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Special Crash Investigations On-Site Air Bag Inflator Rupture Crash Investigation Vehicle: 2001 Honda Civic Location: California Crash Date: September 2016

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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.

This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was published.

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This report documents the on-site investigation of the inflator rupture of a frontal air bag module and the fatal injuries sustained by the driver in a 2001 Honda Civic that was involved in an angled crash with a 2006 Chevrolet Colorado pickup.

16. Abstract

This three-vehicle crash occurred in a three-leg intersection in California. The Honda was being driven westbound under an overpass by a belted 50-year-old female. The Chevrolet was traveling eastbound. A 2013 Jeep Wrangler was stopped facing southwest at the intersection. At the intersection, the Chevrolet turned left and struck the front plane of the Honda. At impact, the Honda driver's frontal air bag deployed and the Takata air bag inflator ruptured. The Honda was displaced clockwise and came to rest facing northeast. The Chevrolet was displaced counterclockwise and struck the front plane of the stopped Jeep. The driver of the Honda was injured by the metal fragments from the inflator. She was removed from her vehicle and initially treated by the driver of the Jeep (who was a nursing student) until EMT personnel arrived. The driver of the Honda was then transported to a local hospital where she died due to those injuries. The Honda and Chevrolet were towed from the scene and placed on a police evidentiary hold. The Jeep sustained minor damage and was driven from the scene.

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air bag, inflator rupture, deployment, fatality	Document is available to the public from the National Technical Information Service, www.ntis.gov.

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Office of Defects Investigation
On-Site Air Bag Inflator Rupture Crash Investigation
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Location: California
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BACKGROUND

This report documents the on-site investigation of the inflator rupture of a frontal air bag module and the fatal injuries sustained by the driver of a 2001 Honda Civic (**Figure 1**) involved in an angled crash with a 2006 Chevrolet Colorado pickup. This case was initiated in response to a police notification to the National Highway Traffic Safety Administration. The case was forwarded to the Office of Defects Investigation (ODI); the Special Crash Investigations (SCI) group assigned the case to Dynamic Science, Inc., in October 2016.

Figure 1. 2001 Honda Civic.

The Honda and Chevrolet were being held as evidence in police storage. Fragments from the inflator were being held by the coroner's office. The Honda's air bag module was removed and disassembled by the investigating police agency. Permission to inspect both vehicles and the air bag module was obtained in September 2016. Permission to include representatives from Honda and Takata was requested by SCI but denied by the district attorney since they were treating the incident as a criminal matter. The SCI inspections took place in September 2016. Detectives from the investigating agency were present during the inspections. The Chevrolet was supported by the Bosch Crash Data Retrieval (CDR) system and the vehicle's event data recorder (EDR) was imaged during the inspection. The Honda was not supported by the CDR system.

According to a CARFAX report, there were four previous owners of the Honda, all in California. The most recent owner purchased the vehicle in June 2015. The vehicle was subject to NHTSA Recall Numbers 15V-320 (Driver Side Frontal Air Bag May Rupture) and 15V-370 (Passenger Side Front Air Bag Inflator May Rupture), and there are no reports that indicate the air bag inflators were replaced.

This three-vehicle crash occurred in a three-leg intersection in California. The Honda was being driven westbound under an overpass by a belted 50-year-old female. The Chevrolet was traveling eastbound. A 2013 Jeep Wrangler was stopped facing southwest at the intersection. At the intersection, the Chevrolet turned left and struck the front plane of the Honda with its front plane. At impact with the Chevrolet, the Honda's frontal air bag deployed and the Takata air bag inflator ruptured. The Honda was displaced clockwise and came to rest facing northeast. The Chevrolet was displaced counterclockwise and struck the front plane of the stopped Jeep.

The driver of the Honda was injured by the metal fragments from the inflator. She was removed from her vehicle and initially treated by the driver of the Jeep (who was a nursing student) until EMT personnel arrived. The driver of the Honda was then was transported to a local hospital, where she died due to those injuries.

The Honda and Chevrolet were towed from the scene and placed on a police evidentiary hold. The Jeep sustained minor damage and was driven from the scene.

Figure 2. Westbound approach for the Honda.

Figure 3. Eastbound approach for the Chevrolet.

Figure 4. Southbound approach for the Jeep.

SUMMARY

Crash Site

The crash site was the three-leg intersection of two undivided urban roadways. The westbound leg consisted of one westbound lane and one eastbound lane (**Figure 2**). The asphalt roadway was straight and level. A roadway overpass measuring 47.2 m (154.8 ft) in width was located 16.3 m (53.4 ft) east of the intersection. The eastbound leg consisted of one eastbound and one westbound lane that were separated by painted double yellow lines that widened creating a painted divider in the westbound direction (**Figure 3**). The southbound lane leg consisted of one southbound and one northbound lane. Southbound traffic was controlled by a stop sign (**Figure 4**). The speed limit was 64 km/h (40 mph) for all roadways. The weather at the nearest reporting station was 32 °C (89 °F), 24 percent humidity, 16 km (10 miles) visibility, and the winds were variable at 5.6 km/h (3.5 mph). A crash diagram is attached at the end of this technical report.

