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Special Crash Investigations On-Site Rollover Crash Investigation; Vehicle: 2015 Toyota Highlander; Location: Texas; Crash Date: March 2018

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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 vehicle(s) or their safety systems. This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was published.			
16. Abstract This report documents the on-site investigation of the single-vehicle rollover crash of a 2015 Toyota Highlander, which was equipped with rollover/side impact inflatable curtain (IC) air bags that were certified to comply with Federal Motor Vehicle Safety Standard (FMVSS) No. 226, Ejection Mitigation. This crash occurred on the north roadside of a six-lane divided State highway that traversed in a northwest-southeast direction. The Toyota was equipped with multistage frontal air bags, front seat-mounted side impact air bags, and rollover/side impact IC air bags. Abelted 67-year-old female drove the vehicle. The Toyota was traveling northwest in the left through lane when the driver lost control on the wet pavement and the vehicle departed the right side of the roadway. The left plane struck the end terminal of a blocked out, W-beam steel guardrail (Event 1). The vehicle rotated clockwise and rolled over (Event 2), left side leading, an estimated 12 quarter turns across a distance of approximately 37 m (121 ft) down an embankment. The vehicle came to final rest at the bottom of the embankment upright heading southeast. The driver sustained police reported "B" (non-incapacitating) injuries and was transported by ambulance to a hospital where she was treated in the emergency room for minor injuries and released. The Toyota was towed from the crash scene due to damage.			
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On-Site Rollover Investigation
Case Number: IN18006
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BACKGROUND

This report documents the on-site investigation of the single-vehicle rollover crash of a 2015 Toyota Highlander (**Figure 1**), which was equipped with rollover/side impact inflatable curtain (IC) air bags that were certified to comply with Federal Motor Vehicle Safety Standard (FMVSS) No. 226, Ejection Mitigation. This crash investigation was initiated by the National Highway Traffic Safety Administration in April 2018 through the sampling activities of the Crash Investigation Sampling System (CISS) and assigned to the Special Crash Investigation (SCI) team at the Indiana University Transportation Research Center. The crash occurred in Texas in March 2018 and was investigated by a local police agency. Cooperation with the driver's insurance company was initiated and finalized in April 2018. Vehicle and crash scene inspections were completed in May 2018. The driver could not be located for interview.

Figure 1. The damaged 2015 Toyota Highlander.

This crash occurred on the north roadside of a six-lane divided State highway that traversed in a northwest-southeast direction. The Toyota was equipped with multistage frontal air bags, front seat-mounted side impact air bags, and rollover/side impact IC air bags. A belted 67-year-old female drove the vehicle. The Toyota was traveling northwest in the left through lane when the driver lost control on the wet pavement and the vehicle departed the right side of the roadway. The left plane struck the end terminal of a blocked out, W-beam steel guardrail (Event 1). The vehicle rotated clockwise and rolled over (Event 2), left side leading, an estimated 12 quarter turns across a distance of approximately 37 m (121 ft) down an embankment. The vehicle came to final rest at the bottom of the embankment upright, heading southeast. The driver sustained police reported "B" (non-incapacitating) injuries and was transported by ambulance to a hospital where she was treated in the emergency room for minor injuries and released. The Toyota was towed from the crash scene due to damage.

SUMMARY

Crash Site

This crash occurred during the night on the north roadside of a six-lane divided State highway. The weather conditions were rain with 14.4 kilometers (9 miles) visibility, southeast winds at

16.1 km/h (10 mph), a temperature and dew point of 13.9 °C (57 °F), according to local weather reports. The Toyota's roadway had three concrete northwest-bound through lanes. The left, center, and right through lanes were 3.1 m (10.2 ft), 3.3 m (10.8 ft) and 3.5 m (11.5 ft) wide, respectively. The through lanes were bordered by shoulders that were each approximately 2 m (7 ft) wide. The median shoulder was concrete and the right shoulder was bituminous. The median was under construction and the roadway had temporary white dotted edge and lane lines (Botts dots) and there were no rumble strips. The median separated the northwest-bound through lanes from three southeast-bound through lanes. The roadway was wet and the positive grade in the area of the Toyota's approach was 3 percent. The speed limit was 113 km/h (70 mph). The crash diagram is included at the end of this report.

Figure 2. Northwest view, Toyota's approach to impact with end terminal.

Pre-Crash

According to the police crash report, the Toyota was traveling northwest in the left through lane. The event data recorder (EDR) reported a speed range of 121 km/h (75.2 mph) to 50 km/h (31.1 mph) from -4.75 to -1.75 sec prior to algorithm enable (AE). The service brake was reported as "On" beginning at -1.25 sec and remained on to 0 sec, at which point the reported speed was 32 km/h (19.9 mph). The police crash report also stated that the Toyota was traveling at an unsafe speed for the wet road and began to hydroplane and veer to the right. The vehicle crossed the other two lanes and departed the roadway (**Figure 2**) onto the right roadside. EDR data indicate the vehicle yawing both directions and the driver eventually steering in both directions to regain control of the vehicle. The final steering maneuver was a maximum turn of the steering wheel to the left as the vehicle was rotating clockwise and approaching impact. The EDR-reported pre-crash speed, percent accelerator, percent throttle, engine rpm, service brake status, yaw rate, and steering input are presented in the table below.

Pre-Crash Data

Time (sec)	-4.75	-4.25	-3.75	-3.25	-2.75	-2.25	-1.75	-1.25	-0.75	-0.25	0 (TRG)
Vehicle Speed km/h (mph)	121 (75.2)	122 (75.8)	119 (73.9)	116 (72.1)	109 (67.7)	81 (50.3)	50 (31.1)	46 (28.6)	63 (39.1)	59 36.7)	32 (19.9)
Accel. Pedal, % Full	38.0	39.0	11.0	0.5	0.0	26.0	0.0	0.0	0.0	0.0	0.0
Percent Engine Throttle	20.0	21.0	4.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0
Engine (RPM)	2,200	2,200	2,200	2,100	2,000	1,500	1,000	1,000	1,300	1,200	800

Svc Brake ON/OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON
Yaw Rate (deg/sec)	0.00	1.46	0.98	-6.83	-20.98	-50.26	-27.33	-4.88	7.81	40.50	61.00
Steering Input (degrees)	0.0	0.0	-19.5	-25.5	25.5	148.5	321.0	375.0	375.0	375.0	375.0

**Positive sign indicates left yaw and left steering input. The upper and lower limits for steering input are 375 and -375 degrees, respectively.*

Crash

The left plane of the Toyota struck the end terminal (Event 1, **Figures 3** and **4**) on the north roadside. The force direction was in the 10 o'clock sector and according to EDR data, no air bags deployed as a result of this impact. The WinSMASH program could not be used to calculate delta V since an impact with a yielding object is out of scope for the program. However, the barrier algorithm of the program was used to calculate a barrier equivalent speed of 10 km/h (6 mph) based on the damage to the left fender. The result was considered to be reasonable. The vehicle continued in a northerly direction and traveled approximately 21 m (69 ft) down the negative 12 percent grade of an embankment and rolled over (Event 2, **Figure 5**), left side leading, an estimated 12 quarter turns across a distance of approximately 37 m (121 ft). The Toyota came to final rest on its wheels at the bottom of the embankment. The vehicle traveled approximately 69 m (226 ft) from road departure to final rest.

Figure 3. Damage from impact with end terminal.

Post-Crash

The driver exited the vehicle without assistance through the right front door according to her medical records. The police were notified of the crash at 0552 hours and arrived at 0623 hours. Rescue and medical personnel also responded. The driver sustained police reported "B" (non-incapacitating) injuries and was transported by ambulance to a hospital where she was treated in the emergency room for minor injuries and released. The vehicle was towed due to damage.

Figure 4. Northwest view, terminal head impact area.

2015 TOYOTA HIGHLANDER

Description

The Toyota was a front-wheel-drive, 7- occupant, 4-door sport utility vehicle (SUV) with the VIN

5TDKKRFH5FSxxxxxx manufactured in May 2015. The vehicle was equipped with a 3.5-liter, V-6 engine, 6-speed automatic transmission, 4-wheel, antilock brakes with electronic brake force distribution and braking assist, traction control, and electronic stability control (ESC). The vehicle was also equipped with multistage frontal air bags, front seat- mounted side impact air bags, and rollover/side impact IC air bags that were certified to comply to (FMVSS) No. 226, Ejection Mitigation. The vehicle had a tilt and telescoping steering column that was adjusted at the center and full forward positions, respectively. The specified wheelbase was 279 cm (109.8 in).

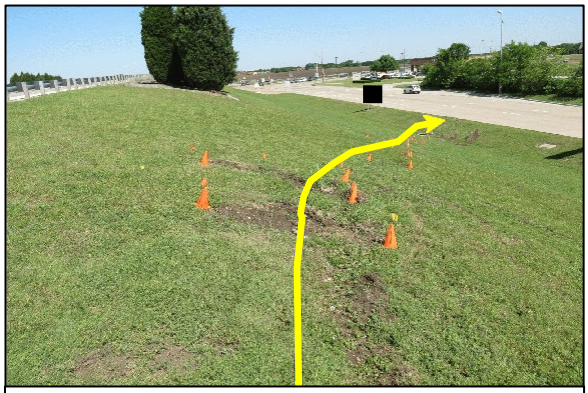


Figure 5. Rollover path and final rest area.

The vehicle manufacturer's recommended tire size was P245/60R18 and the vehicle was equipped with Yokohama YK-HTX tires of the recommended size on the front wheels and Bridgestone Dueler H/L 422 tires of the recommended size on the rear wheels. All tires were in good condition prior to the crash, except the left rear, which showed significant tread wear. The tire data for the Toyota are presented in the table below.

Position	Measured Tread Depth	Restricted	Damage
LF	9 mm (11/32 in)	No	None
LR	3 mm (4 /32 in)	No	None
RR	4 mm (5 /32 in)	No	None
RF	7 mm (9 /32 in)	No	None

The front row was equipped with driver and front right passenger leather-covered bucket seats with adjustable head restraints and the driver's seat track was adjusted between the forward-most and middle positions. The top of the driver's head restraint was adjusted 23 cm (9.1 in) above the top of the seat back. The second row was equipped with leather-covered bucket seats with folding backs and adjustable head restraints. The third row was equipped with a leather covered split bench seat with folding backs and non-adjustable head restraints.

Exterior Damage

Exterior Damage Event 1

The Toyota sustained damage to the left plane during the impact with the end terminal. There was direct damage to the left fender, front wheel, and hood. The direct damage began 287cm (113 in) forward of the left rear axle and extended 89 cm (35 in) rearward. The Field L was 132 cm (52.0 in) beginning 317 cm (124.8 in) forward of the left rear axle. Crush measurements were taken at the upper-door level and the maximum residual crush was 13 cm (5.1 in) occurring 287

(113 in) forward of the left rear axle. The crush values were: C_1 = 5 cm (2.0), C_2 = 6 cm (4.7 in), C_3 = 8 cm (3.1 in), C_4 = 13 cm (5.1 in), C_5 = 6 cm (2.4 in), and C_6 = 0 cm.

