

Side Curtain Air Bag Investigation/Vehicle to Objects
Dynamic Science, Inc./Case Number: DS06016
2006 Chevrolet Cobalt SS Supercharged Coupe
Colorado
June 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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<p>This on-site investigation focused on the side curtain air bag system in a 2006 Chevrolet Cobalt. This single vehicle crash occurred in June 2006 at 2320 hours in an urban area of Colorado. The crash occurred on a three lane, two way roadway. The case vehicle was a 2006 Chevrolet Cobalt SS Supercharged two-door coupe being driven by an unrestrained 16-year-old male. There were no other occupants in the vehicle. The Cobalt was traveling east in lane one. In the pre-crash area, the eastbound lane is straight and then begins to curve to the left. The Cobalt driver did not successfully negotiate the curve and drove off the south side of the roadway. The Cobalt traveled over the south curb, crossed over a sidewalk and traveled up a grass strip that was adjacent to the sidewalk. The Cobalt continued in an eastbound direction and the right side of the case vehicle impacted a tree. This crash event resulted in the deployment of the Cobalt's driver and passenger front air bags, the deployment of the right side curtain and the actuation of the front row seat belt pretensioners. The right side damage from this impact resembled a sideswipe type impact, but as the Cobalt swiped past the tree, its right rear tire snagged on the tree, sending the vehicle into a clockwise rotation. The Cobalt continued east while in a clockwise yaw and the front of the Cobalt impacted a second tree. After striking the second tree, the vehicle was redirected back onto the roadway, crossed all of the travel lanes while still in a clockwise yaw, and the left front tire impacted the curb on the north side of the street, damaging the tire and axle. The Cobalt traveled over the north curb, slid through some low bushes and came to final rest on the north sidewalk, facing southwest. The driver was able to exit the vehicle without assistance and reported that the only injury he sustained was neck pain. The Cobalt was towed from the scene due to damage and was later declared a total loss.</p>		14. Sponsoring Agency Code	
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Background:

This on-site investigation focused on the side curtain air bag system in a 2006 Chevrolet Cobalt. This single vehicle crash occurred in June 2006 at 2320 hours in an urban area of Colorado. The crash occurred on a three lane, two way roadway. The case vehicle was a 2006 Chevrolet Cobalt SS Supercharged two-door coupe being driven by an unrestrained 16-year-old male. There were no other occupants in the vehicle.

The Cobalt was traveling east in lane one. In the pre-crash area, the eastbound lane is straight and then begins to curve to the left. The Cobalt driver did not successfully negotiate the curve and drove off the south side of the roadway. The Cobalt traveled over the south curb, crossed over a sidewalk and traveled up a grass strip that was adjacent to the sidewalk. The Cobalt continued in an eastbound direction and the right side of the case vehicle impacted a tree. This crash event resulted in the deployment of the Cobalt's driver and passenger front air bags, the deployment of the right side curtain and the actuation of the front row seat belt pretensioners. The right side damage from this impact resembled a sideswipe type impact, but as the Cobalt swiped past the tree, its right rear tire snagged on the tree, sending the vehicle into a clockwise rotation.

The Cobalt continued east while in a clockwise yaw, traveled approximately 22.1 m (72.5 ft) and the front of the Cobalt impacted a second tree. The case vehicle was nearly at a 90 degree angle to the tree at impact. After striking the second tree, the vehicle was redirected back onto the roadway, crossed all of the travel lanes while still in a yaw, and the left front tire impacted the curb on the north side of the street, damaging the tire and axle. The Cobalt traveled over the north curb, slid through some low bushes and came to final rest on the north sidewalk, facing southwest.



Figure 1. Front/Right - 2006 Chevrolet Cobalt



Figure 2. Front - 2006 Chevrolet Cobalt



Figure 3. 2006 Chevrolet Cobalt SS Supercharged - Exemplar vehicle

The driver was able to exit the vehicle without assistance and reported that the only injury he sustained was neck pain. He was transported to a local hospital where he was treated and released. The Cobalt was towed from the scene due to damage and was later declared a total loss.

This case was identified within a group of potential cases provided to the NHTSA. DSI received a fax on July 21, 2006 with instructions to locate the vehicle. The Cobalt was located and permission to inspect the vehicle was obtained on July 26, 2006. DSI was assigned the case on July 27, 2006. The original focus of this on-site investigation was to be on the case vehicle's Certified Advanced 208-Compliant (CAC) air bag system. During the vehicle inspection, it was determined that this particular Cobalt model was not equipped with CAC air bags. Field work was completed on August 4, 2006. Data from the electronic data recorder was downloaded using the Vetronix tool and is included as Attachment 2 in this report.

SUMMARY

Crash Site

This single vehicle crash occurred in June 2006 at 2320 hours in an urban area of Colorado. The crash occurred off the south side of a three-lane, two-way, undivided street. There was one eastbound and one westbound lane, separated by painted, no passing, double yellow lane lines. Adjacent to the eastbound lane was a dedicated bike lane separated from the travel lanes by a painted solid white lane line. Adjacent to the bike lane was a 15.0 cm (5.9 in) high curb, then a concrete sidewalk. Adjacent to the sidewalk was a strip of grass, which contained two trees. The sidewalk was level but the grassy strip sloped upward away from the roadway. Adjacent to the westbound lane was a dedicated bike lane, separated from traffic by painted white lane lines. North of the bike lane, there is an additional travel lane, intended to be used by westbound vehicles turning right at one of several intersections in the area. In the area where the Cobalt departed the north side of the street there was a 15.0 cm (5.9 in) high curb, some low shrubs, then a concrete sidewalk and a grassy area.



Figure 4. Approach of 2006 Chevrolet Cobalt to crash scene (east)



Figure 5. Probable roadway departure point (tire scuffs on curb)

In the pre-crash area, the eastbound lane configuration is straight, then curves to the left, then straightens out again for approximately 68.5 m (224.7 ft) and then curves to the right. There were no traffic controls in the immediate area. Both travel lanes were composed of asphalt and were dry at the time of the crash. The case vehicle's Electronic Data Recorder reported that the outside temperature was 20.5 Celsius (68.9 degrees Fahrenheit). There were no adverse weather conditions and no visual obstructions in the area. The crash occurred during evening hours and although it was dark, there were streetlights illuminating the roadway. The posted speed limit was 56 km/h (35 mph).

Pre-Crash

The case vehicle was a 2006 Chevrolet Cobalt two-door coupe being driven by an unrestrained 16-year-old male. There were no other occupants in the vehicle. The Cobalt was traveling east in the curb lane and was approaching the left curve. The investigating officer estimated the driver's pre-crash speed as 113 km/h (70 mph). The driver estimated his pre-crash speed as 68.4 km/h (42.5 mph). The Cobalt driver was not able to successfully negotiate the left curve and traveled off the south edge of the roadway.

Crash

The Cobalt went over the south curb, crossed the sidewalk and traveled up the grass strip that was adjacent to the sidewalk. The Cobalt continued traveling east and the right side of the case vehicle struck a tree (01RYEW2) with a trunk diameter of 0.4 m (1.3 ft). The barrier equivalent routine of the WinSmash program computed a Barrier Equivalent Speed of 12.0 km/h (7.5 mph). The WinSmash barrier delta V results are low, which can be attributed to the fact that this was a sideswipe type impact, up until the right rear tire snagged on the tree. The right rear tire damage could not be captured in terms that are translatable to the WinSmash program.

