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Special Crash Investigations On-Site Rollover Crash Investigation Vehicle: 2017 Mercedes-Benz GLA 250 Location: California Crash Date: July 2017

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicles or their safety systems.

This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was published.

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This report documents the investigation of a 2017 Mercedes-Benz GLA 250 4MATIC involved in a rollover crash in California and the vehicle's safety systems.

16. Abstract

The Mercedes was being driven eastbound by a belted 23-year-old male. The other occupant in the vehicle was a belted 32-year-old male seated in the front right position. The crash occurred when the Mercedes departed a curved section of roadway on the right edge for unknown reasons, struck the ground on a descending embankment and rolled two quarter-turns, right side leading. The vehicle came to rest on its roof. Neither occupant was ejected during the rollover. The Mercedes was equipped with frontal air bags, seat-mounted side impact air bags, knee air bags for the front row seat positions, and combination roll-sensing/side impact inflatable curtain (IC) air bags for both rows. The vehicle is certified to comply with Federal Motor Vehicle Safety Standard (FMVSS) No. 226 Ejection Mitigation, a rule established to reduce the partial and complete ejection of vehicle occupants through side windows in crashes, particularly rollover crashes. During the crash the frontal, knee, and IC air bags, and the front right occupant's seat-mounted side air bag, deployed. The driver and front right passenger of the Mercedes sustained police-reported "C" (possible/complaint of pain) injuries and were transported to an area hospital. The Mercedes was towed due to damage.

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Special Crash Investigations On-Site Rollover Crash Investigation
Case Number: DS17016
Vehicle: 2017 Mercedes-Benz GLA 250
Location: California
Crash Date: July 2017

BACKGROUND

This report documents the investigation of a 2017 Mercedes-Benz GLA 250 4MATIC (**Figure 1**) involved in a rollover crash and the vehicle's safety systems that complied with Federal Motor Vehicle Safety Standard (FMVSS) No. 226, Ejection Mitigation, a rule established to reduce the partial and complete ejection of vehicle occupants through side windows in crashes, particularly rollover crashes. Neither occupant was ejected during the rollover.

Figure 1. 2017 Mercedes-Benz GLA 250

The investigation was initiated by the Special Crash Investigations group of the National Highway Traffic Safety Administration in November 2017, following a notification from Dynamic Science, Inc. The Mercedes was identified in an online auction. The police report was obtained and the vehicle inspection was completed in November 2017. The Mercedes was supported by the Bosch Crash Data Retrieval (CDR) system and the vehicle's event data recorder (EDR) was imaged during the inspection.

The crash occurred during the evening in July 2017 on an undivided, two-lane, east/west roadway in a rural area of California. Conditions were dark without overhead illumination. The Mercedes was being driven eastbound by a belted 23-year-old male. The other occupant in the vehicle was a belted 32-year-old male seated in the front right position. The crash occurred when the Mercedes departed a curved section of roadway on the right edge for unknown reasons, struck the ground on a descending embankment, and overturned, right side leading. The vehicle came to rest on its roof.

The Mercedes was equipped with frontal air bags, seat-mounted side impact air bags, knee air bags for the front row seat positions, and combination roll-sensing/side impact inflatable curtain (IC) air bags for both rows. The IC air bags complied with FMVSS No. 226. During the crash, the frontal, knee, and IC air bags, and the front right occupant's seat-mounted side air bag, deployed. The driver and front right passenger of the Mercedes sustained police-reported "C" (possible/complaint of pain) injuries and were transported to an area hospital. The Mercedes was towed due to damage.

SUMMARY

Crash Site

The crash occurred on an east/west, two-lane, highway in a rural area of California (**Figure 2**). The roadway was configured with one lane for each direction measuring 3.7 m (12.0 ft) wide and bordered by paved shoulders measuring 0.3 m (1.0 ft) wide. The lanes were separated by solid yellow double stripes and bordered by solid white fog lines. The roadway was not configured with rumble strips. In the area of the crash, the roadway curved right in a radius of 286.7 m (940.6 ft) measured from the fog line on the south edge. At the point of departure, the roadway slope measured -5.0 percent and the superelevation measured -3.0 percent. The roadway was paved in asphalt in good condition. The roadside south of the south edge consisted of a descending dirt embankment measuring 5.5 m (18.0 ft) wide with a negative slope measuring -70 percent lateral to the roadway followed by a ditch and positive slope embankment. The roadside contained dirt, grass, brush, and mature trees.

Figure 2. Crash site looking east

Conditions at the time of the crash were dark without illumination, clear, and dry. Local weather services reported a temperature of 26.1 degrees C (79 degrees F), 29 percent humidity, 6.2 km (10.0 mi) visibility, and winds 11.1 km/h (6.9 mph). The posted speed limit for this highway was 89 km/h (55 mph). A crash diagram is included at the end of this report.

Pre-Crash

The driver told police that, while passing the Mercedes on the left, an unidentified vehicle struck the left side of the Mercedes, causing it to depart the roadway on the right edge. Due to lack of physical evidence and an independent witness, police were unable to substantiate the involvement of a second vehicle. The damage patterns and appearance of the Mercedes during the inspection revealed no evidence of vehicle-to-vehicle contact and the investigation determined the Mercedes likely departed the roadway due to dark conditions and a change in alignment from straight to curve. The driver stated in an interview that cruise control was not engaged. The Mercedes was traveling at an EDR-reported vehicle speed of 61 km/h (38 mph) at -5.0 seconds to algorithm enable (AE). Accelerator pedal was 0 percent and service brake activation was “Off.” At -4.0 seconds the brake was “On.” The driver was negotiating a curve when for unknown reasons the vehicle departed the roadway on the right edge. At -3.0 seconds the brake was “Off” again. At -1.5 seconds the accelerator was 100 percent and vehicle speed was 67 km/h (42 mph). It is likely the vehicle had departed the roadway and the right side tires had engaged the descending embankment at approximately -2.0 seconds and the driver was steering left and accelerating while attempting to return the vehicle to the roadway. The front and

rear right side tires furrowed into the dirt during this sequence depositing furrow marks measuring 3.5 m (11.5 ft) and 9.0 m (29.5 ft), respectively. At 0.0 seconds the accelerator had returned to 0 and the brake had returned to "On." The table below summarizes the Mercedes' EDR-reported pre-crash data prior to the first captured event. The EDR vehicle speed data indicated the Mercedes traveled 88.5 m (290.4 ft) from Time -5.0 seconds to 0 seconds.

Time	Vehicle Speed		Distance Traveled			
			Incremental		Cumulative	
-sec	km/h	mph	m	ft	m	ft
5	61	38	NA	NA	NA	NA
4.5	63	39	8.6	28.2	8.6	28.2
4	63	39	8.7	28.6	17.3	56.8
3.5	61	38	8.6	28.2	25.9	85
3	61	38	8.5	27.9	34.4	112.9
2.5	61	38	8.5	27.9	42.9	140.8
2	63	39	8.6	28.2	51.5	169
1.5	64	40	8.8	29	60.4	198
1	68	42	9.2	30.1	69.5	228.1
0.5	71	44	9.6	31.5	79.1	259.6
0	64	40	9.4	30.8	88.5	290.4

The Mercedes' EDR-reported pre-crash driver input status at Time 0.0 seconds of Event 1 is shown in the table below.

Time 0.0 seconds	Speed, Vehicle Indicated mph (km/h)	Accelerator Pedal (%)	Service Brake Activation
At Event	40 (65)	0	On

Crash

The Mercedes' EDR captured four events related to this crash. All four events occurred on the roadside after the vehicle departed the roadway (**Figure 3**). Event 1 was a front plane to ground impact that included undercarriage contact. The EDR captured a frontal, low delta-V non-deployment event for this impact. The lower bumper fascia was displaced and found near the roadway edge. At Event 1 the vehicle was likely in a slight counterclockwise rotation while the driver was attempting to return the vehicle to the roadway. The vehicle traveled down a descending embankment at an angle steep enough for the EDR

Figure 3. Crash site looking east, tire tracks marked by cones

to capture an imminent rollover and trigger deployment of the left and right IC air bags and both seat belt pretensioners. Time between EDR Record 4 (frontal) and Record 3 (rollover) was 158 milliseconds (ms). Prior to the vehicle overturning, it rotated counterclockwise and the left aspect of the front bumper struck the ground (Event 2). The EDR captured this impact as a deployment event triggering deployment of both frontal and knee air bags. Damage included fracturing of the front left bumper fascia, crush to the left aspect of the backing bar, displacement and restriction of the left front tire, and shortening of the left wheelbase.

The Mercedes right side tires engaged the ground with sufficient lateral resistance to cause the vehicle to initiate a right-side-leading trip, two quarter-turn rollover with its right plane striking the ground, followed by its top plane striking the ground. (Event 3). The rollover path traversed a ditch line and the vehicle rolled onto the ascending embankment south of the roadway. During or following the rollover, an unknown plane struck the ground and the EDR captured a frontal event triggering deployment of the front right passenger's seat-mounted side air bag. Time between EDR Record 1 (Most Recent) and Record 2 was 1,624 ms. The Mercedes came to rest upside down with its front left wheel at a police-estimated distance of 4.6 m (15 ft) south of the roadway and facing west. Estimated rollover distance from the trip point to final rest was 4.4 m (14.4 ft). The Mercedes traveled approximately 26.3 m (86.4 ft) on the roadside beginning with Event 1 and ending with Event 3.

For the Mercedes in Event 1, overlapping damage to the front plane and swiping damage to the undercarriage precluded a reconstruction using the WinSMASH program. The EDR Record 4 reported a maximum longitudinal delta V of -23 km/h (-14.3 mph) at 213 ms and a maximum lateral delta V of -7 km/h (-4.3 mph) at 278 ms. The calculated principal direction of force (PDOF) was positive 17 degrees.

For Event 2, the barrier algorithm of the WinSMASH program calculated a total delta V of 11 km/h (7 mph), a longitudinal delta V of -11 km/h (-7 mph) and a lateral delta V of -2 km/h (-1 mph). The barrier equivalent speed (BES) was 11 km/h (7 mph). The reconstruction was considered to be low and borderline. The EDR Record 2 reported a maximum longitudinal delta V of -53 km/h (-32.9 mph) at 300 ms and a maximum lateral delta V of -13 km/h (-8.1 mph) at 300 ms. The difference in longitudinal delta V as calculated by WinSMASH and reported by the EDR was significant. The WinSMASH results did not account for tire and undercarriage contact causing the shortening of the wheelbase. Additionally, the results may have been low due to the corner impact location on the vehicle. The calculated PDOF for this event was positive 14 degrees.

For Event 3, the rollover precluded a WinSMASH reconstruction. The EDR Record 3 reported a maximum longitudinal delta V of -3 km/h (-1.9 mph) at 158 ms and a maximum lateral delta V

of -1 km/h (-1.2 mph) at 61 ms. The EDR Record 1 (Most Recent) was a non-horizontal frontal impact precluded a reconstruction. The EDR recorded a maximum longitudinal delta V of -8 km/h (-59 mph) at 148 ms and a maximum lateral delta V of -5 km/h (-3.1 mph) at 90 ms. The calculated PDOF for this event was positive 32 degrees.

Post-Crash
Following the crash, the vehicle was upside down and both front row doors were jammed shut. The driver and front right occupant forced open their doors and exited the vehicle unassisted. The driver stated during the interview that the Mercedes' crash notification system was attempting to call for roadside assistance but was unsuccessful due to poor cellular reception in the area. They walked approximately one-quarter mile along the roadway to get better cellular reception, at which time they called 911 and reported the crash. Responders arrived approximately 25 minutes after the crash and the occupants were transported by ambulance to a local hospital, where they were treated and released. The vehicle was towed due to damage.

2017 MERCEDES-BENZ GLA 250 4MATIC

Description
The 2017 Mercedes-Benz GLA 250 4MATIC was identified by the Vehicle Identification Number WDCTG4GB3HJxxxxxx. The date of manufacture was September 2017 and the EDR-reported mileage at the time of the crash was 18,130 km (11,265 mi). The Mercedes was a 5-door sedan configured with a 4-cylinder, 2.0 liter, turbo-charged gasoline engine, automatic transmission, all-wheel drive, daytime running lights, and a tilt/telescoping steering column.

The Mercedes' crash avoidance (CA) systems included a forward collision warning system including crash imminent braking and dynamic brake support (active brake assist), blind spot assist, attention assist (drowsiness detection) and rear-view camera. These systems are discussed further in the Crash Avoidance section of this report. It was equipped with an off-road program package consisting of off-road ABS, electronic traction system and electronic stability program and tire pressure monitor. The driver stated that all the vehicle's CA systems were activated. The vehicle was not equipped with lane-keeping technology.

