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Veridian Engineering
Buffalo, NY 14225

REMOTE REDESIGNED AIR BAG NON-DEPLOYMENT ADULT PASSENGER FATALITY INVESTIGATION
SCI TECHNICAL SUMMARY REPORT

VERIDIAN CASE NO. CA99-052

RABSS VEHICLE -1998 BUICK LESABRE

LOCATION - STATE OF TENNESSEE

CRASH DATE - NOVEMBER 1998

Contract No. DTNH22-94-D-07058

Prepared for:

U.S. Department of Transportation
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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.

TECHNICAL REPORT STANDARD TITLE PAGE

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16. *Abstract* This remote investigation focused on a single vehicle crash that involved a 1998 Buick LeSabre that was equipped with redesigned frontal air bags. A split-deployment occurred as a result of a frontal collision with a wooden light support pole. The redesigned driver's side air bag deployed while the front right passenger air bag did not. The driver of the LeSabre was operating the vehicle southbound on a two-lane residential street, when the driver momentarily lost consciousness, which caused him to lose control of the vehicle. The vehicle veered to the right onto the sidewalk, and struck the wooden light support pole with the front center area. Impact with the utility pole resulted in moderate damage to the LeSabre. The 80-year-old male driver was probably restrained by the available 3-point lap and shoulder belt system, however seat belt usage could not be supported by this remote investigative effort. At impact with the pole, he initiated a forward trajectory and loaded the manual restraint and deployed redesigned driver's air bag. He sustained non-incapacitating injuries and was transported by ambulance to a local hospital. His admission status was not reported. The front right passenger was not restrained by the available 3-point lap and shoulder belt system. At impact with the pole, the redesigned front right passenger air bag failed to deploy. She initiated a forward trajectory and struck the instrument panel and windshield. She sustained a contusion and a laceration to the forehead, a laceration on the lower lip and chin, multiple contusions and lacerations on upper and lower extremities, ecchymosis around both knees, a 4 cm tear in the aorta, a fracture of T-6 vertebra, and acute hemorrhage in both lungs. She was transported by ambulance to a local hospital and expired less than one hour after the crash.			
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BACKGROUND

This remote investigation focused on a single vehicle crash that involved a 1998 Buick LeSabre that was equipped with redesigned frontal air bags. A split-deployment occurred as a result of a frontal collision with a wooden light support pole. The redesigned driver's side air bag deployed while the front right passenger air bag did not. The driver of the LeSabre was operating the vehicle southbound on a two-lane residential street, when the driver momentarily lost consciousness, which caused him to lose control of the vehicle. The vehicle veered to the right onto the sidewalk, and struck a wooden light support pole with the front center area. Impact with the utility pole resulted in moderate damage to the LeSabre. The 80-year-old male driver was probably restrained by the available 3-point lap and shoulder belt system, however seat belt usage could not be supported by this remote investigative effort. At impact with the pole, he initiated a forward trajectory and loaded the manual restraint and deployed redesigned driver's air bag. He sustained non-incapacitating injuries and was transported by ambulance to a local hospital. His admission status was not reported. The front right passenger was not restrained by the available 3-point lap and shoulder belt system. At impact with the pole, the redesigned front right passenger air bag failed to deploy. She initiated a forward trajectory and struck the instrument panel and windshield. She sustained a contusion and a laceration to the forehead, a laceration on the lower lip and chin, multiple contusions and lacerations on upper and lower extremities, ecchymosis around both knees, a 4 cm tear in the aorta, a fracture of T-6 vertebra, and acute hemorrhage in both lungs. She was transported by ambulance to a local hospital and expired less than one hour after the crash.

This crash was identified through a search of the Fatality Analysis Reporting System (FARS) for fatalities that occurred in vehicles equipped with redesigned air bags. The crash occurred in November 1998 and was assigned to the Veridian Special Crash Investigation Team on September 2, 1999 as a remote investigation effort. Police photographs and the autopsy report were reviewed which provided the basis for this narrative report.

SUMMARY

Crash Site

This single vehicle crash occurred during the daylight hours of November 1998. At the time of the crash, there were no adverse weather conditions as the asphalt roadway surface was dry. The crash occurred on a north/south residential roadway that consisted of two travel lanes that were straight with a negative grade to the south. The roadside environment consisted of concrete curbs adjacent to concrete sidewalks on both sides of the roadway. The sidewalks measured approximately 1 m (3') in width. Utility poles 30 cm (12") in diameter were positioned in the center of the sidewalk and located approximately 44 m (144')

apart. Adjacent to each sidewalk was a concrete retaining wall approximately 91 cm (36") high and approximately 15 cm (6") wide which separated the sidewalk from the raised front lawn area of the residential properties. The police report listed the posted speed limit as 48 km/h (30 mph).

