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Special Crash Investigations: On-Site Air Bag Non-Deployment Crash Investigation; Vehicle: 2019 Toyota Corolla; Location: Illinois; Crash Date: January 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 published.

16. Abstract

This report documents the investigation of a crash involving a 2019 Toyota Corolla and two other vehicles, with the non-deployment of air bags in the Toyota. It was being driven by a belted 22-year-old male with a belted 15-year-old male front seat passenger. A 2012 Integrated Coach Corporation 3000 school bus was stopped in the lane ahead of the Toyota at an intersection. The bus driver was a belted 49-year-old female and the only other bus occupant was an unbelted 9-year-old female. A 42-year-old female was driving a 2018 Jeep Grand Cherokee westbound at an unknown speed. The Toyota's right plane struck the back of the bus and then its front plane struck the front of the Jeep. The Toyota's frontal air bags did not deploy and the front-row seat belt pretensioners did not actuate. Given the crash configuration and severity of the impact with the Jeep, it appeared the frontal air bags in the Toyota should have deployed. The Toyota driver and passenger and the Jeep driver were transported to hospitals with police-reported "B" (non-incapacitating) severity injuries. The bus driver and passenger were not injured. Following the crash, the Toyota was evaluated by the NHTSA Vehicle Research and Test Center (VRTC) for possible issues relating to electrical overstress (EOS). VRTC imaged the Toyota's event data recorder and determined it did not capture the crash events related to this crash.

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Special Crash Investigations
On-Site Air Bag Non-Deployment Crash Investigation
Office of Defects Investigation
Case Number: DS19010
Vehicle: 2019 Toyota Corolla
Location: Illinois
Crash Date: January 2019

Background

This report documents the investigation of a crash of a 2019 Toyota Corolla (Figure 1) and two other vehicles, during which the Toyota air bags did not deploy. It was being driven by a belted 22-year-old male with a belted 15-year- old male in the front passenger seat. The Toyota's right plane struck the back of a 2012 Integrated Coach Corporation 3000 school bus stopped at an intersection, then its front plane struck the front of a 2018 Jeep Cherokee head-on. None of the Toyota's air bags deployed. Given the crash type and severity of the impact with the Jeep, it appeared the frontal air bags in the Toyota should have deployed.

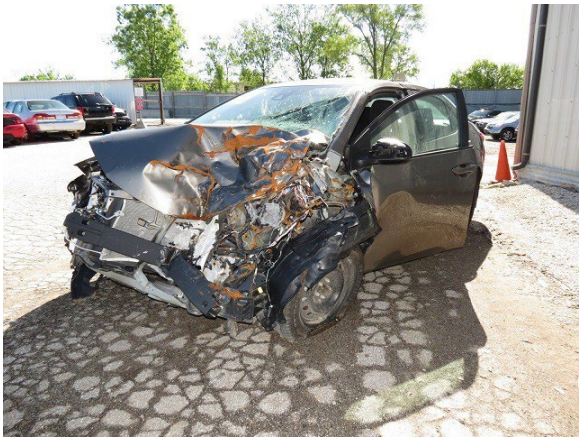


Figure 1. 2019 Toyota Corolla

Following the crash, the Toyota was evaluated by the National Highway Traffic Safety Administration's Vehicle Research and Test Center (VRTC) for possible issues consistent with the findings of the Office of Defects Investigation (ODI) in Engineering Analysis (EA) 19-001,[1] in which electrical overstress (EOS) of an electrical circuit is subjected to an electrical signal outside the voltage magnitude and duration the circuit was designed to withstand. The occurrence can cause damage and failure to the circuit, which may impair air bag performance in a crash. The Toyota had an air bag control unit (ACU) with event data recorder (EDR) capability that was supported by the Bosch Crash Data Retrieval (CDR) tool. The EDR was removed by

[1] Air bag ACU electrical overstress. Certain Fiat-Chrysler, Honda, Hyundai, Kia, Mitsubishi, and Toyota vehicles are equipped with an air bag control unit produced by ZF-TRW Automotive Holdings Corp., which could fail during a crash event resulting in non-deployment of air bags and seat belt pretensioners.

VRTC during its inspection and, following a replacement of the module's DS84 application-specific integrated circuit (ASIC) by ZF-TRW, the EDR was imaged. The VRTC provided SCI with a copy of the EDR report, discussed later in this report and included in Appendix A. VRTC determined the EDR report did not include crash events related to this crash.

This investigation was initiated by ODI to assess the relevance of the case to EA19-001. The Special Crash Investigations (SCI) group assigned the case to Dynamic Science, Inc., in May 2019. The investigation was intended to examine air bag deployment parameters for the Toyota and to document occupant injuries and their sources. The SCI team completed its field inspections in May 2019. VRTC completed its vehicle inspection prior to the SCI inspection.

This three-vehicle crash occurred during the morning in January 2019 on a two-lane east/west county road in Illinois. Conditions were daylight, clear, and dry. The Toyota was being driven eastbound at an unknown speed by a belted 22-year-old male with a belted 15-year-old male front-row passenger. The first other vehicle involved with it was a Coach Corporation 3000 school bus being driven eastbound by a belted 49-year-old male with an unbelted 9-year-old female in the second-row left seat. The bus was stopped in the lane ahead of the Toyota at an intersection. The second other vehicle was a 2018 Jeep Grand Cherokee being driven westbound at an unknown speed by a 42-year-old female who, according to police, had no available manual restraints.

According to statements made by the Toyota front passenger to medical providers, the Toyota driver fell asleep before the crash. The Toyota crossed over the centerline and its right plane rear-ended the bus at an angle, displacing the Toyota into the westbound lane where its front struck the front of the Jeep head-on. The Toyota sustained a WinSMASH calculated longitudinal delta V of -58 km/h (-36 mph) and severe damage to the front end from the Jeep impact, but the Toyota's frontal air bags did not deploy and its front-row seat belt pretensioners did not actuate. The Toyota driver and front passenger and the Jeep driver were transported to hospitals with police-reported "B" (non-incapacitating) severity injuries. The bus driver and second-row occupant were not injured. The Toyota and Jeep were towed due to damage and the bus was driven from the scene.

Summary

Crash Site

The crash site was a two-lane east/west county road in Illinois (Figure 2). The surface was asphalt in traveled and polished condition. The lanes measured 3.4 m (11.1 ft) wide and were separated by a double solid yellow painted stripe and bordered by solid white painted fog lines in fair condition. The roadsides consisted of narrow gravel shoulders measuring approximately 1 m (3 ft) wide that sloped downward transitioning to unpaved ground and drainage ditches. The roadway was straight and in the eastbound direction at 30 m (100 ft) west of the area of impact, the roadway had a negative slope of 1 percent. At the area of impact, the roadway slope and super-elevation were level. A two-lane north/south roadway intersected the east/west roadway on the north edge. The intersection was controlled by a stop sign for southbound traffic entering the east/west roadway. The speed limit was 48 km/h (30 mph). Conditions at the time of the crash were morning, daylight, clear visibility, and dry. Weather as reported by the nearest station was -17.7 °C (0.0 °F), 66 percent humidity, west winds at 22 km/h (14 mph) with gusts to 45 km/h (28 mph) and fair skies. A crash diagram is included at the end of this report.

Figure 2. Crash site looking east, approach view
2019 Toyota Corolla

Pre-Crash

The Toyota was traveling eastbound at an unknown speed. According to statements made by the passenger to medical providers, the Toyota driver fell asleep. Prior to impact the Toyota crossed over the centerline. The bus was stopped facing east in the eastbound lane at the intersection, preparing to turn left. The Jeep was traveling westbound and entered the intersection at an unknown speed.

Crash

The right plane of the Toyota rear-ended the bus (Event 1) at an angle. The relatively narrow and high damage pattern on the Toyota suggested the contact was to the bus's back left bumper corner. The Toyota was displaced left and rotated slightly clockwise in the westbound lane, where its front plane struck the front plane of the Jeep (Event 2) head-on. During the crash, none of the Toyota's air bags deployed and neither of the front-row seat belt pretensioners actuated.

For the Toyota in Event 1, the barrier algorithm of the WinSMASH program calculated a total delta V of 10 km/h (6 mph), longitudinal delta V of -9 km/h (-6 mph), lateral delta V of -3 km/h (-2 mph) and a barrier equivalent speed (BES) of 10 km/h (6 mph). The bus was out of scope for WinSMASH and the results are provided for informational purposes only.

For the Toyota in Event 2, the "missing vehicle" algorithm of WinSMASH calculated a total delta V of 59 km/h (37 mph), longitudinal delta V of -58 km/h (-36 mph), lateral delta V of -10 km/h (-6 mph) and a BES of 53 km/h (33 mph). The reconstruction results are considered borderline. The Toyota's EDR report did not include data related to this crash.

For the Jeep in Event 2, the WinSMASH calculated a total delta V of 37 km/h (23 mph), longitudinal delta V of -37 km/h (-23 mph), lateral delta V of -6 km/h (-4 mph) and a BES of 43 km/h (27 mph). The reconstruction results are considered borderline.

Post-Crash

The bus came to rest in the eastbound lane. Final rest locations for the Toyota and Jeep were unknown. According to his medical records, the Toyota's driver was removed by EMS, probably through the left front door. According to his medical records, the Toyota passenger exited without assistance and walked to the EMS vehicle when it arrived. Both Toyota occupants and the Jeep driver were transported by ambulance to hospitals with police-reported "B" (non-incapacitating) severity injuries. The bus driver and the second-row occupant were not injured or transported. The Toyota and Jeep were towed due to damage and the bus was driven from the scene.

2019 Toyota Corolla

Description

The 2019 Toyota Corolla was a 4-door, 5-passenger sedan identified by the VIN 2T1BURHE2KCxxxxxx. It was manufactured in October 2018 and the electronic odometer reading was unknown. The last reported mileage on a vehicle history report taken in the month of the crash was 4,500 km (2,796 mi). The Toyota had a 4-cylinder, 1.8-liter gasoline engine and front-wheel drive. Standard equipment included antilock braking system, electronic stability control, forward collision warning, lane departure warning, lane keeping support, rear visibility system, pedestrian automatic emergency braking, adaptive driving beam, a tire pressure monitoring system, and tilt/telescoping steering column functionality. It was unknown whether any of the crash avoidance features were disabled or if they played any role in alerting the driver of a potential crash. The EDR report did not include crash avoidance data or event records related to this crash. The front row had bucket seats with adjustable head restraints. The seat track settings were unknown.

Vehicle History

The Toyota was purchased new by the owner about 2 months before the crash. The last reported odometer reading taken about 3 weeks prior to the crash was 4,500 km (2,796 mi). No prior crashes or damage were reported. No service to the air bags was documented.

Exterior Damage

The Toyota had minor severity crush to the right plane in the Event 1 impact with the bus and severe crush to the front plane in the Event 2 impact with the Jeep. Crush damage to the right plane was measured at mid-door level (Figure 3) with direct damage beginning 10 cm (3.9 in) aft of the right rear bumper corner and extended 59 cm (23.3 in) forward. The Field L began at the right rear bumper corner and extended 184 cm (72.4 in) forward ending at the right C-pillar. Six crush measurements were calculated crush as follows: $C_1 = 0$ cm, $C_2 = 1$ cm (0.4 in), $C_3 = 13$ cm (5.1 in), $C_4 = 4$ cm (1.6 in), $C_5 = 0$ cm, and $C_6 = 0$ cm. Maximum crush was located 20 cm (7.9 in) forward of the right rear axle. The principal direction of force (PDOF) was 20 degrees and the collision deformation classification (CDC) for the Toyota in Event 1 was 01RZEW2. The front bumper fascia was missing and the reinforcement bar was used to measure crush damage to the front plane. Direct damage began at the left corner of the reinforcement bar and extended 80 cm (31.5 in) to the right. The Field L extended from corner to corner of the reinforcement bar and measured 95 cm (37.4 in). Thirteen measurements were taken at bumper level using the Nikon total station. The vehicle under-rode the front bumper of the Jeep at impact and sustained above bumper crush.

