Remote, Redesigned Air Bag Special Study

FOR NHTSA'S INTERNAL USE ONLY

Dynamic Science, Inc., Case Number (1998-048-804G)

1998 Chevrolet S-10

Alabama

November, 1998

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient Catalog No.
1998-048-804G		

4. Title and Subtitle	5. Report Date
	May 26, 1999
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401	11. Contract or Grant no. DTNH22-94-D-27058

12. Sponsoring Agency Name and Address	13. Type of report and period Covered
U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590	[Report Month, Year] 14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

This remote investigation focused on the redesigned air bag system deployment of a 1998 Chevrolet S-10 compact pickup truck. This minor injury crash occurred in November, 1998 in the early evening. The weather was clear but the bituminous roadway was wet. The crash occurred on a two lane, undivided, asphalt covered road that had been covered with gravel. The speed limit for this road is 72 kmph (45 mph). There are no traffic controls and the road has a positive grade at the area of impacts. Vehicle 1, a 1998 Chevrolet S-10 compact pickup truck (case vehicle) driven by a 20 year old male (180 cm/71 in, 68 kg/150 lb), was traveling north in the northbound travel lane at a police estimated travel speed of 72 kmph (45 mph). The driver was in the process of negotiating a right hand curved section of the road. The driver was not restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 1. The driver of Vehicle 1 cut the curve too tight and as Vehicle 1 was coming around the curve, the right front wheel dropped off the right side of the road, entering the deposit of loose gravel on the roadside. As the driver attempted to bring the vehicle back onto the road, the wheels began to slide on some of the gravel that had accumulated in this section of the road. Vehicle 1 slid across the roadway and exited the left roadside where it struck a large tree (event 1) with the front plane (12FREW3). After the initial impact, Vehicle 1 rotated clockwise and impacted a second tree (event 2) with the left plane (12LPMS1) in a minor sideswipe configuration. A Delta V was calculated for event 1, utilizing WinSMASH, to be 48 kmph (30 mph). As a result of the frontal impact, the supplemental restraint system (driver and passenger side redesigned air bags) of the case vehicle deployed. The center instrument panel mounted passenger side air bag shut off switch was turned to the “on” position and worked properly. Vehicle 1 came to rest engaged with the two trees facing northwest. The driver of Vehicle 1 was not transported from the scene for medical attention but visited the emergency room at a later time where he was treated and released for minor injuries.

17. Key Words	18. Distribution Statement
Redesigned air bag system, minor injuries, unrestrained occupant	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Remote, Redesigned Air Bag Special Study

FOR NHTSA'S INTERNAL USE ONLY

Dynamic Science, Inc., Case Number (1998-048-804G)

1998 Chevrolet S-10

Alabama

November, 1998

Summary

This remote investigation focused on the redesigned air bag system deployment of a 1998 Chevrolet S-10 compact pickup truck. This minor injury crash occurred in November, 1998 in the early evening. The weather was clear but the bituminous roadway was wet. The crash occurred on a two lane, undivided, asphalt covered road that had been covered with gravel. The speed limit for this road is 72 kmph (45 mph). There are no traffic controls and the road has a positive grade at the area of impacts.

Figure 1. Exterior, Vehicle 1 (Chevrolet S-10)

Vehicle 1, a 1998 Chevrolet S-10 compact pickup truck (case vehicle) driven by a 20 year old male (180 cm/71 in, 68 kg/150 lb), was traveling north in the northbound travel lane at a police estimated travel speed of 72 kmph (45 mph). The driver was in the process of negotiating a right hand curved section of the road. The driver was not restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 1.

Crash Events

The driver of Vehicle 1 cut the curve too tight and as Vehicle 1 was coming around the curve, the right front wheel dropped off the right side of the road, entering the deposit of loose gravel on the roadside. As the driver attempted to bring the vehicle back onto the road, the wheels began to slide on some of the gravel that had accumulated in this section of the road. Vehicle 1 slid across the roadway and exited the left roadside where it struck a large tree (event 1) with the front plane (12FREW3).

Figure 2. Crash scene, point of impacts

After the initial impact, Vehicle 1 rotated

clockwise and impacted a second tree
(event 2) with the left plane (12LPMS1) in a minor sideswipe configuration.

A Delta V was calculated for event 1, utilizing WinSMASH, to be 48 kmph (30 mph).

As a result of the frontal impact, the supplemental restraint system (driver and passenger side redesigned air bags) of the case vehicle deployed. The center instrument panel mounted passenger side air bag shut off switch was turned to the "on" position and worked properly.

