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On-Site Crash Avoidance
Technology Investigation;
Vehicle: 2019 Honda Fit;
Location: Florida;
Crash Date: April 2020**

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Special Crash Investigations
On-Site Crash Avoidance Technology Investigation
Case Number: CR20018
Vehicle: 2019 Honda Fit
Location: Florida
Crash Date: April 2020

Background

This report documents the on-site investigation of the multiple-event/rollover crash of a 2019 Honda Fit (Figure 1) that resulted in fatal injuries to its 60-year-old belted female driver. The Honda had advanced frontal air bags, front seat-mounted side impact air bags, and inflatable curtain (IC) air bags, as well as several crash avoidance features, including forward collision warning (FCW) with collision mitigation braking (CMB), lane departure warning (LDW) with lane keeping assist (LKAS), road departure mitigation (RDM), blind spot detection (BSD), adaptive cruise control (ACC), daytime running lights, and a rearview video system. The RDM, LDW, and LKAS systems were not active during this collision and therefore would not be expected to engage even though the minimum speeds were exceeded, and the lane markings were in good condition. The crash occurred when the Honda departed the right side of the roadway at a high speed and struck several trees before rolling over. Local law enforcement officials stated that they believed the fatally injured driver of the Honda had a medical episode that precipitated the crash.



Figure 1. Front left oblique view of the 2019 Honda during the SCI investigation

The crash was identified by the Fatality Analysis Reporting System (FARS) in June 2020 with notification provided to the Crash Investigation Division of the National Highway Traffic Safety Administration. The police crash report (PCR) was forwarded to the Special Crash Investigations (SCI) team at Crash Research and Analysis, Inc., and assigned for an on-site investigation in June 2020. The on-site portion of this investigation took place in the same month. On-site activities included the exterior and interior inspections of the Honda to measure the exterior deformation, interior damage, document occupant contact, examination of the manual and supplemental restraint systems, and verification of the equipped crash avoidance systems. The Honda had an Event Data Recorder (EDR), which was imaged during the inspection process using the current version of the Bosch Crash Data Retrieval tool and software. The crash site was

photographed and documented by a total station mapping system. The SCI team interviewed the investigating officer as well.

Summary

Crash Site

This crash occurred on a two-lane, undivided roadway in a suburban setting during the afternoon hours. Reported weather in the locale included fair conditions—a temperature of 31.1 °C (88 °F), a 57-percent relative humidity—and calm winds. In the southbound travel direction, the roadway was straight leading into a left curve with a 2-percent uphill grade for the travel lane. The radius of the curve measured 317.7 m (1042.3 ft). The travel lane was 3.7 m (12.1 ft) wide. The roadway lanes were delineated by a solid yellow median line and a single solid white fog line, which were clear and visible. Figure 2 shows a south-facing view of the roadway on approach to the crash site. Speed was regulated by a posted limit of 48 km/h (30 mph). The crash involved an impact to a tree stump and two additional trees (Figure 3). The tree stump was located 5.3 meters (17.4 ft) from the west edge of the roadway. Tree #1 was located 5.8 meters (19.0 ft) from the west edge of the roadway and 83 cm (32.7 in) from the tree stump. Tree #2 was located 4.8 meters (15.7 ft) from the west edge of the roadway and 4.2 meters (13.8 ft) from tree one. A crash diagram is included at the end of this report.



Figure 2. Southbound view of the Honda's pre-crash approach to the crash site



Figure 3. Struck tree stump (middle arrow), tree #1 (top arrow), and tree #2 (bottom arrow) at the crash site

Pre-Crash

The belted 60-year-old female drove the Honda south on the two-lane roadway. Local law enforcement officials stated that they believed the driver lost consciousness due to a medical episode that resulted in the vehicle departing the roadway to the right. They determined that a medical episode was likely after speaking with the driver's sister and brother, who both said the driver had been in previous accidents due to passing out. Additionally, an on-scene witness stated that he didn't see a driver in the vehicle as it went past where he was standing, indicating the driver was likely passed out in the Honda. Data imaged from the vehicle's EDR showed the Honda was traveling at 115 km/h (71 mph) 5.0 seconds prior to algorithm enable (AE) and increased its speed to 144 km/h (89 mph) at AE. The EDR imaged data reported that the crash avoidance features of FCW and CMB were "On." The RDM/LDW, LKA, and ACC were all "Off." No warnings were recorded by the EDR. Reconstruction of the vehicle's trajectory showed the Honda traveled 32.2 meters (105.6 ft) off-road at a departing angle of six degrees as it approached the tree stump.

Crash

The right front wheel of the Honda struck a tree stump 20 cm (7.9 in) tall (Event 1). The directions of force were within the 12 o'clock sector (0-degrees) for the Honda. At approximately the same time, the Honda's front right bumper corner struck a 30 cm (11.8 in) diameter tree (Event 2). As the vehicle crushed, the tree penetrated the right A-pillar area, separating the right front wheel assembly. The vehicle's engagement against the tree sheared the upper A-pillar and overloaded the hinge connection of the right front door. As the vehicle continued forward, the right plane separated along the roof side rail, while the sill crushed laterally. The entire right plane separated at the C-pillar. The offset force of the crash caused the Honda to rotate clockwise as it separated from the tree. The centrifugal forces of the rotation resulted in a left side-leading rollover (Event 3). As the Honda traveled 4.2 meters (13.8 ft) south and began to roll one-quarter turn onto its left plane, the top plane of the Honda struck a 45 cm (17.7 in) diameter tree (Event 4) between the left B-pillar and C-pillar. The force of this impact deformed the roof into a U-shaped pattern with crush below the beltline. This impact interrupted the Honda's rollover and reversed the rotation of the vehicle about the vertical axis. The Honda rotated counterclockwise approximately 180 degrees around the second tree and came to final rest facing east on its left plane (Figure 4).



Figure 4. On-scene photos of the crash site (police-provided image)

Post-Crash

A bystander called local emergency services and reported the crash. The bystander reported that the driver was unresponsive, resting against the driver's side door. Local emergency medical services (EMS) arrived on scene and confirmed the driver was deceased. The driver was removed from the vehicle and taken to the medical examiner's office for autopsy.

A local recovery service towed the Honda from the crash scene to a local yard, where it was deemed a total loss by its insurer. The Honda was then transferred to a regional insurance vehicle salvage facility where it was inspected for this investigation.

2019 Honda Fit

Description

The 2019 Honda Fit (Figure 5), manufactured in September 2018, was identified by the vehicle identification number 3HGGK5H80KMxxxxxx. The Honda was a front-wheel-drive platform, powered by a 1.5-liter, 4-cylinder, gasoline engine linked to a continuous variable transmission. Its service brakes were power-assisted, 4-wheel disc with anti-lock (ABS). The gross vehicle weight rating was 1,590 kg (3,505 lb). At the time of the SCI inspection, the Honda had Firestone FR740 tires for the left front, left rear, and right rear tires. The right front tire separated during the crash and was not present at the time of inspection. The left front, left rear, and right rear tires had at least 6 mm (7/32) of tread, remained inflated, and were not restricted or damaged in the crash.



Figure 5. Front right oblique view of the 2019 Honda Fit during the SCI vehicle inspection

The interior of the Honda had seating of five occupants (2/3), with front-row bucket seats and a second-row bench seat with split forward-folding seatbacks. All seating positions had adjustable head restraints. Manual restraint systems consisted of 3-point lap and shoulder seat belts for all seat positions. Supplemental restraint systems included front seat belt retractors and six air bags consisting of the driver's and passenger's frontal, front-seat-mounted side impact, and IC air bags.

Exterior Damage

This crash involved the undercarriage, front, right, and top planes of the Honda. The undercarriage impact of the right-front wheel (Figure 6) to the tree stump (Event 1) resulted in the tire being holed. A corresponding collision deformation classification (CDC) assigned to this damage profile was 12FRWN03.



Figure 6. Right front wheel from the Honda as found at the crash scene (police-provided image)

The damage pattern to the front and right plane had the characteristics of a corner impact configuration (Figure 7, Event 2). The front bumper reinforcement bar was minimally deformed at the right front corner. The tree deformation at the right front corner and fender separated the right front wheel from the axle (Figure 8) and both right side doors (Figure 9) at the leading edge. The right B-pillar and roof side rail were still attached to the doors, indicating that the tree contacted the interior surfaces of these components as they separated from the vehicle. There was minimal exterior damage to the right side doors, which align with a clean separation of these doors from the A-pillar, roof, and C-pillar.



Figure 7. Front plane damage to the Honda as documented during the SCI vehicle inspection



Figure 8. Damage to the right front axle resulting in separation of the right front tire due to Event 2 impact with tree



Figure 9. View of right side doors of the Honda at the time of inspection

A residual crush profile was documented to the front bumper beam from the impact to a tree (Event 2). The corresponding direct damage width was 16 cm (6.3 in) beginning at the right edge of the beam extending left. The field-L was 127 cm (50.0 in). The crush measurements at the bumper level were C1 = 2 cm (0.8 in), C2 = 8 cm (3.1 in), C3 = 13 cm (5.1 in), C4 = 16 cm (6.3 in), C5 = 14 cm (5.5 in), and C6 = 12 cm (4.7 in). Maximum crush was observed at the right front bumper corner of the vehicle. The damage pattern extended along the entire right plane. A corresponding CDC of 12FREE09 was assigned to this damage profile.

This corner impact was out-of-scope for analysis by the WinSMASH program. However, a barrier equivalent speed (BES) was calculated using the barrier algorithm of the program for comparison purposes. The calculated BES was 22 km/h (13.6 mph).

The rollover damage (Event 3) was minimal and masked by the physical damage sustained from other events in this collision; therefore, no physical measurements could be taken. There was no significant scratching on the left front doors and left front fender that could be attributed to the rollover (Figure 10). However, a corresponding CDC of 00LDAO9 was assigned to this damage profile. The rollover occurred over a distance of 4.2 meters (13.8 ft) and was interrupted by an impact to the second tree. The lack of rollover damage to the left front door provided evidence that the Honda never fully rotated onto its left side when it struck the second tree.



Figure 10. The Honda's minimal left plane damage from the rollover (Event 3)



Figure 11. The Honda's top plane damage from the impact with tree two (Event 4)



Figure 12. View of the max crush from the impact with tree two (Event 4)

The Honda's top plane damage, as a result of the impact to tree two (Event 4), occurred between the B and C-pillars and extended across the vehicle's entire width (Figure 11). The damage resulted in the left rear door of the Honda crushing laterally and vertically into the second row of the passenger compartment (Figure 12) with displacement of the roof. The maximum vertical crush measured 115 cm (45.3 in) at the vehicle's second row highlighted by the arrow in Figure 12. A corresponding CDC of 00TDDW8 was assigned to this damage profile.

Event Data Recorder

The 2019 Honda Fit had an air bag control module (ACM) mounted under the center instrument panel. The ACM monitored three-dimensional acceleration and roll rate and commanded the

actuation and/or deployment of pretensioners and inflatable supplemental restraint systems. It also had EDR capabilities. During the SCI vehicle inspection, the Honda's EDR data were imaged using the Bosch CDR tool and software version 19.4.1, via connecting directly to the module. The data, later read using software version 21.2, are included as Appendix A.

The requirements for event recording included a change in longitudinal velocity of 0.8 km/h (0.5 mph) or greater over a 20-millisecond timeframe, a change in lateral velocity of 0.8 km/h (0.5 mph) or greater over a 5-millisecond timeframe, an activation of the occupant restraint control algorithm is activated, or a command deployment of any type of non-reversible deployable restraint device (air bag). The EDR typically would record only one event unless the time zero values for several events occurred within five seconds of one another. In this manner, a non-deployment event could be recorded and locked if it occurred within five seconds of a deployment event. By definition, a deployment event was any recognized event in which the control unit commanded the deployment of an air bag system. A non-deployment event would not deploy air bags but could include pretensioner actuation-only commanded events.

Depending on the specific control unit type, the EDR could record approximately 255 milliseconds of data associated with a deployment command. If power supply to the ACM was lost during or following a crash event, all or part of the data may not have been recorded to the EDR's memory.

System status data, inclusive of reported Diagnostic Trouble Codes (DTCs), seat belt usage of front row occupants, and vehicle ignition cycle at the time of the event were recorded. Associated with the recording of each respective event was an asynchronous 5-second pre-crash buffer that recorded several pre-crash parameters in 0.5-second intervals. Data recorded included vehicle speed (mph), accelerator pedal (% Full), service brake (On/Off) status, ABS activity (On/Off), stability control (On, Off, Engaged), steering input (+/- 5 degrees), and engine speed (rpm). Data for the vehicle's several crash avoidance systems were also recorded and are discussed in the *Crash Avoidance Systems* section of this report.

The imaged data contained two recorded events, two deployment event types recorded as Event Record 1 and Event Record 2. The data were imaged on ignition cycle counter 1,834, and the ignition cycle at event counter for both events was 1,834. Therefore, the recovered data were related to the crash under investigation.

Event Record 1

The seat belt status of the driver (sole occupant) was reported "On." The driver's seat track position was reported as not in a forward position. There were no DTCs active when the crash occurred, and no supplemental restraint system warning lights were illuminated. A complete file was recorded in association with the deployment event. This event record was attributed to Event 2 of the SCI reconstruction.

