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ON-SITE ADULT AIR BAG-RELATED FATALITY INVESTIGATION

CASE NUMBER - IN-02-016
LOCATION - Texas
VEHICLE - 1993 FORD CROWN VICTORIA
CRASH DATE - November 2002

Submitted:
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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.

Technical Report Documentation Page

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16. <i>Abstract</i> This report covers an on-site adult air bag-related fatality investigation involving a 1993 Ford Crown Victoria LX (case vehicle) and a 1988 Oldsmobile Delta 88 (other vehicle). This crash is of special interest because the case vehicle was equipped with a driver-only air bag that did deploy and the restrained driver (82-year-old female) sustained fatal injuries, probably due to her deploying air bag. There was no other occupant in the case vehicle. The case vehicle was traveling north in the inside northbound lane of an Interstate trafficway. It was daylight, the weather was clear and there were no roadway defects. The Oldsmobile was also traveling north in the same lane, ahead of the case vehicle, and was slowing due to traffic merging to the left because the right lane was closed ahead. The case vehicle driver made no known avoidance maneuvers. Several witnesses stated that the case vehicle driver was slumped against the steering wheel and she may have passed out or fallen asleep. The front of the case vehicle impacted the back of the Oldsmobile, causing the case vehicle's driver-only air bag to deploy. The Oldsmobile's driver steered to the right, attempting to move onto the right (east) shoulder. The case vehicle veered to the right and its right front area struck the left side of the Oldsmobile in a swiping-type engagement. The Oldsmobile's driver brought her vehicle to a controlled stop on the right shoulder. The case vehicle continued its rightward-veering path of travel and drove off the roadway, across the shoulder and onto the unimproved dirt roadside. The case vehicle continued in a northeasterly direction for approximately 79 meters [260 feet], when the front of the case vehicle encountered a small tree and came to rest. The case vehicle driver sustained: a gaping laceration on her neck and face; bilateral fractured ribs; fractured sternum; bilateral lung contusions; various contusions and abrasions over her chest and face. She was declared dead at the scene. The case vehicle and the Oldsmobile were both towed, but neither due to disabling damage.					
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This on-site investigation was brought to the NHTSA's attention on November 14, 2002 when a local police officer called the Auto Safety Hotline. This crash involved a 1993 Ford Crown Victoria LX (case vehicle) and a 1988 Oldsmobile Delta 88 Royale Brougham (other vehicle). The crash occurred in November 2002 at 1:47 p.m., in Texas, and was investigated by the applicable city police department. This crash is of special interest because the case vehicle was equipped with a driver-only air bag that did deploy and the restrained driver (82-year-old female, white, non-Hispanic) sustained fatal injuries, probably due to her deploying air bag. There was no other occupant in the case vehicle. This contractor inspected the case vehicle, other vehicle and crash scene on November 18-19, 2002. This report is based on the police crash report, an interview with the Oldsmobile driver, discussions with the investigating police officer, scene and vehicle inspections, the autopsy report for the case vehicle's driver, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling north in the inside northbound lane of a two-lane roadway that was part of a divided, Interstate trafficway and apparently intended to continue straight ahead. It was daylight, the weather was clear and there were no roadway defects. The Oldsmobile was also traveling north in the same lane, ahead of the case vehicle, and was slowing due to traffic merging to the left because the right lane was closed ahead for a construction project. The case vehicle driver made no known avoidance maneuvers prior to the crash. Several witnesses stated that the case vehicle driver was slumped against the steering wheel and she may have passed out or fallen asleep. The crash sequence began in the inside northbound lane of the roadway.

The front of the case vehicle impacted the back of the Oldsmobile, causing the case vehicle's driver-only air bag to deploy. The Oldsmobile's driver steered to the right, attempting to move onto the right (east) shoulder. The case vehicle veered to the right and its right front area struck the left side of the Oldsmobile in a swiping-type engagement. The Oldsmobile's driver brought her vehicle to a controlled stop on the right shoulder. The case vehicle continued its rightward-veering path of travel and drove off the roadway, across the shoulder and onto the unimproved dirt roadside. The case vehicle continued in a northeasterly direction for approximately 79 meters [260 feet], when the front of the case vehicle encountered a small tree and came to rest.

