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Special Crash Investigations: On-Site Rollover Crash Investigation; Vehicle: 2017 Nissan Altima; Location: California; Crash Date: August 2022

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Special Crash Investigations
On-Site Rollover Crash Investigation
Case No. DS22019
Vehicle: 2017 Nissan Altima
Location: California
Crash Date: August 2022

Background

This report documents the on-site investigation of a fatal single-vehicle rollover crash selected by the Special Crash Investigations (SCI) group of the National Highway Traffic Safety Administration. The SCI team forwarded to SCI headquarters a preliminary police crash report (PCR), on-scene photo, and online news release in September 2022. The case was assigned the following day. The vehicle was a 2017 Nissan Altima (Figure 1) with combination side-impact/roll-sensing inflatable curtain (IC) air bags that deployed during the crash. The vehicle inspection was delayed while the vehicle was on a police evidence hold. The Nissan had an air bag control unit (ACU) with event data recorder (EDR) capability supported by the Bosch CDR tool. The SCI team imaged the crash data during the vehicle inspection, completed in June 2023. SCI obtained the complete PCR in May 2023 and obtained on-scene police photos in July 2023.

The crash occurred at 8:50 p.m. in August 2022 in California on an east/west undivided two-lane county road with a posted speed limit of 80 km/h (50 mph) and an advisory speed of 72 km/h (45 mph) at the crash site. The eastbound lane was initially straight and level before changing to an S-curve that began with a left curve and changed to a right curve. The Nissan was traveling eastbound on the straight section of roadway at an EDR-reported speed of 172 km/h (107 mph), more than twice the posted speed limit. When it entered the left curve, the vehicle departed the roadway on the right edge, struck two traffic warning signs, tripped, and overturned seven quarter turns before coming to rest on its right plane. The Nissan's 29-year-old male driver was ejected during the rollover and came to rest partially underneath the vehicle. He sustained fatal injuries and was pronounced deceased on-scene. Emergency responders found the driver's pretensioned seat belt in the extended and buckled position; the seat belt and latch plate revealed evidence of occupant loading. The EDR reported the driver's belt as "On (fastened)." The evidence suggests the driver was belted but the manner of usage was unknown. The Nissan's restraint systems are discussed in this report. Per the PCR, the coroner's report showed the driver's blood alcohol concentration (BAC) was .295 g/dL, more than three and a half times the legal limit of .08 g/dL BAC at the time of the crash. The vehicle was towed due to disabling damage.

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Figure 1. 2017 Nissan Altima

Summary

Crash Site

The crash occurred on an east/west, undivided, two-lane county road with a posted speed limit of 80 km/h (50 mph) and an advisory speed of 72 km/h (45 mph) at the crash site. The eastbound lane was initially straight and level before changing to an S-curve that began with a left curve and changed to a right curve. The roadway was paved with asphalt and the lanes were separated by a double solid yellow stripe with a milled-in rumble strip and raised yellow reflectors. The pavement was in a traveled, polished, and worn condition. The centerline paint was worn and faded with breaks in the paint, and around the curve many of the yellow reflectors were missing. Four rows of raised white ceramic Botts' dots had been placed across the eastbound lane to alert traffic of the curve ahead, but most of the dots were missing. The roadway was bordered on the left and right by solid white painted fog lines and gravel shoulders. The fog lines were bright and sharply defined and appeared newer than the centerline. The lanes measured 3.7 m (12.0 ft) to the fog lines and 5.0 m (16.0 ft) to the edge of pavement. The right shoulder had a slope measuring -17 percent. The roadside was uneven ground covered with grass. The Nissan's point of departure was in a left curve having a radius of 347 m (1,138 ft).¹ The superelevation at this location was level. Five traffic warning signs were posted on the right shoulder parallel with the curve (Figure 2). Each sign had a black chevron pointing left on a yellow background. They had a prismatic finish and stood approximately 1.9 m (6 ft) in height. The signposts were break-away type square steel tubing. The signs were spaced 14.3 m (46.9 ft) apart and were 1.0 m (3.0 ft) right of the pavement edge. Conditions were dark in an area without streetlights, clear, and dry. A crash diagram is included at the end of this report.

¹ The left curve was preceded by a straight section.



Figure 2. Crash site, looking east to area of roadway departure and showing chevron sign

Pre-Crash

The Nissan was initially traveling eastbound on a straight section of roadway at an EDR-reported speed of 174 km/h (108 mph) at T -5.0 seconds prior to algorithm enable (AE) (Event Record 1). EDR data suggests the driver was actively accelerating and steering. The accelerator pedal was reported as 37 percent full; the brake was off, and steering input was 2.5°. At approximately T-1.5 seconds to AE, the vehicle entered the left curve in the roadway. It departed the roadway on the right edge and traveled onto a gravel shoulder with a negative 17 percent slope. The accelerator pedal was reported as 31 percent full; the brake was off, and steering input was 7.5°. ²

Crash

The crash included three known events. After departing the roadway on the right edge, the Nissan's front plane struck the fourth of five traffic warning signs marking the curve in the road (Event 1). At this point, the Nissan was likely in a counterclockwise yaw; the driver had increased his steering input to 37.5°. The post fractured near its base and the sign was displaced by impact forces into a field on the roadside. It appears likely this was a minor severity impact. Because of impact or other condition, the EDR triggered deployment of the driver's frontal air bag, the right IC air bag, and both front row seat belt pretensioners (Event Record 1). The EDR roll angle data reported a positive value (left to right rotation) of 10° beginning at 0.8 seconds and ending at 1.5 seconds. According to the vehicle owner's manual, the IC air bags are designed to inflate during rollovers and in certain types of "near rollovers." As a result, certain vehicle movements (for example, during severe off-roading activities) may cause the IC air bags to inflate. The Nissan's front plane then struck the second signpost, which fractured near its base (Event 2).

The Nissan continued traveling eastbound on the roadside in a counterclockwise rotation. Based on EDR pre-crash data (Event Record 2), in the 1.5 seconds immediately following Event Record 1, the vehicle's speed slowed from 172 km/h (107 mph) to 126 km/h (78 mph) and it traveled approximately 60 m (200 ft) in an eastbound path parallel to the roadway. The driver's steering input increased to 40°. After the Nissan had rotated approximately 270° counterclockwise, the vehicle's left side tires tripped on the ground, causing a left side leading

² According to the data limitations, a positive sign notation indicates a left turn.

trip rollover (Event 3 – EDR Event Record 2). The EDR roll angle data reported negative values (right to left rotation) beginning with -10° at 0.2 seconds and ending with -560° at 5.0 seconds. This event triggered the deployment of the driver's outboard seat-mounted side-impact air bag and the left IC air bag. Vehicle damage suggests the left, top, right, back planes, and possibly the front plane, contacted the ground during the rollover. The Nissan rolled an estimated seven quarter turns and came to rest on its right plane, facing south on the roadside (Figure 3). The estimated roll distance was 57 m (187 ft).

During the rollover, the driver was fully ejected and came to rest on the ground, partially underneath the vehicle. The evidence suggests he was ejected through the backlight.

Event 1 and Event 2 caused overlapping damage to the front plane. During the rollover, the vehicle's front bumper fascia and EAD were displaced from the vehicle, suggesting the front bumper may have had additional contact with the ground. The rollover event was out of scope for a full WinSMASH reconstruction, but the calculated barrier equivalent speed was 20 km/h (12 mph). The impacts involving the traffic signs were also out of scope. EDR Event Record 1 reported a maximum longitudinal delta V of 1 km/h (1 mph) and a maximum lateral delta V of -6 km/h (-4 mph).

Event 3 caused damage to multiple planes. EDR Event Record 2 reported a maximum longitudinal delta V of 0 km/h and maximum lateral delta V of 0 km/h. The delta V values for this event appear to be invalid and the cause is undetermined.

Post-Crash

The driver was pronounced deceased on-scene approximately 40 minutes after the crash. The Nissan was towed due to disabling damage and placed on a police evidence hold.



*Figure 3. 2017 Nissan Altima at rest
looking east (police photo)*

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2017 Nissan Altima

Vehicle Description

The 2017 Nissan Altima was identified by police using the VIN 1N4AL3AP3HNxxxxxx. The manufacture date and the odometer reading were unknown. The Nissan was a 4-door, full-size sedan with two rows of seats for five occupants. It had a 4-cylinder, 2.5-liter gasoline engine and front-wheel drive. The vehicle manufacturer recommended size 215/55R17 tires with a pressure of 221 kPa (32 psi). At the time of the inspection, the vehicle had a Premiorri Solazo S Plus tire on the left front, and Sentury Touring tires on the left and right rear. The tires were of the recommended size. The right front wheel was fractured, and the rim and tire were missing.