The vehicle manufacturer's recommended tire size was P235/50R18 with a cold tire pressure of 300 kPa (44 psi) for the front and rear. The vehicle was equipped with Bridgestone Dueler tires of the recommended sizes manufactured.

The Mercedes was equipped with two rows of seating for five occupants. The front row was configured with two bucket seats with adjustable head restraints. Both front row seat tracks were adjusted to the middle to rearward track position. The driver's seat back was reclined and the front passenger's seat back was upright. The second row was configured with 60/40 split bench seat with folding backs and adjustable head restraints.

Exterior Damage

The crash included three events causing direct and induced damage to the front, right, top, and bottom planes. The left and right wheelbases were reduced and both front tires were restricted in a rearward displacement. The left side view mirror was displaced downward and the right side view mirror was fractured.

Figure 4. Front end crush measurements, 2017 Mercedes-Benz GLA 250

Event 1 was a minor impact with the ground involving the lower front plane and undercarriage. The damage was overlapped by subsequent damage. The calculated PDOF was positive 17 degrees and the estimated Collision Deformation Classification (CDC) for the Mercedes in Event 1 was 01FDLW1.

Event 2 was a second impact to the front plane with the ground causing more severe damage and overlapping prior damage caused during Event 1. It was captured by the EDR as a frontal deployment event occurring after the rollover event. The investigation determined this impact occurred prior to the vehicle overturning. The impact with the ground caused damage to the front plane beginning at the front left bumper corner and extending 30 cm (11.8 in) to the right. The Field L extended from bumper corner to bumper corner and measured 160 cm (63.0 in). Eighteen measurements were taken at bumper level by the Nikon Total Station and the Faro Blitz program computed crush measurement in six increments as follows: C_1 = 10 cm (3.9 in), C_2= 0 cm, C_3 = 3 cm (1.2 in), C_4 = 3 cm (1.2 in), C_5= 0 cm, C_6 = 0 cm. The calculated PDOF for this event was positive 14 degrees and the CDC for the Mercedes in Event 2 was 12FLEE1 (**Figure 4**).

Event 3 was a two quarter-turn, right-side-leading rollover causing direct damage to the right and top planes. The right side-view mirror was fractured and displaced. Direct damage was present on the right roof side rail and D-pillar. Direct damage to the top plane was distributed both laterally and longitudinally, extending laterally from roof side rail to roof side rail and measuring 109 cm (43.0 in), and extended longitudinally from the leading edge of the hood, continuing on the windshield header and ending at the back light header. Maximum vertical crush to the greenhouse measured 9.0 cm (3.5 in) and was located on the middle roof at 25 cm (9.8 in) aft of the windshield

Figure 5. Rollover measurements, 2017 Mercedes-Benz GLA 250

(**Figure 5**). Maximum lateral crush to the greenhouse measured 7 cm (2.8 in) and was located on the right roof side rail directly above the rear axle. The CDC for the Mercedes in Event 3 was 00TDDO2. The EDR captured a final, frontal deployment event as Record 1 (Most Recent). This event was likely non-horizontal because it occurred following initiation of the rollover. The calculated PDOF for this impact based on EDR data was positive 32 degrees.

FMVSS No. 226 Ejection Mitigation

The 2017 Mercedes-Benz GLA250 4MATIC was certified to comply with FMVSS No. 226, Ejection Mitigation. The rule established for FMVSS No. 226 was intended to reduce the partial and complete ejection of vehicle occupants through side windows, particularly in rollover crashes. The standard applies to the side windows in the first three rows of seats, and a portion of the cargo area behind the first or second rows, in motor vehicles with a gross vehicle weight rating (GVWR) of 4,536 kg (10,000 lb) or less. The FMVSS No. 226 standard evaluates if IC air bags are made sufficiently strong to mitigate occupant ejection regardless of whether the occupant has the window up or down, and even when the glazing is destroyed during the crash.

The vehicle's IC air bags were configured with features including combination deployment capability in side impact and rollover crashes, large areas of coverage over the side glass both longitudinally and vertically, and tethering near the base of the A-pillars (**Figure 6**) to assist in keeping the deployed IC air bags in place and occupants in the occupant compartment.

Figure 6. IC air bag tethered at bottom edge of side glass, 2017 Mercedes-Benz GLA 250

During the rollover event, the side windows were closed and remained intact, and both IC air bags deployed. The front row occupants were restrained and there were no ejections. The driver indicated during the interview he struck the deployed left IC air bag during the rollover.

Rollover Mitigation

The GLA 250 has not been tested by either NHTSA or the Insurance Institute for Highway Safety; its European equivalent was tested by the traffic-safety agency European New Car Assessment Programme in 2014. However, no testing for rollover resistance was performed and no rollover rating was given. The Mercedes was equipped with standard all-wheel drive, electronic stability control, ABS and active brake assist. In this crash, the vehicle's stability was compromised by several variables. The driver misjudged a curve and the vehicle departed the paved roadway and traveled onto the unpaved roadside. The driver braked and steered right attempting to return the vehicle to the roadway and the ESC, ABS, and brake assist features likely engaged at some point. The vehicle lost some traction on the grass while initiating a slight

counter-clockwise rotation. The Mercedes' front plane and undercarriage struck the ground and the vehicle traveled down the descending embankment while in rotation. At this point in the crash sequence the driver had lost control of the vehicle. Its tires furrowed into the ground as the vehicle traveled lateral to its heading angle on a slope measuring -70 percent. The right side tires furrowed into the ground for several feet as the vehicle rotated counterclockwise and the front plane of the vehicle struck the ground. The tires engaged the ground with sufficient lateral resistance to cause a trip rollover, right-side leading. The Mercedes rolled two quarter-turns over an approximate distance of 4.4 m (14.4 ft) and came to rest near the ditch line at the base of the embankment. The rotational forces of the vehicle and the steepness of the embankment superceded the vehicles' stability control technology and driver input.

Event Data Recorder

The Mercedes' EDR was imaged during the vehicle inspection using the Data Link Connector (DLC) interface with power supplied by the vehicle's service battery. The EDR was imaged using Bosch CDR Tool version 17.5 and reported using version 17.10. The complete EDR report is included in this report as an attachment.

No crash avoidance data was included in the CDR report. The EDR was configured to report system status at Event, deployment command data, pre-crash data -5 to 0 seconds, and longitudinal and lateral crash pulse. The pre-crash data included time stamp in 0.5 second increments for 5.0 seconds, vehicle indicated speed, accelerator pedal (%) and service brake activation. The EDR captured four events for this crash, including three frontal events and one rollover event with pre-crash and deployment data included in each record. The first record was a non-deployment event and the second, third, and fourth records were deployment events. The EDR did not report any DTCs for the vehicle during the crash. Pre-crash data at Time Stamp 0.0 seconds for each event is included in the table below.

Time (sec) 0.0 at Event	Speed, Vehicle Indicated MPH (km/h)	Accelerator Pedal (%)	Service Brake Activation	Time From Previous Event (ms)
Record 1 (Most Recent)	1 (1)	0	Off	1,624
Record 2	19 (31)	0	Off	1,076
Record 3	39 (63)	0	On	158
Record 4	40 (65)	0	On	DNA

Interior Damage

The Mercedes' interior revealed damage from impact forces, deployed air bags, actuated seat belt pretensioners, deployed air bags, occupant contacts, and integrity loss. The front row doors were jammed shut. The backlight glazing was disintegrated and the windshield was fractured. Seven air bags deployed and both front row seat belt pretensioners actuated. Occupant contacts

were documented on the driver's deployed frontal air bag and both pretensioned seat belts. The front row of the occupant compartment was reduced by vertical intrusion of the roof as follows: left roof (3 cm [1.2 in]), middle roof (5 cm [2.0 in]) and right roof (5 cm [2.0 in]).

Manual Restraint Systems

The Mercedes' interior was equipped with forward seating for five occupants and all seats were configured with three-point lap and shoulder seat belts. The front row seat belts were equipped with retractor pretensioners, sliding latch plates, and adjustable D-rings. Both belt latch plates revealed scratch marks caused by historical usage.

The driver was using the lap and shoulder belt at the time of the crash. The driver's belt was configured with an emergency locking retractor (ELR) and the D-ring was adjusted to the full-down position. The EDR report stated the driver's belt was buckled and the pretensioner actuated at 0 ms of the first deployment event but the retractor was not locked in place. Evidence of driver loading in the form of scuff and stretch marks was present in two locations of the belt. The lap portion of the belt was scuffed at 20 cm (7.9 in) where it engaged the buckle and the shoulder portion of the belt was stretched at 106 cm (41.7 in) above the stop button where it engaged the D-ring.

The front right occupant was using the lap and shoulder belt at the time of the crash. The front belt was configured with a switchable ELR/automatic locking retractor (ALR) and the D-ring was adjusted to the full-up position. The EDR report stated the front right occupant's belt was buckled and the pretensioner was actuated. The pretensioner was locked at the time of the vehicle inspection and the belt was in the open position. Evidence of occupant loading was present in the form of scuff marks at 22 - 43 cm (8.7- 16.9 in) above the stop button. The shoulder portion of the belt was folded and overlapped itself where it exited the D-ring.

Supplemental Restraint Systems

The Mercedes' supplemental restraint systems included eight air bags in the following configuration: frontal dual-stage air bags for the driver and front right passenger, knee air bags for the driver and front right passenger, seat-mounted side impact air bags for the front row outboard seat positions, and IC air bags for the front and second row outboard seat positions. All the air bags deployed over the course of three separate EDR- captured deployment events except for the driver's seat-mounted side air bag that did not deploy.

The Mercedes was configured with IC air bags that complied with FMVSS No. 226. Both IC air bags deployed during a rollover event.

The driver's frontal air bag deployed from a module in the steering wheel hub. The air bag appeared to have deployed normally without damage to either the air bag or cover flaps. It measured 53 cm (20.9 in) in diameter and was configured with two internal tethers and one vent port. This air bag exhibited evidence of driver loading in the form of skin oil transfers and

scuff marks measuring 9 x 9 cm (3.5 x 3.5 in) located in the center aspect of the front panel (**Figure 7**).

The driver's knee air bag deployed from a module in the lower left instrument panel. This air bag measured 34 cm (13.4 in) vertically and 60 cm (15.7 in) width along the bottom edge. It was unremarkable except for a slight amount of dirt on the front panel likely deposited during post-crash activities.

Figure 7. Driver's frontal air bag contact evidence, 2017 Mercedes-Benz GLA 250

The left IC air bag deployed from the roof side rail above the front and second row seats (**Figure 8**). The air bag measured 40 cm (15.7 in) vertically at the leading edge and 180 cm (70.9 in) in width at the bottom edge. In its post- inflated state the left IC air bag's bottom edge hung 16 cm (6.3 in) below the bottom edge of the side glass in the front row left side door and 10 cm (3.9 in) below the second row left side door. A tether measuring 13 cm (5.1 in) located at the leading edge was attached to the A-pillar 8 cm (3.1 in) above the bottom of the side glass. The air bag covered both left side windows except for a small area near the tether measuring 5 x 5 cm (2.0 x 2.0 in). It appeared to have deployed normally and revealed no damage or driver contact.

Figure 8. Deployed left IC air bag, 2017 Mercedes-Benz GLA 250

The front right occupant's frontal air bag deployed from a module in the top instrument panel. The air bag deployed normally without damage to either the air bag or cover flaps. The front panel measured 40 cm (15.7 in) in width and 56 cm (22.0 in) vertically. The air bag was configured with three vent ports on the upper and left aspects. It revealed no damage or contacts and was unremarkable.

The front right occupant's knee air bag deployed from a module in the lower right instrument panel. This air bag measured 34 cm (13.4 in) vertically and 55 cm (21.7 in) in width along the bottom edge.

The front right occupant's seat-mounted side air bag deployed from the right aspect of the seat-back. It measured 55 cm (21.7 in) vertically and 30 cm (11.8 in) in width at its widest point. The air bag was configured with two vent ports at its forward aspect.

The right IC air bag deployed from the roof side rail above the front and second rows. It was configured identically to the left IC air bag.

Crash Avoidance Technology

The Mercedes was equipped with crash avoidance technologies that serve as an aid to assist driving. No CA data was included in the CDR report. The driver stated during the interview that he was familiar with crash avoidance technology and all systems were active at the time of the crash. The systems on this vehicle included the following:

Collision Prevention Assist Plus. Consists of a radar sensor-based distance warning function with an autonomous braking function and adaptive brake assist. If the system detects a risk of a forward collision, the driver is warned visually and audibly. If the driver does not brake, the system will brake autonomously in critical situations. If the driver does brake, in critical situations the BAS will engage. The distance warning feature functions within a speed range of approximately 7 to 70 km/h (4 to 44 mph). The distance warning function reacts to moving and stationary objects.

