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Special Crash Investigations: Front Axle Shaft/U-Joint Malfunction Crash Investigation; Vehicle: 2006 Dodge Ram 3500; Location: Nebraska; Crash Date: March 2019

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15. Supplementary Notes

Each crash represents a unique sequence of events, and generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicles 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 submitted.

16. Abstract

This report documents the on-site investigation of the mechanical malfunction in the front axle shaft/U-joint of a 2006 Dodge Ram 3500 4x4 quad cab pickup. The vehicle was involved in a right-plane-to-front-plane crash with a 2005 Chevrolet Silverado pickup. This two-vehicle crash occurred in March 2019 in the afternoon on a two-lane, undivided, State highway in rural Nebraska. The Dodge was traveling northbound and was pulling an empty Titan tri-axle 40-ft flatbed trailer. The Dodge was being driven by a 43-year-old male. The front right seat was occupied by a 74-year-old male. The second vehicle was a 2005 Chevrolet Silverado pickup driven by a 16-year-old male. There were two additional occupants in the vehicle. The Dodge crossed over the centerline into the path of the Chevrolet. The vehicles collided in an angled configuration. Both vehicles then came to rest in a ditch on the west side of the roadway. The driver of the Dodge sustained "A" (incapacitating) injuries to his chest area and was transported from the scene by ambulance. The front right passenger of the Dodge sustained fatal injuries to the head area. The driver of Chevrolet sustained "A" (incapacitating) injuries and was transported from the scene by ambulance. The front right passenger of the Chevrolet sustained fatal injuries. The third occupant of the Chevrolet sustained serious injuries. He was transported by helicopter to an area trauma center, where he passed away a week after the crash. Both vehicles were towed from the scene and placed on a police hold. Based on available evidence, it is likely that the U-joint failed pre-crash, causing a steering malfunction that caused the vehicle to yaw and cross the centerline.

17. Key Words	18. Distribution Statement
frontal axle shaft, U-joint, air bag, deployment, fatality, injury	The document is available to the public from the National Technical Information Service, ww.ntis.gov.

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On-Site Office of Defects Investigation
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BACKGROUND

This report documents the on-site investigation of the reported mechanical malfunction in the front axle shaft/U-joint of a 2006 Dodge Ram 3500 4x4 quad cab pickup. The vehicle was involved in a right-plane-to-front-plane crash with a 2005 Chevrolet Silverado pickup (**Figure 1**). The inspection documented the front drive shaft/front suspension and its role in the crash events. This investigation was initiated by the Office of Defects Investigation (ODI) in response to a police agency notification. The Special Crash Investigations (SCI) group of the National Highway Traffic Safety Administration assigned the case to Dynamic Science, Inc., in May 2019. The vehicle inspections were conducted during May 2019. Both vehicles were supported by the Bosch Crash Data Retrieval (CDR) system. The Dodge's EDR was imaged by SCI at the investigating police agency's office by going directly to the module. A copy of the Chevrolet's EDR report was obtained from the investigating police agency. Representatives from Fiat Chrysler Automobiles and police investigators were present during the inspections.

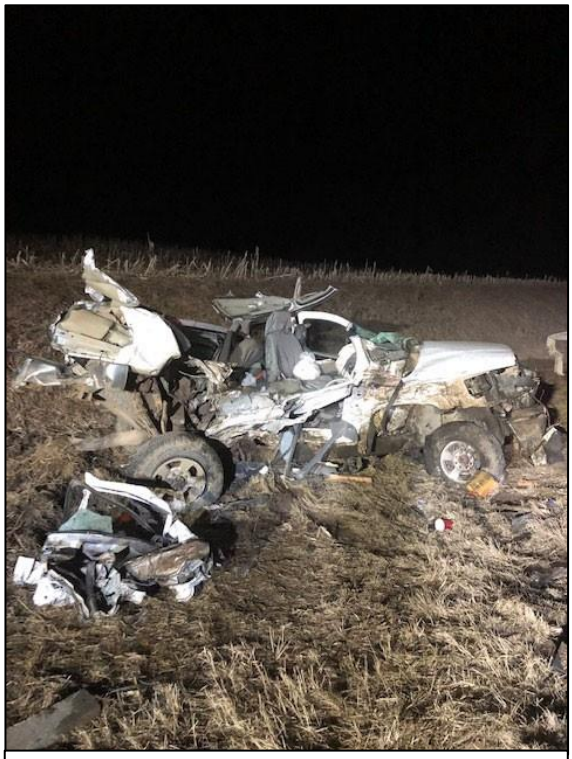


Figure 1. The 2006 Dodge Ram 3500, right plane (police photo).

This two-vehicle crash occurred in March 2019 in the afternoon on a two-lane, undivided, State highway in rural Nebraska. The Dodge was traveling northbound and was pulling an empty Titan tri-axle 40-ft flatbed trailer. The Dodge was driven by a belted 43-year-old male. The front right seat was occupied by a belted 74-year-old male. The second vehicle was a 2005 Chevrolet Silverado pickup and was traveling southbound. The vehicle was driven by a 16-year-old male. The front row right seat was occupied by an 18-year-old male. There was a third occupant, a 16-year-old male, seated in an unknown location. The left front wheel of the Dodge locked up due to a mechanical malfunction, causing the vehicle to veer to the left and cross over the centerline into the path of the Chevrolet. The vehicles collided in an angled configuration. Both vehicles then came to rest in a ditch on the west side of the roadway.

The driver of the Dodge sustained “A” (incapacitating) injuries to his chest area and was transported from the scene by ambulance. The front right passenger of the Dodge sustained fatal injuries to the head area. The driver of the Chevrolet sustained “A” (incapacitating) injuries to his chest area and was transported from the scene by ambulance. The front right passenger of the Chevrolet sustained fatal injuries. The third occupant of the Chevrolet sustained serious injuries. He was transported by helicopter to an area trauma center, where he passed away a week after the crash. Both vehicles were towed from the scene and placed on a police hold.

Figure 2. Southbound approach.

SUMMARY

Crash Site

The crash site was a two-lane, undivided, State highway in rural Nebraska (**Figure 2**). The asphalt roadway was straight with a less than 2 percent negative grade in the northbound direction. The travel lanes measured between 3-3.3 m (10-11 ft) wide and were separated by solid/dashed yellow painted lines and bordered by solid white painted fog lines. The east shoulder and region immediately east was slightly sloped to the east, with an open field to the east. The area to the west descended into a ditch that rose to a raised earth berm. West of the raised berm was an open field. The speed limit, according to the Nebraska speed limit map, was 96 km/h (60 mph) in both directions. The weather at the nearest reporting station was 0.5 °C (33 °F), clear visibility, and calm winds. A crash diagram is attached at the end of this technical report.

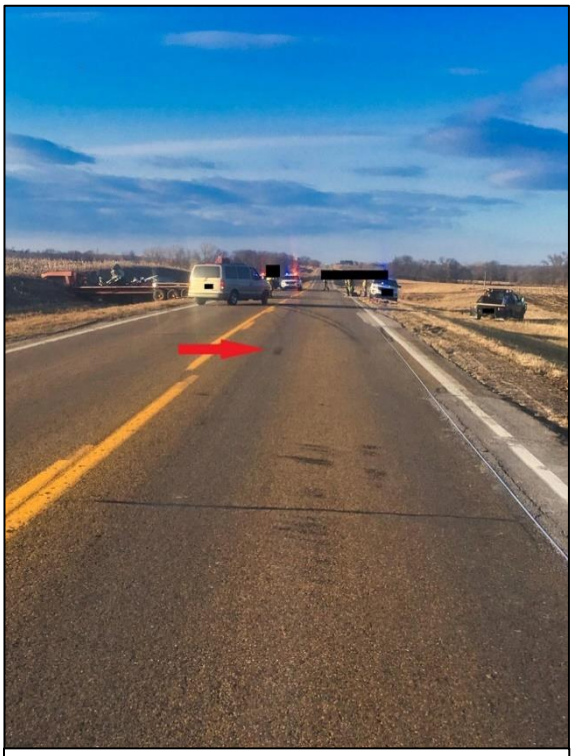


Figure 3. Northbound approach, arrow shows point of possible initial lock up (police image).

Pre-Crash

The Dodge was traveling northbound and was pulling the Titan trailer. The vehicle was equipped with an electronically shifted transfer case. At the time of the inspection, the transfer case switch in the Dodge was set to two-wheel drive. The Titan trailer had not been used in two to three months, according to the driver. During the trip, he indicated that he felt a slight vibration but assumed it was coming from the trailer. The Chevrolet was traveling southbound at an EDR-reported speed of 99 km/h (62 mph) at five seconds prior to impact. The brake switch circuit status was “off” until 1 second before impact. The table below documents the EDR-reported vehicle speeds and calculated travel distances for the Chevrolet during the 5.0 seconds of

recorded pre-crash data. As the Dodge continued northbound, the driver felt the vehicle abruptly pull to the left and the left front wheel lock (**Figure 3**). The Dodge began a sharp counterclockwise rotation as the driver was braking.