Damage Classification Event 1
The collision deformation classification (CDC) was 10LFEW2 (310 degrees). The severity of the damage was considered moderate based on damage to the fender.

Exterior Damage Event 2
The Toyota's left, right, top, and back planes sustained damage during the rollover. The left plane sustained direct damage to the fender, front door, roof side rail and at the back of the quarter panel. The right plane sustained direct damage that extended from the fender to the quarter panel (**Figure 6**). The top plane sustained direct damage to the fender, windshield and front portion of the roof. The maximum vertical crush was 6 cm (2.4 in) occurring to the windshield header near the right A-pillar. The maximum lateral crush was 1 cm (0.4 in) occurring at the left A-pillar.

Figure 6. Right side rollover damage.

Damage Classification Event 2
The CDC was 00TYDO2. The severity of the damage was minor based on the extent of crush to the top plane.

Event Data Recorder
The Toyota's EDR was imaged with version 17.7 of the Bosch Crash Data Retrieval software and reported with version 19.1.1. External electrical power was applied to the fuse block to image the data via the diagnostic link connector. The EDR reported a front/rear event, two side events, and a rollover. Each event recording was complete and all occurred on the same ignition cycle. For all recorded events, the air bag warning lamp was "OFF," the driver's seat belt status was "ON" and no trouble codes were reported.

The EDR was capable of recording front, rear, and side impacts, as well as rollovers. For any air bag deployment, data from that deployment cannot be overwritten or deleted following that event. If none of the air bags have deployed, data from a non-deployment can be overwritten by a following event that involves an air bag deployment or pretensioner actuation.

System Status at Event,3rd, 2nd, and 1st Prior Events (TRGs 1, 2, and 3): These three non-deployment events occurred during the impacts with the guardrail. No delta V values were reported for the 3rd and 2nd prior events. The 1st prior event reported the maximum longitudinal delta V as -20.1 km/h (-12.5 mph).

System Status at Event (Most Recent Event, TRG 4): This deployment event was a rollover and was the fourth event recorded by the EDR. The time from pre-crash trigger (TRG) was 119

msec. Both IC air bags and the driver's pretensioner deployed at 366 msec after TRG. The maximum roll rate was 206.9 deg/sec and occurred 913 msec after TRG.

Interior Damage

The interior of the Toyota sustained moderate damage from intrusion into the occupant compartment. There were 10 intrusions. The most severe intrusions in the driver's seating position involved the roof and windshield header that intruded vertically 9 cm (3.5 in) and 6 cm (2.4 in), respectively. The left B-pillar intruded laterally 8 cm (3.1 in). Evidence of occupant contact consisted of hair transfer on the left roof side rail from contact by the driver's head and a scuff to the left side of the console from possible right knee contact. All doors remained closed and operational.

Manual Restraint Systems

The front row seating positions were equipped with three-point lap and shoulder seat belts with sliding latch plates, adjustable upper anchors, and retractor-mounted pretensioners. The driver's upper anchor was adjusted to the full-down position. The second and third row seating positions were equipped with three-point lap and shoulder seat belts with sliding latch plates and fixed upper anchors.

The driver was restrained by her lap and shoulder seat belt as evidenced by load marks from the belt webbing on the latch plate belt guide. Also, a length of webbing was extended from the locked retractor consistent with usage. The EDR reported the driver's seat belt status as "ON."

Supplemental Restraint Systems

The Toyota was equipped with multistage frontal air bags, front seat-mounted side impact air bags, and rollover/side impact IC air bags. Both IC air bags deployed during the crash.

The left IC air bag was located along the left roof side rail inside the headline and extended from the D-pillar to the middle of the A-pillar. The IC Air bag measured 256 cm (100.8 in) in length, 50 cm (19.7 in) in height, and extended 20 cm (7.9 in) below the beltline at the driver's seating position. The width of the gap between the IC air bag and the base of the A-pillar was 11 cm (4.3 in) and the height of the IC air bag at the front attach point was 18 cm (7.1 in). The intrusion of the B-pillar, which was flush against the driver's seat back (**Figure 7**), did not allow the driver's IC air bag to extend fully down the side of the seat back.

Figure 7. Left IC air bag impeded by left seat back and intruded B-pillar.

Rollover Mitigation

The Toyota's rollover mitigation features consisted of ESC and roll sensing. The ESC uses sensors to detect a loss of steering control and selectively applies the brakes to minimize the control loss and keep the vehicle on the intended path. ESC operation was not reported by the vehicle's EDR. The driver lost control of the vehicle on wet concrete pavement. The driver was unable to regain control and the vehicle departed the roadway resulting in a crash.

The rollover sensor considers the roll angle, rate of roll, and speed to determine an impending rollover situation and deploy the IC air bags. The specific threshold parameters for deploying the IC air bags for the Toyota are proprietary and not known. The NHTSA has given this vehicle model a four-star rollover rating on a five-star scale.[1] The rollover star rating is determined based on a static measurement and a dynamic test for rollover. The static measurement is a mathematical calculation considering the vehicle's weight, track width, and height of the center of gravity and is referred to as the static stability factor. The dynamic test is conducted with a weighted vehicle that simulates a load of five occupants and a full tank of fuel. The test vehicle enters a left steering avoidance maneuver of 270 degrees at 56 - 81 km/h (35 - 50 mph), and then a right steering over-correction of 540 degrees is initiated. If instruments detect two tires that lift at least 5 cm (2 in), then the vehicle is considered to have "tipped up," which is the precursor to a rollover. The "Dynamic Test Results" for the 2015 Toyota Highlander were reported as "No Tip," and the vehicle was reported to have a 16.9 percent risk of a rollover.

Rollover Discussion

The rollover of the Toyota was initiated following the left plane impact with the end terminal as the vehicle traveled down the negative 12 percent grade of an embankment and rotated clockwise. The left side wheels furrowed into the ground as evidenced by grass and dirt deposits in both wheels and furrow marks in the ground. The vehicle then rolled over, left side leading, an estimated 12 quarter turns across a distance of approximately 37 m (121 ft). The rollover initiation type was classified as "Trip Over."

The vehicle's rollover/side impact IC air bags were certified to comply with FMVSS No. 226 Ejection Mitigation. They provided coverage of the side window glazing in the front and second rows and the deflated IC extended 20 cm (7.9 in) below the beltline. The left front glazing was closed at the time of the crash and disintegrated during the rollover. The driver was restrained by the three-point lap and shoulder seat belt and remained in the vehicle throughout the crash.

2015 TOYOTA HIGHLANDER OCCUPANT

Driver Demographics

Age/sex:	67 years/female
Height:	155 cm (61 in)
Weight:	81 kg (178 lbs)
Eyewear:	Unknown
Seat type:	Bucket
Seat track position:	Between forward-most and middle
Manual restraint usage:	Lap and shoulder seat belt
Usage source:	Vehicle inspection
	Frontal, seat-mounted side impact, not deployed; both IC air bags, deployed
Alcohol/drug data:	None
Egress from vehicle:	Exited without assistance through right front door
Transport from scene:	Ambulance to hospital
Medical treatment:	Treated in emergency room and released

[1] www.safercar.gov

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1 2	Abrasion and contusion (bump) overlying left parietal region, without any underlying fracture	110202.1 110402.1	Roof, left front side rail	Certain
3	Abrasion right forearm, not further specified	710202.1	Left instrument panel	Probable
4	Abrasion right thumb with tenderness	710202.1	Left instrument panel	Probable
5 6	Abrasion right thumb with tenderness, contusion (ecchymosis) over right thenar eminence,[2] and a right thumb sprain	710402.1 772510.1	Interior, center console first row	Probable
7	Abrasion left hand, not further specified	710202.1	Left instrument panel	Probable

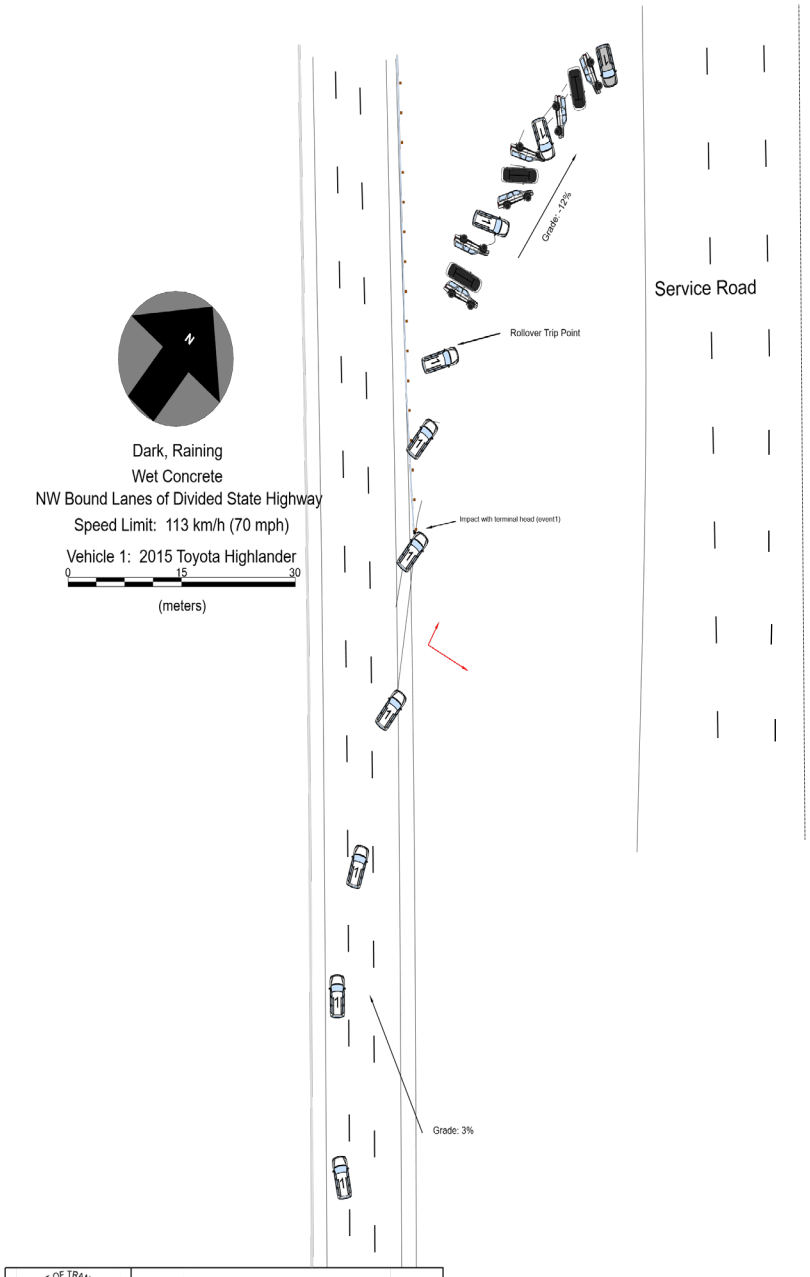
Source: Emergency room records.