The Nissan had standard ABS, electronic stability control, traction control, and backup camera. It had front row bucket seats with adjustable head restraints. The driver's seat cushion appeared to be set between the middle to rear-most track position. The steering column had tilt and telescoping functionality; at inspection the tilt was centered, and the telescoping adjustment was at the midpoint.

Exterior Damage

Events 1 and 2 were frontal impacts to breakaway steel signposts that likely caused overlapping damage. Additional front-end contact with the ground was likely during a subsequent event. The headlamp assemblies, grille, and front trim components were missing; the radiator was detached. The front bumper fascia and the energy absorbing device were detached from the vehicle during the rollover and were not present at the vehicle inspection. The front bumper reinforcement bar was used to measure crush damage to the front plane. Thirteen measurements were taken at bumper level using the Nikon total station and the AutoCrush program calculated six crush measurements as follows. $C_1 = 7$ cm (2.8 in), $C_2 = 6$ cm (2.4 in), $C_3 = 5$ cm (2.0 in), $C_4 = 6$ cm (2.4 in), $C_5 = 9$ cm (3.5 in), and $C_6 = 12$ cm (4.7 in). Maximum crush measured 12 cm (4.7 in) and was located 64 cm (25.2 in) right of center and the collision deformation classification (CDC) for Event 1 was 12FLEN1 (Figure 4). The CDC for Event 2 was 12F9EN99.

Event 3 was a rollover that caused direct and induced damage to the left, top, right, and back planes (Figures 5 and 6). The left front and right rear tires were de-beaded, and the right front wheel was fractured and missing. Police indicated the right front tire had separated from the rim during the rollover. All four doors were jammed shut. The hood was crushed and buckled; the trunk lid was crushed and displaced from its hinges. The left and right planes had direct damage distributed from bumper corner to bumper corner and from sill to roof side rail. Both side view mirrors were fractured and missing. The greenhouse exhibited damage to all sides. Direct damage to the roof extended laterally from roof side rail to roof side rail, and longitudinally from windshield header to backlight header. Maximum lateral greenhouse crush was located at the top of the left C-pillar and measured 10 cm (3.9 in). Maximum vertical greenhouse crush was located on the upper aspect of the left A-pillar and measured 8 cm (3.1 in). The CDC for Event 3 was 00LDAO3.



Figure 4. Front plane damage, 2017 Nissan Altima

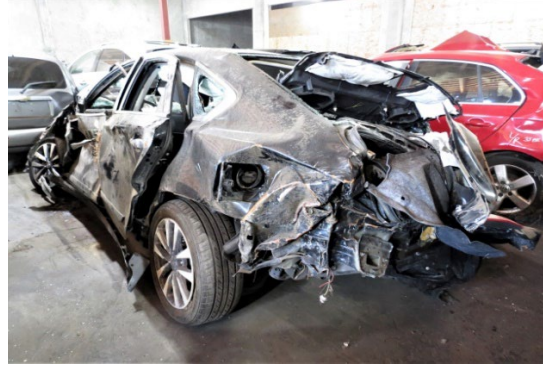


Figure 5. Left and back plane damage, 2017 Nissan Altima



Figure 6. Top plane damage, 2017 Nissan Altima

Rollover Discussion

According to NHTSA's rating system,³ the Nissan had a rollover rating of 4 stars (of a possible 5 stars). A rollover resistance test was used to measure the risk of rollover in a single-vehicle, loss-of-control scenario; the results for this vehicle was a rollover risk of 10.3 percent.

The Insurance Institute for Highway Safety gave the Nissan a "good" (highest) rating for roof strength.⁴ The test vehicle was a 2013 Nissan Altima 2.5 S sedan, and the rating applies to 2013-2018 models. During testing, the peak strength-to-weight ratio recorded at any time before the roof is crushed 5 inches is the key measurement of roof strength. A good rating requires a strength-to-weight ratio of at least 4. The roof must withstand a force of at least 4 times the vehicle's weight before the plate crushes the roof by 5 inches. The strength-to-weight ratio for this vehicle was 5.29.

The Nissan had the following passenger restraint systems designed to deploy in rollover crashes.

- Front row seat belt retractor pretensioners. Based on EDR data, the pretensioners actuated during EDR Event Record 1, approximately 1.5 seconds prior to the rollover event.
- IC air bags. According to the vehicle owner's manual, "in a rollover, the curtain air bags are designed to inflate and remain inflated for a short time." In this crash, the right IC air bag deployed at 250 ms after AE of EDR Event Record 1 and the left IC air bag deployed at 250 ms after AE of EDR Event Record 2.

The rollover followed a scenario that included a roadway departure, driver loss of control, two pole impacts, and a deployment event. Based on EDR data, no braking was applied at any time during the crash sequence. The driver steered left in varying degrees, apparently attempting to return to the roadway. The vehicle tripped on the ground while in a counterclockwise, left-side-leading rotation. The EDR reported a vehicle indicated speed of 126 km/h (78 mph) at T-0.0 seconds to AE. The Nissan rolled an estimated seven quarter turns and came to rest on its right plane and facing south on the roadside. The estimated roll distance was 57 m (187 ft).

Event Data Recorder

The Nissan had an ACU with EDR capability. Using the direct-to-module method with the Bosch CDR CANplus tool, the crash data was imaged during the vehicle inspection using CDR software version 23.1.2. It was reported using software version 24.3.576. The EDR report included two deployment events; maximum capacity for the ACU was two recorded events. Ignition cycles at crash were 13,722 and ignition cycles at download were 13,724. The EDR report included pre-crash, post-crash, rollover, and deployment data. The complete EDR report is included in Appendix A of this report.

³ National Highway Traffic Safety Administration. (n.d.). *2017 Nissan Altima 4 DR FWD* (Safety rating system web page). <https://www.nhtsa.gov/vehicle/2017/NISSAN/ALTIMA/4%252520DR/FWD#safety-ratings-rollover>

⁴ Insurance Institute for Highway Safety. (n.d.). 2017 Nissan Altima midsize car / 4-door sedan. [Web page.]. <https://www.iihs.org/ratings/vehicle/Nissan/altima-4-door-sedan/2017#roof-strength>

Interior Damage

The Nissan had interior damage caused by impact forces, integrity loss, air bag deployments and occupant contacts (Figure 7). The windshield was fractured and holed, and the backlight and side glass were disintegrated; only the second-row right-side glass was intact. All four doors were jammed shut. Four of six available air bags were deployed, and the front-row seat belt pretensioners were actuated. The seat belt was scuffed and stretched, the center console was deformed, the gear shift lever was fractured, the driver's seat back was bent to the right, the front passenger seat head restraint was bent forward, and the roof header was gouged and scuffed. The front-row space was reduced by lateral intrusion of the forward upper quadrant of the left door panel (5 cm [2.0 in]) and the left A-pillar (7 cm [2.8 in]). It was reduced by vertical intrusion of the left windshield header (11 cm [4.3 in]) and left roof (4 cm [1.6 in]). The second-row space was reduced by vertical intrusion of the right backlight header (10 cm [3.9 in]).

Manual Restraint Systems

The Nissan had continuous loop lap and shoulder seat belts with sliding latch plates for all seat positions. Emergency responders found the driver's pretensioned seat belt extended and buckled (Figure 8). The SCI investigation found evidence of occupant loading on the belt and latch plate. The plastic trim on the latch plate was scuffed, and the belt was stretched at the D-ring and scuffed at 60 cm (23.6 in) above the stop button where it engaged the latch plate. The EDR reported the driver's belt as "On (fastened)." The evidence suggests the driver was using the lap and shoulder belt but their positions prior to the crash were unknown. How the driver was displaced from his belted position was undetermined. The driver's domestic partner who was interviewed stated the driver typically wore his seat belt in a proper manner. The PCR reported the driver's belt usage as unknown.



Figure 7. Front row damage, 2017 Nissan Altima



Figure 8. Driver's seat belt, 2017 Nissan Altima

Supplemental Restraint Systems

The Nissan had driver's and passenger's frontal air bags, front row outboard seat-mounted side-impact air bags, combination side-impact/roll-sensing IC air bags for both rows (Figures 9 and 10), and front row seat belt retractor pretensioners. Per the EDR report, the driver's frontal air bag, the right IC air bag, and both pretensioners deployed during Event Record 1. The driver's outboard seat-mounted side air bag and the left IC air bag deployed during Event Record 2 (rollover event). Both IC air bags deployed at 250 ms after AE, but during separate events. All deployed air bags appeared to have deployed normally and none appeared damaged. During his movement within the vehicle and while being ejected, it appears likely the driver contacted one or more air bags, but no physical evidence of loading or contact was visually present. The driver was fully ejected and came to rest on the ground, partially underneath the vehicle. The evidence, including occupant contacts to the roof and a disintegrated backlight, suggests he was ejected through the backlight.