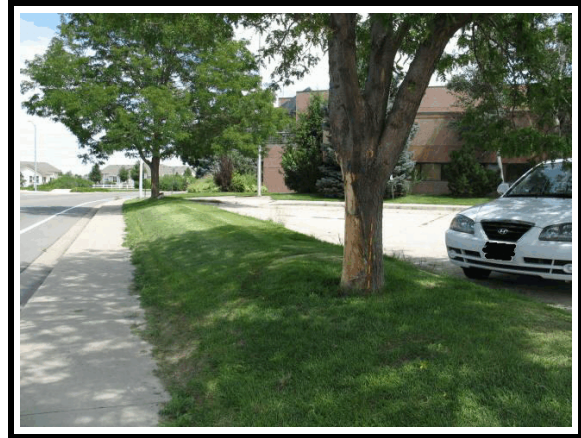


Figure 6. First struck tree (east)



Figure 7. Vehicle continues east towards another tree



Figure 8. Second struck tree

This crash event resulted in the deployment of the Cobalt's driver and passenger front air bags, the deployment of the right side curtain and the actuation of the front row seat belt pretensioners. The right side damage from this impact resembled a sideswipe type impact, but as the Cobalt swiped past the tree, its right rear tire snagged on the tree, sending the vehicle into a clockwise rotation.

The Cobalt continued east while in a yaw, traveled approximately 22.1 m (72.5 ft) and the front of the Cobalt impacted a second tree (10FZEW3), with a trunk diameter of 0.5 m (1.3 ft). The case vehicle was nearly at a 90 degree angle to the tree at impact. The barrier equivalent routine of the WinSmash program computed a total delta V of 25.0 km/h (15.5 mph). The longitudinal and lateral components were -8.6 km/h (-5.3 mph) and 23.5 km/h (14.6 mph), respectively. After striking the second tree, the vehicle was redirected back onto the roadway, crossed all of the travel lanes while still in a yaw, and the left front tire impacted the curb on the north side of the street (09LFWN1), damaging the tire and axle. The Cobalt traveled over the north curb, slid through some low bushes and came to final rest on the north sidewalk, facing southwest.

Post-Crash

The investigating officer reported that the driver sustained a "possible" injury. The driver reported neck pain following the crash. He was transported to a local hospital where he was treated and released. He had no diagnosed injuries. The Cobalt was towed from the scene due to damage and was later declared a total loss.



Figure 9. Case vehicle travels back onto the roadway, still out of control (northeast)



Figure 10. Case vehicle continues northeast towards the north curb



Figure 11. Area where the case vehicle departed the north side of the street (northeast)



Figure 12. Case vehicle travels through the low shrubs and onto the sidewalk (scrapes to sidewalk)



Figure 13. Looking back from final rest to the roadway (southwest)

Vehicle Data - 2006 Chevrolet Cobalt SS Supercharged Level 4

The 2006 Chevrolet Cobalt was identified by the Vehicle Identification Number (VIN): 1G1AP14P367xxxxxx. The Cobalt is a two door coupe with seating for five. The case vehicle was equipped with a 2.0 liter four-cylinder engine, a five speed manual transmission with overdrive, four wheel anti-lock brakes, daytime running lights, halogen fog lights and headlights, side guard door beams, a multi-function steering wheel including steering wheel mounted controls for audio and cruise control, and a tilt steering adjustment. The vehicle's digital odometer could not be read at the time of the inspection because there was no power to the instrument panel. The owner of the Cobalt estimated the mileage was 483 km (300 miles) at the time of the crash.

The 2006 Chevrolet Cobalt was equipped with Pirelli PZero Rosso P215/45R18 tires. The vehicle manufacturer's recommended cold tire pressure was 221 kPa (32 psi) for the front and rear and the maximum tire pressure was 345 kPa (50 psi). The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	186 kPa (27 psi)	7 mm (9/32 in)	No	Broke off axle
LR	186 kPa (27 psi)	8 mm (10/32 in)	No	Bottom of tire angled inward
RR	Flat	7 mm (9/32 in)	Yes	Tire holed, rim deformed
RF	Flat	7 mm (9/32 in)	Yes	Tire torn, rim damaged

The front row seating in the Cobalt was configured with dual leather covered bucket seats with folding backs. The seats were equipped with adjustable head restraints that were not damaged. Both front seats had plastic seat belt positioning devices attached near the bottom portion of the

head restraints. The driver's seat belt positioning device broke off when the left front belt pretensioner actuated. The second row was configured as a fabric covered 60/40 bench seat with folding backs. The two outboard second row seating positions were equipped with adjustable head restraints that were not damaged. All three second row outboard seating positions were equipped with the lower anchor points and top tether anchors that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. The top tether anchors were located on the hat shelf behind the second row seat backs.

Vehicle Damage

Exterior Damage - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt sustained moderate right side damage as a result of the impact with the first tree. The case vehicle sustained 248.0 cm (97.6 in) of direct damage along the right side, beginning 20.0 cm (7.9 in) forward of the right rear axle, extending forward. Since there were no undamaged axles on this vehicle post-crash, a damaged axle had to be used to document the location of the direct damage for this crash event.

The right front tire was restricted and torn, although this damage may have occurred during the second crash event. The right rear tire was also restricted, holed and the rim was deformed. Both right side tires had moved rearward from the crash events, and the right wheelbase was shortened by 6.0 cm (2.4 in). The location of the maximum lateral crush for this impact was 25.0 cm (9.8 in) forward of the post-crash right rear axle and measured 4.0 cm (1.6 in).

The Collision Deformation Classification (CDC) for this impact was 01RYEW2. The EDR reported estimated principle direction of force was 20 degrees.



Figure 14. Right side damage



Figure 15. Right front damage

The case vehicle sustained 84.0 cm (33.1 in) of direct damage along the front bumper beginning 14.0 cm (5.5 in) left of the pre-crash centerpoint, extending to the right. The right front tire was restricted, the tire was torn, and the rim was damaged. The right wheelbase was shortened by 6.0 cm (2.4 in). The left wheelbase was lengthened by 5.0 cm (2.0 in). The bumper had shifted to the right from the impact forces. The right frame rail had shifted more than 10.0 cm (4.0 in) to the right but the left frame rail did not shift enough to increment the CDC. The bumper cover and energy absorbing styrofoam were no longer attached and were found inside the Cobalt's passenger compartment.

Additional freespace was subtracted from the crush profile to account for the width of the cover and foam. Due to the extent of the front bumper damage, an exemplar vehicle was located and measured so that the appropriate freespace could be subtracted from the front crush profile. Six crush measurements were documented along the front bumper backing bar as follows: C1=0.0 cm (0.0 in), C2=16.0 cm (6.3 in), C3=43.0 cm (16.9 in), C4=52.0 cm (20.5 in), C5=50.0 cm (19.7 in), C6=43.0 cm (16.9 in). The bumper backing bar had a width of 114.0 cm (44.9 in). The original undeformed front end width was 140.0 cm (55.1 in). The location of maximum crush was at C4.

The CDC for this impact was 10FZEW3. The EDR reported estimated principle direction of force for this crash event was 255 degrees.

The Cobalt sustained moderate damage to the left front tire as a result of the impact with the north curb. The tire broke off the front axle and the rim was scuffed. At the scene inspection, small pieces of the north curb were missing. The CDC for this impact was 09LFWN1.



Figure 16. Right side tree impact damage



Figure 17. Front crush profile



Figure 18. LF tire/axle damage



Figure 19. Damage to RR tire

CDC (Impact 1):	01RYEW2
(Impact 2):	10FZEW3
(Impact 3):	09LFWN1

Delta V (Impact 1) ¹ :	Barrier Equivalent Speed: 12.0 km/h (7.5 mph)
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Delta V (Impact 2):	Total	25.0 km/h (15.5 mph)
	Longitudinal	-8.6 km/h (-5.3 mph)
	Latitudinal	23.5 km/h (14.6 mph)
	Energy	105,909 Joules (78,114 ft lb)

¹Calculated using WinSmash with CDC only

Interior Damage - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt sustained moderate interior damage due to intrusion, occupant contacts and normal air bag deployment related damage.