Time	Vehicle Speed		Distance Traveled			
			Incremental		Cumulative	
-sec	km/h	mph	m	ft	m	ft
5	100	62	NA	NA	NA	NA
4	100	62	27.7	90.9	27.7	90.9
3	98	61	27.5	90.1	55.2	181
2	98	61	27.2	89.4	82.6	225.4
1	97	60	27	88.7	109.4	359.1
0	93	58	26.4	86.5	135.8	445.6

Crash

The Dodge crossed the center line and entered the southbound travel lane. Just prior to impact, the driver of the Chevrolet braked. The front plane of the Chevrolet struck the right plane of the Dodge. Both frontal air bags in the Dodge deployed and the front row seat belt pretensioners actuated.

The WinSMASH program was not run because of the extensive crash damage and the presence of the trailer, putting the crash out of scope. Using the known delta V for the Chevrolet, SCI hand-calculated the delta V for the Dodge (minus weight considerations for the trailer) as -55.6 km/h (-34.6 mph).[1]

For the Chevrolet, the EDR reported a maximum recorded delta V of -64.3 km (-39.96 mph) at 107.5 milliseconds (ms). The Chevrolet was pushed rearward, and the cab was displaced (**Figure 4**).

The Dodge was displaced to the east in a clockwise rotation. The vehicle came to rest in the ditch on the west side of roadway facing northeast (**Figure 5**).

Figure 4. Final rest, the 2005 Chevrolet Silverado, looking northwest (police photo).

Post-Crash

The driver of the Dodge sustained "A" (incapacitating) injuries to his chest area and was transported from the scene by ambulance. The front right passenger of the Dodge sustained fatal injuries to the head area. He was declared deceased at the scene. The driver of the Chevrolet sustained "A" (incapacitating) injuries to his

[1] delta V V_1 = delta V V_2 ($weight_2$ / $weight_1$) = -39.96 (5817/6704) = 34.67.

chest area and was transported from the scene by ambulance. The front right passenger of the Chevrolet sustained fatal injuries. The third occupant of the Chevrolet sustained serious injuries. He was transported by helicopter to an area trauma center where he passed away a week after the crash. Both vehicles were towed from the scene and placed on a police hold.

Figure 5. Final rest, the 2006 Dodge Ram, looking southeast (police photo).

2006 DODGE RAM 3500 SLT QUAD CAB 4X4

Description

The 2006 Dodge Ram 3500 Bighorn Edition pickup was identified by the Vehicle Identification Number (VIN) 3D7LX38C16Gxxxxxx and was manufactured in May 2006. The vehicle was equipped with a 5.9-liter, 6-cylinder, diesel engine coupled to a manual transmission; a 4-wheel drive; antilock 4-wheel disc brakes; a 6-foot box; an electric brake controller; a gooseneck trailer hitch; and a quad cab. The gross vehicle weight rating (GVWR) was 4,491 kg (9,900 lbs). The vehicle manufacturer's recommended tire size was LT265/70R17 with cold pressures of 414 kPa (60 psi) for the front and 517 kPa (75 psi) for the rear. The vehicle was equipped with BF Goodrich All Terrain tires of the recommended size. The specific tire information was as follows:

Position	Measured Tread Depth	Restricted	Damage
LF	4 mm (5/32 in)	No	None
LR	6 mm (8/32 in)	Yes	None
RR	9 mm (11/32 in)	No	Sidewall torn
RF	6 mm (98/32 in)	No	De-beaded

The vehicle was configured with 40/20/40 cloth bench seats for the front row and a 60/40 cloth split folding bench seat for the second row. The front row seat track positions are not known.

Trailer Description/Damage

The Dodge was pulling a Titan tri-axle flatbed trailer. The trailer license plate provided a VIN that identified the unit as being manufactured in 1989, but it is unlikely the plate was on the correct trailer. The size identified by the VIN was different than the actual size (26 ft versus 36 ft). The trailer was equipped with a gooseneck hitch. The measured bed length was 10.9 m (36

ft), the width 2.5 m (8.5 ft), and the hitch length was 279 cm (110 in). The trailer was designed with electric brakes operated by a brake controller in the Dodge cab. The tire configuration is described in the following table:

	Left	Right
Axle 1	Firestone Transforce AT LT 265/75R16	Firestone Transforce AT LT 265/75R16
Axle 2	Goodyear G159 LT235/85R16	Goodyear G614 RST LT235/85R16
Axle 3	Michelin LTS A/S LT265/75R16	Wildcat Radial A/T LT265/75R16

The trailer sustained moderate damage during the crash. The gooseneck trailer hitch was deformed rearward by impact forces.

Vehicle History

The driver of the Dodge reported to the police that the vehicle was in good working order. It was used on a regular basis. He indicated that, one to two months before, the vehicle's brake pads had been replaced and that new steering parts had been installed. There was evidence that the left front axle had been serviced (i.e., marks on axle nut, new cotter pin). Efforts to locate a repair order related to this repair or to find the replaced parts were unsuccessful. Other repair orders regarding vibration at idle were obtained, but they were determined not to be related to steering issues.

Exterior Damage

The Dodge sustained catastrophic right plane damage as a result of the frontal impact of the Chevrolet (**Figure 6**). The damage could not be measured. There was extensive crush to the passenger compartment. The right doors were removed during extrication. The vehicle's bed was shifted to the right and deformed upward both from the impact with the Chevrolet and intra-unit movement with the trailer (**Figure 7**). The estimated Collision Deformation Classification (CDC) was 01RDAW9.

Event Data Recorder

The Dodge was equipped with an occupant restraint controller (ORC) that had EDR capability to store deployment and non-deployment events. One event was recovered. For the pre-crash data, there is a 5-second buffer that records vehicle speed, engine rpm, accelerator pedal %, service brake status, and service switch #2 status. There was a 2-second buffer that records antilock brake, electric stability, electronic throttle control, and cruise control data.

The data from the Dodge's EDR was imaged using the Bosch Crash Data Retrieval Tool version 18.0.2 via the direct-to-module method and reported using version 19.5. One event was recovered (Most Recent Event). There was no usable data stored for this event. The values were either zeroed out or had default values. The reason for the lack of data is unknown. It might have been the case that there was sufficient power to deploy the air bags, but that power was cut off prior to the system being able to write the data to the ORC. The Bosch CDR report is included as **Appendix A** at the end of this report.

NHTSA Recalls and Investigations

There were no recalls associated with the VIN for this vehicle when the database was last queried in September 2020.

Interior Damage

The Dodge sustained severe interior damage from intrusions and extrication efforts. There were lateral intrusions to the right front door, right B-pillar, right roof rail, roof, and right sill. Both right doors were initially jammed shut but were removed during extrication of the front right seat occupant.

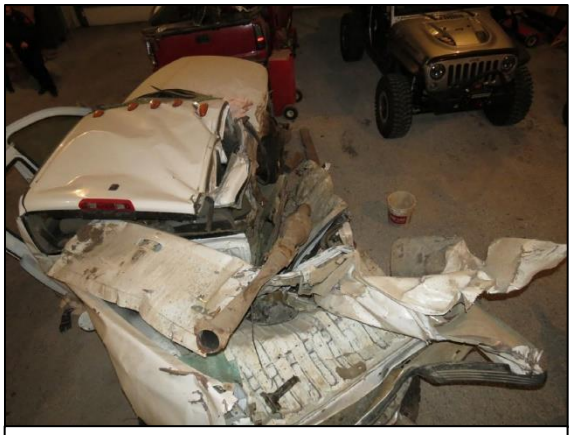


Figure 6. Right plane damage, the 2006 Dodge Ram 3500 pickup.

Front Steering/Axle Shaft U-joint Examination

The front suspension and steering components were examined during the vehicle inspection. The vehicle was jacked up and the left front tire was removed for the examination by investigators. The steering system consisted of a steering gearbox, pitman arm, drag link, tie rod and a steering damper. When the steering wheel is turned, the gear rotates the pitman arm which forces the drag link to one side. The drag link is connected to the right steering knuckle; the tie rod is connected to the drag link and the left steering knuckle. The steering damper is attached to a bracket on the axle and to the tie rod.

Figure 7. View from left, shows compressed left frame and deformed trailer mount, the 2006 Dodge Ram 3500.

The steering damper was deformed, as was the tie rod (**Figure 8**). This is likely crash-related damage. The left axle shaft U-joint was fractured in multiple locations (**Figures 9–11**). The left wheel was locked in place and could not be rotated. The wheel could be turned slightly from side to side when turning the steering wheel, indicating the steering linkages were still connected. Based on available evidence, it is likely that the U-joint failed pre-crash, causing a steering malfunction that caused the vehicle to yaw and cross the centerline.

Figure 8. Damaged steering damper, the 2006 Dodge Ram 3500.

Figure 9. Fractured left axle U-joint, the 2006 Dodge Ram 3500.

Figure 10. Left axle U-joint, the 2006 Dodge Ram 3500.