NHTSA Recalls and Investigations

VIN-based NHTSA recall searches queried in September 2022 and February 2025 revealed one unrepaired recall for this vehicle. NHTSA Recall Number 20V-315 was dated May 28, 2020. In summary, if the primary hood latch is disengaged and the hood is partially opened, the secondary hood latch may become contaminated with dirt or corrosion, and such dirt or corrosion could then prevent the secondary hood latch from engaging properly. The investigation found no evidence suggesting the recall issue contributed to this crash.



Figure 9. Left IC air bag, 2017 Nissan Altima



Figure 10. Right IC air bag, 2017 Nissan Altima

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2017 Nissan Altima Occupant

Driver Demographics

Age/sex: 29 years/male
 Height: 170 cm (67 in)
 Weight: 86 kg (190 lb)
 Eyewear: None
 Seat type: Bucket with adjustable head restraint
 Seat track position: Between middle and rear-most
 Manual restraint usage: Lap and shoulder belt available; used, but belt positions were unknown
 Usage source: Vehicle inspection, EDR report, PCR
 Air bags: Frontal, seat-mounted, and IC air bags available; all deployed
 Alcohol/drug data: BAC of .295 g/dL, per toxicology report
 Egress from vehicle: Fully ejected through backlight
 Transport from scene: Not transported
 Type of medical treatment: None; pronounced deceased on-scene

Driver Injuries

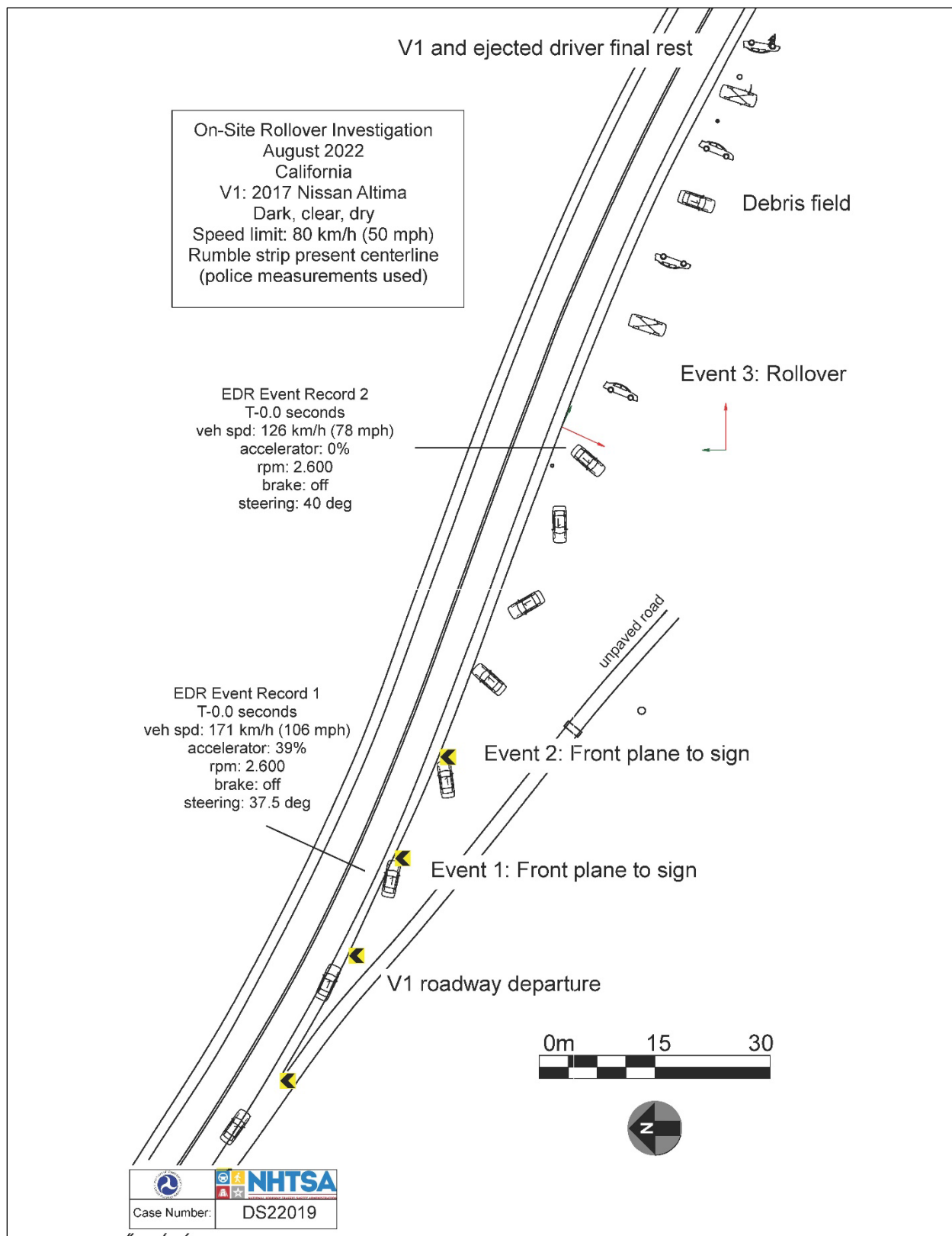
Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Asphyxia NFS, head	020000.3	Critical 2-point Exterior of vehicle Ground	Probable Probable
2	Subarachnoid hemorrhage, cerebrum	140693.2	Roof Ground	Probable Possible
3	Subgaleal hematoma, (6 x 12 cm [2.4 x 4.7 in]), vertex scalp	110402.1	Roof	Possible
4	Hemorrhage (contusion), left temporal muscle	210402.1	Windshield	Possible
5	Abrasions, face (forehead, right eyebrow, nose, left cheek,)	210202.1	Windshield	Possible
6	Contusions, right and left chest	410402.1	Exterior of vehicle	Possible
7	Contusion with abrasion, back	410402.1	Ground	Possible
8	Abrasion (13 cm / 5.1 in), left abdomen	510202.1	Exterior of vehicle	Possible
9	Contusions (up to 10 cm / 3.9 in]), right and left abdomen	510402.1	Exterior of vehicle	Possible
10	Abrasions, right hand	710202.1	Ground	Possible
11	Abrasion (11 cm/4.3 in), left hip	810202.1	Exterior of vehicle	Possible
12	Abrasions, left and right knees	810202.1	Exterior of vehicle	Possible
13		810202.1		
14	Abrasions, left thigh, lower leg	810202.1	Exterior of vehicle	Possible

Source: Autopsy report

Driver Kinematics

The evidence suggested the driver was using the lap and shoulder belt, but the belt positions were unknown. Per EDR pre-crash data, the driver was actively steering left and accelerating while negotiating a left curve when the vehicle departed the roadway on the right edge. The vehicle's front plane sheared off two steel signposts that had little input on the driver's kinematics. The driver's frontal air bag deployed and his seat belt pretensioner actuated and he likely loaded both restraints. The vehicle was traveling at a high rate of speed and was likely bouncing in multiple directions on the uneven ground, causing the driver to be displaced within his seated position. While the driver increased his steering to the left, the Nissan rotated counterclockwise and the left side tires tripped on the ground, initiating a left-side-leading rollover. The driver's outboard seat-mounted side-impact air bag and the left IC air bag deployed, and the driver likely contacted both air bags. The driver was apparently displaced from his seatbelted position and moved within the occupant compartment in response to the vehicle's rotational forces. Unknown parts of his body contacted the left and middle sectors of the roof above the front row, depositing scrape marks and gouges in the header. The driver probably contacted the center console; it was deformed and out of place, and the gear shift lever was broken off. The vehicle rolled an estimated seven quarter turns and near the end of the sequence the driver was fully ejected, probably through the backlight. Occupant contacts were present on the roof above the second row and the backlight glazing was disintegrated. The doors were jammed shut. The vehicle came to rest on its right plane and the driver came to rest partially underneath the vehicle. He sustained minor and moderate severity injuries and was pronounced deceased on-scene. A forensic pathologist determined the cause of death to be "positional asphyxia" due to "motor vehicle accident (vehicle on chest)."

