

**TRANSPORTATION SCIENCES  
CRASH RESEARCH SECTION**

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**CALSPAN REMOTE DEPOWERED AIR BAG DEPLOYMENT  
INVESTIGATION**

**CALSPAN CASE NO. CA98-009**

**SUBJECT VEHICLE - 1998 SATURN SL2**

**LOCATION - STATE OF FLORIDA**

**CRASH DATE - DECEMBER, 1997**

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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<p>16. <i>Abstract</i></p> <p>This remote investigation focused on a left turn across path type intersection crash which resulted in the deployment of the depowered front left and front right air bag system of a 1998 Saturn SL2, 4-door sedan. The frontal plane of the Saturn impacted with the right side of a 1986 Chevrolet S-10, 4x2 pickup truck, when the Chevrolet initiated a left turn across the travel path of the Saturn. The impact was sufficient to deploy the depowered air bag system of the Saturn. The Chevrolet subsequently departed the southeast corner of the intersection and impacted its frontal plane with a fence. The Saturn was occupied by a 25 year old male driver and a 27 year old female right front passenger. The restrained driver was not injured as a result of the crash, however, the right front passenger sustained an anterior right upper arm contusion (AIS-1) as a result of loading the 3-point manual lap and shoulder belt. The female passenger refused medical treatment. Available documentation of the involved vehicles consisted only of exterior photographs of the Saturn and a summary of this vehicle's repaired damaged components.</p>			
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**CRASH DATE: DECEMBER, 1997**

***Background***

This remote investigation focused on a left turn across path type intersection crash which resulted in the deployment of the depowered front left and front right air bag system of a 1998 Saturn SL2, 4-door sedan. The frontal plane of the Saturn impacted with the right side of a 1986 Chevrolet S-10, 4x2 pickup truck, when the Chevrolet initiated a left turn across the travel path of the Saturn. The impact was sufficient to deploy the depowered air bag system of the Saturn. **Figure 1** identifies the damage sustained by the Saturn. The Chevrolet subsequently departed the southeast corner of the intersection and impacted its frontal plane with a fence. The Saturn was occupied by a 25 year old male driver and a 27 year old female right front passenger. The restrained driver was not injured as a result of the crash, however, the right front passenger sustained an anterior right upper arm contusion (AIS-1) as a result of loading the 3-point manual lap and shoulder belt. The female passenger refused medical treatment.



**Figure 1.** Damage sustained by the frontal plane of the Saturn SL2.

A Police Crash Report (PCR) which indicated the involvement of a 1998 model year vehicle was identified by a GES coordinator and subsequently sent to the Special Crash Investigations COTR for confirmation of the vehicle's depowered air bag status. Depowered status was confirmed and a remote investigation was subsequently assigned to Calspan's Special Crash Investigation team on February 13, 1998 due to the repaired state of the vehicle.

***Summary***

The crash occurred in a T-type intersection of a primarily residential locale during the late evening hours. The police reported concrete road surface was wet due to rainy conditions and had a posted speed limit of 56 km/h (35 mph) for the north/southbound directions of travel. The intersection was artificially illuminated and traffic control devices were not present.

The Saturn SL2, 4-door sedan (1.9 L, L-4), was equipped with manual 3-point lap and shoulder belt systems with dual mode lap belt retractors for the four outboard seated positions and manual height adjusters for the front outboard seated positions only. A manual lap belt was available for the second center seated position. A Supplemental Inflatable Restraint (SIR) system was available for this vehicle which consisted of depowered front left and front right air bags. **Figure 2** identifies

the interior of an exemplar Saturn SL2. The Saturn SL2 was not equipped with an anti-lock braking system. The vehicle was identified by Vehicle Identification Number (V.I.N.) 1G8ZK5271WZ (production number omitted) and had approximately 480 kilometers (300 miles) on the odometer at the time of the crash. The vehicle was purchased two weeks pre-crash at which time the owners indicated that they were informed of the depowered status of the Saturn's air bag system via explanation from a Saturn sales representative. Insurance photographs did not capture the Saturn's left or right side window glazing which may have been equipped with "REDUCED FORCE AIR BAG" identifiers.



**Figure 2.** Interior view of an exemplar 1998 Saturn SL-2.

The 1986 Chevrolet S-10, 4x2 pickup truck, (2.5 L, L-4) was equipped with a standard cab and short bed and was identified by V.I.N. 1GCBS14E3G2 (production number omitted). The pickup truck was manufactured with 3-point manual lap and shoulder belt systems for the outboard seated positions and a 2-point manual lap belt for the center seated position.