The case vehicle was a 1993 Ford Crown Victoria LX rear wheel drive, four-door, six-passenger sedan (VIN: 2FACP74WXPX-----). The case vehicle was not equipped with anti-lock brakes. Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **12-FDLW-1 (0)** for the first impact, **12-RDES-1 (0)** for the second impact, and **12-FCEN-1 (0)** for the third impact. The WinSMASH reconstruction program, damage algorithm based on the measured crush profile for both vehicles, was used on the case vehicle's highest severity (first) impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 16 km.p.h. [9.9 m.p.h.], -16 km.p.h. [-9.9 m.p.h.], and 0 km.p.h. [0 m.p.h.]. No reconstruction program was used on the second and third events because the second was a swiping-type impact and the third involved a small tree that yielded. The crash severity for the case vehicle was low (14-23 km.p.h. [9-14 m.p.h.]). The case vehicle was towed, but not due to disabling damage.

The case vehicle's initial contact with Oldsmobile involved the left three-quarters of the front bumper. Maximum crush was measured as 3 centimeters [1.2 inches] at C1. The wheelbase on the case vehicle's left side was shortened 2 centimeters [0.8 inches] while the right side wheelbase was unchanged. The case vehicle's bumper was directly damaged, but the amount of crush was slight. There was also direct contact along most of the right side of the case vehicle, with only surface scratches and very minor or no crush damage. The front right turn signal lens was broken. There was some light remote damage to the hood such that it could not be closed properly.

The case vehicle's driver air bag was located in the steering wheel hub. Inspection of the air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points, with no evidence of damage to the air bag or the cover flap. The deployed driver's air bag was round with a diameter of 68 centimeters [26.8 inches] There was a substantial amount of blood on the front of the driver's air bag. There was no front right passenger air bag, and no other automatic restraint system, in this 1993 vehicle.

Inspection of the case vehicle's interior revealed heavy blood stains on the front of the driver's air bag, with no blood or other evidence of contact on the back of the air bag. The top half of the steering wheel rim was bent forward 5 centimeters [2.0 inches]. The safety belt webbing was cut, presumably to enable extrication. There was blood and mucus splattered on the windshield, the driver's door window glazing and the driver's sun visor. There was what appeared to be a small piece of flesh on the head liner fabric, near the front header.

Immediately prior to the crash the case vehicle driver (82-year-old female, white, non-Hispanic, 155 centimeters and 67 kilograms [61 inches, 148 pounds]) was sitting on a large cushion/pillow, apparently in an effort to raise her seated height. Her posture is otherwise not known, but witnesses reported seeing her slumped forward and she may have passed out or fallen asleep. She was probably leaning forward against the steering wheel rim with her left foot on the floor and right foot stuck on the accelerator. Her hand/arm positions are unknown. Her seat track was located between its middle and forward-most positions. At time of inspection, the seat back was fully reclined, probably due to rescue efforts.

The case vehicle's driver was restrained by her available, active, three-point, lap-and-shoulder, safety belt system. There were no overt signs of loading but the belt webbing was cut by rescue personnel to extricate the driver.

The case vehicle's driver made no known pre-crash avoidance maneuvers. It is highly likely that the driver was slumped forward toward the steering wheel just prior to impact. The case vehicle's initial impact with the Oldsmobile caused the driver to move forward and upward, toward the 12:00 o'clock direction of force as the air bag deployed. The air bag probably contacted her face, neck and chest. She probably moved forward again in response to the slight deceleration from second impact with the Oldsmobile. As the case vehicle veered off the roadway, the driver was likely up against the steering wheel, where she bled significantly. She was jostled as her car traveled across the unimproved desert landscape on the roadside. The final (third) impact caused the case vehicle driver to move forward slightly, against the now-deflated air bag and the steering wheel. The driver was pronounced dead at the scene.

