

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-049-206C)

1999 Chevrolet Corvette

Texas

December/1998

**Technical Report Documentation Page**

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16. Abstract  This remote investigation focused on the redesigned air bag system deployment of a 1999 Chevrolet Corvette 3-door hatchback. This crash occurred in December, 1998 in the morning. The weather was clear and the concrete roadway was dry. The crash occurred on a four lane straight and level divided roadway. The road contains three northbound lanes, three southbound lanes, and left turn lanes for each direction. Northbound traffic is separated from southbound traffic by a raised concrete median. The speed limit for this road is 48 kmph (30 mph). There are no traffic controls at the area of impact. Vehicle 1, a 1997 Chevrolet Cavalier 2-door coupe driven by a 22 year old female, was traveling north in the northbound left turn lane preparing to make a left turn onto a private driveway. The driver was restrained by the available manual lap/shoulder restraint. The front right seat was occupied by a 25 year old female who was also restrained by the available manual lap/shoulder restraint. Vehicle 2, a 1999 Chevrolet Corvette 3-door hatchback (case vehicle) driven by a 21 year old male (173 cm/68 in, 68 kg/150 lb), was traveling south in the southbound right lane at a driver estimated speed of 32-40 kmph (20-25 mph). The driver was not restrained. There were no other occupants in Vehicle 2. There was heavy southbound traffic at the time of the collision and traffic in the center and left lanes had stopped to allow Vehicle 1 to make the turn. The driver of Vehicle 1 initiated the left turn and began crossing the southbound lanes. The driver of Vehicle 2 did not realize that Vehicle 1 was turning and the front plane of Vehicle 2 (11FDEW1) struck the right plane of Vehicle 1 (02RYEW3) in the southbound right lane. A Delta V was calculated for this event for Vehicle 2, utilizing WinSMASH, as 19 kmph (12 mph) with a longitudinal Delta V of -19 kmph (-12 mph). As a result of the frontal impact, the supplemental restraint system (driver and passenger side redesigned air bags) of the case vehicle deployed. After the impact, Vehicle 1 rotated counter-clockwise approximately 55 degrees and came to rest with its front wheels up on the east curb facing southwest. Vehicle 2 rotated clockwise approximately 15 degrees after impact and came to rest in the driveway facing southwest. The driver of the case vehicle sustained injuries but received on-scene treatment only from paramedics. The driver of Vehicle 1 sustained injuries but received on-scene treatment only from paramedics. The right front passenger of Vehicle 1 sustained incapacitating injuries and was transported from the scene to a hospital where she was treated and released. Both vehicles became disabled from damage sustained in the crash and were towed from the scene.			
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**Summary**

This remote investigation focused on the redesigned air bag system deployment of a 1999 Chevrolet Corvette 3-door hatchback. This crash occurred in December, 1998 in the morning. The weather was clear and the concrete roadway was dry. The crash occurred on a four lane straight and level divided roadway. The road contains three northbound lanes, three southbound lanes, and left turn lanes for each direction. Northbound traffic is separated from southbound traffic by a raised concrete median. The speed limit for this road is 48 kmph (30 mph). There are no traffic controls at the area of impact.

Vehicle 1, a 1997 Chevrolet Cavalier 2-door coupe driven by a 22 year old female, was traveling north in the northbound left turn lane preparing to make a left turn onto a private driveway. The driver was restrained by the available manual lap/shoulder restraint. The front right seat was occupied by a 25 year old female who was also restrained by the available manual lap/shoulder restraint.

Vehicle 2, a 1999 Chevrolet Corvette 3-door hatchback (case vehicle) driven by a 21 year old male (173 cm/68 in, 68 kg/150 lb), was traveling south in the southbound right lane at a driver estimated speed of 32-40 kmph (20-25 mph). The driver was not restrained. There were no other occupants in Vehicle 2.



**Figure 1.** Exterior, Vehicle 1 (1997 Chevrolet Cavalier)



**Figure 2.** Exterior, Vehicle 2 (1999 Chevrolet Corvette)

**Crash Events**

There was heavy southbound traffic at the time of the collision and traffic in the center and left lanes had stopped to allow Vehicle 1 to make the turn. The driver of Vehicle 1 initiated the left turn and began crossing the southbound lanes. The driver of Vehicle 2 did not realize that Vehicle 1 was turning and the front plane of Vehicle 2 (11FDEW1) struck the right plane of Vehicle 1 (02RYEW3) in the southbound right lane.

A Delta V was calculated for this event for Vehicle 2, utilizing WinSMASH, as 19 kmph (12 mph) with a longitudinal Delta V of -19 kmph (-12 mph).



**Figure 3.** Crash scene, approach to impact (V2 perspective)

As a result of the frontal impact, the supplemental restraint system (driver and passenger side redesigned air bags) of the case vehicle deployed.

After the impact, Vehicle 1 rotated counter-clockwise approximately 55 degrees and came to rest with its front wheels up on the east curb facing southwest. Vehicle 2 rotated clockwise approximately 15 degrees after impact and came to rest in the driveway facing southwest.

