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

NHTSA

DOT HS 813 549

March 2024

Special Crash Investigations: On-Site Child Restraint System Crash Investigation; Vehicle: 2020 Honda Accord; Location: Indiana; Crash Date: September 2021

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Suggested APA Format Citation:

Crash Research & Analysis, Inc. (2024, March). *Special Crash Investigations: On-site child restraint system crash investigation; Vehicle: 2020 Honda Accord; Location: Indiana; Crash Date: September 2021* (Report No. DOT HS 813 549). National Highway Traffic Safety Administration.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
DOT HS 813 549		

4. Title and Subtitle	5. Report Date
Special Crash Investigations: On-Site Child Restraint System Crash Investigation; Vehicle: 2020 Honda Accord; Location: Indiana; Crash Date: September 2021	March 2024
	6. Performing Organization Code

7. Author	8. Performing Organization Report No.
Crash Research & Analysis, Inc.	CR21024

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Crash Research & Analysis, Inc. PO Box 302 Elma, NY 14059	11. Contract or Grant No. 693JJ919C000004

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Highway Traffic Safety Administration 1200 New Jersey Avenue SE Washington, DC 20590	Technical Report
	14. Sponsoring Agency Code

15. Supplementary Notes

Each crash represents a unique sequence of events, and generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicles or their safety systems. This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was submitted.

16. Abstract

This on-site investigation documents the road departure/fixed object crash of a 2020 Honda Accord Hybrid and the fatal injuries sustained by a 3-year-old male restrained by the 5-point harness of a forward-facing child restraint system (CRS) that was secured in the second-row-left seat. A belted 24-year-old female was driving the Honda when it departed the right side of the roadway well in excess of the posted speed limit of 73 km/h (45 mph), struck a fence, traveled through a pasture, struck a second fence, struck and ramped up an embankment, vaulted a driveway, struck a tree, rotated clockwise, and fell onto the ground, coming to final rest facing southeast. The driver submarined her 3-point lap and shoulder belt and sustained police-reported A-level (incapacitating) injuries. She was flown to a local hospital and hospitalized for 16 days. The child passenger remained harnessed in the CRS and was struck in the head by a fence post that penetrated the windshield. He was pronounced deceased at the scene.

17. Key Words	18. Distribution Statement
child restraint system, fatality, road departure	This document is available to the public from the National Highway Traffic Safety Administration, National Center for Statistics and Analysis, crashstats.nhtsa.dot.gov.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	70	

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On-Site Child Restraint System Crash Investigation
Case Number: CR21024
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Background

This on-site investigation documents the road-departure/fixed-object crash of a 2020 Honda Accord Hybrid (Figures 1 and 2) and the fatal injuries sustained by a 3-year-old male restrained by the 5-point harness of a forward-facing child restraint system (CRS) that was secured in the second-row-left seat. A belted 24-year-old female was driving the Honda. It departed the right side of the roadway well in excess of the posted speed limit of 73 km/h (45mph), struck a fence, traveled through a pasture, struck a second fence, struck and ramped up an embankment, vaulted a driveway, struck a tree, rotated clockwise, and fell onto the ground, coming to final rest facing southeast. The driver submarined her 3-point lap and shoulder belt and sustained police-reported A-level (incapacitating) injuries. She was flown to a local hospital and hospitalized for 16 days. The child passenger remained harnessed in the CRS and was struck in the head by a fence post that penetrated the vehicle's windshield. He was pronounced deceased at the scene.

Figure 1. On-scene image of the Honda at final rest provided by local law enforcement

Figure 2. Front-right oblique view of the Honda at the time of the SCI inspection

This crash was identified by the National Highway Traffic Safety Administration's Crash Investigation Division in September 2021 and assigned to the Special Crash Investigations (SCI) team at Crash Research & Analysis, Inc., in the same month. Cooperation with the investigating police agency was obtained and the on-site investigation occurred in September 2021. The investigation consisted of a detailed inspection of the Honda to document the exterior damage and assess the manual restraints, supplemental restraints, CRS, identify sources of occupant injury, and image the Honda's event data recorder (EDR). The imaged data is included at the end of this report as an appendix. The crash site was also inspected, documented by photographs, and mapped by total station. The SCI investigator interviewed the mother of the Honda's occupants following the vehicle inspection.

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Summary

Crash Site

This crash occurred in the morning on the right roadside of a two-lane east/west roadway (Figure 3). Reported weather conditions in the locale included light rain, a temperature of 21 ºC (70 ºF), 93 percent humidity, and winds from the west at 14 km/h (9 mph). On the approach to the crash site, the bituminous-surfaced roadway curved to the left for westbound traffic with a radius of curvature measuring 345 m (1,132 ft). The roadway then transitioned to a straight segment. The travel lanes were 2.9 m (9.5 ft) and 3.3 m (10.8 ft) in width with the wider lane for the Honda's direction of travel. The roadway had a negative grade of 1.4 percent along the Honda's path of travel. The outboard edges of the travel lanes were marked with painted solid white edge lines with a painted double yellow centerline delineating the travel directions. The north (right) road edge consisted of cut grass with a negative slope. A wooden post-and-rail fence was located at the base of the slope bordering a grassy pasture. The fence had 10x10 cm (4x4 in) wood posts spaced on 1.5 m (5 ft) centers with three horizontal rails. At the west end of the pasture the fence formed a 90º transition along a positive embankment next to a driveway. The driveway was oriented north. On the opposing side of the driveway, the post-and-rail fence continued along the roadside. A large diameter spruce tree was located inside of the fence on the west side of the driveway. The posted speed limit was 72 km/h (45 mph). A crash diagram is included at the end of this report.

Figure 3. Northwest view showing the Honda's pre-crash approach to the crash site

Pre-Crash

The Honda was traveling in the right lane of the two-lane rural roadway at an EDR-reported speed of 180 km/h (112 mph) 5.0-seconds prior to algorithm enable (AE). The driver's medical record reported that she had a seizure history with prescribed medications documented by police images. Although undetermined, the driver may have experienced a medical episode. She was restrained by the lap and shoulder belt system. The child passenger was secured by the CRS's internal harness in the second-row-left position. The driver operated the vehicle at an EDR-recorded accelerator pedal position of 53 percent with the service brakes recorded as off. As the Honda was exiting the left curve, the vehicle drifted to the right and departed the north road edge

in a tracking mode. It traveled down the grass embankment as the driver applied a left steering input in a possible attempt to regain the roadway.

Crash

The Honda's front struck and penetrated the wooden post-and-rail fence (Event 1, Figure 4). The 12 o'clock direction of force fractured six fence posts and damaged 10.4 m (34.1 ft) of the wood rail fence. The engagement with the fence was distributed across the full end-width of the vehicle but did not impede the vehicle's trajectory or result in a recordable EDR event. The Honda continued its off-road trajectory and traveled an additional 19.7 m (64.6 ft) through the pasture area approaching a driveway into the property north of the road. The vehicle's front struck and penetrated the post-and-rail fence that paralleled the driveway (Event 2, Figure 5) resulting in overlapping damage to the Honda's front. Fence components penetrated the vehicle's windshield and entered the passenger compartment, striking the driver and child passenger (Event 3). Nearly simultaneous to the Event 2 fence impact, the Honda's lower frontal structure and undercarriage struck the driveway embankment (Event 4) resulting in the EDR-recorded Event Record 1. The EDR recorded a maximum longitudinal delta V of -45 km/h (-28 mph) at 300 milliseconds after time zero with a lateral component of -7 km/h (-4 mph), which occurred at 235 milliseconds. The embankment impact was non-horizontal and applied a vertical component to the vehicle's velocity change. This impact actuated the driver's pretensioners and deployed the driver's frontal air bag (stage 1), driver knee air bag, right outboard seat-mounted side-impact air bag, and right ilatable curtain (IC) air bag.

Figure 4. View of the Event 1 (fence) impact area

Figure 5. View of the Event 2 (fence) and Event 4 (embankment) area

The Honda ramped up the embankment due to the high speed and vaulted the driveway with the front of the vehicle elevated with respect to the back. The Honda's undercarriage struck the post-and-rail fence (Figure 6) on the west side of the driveway (Event 5). While airborne, the front-right corner of the vehicle struck a spruce tree (Event 6, Figure 6) at an elevation approximately 1.5 m (5 ft) above the ground. This 12 o'clock direction of force impact resulted in an EDR-recorded Event Record 2 longitudinal delta V of -30 km/h (-19 mph) with a lateral component of 4 km/h (2 mph). This event was classified as a deployment-level event that would have actuated the driver's pretensioners and deployed the driver's frontal and knee air bags. The tree impact resulted in severe damage to the front-right corner that extended along the right side to the base

of the Honda's windshield with complete separation of the front-right suspension, tire, and wheel.

Figure 6. On-scene image showing Event 5 (fence) and Event 6 (tree) provided by local law enforcement

Figure 7. View of the Event 5 (fence) and Event 6 (tree) area during the SCI scene inspection

As a result of the offset right tree impact, the Honda rotated clockwise and fell to the ground approximately 4 m (13 ft) west of the tree impact. Before coming to rest, the Honda's undercarriage struck the post-and-rail fence (Event 7, Figure 7). The back undercarriage area struck the ground (Event 8) as the vehicle came to rest on top of the fractured fence, facing in a southeasterly direction, approximately 180º opposite of its initial pre-crash heading (Figure 8 and 9).

Figure 8. On-scene image showing the Event 7 (fence) and Event 8 (ground) area provided by local law enforcement

Figure 9. View of the Event 7 (fence) and Event 8 (ground) area facing opposite of the pre-crash heading

Post-Crash

Local emergency services were notified of the crash. Police, emergency medical services, and local fire department personnel were dispatched to the crash site. The first responders found the child passenger in the second-row-left seating position secured in the forward-facing CRS. The first responder started to unbuckle the child when he realized the child was unresponsive. Additional emergency personnel advised against removing the child at that time. The child was evaluated and declared deceased. The child was removed from the vehicle in the CRS. The female driver had submarined the seat belt system and was found with her back resting on the seat cushion and her head at the bight of the seat cushion/seatback juncture. Her lower extremities and pelvic region were forward of the seat cushion in the toe/floor pan, below the steering wheel. Rescue personnel used hydraulic tools to cut the roof and right-front door from the Honda. The driver was transported by helicopter to a local trauma center where she was hospitalized for 16 days. The Honda was removed from the scene by a local towing service.

SCI Crash Reconstruction

Based on the EDR-reported speeds of the Honda, a time and distance calculation was performed to reconstruct the approximate pre-crash position of the vehicle relative to the tree impact (Event 6). The speed of the Honda at impact with the tree was an estimation using the reported speed at impact with the embankment plus the longitudinal delta V of that impact (i.e., 184 km/h plus -45 km/h = 139 km/h).

The results of this calculation are listed in Table 1 and are shown on the scaled scene diagram along the vehicle's known path of travel.

Table 1. Time and distance calculation data

Time	Speed		Distance	Crash	Steering
Seconds	km/h	m/sec	Meters	Event	Degrees
-5.0	181.0	50.3	250.0		0
-4.5	181.0	50.3	224.9		0
-4.0	181.0	50.3	199.7		0
-3.5	181.0	50.3	174.6		0
-3.0	182.0	50.6	149.4		5
-2.5	182.0	50.6	124.1		5
-2.0	183.0	50.8	98.8		15
-1.5	183.0	50.8	73.3		25
-1.0	183.0	50.8	47.9		35
-0.5	184.0	51.1	22.4		15
-0.3	184.0	51.1	13.5	Embankment	15
				Vault	
0.0	139.0	38.6	0.0	Tree	185

It was determined that the Honda departed the road approximately 1.5 to 2.0 seconds prior to the impact with the tree.

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2020 Honda Accord

Description

The 2020 Honda Accord EX-L Hybrid (Figure 10) was identified by the Vehicle Identification Number 1HGCV3F56LAxxxxxx. It was built on a front-wheel-drive platform and powered by a 2.0-liter, 4-cylinder gasoline engine and two electric motors linked to a continuously variable transmission. The hybrid battery was a 1.3 kWh lithium-ion battery that was mounted under the back seat. The service brakes were power-assisted 4-wheel disc with an antilock brake system . The curb weight was 1,524 kg (3,360 lb) and the gross vehicle weight rating was 2,050 kg (4,519 lb). The vehicle manufacturer's recommended tire size was P225/50R17. At the time of the crash the Honda had Michelin Energy Saver tires of the recommended size mounted on original equipment manufacturer alloy wheels with tread of 6 mm (7/32s) for all four tires. Safety features included vehicle stability assist with traction control, electronic brakeforce distribution, brake assist, and a tire pressure monitoring system.

Figure 10. Front-left oblique view of the Honda Accord

The 2020 Honda had driver assist features that included forward collision warning (FCW) with collision mitigation braking, lane departure mitigation and lane keeping assist, blind spot detection, a multi-angle rearview backup camera, and adaptive cruise control.

The Honda's interior had seating for five occupants (2/3), with front-row bucket seats and a second-row bench seat with split forward-folding seatbacks. The seating surfaces were leather. All seating positions had adjustable head restraints. Manual restraint systems consisted of 3-point lap and shoulder belts for all seat positions. The driver and front passenger seating positions had retractor and lower anchor pretensioners. Additional supplemental restraint systems included seven air bags consisting of driver's and passenger's frontal, driver knee, front outboard seat-mounted side impact, and IC air bags.

