TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION

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

NASS RABSS CASE NO. 1998-43-801G

RABSS VEHICLE - 1998 CHEVROLET S-10 PICKUP TRUCK

LOCATION - STATE OF NORTH CAROLINA

CRASH DATE - JULY, 1998

Contract No. DTNH22-94-D-07058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

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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

1. *Report No.* 98-43-801G	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* Redesigned Air Bag Special Study (RABSS) RABSS Vehicle - 1998 Chevrolet S-10 pickup truck Location - State of North Carolina		5. *Report Date*: July, 1999 6. *Performing Organization Code*	
7. *Author(s)* Crash Research Section		8. *Performing Organization Report No.*	
9. *Performing Organization Name and Address* Transportation Sciences Crash Research Section Veridian Engineering (Calspan Operations) P.O. Box 400 Buffalo, New York 14225		10. *Work Unit No.* C01115.0225.(0000-0009) 11. *Contract or Grant No.* DTNH22-94-D-07058	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		13. *Type of Report and Period Covered* Technical Summary Report Crash Date: July, 1998 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* NASS investigation of a head-on collision that involved a 1998 Chevrolet S-10 pickup truck with redesigned frontal air bags.			
16. *Abstract* This investigation focused on a two-vehicle crash involving a 1998 Chevrolet S-10 pickup truck (subject vehicle) and a 1996 Honda Accord EX 4-door sedan. The Chevrolet S-10 was equipped with redesigned frontal air bags that deployed as a result of a head-on collision with the Honda Accord. The Honda was westbound and attempted to turn left (south) at a 4-leg intersection when it crossed into the path of the eastbound Chevrolet. As the Honda turned left and crossed the eastbound lane the front left area of the Chevrolet struck the front right area of the Honda. Impact resulted in moderate damage to both vehicles. At this point, the Honda rotated counterclockwise as both vehicles came to rest in the south sector of the intersection facing southeast. The 16 year old male driver of the Chevrolet S-10 was properly restrained by the 3-point manual lap and shoulder belt system and initiated a forward trajectory in response to the 11 o'clock impact force, loading the manual restraint and deployed redesigned driver air bag. He sustained a laceration to the posterior aspect of the right hand from contact to the ashtray. Neither driver was transported to a local hospital for treatment.			
17. *Key Words* Redesigned frontal air bag system Collision Deformation Classification (CDC): 71-FDEW-3 Proper use of the manual belt system		18. *Distribution Statement* General Public	
19. *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 5	22. *Price*

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BACKGROUND

This investigation focused on a two-vehicle crash involving a 1998 Chevrolet S-10 pickup truck (subject vehicle) and a 1996 Honda Accord EX 4-door sedan. The Chevrolet S-10 was equipped with redesigned frontal air bags that deployed as a result of a head-on collision with the Honda Accord. The Honda was westbound and attempted to turn left (south) at a 4-leg intersection when it crossed into the path of the eastbound Chevrolet. As the Honda turned left and crossed the eastbound lane the front left area of the Chevrolet struck the front right area of the Honda. Impact resulted in moderate damage to both vehicles. At this point, the Honda rotated counterclockwise as both vehicles came to rest in the south sector of the intersection facing southeast. The 16 year old male driver of the Chevrolet S-10 was properly restrained by the 3-point manual lap and shoulder belt system and initiated a forward trajectory in response to the 11 o'clock impact force, loading the manual restraint and deployed redesigned driver air bag. He sustained a laceration to the posterior aspect of the right hand from contact to the ashtray. Neither driver was transported to a local hospital for treatment.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-43-801G for the Redesigned Air Bag Special Study. The Field Operations Branch of the National Highway Traffic Safety Administration (NHTSA) assigned the Special Crash Investigation (SCI) team at Veridian/Calspan the task of case review and final report preparation.

SUMMARY

Crash Site

This two-vehicle crash occurred during the evening hours of July, 1998. At the time of the crash, it was dark (street lighted) with no adverse conditions as the roads were dry. The crash occurred in the eastbound lane of a 4-leg rural (level/asphalt) intersection which is controlled by overhead tri-lights **(see Figure 9 - page 5)**. The speed limit at the crash scene was 72 km/h (45 mph).

Pre-Crash

The 16 year old male driver of the 1998 Chevrolet S-10 was operating the vehicle eastbound **(Figure 1)** at a police reported speed of 72 km/h (45 mph) and proceeding straight when he observed the Honda Accord turn left (south) across his lane of travel. Upon recognition of the impending harmful event, the driver braked in avoidance remaining in the eastbound travel lane prior to the collision. The 1996 Honda Accord was driven by a 25 year old male who was operating the vehicle westbound **(Figure 2)** when he failed to detect the Chevrolet as he turned left (south) at a police reported speed of 24 km/h (15 mph).