Driver Kinematics

The driver was restrained by the lap and shoulder seat belt. The seat track was adjusted between the forward-most and middle positions and the seat back was slightly reclined. The top of the head restraint was located 23 cm (9.1 in) above the top of the seat back. The driver was displaced to the left and forward as a result of the left plane impact with the end terminal. She probably contacted her right forearm and both hands on the left instrument panel resulting in an abrasion to the left and right thumb. The driver was then redirected in multiple directions during the left side leading rollover. She contacted her head on the left roof side rail as evidenced by hair transfer on the side rail resulting in an abrasion and contusion to the left parietal region. She probably contacted her right hand on the center console resulting in an abrasion, contusion, and sprain to the right thumb. The driver exited the vehicle without assistance through the right front door according to her medical records. She sustained police reported "B" (non-incapacitating) injuries and was transported by ambulance to a hospital where she was treated in the emergency room for minor injuries and released.

[2] "Thenar eminence" refers to the group of muscles on the palm of the human hand at the base of the thumb. The skin overlying this region is the area stimulated when trying to elicit a palmomental reflex. The word "thenar" comes from Greek (thenar), meaning "palm of the hand." The information source is retrievable from https://en.wikipedia.org/wiki/Thenar _eminence#cite_note-1.

CRASH DIAGRAM



DEPARTMENT OF TRANSPORTATION UNITED STATES OF AMERICA	NHTSA
Case Number:	IN18006

APPENDIX A : 2015 Toyota Highlander Event Data Recorder (EDR) Report[3]

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

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

CDR File Information

User Entered VIN/Frame Number	5TDKKRFH5FS******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN18006_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 17.7
Imaged with Software Licensed to (Company Name)	NHTSA
Reported with CDR version	Crash Data Retrieval Tool 19.1.1
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Front/Rear (1), 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
- 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:
1)
- 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_r026

System Status at Time of Retrieval

ECU Part Number	89170-0E111
EDR Generation	13EDR
Complete File Recorded	Yes
Freeze Signal	ON
Freeze Signal Factor	Rollover CSA Deployment
Diagnostic Trouble Codes Exist	No
Ignition Cycle ,Download (times)	3731
Multi-event, number of events (times)	2 or greater
Time from event 1 to 2 (s)	0.121
Time from Previous Pre Crash TRG (msec)	16381 or greater
Latest Pre-Crash Page	0
Contains Unlinked Pre-Crash Data	No

Event Record Summary at Retrieval

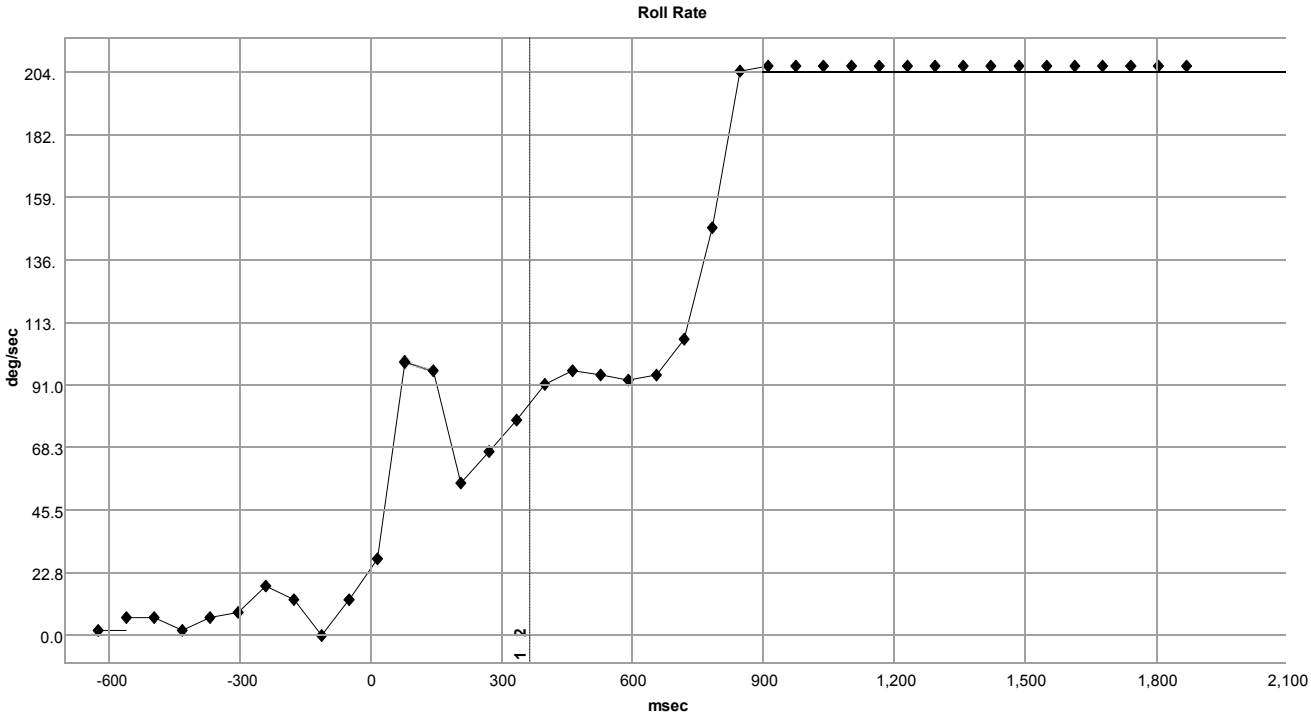
Events Recorded	TRG Count	Crash Type	Time (msec)	Pre-Crash & DTC Data Recording Status	Event & Crash Pulse Data Recording Status
Most Recent Event	4	Rollover	0	Complete (Page 0)	Complete (Rollover Page 0)
1st Prior Event	3	Front/Rear Crash	-121	Complete (Page 0)	Complete (Front/Rear Page 0)
2nd Prior Event	2	Side Crash	-18	Complete (Page 0)	Complete (Side Page 1)
3rd Prior Event	1	Side Crash	-119	Complete (Page 0)	Complete (Side Page 0)

System Status at Event (Most Recent Event, TRG 4)

Recording Status, Rollover Crash Info.	Complete
Crash Type	Rollover
TRG Count (times)	4
Previous Crash Type	Front/Rear Crash
Time from Pre-Crash TRG (msec)	119
Linked Pre-Crash Page	0
Side Curtain Airbag Deployment, Time to Deploy (msec)	366
Pretensioner Deployment, Time to Fire, Driver (msec)	366
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	366

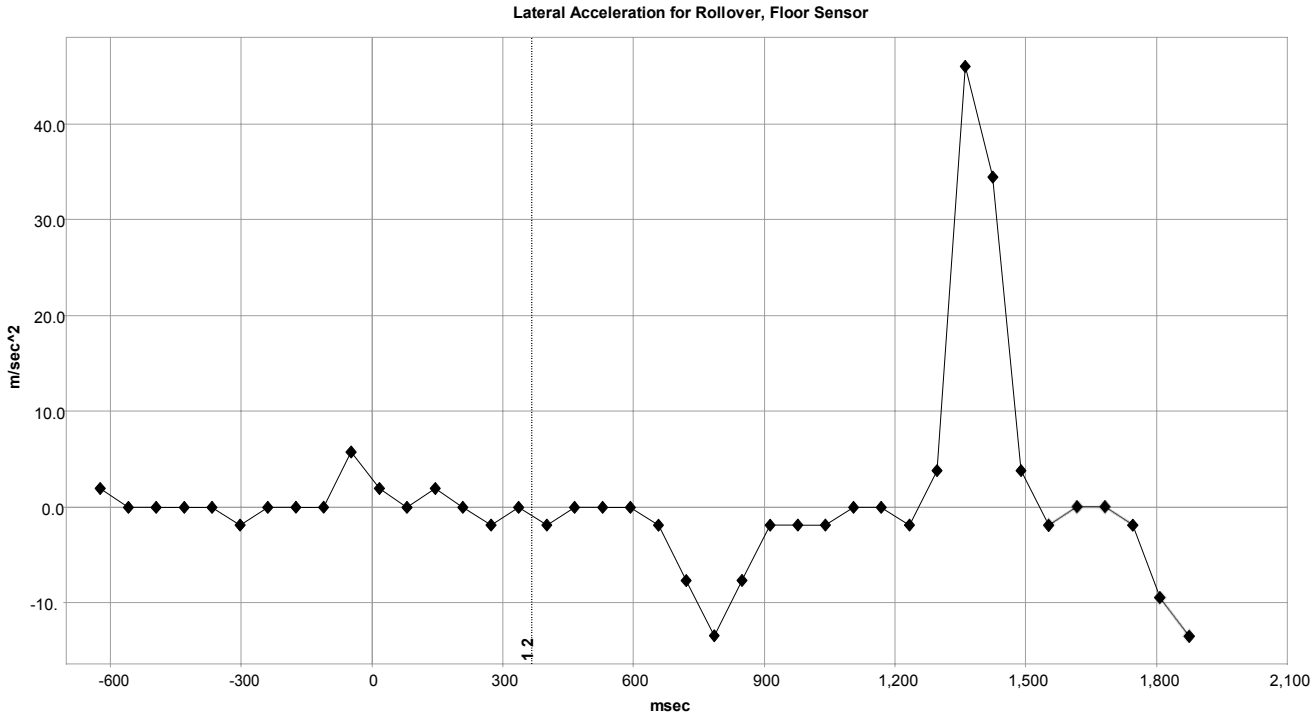
Rollover Crash Pulse (Most Recent Event, TRG 4 - table 1 of 2)

Recording Status, Time Series Data	Complete
Time from TRG to Next Sample (msec)	17
Roll Angle Peak (degrees)	454.6
Roll Angle at the Time of TRG (degrees)	4.8



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 (Most Recent Event, TRG 4 - table 2 of 2)