Crash Diagram



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Appendix A: Event Data Recorder Report – 2017 Nissan Altima⁵

⁵ The EDR Report contained in this 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	1N4AL3AP3HN*****
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS22019_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 23.1.2
Imaged with Software Licensed to (Company Name)	NHTSA
Reported with CDR version	Crash Data Retrieval Tool 24.3.576
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Event Record 1, Event Record 2

Comments

No comments entered.

Data Limitations

General Information:

Data limitations are intended to assist in reading event data that has been imaged from the vehicle's Air bag Control Unit (ACU). Event data should be considered in conjunction with other available physical evidence from the vehicle and scene.

Airbag Control Unit (ACU)

- The Air bag Control Unit (ACU) can store two types of events: Non-Deployment Events and Deployment.
 - A Non-Deployment Event is a crash or other physical occurrence which causes the ACU algorithm to be activated, but in which deployment thresholds are not reached.
 - A Deployment Event is a crash or other physical occurrence which causes ACU deployment thresholds to be reached or exceeded. Depending on the vehicle model, one or more of the following may be activated during a Deployment Event: front air bags, seat-mounted side airbags, roof-mounted or door-mounted curtain air bags, pretensioners, or pop-up roll bars.
- The ACU can record up to two events. If additional events occur subsequently, the older of the two events already recorded (i.e. the one which occurred first) is overwritten.
 - A Non-Deployment Event can be overwritten by another Non-Deployment event, or by a Deployment Event.
 - A Deployment Event has higher priority than a Non-Deployment Event, and cannot be interrupted or overwritten by another event.
 - The data pertaining to a Deployment Event is locked after being recorded. However, a second event can still be recorded subsequently in the portion of the event memory which is not locked.
- Event data includes both pre-crash data and crash data.
 - If the power supply to the ACU is lost during an event, all or part of the event data may not be recorded.
 - In addition to the recording of event data, the ACU has the ability to perform diagnostics and record Diagnostic Trouble Codes (DTCs).

Data Element Sign Convention:

The following table provides an explanation of the sign convention for data elements in the CDR report.

Data Element Name	Positive Sign Notation Indicates
Longitudinal Acceleration	Forward
Delta-V, Longitudinal	Forward
Maximum Delta-V, Longitudinal	Forward
Lateral Acceleration	Left to Right
Delta-V, Lateral	Left to Right
Maximum Delta-V, Lateral	Left to Right
Vehicle Roll Angle	Left to Right Rotation
Steering Input	Left Turn

- "Life Time Counter (sec)" indicates the elapsed time, in seconds, from the vehicle's first ignition activation until the start of the first recorded event. The counter is incremented whenever the vehicle's ignition is on. The counter is reset to 0 if the ACU is replaced.
- "Complete File Recorded" indicates whether a complete EDR data set has been stored after the event. "Yes" indicates that a complete data set

has been recorded. "No" indicates that only a portion of the data set has been recorded, for example due to the power to the ACU being lost during the event.

- "Multi-Event, Number of Events (1, 2)" indicates the number of events which are stored during a given ignition cycle. A Multi-Event occurs whenever the time between Event 2 trigger threshold and Event 1 trigger threshold is less than or equal to 5 seconds during the same ignition cycle, and "2" will be recorded in this case. Otherwise, "1" will be recorded.
- "Air Bag Warning Lamp (On, Off)" indicates whether the ACU was in trouble mode or in normal operation mode at the time of the event. "On" indicates that the air bag warning lamp was illuminated at the time of the event, and the ACU was in trouble mode. "Off" indicates that the air bag warning lamp was not illuminated at the time of the event, and the ACU was in normal operation mode.
- "Frontal Air Bag Suppression Switch Status" indicates whether front passenger air bag deployment was suppressed at the time of the event. "On" indicates that the front passenger air bag was suppressed at the time of the event (deployment inhibited). "Off" indicates that the front passenger air bag was not suppressed at the time of the event (deployment enabled). This data will not be available for all vehicles.
- "Delta-V, Longitudinal" indicates the cumulative change in velocity along the longitudinal direction.
- "Acceleration, Longitudinal" indicates the rate of change of velocity with time along the longitudinal direction.
- "Delta-V, Lateral" indicates the cumulative change in velocity along the lateral direction.
- "Acceleration, Lateral" indicates the rate of change of velocity with time along the lateral direction.
- "Engine Throttle, % full" indicates the position of the accelerator pedal as a percentage of the fully depressed position.
- "Service Brake (On, Off)" indicates whether the service brake is activated ("On") or not activated ("Off").
- "Steering Input (deg)" indicates the angular displacement of the steering wheel measured in degrees. -250 deg indicates a 250 degree turn to the right of the steering wheel, 0 deg indicates the straight-ahead steering wheel position, and 250 deg indicates a 250 degree turn to the left of the steering wheel.
- The notation "CLP" indicates that the measurement captured by a sensor exceeded the design range of the sensor.
- "Seat Track Position Switch, Foremost, Status, Driver (Yes/No)" indicates whether the driver's seat is positioned within a designated threshold value of the most forward adjustment position. "Yes" indicates that the driver's seat is positioned within a designated threshold value of the most forward adjustment position. For all other adjustment positions, "No" is displayed. This data will not be available if the seat track position switch is not installed in the vehicle.
- "Occupant Size Classification, Right Front Passenger, Child (Yes/No)" indicates whether or not the right front passenger is classified as a child (as defined in 49 CFR part 572, subpart N or smaller). This data will not be available for all vehicles.
- "e-pedal ON/OFF Status" indicates whether "e-pedal" is activated (ON), or not activated (OFF). This data will not be available for all vehicles.
- "ABS Warning lamp, on/off" indicates whether "Anti-lock Brake System" was in trouble mode or in normal operation mode at the time of the event. This data will not be available for all vehicles.
- "AEB/FCW switch status ON/OFF (from ADAS)" indicates whether the switch of "Automatic Emergency Braking or Forward Collision Warning controlled by ADAS unit" was ON, or OFF at the time of the event. This data will not be available for all vehicles.
- "AEB Warning lamp (from ADAS)" indicates whether "Automatic Emergency Braking controlled by ADAS unit" was in trouble mode or in normal operation mode at the time of the event. This data will not be available for all vehicles.
- "ABS regulation status" indicates whether "Anti-lock Brake System" was activated (ABS in regulation), or not activated (no ABS regulation). This data will not be available for all vehicles.
- "VDC switch status ON/OFF" indicates whether the switch of "Vehicle Dynamic Control" in ON, or OFF. This data will not be available for all vehicles.
- "VDC status/warning" indicates whether "Vehicle Dynamic Control" was in normal operation mode and not activated (No failure and no control), in trouble mode and not activated (Failure), or in normal mode and activated (In active control). This data will not be available for all vehicles.
- "Adaptive Cruise Control status" indicates whether "Intelligent Cruise Control status" was activated (ACC activated), waiting (ACC waiting), suspended (ACC suspended), or not activated (No display request). This data will not be available for all vehicles.
- "AEB operating capability" indicates whether "Automatic Emergency Braking" was in trouble mode (Impossible to execute request) or in normal operation mode (Braking fully operational). This data will not be available for all vehicles.
- "AEB Brake request (from ADAS)" indicates whether "Automatic Emergency Braking controlled by ADAS unit" was activated (Brake Torque AEB Maximum), or not activated (No Brake Request). This data will not be available for all vehicles.
- "VIN retrieval from other ECU" indicates VIN data retrieval from other ECU when CDR connect to vehicle by using OBD system if available.
- "VIN retrieval from ACU" indicates VIN data retrieval from ACU. It will not be available for all vehicles.
- "Engine RPM (Gearbox Input Shaft)" indicates RPM of motor used for vehicle drive on electric or hybrid vehicles. In case of ICE vehicles, this indicates input shaft revolution that is input to Gearbox. This data will not be available for all vehicles.
- "Engine RPM (Front Electrical Motor)" indicates RPM of motor used for vehicle drive on electric vehicles. This data will not be available for all vehicles.
- "Engine RPM (Rear Electrical Motor)" indicates RPM of motor used for 4WD vehicle drive on electric vehicles. This data will not be available for all vehicles.
- "Engine RPM" indicates RPM of engine used for vehicle drive on electric vehicles. This data will not be available for all vehicles.
- "Airbag Deployment Time" indicates deployment time of each airbag. This data will not be available for all vehicles.
- "Seat Track Position Switch, Foremost, Status, Passenger" indicates whether the passenger's seat is positioned within a designated threshold value of the most forward adjustment position. "Yes" indicates that the passenger's seat is positioned within a designated threshold value of the most forward adjustment position. For all other adjustment positions, "No" is displayed. This data will not be available if the seat track position switch is not installed in the vehicle.