Pre-Crash

The Honda was traveling westbound at an unknown speed approaching the intersection. The vehicle was emerging from the shadow of the overpass. The Chevrolet was traveling eastbound at an EDR-reported speed of 53 km/h (33 mph) at 5 seconds prior to algorithm enable (AE). The driver was braking and had slowed to 23 km/h (14 mph) before attempting a left turn to travel northbound. The Jeep was stopped at the intersection facing southwest.

Crash

The driver of the Chevrolet reported that he did not see the Honda as he began the left turn due to the darkness of the overpass. As the Chevrolet continued the turn, the front plane of the Chevrolet struck the front plane of the Honda (Event 1). The standard algorithm of the WinSMASH program calculated a total delta-V of 31 km/h (19 mph) for the Honda. The longitudinal and lateral compo-

nents were -31 km/h (-19 mph) and 5 km/h (3 mph), respectively. The results appear to be reasonable. Both frontal air bags in the Honda deployed during this event. The program calculated a total delta-V of 21 km/h (13 mph) for the Chevrolet. The longitudinal and lateral components were -20 km/h (-12 mph) and -7 km/h (-4 mph), respectively. The EDR reported a maximum SDM-recorded velocity change of 18.8 km/h (-11.7 mph).

The Honda was displaced clockwise and came to rest facing northeast. The Chevrolet was displaced counterclockwise and struck the front of the Jeep (Event 2) where it came to rest (**Figure 5**).

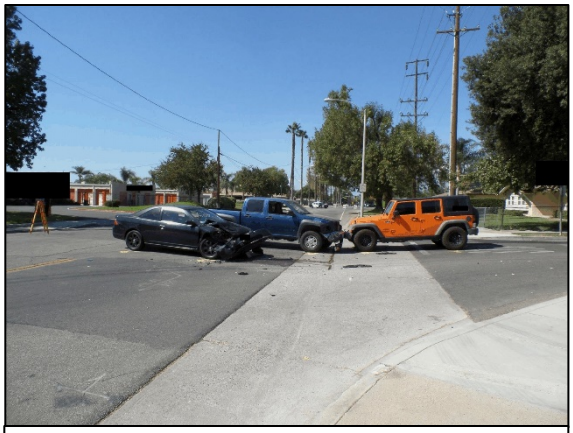


Figure 5. Final rest, looking west (police photo).

Post-Crash

The driver of the Honda was contacted and injured by at least two metal fragments from the inflator. She was removed from her vehicle and initially treated by the driver of the Jeep (who was a nursing student) until EMT personnel arrived. The driver of the Honda was then transported to a local hospital, where she arrived at 1219 hours. The admitting diagnosis was cardiac arrest. The driver did not respond to treatment and was pronounced deceased at 1246 hours.

The Honda and Chevrolet were towed from the scene and placed on a police evidentiary hold. The Jeep was driven from the scene by the owner.

2001 HONDA CIVIC

Description

The Honda was a front-wheel drive, 5-passenger, 2-door coupe. The vehicle was identified by the VIN 1HGEM22911Lxxxxxx with a manufacture date of November 2000. The vehicle was equipped with a 1.7-liter, 4-cylinder gas engine, a 4-speed automatic transmission, and 4-wheel disc brakes with ABS. The vehicle manufacturer's recommended tire size was P185/65R15 with a cold pressure of 297 kPa (30 psi). The vehicle was equipped with Ohtsu FP0162 P205/60R15 tires of the recommended size. The specific tire information was as follows.

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	145 kPa (21 psi)	6 mm (7/32 in)	No	None
LR	152 kPa (22 psi)	6 mm (7/32 in)	No	None
RR	159 kPa (23 psi)	6 mm (7/32 in)	No	None
RF	159 kPa (23 psi)	6 mm (7/32 in)	No	None

The Honda was configured with seating for five occupants. The front row was equipped with fabric covered bucket seats with adjustable head restraints. The driver's seat was slightly reclined and was adjusted to the full rearward track position.

Exterior Damage

The Honda sustained moderate severity frontal damage from the impact to the front of the Chevrolet (**Figure 6**). The direct damaged began at the right front bumper corner and extended 112 cm (44.0 in) to the left. The Field L extended from bumper corner to bumper corner. Seventeen measurements were taken at bumper level by the Nikon Total Station and the Faro Blitz program computed crush measurement in six increments as follows: C_1 = 1 cm (0.4 in), C_2 = 0 cm, C_3 = 19 cm (7.4in), C_4 = 33 cm (12.9 in), C_5 = 21 cm (8.2 in), C_6 = 13 cm (5.1 in). The Collision Deformation Classification (CDC) was 12FZEW2. The maximum crush was located 7 cm (2.7 in) right of the bumper centerline.

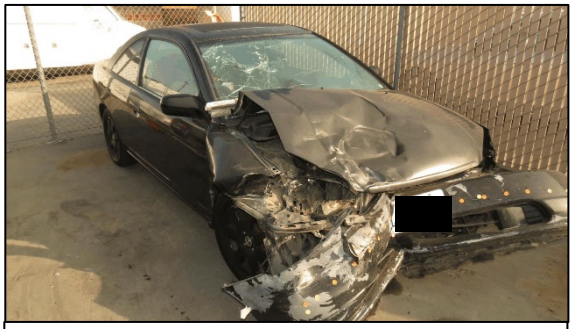


Figure 6. Frontal damage, 2001 Honda Civic.

