

TRANSPORTATION RESEARCH CENTER

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DEPOWERED AIR BAG REPORT

CASE NUMBER - IN97-064
LOCATION - TEXAS
VEHICLE - 1998 SATURN SL1
CRASH DATE - December, 1997

Submitted:

March 25, 1998

Contract Number: DTNH22-94-D-17058

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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 STANDARD TITLE PAGE

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<p>15. <i>Supplementary Notes</i> On-site depowered/second generation air bag deployment investigation involving a 1998 Saturn SL1 and a 1983 Chevrolet G-20 Conversion van.</p>			
<p>16. <i>Abstract</i> This report covers an on-site investigation of an air bag deployment crash. This case is of special interest because the case vehicle (1998 Saturn SL1) was equipped with a depowered/second generation air bag system that deployed as a result of the crash events. The case vehicle was traveling south in the outside southbound lane of a divided city street, approaching a four-leg intersection and intending to continue traveling south. Vehicle #2 (Chevrolet van) was traveling west in the outside westbound lane of the intersecting roadway and intended to continue traveling west. The case vehicle's driver observed vehicle #2 approaching and braked, attempting to avoid the crash. The crash occurred within the intersection. The front of the case vehicle impacted the right side of vehicle #2, causing the case vehicle's driver and front right passenger air bags to deploy. This was a crash of moderate severity for both vehicles. Both vehicles were towed from the scene due to damage. The case vehicle's driver did not sustain any injuries and did not seek any medical treatment. The driver of vehicle #2 sustained police-reported "C" (possible) injuries and was transported from the scene to a hospital via ambulance.</p>			
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Background

This on-site investigation was brought to the NHTSA's attention on December 23, 1997 through NASS/GES sampling activities. This contractor inspected the scene and vehicles on January 15 and December 30, respectively. The crash occurred in December 1997, at 2:17 p.m., in Texas and was investigated by the applicable city police department. This crash involved a 1998 Saturn SL1 four-door sedan and a 1983 Chevrolet G-20 conversion van. This crash is of special interest because the Saturn was equipped with depowered (second generation) air bags that deployed during the impact with the conversion van.

Crash Circumstances

The case vehicle (Saturn SL1) was traveling south in the outside southbound lane of a divided city street (two southbound through lanes and a left turn lane, with two northbound lanes on the other side of a curbed grass median), approaching a four-leg intersection and intending to continue traveling south. Vehicle #2 (Chevrolet van) was traveling west in the outside westbound lane of the intersecting roadway (two westbound through lanes and a left turn lane, with two eastbound lanes on the other side of a curbed grass median) and intended to continue traveling west. The concrete roadway was dry, level and straight, the weather was clear and the intersection was controlled by horizontally mounted, on-colors traffic control signal. The speed limit for the case vehicle was 56 kmph (35 mph) while the speed limit for vehicle #2 was 72 kmph (45 mph). The case vehicle's driver observed vehicle #2 approaching and braked, attempting to avoid the crash. The crash occurred within the intersection. The front of the case vehicle impacted the right side of vehicle #2, causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle rotated approximately 100 degrees clockwise and came to rest heading west, approximately 5 meters (16 ft) west of the intersection. Vehicle #2 was pushed to its left and rotated clockwise, loading the left side wheels with the left front wheel digging into the pavement and leaving a gouge. Vehicle #2 rolled one quarter-roll onto its left side (NASS rollover initiation type "trip over") and encountered the median barrier curb which caused it to bounce back onto its wheels. Vehicle #2 came to rest on its wheels heading west in the inside westbound lane approximately 12 meters (39 ft) west of intersection. Both vehicles were towed from the scene due to damage. The case vehicle's driver did not sustain any injuries and did not seek any medical treatment. The driver of vehicle #2 sustained police-reported "C" (possible) injuries and was transported from the scene to a hospital via ambulance.

Case Vehicle

The case vehicle was a front wheel drive 1998 Saturn SL1, four-door sedan (VIN: 1G8ZH5288WZ-----) equipped with anti-lock brakes. Direct contact damage extended across the entire front end. The hood was forced rearward into the windshield and caused two distinct areas of cracking, at the lower left and lower right corners. The left front window disintegrated from impact forces. The driver's door was jammed shut, with all

other doors remaining closed and operational. The CDC for the case vehicle was determined to be 11-FDEW-2, with maximum crush 27 centimeters (10.6 inches) at the front left corner. The SMASH reconstruction program, damage only algorithm, was used on the case vehicle's highest severity impact. The Total, Longitudinal, and Lateral Delta Vs were, respectively, 23 kmph (14 m.p.h.), -17 kmph (-11 m.p.h.), and +15 kmph (+9 m.p.h.). The case vehicle was traveling approximately 56-64 kmph (35-40 mph) prior to impact.

