

Remote, Redesigned Air Bag Special Study

**FOR NHTSA'S INTERNAL USE ONLY**

Dynamic Science, Inc., Case Number (1999-48-134C)

1998 Chevrolet Cavalier

Alabama

August, 1999

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<p>16. Abstract</p> <p>This remote investigation was focused on the redesigned air bag system deployment of a 1998 Chevrolet Cavalier two-door sedan. This two vehicle angled crash took place during the late morning hours of summer day in August, 1999. This crash took place at a four-leg intersection. The bituminous roadway was dry at the time of the crash. The west leg of the intersection consists of two eastbound through lanes, one left turn only lane, and one right turn only lane. There are two westbound travel lanes present. There is a grass-covered median that separates the west and eastbound travel lanes. The south leg of the intersection consists of one northbound lane and one southbound lane. There is a stop sign for northbound traffic. The speed limit is 72 km/h (45 mph) for all the roadways.</p> <p>The case vehicle (Vehicle 2) is a 1999 Chevrolet Cavalier two-door sedan driven by a properly restrained 44-year-old female (163 cm/64 in., 100 kg/220 lbs.). Vehicle 2 was traveling eastbound in the second travel lane at an unknown speed. Vehicle 1, a 1992 Nissan Stanza driven by a restrained 22-year-old female, was traveling northbound.</p> <p>As Vehicle 1 entered the intersection at a reported travel speed of 16 km/h (9.9 mph), intending to turn to the west, the driver of Vehicle 2 saw Vehicle 1 and began braking (no lockup). The driver could not stop in time and Vehicle 1 was struck in the left side (09LPEW3) by the front of Vehicle 2 (12FDEW1). The frontal impact was of sufficient force to deploy the redesigned air bags in Vehicle 2. The calculated Delta V for Vehicle 2 (Chevrolet Cavalier) was 23 km/h (14 mph) with a longitudinal Delta V of -23 km/h (-14 mph). The Delta V for Vehicle 1 (Nissan Stanza) was computed at 22 km/h (14 mph). Vehicle 2 was rotated in a counterclockwise rotation before coming to rest.</p> <p>The 44-year-old female driver of Vehicle 2 sustained a contusion to the center of her chest, as well as lumbar and cervical spine strains. She was transported by ground ambulance to a local trauma center where she was treated and released. She lost seven days of work due to the crash.</p> <p>Both vehicles were towed from the scene due to damage.</p>			
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***Summary***

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Chevrolet Cavalier two-door coupe. This two vehicle angled crash took place during the late morning hours of summer day in August, 1999. This crash took place at a four-leg intersection. The bituminous roadway was dry at the time of the crash. The west leg of the intersection consists of two eastbound through lanes, one left turn only lane, and one right turn only lane. There are two westbound travel lanes present. There is a grass-covered median that separates the west and eastbound travel lanes. The south leg of the intersection consists of one northbound lane and one southbound lane. There is a stop sign for northbound traffic. The speed limit is 72 km/h (45 mph) for all the roadways.



**Figure 1.** Vehicle 1--approach to area of impact

The case vehicle (Vehicle 2) is a 1999 Chevrolet Cavalier two-door sedan driven by a properly restrained 44-year-old female (163 cm/64 in., 100 kg/220 lbs.). Vehicle 2 was traveling eastbound in the second travel lane at an unknown speed. Vehicle 1, a 1992 Nissan Stanza driven by a restrained 22-year-old female, was traveling northbound.

***Crash Events***

As Vehicle 1 entered the intersection at a reported travel speed of 16 km/h (9.9 mph), intending to turn to the west, the driver of Vehicle 2 saw Vehicle 1 and began braking (no lockup). The driver could not stop in time and Vehicle 1 was struck in the left side (09LPEW3) by the front of Vehicle 2 (12FDEW1). The frontal impact was of sufficient force to deploy the redesigned air bags in Vehicle 2.



**Figure 2.** Exterior, Vehicle 2 (case vehicle)

The calculated Delta V for Vehicle 2 (Chevrolet Cavalier) was 23 km/h (14 mph) with a longitudinal Delta V of -23 km/h (-14 mph). The Delta V for Vehicle 1 (Nissan Stanza) was computed at 22 km/h (14 mph)<sup>1</sup>. Vehicle 2 was rotated in a counterclockwise rotation before coming to rest.

The 44-year-old female driver of Vehicle 2 sustained a contusion to the center of her chest, as well as lumbar and cervical spine strains. She was transported by ground ambulance to a local trauma center where she was treated and released. She lost seven days of work due to the crash.

Both vehicles were towed from the scene due to damage.