Time (msec)	Roll Rate (deg/sec)	Lateral Acceleration for Rollover, Floor Sensor (m/sec^2)
-623	1.6	1.9
-559	6.5	0.0
-495	6.5	0.0
-431	1.6	0.0
-367	6.5	0.0
-303	8.1	-1.9
-239	17.9	0.0
-175	13.0	0.0
-111	0.0	0.0
-47	13.0	5.7
17	27.7	1.9
81	99.4	0.0
145	96.1	1.9
209	55.4	0.0
273	66.8	-1.9
337	78.2	0.0
401	91.2	-1.9
465	96.1	0.0
529	94.5	0.0
593	92.8	0.0
657	94.5	-1.9
721	107.5	-7.7
785	148.2	-13.4
849	205.2	-7.7
913	206.9	-1.9
977	206.9	-1.9
1041	206.9	-1.9
1105	206.9	0.0
1169	206.9	0.0
1233	206.9	-1.9
1297	206.9	3.8
1361	206.9	46.0
1425	206.9	34.5
1489	206.9	3.8
1553	206.9	-1.9
1617	206.9	0.0
1681	206.9	0.0
1745	206.9	-1.9
1809	206.9	-9.6
1873	206.9	-13.4

DTCs Present at Time of Event (Most Recent Event, TRG 4)

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 4)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	250
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	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	3729

Pre-Crash Data, -5 to 0 seconds (Most Recent Event, TRG 4)

Time (sec)	-4.75	-4.25	-3.75	-3.25	-2.75	-2.25	-1.75	-1.25	-0.75	-0.25	0 (TRG)
Vehicle Speed (MPH [km/h])	75.2 [121]	75.8 [122]	73.9 [119]	72.1 [116]	67.7 [109]	50.3 [81]	31.1 [50]	28.6 [46]	39.1 [63]	36.7 [59]	19.9 [32]
Accelerator Pedal, % Full (%)	38.0	39.0	11.0	0.5	0.0	26.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	20.0	21.0	4.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	2,200	2,200	2,200	2,100	2,000	1,500	1,000	1,000	1,300	1,200	800
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	ON	ON	ON	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.38	12.14	12.14	11.86
Longitudinal Acceleration , VSC Sensor (m/sec^2)	0.287	0.000	-0.359	-1.005	-0.861	-1.148	-1.005	-0.933	-0.718	-5.168	-8.614
Yaw Rate (deg/sec)	0.00	1.46	0.98	-6.83	-20.98	-50.26	-27.33	-4.88	7.81	40.50	61.00
Steering Input (degrees)	0.0	0.0	-19.5	-25.5	25.5	148.5	321.0	375.0	375.0	375.0	375.0
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	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

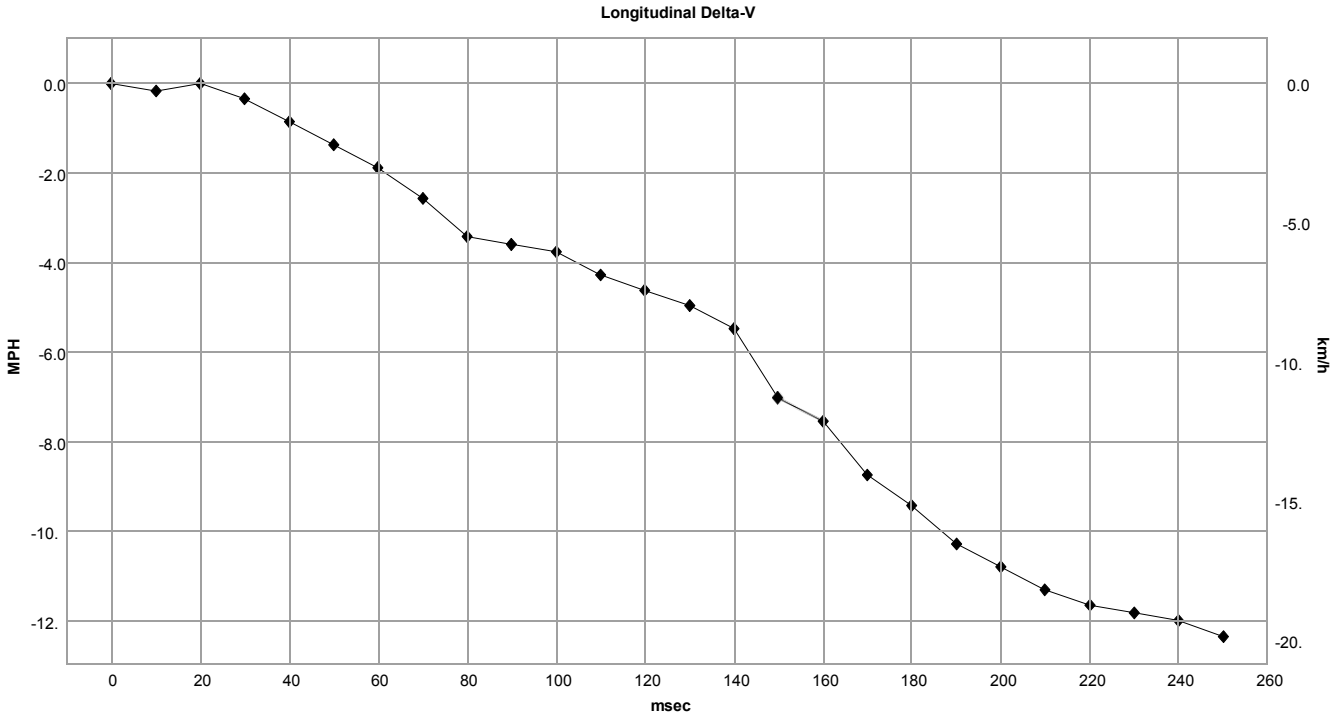
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (1st Prior Event, TRG 3)

Recording Status, Front/Rear Crash Info.	Complete
Crash Type	Front/Rear Crash
TRG Count (times)	3
Previous Crash Type	Side Crash
Time from Pre-Crash TRG (msec)	107
Linked Pre-Crash Page	0
Frontal Airbag Deployment, Time to 1st Stage Deployment, Driver (msec)	No
Frontal Airbag Deployment, Time to 1st Stage Deployment, Front Passenger (msec)	No
Pretensioner Deployment, Time to Fire, Driver (msec)	No
Pretensioner Deployment, Time to Fire, Front Passenger (msec)	No
Frontal Airbag Deployment, Time to 2nd Stage, Driver (msec)	N/A
Frontal Airbag Deployment, Time to 2nd Stage, Front Passenger (msec)	N/A
Active Head Restraint, Time to Deploy, Driver (msec)	SNA
Active Head Restraint, Time to Deploy, Front Passenger (msec)	SNA
Side Curtain Airbag Deployment, Time to Deploy, Driver (msec)	No
Side Curtain Airbag Deployment, Time to Deploy, Passenger (msec)	No
Side Airbag Deployment, Time to Deploy, Driver (msec)	No
Side Airbag Deployment, Time to Deploy, Passenger (msec)	No
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

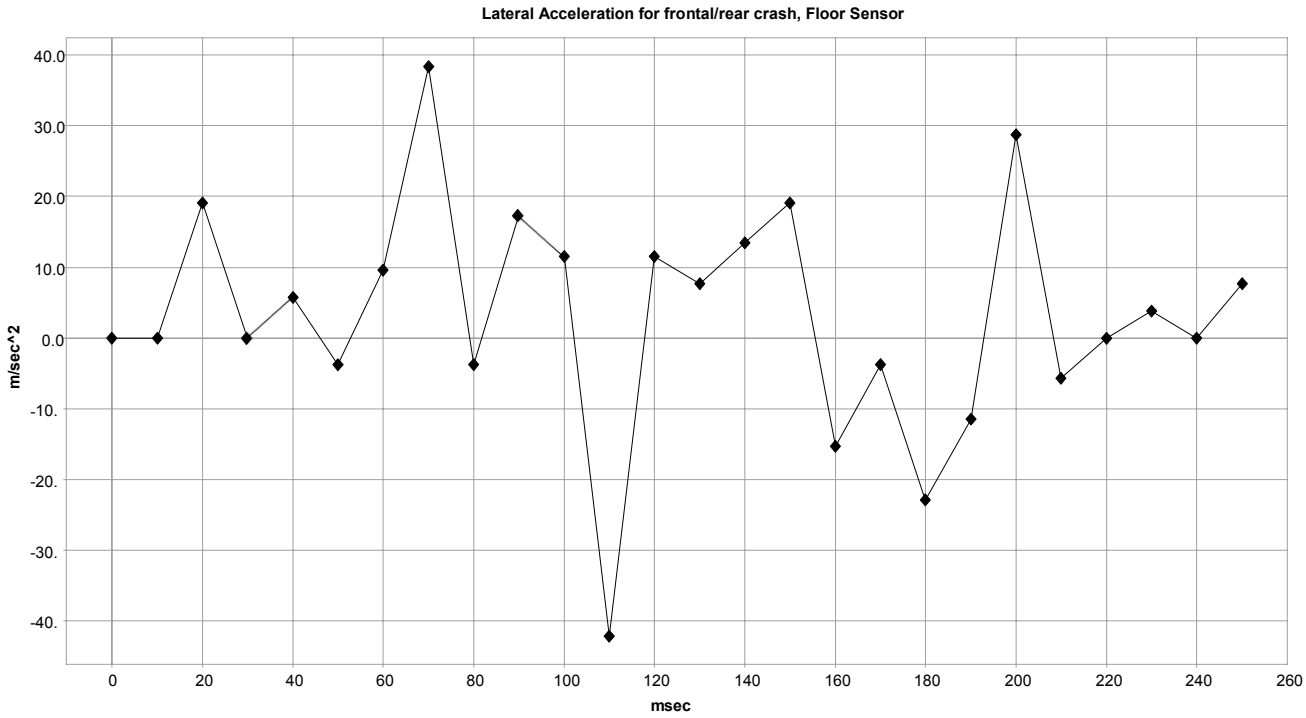
Longitudinal/Lateral Crash Pulse (1st Prior Event, TRG 3 - table 1 of 2)

Recording Status, Time Series Data	Complete
Time from Time Zero to TRG (msec)	109.0
Length of Delta-V (msec)	250
Max. Longitudinal Delta-V (MPH [km/h])	-12.5 [-20.1]
Time, Maximum Delta-V, Longitudinal (msec)	254.5
Power Supply Status at Max. Delta-V	ON
Clipping Time of Longitudinal Delta-V (msec)	No
Clipping Time of Lateral Acceleration, Floor Sensor (msec)	No



Deployment Time Marker Key

1	Driver Airbag Deployment Time
2	Passenger Airbag Deployment Time
3	Driver/Passenger Pretensioner
4	Driver 2nd Stage Airbag Deployment Time
5	Passenger 2nd Stage Airbag Deployment
6	Driver/Passenger AHR
7	Driver CSA
8	Passenger CSA
9	Rear Window Airbag Deployment Time
10	Driver SAB
11	Passenger SAB