The maximum longitudinal delta V reported was -36 km/h (-22 mph) at 72.5 milliseconds after time zero. The maximum lateral delta V was -5 km/h (-3 mph), which occurred at 72.5 milliseconds after time zero. Associated with the frontal event were the following supplemental restraint system deployment/actuation commands relative to time zero: driver's retractor

pretensioner at 4 ms, driver’s frontal air bag first stage at 5 ms, driver’s frontal air bag second stage at 10 ms, passenger outboard side air bag at 24 ms, and right IC air bag at 24 ms.

The following recorded pre-crash buffer data were reported with the recorded Event Record 1:

Time (sec)	Speed (km/h [mph])	Accel. Pedal (%)	Service Brake	ABS Activity	Steering Input	Engine rpm
-5.0	115 [71]	100	OFF	OFF	10	6,400
-4.5	118 [73]	100	OFF	OFF	-35	6,400
-4.0	120 [75]	100	OFF	OFF	30	6,500
-3.5	122 [76]	100	OFF	OFF	5	6,500
-3.0	124 [77]	100	OFF	OFF	30	6,500
-2.5	126 [78]	100	OFF	OFF	-20	6,400
-2.0	127 [79]	100	OFF	OFF	10	6,500
-1.5	129 [80]	100	OFF	OFF	0	6,400
-1.0	134 [83]	100	OFF	OFF	0	6,500
-0.5	144 [89]	100	OFF	OFF	-10	5,800
0.0	144 [89]	100	OFF	OFF	-10	5,700

Event Record 2

The recorded pre-crash buffer data for Event Record 2 read the same as Event Record 1 with only two differences at AE (0.0 seconds). The steering input was recorded at 0 degree and the engine rpm was recorded at 5,300. Based on the similarities in both Event Records, the SCI investigator was able to determine that the two recorded records were less than 0.5 seconds apart.

Roll rate data were recorded in this event record. The EDR data limitations supported that the presence of roll rate was indicative of rollover algorithm enable. Therefore, Event Record 2 of the EDR could be attributed to Event 3 of the SCI reconstruction. Roll rate data were recorded for a 3-second time period with one second being before the deployment of the IC and two seconds after deployment. Integration of the roll data determined a maximum roll angle of 115.6 degrees and correlated to the one-quarter turn rollover. The sudden change in the roll rate pulse at 0.9 sec was indicative of the interruption of the roll due to Event 4 tree impact in the SCI reconstruction. The maximum longitudinal delta V reported was -23 km/h (-14 mph) at 25 milliseconds after time zero. The maximum lateral delta V was -6 km/h (-4 mph), which occurred at 42.5 milliseconds after time zero.

The EDR reported that the right side impact air bag and right IC air bag deployed at 12 ms. However, those supplemental restraints had previously deployed in Event Record 1. The value of zero (0 ms) was reported for the deployment time of the left side and IC air bags. It was the conclusion of the SCI team that the 12 ms deployment time should be attributed to the left side impact air bag and the left IC air bag. The deployment of the left air bags was consistent with the circumstances of the rollover event.

Interior Damage

There was total loss of integrity to the interior occupant compartment of the Honda associative to the crash (Figure 13). The entire right plane had separated from the vehicle. Additionally, the roof of the Honda was peeled rearward and right, separating at the right and left A- and B-pillars. Although separated, the right front door and right rear door glazing remained intact and were not damaged. All other glazing was disintegrated.



Figure 13. Top view of the Honda depicting the integrity loss

The interior of the Honda sustained severe intrusion damage from the impacts. The right front seat intruded rearward an estimated 25 cm (9.8 in) into the second row and its seatback was forced to the fully reclined position. The left B-pillar intruded laterally an estimated 25 cm (9.8 in) and contacted the driver's seatback. The driver's seatback (Figure 14) was laterally compressed approximately 8 cm (3.1 in) with the seatback intruded estimated as 15 cm (5.9 in). The left rear door (Figure 15) intruded laterally an estimated 40 cm (15.7 in). The left roof side rail intruded vertically an estimated 155 cm (61.0 in).



Figure 14. View of the Honda's deformed driver seatback, cut driver's seat belt, and B-pillar



Figure 15. View of the Honda's left rear door and left roof side rail intrusion

The only discernable occupant contact evidence in the Honda's interior was scuffing to the driver's frontal airbag described in the supplemental restraints section below.

Manual Restraint Systems

The Honda had 3-point continuous loop lap and shoulder seat belt systems for all five seat positions. All used sliding latch plates, and the front row (driver's and front row right) systems were configured with adjustable D-rings. The driver's seat belt retracted onto an emergency locking retractor (ELR), while the other systems all used switchable ELR/automatic locking retractors (ALR). Both front seat belt systems were equipped with retractor pretensioners. Data imaged from the Honda's EDR reported actuation commands for the driver's retractor pretensioners. At the time of the inspection, the SCI Investigator found the driver's seat belt system lying loosely in the driver's seat and cut from the extraction process (Figures 16 & 17).

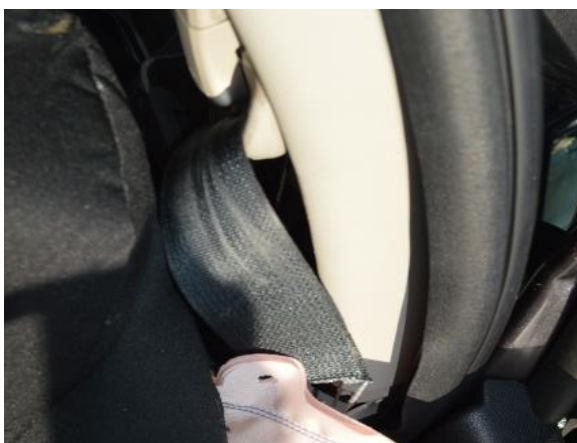


Figure 16. Driver's seat belt system loading evidence and cut by emergency personnel



Figure 17. Driver's seat belt laying loose and cut by emergency personnel

The driver's retractor pretensioner was actuated. There was evidence of loading on the driver's seat belt. Based on the loading evidence, EDR, and SCI observations, it was determined that the driver was belted at the time of the crash.

Supplemental Restraint Systems

The Honda had several supplemental restraints for its occupants. These included a Certified Advanced 208-Compliant frontal air bag system, front seat-mounted side impact air bags, and dual-sensing (side impact and rollover) IC air bags. The driver's frontal, both seat-mounted side impact, and both IC air bags deployed in the crash.

The driver's frontal air bag (Figure 18) deployed from the steering wheel hub-mounted module and through the cover flaps without damage. In its deflated state, the driver's air bag measured 60 cm (23.6 in) in overall diameter. The air bag was vented on its rear aspect by a pair of 4 cm (1.6 in) diameter vent ports, located at the 11 o'clock and 1 o'clock positions. There was crash-related scuffing contact to the upper aspect of the deployed air bag. The left upper quadrant scuff measured 9 cm (3.5 in) long and 5 cm (2.0 in) wide. The right upper quadrant scuff measured 7 cm (2.8 in) long and 8 cm (3.1 in) wide.



Figure 18. View of the driver's frontal air bag during the SCI vehicle inspection



Figure 19. View of the left IC air bag



Figure 20. View of the deployed right IC attached to the separated components of the Honda's right plane

The Honda's IC air bags deployed downward from their respective roof side rail mounting locations through the edge of the headliner. Figure 19 shows the deployed left IC air bag. The left IC air bag was pinned down in components of the vehicle, which hampered full inspection of the air bag. The right IC air bag (Figure 20), which remained attached to the separated right plane, was devoid of contact evidence. Both seatback-mounted side impact air bags deployed and were devoid of contact evidence.

Crash Avoidance Systems

The 2019 Honda Fit had crash avoidance systems were designed to assist/support the driver in both avoiding a potential crash and/or reducing the severity of a crash event should a collision become imminent. The driver was able to turn these crash avoidance systems on or off by pushing a button representative of the crash avoidance system located on the instrument panel, left of the steering column (Figures 21 & 22). The Honda's crash avoidance systems used two distinct sensors to support their functionality, including a radar sensor and an optical camera sensor. The radar sensor was located in the front grille, while the optical sensor was located on the interior of the windshield in front of the rearview mirror.



Figure 21. View of the crash avoidance buttons located on the instrument panel left of the steering column



Figure 22. View of the crash avoidance buttons located on the instrument panel left of the steering column

The Honda's crash avoidance systems included FCW with CMB, RDM, LDW with LKAS, BSD, ACC, daytime running lights, and a rearview video system. The LKAS and RDM systems were forms of LDW with lane keeping, while the CMB was a form of FCW with CIB. The information discussed and concerning the 2019 Honda Fit's crash avoidance systems was obtained from the vehicle owner's manual provided with the vehicle by its manufacturer at the time of its original sale/delivery.¹

The LKAS aids the driver in maintaining the travel lane and provides "visual and tactile alerts when it sensed that the vehicle was drifting from the detected lane." It was functional between speeds of "72-145 km/h (45-90 mph)." It was capable of providing "torque to the steering wheel" to allow the vehicle to "maintain a detected lane" without driver input. If the system sensed that the vehicle was drifting from a detected lane, it provided "vibrations of the steering wheel and illuminated a warning display." Use of the vehicle's turn signals would suspend functionality of the LKAS, such that the driver could change lanes without receiving the system's alerts. The alert functionality of the system would return once the turn signal was off. In addition, the system would not work if the driver removed his or her hands from the steering wheel.

The RDM system functioned in a way similar to the LKAS by providing alerts to prevent the vehicle from "unintentionally departing a detected lane or leaving the roadway." It also was functional between speeds of "72-145 km/h (45-90 mph)." Should the vehicle get too close to detected lane or roadway markings without activation of the turn signal, the system would provide "visual/vibration alerts and apply torque to the steering wheel" to help the driver maintain the lane/roadway. Braking was applied if the "lane markings were solid/continuous." The manufacturer warned that "over-reliance on the systems could result in a collision."

The CMBS could alert the driver of a potential collision with an object and was capable of "reducing the vehicle's speed without driver input" to help reduce the severity if a collision became unavoidable. There were three stages of warnings, which may or may not be progressive dependent upon circumstances and/or settings: (1) "visual and audible warnings," (2) "visual and audible warnings with light brake application," and (3) "visual and audible warnings with strong

¹ Honda Motor Co., Ltd. (2019). *FIT: 2019 owner's guide*.

brake application.” A manufacturer warning stated that the system “could reduce the severity of an unavoidable collision but could not prevent collisions or stop the vehicle automatically.”

The EDR component of the Honda’s ACM was capable of recording data concerning the vehicle’s crash avoidance systems and their respective status/functionality. These data were contained in the imaged CDR report only if the vehicle had the systems and data were recorded.

The reported data included: FCW (warning/not warning), CMBS (engaged/not engaged), CMBS/FCW status (on/off), LDW (warning/not warning), RDM (engaged/not engaged), RDM/LDW status (on/off), ACC (engaged/not engaged), ACC status (on/off), LKAS (engaged/not engaged), LKAS status (on/off), cruise control (engaged/not engaged), and cruise control status (on/off). According to the data, all systems were “Off” except for CMBS and FCW, which were recorded as “On” for all recorded pre-crash intervals. All systems indicated that they were all “Not engaged” and “Not warning,” leading up to the recorded crash event. The recorded data were as follows:

Time (sec)	FCW	CMBS	CMBS/FCW	RDM	RDM	LKAS	LKAS
-5.0	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-4.5	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-4.0	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-3.5	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-3.0	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-2.5	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-2.0	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-1.5	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-1.0	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
-0.5	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off
0.0	Not warning	Not engaged	On	Not engaged	Off	Not engaged	Off

The RDM system was “Off,” indicating that the RDM system would not be expected to engage in order to prevent the lane and roadway departure. With the RDM and LKAS systems off, this allowed the vehicle to depart the roadway without the introduction of any mitigation. It should be noted that the speeds of travel would have allowed the system to be activated had it been “Engaged” since the minimum activation speed was exceeded, and the lane markings were in good condition.