The other vehicle was 1988 Oldsmobile Delta 88 Royale Brougham front wheel drive, four-door, six-passenger sedan (VIN: 1G3HY54C1JW-----). Based on the vehicle inspection, the CDC for the Oldsmobile's most severe (first) impact was determined to be: **06-BDLW-2 (180)** (maximum crush was 23 centimeters [9.1 inches]). The second impact CDC was: **06-LBES-1 (180)**. This second impact involved surface scratches only, with no crush damage, and no measurements were taken. The WinSMASH reconstruction program, damage algorithm based on the measured crush profile for both vehicles, was used on the Oldsmobile's highest severity (first) impact. The Total, Longitudinal and Lateral DeltaVs are, respectively: 19.0 km.p.h. [11.8 m.p.h.], +19 km.p.h. [+11.8 m.p.h.] and 0 km.p.h. [0 m.p.h.]. The Oldsmobile was towed, but not due to damage.

CRASH CIRCUMSTANCES

The case vehicle was traveling north in the inside northbound lane of a two-lane roadway that was part of a divided, Interstate trafficway and apparently intended to continue straight ahead (**Figure 1**). It was daylight, the weather was clear and the asphalt road surface was free of defects. The speed limit was 97 km.p.h. [60 m.p.h.], but there was a construction zone ahead. The Oldsmobile was also traveling north in the same lane, ahead of the case vehicle, and was slowing due to traffic merging to the left because the right lane was closed ahead for a construction project. The case vehicle's driver made no known avoidance maneuvers prior to the crash. Several witnesses stated that the case vehicle driver was slumped against the steering wheel and she may have passed out or fallen asleep. The crash sequence began in the inside northbound lane of the roadway.



Figure 1: Case vehicle's pre-crash northbound path of travel; the right lane was closed ahead with traffic slowing and merging left (case photo #01a)

The front of the case vehicle impacted the back of the Oldsmobile, causing the case vehicle's driver air bag to deploy. The Oldsmobile's driver and several witnesses indicated that the case vehicle bumped the back of the Oldsmobile several times. The Oldsmobile's driver steered to the right, attempting to move onto the right (east) shoulder. The case vehicle veered to the right and its right front area struck the left side of the Oldsmobile in a swiping-type engagement. The Oldsmobile's driver brought her vehicle to a controlled stop on the right shoulder. The case vehicle continued its rightward-veering path of travel and drove off the roadway, across the



Figure 2: Case vehicle's northeastward path to final rest against a tree (arrow) (case photo #02)

shoulder and onto the unimproved dirt roadside (Figure 2). The case vehicle continued in a northeasterly direction for approximately 79 meters [260 feet], when the front of the case vehicle encountered a small tree and came to rest (Figure 3).

CASE VEHICLE

The case vehicle was a 1993 Ford Crown Victoria rear wheel drive, four-door, six-passenger sedan (VIN: 2FACP74WXPX-----), equipped with a 4.6 liter V8 gasoline engine and an automatic transmission with a column mounted selector lever. The case vehicle was not equipped with anti-lock brakes. The odometer reading is not known due to the non-functional electronic instruments. The case vehicle's wheelbase was 291 centimeters [114.4 inches].

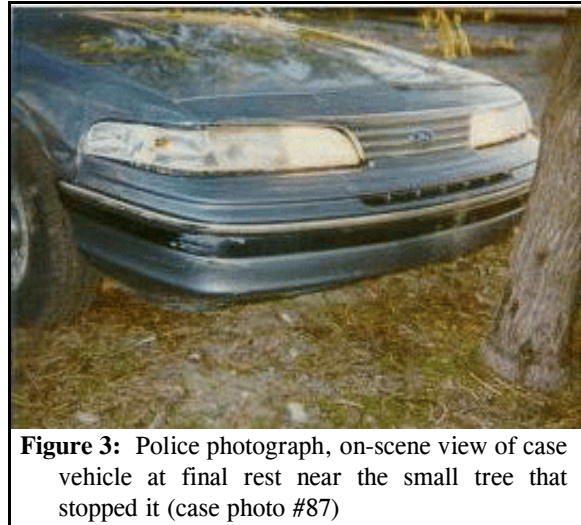


Figure 3: Police photograph, on-scene view of case vehicle at final rest near the small tree that stopped it (case photo #87)

CASE VEHICLE DAMAGE

The case vehicle's initial contact with Oldsmobile involved the left three-quarters of the front bumper. Direct damage began at the front left bumper corner and extended 126 centimeters [49.6 inches] inward along the front bumper. Maximum crush was measured as 3 centimeters [1.2 inches] at C1. The wheelbase on the case vehicle's left side was shortened 2 centimeters [0.8 inches] while the right side wheelbase was unchanged. The case vehicle's bumper was directly damaged, but the amount of crush was slight. There was also direct contact along most of the right side of the case vehicle, with only surface scratches and very minor or no crush damage. The front right turn signal lens was broken. There was some light remote damage to the hood such that it could not be closed properly (Figure 4).