Deployment Time Marker Key

1	Driver Airbag Deployment Time
2	Passenger Airbag Deployment Time
3	Driver/Passenger Pretensioner
4	Driver 2nd Stage Airbag Deployment Time
5	Passenger 2nd Stage Airbag Deployment
6	Driver/Passenger AHR
7	Driver CSA
8	Passenger CSA
9	Rear Window Airbag Deployment Time
10	Driver SAB
11	Passenger SAB

Longitudinal/Lateral Crash Pulse (1st Prior Event, TRG 3 - table 2 of 2)

Time (msec)	Longitudinal Delta-V (MPH [km/h])	Lateral Acceleration for Frontal/Rear Crash, Floor Sensor (m/sec^2)	Power Supply Status
0	0.0 [0.0]	0.0	ON
10	-0.2 [-0.3]	0.0	ON
20	0.0 [0.0]	19.2	ON
30	-0.3 [-0.6]	0.0	ON
40	-0.9 [-1.4]	5.7	ON
50	-1.4 [-2.2]	-3.8	ON
60	-1.9 [-3.0]	9.6	ON
70	-2.6 [-4.1]	38.3	ON
80	-3.4 [-5.5]	-3.8	ON
90	-3.6 [-5.8]	17.2	ON
100	-3.8 [-6.1]	11.5	ON
110	-4.3 [-6.9]	-42.1	ON
120	-4.6 [-7.4]	11.5	ON
130	-5.0 [-8.0]	7.7	ON
140	-5.5 [-8.8]	13.4	ON
150	-7.0 [-11.3]	19.2	ON
160	-7.5 [-12.1]	-15.3	ON
170	-8.7 [-14.1]	-3.8	ON
180	-9.4 [-15.2]	-23.0	ON
190	-10.3 [-16.5]	-11.5	ON
200	-10.8 [-17.4]	28.7	ON
210	-11.3 [-18.2]	-5.7	ON
220	-11.7 [-18.8]	0.0	ON
230	-11.8 [-19.0]	3.8	ON
240	-12.0 [-19.3]	0.0	ON
250	-12.3 [-19.9]	7.7	ON

DTCs Present at Time of Event (1st Prior 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 (1st Prior Event, TRG 3)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	250
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	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	3729

Pre-Crash Data, -5 to 0 seconds (1st Prior Event, TRG 3)

Time (sec)	-4.75	-4.25	-3.75	-3.25	-2.75	-2.25	-1.75	-1.25	-0.75	-0.25	0 (TRG)
Vehicle Speed (MPH [km/h])	75.2 [121]	75.8 [122]	73.9 [119]	72.1 [116]	67.7 [109]	50.3 [81]	31.1 [50]	28.6 [46]	39.1 [63]	36.7 [59]	19.9 [32]
Accelerator Pedal, % Full (%)	38.0	39.0	11.0	0.5	0.0	26.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	20.0	21.0	4.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	2,200	2,200	2,200	2,100	2,000	1,500	1,000	1,000	1,300	1,200	800
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	ON	ON	ON	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.38	12.14	12.14	11.86
Longitudinal Acceleration , VSC Sensor (m/sec^2)	0.287	0.000	-0.359	-1.005	-0.861	-1.148	-1.005	-0.933	-0.718	-5.168	-8.614
Yaw Rate (deg/sec)	0.00	1.46	0.98	-6.83	-20.98	-50.26	-27.33	-4.88	7.81	40.50	61.00
Steering Input (degrees)	0.0	0.0	-19.5	-25.5	25.5	148.5	321.0	375.0	375.0	375.0	375.0
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	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

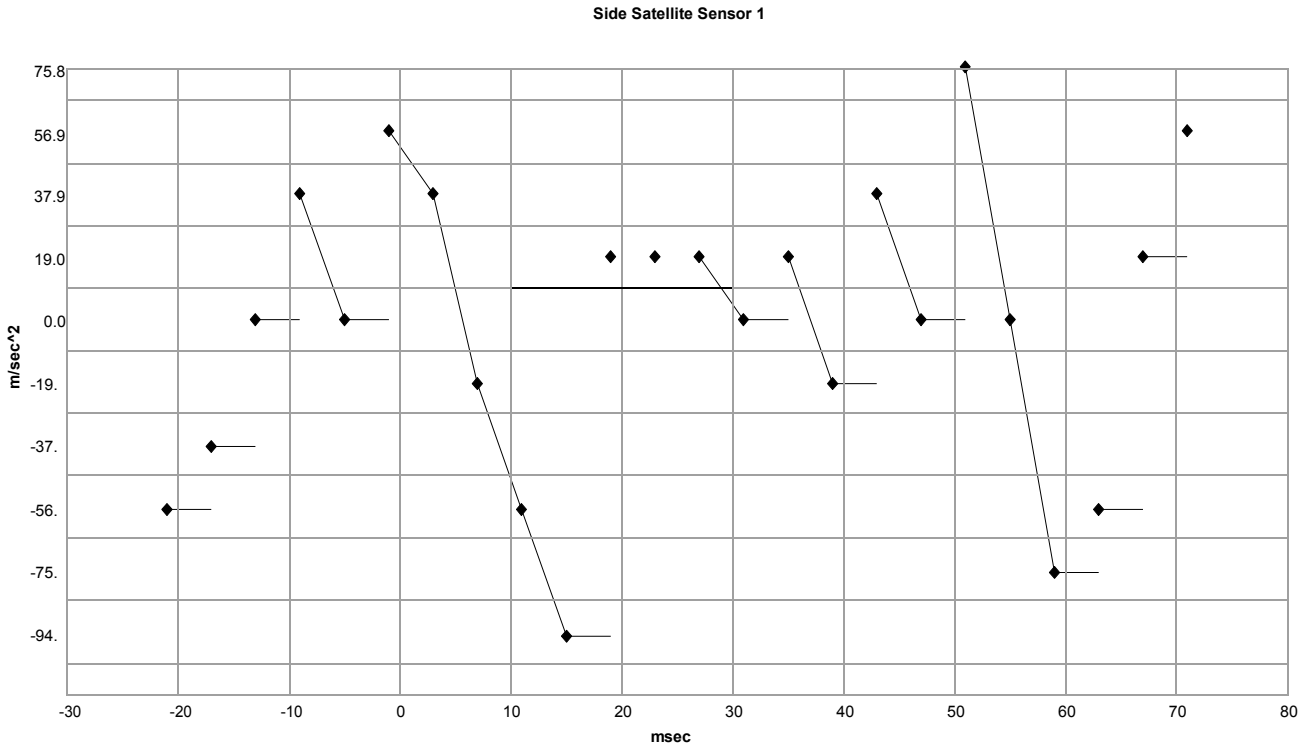
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

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

Recording Status, Side Crash Info.	Complete
Crash Type	Side Crash
TRG Count (times)	2
Previous Crash Type	Side Crash
Time from Pre-Crash TRG (msec)	101
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)	SNA
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

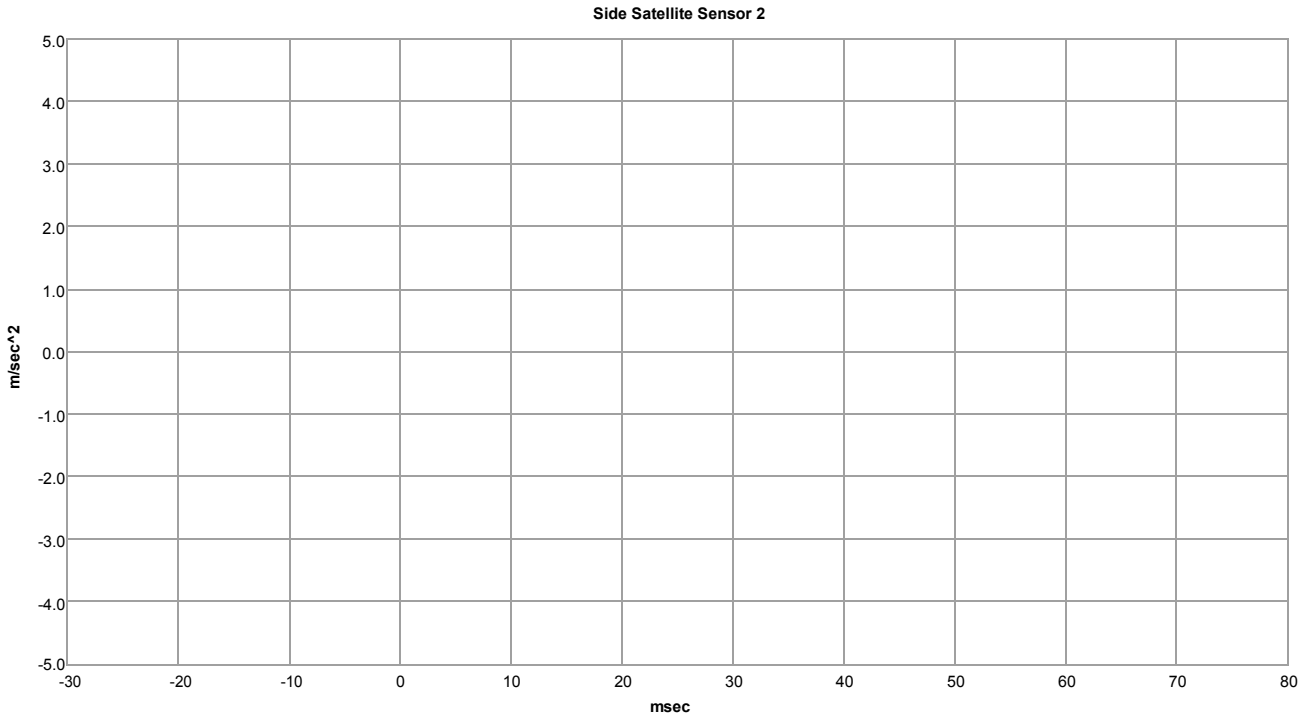
Lateral Crash Pulse (2nd Prior Event, TRG 2 - table 1 of2)