The case vehicle was fitted with bucket seats in the front row. The driver's seat track was adjusted between the middle and rearmost positions. There was no evidence of seat or track failure. The driver's seatback was slightly reclined and retained its pre-crash adjustment. The case vehicle was equipped with manual three-point lap-and-shoulder safety belts at the four outboard seat positions. The driver's safety belt was the only belt system in the car that showed any signs of use. The tilt steering wheel was found to be adjusted between the middle and full-up positions, although the driver said he thought it was in the center position. The upper half of the steering wheel rim was bent forward 2 centimeters (0.8 inches). There was no evidence that the steering column had moved and the shear module was not inspected. The driver's air bag was located in the steering wheel hub, with cover flaps in the I-configuration. The cover flaps opened along the seams, with no evidence of damage to the flaps or the air bag. The deployed driver's air bag was round with diameter 56 centimeters (22 inches), four tether straps and two 3 centimeter (1.2 inch) vent ports at the 11 and 1 o'clock positions. The only visible marks on the driver's air bag were scuffs just below the center on the front and an area of scorching discoloration on the back in the lower half. The front right air bag was located in the middle of the instrument panel with a single cover flap. The cover flap opened along the seams and there was no evidence of damage to the flap or the air bag. The deployed front right air bag was a rectangle 35 centimeters (13.8 inches) high and 72 centimeters (28.3 inches) wide, with one tether strap and no vent ports.

Case Vehicle Occupant

The case vehicle's driver was male, 26 years, 170 centimeters and 132 kilograms (67 inches, 290 pounds)] and was restrained by his available active three-point lap-and-shoulder safety belt with the anchorage adjustment in the full down position. There was no other occupant in the case vehicle. Immediately prior to the crash the case vehicle's driver was seated in a slightly reclined posture with his back against the seatback, his left foot on the floor, his right foot on the brake, and both hands on the steering wheel.

The case vehicle's driver braked, attempting to avoid the crash. As a result of this attempted avoidance maneuver and the use of his available safety belts, he moved slightly forward just prior to impact. The case vehicle's impact with vehicle #2 caused the driver and front right air bags to deploy and thrust the driver forward and leftward. The case vehicle's clockwise rotation forced the driver against the front left door panel, but due to his weight and low center of gravity, he remained in his seated posture and leaned to his left. The driver's interaction with the deploying air bag caused the air bag to be deflected forward, resulting in the minor steering wheel rim deformation. Because the driver was wearing his safety belt, his forward motion was restricted and

he did not engage the air bag with the full force of his inertial motion. The steering wheel would probably have been more seriously deformed had he not been wearing his restraints. As the vehicle came to rest the driver rebounded back to his right away from the driver door panel. The case vehicle's driver did not sustain any specific injuries, but did claim to be sore. The driver did not seek any medical treatment as a result of this crash.

Vehicle #2

Vehicle #2 was a rear wheel drive 1983 Chevrolet G-20 conversion van (VIN: 2GBEG25H0D4-----). The damage from event #1 (the case vehicle impact) was at the sill level with the crush profile centered approximately on the right side C-pillar. Maximum crush was 17 centimeters (6.7 inches), slightly forward of the C-pillar. The CDC for this impact was 02-RZEW-2. The SMASH damage only reconstruction algorithm indicated total delta v 13 kmph (8 mph), with longitudinal delta v -9 kmph (-5 mph) and lateral delta v -10 kmph (-6 mph). The damage from event #2 (rollover) was distributed along the entire left side and was limited to scratching and minor crushing. The CDC for the rollover event was determined to be 00-LDAO-1. The left front corner of vehicle #2 impacted the median barrier curb while the van was on its left side, causing it to bounce back onto its wheels. The curb impact resulted in maximum crush of 12 centimeters (4.7 inches) on the left front fender. The CDC for this third event was 00-LFMW-2. Vehicle #2 was towed due to damage. The driver (male, 29 years, unknown height and weight) was restrained by his available, active, three-point lap-and-shoulder safety belt and sustained unknown police-reported "C" (possible) injuries. There was no other occupant in vehicle #2. The driver was transported from the scene via ambulance directly to a hospital for treatment.

Selected Photographs

(See following pages.)

