TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION

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REDESIGNED AIR BAG SPECIAL STUDY (RABSS)
SCI TECHNICAL SUMMARY REPORT

NASS CDS CASE NO. 1998-12-150E

RABSS VEHICLE - 1998 BUICK LESABRE LIMITED

LOCATION - STATE OF MICHIGAN

CRASH DATE - AUGUST, 1998

Contract No. DTNH22-94-D-07058

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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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16. *Abstract* This investigation focused on a two vehicle crash involving a 1998 Buick LeSabre Limited 4-door sedan (subject vehicle) and a 1997 Dodge B250 van. The Buick LeSabre was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a right angle collision with the Dodge van. The driver of the Buick was operating the vehicle eastbound when she failed to observe the yield sign or southbound Dodge as she proceeded straight through a 4-leg intersection. As the Buick entered the intersection, the front left area impacted the right front side surface of the Dodge resulting in moderate damage to both vehicles. The restrained 74 year old female driver of the Buick LeSabre initiated a forward trajectory in response to the 11 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. She was uninjured in the collision.			
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BACKGROUND

This investigation focused on a two vehicle crash involving a 1998 Buick LeSabre Limited 4-door sedan (subject vehicle) and a 1997 Dodge B250 van. The Buick LeSabre was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a right angle collision with the Dodge van. The driver of the Buick was operating the vehicle eastbound when she failed to observe the yield sign or southbound Dodge as she proceeded straight through a 4-leg intersection. As the Buick entered the intersection, the front left area impacted the right front side surface of the Dodge resulting in moderate damage to both vehicles. The restrained 74 year old female driver of the Buick LeSabre initiated a forward trajectory in response to the 11 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. She was uninjured in the collision.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as CDS case number 98-12-150E and also included in the Redesigned Air Bag Special Study. The Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) assigned the Special Crash Investigation (SCI) team at Veridian the task of case review and final report preparation.

SUMMARY

Crash Site

This two vehicle crash occurred during the afternoon hours of August, 1998. At the time of the crash, it was daylight with no adverse conditions as the roads were dry. The crash occurred in a straight and level 4-leg asphalt intersection **(see Figure 7 - page 4)**. Traffic flow through the intersection was controlled by yield signs for east/westbound traffic. The posted speed limit at the crash site was 64 km/h (40 mph).

Pre-Crash

The 74 year old female driver of the 1998 Buick LeSabre was operating the vehicle eastbound **(Figure 1)** when she failed to observe the yield sign or southbound Dodge as she proceeded straight through the 4-leg intersection. She reported to police that she thought she had the right-of-way and didn't notice the stop sign. The Buick driver reported no avoidance maneuvers in anticipation of the impending crash. The 30 year old female driver of the 1997 Dodge van was operating the vehicle southbound **(Figure 2)** on approach to the 4-leg intersection at a (driver reported) speed of 40 km/h (25 mph) when she observed the Buick cross her path of travel. The Dodge driver also reported no avoidance maneuvers in anticipation of the impending crash. The front right seating position of the Dodge was occupied by a 5 year old female.

Figure 1. Eastbound approach for the 1998 Buick LeSabre.

Figure 2. Southbound approach for the 1997 Dodge B250 van.

Crash

As the Buick entered the 4-leg intersection, the front left area impacted the right front side surface of the Dodge resulting in moderate damage to both vehicles. The *(SCI revised)* damage algorithm of the WinSMASH program computed velocity changes of 18.8 km/h (11.7 mph) for the subject vehicle and 16.2 km/h (10.1 mph) for the struck Dodge. Respective longitudinal components were -14.4 km/h (-8.9 mph) and -10.4 km/h (-6.5 mph). The impact induced deceleration was sufficient to deploy the Buick's redesigned frontal air bag system. Both vehicles came to rest in the southeast sector of the intersection facing southeast.

Post-Crash

All occupants exited their respective vehicles under their own power. Treatment was rendered at the scene by fire department personnel and emergency medical technicians (EMTs). The Buick driver was reported by police as uninjured as the Dodge occupants were transported by ambulance to a local hospital for treatment and released. Both vehicles were towed from the scene due to disabling damage.

RABSS VEHICLE

The 1998 Buick LeSabre was identified by the Vehicle Identification Number (VIN): 1G4HR52K2WH (production sequence deleted). The vehicle was a 4-door sedan equipped with front wheel drive and a 3.8 liter, V-6 engine. The vehicle's odometer reading was 28,899 km (17,957 miles) at the time of the crash. The police report did not specify the owner of the vehicle. The seating was configured with front split and rear bench seats. The driver reported no previous crashes or maintenance on the air bag system (original equipment). No cell phone was present or in-use at the time of the collision.

VEHICLE DAMAGE

Exterior Damage

The 1998 Buick LeSabre sustained moderate frontal damage as a result of the impact with the Dodge van **(Figure 3)**. The direct contact damage began at the front left bumper corner and extended 98.0 cm (38.6 in) inboard. The impact deformed the full frontal width resulting in a combined direct and induced damage length (Field L) of 130.0 cm (51.2 in). Six crush measurements were documented at the level of the reinforcement bar *(partial bumper fascia separation)*: C1= 21.0 cm (8.3 in), C2= 27.0 cm

Figure 3. Frontal damage to the 1998 Buick LeSabre Limited.

