Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-075-801E)

1998 Chevrolet Cavalier, Two-Door Coupe

Colorado

July/1998

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16. Abstract

This remote investigation focused on the depowered air bag system deployment of a 1998 Chevrolet Cavalier two-door Coupe. This single vehicle crash occurred in the late morning hours in July of 1998. The weather was clear and the level bituminous roadway surface was dry. This crash occurred in the center median area of the eastbound travel lanes. A strong post W-beam guardrail barrier separates the four eastbound travel lanes from the three westbound travel lanes. The one-way eastbound roadway is comprised of a deceleration off-ramp lane and three through lanes. There are no traffic controls at the crash location. The posted speed limit is 89 km/h (55 mph) for both east and westbound roadways. Vehicle 1, a 1998 Chevrolet Cavalier two-door coupe was driven by a fully restrained 26 year old female (165 cm /65 in., 54 kg/119 lbs.) who was traveling in lane four (outboard travel lane) of the eastbound travel lanes at a police reported estimated speed of 113 km/h (70 mph). Police reported that the driver of Vehicle 1 was weaving in and out of travel lanes while passing slower moving vehicles prior to the crash. Driver 1 was overtaking a slower moving vehicle which was in lane 3, when she allowed her vehicle to drift over the north road edge line. The front left corner (12FLEE4) of Vehicle 1 impacted the guardrail and strong post structure. Both the driver and passenger air bags deployed . The longitudinal delta V of 14.4 km/h (8.9 mph) was at the borderline threshold necessary for air bag deployment. The initial guardrail impact deflected Vehicle 1in a clockwise direction as the left quarter-panel impacted the guard-rail in a secondary separate impact (09LBEW1). Vehicle 1 sustained a lateral delta V of 5 km/h (3.1 mph) as a result of this impact. The vehicle was deflected back onto the roadway entering lane 4 while engaged in a clockwise yaw. Vehicle 1 rotated approximately 165 degrees in a clockwise fashion before coming to rest slightly askew in lane 3 and facing southwest. The driver of Vehicle 1 sustained a cervical neck strain (whiplash injury) as a result of her interaction with the deploying drivers air bag. She was transported to a local hospital where she was treated and released the same day.

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Summary

This remote investigation focused on the depowered air bag system deployment of a 1998 Chevrolet Cavalier two-door coupe. This single vehicle crash occurred in the late morning hours in July of 1998. The weather was clear and the level bituminous roadway surface was dry. This crash occurred in the center median area of the eastbound travel lanes. A strong post W-beam guardrail barrier separates the four eastbound travel lanes from the three westbound travel lanes. The one-way eastbound roadway is comprised of a deceleration off-ramp lane and three through lanes. There are no traffic controls at the crash location. The posted speed limit is 89 km/h (55 mph) for both east and westbound roadways.

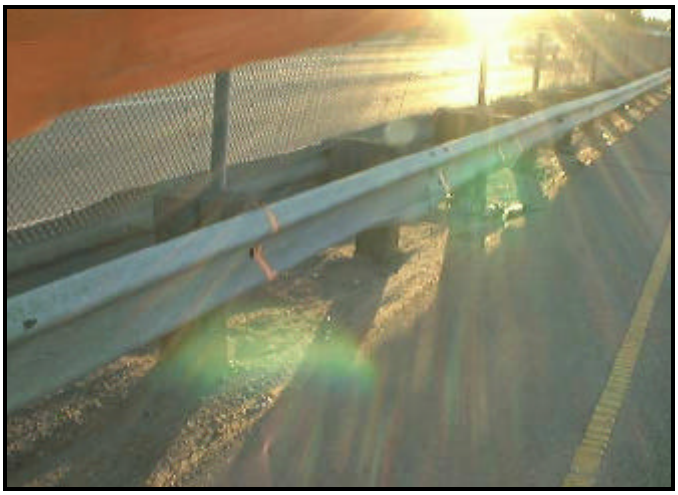

Figure 1. Primary Point of Impact

Vehicle 1, a 1998 Chevrolet Cavalier two-door coupe was driven by a fully restrained 26 year old female (165 cm/65 in., 54 kg/119 lbs.) who was traveling in lane four (outboard travel lane) of the eastbound travel lanes at a police reported estimated speed of 113 km/h (70 mph). Police reported that the driver of Vehicle 1 was weaving in and out of travel lanes while passing slower moving vehicles, prior to the crash. Driver 1 was overtaking a slower moving vehicle which was in lane, when she allowed her vehicle to drift over the north road edge line. The front, left corner (12FLEE4) of Vehicle 1 impacted the guardrail and strong post structure. Both the driver and passenger air bags deployed.

Figure 2. Frontal Deformation to Vehicle 1

The longitudinal delta V of 14.4 km/h (8.9 mph) was at the borderline threshold necessary for air bag deployment. The initial guardrail impact deflected Vehicle 1 in a clockwise direction as the left quarter-panel impacted the guardrail in a secondary separate impact (09LBEW1). Vehicle 1 sustained a lateral delta V of 5 km/h (3.1 mph) as a result of this impact.

Figure 3. Close-up View of Frontal Damage to Vehicle 1

The vehicle was deflected back onto the roadway entering lane 4 while engaged in a clockwise yaw. Vehicle 1 rotated approximately 165 degrees in a clockwise fashion before coming to rest slightly askew in lane 3 and facing southwest.

The driver of Vehicle 1 sustained a cervical neck strain (whiplash injury) as a result of her interaction with the deploying drivers air bag. She was transported to a local hospital where she was treated and released the same day.