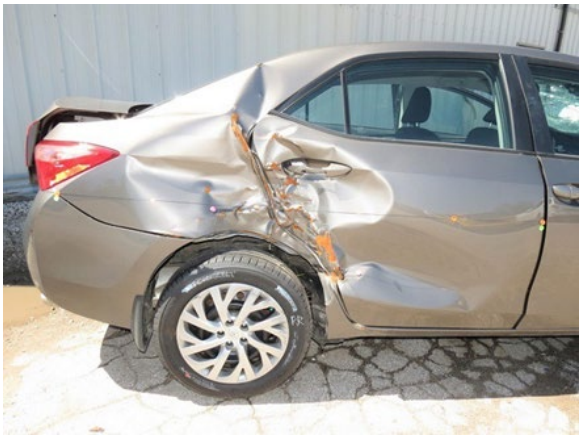


Figure 3. Right plane damage, 2019 Toyota Corolla

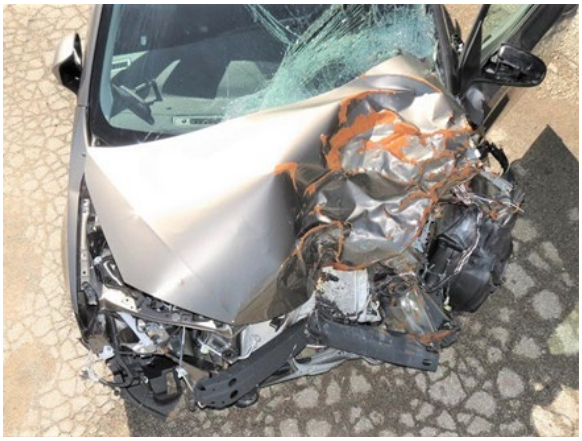


Figure 4. Front plane damage, 2019 Toyota Corolla

Direct damage above the bumper was 95 cm (37.4 in) long, distributed across the right and middle aspects of the hood and upper radiator support. Fifteen crush measurements were taken at the upper radiator support and crush averaging was used to calculate crush as follows: C_1 = 48 cm (18.9 in), C_2 = 53 cm (20.9 in), C_3 = 51 cm (20.1in), C_4 = 52 cm (20.5 in), C_5 = 27 cm (10.6 in) and C_6 = 9 cm (3.5 in). Maximum crush above bumper was 73 cm (28.7 in); maximum crush at bumper level was 53 cm (20.5 in) at 125 cm (49.2 in) right of the front left bumper corner. The left and right frame rails were shifted to the left at their forward aspects. The PDOF was 10 degrees and the CDC for the Toyota in Event 2 was 12FYEW3 (Figure 4).

Air Bag Non-Deployment Discussion

According to the Toyota owner's manual, frontal air bags will deploy in the event of an impact that exceeds the set threshold level (the level of force corresponding to an approximately 20- to 30 km/h (12-18 mph) frontal collision with a fixed wall that does not move or deform). However, the threshold velocity will be considerably higher in the following situations: (1) if the vehicle strikes an object that can move or deform on impact, or (2) if the vehicle is involved in an underride collision. The Toyota struck the front of the Jeep head-on. The Toyota sustained a WinSMASH-calculated longitudinal delta V of -58 km/h (-36 mph) and severe damage to the front end with a 12 o'clock observed direct of force. The head-on crash type and severity suggest

the frontal air bags should have deployed and the front-row seat belt pretensioners should have actuated.

The Toyota sustained some underride damage in the Event 2 impact with the Jeep. Given the damage severity and WinSMASH-calculated longitudinal velocity change of -58 km/h (-36 mph) it appears reasonable to expect frontal air bags to deploy and seat belt pretensioners to actuate in such crashes. The owner's manual states that the vehicle's seat-mounted and inflatable curtain (IC) air bags may deploy in a severe frontal crash. It does not specify parameters for crash severity.

During the SCI vehicle inspection the Toyota's left and right frontal OEM air bag sensors were identified and documented in photos. The sensors and wiring harnesses were detached from their originally installed locations in the damaged area of the forward engine compartment. A prior VRTC inspection had taken place and the air bag sensors original post-crash locations were unknown.

ODI opened EA19-001 in April 2019. The subject was ACU EOS. The EA is investigating whether an ACU electrical circuit may be subjected to an electrical signal outside the voltage magnitude and duration circuit design parameters during certain crash events, causing damage and failure. It has been reported that this disablement has occurred in certain types of frontal crashes involving several vehicle makes, including the year model of the Toyota involved in this crash. The ACU at issue is manufactured by ZF-TRW. The ACU removed from the Toyota in this crash was OEM part number 89170-02K90.

Event Data Recorder

The Toyota was evaluated by VRTC for suspected issues consistent with the findings of ODI in EA 19-001. The vehicle had an air bag supplemental restraint system including an ACU with EDR capability to store deployment and non-deployment events. The vehicle's ACU was removed during a prior inspection by VRTC who retained custody. According to VRTC, they were unsuccessful in imaging the EDR using the direct-to-module method. Following a replacement of the module's DS84 ASIC by ZF-TRW, the EDR was imaged. The EDR captured three non-deployment events containing all lateral force data when the vehicle damage in Event 2 was caused by longitudinal forces. VRTC determined the crash events captured in the EDR report were not related to this crash. Bosch CDR version 18.0 was used to image the ACU and the data was reported using version 21.5.1. VRTC provided SCI with the EDR report in CDRx format for inclusion in this report as Appendix A.

NHTSA Recalls and Investigations

A search last queried in June 2022 using the vehicle's VIN revealed two incomplete recalls. The NHTSA Recall Number 20V012 (Manufacturer Recall Number 20TA02) was issued in January 2020 and involved a low-pressure fuel pump that may stop operating, resulting in a possible stalled engine. The NHTSA Recall Number 20V024 (Manufacturer Recall Number 20TA03) was issued in January 2020 and is described as follows:

Summary
The subject vehicles are equipped with an electronic control unit (ECU) from a specific supplier that is designed to receive signals from crash sensors and deploy the air bags and seat belt pretensioners. The ECU may not have adequate protection against certain electrical noise that

can occur in certain crashes, such as severe underride crashes. This can lead to incomplete or non-deployment of the air bags and/or seat belt pretensioners.

Safety Risk
Air bags and seat belt pretensioners that do not deploy as intended can increase the risk of injury in a crash.

Remedy
Any authorized Toyota dealer will install a noise filter between the air bag control module and its wire harness.

The Toyota was also subject to the Investigation EA19-001.

Interior Damage

The Toyota's interior had damage caused by impact forces, occupant contacts, and post-crash activities. The windshield was fractured and the left front door was jammed shut. The steering column was collapsed and the upper half of the steering wheel was bent forward 10 cm (3.9 in) from its original position (Figure 5). Both front-row seat belts revealed scuff marks caused by occupant loading. The front row was reduced by longitudinal intrusion of the left, middle and right instrument panel (4 cm [1.6 in]) and left windshield (10 cm [3.9 in]). The second row was reduced by lateral intrusion of the right rear door (rear lower quadrant) and armrest (5 cm [2.0 in]). The interior sustained post-crash damage caused during a prior vehicle inspection when trim panels and the ECU were removed from the center stack of the instrument panel.

Figure 5. Steering wheel deformation, 2019 Toyota Corolla

Figure 6. Driver's seat belt webbing, 2019 Toyota Corolla

Manual Restraint Systems

The Toyota had three-point continuous lap and shoulder seat belts for the driver and front right occupant. Both front-row occupants were belted at the time of the crash and loaded the seat belts causing elongated abrasions to the webbing (Figure 6) and scuff marks to latch plates. The belts were configured with retractor pretensioners which did not appear to have actuated during the crash. The front-row belt retractors spooled and unspooled easily and were not locked.

Supplemental Restraint Systems

The Toyota had advanced driver's and passenger's frontal and seat-mounted side impact air bags, a knee air bag for the driver, a seat cushion air bag for the front right occupant, and combination side impact/roll-sensing IC air bags for both rows. None of the air bags deployed during the crash. Given the head-on crash type, calculated longitudinal delta V, and severe front plane crush damage to the Toyota, it is reasonable to expect the frontal air bags to have deployed in this crash. According to a vehicle history report, no prior crashes were reported and no air bag replacement or service was performed. Efforts by SCI to interview the driver or other family members via phone were unsuccessful because they did not respond to calls or voice mails. The frontal air bags are discussed further in the Air Bag Non-Deployment Discussion section of this report.

2019 Toyota Corolla Occupants

Driver Demographics

Age/sex:	22 years/male
Height:	183 cm (72 in)
Weight:	98 kg (215 lb)
Eyewear:	Unknown
Seat type:	Bucket with adjustable head restraint
Seat track position:	Unknown
Manual restraint usage:	Lap and shoulder belt used
Usage source:	Vehicle inspection
Air bags:	Frontal, seat-mounted side impact and IC air bags available; none deployed
Alcohol/drug data:	BAC of .057 g/dL
Egress from vehicle:	Removed due to perceived serious injuries
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Treated in ER and transferred to another hospital

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Brief LOC NFS	161002.2	Steering wheel rim	Probable
2	Laceration, gaping, minor (7 cm [2.8 in]), chin	210602.1	Steering wheel rim	Probable
3	Contusion, face	210402.1	Steering wheel rim	Probable
4	Abrasion, chest	410202.1	Seat belt webbing	Certain
5	Contusion, abdomen	510402.1	Seat belt webbing	Certain
6	Contusion, left hip	810402.1	Seat belt webbing	Probable

Source: medical records

Driver Kinematics

The belted 22-year-old male driver was seated in an unknown posture. He was reported by his passenger to have fallen asleep at some point prior to impact. At impact with the bus, the driver was displaced forward and right in response to the 1 o'clock direction of force and was held in his seated position by the lap and shoulder seat belt. Following impact the Toyota was displaced to the left and rotated slightly clockwise in the westbound lane where its front plane struck the front plane of the Jeep head-on. At impact with the Jeep, the driver was displaced forward in response to the 12 o'clock direction of force loading and stretching the seat belt webbing and depositing scuff marks to the webbing and latch plate. The belt caused an abrasion to the chest and a contusion to the left hip. His chest, neck, and head continued to be displaced forward and

the driver loaded the steering wheel and column compressing the column forward and deforming the upper half of the steering wheel rim. The left instrument panel and windshield intruded longitudinally reducing the occupant compartment. The driver's face contacted the steering wheel rim causing multiple lacerations and a contusion. The driver sustained a positive brief loss of consciousness. According to his medical records he was removed from the vehicle by EMS, probably through the left front door. The driver was transported by ambulance to a local hospital. Prior to admission, he was transferred to another hospital where he was treated for an unknown length of time.

Front-Row Right Occupant Demographics

Age/sex:	15 years/male
Height:	183 cm (72 in)
Weight:	64 kg (141 lb)
Eyewear:	Unknown
Seat type:	Bucket with adjustable head restraint
Seat track position:	Unknown
Manual restraint usage:	Lap and shoulder belt used
Usage source:	Vehicle inspection
Air bags:	Frontal, seat-mounted side impact and IC air bags available; none deployed
Egress from vehicle:	Exited without assistance
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Treated in ER and transferred to another hospital

Front-Row Right Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Head injury NFS involving only headache	110009.1	Right IP	Probable
2	Laceration, minor (6 cm [2.4 in]), left eyebrow to forehead, face	210602.1	Right IP	Probable
3	Abrasion, chest	410202.1	Seat belt webbing	Certain
4	Contusion, left hip	810402.1	Seat belt webbing	Probable

Source: medical records

Front-Row Right Occupant Kinematics

The belted 15-year-old male occupant was seated in an unknown posture. At impact with the bus he was displaced forward and right in response to the 1 o'clock direction of force and was held in his seated position by the lap and shoulder seat belt. Following the impact, the Toyota was displaced to the left and rotated slightly clockwise in the westbound lane where it struck the Jeep

head-on. At impact with the Jeep, the passenger was displaced forward in response to the 12 o'clock direction of force loading and stretching the seat belt webbing and depositing scuff marks to the webbing and latch plate. The seat belt caused an abrasion to the chest and contusion to the left hip. His chest, neck, and head continued to be displaced forward and his head and face likely contacted the right instrument panel causing a laceration to the left eyebrow and an unspecified head injury involving only a headache. He exited unassisted through the right-front door and was reportedly walking without assistance at the crash site. Emergency responders arrived and transported him by ambulance to a local hospital. Prior to admission, he was transferred to another hospital where he was treated for an unknown length of time.