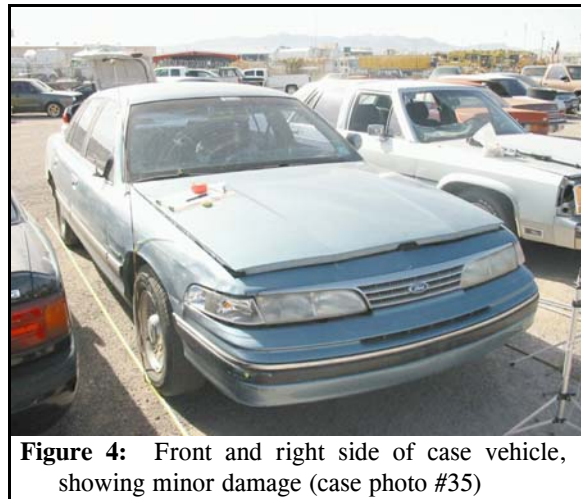


Figure 4: Front and right side of case vehicle, showing minor damage (case photo #35)

Based on the vehicle inspection, the CDCs for the case vehicle were determined to be: **12-FDLW-1 (0)** for the first impact, **12-RDES-1 (0)** for the second impact, and **12-FCEN-1 (0)** for the third impact. The WinSMASH reconstruction program, damage algorithm based on the measured crush profile for both vehicles, was used on the case vehicle's highest severity (first) impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 16 km.p.h. [9.9 m.p.h.], -16 km.p.h. [-9.9 m.p.h.], and 0 km.p.h. [0 m.p.h.]. No reconstruction program was used on the second and third events because the second was a swiping-type impact and the third involved a small tree that yielded. The crash severity for the case vehicle was low (14-23 km.p.h.

[9-14 m.p.h.]). The case vehicle was towed, but not due to damage.

Inspection of the case vehicle's interior revealed heavy blood stains on the front of the driver's air bag (**Figure 5**), with no blood or other evidence of contact on the back of the air bag. The top half of the steering wheel rim was bent forward 5 centimeters [2.0 inches]. The safety belt webbing was cut, presumably to enable extrication. There was blood and mucus splattered on the windshield, the driver's door window glazing and the driver's sun visor (**Figure 8**). There was what appeared to be a small piece of flesh on the head liner fabric, near the front header.



Figure 5: Front of driver's air bag (case photo #65)

AUTOMATIC RESTRAINT SYSTEM

The case vehicle driver air bag was located in the steering wheel hub. Inspection of the air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points, with no evidence of damage to the air bag or the cover flap (**Figure 6**). The deployed driver's air bag was round with a diameter of 68 centimeters [26.8 inches]. The air bag was designed with four tethers, each 6 centimeters [2.6 inches] wide, and two vent ports, each approximately 3.5 centimeters [1.4 inches] in diameter, located at the 11 and 1 o'clock positions. There was a substantial amount of blood on the front of the driver's air bag. There was no front right passenger air bag, and no other automatic restraint system, in this 1993 vehicle.