Event Data Recorder

The Honda was equipped with an air bag control module that was not supported by the Bosch CDR tool.

Interior Damage

The inspection of the interior revealed minor damage related to the air bag deployments and an area of blood deposits. The driver's air bag module had been removed by police prior to the vehicle inspection. The interior of the vehicle was filled with trash and clothing. Fabric covering the roof and visors was worn and ripped in spots. There was an area of blood deposits located along the left lower door opening. There was no deformation of the steering wheel rim or compression of the column. There were no deformations to any of the seats. All the doors remained closed and operational. The windshield was fractured from this crash; there was no additional glazing damage. There was no intrusion into the passenger compartment.

Figure 7. Driver's seat belt, 2001 Honda Civic.

Manual Restraint Systems

The front row was equipped with driver and front right passenger lap and shoulder seat belts. The driver's belt was equipped with continuous loop belt webbing, a sliding latch plate, an emergency locking retractor (ELR), and non-adjustable upper anchor. There was a 46 cm (18.1 in) area of blood on the webbing located 52 cm (20.4 in) above the floor anchor (**Figure 7**). The belt was in poor condition with a 26 cm area (10.2 in) area of shredding (from use) located 24 cm (9.4 in) above the anchor and a 16 cm (6.3 in) area of shredding located 87 cm (34.2 in) above the anchor. This damage was not related to any crash. The front right passenger's seat belt was equipped the same as the driver, but had a switchable ELR/automatic

locking retractor (ALR). The second row seat belts were equipped with continuous loop belt webbing, sliding latch plates, switchable ELR/ALRs, and non-adjustable upper anchors.

Supplemental Restraint Systems

The Honda was equipped with dual-stage frontal air bags for the driver and front right passenger positions. As a result of the head-on impact with the Chevrolet both frontal air bags deployed. The air bag system included a control module and external sensors. The module was located on the forward aspect of the center tunnel forward of the transmission shifter. Two external sensors were mounted to the outboard forward aspects of the front frame rails. The sensors were not damaged.

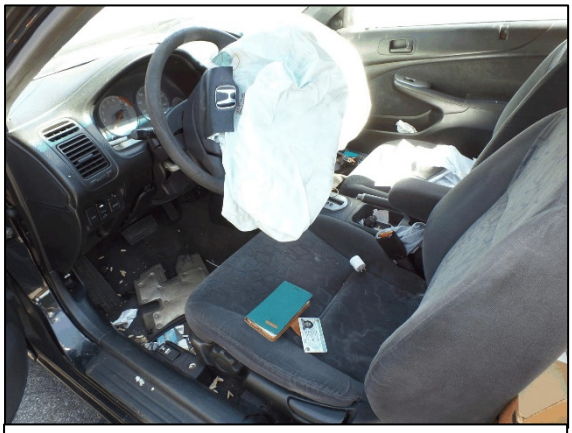


Figure 8. Driver's air bag, 2001 Honda Civic (police photo).

The driver's frontal air bag deployed from an H-configuration module cover located in the spokes of the steering wheel rim (**Figure 8**). The air bag was circular and measured 62 cm (24.4 in) in diameter in its deflated state. The air bag was configured with two rear-panel vent ports and two tethers. The air bag inflator ruptured during some phase of deployment. The air bag was holed in two locations on the front panel (**Figure 9**). The first hole was located adjacent to the tether stitching and measured 4 cm (1.6 in). The second hole was located along the center line and below the tether stitching. It measured 3 cm (1.2 in). A single small hole was documented to the back panel.

Figure 9. Holes in driver air bag front panel, 2001 Honda Civic.

The passenger's frontal air bag was a top-mount design in the upper right instrument panel. The passenger air bag deployed from H-configuration cover flaps (**Figure 10**). The air bag measured 46 cm (18.1 in) wide and 59 cm (23.2 in) high. This vehicle was not equipped with the optional side impact air bags.

Figure 10. Passenger's frontal air bag, 2001 Honda Civic.

Air Bag Inflator Rupture Discussion

The driver's frontal air bag inflator was manufactured in July 2000 by Takata Corporation and was original to this vehicle (**Figure 11**). The air bag inflator contained phase-stabilized ammonium nitrate (PSAN) as a propellant. The inflator was seated in the air bag assembly and held in place by four lock nuts. During the deployment the air bag inflator ruptured (**Figure 12**). Fragments from the inflator holed the front and back panels of the air bag. Two moderately sized

fragments were recovered from the driver. One was removed from the driver's cheek (**Figure 13**) and one was removed from the driver's lung (**Figure 14**). The first had a batwing shape measuring approximately 3 x 4 cm (1.1 x 1.5 in) and weighed 2.08 grams (0.07 oz). The second was irregularly shaped and measured approximately 2 x 3.5 cm (0.8 x 1.3 in) and weighed 1.87 grams (0.06 oz).