2012 Integrated Coach Corporation 3000 School Bus

Description

The 2012 Integrated Coach Corporation 3000 was a conventional, engine-in-front type truck used as a school bus. The vehicle had a 6-cylinder, 7.6-liter diesel engine and hydraulic brakes.

Exterior Damage

The bus sustained non-disabling damage to the back plane caused by the Event 1 impact with the Toyota. It was driven from the scene and not available for inspection.

Occupant Data

According to the police report, the belted 49-year-old male driver was not injured. The police report indicated that no seat belt was available for the 9-year-old female in the second-row left seat position, and she was not injured.

2018 Jeep Grand Cherokee

Description

The 2018 Jeep Grand Cherokee (Figure 7) was a full-size SUV with a 6-cylinder, 3.6-liter gasoline engine, 4-wheel drive, and hydraulic brakes. It had standard crash avoidance features including adaptive cruise control, crash imminent braking, blind spot warning, forward collision warning, lane departure warning, lane keeping assistance, lane keeping assistance, dynamic brake support and daytime running lights. It is unknown which crash avoidance features were activated at the time of the crash.

Figure 7. 2018 Jeep Grand Cherokee (auction image)

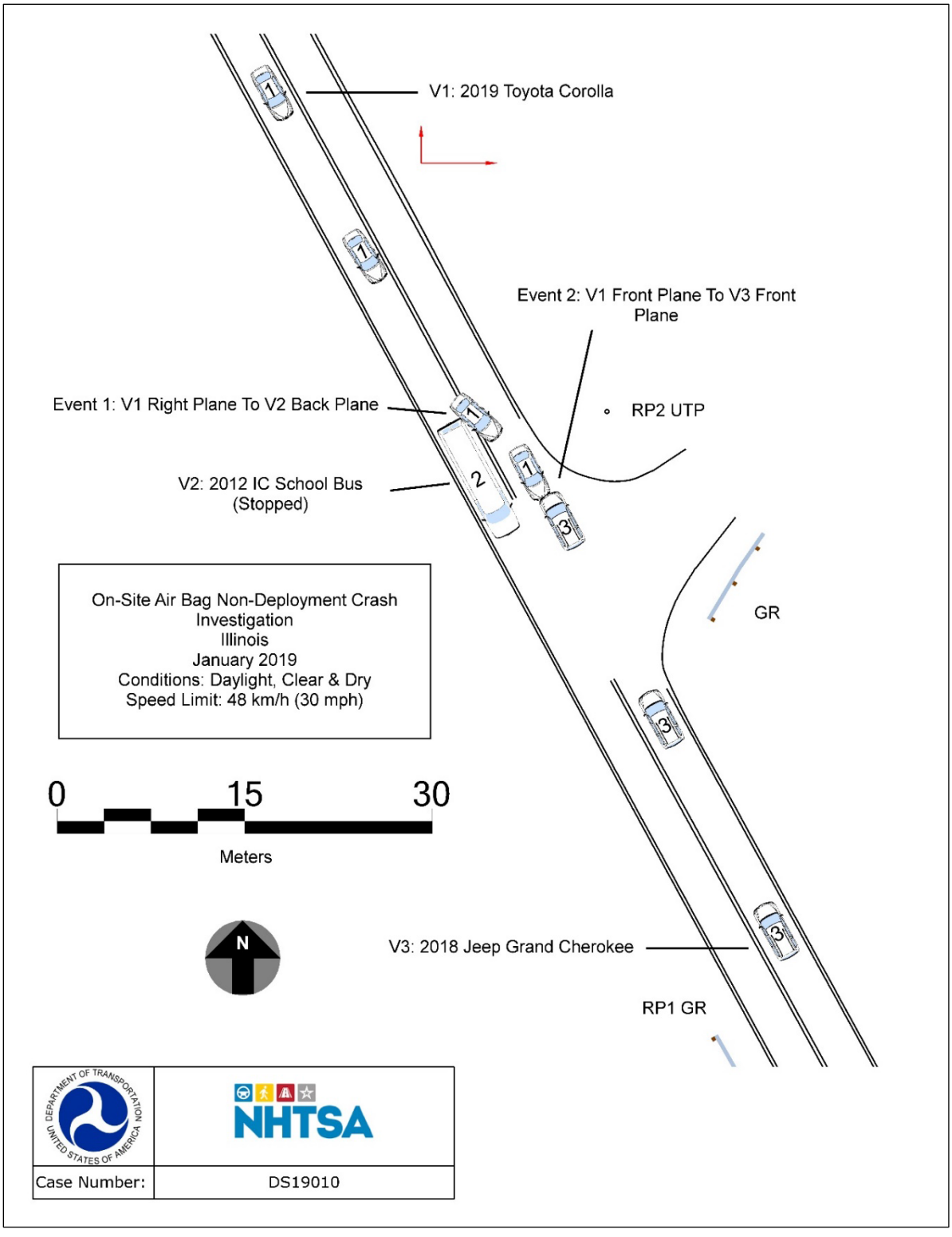
Exterior Damage

The Jeep had disabling damage to the front plane caused by the Event 2 impact with the Toyota. Auction photos were obtained and used for a partial exterior inspection. The estimated CDC for the Jeep in Event 2 was 12FDEW1. It was towed due to damage, declared a total loss, and sold in 2019.

Occupant Data

The 42-year-old female driver had police-reported non-incapacitating injuries and was transported by ambulance to a local hospital where her treatment status was unknown. The police report indicated no manual restraints were available for this occupant.

Crash Diagram



Appendix A: 2019 Toyota Corolla EDR Report[2]

[2] The EDR report contained in this technical report was imaged by VRTC, who provided a copy of the CDRx file to SCI. The current version of the Bosch CDR software was used at the time of the vehicle inspection and the file was updated with the latest version at the time of this report. The EDR report contained in the 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/Frame Number	2T1BURHE2KC******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS19010_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 18.0
Imaged with Software Licensed to (Company Name)	NHTSA Vehicle Research & Test Center
Reported with CDR version	Crash Data Retrieval Tool 21.5.1
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Side (2), Rollover (1)

Comments

No comments entered.

Data Limitations

CDR Record Information:

- Due to limitations of the data recorded by the airbag ECU, such as the resolution, data range, sampling interval, time period of the recording, and the items recorded, the information provided by this data may not be sufficient to capture the entire crash.
- Pre-Crash data is recorded in discrete intervals. Due to different refresh rates within the vehicle's electronics, the data recorded may not be synchronous to each other.
- Airbag ECU data should be used in conjunction with other physical evidence obtained from the vehicle and the surrounding circumstances.
- If any of the front passenger seat airbags, side airbags, or Curtain Shield Airbags have deployed, data will not be overwritten or deleted by the airbag ECU following that event. If none of the airbags have deployed, the data of that event may be overwritten by a following event even if other airbags (pretensioner, rear seat airbag, etc.) have deployed.
- If power supply to the airbag ECU is lost during an event, all or part of the data may not be recorded.
- "Diagnostic Trouble Codes" are information about faults when a recording trigger is established. Various diagnostic trouble codes could be set and recorded due to component or system damage during an accident.
- The airbag ECU records only diagnostic information related to the airbag system. It does not record diagnostic information related to other vehicle systems.
- The TaSCAN, Global Tech Stream, or Intelligent Tester II devices (or any other Toyota genuine diagnostic tool) can be used to obtain detailed information on the diagnostic trouble codes from the airbag system, as well as diagnostic information from other systems. However, in some cases, the diagnostic trouble codes of the airbag system recorded by the airbag ECU when the event occurred may not match the diagnostic trouble codes read out when the diagnostic tool is used.

General Information:

- The data recording specifications of Toyota's airbag ECUs are divided into the following categories. The specifications for 12EDR or later are designed to be compatible with NHTSA's 49CFR Part 563 rule.
  - 00EDR / 02EDR / 04EDR / 06EDR / 10EDR / 12EDR / 13EDR / 15EDR / 17EDR / 19EDR
- The airbag ECU records data for all or some of the following accident types: frontal crash, rear crash , side crash, and rollover events. Depending on the installed airbag ECU, data for side crash and/or rollover events may not be recorded.
- This airbag ECU records record pre-crash data and post-crash data.
  - If a single event occurs independently, the data for that event is recorded on a one-to-one basis.
  - If multiple events occur successively (within a period of approximately 500ms), the establishment of the recording trigger for the first event is defined as the "pre-crash recording trigger". Pre-crash data for the first event and post-crash data for each successive event is then recorded.
- The airbag ECU has two recording pages (memory maps) to store pre-crash data. Additionally, to store post-crash data, the airbag ECU has two recording pages for each accident type: two pages for frontal and rear crash, two pages for a side crash, and two pages for rollover event.
- The data recorded by the airbag ECU includes correlating information between each previously occurring event (i.e., information that clarifies the collision event sequence. This correlation information consists of the following items.
  - Time from Previous Pre-Crash TRG
  - Linked Pre-Crash Page
  - Time from Pre-Crash TRG
  - TRG Count
  - Previous Crash Type

- In frontal and rear collision events, the first point where a longitudinal cumulative delta-V of over 0.8 km/h (0.5 mph) is reached is regarded as time zero for the recorded data. In side impact collision and rollover events, the point in time at which the recording trigger is established is regarded as time zero for the recorded data.
- The recording trigger judgment threshold value differs depending on the collision type (i.e., frontal crash, rear crash, side crash, or rollover event).
- Some of the data recorded by the airbag ECU is transmitted to the airbag ECU from various vehicle control modules by the vehicle's Controller Area Network (CAN).
- In some cases, the airbag ECU part number printed on the ECU label may not match the airbag ECU part number that the CDR tool reports. The part number retrieved by the CDR tool should be considered as the official ECU part number.
- In frontal and rear collision events, the record time varies depending on the period during which a longitudinal cumulative delta-V of over 0.8 km/h (0.5 mph) is reached, and time series data is recorded for up to 250 ms. The record time described above is indicated as "Length of Delta-V". "Delta-V, Longitudinal" outside the record time is indicated by area shaded in the table, and not indicated in the graph.

Data Element Sign Convention:
The following table provides an explanation of the sign notation for data elements that may be included in this CDR report.

