Certified Advanced 208-Compliant Air Bag Investigation/Vehicle to Objects
Dynamic Science, Inc./Case Number: DS06011
2006 Chevrolet Cobalt
Nevada
March 2006

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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16. Abstract

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) air bag system in a 2006 Chevrolet Cobalt. The multi-stage air bags were certified by the manufacturer to meet the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This single vehicle crash occurred in March 2006 during daylight hours in an urban area of Nevada. The crash occurred on a two-way divided state freeway. The case vehicle was a 2006 Chevrolet Cobalt four-door sedan being driven by a restrained 31-year-old female. There were no other occupants in the vehicle. The Cobalt was traveling southbound in the inside lane of a curved, three lane US highway. The roadway was bordered by concrete barriers. Prior to the crash, a ladder had fallen from an unknown southbound vehicle and had come to rest in the inside travel lane. As the Cobalt came upon the ladder, the driver steered to the right in order to avoid striking the object. The driver lost control of the vehicle and the Cobalt began a clockwise rotation. As the vehicle continued its rotation, it crossed over the other two southbound travel lanes and the front of the vehicle struck the right side concrete barrier, resulting in the deployment of the driver's front air bag. The vehicle continued its rotation and struck the barrier a second time with its left rear. The vehicle came to final rest in the right lane, facing northeast. The driver of the Cobalt claimed a injury to an upper extremity but the details of the injury are not known. She was not treated by paramedics on-scene and was not transported for medical treatment. The Cobalt was towed from the scene due to damage and was later declared a total loss.

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Crash Investigation
Case Number: DS06011

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Background

Description:

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Figure 1. Front/Left - 2006 Chevrolet Cobalt

Figure 2. Back/Left - 2006 Chevrolet Cobalt

This CAC case was identified within a group of potential cases provided to the NHTSA by Nationwide Insurance. DSI received the spreadsheet containing the potential cases on April 11, 2006. DSI personnel located and obtained permission to inspect the case vehicle on May 5, 2006. Field work was completed during the week of May 10, 2006.

Summary

Crash Site

This single vehicle crash occurred in March 2006 at 1221 hours in an urban area of Nevada. The crash occurred on a two-way, level, curved, divided state freeway with three southbound travel lanes. The Cobalt was traveling southbound in the inside lane. The roadway was composed of asphalt, which was dry at the time of the crash. The freeway was bordered by concrete barriers. The posted speed limit was 89 km/h (55 mph).

Figure 3. Approach of case vehicle to area of impact (south)

Pre-Crash

The case vehicle was a 2006 Chevrolet Cobalt four-door sedan being driven by a restrained 31-year-old female. There were no other occupants in the vehicle. Prior to the crash, a ladder had fallen from an unknown southbound vehicle and had come to rest in the inside lane. As the Cobalt came upon the ladder, the driver steered to the right in order to avoid striking the object.

Crash

When the driver steered right, she lost control of the vehicle and the Cobalt began a clockwise rotation. As the vehicle continued its rotation, it crossed over the other two southbound lanes and the front of the vehicle (11FYEE2) struck the right side concrete barrier, resulting in the deployment of the driver's front air bag. The barrier equivalent routine of the WinSmash program computed a total delta V of 32.0 km/h (19.9 mph). The longitudinal and lateral components were -30.1 km/h (-18.7 mph) and 10.9 km/h (6.8 mph), respectively. The vehicle continued its rotation and struck the barrier a second time with its left rear (09LBEW2). The vehicle came to rest in the right lane, facing northeast.

Post-Crash

The driver of the Cobalt claimed a minor injury to an upper extremity. According to the police report, she was not medically treated at the scene and was not transported for treatment. The Cobalt was towed from the scene due to damage and was later declared a total loss.

Vehicle Data - 2006 Chevrolet Cobalt LT Level 2

The 2006 Chevrolet Cobalt was identified by the Vehicle Identification Number (VIN): 1G1AL55FX67xxxxxx. The Cobalt is a four-door sedan with seating for five. The case vehicle was equipped with a 2.2 liter four cylinder engine, a four speed automatic transmission, front wheel drive, four wheel disc ABS, daytime running lights, and a multi-function steering wheel including steering wheel mounted remote audio controls and a tilt adjustment.