The driver and right front seat belt retractor pretensioners actuated during the first crash event and were locked in the stowed position post-crash. A piece of the left front plastic seat belt positioning device that had been attached to the bottom of the head restraint broke off when the pretensioner activated. The seat belt was not in use at the time of the crash.

There was integrity loss to the passenger compartment. The right front window glazing shattered, leaving an opening that measured 106.0 cm (41.7 in) wide by 34.0 cm (13.4 in) high. The right front door was jammed shut and was slightly displaced, although the door latch/striker and hinges remained intact. At the latch/striker area, there was a 2.0 cm (0.8 in) gap between the damaged right front door panel and the door panel's pre-crash location. The widest gap was at the bottom of the right front door panel and measured 5.0 cm (2.0 in) in width. The left front door remained closed and operational.

The windshield was cracked by impact forces and by the cover flap of the deploying front passenger air bag. The rearview mirror was cracked, possibly due to occupant contact. There was a scuff to the lower section of the center console, near the driver's foot controls that may have been due to contact from the driver's right ankle. There was a faint scuff to the top of the left A pillar, possibly due to contact from the driver's left wrist and/or hand. The glove compartment door was partially open and could not be closed.



Figure 20. Damage to rearview mirror

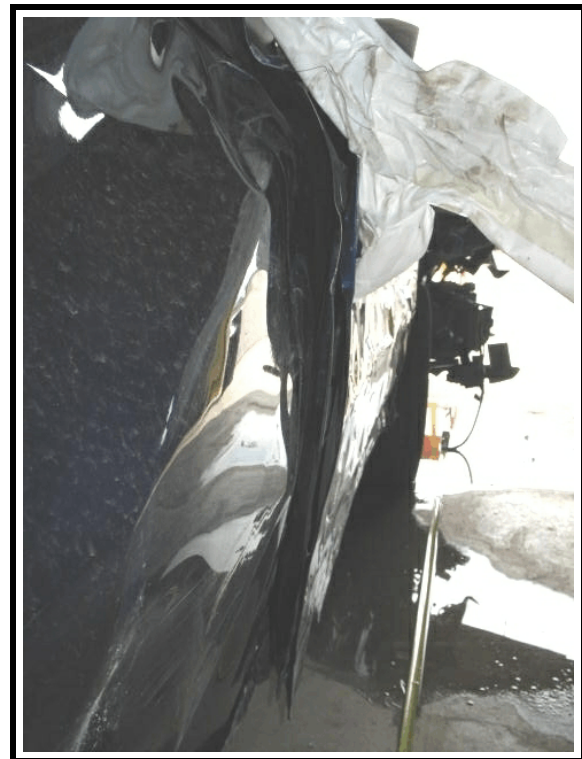


Figure 21. RF door damage (no integrity loss)

There was one longitudinal and multiple lateral intrusions into the passenger compartment seating areas. The specific passenger compartment intrusions were documented as follows:

Row/Position	Intruded Component	Magnitude of Intrusion	Direction
1L	Center console cover	3.0 cm (1.2 in)	Lateral
1R	Side panel (forward of the A pillar)	11.0 cm (4.3 in)	Lateral
1R	Glove compartment door	9.0 cm (3.5 in)	Longitudinal
1R	Door panel	5.0 cm (2.0 in)	Lateral
1R	Center console cover	4.0 cm (1.6 in)	Lateral
1R	B pillar	1.0 cm (0.4 in)	Lateral
2R	C pillar cover	7.0 cm (2.8 in)	Lateral
2R	Side panel	1.0 cm (0.4 in)	Lateral

Manual Restraints - 2006 Chevrolet Cobalt

The 2006 Chevrolet Cobalt was configured with manual 3-point lap and shoulder belts for each of the five seating positions. Both front seat belts were equipped with B-pillar pretensioners with load limiters and seat belt positioning devices. Neither belt had anchorage adjustments. Both pretensioners actuated during the first collision event and were locked in the stowed position post-crash. The front row safety belts were configured with sliding latch plates. The retractor types could not be determined during the inspection because the belts were locked in place. An exemplar vehicle was used to determine the front row retractor types. The driver's safety belt had an emergency locking retractor (ELR). The right front seat belt had a switchable ELR/automatic locking retractor. The second row seating positions were equipped with sliding latch plates and switchable retractors.

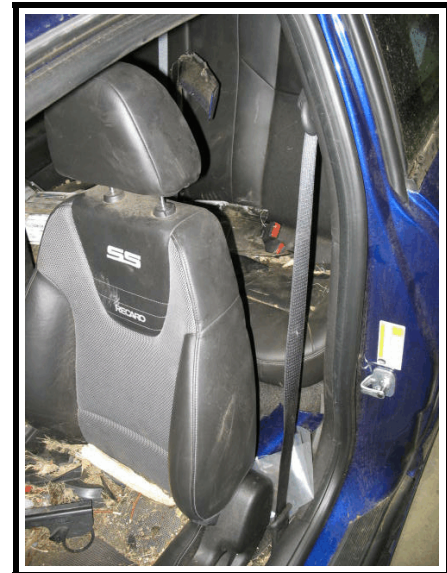


Figure 22. Driver's seat belt - not in use (pretensioner actuated)

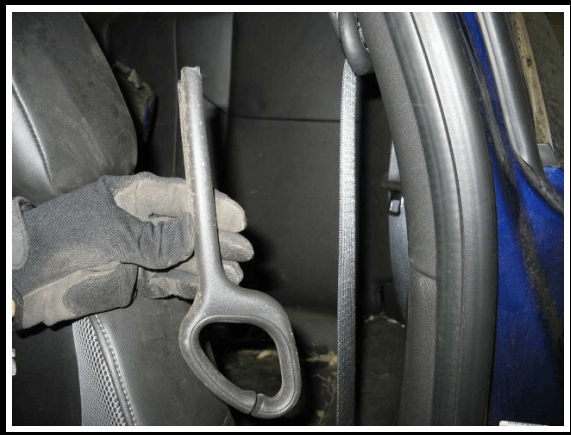


Figure 23. Damaged left front seat belt positioning device (belt not worn during crash)



Figure 24. Undamaged right front seat belt positioning device (for comparison)

Supplemental Restraint Systems - 2006 Chevrolet Cobalt

The Chevrolet Cobalt was equipped with advanced occupant protection systems. These systems include the Sensing and Diagnostic Module (SDM), dual stage driver and front right passenger air bags and right/left side curtains. The systems are controlled by the SDM. 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.

For Deployment Events and Deployment Level Events, the SDM will record up to 70 milliseconds of data before the deployment criteria is met and 220 milliseconds of data after the deployment criteria is met. For Non-Deployment events, the SDM will record up to the first 300 milliseconds of data after algorithm enable. The minimum SDM Recorded Vehicle Forward Velocity change that is needed to record a Non-Deployment event is 8 km/h (5 mph). The SDM data was downloaded using the Vetronix Crash Data Retrieval System.

One Deployment and one Non-Deployment Event were recorded by the SDM. The Deployment Event occurred as a result of the initial impact between the Cobalt and the first tree. The stored non-deployment event followed the deployment event. The Vetronix system status at deployment report indicates that:

- The SIR warning lamp status was OFF.
- The driver's belt switch status was UNBUCKLED.
- The passenger's belt switch status was BUCKLED².
- Ignition cycles at deployment = 133
- Ignition cycles at investigation = 134
- Number of ignition cycles SIR Warning Lamp was ON/OFF continuously = 132
- Maximum SDM recorded longitudinal velocity change -20.73 km/h (-8.13 mph).
- Maximum SDM recorded lateral velocity change 16.37 km/h (-2.71 mph).