Hexadecimal Data:

All data that has been specified for retrieval is shown in the Hexadecimal Data section of this report. However, the Hexadecimal Data section may contain data that is not translated by the CDR tool.

Data Sources:

- Crash data is measured internally in the ACU.
- Pre-crash data is not measured internally in the ACU, but is transmitted from other control units through the Controller Area Network (CAN).
- Pre-crash data and crash data are asynchronous.

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DTCs at Time of Retrieval

DTC	Status	Description
B1421	Current	FRONTAL COLLISION DETECTION
B0094	Current	CRASH ZONE SENSOR [DISCONNECT]
B0092	Current	C-PILLAR SATELLITE SENSOR LH [DISCONNECT]
B0097	Current	C-PILLAR SATELLITE SENSOR RH [DISCONNECT]
U1000	Current	(CAN COMMUNICATION FAILER)
B0001	Current	DRIVER AIRBAG MODULE CIRCUIT [OPEN]
B0010	Current	ASSIST AIRBAG MODULE CIRCUIT [OPEN]
B1431	Current	FRONT PRE-TEN RH CIRCUIT [OPEN]
B1430	Current	FRONT PRE-TEN LH CIRCUIT [OPEN]
B1433	Current	FRONT PRE-TEN2 RH CIRCUIT [OPEN]
B1432	Current	FRONT PRE-TEN2 LH CIRCUIT [OPEN]
B00D5	Current	PASSENGER AIRBAG INDICATOR CIRCUIT [OPEN]
B0002	Current	DRIVER AIRBAG MODULE 2ND CIRCUIT [OPEN]
B0011	Current	ASSIST AIRBAG MODULE 2ND CIRCUIT [OPEN]
B0028	Current	SIDE AIRBAG MODULE RH CIRCUIT [OPEN]
B0020	Current	SIDE AIRBAG MODULE LH CIRCUIT [OPEN]
B0028	Past	SIDE AIRBAG MODULE RH CIRCUIT [OPEN]
B00A0	Past	OCCUPANT DETECTION SENSOR [POWER FAIL]
B142A	Past	IGN VOLTAGE [LOW]
B1421	Past	FRONTAL COLLISION DETECTION
U1000	Trouble Diag. Record	(CAN COMMUNICATION FAILER)
B00A0	Trouble Diag. Record	OCCUPANT DETECTION SENSOR [POWER FAIL]
B142A	Trouble Diag. Record	IGN VOLTAGE [LOW]

System Status at Event (Event Record 1)

Life Time Counter (sec)	15921733
Complete File Recorded (Yes/No)	Yes (Complete)
Ignition Cycle, Crash	13722
Ignition Cycle, Download	13724
Multi-Event, Number of Events (1, 2)	1
Time from Event 1 to 2 (sec)	N/A
Safety Belt Status, Driver	On (Fastened)
Safety Belt Status, Right Front Passenger	Off (Unfastened)
Frontal Air Bag Warning Lamp (On, Off)	On or Blinking
Frontal Air Bag Suppression Switch Status	On (AS airbag inhibit)
Maximum Delta-V, Longitudinal (MPH [km/h])	-1 [-1]
Time, Maximum Delta-V, Longitudinal (msec)	275
Maximum Delta-V, Lateral (MPH [km/h])	-4 [-6]
Time, Maximum Delta-V, Lateral (msec)	300
Maximum Acceleration, Longitudinal (g)	1.5
Time, Maximum Acceleration, Longitudinal (msec)	207.5
Maximum Acceleration, Lateral (g)	-2.5
Time, Maximum Acceleration, Lateral (msec)	242.5

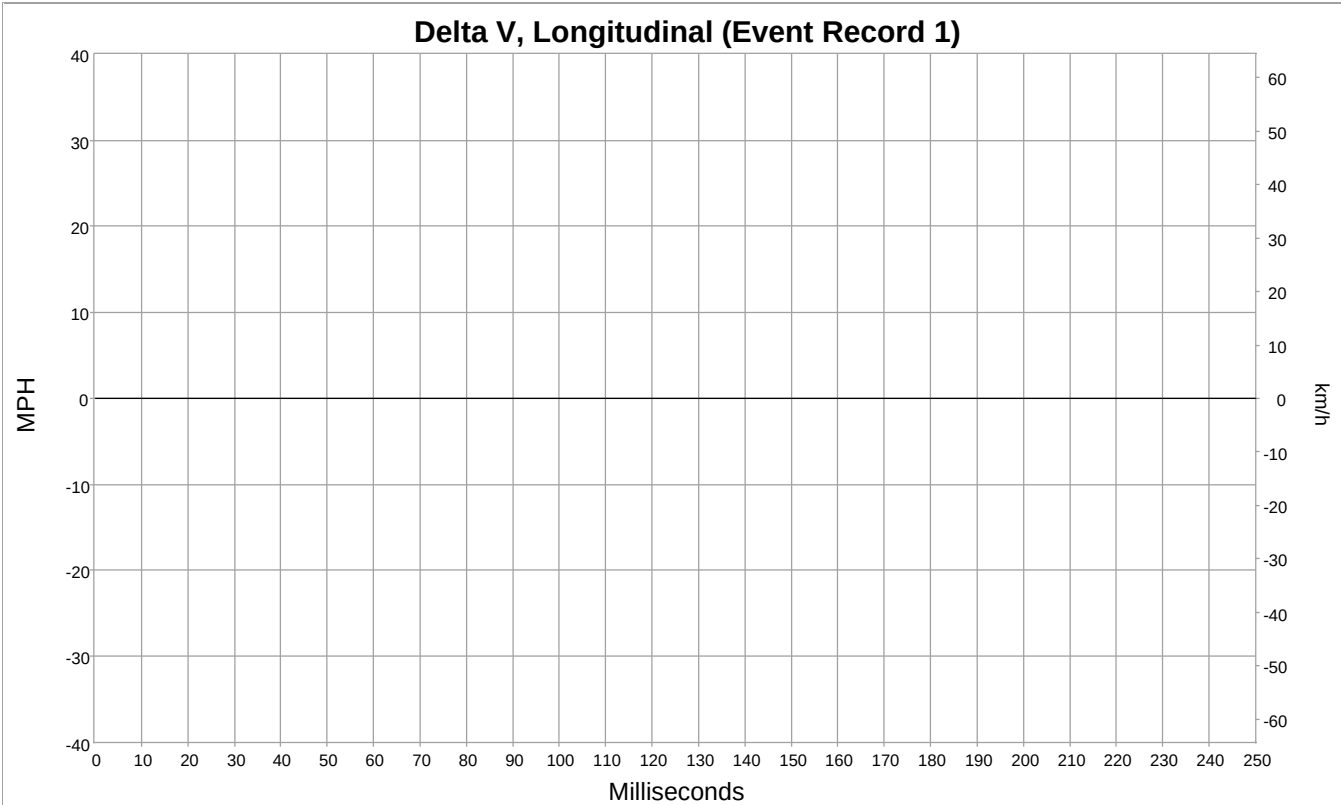
Deployment Command Data (Event Record 1)

Frontal Air Bag Deployment, Time to Deploy/First Stage, Driver (msec)	250
Frontal Air Bag Deployment, Time to Deploy/First Stage, Passenger (msec)	N/A
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (msec)	250
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (msec)	N/A
Side Air Bag Deployment, Time to Deploy, Driver (msec)	N/A
Side Air Bag Deployment, Time to Deploy, Right Front Passenger (msec)	N/A
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Driver Side (msec)	N/A
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Right Side (msec)	250
Pretensioner Deployment, Time to Fire, Driver (msec)	250
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	250

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1)