Brake Assist System. BAS operates in emergency braking situations. If you depress the brake pedal quickly, BAS automatically boosts the braking force to shorten the stopping distance.

Anti-lock braking system. ABS regulates brake pressure in such a way that the wheels do not lock when braking.

Electronic Stability Program. ESP monitors driving stability and traction, i.e., power transmission between the tires and the road surface. ESP is deactivated when the sport handling mode is selected. The handling mode was not known.

Attention Assist. If the system detects indicators of driver fatigue or lapses in concentration, it suggests taking a break by using visual and audible warnings. It is active in a speed range of 60 to 200 km/h (37 to 125 mph).

Blind Spot Assist. Active blind spot assist uses lateral, rear-facing radar sensors located in the rear bumper to monitor the side areas of the vehicle which are not visible to the driver. A warning display in the exterior mirrors draws attention to vehicles detected in the monitored area. If the driver switches on a turn signal for the side in which vehicles are detected, the system will alert the driver with optical and audible warnings.

Rear View Camera. The rear-view camera is an optical parking and maneuvering aid that is engaged in reverse gear and deactivated when shifted to Park or the vehicle is driven forward a short distance. The system uses a series of colored guidelines indicating the distance of the back bumper relative to objects behind the vehicle.

Automatic Crash Notification. An emergency call is dialed automatically if a seat belt pretensioner or air bag is deployed. The driver or occupant cannot end an emergency triggered call. If there is no response from the occupant, an ambulance is sent to the vehicle location. The system was activated at the time of the crash. According to the driver, the system attempted to send crash notifications following the crash, but poor cellular reception prevented a successful transmission.

NHTSA Recalls and Investigations

A search using the Mercedes' VIN revealed one safety recall associated with this vehicle as described in the table below. An electrostatic discharge, when combined with a broken steering column module clock spring and an insufficient grounding of the steering components, could lead to an inadvertent deployment of the driver air bag. An inadvertent driver air bag deployment may cause a risk of injury to the driver and might increase the risk of a potential crash. As a precautionary measure an authorized Mercedes-Benz dealer will add sufficient grounding to the steering components on the affected vehicles. The recall was three months after this crash.

NHTSA Campaign No.	Manufacturer Recall No.	Recall Date	Components
17V627	2017100005	10/6/2017	Air Bag

2016 MERCEDES-BENZ GLA 250 OCCUPANTS

Driver Demographics

Age/Sex:	23 years/male
Height:	183 cm (72 in)
Weight:	73 kg (160 lb)
Eyewear:	None
Seat type:	Bucket seat with adjustable head restraint
Seat track position:	Middle to full-rearward
Manual restraint usage:	Lap and shoulder seat belt used
Usage source:	Vehicle inspection, EDR report
Air bags:	Frontal, knee, and IC air bags deployed; seat-mounted side impact air bag not deployed
Alcohol/drug data:	None
Egress from vehicle:	Exited vehicle unassisted
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Treated and released

Driver Injuries

Inj. No.	Injury	AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Cervical spinal muscle strain	640278.1	Seat belt	Probable
2	Contusion, left shoulder	710402.1	Seat belt	Certain
3	Contusion, chest	410402.1	Seat belt	Certain

Source: EMS Records, Interview

Driver Kinematics

The belted 23-year-old male driver of the Mercedes was seated in a normal upright posture and was negotiating a right curve while operating the vehicle below the speed limit in dark conditions. The vehicle departed the roadway on the right edge and traveled onto a descending embankment on the roadside. The front end and undercarriage struck the unpaved ground causing the driver to be displaced forward while he braked and attempted to steer the vehicle left toward the roadway. The Mercedes traveled onto a steeper section of embankment rotating counterclockwise and tilted, causing the IC air bags and seat belt pretensioners to deploy. The driver remained held in his seated position by the pretensioned belt. The vehicle's front end struck the ground triggering deployment of the driver's frontal and knee air bags. The driver was displaced forward in response loading the shoulder portion of the seat belt with his left shoulder and chest and contacting the deployed frontal air bag with his face, head and chest. He sustained contusions to the left shoulder and chest caused by the seat belt, and a cervical muscle strain caused by hyper-extension of the head and neck. The vehicle overturned right side leading first onto its right plane and then onto the roof. The driver was displaced to the right contacting the center console and then toward the roof in response to the rollover dynamics. He remained held in his seat by the pretensioned seat belt.

The Mercedes came to rest upside down . The driver unbuckled his seat belt and exited the vehicle unassisted through the left side door and walked approximately one-quarter mile to get better cellular reception. Once that was reached he called 911 and reported the crash. Responders arrived 25 minutes later and transported him by ambulance to a local hospital. He was treated for minor injuries and released. He missed one day of work due to his injuries.

Front Row Right Occupant Demographics

Age/Sex:	32 years/male
Height:	175 cm (69 in)
Weight:	77 kg (170 lb)
Eyewear:	None
Seat type:	Bucket seat with adjustable head restraint
Seat track position:	Middle to full-rearward
Manual restraint usage:	Lap and shoulder seat belt
Usage source:	Vehicle inspection, EDR report
Air bags:	Frontal, knee, IC, and seat-mounted side impact air bags deployed
Egress from vehicle:	Exited vehicle unassisted
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Treated and released

Front Row Right Occupant Injuries

Inj. No.	Injury	AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Abrasions, left lower leg	810202.1	Lower right IP	Probable

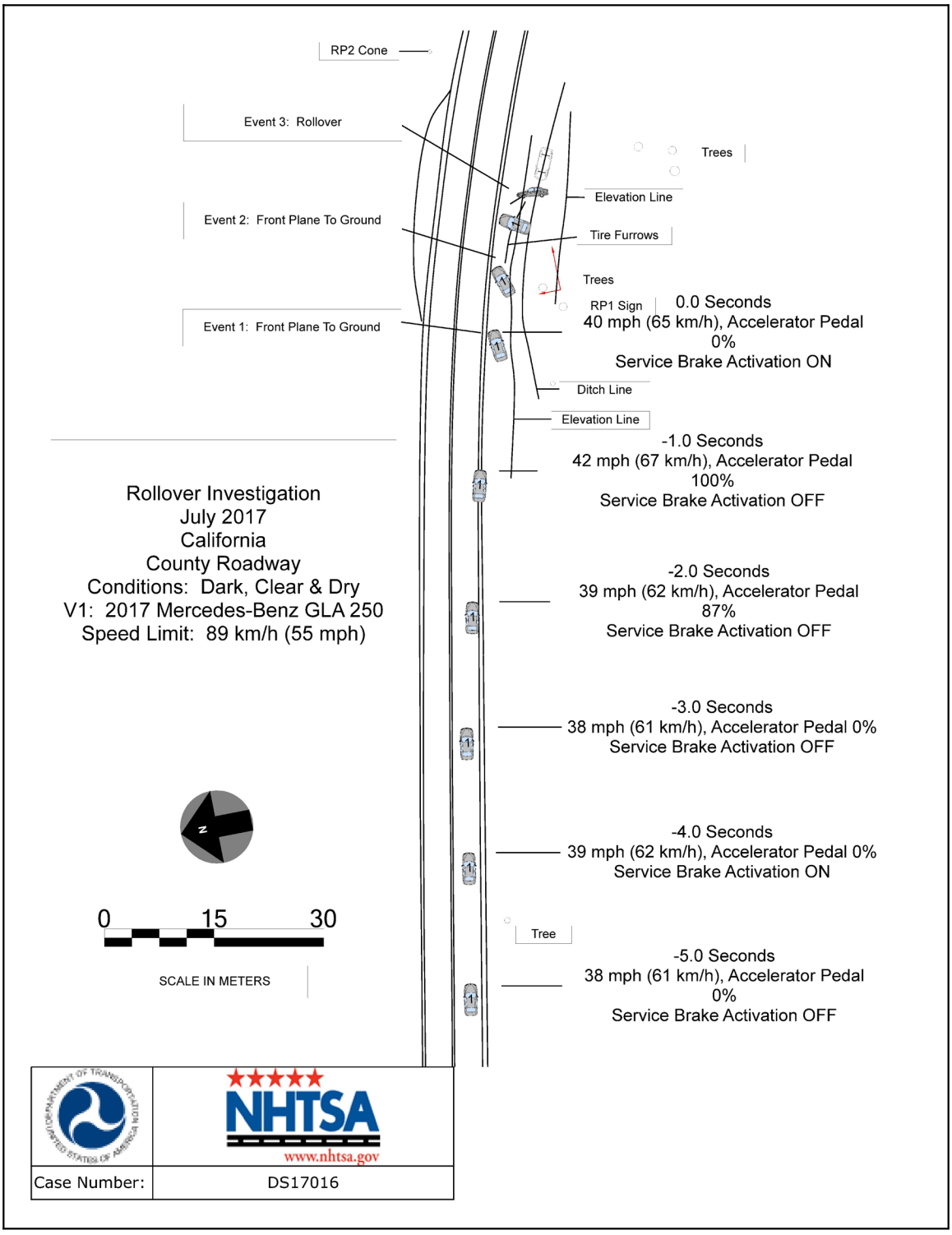
Source: EMS Records, Interview

Front Row Right Occupant Kinematics

The belted 32-year-old male front row right occupant was seated in a normal upright posture. The vehicle departed the roadway on the right edge and traveled onto a descending embankment on the roadside. The front end and undercarriage struck the unpaved ground causing the occupant to be displaced forward. The Mercedes traveled onto a steeper section of embankment rotating counterclockwise and tilting causing the occupant's IC air bag and seat belt pretensioner to deploy. The occupant remained held in his seated position by the pretensioned belt. The vehicle's front end struck the ground triggering deployment of the occupant's frontal and knee air bags. He was displaced forward in response loading the shoulder portion of the seat belt with his left shoulder and chest and struck the deployed frontal air bag with his face, head, and chest. His left lower leg likely contacted the lower IP, causing an abrasion to the leg. The vehicle overturned right side leading first onto its right plane and then onto the roof. The occupant was displaced to the right contacting the deployed IC air bag and toward the roof in response to the rollover dynamics. He remained held in his seat by the pretensioned seat belt.

The Mercedes came to rest upside down . The occupant unbuckled his seat belt and exited the vehicle unassisted through the right side door and walked with the driver approximately one-quarter mile to get better cellular reception. Once that was reached they called 911 and reported the crash. Responders arrived 25 minutes later and transported the occupant by ambulance to a local hospital. He was treated for minor injuries and released.

CRASH DIAGRAM



APPENDIX A: Event Data Recorder Report 2017 Mercedes-Benz GLA 250[1]

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

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

CDR File Information

User Entered VIN	WDCTG4GB3HJ******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS17016_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 17.5
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 17.10
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Record 1 (CRC Check Failed - Saved Without VIN Sequence Number), Record 2 (CRC Check Failed - Saved Without VIN Sequence Number), Record 3 (CRC Check Failed - Saved Without VIN Sequence Number), Record 4 (CRC Check Failed - Saved Without VIN Sequence Number)

Comments

No comments entered.

Data Limitations

MERCEDES-BENZ SUPPLEMENTAL RESTRAINT SYSTEM (SRS) CONTROL MODULE DATA LIMITATIONS:

General Information:
SRS Control Module data limitations are intended to assist in reading event data that has been imaged from the vehicle's SRS control module. They are not intended to provide specific information regarding data interpretation. Event data should be considered in conjunction with other available physical evidence from the vehicle and scene.

Certain MY2014 and later Mercedes-Benz passenger vehicles are designed to fulfill the requirements of 49 CFR 563 - Event Data Recorders, and to be compatible with the Bosch CDR tool.

The Recorded Crash Events can be read by the CDR tool via the vehicle's OBD connector. Connecting the CDR tool directly to the SRS Control Module should ONLY be considered if the vehicle's electrical system has been compromised. If it is necessary to remove the SRS Control Module from the vehicle, proceed with CAUTION! During bench top imaging, make sure the SRS Control Module remains stationary, and is NOT moved, tilted or rotated while connected to and powered by the CDR Interface Module. Also, after CDR imaging, wait at least one minute after power is removed from the SRS Control Module before attempting to move the module. Not following these general SRS Control Module guidelines for bench top imaging could cause new events to be recorded in the Module.
NOTE: When the CDR tool is connected directly to the SRS Control Module, the current fault status will be altered if the Module is powered-up without having all of the other vehicle inputs connected (e.g., benchtop imaging). However, this will not affect the stored fault data information in any of the Event Records.

To increase data safety, the transmitted data will be first signed by the SRS Control Module. This can take up to 60 seconds for each recorded event.