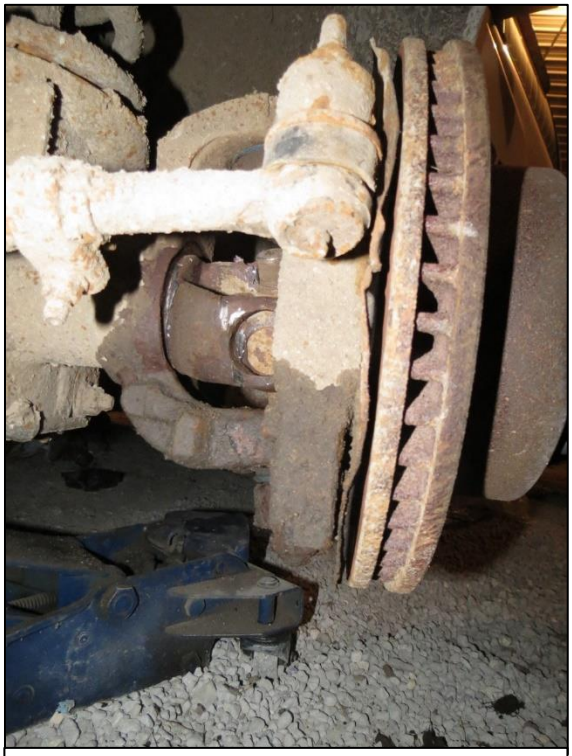


Figure 11. Left axle U-joint, the 2006 Dodge Ram 3500.

Manual Restraint Systems

The Dodge was equipped with 3-point lap and shoulder seat belts for the front row outboard seating positions. The driver's belt was equipped with continuous loop belt webbing, a sliding latch plate, an emergency locking retractor (ELR), and an adjustable anchor in the full-down position. The front right passenger's seat belt was equipped the same as the driver, but had a switchable ELR/automatic locking retractor (ALR) and the adjustable upper anchor was in the full-down position.

The driver's seat belt was found in the spooled-out position. The retractor was locked in position, resultant from actuation of the retractor pretensioner. There was loading evidence measuring 44 cm (17.3 in) long that was located 55 cm (21.6 in) above the stop button (**Figure 12**). The front right passenger's seat belt had been cut during the passenger's extrication suggesting that the belt was used in the crash.

Figure 12. Driver's seat belt, the 2006 Dodge Ram 3500.

Figure 13. Driver's frontal air bag, the 2006 Dodge Ram 3500.

Supplemental Restraint Systems

The Dodge was equipped with driver and passenger frontal air bags as a supplement to the seat belt restraint systems. Both frontal air bags deployed during the vehicle to vehicle crash.

The driver's frontal air bag was located in the steering wheel hub. The air bag had a deflated diameter of 48 cm (18.8 in) and was configured with a tether and two vent ports. The cover flaps opened at the designated tear seams and were undamaged. There was no discernible evidence of occupant contact to the air bag (**Figure 13**).

Figure 14. Passenger's frontal air bag, the 2006 Dodge Ram 3500.

The passenger's frontal air bag was located on top of the instrument panel above the glove box. The cover flaps opened at the designated tear seams and were undamaged. There was no discernible evidence of occupant contact to the air bag (**Figure 14**).

2006 DODGE RAM 3500 OCCUPANTS

Driver Demographics

Age/sex:	43 years/male
Height:	178 cm (70 in)
Weight:	84 kg (185 lbs)
Eyewear:	Unknown
Seat type:	40/20/40 Bench
Seat track position:	Unknown
Manual restraint usage:	Lap and shoulder belt used
Usage source:	Vehicle inspection
Air bags:	Frontal air bag, deployed

Alcohol/drug data:	BAC=.000, no drugs present
Egress from vehicle:	Removed due to injuries
Transport from scene:	Transported by ambulance
Type of medical treatment:	Treated, hospitalized one day

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Fracture, right posterior 10th, 11th, 12th ribs	450203.3	Center Console Driver seat back	Probable Possible
2	Liver contusion	541899.2	Lap portion of seat belt	Certain
3	Left forearm contusion/hematoma	710402.1	Driver air bag	Probable
4	Multiple abrasions to hands and arms	710202.1	Driver air bag	Possible

Source: emergency department physician record, radiology.

Driver Kinematics

The 43-year-old male driver was seated in an unknown posture with the bench seat adjusted to an unknown position. He was restrained by the lap and shoulder seat belt. Prior to the crash, the driver was actively steering the vehicle, his right foot presumably on the accelerator. As the left tire locked up the driver began braking. The vehicle veered to the left and the driver reported to the police that he tried to steer back to the right but it was too late. At impact, he was displaced forward and to the right. He loaded the seat belt and probably contacted the deployed frontal air bag. The vehicle was re-directed into a clockwise direction as it came to rest on the roadside. The driver attempted to get the right passenger to respond but couldn't get him to say anything. The driver was extricated from the vehicle by emergency personnel.

Front Row Right Occupant Demographics

Age/sex:	74 year/male
Height:	180 cm (70 in)
Weight:	95 kg (209 lbs)
Eyewear:	Unknown
Seat type:	40/20/40 bench
Seat track position:	Unknown
Manual restraint usage:	Lap and shoulder belt used
Usage source:	Vehicle inspection, police report
Air bags:	Frontal air bag, deployed
Egress from vehicle:	Fatal at scene, extricated by EMS
Transport from scene:	N/A
Type of medical treatment:	None

Front Row Right Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1 2	Separation of midbrain from pons and lacerated corpus callosum	140218.6 140688.3	Door panel	Probable
3 4	Lacerated aorta (ascending), two lacerations within right atrium	441016.6 420206.4	Door panel	Certain
5	Subarachnoid hemorrhage	140466.2	Door panel	Possible
6	Multiple rib fractures	450210.2	Door panel	Certain
7	Lacerated liver	541820.2	Lap portion of seat belt	Probable
8	Bilateral lung contusions	441410.3	Door panel	Certain
9	Fracture, right pelvis	856100.2	Door panel	Certain
10	Fracture, right humerus	751100.2	Door panel	Probable
11 12	Fracture, cervical vertebrae, C4 and C6	650216.2 650216.2	Door panel	Probable
13	Fracture, thoracic vertebrae, T7	650416.2	Door panel	Probable
14	Scalp hematoma	110402.1	Unknown	Unknown
15	Lacerations, right face	210600.1	Flying glass	Possible
16	Laceration, right neck	310600.1	Shoulder portion of seat belt	Possible
17	Laceration, right posterior hand	710600.1	Flying glass	Possible
18	Laceration, right anterior lower leg	810600.1	Unknown	Unknown
19	Contusion, right forehead	210402.1	Unknown	Unknown
20	Contusions, bilateral lower extremities	810402.1	Right instrument panel	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
21	Abrasion, left scrotum	544099.1	Unknown	Unknown
22	Contusions, posterior left and right hands	710402.1	Unknown	Unknown

Source: autopsy.

Front Row Right Occupant Kinematics

The 74-year-old male front right occupant was sitting in an unknown posture and was belted. At impact, he was displaced to the right and likely struck the right intruding door. He was declared deceased at the scene approximately 2 hours after the crash. An autopsy was requested by the acting coroner and his body was transported to different county for the examination.

2005 CHEVROLET SILVERADO PICKUP

Description

The 2005 Chevrolet Silverado 1500 4-door crew cab pickup was identified by the VIN 2GCEK13T751xxxxxx and was manufactured in February 2005. The vehicle was equipped with a 5.3-liter, 8-cylinder, gasoline engine, automatic transmission, 4-wheel drive, and 4-wheel disc brakes with ABS.

Figure 15. The 2005 Chevrolet Silverado pickup (police photo).

Exterior Damage

The Chevrolet sustained severe frontal damage from the impact to the right side of the Dodge. The impact caused the cab portion of the vehicle to be displaced from the chassis (**Figure 15**). The estimated CDC was 12FDAW6.

Event Data Recorder

The Chevrolet was equipped with a sensing and diagnostic module (SDM) 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 (rpm), and percentage of throttle. There is an 8-second buffer that records the brake switch circuit state.

The data from the Chevrolet's EDR was imaged using the Bosch Crash Data Retrieval Tool version 17.9 via direct-to-module method by the investigating police agency and reported using version 18.0. SCI was provided with a PDF version of the report. Two events were recovered: a deployment event and a non-deployment event.

The deployment events resulted from the impact with the right plane of the Dodge. The event recording was complete and locked. The maximum longitudinal Delta V was 64 km/h (-39.96

mph) at 107.5 ms. The first stage driver's frontal air bag deployed at 15 ms; the second stage deployed at 17.5 ms. The first stage passengers's frontal air bag deployed at 15 ms; the second stage deployed at 17.5 ms. The belt switch status for the front row occupant positions was "unbuckled" for both.