The driver of the case vehicle sustained injuries but received on-scene treatment only from paramedics. The driver of Vehicle 1 sustained injuries but received on-scene treatment only from paramedics. The right front passenger of Vehicle 1 sustained incapacitating injuries and was transported from the scene to a hospital where she was treated and released.

Both vehicles became disabled from damage sustained in the crash and were towed from the scene.

**Table 1. Delta V**

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	19	11.8	22	13.7
Longitudinal	-19	-11.8	-11	-6.8
Lateral	5	3.1	-19	-11.8
Barrier speed	23	14.3	17	10.6

**Exterior of Case Vehicle**

**Table 2. Vehicle Information**

Model year, make and model	1999 Chevrolet Corvette
VIN	1G1YY22G5X5
CDC	11FDEW1



**Figure 4.** Exterior, Vehicle 2 (1999 Chevrolet Corvette)



**Figure 5.** Exterior, Vehicle 2 (1999 Chevrolet Corvette)

**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	103	8	13	14	19	20	12
	40.6	3.1	5.1	5.5	7.5	7.9	4.7



### ***Interior of Case Vehicle***

The interior of the Chevrolet Corvette sustained minor damage from occupant contact. There were no areas of intrusion into the passenger compartment. The driver reported that his left wrist contacted the driver side air bag and windshield. A spider web crack was noted on the windshield indicative of occupant contact.

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 middle track positions. Both front seats were equipped with integral head restraints which were not damaged in the crash. There are no back seats in this vehicle.

### ***Case Vehicle Occupant Protection Systems***

The Chevrolet Corvette 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 two tether straps and two vent ports. Contact evidence consisting of a small cloth transfer was found on the lower half of the front of the bag from contact with the driver's chest. The air bag was not damaged in the crash.



**Figure 6.** Interior, case vehicle. Driver's side air bag.

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 tether strap and no vent ports. No contact evidence was found on the air bag and the bag was not damaged in the crash.

## *Case Vehicle Occupant Demographics*

**Table 4. Case Vehicle Occupant Demographics**

	Occupant 1
Age/Sex:	21/Male
Seated Position:	Front left
Seat Type:	Bucket with folding back - leather covered
Height (cm/in.):	173      68
Weight (kg/lbs):	68      150
Pre-existing Medical Condition:	None noted
Body Posture:	Normal, upright facing forward in seat
Hand Position:	Both on steering wheel, unknown positions
Foot Position:	On floor or foot controls
Restraint Usage:	None used
Air bag:	Deployed redesigned air bag system

## *Occupant Injuries*

**Table 5. Injuries**

<b>Injury</b>	<b>Injury Severity (AIS)</b>	<b>Injury Mechanism</b>
Contusion left wrist (2" diameter)	1	Air bag + Windshield

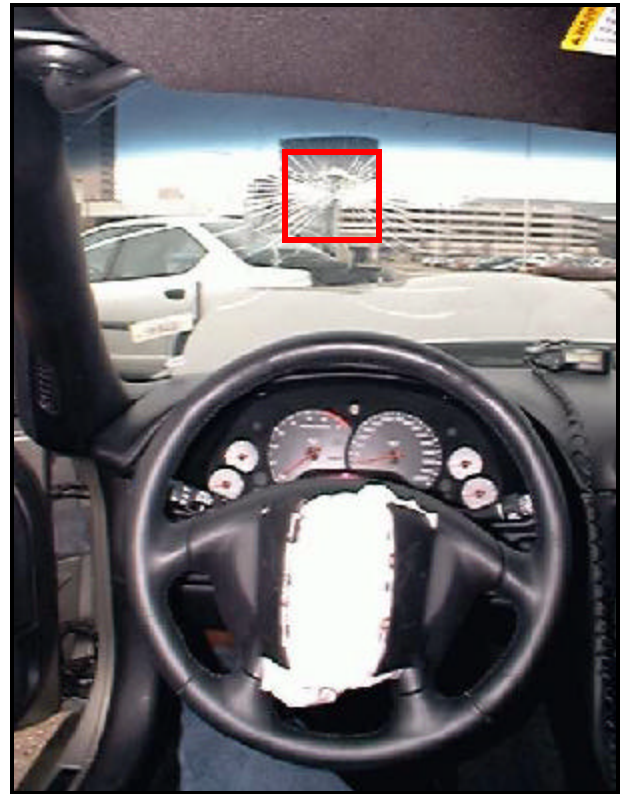
## ***Occupant Kinematics***

The driver (case occupant 01) of the Chevrolet Corvette 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 of the crash. Seat belt usage was determined through visual inspection by the researcher. The driver reported that prior to the collision he applied the brakes which locked-up. It does not appear however that the occupant contacted any component of the vehicle's interior prior to impact.

At impact, the driver reacted to the 345 degree principle direction of force by moving forward and slightly left. The driver is believed to have engaged the deploying air bag with his chest-causing no injuries (see figure 7). The driver reported that the force of the deploying air bag propelled his left hand into the windshield-causing the left wrist contusion (see figure 8). No other injuries were sustained by the case occupant. The driver required on-scene medical treatment only for this injury.



**Figure 7.** Interior, case vehicle. Air bag contact.



**Figure 8.** Interior, case vehicle. Box shows w/s contact.



Scene Diagram