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.

The SRS Control Module can store six events in total, such as Non-Deployment Events (NDE) and Deployment Events (DE):

- A Non-Deployment Event is recorded if the change in longitudinal or lateral velocity equals or exceeds 8km/h over a 150ms timeframe. Non-Deployment Events are stored into memory but (the oldest) can be over-written by subsequent Non-Deployment or Deployment Events.
- A Deployment Event is recorded if any type of non-reversible deployable restraint device (e.g., belt pretensioners, front airbag(s), side airbag(s), side curtain airbag(s), etc.) are commanded to deploy. Deployment Events are stored into memory and cannot be over-written.

The events will be imaged by the CDR tool in chronological order (e.g. the first event is the most recent one).

If power to the SRS Control Module is interrupted during an event, all data from this event will be stored (see information "Complete file recorded"). For subsequent events, all or part of the event data record may not be recorded. Such events cannot be retrieved by the CDR tool.

The "event begin" t_0 is initiated by:
- the change in longitudinal velocity equals or exceeds 0.8km/h over a 20ms timeframe (front threshold)
- the change in lateral velocity equals or exceeds 0.8km/h over a 5ms timeframe (side threshold)
- wake-up of the front, side or rear algorithm
- deployment of a restraint by the rollover algorithm.

The event monitoring for recording will always be 300ms even if:
- the change in longitudinal and lateral velocity equals or falls below 0.8km/h over a 20ms timeframe
- each algorithm is inactive.

Multiple Events:
Data recorded by the SRS Control Module and imaged by the CDR tool is displayed relative to t_0, NOT the time at which the vehicle made contact with another vehicle or object.

Vehicle crash events may result in one or more stored Deployment or Non-Deployment events in the EDR.

Parallel Event: If there are more than one crash algorithms active during an accident, and if the start time for any algorithm occurs within 300ms of t_0 for another algorithm, (e.g. angular impact, where front algorithm and side algorithm starts and resets individually), then these overlapping recordings are considered a "parallel event". In this case, the initial stored event is characterized by one of the following: 1) the first triggered algorithm (e.g., front, side, or rear); 2) the first event threshold which was exceeded (e.g., longitudinal or lateral velocity threshold); or 3) the a deployment of a restraint by the rollover algorithm. Subsequent events are reported with reference to the initial event t_0

Multiple Event: If there are more than one crash algorithms active during an accident and if the algorithms do not overlap as described above, this is considered a "multiple event if t_0 for any algorithm occurs within 5 seconds of t_0 for another algorithms. The chronological sequence within a multiple event is marked by the data element "multi-event, number of events." The time period between this event and the preceding event is marked in the data element "time from event n to n+1."

Separate Events: If there are more than one crash algorithms active during an accident that do not overlap in time and for which start times t_0 are set apart more than 5 seconds, then these are considered as separate events.

Data Element Sign Convention:
The sign convention is according to "NHTSA 49 CFR 563 - Event Data Recorders".

Data Element Name	Positive Sign Notation Indicates
Delta-V, Longitudinal	Forward
Maximum Delta-V, Longitudinal	Forward
Delta-V, Lateral	Left to Right
Maximum Delta-V, Lateral	Left to Right
Vehicle Roll Angle	Clockwise Rotation around vehicles longitudinal axis

Data Elements:
Pre-Crash Data:
- Pre-Crash Data is recorded at 2 samples per second starting 5 seconds before t_0.
- Pre-Crash Data is recorded asynchronously.
- Recorded Pre-Crash Data has a time resolution of 500ms. Therefore, the indicated time associated with the first pre-crash data element may be delayed by up to 500ms.
- Pre-Crash Data indicates "Data Invalid" if a message with an "invalid" flag from the module sending the pre-crash data is sent.
- Pre-Crash Data indicates "Data Not Available" if no data is received from the module sending the pre-crash data.
- "Speed, vehicle indicated" accuracy can be affected by various factors, such as significant changes in tire size from the factory original vehicle specification, wheel lockup or slip.
- "Accelerator Pedal Position, percent full" is the ratio of accelerator pedal position compared to the fully depressed position.
- "Service Brake Status" only indicates driver-initiated braking. Automatic braking (e.g. Autonomous Cruise Control) will not be recorded.

Crash data:
- Delta-V data is recorded at 100Hz from t_0 to 250ms.
- "Delta-V, longitudinal" reflects the change in velocity that the SRS Control Module experienced in the longitudinal direction during the recorded portion of the event and is not the speed at which the vehicle was traveling before the event.
- Depending on the severity of the event relative to the range of the accelerometer, saturation of the SRS Control Module longitudinal or lateral accelerometers may occur. This condition is recorded in the EDR.
- "Restraint Deployment Time" (e.g. airbag(s)) is reported as the time t which a deployment was requested by this device.
- "Restraint Disposal" (e.g. 2nd stage of the frontal airbag(s)) is reported if a disposal request of this device occurs.
- "Seat Track Position Switch Status, front passenger" is reported as "foremost" or "not foremost".

- "Occupant size classification, right front passenger airbag suppressed" data is recorded as "yes" (suppressed), if the front passenger seat sensor system determined the passenger seat was empty or occupied by a child-seat.

Data Source:
All recorded data is measured and calculated within the SRS Control Module except for the following parameters (if applicable) which are transmitted via the vehicle's communication network to the SRS Control Module:
- Speed, vehicle indicated
- Accelerator pedal position, percent full
- Service brake
- Safety Belt Status (the Belt Switch Circuit is wired directly to the SRS Control Module)

Hexadecimal Data:
All data that has been specified for imaging are shown in the hexadecimal data section of this report. However, not all of these data are translated by the CDR tool. The imaged SRS Control Module may contain additional data that are not retrievable by the CDR tool.

Privacy Issue

As of February 2013 the following states: Arkansas, California, Connecticut, Maine, Nevada, New Hampshire, New York, North Dakota, Oregon, Texas, Virginia, and Washington all have EDR Laws to address vehicle owner's privacy and consumer concerns. Subsequently, a 2015 Federal law prescribed privacy restrictions to address these same concerns. It is the responsibility of the user and end user to observe all applicable State and Federal privacy laws.

09001_Daimler001_r004

System Status at Event (Record 1, Most Recent)

Event Type	Frontal
Time From Time Zero to Algo Start (Front) (msec)	Algorithm Started at t0
Time From Time Zero to Algo Start (Side) (msec)	618
Time From Time Zero to Algo Start (Rear) (msec)	621
Time From Time Zero to Deployment (Rollover) (msec)	Algorithm Not Started
Time From Time Zero to Algo Start (Pedestrian Protection) (msec)	Algorithm Not Started
Maximum Delta-V, Longitudinal (MPH [km/h])	-5.0 [-8]
Maximum Delta-V, Lateral (MPH [km/h])	-3.1 [-5]
Time, Maximum Delta-V, Longitudinal (msec)	148
Time, Maximum Delta-V, Lateral (msec)	90
Clipping Time Longitudinal Sensor (msec)	Clipping Not Reached
Clipping Time Lateral Sensor (msec)	Clipping Not Reached
Multi-Event, Number of Events	4. Event
Time From Previous Event to Current Event (msec)	1,624
Time From Last Speed Data Sample (Precrash) to Time Zero (msec)	25
Complete File Recorded, Generic, Prio 1 Data	Completed Successfully
Ignition Cycle, Crash (cycle)	15,361
Ignition Cycle, Download (cycle)	15,525
Vehicle Mileage (km)	18,130
Operating Time (min)	15,939
Vehicle Identification Number	WDCTG4GB3HJ******
Event Counter (counts)	4

Deployment Command Data (Record 1, Most Recent)

Frontal Air Bag, Time to 1st Stage Deployment, Driver (msec)	1,131
Frontal Air Bag, Time to 2nd Stage Deployment, Driver (msec)	1,136
Frontal Air Bag, 2nd Stage Disposal, Driver	No Disposal
Frontal Air Bag, Time to 1st Stage Deployment, Front Passenger (msec)	1,131
Frontal Air Bag, Time to 2nd Stage Deployment, Front Passenger (msec)	1,136
Frontal Air Bag, Time to 3rd Stage (Vent) Deployment, Front Passenger (msec)	1,175
Frontal Air Bag, 2nd Stage Disposal, Front Passenger	No Disposal
Frontal Air Bag, 3rd Stage (Vent) Disposal, Front Passenger	No Disposal
Side Air Bag, Time to Deployment 1st Stage, Driver (msec)	Data Not Available
Side Curtain/Tube Air Bag,Time to Deployment, Driver Side (msec)	Data Not Available
Pretensioner (1), Time to Deploy, Driver (msec)	Data Not Available
Side Air Bag, Time to Deployment 1st Stage, Front Passenger (msec)	625
Side Curtain/Tube Air Bag, Time to Deployment, Passenger Side (msec)	Data Not Available
Pretensioner (1), Time to Deploy, Front Passenger (msec)	Data Not Available

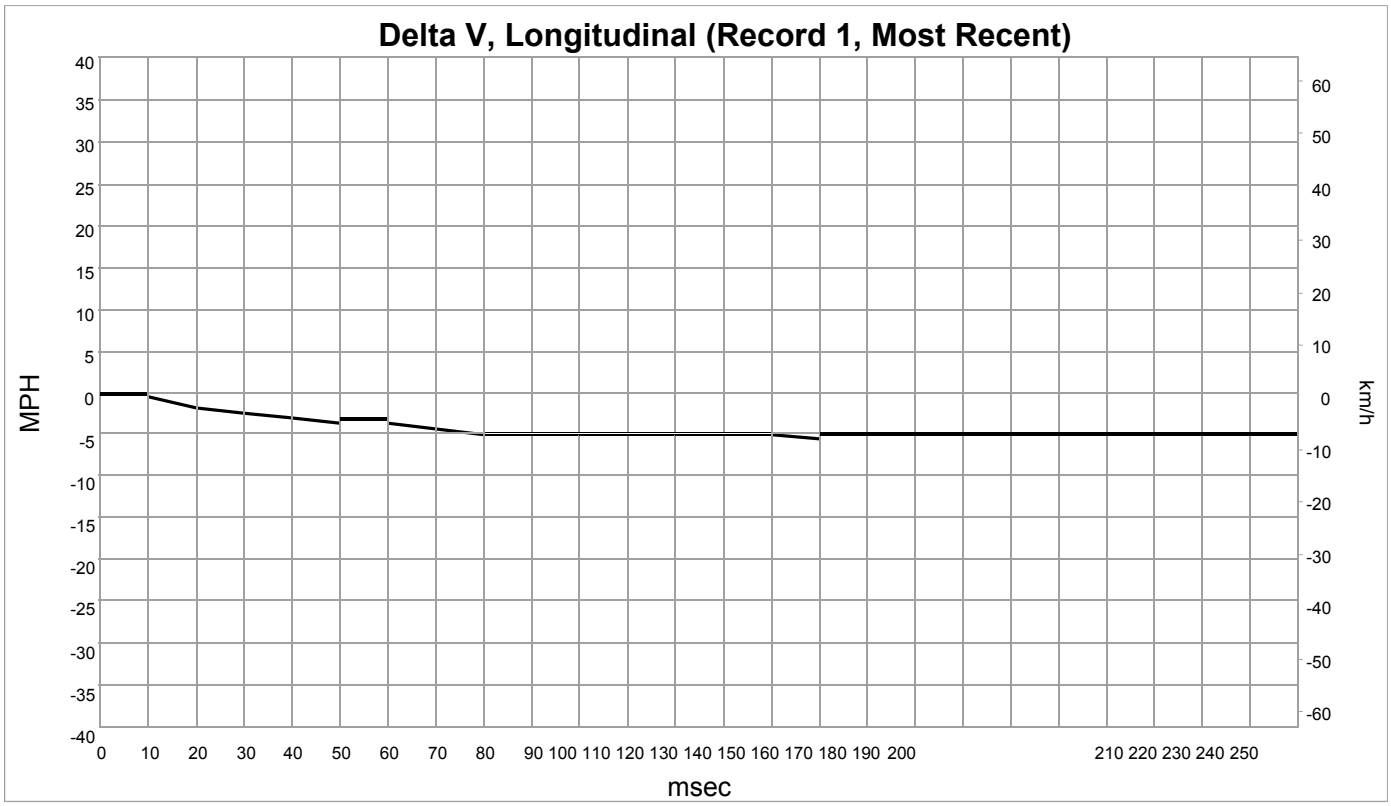
Pre-Crash Data -1 Sec (Record 1, Most Recent)

Safety Belt Status, Driver	Belted
Seat Track Position Switch Status, Driver	Data Not Available
Air Bag Warning Lamp (AWL)	Off
Safety Belt Status, Front Passenger	Belted
Seat Track Position Switch Status, Front Passenger	Rear
Occupant Size Classification, Front Passenger	50% Male