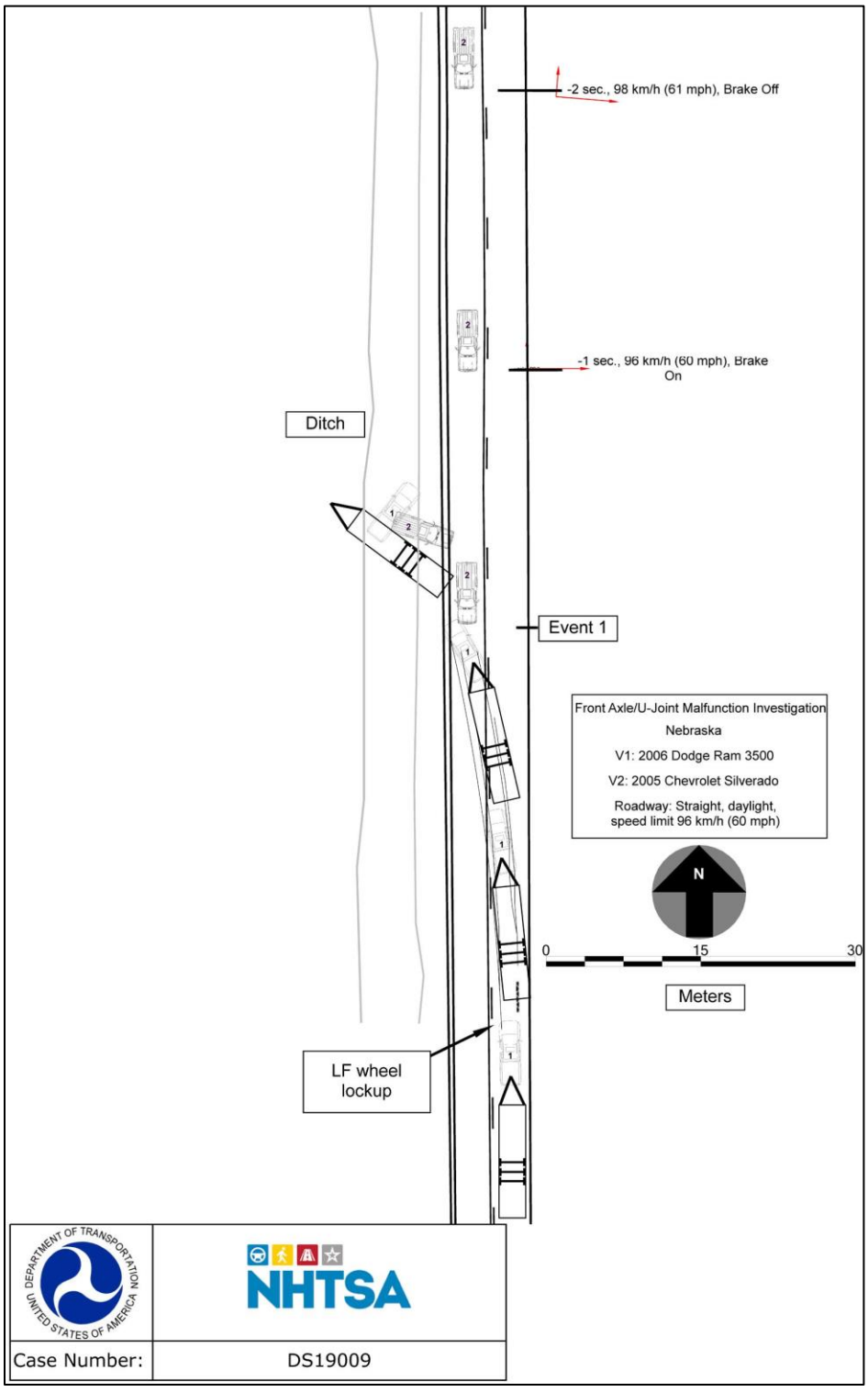
The Bosch CDR report is included at the end of this report as **Appendix B**. The pre-crash data at -1 seconds from algorithm enable (AE) was as follows:

Vehicle Speed:	96.5 (60 mph)
Engine Speed (rpm):	1536
Percent Throttle:	0
Brake Switch Circuit State:	On

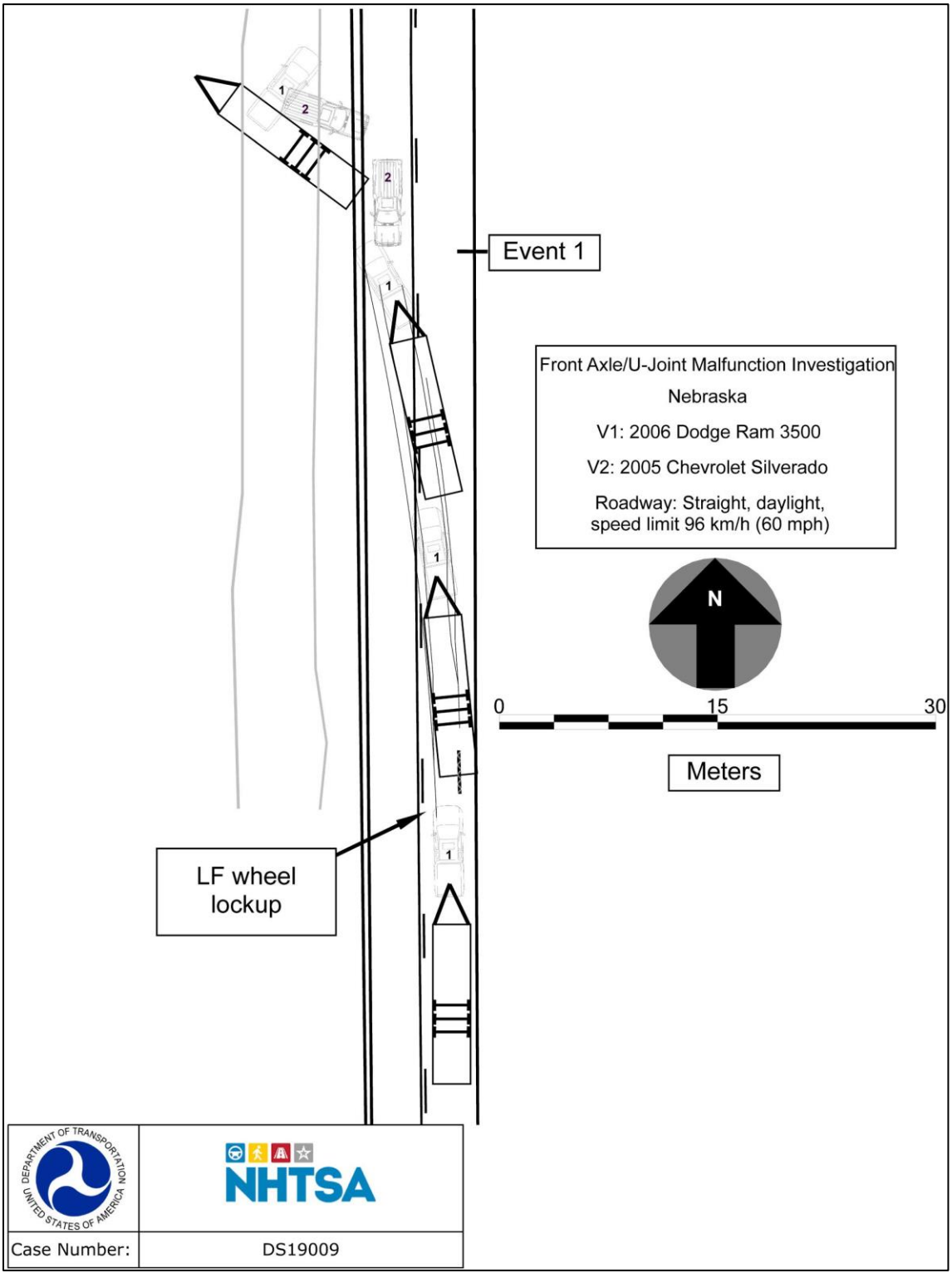
Occupant Data

The 16-year-old male driver of the Chevrolet was unbelted and sustained "A" (incapacitating) injuries to his chest area and was transported from the scene by ambulance. The 18-year-old male front right passenger of the Chevrolet was unbelted and sustained fatal injuries. The 16-year-old male third occupant of the Chevrolet sustained serious injuries. He was transported by helicopter to an area trauma center, where he passed away a week after the crash.

CRASH DIAGRAM



CRASH DIAGRAM: A Detailed View



APPENDIX A: Event Data Recorder Report for 2006 Dodge Ram 3500[2]

[2]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 View 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	3D7LX38C16G******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS19009_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 18.0.2
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 19.5
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Most Recent Event

Comments

No comments entered.

Data Limitations

AIRBAG CONTROL MODULE (ACM) DATA LIMITATIONS:

GENERAL INFORMATION:

CAUTION: During direct-to-module imaging where the Airbag Control Module (ACM) is disconnected and removed from a vehicle, make sure the ACM is not moved, tilted or turned over while connected to and powered by the CDR Interface Module (with appropriate adaptors in place, where required). Also, after a CDR imaging process, wait 2 minutes after power is removed from the ACM before attempting to move the module. Not following these general ACM guidelines direct-to-module imaging could cause new events to be recorded in the ACM.

- For additional definitions, please refer to the CDR Help File Glossary.
- As the VIN may be used to determine the configuration of the restraint system, it is imperative that the correct VIN be entered into the CDR Tool during the imaging process.
- For Fiat vehicles, the "Read VIN from Vehicle" feature in the CDR Tool will not work. The VIN will have to be manually entered.
- Delta-V is first available starting with some 2010 MY vehicles.
    - On vehicles not equipped with side impact sensing, Lateral acceleration and Delta-V will not be available.
    - Lateral acceleration may not be available for the 2008-2009 MY Chrysler Town and Country/ Dodge Grand Caravan/Lancia Voyager and 2010 MY Dodge Journey and Fiat Freemont even when equipped with side impact sensing.
    - Longitudinal and Lateral Delta-V are not available for the 2010-2012 MY Chrysler Town and Country/ Dodge Grand Caravan/Lancia Voyager.
- If a vehicle has rollover sensing but there is no angular rate recorded during the event, the Rollover Crash Pulse may not be displayed.
- The following table provides an explanation of the sign notation for data elements that may be included in this CDR report. All directional references to sign notation are from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.