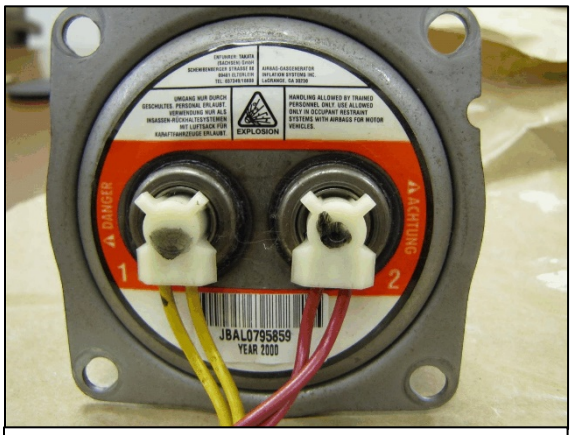


Figure 11. Inflator manufacture date, 2001 Honda Civic.

Figure 12. Ruptured inflator, 2001 Honda Civic.

Figure 13. Fragment removed from driver's left cheek, 2001 Honda Civic.

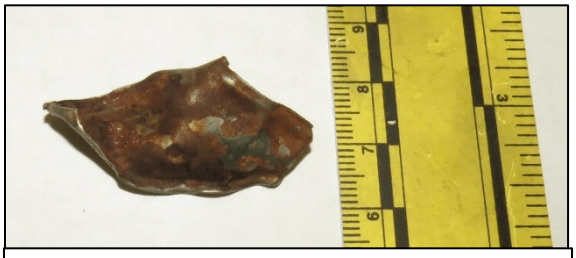


Figure 14. Fragment removed from driver's right lung, 2001 Honda Civic.

One 5 x 5.5 cm (1.9 x 2.1 in) fragment was recovered by the investigating agency inside the vehicle (**Figure 15**). Multiple smaller fragments were recovered from within the air bag.

Figure 15. Inflator fragment found in vehicle, 2001 Honda Civic.

NHTSA Recalls and Investigations

The vehicle was subject to NHTSA Recall Numbers 15V-320 and 15V-370. The first recall indicates that the driver's frontal air bag inflator could produce excessive internal pressure at deployment that may cause the inflator to rupture. The second recall addresses the passenger's frontal air bag inflator. The remedy was for Honda to notify owners and dealers in all affected vehicles and to replace the inflators free of charge. The inflators in this vehicle were original to the vehicle. It is not known if any notifications

were received by the current or previous vehicle owners.

2001 HONDA CIVIC OCCUPANT

Driver Demographics

Age/Sex:	50 years/female
Height:	168 cm/66 in
Weight:	64 kg/141 lbs
Eyewear:	Unknown
Seat type:	Bucket
Seat track position:	Full rearward (at time of inspection)
Manual restraint usage:	Lap and shoulder used
Usage source:	Vehicle inspection
Air bags:	Frontal air bag, deployed
Alcohol/drug data:	None per autopsy report
Egress from vehicle:	Removed from vehicle by driver of Vehicle 3
Transport from scene:	Ambulance
Type of medical treatment:	Transported, pronounced deceased at hospital

Driver Injuries

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Right hemothorax, NFS (1300 milliliters blood in chest cavity)	442200.3	Air bag inflator fragment	Certain
2	Fracture, right posterior rib 1, right anterior ribs 4, 8, and 9	450203.3	Air bag inflator fragment	Certain
3	Right lung wound, 2.0 x 1.0 cm (0.8 x 0.4 in)	441431.3	Air bag inflator fragment	Certain
4	Facial avulsion, 3.0 x 3.0 cm (1.2 x 1.2 in), left	210800.1	Air bag inflator fragment	Certain
5	Abrasion, right upper chest, 6.0 x 2.0 cm (2.3 x 0.8 in)	410202.1	Air bag inflator fragment	Certain
6	Forehead laceration, 2.0 x 1.5 cm (0.8 x 0.6 in)	210602.1	Air bag inflator fragment	Probable

Source: Autopsy Report

Driver Kinematics

The 50-year-old female driver of the Honda was seated in an unknown posture and was using the available lap and shoulder seat belt. The bucket seat was adjusted to an unknown track position and

the seat back was slightly reclined. The seat may have been moved prior to the vehicle inspection. There were no indications that the driver braked or attempted any avoidance maneuvers. At impact with the Chevrolet, both frontal air bags deployed. The driver was displaced forward and to the left. The driver's air bag inflator ruptured and fragments penetrated the driver's left cheek and her chest. The penetrating chest injury lacerated the right lung and the driver began bleeding internally.

She remained in her seated position post-crash. She was then was removed from her vehicle and initially treated by the driver of the Jeep (who was a nursing student) until EMT personnel arrived. The driver of the Honda was then transported to a local hospital where she arrived at 1219 hours. The admitting diagnosis was cardiac arrest. The driver did not respond and was pronounced deceased at 1246 hours.

2006 CHEVROLET COLORADO PICKUP

Description

The 2006 Chevrolet Colorado 4-door crew cab pickup was identified by the VIN: 1GCDT136468xxxxxx. The vehicle was equipped with a 3.5-liter, 5-cylinder, gasoline engine, an automatic transmission, and 4-wheel drive. The tire placard was blank and the recommended tire size and inflation are not known. The Chevrolet was equipped with Hercules Terra Trac AT II 31x 10/50R15LT tires. The specific tire information is as follows.