Selected Photographs



Figure 1: Vehicle #2's west-bound approach with point of impact for first harmful event at middle foreground (case photo #5)



Figure 2: Front and left side of case vehicle (case photo #12)

Selected Photographs (continued)



Figure 3: Front and right side of case vehicle (case photo #20)

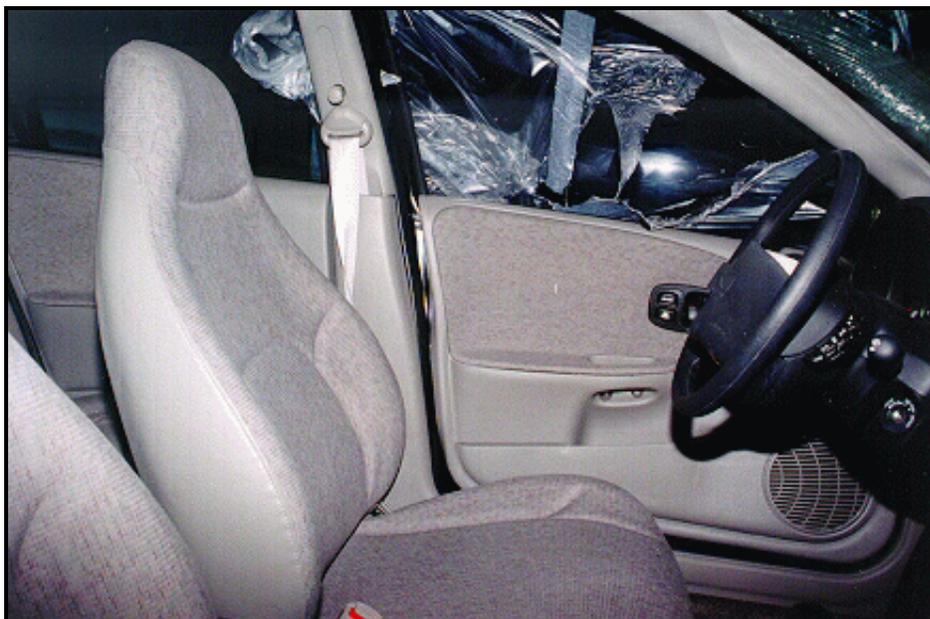


Figure 4: Case vehicle's driver seat area -- note deformed steering wheel rim and shattered side glass (case photo #21)

Selected Photographs (continued)



Figure 5: Front view of case vehicle's steering wheel (case photo #32)

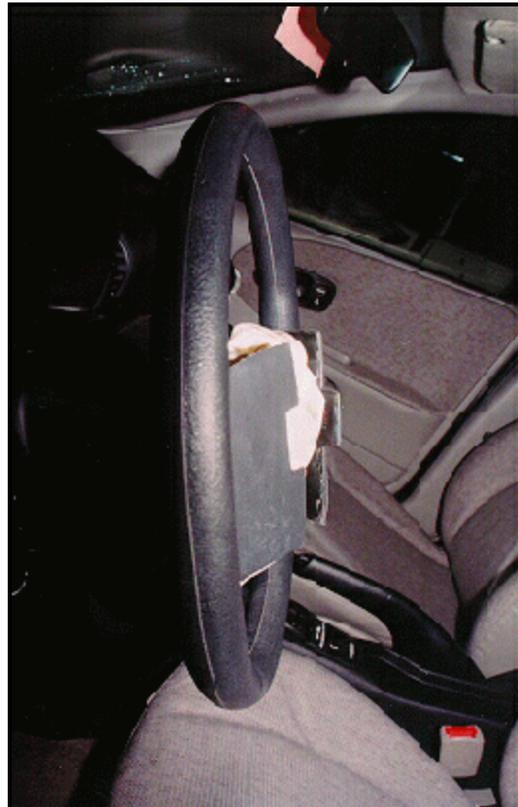


Figure 6: Side view of case vehicle's steering wheel (case photo #23)



Figure 7: Case vehicle's front right air bag module (case photo #29)

Selected Photographs (continued)



Figure 8: Front of case vehicle's driver air bag -- tape indicates area of scuffs and discoloration (case photo #25)



Figure 9: Back bottom half of case vehicle's driver's air bag -- tape indicates area of scorching (case photo #28)

Select Photographs (continued)



Figure 10: Vehicle #2 right side damage from impact with case vehicle (case photo #42)



Figure 11: Vehicle #2 left side rollover damage (case photo #35)



Figure 12: Vehicle #2 left side rollover damage (case photo #37)