²Pretensioner actuated. Belt found locked in stowed position.

of the left and right cover flaps measured 7.0 cm (2.8 in) wide and the bottom sections measured 6.0 cm (2.4 in) wide. Both flaps were 12.0 cm (4.7 in) high. There was a semi-circular cutout located in the center of the cover flaps that was 7.0 cm (2.8 in) high. Above the cutout there were 2.0 cm (0.8 in) high facets and below the cutout there were 3.0 cm (1.2 in) high facets. The deployed driver air bag measured 60.0 cm (23.6 in) in diameter in its deflated state and the bag had a maximum excursion of 32.0 cm (12.6 in) from the module face. The distance between the cover flap and right front seat back was 63.0 cm (24.8 in). The air bag was tethered by a single internal strap and there were two circular vent ports located at the 11 and 1 o'clock positions on the back of the air bag. There were dirty sections on the front and back of the air bag which were likely caused by the vehicle and roadway debris that had been put in the passenger compartment areas post-crash. There was no damage or occupant contact visible on either the cover flaps or air bag, although it is likely that the unrestrained driver contacted the bag during the crash.



Figure 26. Right front passenger air bag

The passenger front air bag deployed from a top mounted single air bag module cover flap. The cover flap was generally rectangular in shape and measured 32.0 cm (12.6 in) wide. The left side of the flap measured 22.0 cm (8.7 in) high and the right side measured 16.0 cm (6.3 in) high. The cover flap was slightly deformed, which likely occurred during the deployment. The air bag was rectangular in shape and measured 45.0 cm (17.7 in) seam to seam laterally and 70.0 cm (27.6 in) in height in its deflated state. The air bag had a maximum excursion of 38.0 cm (15.0 in) in its deflated state. The distance between the cover flap and right front seat back was 98.0 cm (38.6 in). There was one internal tether at the center of the bag and two circular vent ports on the sides of the air bag at the 3 and 9 o'clock locations. There was dirt on the upper right corner of the air bag face, which was likely due to the debris that was put in the passenger compartment post-crash. There was no occupant contact evidence visible on the cover flap and air bag.

The Cobalt was also equipped with left and right side curtain air bags. The right side curtain deployed and extended from the A pillar to the C pillar. There was a small coverage gap present at the right A-pillar. The gap consisted of a triangular shaped area measuring 26.0 cm (10.2 in) in height at the forward aspect of the bag, 28.0 cm (11.0 in) in width along the belt line and 18.0 cm (7.1 in) in length along the A-pillar. The curtain was fairly rectangular in shape and in its deflated state, measured 173.0 cm (68.1 in) in length. The height of the front section of the curtain measured 38.0 cm (15.0 in) and the back



Figure 27. Right side curtain and gap distance at the right A pillar

section measured 26.0 cm (10.2 in). The air bag had one external tether, located at the front of the bag at the A pillar. There were no vent ports. The side curtain deployed from the right roof side rail and had no visible signs of occupant contact or damage. There were black deployment streaks found on the inner curtain material near the lower portion of the bag, in the front and center sections.

DTC B0052 note:

According to GM service information, the DTC descriptor for B0052 is Deployment Commanded. The conditions for setting the DTC include the following:

- The SDM detects a frontal impact of sufficient force to warrant deployment of the frontal modules.
- The SDM detects a side impact of sufficient force to warrant deployment of a side impact module and/or roof rail module.
- The SDM has deployed the seat belt pretensioner for 3 separate deployments.

The action taken when the DTC sets include the following:

- The SDM will only set DTC B0052 or the SDM sets DTC B0053 along with DTC B0052.
- The SDM commands the AIR BAG warning lamp ON via serial data communications.
- The SDM records crash data.

The SDM is capable of sustaining 3 pretensioner deployment events, or one frontal or side deployment event. After the maximum number of deployments has occurred DTC B0052 sets and becomes a latched code, which cannot be cleared.

Occupant Demographics - 2006 Chevrolet Cobalt

	Driver
Age/Sex:	16/Male
Seated Position:	Front left
Seat Type:	Bucket with a folding back
Height:	188 cm (74 in)
Weight:	79 kg (175 lb)
Occupation:	Student (worked 2 part-time jobs over the summer)
Pre-existing Medical Condition:	Asthma
Alcohol/Drug Involvement:	Medical records show a post crash BAL of .242 (242 mg/dl).
Driving Experience:	One year
Body Posture:	Upright posture, forward facing
Hand Position:	Both hands on steering wheel, exact positions unknown.
Foot Position:	Both feet on floor or foot controls, exact positions unknown.
Restraint Usage:	Manual 3-point lap and shoulder belt available - not used
Air bag:	Front air bag available - deployed. Side curtain available - nondeployed.

Occupant Injuries - 2006 Chevrolet Cobalt

Driver: Interviewee reported that the driver had neck pain following the crash. Not injured per medical records. Records do report that this driver was suffering from alcohol intoxication. Medical information was obtained from the emergency room and radiographic records.

Occupant Kinematics - 2006 Chevrolet Cobalt

Driver Kinematics

The 16-year-old male driver appears to have been seated in an upright posture in the leather covered bucket seat with a folding back, and was not restrained by the available 3-point manual lap and shoulder belt. The seat was adjusted to between the center and rearward most track position. The seat back was reclined at a 99 degree angle and the seat bottom had a 16 degree angle. During the initial tree impact, the driver initiated a forward and slightly lateral trajectory towards the 1 o'clock direction of force. This crash event resulted in the deployment of the Cobalt's driver and passenger front air bags, the deployment of the right side curtain and the actuation of the front row seat belt pretensioners.

During this initial crash event, the driver's left hand may have been pushed from the steering wheel by the deploying driver's front air bag, and may have contacted the upper left A pillar, leaving a faint scuff.

The right side damage from this impact resembled a sideswipe type impact, but as the Cobalt swiped past the tree, its right rear tire snagged on the tree, sending the vehicle into a clockwise rotation.

The driver's body pitched to the right, and his right ankle may have scuffed the lower corner of the center console cover. The case vehicle continued traveling east while in a yaw and the front of the Cobalt struck the second tree. The case vehicle was nearly at a 90 degree angle to the tree at impact. The male driver initiated a lateral trajectory towards the 9 o'clock direction of force.

The Cobalt was redirected from the second impact and traveled northeast, reentering the roadway. The case vehicle continued across all three travel lanes and the left front tire impacted