Exterior Damage

The Honda sustained overlapping damage to the front and undercarriage areas from the eight impact events during the crash sequence. The frontal impact events (Event 1 and 2) were distributed across the vehicle's front bumper and hood face (Figure 11). Although the damage

could not be isolated by event, the bumper beam sustained damage that resulted in the following documentation. The Field L was 156 cm (61.4 in) that extended from corner to corner. The crush profile was documented as follows: C1 = 0 cm, C2 = 5 cm (2.0 in), C3 = 13 cm (5.1 in), C4 = 21 cm (8.3 in), C5 = 21 cm (8.3 in), C6 = 0 cm. The collision deformation classification[1] (CDC) for both events was 12FDEW99.

Figure 11. Front view of the Honda Accord

Fractured components of the fence consisting of posts and rails struck and penetrated the Honda's windshield and entered the passenger compartment. At a minimum, a fence post penetrated through the interior and disintegrated the backlight glazing. These components struck the driver and child passenger. The CDC for this Event 3 impact was 12FDGW9.

Almost simultaneous to the Event 2 fence impact, the lower aspect of the Honda's front and undercarriage struck the earth embankment (Event 4) that supported the private driveway. The event triggered the EDR to record Event Record 1 that resulted in the actuation of the driver's pretensioners and the deployment of the driver's frontal and knee air bags and the unoccupied right front seat-mounted and right IC air bags. This event also produced a longitudinal delta V of -45 km/h (-28 mph) at 300 milliseconds after time zero with a lateral component of -7 km/h (-4 mph). The slope of the embankment resulted in a non-horizontal impact force. The CDC associated to this event was 00UFDW99 (where 99 represents an unknown value).

The Honda's high speed caused the vehicle to vault the driveway as it continued in a near-straight-line trajectory following the initial road departure. The slope of the embankment caused the Honda to vault with its front end pitched upwards. This allowed the undercarriage of the Honda to impact the fence on the west side of the driveway (Event 5). The estimated CDC for this event was 00U99999.

During the vault, the Honda's front-right corner struck the branches and trunk of the large diameter spruce tree (Event 6) approximately 1.5 m (5 ft) above the ground. The impact occurred at the right end of the bumper beam and involved the hood, headlamp assembly, front-right fender, and front-right suspension, tire, and wheel. This contact pattern extended to the base of the windshield. The right-corner of the aluminum bumper beam fractured and was in the deformed sheet metal 103 cm (40.6 in) aft of its original location. The tree engagement fractured

[1] SAE J224_202205 – SAE Recommended Practice describing vehicle collision damage in an alphanumeric format.

the front-right suspension from the undercarriage, thus separating the tire, wheel, and brake assembly from the Honda. The CDC assigned to this damage pattern was 12FRAE6.

The offset right corner tree impact induced a clockwise rotation to the Honda as it separated from the tree. It rotated approximately 180º clockwise and fell to the ground. Prior to ground contact, the Honda's undercarriage struck another section of the wood and rail fence, fracturing the fence on a vertical trajectory (Event 7). The estimated CDC for this event was 00U99999.

The Honda's back bumper struck the ground (Event 8) as the vehicle came to final rest. The impact fractured the bumper fascia and the Styrofoam energy absorber. The estimated CDC for this event was 00UB9999.

Post-crash, firefighters removed the roof and front-right door during the extrication efforts for the driver. They also removed some of the wood fencing that entered the passenger compartment.

Event Data Recorder

The 2020 Honda Accord had an air bag control module (ACM) mounted to the center tunnel of the vehicle, beneath the center instrument stack. The control unit monitored three-dimensional acceleration and commanded the actuation or deployment of pretensioners and inflatable supplemental restraint systems. It also had EDR capabilities. At the time of the SCI inspection the police had removed the ACM from the vehicle as part of their investigation and stored the ACM as evidence. The police had imaged the module's EDR component via a direct-to-module connection using the Bosch Crash Data Retrieval (CDR) tool and software (version 21.1). The imaged CDRx file was shared with the SCI investigator. The EDR data is included as Appendix A to this technical report and is reported with version 23.3 of the Bosch software.

The data limitations reported that crash data could be reported for front, side, rear, and rollover events and recorded as either non-deployment or deployment events. The requirements for event recording included a change in longitudinal or lateral velocity of 8 km/h (5 mph) or greater over a 150-millisecond timeframe, or commandment of a non-reversible restraint device (air bag). The EDR had the capacity to store two events. The EDR typically would record only one event unless the time zero values for multiple events occurred within 5 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 deployment of an air bag system. A non-deployment event was a recognized event that did not deploy air bags but could include a pretensioner actuation-only command.

Depending on the specific control unit type, it could record approximately 255 milliseconds of data associated with a deployment command. If power supply to the control unit 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, seat belt usage of front-row occupants, and vehicle ignition cycle at the time of the events were recorded. Associated to the recording of each respective event was an asynchronous five-second pre-crash buffer that recorded multiple pre-crash data points in 0.5-second intervals. Data recorded included vehicle speed, accelerator pedal (% full), service brake status (on/off), ABS activity (on/off), stability control (on, off, engaged), steering input (+/- 5º), and engine speed RPM data. Data for the

vehicle's crash avoidance systems was also recorded and is discussed in the Crash Avoidance Systems section of this report.

The imaged data had two events that were recorded on ignition cycle 2,598. The EDR data was imaged during the police investigation on ignition cycle 2,599. Therefore, the recovered data was related to the crash under investigation. Both events were severe enough to be considered deployment events. The driver's seat belt was buckled, the air bag warning lamp was off, the driver's seat track position was reported as not in a forward position, and both events were completely recorded.

Event Record 1

This record was identified as the first event of the crash sequence and was attributed to the embankment impact, crash Event 4 of the SCI reconstruction. The maximum longitudinal delta V reported was -45 km/h (-28 mph) at 300 milliseconds after time zero. The maximum lateral delta V was -7 km/h (-4 mph), which occurred at 235 milliseconds after time zero. Associated with the frontal event were the following actuation and deployment commands of the safety systems.

- Driver's retractor pretensioner 53 milliseconds
- Driver's knee air bag 53 milliseconds
- Driver's lower anchor pretensioner 69 milliseconds
- Driver's frontal air bag 1st stage 70 milliseconds
- Right seat-mounted side air bag 73 milliseconds
- Right IC air bag 73 milliseconds.

Event Record 2

This record was identified as the second event in the crash sequence and was attributed to the tree impact, crash Event 6 of the SCI reconstruction. This event began 0.3 seconds after Event Record 1. The time and distance between the two events were consistent with the recorded speed of the Honda and the calculations of the SCI crash reconstruction. The maximum longitudinal delta V of this event was -30 km/h (-19 mph) at 300 milliseconds after time zero. The maximum lateral delta V was 4 km/h (2 mph), which occurred at 225 milliseconds after time zero. The data reported the following actuation and deployment times; however, these safety systems had already been commanded to deploy during Record 1.

- Driver's retractor pretensioner 229 milliseconds
- Driver's knee air bag 229 milliseconds
- Driver's frontal air bag 1st stage 229 milliseconds
- Driver's lower anchor pretensioner 245 milliseconds

The data recorded within the two pre-crash buffers was consistent throughout the -5.0-second to -0.5-second intervals with minor differences at AE for each event. A portion of the data is listed in Table 2.

Table 2. EDR data from Event Record 2

	Time (sec)	Speed km/h (mph)	Accel. Pedal (%)	Service Brake	ABS Activity	Degrees Steering Left Positive
	-5.0	181 (112)	53	Off	Off	0
	-4.5	181 (112)	53	Off	Off	0
	-4.0	181 (112)	53	Off	Off	0
	-3.5	181 (112)	53	Off	Off	0
	-3.0	182 (113)	53	Off	Off	5
	-2.5	182 (113)	53	Off	Off	5
	-2.0	183 (114)	52	Off	Off	15
	-1.5	183 (114)	53	Off	Off	25
	-1.0	183 (114)	50	Off	Off	35
	-0.5	184 (114)	52	Off	Off	15
AE1	0.0	184 (114)	59	Off	Off	25
AE2	0.0	189 (117)	99	On	On	185

The data trends showed the Honda was traveling at high speed through the pre-crash recording with the accelerator pedal depressed. As the vehicle departed the road and struck the fence, a left steer was initiated. Between the embankment impact (AE1) and tree impact (AE2), the accelerator pedal was depressed to 99 percent, the steering wheel was turned left an additional 160º, and the brake was applied. The driver's sandals were found in the left footwell during the SCI inspection. Examination revealed the right sandal had an impression from the accelerator pedal, shown by the yellow arrow in Figure 12, which was indicative of crash-induced loading while the foot displaced the pedal to the floor.

Figure 12. Driver's sandals showing right sandal with an impression from the accelerator pedal

Interior Damage

The Honda's interior (Figure 13) sustained damage that included intrusions due to impact forces, exterior debris (fence components) entering the Honda during the crash sequence, and occupant contacts. The driver's seatback was ripped by a fence component that penetrated through the windshield. The driver's lower extremities engaged the deployed knee air bag, the lower instrument panel, and the substructures below. Firefighters placed a hydraulic ram against the lower instrument panel structure to aid in the extrication of the driver, causing further damage. The accelerator pedal was displaced left 5 cm (2.0 in) due to impact forces and probable driver loading. The second-row center and right seating positions also sustained damage from fencing impact. All intrusions are documented as follows.

Figure 13. Interior view of the Honda showing damage

Intruding Component	Location	Magnitude	Direction
Instrument Panel	Right Side	>/= 3 cm but < 8 cm	Longitudinal
Instrument Panel	Center	>/= 3 cm but < 8 cm	Longitudinal
Instrument Panel	Left Side	>/= 3 cm but < 8 cm	Longitudinal
Fence Post	Through Windshield	> 61 cm	Longitudinal
Fence Railing	Through Windshield	> 61 cm	Longitudinal
Tree Branches	Through Windshield	>/= 46 cm but < 61 cm	Longitudinal

During Event 3, a fence post and railing fragments penetrated through the windshield and struck the driver's right facial area. A clump of her hair was embedded into the top aspect of the driver's seatback (Figure 14). The fence post from this event struck the child secured in the CRS in the second-row-left position. After striking the child, the fence post disintegrated the backlight and came to final rest partially extruding from the passenger compartment area. Figure 15 shows the fence post at final rest.

Figure 14. View of the driver's hair in the driver's seat back from intruding fence post

Figure 15. View of fence post at final rest partially extruding from the Honda's rear window

Manual Restraint System

The Honda had manual 3-point lap and shoulder seat belts for all five seating positions. All belts consisted of continuous loop webbing with sliding latch plates. The driver's and front passenger's seat belt systems used retractor and lower anchor pretensioners. The driver's seat belt retracted onto an emergency locking retractor while the front-row-right and three second-row seat belts used switchable emergency locking and automatic locking retractors.

The driver's seat belt was found lying on the driver's seat at the time of the SCI inspection. Rescue personnel cut the driver's belt webbing at the lap belt. Loading evidence that consisted of longitudinal striations on the lap belt webbing was present along the driver's seat belt indicative of use by the driver (Figures 16 and 17). The driver had abrasions and contusions on her body indicative of her submarining the seat belt. Based on images of the driver, the lap belt appeared to have been worn high on the abdomen above the umbilicus at the time of the crash. This, in combination with her being obese, contributed to her submarining the seat belt. There was no evidence to support malfunction or failure of the driver's seat belt at the time of the SCI inspection.

Figure 16. View of the driver's seat belt showing loading evidence from the B-pillar D-ring

Figure 17. View of the driver's seat belt showing loading evidence

The CRS was secured to the Honda's second-row-left position by the vehicle's 3-point lap and shoulder belt. Although the CRS had the lower anchor and tethers for children (LATCH), the lower anchor straps and top tether were not used. At the time of the SCI inspection the latch plate was still in the buckle, as the belt webbing was cut by rescue personnel. The seat belt webbing was originally routed through the forward-facing belt path of the CRS and was cut to remove the CRS and child from the vehicle. The first cut was located 21 cm (8.3 in) from the base of the lower anchor (Figure 18). The second cut was towards the top of the seat belt where it came out of the seatback. The remainder of this seat belt spooled back into the retractor and could not be accessed during the SCI inspection. At the time of the inspection there was 98 cm (38.6 in) of webbing still routed through the latch plate (Figure 19). It should be noted that during the SCI interview with the mother of the child passenger, she insisted the locking mode of the retractor was set during her installation of the CRS in the Honda.

Figure 18. View of the second-row-left seat belt showing the extracting cuts

Figure 19. View of the second-row-left seat belt showing the extracting cuts

Supplemental Restraint System

The Honda had several supplemental restraint systems. These included dual-stage certified advanced 208-compliant driver's and passenger's frontal air bags, driver knee air bag, front outboard seat-mounted side impact air bags, and side impact and rollover sensing IC air bags. The driver's frontal (Figure 20), knee, and right seat-mounted and right IC air bags deployed during the crash.

The driver's frontal air bag deployed through the steering wheel-mounted module. Components from the fractured fence penetrated the windshield and contacted and tore the air bag fabric at the lower center area. Due to the severity of the crash, damage to the Honda's interior, and extrication efforts no discernable driver contacts were visible on the air bag.

The driver's knee air bag (Figure 21) deployed through a single cover flap in the lower instrument panel and knee bolster. The rectangular air bag measured 58 cm (22.8 in) by 45 cm (17.7 in). The driver's lower extremities contacted and loaded the deployed knee air bag; however, as noted above, no specific contact evidence was discernable on the air bag.

Figure 20. View of the driver's deployed frontal air bag in the Honda

Figure 21. View of the deployed driver knee air bag in the Honda

The right seat-mounted and IC air bags deployed in the unoccupied seat position. The seat-mounted air bag was 55 cm (21.7 in) in height and 28 cm (11.0 in) in width.