2019 Honda Fit Occupant

Driver Demographics

Age/sex: 60 years/female
 Height: 170 cm (67 in)
 Weight: 97 kg (214 lb)
 Eyewear: Unknown
 Seat type: Forward-facing bucket seat with adjustable head restraint
 Seat track position: Between forwardmost and middle track position
 Manual restraint usage: 3-point lap and shoulder seat belt with retractor and pretensioners (actuated)
 Usage source: Vehicle inspection, EDR data
 Air bags: Frontal, seat-mounted side impact, and IC air bags available and deployed
 Alcohol/drug data: None
 Egress from vehicle: Fatal prior to removal from the vehicle
 Transport from scene: Not medically transported
 Type of medical treatment: None

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Partial thickness laceration at junction of pons and medulla of brainstem	140212.6	Tandem IPC Initial: Left Air Bag – Left roof rail Secondary: Roof – Roof left side rail	Possible Probable
2	Multiple, up to 0.3 cm hemorrhages in pons	140204.5	Tandem IPC Initial: Left Air Bag – Left roof rail Secondary: Roof – Roof left side rail	Possible Probable
3	Multiple skull base fractures in anterior, middle, and posterior compartments, including hinge fracture	150206.4	Tandem IPC Initial: Left Air Bag – Left roof rail Secondary: Roof – Roof left side rail	Possible Probable
4	Moderate-to-severe diffuse subarachnoid hemorrhages	140693.2	Tandem IPC Initial: Left Air Bag – Left roof rail Secondary: Roof – Roof left side rail	Possible Probable
5	9.0 x 4.5 cm pleural and parenchymal hemorrhage on right upper and middle lobes of lung; 5.5 x 4.0 cm	441411.3	Tandem IPC Initial: Interior – Shoulder portion of belt restraint	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
5 (cont.)	pleural and parenchymal hemorrhage on left upper lobe of lung		Secondary: Left Air Bag – Steering wheel hub Tertiary: Front – Steering wheel (combination of rim and hub/spoke)	Possible Possible
6	Rib fractures: right anterior 2nd, right lateral 2-6, left anterior 2-3, left lateral 6-7	450203.3	Tandem IPC Initial: Interior – Shoulder portion of belt restraint Secondary: Left Air Bag – Steering wheel hub Tertiary: Front – Steering wheel (combination of rim and hub/spoke)	Probable Possible Probable
7	Sternum fracture	450804.2	Tandem IPC Initial: Interior – Shoulder portion of belt restraint Secondary: Left Air Bag – Steering wheel hub Tertiary: Front – Steering wheel (combination of rim and hub/spoke)	Certain Possible Possible
8	Multiple lacerations of serosal surface of sigmoid colon, NFS	540820.2	Isolated Interior – Lap portion of belt restraint	Probable
9	Multiple lacerations of mesentery, NFS	542020.2	Isolated Interior – Lap portion of belt restraint	Probable
10	Multiple hemorrhages to serosal surface of bladder	540610.2	Isolated Interior – Lap portion of belt restraint	Probable
11	3.8 x 0.9 cm laceration on left parietal scalp	110602.1	Isolated Roof – Roof left side rail	Probable
12	Left temporalis muscle hemorrhage; 2.5 x 5.6 cm ecchymosis on right and left upper and lower eyelids; 2.8 x 2.0 cm contusion on left ear	210402.1	Isolated Roof – Roof left side rail	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
13	Multiple, up to 3.7 cm abrasions on skin of face	210202.1	Isolated Left Air Bag – Steering wheel hub	Possible
14	0.3 cm hemorrhage on upper frenulum; multiple, up to 1.1 cm lacerations on oral mucosa of lower lip	243099.1	Isolated Left Air Bag – Steering wheel hub	Possible
15	Multiple, up to 10.0 cm, curvilinear red abrasion on left side of neck	310202.1	Isolated Interior – Shoulder portion of belt restraint	Certain
16	Contusion over sternum; 6.0 x 3.0 cm contusion on right side of chest	410402.1	Isolated Interior – Shoulder portion of belt restraint	Certain
17	Multiple, up to 10.0 cm, abrasions to left and right sides of chest	410202.1	Isolated Left Air Bag – Steering wheel hub	Possible
18	Multiple, up to 3.5 cm contusions to right and left upper quadrant of abdomen	510402.1	Isolated Front – Steering wheel (combination of rim and hub/spoke)	Possible
19	Few, up to 5.4 cm linear abrasions on lateral aspect of right side of abdomen	510202.1	Isolated Interior – Shoulder portion of belt restraint	Probable
20	14.0 x 0.3 cm curvilinear laceration on posterior aspect of right shoulder	710602.1	Isolated Roof – Roof left side rail	Probable
21	14.0 x 0.3 cm curvilinear laceration on posterior aspect of right arm	710602.1	Isolated Roof – Roof left side rail	Probable
22	3.2 x 2.8 cm contusion on posterior left hand	710402.1	Isolated Left Door Panel – Left forward upper quadrant	Possible
23	Multiple, up to 17.0 cm contusions to right upper extremity	710402.1	Isolated Roof – Roof left side rail	Probable
24	Multiple, up to 1.0 cm abrasions to right upper extremity	710202.1	Isolated Roof – Roof left side rail	Probable
25	7.0 x 0.2 cm laceration on medial aspect of right thigh	810602.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable
26	7.0 x 0.2 cm laceration on medial aspect of right knee	810602.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
27	7.0 x 0.2 cm laceration on medial aspect of right shin	810602.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable
28	2.0 x 1.1 cm laceration on medial aspect of left leg; 4.0 x 0.9 cm laceration on lateral aspect of left leg	810602.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable
29	Multiple, up to 11.5 cm contusion on right lower extremity	810402.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable
30	Multiple, up to 11.5 cm contusion on left lower extremity	810402.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable
31	Multiple, up to 1.5 cm abrasions to right lower extremity	810202.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable
32	Multiple, up to 1.5 cm abrasions to left lower extremity	810202.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Probable

Source: autopsy report (internal).

Driver Kinematics

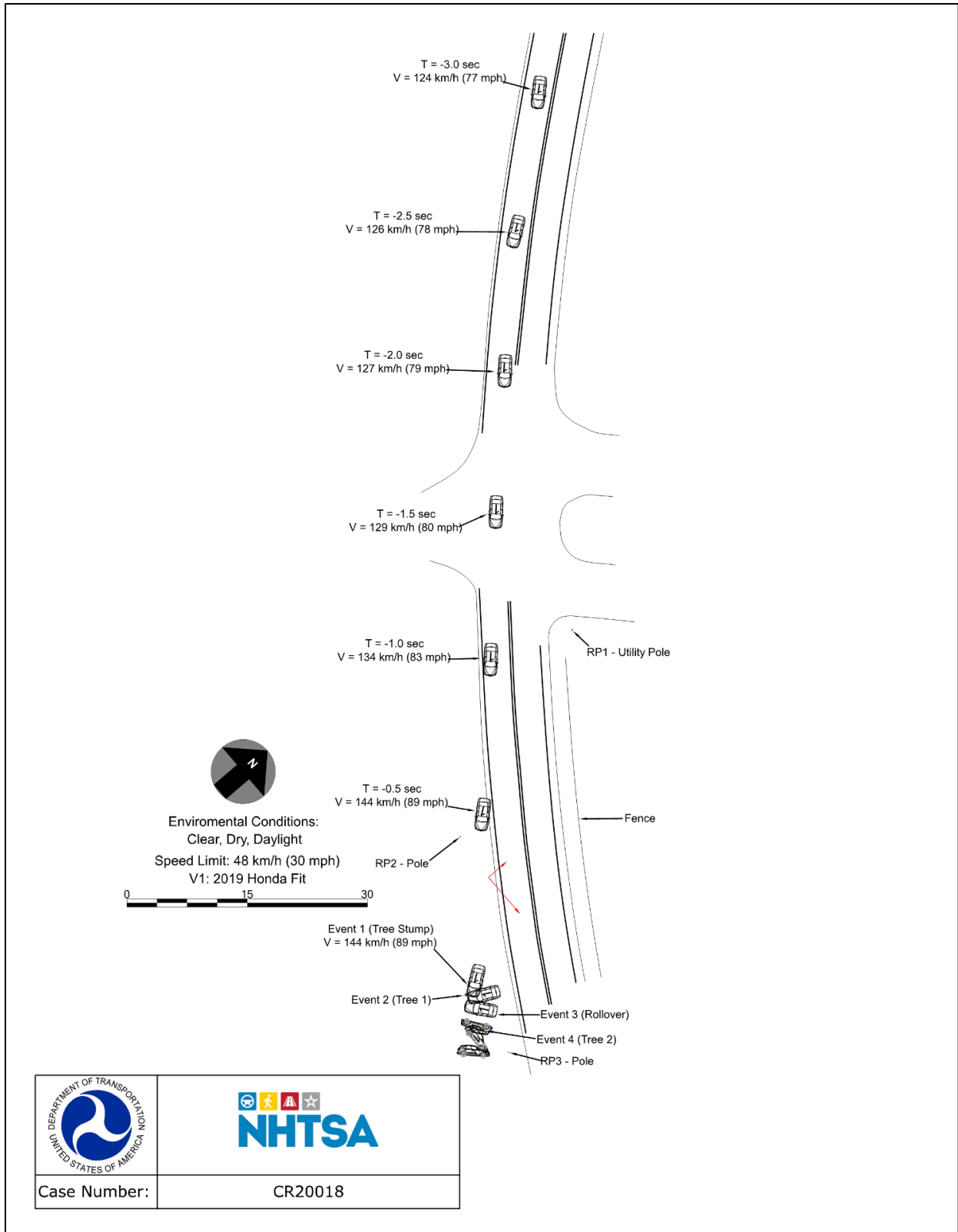
The 60-year-old female driver was seated with the track position adjusted between the forwardmost and middle track position. The driver used the available 3-point lap and shoulder seat belt system for manual restraint. Her use of the seat belt system was determined by on-scene photo images and corroborated by the SCI vehicle inspection as well as data imaged from the vehicle’s EDR.

The driver operated the Honda southbound on the two-lane roadway. Local law enforcement interviewed the sister and nephew of the driver, who both said she had previously been involved in incidents resulting from her passing out due to her medical condition. Additionally, local law enforcement took an on-scene statement from a witness who stated that he didn’t see a driver in the vehicle as it passed where he was standing. With the information from the witness and the driver’s family members, it seems likely that the driver suffered a medical episode, resulting in her accelerating the vehicle, steering left and right, then departing the roadway to the right. The driver had the available crash avoidance systems disabled, resulting in no alerts or maneuvers from these safety systems to mitigate the roadway departure.

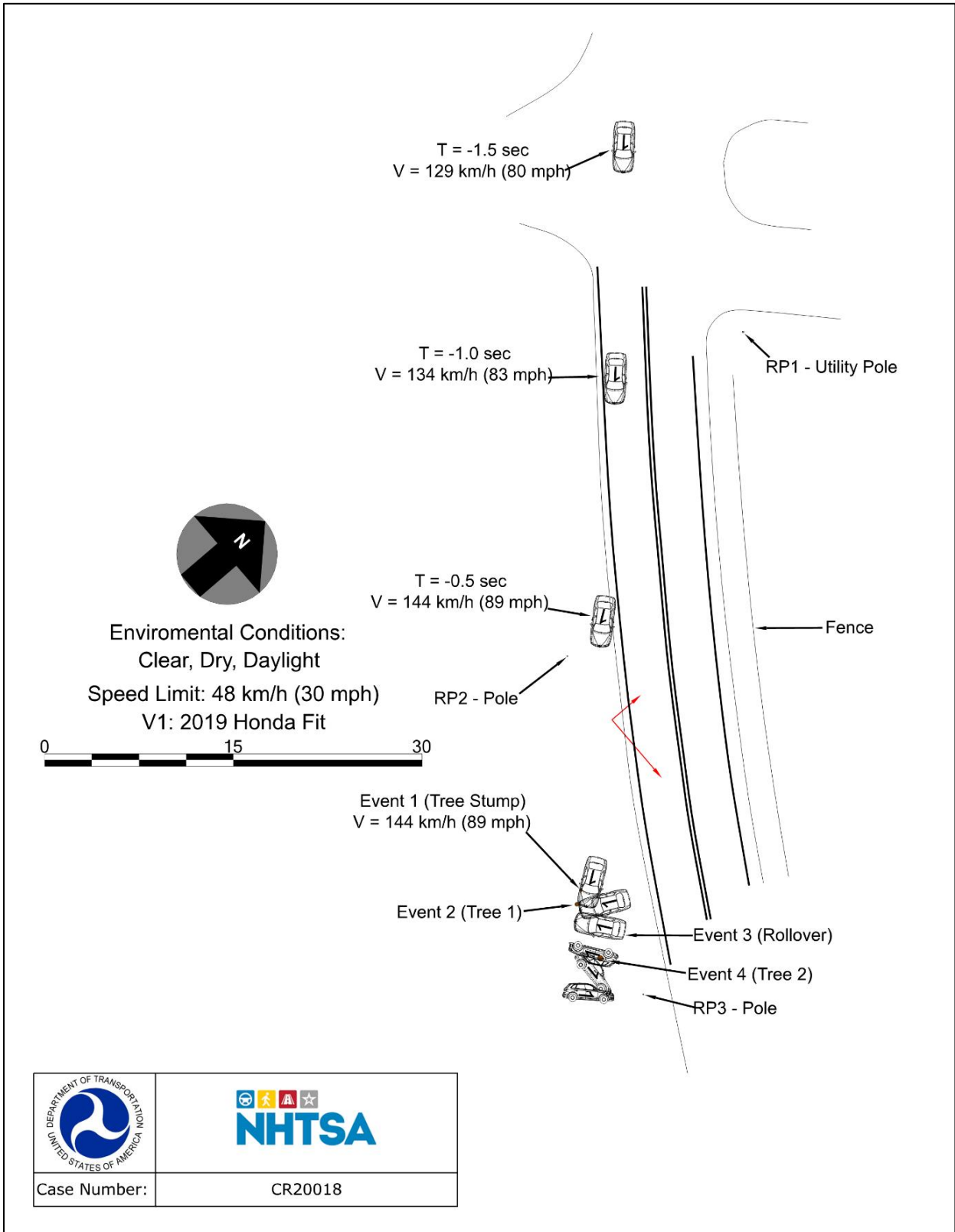
Upon striking the first tree (Event 2), the driver responded in a forward trajectory, resulting in the loading of the driver’s seat belt, the driver’s frontal air bag, and the steering wheel with her

chest. This loading resulted in several rib fractures, a sternum fracture, and lung contusions. Other injuries that occurred due to this event include lacerations to the sigmoid colon, mesentery, and bladder due to lap belt loading. Following this event, the vehicle rotated clockwise and initiated its left side-leading roll, which resulted in the deployment of the driver's seat-mounted side impact and IC air bags. The driver responded to the rollover dynamics with a lateral trajectory. In the process of the rollover, the vehicle struck a second tree. This tree impact interrupted the rollover, causing extensive intrusion to the left roof side rail, left B-pillar, and left rear door. The driver responded to this tree impact with a vertical trajectory, and her head struck the left roof side rail via the IC air bag, causing extensive skull fractures and brain injuries. The driver was pronounced deceased at the scene.