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	193 kPa (28 psi)	10 mm (13/32 in)	No	None
LR	193 kPa (28 psi)	10 mm (13/32 in)	No	None
RR	207 kPa (30 psi)	10 mm (13/32 in)	No	None
RF	179 kPa (26 psi)	10 mm (13/32 in)	Yes	None

Exterior Damage

The Chevrolet sustained moderate severity frontal damage from the impact to the front of the Honda (**Figure 16**). The direct damaged began at the right front bumper corner and extended 23 cm (9.0 in) to the left. The Field L extended from bumper corner to bumper corner. Seventeen measurements were taken at bumper level by the Nikon Total Station and the Faro Blitz program computed crush measurement in six increments as follows: $C_1 = 0$ cm, $C_2 = 0$ cm, $C_3 =$ 1 cm (0.4 in), $C_4 = 3$ cm (1.2 in), $C_5 = 5$ cm (1.9 in), $C_6 = 19$ cm (7.4 in). The CDC was 01FREE1. The maximum crush was located at the right front bumper corner.

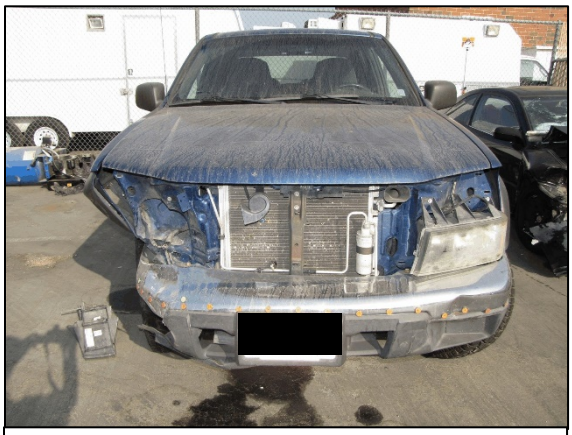


Figure 16. 2006 Chevrolet Colorado.

The Chevrolet also struck the front of the stopped Jeep Cherokee. The estimated CDC was 12FLLN1.

Event Data Recorder

The Chevrolet was equipped with an air bag supplemental restraint system that had EDR capability to store deployment and non-deployment events. Both types of events can contain pre- crash and crash data. For the pre-crash data there is a 5-second buffer that records vehicle speed, engine speed, and percent throttle. There is also an 8-second buffer that records brake switch circuit state.

The data from the Chevrolet's EDR was imaged using the Bosch Crash Data Retrieval Tool version 17.0 using the DLC method and reported using version 17.9. The EDR was imaged by the investigating police agency and a copy of the Bosch file was provided to SCI during the vehicle inspection. A single non-deployment event was recovered. The Bosch CDR report is included at the end of this report and the EDR-reported data not discussed elsewhere in this report is summarized below.

The recorded event was a non-deployment event that resulted from the impact with the Honda. The maximum SDM recorded velocity change was -18.8 mph (-11.7 km/h) at 125 ms.

The pre-crash data at -1 second before AE was as follows.

Vehicle Speed (mph):	14
Engine Speed (rpm):	640
Percent Throttle:	0
Brake Switch Circuit State:	Off ("On" for the previous 5 one-second samples)

Occupant Data

The Chevrolet was driven by a 19-year-old male driver. There were no reported injuries.

2013 JEEP WRANGLER

Description

The 2013 Jeep Wrangler Unlimited Sport 4-door SUV was identified from the VIN 1C4BJWDG2DLxxxxxx. The vehicle was equipped with a 3.6-liter, 6-cylinder, gasoline engine and 4-wheel drive.