(10.6 in), C3= 37.0 cm (14.6 in), C4= 31.0 cm (12.2 in), C5= 24.0 cm (9.4 in), C6= 16.0 cm (6.3 in). The *(SCI revised)* Collision Deformation Classification (CDC) for this impact to the Buick was 71-FDEW-2 with a principal direction of force of (-)40 degrees (principal direction of force incremented to reflect end shifting to the right). The end structure shifted approximately 14.0 cm (5.5 in) to the right. The grille assembly fractured and separated from the vehicle during the collision sequence. The fenders were displaced rearward which restricted the right front wheel/tire (not deflated). The hood was deformed up and rearward from engagement against the side surface of the Dodge. Reduction in the right side wheelbase measured 7.0 cm (2.8 in). The windshield was fractured from exterior impact forces (only) as all tempered glazing remained undamaged.

Figure 4. Right front side surface damage to the 1997 Dodge B250 van.

The 1997 Dodge B250 van sustained moderate right front side surface damage as a result of the impact with the Buick LeSabre **(Figure 4)**. The direct contact damage began 56.0 cm (22.0 in) forward of the right front axle and extended 157.0 cm (61.8 in) rearward. The combined direct and induced damage length (Field L) began 59.0 cm (23.2 in) forward of the right front axle and extended 381.0 cm (150.0 in) rearward. A maximum crush value of 15.0 cm (5.9 in) was documented just rearward of the front axle. The *(SCI revised)* CDC for this impact to the Dodge was 02-RYEW-2 with a principal direction of force of (+)50 degrees. The right fender was deformed laterally to the left with minor outward bowing of the upper right front window frame noted (tempered glazing disintegrated).

Interior Damage

There was no damage to the interior surfaces of the Buick LeSabre from intrusions or occupant contact.

REDESIGNED AIR BAG SYSTEM

The 1998 Buick LeSabre was equipped with redesigned frontal air bags for the driver and front right passenger positions. The air bags had deployed as a result of the crash. The driver air bag was housed in the center of the steering wheel with a vertically oriented flap tear seam (I-configuration). The flaps were symmetrical and rectangular in shape. Although no contact evidence was identified on the exterior surface of the module cover flaps, skin tissue transfers were documented along the center portion and upper left quadrant of the air bag face. The NASS researcher measured the diameter of the driver air bag at 60.0 cm (23.6 in) in its deflated state **(Figure 5)**. No internal tether straps were present. The bag was vented by two ports located at the 9 o'clock and 3 o'clock sectors on the rear aspect of the air bag.

The front right passenger air bag deployed from the right mid-instrument panel area with a single cover flap design rectangular in shape and hinged at the top aspect. No contact evidence was identified on the air bag or exterior surface of the module cover flap. The NASS researcher measured the passenger air bag at 68.0 cm (26.8 in) in width and 53.0 cm (20.9 in) in height in its deflated state **(Figure 6)**. No internal tether straps were present. The bag was vented by two ports located at the 9 o'clock and 3 o'clock sectors on the side aspect of the air bag. No cutoff switch was found for the front right air bag.

Figure 5. 1998 Buick LeSabre redesigned driver air bag.

Figure 6. 1998 Buick LeSabre redesigned passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex:	74 year old female
Height:	160 cm (63 in)
Weight:	56 kg (124 lb)
Seat Track Position:	Mid-to-forward position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	NASS vehicle inspection, driver interview, police report
Eyeware:	Prescription glasses
Type of Medical Treatment:	None

Driver Injuries

Injury	*Severity (AIS 90)*	*Injury Mechanism*
None reported	N/A	N/A

Driver Kinematics

The 74 year old female driver of the 1998 Buick LeSabre was properly restrained by the available 3-point manual lap and shoulder belt system, seated in an upright posture with the seat track adjusted to the mid-to-forward position. Belt usage was confirmed by the lack of significant interior contacts and injury. At impact, she initiated a forward trajectory in response to the 11 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. Contact to the deployed driver air bag was confirmed by the skin tissue transfers documented along the center portion and upper left quadrant of the air bag face. The driver was uninjured in the collision. The combination of restraint options provided protection against further contact to the steering wheel hub/rim and potential serious injury.

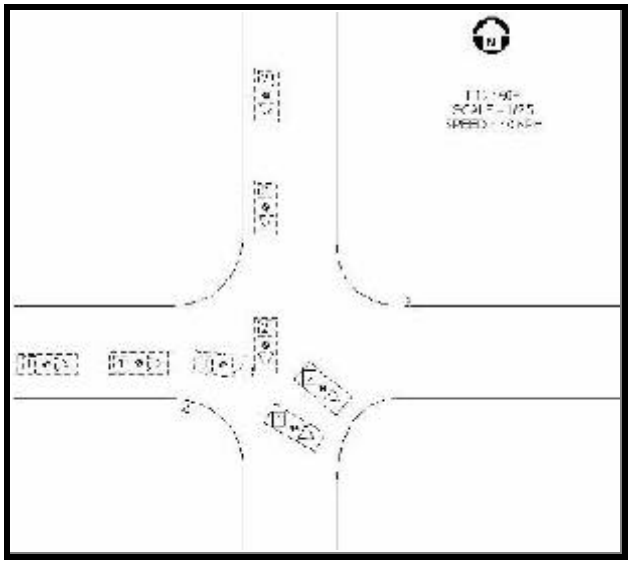

Figure 7. NASS Scene Diagram.