Figure 28. Driver's seating area



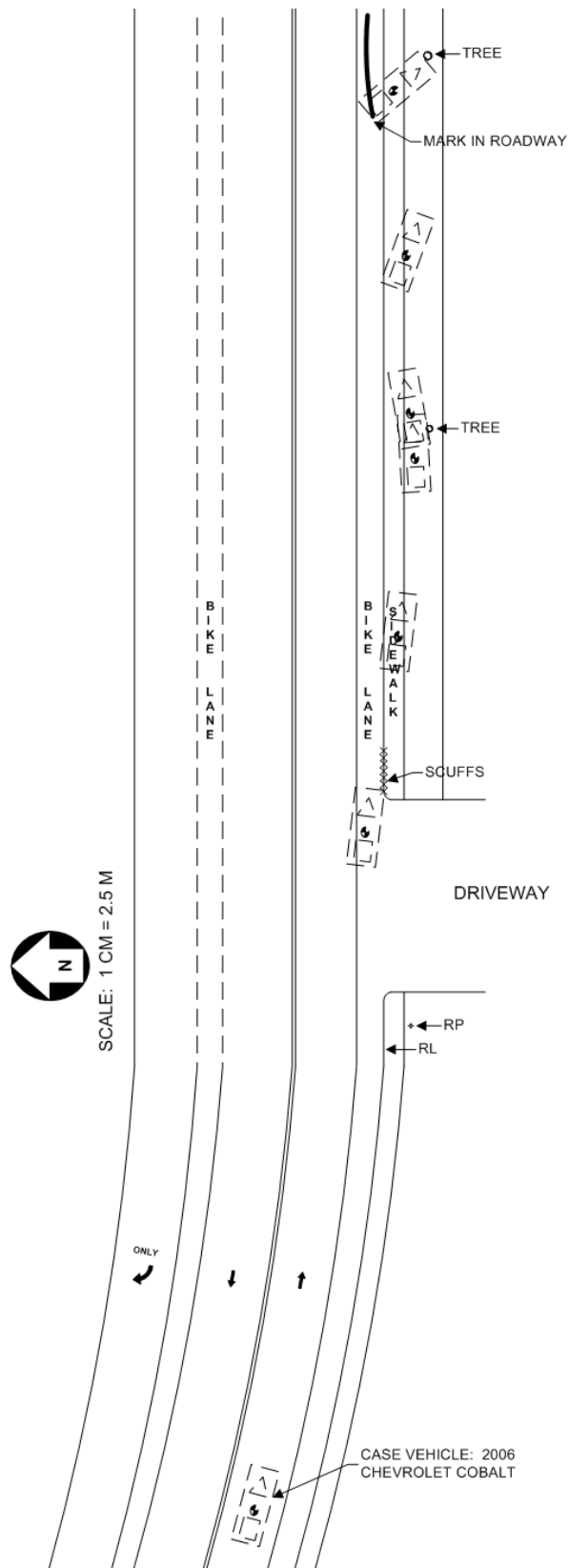
Figure 29. Exemplar vehicle's passenger compartment

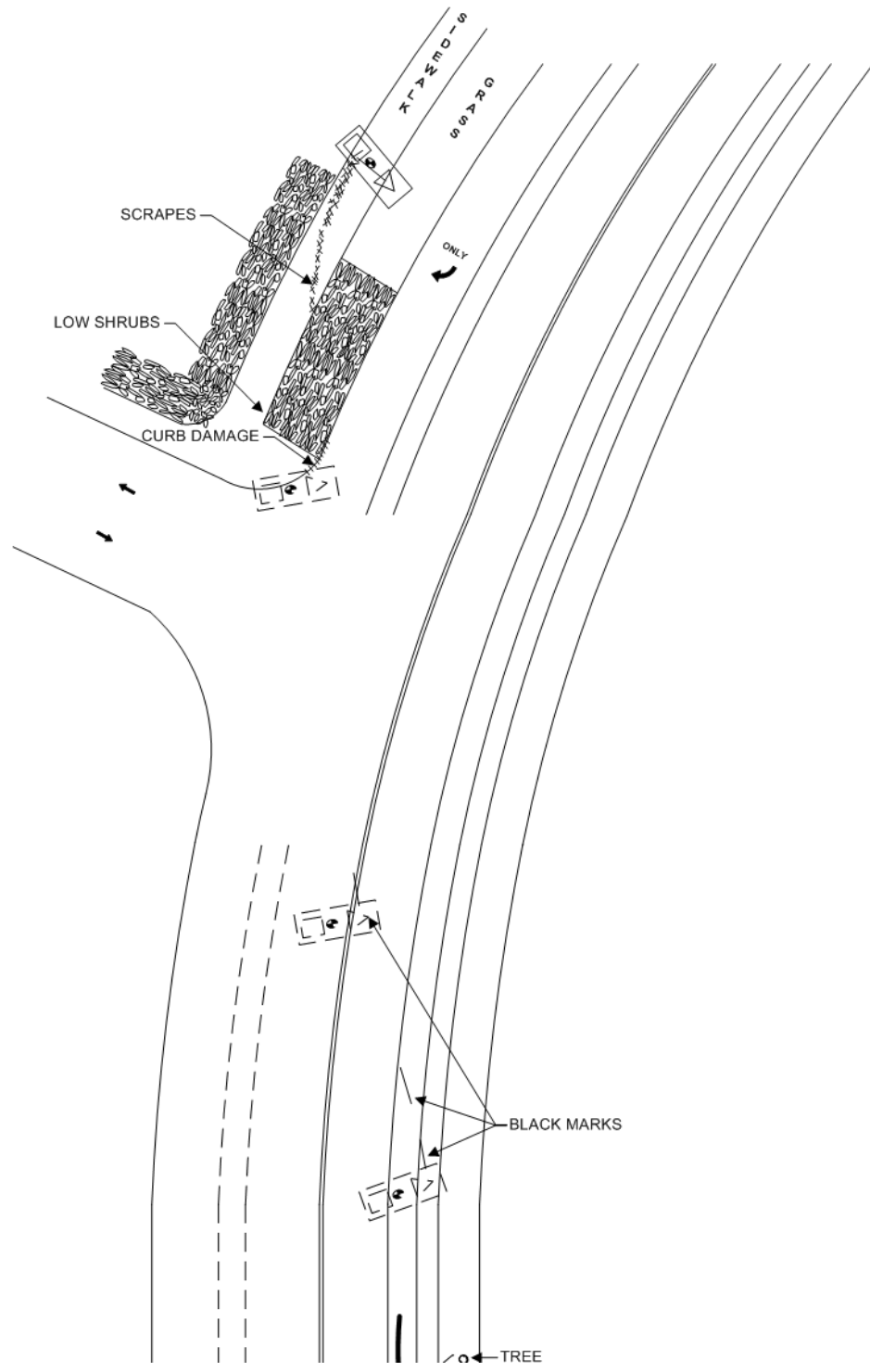
the north curb, breaking the tire off the axle and causing the driver to initiate a lateral trajectory towards the 9 o'clock direction of force. The Cobalt traveled over the curb and through some low shrubs before it came to final rest, facing southwest on the north sidewalk. The driver was able to exit the vehicle on his own, without assistance. According to the police report, this driver sustained a "possible" injury. The driver reported that he had some neck pain following the crash. He was transported by ambulance to a local hospital where he was treated and released. No injuries were diagnosed.



Figure 30. Scuff to left side of center console (possible occupant contact)

Attachment 1. Scene Diagram





Attachment 2. Vetrnix Report



CDR File Information

Vehicle Identification Number	1G1AP14P367*****
Investigator	NONE
Case Number	NONE
Investigation Date	8/4/2006
Crash Date	8/4/2006
Filename	DS06016.CDR
Saved on	Friday, August 4 2006 at 02:32:40 PM
Collected with CDR version	Crash Data Retrieval Tool 2.800
Collecting program verification number	9238B95E
Reported with CDR version	Crash Data Retrieval Tool 2.800
Reporting program verification number	9238B95E
Interface used to collected data	Block number: 00 Interface version: 4A Date: 11-08-05 Checksum: 7500
Event(s) recovered	Deployment Non-Deployment

SDM Data Limitations

SDM Recorded Crash Events:

There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). It can contain Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.

The second type of SDM recorded crash event is the Deployment Event. It also can contain Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. Deployment Events cannot be overwritten or cleared from the SDM. Once the SDM has deployed the air bag, the SDM must be replaced.

The data in the Non-Deployment Event file will be locked after a Deployment Event, if the Non-Deployment Event occurred within 5 seconds before the Deployment Event unless a Deployment Level Event occurs within 5 seconds after the Deployment Event, then the Deployment Level Event will overwrite the Non-Deployment Event file.