Data Element Name	Positive Sign Notation Indicates
Maximum Delta-V, Longitudinal	Forward
Delta-V, Longitudinal	Forward
Lateral Acceleration for Frontal/Rear Crash, Floor Sensor	Left to Right
Lateral Acceleration, Side Satellite Sensor 1	Left to Right
Lateral Acceleration, Side Satellite Sensor 2	Left to Right
Lateral Acceleration, Side Satellite Sensor 3	Left to Right
Lateral Acceleration, Side Satellite Sensor 4	Left to Right
Lateral Acceleration for Side Crash, Floor Sensor	Left to Right
Roll Angle Peak	Clockwise Rotation
Roll Angle at the Time of TRG	Clockwise Rotation
Roll Rate	Clockwise Rotation
Lateral Acceleration for Rollover, Floor Sensor	Left to Right
Longitudinal Acceleration , VSC Sensor	Forward
Yaw Rate	Left Turn
Steering Input	Left Turn

Data Definitions:

- The "ON" setting for the "Freeze Signal" indicates a state in which the non-volatile memory can not be overwritten or deleted by the airbag ECU. After "Freeze Signal" has been turned ON, subsequent events will not be recorded.
- "Recording Status" indicates a state in which all recorded event data has been written into the non-volatile memory, or a state in which this process was interrupted and not fully written into the non-volatile memory. If "Recording Status" is "Incomplete", recorded event data may not be valid.
- If the "Occupant Size Classification, Front Passenger" displays "Child" or "Not Occupied", "Side Air Bag Deployment, Time to Deploy" and "Pretensioner Deployment, Time to Fire" may indicate a time even if deployment did not occur on the for following part no's:
  - 89170-07280, 35400, 35410, 35470, 42660, 0R120, 0R080, 0R081, 0R150
- "Engine RPM" indicates the number of engine revolutions, not the number of motor revolutions. The recorded value has an upper limit of 12,800 rpm. Resolution is 100 rpm and the value is rounded down and recorded. For example, if the actual engine speed is 799 rpm, the recorded value will be 700 rpm.
- If the electric vehicle is using a calculated/virtual engine RPM for drivetrain control, "Engine RPM" may be recorded, but should not be used during data analysis.
- The upper limit for the recorded "Vehicle Speed" value is 200 km/h (125mph). Resolution is 1km/h (0.6mph) and the value is rounded down and recorded. The accuracy of the "Vehicle Speed" value can be affected by various factors. These include, but not limited, to the following.
  - Significant changes in the tire's rolling radius
  - Wheel lock and wheel slip
- "Accelerator Pedal" has two recording specifications. Both the recorded value increases as the driver depresses the accelerator.
  - Percentage of accelerator pedal depressed (recorded as 0-100(%)).
  - Output voltage of accelerator pedal module (recorded as 0-5(V)).
- If M/T transmission vehicle of some limited model, "Shift Position" may display "Drive" regardless of the actual shift position.
- Depending on the type of occupant sensor installed in the vehicle, one of the following three recording formats for "Occupant Size Classification, Front Passenger" will be utilized.
  - Occupied / Not Occupied
  - AM50 / AF05 / Child / Not Occupied
  - AM50 / AF05 / Child or Not Occupied
- "Cruise Control Status" indicates whether the cruise control system is actuated or not. OFF indicates that the cruise control system is not actuated, but can also indicates that the vehicle is not equipped with the system.
- "Air Bag Warning Lamp, On/Off", "Ignition Cycle, Crash", "Seat Track Position Switch, Foremost, Status, Driver", "Occupant Size Classification, Front Passenger", "Safety Belt Status, Driver", "Safety Belt Status, Front Passenger", "Frontal Air Bag Suppression Switch Status, Front Passenger", and "RSCA Disable Switch" indicate the state approximately 1 second before time zero. They may not always indicate the state at the moment of collision.
- The upper and lower limits for the recorded value of "Motor RPM" is 17,500 rpm and -7,500 rpm respectively. Resolution is 100 rpm and the value is rounded down and recorded.
- "Brake Oil Pressure" has an upper limit of 12.14 Mpa. In the case of the vehicle that has not VSC system, "0 Mpa" or "Invalid" may be displayed.
- "Longitudinal Acceleration , VSC Sensor" has upper and lower limits for the recorded value of 8.973 m/s^2 and -8.973 m/s^2 respectively. This acceleration sensor does not sense collisions.

- "Sequential Shift Range" displaying "Undetermined" indicates the shift range is undetermined or was not being used.
- Some vehicles will not be equipped with all "Drive Mode" types indicated in the "Drive Mode" table. If some or all drive modes are not applicable to vehicle, "OFF" or "Invalid" may be displayed. The item in the "Drive Mode" table may not match the name of switch or indicator that equipped the vehicle.
- The upper and lower limits for the recorded value of "Steering Input" is 375 deg and -375 deg respectively. Resolution is 1.5 deg and the value is rounded down and recorded.
- Resolution of the "Air Bag Warning Lamp ON Time Since DTC was Set" is 15 minutes, and the value is rounded down and recorded.
- "Delta-V, Longitudinal" indicates the change in forward speed after time zero. This does not refer to vehicle speed, and it does not include the change in speed during the period from the start of the actual collision to establishment of the time zero.
- "Location of Side Satellite Sensor" shows the outline of a typical sensor position. Sensory location can be confirmed using the repair manual.
- "Time from Previous Pre-Crash TRG" indicates the time between the establishment of an event's pre-crash recording trigger to the establishment of a more recent event's pre-crash recording trigger. The upper limit for the recorded value is 16,381 milliseconds. In the event of establishment of the first pre-crash recording trigger after the ignition is switched ON, the upper limit value(max value) is recorded.
- "TRG Count" indicates a calculated value of the number of times recording triggers have been established for all crash types. The sequence in which each event occurred can be verified from the "TRG Count". The smaller the "TRG Count" value, the older the data. The upper limit for the recorded value is 65,533 times. When more than one event reaches the upper limit, the actual "TRG Count" may be greater than what is displayed for that event.
- "Linked Pre-Crash Page" is used to link 'paged" pre-crash data with 'paged" post-crash data. When old pre-crash data is overwritten by new pre-crash data, the "Linked Pre-Crash Page" value may record a page number that is not actually linked.
- Resolution of the "Time from Pre-Crash to TRG" is 50 [ms], and the value is rounded up and recorded.
- "Roll Angle at the Time of TRG" and "Roll Angle Peak" do not represent the actual roll angle of the vehicle. These values are used internally by the airbag ECU for sensing a rollover.

05013_ToyotaS00std_r028

System Status at Time of Retrieval

ECU Part Number	89170-02K90
EDR Generation	13EDR
Complete File Recorded	Yes
Freeze Signal	OFF
Freeze Signal Factor	None
Diagnostic Trouble Codes Exist	No
Ignition Cycle ,Download (times)	270
Multi-event, number of events (times)	1
Time from event 1 to 2 (s)	5.0 or greater
Time from Previous Pre Crash TRG (msec)	16381 or greater
Latest Pre-Crash Page	1
Contains Unlinked Pre-Crash Data	No

Event Record Summary at Retrieval

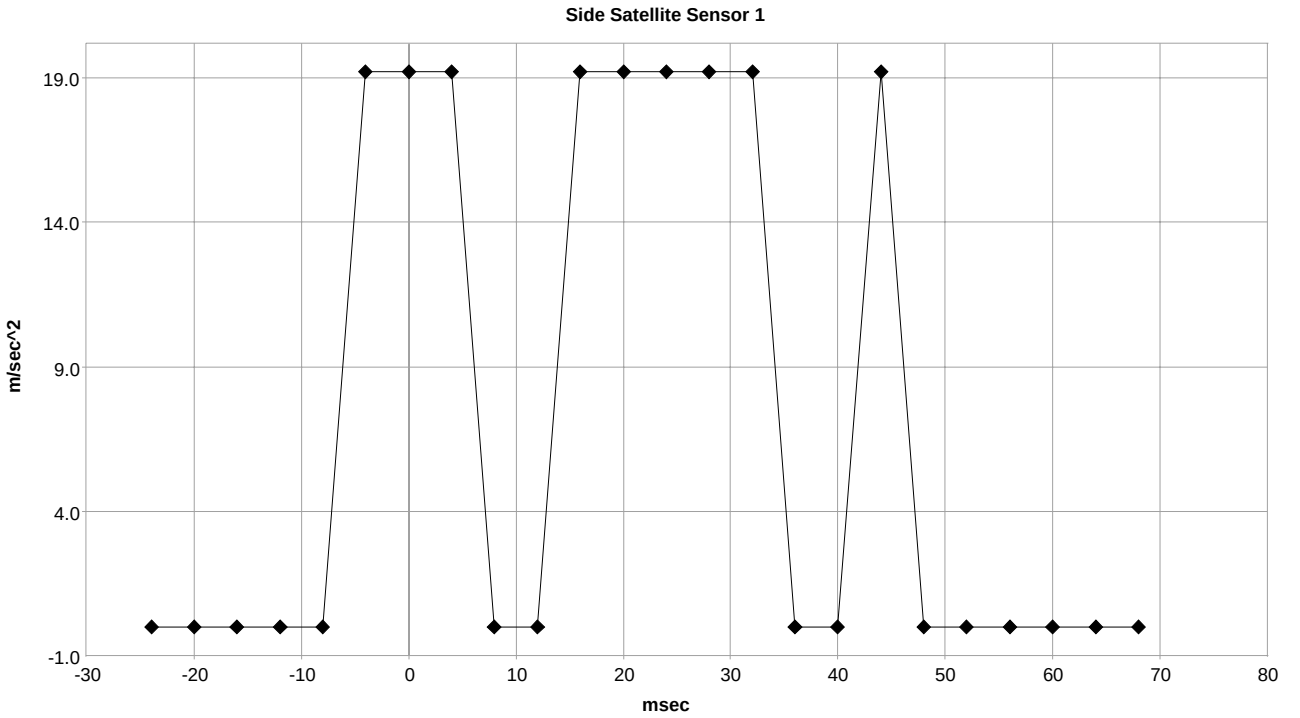
Events Recorded	TRG Count	Crash Type	Time (msec)	Pre-Crash & DTC Data Recording Status	Event & Crash Pulse Data Recording Status
Most Recent Event	3	Side Crash	0	Complete (Page 1)	Complete (Side Page 1)
1st Prior Event	2	Rollover	-16381 or greater	Complete (Page 0)	Complete (Rollover Page 0)
2nd Prior Event	1	Side Crash	-16381 or greater	Complete (Page 0)	Complete (Side Page 0)

System Status at Event (Most Recent Event, TRG 3)

Recording Status, Side Crash Info.	Complete
Crash Type	Side Crash
TRG Count (times)	3
Previous Crash Type	No Event
Time from Pre-Crash TRG (msec)	0
Linked Pre-Crash Page	1
Side Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Side Curtain Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Pretensioner Deployment, Time to Fire (msec)	No
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

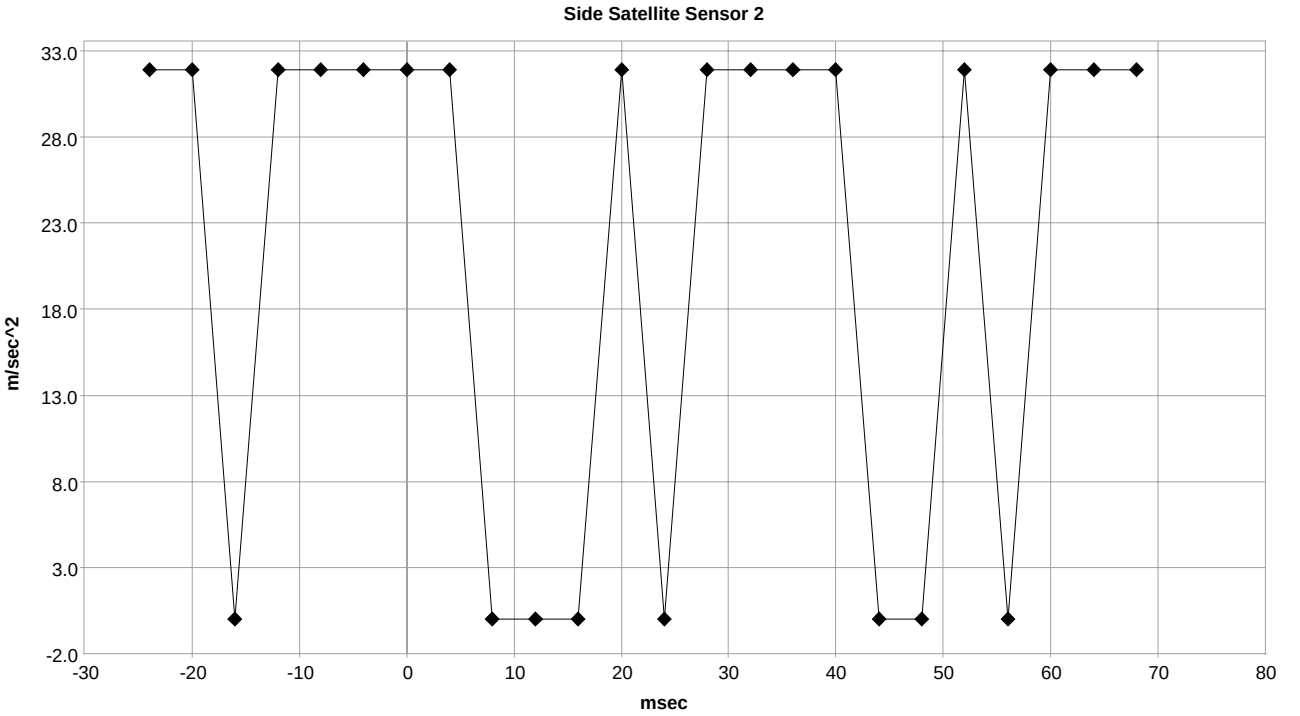
Lateral Crash Pulse (Most Recent Event, TRG 3 - table 1 of 2)