Pre-Crash Data -5 to 0 sec (Record 1, Most Recent)

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal (%)	Service Brake Activation
-5.0	38 [61]	0	Off
-4.5	38 [61]	0	Off
-4.0	39 [62]	87	Off
-3.5	40 [64]	100	Off
-3.0	42 [67]	100	Off
-2.5	44 [71]	0	Off
-2.0	40 [65]	0	On
-1.5	39 [63]	0	On
-1.0	19 [31]	0	Off
-0.5	19 [30]	0	Off
0.0	1 [1]	0	Off

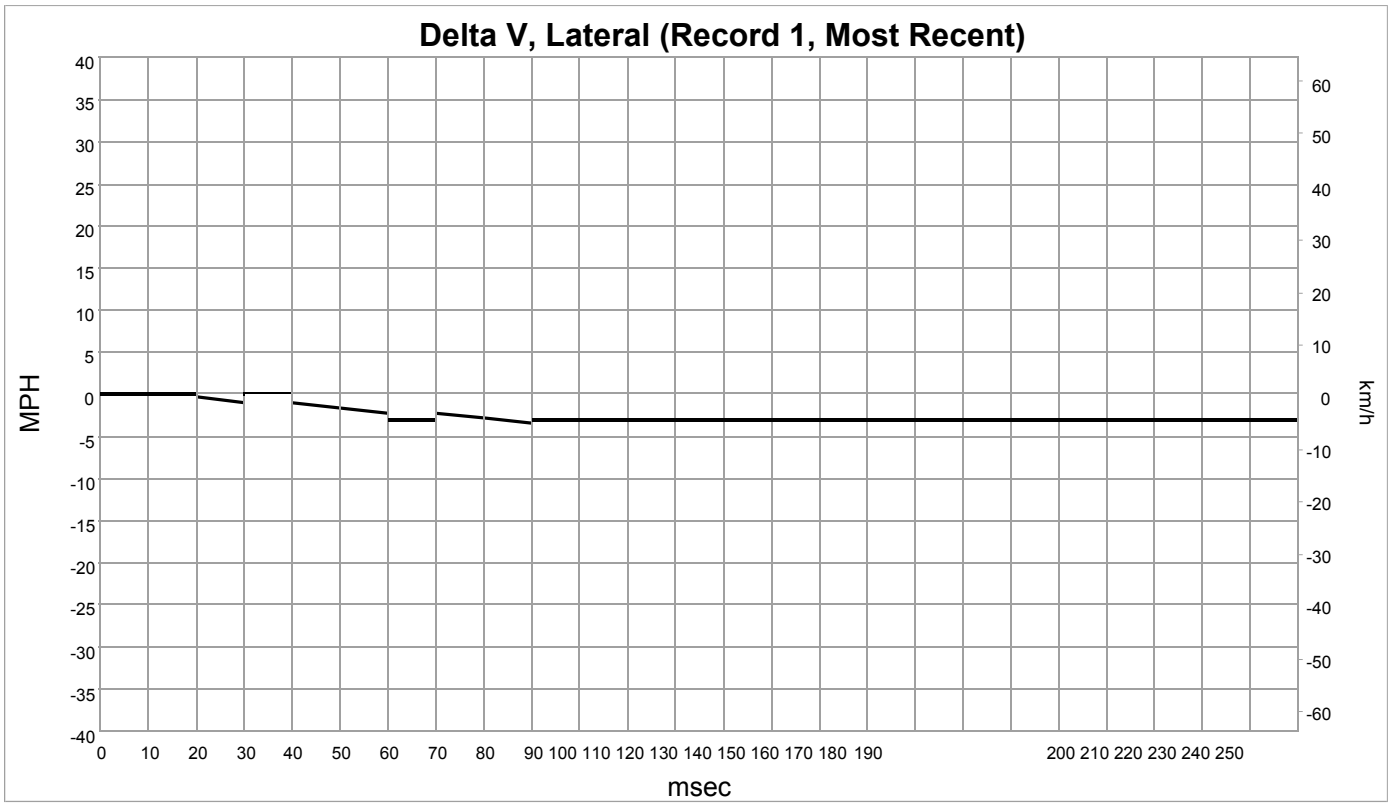
Longitudinal Crash Pulse (Record 1, Most Recent)



Time (msec)	Delta-V, Longitudinal (MPH [km/h])
0	0.0 [0]
10	0.0 [0]
20	-1.2 [-2]
30	-1.9 [-3]
40	-2.5 [-4]
50	-3.1 [-5]
60	-3.1 [-5]
70	-3.7 [-6]
80	-4.3 [-7]
90	-4.3 [-7]
100	-4.3 [-7]
110	-4.3 [-7]
120	-4.3 [-7]
130	-4.3 [-7]
140	-4.3 [-7]
150	-5.0 [-8]
160	-5.0 [-8]
170	-5.0 [-8]
180	-5.0 [-8]
190	-5.0 [-8]
200	-5.0 [-8]
210	-5.0 [-8]
220	-5.0 [-8]
230	-5.0 [-8]
240	-5.0 [-8]

Time (msec)	Delta-V, Longitudinal (MPH [km/h])
250	-5.0 [-8]

Lateral Crash Pulse (Record 1, Most Recent)



Time (msec)	Delta-V, Lateral (MPH [km/h])
0	0.0 [0]
10	0.0 [0]
20	0.0 [0]
30	-0.6 [-1]
40	-0.6 [-1]
50	-1.2 [-2]
60	-1.9 [-3]
70	-1.9 [-3]
80	-2.5 [-4]
90	-3.1 [-5]
100	-3.1 [-5]
110	-3.1 [-5]
120	-3.1 [-5]
130	-3.1 [-5]
140	-3.1 [-5]
150	-3.1 [-5]
160	-3.1 [-5]
170	-3.1 [-5]
180	-3.1 [-5]
190	-3.1 [-5]
200	-3.1 [-5]
210	-3.1 [-5]
220	-3.1 [-5]
230	-3.1 [-5]
240	-3.1 [-5]

Time (msec)	Delta-V, Lateral (MPH [km/h])
250	-3.1 [-5]

System Status at Event (Record 2)

Event Type	Frontal
Time From Time Zero to Algo Start (Front) (msec)	5
Time From Time Zero to Algo Start (Side) (msec)	22
Time From Time Zero to Algo Start (Rear) (msec)	Algorithm Not Started
Time From Time Zero to Deployment (Rollover) (msec)	Algorithm Not Started
Time From Time Zero to Algo Start (Pedestrian Protection) (msec)	Algorithm Not Started
Maximum Delta-V, Longitudinal (MPH [km/h])	-32.9 [-53]
Maximum Delta-V, Lateral (MPH [km/h])	-8.1 [-13]
Time, Maximum Delta-V, Longitudinal (msec)	300
Time, Maximum Delta-V, Lateral (msec)	300
Clipping Time Longitudinal Sensor (msec)	Clipping Not Reached
Clipping Time Lateral Sensor (msec)	Clipping Not Reached
Multi-Event, Number of Events	3. Event
Time From Previous Event to Current Event (msec)	1,076
Time From Last Speed Data Sample (Precrash) to Time Zero (msec)	477
Complete File Recorded, Generic, Prio 1 Data	Completed Successfully
Ignition Cycle, Crash (cycle)	15,361
Ignition Cycle, Download (cycle)	15,525
Vehicle Mileage (km)	18,130
Operating Time (min)	15,939
Vehicle Identification Number	WDCTG4GB3HJ******
Event Counter (counts)	3

Deployment Command Data (Record 2)

Frontal Air Bag, Time to 1st Stage Deployment, Driver (msec)	56
Frontal Air Bag, Time to 2nd Stage Deployment, Driver (msec)	61
Frontal Air Bag, 2nd Stage Disposal, Driver	No Disposal
Frontal Air Bag, Time to 1st Stage Deployment, Front Passenger (msec)	56
Frontal Air Bag, Time to 2nd Stage Deployment, Front Passenger (msec)	61
Frontal Air Bag, Time to 3rd Stage (Vent) Deployment, Front Passenger (msec)	100
Frontal Air Bag, 2nd Stage Disposal, Front Passenger	No Disposal
Frontal Air Bag, 3rd Stage (Vent) Disposal, Front Passenger	No Disposal
Side Air Bag, Time to Deployment 1st Stage, Driver (msec)	Data Not Available
Side Curtain/Tube Air Bag,Time to Deployment, Driver Side (msec)	Data Not Available
Pretensioner (1), Time to Deploy, Driver (msec)	Data Not Available
Side Air Bag, Time to Deployment 1st Stage, Front Passenger (msec)	Data Not Available
Side Curtain/Tube Air Bag, Time to Deployment, Passenger Side (msec)	Data Not Available
Pretensioner (1), Time to Deploy, Front Passenger (msec)	Data Not Available

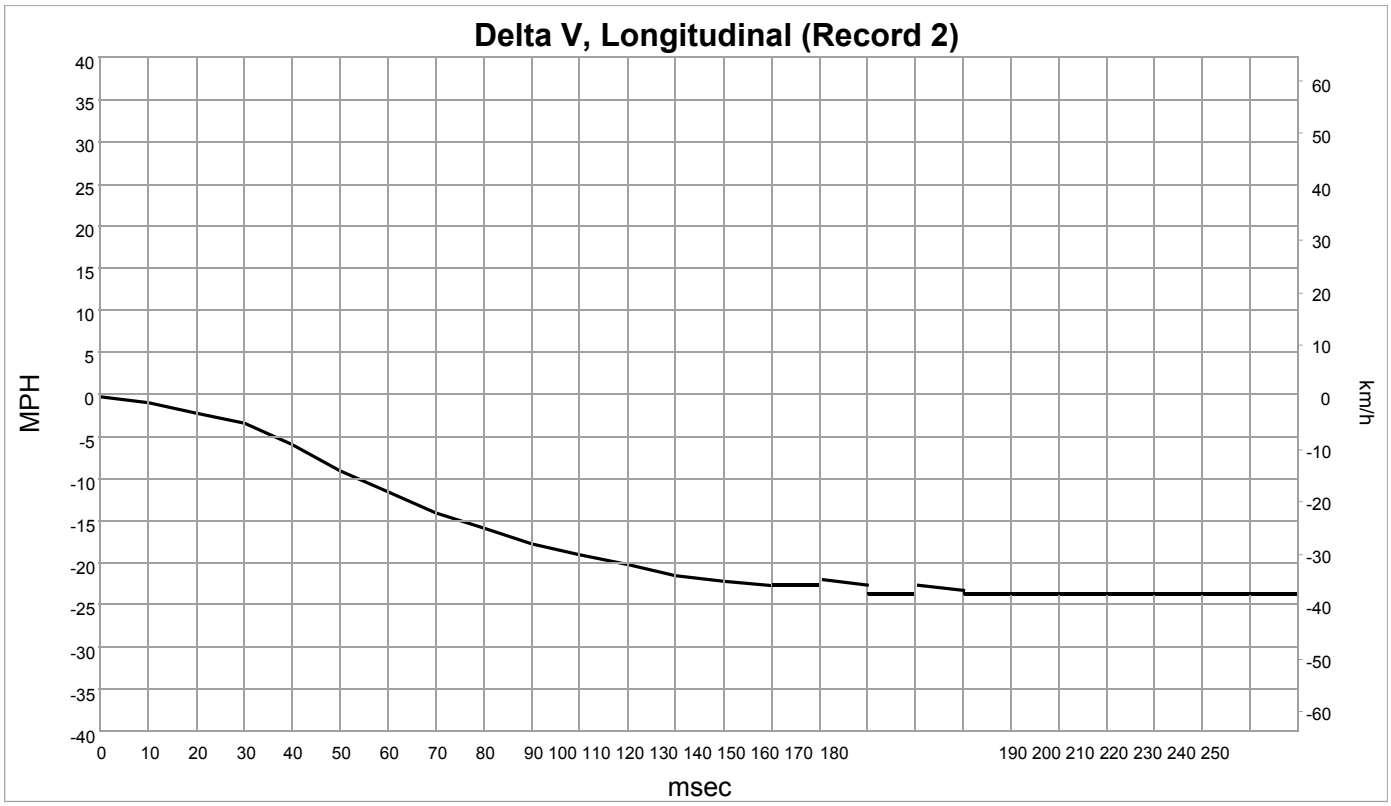
Pre-Crash Data -1 Sec (Record 2)

Safety Belt Status, Driver	Belted
Seat Track Position Switch Status, Driver	Data Not Available
Air Bag Warning Lamp (AWL)	Off
Safety Belt Status, Front Passenger	Belted
Seat Track Position Switch Status, Front Passenger	Rear
Occupant Size Classification, Front Passenger	50% Male