The right IC air bag deployed from the separation of the headliner from the roof side rail. The IC air bag extended from A-pillar to C-pillar. The height of the IC air bag extended below the level of the beltline. Measurements of the IC air bag were not obtained due to the extent of damage from the crash sequence and post-crash extrication process. The IC air bag was cut at the A- and C-pillar tether to aid in the treatment and extrication of the driver.

Crash Avoidance Systems

The Honda had CA systems that were designed to aid and support the driver in both avoiding a potential crash and mitigating the severity of a crash event should a collision be imminent. These CA systems included FCW, a collision mitigation braking system (CMBS), roadway departure mitigation (RDM), lane departure warning (LDW) with lane keeping assist system (LKAS), blind spot detection, adaptive cruise control, brake assist, daytime running lights, and a rearview

video camera. The driver could turn some of these features on or off by pushing buttons located on the lower left instrument panel or right post of the steering wheel (Figures 22 and 23).

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

Figure 23. View of the crash avoidance system buttons located on the right post of the steering wheel

The information discussed hereafter and concerning the 2020 Honda Accord's CA systems was obtained from the vehicle owner's manual provided with the vehicle by its manufacturer at the time of its original sale/delivery.[2]

The LKAS "provides steering input to help keep the vehicle in the middle of the detected lane and provides tactical and visual alerts if the vehicle is detected drifting out of its lane." This system was functional at speeds from "72-145 km/h (45-90 mph)." If the system sensed that the vehicle was drifting from a detected lane, it gave "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

[2] Honda Motor Co., Ltd. (2020).Accord: 2020 owner's guide.

alert functionality of the system would return once the turn signal was off." In addition, the system would not work if the "driver removed their hands from the steering wheel."

The RDM system applies intermittent steering torque and alerts to prevent the vehicle from "unintentionally departing a detected lane or leaving the roadway." It also was functional at speeds from "72-145 km/h (45-90 mph)." Should the vehicle get too close to detected lanes or roadway markings without activation of the turn signal, the system would give "visual/vibration alerts and apply torque to the steering wheel" to help the driver maintain the lane/roadway. "If the system determines that its steering input is insufficient to keep your vehicle on the roadway, it may apply braking. Braking is applied if the lane markings are 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 settings: (1) "visual and audible warnings," (2) "visual and audible warnings with light brake application," and (3) "visual and audible warnings with strong brake application." A manufacturer warning said 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 CA systems and their respective status and functionality. The data was contained in the imaged data (CDR report) only if the vehicle had the systems and data was 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), lane keeping assist (engaged/not engaged), lane keeping assist status (on/off), cruise control (engaged/not engaged), and cruise control status (on/off). According to the data all systems were "on" for all recorded pre-crash intervals. However, all systems showed they were "not engaged" and "not warning" leading up to the recorded crash event. The recorded data was as follows:

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

The imaged data shows that the Honda's RDM and LKAS systems were "on." These systems were manually turned on by the driver during this trip. The systems never activated to alert or warn the driver prior to the crash. This is due to system limitations shown in the owner's manual stating that these systems were only functional at speeds from 72 to 145 km/h (45-90 mph). As shown by the EDR data the vehicle was travelling at speeds from 181 to 184 km/h (112-117 mph).

Child Restraint System

The CRS was a Graco Extend2Fit Convertible (Figure 24). The CRS was manufactured on March 2, 2016, and was identified by model number 1957912. The convertible CRS was designed for rear-facing children with a weight range of 1.8 to 22.7 kg (4-50 lb) and forward-facing 10.0 to 29.5 kg (22-65 lb). The 15 kg (33 lb) weight of the child was proper for forward-facing use.

Figure 24.The CRS that was secured in the second-row-left seating position of the Honda

The polymer shell was fitted with a fabric cover and gave lateral head support and protection via bolstering. A 5-point internal harness system gave restraint for the child in the CRS. The CRS had a LATCH system; however, this system was not used to secure the CRS to the vehicle. The vehicle's manual 3-point lap and shoulder seat belt was routed through the forward-facing path to secure the CRS to the vehicle's second-row-left seat position.

The first responders evaluated the child in the CRS and determined he was deceased. They cut the vehicle's seat belt webbing and removed the child from the vehicle while still in the CRS. Stress marks were found on the polymer surface at the left aspect of the forward-facing belt path (Figure 25) indicative of loading against the belt system.

Figure 25. View of the left side of the CRS showing the front facing belt route stress damage

Figure 26. Right side view of the CRS showing the LATCH clip wedged under the metal routing bar

The connectors of the lower anchor straps were located at the right side of the CRS. The right lower anchor connector was wedged into the metal routing bar (Figure 26) showing the lack of use during this crash sequence.

The CRS's upper right aspect was damaged by impact from the intruding fence post (Figures 27 and 28). The fabric liner of the CRS was torn, and the polymer shell was fractured to the right of the child's head.

Figure 27. Front view of the damage to the CRS by the fence post

Figure 28. Rear view of the damage to the CRS by the fence post

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2020 Honda Accord Occupants

Driver Demographics

Age/sex:	24 years/female
Height:	178 cm (70 in)
Weight:	134 kg (295 lb)
Eyewear:	Contacts
Seat type:	Forward-facing bucket seat with adjustable head restraint
Seat track position:	Middle track position
Manual restraint usage:	Lap and shoulder belt
Usage source:	Vehicle inspection, EDR
Air bags:	Frontal, knee, seat-mounted, and IC air bags available; Frontal and knee air bags deployed
Alcohol/drug involvement:	Alcohol=0; positive for cannabinoids (amount not reported)
Egress from vehicle:	Removed from vehicle due to perceived serious injuries
Transport from scene:	EMS helicopter transport to level 1 trauma center
Type of medical treatment:	Hospitalized 16 days; transferred to sub-acute rehab

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Type III right occipital condyle fracture (medial inferior aspect)	150200.3	Isolated IPC Interior – Shoulder portion of belt restraint	Certain
2	Intraventricular hemorrhage layering within occipital horns of lateral ventricles	140678.2	Isolated IPC Interior – Shoulder portion of belt restraint	Certain
3	Diffuse subarachnoid hemorrhage within sulci of right frontal and parietal sulci and perimesencephalic cistern	140693.2	Isolated IPC Interior – Shoulder portion of belt restraint	Certain
4	Diffuse subarachnoid hemorrhage within sulci of left frontal and parietal sulci and perimesencephalic cistern	140693.2	Isolated IPC Interior – Shoulder portion of belt restraint	Certain
5	Rib fractures: left 4 lateral, left 5-8 anterolateral; right 10-11 posterior	450203.3	Isolated IPC Primary: Interior – Shoulder portion of belt restraint	Certain
6	Fracture of T11 vertebra with superior endplate	650434.3	Isolated IPC	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
Cont.	depression with 10 mm loss in height		Interior – This occupant's seat cushion	
7	Right lateral mass fracture (superior aspect) at C1	650226.2	Isolated IPC Interior – Shoulder portion of belt restraint	Certain
8	Right alar ligament avulsion from occipital condyle insertion; tear of the posterior atlantoaxial ligament; tectorial membrane posterior to the dens	640284.1	Isolated Interior – Shoulder portion of belt restraint	Certain
9	Small areas of ligamentum flavum sprain at C5	640284.1	Isolated Interior – Shoulder portion of belt restraint	Certain
10	Small areas of ligamentum flavum sprain at C6	640284.1	Isolated Interior – Shoulder portion of belt restraint	Certain
11	Small areas of ligamentum flavum sprain at C7	640278.1	Isolated Interior – Shoulder portion of belt restraint	Certain
12	Ventral subdural hygroma within spinal canal from C1-C6 (C1)	610299.1	Isolated Interior – Shoulder portion of belt restraint	Certain
13	Ventral subdural hygroma within spinal canal from C1-C6 (C2)	610299.1	Isolated Interior – Shoulder portion of belt restraint	Certain
14	Ventral subdural hygroma within spinal canal from C1-C6 (C3)	610299.1	Isolated Interior – Shoulder portion of belt restraint	Certain
15	Ventral subdural hygroma within spinal canal from C1-C6 (C4)	610299.1	Isolated Interior – Shoulder portion of belt restraint	Certain
16	Ventral subdural hygroma within spinal canal from C1-C6 (C5)	610299.1	Isolated Interior – Shoulder portion of belt restraint	Certain
17	Ventral subdural hygroma within spinal canal from C1-C6 (C6)	610299.1	Isolated Interior – Shoulder portion of belt restraint	Certain
18	Subtle bone marrow edema in the superior bodies of T1 and T3, compatible with small trabecular fractures without compression (T1)	650430.2	Isolated IPC Interior – Shoulder portion of belt restraint	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
19	Subtle bone marrow edema in the superior bodies of T1 and T3, compatible with small trabecular fractures without compression (T3)	650432.2	Isolated IPC Interior – Shoulder portion of belt restraint	Probable
20	T4 transverse process fracture	650420.1	Isolated Interior – Shoulder portion of belt restraint	Probable
21	Right orbital wall fracture which involves the infraorbital foramen	251221.2	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
22	Right mildly displaced nasal bone fracture	251000.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Probable
23	Penetrating injury to right knee with joint involvement and numerous foreign bodies, 15 x 10 cm	816016.2	Isolated Front – Left lower instrument panel (includes knee bolster)	Certain
24	Degloving injury to right thigh and knee, 20 x 25 cm	814004.2	Isolated IPC Front – Left lower instrument panel (includes knee bolster)	Certain
25	Right patella dislocation	874030.2	Isolated IPC Front – Left lower instrument panel (includes knee bolster)	Certain
26	Non-displaced fracture of right fibular head	854471.2	Isolated Front – Left lower instrument panel (includes knee bolster)	Certain
27	Fracture at sacrococcygeal junction with small volume of presacral fluid	856151.2	Isolated IPC Interior – This occupant's seat cushion	Probable
28	Grade II sprain of lateral patellar retinaculum	874010.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Certain
29	Large right hemispheric scalp hematoma	110402.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Certain
30	Laceration to right eyelid with shards of glass	210602.1	Isolated	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
Cont.	embedded – 3 cm upper and 1 cm lower lid; 1 cm laceration at edge of right mouth; 1 cm laceration to left chin; 1 cm laceration to left cheek		Non-contact Injury – Flying glass	
31	Right cheek ecchymosis	210402.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Certain
32	Right eye ecchymosis	210402.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Certain
33	Forehead abrasion	210202.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Probable
34	Anterior neck contusion	310402.1	Isolated Interior – Shoulder belt	Certain
35	Right anterior chest wall contusion	410402.1	Isolated Interior – Shoulder portion of belt restraint	Certain
36	Abrasion to mid-sternal chest; superficial abrasion to left anterior torso	410202.1	Isolated Interior – Shoulder portion of belt restraint	Certain
37	Low abdominal contusion	510402.1	Isolated Interior – Lap portion of belt restraint	Certain
38	Low abdominal abrasion	510202.1	Isolated Interior – Lap portion of belt restraint	Certain
39	Fracture of proximal phalanx of right middle finger with intra-articular extension	752663.1	Isolated Injured – Unknown source	Unknown
40	Left fourth metacarpal extra-articular oblique fracture with mild displacement	752553.2	Isolated Injured – Unknown source	Unknown
41	Laceration to right mid upper arm with foreign debris, 7-8 cm	710602.1	Isolated Non-contact Injury – Flying glass	Probable
42	Abrasion to right shoulder with foreign debris	710202.1	Isolated Non-contact Injury – Flying glass	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
43	Abrasion over right scapula with foreign debris	410202.1	Isolated Non-contact Injury – Flying glass	Probable
44	Laceration to right third metacarpal, 3 cm	710602.1	Isolated Non-contact Injury – Flying glass	Possible
45	Laceration to right second proximal phalanx joint, 2 cm	710602.1	Isolated Non-contact Injury – Flying glass	Possible
46	Left knee laceration, 3 cm	810602.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Certain
47	Laceration to left tibia, NFS	810600.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Certain
48	Left shin contusion	810402.1	Isolated Front – Left lower instrument panel (includes knee bolster)	Certain
49	Abrasion to right eye	210202.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Certain

Source: Hospital records and injury images.

Driver Kinematics

The 24-year-old female driver was reported as morbidly obese in the medical records with a weight of 134 kg (295 lb). The medical records showed she had a history of seizures. At the time of the SCI inspection, the power adjustable driver's seat was in a mid-track position. Based on on-scene police images the seatback was adjusted slightly aft of vertical. The adjustable head restraint was removed from the seatback by EMS. She was wearing the manual 3-point lap and shoulder seat belt system. Based on abrasions and contusions of the abdomen, the driver appeared to have worn the lap belt portion of the seat belt high on her abdomen, approximately 15 cm (6 in) above the umbilicus and above the anatomical structure of the pelvis.

The Honda's pre-crash speed was recorded at 181 km/h (112 mph) with 53 percent accelerator pedal position and no braking by the driver. She did not negotiate the left curve as the vehicle tracked off the right road edge. The vehicle's speed was above the operational range of the driver assistance features.

The Honda departed onto the right roadside and traveled down the grass-surfaced embankment. The vehicle's front struck and penetrated a wood rail fence, displacing the rails and posts. This impact did not displace the driver from her pre-crash position. The Honda traversed the grassy pasture and traveled up the positive embankment. The Honda's front struck and penetrated the second fence (Event 2). Portions of the fence (post and rail) penetrated the windshield and

entered the passenger compartment striking the driver in the right face (Event 3). She sustained a right orbital wall fracture, a nasal fracture, scalp and facial contusions, and a forehead abrasion. The driver also sustained soft tissue lacerations of the right eyelid and right upper extremity with embedded debris from flying windshield glass.