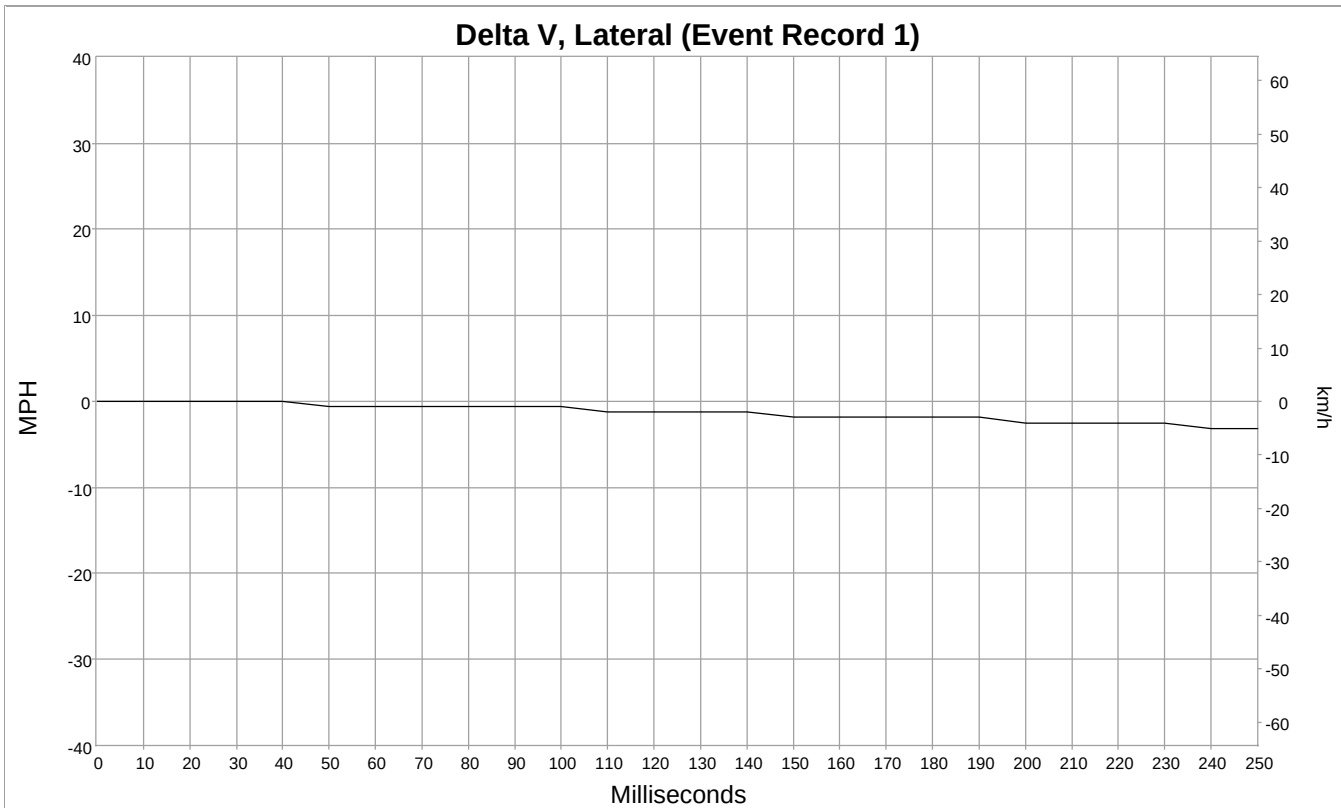
(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % full	Engine RPM	Motor RPM	Service Brake (On, Off)	Steering Input (deg)
-5.0	108 [174]	37	2900	3000	Off (Brake Not Activated)	2.5
-4.5	107 [173]	33	2800	2800	Off (Brake Not Activated)	5
-4.0	107 [173]	30	2600	2600	Off (Brake Not Activated)	0
-3.5	107 [173]	30	2600	2600	Off (Brake Not Activated)	-2.5
-3.0	107 [173]	30	2600	2600	Off (Brake Not Activated)	0
-2.5	107 [172]	31	2600	2600	Off (Brake Not Activated)	0
-2.0	107 [172]	31	2600	2600	Off (Brake Not Activated)	2.5
-1.5	107 [172]	31	2600	2600	Off (Brake Not Activated)	7.5
-1.0	107 [172]	37	2600	2600	Off (Brake Not Activated)	25
-0.5	106 [171]	39	2600	2600	Off (Brake Not Activated)	27.5
0.0	106 [171]	39	2600	2600	Off (Brake Not Activated)	37.5



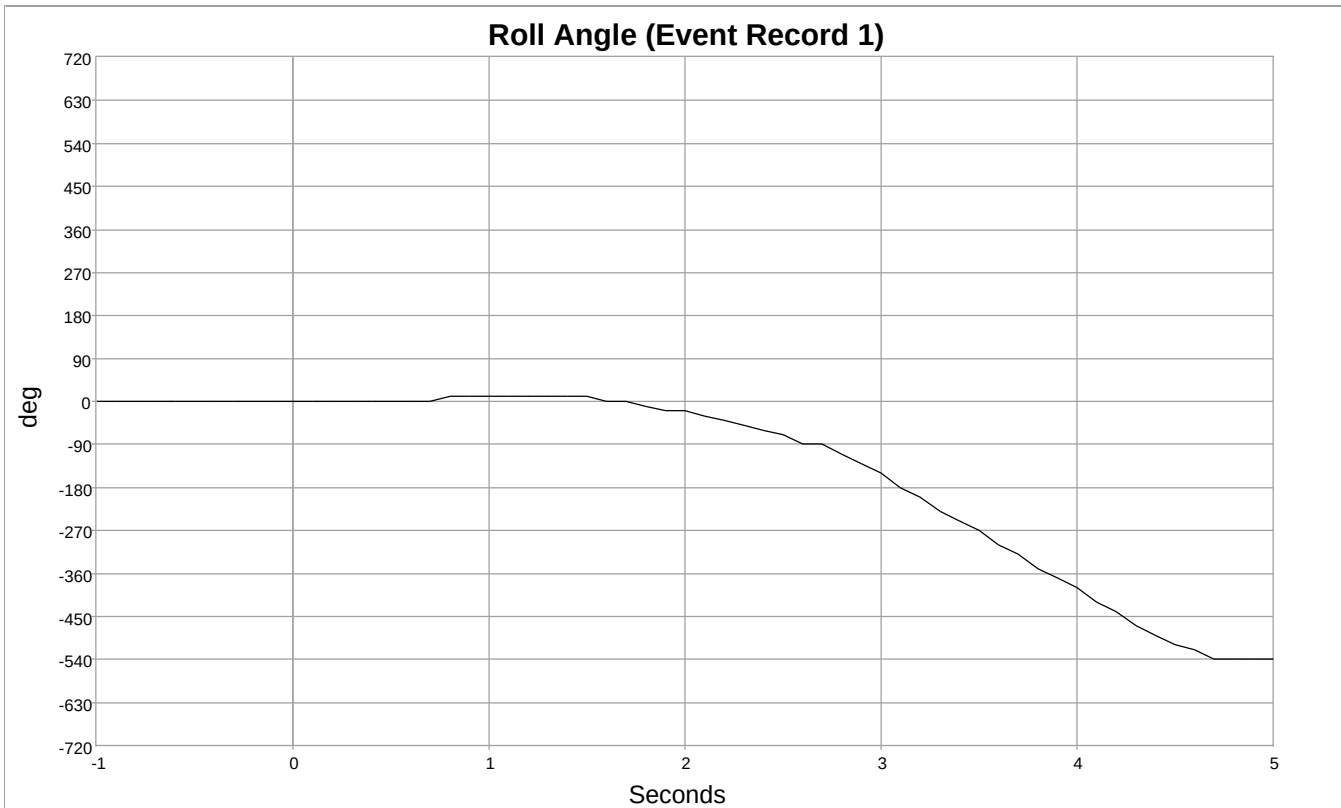
Longitudinal Delta V (Event Record 1)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	0 [0]
30	0 [0]
40	0 [0]
50	0 [0]
60	0 [0]
70	0 [0]
80	0 [0]
90	0 [0]
100	0 [0]
110	0 [0]
120	0 [0]
130	0 [0]
140	0 [0]
150	0 [0]
160	0 [0]
170	0 [0]
180	0 [0]
190	0 [0]
200	0 [0]
210	0 [0]
220	0 [0]
230	0 [0]
240	0 [0]
250	0 [0]



Lateral Delta V (Event Record 1)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	0 [0]
30	0 [0]
40	0 [0]
50	-1 [-1]
60	-1 [-1]
70	-1 [-1]
80	-1 [-1]
90	-1 [-1]
100	-1 [-1]
110	-1 [-2]
120	-1 [-2]
130	-1 [-2]
140	-1 [-2]
150	-2 [-3]
160	-2 [-3]
170	-2 [-3]
180	-2 [-3]
190	-2 [-3]
200	-2 [-4]
210	-2 [-4]
220	-2 [-4]
230	-2 [-4]
240	-3 [-5]
250	-3 [-5]



Roll Angle (Event Record 1)

Time (sec)	deg
-1.0	0
-0.9	0
-0.8	0
-0.7	0
-0.6	0
-0.5	0
-0.4	0
-0.3	0
-0.2	0
-0.1	0
0.0	0
0.1	0
0.2	0
0.3	0
0.4	0
0.5	0
0.6	0
0.7	0
0.8	10
0.9	10
1.0	10
1.1	10
1.2	10
1.3	10
1.4	10
1.5	10
1.6	0
1.7	0
1.8	-10
1.9	-20