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



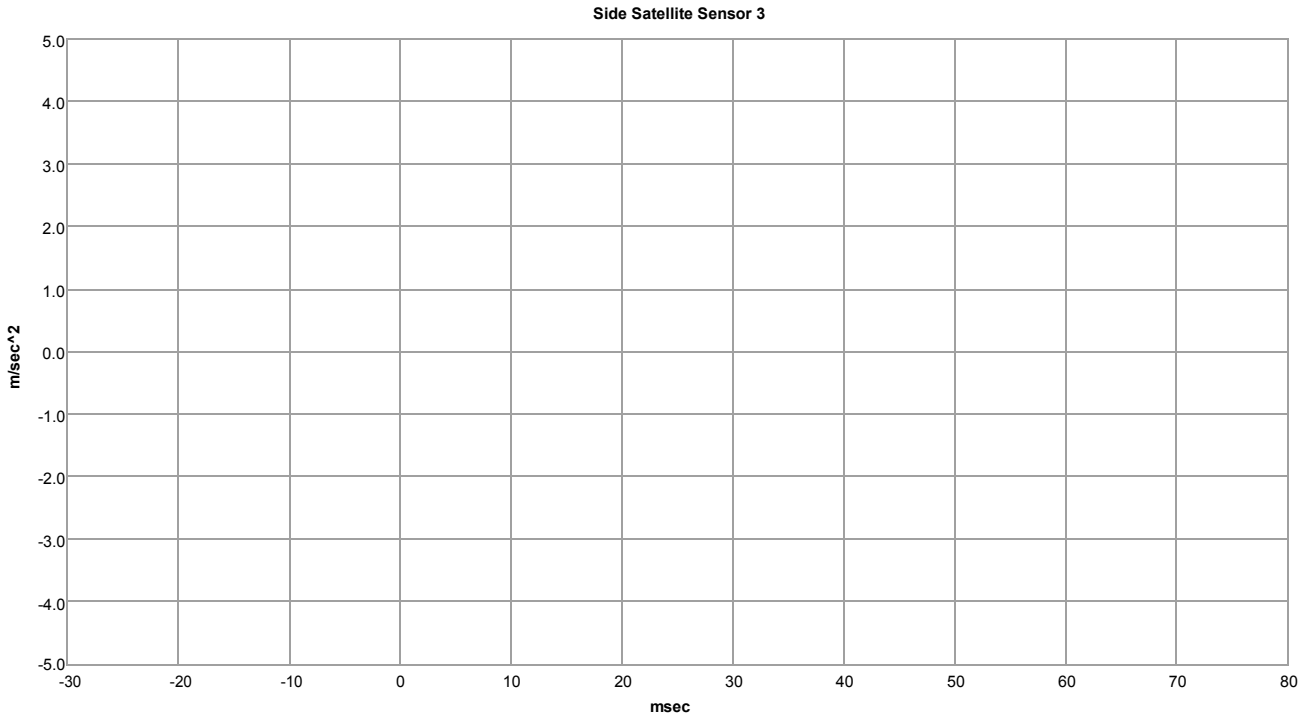
Deployment Time Marker Key

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



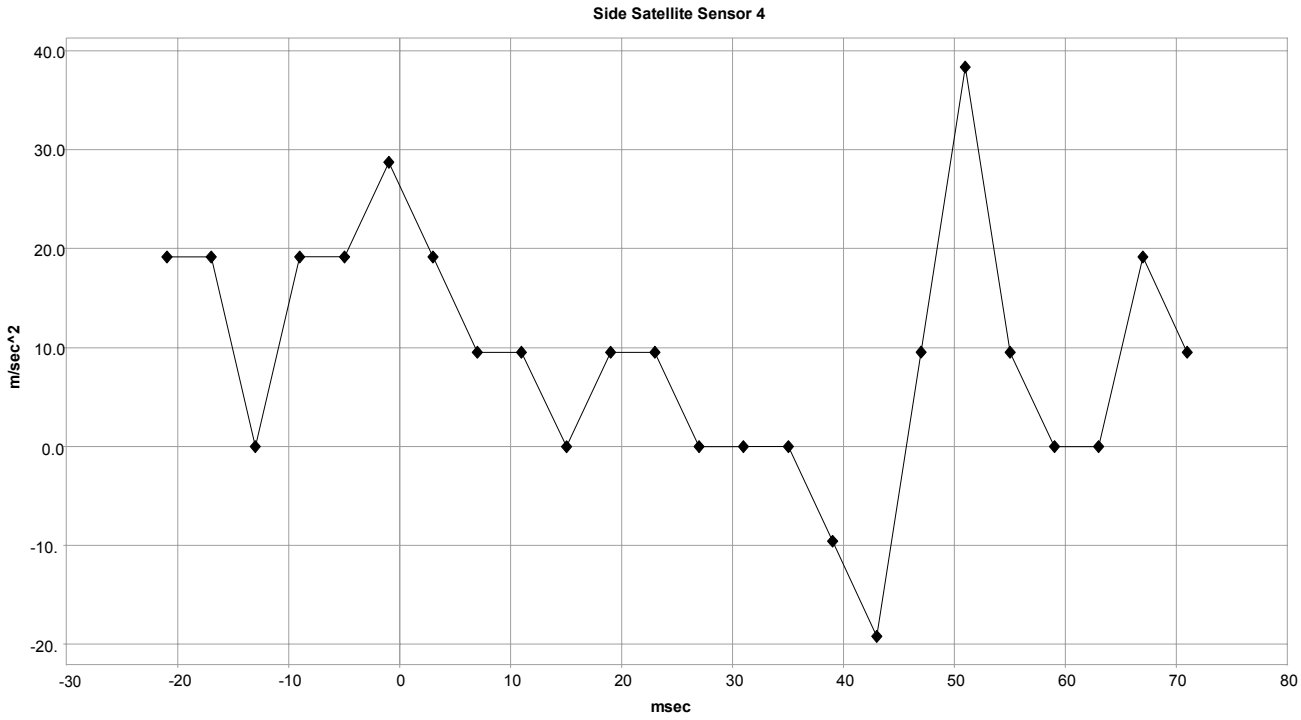
Deployment Time Marker Key

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



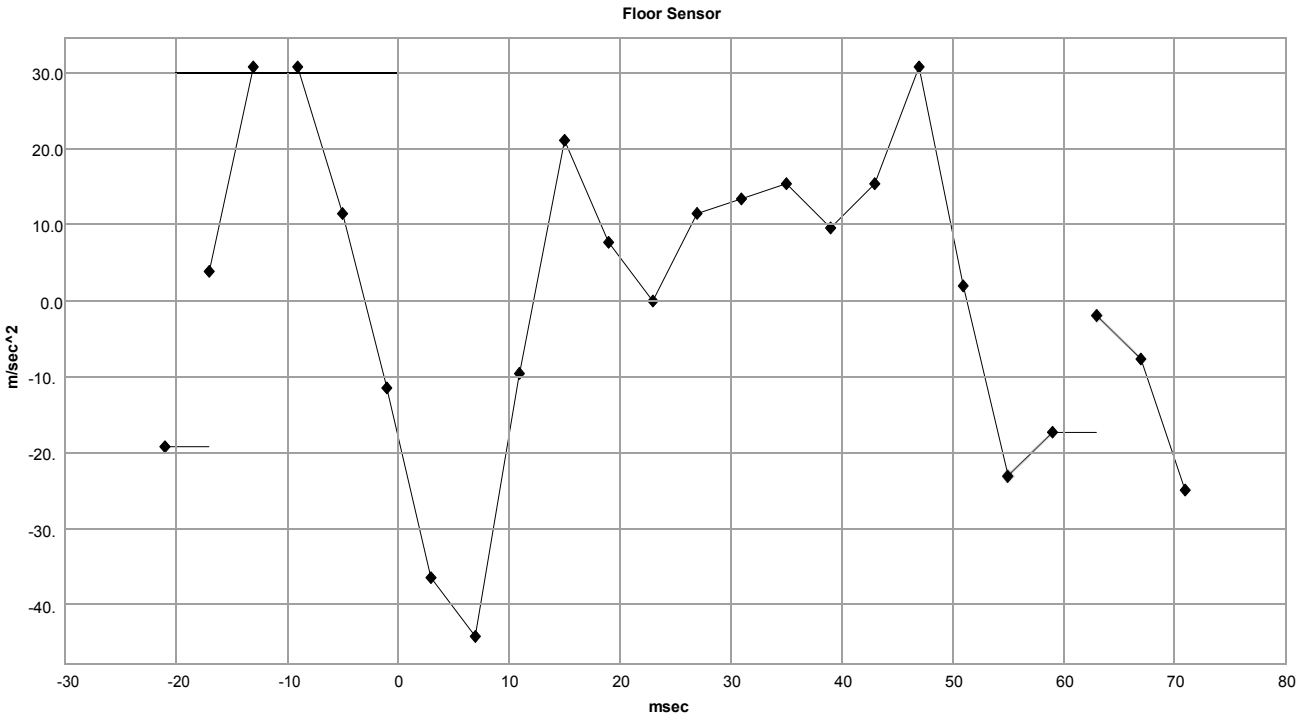
Deployment Time Marker Key

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 (2nd Prior Event, TRG 2 - table 2 of2)

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)
-21	-57.5	SNA	SNA	19.2	-19.2
-17	-38.3	SNA	SNA	19.2	3.8
-13	0.0	SNA	SNA	0.0	30.6
-9	38.3	SNA	SNA	19.2	30.6
-5	0.0	SNA	SNA	19.2	11.5
-1	57.5	SNA	SNA	28.7	-11.5
3	38.3	SNA	SNA	19.2	-36.4
7	-19.2	SNA	SNA	9.6	-44.1
11	-57.5	SNA	SNA	9.6	-9.6
15	-95.8	SNA	SNA	0.0	21.1
19	19.2	SNA	SNA	9.6	7.7
23	19.2	SNA	SNA	9.6	0.0
27	19.2	SNA	SNA	0.0	11.5
31	0.0	SNA	SNA	0.0	13.4
35	19.2	SNA	SNA	0.0	15.3
39	-19.2	SNA	SNA	-9.6	9.6
43	38.3	SNA	SNA	-19.2	15.3
47	0.0	SNA	SNA	9.6	30.6
51	76.6	SNA	SNA	38.3	1.9
55	0.0	SNA	SNA	9.6	-23.0
59	-76.6	SNA	SNA	0.0	-17.2
63	-57.5	SNA	SNA	0.0	-1.9
67	19.2	SNA	SNA	19.2	-7.7
71	57.5	SNA	SNA	9.6	-24.9

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

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	250
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	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	3729

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

Time (sec)	-4.75	-4.25	-3.75	-3.25	-2.75	-2.25	-1.75	-1.25	-0.75	-0.25	0 (TRG)
Vehicle Speed (MPH [km/h])	75.2 [121]	75.8 [122]	73.9 [119]	72.1 [116]	67.7 [109]	50.3 [81]	31.1 [50]	28.6 [46]	39.1 [63]	36.7 [59]	19.9 [32]
Accelerator Pedal, % Full (%)	38.0	39.0	11.0	0.5	0.0	26.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	20.0	21.0	4.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	2,200	2,200	2,200	2,100	2,000	1,500	1,000	1,000	1,300	1,200	800
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	ON	ON	ON	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.38	12.14	12.14	11.86
Longitudinal Acceleration , VSC Sensor (m/sec^2)	0.287	0.000	-0.359	-1.005	-0.861	-1.148	-1.005	-0.933	-0.718	-5.168	-8.614
Yaw Rate (deg/sec)	0.00	1.46	0.98	-6.83	-20.98	-50.26	-27.33	-4.88	7.81	40.50	61.00
Steering Input (degrees)	0.0	0.0	-19.5	-25.5	25.5	148.5	321.0	375.0	375.0	375.0	375.0
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	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