Pre-Crash Data -5 to 0 sec (Record 2)

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal (%)	Service Brake Activation
-5.0	39 [62]	0	On
-4.5	38 [61]	0	On
-4.0	38 [61]	0	Off
-3.5	38 [61]	0	Off
-3.0	39 [62]	87	Off
-2.5	40 [64]	100	Off
-2.0	42 [67]	100	Off
-1.5	44 [71]	0	Off
-1.0	40 [65]	0	On
-0.5	39 [63]	0	On
0.0	19 [31]	0	Off

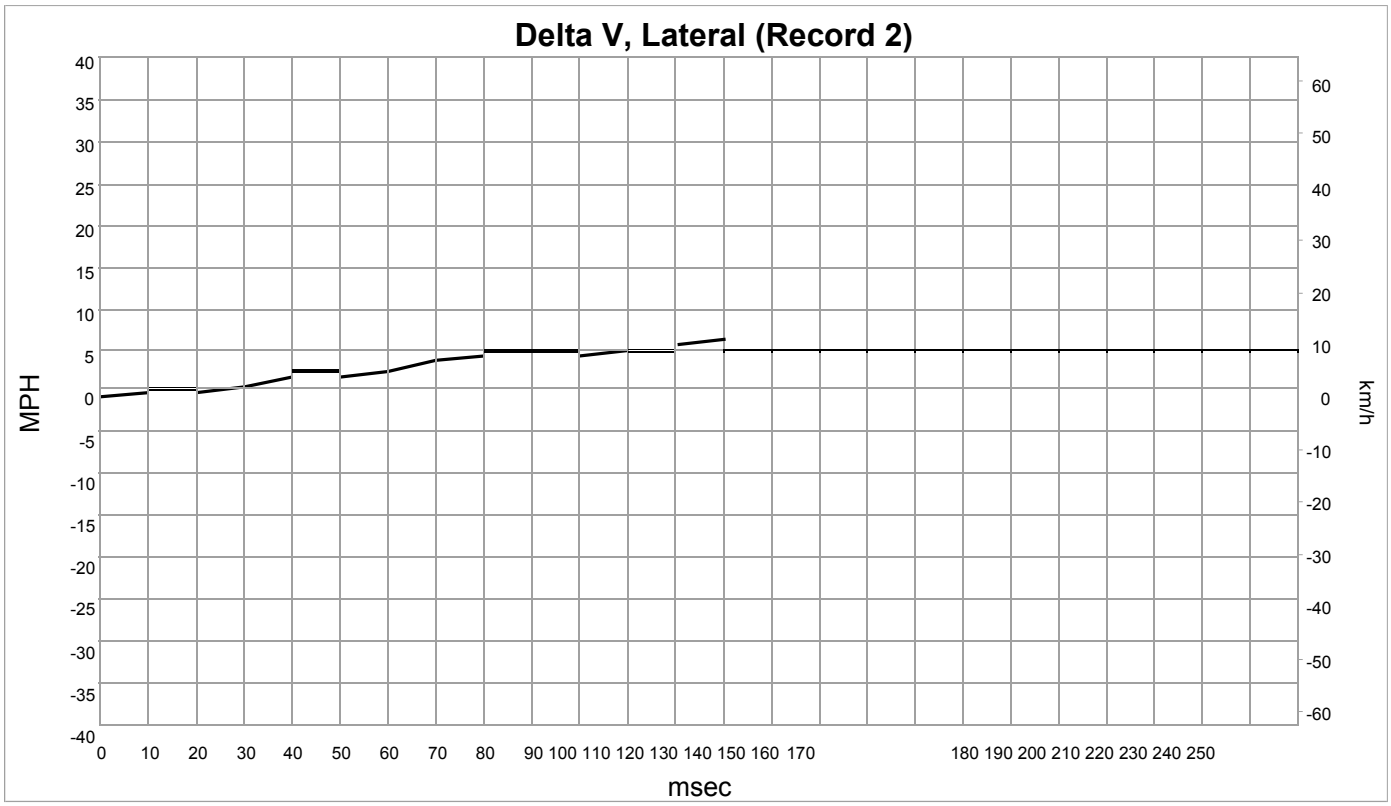
Longitudinal Crash Pulse (Record 2)



Time (msec)	Delta-V, Longitudinal (MPH [km/h])
0	0.0 [0]
10	-0.6 [-1]
20	-1.9 [-3]
30	-3.1 [-5]
40	-5.6 [-9]
50	-8.7 [-14]
60	-11.2 [-18]
70	-13.7 [-22]
80	-15.5 [-25]
90	-17.4 [-28]
100	-18.6 [-30]
110	-19.9 [-32]
120	-21.1 [-34]
130	-21.7 [-35]
140	-22.4 [-36]
150	-22.4 [-36]
160	-23.0 [-37]
170	-23.0 [-37]
180	-23.6 [-38]
190	-23.6 [-38]
200	-23.6 [-38]
210	-23.6 [-38]
220	-23.6 [-38]
230	-23.6 [-38]
240	-23.6 [-38]

Time (msec)	Delta-V, Longitudinal (MPH [km/h])
250	-23.6 [-38]

Lateral Crash Pulse (Record 2)



Time (msec)	Delta-V, Lateral (MPH [km/h])
0	0.0 [0]
10	0.6 [1]
20	0.6 [1]
30	1.2 [2]
40	2.5 [4]
50	2.5 [4]
60	3.1 [5]
70	4.3 [7]
80	5.0 [8]
90	5.0 [8]
100	5.0 [8]
110	5.6 [9]
120	5.6 [9]
130	6.2 [10]
140	6.2 [10]
150	6.2 [10]
160	6.2 [10]
170	6.2 [10]
180	6.2 [10]
190	6.2 [10]
200	6.2 [10]
210	6.2 [10]
220	6.2 [10]
230	6.2 [10]
240	6.2 [10]

Time (msec)	Delta-V, Lateral (MPH [km/h])
250	6.2 [10]

System Status at Event (Record 3)

Event Type	Rollover
Time From Time Zero to Algo Start (Front) (msec)	Algorithm Not Started
Time From Time Zero to Algo Start (Side) (msec)	Algorithm Not Started
Time From Time Zero to Algo Start (Rear) (msec)	Algorithm Not Started
Time From Time Zero to Deployment (Rollover) (msec)	7,395
Time From Time Zero to Algo Start (Pedestrian Protection) (msec)	Algorithm Not Started
Maximum Delta-V, Longitudinal (MPH [km/h])	-1.9 [-3]
Maximum Delta-V, Lateral (MPH [km/h])	-1.2 [-2]
Time, Maximum Delta-V, Longitudinal (msec)	210
Time, Maximum Delta-V, Lateral (msec)	220
Clipping Time Longitudinal Sensor (msec)	Clipping Not Reached
Clipping Time Lateral Sensor (msec)	Clipping Not Reached
Multi-Event, Number of Events	2. Event
Time From Previous Event to Current Event (msec)	158
Time From Last Speed Data Sample (Precrash) to Time Zero (msec)	61
Complete File Recorded, Generic, Prio 1 Data	Completed Successfully
Ignition Cycle, Crash (cycle)	15,361
Ignition Cycle, Download (cycle)	15,525
Vehicle Mileage (km)	18,130
Operating Time (min)	15,939
Vehicle Identification Number	WDCTG4GB3HJ******
Event Counter (counts)	2

Deployment Command Data (Record 3)

Frontal Air Bag, Time to 1st Stage Deployment, Driver (msec)	Data Not Available
Frontal Air Bag, Time to 2nd Stage Deployment, Driver (msec)	Data Not Available
Frontal Air Bag, 2nd Stage Disposal, Driver	No Disposal
Frontal Air Bag, Time to 1st Stage Deployment, Front Passenger (msec)	Data Not Available
Frontal Air Bag, Time to 2nd Stage Deployment, Front Passenger (msec)	Data Not Available
Frontal Air Bag, Time to 3rd Stage (Vent) Deployment, Front Passenger (msec)	Data Not Available
Frontal Air Bag, 2nd Stage Disposal, Front Passenger	No Disposal
Frontal Air Bag, 3rd Stage (Vent) Disposal, Front Passenger	No Disposal
Side Air Bag, Time to Deployment 1st Stage, Driver (msec)	Data Not Available
Side Curtain/Tube Air Bag,Time to Deployment, Driver Side (msec)	0
Pretensioner (1), Time to Deploy, Driver (msec)	0
Side Air Bag, Time to Deployment 1st Stage, Front Passenger (msec)	Data Not Available
Side Curtain/Tube Air Bag, Time to Deployment, Passenger Side (msec)	0
Pretensioner (1), Time to Deploy, Front Passenger (msec)	0

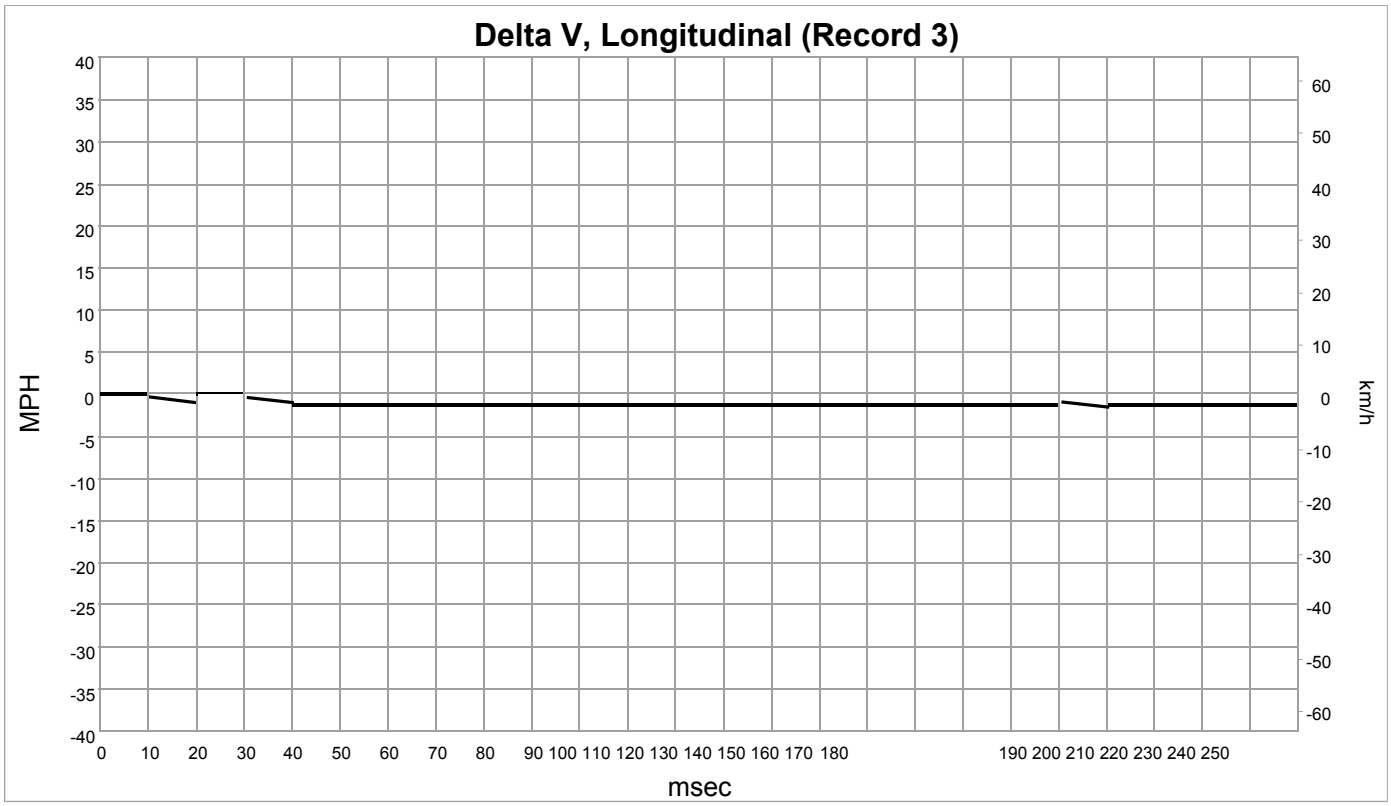
Pre-Crash Data -1 Sec (Record 3)

Safety Belt Status, Driver	Belted
Seat Track Position Switch Status, Driver	Data Not Available
Air Bag Warning Lamp (AWL)	Off
Safety Belt Status, Front Passenger	Belted
Seat Track Position Switch Status, Front Passenger	Rear
Occupant Size Classification, Front Passenger	50% Male