Figure 3. Exterior, Vehicle 1

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	23	14.3	22	13.7
Longitudinal	-23	-14.3	-4	-2.5
Lateral	-4	-2.5	21	13

**Exterior of Case Vehicle**

Table 2. Vehicle Information

Model year, make and model	1998 Chevrolet Cavalier 2-door sedan
VIN	3G1JC1243WSxxxxxx
CDC	12FDEW1



Figure 4. Exterior, Vehicle 2 (case vehicle)

<sup>1</sup> Calculated utilizing the Damage Only Mode of the WinSmash 1.2.1 program

**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	143	6	1	0	0	0	0
	56.3	2.4	0.4	0	0	0	0

***Interior of Case Vehicle***

The interior of the 1998 Chevrolet Cavalier was undamaged as a result of this moderate frontal crash. The case vehicle maintained its integrity and there were no intruding components. There was a light brown cloth transfer to the right side of the driver’s air bag, a scratching contact to the transmission lever, and the mirror had been moved. This vehicle is equipped with bucket seats with folding backs and adjustable head restraints. Both front seats were in the middle track position. The second row was equipped with a bench seat with folding backs. There was no intrusion or integrity loss.

***Case Vehicle Occupant Protection Systems***

The 1998 Chevrolet Cavalier two-door coupe was equipped with a redesigned air bag system which consisted of a crash sensor diagnostic control module, air bag warning lamp, front left and front right air bag modules which housed the air bags and inflator units. The front left air bag was housed in the steering wheel hub and was concealed by symmetrical double vertical module cover flaps. The circular air bag was an untethered design equipped with two vent port holes. The lower instrument panel is equipped with a rigid plastic knee bolster. There was no discernible contact damage to the knee bolster, air bag, or module cover flaps.

The front right air bag was located on the instrument panel, top surface plane. The module flap cover is rectangular in design and broke the laminated windshield glazing upon deployment. The air bag was not equipped with either tethers or vent port holes. There were no indications of damage or contact to either the air bag or the module cover.



**Figure 5.** Interior, Vehicle 2—left front seat position



**Figure 6.** Interior, Vehicle 2

## *Case Vehicle Occupant Demographics*

Occupant 1  
Age/Sex: 44/Female  
Seated Position: Front left  
Seat Type: Bucket with folding back  
Height (cm/in.): 163 64.2  
Weight (kg/lbs.): 100 220  
Pre-existing Medical Condition: None noted  
Body Posture: Upright, normal  
Hand Position: Unknown  
Foot Position: Unknown  
Restraint Usage: Lap and shoulder belt used properly  
Air bag: Deployed at impact

## *Occupant Injuries*

**Table 4. Injuries**

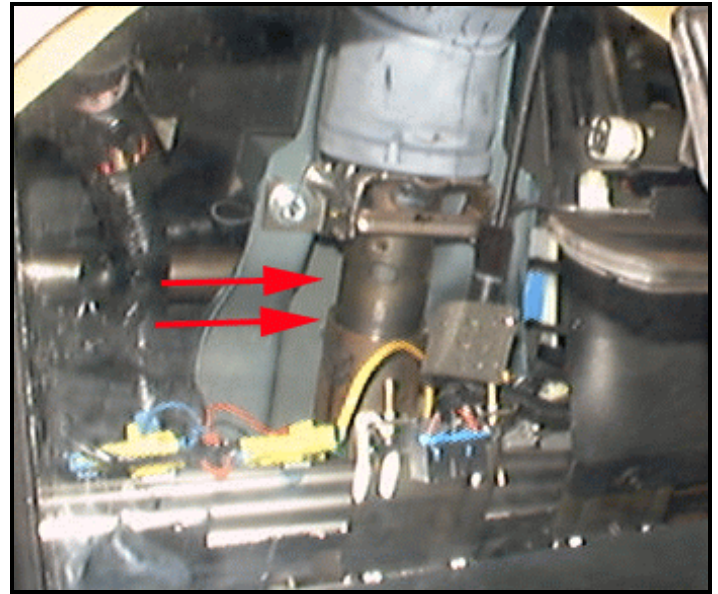
<b>Injury</b>	<b>Injury Severity (AIS)</b>	<b>Injury Mechanism</b>
Lumbar spine strain	1	Seat, back support
Chest contusion	1	Air bag/seat belt
Cervical spine strain	1	Air bag

### ***Occupant Kinematics***

The 44-year-old female driver of the Chevrolet Cavalier was wearing the available three-point manual lap and shoulder belt. She was seated in a forward facing position. The cloth-covered bucket seat was in the middle track position. Prior to impact, the driver began braking (no lockup). At impact, the driver reacted to the slight positive principle direction of force by moving forward and to the right. The driver's forward momentum was restrained by the lap and shoulder harness but there appears to have been some significant loading of the air bag. This was evidenced by what appears to be some compression of the steering column (see Figure 8). This contact likely caused the chest contusion.



**Figure 7.** Interior, Vehicle 2



**Figure 8.** Steering column

*Scene Diagram*