Data Element Name	Positive Sign Notation Indicates
Longitudinal Acceleration	Forward
Delta-V, Longitudinal	Forward
Maximum Delta-V, Longitudinal	Forward
Lateral Acceleration	Left to Right
Delta-V, Lateral	Left to Right
Maximum Delta-V, Lateral	Left to Right
Steering Input*	Steering wheel turned counter clockwise
Angular Rate	Left to Right RotationClockwise rotation around the longitudinal axis
Yaw Rate**	Counter clockwise rotation

* The Steering Input for the following vehicles has a positive sign notation for the steering wheel turned clockwise:

- o 2006 - 2007 Grand Cherokee
- o 2006 - 2007 Commander
- o 2005 - 2010 300, Magnum, and Charger
- o 2008 - 2010 Challenger

**The Yaw Rate for the 2011-2012 MY RAM has a positive sign notation for clockwise rotation.

CDR FILE INFORMATION:

- For ACMs that store non-deployment events, an event will be stored when the delta V is approximately 5 mph (8 km/h) or greater within a 150 ms interval.
- For non-NAFTA ACMs that control pedestrian protection devices, a non-deployment event will be stored when the pedestrian protection devices are activated.

Event(s) Recovered definitions:
- None - There are no stored events in the ACM
- Not Retrievable - Event Data may be stored in the ACM but is not retrievable by the CDR tool.
- For Continental ACMs:
  - Event Record 1 - Data from an event is stored in the ACM (not necessarily in chronological order)
  - Event Record 2 - Data from another event is stored in the ACM (not necessarily in chronological order)
  - Event Record 3 - Data from another event is stored in the ACM (not necessarily in chronological order) (for modules with 3 stored events)
- For all other ACMs:
  - Most Recent Event - Data of the most recent event is displayed in the report
  - 1st Prior Event - Two events are stored in the ACM, Data displayed is of the first prior event.
  - 2nd Prior Event - Three events are stored in the ACM, Data displayed is of the second prior event.
  - Etc., (for modules with 3 to 5 stored events)
- For TRW modules:
  - If there is a side impact, two EDR events may be stored for the one side impact event. The second event may be recorded due to the Lateral Delta V exceeding 5 mph (8 km/h) within a 150 ms interval after the side deployment occurred.
- For some Fiat vehicles:
  - Two EDR events may be stored for one impact event. The second event may be recorded due to the deployment of the frontal airbag, 3rd stage passenger.
- During an event, if power to the ACM is lost, all or part of the event data record may not be recorded. An indication may be observed in the recorded data under this condition:
  - "None" may be displayed in the "Event(s) Recovered" section of the report indicating no pre-crash vehicle data.
  - An event may be displayed in the "Event(s) Recovered" section of the report and "Interrupted" will be displayed for Vehicle Event /Pre-Crash Recorder Status.
- For 2010-2012 MY Dodge Journey and 2010-2012 MY Chrysler Town and Country/Dodge Grand Caravan/Lancia Voyager, a non-deployment event will also display "Interrupted" for the Vehicle Event/Pre-Crash Recorder Status. This non-deployment event can be distinguished from a power loss by:
  - In the System Status at Event and Deployment Command Data section, Event/Deployment Recorder Status will display "Interrupted".
  - In the Deployment Command Data section, a value of "No" will be displayed for each deployment data element.

SYSTEM STATUS AT RETRIEVAL:

- Original VIN - The VIN is captured by the ACM and then recorded as the Original VIN after 10 consecutive ignition cycles of capturing the same number. Once it has been recorded, this number cannot be changed.

SYSTEM CONFIGURATION AT RETRIEVAL:

- The System Configuration data tables indicate the components that the ACM for a particular vehicle monitors and/or controls.
- Active Head Restraint (AHR) - This refers to the active head restraint systems that are electronically controlled by the ACM. AHRs may activate but not store an EDR Record if the delta V does not exceed the minimum delta V threshold. It is possible that the AHRs may activate after the EDR record has been stored and written, based on achieving the minimum delta V. This condition will result in an EDR but no record of the AHR activation in the CDR report. Activation of only the AHRs, if stored, will be a non-deployment event.

SYSTEM STATUS AT EVENT (if applicable):

- Event Number -
  - Indicates the event number per vehicle ignition cycle for 2010-2012 Sebring, Avenger, Caliber, Nitro, Compass, Liberty, Patriot, Wrangler, and Ram
  - Indicates the overall order of the events for all other applicable vehicles.
- Event Signal Transmission, Complete - "Yes" indicates that the ACM has sent the automatic collision notification (ACN) message.
- Odometer at Event - Vehicle odometer at the time of the event
- Operation via Energy Reserve Only -"Yes" indicates that the ACM had lost power at or before T0 and was only operating on energy reserve at T0.
- Side Fuel Cutoff, Activated - Applicable to the Fiat 500, "Yes" indicates that the ACM has sent the automatic collision notification (ACN) message.
- System Voltage at Event, ECU - Voltage at the ACM as measured by the ACM.
- System Voltage at Event, Bussed - Voltage of the vehicle system, communicated on the communication bus to other electronic modules in the vehicle.
- Temperature, Outside - Ambient Air Temperature.

- Time, Airbag Warning Lamp On - This is a cumulative time. It indicates the total amount of time that the ACM has requested the Airbag Warning Lamp be turned on.
    - This time does not include the warning lamp bulb check time, which occurs at every ignition cycle
- Time from event 1 to 2 -
    - If only one event is stored, either a value of 0 or >5 may be displayed for this data element.
    - If multiple events exist in the EDR, the time from event 1 to event 2 is defined as:
        - For Bosch and TRW modules, the time from the prior recorded event (even if it has been overwritten) to the current recorded event.
        - For Continental modules, the time from the prior existing recorded event (as long as it is still displayed in the CDR report) to the current recorded event**.** If the prior event in a multi-event condition is overwritten by a subsequent event, the multi-event status will no longer be displayed.
- Time, Operation System Time - This is a cumulative lifetime timer for the ACM. It indicates the total amount of time the ACM has been powered up.
- Total Number of Events -
    - Stops incrementing when each event record is recorded by the ACM for 2010 - 2012 Sebring, Avenger, Caliber, Nitro, Compass, Liberty, Patriot, Wrangler, and Ram
    - Indicates the total number of events that the ACM has recorded, including those non-deployment events that have been overwritten by a subsequent event, for all other applicable vehicles.
- VIN at Event, Last 8 Digits- Last 8 digits of the VIN of the vehicle at the time the ACM records the event.

STATUS OF THE DATA IN THE MOST RECENT EVENT (if applicable):

Definitions for Data Blocks 1 - 7 and Overall Data Record Complete:

1. Crash Record (system status and DTCs)
2. NHTSA Table #1 Vehicle System data
3. NHTSA Table #1 Longitudinal delta-V
4. NHTSA Table #2 Vehicle System Data
5. NHTSA Table #2 Lateral delta-V - will be a NO if vehicle is not equipped with side sensing
6. ACM angular rate data - will be a NO if vehicle is not equipped with roll-over sensing
7. Other Vehicle System Data - Chrysler Specific Data

Overall Data Record Complete - Yes, No is defined based on the specific vehicle configuration. For example, a NO may be present for a non-applicable data block but a YES may be present for overall data record complete as all of the applicable data is complete.

DEPLOYMENT COMMAND DATA (if applicable):

- A "Yes" for a particular item in the Deployment Command Data section of the report indicates that the ACM commanded the deployment /activation of the associated device.
- Deployment of Seatbelt Pretensioners is not stored in the EDR for the 2010 MY vehicles that utilize a TRW ACM. Assessment of the seatbelt pretensioners' deployment status in these vehicles must be made by physical inspection in the vehicle.

DTCs PRESENT AT START OF EVENT (if applicable):

- If any DTCs (diagnostic trouble codes) are present in the ACM at the start of the event, these will be listed in this section. A dealership service manual can be used to decode the DTCs.

PRE-CRASH DATA:

- The recorded Event may contain Pre-Crash data. Pre-Crash data from the various electronic control modules in the vehicle is transmitted to the Airbag Control Module via the vehicle's communication bus.
- If a recorded event has Engine RPM equal to SNA and Speed, Vehicle Indicated equals SNA for each time stamp, then the data is default data and the event stored in the ACM is not valid.
- (if equip.) - If a parameter name is followed by the words (if equip.), then the parameter is only valid for vehicles equipped with the associated parameter/vehicle system.
- The MIL (Malfunction Indicator Lamp) Status for the various recorded systems indicates the requested state of the applicable malfunction indicator lamp at the time that the data was captured. Note: Some fault codes could be stored due to component/system damage from the accident. The appropriate diagnostic tool should be used to read any stored Diagnostic Trouble Codes (DTC's) in the various electronic modules (ACM, PCM, ABS, TCM, etc., where applicable) for use in interpretation of some vehicle specific recorded data.
- ABS Activity - "Yes" indicates an active ABS event in which the ABS is actively controlling the brakes.
- ABS MIL- This indicates the ABS fault indicator lamp status. It will only be "On" when there is a fault in the ABS system. The Electronic brake module DTC's should be read and recorded for final system interpretation.
- Accelerator Pedal, % Full - This indicates the actual position of the accelerator pedal.
- Brakes:
    - Brake Lamps On - "On" indicates that the brake lamps/CHMSL are illuminated.
    - Brake Switch #2 Status - "On" indicates that the brake pedal is depressed.
    - Braking System, Intervention by ESP - "Yes" indicates that the stability control system has engaged the brakes.
    - Braking System, Intervention Enabled "Yes" indicates that the ESC system is functional.
    - Braking System, Emergency Braking - "Yes" indicates that panic brake assist is active.
    - Braking System, Maximum Braking -- "Yes" indicates that ABS is active on all 4 wheels.
    - Panic Brake Assist Active - "Yes" indicates that all four of the brake circuits are undergoing ABS control.
    - Service Brake - "On" indicates that the brake pedal is depressed.