Recording Status, Time Series Data	Complete
Recorded Side	Right Side
Time from TRG to Next Sample (msec)	0
Location of Side Satellite Sensor 1	B-Pillar
Location of Side Satellite Sensor 2	Front Door
Location of Side Satellite Sensor 3	C-Pillar
Location of Side Satellite Sensor 4	Not Equipped
Location of Floor Sensor	Airbag ECU
Clipping Time of Lateral Acceleration, Side Satellite Sensor 1 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 2 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 3 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 4 (msec)	SNA
Clipping Time of Lateral Acceleration, Floor Sensor (msec)	No



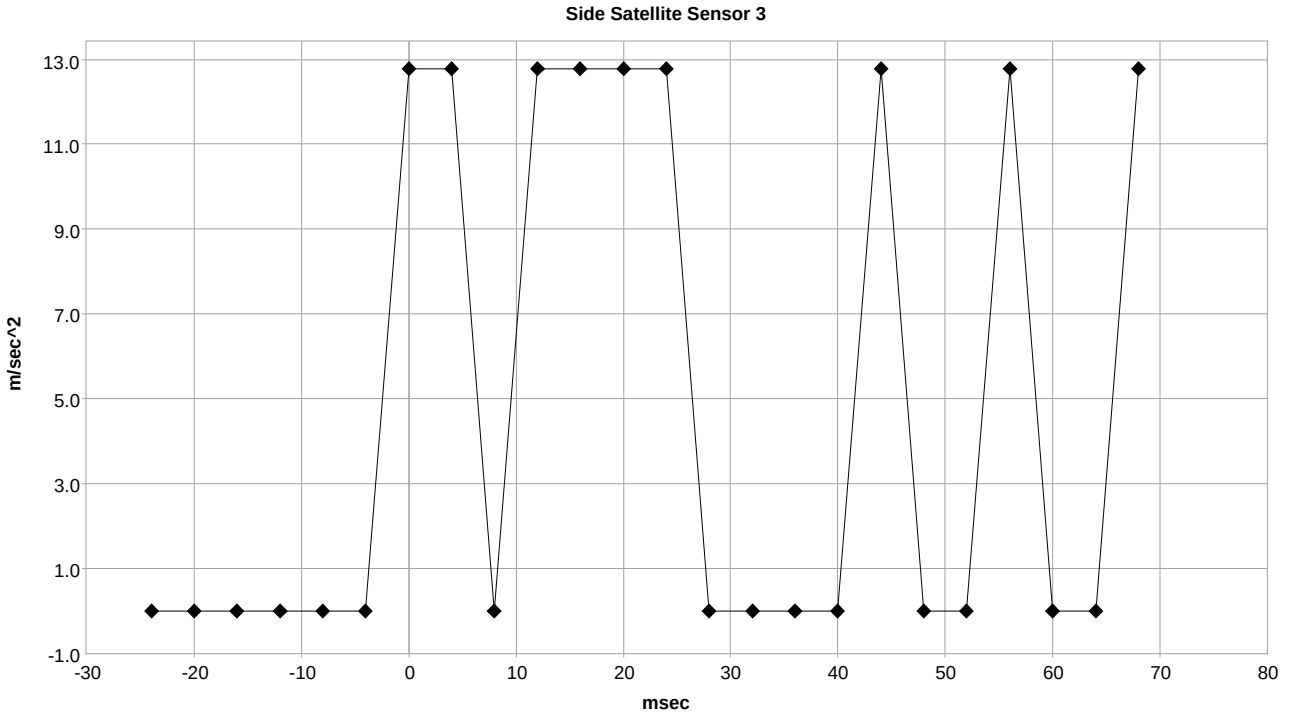
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



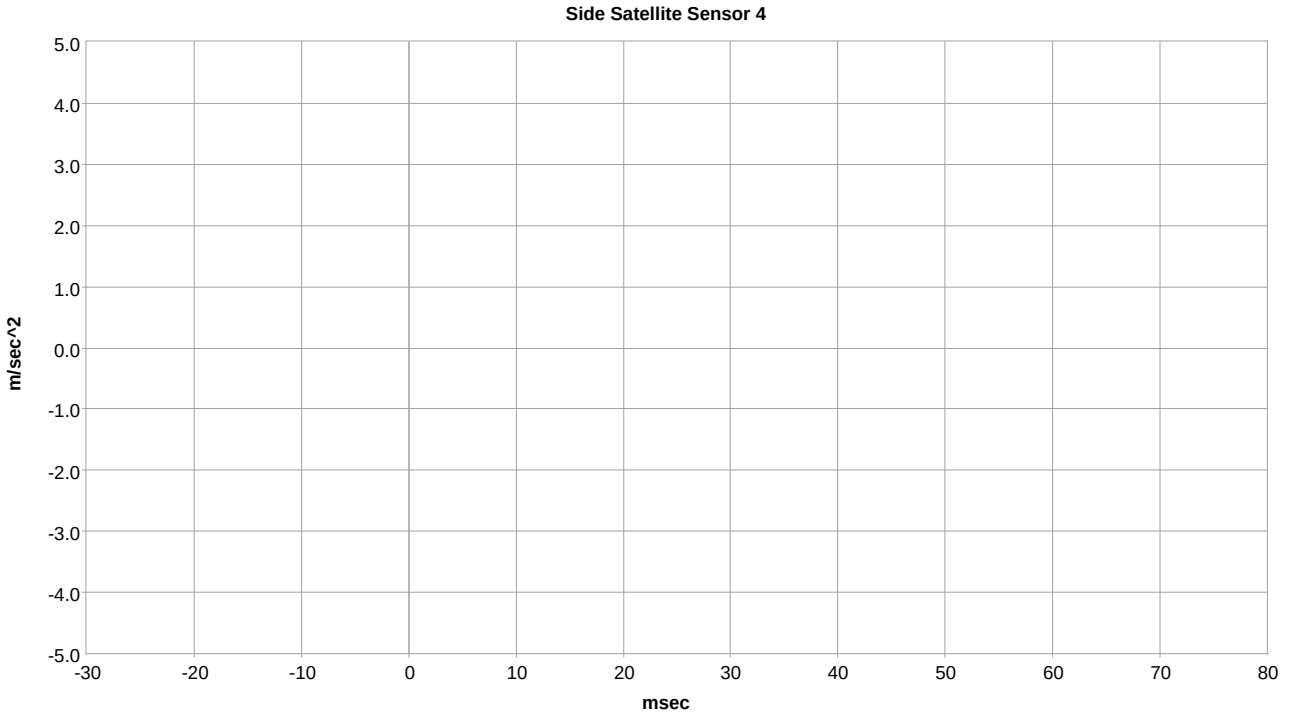
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



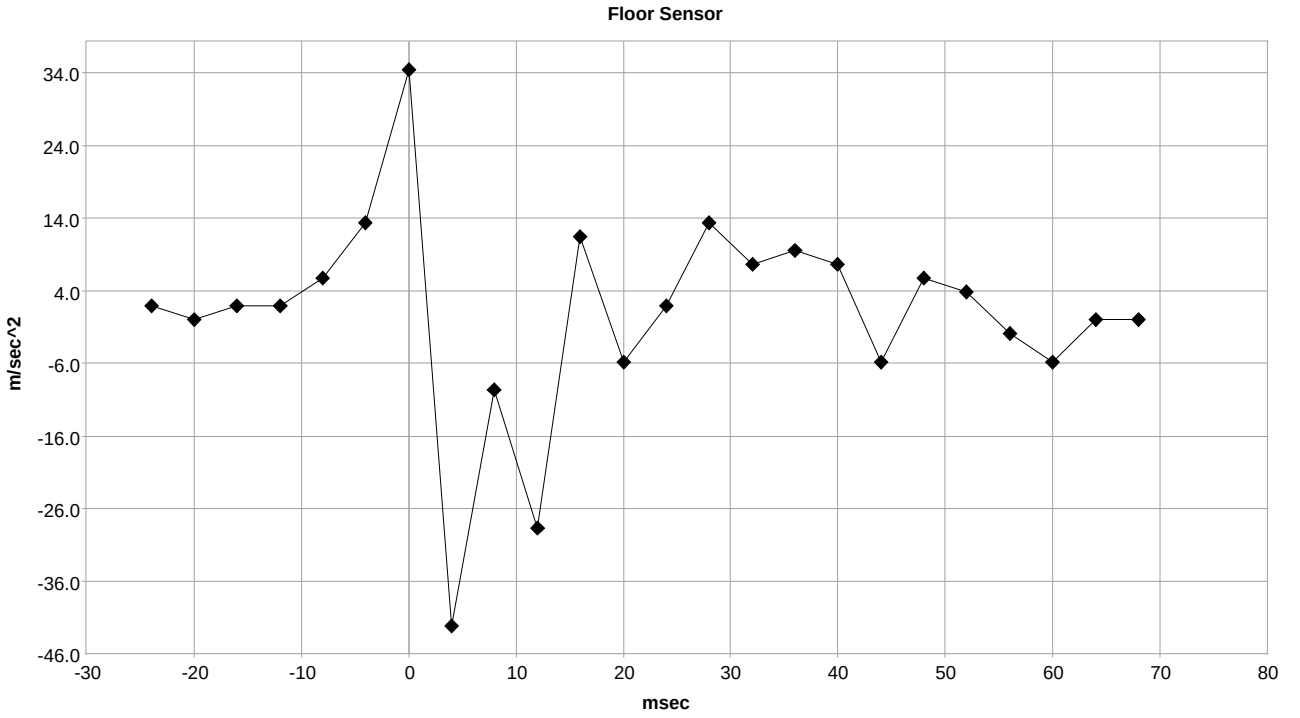
Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time
4	Side Curtain Airbag

Lateral Crash Pulse (Most Recent Event, TRG 3 - table 2 of 2)

Time (msec)	Lateral Acceleration, Side Satellite Sensor 1 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 2 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 3 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 4 (m/sec^2)	Lateral Acceleration for Side Crash, Floor Sensor (m/sec^2)
-24	0.0	31.9	0.0	SNA	1.9
-20	0.0	31.9	0.0	SNA	0.0
-16	0.0	0.0	0.0	SNA	1.9
-12	0.0	31.9	0.0	SNA	1.9
-8	0.0	31.9	0.0	SNA	5.7
-4	19.2	31.9	0.0	SNA	13.4
0	19.2	31.9	12.8	SNA	34.5
4	19.2	31.9	12.8	SNA	-42.1
8	0.0	0.0	0.0	SNA	-9.6
12	0.0	0.0	12.8	SNA	-28.7
16	19.2	0.0	12.8	SNA	11.5
20	19.2	31.9	12.8	SNA	-5.7
24	19.2	0.0	12.8	SNA	1.9
28	19.2	31.9	0.0	SNA	13.4
32	19.2	31.9	0.0	SNA	7.7
36	0.0	31.9	0.0	SNA	9.6
40	0.0	31.9	0.0	SNA	7.7
44	19.2	0.0	12.8	SNA	-5.7
48	0.0	0.0	0.0	SNA	5.7
52	0.0	31.9	0.0	SNA	3.8
56	0.0	0.0	12.8	SNA	-1.9
60	0.0	31.9	0.0	SNA	-5.7
64	0.0	31.9	0.0	SNA	0.0
68	0.0	31.9	12.8	SNA	0.0

DTCs Present at Time of Event (Most Recent Event, TRG 3)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (Most Recent Event, TRG 3)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	50
TRG Count when Pre-crash TRG was Established (times)	3
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Child or Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	SNA
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	265