Due to the speed of the Honda, the lower front and undercarriage gouged the embankment (Event 4) resulting in an EDR-recorded longitudinal delta V of -45 km/h (-28 mph) at 300 milliseconds of AE and an unrecorded vertical component. The driver responded to the frontal and vertical components of the impact forces. Due to the position of the seat belt, she loaded the shoulder belt and began to submarine the lap belt. A laterally oriented lap belt abrasion was present on her abdomen above the umbilicus. She sustained additional seat belt abrasions and contusions of the chest and anterior neck as she submarined the belt system. Her loading of the shoulder belt fractured seven ribs. The vertical components of the undercarriage impact caused the driver to compress into the seat cushion causing a T11 vertebral fracture with 10 mm of height loss and a fracture of the sacroccoccygeal junction.

The driver's head translated forward over the shoulder belt causing flexion of the neck. She sustained a type III occipital condyle fracture with intraventricular hemorrhage and bilateral subarachnoid hemorrhage. The flexion also caused several areas of ligamentum flavum of the cervical spine, ventral subdural hygroma from C1 to C6, and a lateral mass fracture at C1.

The driver's lower extremities submarined the deployed knee air bag and engaged the lower and substructure of the left instrument panel. She sustained a large degloving injury of the right knee and thigh, a fracture of the right patella, a penetrating injury of the right knee with foreign material, a fracture of the right fibular head, and soft tissue lacerations of the left lower extremity.

As the Honda vaulted the driveway, it struck another section of the post-and-rail fence. This Event 5 impact did not alter or displace the driver. The front-right corner then struck the tree (Event 6). The vehicle and occupants experienced a second closely spaced event that further displaced the driver forward and contributed to her injuries noted above. The Honda rotated approximately 180º clockwise and fell onto a fourth section of fence before coming to final rest.

The driver was found in the vehicle with her head resting on the seat cushion at the bight of the cushion and seatback. Her back was on the cushion and her pelvic region and lower extremities were compressed into the floor area under the lower left instrument panel. Based on her injuries, the shoulder belt webbing was engaged against her neck and the lap belt webbing was high on her torso. The first responders cut the lap belt webbing and initiated treatment and extrication activities to remove the driver from the vehicle. She was transported by helicopter to a regional medical center where she was hospitalized for 16 days and then transferred to sub-acute rehab.

Second-Row-Left Occupant Demographics

Age/sex:	3 years/male
Height:	97 cm (38 in)
Weight:	15 kg (33 lb)
Eyewear:	None
Seat type:	Forward-facing bench seat with adjustable head restraint
Seat track position:	Not adjustable

Manual restraint usage: 5-point harness in forward-facing CRS that was secured with the vehicle's 3-point lap and shoulder seat belt
Usage source: Vehicle inspection
Air bags: IC air bag available; not deployed
Alcohol/drug involvement: None given
Egress from vehicle: Fatal before removal
Transport from scene: Transported to local coroner
Type of medical treatment: No treatment

Second-Row-Left Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Penetrating injury to skull, NFS	116000.3	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
2	Subarachnoid hemorrhage, NFS, right cerebrum	140693.2	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
3	Subarachnoid hemorrhage, NFS, left cerebrum	140693.2	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
4	Fracture of cervical spine at level of C4, NFS	610200.3	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
5	Penetrating injury extending from left side of philtrum, leftward toward cheek/maxillary region	216004.2	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
6	Fracture of maxilla, NFS	250800.2	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
7	Fracture of mandible, NFS	250600.1	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain
8	Open defect near left medial canthus, 1.5 cm	210602.1	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
9	Contusion near left lateral canthus, 2 cm	210402.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Certain
10	Scattered abrasions on right side of forehead and midface	210202.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Certain
11	Linear abrasions on left side of face	210202.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Certain
12	Retropharyngeal/pre-cervical hematoma	340602.2	Isolated Other Vehicle or Object – Other object (specify): Fence post	Probable
13	Fracture of right distal humerus	751331.2	Isolated IPC Other Vehicle or Object – Other object (specify): Fence post	Probable
14	Dislocation of right ulna	772030.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Probable
15	Abrasion of left antecubital fossa region, 8 x 3 cm	710202.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Probable
16	Laceration of right thigh, 1.5 cm	810602.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Probable
17	Deep abrasion of right thigh, 3 x 2 cm	810202.1	Isolated Other Vehicle or Object – Other object (specify): Fence post	Probable
18	Linear abrasions of right shin, 2 and 3 cm	810202.1	Isolated Interior – Other seating position seatback	Possible

Source: Autopsy report and on-scene images.

Second-Row-Left Occupant Kinematics

The 3-year-old male child was seated in the Graco Extend2Fit Convertible CRS in the second-row-left position of the Honda. The CRS was installed forward-facing and was secured to the vehicle by the 3-point lap and shoulder seat belt. The switchable retractor's specific mode was unknown. The child was secured in the CRS using the 5-point harness system. Throughout the entire crash sequence the child remained secured in the CRS although he did respond to the frontal and vertical crash forces by moving forward and vertically, loading the seated part of the CRS's shell. His lower-right leg possibly contacted the back of the left-front seatback resulting in linear abrasions. During Event 3, a fence post penetrated the windshield and struck the child in the face, right arm, and thigh. He sustained a penetrating injury of the skull, subarachnoid hemorrhage, a cervical spine fracture, fractures of the mandible and maxilla, a fracture of the distal right humerus, and a dislocation of the right ulna. Soft tissue injuries surrounded the underlying injuries.

The first responders arrived on-scene and evaluated the status of the child. He was seated in the CRS with his head slumped forward, but unresponsive and deceased. Rescue personnel cut the vehicle's seat belt webbing and removed the child from the vehicle while still in the CRS. His body was transported to the coroner's office for an autopsy, which gave the basis for his injuries.

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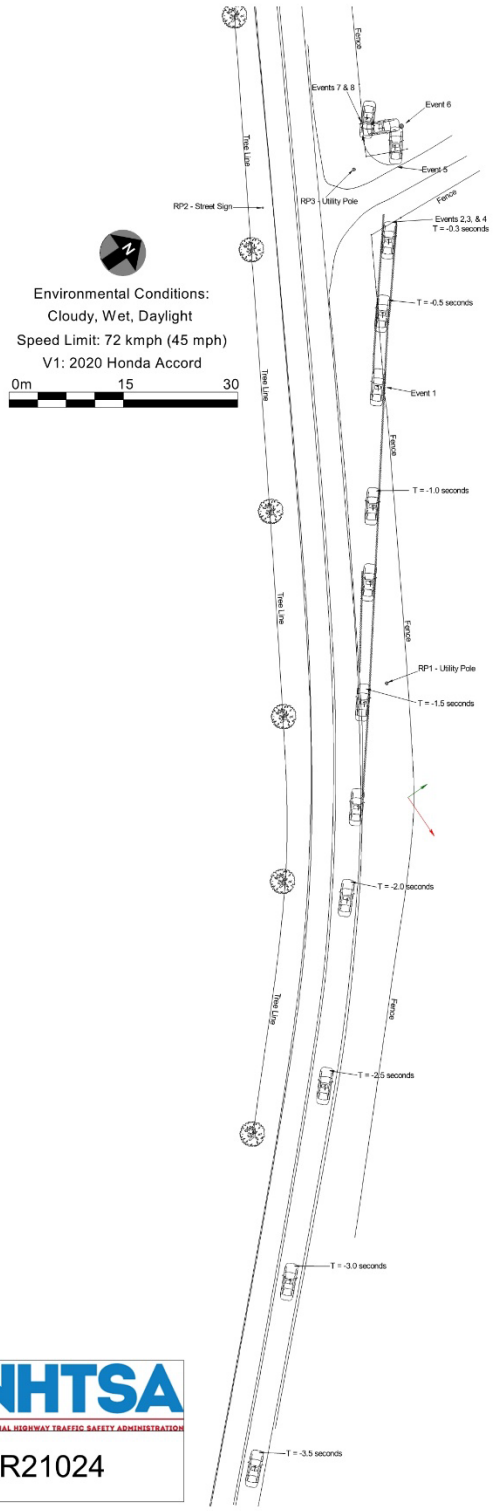
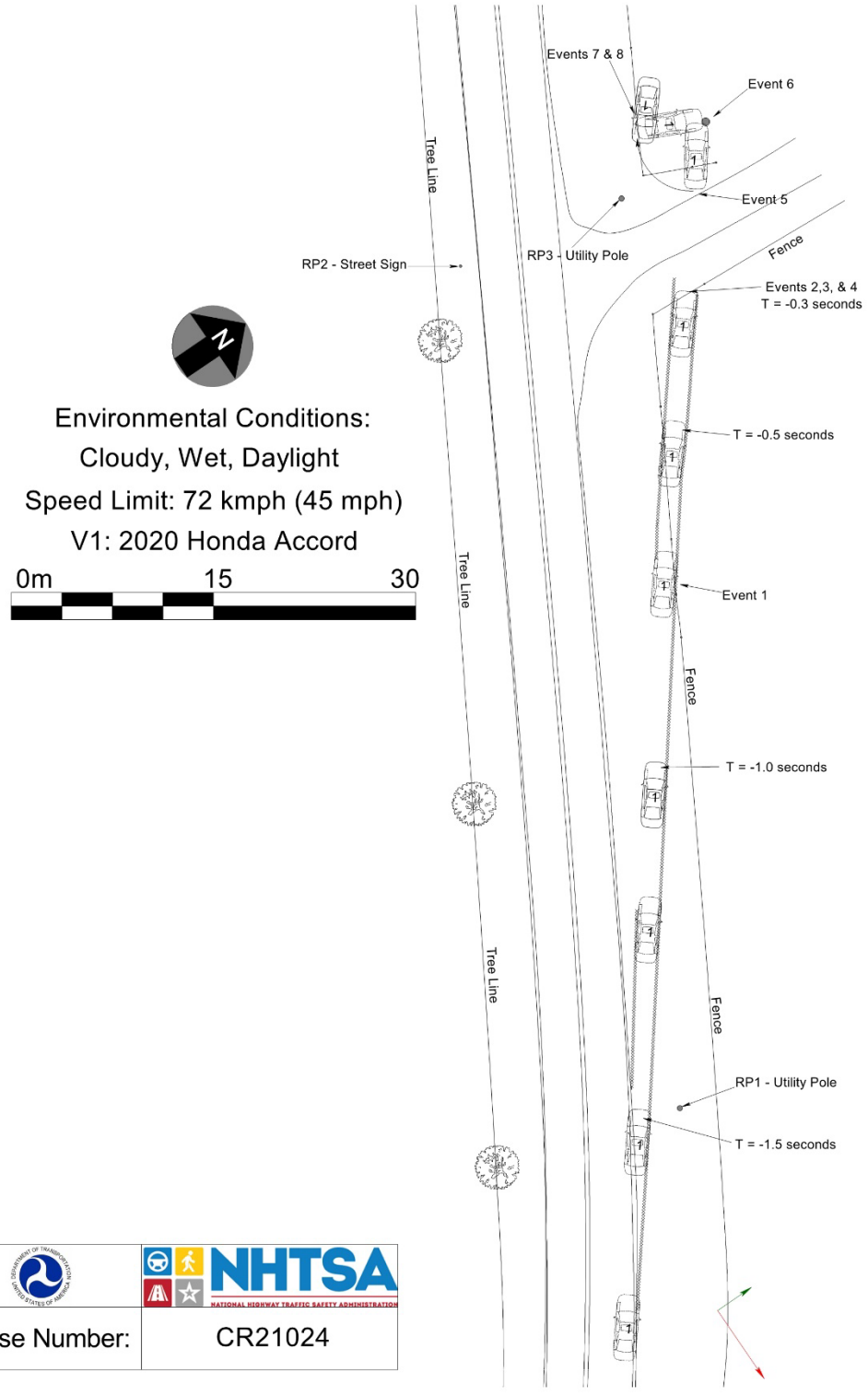
Crash Diagram



	NHTSA NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Case Number:	CR21024

Crash Diagram: A Detailed View



Appendix A: 2020 Honda Accord Event Data Recorder Report[3]

[3] The EDR contained in this technical report was imaged during the police investigation and the imaged CDRx file was shared with SCI. 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	1HGCV3F56LA******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CR21024_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 21.1
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 23.3
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.
- *Service brake* is the status of the driver operated brake pedal. For Acura RDX, this includes the braking support of Collision Mitigation Braking System (CMBS) and Adaptive Cruise Control (ACC). For models other than RDX, this represents only the driver input and does not include the braking support of CMBS or ACC.
- *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.
- *Ignition switch status* represents the status of the ignition switch at T0 of the event.
- *Time, ignition switch off prior to event* is recorded in 1 second increments. This value represents the number of full seconds that have elapsed between the time the ignition switch was turned off and T0, with a maximum of 255 seconds.
- 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**	Left to right (clockwise) rotation
*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*
- *Ignition switch status*
- *Time, ignition switch off prior to event*

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.