Crash Diagram



Crash Diagram: A Detailed View



Appendix A: Event Data Recorder Report for 2019 Honda Fit ²

² The EDR report contained in this technical report was imaged using the version of the Bosch CDR software current 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	3HGGK5H80KM*****
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CR20018_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 19.4.1
Imaged with Software Licensed to (Company Name)	Company Name information was removed when this file was saved without VIN sequence number
Reported with CDR version	Crash Data Retrieval Tool 21.2
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	2

Comments

No comments entered.

Data Limitations

General Information:

These limitations are intended to assist you in reading the event data that has been imaged from the vehicle's SRS control unit. They contain general information and are not specific to this particular event. Event data should be considered in conjunction with other available physical evidence from the vehicle and scene.

Honda and Acura passenger vehicles designated as 2013 or later model year production are designed to be compatible with the Bosch CDR tool. Only some 2012 model year vehicles are compatible with the Bosch CDR tool.

Recorded Crash Events:

Data for front, side, rear and rollover events can be recorded as either non-deployment or deployment events. Both types of events can contain pre-crash and crash data.

- A non-deployment event is recorded if the change in longitudinal or lateral velocity equals or exceeds 8km/h over a 150ms timeframe or another type of non-reversible deployable restraint device other than a front, side, or side curtain airbag (e.g. seatbelt pretensioner) is commanded to deploy. Except as indicated below, non-deployment events are not locked into memory and can be over-written by subsequent non-deployment or deployment events.
- A deployment event is recorded if front airbag(s), side airbag(s), or side curtain airbag(s) are commanded to deploy. Deployment events are locked into memory and cannot be over-written.

The SRS control unit typically records only one event. Two events can be recorded if the T0 (time zero) values for each event occur within 5 seconds of each other. Therefore, a non-deployment event can be recorded and locked if it occurs within 5 seconds of a deployment event.

T0 is established by whichever of the following occurs first: (1) the change in longitudinal velocity at the SRS control unit equals or exceeds 0.8km/h over a 20ms timeframe; or (2) the change in lateral velocity at the SRS control unit equals or exceeds 0.8km/h over a 5ms timeframe; or (3) the occupant restraint control algorithm is activated; or (4) a commanded deployment of any type of non-reversible deployable restraint device (e.g. airbag or seatbelt pretensioner). If the time to deploy equals 0, then the command to deploy occurred at T0 or the device was not commanded to deploy during the event.

TEnd (end of event) is established by whichever of the following occurs first: (1) the change in longitudinal and lateral Delta V equals or falls below 0.8km/h over a 20ms timeframe; or (2) the occupant restraint control algorithm resets; or (3) time from T0 exceeds 300ms.

Data:

- Data recorded by the SRS control unit and imaged by the CDR tool is displayed relative to T0, not the time at which the vehicle made contact with another vehicle or object.
- Pre-crash data is recorded at 2 samples per second within the 5 seconds before T0. The sampling point at 0.0 is taken at T0 and is asynchronous with the other sample points. The time between -0.5 and 0.0 is not recorded and is between 1 and 500ms.
- Delta V data is recorded at 100 samples per second from T0 to 250ms or T0 to TEnd plus 30ms.
- Acceleration data is recorded at 100 samples per second from T0 to 250ms.
- Delta V, longitudinal reflects the change in velocity that the SRS control unit experienced in the longitudinal direction during the recorded portion of the event and is not the speed the vehicle was traveling before the event.
- Depending on the severity of the event and the accelerometer characteristics, saturation of the SRS control unit longitudinal or lateral accelerometers may occur, decreasing the recorded Delta V value.

- Time, accelerometer range exceeded is recorded if saturation of the SRS control unit longitudinal, lateral and/or normal (vertical) accelerometer occurs. The recorded data is the time at which the sensor range is first exceeded.
- The maximum recording capability of Deployment Command Data is 254ms or 255ms depending on vehicle model. A recorded value of 254ms or 255ms may indicate that the recording maximum was exceeded. In this case, the deployment command may have occurred between the recorded time and TEnd.
- Speed, vehicle indicated data is the speed indicated to the driver by the speedometer, not actual vehicle ground speed. Data accuracy can be affected by various factors, including but not limited to the following:
 - Significant changes in tire size from the factory setting
 - Wheel lockup or spin
 - Data latency or filtering and hysteresis within the speedometer module
- Accelerator pedal position, percent full is the ratio of accelerator pedal position compared to the fully depressed position.
- PCM (Powertrain Control Module) derived accelerator pedal position, percent full may differ from the accelerator pedal position, percent full under circumstances such as brake override activation or cruise control system engagement. These circumstances are based on vehicle equipment application and vary by model.
- Steering input angle is recorded in 5 degree increments.
- Side air bag suppression system status, right front passenger is recorded when the vehicle is equipped with the Occupant Position Detection System (OPDS).
- Occupant size classification, right front passenger airbag suppressed data is recorded as yes (suppressed) if the front passenger seat weight sensor system determined the passenger seat was empty or occupied by a child-size occupant.
- EV mode data records the vehicle powertrain status, not a driver selected operation mode. EV mode is recorded as On when the vehicle is moving and the internal combustion engine is not operating. EV mode may be recorded as On or Off when the vehicle is stopped.
- If power to the SRS control unit is lost during an event, all or part of the data may not be recorded.

Roll Rate Data:

- Vehicle roll rate data is recorded separately from the non-deployment and deployment events as described above. Therefore, the T0 for the roll rate data may differ from the T0 for the other data in this report.
- Roll rate recording trigger (T0) is established by whichever of the following occurs first: (1) a rollover algorithm ON judgment (SRS control unit decision to command deployment); or (2) a change in relative roll angle at the SRS control unit equal to or exceeding 30 degrees (roll angle is not measured, but is calculated from the roll rate data); or (3) the rollover algorithm is activated.
- Once a recording trigger has been met, roll rate data is recorded for one rollover event at 10 samples per second from 1 second before to 2 seconds after T0. If a roll angle trigger is satisfied without a rollover algorithm ON judgment, the recorded roll rate data is unlocked and can be over-written by a subsequent rollover event. Roll rate data triggered by or recorded during a rollover algorithm ON judgment is locked into memory and cannot be over-written.
- If roll rate is detected at the SRS control unit during a non-deployment or deployment event but the recording trigger has not been satisfied, no roll rate data will be recorded. A graph of roll rate data will only be present in this report if roll rate data is recorded.

Data Element Sign Convention:

Except as noted below, all data is displayed in SAE J211 sign convention. The following table provides an explanation of the sign notation for data elements that may be included in this CDR report. All directional references to sign notation are from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.

Data element name	Positive sign indicates
Longitudinal Acceleration	Forward direction acceleration
Delta-V, Longitudinal	Forward direction acceleration
Lateral Acceleration	Left to right direction acceleration
Delta-V, Lateral	Left to right direction acceleration
Normal (Vertical) Acceleration	Downward direction acceleration
Vehicle Roll Rate*	See roll rate graph and data (if recorded)
Steering Input Angle*	Left Turn

*Not SAE J211 sign convention

Data Source:

All recorded data is measured and calculated within the SRS control unit except for the following parameters (if applicable) which are transmitted via the vehicle's communication network to the SRS control unit:

- Speed, vehicle indicated
- Accelerator pedal position, percent full
- Service brake
- ABS activity
- Stability control
- Steering input angle
- Engine RPM
- PCM derived accelerator pedal position, percent full
- EV mode
- Forward Collision Warning
- Collision Mitigation Braking System information
- Lane Keeping Assist System information
- Lane Departure Warning
- Road Departure Mitigation information
- Cruise Control status
- Adaptive Cruise Control status

Depending on vehicle feature content, capability, or conditions described above, the following items may not be recorded. If these items are not recorded, they will not be present in this document.

- EV mode

- Forward Collision Warning
- Collision Mitigation Braking System information
- Lane Keeping Assist System information
- Lane Departure Warning
- Road Departure Mitigation information
- Cruise Control status
- Adaptive Cruise Control status

Hexadecimal Data:

All data that has been specified for imaging is shown in the hexadecimal data section of this report. However, not all of this data is translated by the CDR tool. The SRS control unit may contain additional data that is not retrievable by the CDR tool.

Data Imaging:

If the SRS control unit is imaged outside of the vehicle, ensure that it is not moved, tilted or turned while connected to the CDR tool. Also, after imaging is complete, wait 3 minutes after removing the CDR tool before moving the SRS control unit. Not following this guideline could cause current non-deployment event data to be overwritten and a new event to be recorded. Current fault status could also be altered if the SRS control unit is imaged outside of the vehicle.

04002_HondaSRS_GEN2_r002

System Status at Retrieval

EDR Version	1.3.2.0
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System Status at Event (Event Record 1)

Multi-Event, Number of Events (1, 2)	1
Complete File Recorded (Yes/No)	Yes
Ignition Cycle, Download	1835
Maximum Delta-V, Longitudinal (MPH [km/h])	-22 [-36]
Time, Maximum Delta-V, Longitudinal (msec)	72.5
Maximum Delta-V, Lateral (MPH [km/h])	-3 [-5]
Time, Maximum Delta-V, Lateral (msec)	72.5
Time, Maximum Delta-V, Resultant (msec)	72.5
Time, Accelerometer Range Exceeded, Longitudinal (msec)	31.5
Time, Accelerometer Range Exceeded, Lateral (msec)	19.5
Time, Accelerometer Range Exceeded, Normal (msec)	0

Deployment Command Data (Event Record 1)

Pretensioner Deployment, Time to Fire, Driver (msec)	4
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	0
Lap Pretensioner Deployment, Time to Fire, Driver (msec)	7
Frontal Air Bag Deployment, Time to Deploy First Stage, Driver (msec)	5
Frontal Air Bag Deployment, Time to Deploy First Stage, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (msec)	10
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (msec)	0
Safety Belt Adaptive Load Limiter, Time to Initiation, Right Front Passenger (msec)	0
Side Air Bag Deployment, Time to Deploy, Driver (msec)	0
Side Air Bag Deployment, Time to Deploy, Right Front Passenger (msec)	24
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Driver Side (msec)	0
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Right Side (msec)	24
Frontal Air Bag Deployment, 2nd Stage Disposal, Driver (Yes/No)	No
Frontal Air Bag Deployment, 2nd Stage Disposal, Right Front Passenger (Yes/No)	No

Pre-Crash Data -1 sec (Event Record 1)

Safety Belt Status, Driver	On
Safety Belt Status, Right Front Passenger	Off
Seat Track Position Switch, Foremost, Status, Driver	No
Occupant Size Classification, Right Front Passenger Airbag Suppressed (Yes/No)	Yes
Frontal Air Bag Warning Lamp (On, Off)	Off
Ignition Cycle, Crash	1834

