tire information at the time of the NASS inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Damage
LF	186 kPa (27 PSI)	9 mm (11/32”)	None
LR	186 kPa (27 PSI)	8 mm (10/32”)	None
RF	186 kPa (27 PSI)	8 mm (10/32”)	None
RR	159 kPa (23 PSI)	8 mm (10/32”)	None

The front row of the Oldsmobile was configured with a split bench seat with separate back cushions for the driver, center, and right seating positions. The driver’s seat was adjusted between mid and rear track while the center and right positions were adjusted to the full-rear positions. The front left and right seats were equipped with adjustable head restraints, both of which were in the full-down position. The second row was equipped with a bench seat for all three seating locations. The second row was not occupied at the time of the crash.

Vehicle Data – 1993 Jeep Cherokee Sport Utility Vehicle

The 1993 Jeep Cherokee Sport Utility Vehicle was identified by the VIN: 1J4GZ58S8PC (production number omitted). The vehicle was not inspected by the NASS team and no further data is available on this vehicle.

Crash Sequence

Pre-Crash

The 80-year old driver of the Oldsmobile was operating the vehicle southbound on the three-lane roadway and was intending to continue straight (**Figure 2**). The 56-year old male driver of the Jeep Cherokee was exiting a private driveway from the west side of the roadway and was intending to turn left to travel northbound (**Figure 3**). The driver of the Oldsmobile claimed that he saw the Cherokee pull out from the driveway and had no time to initiate any avoidance measures. He denied any avoidance measures; however,

the frontal damage to the Oldsmobile indicated an avoidance maneuver to the right which exposed the left aspect of the vehicle to the impact. He did warn the front right occupant, who is partially blind, by shouting that they were going to crash.



Figure 2 - Southbound approach of 1996 Oldsmobile Ninety-Eight.



Figure 3 - Westbound approach of 1993 Jeep Cherokee.

Crash

The front left and center aspects of the Oldsmobile contacted the forward aspect of the Cherokee on the left side in the southbound lane. The direction of force for the Oldsmobile was in the 1 o'clock sector. The impact resulted in moderate damage to the Oldsmobile that was sufficient to deploy the frontal air bags in the vehicle. An Event Data Recorder (EDR) was present in the vehicle; however, the NASS team reported that damage to the vehicle prevented the downloading of the data. The SCI revised missing vehicle routine of the WinSMASH program calculated a total delta-V of 22 km/h (13.7 mph), based on the frontal crush profile of the Oldsmobile. The specific longitudinal and lateral velocity changes for the Oldsmobile were -21 km/h (-13 mph) and -8 km/h (-5 mph), respectively. Following the impact the Oldsmobile was deflected laterally to the left and came to rest with its front end in the center turn lane and was facing in southeast direction. The Cherokee came to rest facing eastbound.

Post-Crash

The 80-year old driver and 84-year old front right passenger were removed from the vehicle due to perceived serious injuries. They were both transported by ambulance to a local trauma center where they both were admitted for six days. The driver of the Cherokee was not injured or transported to a medical facility. Both vehicles were towed from the crash scene due to damage.

Vehicle Damage

Exterior Damage – 1996 Oldsmobile Ninety-Eight

The 1996 Oldsmobile Ninety-Eight (**Figure 4**) sustained moderate frontal damage as a result of the impact with the 1993 Jeep Cherokee. The SCI revised direct contact damage began at the left front corner and measured 78 cm (30") in



Figure 2 - Damaged 1996 Oldsmobile Ninety-Eight.

length. The combined direct and induced damage encompassed the entire front end and measured 156 cm (61.4”). The maximum crush was located at the front left bumper corner and measured 41 cm (16.1”) in depth. Six equidistant crush measurements were documented across the full width of the bumper and were as follows: C1 = 41 cm (16.1”), C2 = 26 cm (10.2”), C3 = 19 cm (7.5”), C4 = 12 cm (4.7”), C5 = 7 cm (2.8”), C6 = 1 cm (0.4”). The Collision Deformation Classification (CDC) was 01-FYEW-2.

Interior Damage - 1996 Oldsmobile Ninety-Eight

The NASS investigation revealed minor interior damage associated with occupant contact damage. Minor scuffing was identified on the front left knee bolster and front right glove compartment door by the NASS team. The windshield was fractured from interaction with the front right air bag cover flap which contacted the windshield as the air bag deployed. There were no intrusions inside the vehicle.

Manual Restraints - 1996 Oldsmobile Ninety-Eight

The 1996 Oldsmobile Ninety-Eight was equipped with manual 3-point lap and shoulder belts for all four outboard seating positions. The center seating positions in both rows were equipped with a lap belt. The front belts were configured with sewn-on latch plates, adjustable D-rings, and Emergency Locking Retractors (ELR’s). The second row belts were configured with locking latch plates and ELR’s. The driver’s and front right passenger’s belt webbing exhibited loading evidence in the form of D-ring loading on the webbing, indicative of usage. The dimensions associated with the loading evidence were not reported in the NASS case; however, images of the restraints were provided (**Figures 5 and 6**).