04003_HondaSRS_GEN3_r003

System Status at Retrieval

EDR Version	1.5.4.0

System Status at Event (Event Record 1)

Multi-Event, Number of Events (1, 2)	1
Complete File Recorded (Yes/No)	Yes
Ignition Cycle, Download	2599
Maximum Delta-V, Longitudinal (MPH [km/h])	-28 [-45]
Time, Maximum Delta-V, Longitudinal (msec)	300.0
Maximum Delta-V, Lateral (MPH [km/h])	-4 [-7]
Time, Maximum Delta-V, Lateral (msec)	235.0
Time, Maximum Delta-V, Resultant (msec)	300.0
Time, Accelerometer Range Exceeded, Longitudinal (msec)	0
Time, Accelerometer Range Exceeded, Lateral (msec)	0
Time, Accelerometer Range Exceeded, Normal (msec)	26.0

Deployment Command Data (Event Record 1)

Pretensioner Deployment, Time to Fire, Driver (msec)	53
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	0
Lap Pretensioner Deployment, Time to Fire, Driver (msec)	69
Lap Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to Deploy First Stage, Driver (msec)	70
Frontal Air Bag Deployment, Time to Deploy First Stage, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (msec)	0
Knee Air Bag Deployment, Time to Deploy, Driver (msec)	53
Knee Air Bag Deployment, Time to Deploy, 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)	73
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)	73
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
Ignition Switch Status (On, Off)	On
Frontal Air Bag Warning Lamp (On, Off)	Off
Ignition Cycle, Crash	2598
Time, Ignition switch off prior to Event (sec)	0

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

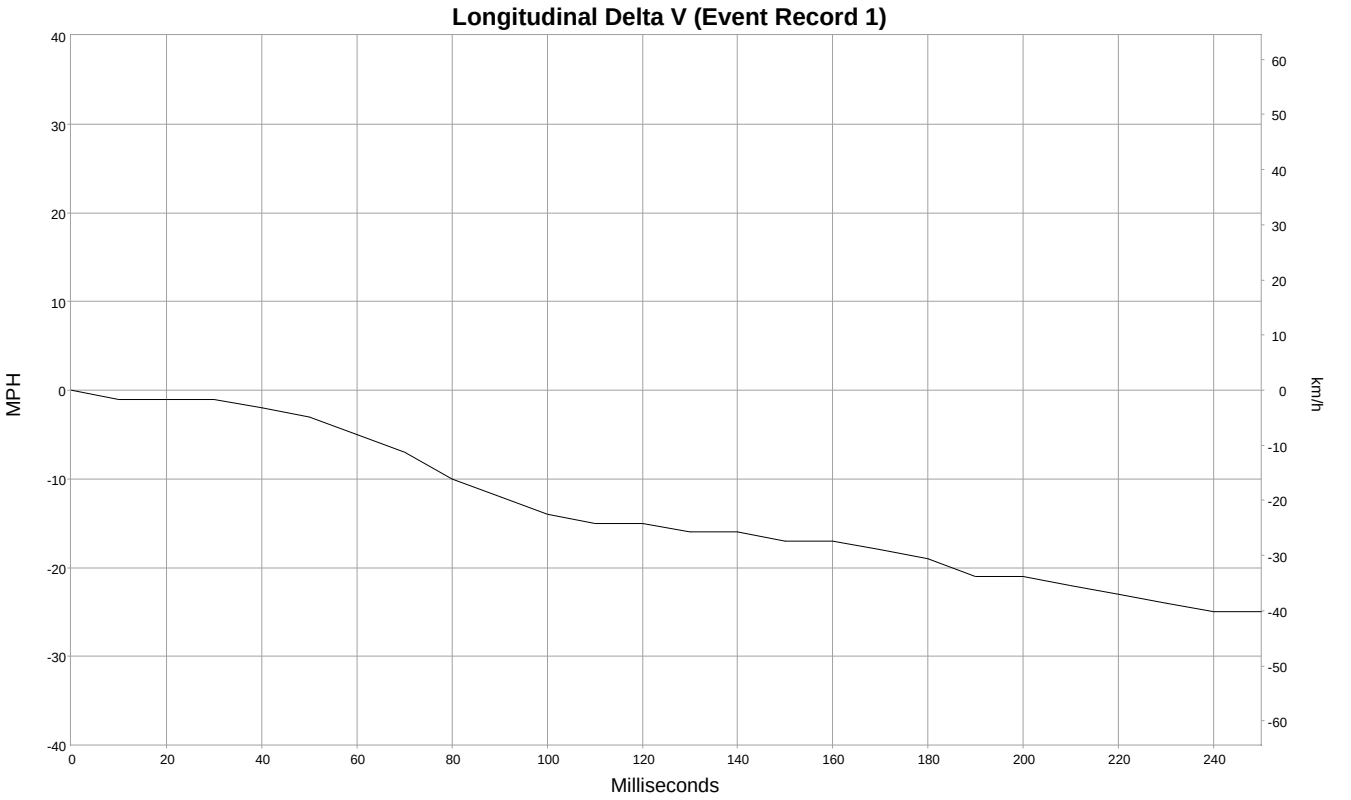
Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal Position, % full	Service Brake (On, Off)	ABS Activity (On, Off)	Stability Control (On, Off, Engaged)	Steering Input (deg)	Engine RPM
-5.0	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-4.5	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-4.0	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-3.5	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-3.0	113 [182]	53	Off	Off	On Non-Engaged	5	10,000
-2.5	113 [182]	53	Off	Off	On Non-Engaged	5	10,000
-2.0	114 [183]	52	Off	Off	On Non-Engaged	15	10,000
-1.5	114 [183]	53	Off	Off	On Non-Engaged	25	10,000
-1.0	114 [183]	50	Off	Off	On Non-Engaged	35	10,000
-0.5	114 [184]	52	Off	Off	On Engaged	15	10,000
0.0	114 [184]	59	Off	Off	On Engaged	15	10,000

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	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-4.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-4.0	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-3.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-3.0	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-2.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-2.0	52	Not warning	Not engaged	On	Not warning	Not engaged	On
-1.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-1.0	50	Not warning	Not engaged	On	Not warning	Not engaged	On
-0.5	52	Not warning	Not engaged	On	Not warning	Not engaged	On
0.0	59	Not warning	Not engaged	On	Not warning	Not engaged	On

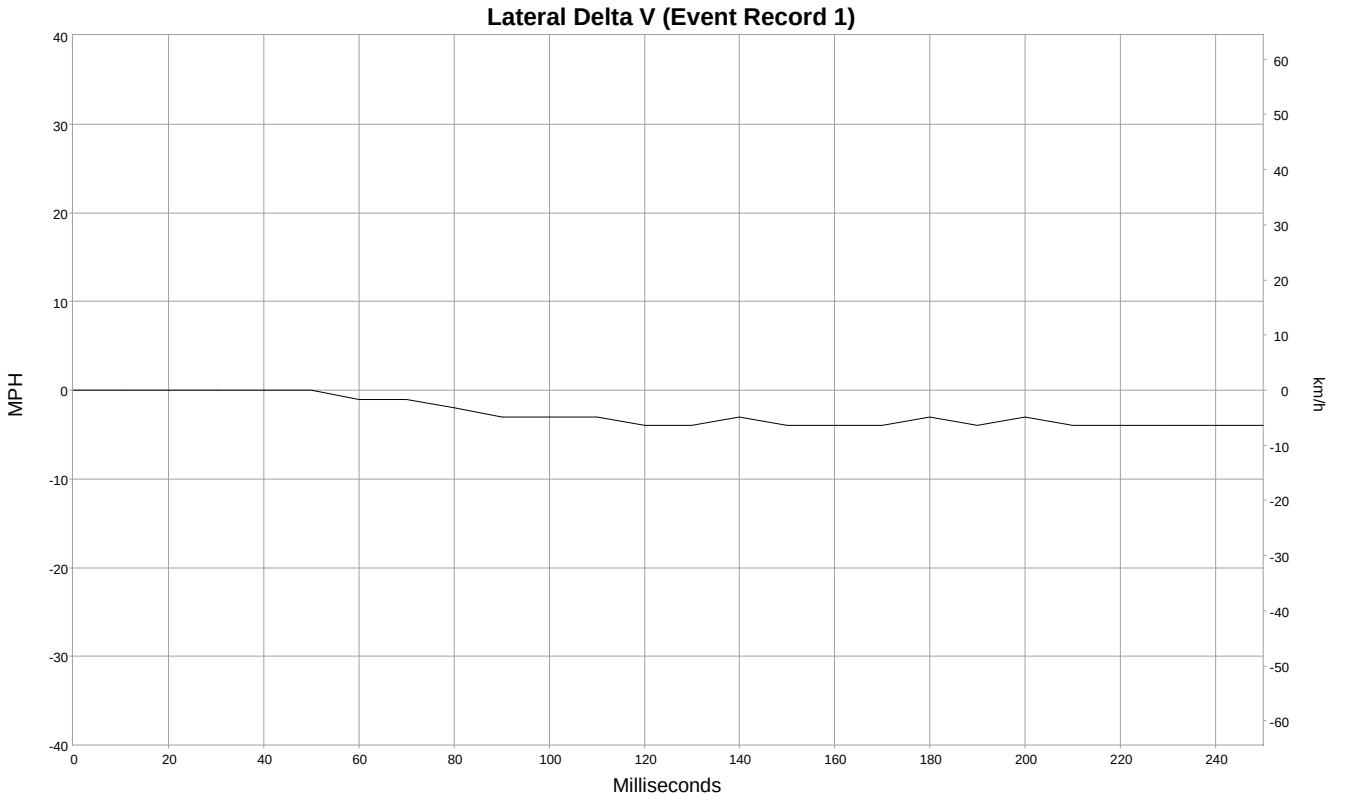
Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 1) - Table 3 of 3

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	On	Not engaged	On	Not Engaged	On
-4.5	Not engaged	On	Not engaged	On	Not Engaged	On
-4.0	Not engaged	On	Not engaged	On	Not Engaged	On
-3.5	Not engaged	On	Not engaged	On	Not Engaged	On
-3.0	Not engaged	On	Not engaged	On	Not Engaged	On
-2.5	Not engaged	On	Not engaged	On	Not Engaged	On
-2.0	Not engaged	On	Not engaged	On	Not Engaged	On
-1.5	Not engaged	On	Not engaged	On	Not Engaged	On
-1.0	Not engaged	On	Not engaged	On	Not Engaged	On
-0.5	Not engaged	On	Not engaged	On	Not Engaged	On
0.0	Not engaged	On	Not engaged	On	Not Engaged	On



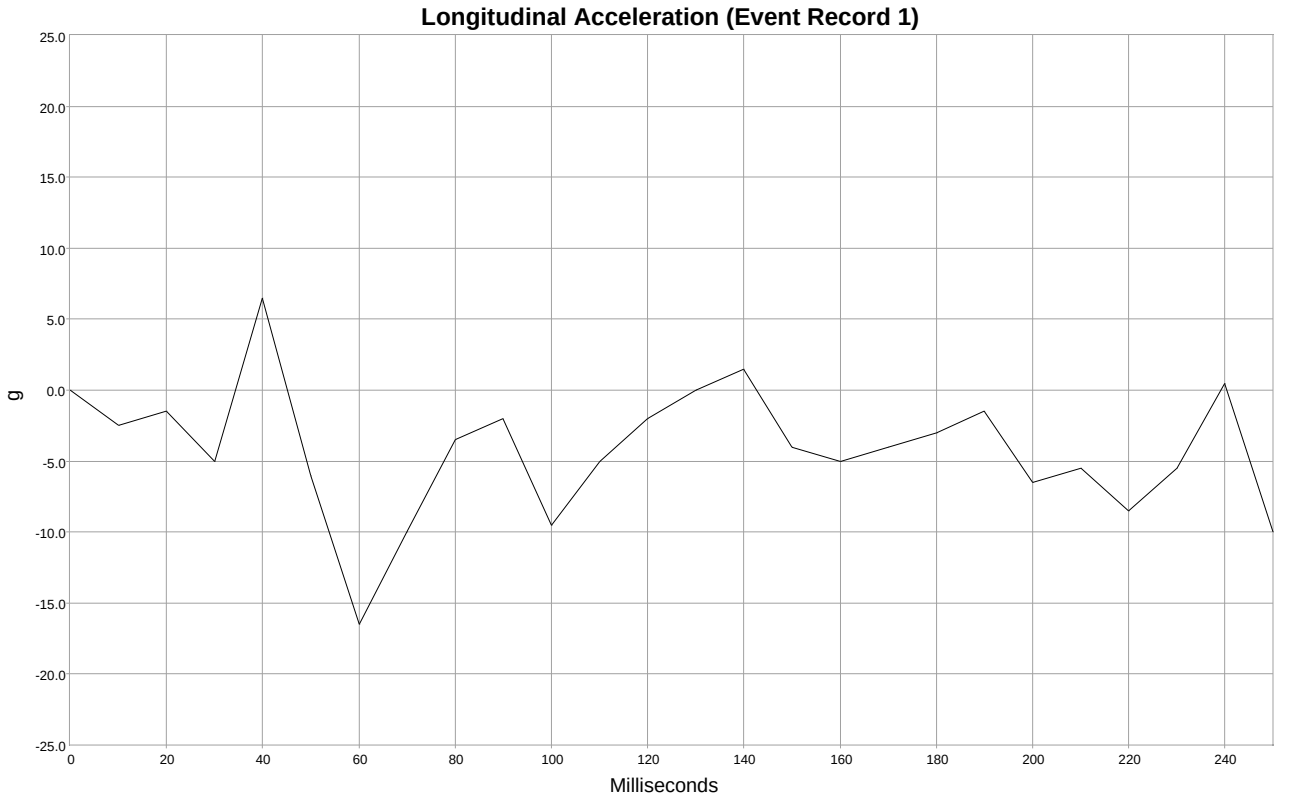
Longitudinal Delta V (Event Record 1)

Time (msec)	MPH [km/h]
0	0 [0]
10	-1 [-1]
20	-1 [-1]
30	-1 [-1]
40	-2 [-3]
50	-3 [-5]
60	-5 [-8]
70	-7 [-12]
80	-10 [-16]
90	-12 [-20]
100	-14 [-22]
110	-15 [-24]
120	-15 [-24]
130	-16 [-25]
140	-16 [-25]
150	-17 [-27]
160	-17 [-28]
170	-18 [-29]
180	-19 [-30]
190	-21 [-33]
200	-21 [-34]
210	-22 [-36]
220	-23 [-37]
230	-24 [-39]
240	-25 [-40]
250	-25 [-41]