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1) - Table 1 of 3

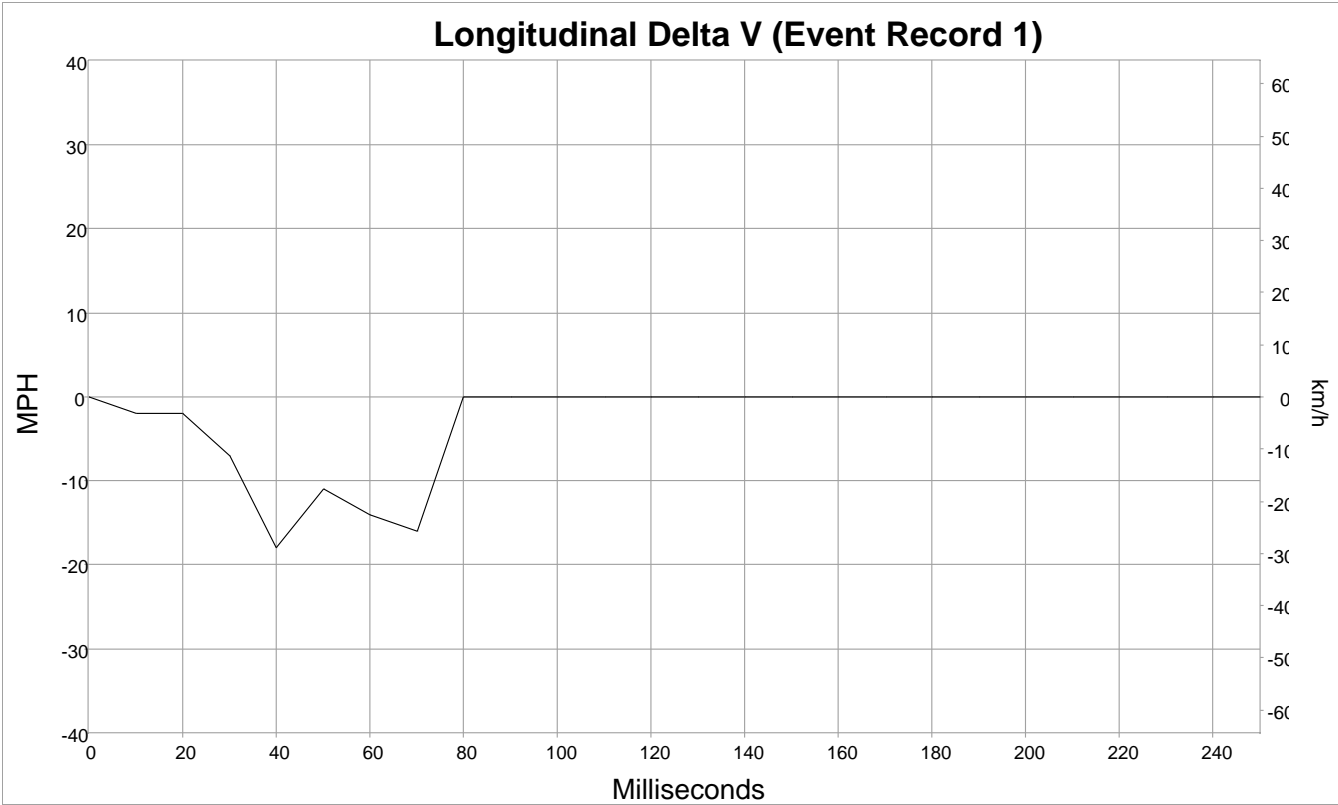
Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal Position, % full	Service Brake (On, Off)	ABS Activity (On, Off)	Stability Control (On, Off, Engaged)	Steering Input (deg)	Engine RPM
-5.0	71 [115]	100	Off	Off	On Non-Engaged	10	6,400
-4.5	73 [118]	100	Off	Off	On Non-Engaged	-35	6,400
-4.0	75 [120]	100	Off	Off	On Non-Engaged	30	6,500
-3.5	76 [122]	100	Off	Off	On Non-Engaged	5	6,500
-3.0	77 [124]	100	Off	Off	On Non-Engaged	30	6,500
-2.5	78 [126]	100	Off	Off	On Non-Engaged	-20	6,400
-2.0	79 [127]	100	Off	Off	On Non-Engaged	10	6,500
-1.5	80 [129]	100	Off	Off	On Non-Engaged	0	6,400
-1.0	83 [134]	100	Off	Off	On Non-Engaged	0	6,500
-0.5	89 [144]	100	Off	Off	On Engaged	-10	5,800
0.0	89 [144]	100	Off	Off	On Engaged	-10	5,700

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1) - Table 2 of 3

Time Stamp (sec)	PCM Derived Accelerator Pedal Position, % full	Forward Collision Warning (Not Warning/ Warning)	Collision Mitigation Braking System (Not Engaged/ Engaged)	Collision Mitigation Braking System, Forward Collision Warning (On/Off)	Lane Departure Warning (Not Warning/ Warning)	Road Departure Mitigation (Not Engaged/ Engaged)	Road Departure Mitigation, Lane Departure Warning (On/Off)
-5.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-4.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-4.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-3.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-3.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-2.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-2.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-1.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-1.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-0.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
0.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off

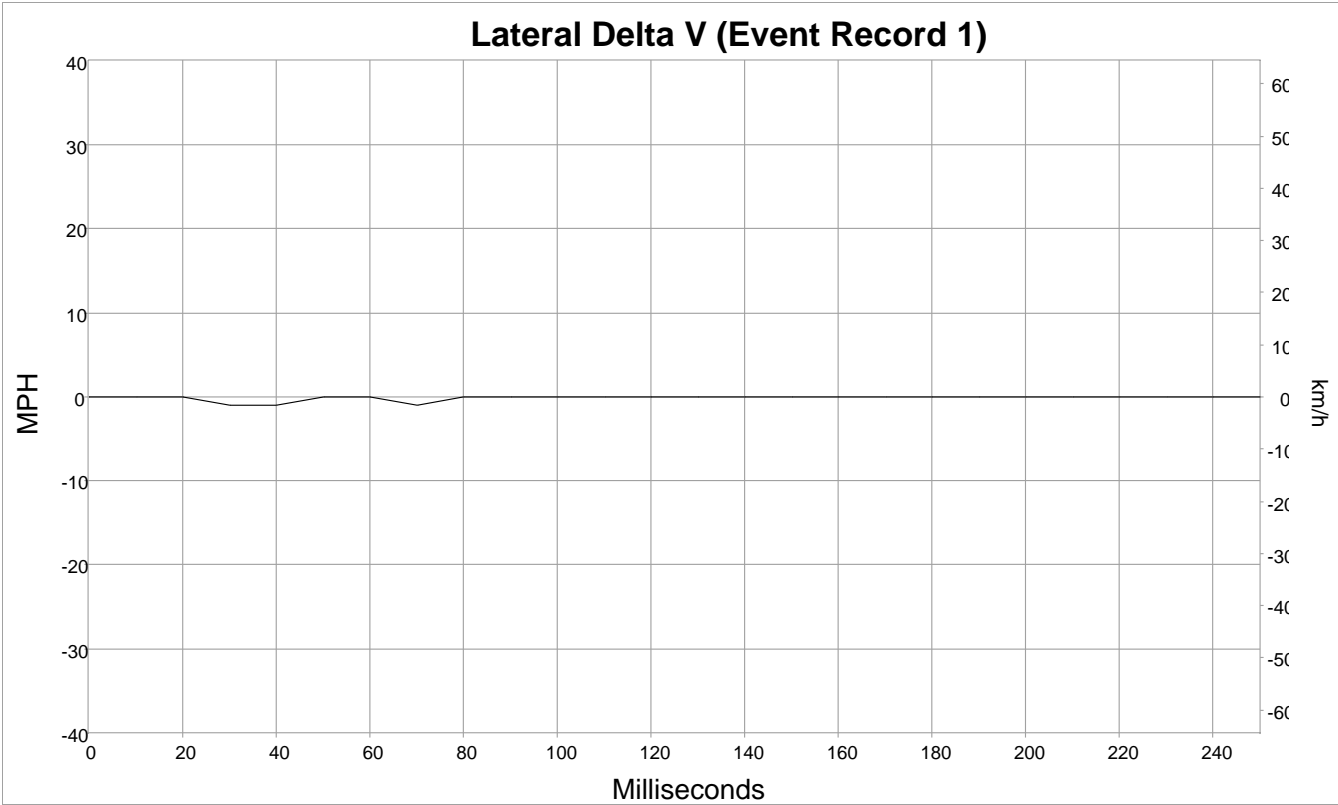
Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1) - Table 3 of 3

Time Stamp (sec)	Adaptive Cruise Control (Not Engaged/ Engaged)	Adaptive Cruise Control (On/Off)	Lane Keeping Assist (Not Engaged/ Engaged)	Lane Keeping Assist (On/Off)	Cruise Control (Not Engaged/ Engaged)	Cruise Control (On/Off)
-5.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-4.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-4.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-3.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-3.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-2.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-2.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-1.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-1.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-0.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
0.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off



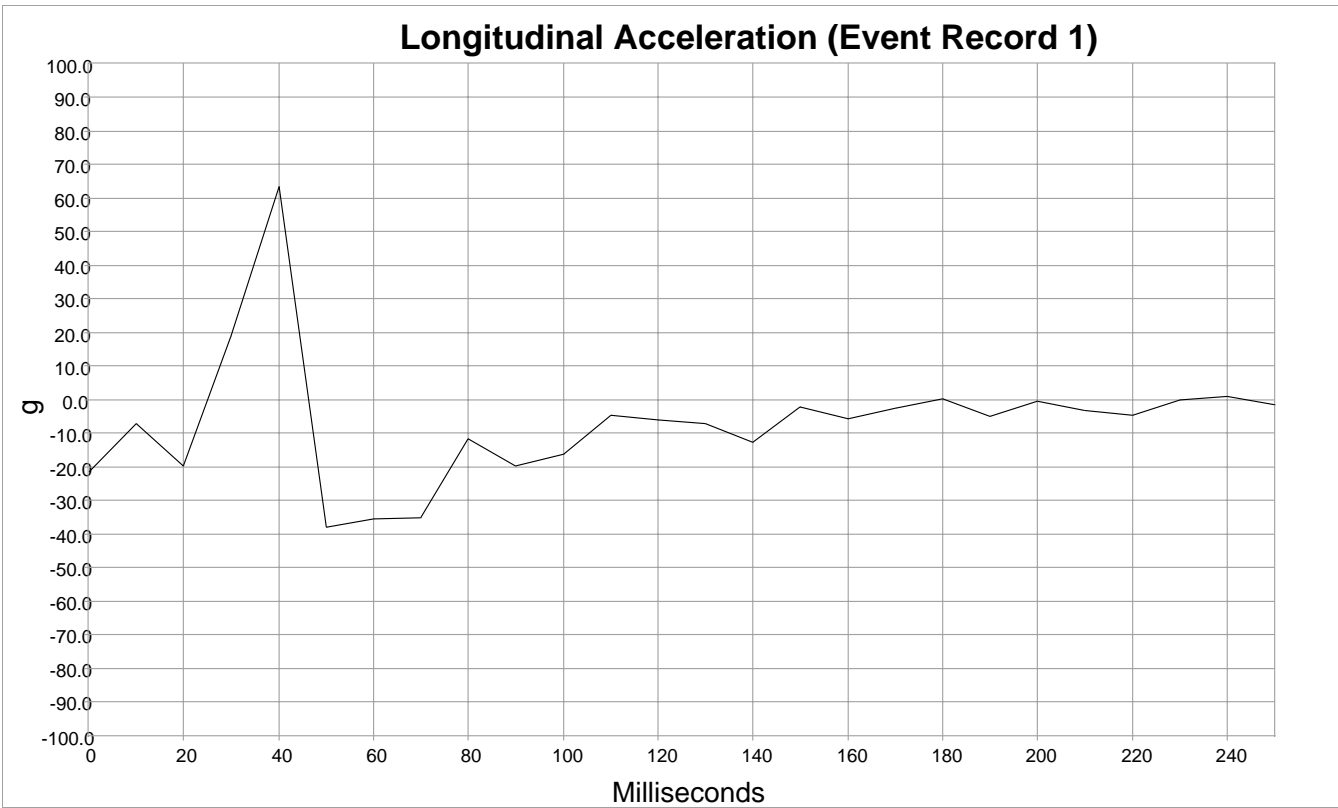
Longitudinal Delta V (Event Record 1)

Time (msec)	MPH [km/h]
0	0 [0]
10	-2 [-3]
20	-2 [-3]
30	-7 [-11]
40	-18 [-29]
50	-11 [-18]
60	-14 [-23]
70	-16 [-25]
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]



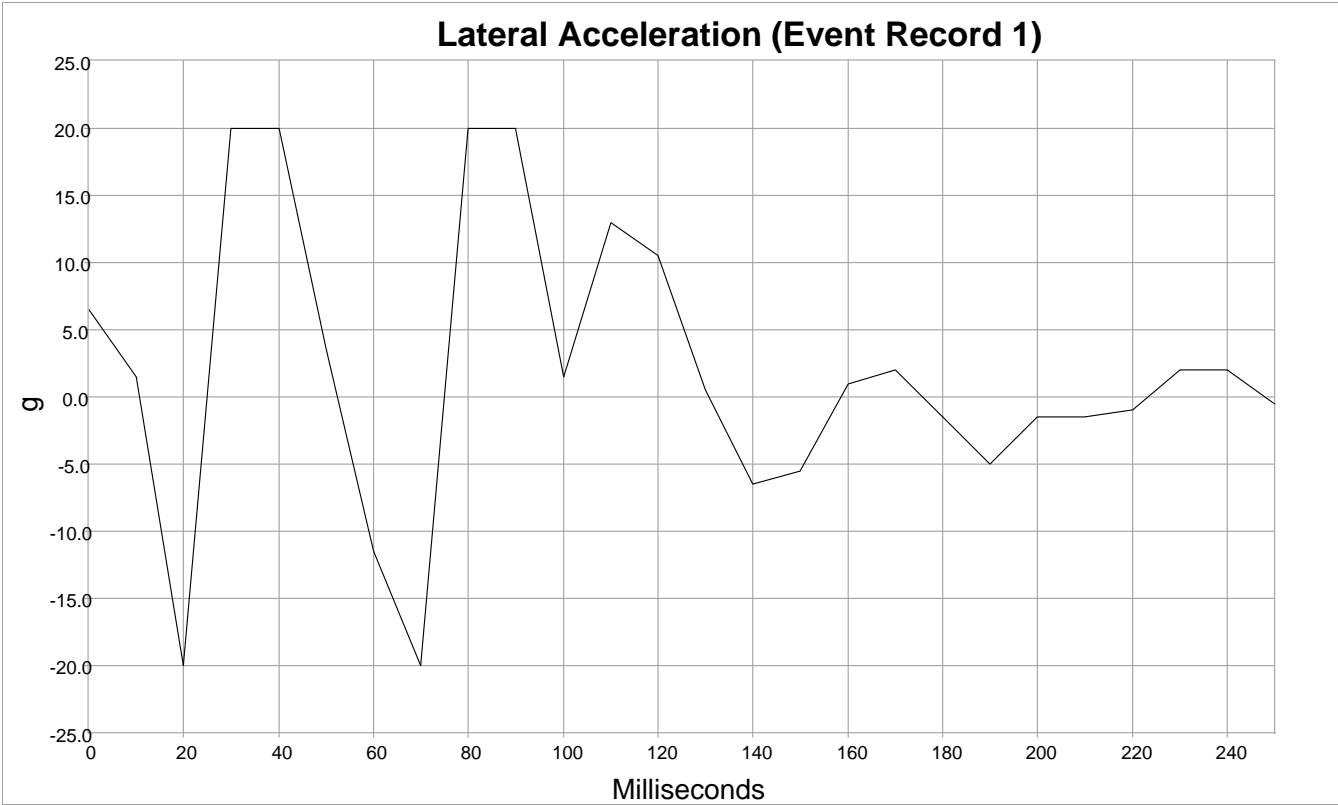
Lateral Delta V (Event Record 1)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	0 [0]
30	-1 [-1]
40	-1 [-1]
50	0 [0]
60	0 [0]
70	-1 [-2]
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]