Pre-Crash

The 80-year-old male driver of the 1998 Buick LeSabre was operating the vehicle southbound on the residential roadway when he momentarily lost consciousness. During the episode, he relinquished control of the vehicle which caused it to veer to the right side of the roadway **(Figure 1)**. The right front tire over rode the right curb edge and the vehicle rode up onto the sidewalk. The vehicle traveled south straddling the curb for approximately 23 m (75') prior to impact with the utility pole. There was no evidence within the vehicle's trajectory indicative of attempted driver avoidance maneuvers.

Figure 1. Southbound path of travel for the Buick LeSabre

Crash

The front center area of the LeSabre impacted the utility pole. Impact resulted in moderate damage to the vehicle. The principal direction of force was within the 12 o'clock sector. The damage algorithm of the WinSMASH program computed a total velocity change of 34 km/h (21 mph) for the LeSabre based on the estimated crush profile. The impact induced deceleration was sufficient to deploy the redesigned frontal air bag system. The driver's air bag deployed, but the front right passenger air bag did not. The vehicle came to rest against the utility pole primarily on the west sidewalk with the left front and left rear wheels still on the roadway surface adjacent to the west curb **(Figure 2)**.

Figure 2. Point of impact and final rest position against the utility pole

Post-Crash

It is unknown how the occupants exited the vehicle. According to police reports, the driver sustained non-incapacitating injuries and was transported by ambulance to a local hospital. His admission status was not reported. CPR and additional medical treatment were administered to the front right passenger by rescue personnel at the scene. She was transported by ambulance to a local hospital where she expired within one hour of the crash. The vehicle was towed from the scene.

***RABSS VEHICLE* - 1998 Buick LeSabre**

The 1998 Buick LeSabre was identified by the Vehicle Identification Number (VIN): 1G4HR52K5WH (production sequence omitted). The vehicle was a 4-door sedan equipped with front wheel drive, 4-wheel disc brakes with anti-lock, and a 3.8 liter, 6 cylinder engine. The police report listed the driver as the owner of the vehicle. The seating was configured with a 55/45 split bench front seat with tilt adjustable head restraints and fixed rear bench seat. The 3-point lap and shoulder belt systems for the front left and front right occupants were equipped with adjustable height D-ring anchors.

***VEHICLE DAMAGE* - 1998 Buick LeSabre**

Exterior Damage

The 1998 Buick LeSabre sustained moderate frontal damage as a result of the impact with the utility pole **(Figure 3)**. The Collision Deformation Classification (CDC) for this impact was 12-FCEN-2. The direct contact damage was estimated to begin approximately 15 cm (6") to the right of the center of the frontal plane and extended approximately 30 cm (12") left across the frontal plane **(Figure 4)**. The combined direct and induced damage involved the full frontal width of the vehicle. Six crush measurements were estimated at the level of the bumper: C1 = 0 cm, C2 = 15 cm (6"), C3 = 50 cm (20"), C4 = 60 cm (24"), C5 = 20 cm (8"), C6 = 0 cm. The impact displaced the hood upward and rearward in addition to buckling at the designated fold points **(Figure 5)**.

Figure 3. Frontal damage to the Buick LeSabre

Figure 4. Close up of the frontal damage

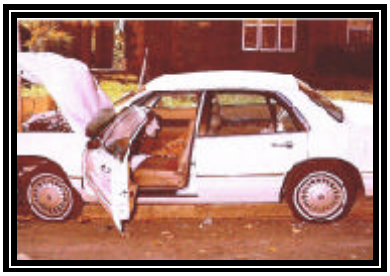

Figure 5. Left side view showing hood damage

Interior Damage

Interior damage to the Buick LeSabre was minor, and was attributed to occupant contact and passenger compartment intrusion. The knee bolster was displaced and the steering column appeared to have been compressed slightly **(Figure 6)**. There was minor deformation to the driver's side rigid plastic knee bolster as evidenced by two depressions on either side of the steering column. A scuff mark was present on the mid instrument panel above the right corner of the glove compartment door estimated to be approximately 7 cm (3") in width and 4 cm (2") in height. The glove box door was open. The trim on the top of the right instrument panel was displaced upward approximately 3 cm (1") at the corner where it met the right door trim from occupant contact **(Figure 7)**. The windshield on the right side was cracked in a spider web fashion from occupant contact. Intrusions included the left, center, and right toe pan areas, the center being the most intruded component **(Figure 8)**.

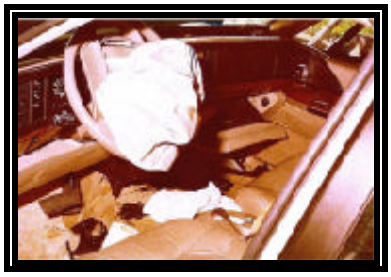

Figure 6. Interior view showing damage to the knee bolster and steering column

Figure 7. Interior view of the right instrument panel

Figure 8. Interior view of the intruded toe pan and damaged knee bolster

REDESIGNED AIR BAG SYSTEM

The 1998 Buick LeSabre was equipped with redesigned frontal air bags for the driver and front right passenger positions. The redesigned driver's air bag deployed as a result of the impact with the utility pole, but the redesigned front right passenger air bag did not deploy. The driver's air bag was housed in the center of the steering wheel with a vertically oriented flap tear seam (I-configuration). No contact evidence was identified on the air bag or exterior surface of the module cover flaps.

