

Remote, Redesigned Air Bag Special Study

**FOR NHTSA'S INTERNAL USE ONLY**

Dynamic Science, Inc., Case Number (1998-074-089E)

1998 Chevrolet Cavalier

Nebraska

July/1998

1. Report No. 1998-074-089E		2. Government Accession No.		3. Recipient Catalog No.	
4. Title and Subtitle				5. Report Date September 15, 1999	
				6. Performing Organization Report No.	
7. Author(s) Dynamic Science, Inc.				8. Performing Organization Report No.	
9. Performing Organization name and Address Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401				10. Work Unit No. (TRAIS)	
				11. Contract or Grant no. DTNH22-94-D-27058	
12. Sponsoring Agency Name and Address U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590				13. Type of report and period Covered [Report Month, Year]	
				14. Sponsoring Agency Code	
15. Supplemental Notes					
16. Abstract <p>This remote investigation focused on the redesigned air bag system deployment of a 1998 Chevrolet Cavalier 2-door coupe. This minor injury crash occurred in July, 1998 in the early morning. The weather was clear and the concrete roadway was dry. The crash occurred in a four-leg intersection. The southbound leg of the intersection is a two-way, divided roadway and is comprised of five travel lanes; two southbound lanes, one southbound left-turn lane, and two northbound lanes. Southbound traffic is separated from northbound traffic by a raised concrete median strip. The speed limit for this road is 56 kmph (35 mph). It is controlled by overhead traffic signals. The road is level at the area of impact. The westbound leg of the intersection is a two-way, divided roadway and is comprised of six travel lanes; two westbound lanes, one westbound right-turn lane, one westbound left-turn lane, and two eastbound lanes. The speed limit for this road is 56 kmph (35 mph). It is controlled by overhead traffic signals. The road is level at the area of impact. Vehicle 1, an unknown Isuzu compact pickup truck, was traveling south in the right southbound travel lane approaching the intersection at an unknown speed, preparing to travel straight through the intersection. The traffic signal was in the red mode for southbound traffic at the time. The vehicle fled the scene after the impact so very little information is known of the vehicle or occupants. A witness stated that there were "two male occupants" in Vehicle 1 and that it was a "blue Isuzu pickup truck". It is unknown if the occupants were restrained. Vehicle 2, a 1998 Chevrolet Cavalier 2-door coupe (case vehicle) driven by a 32 year old female (173 cm/68in, 73 kg/160 lb), was traveling west in the second westbound travel lane from the right approaching the intersection at a driver estimated speed of 40 kmph (25 mph), preparing to travel straight through the intersection. The traffic signal was in the green mode for westbound traffic at the time. The driver was restrained by the available manual lap/shoulder restraint. The back center seat was occupied by a 6 year old female (91 cm/36 in, 20 kg/45 lb) who was restrained by the available manual lap restraint. Vehicle 1 entered the intersection against the red traffic signal. Vehicle 2 entered the intersection with the green traffic signal. Vehicle 2 crossed the path of Vehicle 1 and was struck. The front plane of Vehicle 1 (unknown CDC) struck the right plane of Vehicle 2 (01RZEW3) in the intersection. No Delta V was calculated for either vehicle due to insufficient data. It appears that the longitudinal component of force was sufficiently high enough to deploy the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle. Vehicle 1 was still driveable after the impact and left the scene prior to police arriving. Vehicle 2 rotated slightly counter-clockwise after impact and came to rest in the original lane facing southwest. Vehicle 2 was towed from the scene due to damage. No injury data is known of the occupants in Vehicle 1. Both occupants of the case vehicle reportedly sustained non-incapacitating injuries and were not transported from the scene for medical attention.</p>					
17. Key Words Redesigned air bag system			18. Distribution Statement		
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 (1998-074-089E)  
1998 Chevrolet Cavalier  
Nebraska  
July/1998

***Summary***

This remote investigation focused on the redesigned air bag system deployment of a 1998 Chevrolet Cavalier 2-door coupe. This minor injury crash occurred in July, 1998 in the early morning. The weather was clear and the concrete roadway was dry. The crash occurred in a four-leg intersection. The southbound leg of the intersection is a two-way, divided roadway and is comprised of five travel lanes; two southbound lanes, one southbound left-turn lane, and two northbound lanes. Southbound traffic is separated from northbound traffic by a raised concrete median strip. The speed limit for this road is 56 kmph (35 mph). It is controlled by overhead traffic signals. The road is level at the area of impact. The westbound leg of the intersection is a two-way, divided roadway and is comprised of six travel lanes; two westbound lanes, one westbound right-turn lane, one westbound left-turn lane, and two eastbound lanes. The speed limit for this road is 56 kmph (35 mph). It is controlled by overhead traffic signals. The road is level at the area of impact.



**Figure 1.** Exterior, Vehicle 2 (Chevrolet Cavalier)

Vehicle 1, an unknown Isuzu compact pickup truck, was traveling south in the right southbound travel lane approaching the intersection at an unknown speed, preparing to travel straight through the intersection. The traffic signal was in the red mode for southbound traffic at the time. The vehicle fled the scene after the impact so very little information is known of the vehicle or occupants. A witness stated that there were “two male occupants” in Vehicle 1 and that it was a “blue Isuzu pickup truck”. It is unknown if the occupants were restrained.

Vehicle 2, a 1998 Chevrolet Cavalier 2-door coupe (case vehicle) driven by a 32 year old female (173 cm/68in, 73 kg/160 lb), was traveling west in the second westbound travel lane from the right approaching the intersection at a driver estimated speed of 40 kmph (25 mph), preparing to travel straight through the intersection. The traffic signal was in the green mode for westbound traffic at the time. The driver was restrained by the available manual lap/shoulder restraint. The back center seat was occupied by a 6 year old female (91 cm/36 in, 20 kg/45 lb) who was restrained by the available manual lap restraint.