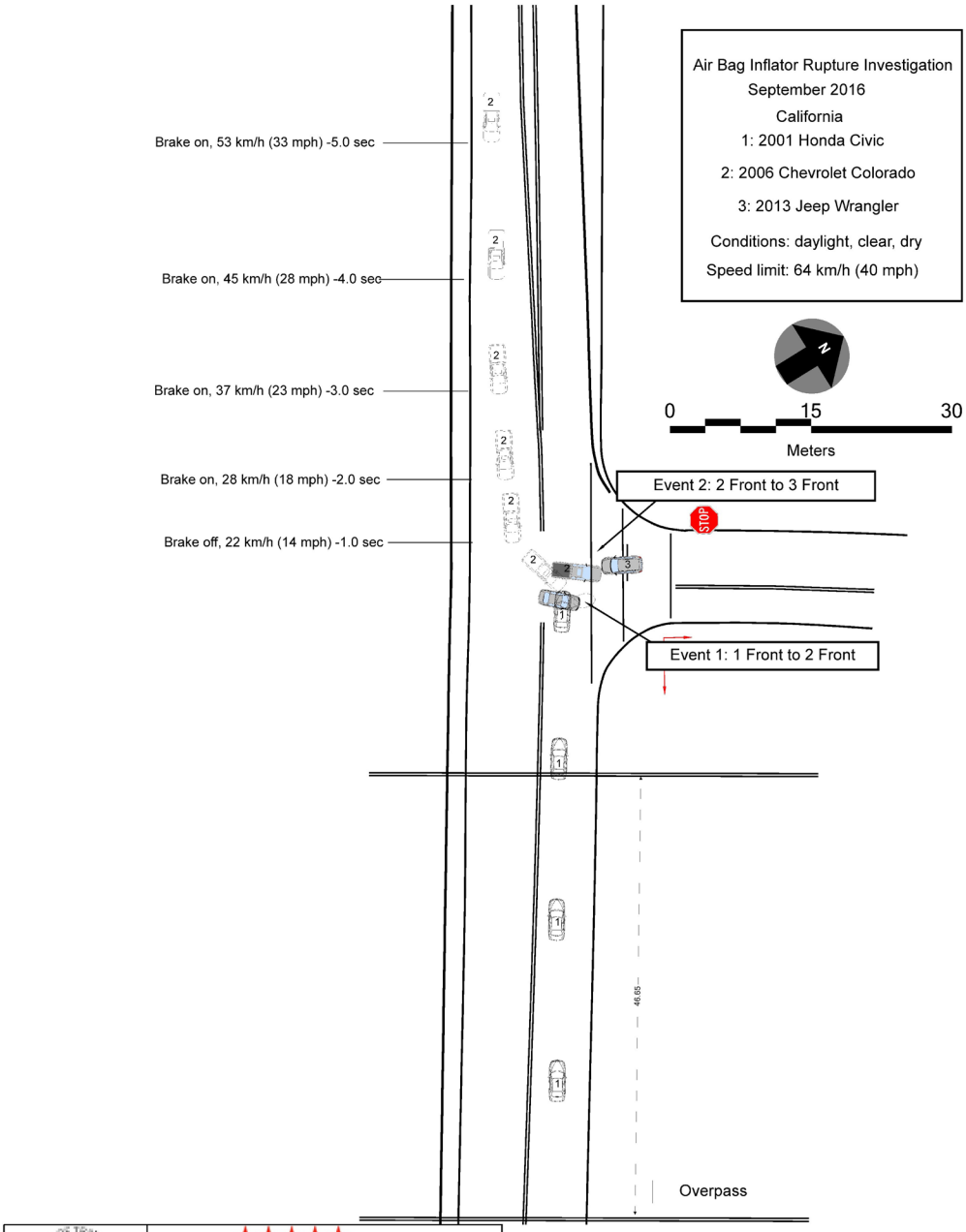
Exterior Damage

The Jeep sustained minor front-end damage from a minor impact with the front of the Chevrolet.

Occupant Data

The Jeep was driven by a 28-year-old female driver. She did not sustain any injuries.

CRASH DIAGRAM



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Appendix A: Event Data Recorder Report
2006 Chevrolet Colorado[1]

[1]The EDR report contained in this technical report was imaged using the current version of the Bosch CDR software at the time of the vehicle inspection. The CDR report contained in the associated Crash Viewer application may differ relative to this report.

IMPORTANT NOTICE: Robert Bosch LLC and the manufacturers whose vehicles are accessible using the CDR System urge end users to use the latest production release of the Crash Data Retrieval system software when viewing, printing or exporting any retrieved data from within the CDR program. Using the latest version of the CDR software is the best way to ensure that retrieved data has been translated using the most current information provided by the manufacturers of the vehicles supported by this product.

CDR File Information

User Entered VIN	1GCDT136468******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS16020_V2_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 17.0
Imaged with Software Licensed to (Company Name)	Company Name information was removed when this file was saved without VIN sequence number
Reported with CDR version	Crash Data Retrieval Tool 17.9
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Non-Deployment

Comments

No comments entered.

Data Limitations

Recorded Crash Events:

There are two types of Recorded Crash Events. The first is the Non-Deployment Event. A Non-Deployment Event records data but does not deploy the air bag(s). It contains Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event may be overwritten by another Non-Deployment Event. This event will be cleared by the SDM, after approximately 250 ignition cycles. This event can be overwritten by a second Deployment Event, referred to as a Deployment Level Event, if the Non-Deployment Event is not locked. The data in the Non-Deployment Event file will be locked, if the Non-Deployment Event occurred within five seconds before a Deployment Event. A locked Non Deployment Event cannot be overwritten or cleared by the SDM. The second type of SDM recorded crash event is the Deployment Event. It also contains Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. If multiple Non-Deployment Events occur within five seconds prior to a Deployment Event, then the most severe Non-Deployment Event will be recorded and locked. If multiple Non-Deployment Events precede a Deployment Event, and occur within five seconds of each other (but not necessarily all within five seconds of the Deployment Event), then the most severe of the Non-Deployment Events (which may have occurred more than five seconds prior to the Deployment Event) will be recorded and locked. If a Deployment Level Event occurs within five seconds after the Deployment Event, the Deployment Level Event will overwrite any non-locked Non-Deployment Event. If multiple Non-Deployment Events occur within five seconds prior to a Deployment Event, and one or more of those events was a Pretensioner Deployment Event, then the most recent Pretensioner Deployment Event will be recorded and locked. Deployment Events cannot be overwritten or cleared by the SDM. Once the SDM has deployed an air bag, the SDM must be replaced.