2.0	-20
2.1	-30
2.2	-40
2.3	-50
2.4	-60
2.5	-70
2.6	-90
2.7	-90
2.8	-110
2.9	-130
3.0	-150
3.1	-180
3.2	-200
3.3	-230
3.4	-250
3.5	-270
3.6	-300
3.7	-320
3.8	-350
3.9	-370
4.0	-390
4.1	-420
4.2	-440
4.3	-470
4.4	-490
4.5	-510
4.6	-520
4.7	-540
4.8	-540
4.9	-540
5.0	-540

System Status at Event (Event Record 2)

Life Time Counter (sec)	15921734
Complete File Recorded (Yes/No)	Yes (Complete)
Ignition Cycle, Crash	13722
Ignition Cycle, Download	13724
Multi-Event, Number of Events (1, 2)	1
Time from Event 1 to 2 (sec)	N/A
Safety Belt Status, Driver	On (Fastened)
Safety Belt Status, Right Front Passenger	Off (Unfastened)
Frontal Air Bag Warning Lamp (On, Off)	On or Blinking
Frontal Air Bag Suppression Switch Status	On (AS airbag inhibit)
Maximum Delta-V, Longitudinal (MPH [km/h])	0 [0]
Time, Maximum Delta-V, Longitudinal (msec)	232.5
Maximum Delta-V, Lateral (MPH [km/h])	0 [0]
Time, Maximum Delta-V, Lateral (msec)	75
Maximum Acceleration, Longitudinal (g)	2
Time, Maximum Acceleration, Longitudinal (msec)	2.5
Maximum Acceleration, Lateral (g)	2.5
Time, Maximum Acceleration, Lateral (msec)	10

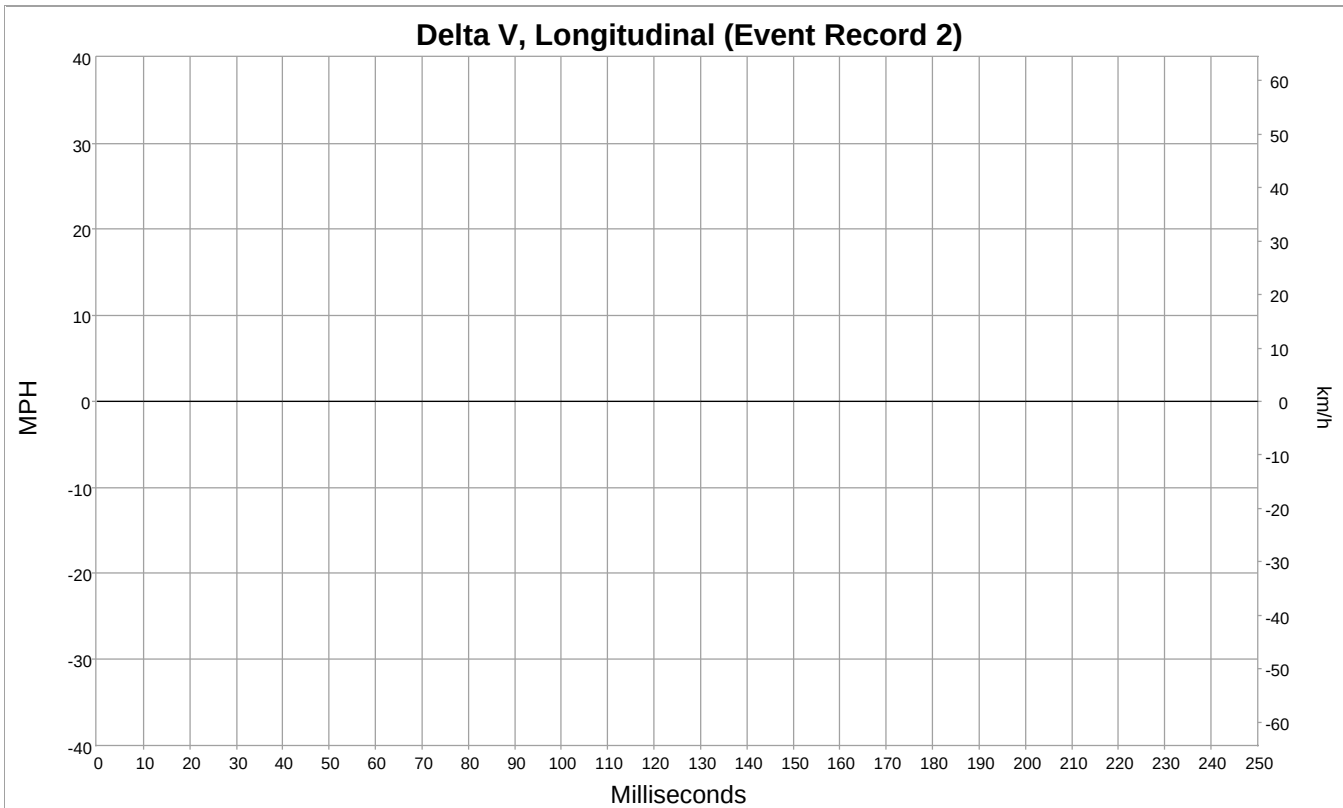
Deployment Command Data (Event Record 2)

Frontal Air Bag Deployment, Time to Deploy/First Stage, Driver (msec)	N/A
Frontal Air Bag Deployment, Time to Deploy/First Stage, Passenger (msec)	N/A
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (msec)	N/A
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (msec)	N/A
Side Air Bag Deployment, Time to Deploy, Driver (msec)	250
Side Air Bag Deployment, Time to Deploy, Right Front Passenger (msec)	N/A
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Driver Side (msec)	250
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Right Side (msec)	N/A
Pretensioner Deployment, Time to Fire, Driver (msec)	N/A
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	N/A

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 2)

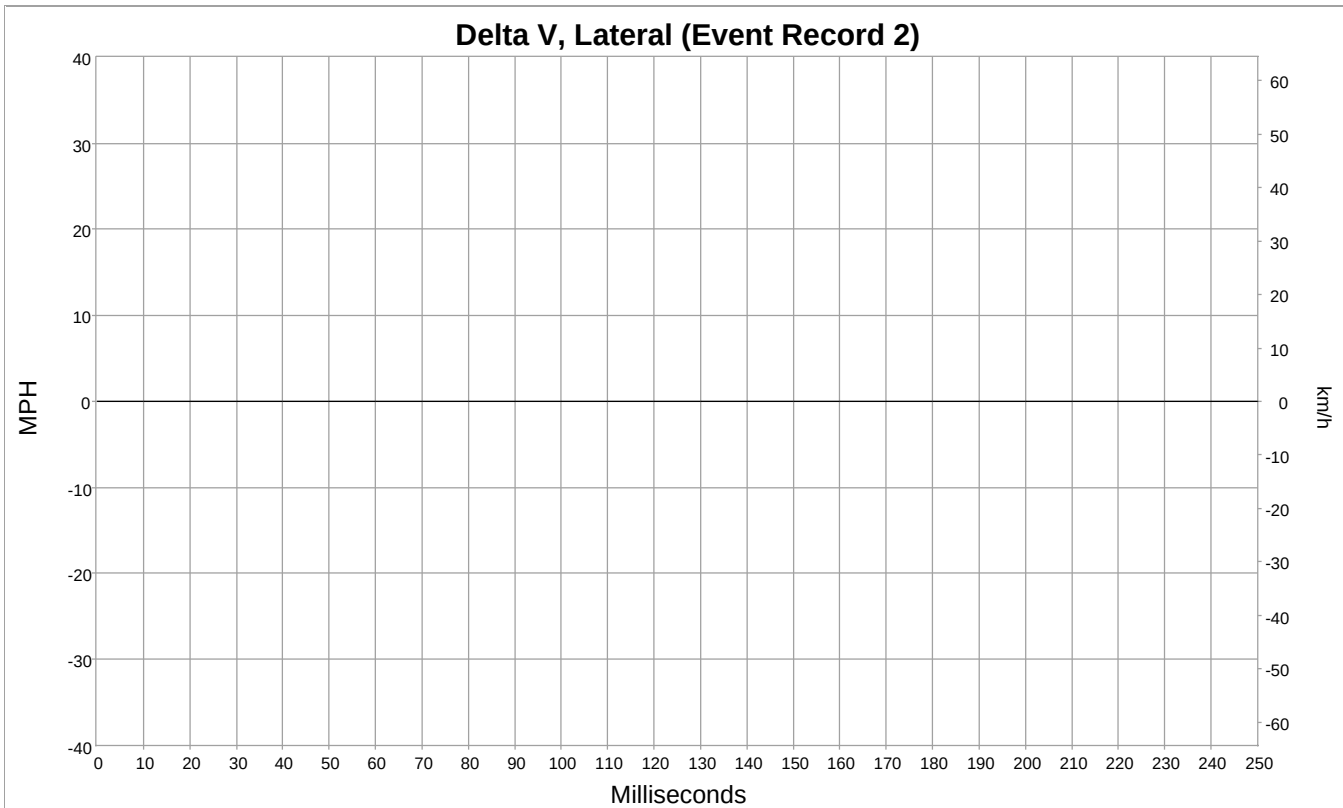
(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal, % full	Engine RPM	Motor RPM	Service Brake (On, Off)	Steering Input (deg)
-5.0	107 [173]	30	2600	2600	Off (Brake Not Activated)	-2.5
-4.5	107 [173]	30	2600	2600	Off (Brake Not Activated)	0
-4.0	107 [172]	31	2600	2600	Off (Brake Not Activated)	0
-3.5	107 [172]	31	2600	2600	Off (Brake Not Activated)	2.5
-3.0	107 [172]	31	2600	2600	Off (Brake Not Activated)	7.5
-2.5	107 [172]	37	2600	2600	Off (Brake Not Activated)	25
-2.0	106 [171]	39	2600	2600	Off (Brake Not Activated)	27.5
-1.5	107 [172]	59	2800	2800	Off (Brake Not Activated)	42.5
-1.0	93 [150]	81	3600	3500	Off (Brake Not Activated)	25
-0.5	93 [149]	100 (clp)	4700	4700	Off (Brake Not Activated)	22.5
0.0	78 [126]	0	4600	3500	Off (Brake Not Activated)	40