Pre-Crash Data -5 to 0 sec (Record 3)

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal (%)	Service Brake Activation
-5.0	39 [62]	0	Off
-4.5	39 [62]	0	On
-4.0	38 [61]	0	On
-3.5	38 [61]	0	Off
-3.0	38 [61]	0	Off
-2.5	39 [62]	87	Off
-2.0	40 [64]	100	Off
-1.5	42 [67]	100	Off
-1.0	44 [71]	0	Off
-0.5	40 [65]	0	On
0.0	39 [63]	0	On

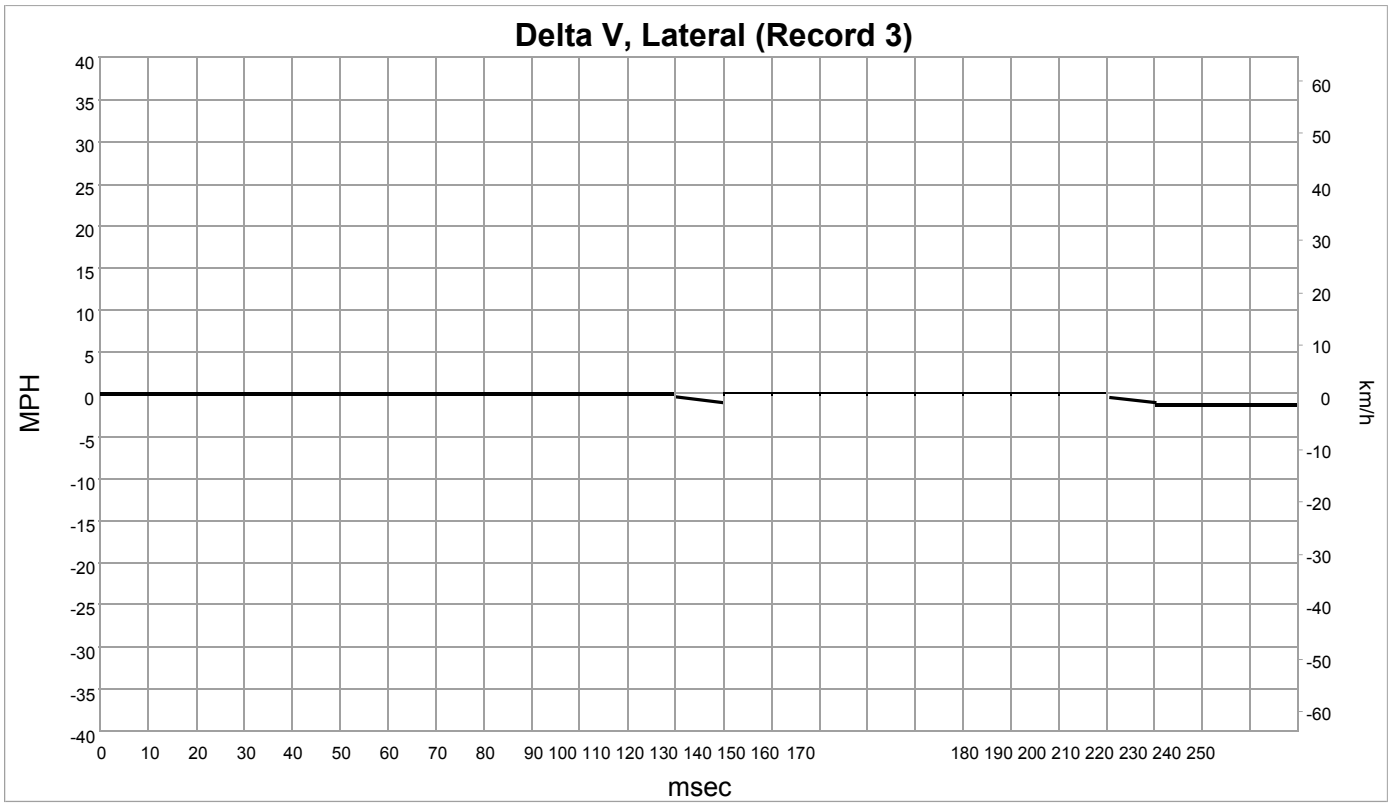
Longitudinal Crash Pulse (Record 3)



Time (msec)	Delta-V, Longitudinal (MPH [km/h])
0	0.0 [0]
10	0.0 [0]
20	-0.6 [-1]
30	-0.6 [-1]
40	-1.2 [-2]
50	-1.2 [-2]
60	-1.2 [-2]
70	-1.2 [-2]
80	-1.2 [-2]
90	-1.2 [-2]
100	-1.2 [-2]
110	-1.2 [-2]
120	-1.2 [-2]
130	-1.2 [-2]
140	-1.2 [-2]
150	-1.2 [-2]
160	-1.2 [-2]
170	-1.2 [-2]
180	-1.2 [-2]
190	-1.2 [-2]
200	-1.2 [-2]
210	-1.9 [-3]
220	-1.9 [-3]
230	-1.9 [-3]
240	-1.9 [-3]

Time (msec)	Delta-V, Longitudinal (MPH [km/h])
250	-1.9 [-3]

Lateral Crash Pulse (Record 3)



Time (msec)	Delta-V, Lateral (MPH [km/h])
0	0.0 [0]
10	0.0 [0]
20	0.0 [0]
30	0.0 [0]
40	0.0 [0]
50	0.0 [0]
60	0.0 [0]
70	0.0 [0]
80	0.0 [0]
90	0.0 [0]
100	0.0 [0]
110	0.0 [0]
120	0.0 [0]
130	-0.6 [-1]
140	-0.6 [-1]
150	-0.6 [-1]
160	-0.6 [-1]
170	-0.6 [-1]
180	-0.6 [-1]
190	-0.6 [-1]
200	-0.6 [-1]
210	-0.6 [-1]
220	-1.2 [-2]
230	-1.2 [-2]
240	-1.2 [-2]

Time (msec)	Delta-V, Lateral (MPH [km/h])
250	-1.2 [-2]

System Status at Event (Record 4)

Event Type	Frontal
Time From Time Zero to Algo Start (Front) (msec)	Algorithm Started at t0
Time From Time Zero to Algo Start (Side) (msec)	Algorithm Not Started
Time From Time Zero to Algo Start (Rear) (msec)	Algorithm Not Started
Time From Time Zero to Deployment (Rollover) (msec)	Algorithm Not Started
Time From Time Zero to Algo Start (Pedestrian Protection) (msec)	Algorithm Not Started
Maximum Delta-V, Longitudinal (MPH [km/h])	-14.3 [-23]
Maximum Delta-V, Lateral (MPH [km/h])	-4.3 [-7]
Time, Maximum Delta-V, Longitudinal (msec)	213
Time, Maximum Delta-V, Lateral (msec)	278
Clipping Time Longitudinal Sensor (msec)	Clipping Not Reached
Clipping Time Lateral Sensor (msec)	Clipping Not Reached
Multi-Event, Number of Events	1. Event
Time From Previous Event to Current Event (msec)	Data Not Available
Time From Last Speed Data Sample (Precrash) to Time Zero (msec)	404
Complete File Recorded, Generic, Prio 1 Data	Completed Successfully
Ignition Cycle, Crash (cycle)	15,361
Ignition Cycle, Download (cycle)	15,525
Vehicle Mileage (km)	18,130
Operating Time (min)	15,939
Vehicle Identification Number	WDCTG4GB3HJ******
Event Counter (counts)	1

Deployment Command Data (Record 4)

Frontal Air Bag, Time to 1st Stage Deployment, Driver (msec)	Data Not Available
Frontal Air Bag, Time to 2nd Stage Deployment, Driver (msec)	Data Not Available
Frontal Air Bag, 2nd Stage Disposal, Driver	Data Not Available
Frontal Air Bag, Time to 1st Stage Deployment, Front Passenger (msec)	Data Not Available
Frontal Air Bag, Time to 2nd Stage Deployment, Front Passenger (msec)	Data Not Available
Frontal Air Bag, Time to 3rd Stage (Vent) Deployment, Front Passenger (msec)	Data Not Available
Frontal Air Bag, 2nd Stage Disposal, Front Passenger	Data Not Available
Frontal Air Bag, 3rd Stage (Vent) Disposal, Front Passenger	Data Not Available
Side Air Bag, Time to Deployment 1st Stage, Driver (msec)	Data Not Available
Side Curtain/Tube Air Bag,Time to Deployment, Driver Side (msec)	Data Not Available
Pretensioner (1), Time to Deploy, Driver (msec)	Data Not Available
Side Air Bag, Time to Deployment 1st Stage, Front Passenger (msec)	Data Not Available
Side Curtain/Tube Air Bag, Time to Deployment, Passenger Side (msec)	Data Not Available
Pretensioner (1), Time to Deploy, Front Passenger (msec)	Data Not Available

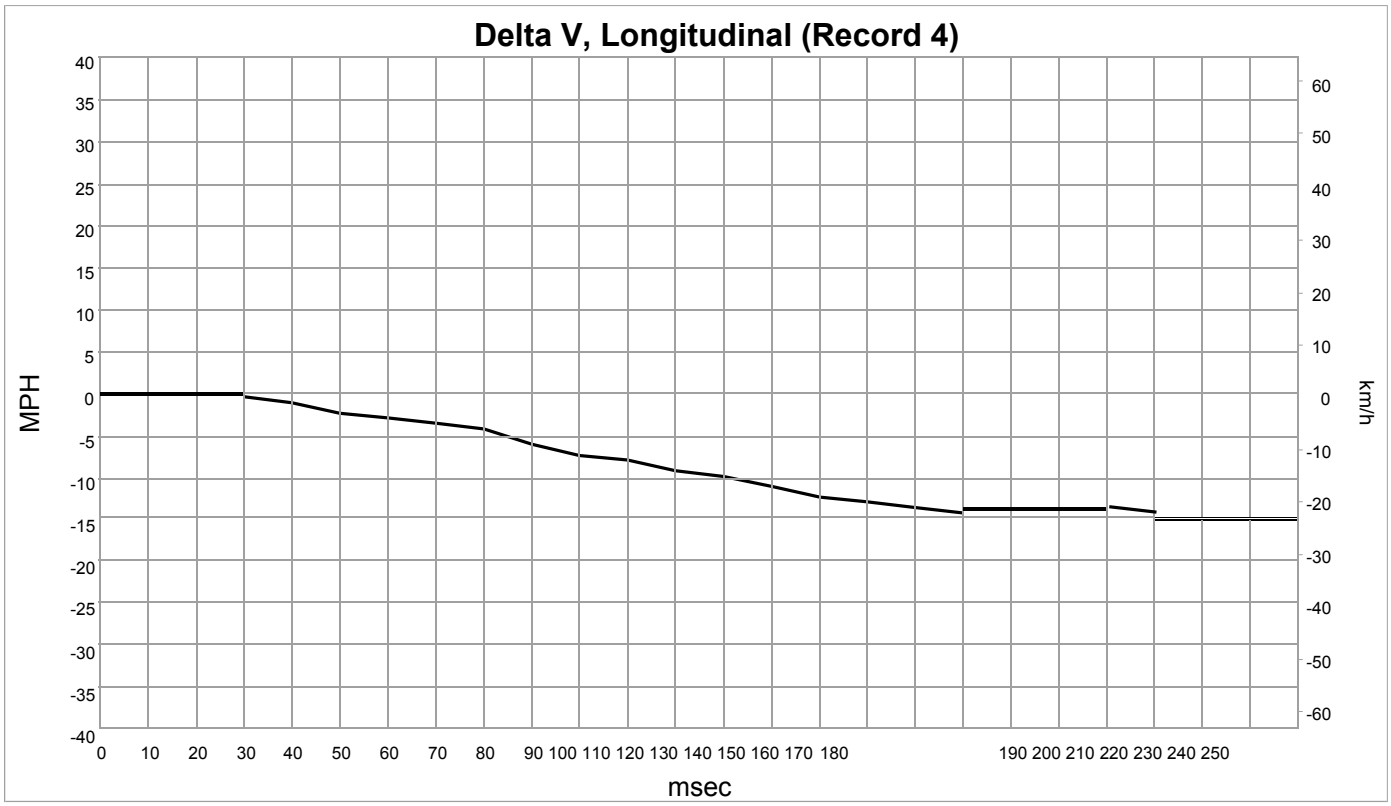
Pre-Crash Data -1 Sec (Record 4)

Safety Belt Status, Driver	Belted
Seat Track Position Switch Status, Driver	Data Not Available
Air Bag Warning Lamp (AWL)	Off
Safety Belt Status, Front Passenger	Belted
Seat Track Position Switch Status, Front Passenger	Rear
Occupant Size Classification, Front Passenger	50% Male