Data:

-SDM Recorded Vehicle Longitudinal Velocity Change reflects the change in longitudinal velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Longitudinal 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. For Deployment Events, the SDM will record 100 milliseconds of data after Deployment criteria is met and up to 50 milliseconds before Deployment criteria is met. For Non-Deployment Events, the SDM can record up to the first 150 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.
-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 by various factors, including but not limited to the following:
    -Significant changes in the tire's rolling radius
    -Final drive axle ratio changes
    -Wheel lockup and wheel slip
-Brake Switch Circuit Status indicates the open/closed state of the brake switch circuit.
-Pre-Crash data is recorded asynchronously. The 1.0 second Pre-crash data value (most recent recorded data point) is the data point last sampled before AE. That is to say, the last data point may have been captured just before AE but no more than 1.0 second before AE. All subsequent Pre-crash data values are referenced from this data point.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:
    -The SDM receives a message with an "invalid" flag from the module sending the pre-crash data
    -No data is received from the module sending the pre-crash data

-No module present to send the pre-crash data

-Engine Speed is reported at two times the actual value in the following vehicles, if the vehicle is equipped with a 6.6L Duramax diesel engine (RPO LB7, LBZ, LLY, or LMM):

-2001-2006 Chevrolet Silverado
-2007 Chevrolet Silverado Classic
-2001-2006 GMC Sierra
-2007 GMC Sierra Classic
-2006-2007 Chevrolet Express
-2006-2007 GMC Savana
-2003-2009 Chevrolet Kodiak
-2003-2009 GMC Topkick

-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. If the vehicle's electrical system is compromised during a crash, the state of the Driver's Belt Switch Circuit may be reported other than the actual state.
-The Time between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than 25.4 seconds, "N/A" is displayed in place of the time.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-Multiple Events will indicate whether one or more associated events preceded the recorded event.
-Multiple Events Not Recorded can be used in the following scenarios:

-If a single event is recorded, this parameter will indicate whether one or more associated events prior to the recorded event was not recorded due to insufficient record space (because there were more events than there were available event records).
-If two associated events are recorded, this parameter for the first event will indicate whether one or more associated events prior to the first event was not recorded due to insufficient record space.
-If two associated events are recorded, this parameter for the second event will indicate whether one or more associated events between the first and second events was not recorded due to insufficient record space.

-All data should be examined in conjunction with other available physical evidence from the vehicle and scene.

Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted by the Powertrain Control Module (PCM), via the vehicle's communication network, to the SDM.
-Brake Switch Circuit Status data is transmitted by either the ABS module or the PCM, via the vehicle's communication network, to the SDM.
-The Belt Switch Circuit is wired directly to the SDM.

Hexadecimal Data:
Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR tool.