Figure 5 - Driver 3-point lap and shoulder restraint.



Figure 6 - Front right passenger's 3-point lap and shoulder restraint.

Frontal Air Bag System - 1996 Oldsmobile Ninety-Eight

The 1996 Oldsmobile Ninety-Eight was equipped with frontal air bags for the driver’s and front right passenger’s seating positions. The driver’s air bag (**Figure 7**) deployed from the steering wheel hub through symmetrical I-configuration module cover flaps. Each cover flap measured 8 cm (3.2”) in width and 12 cm (4.7”) in height. The deployed driver’s air bag measured 56 cm (22”) in diameter in its deflated state. The air bag was vented by two ports located near the membrane’s centerline in the 3 and 9 o’clock

positions on the back of the bag. The air bag was not tethered and exhibited no discernable contact evidence.

The front right air bag deployed through a top-hinged single cover flap that was 39 cm (15.4”) in width and 20 cm (7.9”) in height. The deployed front right air bag (**Figure 8**) was 61 cm (24”) in width and 48 cm (18.9”) in height in its deflated state. The air bag was vented by two ports located at the 10 and 2 o’clock positions on the rear of the bag and was tethered by two straps in unknown locations. Vinyl striations were present on the upper aspect of air bag; however, no discernable occupant loading evidence was present.



Figure 7 - Deployed driver's air bag.



Figure 8 - Deployed front right air bag.

Event Data Recorder

The 1996 Oldsmobile Ninety-Eight was equipped with an EDR located under the front right seat. The NASS team indicated that vehicle damage prevented access to the EDR and no data was downloaded.

Occupant Demographics

Driver - 1996 Oldsmobile Ninety-Eight

Age/Sex: 80-year old/Male
 Height: 180 cm (71”)
 Weight: 79 kg (174 lbs)
 Seat Track Position: Between mid and rear-track
 Manual Restraint Use: 3-point lap and shoulder belt
 Usage Source: Vehicle inspection
 Eyewear: Eyeglasses
 Type of Medical Treatment: Transported by ambulance to local trauma center and hospitalized for 6 days.

Driver Injuries

Injury	Injury Severity	Injury Source
8 mm Cerebrum subfalcine subdural hematoma	Severe (140652.4,1)	SCI Revised - Expanding driver’s air bag.
Multiple Nose abrasions	Minor (290202.1,4)	Expanding driver’s air bag contacting eyeglasses.

Injury	Injury Severity	Injury Source
Nose contusion (bridge of nose)	Minor (290402.1,4)*	Expanding driver's air bag contacting eyeglasses.
Forehead abrasion	Minor (290202.1,7)	Expanding driver's air bag.
Chest contusion (OIS Grade I)	Minor (490402.1,1)	Shoulder restraint webbing.
Thumb contusion	Minor (790402.1,1)	Unknown source.

Source: Medical Records

**Indicates interview*

Driver Kinematics

The 80-year old male driver was seated in an upright posture and was restrained by the manual 3-point lap and shoulder restraint. At impact, the driver initiated a forward and lateral right trajectory responding to the 1 o'clock direction of force. The driver loaded the manual restraint evidenced by the stretching of the shoulder webbing, and he sustained a contusion to the right lower aspect of his chest. The driver then loaded the expanding driver's air bag resulting in soft tissue injuries to his nose and forehead. The driver was wearing eyeglasses which were compressed into his face from the air bag membrane. The compression of his eyeglasses resulted in a contusion to the bridge of his nose. The interaction with the air bag caused a rearward acceleration of the driver's head resulting in 8 mm cerebrum subfalcine subdural hematoma to the right aspect of the driver's brain. The NASS case indicated that the driver's right thumb was contused from the sun visor resulting from a fling injury following the deployment of the frontal air bag. The absence of corroborative physical evidence to the sun visor limits substantiation of this source. Emergency personnel arrived on scene and removed the driver from the vehicle due to perceived serious injuries. He was transported by ambulance to a local hospital where he was admitted for six days.

Front Right Passenger - 1996 Oldsmobile Ninety-Eight

Age/Sex: 84-year old/Female
 Height: 168 cm (66")
 Weight: 83 kg (183 lbs)
 Seat Track Position: Full-rear
 Manual Restraint Use: 3-point lap and shoulder belt
 Usage Source: Vehicle inspection
 Eyewear: Eyeglasses
 Type of Medical Treatment: Transported by ambulance to local trauma center and hospitalized for 6 days.