The redesigned front right passenger air bag did not deploy as a result of the crash. The air bag was located in the mid instrument panel and the cover flap was rectangular in shape. There was no identifiable cutoff switch noted in the vehicle.

OCCUPANT DEMOGRAPHICS

Driver

Age/Sex:	80-year-old male
Height:	Not reported
Weight:	Not reported
Seat Track Position:	Mid-to-full forward (on-scene police photographs)
Manual Restraint Use:	Probably restrained by manual 3-point lap and shoulder belt
Usage Source:	Police report, occupant trajectory, and lack of serious injury
Eyewear:	Prescription eyeglasses
Type of Medical Treatment:	Transported by ambulance to a local hospital, admission status was not reported

Driver Kinematics

The 80-year-old male driver of the Buick LeSabre was presumed to be seated in an upright posture with the seat track adjusted to the mid-to-full forward positions prior to the loss of consciousness. It is unknown how long he had lost consciousness or when he regained consciousness. He was probably restrained by the available 3-point lap and shoulder belt system, however, seat belt usage could not be confirmed due to the remote nature of this case. Given the severity of the crash, the lack of contact evidence on the air bag surface and the lack of serious injuries suggest that the driver was probably restrained. At impact, he

initiated a forward trajectory in response to the frontal impact force. He loaded the manual restraint, with the driver's side air bag providing additional restraint against further contact with the steering wheel hub/rim. He also loaded the knee bolster as evidenced by the displacement and two depressions on either side of the steering column. The steering column appeared to be compressed, possibly due to his proximity to the steering wheel, given the mid-to-full forward seat track position. The police accident report check box indicated that the driver sustained non-incapacitating injuries. He was transported by ambulance to a local hospital however, his admission status was not reported.

Front Right Passenger

Age/Sex:	78-year-old female
Height:	160 cm (63")
Weight:	52 kg (115 lb)
Seat Track Position:	Mid-track (on-scene police photographs)
Manual Restraint Use:	Unrestrained
Usage Source:	Police report, injury data/contact evidence
Eyewear:	Not reported
Type of Medical Treatment:	Transported by ambulance to a local hospital where she expired within one hour of the crash

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanisms
4 cm (2") anterior laceration of the aorta	Severe (420208.4,4)	Right instrument panel in association with T-6 vertebrae fracture
Fracture of T-6 vertebra with complete transection of the vertebral body	Moderate (650430.2,7)	Indirect - right instrument panel
6.4 x 7.6 cm (2.5 x 3.0") contusion above the eyebrows on the midline	Minor (190402.1,5)	Windshield glazing
1.0 x 5.8 cm (0.5 x 2.3") laceration of the chin on the right side and a laceration of the lower lip (NFS)	Minor (290600.1,8)	Windshield glazing
Contusion of the dorsal aspect of the left hand and left forearm	Minor (790402.1,2)	Right instrument panel

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanisms
3.8 cm (1.5") laceration of the dorsal aspect of the right hand	Minor (790602.1,1)	Right instrument panel
2.5 x 0.8 cm (1.0 x 0.3") abrasion of the medial aspect of the right knee	Minor (890202.1,1)	Glove box door
Bilateral knee contusions	Minor (890402.1,3)	Glove compartment door
Bilateral acute hemorrhage in the lungs	N/A (not coded under AIS 90/Update 98)	Result of internal chest injuries

Injury source: Autopsy report

Front Right Passenger Kinematics

The 78-year-old female passenger was presumed to be seated in an upright posture with the seat track adjusted close to the mid-track position. The police report stated that she was unrestrained. This was confirmed by her trajectory and the location and nature of her injuries. She initiated a forward trajectory in response to the 12 o'clock impact force. The redesigned front right passenger air bag did not deploy. She loaded the windshield, evidenced by fractured laminate in a spider-web fashion. The windshield contact resulted in a contusion on the forehead with a small laceration, lower lip laceration, and chin laceration. She loaded the upper instrument panel with her torso, evidenced by a scuff mark above the glove compartment door and displacement of the right instrument panel trim piece. She sustained a 4 cm (2") laceration of the aorta and an anterior fracture of the T-6 vertebra through the vertebral body as a result of loading the instrument panel. She also loaded the lower instrument panel and glove compartment door which resulted in bilateral knee contusions, a right knee abrasion, and contusions on the dorsal aspect of the left hand and left forearm. The autopsy report stated that she sustained bilateral acute hemorrhage in the lungs as a result of the internal chest injuries. She was transported by ambulance to a local hospital where she expired within one hour of the crash.