Vehicle 1 came to rest engaged with the two trees facing northwest.

The driver of Vehicle 1 was not transported from the scene for medical attention but visited the emergency room at a later time where he was treated and released for minor injuries.

Vehicle 1 became disabled due to damage sustained in the crash and was towed from the scene.

Table 1. Delta V

	Case Vehicle	
	km/h	mph
Total	48	30
Longitudinal	-47	-29
Lateral	-8	-5
Barrier speed	48	30

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Chevrolet S-10
VIN	1GCCS1445WK
CDC	12FREW3

Figure 3. Exterior, Case vehicle (event 1 damage)

Figure 4. Exterior, Case vehicle (event 2 damage)

Table 3. Crush Measurements

Plane of Impact	Field L cm/in.	C1 cm/in.	C2 cm/in.	C3 cm/in.	C4 cm/in.	C5 cm/in.	C6 cm/in.
Bumper	123	0	7	18	38	70	63
	48.4	0	2.8	7.1	15	27.6	24.8

Interior of Case Vehicle

The interior of the Chevrolet S-10 sustained minor damage from occupant contact. The researcher measured a possible intrusion of the right toe pan but the result came up as 0 cm. The measurement is reported in Table 4. There was occupant contact evidence to the windshield, rearview mirror, and passenger side air bag.

The case vehicle was equipped with spit bench seats with folding backs in all three frontal seating positions. All three seats were adjusted to the rear most track positions. The outboard seats were equipped with integral head restraints which were not damaged in the crash. The front center seat was not equipped with a head restraint system. There are no other seats in this vehicle.

Table 4. Intrusions

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Toe pan	Right	0	0	Longitudinal

Case Vehicle Occupant Protection Systems

The Chevrolet S-10 compact pickup truck was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units, and a front right air bag shut off switch.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical I-configuration cover flaps. The circular air bag was equipped with two tethers and two vent ports. No contact evidence was found on the bag and the bag and cover flaps were not damaged.

Figure 5. Interior, case vehicle. Frontal air bags.

The front right air bag was housed in the mid-instrument panel position. The single air bag module cover flap was a rectangular configuration. The rectangular air bag was equipped with two vent ports and was not tethered. Contact evidence consisting of blood was found on the left side of the front of the bag as a result of contact with the drive's face. The bag and cover flap were not damaged.

The front right air bag shut off switch was located on the center-instrument pane area. The switch is key activated and was turned to the "on" position at the time of the crash.

Figure 6. Interior, case vehicle. Air bag shut off switch.

Figure 7. Interior, case vehicle. Passenger air bag contact evidence (blood).

Case Vehicle Occupant Demographics

Table 5. Case Vehicle Occupant Demographics

	Occupant 1
Age/Sex:	20/Male
Seated Position:	Front left
Seat Type:	Split bench with folding back, cloth covered
Height (cm/in:):	180 71
Weight (kg/lbs).:	68 150
Pre-existing Medical Condition:	None noted
Body Posture:	Normal, upright facing forward
Hand Position:	At the 10 & 2 o'clock positions on the steering wheel
Foot Position:	On floor or foot controls
Restraint Usage:	None used
Air bag:	Deployed redesigned air bag system

Occupant Injuries

Table 6. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
3" forehead laceration	1	Windshield

Occupant Kinematics

The driver of the Chevrolet pickup was seated in a normal upright posture in the front left position of the vehicle. He was not wearing the available manual lap/shoulder restraint at the time. The lack of belt usage was determined from prominent frontal contact evidence in the vehicle as well as observations of the investigating police officer at the scene of the crash. Prior to the impact, the driver reported that he steered left in an attempt "to keep the truck going straight". Scene evidence also shows some pre-impact braking. As a result of the pre-impact maneuvering, the unrestrained driver may have been out of position prior to impact.

At impact, the unrestrained driver initiated a forward trajectory in response to the 10 degree principle direction of force. It appears that the driver's torso engaged the right side of the driver side air bag. The driver's head then struck the windshield (spider web crack) and rearview mirror (deformed/cracked) causing the forehead laceration. At some point it also appears that the driver struck the passenger side air bag (blood), but it is unclear if this was during the impact or post-impact. The driver reported that he did not lose consciousness and he was "sore all over" as a result of the crash.

Figure 8. Interior, case vehicle. Windshield contact.

Figure 9. Interior, case vehicle. Rearview mirror contact.

Scene Diagram