The 2006 Chevrolet Cobalt was equipped with Pirelli Four Seasons P205/55R16 tires. The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	248 kPa (36 psi)	7 mm (9/32 in)	No	None
LR	262 kPa (38 psi)	8 mm (10/32 in)	No	Bottom section of tire slanted inward
RR	276 kPa (40 psi)	8 mm (10/32 in)	No	None
RF	248 kPa (36 psi)	8 mm (10/32 in)	No	None

The front row seating in the Cobalt was configured with dual fabric covered bucket seats. The seats were equipped with adjustable head restraints that were not damaged. The second row was configured as a fabric covered bench seat with folding backs. The outboard seating positions in the second row were equipped with adjustable head restraints that were not damaged.

Vehicle Damage

Exterior Damage - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt sustained moderate front end damage as a result of the first impact with the concrete barrier. The case vehicle sustained 30.0 cm (11.8 in) of direct damage along the front bumper, beginning at the left front bumper corner, extending to the right. The left wheelbase was shortened by 2.0 cm (0.8 in). Six crush measurements were documented along the front bumper as follows: C1=36.0 cm (14.1 in), C2=34.0 cm (13.4 in), C3=20.0 cm (7.9 in), C4=18.0 cm (7.1 in), C5=14.0 cm (5.5 in), C6=22.0 cm (8.6 in).

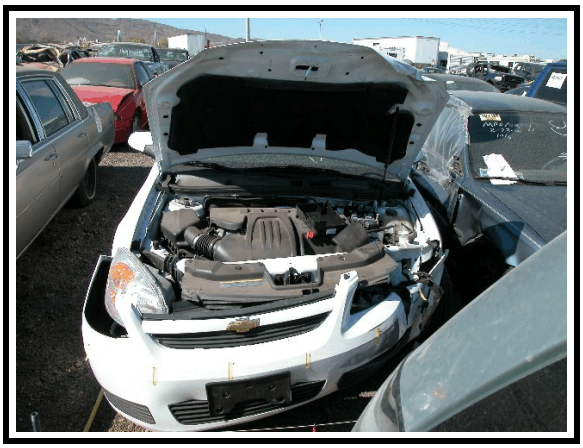

Figure 4. Front - 2006 Chevrolet Cobalt

The case vehicle sustained moderate left side damage as a result of the secondary impact with the concrete barrier. The case vehicle sustained 108.0 cm (42.5 in) of direct damage along the left side beginning at the left rear bumper corner, extending forward along the left side of the vehicle. The bottom of the left rear tire was angled inward as a result of the impact. Four crush measurements were documented along the left side as follows: C1=10.0 cm (3.9 in), C2=8.0 cm (3.1 in), C3=4.0 cm (1.6 in), C4=4.0 cm (1.6 in).

Figure 5. Left rear damage - 2006 Chevrolet Cobalt

CDC (Impact 1):	11FLEE2	
(Impact 2):	09LBEW2	
Delta V (Impact 1):	Total	32.0 km/h (19.9 mph)
	Longitudinal	-30.1 km/h (-18.7 mph)
	Latitudinal	10.9 km/h (6.8 mph)
	Energy	55,273 joules (40,767 ft lbs)

Interior Damage - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt sustained minor interior damage due to normal air bag deployment related damage.

The driver's B pillar seat belt pretensioner actuated during the collision and was locked in place post-crash. The front right seat belt retractor also actuated and was locked in the stowed position.

There was no intrusion, no integrity loss and no damage or evidence of occupant contact to any of the vehicle glazing. All four doors remained closed and operational.