Pre-Crash Data -5 to 0 sec (Record 4)

Time (sec)	Speed, Vehicle Indicated (MPH [km/h])	Accelerator Pedal (%)	Service Brake Activation
-5.0	38 [61]	0	Off
-4.5	39 [62]	0	Off
-4.0	39 [62]	0	On
-3.5	38 [61]	0	On
-3.0	38 [61]	0	Off
-2.5	38 [61]	0	Off
-2.0	39 [62]	87	Off
-1.5	40 [64]	100	Off
-1.0	42 [67]	100	Off
-0.5	44 [71]	0	Off
0.0	40 [65]	0	On

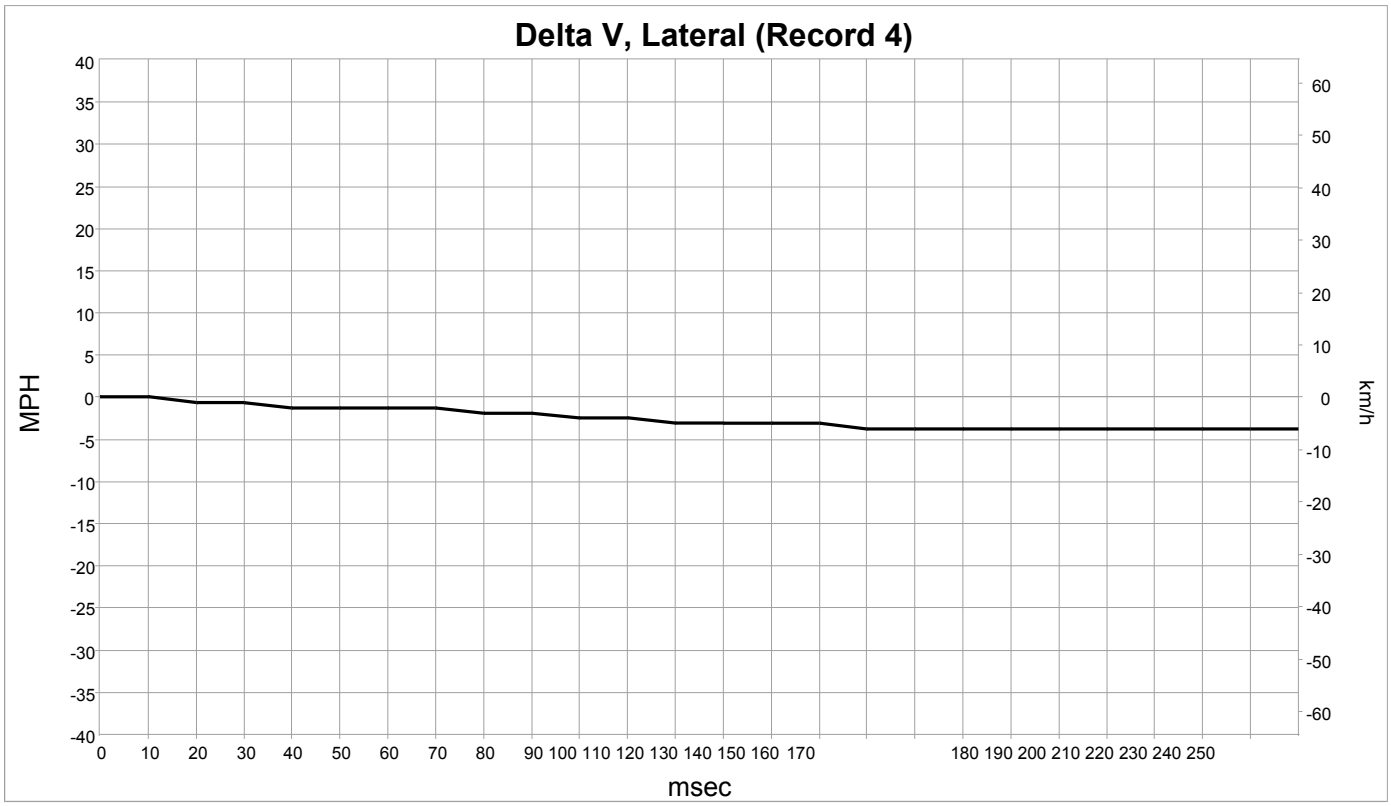
Longitudinal Crash Pulse (Record 4)



Time (msec)	Delta-V, Longitudinal (MPH [km/h])
0	0.0 [0]
10	0.0 [0]
20	0.0 [0]
30	0.0 [0]
40	-0.6 [-1]
50	-1.9 [-3]
60	-2.5 [-4]
70	-3.1 [-5]
80	-3.7 [-6]
90	-5.6 [-9]
100	-6.8 [-11]
110	-7.5 [-12]
120	-8.7 [-14]
130	-9.3 [-15]
140	-10.6 [-17]
150	-11.8 [-19]
160	-12.4 [-20]
170	-13.0 [-21]
180	-13.7 [-22]
190	-13.7 [-22]
200	-13.7 [-22]
210	-13.7 [-22]
220	-14.3 [-23]
230	-14.3 [-23]
240	-14.3 [-23]

Time (msec)	Delta-V, Longitudinal (MPH [km/h])
250	-14.3 [-23]

Lateral Crash Pulse (Record 4)



Time (msec)	Delta-V, Lateral (MPH [km/h])
0	0.0 [0]
10	0.0 [0]
20	-0.6 [-1]
30	-0.6 [-1]
40	-1.2 [-2]
50	-1.2 [-2]
60	-1.2 [-2]
70	-1.2 [-2]
80	-1.9 [-3]
90	-1.9 [-3]
100	-2.5 [-4]
110	-2.5 [-4]
120	-3.1 [-5]
130	-3.1 [-5]
140	-3.1 [-5]
150	-3.1 [-5]
160	-3.7 [-6]
170	-3.7 [-6]
180	-3.7 [-6]
190	-3.7 [-6]
200	-3.7 [-6]
210	-3.7 [-6]
220	-3.7 [-6]
230	-3.7 [-6]
240	-3.7 [-6]

Time (msec)	Delta-V, Lateral (MPH [km/h])
250	-3.7 [-6]

Hexadecimal Data

```
FA10   02

FA12   01 00 00 06 4A 00 00 04 89

FA11   01 00 03

FA13   00 05 00 01 00 00 04 00 00 00 05 02 6A 00 06 02
       6D 00 07 FF FF 00 09 FF FF 00 1F 64 00 00 1A 7F
       7F 7D 7C 7B 7A 7A 79 78 78 78 78 78 78 78 77 77
       77 77 77 77 77 77 77 77 00 20 64 00 00 1A 7F
       7F 7F 7E 7E 7D 7C 7C 7B 7A 7A 7A 7A 7A 7A 7A 7A
       7A 7A 7A 7A 7A 7A 7A 7A 7A 00 21 77 00 22 7A 00
       23 3B 00 24 24 00 28 FF 00 29 FF 00 2D 04 00 2E
       0C B0 00 2F 00 19 00 33 04 6B 00 34 04 70 00 36
       00 00 38 04 6B 00 39 04 70 00 3A 04 97 00 3B 00
       00 3C 00 00 3D FF FF 00 3E FF FF 00 3F FF FF 00
       41 02 71 00 42 FF FF 00 43 FF FF 00 47 01 00 48
       FF 00 4B 00 00 4D 01 00 4E 02 00 4F 03 00 5B 3D
       3D 3E 40 43 47 41 3F 1F 1E 01 00 5C 00 00 57 64
       64 00 00 00 00 00 00 00 5F 00 00 00 00 00 00 01
       01 00 00 00 03 E8 A5 03 E9 3C 01 03 EA 3C A5 03
       F1 07 15 03 F2 00 3E 43 03 F3 57 44 43 54 47 34
       47 42 33 48 4A 2A 2A 2A 2A 2A 2A 03 FB 04 03 FD
       00 04 03 FE C2 92 85 E2

FA14   00 05 00 01 00 00 04 00 05 00 05 00 16 00 06 FF
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       7E 7C 7A 76 71 6D 69 66 63 61 5F 5D 5C 5B 5B 5A
       5A 59 59 59 59 59 59 59 59 00 20 64 FF FF FF 7F
       80 80 81 83 83 84 86 87 87 87 88 88 89 89 89 89
       89 89 89 89 89 89 89 89 89 00 21 4A 00 22 72 00
       23 78 00 24 78 00 28 FF 00 29 FF 00 2D 03 00 2E
       08 67 00 2F 01 DD 00 33 00 38 00 34 00 3D 00 36
       00 00 38 00 38 00 39 00 3D 00 3A 00 64 00 3B 00
       00 3C 00 00 3D FF FF 00 3E FF FF 00 3F FF FF 00
       41 FF FF 00 42 FF FF 00 43 FF FF 00 47 01 00 48
       FF 00 4B 00 00 4D 01 00 4E 02 00 4F 03 00 5B 3E
       3D 3D 3D 3E 40 43 47 41 3F 1F 00 5C 00 00 00 00
       57 64 64 00 00 00 00 00 5F 01 01 00 00 00 00 00
       00 01 01 00 03 E8 A5 03 E9 3C 01 03 EA 3C A5 03
       F1 07 15 03 F2 00 3E 43 03 F3 57 44 43 54 47 34
       47 42 33 48 4A 2A 2A 2A 2A 2A 2A 03 FB 04 03 FD
       00 03 03 FE DA 17 0D 4E

FA15   00 05 00 01 03 00 04 FF FF 00 05 FF FF 00 06 FF
       FF 00 07 1C E3 00 09 FF FF 00 1F 64 01 00 1A 7F
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       7D 7D 7D 7D 7C 7C 7C 7C 7C 00 20 64 01 00 1A 7F
       7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7F 7E 7E 7E 7E
       7E 7E 7E 7E 7E 7D 7D 7D 7D 00 21 7C 00 22 7D 00
       23 54 00 24 58 00 28 FF 00 29 FF 00 2D 02 00 2E
       01 3B 00 2F 00 3D 00 33 FF FF 00 34 FF FF 00 36
       00 00 38 FF FF 00 39 FF FF 00 3A FF FF 00 3B 00
       00 3C 00 00 3D FF FF 00 3E 00 00 00 3F 00 00 00
       41 FF FF 00 42 00 00 00 43 00 00 00 47 01 00 48
       FF 00 4B 00 00 4D 01 00 4E 02 00 4F 03 00 5B 3E
       3E 3D 3D 3D 3E 40 43 47 41 3F 00 5C 00 00 00 00
       00 57 64 64 00 00 00 00 5F 00 01 01 00 00 00 00
       00 00 01 01 03 E8 A5 03 E9 3C 01 03 EA 3C A5 03
       F1 07 15 03 F2 00 3E 43 03 F3 57 44 43 54 47 34
       47 42 33 48 4A 2A 2A 2A 2A 2A 2A 03 FB 04 03 FD
       00 02 03 FE D9 20 0A C9
```

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FA16    00 05 00 01 00 00 04 00 00 00 05 FF FF 00 06 FF
        FF 00 07 FF FF 00 09 FF FF 00 1F 64 00 00 1A 7F
        7F 7F 7F 7E 7C 7B 7A 79 76 74 73 71 70 6E 6C 6B
        6A 69 69 69 69 68 68 68 68 00 20 64 00 00 1A 7F
        7F 7E 7E 7D 7D 7D 7D 7C 7C 7B 7B 7A 7A 7A 7A 79
        79 79 79 79 79 79 79 79 00 21 68 00 22 78 00
        23 55 00 24 6F 00 28 FF 00 29 FF 00 2D 01 00 2E
        FF FF 00 2F 01 94 00 33 FF FF 00 34 FF FF 00 36
        FF 00 38 FF FF 00 39 FF FF 00 3A FF FF 00 3B FF
        00 3C FF 00 3D FF FF 00 3E FF FF 00 3F FF FF 00
        41 FF FF 00 42 FF FF 00 43 FF FF 00 47 01 00 48
        FF 00 4B 00 00 4D 01 00 4E 02 00 4F 03 00 5B 3D
        3E 3E 3D 3D 3D 3E 40 43 47 41 00 5C 00 00 00 00
        00 00 57 64 64 00 00 00 5F 00 00 01 01 00 00 00
        00 00 00 01 03 E8 A5 03 E9 3C 01 03 EA 3C A5 03
        F1 07 15 03 F2 00 3E 43 03 F3 57 44 43 54 47 34
        47 42 33 48 4A 2A 2A 2A 2A 2A 2A 03 FB 04 03 FD
        00 01 03 FE EF 04 1B F2

FA17    00 00

FA18    00 00
```

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May 2019

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**National Highway
Traffic Safety
Administration**

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