- Cruise Control:
    - Cruise Control System/Status -"On" indicates that the Cruise Control system is turned on.
    - Cruise Control Engaged/Active - "Engaged"/"Yes" indicates the Cruise Control system is actively controlling vehicle speed. "Not Engaged"/"No" indicates the system is NOT controlling vehicle speed.
- Electronic Brake/Stability Control information:
    - ESC/ESP MIL - This indicates the ESC/ESP fault indication lamp status. It will only be "On" when there is a fault or thermal mode shutdown in the ESC/ESP system. The ESC/ESP module DTC's should be read and recorded for final system interpretation.
    - ESP Lamp - This is the status of the ESP symbol - "car with squiggly lines" indicator lamp. "On" indicates ESP has been turned off by the driver or has reduced performance and is not an indication of a fault in the system.
    - ESP Lamp Flashing Requested - If "Yes", then an ESP, Traction Control or Trailer Sway Control (if equipped) event was active at the time of data capture.
    - ESP Disabled - "Yes" indicates that ABS & ESP have been disabled by the driver or due to system performance.
    - ESP/ESC Functional/Active - "YES" indicates that the ESP system is functional and has no faults.
    - ESC System Status - "OK' indicates no faults in the ABS or ESC system that affect the system functionality; "ABS Fault" indicates a fault in the ABS system and "ESC Fault" indicates a fault in the ESC system.
    - Engine Torque Applied - "No" indicates no engine torque output was applied (as in Park/Neutral for Automatic transmissions or clutch depressed on manual or during an ESP/Traction Control event). If "Yes", then engine torque output was applied.
    - Stability Control - This is the status of the ESC symbol - "car with squiggly lines" indicator lamp. "On" indicates that the ESC system is functional. "Off" indicates that the ESC system was turned off either by the driver or due to a fault or thermal mode shutdown. "Engaged" indicates an active ESC/TCS event.
    - Traction Control Intervention Active - "Yes" indicates that the traction control system is actively controlling the vehicle's wheels.
- Engine RPM - On 2006-2009 Ram 2500/3500, the Engine RPM recorded is limited to a maximum of 4080 RPM. On the 2008 - 2010 Dodge Grand Caravan, 2008-2010 Chrysler Town and Country and 2009-2010 Dodge Journey, the engine RPM resolution is 256 rpm. On all other vehicles, the resolution is 32 rpm.
- Engine Throttle, % Full - This indicates the actual position of the Engine Throttle blade.
- ETC -
    - On vehicles equipped with ETC, "Accelerator Pedal, % Full" and "Engine Throttle, % Full" are relative values - relative pedal position and relative engine throttle. These parameters may record values of less than 100% when the pedal/throttle is actually at its maximum. (Max. ~ 77%)
    - ETC Lamp - Lamp "ON "indicates there is an active Electronic Throttle DTC.
    - ETC Lamp Flashing - "Yes" indicates that the ETC is in the limp-in mode.
- PCM MIL - This indicates the PCM fault indicator lamp status. It will only be "On" when there is a fault in the PCM. The Powertrain Control Module DTC's should be read and recorded for final system interpretation.
- Raw Manifold Pressure - This indicates engine load in kPa.
- Speed, Vehicle Indicated - This indicates the average of the wheel speeds of the drive wheels.
    - On the 2008 - 2009 Dodge Grand Caravan, 2008-2009 Chrysler Town and Country and 2009 Dodge Journey, the reporting resolution is 2 km/h. On all other vehicles, the reporting resolution is 1 km/h.
    - To display this data element in mph, the CDR Tool converts the km/h to mph and reports a rounded value in mph.
    - The accuracy of the recorded Speed, Vehicle Indicated may be affected by a significant change of the tire size for the drive wheels or the final drive axle ratio of the transmission from the factory build specifications, wheel lockup, wheel slip, or wheel spin.
    - On some vehicles capable of speeds in excess of 255km/h (about 158mph), the actual vehicle speed may have exceeded the reporting range. It is always prudent to check the reported wheel speeds and other parameters to confirm the Speed, Vehicle Indicated value(s).
- Tire Information:
    - XX where LF = Left Front Tire, RF = Right Front Tire, LR = Left Rear Tire, and RR = Right Rear Tire.
    - Tire X Location - This indicates the location of the tire pressure sensor data being displayed for that time stamp. Default is used to indicate that the location of the tire pressure sensor is unknown or there is no tire pressure sensor in that wheel. Vehicles with Base Tire Pressure Monitoring systems will display SNA for both Tire Locations as these vehicles do not send actual pressure values across the communication bus.
    - Tire X Pressure/Tire Pressure Status, XX -This indicates the actual pressure status of the Tire Location defined in the previous column (Tire X Location) or by the values for XX. Possible values are LOW, NORMAL, HIGH, or SNA for this parameter. Vehicles with Base Tire Pressure Monitoring systems may display NORMAL even though these vehicles do not send actual pressure values across the communication bus.
    - Tire X Pressure/Tire Pressure, XX (psi) - This indicates the actual tire pressure value of the Tire Location defined in the previous column (Tire X Location) or by the values for XX. Vehicles with Base Tire Pressure Monitoring systems will display N/A for this parameter as these vehicles do not send actual pressure values across the communication bus.
    - Wheel Speed, XX - This indicates the speed value (in revolutions per minute) of a particular tire as denoted by XX.
    - For the following vehicles, the tire location, if displayed, may not be accurate if the tires have been rotated:
        - 2011-2012 MY Jeep Wrangler
        - 2010-2012 MY Jeep Patriot
        - 2010-2012 MY Chrysler 200
        - 2010-2012 MY Jeep Compass
    - Tire pressure is not stored in the EDR for the following vehicles. If a value is displayed, it may not be accurate:
        - 2011-2012 MY Jeep Grand Cherokee
        - 2011-2012 MY Dodge Durango
        - 2010-2012 MY Dodge Challenger
        - 2011-2012 MY Chrysler Town and Country
        - 2011-2012 MY Dodge Grand Caravan
        - 2010-2012 MY Ram
- Tire Pressure Monitor Indicator Lamp - "On" indicates a fault in the tire pressure monitoring system. The TPM module DTC's should be read and recorded for final system interpretation.
- "T0" ("Time zero" where '0' is seen as subscript) is defined as "beginning of the crash event". T0 is the time at which the ACM algorithm is activated, a specific Delta-V is exceeded, or a non-reversible restraint device is deployed. T0 may be defined differently for front, side, rear and roll-

over events.
- If multiple algorithm decisions (i.e.: frontal, side, rear and/or rollover) are made before the first recorded event ends, all of those events are part of the same event record and "T0" is defined as the "T0" from the first recorded event.
- In the Pre-Crash data tables, the relative time marker "-0.1s" represents the last set of data captured in the buffer prior to "T0."

- Transmission/Shifter Position -
  - Gear Status - This indicates the current transmission gear.
  - PRND/PRNDL Status - This indicates the status of the Shifter Position.
  - Reverse Gear - For manual transmission vehicles only, "Yes" indicates the transmission is in the reverse gear.
  - Shift Gear Position - This indicates the current transmission gear/Shifter Position.
- Vehicle Data Recorder Complete - Due to the interruption of data recording in one section, this data element may display "Interrupted" for all sections when some data sections are actually complete.

APPLICATION INFORMATION:

- 2005 - 2009 Durango’s equipped with side airbags have EDR data that can be imaged by the CDR tool. Durango’s not equipped with side airbags have EDR Data that might be imaged by the CDR tool and may be imaged by the supplier.
- For 2005 & 2006 MY, some Chrysler 300, Dodge Magnum, Dodge Charger, Jeep Grand Cherokee, and Jeep Commander models may contain EDR data that cannot be imaged by the CDR tool, but may be imaged by the supplier.
- For 2006 & 2007 MY, some PT Cruiser models may contain EDR data that cannot be imaged by the CDR tool, but may be imaged by the supplier
- EDR Data is only recorded for frontal deployments in the following vehicles:
  - 2005-2007 Durango
  - 2006-2007 Ram 1500
  - 2006-2009 Ram 2500/3500 Heavy Duty
  - 2007 Aspen, Caliber, Compass, Patriot, Nitro, Sebring, Wrangler