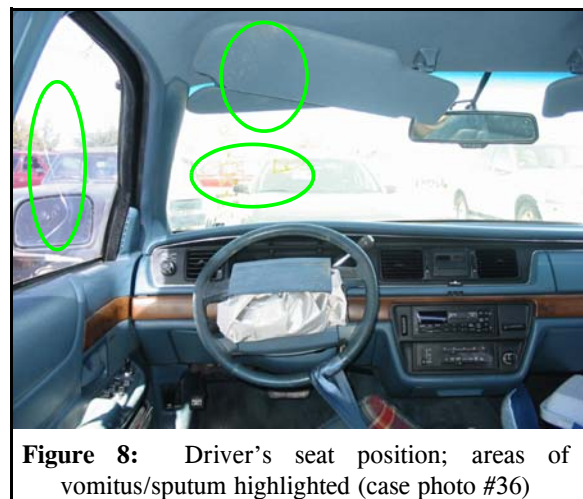
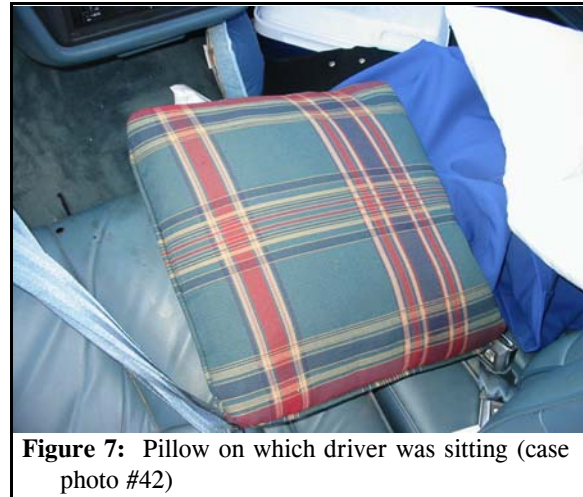
Figure 6: Case vehicle driver air bag cover flap (case photo #63)

CASE VEHICLE DRIVER KINEMATICS

The case vehicle driver (82-year-old female, white, non-Hispanic, 155 centimeters and 67 kilograms [61 inches, 148 pounds]) was sitting on a large cushion/pillow, apparently in an effort to raise her seated height (**Figure 7**). Her pre-crash posture is otherwise not known, but several witnesses stated that the case vehicle driver was slumped against the steering wheel and she may have passed out or fallen asleep. She was probably leaning forward against the steering wheel rim with her left foot on the floor and right foot stuck on the accelerator. Her hand/arm positions are unknown. Her seat track was located between its middle and forward-most positions. At the time of inspection, the seat back was fully reclined, probably due to rescue efforts.

The case vehicle's driver was restrained by her available, active, three-point, lap-and-shoulder, safety belt system. There were no overt signs of loading but the belt webbing had been cut by rescue personnel to extricate the driver.

The case vehicle's driver made no known pre-crash avoidance maneuvers, and it is highly likely that the driver was slumped forward against the steering wheel just prior to the first impact. The case vehicle's initial impact with the Oldsmobile caused the driver to move forward and slightly upward, toward the 12:00 o'clock direction of force as the air bag deployed. The safety belt system's emergency locking retractor (ELR) locked in response to the deceleration, but because she was slumped forward there was substantial slack in the belt when the retractor locked. The deploying module cover flap probably struck her neck and face. She sustained: a gaping laceration along the left side of her neck and onto her left cheek; fracture of a cervical vertebra; lacerations inside her mouth from the forced closing of her lower jaw. The cover flap probably lifted her slightly as she pitched forward. The air bag followed immediately, contacting her chest. She sustained: multiple anterior bilateral fractured ribs; fracture of the sternum; multiple bilateral contusions of the lungs; abrasions on her upper-central chest; contusions on both breasts. The force of the air bag probably propelled her upward such that her head impacted the roof, causing a subgaleal hemorrhage at the vertex of her skull. Her hands flailed, contacting the instrument panel and causing multiple contusions on the dorsum of both hands. She vomited and/or expelled sputum, which was found splattered around the driver's seat area (**Figure 8**). She fell back into the seat, but she probably moved forward again in response to the slight deceleration from the second impact with the Oldsmobile. As the case vehicle veered off the roadway, the driver was likely up against the steering wheel, where she bled significantly (**Figure 5**). She was jostled as her car traveled across the unimproved desert landscape on the roadside. The final (third) impact caused the case vehicle driver to move forward slightly, against the now-deflated air bag and the steering wheel. The driver was pronounced dead at the scene approximately one-half hour after the crash events. Her body was transported directly to the morgue.