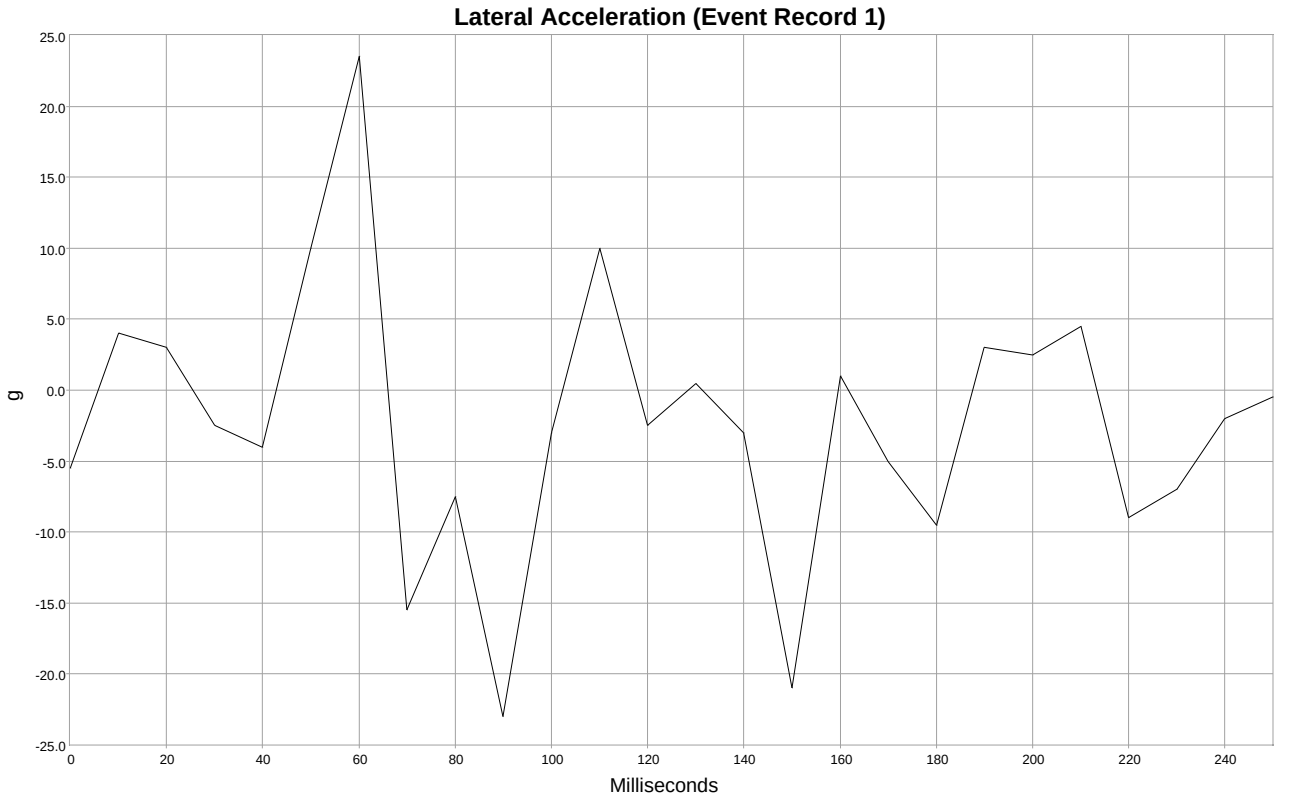
Lateral Delta V (Event Record 1)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	0 [0]
30	0 [0]
40	0 [0]
50	0 [0]
60	-1 [-2]
70	-1 [-2]
80	-2 [-3]
90	-3 [-5]
100	-3 [-5]
110	-3 [-5]
120	-4 [-6]
130	-4 [-6]
140	-3 [-5]
150	-4 [-6]
160	-4 [-6]
170	-4 [-6]
180	-3 [-5]
190	-4 [-6]
200	-3 [-5]
210	-4 [-6]
220	-4 [-6]
230	-4 [-6]
240	-4 [-7]
250	-4 [-6]



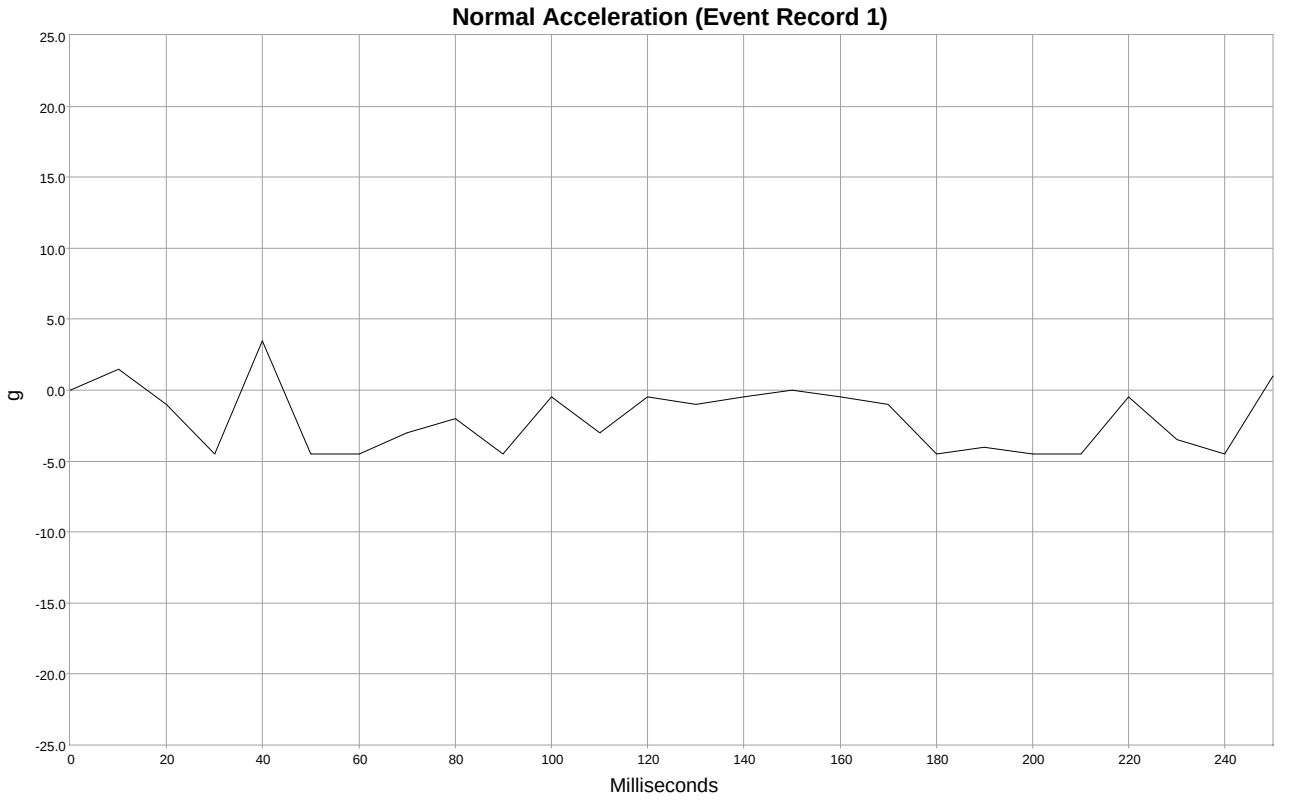
Longitudinal Acceleration (Event Record 1)

Time (msec)	g
0	0.0
10	-2.5
20	-1.5
30	-5.0
40	6.5
50	-6.0
60	-16.5
70	-10.0
80	-3.5
90	-2.0
100	-9.5
110	-5.0
120	-2.0
130	0.0
140	1.5
150	-4.0
160	-5.0
170	-4.0
180	-3.0
190	-1.5
200	-6.5
210	-5.5
220	-8.5
230	-5.5
240	0.5
250	-10.0



Lateral Acceleration (Event Record 1)

Time (msec)	g
0	-5.5
10	4.0
20	3.0
30	-2.5
40	-4.0
50	10.0
60	23.5
70	-15.5
80	-7.5
90	-23.0
100	-3.0
110	10.0
120	-2.5
130	0.5
140	-3.0
150	-21.0
160	1.0
170	-5.0
180	-9.5
190	3.0
200	2.5
210	4.5
220	-9.0
230	-7.0
240	-2.0
250	-0.5



Normal Acceleration (Event Record 1)

Time (msec)	g
0	0.0
10	1.5
20	-1.0
30	-4.5
40	3.5
50	-4.5
60	-4.5
70	-3.0
80	-2.0
90	-4.5
100	-0.5
110	-3.0
120	-0.5
130	-1.0
140	-0.5
150	0.0
160	-0.5
170	-1.0
180	-4.5
190	-4.0
200	-4.5
210	-4.5
220	-0.5
230	-3.5
240	-4.5
250	1.0

System Status at Event (Event Record 2)

Multi-Event, Number of Events (1, 2)	2
Complete File Recorded (Yes/No)	Yes
Ignition Cycle, Download	2599
Time from Event 1 to 2 (sec)	0.3
Maximum Delta-V, Longitudinal (MPH [km/h])	-19 [-30]
Time, Maximum Delta-V, Longitudinal (msec)	300.0
Maximum Delta-V, Lateral (MPH [km/h])	2 [4]
Time, Maximum Delta-V, Lateral (msec)	225.0
Time, Maximum Delta-V, Resultant (msec)	300.0
Time, Accelerometer Range Exceeded, Longitudinal (msec)	0
Time, Accelerometer Range Exceeded, Lateral (msec)	0
Time, Accelerometer Range Exceeded, Normal (msec)	243.0

Deployment Command Data (Event Record 2)

Pretensioner Deployment, Time to Fire, Driver (msec)	229
Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	0
Lap Pretensioner Deployment, Time to Fire, Driver (msec)	245
Lap Pretensioner Deployment, Time to Fire, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to Deploy First Stage, Driver (msec)	229
Frontal Air Bag Deployment, Time to Deploy First Stage, Right Front Passenger (msec)	0
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (msec)	0
Knee Air Bag Deployment, Time to Deploy, Driver (msec)	229
Knee Air Bag Deployment, Time to Deploy, 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)	0
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)	0
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
Ignition Switch Status (On, Off)	On
Frontal Air Bag Warning Lamp (On, Off)	Off
Ignition Cycle, Crash	2598
Time, Ignition switch off prior to Event (sec)	0

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

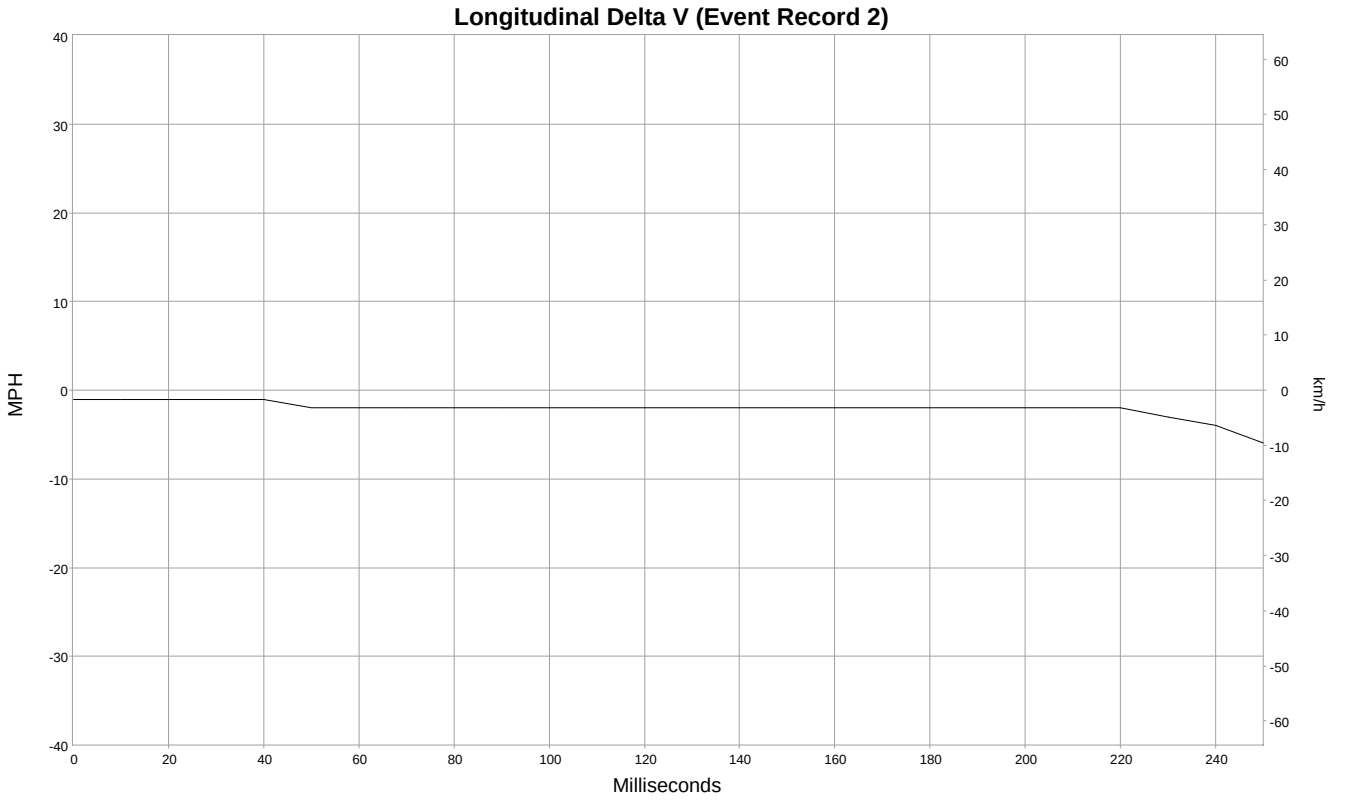
Time Stamp (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal Position, % full	Service Brake (On, Off)	ABS Activity (On, Off)	Stability Control (On, Off, Engaged)	Steering Input (deg)	Engine RPM
-5.0	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-4.5	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-4.0	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-3.5	112 [181]	53	Off	Off	On Non-Engaged	0	10,000
-3.0	113 [182]	53	Off	Off	On Non-Engaged	5	10,000
-2.5	113 [182]	53	Off	Off	On Non-Engaged	5	10,000
-2.0	114 [183]	52	Off	Off	On Non-Engaged	15	10,000
-1.5	114 [183]	53	Off	Off	On Non-Engaged	25	10,000
-1.0	114 [183]	50	Off	Off	On Non-Engaged	35	10,000
-0.5	114 [184]	52	Off	Off	On Engaged	15	10,000
0.0	117 [189]	99	On	On	On Non-Engaged	185	9,900