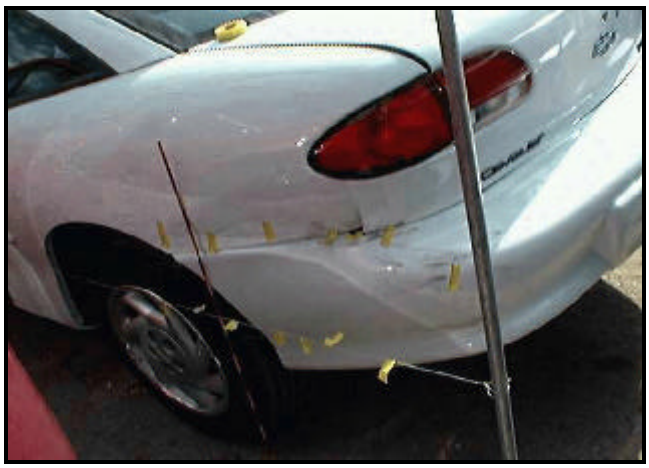

Figure 4. Secondary Impact with Guardrail

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	14.4	8.9	Barrier / NA	0
Longitudinal	-14.4	-8.9	Barrier / N/A	0
Lateral	2.5	1.6	Barrier / N/A	0

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Chevrolet Cavalier, Two-Door Coupe
VIN	1G1JC1247W7xxxxxx
CDC's	12FLEE4 (Primary) / 09LBEW1(Secondary)

Figure 5. Secondary Impact to Left Quarter-Panel and Bumper

Figure 6. Frontal Primary Impact Vehicle 1 (1998 Chevrolet Cavalier)

Table 3. Crush Measurements (Primary Impact)

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.
Front Bumper	131	8	7	3	1	0	0
	51.6	3.1	2.8	1.2	0.4	0	0

Table 4. Crush Measurements (Secondary Impact)

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.
Left Side	55	4	7	8	7	4	1
	21.7	1.6	2.8	3.1	2.8	1.6	.4

Interior of Case Vehicle

Damage to the interior of the 1998 Chevrolet Cavalier was isolated to windshield glazing damage. The damage to the windshield was due to the passenger side air bag module flap contacting the windshield during deployment. There were no intruding components and no discernible areas of occupant contact.

This vehicle was equipped with front bucket seats and a rear bench seat with folding backs. The driver's front, left bucket seat was in the slightly reclined position prior to the impact. The front seats are equipped with adjustable head restraints-which were not damaged during the collision.

Case Vehicle Occupant Protection Systems

The 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 seats are equipped with active three-point lap and shoulder restraints with non-adjustable anchorage adjustments.

Figure 7. Interior of Case Vehicle

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. The 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 8. View Showing Deployed Air Bag

Case Vehicle Occupant Demographics

	Occupant 1
Age/Sex:	26/Female
Seated Position:	Front Left
Seat Type:	Bucket-cloth covered
Height (cm/in:):	165 64.9
Weight (kg/lbs).:	54 119
Pre-existing Medical Condition:	None Reported
Body Posture:	Normal /Upright
Hand Position:	Unknown
Foot Position:	Right foot likely on accelerator pedal
Restraint Usage:	Active three-point lap and shoulder belt reportedly utilized properly
Air bag:	Driver air bag, deployed as a result of the primary impact

Occupant Injuries

Table 6. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Cervical Neck Strain (Whiplash)	1	Air bag interaction

Occupant Kinematics

The 26 year old female driver of the Chevrolet Cavalier was situated in the front left position in an upright and normal driving posture. She was fully restrained by the available three-point manual lap and shoulder belt. She reportedly was wearing the manual restraint system in a normal fashion with the shoulder belt flush against her chest and upper torso.

The driver responded to the 350 degree principle Direction of Force by moving forward. She loaded the lap belt webbing which prohibited further forward motion of her lower torso. Her upper torso/chest pitched forward, loading the shoulder restraint webbing. Upon air bag deployment, her head pitched slightly downward making contact with the air bag. As the air bag achieved the maximum inflation level, her head pivoted rearward resulting in a cervical neck strain/ whiplash injury (AIS-1).

The secondary impact to the left quarter panel/ bumper region was not of sufficient force to significantly displace the driver. In response to the primary impact, she rebounded rearward making contact with the seatback support. She remained in her pre-impact seated position as the case vehicle came to final rest.

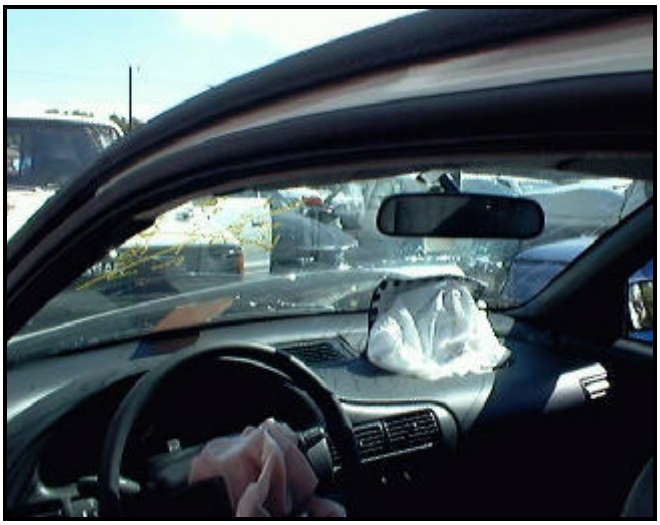

Figure 9. Interior, case vehicle/ windshield and upper instrument panel

Figure 10. View showing deployed air bag/injury causing mechanism

Scene Diagram