DRIVER'S INJURIES

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Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusions, multiple, right and left lungs, not further specified, with bilateral hemothoraces: 500 ml left, 400 ml right	441410.4 severe	Air bag, driver's	Probable	Autopsy
2	Laceration {tear} mediastinum, not further specified	441800.2 moderate	Air bag, driver's	Probable	Autopsy
3	Fracture ribs bilaterally: left 2 nd to 6 th ribs anteriorly and right 2 nd to 6 th ribs anteriorly with bilateral hemothoraces	450242.5 critical	Air bag, driver's	Possible	Autopsy
4	Fracture sternum, not further specified	450804.2 moderate	Air bag, driver's	Possible	Autopsy
5	Fracture C ₃ , not further specified	650216.2 moderate	Driver module's cover flap	Probable	Autopsy
6	Contusion {subgaleal hemorrhage} underlying scalp at vertex	190402.1 minor	Roof	Possible	Autopsy
7	Abrasion, 7.0 x 5.7 cm (2.75 x 2.25 in), right cheek	290202.1 minor	Air bag, driver's	Certain	Autopsy
8	Abrasion underneath tongue	243099.1 minor	Driver module's cover flap	Possible	Autopsy
9	Laceration, 5.1 cm (2 in), gaping, underneath tongue	243204.1 minor	Driver module's cover flap	Probable	Autopsy
10	Laceration, 7.6 cm (3 in), gaping, left neck extending onto left cheek	390602.1 minor	Driver module's cover flap	Probable	Autopsy
11	Abrasion surround laceration cited above	390202.1 minor	Driver module's cover flap	Probable	Autopsy
12	Abrasion, 20.3 x 19.7 cm (8 x 7.75 in), mid-upper anterior chest wall	490202.1 minor	Air bag, driver's	Certain	Autopsy
13	Contusions both breasts, not further specified	490402.1 minor	Air bag, driver's	Certain	Autopsy
14	Contusions, multiple, dorsum of both hands	790402.1 minor	Left instrument panel and below	Probable	Autopsy
15	Abrasion, stretch-type, 5.7 x 0.6 cm (2.25 x 0.25 in) right groin	890202.1 minor	Unknown contact mechanism	Unknown	Autopsy

OTHER VEHICLE

IN-02-016

The other vehicle was 1988 Oldsmobile Delta 88 Royale Brougham front wheel drive, four-door, six-passenger sedan (VIN: 1G3HY54C1JW-----). Based on the vehicle inspection, the CDC for the Oldsmobile's most severe (first) impact was determined to be: **06-BDLW-2 (180)** (maximum crush was 23 centimeters [9.1 inches]). The second impact CDC was: **06-LBES-1 (180)**. This second impact involved surface scratches only, with no crush damage, and no measurements were taken. The WinSMASH reconstruction program, damage algorithm based on the measured crush profile for both vehicles, was used on the Oldsmobile's highest severity(first) impact. The Total, Longitudinal and Lateral DeltaVs are, respectively: 19.0 km.p.h. [11.8 m.p.h.], +19 km.p.h. [+11.8 m.p.h.] and 0 km.p.h. [0 m.p.h.]. The Oldsmobile was towed, but not due to damage (**Figure 9**).

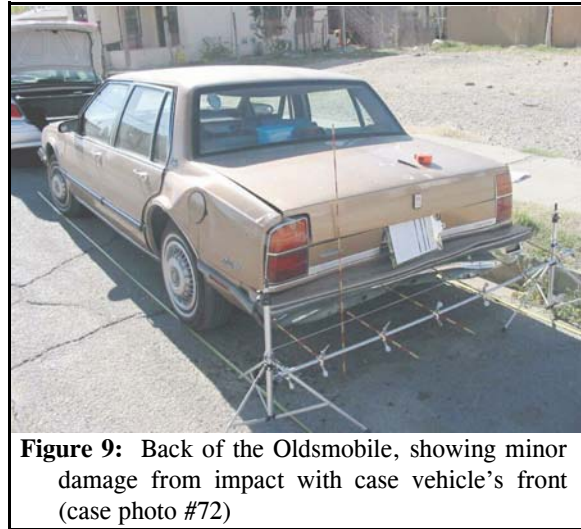


Figure 9: Back of the Oldsmobile, showing minor damage from impact with case vehicle's front (case photo #72)

The Oldsmobile's driver (36-year-old female) and front right passenger (56-year-old female) sustained police-reported "C" (possible) injuries, and the back left passenger (2-year-old male) was reported as not injured. There were no other occupants in the Oldsmobile. Their treatment status and specific injuries, if any, are not known.