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	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-4.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-4.0	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-3.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-3.0	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-2.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-2.0	52	Not warning	Not engaged	On	Not warning	Not engaged	On
-1.5	53	Not warning	Not engaged	On	Not warning	Not engaged	On
-1.0	50	Not warning	Not engaged	On	Not warning	Not engaged	On
-0.5	52	Not warning	Not engaged	On	Not warning	Not engaged	On
0.0	99	Not warning	Not engaged	On	Not warning	Not engaged	Off

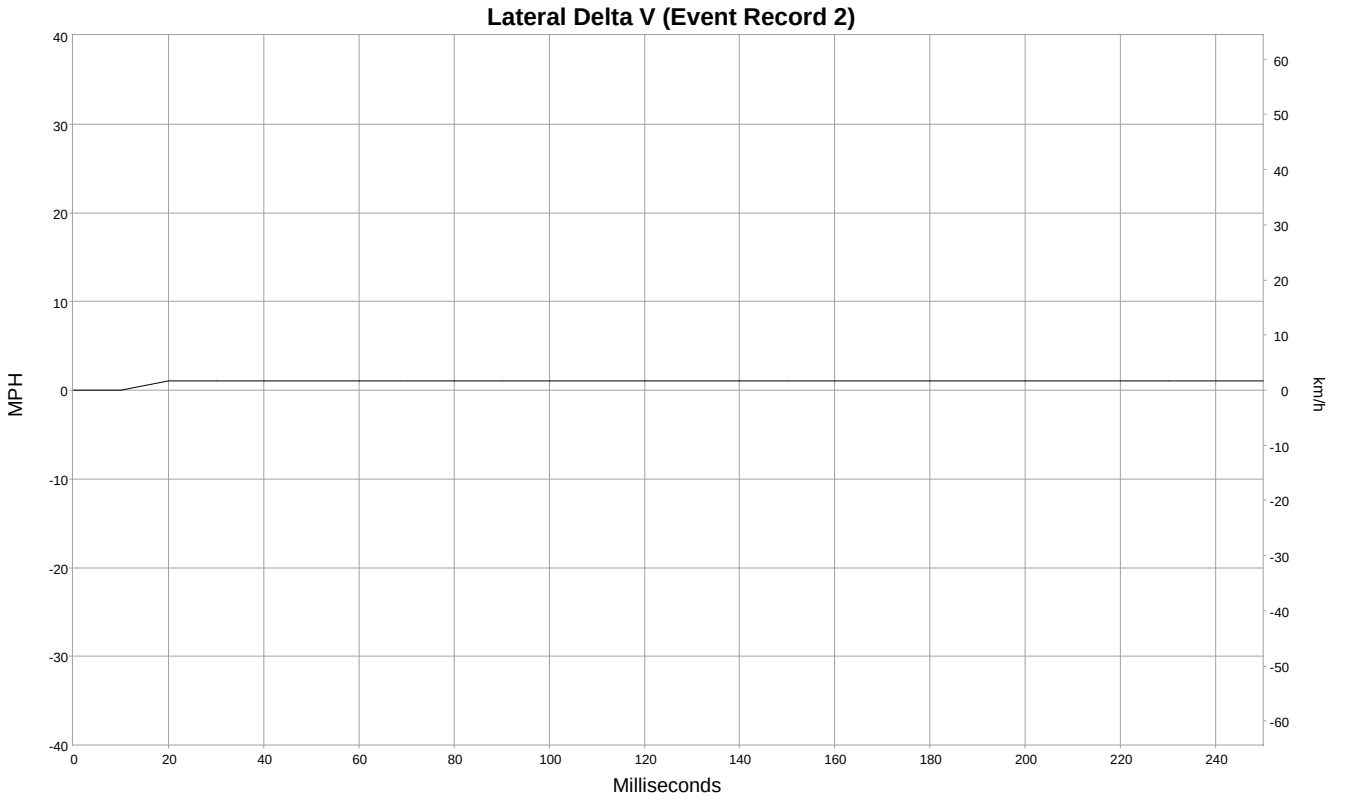
Pre-Crash Data -5 to 0 sec [2 samples/sec] (Event Record 2) - Table 3 of 3

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	On	Not engaged	On	Not Engaged	On
-4.5	Not engaged	On	Not engaged	On	Not Engaged	On
-4.0	Not engaged	On	Not engaged	On	Not Engaged	On
-3.5	Not engaged	On	Not engaged	On	Not Engaged	On
-3.0	Not engaged	On	Not engaged	On	Not Engaged	On
-2.5	Not engaged	On	Not engaged	On	Not Engaged	On
-2.0	Not engaged	On	Not engaged	On	Not Engaged	On
-1.5	Not engaged	On	Not engaged	On	Not Engaged	On
-1.0	Not engaged	On	Not engaged	On	Not Engaged	On
-0.5	Not engaged	On	Not engaged	On	Not Engaged	On
0.0	Not engaged	On	Not engaged	On	Not Engaged	On



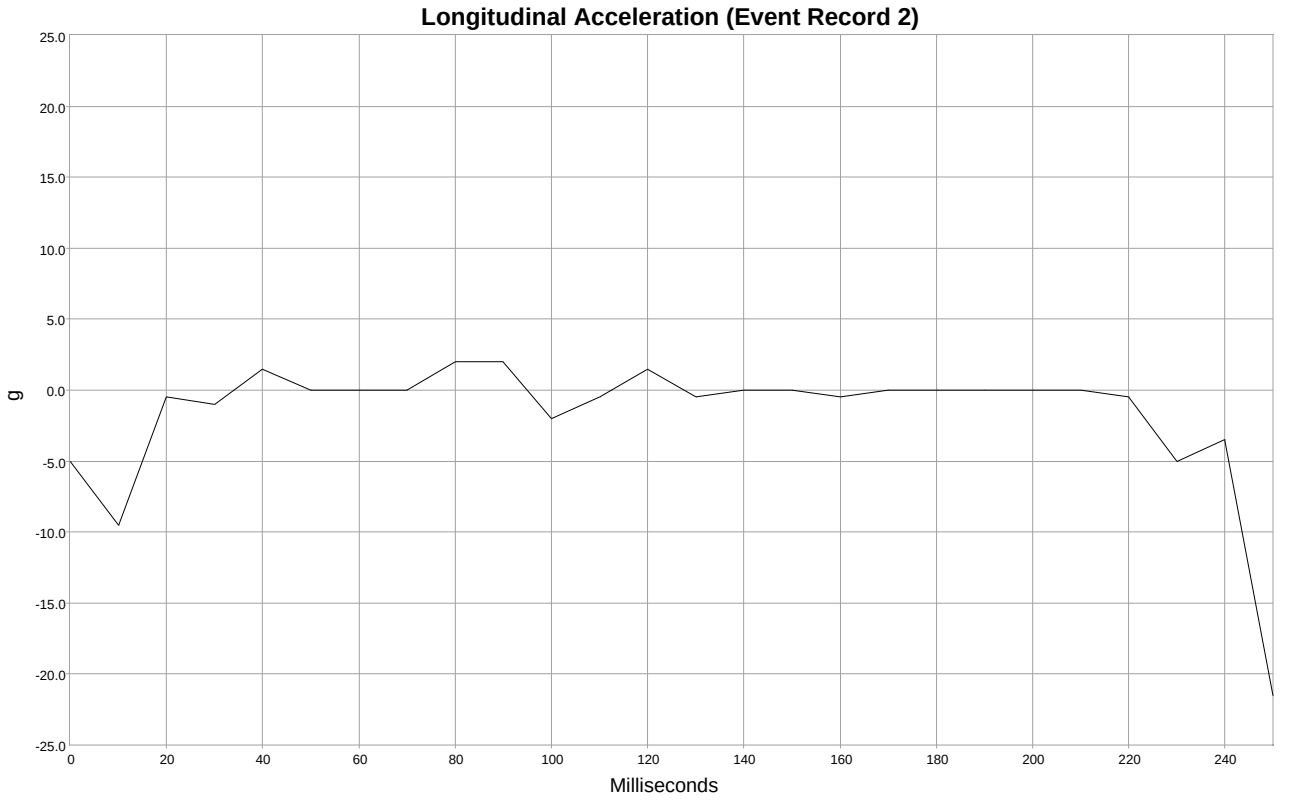
Longitudinal Delta V (Event Record 2)

Time (msec)	MPH [km/h]
0	-1 [-1]
10	-1 [-1]
20	-1 [-2]
30	-1 [-2]
40	-1 [-2]
50	-2 [-3]
60	-2 [-3]
70	-2 [-3]
80	-2 [-3]
90	-2 [-3]
100	-2 [-3]
110	-2 [-3]
120	-2 [-3]
130	-2 [-3]
140	-2 [-3]
150	-2 [-3]
160	-2 [-3]
170	-2 [-3]
180	-2 [-3]
190	-2 [-3]
200	-2 [-3]
210	-2 [-4]
220	-2 [-4]
230	-3 [-5]
240	-4 [-7]
250	-6 [-9]



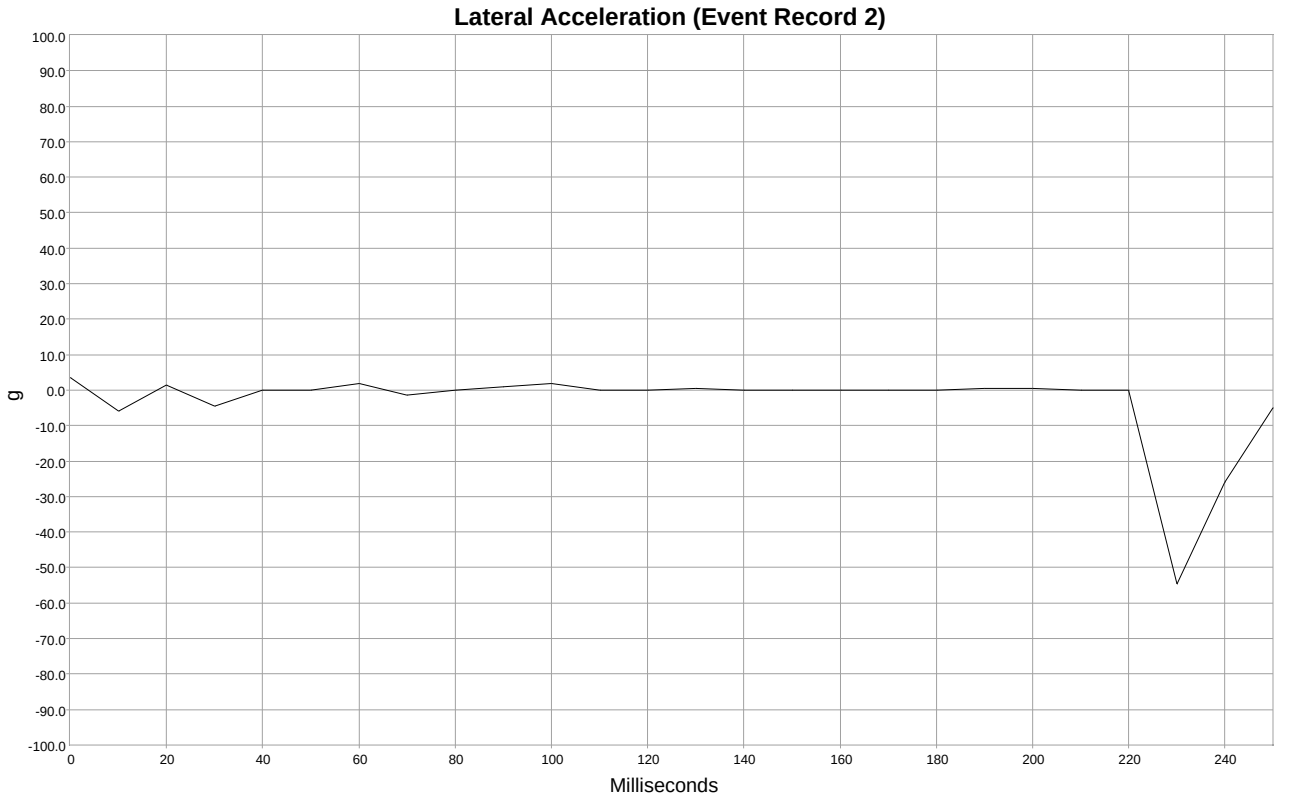
Lateral Delta V (Event Record 2)