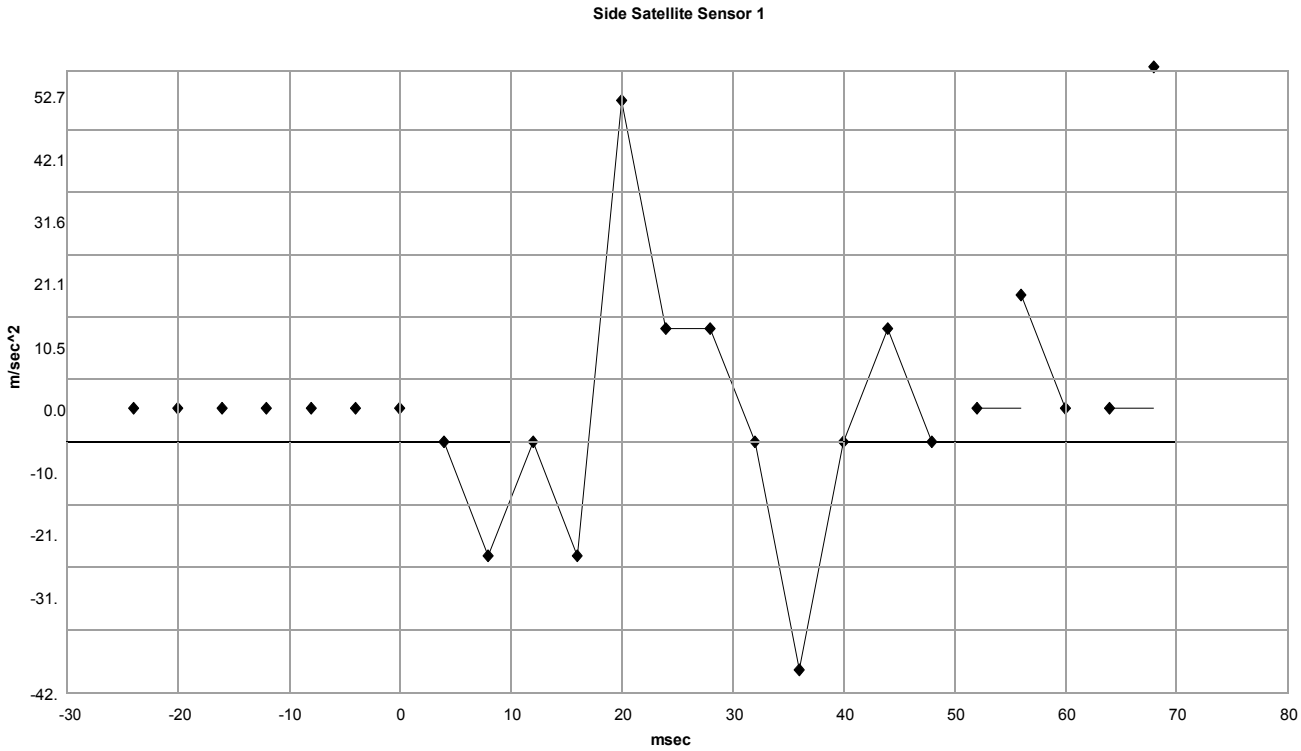
Fuel Injection Quantity (mm3/st)	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

System Status at Event (3rd 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)	SNA
Rear Window Airbag Deployment, Time to Deploy (msec)	SNA

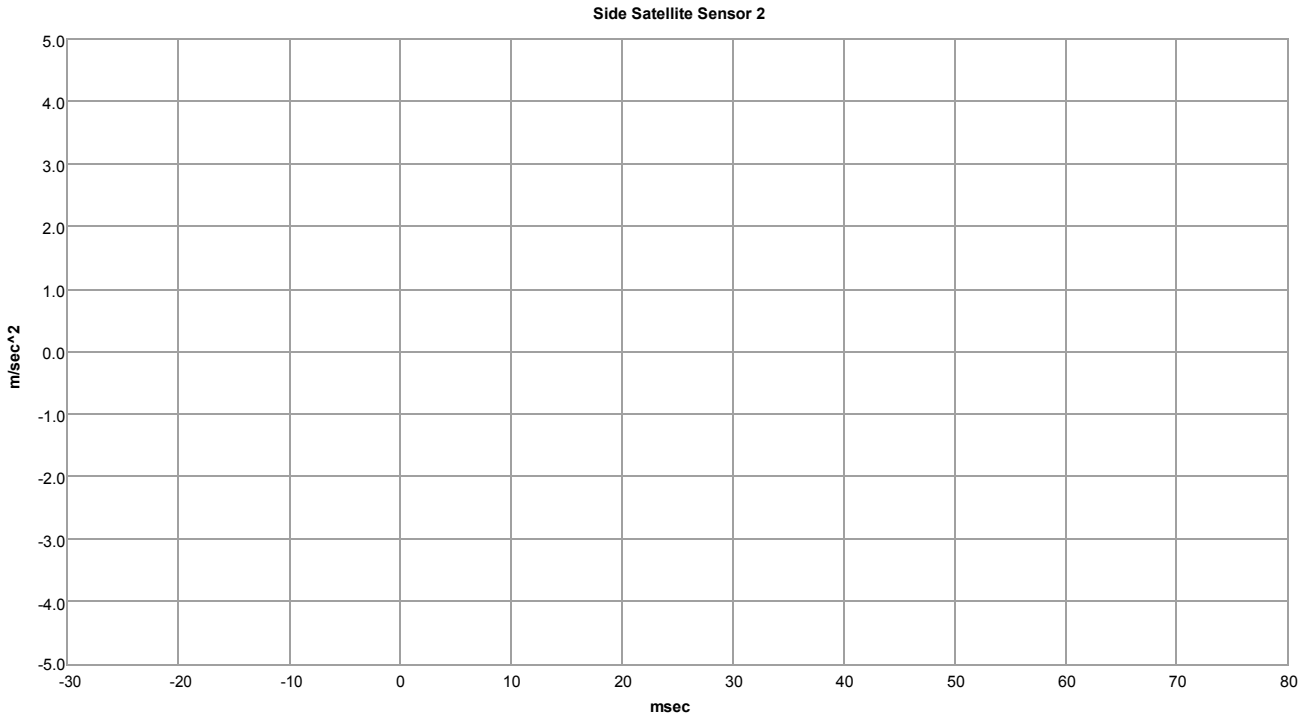
Lateral Crash Pulse (3rd Prior Event, TRG 1 - table 1 of2)