Pre-Crash Data, -5 to 0 seconds (Most Recent Event, TRG 3)

Time (sec)	-4.55	-4.05	-3.55	-3.05	-2.55	-2.05	-1.55	-1.05	-0.55	-0.05	0 (TRG)
Vehicle Speed (MPH [km/h])	67.7 [109]	67.7 [109]	67.7 [109]	67.7 [109]	67.7 [109]	67.1 [108]	67.1 [108]	67.7 [109]	67.7 [109]	67.7 [109]	69 [111]
Accelerator Pedal, % Full (%)	25.5	25.5	25.5	0.0	12.5	25.5	28.0	27.5	24.0	21.0	21.0
Percentage of Engine Throttle (%)	18.5	18.5	18.5	0.5	1.5	18.0	20.0	19.5	19.0	15.0	15.0
Engine RPM (RPM)	2,100	2,100	2,100	1,900	1,800	1,800	2,000	2,200	2,200	1,900	1,900
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Longitudinal Acceleration , VSC Sensor (m/sec^2)	0.000	0.000	0.000	-0.144	-0.431	-0.287	-0.144	0.000	0.000	-0.431	Invalid
Yaw Rate (deg/sec)	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.00	0.00	-0.98	0.00
Steering Input (degrees)	-3.0	-3.0	-3.0	-3.0	-3.0	-1.5	6.0	-3.0	-3.0	-4.5	-4.5
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, EV	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

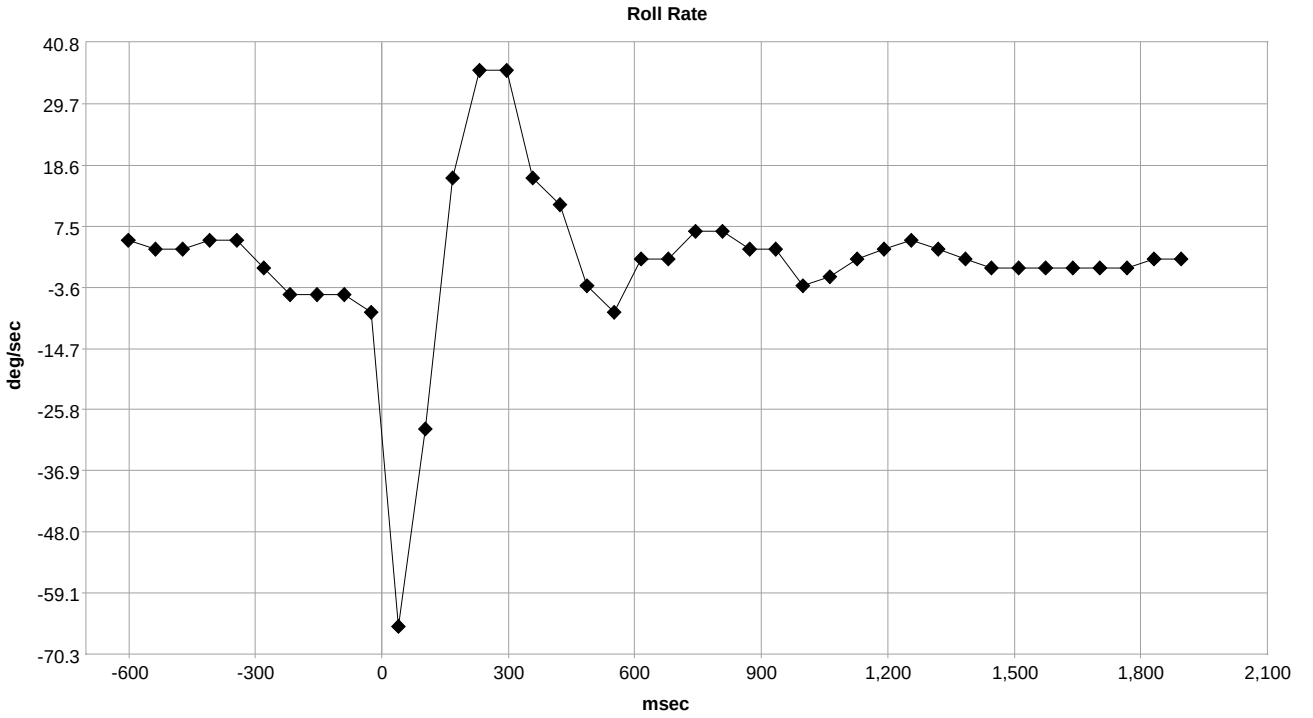
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (1st Prior Event, TRG 2)

Recording Status, Rollover Crash Info.	Complete
Crash Type	Rollover
TRG Count (times)	2
Previous Crash Type	Side Crash
Time from Pre-Crash TRG (msec)	51
Linked Pre-Crash Page	0
Side Curtain Airbag Deployment, Time to Deploy (msec)	No
Pretensioner Deployment, Time to Fire, Driver (msec)	No
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	No

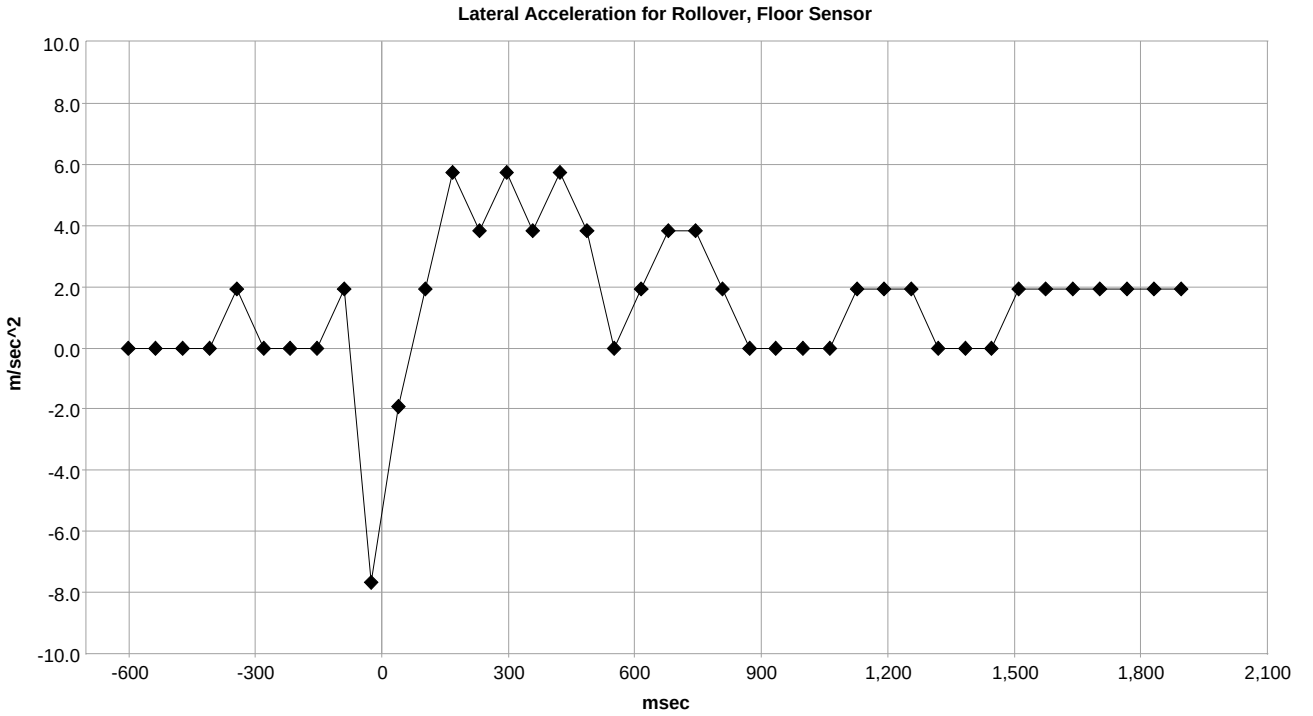
Rollover Crash Pulse (1st Prior Event, TRG 2 - table 1 of 2)

Recording Status, Time Series Data	Complete
Time from TRG to Next Sample (msec)	39
Roll Angle Peak (degrees)	-6.6
Roll Angle at the Time of TRG (degrees)	-2.8



Deployment Time Marker Key

1	Driver/Passenger CSA
2	Driver/Passenger Pretensioner



Deployment Time Marker Key

1	Driver/Passenger CSA
2	Driver/Passenger Pretensioner

Rollover Crash Pulse (1st Prior Event, TRG 2 - table 2 of 2)

Time (msec)	Roll Rate (deg/sec)	Lateral Acceleration for Rollover, Floor Sensor (m/sec^2)
-601	4.9	0.0
-537	3.3	0.0
-473	3.3	0.0
-409	4.9	0.0
-345	4.9	1.9
-281	0.0	0.0
-217	-4.9	0.0
-153	-4.9	0.0
-89	-4.9	1.9
-25	-8.1	-7.7
39	-65.2	-1.9
103	-29.3	1.9
167	16.3	5.7
231	35.8	3.8
295	35.8	5.7
359	16.3	3.8
423	11.4	5.7
487	-3.3	3.8
551	-8.1	0.0
615	1.6	1.9
679	1.6	3.8
743	6.5	3.8
807	6.5	1.9
871	3.3	0.0
935	3.3	0.0
999	-3.3	0.0
1063	-1.6	0.0
1127	1.6	1.9
1191	3.3	1.9
1255	4.9	1.9
1319	3.3	0.0
1383	1.6	0.0
1447	0.0	0.0
1511	0.0	1.9
1575	0.0	1.9
1639	0.0	1.9
1703	0.0	1.9
1767	0.0	1.9
1831	1.6	1.9
1895	1.6	1.9

DTCs Present at Time of Event (1st Prior Event, TRG 2)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (1st Prior Event, TRG 2)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	150
TRG Count when Pre-crash TRG was Established (times)	1
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Child or Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	SNA
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	156

Pre-Crash Data, -5 to 0 seconds (1st Prior Event, TRG 2)

Time (sec)	-4.65	-4.15	-3.65	-3.15	-2.65	-2.15	-1.65	-1.15	-0.65	-0.15	0 (TRG)
Vehicle Speed (MPH [km/h])	28 [45]	27.3 [44]	27.3 [44]	26.7 [43]	26.1 [42]	25.5 [41]	25.5 [41]	24.9 [40]	24.9 [40]	22.4 [36]	21.7 [35]
Accelerator Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	17.5	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.0	0.0	0.0	0.0
Engine RPM (RPM)	1,200	1,200	1,200	1,100	1,100	1,100	1,100	1,500	1,200	1,000	1,000
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.10	0.00	0.05	0.00	0.00	0.00	0.82	1.34	1.34
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.431	-0.574	-0.646	-0.287	-0.574	-0.718	-0.431	0.359	-1.220	-2.584	Invalid
Yaw Rate (deg/sec)	-0.98	-0.98	0.49	-1.46	-3.42	0.00	1.46	6.83	7.81	1.95	0.98
Steering Input (degrees)	-7.5	-6.0	3.0	-9.0	-28.5	-4.5	16.5	45.0	40.5	9.0	-4.5
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, EV	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