Time (msec)	MPH [km/h]
0	0 [0]
10	0 [0]
20	1 [1]
30	1 [1]
40	1 [2]
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	1 [2]
160	1 [2]
170	1 [2]
180	1 [2]
190	1 [2]
200	1 [2]
210	1 [2]
220	1 [2]
230	1 [2]
240	1 [2]
250	1 [1]



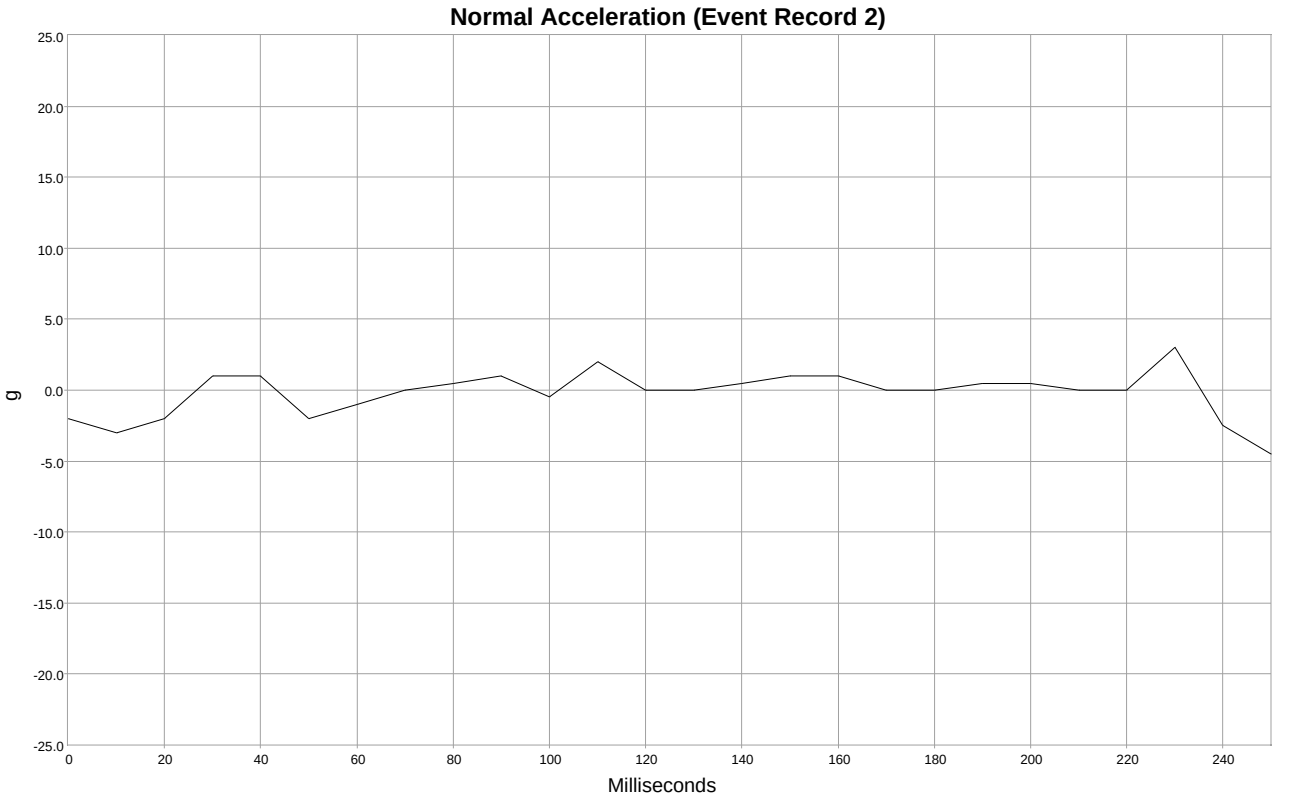
Longitudinal Acceleration (Event Record 2)

Time (msec)	g
0	-5.0
10	-9.5
20	-0.5
30	-1.0
40	1.5
50	0.0
60	0.0
70	0.0
80	2.0
90	2.0
100	-2.0
110	-0.5
120	1.5
130	-0.5
140	0.0
150	0.0
160	-0.5
170	0.0
180	0.0
190	0.0
200	0.0
210	0.0
220	-0.5
230	-5.0
240	-3.5
250	-21.5



Lateral Acceleration (Event Record 2)

Time (msec)	g
0	3.5
10	-6.0
20	1.5
30	-4.5
40	0.0
50	0.0
60	2.0
70	-1.5
80	0.0
90	1.0
100	2.0
110	0.0
120	0.0
130	0.5
140	0.0
150	0.0
160	0.0
170	0.0
180	0.0
190	0.5
200	0.5
210	0.0
220	0.0
230	-54.5
240	-26.0
250	-5.0



Normal Acceleration (Event Record 2)

Time (msec)	g
0	-2.0
10	-3.0
20	-2.0
30	1.0
40	1.0
50	-2.0
60	-1.0
70	0.0
80	0.5
90	1.0
100	-0.5
110	2.0
120	0.0
130	0.0
140	0.5
150	1.0
160	1.0
170	0.0
180	0.0
190	0.5
200	0.5
210	0.0
220	0.0
230	3.0
240	-2.5
250	-4.5

Hexadecimal Data

DID #	Data
$8000	41 5B 14 14 11 9B 00 5D 00 55 00 00 11 33 00 00 20 0F 00 E9 02 06 12 00 00 00 00 00 00 00 00 00 11 11 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 46
$8020	01 05 00 00 00 00 00 00 00 00 00 00 00 00 00 FA
$8021	AA 00 01 02 00 03 00 00 00 00 00 50 0A 27 AA AA
$8022	AA 01 CC 6E E6 00 00 00 35 00 00 00 45 00 00 00 00 46 00 00 00 35 00 00 00 00 49 00 00 00 49 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 AD
$8023	AA 01 CC 6E E6 00 00 00 E5 00 00 00 F5 00 00 00 00 E5 00 00 00 E5 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 90
$8024	AA 01 FF 80 00 40 43 02 12 12 31 00 0A 26 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 CC
$8025	AA 01 FF 80 00 40 43 02 12 12 31 00 0A 26 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 CC
$8026	AA 01 FC D0 35 00 00 77 33 00 30 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B6 35 01 64 35 00 00 00 00 00 00 00 00 00 00 00 B6 35 01 64 35 00 00 00 00 00 00 00 00 00 00 00 B7 34 03 64 34 00 00 00 00 00 00 00 00 00 00 00 B7 35 05 64 35 00 00 00 00 00 00 00 00 00 00 00 B7 32 07 64 32 00 00 00 00 00 00 00 00 00 00 00 B8 34 03 64 34 20 00 00 00 00 00 00 00 00 00 00 B8 3B 03 64 3B 20 00 00 00 00 00 00 00 00 00 72
$8027	AA 01 FC D0 35 00 00 77 33 00 30 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B5 35 00 64 35 00 00 00 00 00 00 00 00 00 00 00 B6 35 01 64 35 00 00 00 00 00 00 00 00 00 00 00 B6 35 01 64 35 00 00 00 00 00 00 00 00 00 00 00 B7 34 03 64 34 00 00 00 00 00 00 00 00 00 00 00 B7 35 05 64 35 00 00 00 00 00 00 00 00 00 00 00 B7 32 07 64 32 00 00 00 00 00 00 00 00 00 00 00 B8 34 03 64 34 20 00 00 00 00 00 00 00 00 00 00 BD 63 25 63 63 05 00 00 01 00 00 00 00 00 00 16
$8028	AA 00 00 FF FF FF FD FB F8 F4 F0 EC EA E8 E8 E7 E7 E5 E4 E3 E2 DF DE DC DB D9 D8 D7 00 00 00 00 00 00 00 00 00 00 00 00 D3 78 00 00 00 00 00 3C
$8029	AA 00 FF FF FE FE FE FD FD FD FD FD FD FD FD FD FD FD FD FD FD FD FD FC FC FB F9 F7 00 00 00 00 00 00 00 00 00 00 00 00 E2 78 00 00 00 00 00 51
$802A	AA 00 00 00 00 00 00 00 FE FE FD FB FB FB FA FA FB FA FA FA FB FA FB FA FA FA F9 FA 00 00 00 00 00 00 00 00 00 00 00 00 F9 5E 00 78 00 00 00 EF

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$802B          AA 00 00 00 01 01 02 01 01 01 01 01 01 02 02 02
               02 02 02 02 02 02 02 02 02 01 00 00 00 00
               00 00 00 00 00 00 00 00 04 5A 00 78 00 00 00 59

$802C          AA 01 00 FB FD F6 0D F4 DF EC F9 FC ED F6 FC 00
               03 F8 F6 F8 FA FD F3 F5 EF F5 01 EC 00 00 00 00
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 2E

$802D          AA 01 F6 ED FF FE 03 00 00 00 04 04 FC FF 03 FF
               00 00 FF 00 00 00 00 00 FF F6 F9 D5 00 00 00 00
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 AB

$802E          AA 01 F5 08 06 FB F8 14 2F E1 F1 D2 FA 14 FB 01
               FA D6 02 F6 ED 06 05 09 EE F2 FC FF 00 00 00 00
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 CA

$802F          AA 01 07 F4 03 F7 00 00 04 FD 00 02 04 00 00 01
               00 00 00 00 00 01 01 00 00 93 CC F6 00 00 00 00
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 01

$8030          AA 01 00 03 FE F7 07 F7 F7 FA FC F7 FF FA FF FE
               FF 00 FF FE F7 F8 F7 F7 FF F9 F7 02 01 04 00 00
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 B6

$8031          AA 01 FC FA FC 02 02 FC FE 00 01 02 FF 04 00 00
               01 02 02 00 00 01 01 00 00 06 FB F7 09 7E 00 00
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 D9

$8007          AA 00 00 00 00 00 00 00 0E 00 00 00 00 00 00 00
               00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 F2

$803F          AA 02 00 20 00 00 18 30 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 02 C4 2F 80 00 00 00 00 01 27 16 00 00 00 16
               00 00 00 00 07 00 10 7F FF 10 FF 00 00 00 00 00
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               00 00 00 00 00 00 00 00 00 E9

$8012          AA 00 04 19 0D 0F 53 05 C4 00 00 00 00 00 00 00
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$8013          AA 02 C4 2F 80 00 00 00 00 01 27 16 00 00 00 16
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$8014          AA 00 04 3D AE 02 67 06 C8 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 D3

$8015          AA 02 C4 2F 80 00 00 00 00 01 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
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               00 00 00 00 00 00 00 00 00 E0

$8016          AA 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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$8017          AA 02 C4 2F 80 00 00 00 00 01 27 16 00 00 00 16
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$8018           AA 00 90 01 17 30 1A 08 00 00 00 00 00 20 00
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$801B           AA 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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$8001           AA 01 C4 18 00 00 00 00 36 36 00 00 00 36 00 00
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$8002           AA 01 E0 FE F8 FF 00 00 00 80 31 00 00 00 00 00
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                80 9F 27 F9 FF 00 0C 6A 00 00 00 00 00 00 00 00
                00 00 00 00 00 00 00 00

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$8005           AA 01 F8 F0 F0 F0 DE 03 DE 01 DE 03 00 00 00 00
                00 7F FF 00 FF 00 00 00 00 00 00 00 00 00 00 00
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                FF BA 00 00 EE FE CC 00 00 00 00 00 00 01 8E
                04 18 00 00 9E 03 7A 00 00 00 00 00 00 00 C9
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$8008           00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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$8009           AA 01 B7 F8 AA AA AA AA 00 FF F2 00 49 00 11 07
                00 00 00 00

$800A           AA 00 00 31 00 00 50 E0 92 13 B2 50 DA 9A 9F 5C
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$800F           AA 00 B6 63 99 80 00 00 C0 00 80 80 00 C0 C0 00
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$8010           AA 01 F8 F8 F8 F8 F0 F0 E0 E3 00 00 00 00 00 00
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           A0 C0 03 21 01 00 00 00 60 00 00 01 3F 3F 00 00
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$8041      AA 01 BF CC C4 00 00 00 8F 00 8F 8F 8F 8F 8F 8F
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$8043      AA 01 01 FF 01 FF 01 FF 01 FF 01 FF 01 FF 00 00
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$8044      AA 00 FF 00 00 FF 00 00 FF FB 00 FF 00 00 00 00
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$8045      AA 01 FC 00 76 77 9F 32 20 01 00 00 00 00 00 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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$8050      FF FF FF FF FF FF 00 00 00 00 00 00 00 00 00 00
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$8051    51 11 09 00 52 11 09 00 51 70 02 00 11 10 FF 00
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$8052    32 1F 00 00 00 B0 01 00 00 00 00 00 00 00 00 00

$8053    88 48 44 00 00 A4 A6 00 00 00 00 00 00 00 00 00

$8054    AA 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
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$8063    AA 00 FF FF 00 00 00 00 00 00 00 00 00 00 00 00
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$8064    AA 00 F0 32 00 00 00 00 00 00 00 00 00 00 00 00
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$8065     AA 00 CF FF F0 CC F0 30 00 00 00 00 00 00 00 00
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$8070     AA 00 00 00 00 00 00 00 00 00 00 00 0A 26 00 00
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$E600         2E 8F

$E604         01 00 00 00

$F100         00 00 00 00

$F110         0E 37 37 39 36 30 54 57 41 41 34 34 30 4D 34 00
              00

$F112         0B 43 31 42 35 30 5A 5A 4B 56 33 4F 00 00 00 00
              00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

$F181         37 37 39 35 39 2D 54 57 41 2D 41 34 34 30 00 00
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March 2024

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

16159-021424-v3