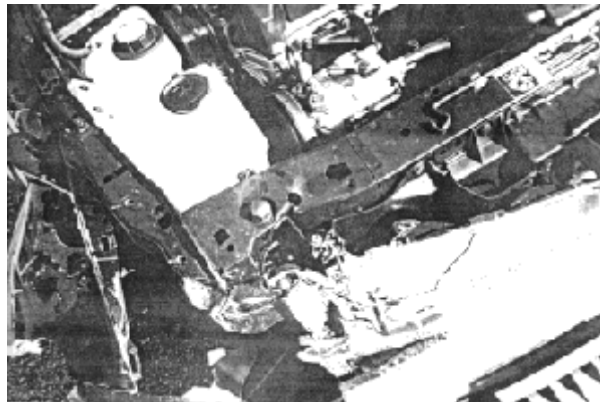
The Saturn was traveling northbound on the two lane undivided roadway at a police estimated speed of 48 km/h (30 mph). The Chevrolet pick-up truck was traveling southbound on the same roadway at a police estimated speed of 32 km/h (20 mph). The driver of the Saturn observed the pickup truck initiate a left turn, across the path of the Saturn, with the intention to enter an intersecting roadway. The driver subsequently initiated avoidance maneuvers to an impending crash by applying the brakes and steering to the left. The road surface was wet at the time of the crash and skidding evidence was not observed by the investigating police officer or the passenger of the Saturn. The frontal plane of the Saturn impacted the right side of the Chevrolet pickup truck in an 11 o'clock/2 o'clock impact configuration which initiated the deployment sequence of the Saturn's depowered air bag system. Delta V for this impact was estimated at 16-24 km/h (10-15 mph) for the Saturn based on insurance photographs. The Chevrolet subsequently departed the southeast corner of the intersection and impacted its frontal plane with a fence at an estimated 12 o'clock direction of force. The Saturn was towed from the scene of the crash due to police reported disabling damage. The Chevrolet was driven from the scene due its reported functional status.

### ***Vehicle Damage***

Contact to the frontal plane of the Saturn generated direct contact damage which insurance photographs identify at the front right bumper corner extending approximately 20 cm (8 in) left of the bumper fascia's center point. Maximum crush was estimated at 5 cm (2 in) located at the front right bumper corner (**Figure 3**). Laterally oriented abrasions were evident on the Saturn's hood face resultant from contact with the right plane of the pickup truck. Minor longitudinal damage was noted at the right aspect of the upper radiator support (**Figure 4**) and had an estimated crush value of 2.0 cm (0.8 in). In addition, the forward aspect of the composite right front fender fractured. The Collision Deformation Classification (CDC) for this impact was 11-FZEW-1. The cost of repair to the vehicle was \$4188.00. Damage data or documentation for the right side impact to the pickup truck was not available.



**Figure 3.** Damage to the frontal plane and right fender of the Saturn.



**Figure 4.** Longitudinal damage to the right aspect of the upper radiator support.

### ***Automatic Restraint System***

The automatic restraint system of the Saturn consisted of the Sensing and Diagnostic Module (SDM) and the depowered front left and front right air bag system. The SDM was located in the center passenger compartment of the vehicle and collected information from the crash sensors. The front left air bag was housed in the steering wheel hub and deployed from an I-configuration module cover flap. The front right air bag module was housed in the right side instrument panel in a mid-mount position. The instrument panel was equipped with a brow above the front right air bag module cover flap which was designed to direct the deployment path of the air bag rearward.

Insurance photographs did not document the interior of the damaged Saturn, however, the damage description indicated that the following Supplemental Inflatable Restraint (SIR) system components were repaired: front left and front right air bag modules, the diagnostic unit with sensors, air bag system diagnosis, and the clockspring. It was unknown if the air bags or the module cover flaps sustained damage or contact during the crash sequence. **Figure 5** identifies the instrument panel area with deployed air bags of an exemplar Saturn SL2.



**Figure 5.** Frontal interior view with deployed air bags for an exemplar 1998 Saturn SL-2.

***Driver Demographics and Kinematics***

The driver of the Saturn was a 25 year old male with a reported height of 170 cm (67 in) and weight of 86 kgs (190 lbs). He was reportedly (PCR and right front passenger) restrained by the available 3-point lap and shoulder belt system. The seat track was adjusted to the mid position and the seat back was in an upright to slightly reclined position. At impact, the driver responded to the 12 o'clock direction of force and loaded the manual belt system and probably contacted the deployed front right air bag. The driver did not sustain injury as a result of the crash and was not treated at a medical facility.

***Right Front Passenger Demographics***

The right front passenger of the Saturn was a 27 year old female with a stated height of 163 cm (64 in) and weight of 72 kgs (158 lbs). She was restrained by the 3-point manual lap and shoulder belt as reported on the PCR and during her interview. The seat track was adjusted to the mid position and the seat back was in an upright to slightly reclined position.

***Right Front Passenger Injuries***

<b>Injury</b>	<b>Injury Severity (AIS-90)</b>	<b>Injury Mechanism</b>
Right anterior upper arm contusion	Minor (790402.1,1)	Torso portion of the right front 3-point manual restraint system



### ***Right Front Passenger Kinematics***

At impact, the right front passenger responded to the 11 o'clock direction of force and initiated movement towards the front of the vehicle and to the left. The 3-point manual lap and shoulder belt restricted her forward movement and the subsequent loading to the belt system resulted in a contusion (AIS-1) to the anterior aspect of her right upper arm. She was not treated at a medical facility. EMS personnel did not respond to the crash.

### ***Driver of the Chevrolet Pickup Truck***

The driver of the Chevrolet pickup truck was a 28 year old male who police reported as not restrained during this crash. The PCR also indicated that the crash did not result in injury to the driver.