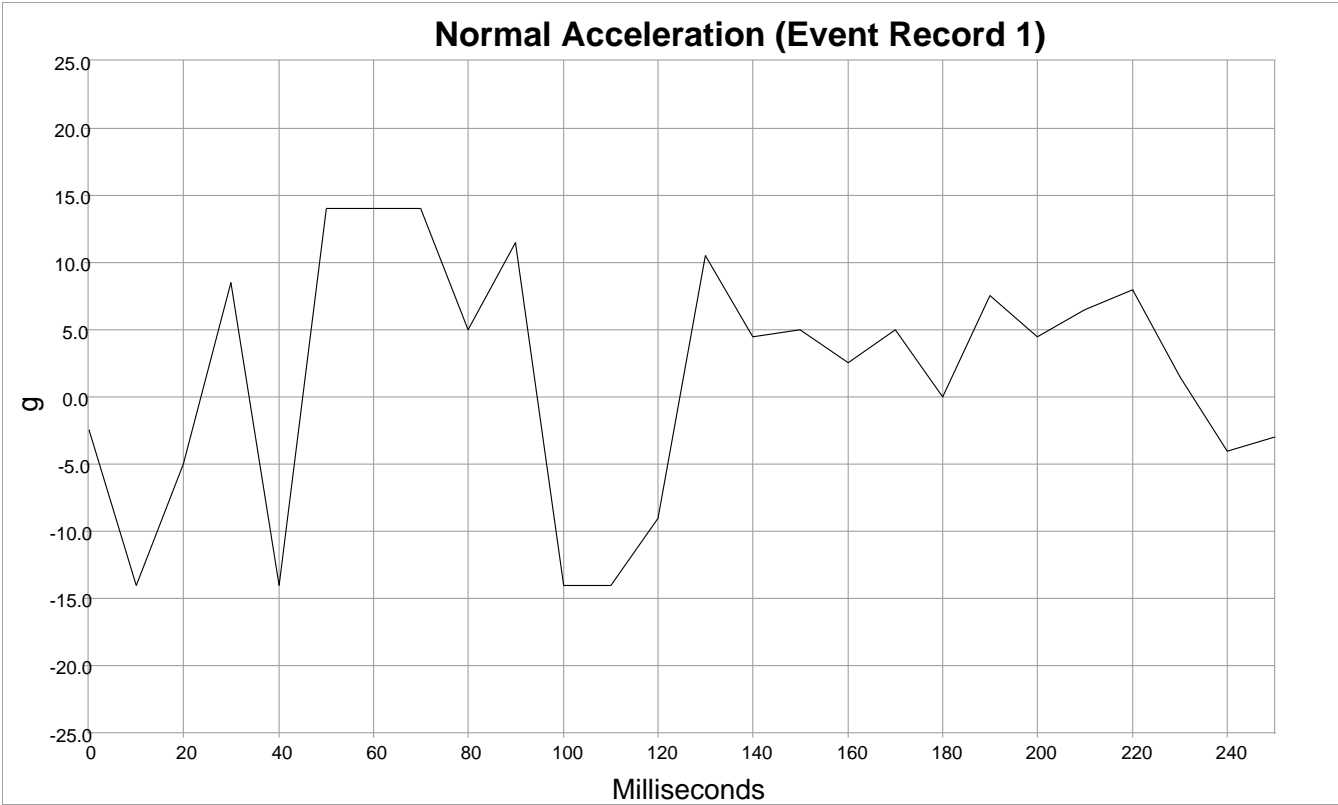
Longitudinal Acceleration (Event Record 1)

Time (msec)	g
0	-21.5
10	-7.0
20	-19.5
30	19.0
40	63.5
50	-38.0
60	-35.5
70	-35.0
80	-11.5
90	-19.5
100	-16.0
110	-4.5
120	-6.0
130	-7.0
140	-12.5
150	-2.0
160	-5.5
170	-2.5
180	0.5
190	-5.0
200	-0.5
210	-3.0
220	-4.5
230	0.0
240	1.0
250	-1.5



Lateral Acceleration (Event Record 1)

Time (msec)	g
0	6.5
10	1.5
20	-20.0
30	20.0
40	20.0
50	3.5
60	-11.5
70	-20.0
80	20.0
90	20.0
100	1.5
110	13.0
120	10.5
130	0.5
140	-6.5
150	-5.5
160	1.0
170	2.0
180	-1.5
190	-5.0
200	-1.5
210	-1.5
220	-1.0
230	2.0
240	2.0
250	-0.5



Normal Acceleration (Event Record 1)

Time (msec)	g
0	-2.5
10	-14.0
20	-5.0
30	8.5
40	-14.0
50	14.0
60	14.0
70	14.0
80	5.0
90	11.5
100	-14.0
110	-14.0
120	-9.0
130	10.5
140	4.5
150	5.0
160	2.5
170	5.0
180	0.0
190	7.5
200	4.5
210	6.5
220	8.0
230	1.5
240	-4.0
250	-3.0

System Status at Event (Event Record 2)

Multi-Event, Number of Events (1, 2)	2
Complete File Recorded (Yes/No)	Yes
Ignition Cycle, Download	1835
Time from Event 1 to 2 (sec)	0
Maximum Delta-V, Longitudinal (MPH [km/h])	-14 [-23]
Time, Maximum Delta-V, Longitudinal (msec)	25.0
Maximum Delta-V, Lateral (MPH [km/h])	4 [6]
Time, Maximum Delta-V, Lateral (msec)	42.5
Time, Maximum Delta-V, Resultant (msec)	25.0
Time, Accelerometer Range Exceeded, Longitudinal (msec)	0
Time, Accelerometer Range Exceeded, Lateral (msec)	2.5
Time, Accelerometer Range Exceeded, Normal (msec)	0

Deployment Command Data (Event Record 2)

Pretensioner Deployment, Time to Fire, Driver (msec)	0
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	0
Lap Pretensioner Deployment, Time to Fire, Driver (msec)	0
Frontal Air Bag Deployment, Time to Deploy First Stage, Driver (msec)	0
Frontal Air Bag Deployment, Time to Deploy First Stage, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (msec)	0
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (msec)	0
Safety Belt Adaptive Load Limiter, Time to Initiation, Right Front Passenger (msec)	0
Side Air Bag Deployment, Time to Deploy, Driver (msec)	0
Side Air Bag Deployment, Time to Deploy, Right Front Passenger (msec)	12
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Driver Side (msec)	0
Side Curtain/Tube Air Bag Deployment, Time to Deploy, Right Side (msec)	12
Frontal Air Bag Deployment, 2nd Stage Disposal, Driver (Yes/No)	No
Frontal Air Bag Deployment, 2nd Stage Disposal, Right Front Passenger (Yes/No)	No

Pre-Crash Data -1 sec (Event Record 2)

Safety Belt Status, Driver	On
Safety Belt Status, Right Front Passenger	Off
Seat Track Position Switch, Foremost, Status, Driver	No
Occupant Size Classification, Right Front Passenger Airbag Suppressed (Yes/No)	Yes
Frontal Air Bag Warning Lamp (On, Off)	Off
Ignition Cycle, Crash	1834

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 2) - Table 1 of 3

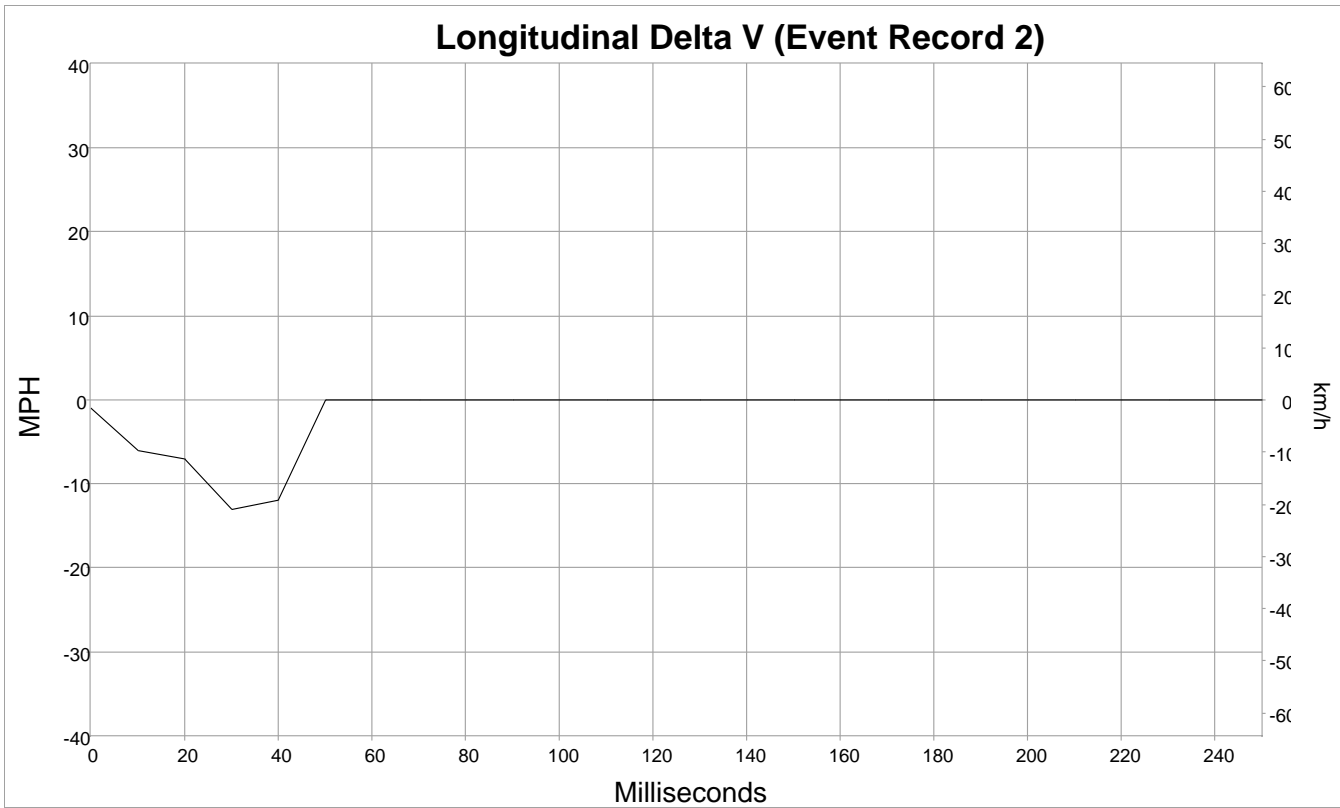
Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal Position, % full	Service Brake (On, Off)	ABS Activity (On, Off)	Stability Control (On, Off, Engaged)	Steering Input (deg)	Engine RPM
-5.0	71 [115]	100	Off	Off	On Non-Engaged	10	6,400
-4.5	73 [118]	100	Off	Off	On Non-Engaged	-35	6,400
-4.0	75 [120]	100	Off	Off	On Non-Engaged	30	6,500
-3.5	76 [122]	100	Off	Off	On Non-Engaged	5	6,500
-3.0	77 [124]	100	Off	Off	On Non-Engaged	30	6,500
-2.5	78 [126]	100	Off	Off	On Non-Engaged	-20	6,400
-2.0	79 [127]	100	Off	Off	On Non-Engaged	10	6,500
-1.5	80 [129]	100	Off	Off	On Non-Engaged	0	6,400
-1.0	83 [134]	100	Off	Off	On Non-Engaged	0	6,500
-0.5	89 [144]	100	Off	Off	On Engaged	-10	5,800
0.0	89 [144]	100	On	Off	On Engaged	0	5,300

Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 2) - Table 2 of 3

Time Stamp (sec)	PCM Derived Accelerator Pedal Position, % full	Forward Collision Warning (Not Warning/ Warning)	Collision Mitigation Braking System (Not Engaged/ Engaged)	Collision Mitigation Braking System, Forward Collision Warning (On/Off)	Lane Departure Warning (Not Warning/ Warning)	Road Departure Mitigation (Not Engaged/ Engaged)	Road Departure Mitigation, Lane Departure Warning (On/Off)
-5.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-4.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-4.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-3.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-3.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-2.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-2.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-1.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-1.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
-0.5	100	Not warning	Not engaged	On	Not warning	Not engaged	Off
0.0	100	Not warning	Not engaged	On	Not warning	Not engaged	Off