SDM Data Limitations:

- SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Forward Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change. For Deployment Events and Deployment Level Events, the SDM will record 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record up to the first 300 milliseconds of data after algorithm enable. The minimum SDM Recorded Vehicle Forward Velocity Change, that is needed to record a Non-Deployment Event, is 5 MPH.
- Maximum Recorded Vehicle Velocity Change is the maximum recorded velocity change in the vehicle's combined "X" and "Y" axis.
- Calculated Principal Direction of Force (PDOF) is the arctangent of the maximum observed lateral velocity change divided by the maximum observed longitudinal velocity change. PDOF is displayed where zero degrees is located at the front of the vehicle, with 90 degrees is displayed to the right side of the vehicle and so on, clockwise around the vehicle.
- Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.
- SDM Recorded Vehicle Speed accuracy can be affected if the vehicle has had the tire size or the final drive axle ratio changed from the factory build specifications.
- Brake Switch Circuit Status indicates the status of the brake switch circuit.
- Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if the SDM receive an invalid message from the module sending the pre-crash data.
- Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. The Passenger Belt Switch Circuit Status for 2006 Chevrolet Cobalt Sport Coupe (AP) model vehicles, with the option package that includes Recaro brand seats (RPO ALV), will always report a default value of "Buckled".
- The Time Between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than 5 seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.
- If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
- The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-modding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the

ignition counter.

SDM Data Source:

All SDM recorded data is measured, calculated, and stored internally, except for the following:

- Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle's communication network.
- The Belt Switch Circuit is wired directly to the SDM.



System Status At AE

Vehicle Identification Number	**1AP14P*6*****
Low Tire Pressure Warning Lamp (If Equipped)	OFF
Vehicle Power Mode Status	Run
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Active
Brake System Warning Lamp (If Equipped)	OFF

System Status At 1 second

Transmission Range (If Equipped)	Invalid
Transmission Selector Position (If Equipped)	Invalid
Traction Control System Active (If Equipped)	Invalid
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	68.9
Left Front Door Status (If Equipped)	Closed
Right Front Door Status (If Equipped)	Closed
Left Rear Door Status (If Equipped)	Unused
Right Rear Door Status (If Equipped)	Unused
Rear Door(s) Status (If Equipped)	Closed

Pre-crash data

Parameter	-2 sec	-1 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No

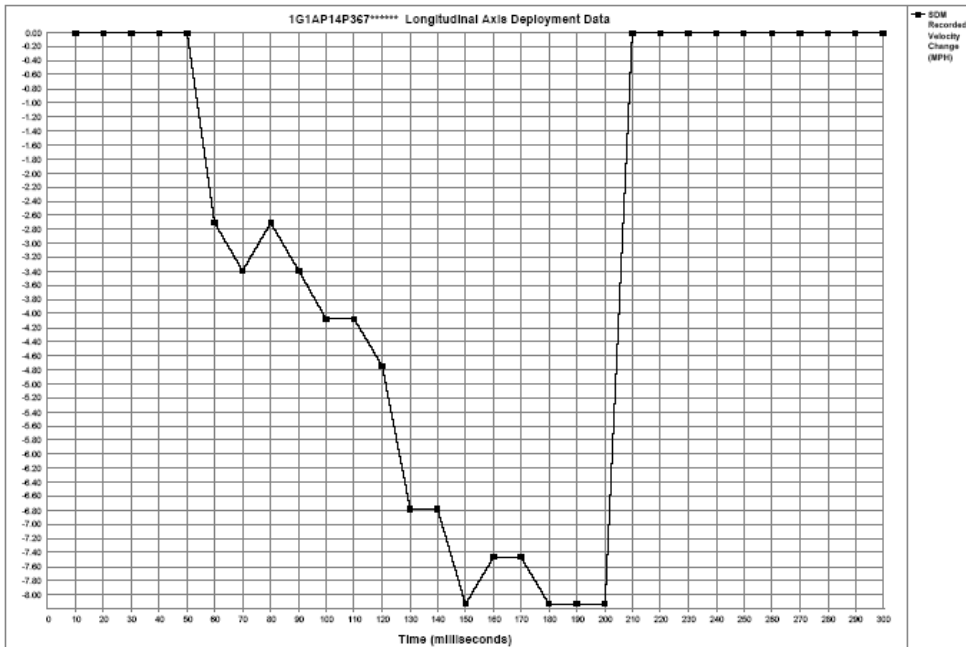
Pre-crash data

Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	Invalid	Invalid	Invalid	Invalid	Invalid
Engine Speed (RPM)	5952	6144	5696	3904	3008
Percent Throttle	100	100	49	22	29
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF
Accelerator Pedal Position (percent)	97	97	16	0	9
Antilock Brake System Active (If Equipped)	No	No	No	No	No
Lateral Acceleration (feet/s ²)(If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Yaw Rate (degrees per second) (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Steering Wheel Angle (degrees) (If Equipped)	0	0	0	0	0
Vehicle Dynamics Control Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid

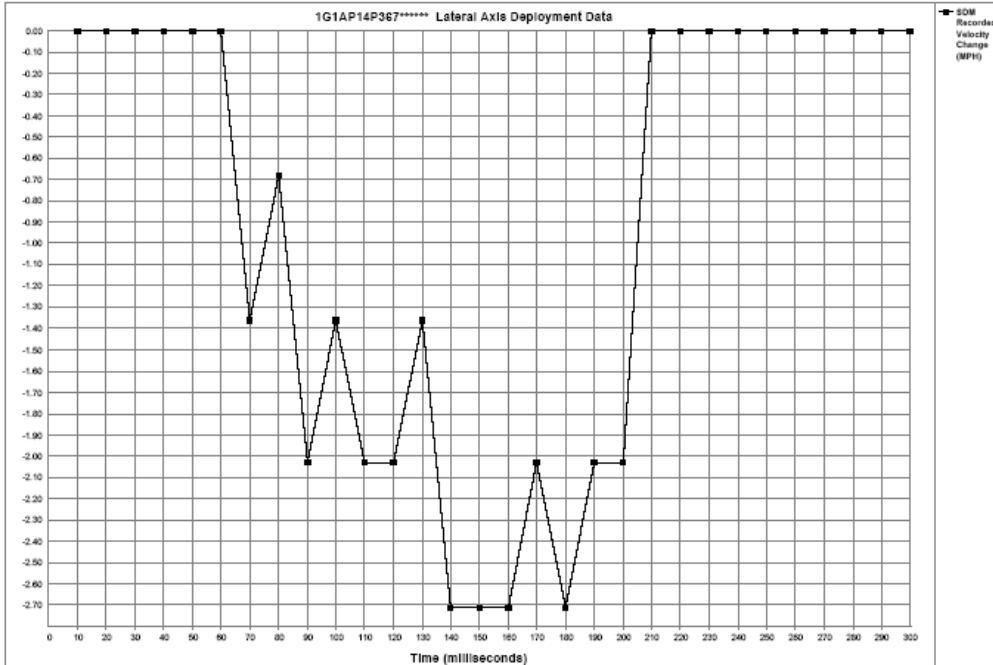


System Status At Deployment

Ignition Cycles At Investigation	134
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	57640
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	132
Ignition Cycles At Event	133
Ignition Cycles Since DTCs Were Last Cleared	127
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	12
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	28
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	12
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	28
Driver Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	11.25
Time Between Events (sec)	N/A
Driver First Stage Deployment Loop Commanded	Yes
Driver Second Stage Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	Yes
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	Yes
Passenger Second Stage Deployment Loop Commanded	Yes
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	Yes
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	Yes
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Multiple Event Counter	1
An Event(s) Preceded the Recorded Event(s)	No
An Event(s) was in Between the Recorded Event(s)	No
An Event(s) Followed the Recorded Event(s)	Yes
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	Yes
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes
Estimated Principal Direction of Force (PDOF) degrees	20



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	0.00	0.00	0.00	0.00	-2.71	-3.39	-2.71	-3.39	-4.07	-4.07	-4.74	-6.78	-6.78	-8.13
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-7.46	-7.46	-8.13	-8.13	-8.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