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



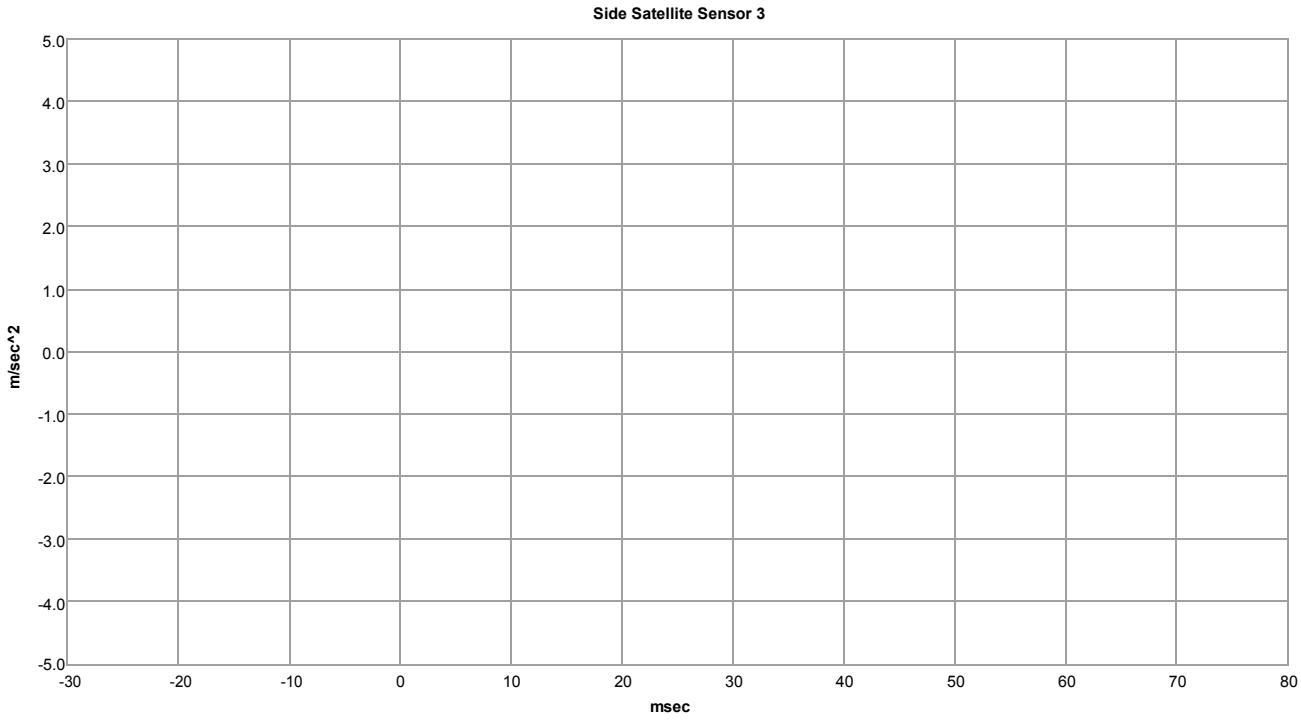
Deployment Time Marker Key

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



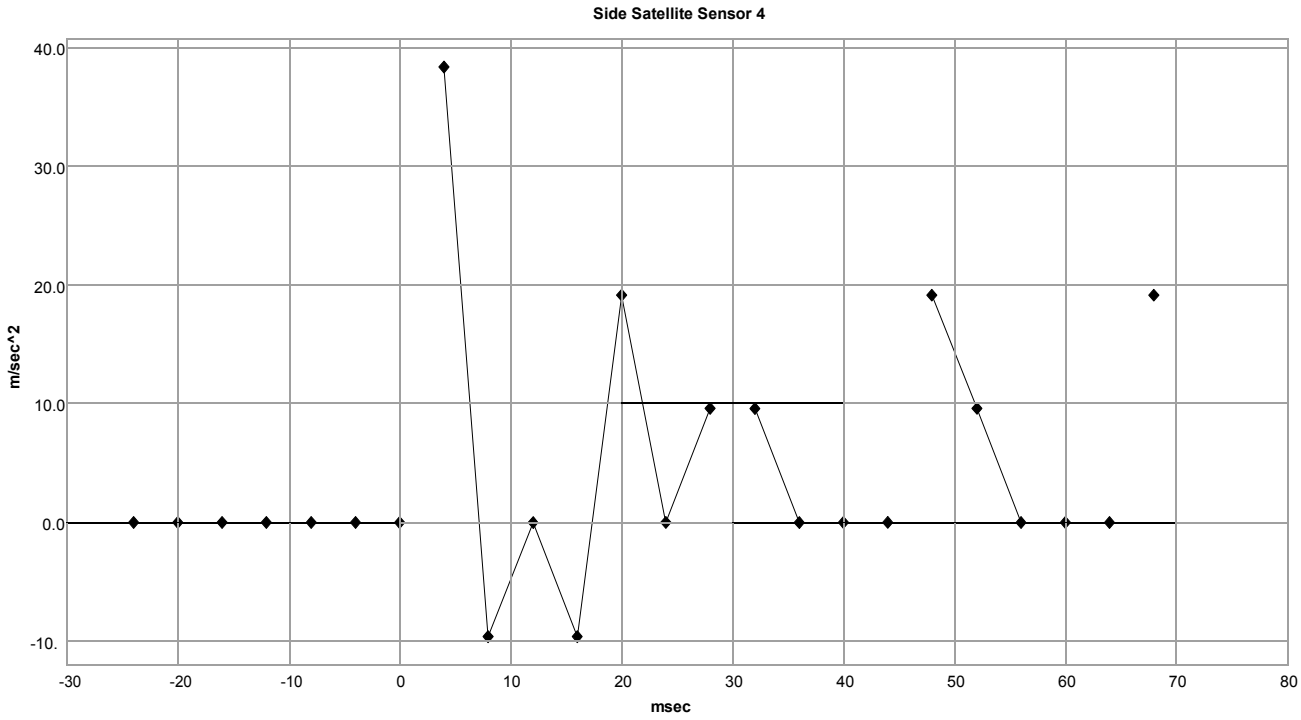
Deployment Time Marker Key

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



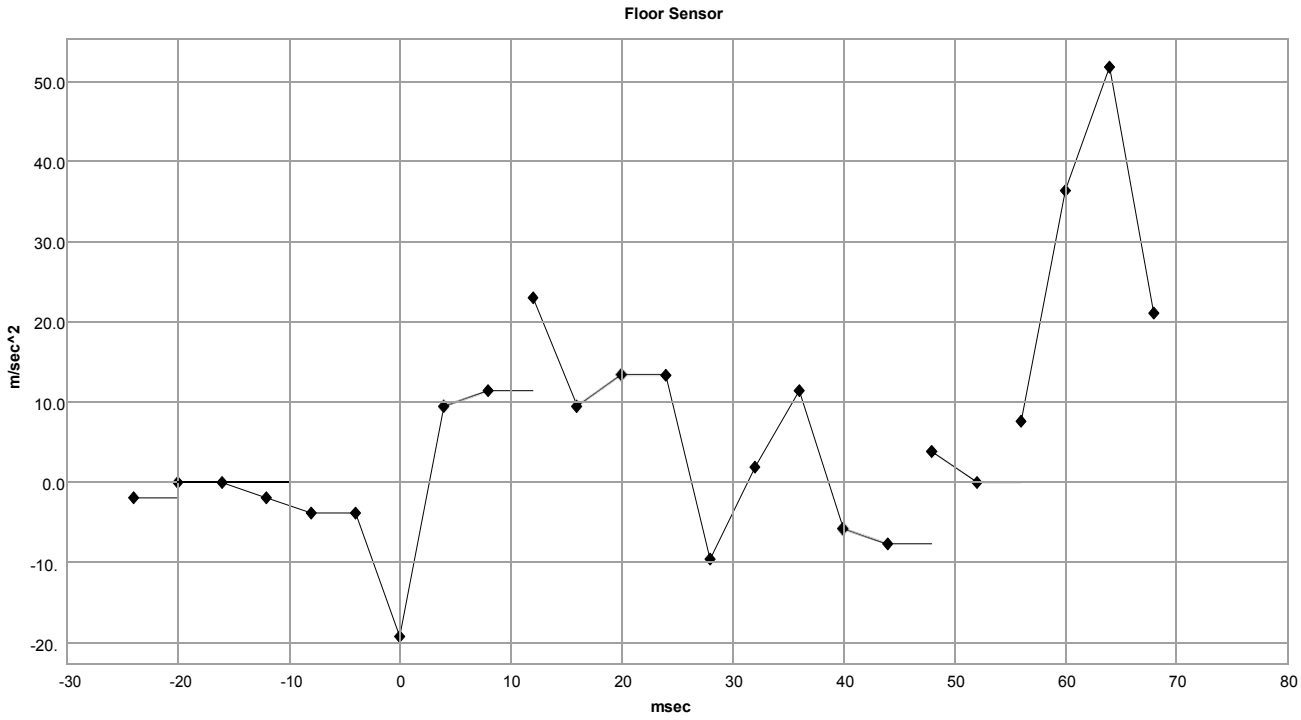
Deployment Time Marker Key

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 (3rd Prior Event, TRG 1 - table 2 of2)

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	SNA	SNA	0.0	-1.9
-20	0.0	SNA	SNA	0.0	0.0
-16	0.0	SNA	SNA	0.0	0.0
-12	0.0	SNA	SNA	0.0	-1.9
-8	0.0	SNA	SNA	0.0	-3.8
-4	0.0	SNA	SNA	0.0	-3.8
0	0.0	SNA	SNA	0.0	-19.2
4	0.0	SNA	SNA	38.3	9.6
8	-19.2	SNA	SNA	-9.6	11.5
12	0.0	SNA	SNA	0.0	23.0
16	-19.2	SNA	SNA	-9.6	9.6
20	57.5	SNA	SNA	19.2	13.4
24	19.2	SNA	SNA	0.0	13.4
28	19.2	SNA	SNA	9.6	-9.6
32	0.0	SNA	SNA	9.6	1.9
36	-38.3	SNA	SNA	0.0	11.5
40	0.0	SNA	SNA	0.0	-5.7
44	19.2	SNA	SNA	0.0	-7.7
48	0.0	SNA	SNA	19.2	3.8
52	0.0	SNA	SNA	9.6	0.0
56	19.2	SNA	SNA	0.0	7.7
60	0.0	SNA	SNA	0.0	36.4
64	0.0	SNA	SNA	0.0	51.7
68	57.5	SNA	SNA	19.2	21.1

DTCs Present at Time of Event (3rd 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 (3rd Prior Event, TRG 1)

Recording Status, Pre-Crash/Occupant	Complete
Time from Pre-Crash to TRG (msec)	250
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	No
Airbag Warning Lamp, On/Off	OFF
Ignition Cycle ,Crash (times)	3729

Pre-Crash Data, -5 to 0 seconds (3rd Prior Event, TRG 1)

Time (sec)	-4.75	-4.25	-3.75	-3.25	-2.75	-2.25	-1.75	-1.25	-0.75	-0.25	0 (TRG)
Vehicle Speed (MPH [km/h])	75.2 [121]	75.8 [122]	73.9 [119]	72.1 [116]	67.7 [109]	50.3 [81]	31.1 [50]	28.6 [46]	39.1 [63]	36.7 [59]	19.9 [32]
Accelerator Pedal, % Full (%)	38.0	39.0	11.0	0.5	0.0	26.0	0.0	0.0	0.0	0.0	0.0
Percentage of Engine Throttle (%)	20.0	21.0	4.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0
Engine RPM (RPM)	2,200	2,200	2,200	2,100	2,000	1,500	1,000	1,000	1,300	1,200	800
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	ON	ON	ON	ON
Brake Oil Pressure (Mpa)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.38	12.14	12.14	11.86
Longitudinal Acceleration , VSC Sensor (m/sec^2)	0.287	0.000	-0.359	-1.005	-0.861	-1.148	-1.005	-0.933	-0.718	-5.168	-8.614
Yaw Rate (deg/sec)	0.00	1.46	0.98	-6.83	-20.98	-50.26	-27.33	-4.88	7.81	40.50	61.00
Steering Input (degrees)	0.0	0.0	-19.5	-25.5	25.5	148.5	321.0	375.0	375.0	375.0	375.0
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	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid	Invalid

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 45 31 31 31 30 30 30 39 33 30 30 30 39 33 30 30 30 39 44 30 30 30 39 44 30 30 30 39 46 30 30 30 39 46
	04	02 03 01 01
	05	01
	06	16
	0A	03
	0B	00
	20	80 00 00 01
	21	02 A0
	40	00 00 00 01
	60	FF FF F0 01
	61	02 05 E8 00 C0 E0 05 00 02 80 02 80 00 00 00 00 00 00 00 00 05 00 05 00 19 00 29 B1 85 5F 88 00
	62	A5 20 3F FD 0E 93 00 00 00 00
	63	55 10 0E 91 11 10 00 00 11 11 11 11 11 10 79 7A 77 74 6D 51 32 2E 3F 3B 20 4C 4E 16 01 00 34 00 00 00 00 00 00 01 54 16 16 16 15 14 0F 0A 0A 0D 0C 08 00 00 00 00 00 00 00 01
	64	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 00 00 00
	65	55 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	66	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
	67	55 10 6B 00 03 FE FE FE FE FE 55 FD FD FF FE FF FE FF FE FF FE 03 FE
	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 DA 1A 00 00 00 01 00 00 00 02 00 05 00 08 00 0B 00 0F 00 14 00 15 00 16 00 19 00 1B 00 1D 00 20 00 29 00 2C 00 33 00 37 00 3C 00 3F 00 42 00 44 00 45 00 46 00 48 00 49 01 FD
	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 00
	6B	55 E0 00 00 01 FE FE FE FE 55 00 00 00 00 00 00 00 00 00 FF 00 FF 03 01 01 00 FE 00 01 00 00 01 00 00 03 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
	6C	55 10 65 00 02 FE FE FE FE 55 03 FD FE 00 02 00 03 02 FF FD FB 01 01 01 00 01 FF 02 00 04 00 FC FD 01 03 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
	6D	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 04 FF 00 FF 02 00 01 01 00 00 00 02 01 00 00 00 02 00 FE 01 FE 01 FE 01 FE 01 FE
	6E	00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 02 02 00 02 02 03 02 01 01 00 01 01 00 00 00 FF FE 01 04 01 00 00 02 01 00 FE 01 FE 01 FE 01 FE 01 FE
	6F	55 01 6E 00 77 00 04 55 D1 01 04 04 01 04 05 0B 08 00 08 11 3D 3B 22 29 30 38 3B 3A 39 3A 42 5B 7E 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 00 5D 22 17
	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	FF 00 00 00 00 01 00 00 00 FD FF 00 FF 00 01 00 01 00 00 00 01 04 07 04 01 01 01 00 00 01 FE E8 EE FE 01 00 00 01 05 07
	72	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
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May 2020

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

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