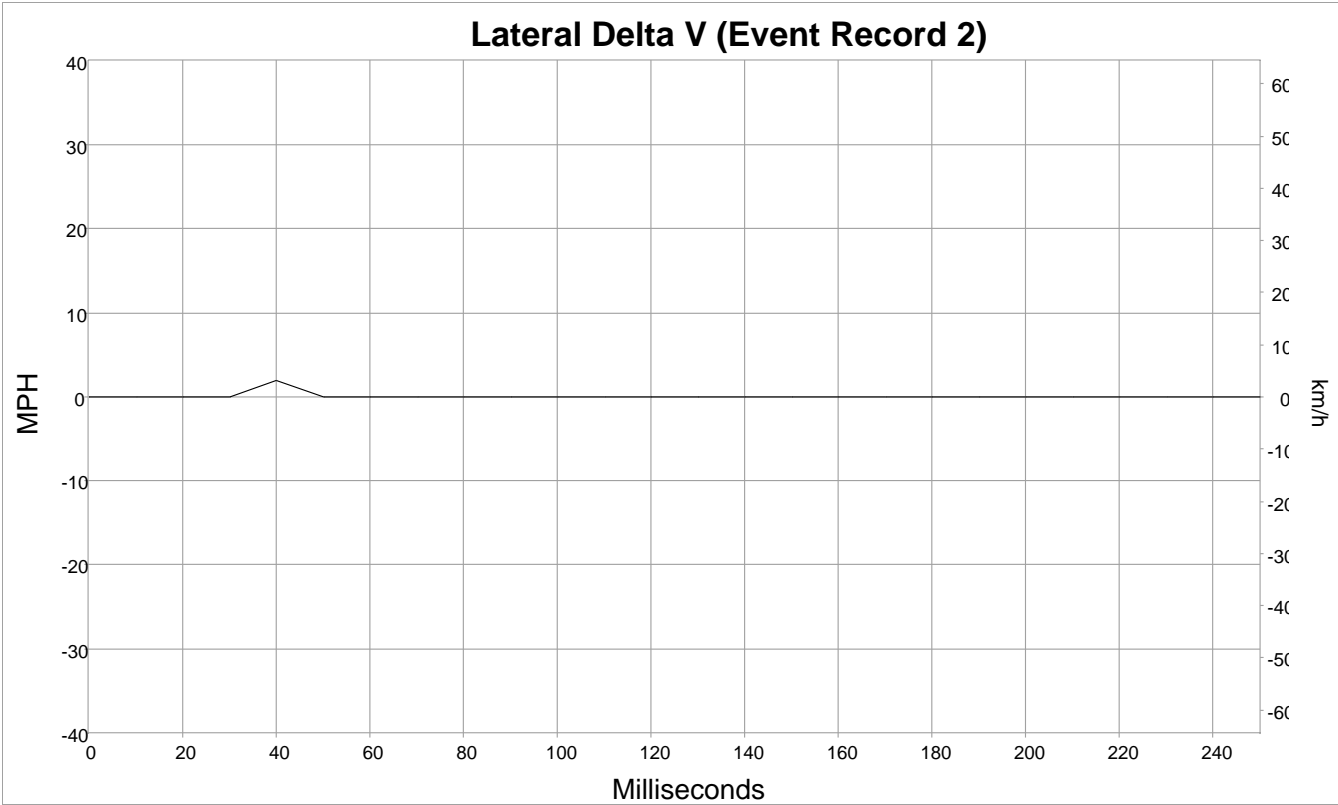
Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 2) - Table 3 of 3

Time Stamp (sec)	Adaptive Cruise Control (Not Engaged/ Engaged)	Adaptive Cruise Control (On/Off)	Lane Keeping Assist (Not Engaged/ Engaged)	Lane Keeping Assist (On/Off)	Cruise Control (Not Engaged/ Engaged)	Cruise Control (On/Off)
-5.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-4.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-4.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-3.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-3.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-2.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-2.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-1.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-1.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off
-0.5	Not engaged	Off	Not engaged	Off	Not Engaged	Off
0.0	Not engaged	Off	Not engaged	Off	Not Engaged	Off



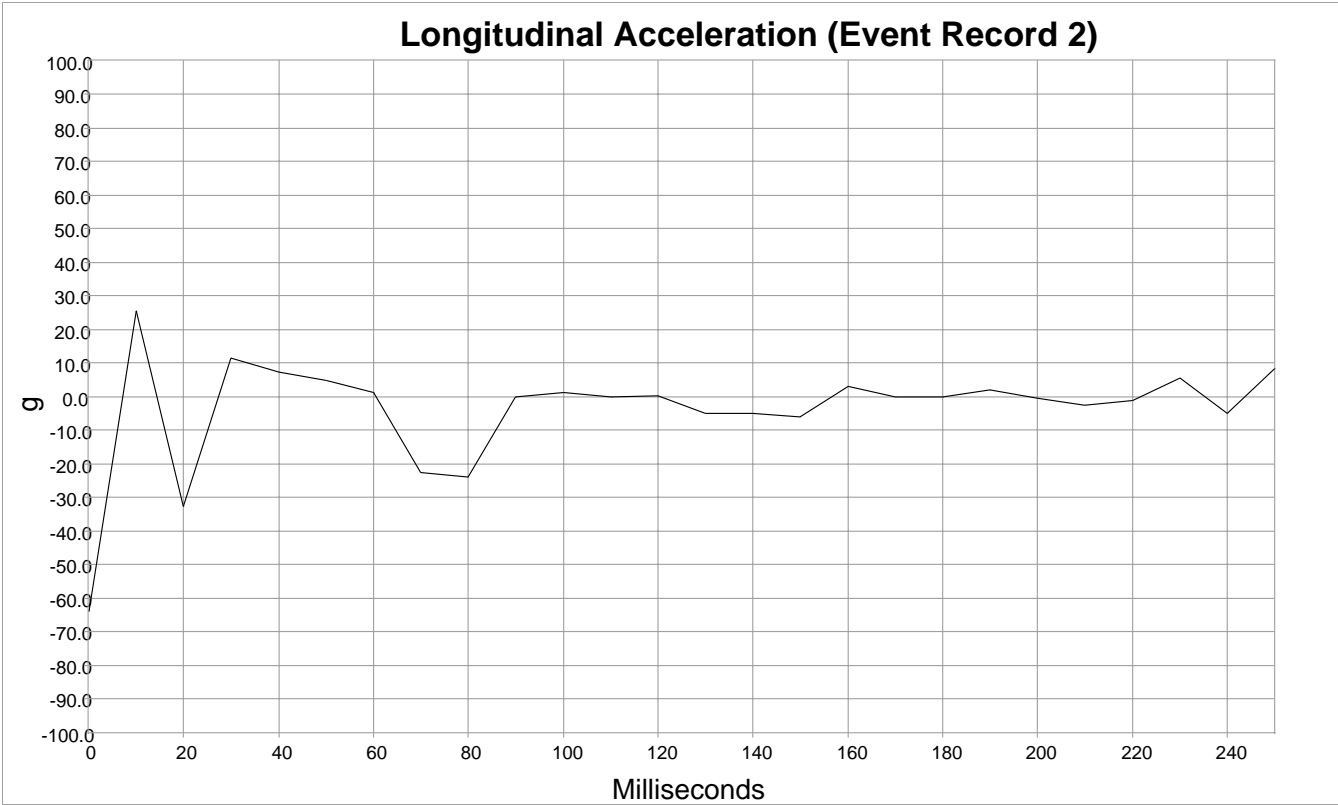
Longitudinal Delta V (Event Record 2)

Time (msec)	MPH [km/h]
0	-1 [-1]
10	-6 [-9]
20	-7 [-12]
30	-13 [-21]
40	-12 [-20]
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]



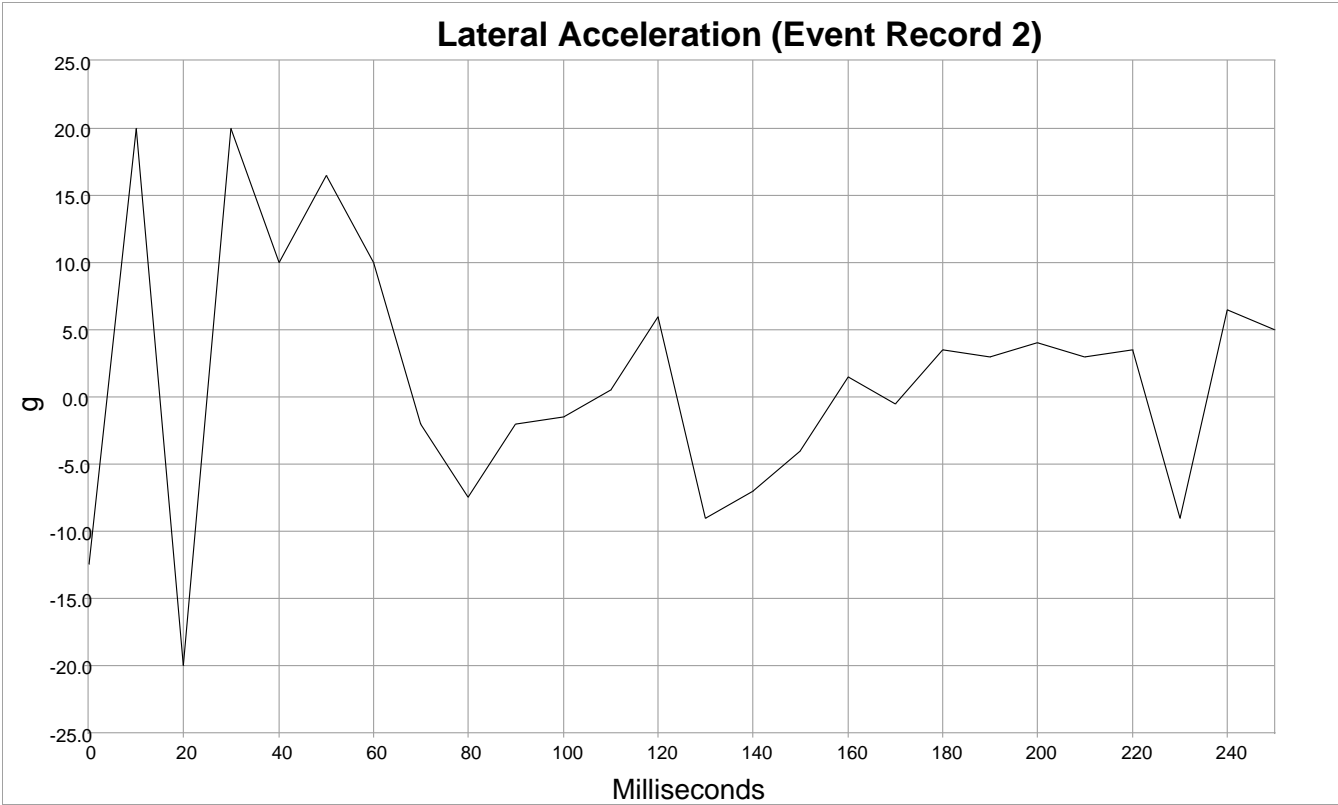
Lateral Delta V (Event Record 2)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	0 [0]
30	0 [0]
40	2 [4]
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]



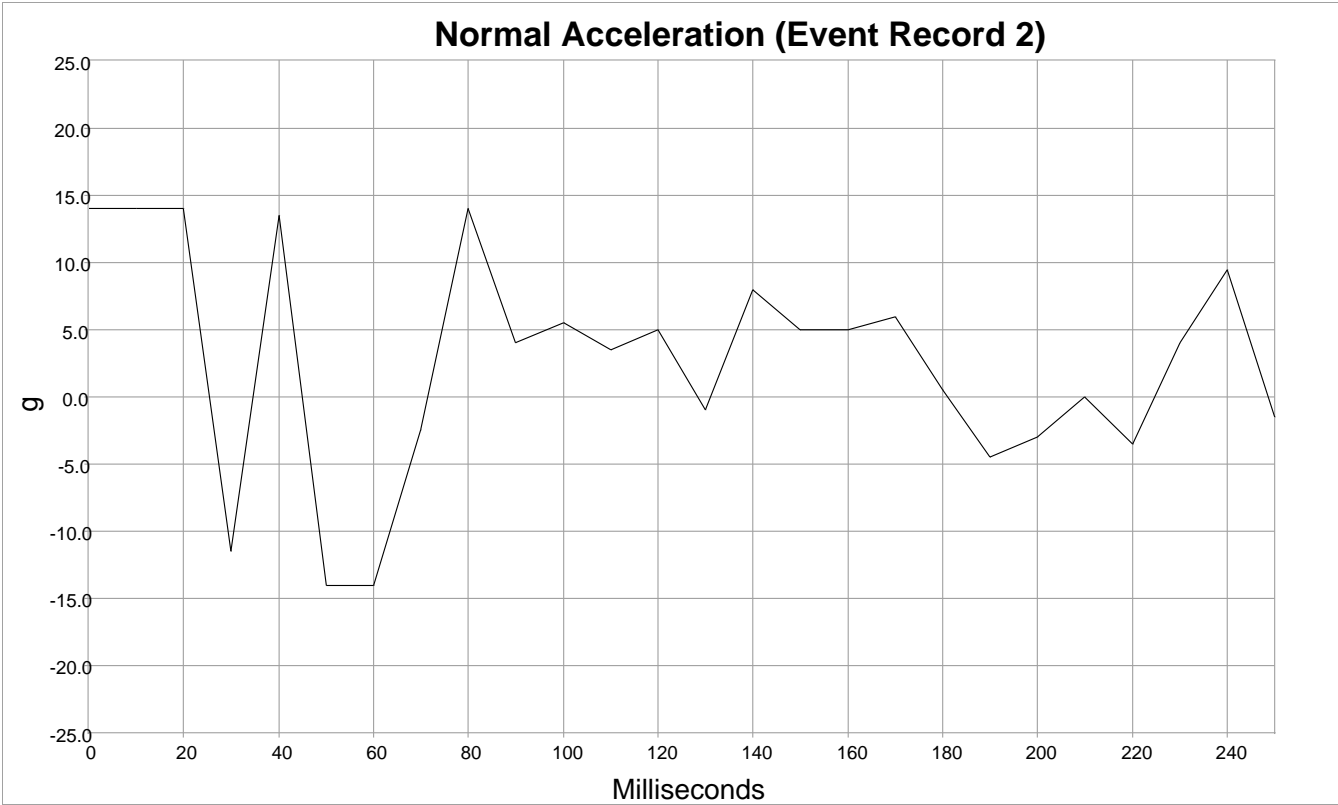
Longitudinal Acceleration (Event Record 2)