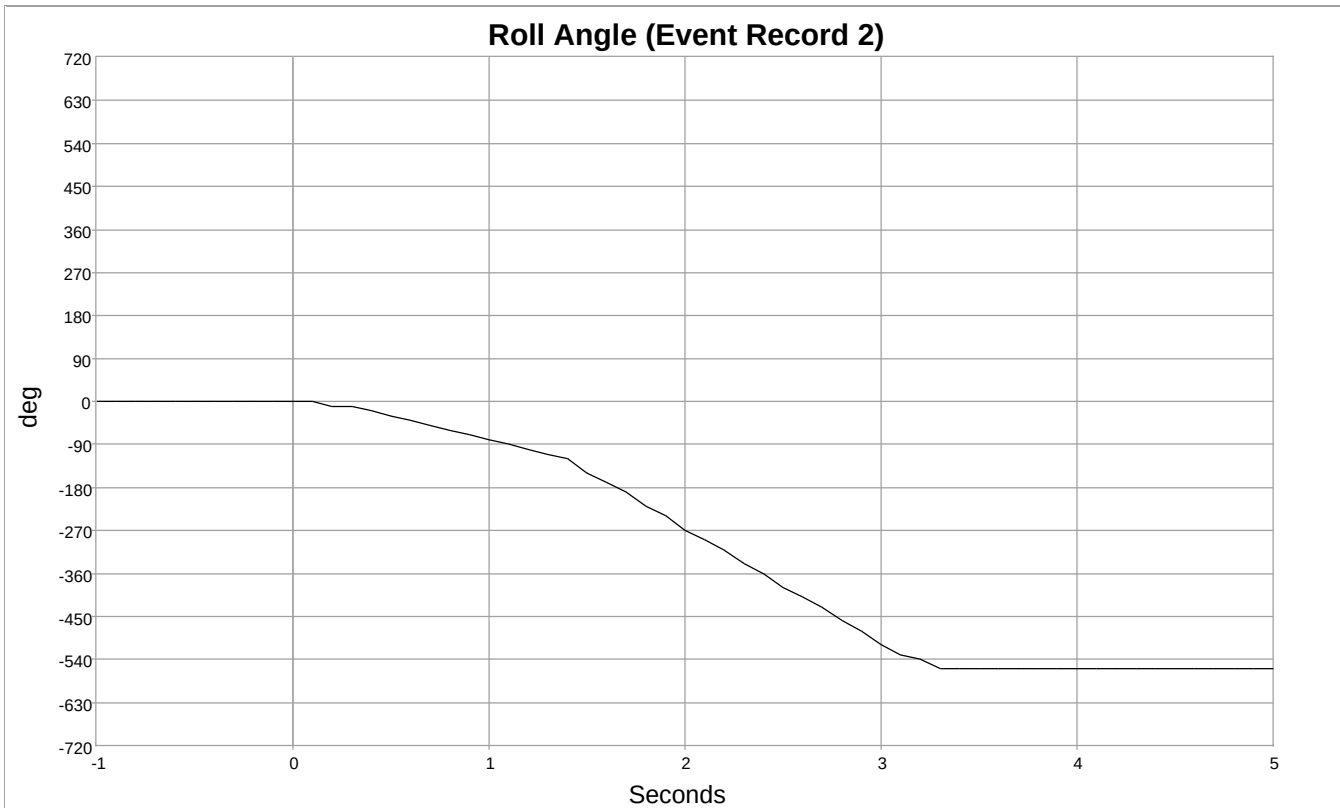
Longitudinal Delta V (Event Record 2)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	0 [0]
30	0 [0]
40	0 [0]
50	0 [0]
60	0 [0]
70	0 [0]
80	0 [0]
90	0 [0]
100	0 [0]
110	0 [0]
120	0 [0]
130	0 [0]
140	0 [0]
150	0 [0]
160	0 [0]
170	0 [0]
180	0 [0]
190	0 [0]
200	0 [0]
210	0 [0]
220	0 [0]
230	0 [0]
240	0 [0]
250	0 [0]



Lateral Delta V (Event Record 2)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	0 [0]
30	0 [0]
40	0 [0]
50	0 [0]
60	0 [0]
70	0 [0]
80	0 [0]
90	0 [0]
100	0 [0]
110	0 [0]
120	0 [0]
130	0 [0]
140	0 [0]
150	0 [0]
160	0 [0]
170	0 [0]
180	0 [0]
190	0 [0]
200	0 [0]
210	0 [0]
220	0 [0]
230	0 [0]
240	0 [0]
250	0 [0]



Roll Angle (Event Record 2)

Time (sec)	deg
-1.0	0
-0.9	0
-0.8	0
-0.7	0
-0.6	0
-0.5	0
-0.4	0
-0.3	0
-0.2	0
-0.1	0
0.0	0
0.1	0
0.2	-10
0.3	-10
0.4	-20
0.5	-30
0.6	-40
0.7	-50
0.8	-60
0.9	-70
1.0	-80
1.1	-90
1.2	-100
1.3	-110
1.4	-120
1.5	-150
1.6	-170
1.7	-190
1.8	-220
1.9	-240

2.0	-270
2.1	-290
2.2	-310
2.3	-340
2.4	-360
2.5	-390
2.6	-410
2.7	-430
2.8	-460
2.9	-480
3.0	-510
3.1	-530
3.2	-540
3.3	-560
3.4	-560
3.5	-560
3.6	-560
3.7	-560
3.8	-560
3.9	-560
4.0	-560
4.1	-560
4.2	-560
4.3	-560
4.4	-560
4.5	-560
4.6	-560
4.7	-560
4.8	-560
4.9	-560
5.0	-560

Hexadecimal Data

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94 33 13 94 32 13 80 D5 13 80 02 13 80 11 13 80 28 13 80 20 13 14 FF FF FF FF 00 05 00 CE

61 02 80 28 13 00 83 03 16 02 46 C6 01 80 A0 00 02 02 01 0F 01 5B DB 00 94 2A 16 01 89 01 10 01
5B DB 00 94 21 00 00 00 01 1E 02 5D 87 01 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 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

61 03 D0 00 01 00 00 03 03 00 12 3B 00 80 A0 00 00 00 02 05 00 47 3D 00 94 2A 16 01 90 02 0F 00
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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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80 80 80 80

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01 00 FF FF FA FF FA FF FF 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80
80 80 80 80

61 1E 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 80 00 00 00 00
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FF FF FF FF FF 00 F2 F2 46

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20 13 09
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59 02 09 80 28 13 09 80 A0 00 08 94 2A 16 08 94 21 00 09
59 0F 08 D0 00 01 08 80 A0 00 08 94 2A 16 08

Disclaimer of Liability

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

DOT HS 813 711
May 2025



U.S. Department
of Transportation
**National Highway
Traffic Safety
Administration**



16620-042225-v3