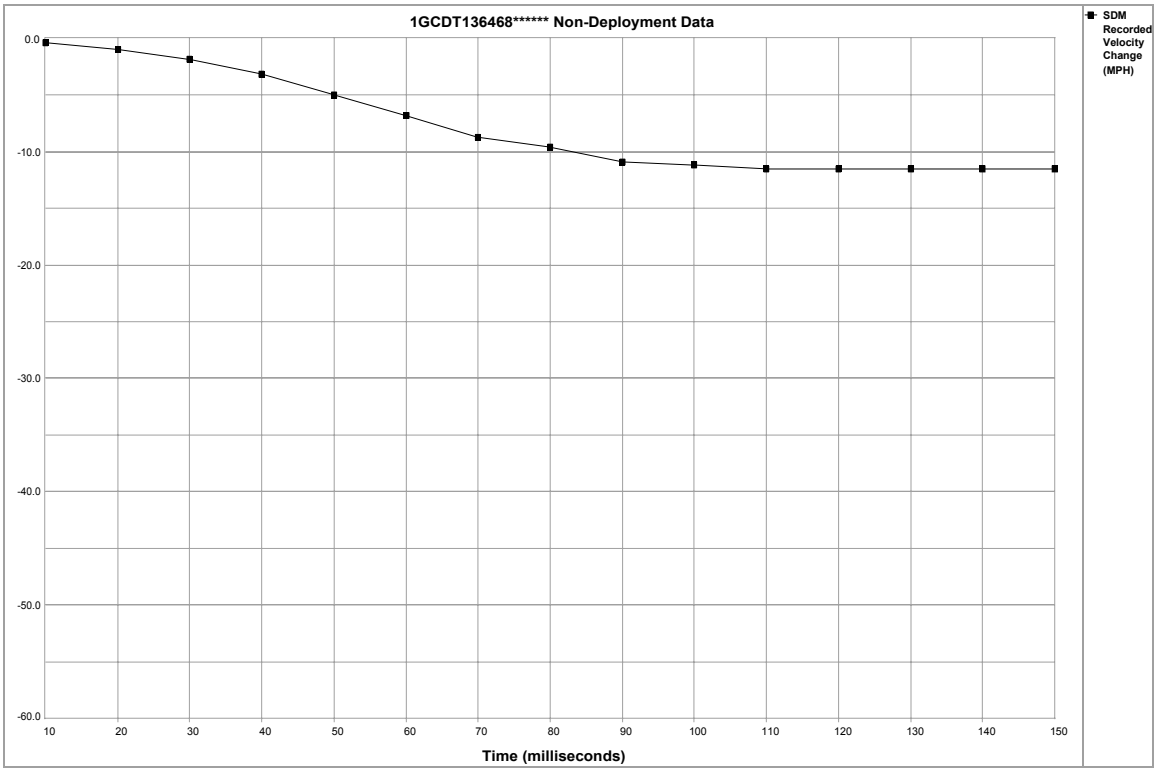
01027_SDMGF_r007

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Passenger Seat Position Switch Circuit Status	Rearward
Ignition Cycles At Non-Deployment	16271
Ignition Cycles At Investigation	16272
Maximum SDM Recorded Velocity Change (MPH)	-11.74
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	125
Crash Record Locked	No
Event Recording Complete	Yes
Multiple Events	No
Multiple Events Not Recorded	No

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	33	896	0
-4	28	832	0
-3	23	768	0
-2	18	768	0
-1	14	640	0

Seconds Before AE	Brake Switch Circuit State
-8	OFF
-7	OFF
-6	ON
-5	ON
-4	ON
-3	ON
-2	ON
-1	OFF



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.31	-0.93	-1.86	-3.10	-4.96	-6.82	-8.68	-9.61	-10.85	-11.16	-11.47	-11.47	-11.47	-11.47	-11.47

Hexadecimal Data

```
$01   F0 3C E3 42 C2 E4
$02   60 60 00 00 C4 00
$03   41 53 35 33 34 36
$04   4B 37 30 56 34 32
$05   53 53 53 32 39 33
$06   10 35 63 08 00 00
$07   33 05 31 56 00 00
$08   41 44 90 05 58 53
$09   28 41 34 30 4B 45
$0A   41 44 90 05 58 53
$0B   28 41 34 30 4D 32
$0C   00 00 00 00 00 00
$0D   00 00 00 00 00 00
$0E   00 00 00 00 00 00
$0F   00 00 00 00 00 00
$10   F8 0D FF 00 00 00
$11   83 81 83 7E 7E 7F
$12   94 00 00 90 3E 04
$13   00 01 00 00 00 00
$14   1D 1D 00 00 64 40
$15   FA FA FA FA FA FA
$16   FA FA FA FA FA FA
$17   FA FA 00 00 00 00
$18   00 CF 05 EC F5 00
$19   09 00 0A 00 00 64
$1A   00 00 00 00 00 00
$1B   00 00 00 00 00 00
$1C   00 0C 00 00 00 00
$1D   00 00 00 00 00 00
$1F   FF 00 00 00 00 00
$20   12 FD 00 00 FF FF
$21   FF FF FF FF FF FF
$22   FF FF FF FF FF FF
$23   FF FF FF FF FF FF
$24   00 02 5D 34 32 4B
$25   26 00 00 07 FF FF
$26   01 03 06 0A 10 16
$27   1C 1F 23 24 25 25
$28   25 25 25 00 F8 0E
$29   80 A5 FF FF FF FF
$2A   FF FF FF FF FF FF
$2B   FF FF FF FF FF FF
$2C   FF FF FF FF FF FF
$2D   FF FF 00 00 00 00
$30   FF FF FF FF FF FF
$31   FF FF FF FF FF FF
$32   FF FF FF FF FF FF
$33   FF FF FF FF FF FF
$34   FF FF FF FF FF FF
$35   FF FF FF FF FF FF
$36   FF FF FF FF FF FF
$37   FF FF FF FF FF FF
$38   FF FF FF FF FF FF
$39   FF FF FF FF FF FF
$3A   FF FF FF FF FF FF
$3B   FF FF FF FF FF FF
$3C   FF FF FF FF FF FF
$3D   FF FF 00 00 00 00
$40   02 17 1D 25 2D 00
$41   3E 00 00 00 00 00
$42   00 00 0A 0A 0C 0C
$43   0D 00 7D 80 00 00
$44   17 1D 25 2D 35 00
$45   7C 00 00 00 00 00
```

```
$46   00 00 0A 0C 0C 0D
$47   0E 00 7D 80 00 00
$48   00 00 04 06 02 00
$49   73 00 00 00 00 00
$4A   53 00 0A 0C 0D 0F
$4B   19 00 7D 80 00 00
$4C   FF FF FF FF FF FF
$4D   FF FF FF FF FF FF
$4E   FF FF FF FF FF FF
$4F   FF FF FF FF 00 00
$50   FF FF FF FF FF FF
$51   FF FF FF FF FF FF
$52   FF FF FF FF FF FF
$53   FF FF FF FF FF FF
$54   FF FF FF FF FF FF
```

Disclaimer of Liability

The users of the CDR product and reviewers of the CDR reports and exported data shall ensure that data and information supplied is applicable to the vehicle, vehicle's system(s) and the vehicle ECU. Robert Bosch LLC and all its directors, officers, employees and members shall not be liable for damages arising out of or related to incorrect, incomplete or misinterpreted software and/or data. Robert Bosch LLC expressly excludes all liability for incidental, consequential, special or punitive damages arising from or related to the CDR data, CDR software or use thereof.

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U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

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