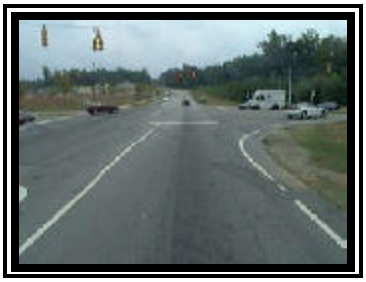

Figure 1. Eastbound approach for the 1998 Chevrolet S-10 pickup truck.

Figure 2. Westbound approach for the 1996 Honda Accord EX.

Crash

As the Honda crossed the eastbound lanes of the 3-lane undivided roadway, the front left area of the Chevrolet struck the front right area of the Honda. The impact induced deceleration was sufficient to deploy the Chevrolet's redesigned frontal air bag system. The damage algorithm of the WinSMASH program computed velocity changes of 30.6 km/h (19.0 mph) for the subject vehicle and 31.7 km/h (19.7 mph) for the struck Honda. Respective longitudinal components were -23.5 km/h (-14.6 mph) and -29.8 km/h (-18.5 mph). The Collision Deformation Classification (CDC) for this impact to the Chevrolet S-10 was 71-FDEW-3 (PDOF incremented for lateral end shifting to the right) and 01-FZEW-2 for the Honda Accord. At this point, the Honda rotated counterclockwise as both vehicles came to rest in the south sector of the intersection facing southeast.

Post-Crash

Each driver exited the vehicle under their own power. No ambulance was summoned to the crash site. Both vehicles were towed from the scene.

RABSS VEHICLE

The 1998 Chevrolet S-10 was identified by the Vehicle Identification Number (VIN): 1GCCS19X0W8 (production sequence deleted). The vehicle was an extended cab pickup truck (3-door model) equipped with rear wheel drive and a 4.3 liter, V-6 engine. Air bag warning labels were affixed to each sun visor. The vehicle's odometer reading was unknown at the time of the crash. The police report listed the driver's father as the owner of the vehicle. The seating was configured with a front split bench (with folding backs) and a folding side facing seat for the rear right position. The driver reported no previous crashes or maintenance on the air bag system (original equipment). A bag phone was present but not in use at the time of the collision.

VEHICLE DAMAGE

Exterior Damage

Figure 3. Frontal damage to the 1998 Chevrolet S-10 pickup truck.

The Chevrolet S-10 sustained moderate frontal damage as a result of the impact with the Honda Accord **(Figure 3)**. The direct contact damage encompassed the full frontal width resulting in a combined direct and induced damage length (Field L) of 141.0 cm (55.5 in). Six crush measurements were documented at the level of the bumper: C1= 0 cm, C2= 18.0 cm (7.1 in), C3= 33.0 cm (13.0 in), C4= 48.0 cm (18.9 in), C5= 53.0 cm (20.9 in), C6= 58.0 cm (22.8 in). Damage was noted to the hood which was displaced up and rearward from the impact force. The end structure was displaced approximately 12.0 cm (4.7 in) to the right. Induced buckling was noted to the roof area between the A-pillar and B-pillar. The right fender was displaced rearward which restricted/deflated the wheel/tire and jammed the right door. Bed to cab contact was documented to the right side. No windshield damage was found from exterior forces or the (interior) front right air bag deployment.

Figure 4. Frontal damage to the 1996 Honda Accord EX.

The Honda Accord sustained moderate frontal damage as a result of the impact with the Chevrolet S-10 **(Figure 4)**. The direct contact damage began at the front right bumper corner and extended 62.0 cm (24.4 in) inboard. The impact deformed the full frontal width resulting in a combined direct and induced damage length (Field L) of 94.0 cm (37.0 in). The bumper fascia separated from the reinforcement bar. The direct contact damage continued rearward to the A-pillar from sustained contact between the vehicles during spinout. This damage pattern restricted/bowed the right front door and shattered the side glazing. The right fender was displaced laterally which restricted the right front wheel/tire (not deflated). The windshield was fractured and out of place.

Interior Damage

Interior damage to the Chevrolet S-10 identified through the NASS vehicle inspection was minimal and was attributed to occupant contact. The front left energy management loop deployed, located at the lower (sill) anchorage point **(Figure 5)**. A scratch mark was documented to the ashtray. No contacts were found on the left knee bolster (rigid plastic type). No steering wheel rim deformation was noted (fixed column). Longitudinal intrusions into the front right passenger space included 15.0 cm (5.9 in) of toepan intrusion and 10.0 cm (3.9 in) of instrument panel intrusion.