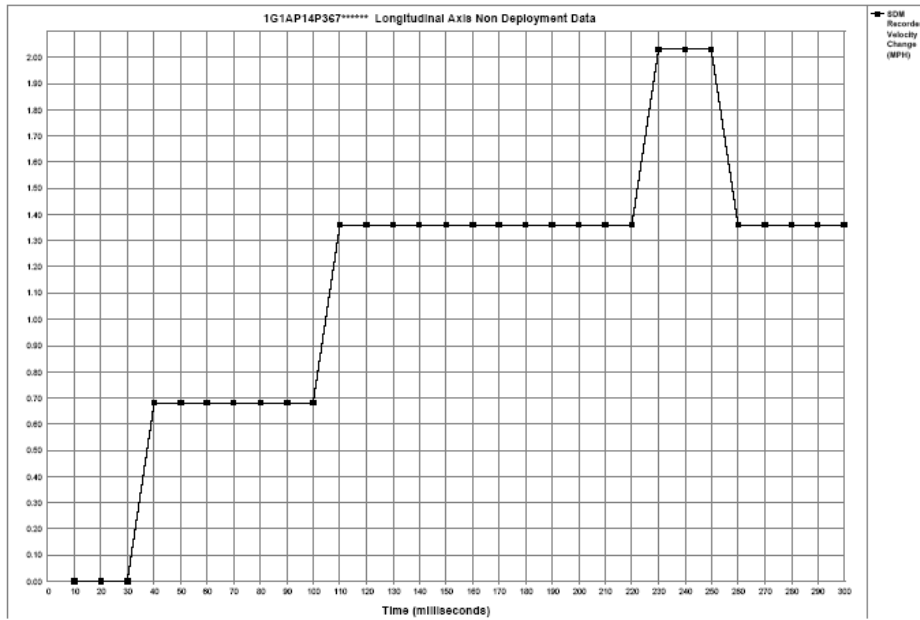


Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	-1.36	-0.68	-2.03	-1.36	-2.03	-2.03	-1.36	-2.71	-2.71
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	-2.71	-2.03	-2.71	-2.03	-2.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

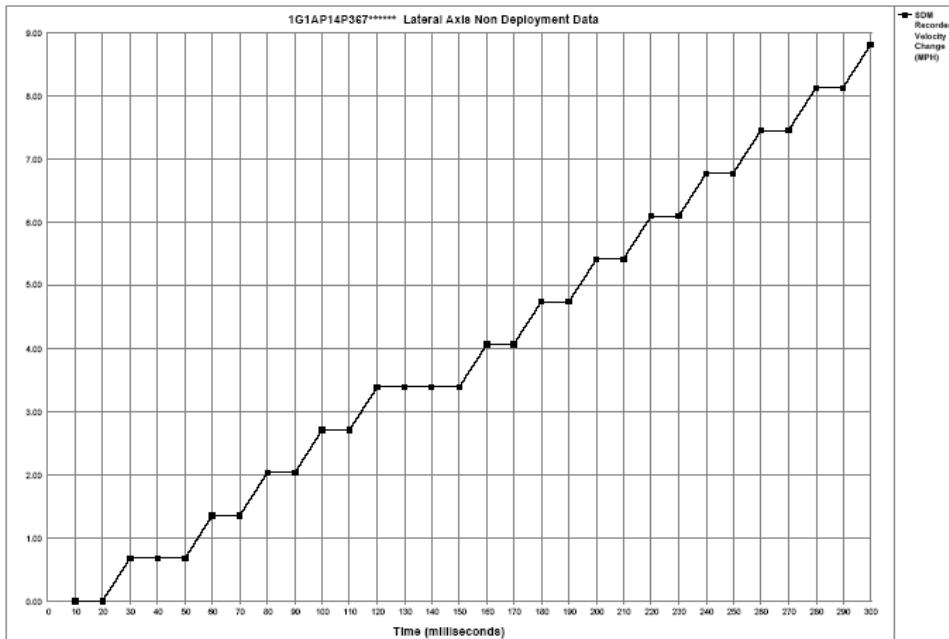


System Status At Non-Deployment

Ignition Cycles At Investigation	134
SIR Warning Lamp Status	ON
SIR Warning Lamp ON/OFF Time (seconds)	0
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	0
Ignition Cycles At Event	133
Ignition Cycles Since DTCs Were Last Cleared	127
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	B0052
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Maximum SDM Recorded Velocity Change (MPH)	32.72
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	680
Driver First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	No
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	No
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes
Estimated Principal Direction of Force (PDOF) degrees	255



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	0.00	0.00	0.68	0.68	0.68	0.68	0.68	0.68	0.68	1.36	1.36	1.36	1.36	1.36
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	1.36	1.36	1.36	1.36	1.36	1.36	1.36	2.03	2.03	2.03	1.36	1.36	1.36	1.36	1.36



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.68	0.68	0.68	1.36	1.36	2.03	2.03	2.71	2.71	3.39	3.39	3.39	3.39
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	4.07	4.07	4.74	4.74	5.42	5.42	6.10	6.10	6.78	6.78	7.46	7.46	8.13	8.13	8.81



Hexadecimal Data

This page displays all the data retrieved from the air bag module.
It contains data that is not converted by this program.

```

$01 08 00 00 00 00 00 00
$02 30 00 00 00 00 00 00
$03 00 00 00 00 00 00 00
$04 00 00 00 00 00 00 00
$05 00 00 00 00 00 00 00
$06 00 0A 00 03 0A 00 00
$07 00 20 00 00 00 00 00
$08 00 00 00 00 00 00 00
$09 00 00 00 00 00 00 00
$0A 00 00 00 00 00 00 00
$0B 00 00 01 0F 00 00 00
$0C 00 00 00 00 00 00 00
$0D 00 00 40 00 00 00 00
$0E 00 00 00 00 00 00 00
$0F 00 00 00 00 00 00 00
$10 00 00 00 00 00 00 00
$11 00 00 00 00 00 00 00
$12 00 00 00 00 00 00 00
$13 00 00 00 00 00 00 00
$14 00 00 00 00 00 00 00
$15 00 00 00 00 00 00 00
$16 03 06 0C 16 34 00 00
$17 00 00 00 00 00 00 00
$18 00 00 00 00 00 00 00
$19 00 00 00 00 00 00 00
$1B 3F 30 00 66 00 78 00
$1C 3F 30 00 62 00 18 00
$1D 00 00 00 00 00 00 00
$1E 00 00 00 00 00 00 00
$1F 20 00 00 00 00 00 00
$20 40 00 00 00 00 00 00
$21 00 00 00 00 F0 00 00
$22 00 94 00 00 00 00 00
$24 00 00 00 00 00 00 00
$25 00 00 00 00 00 00 00
$26 00 00 00 00 00 00 00
$27 FF 00 FF 00 00 00 00
$2A 00 00 00 00 00 00 00
$2B 00 00 00 00 00 00 00
$2D 00 00 00 00 00 00 00
$2E 80 00 01 00 01 00 00
$2F 00 80 00 86 01 00 00
$30 9D 00 00 00 00 00 00
$31 17 00 29 F7 F7 00 00
$32 00 00 00 00 00 00 00
$33 49 39 7D FE FE 00 00
$34 2F 3D 59 60 5D 00 00
$35 91 9B 9F 9E 98 80 00
$36 00 00 00 00 00 00 00
$37 00 00 00 09 0F 00 78
$38 79 00 40 00 03 C0 00
$39 00 00 00 00 00 80 00
$3A 00 00 00 00 00 80 00
$3B 03 06 0C 00 00 00 00
$3C 00 00 00 00 00 00 C0
$3D 31 41 50 31 34 50 00
$3E 36 81 61 39 00 00 00
$3F 29 00 90 00 00 00 00
$40 80 A5 00 00 00 00 00
$41 00 00 00 00 00 00 00
$42 80 00 00 00 00 00 00