**Crash Events**

Vehicle 1 entered the intersection against the red traffic signal. Vehicle 2 entered the intersection with the green traffic signal. Vehicle 2 crossed the path of Vehicle 1 and was struck. The front plane of Vehicle 1 (unknown CDC) struck the right plane of Vehicle 2 (01RZEW3) in the intersection.

No Delta V was calculated for either vehicle due to insufficient data. It appears that the longitudinal component of force was sufficiently high enough to deploy the supplemental restraint system (driver’s and passenger’s frontal redesigned air bags) of the case vehicle.



**Figure 2.** Crash scene, Vehicle 2 approach to impact.

Vehicle 1 was still driveable after the impact and left the scene prior to police arriving. Vehicle 2 rotated slightly counter-clockwise after impact and came to rest in the original lane facing southwest. Vehicle 2 was towed from the scene due to damage.

No injury data is known of the occupants in Vehicle 1. Both occupants of the case vehicle reportedly sustained non-incapacitating injuries and were not transported from the scene for medical attention.

**Table 1. Delta V**

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	Unknown	Unknown	Unknown	Unknown
Longitudinal	Unknown	Unknown	Unknown	Unknown
Lateral	Unknown	Unknown	Unknown	Unknown

**Exterior of Case Vehicle**

**Table 2. Vehicle Information**

Model year, make and model	1998 Chevrolet Cavalier
VIN	1G1JC1240W7
CDC	01RZEW3



**Figure 3.** Exterior, Vehicle 2 (1998 Chevrolet Cavalier)



**Figure 4.** Exterior, Vehicle 2 (1998 Chevrolet Cavalier)

**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.
No crush data	Unk	Unk	Unk	Unk	Unk	Unk	Unk

**Interior of Case Vehicle**

The interior of the Chevrolet Cavalier sustained no damage from occupant contact. There were several areas of significant intrusion into the passenger compartment on the right side of the vehicle. See Table 4 for intruded values.

The case vehicle was equipped with bucket seats with folding backs in the front left and front right seating positions. Both front seats were adjusted to the rear most track positions. Both front seats were equipped with adjustable head restraints which were not damaged. The rear of the vehicle was equipped with bench seats with folding backs. There were no head restraints available for these seating positions and they were not adjustable.

**Table 4. Intrusions**

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Door panel	back right	16	6.3	Lateral
B-pillar	back-right	16	6.3	Lateral
Window frame	back-right	3	1.2	Lateral
Roof side rail	back-right	0	0	Lateral

## Case Vehicle Occupant Protection Systems

The Chevrolet Cavalier 2-door coupe 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.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical I-configuration cover flaps which were not damaged. The circular air bag was equipped with one vent port and no tether straps. No contact evidence was found on the bag and the bag was not damaged.

The front right air bag was housed in the mid-instrument panel position. The single air bag module cover flap was a rectangular configuration and was not damaged. The rectangular air bag was equipped with one vent port and no tether straps. No contact evidence was found on the bag and the bag was not damaged.

## Case Vehicle Occupant Demographics

**Table 5. Case Vehicle Occupant(s) Demographics**

	Occupant 1		Occupant 2	
Age/Sex:	32/Female		6/Female	
Seated Position:	Front left		Back center	
Seat Type:	Bucket with folding back - cloth covered		Bench with folding back - cloth covered	
Height (cm/in.):	173	68	91	36
Weight (kg/lbs):	73	160	20	45
Pre-existing Medical Condition:	None noted		None noted	
Body Posture:	Normal, upright facing forward		Unknown	
Hand Position:	Both on steering wheel		Unknown	
Foot Position:	On floor or foot controls		Unknown	
Restraint Usage:	Manual lap/shoulder restraint		Manual lap restraint	
Air bag:	Deployed redesigned air bag system		Deployed redesigned air bag system	



**Figure 5.** Interior, case vehicle. Driver's frontal air bag)

## Occupant Injuries

**Table 6. Injuries (V1 Occupant 1)**

Injury	Injury Severity (AIS)	Injury Mechanism
Right kidney contusion	2	Lap belt
Cervical strain	1	Impact forces
Left shoulder contusion	1	Shoulder belt
Right hip contusion	1	Lap belt

## *Occupant Kinematics*

The driver (case occupant 01) of the Chevrolet Cavalier was seated in a normal upright posture in the front left position of the vehicle. She was wearing the manual lap/shoulder restraint. The back center passenger (case occupant 02) was seated in an unknown posture and was wearing the manual lap restraint. Seat belt usage was determined by visual inspection by the researcher, observations of the investigating officer at the scene of the crash, and statements by the driver. The driver reported that there were no pre-impact avoidance maneuvers performed so the occupants should not have significantly moved prior to the impact.

At impact, the occupants reacted to the 30 degree principle direction of force by moving forward and right loading the restraint systems. As the lap/shoulder restraint locked, further frontal movement of the driver was prevented. Impact with the locked restraint caused several injuries-right kidney contusion, left shoulder contusion, and right hip contusion. The occupant also sustained a cervical strain most likely caused by impact forces, not direct contact. As the lap belt locked, the back seat occupant's lower torso was prevented from further frontal movement. Due to the lack of a shoulder belt, the occupant pitched forward causing heavy abdominal pressure. The occupant reported that her "stomach hurt" as a result of striking the belt. Neither occupant was transported from the scene and neither occupant sought medical treatment at a later time.



**Figure 6.** Interior, case vehicle.



**Figure 7.** Interior, case vehicle.

Scene Diagram