Figure 5. Loading to the front left manual restraint.

REDESIGNED AIR BAG SYSTEM

The 1998 Chevrolet S-10 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 in shape and measured 12.0 cm (4.7 in) in width and 10.0 cm (3.9 in) in height. No contact evidence was identified on the air bag or exterior surface of the module cover flaps. The NASS researcher measured the diameter of the driver air bag at 60.0 cm (23.6 in) in its deflated state **(Figure 6)**. The bag was tethered by two internal straps and vented by two ports located at the 11 o'clock and 1 o'clock sectors on the rear aspect of the air bag.

Figure 6. 1998 Chevrolet S-10 redesigned driver air bag.

Figure 7. 1998 Chevrolet S-10 redesigned passenger air bag.

The front right passenger air bag deployed from a mid-mount module in the right instrument panel with a single cover flap design hinged at the bottom aspect. No contact evidence was identified on the air bag or exterior surface of the module cover flap. The cover flap was rectangular in shape which opened in a downward direction away from the windshield and measured 32.0 cm (12.6 in) in width and 13.0 cm (5.1 in) in height. The NASS researcher measured the passenger air bag at 56.0 cm (22.0 in) in width and 44.0 cm (17.3 in) in height in its deflated state **(Figure 7)**. No 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. A cutoff switch was located on the instrument panel **(Figure 8)** to the right of the steering column.

Figure 8. Cutoff switch for the passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex:	16 year old male
Height:	160 cm (63 in)
Weight:	54 kg (120 lb)
Seat Track Position:	Forward most position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	NASS vehicle inspection, driver interview
Eyeware:	Prescription contact lenses
Type of Medical Treatment:	None

Driver Injuries

Injury	*Severity (AIS 90)*	*Injury Mechanism*
Laceration posterior right hand (1.3 cm)	Minor (790602.1,1)	Ashtray

Driver Kinematics

The 16 year old male driver of the 1998 Chevrolet S-10 was seated in an upright posture with his left hand at the 10 o'clock position on the steering wheel rim and the right hand on the seat cushion. He was properly restrained by the 3-point manual lap and shoulder belt system with the seat track adjusted to a forward position. At impact, he initiated a forward trajectory in response to the 11 o'clock impact force and loaded the manual belt system and deployed redesigned driver air bag. Belt usage was confirmed by the deployment of the energy management loop at the lower (sill) anchorage point. The air bag provided additional restraint against further contact to the steering wheel hub/rim preventing serious injury. His right hand struck the ashtray resulting in a minor laceration to the posterior aspect of the right hand, evidenced by the scratch mark documented to this component. The driver was not transported to a local hospital for treatment.

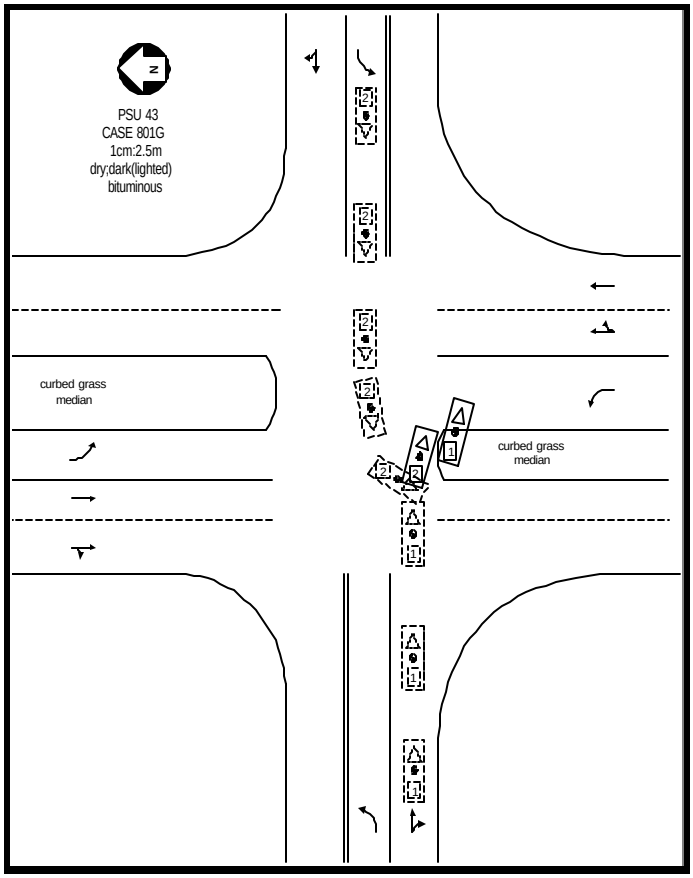

Figure 9. NASS Scene Diagram