03001_Chrysler_r026

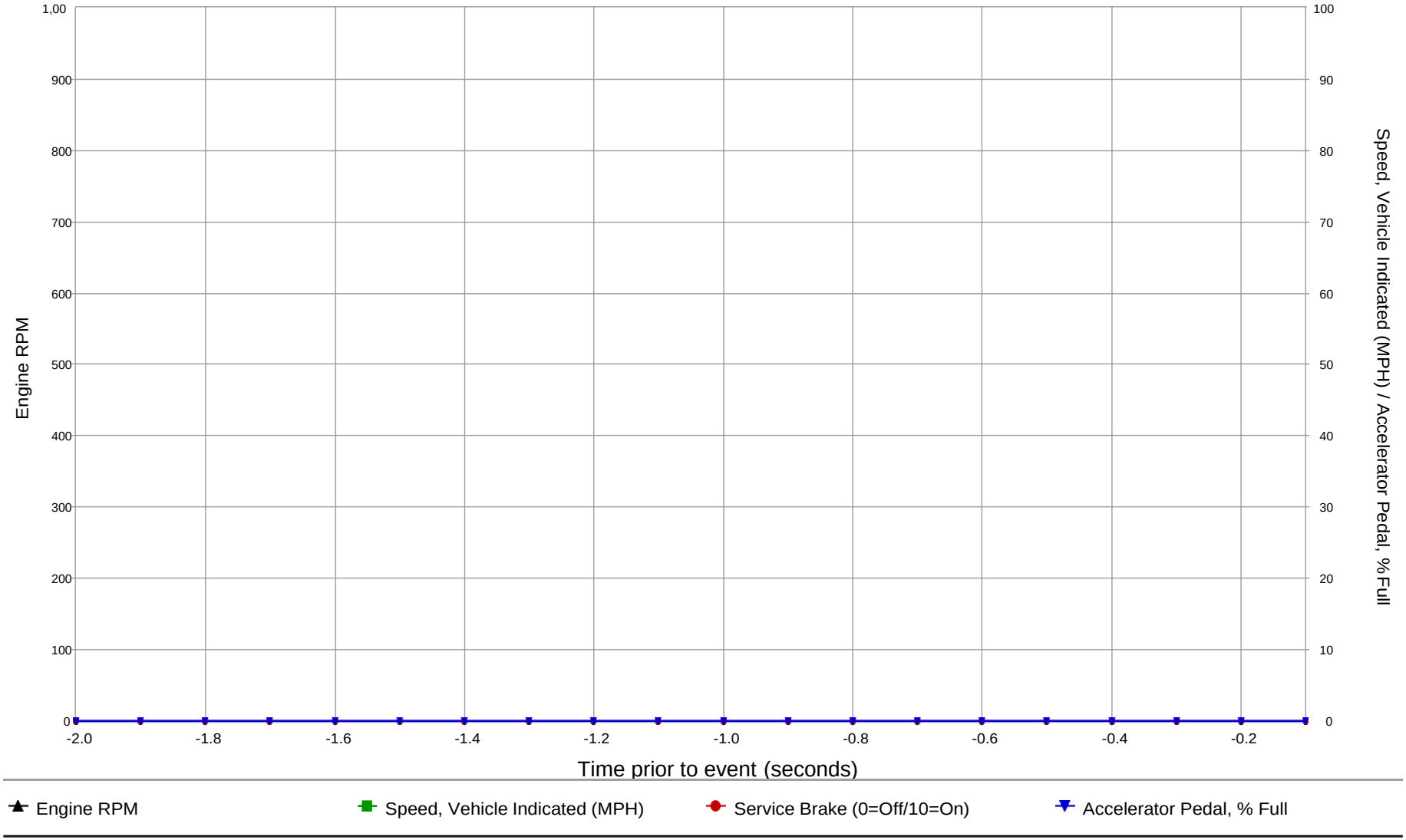
System Status at Retrieval

Original VIN	3D7LX38C16G******
Airbag Control Module Part Number	56043708AE
Airbag Control Module Serial Number	TQCME1316C0365a
Airbag Control Module Supplier	TRW

System Configuration at Retrieval

Configured for Driver Seatbelt Switch	No
Configured for Front Center Seatbelt Switch	No
Configured for Front Passenger Seatbelt Switch	No
Configured for 2nd Row Left Seatbelt Switch	No
Configured for 2nd Row Center Seatbelt Switch	No
Configured for 2nd Row Right Seatbelt Switch	No
Configured for 3rd Row Left Seatbelt Switch	No
Configured for 3rd Row Center Seatbelt Switch	No
Configured for 3rd Row Right Seatbelt Switch	No
Configured for Driver Knee Airbag	No
Configured for Left Curtain #1	No
Configured for Right Curtain #1	No
Configured for Left Curtain #2	No
Configured for Right Curtain #2	No
Configured for Front Driver Seatbelt Pretensioner	Yes
Configured for Front Center Seatbelt Pretensioner	No
Configured for Front Passenger Seatbelt Pretensioner	Yes
Configured for 2nd Row Left Seatbelt Pretensioner	No
Configured for 2nd Row Center Seatbelt Pretensioner	No
Configured for 2nd Row Right Seatbelt Pretensioner	No
Configured for 3rd Row Left Seatbelt Pretensioner	No
Configured for 3rd Row Center Seatbelt Pretensioner	No
Configured for 3rd Row Right Seatbelt Pretensioner	No
Configured for Left Side Sensor #1	No
Configured for Left Side Sensor #2	No
Configured for Left Side Sensor #3	No
Configured for Right Side Sensor #1	No
Configured for Right Side Sensor #2	No
Configured for Right Side Sensor #3	No
Configured for Left Up Front Sensor	No
Configured for Right Up Front Sensor	No
Configured for Front Driver Digressive Load Limiter	No
Configured for Front Passenger Digressive Load Limiter	No
Configured for Driver Seat Track Position Sensor	No
Configured for Front Passenger Seat Track Position Sensor	No
Configured for Passenger Airbag Disable Switch	No
Configured for Front Passenger Occupant Classification System	No

Pre-Crash Data (Most Recent Event)



SNA values will not be plotted on the graph

Pre-Crash Data (Most Recent Event - table 1 of 3)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Vehicle Event Recorder Status	Engine RPM	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % Full	Raw Manifold Pressure (kPa)	Service Brake	Brake Switch #2 Status
-2.0	Complete	SNA	SNA	0.0	0	Off	Open
-1.9	Complete	SNA	SNA	0.0	0	Off	Open
-1.8	Complete	SNA	SNA	0.0	0	Off	Open
-1.7	Complete	SNA	SNA	0.0	0	Off	Open
-1.6	Complete	SNA	SNA	0.0	0	Off	Open
-1.5	Complete	SNA	SNA	0.0	0	Off	Open
-1.4	Complete	SNA	SNA	0.0	0	Off	Open
-1.3	Complete	SNA	SNA	0.0	0	Off	Open
-1.2	Complete	SNA	SNA	0.0	0	Off	Open
-1.1	Complete	SNA	SNA	0.0	0	Off	Open
-1.0	Complete	SNA	SNA	0.0	0	Off	Open
-0.9	Complete	SNA	SNA	0.0	0	Off	Open
-0.8	Complete	SNA	SNA	0.0	0	Off	Open
-0.7	Complete	SNA	SNA	0.0	0	Off	Open
-0.6	Complete	SNA	SNA	0.0	0	Off	Open
-0.5	Complete	SNA	SNA	0.0	0	Off	Open
-0.4	Complete	SNA	SNA	0.0	0	Off	Open
-0.3	Complete	SNA	SNA	0.0	0	Off	Open
-0.2	Complete	SNA	SNA	0.0	0	Off	Open
-0.1	Complete	SNA	SNA	0.0	0	Off	Open

Pre-Crash Data (Most Recent Event - table 2 of 3)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	ABS MIL (if equip.)	ESP MIL (if equip.)	ESP Lamp (if equip.)	ESP Lamp Flashing Requested (if equip.)
-2.0	Off	Off	Off	No
-1.9	Off	Off	Off	No
-1.8	Off	Off	Off	No
-1.7	Off	Off	Off	No
-1.6	Off	Off	Off	No
-1.5	Off	Off	Off	No
-1.4	Off	Off	Off	No
-1.3	Off	Off	Off	No
-1.2	Off	Off	Off	No
-1.1	Off	Off	Off	No
-1.0	Off	Off	Off	No
-0.9	Off	Off	Off	No
-0.8	Off	Off	Off	No
-0.7	Off	Off	Off	No
-0.6	Off	Off	Off	No
-0.5	Off	Off	Off	No
-0.4	Off	Off	Off	No
-0.3	Off	Off	Off	No
-0.2	Off	Off	Off	No
-0.1	Off	Off	Off	No

Pre-Crash Data (Most Recent Event - table 3 of 3)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	ETC Lamp (if equip.)	ETC Lamp Flashing (if equip.)	Cruise Control System	Cruise Control Active
-2.0	Off	No	Off	No
-1.9	Off	No	Off	No
-1.8	Off	No	Off	No
-1.7	Off	No	Off	No
-1.6	Off	No	Off	No
-1.5	Off	No	Off	No
-1.4	Off	No	Off	No
-1.3	Off	No	Off	No
-1.2	Off	No	Off	No
-1.1	Off	No	Off	No
-1.0	Off	No	Off	No
-0.9	Off	No	Off	No
-0.8	Off	No	Off	No
-0.7	Off	No	Off	No
-0.6	Off	No	Off	No
-0.5	Off	No	Off	No
-0.4	Off	No	Off	No
-0.3	Off	No	Off	No
-0.2	Off	No	Off	No
-0.1	Off	No	Off	No

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 system.