Time (msec)	g
0	-64.0
10	25.5
20	-32.5
30	11.5
40	7.5
50	5.0
60	1.5
70	-22.5
80	-24.0
90	0.0
100	1.5
110	0.0
120	0.5
130	-5.0
140	-5.0
150	-6.0
160	3.0
170	0.0
180	0.0
190	2.0
200	-0.5
210	-2.5
220	-1.0
230	5.5
240	-5.0
250	8.5



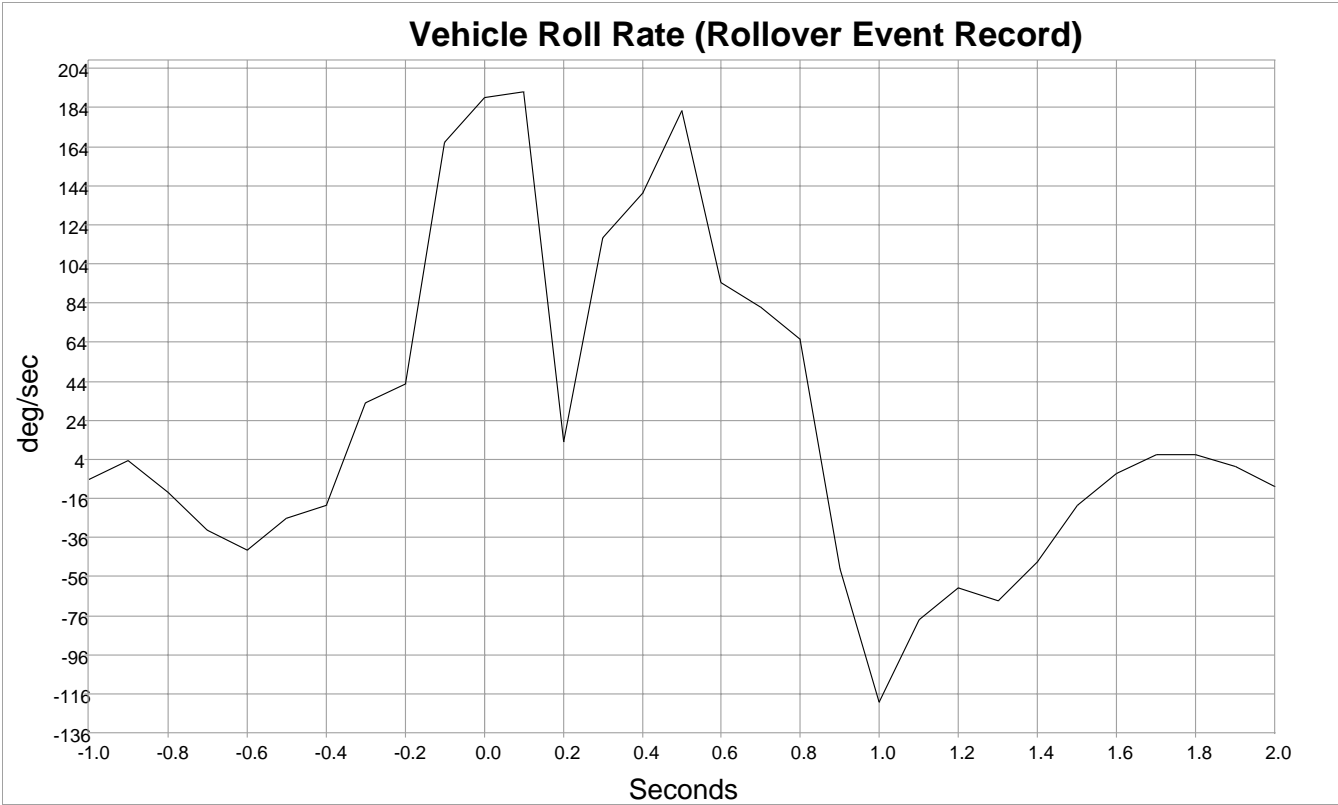
Lateral Acceleration (Event Record 2)

Time (msec)	g
0	-12.5
10	20.0
20	-20.0
30	20.0
40	10.0
50	16.5
60	10.0
70	-2.0
80	-7.5
90	-2.0
100	-1.5
110	0.5
120	6.0
130	-9.0
140	-7.0
150	-4.0
160	1.5
170	-0.5
180	3.5
190	3.0
200	4.0
210	3.0
220	3.5
230	-9.0
240	6.5
250	5.0



Normal Acceleration (Event Record 2)

Time (msec)	g
0	14.0
10	14.0
20	14.0
30	-11.5
40	13.5
50	-14.0
60	-14.0
70	-2.5
80	14.0
90	4.0
100	5.5
110	3.5
120	5.0
130	-1.0
140	8.0
150	5.0
160	5.0
170	6.0
180	0.5
190	-4.5
200	-3.0
210	0.0
220	-3.5
230	4.0
240	9.5
250	-1.5



Positive roll rate indicates right-to-left (counterclockwise) rotation

Vehicle Roll Rate

Time (sec)	deg/sec	Time (sec)	deg/sec
-1.0	-6.5	0.6	94.4
-0.9	3.3	0.7	81.4
-0.8	-13.0	0.8	65.1
-0.7	-32.6	0.9	-52.1
-0.6	-42.3	1.0	-120.4
-0.5	-26.0	1.1	-78.1
-0.4	-19.5	1.2	-61.8
-0.3	32.6	1.3	-68.4
-0.2	42.3	1.4	-48.8
-0.1	166.0	1.5	-19.5
0.0	188.8	1.6	-3.3
0.1	192.0	1.7	6.5
0.2	13.0	1.8	6.5
0.3	117.2	1.9	0.0
0.4	140.0	2.0	-9.8
0.5	182.3		

Hexadecimal Data

DID #	Data
\$8000	21 61 15 15 01 33 00 59 00 55 00 00 11 33 00 00 60 0F 00 E9 02 05 00 00 00 00 00 00 00 00 00 00 11 11 00 AD
\$8020	01 03 00 00 00 00 00 00 00 00 00 00 00 00 00 FC
\$8021	AA 00 01 02 00 00 00 00 00 00 00 53 07 2B AA AA
\$8022	AA 00 C8 78 E6 00 00 00 04 00 00 00 07 00 00 00 00 05 00 0A 00 00 00 00 00 00 18 00 00 00 18 00 11 00 00 00 00 00 00 00 00 00 00 00 00 00 00 D5
\$8023	AA 00 C8 78 E6 00 0C 00 00 00 0C 00 11 00 00 00 00 00 00 00 00 00 00 00 00 00 00 07
\$8024	AA 00 FF 00 00 40 43 02 12 12 11 00 07 2A 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 6C
\$8025	AA 00 FF 00 00 40 43 02 12 12 11 00 07 2A 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 6C
\$8026	AA 01 FC D0 35 00 00 77 33 00 30 00 00 00 00 00 73 64 02 40 64 00 00 00 01 11 00 10 00 00 00 00 76 64 F9 40 64 00 00 00 01 11 00 10 00 00 00 00 78 64 06 41 64 00 00 00 01 11 00 10 00 00 00 00 7A 64 01 41 64 00 00 00 01 11 00 10 00 00 00 00 7C 64 06 41 64 00 00 00 01 11 00 10 00 00 00 00 7E 64 FC 40 64 00 00 00 01 11 00 10 00 00 00 00 7F 64 02 41 64 00 00 00 01 11 00 10 00 00 00 00 81 64 00 40 64 00 00 00 01 11 00 10 00 00 00 00 86 64 00 41 64 00 00 00 01 11 00 10 00 00 00 00 90 64 FE 3A 64 20 00 00 01 11 00 10 00 00 00 00 90 64 FE 39 64 20 00 00 01 11 00 10 00 00 00 F7
\$8027	AA 01 FC D0 35 00 00 77 33 00 30 00 00 00 00 00 73 64 02 40 64 00 00 00 01 11 00 10 00 00 00 00 76 64 F9 40 64 00 00 00 01 11 00 10 00 00 00 00 78 64 06 41 64 00 00 00 01 11 00 10 00 00 00 00 7A 64 01 41 64 00 00 00 01 11 00 10 00 00 00 00 7C 64 06 41 64 00 00 00 01 11 00 10 00 00 00 00 7E 64 FC 40 64 00 00 00 01 11 00 10 00 00 00 00 7F 64 02 41 64 00 00 00 01 11 00 10 00 00 00 00 81 64 00 40 64 00 00 00 01 11 00 10 00 00 00 00 86 64 00 41 64 00 00 00 01 11 00 10 00 00 00 00 90 64 FE 3A 64 20 00 00 01 11 00 10 00 00 00 00 90 64 00 35 64 21 00 00 01 11 00 10 00 00 00 F8
\$8028	AA 00 00 FD FD F5 E3 EE E9 E7 00 DC 1D 00 00 00 00 CD
\$8029	AA 00 FF F7 F4 EB EC 00 E9 0A 00 00 00 00 00 A2
\$802A	AA 00 00 00 00 FF FF 00 00 FE 00 FB 1D 00 1D 00 00 00 25

\$802B AA 00 00 00 00 00 04 00 00 00 00 00 00 00 00 00 00
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00 00 00 00 00 00 00 00 06 11 00 0A 00 00 00 31

\$802C AA 01 D5 F2 D9 26 7F B4 B9 BA E9 D9 E0 F7 F4 F2
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\$802D AA 01 80 33 BF 17 0F 0A 03 D3 D0 00 03 00 01 F6
F6 F4 06 00 00 04 FF FB FE 0B F6 11 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 15

\$802E AA 01 0D 03 D8 28 28 07 E9 D8 28 28 03 1A 15 01
F3 F5 02 04 FD F6 FD FD FE 04 04 FF 00 C3 00 00
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\$802F AA 01 E7 28 D8 28 14 21 14 FC F1 FC FD 01 0C EE
F2 F8 03 FF 07 06 08 06 07 EE 0D 0A 00 19 00 00
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\$8030 AA 01 FB E4 F6 11 E4 1C 1C 1C 0A 17 E4 E4 EE 15
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00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 FF

\$8031 AA 01 1C 1C 1C E9 1B E4 E4 FB 1C 08 0B 07 0A FE
10 0A 0A 0C 01 F7 FA 00 F9 08 13 FD 00 00 00 00
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\$8007 AA 00 00 00 00 00 00 00 00 0E 00 00 00 00 00 00
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\$803F AA 01 00 20 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

\$8011 AA 01 C4 2F E0 00 00 00 00 01 27 16 00 00 00 10
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\$8012 AA 00 51 07 FA 03 B6 02 A0 01 33 00 01 06 25 00
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\$8014 AA 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 94

\$8015 AA 01 C4 2F E0 00 00 00 00 01 27 16 00 00 00 10
00 00 00 00 07 00 10 FE B1 FF 00 00 00 00 00 00
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\$8016 AA 00 01 42 05 59 0A 83 00 00 F4 B5 DE 6D 00 00
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\$801B AA 00 FE 01 FC F6 F3 F8 FA 0A 0D 33 3A 3B 04 24
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00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
FC 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

\$8001 AA 00 C4 18 00 00 00 00 36 36 00 00 00 30 00 00
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\$8002 AA 01 E0 FE F8 00 00 00 02 80 3F 00 00 00 00 00
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\$8004 Not Used

\$8005 AA 00 FE FF FF FF DE F1 DE F1 80 00 00 00 00 00
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FF F8 00 FF 89 00 7B 00 00 5C FF 97 00 00 00 14
11 3A 00 01 57 07 6C 00 03 CA 04 AB 00 00 00 6E
01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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\$8008 Not Used

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\$8010 AA 00 F8 F8 F8 F8 E0 E0 E0 E3 00 00 00 00 00 00
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A0 91 11 00 00 00 00 00 AF 11 11 00 00 00 00 00
A0 D0 01 00 00 00 00 00 A0 D1 02 00 00 00 00 00
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\$801F Not Used

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\$8041 AA 00 FE CC 04 00 00 00 57 57 57 57 57 57 55 00
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\$8046 AA 00 C0 00 00 00 00 00 00 00 00 00 00 00 00 00
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\$8052 3B 33 15 15 01 15 15 01 E1 00 00 00 00 00 00 00

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\$8062 AA 01 FF F0 3F FC 00 00 00 00 00 00 00 00 00 00
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December 2021



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