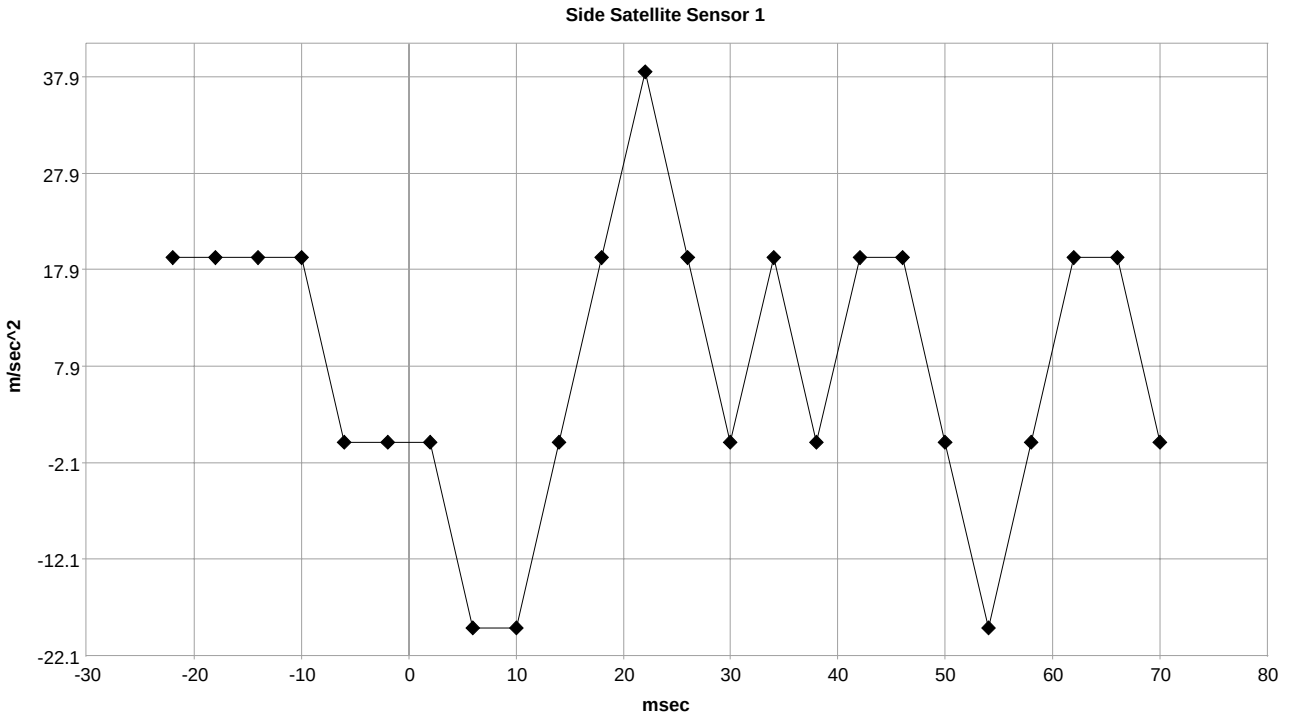
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (2nd Prior Event, TRG 1)

Recording Status, Side Crash Info.	Complete
Crash Type	Side Crash
TRG Count (times)	1
Previous Crash Type	No Event
Time from Pre-Crash TRG (msec)	0
Linked Pre-Crash Page	0
Side Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Side Curtain Airbag Deployment, Time to Deploy (If Equipped) (msec)	No
Pretensioner Deployment, Time to Fire (msec)	No
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

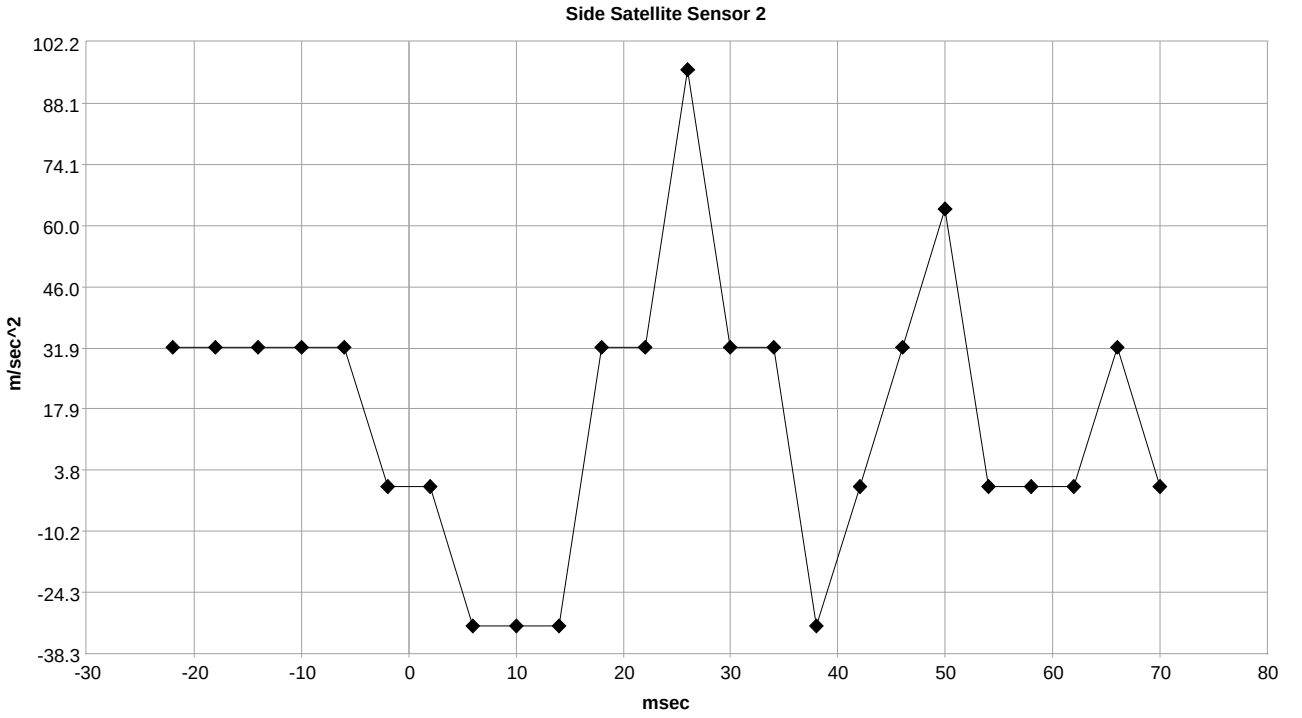
Lateral Crash Pulse (2nd Prior Event, TRG 1 - table 1 of 2)

Recording Status, Time Series Data	Complete
Recorded Side	Right Side
Time from TRG to Next Sample (msec)	2
Location of Side Satellite Sensor 1	B-Pillar
Location of Side Satellite Sensor 2	Front Door
Location of Side Satellite Sensor 3	C-Pillar
Location of Side Satellite Sensor 4	Not Equipped
Location of Floor Sensor	Airbag ECU
Clipping Time of Lateral Acceleration, Side Satellite Sensor 1 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 2 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 3 (msec)	No
Clipping Time of Lateral Acceleration, Side Satellite Sensor 4 (msec)	SNA
Clipping Time of Lateral Acceleration, Floor Sensor (msec)	5.0



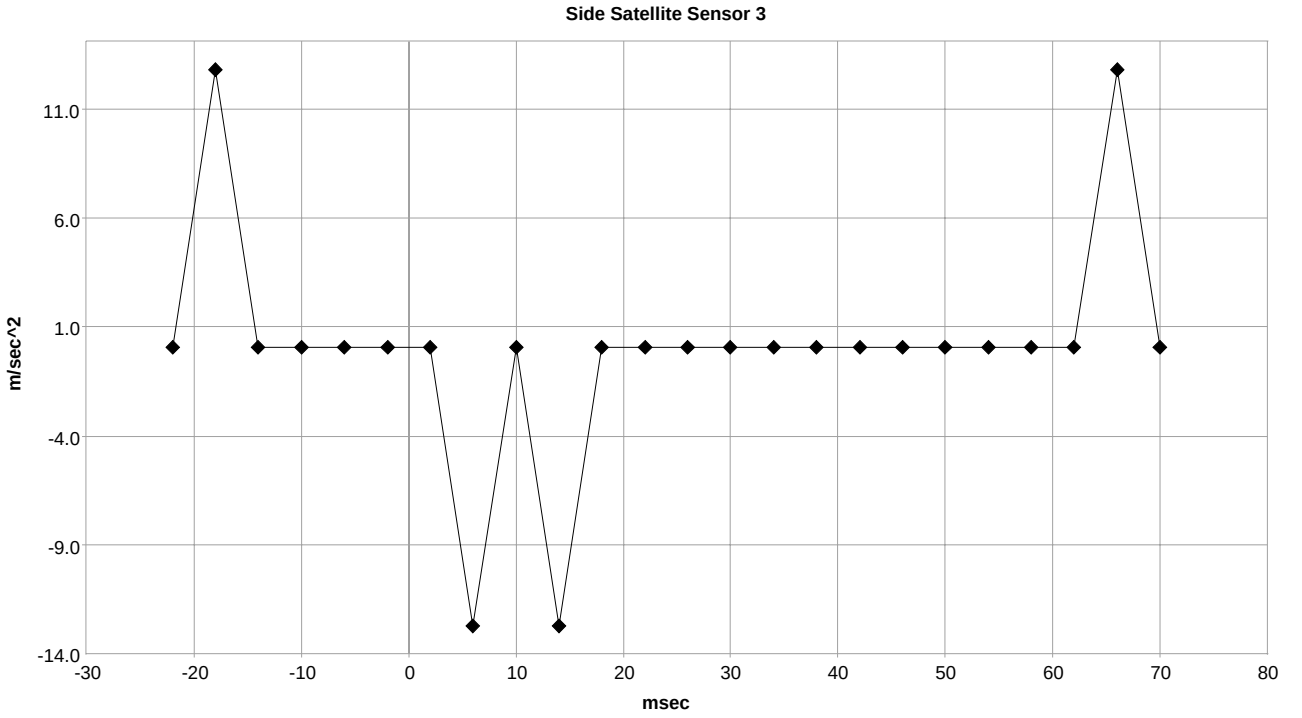
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



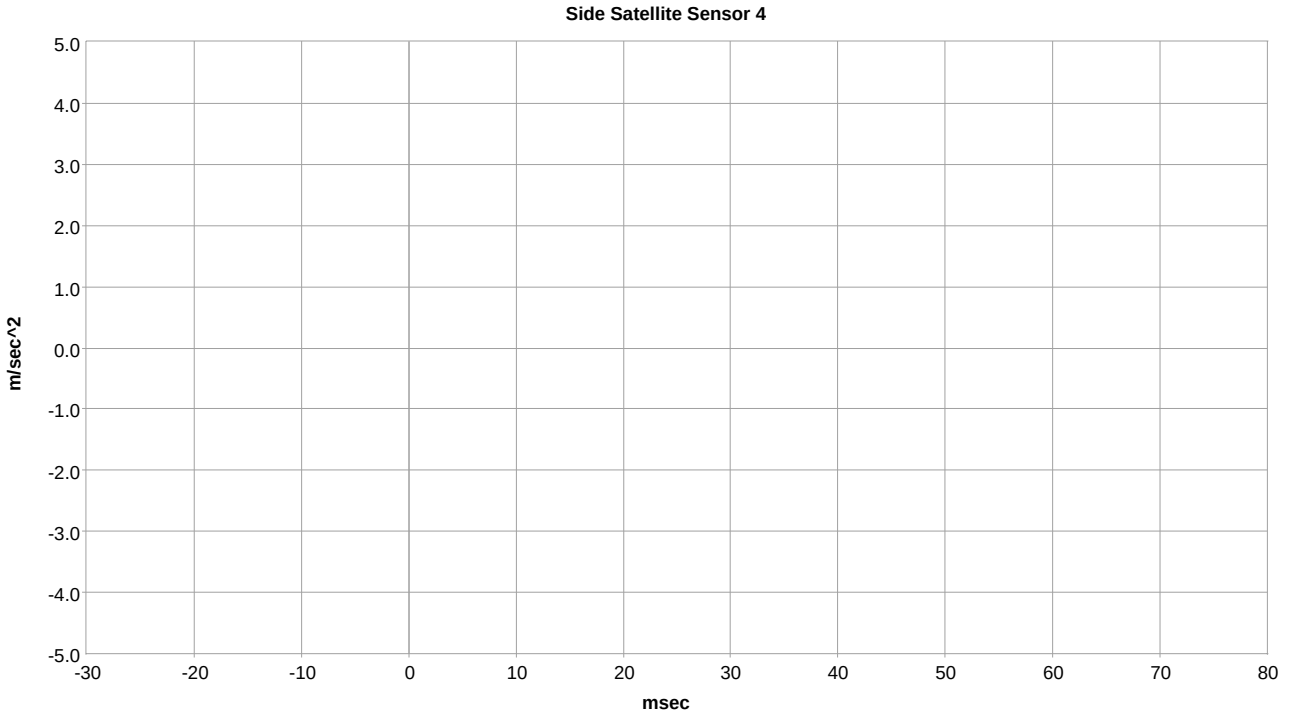
Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time