Front Right Passenger Injuries

Injury	Injury Severity	Injury Source
Right distal radius fracture with impaction and overriding of fracture fragments and one shaft with posterior dislocation – open/displaced/comminuted	Serious (752804.3,1)	Front right instrument panel

Injury	Injury Severity	Injury Source
Closed right distal ulna fracture	Moderate (753202.2,1)	Front right instrument panel

Source: Medical Records.

Front Right Passenger Kinematics

The 84-year old female front right passenger was seated in an upright posture and was restrained by the manual 3-point lap and shoulder restraint. At impact, she initiated a forward and lateral right trajectory responding to the 1 o'clock direction of force. She loaded her manual restraint evidenced by the stretching of the shoulder webbing. Prior to impact, the driver alerted this occupant of the crash and she braced her arms against the instrument panel in anticipation. The driver's right arm loaded the instrument panel due to her bracing resulting in fractures to her right distal radius and right distal ulna. Emergency personnel removed the front right passenger from the vehicle due to perceived serious injuries. She was transported by ambulance to a local trauma center where she was admitted for six days.

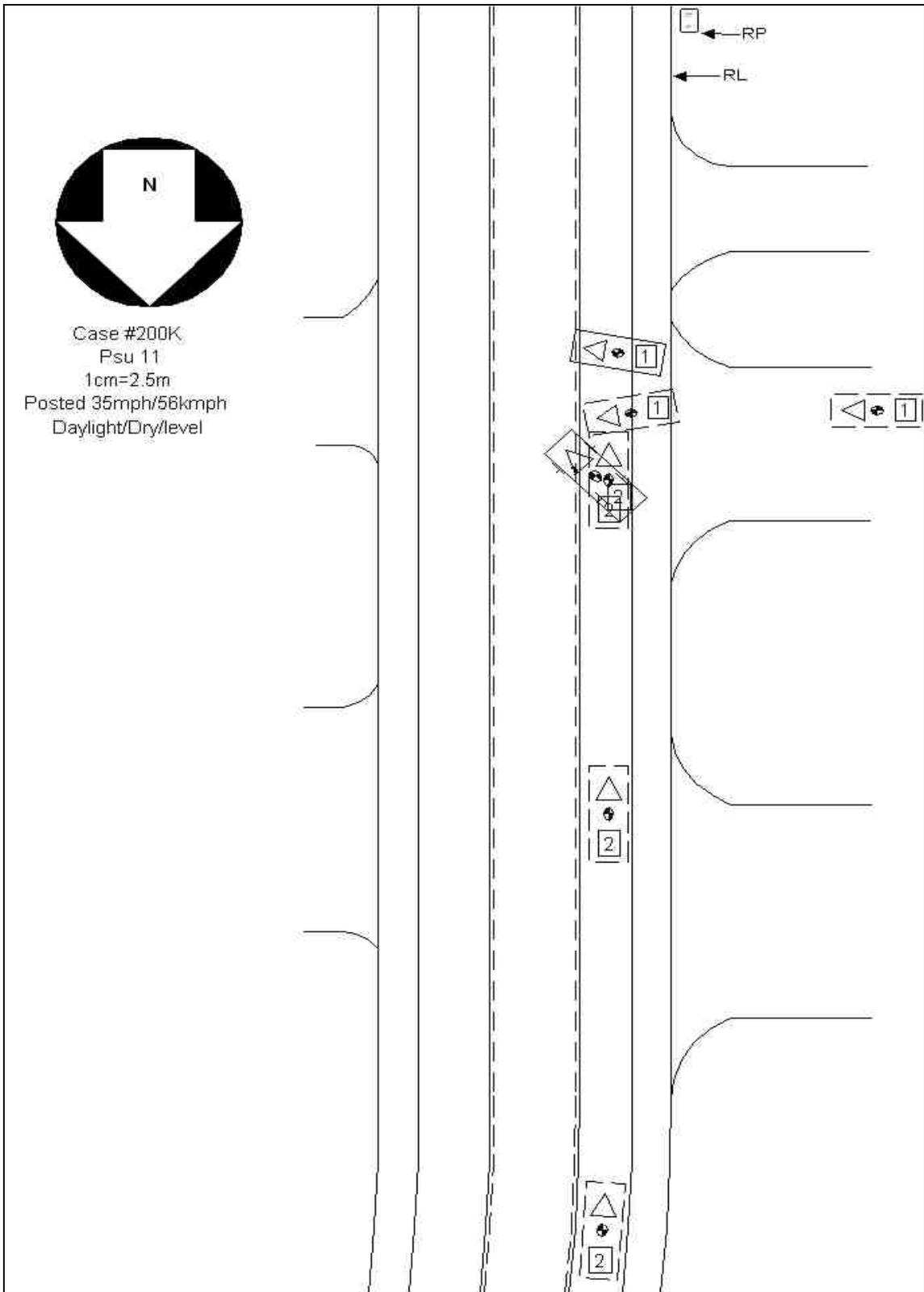


Figure 9 – NASS Scene Schematic