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5A 87 02 27 01 52 FF 41 45 01 06 04 35 36 30 34 33 37 30 38 41 45

5A 88 33 44 37 4C 58 33 38 43 31 36 47 2A 2A 2A 2A 2A 2A

7F 1A 22 00 00 00 00 00 00 00 00 00 00 2A 2A 2A 2A 2A 2A

61 E1 54 51 43 4D 45 31 33 31 36 43 30 33 36 35

61 EA 00 80 02 00 40

73 E2 35 C1 00 9B 0A FF FF 9B 06 FF FF 9B 0E FF FF 9B 2A FF FF 9B 2E FF FF D4 14 FF FF C0 19 FF
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71 02 01 03 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 04 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 05 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 06 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 07 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 08 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 09 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 0A CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 0B CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 0C CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 0D CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 0E CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 0F CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 10 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 11 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 12 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

71 02 01 13 CC 00 FF FF 00 00 00 00 00 00 00 00 00 00

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Disclaimer of Liability

APPENDIX B: Event Data Recorder Report for 2005 Chevrolet Silverado[3]

[3] The Bosch CDR report contained in this technical report was imaged by the investigating police department. Only a PDF copy of the Bosch CDR Report was provided by the police, and the hexadecimal data contained in the report has been deleted due to the potential personal identifiable information contained (vehicle identification number) in the 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	2GCEK13T75xxxxxx
User	
Case Number	
EDR Data Imaging Date	
Filename	2GCEK13T75xxxxxx_ACM.CDRX
Saved on	Wednesday, March 20 2019 at 17:55:41
Imaged with CDR version	Crash Data Retrieval Tool 17.9
Imaged with Software Licensed to (Company Name)	
Reported with CDR version	Crash Data Retrieval Tool 18.0
Reported with Software Licensed to (Company Name)	
EDR Device Type	Airbag Control Module
Event(s) recovered	Deployment Non-Deployment

Comments

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 Eventwill be recorded and locked. If multipleNon-Deployment Eventsprecede 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 Chanigsethe 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 Eventswill indicate whether one or more associated events preceded the recorded event.
-Multiple Events Not Recorded can be used in the followingscenarios:
    -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.

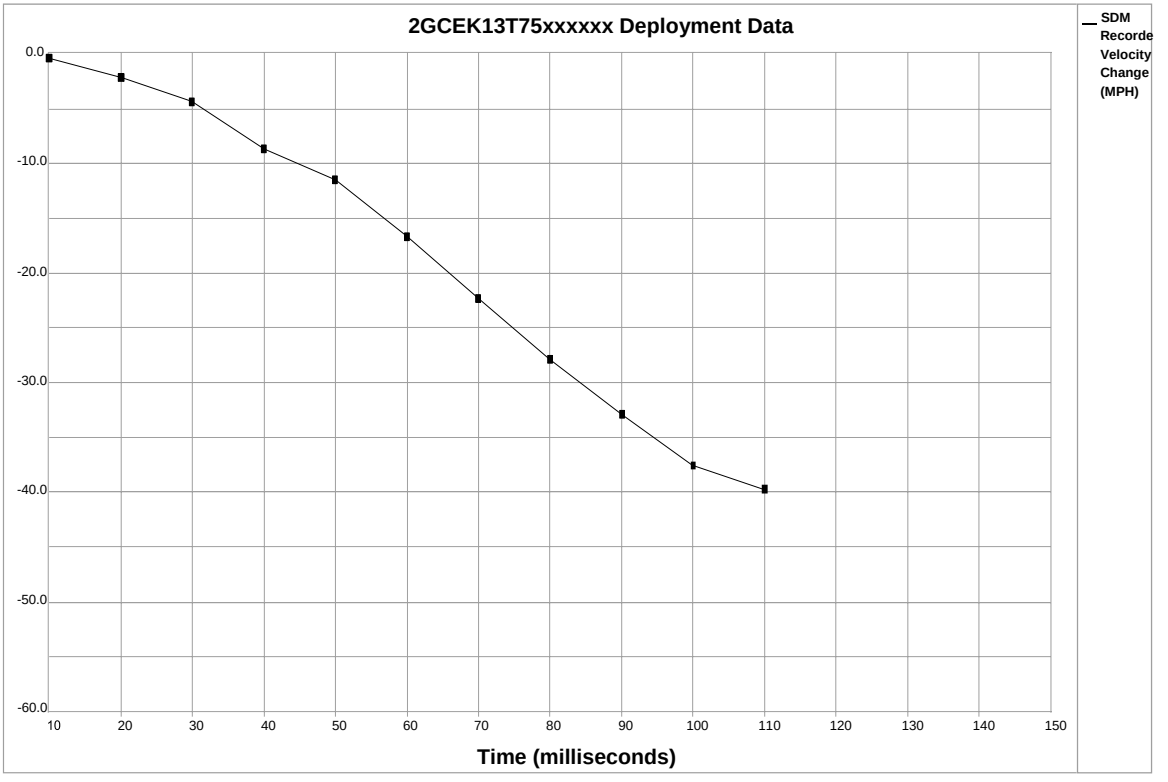
01027_SDMGF_r007

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Passenger Seat Position Switch Circuit Status	Rearward
Ignition Cycles At Deployment	24049
Ignition Cycles At Investigation	24056
Maximum SDM Recorded Velocity Change (MPH)	-39.96
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	107.5
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	15
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	17.5
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	15
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	17.5
Time Between Non-Deployment And Deployment Events (sec)	N/A
Frontal Deployment Level Event Counter	1
Event Recording Complete	Yes
Multiple Events	No
Multiple Events Not Recorded	No

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	62	1600	22
-4	62	1600	22
-3	61	1600	22
-2	61	1600	22
-1	60	1536	0

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



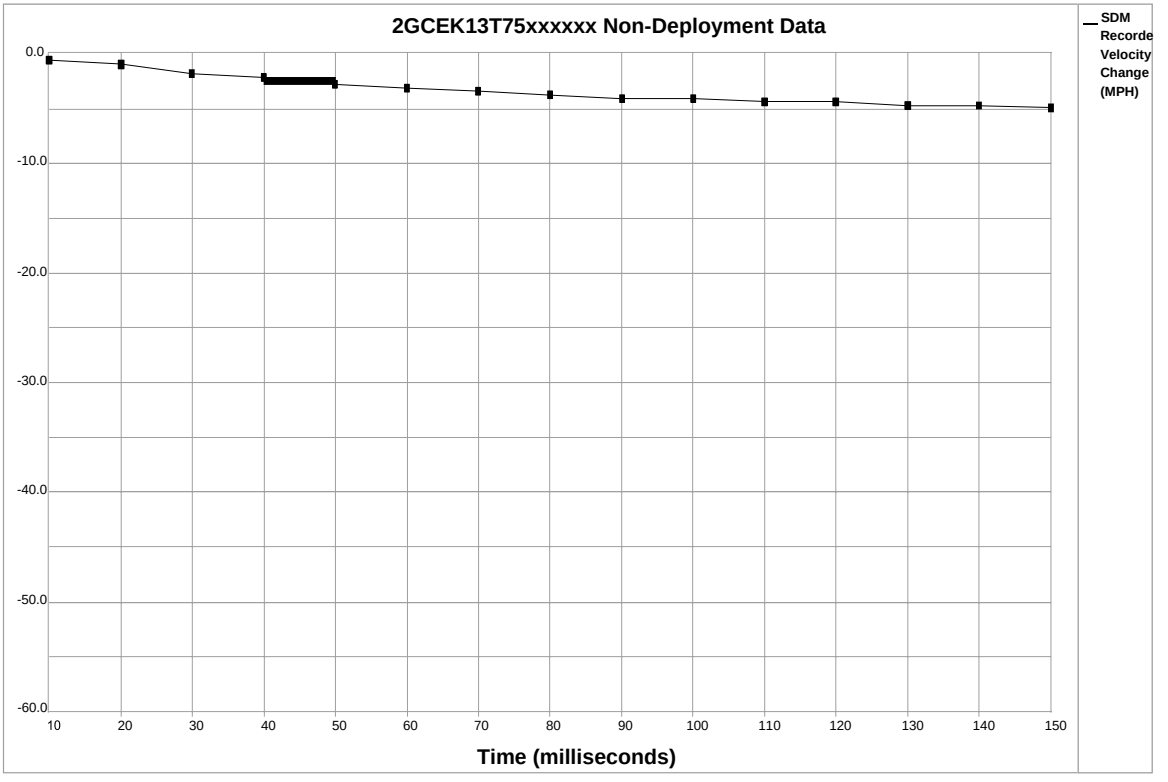
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.31	-2.17	-4.34	-8.68	-11.47	-16.74	-22.32	-27.90	-32.86	-37.51	-39.68	N/A	N/A	N/A	N/A

System Status At Non-Deployment

SIR Warning Lamp Status	ON
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Passenger Seat Position Switch Circuit Status	Rearward
Ignition Cycles At Non-Deployment	24049
Ignition Cycles At Investigation	24056
Maximum SDM Recorded Velocity Change (MPH)	-5.96
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	210
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	62	1600	22
-4	62	1600	22
-3	61	1600	22
-2	61	1600	22
-1	60	1536	0

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



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.62	-0.93	-1.86	-2.17	-2.79	-3.10	-3.41	-3.72	-4.03	-4.03	-4.34	-4.34	-4.65	-4.65	-4.96

DOT HS 813 044
December 2020

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

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