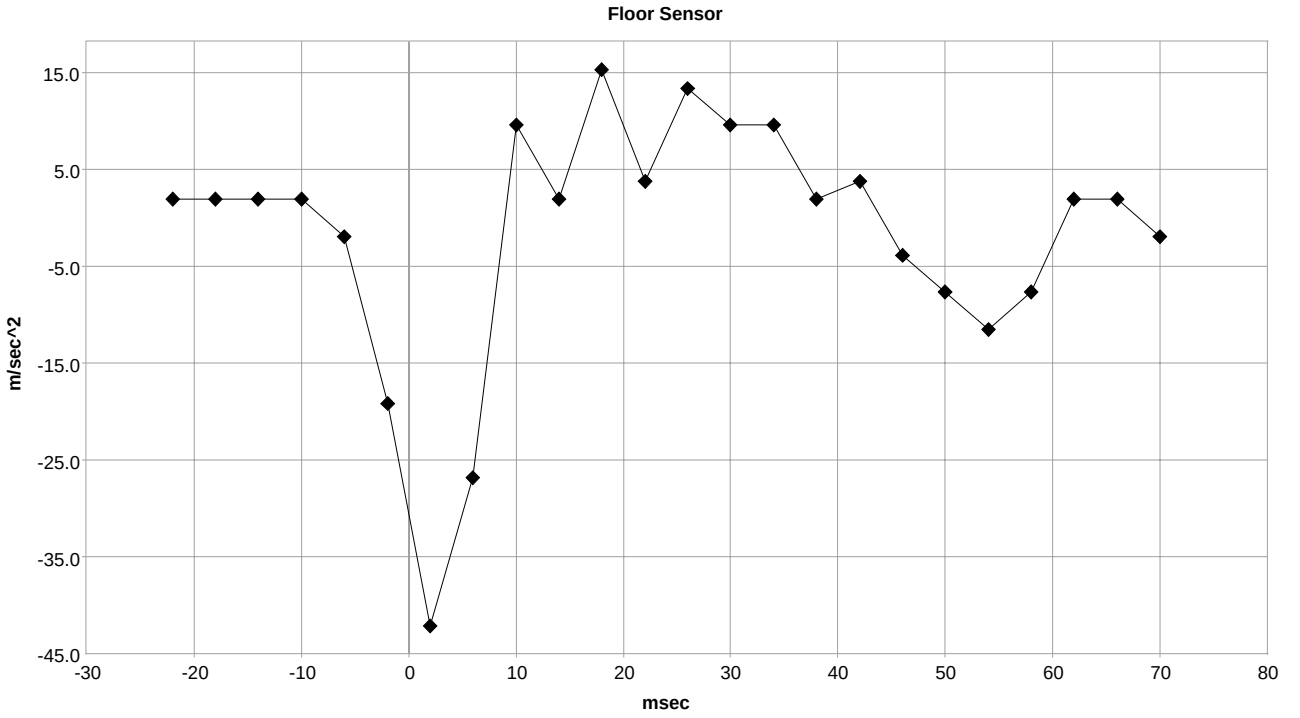
Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Side Curtain Airbag



Deployment Time Marker Key

1	Driver/Passenger Pretensioner
2	Side Airbag
3	Rear Window Airbag Deployment Time
4	Side Curtain Airbag

Lateral Crash Pulse (2nd Prior Event, TRG 1 - table 2 of 2)

Time (msec)	Lateral Acceleration, Side Satellite Sensor 1 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 2 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 3 (m/sec^2)	Lateral Acceleration, Side Satellite Sensor 4 (m/sec^2)	Lateral Acceleration for Side Crash, Floor Sensor (m/sec^2)
-22	19.2	31.9	0.0	SNA	1.9
-18	19.2	31.9	12.8	SNA	1.9
-14	19.2	31.9	0.0	SNA	1.9
-10	19.2	31.9	0.0	SNA	1.9
-6	0.0	31.9	0.0	SNA	-1.9
-2	0.0	0.0	0.0	SNA	-19.2
2	0.0	0.0	0.0	SNA	-42.1
6	-19.2	-31.9	-12.8	SNA	-26.8
10	-19.2	-31.9	0.0	SNA	9.6
14	0.0	-31.9	-12.8	SNA	1.9
18	19.2	31.9	0.0	SNA	15.3
22	38.4	31.9	0.0	SNA	3.8
26	19.2	95.8	0.0	SNA	13.4
30	0.0	31.9	0.0	SNA	9.6
34	19.2	31.9	0.0	SNA	9.6
38	0.0	-31.9	0.0	SNA	1.9
42	19.2	0.0	0.0	SNA	3.8
46	19.2	31.9	0.0	SNA	-3.8
50	0.0	63.8	0.0	SNA	-7.7
54	-19.2	0.0	0.0	SNA	-11.5
58	0.0	0.0	0.0	SNA	-7.7
62	19.2	0.0	0.0	SNA	1.9
66	19.2	31.9	12.8	SNA	1.9
70	0.0	0.0	0.0	SNA	-1.9

DTCs Present at Time of Event (2nd Prior Event, TRG 1)

Recording Status, Diagnostic	Complete
Ignition Cycle Since DTC was Set (times)	0
Airbag Warning Lamp ON Time Since DTC was Set (min)	0
Diagnostic Trouble Codes	None

Pre-Crash Data, 1 Sample (2nd Prior Event, TRG 1)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	150
TRG Count when Pre-crash TRG was Established (times)	1
Safety Belt Status, Driver	ON
Safety Belt Status, Front Passenger	OFF
Occupant Size Classification, Front Passenger	Child or Not Occupied
Frontal Airbag Suppression Switch Status, Front Passenger	SNA
RSCA Disable Switch	SNA
Seat Track Position Switch, Foremost, Status, Driver	SNA
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	156

Pre-Crash Data, -5 to 0 seconds (2nd Prior Event, TRG 1)

Time (sec)	-4.65	-4.15	-3.65	-3.15	-2.65	-2.15	-1.65	-1.15	-0.65	-0.15	0 (TRG)
Vehicle Speed (MPH [km/h])	28 [45]	27.3 [44]	27.3 [44]	26.7 [43]	26.1 [42]	25.5 [41]	25.5 [41]	24.9 [40]	24.9 [40]	22.4 [36]	21.7 [35]
Accelerator Pedal, % Full (%)	0.0	0.0	0.0	0.0	0.0	0.0	17.5	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	0.0	0.0	0.0	0.0	0.0	0.0	1.5	1.0	0.0	0.0	0.0
Engine RPM (RPM)	1,200	1,200	1,200	1,100	1,100	1,100	1,100	1,500	1,200	1,000	1,000
Motor RPM (RPM)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid
Service Brake, ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.10	0.00	0.05	0.00	0.00	0.00	0.82	1.34	1.34
Longitudinal Acceleration , VSC Sensor (m/sec^2)	-0.431	-0.574	-0.646	-0.287	-0.574	-0.718	-0.431	0.359	-1.220	-2.584	Invalid
Yaw Rate (deg/sec)	-0.98	-0.98	0.49	-1.46	-3.42	0.00	1.46	6.83	7.81	1.95	0.98
Steering Input (degrees)	-7.5	-6.0	3.0	-9.0	-28.5	-4.5	16.5	45.0	40.5	9.0	-4.5
Shift Position	D	D	D	D	D	D	D	D	D	D	D
Sequential Shift Range	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined
Cruise Control Status	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, PWR	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, ECO	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Sport	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, Snow	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
Drive Mode, EV	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

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.

PIDs	PID	Data
	00	BC 64 00 01
	01	00
	03	30 32 4B 39 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30
	04	FF FF FF
	05	01
	06	00
	0A	03
	0B	00
	20	80 00 00 01
	21	04 A0
	40	C0 00 E0 01
	41	54 57
	42	45 53 16 18 02
	51	FF
	52	F9
	53	00
	60	FF FF F0 01
	61	04 05 C8 00 B2 60 28 00 02 7E 02 7E 01 80 01 80 03 C0 03 C0 00 00 00 00 1F 40 29 B1 85 5F C8 00 19 00 19 00
	62	00 00 7F FD 01 0E 00 00 00 00
	63	55 08 00 9C F1 10 FF 00 11 11 11 11 11 10 2D 2C 2C 2B 2A 29 29 28 28 24 23 00 00 00 00 00 00 23 00 00 00 00 00 00 54 0C 0C 0C 0B 0B 0B 0B 0F 0C 0A 0A 00 00 00 00 00 00 00 01
	64	55 00 01 09 F1 10 FF 00 11 11 11 11 11 10 6D 6D 6D 6D 6D 6C 6C 6D 6D 6D 6F 33 33 33 00 19 33 38 37 30 2A 2A 00 00 00 15 15 15 13 12 12 14 16 16 13 13 00 00 00 00 00 00 00 03
	65	55 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	66	55 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	67	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	68	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	69	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	6A	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	6B	55 E0 00 00 01 FE FE FE FE 55 12 FF FF FF FF 00 00 00 01 01 00 FF FE FF 00 FF 00 FF FF 00 01 00 FF FF 00 00 FF 00 00 00 00 00 01 00 01 00 00 00 00 00 00 00 00 00 00 00 00 FF 00
	6C	55 E4 00 00 03 FE FE FE FE 55 10 00 00 00 00 00 FF FF FF 00 00 FF FF FF FF FF 00 00 FF 00 00 00 00 00 00 00 00 00 00 00 00 FF FF 00 FF FF FF FF 00 00 00 00 FF 00 00 FF 00 00 FF
	6D	FF FF FF FF FF 00 00 01 01 01 FF FF FD FF FF 01 00 FF FE 00 00 00 FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 FE 01 FE 01 FE 01 FE
	6E	FF FF 00 FF FF FF FF FF 00 00 00 FF 00 FF FF FF FF 00 00 FF 00 FF FF FF 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 FE 01 FE 01 FE 01 FE
	6F	55 FF FE 10 33 00 02 55 E7 FD FE FE FD FD 00 03 03 03 05 28 12 F6 EA EA F6 F9 02 05 FF FF FC FC FE FE 02 01 FF FE FD FE FF 00 00 00 00 00 00 FF FF 00 35 00 7E
	70	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	71	00 00 00 00 FF 00 00 00 FF 04 01 FF FD FE FD FE FD FE 00 FF FE FE FF 00 00 00 00 FF FF FF 00 00 00 FF FF FF FF FF FF FF
	72	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

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      00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
73    00 00 02 00 01 00 00 00 11 1C 1C 00 00 00 00 00 00 00 00 00 00
      FE FE 01 FD F9 00 03 0E 10 04 02 FA F8 F7 FC F8 F6 FA 05 EF DC 7E
      00 00 00 00 00 00 03 02 00 00 00 00 00 00
74    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      00 00 00 00 00 00 03 00 00 FE 00 00 00 00 FE FA FC FE 00 00 FA 7E
      25 25 25 01 03 24 28 27 26 1E 1E 00 00 00
80    00 00 00 01
A0    0C 00 DF 81
A5    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE
      FE FE FE FE FE FE FE FE FE FE FE
A6    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE FE
      FE FE FE FE FE FE FE FE FE FE FE
B4    FF FF FF FF 01 0A 16 0E FB FF F8 FE F9 FB FB FF FE 02 04 06 04 FF
      FF 01 00 0A
B5    FF 00 FF FF FD F9 EE 16 05 0F FA 03 FF F9 FC FB FC 03 FD FE 01 03
      00 00 01 FE
B6    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      00 00 00 00 00 00
B7    00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
      00 00 00 00 00 00
B8    03 FB 03 FC 00 02 03 FA 03 ED 03 FD 00 0B 00 1E 00 1B 00 06 03 FD

B9    03 FE 03 FE 03 FE 03 FE 03 FE 03 FF 00 04 03 FE 03 FE 03 FD 03 FD
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U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

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