Manual Restraints Systems - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt was configured with manual 3-point lap and shoulder belts for each of the five seating positions. The front seat belts were equipped with B-pillar pretensioners with load limiters and seat belt height adjusters. Both pretensioners actuated during the crash. The driver's seat belt height adjuster was in the full up position and the right front adjuster was in the full down position. The driver's safety belt was configured with a sliding latch plate and an emergency locking retractor (ELR). The right front safety belt had a sliding latch plate and a switchable ELR/Automatic Locking Retractor. All three second row seat belts were equipped with sliding latchplates and switchable retractors.

The three second row seating positions were equipped with the lower anchor points that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. All three seating positions were also equipped with child safety seat top tether anchor points.

Supplemental Restraint Systems - 2006 Chevrolet Cobalt

The Chevrolet Cobalt was equipped with advanced occupant protection systems. The systems consist of the Sensing and Diagnostic Module (SDM), dual stage, "intelligent" Certified Advanced 208-Compliant driver and front right passenger air bags, including front right passenger sensors. The sensors are designed to detect the presence of a properly seated occupant and determine if the passenger frontal air bag should be deployed or not. In certain conditions the passenger sensing system will turn off the right front air bag. The multi-stage air bags were certified by the manufacturer to meet the requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208.

Figure 6. Driver's deployed air bag

The primary function of the SDM is to control the deployment of the occupant protection systems. The system records the vehicle's forward velocity change. Attempts were made to download the SDM data using the Vetronix Crash Data Retrieval system, but they were not successful due to a bus command error. It is possible that there was a short in the Data Link Connector (DLC). The SDM itself could not be accessed.

The Cobalt was not equipped with side impact air bags or side curtains.

As a result of the longitudinal deceleration of the Cobalt during the first impact with the barrier, the driver's front passenger air bag deployed and the seat belt pretensioner actuated.

Figure 7. Occupant sensors - Front right seat

The driver's air bag deployed from the center of the steering wheel hub through symmetrical I-configuration cover flaps. Each flap measured 7.0 cm (2.8 in) wide and 11.0 cm (4.3 in) high, with a semi-circular cutout located in the center of the flaps. The deployed driver air bag measured 45.0 cm (17.7 in) in diameter in its deflated state. The air bag had no tethers. There were two circular vent ports that were located at the 11 and 1 o'clock positions on the rear of the air bag. There was no damage or occupant contact visible on either the cover flaps or air bag.

The front right passenger air bag was a top instrument mount. The air bag did not deploy.

Occupant Demographics - 2006 Chevrolet Cobalt

	Driver
Age/Sex:	31/Female
Seated Position:	Front left
Seat Type:	Fabric covered bucket seat
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Presumed to be upright, forward facing
Hand Position:	Presumed to be on the steering wheel, actively steering
Foot Position:	Presumed to be on foot control(s)/floorboards
Restraint Usage:	Manual 3-point lap and shoulder belt available - used
Air bag:	Driver front air bag available - deployed

Occupant Injuries - 2006 Chevrolet Cobalt

Driver: Injuries obtained from the police report. The police report indicated that the driver "claimed"an injury to her upper extremity (specifics unknown).

Occupant Kinematics - 2006 Chevrolet Cobalt

Driver Kinematics

Figure 8. Driver's seat belt (Retractor pretensioner actuated)

The 31-year-old female driver appears to have been seated in an upright posture in the fabric covered bucket seat and was restrained by the available 3-point manual lap and shoulder belt. The shoulder belt anchorage was in the full up position. The seat was adjusted to the rearward most track position. The seat back was reclined at an 80 degree angle and the seat bottom had a 10 degree angle. During the initial impact, the driver's front air bag deployed and the left side safety belt pretensioner actuated. The female driver initiated a forward and slightly lateral trajectory towards the 11 o'clock direction of force. As the vehicle continued to rotate post-impact, the driver was held within her general seating area by the activated seat belt pretensioner. As the left rear of the case vehicle impacted the concrete barrier during the second crash event, the driver initiated a lateral trajectory. According to the police report, the driver claimed an injury to an upper extremity, but the specifics of this claimed injury are not known. Per the police report, this driver was not treated at the scene and was not transported for medical treatment.

Attachment 1. Scene Diagram