```

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\$43 7F 00 85 00 00 00 00
 \$44 80 52 00 00 00 00 00
 \$45 00 00 00 00 00 00 00
 \$46 00 00 00 00 00 00 00
 \$47 00 00 00 00 01 00 00
 \$48 01 01 01 01 02 01 00
 \$49 02 01 03 01 03 01 00
 \$4A 04 01 04 02 05 02 00
 \$4B 05 02 05 02 05 02 00
 \$4C 06 02 06 02 07 02 00
 \$4D 07 02 08 02 08 02 00
 \$4E 09 02 09 03 0A 03 00
 \$4F 0A 03 0B 02 0B 02 00
 \$50 0C 02 0C 02 0D 02 00
 \$51 70 00 00 00 00 00 00
 \$52 80 00 00 10 00 00 00
 \$53 44 09 1A 00 00 00 00
 \$54 00 00 00 00 00 00 00
 \$55 00 00 00 00 00 00 00
 \$67 A0 A5 00 00 00 00 00
 \$68 D0 D8 00 00 00 00 00
 \$69 00 16 84 00 84 00 00
 \$6A 7F 00 85 00 00 00 00
 \$6B 00 00 00 00 00 00 00
 \$6C 00 00 00 00 00 00 00
 \$6D 00 00 00 00 00 00 00
 \$6E 00 00 00 00 00 00 00
 \$6F 00 00 00 00 00 FC 00
 \$70 FE FB FF FC FD FB 00
 \$71 FE FA FD FA FD F9 00
 \$72 FE F6 FC F6 FC F4 00
 \$73 FC F5 FD F5 FC F4 00
 \$74 FD F4 FD F4 00 00 00
 \$75 00 00 00 00 00 00 00
 \$76 00 00 00 00 00 00 00
 \$77 00 00 00 00 00 00 00
 \$78 70 00 00 00 00 00 00
 \$79 80 00 00 10 00 00 00
 \$7A 80 00 00 00 00 00 00
 \$7B 06 0E 06 0E 00 09 00

\$01 41 55 32 39 34 39 52 35 33 35 30 33 31 43 33 4A
 \$02 41 0A 99 B3
 \$03 41 54 32 39 34 39 52 36 30 30 35 33 31 45 4D 4D
 \$04 41 0A 99 B3
 \$05 42 55 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
 \$06 FF FF FF FF
 \$07 42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
 \$08 FF FF FF FF
 \$0D 41 48 32 39 35 31 52 35 33 35 30 31 36 38 32 5A
 \$0E 01 5A 4B 31
 \$0F 41 4A 01 02 03 04 52 45 41 32 30 32 33 30 30 30
 \$10 01 02 03 04
 \$13 42 52 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
 \$14 FF FF FF FF
 \$17 42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
 \$18 FF FF FF FF
 \$21 33 19 2A B4 E6 87 91 9A
 \$22 94 05
 \$23 31 41 FA FA FA FA FA
 \$24 31 41 FA FA FA FA FA
 \$25 32 41 FA FA FA FA FA
 \$26 32 41 FA FA FA FA FA
 \$40 00 00
 \$41 3F 30 00 62 00 18
 \$42 10 C4
 \$43 00 00 8E 80
 \$44 C6 00 00 FC C0 C0
 1G1AP14P367*****



```
$45 07 01 07 01 05 01
$46 FF 1A 1A 64 64
$47 0A 64 06 04 04 05 0A 06 04 0A 00 00 FA 00 00 FF 04 64
$48 18 08 08
$B0 58
$B1 FD FE 00
$B2 FF FF FF FF FF
$B4 41 53 39 34 30 35 32 31 30 33 54 47 20 20 20 20
$B7 50 AA 04 0F 03
$B8 41 57 68 09 19
$C1 30 46 30 33
$CA 30 46 30 33
$CB 00 E9 4C 3D
$CC 00 E9 4C 3D
$D1 00 00
$DB 00 00
$DC 00 00
```

Attachment 3. Excerpt from Service Manual

Sep 26 06 11:09a perry
 nt By: SCUMM...

7609401977
 Sep-25-06 10:22AM;

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Service Information

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 2006 Chevrolet Cobalt

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DTC B0052 or B0053

Diagnostic Instructions

- Perform the Diagnostic System Check - Vehicle prior to using this diagnostic procedure.
- Review Strategy Based Diagnosis for an overview of the diagnostic approach.
- Diagnostic Procedure Instructions provides an overview of each diagnostic category.

DTC Descriptors

DTC B0052: Deployment Commanded

DTC B0053: Deployment Commanded with Loop DTCs Present

Circuit/System Description

The inflatable restraint sensing and diagnostic module (SDM) contains a sensing device that converts vehicle velocity changes into an electrical signal. The SDM compares this electrical signal to a value stored in memory. When the generated signal exceeds the stored value, the SDM performs additional signal processing and compares the generated signals to values stored in memory. When 2 of the generated signals exceed the stored values, the SDM will cause current to flow through the deployment loops, deploying the air bags and/or pretensioners causing DTC B0052 to set.

Conditions for Running the DTC

Ignition voltage is between 9-16 volts.

Conditions for Setting the DTC

B0052

- The SDM detects a frontal impact of sufficient force to warrant deployment of the frontal modules.
- The SDM detects a side impact of sufficient force to warrant deployment of a side impact module and/or roof rail module.
- The SDM has deployed the seat belt pretensioner for 3 separate deployments.

B0053

SDM commands inflators deployment with loop faults present.

Action Taken When the DTC Sets

- The SDM will only set DTC B0052 or the SDM sets DTC B0053 along with DTC B0052.
- The SDM commands the AIR BAG warning lamp ON via serial data communications.
- The SDM records crash data.

<http://service.gm.com/servlets/BlobServlet?ServletFile=1569874&psdid=1310&evc=sm>

9/25/2006

Sep 26 06 11:09a perry
Sent By: ~~SEAN@GM.COM~~

7609401977
Sep-25-06 10:22AM;

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Service Information

Conditions for Clearing the DTC

DTC B0052 can be cleared if the following conditions are met.

- Three consecutive seat belt pretensioner deployment events have not occurred.
- One frontal or side air bag deployment has not occurred.

DTC B0052 becomes a latched code after 3 consecutive pretensioner deployments or 1 frontal or side air bag deployment. You cannot clear a latched code. Replace the SDM after following the instructions in the diagnostic table.

Diagnostic Aids

Important: The seat belt pretensioners may deploy for impacts that are not severe enough to warrant frontal or side air bag deployment. The SDM is capable of sustaining 3 pretensioner deployment events, or one frontal or side deployment event. After the maximum number of deployments has occurred, DTC B0052 sets and becomes a latched code, which cannot be cleared.

When DTC B0053 is accompanied by additional DTCs, other than B0052, repair the malfunction causing the other DTCs before replacing SDM.

Reference Information

Electrical Information Reference

- [Circuit Testing](#)
- [Connector Repairs](#)
- [Testing for Intermittent Conditions and Poor Connections](#)
- [Wiring Repairs](#)

Circuit/System Verification

1. Ignition OFF, inspect the vehicle for signs of inflator module or pretensioner deployment. Verify that the vehicle does not show any signs of inflator deployment.
 - If the vehicle displays any signs of inflator deployment, refer to [Repairs and Inspections Required After a Collision](#).
2. Use a scan tool to clear DTCs. Verify that DTC B0052 does not reset.
 - If the DTC resets, replace the SDM.

Repair Instructions

Perform the Diagnostic Repair Verification after completing the diagnostic procedure.

[Control Module References](#) for SDM replacement, setup, and programming

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