

On-Site Ambulance Crash Investigation

Case Number DS15009

Vehicle: 2009 Ford E-350 Type II Ambulance

Ambulance Body: Custom Truck & Body Works

Location: California

Crash Date: July 2015

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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 vehicle(s) or their safety systems.

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

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<p>Abstract</p> <p>The primary interest of this investigation is the crash involving a 2009 Ford E-350 Type II ambulance and the injuries sustained by the occupants and patient. The Ford was transporting a 79-year-old male to a non-emergency medical appointment without emergency lights or siren activated when it impacted another vehicle in a head-on crash. The crash occurred during afternoon hours in July 2015 on a north/south roadway in the state of California. The Ford E-350 chassis was configured with a forward cab and rear patient compartment equipped for the treatment of medical emergencies in a mobile environment. It was being driven by a belted 20-year-old male Emergency Medical Technician (EMT). A second EMT, an unbelted 27-year-old male, was seated in the rear-facing captain's chair attending to the patient in the rear compartment. The 79-year-old male patient was restrained on the ambulance cot in the rear compartment. The other vehicle in the crash was a 2014 Jaguar XF 3.0 being driven northbound by a 68-year-old female. For unknown reasons, the Jaguar crossed over the center line, entered the southbound lanes, and the two vehicles impacted in a head-on configuration. The patient in the ambulance was displaced from the cot restraints and sustained a serious head injury which was followed by cardiac arrest. He was transported to a local hospital where he was pronounced deceased. The two EMTs sustained minor injuries and were transported to a local hospital. The driver of the Jaguar sustained incapacitating injuries and was hospitalized. Both vehicles were towed due to damage and placed on a police hold.</p>			
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Ambulance Body: Custom Truck & Body Works
Location: California
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BACKGROUND

The primary interest of this investigation is the crash involving a 2009 Ford E-350 Type II ambulance and the injuries sustained by the two occupants and patient (**Figure 1**). The ambulance was transporting a 79-year-old male to a non-emergency medical appointment without emergency lights or siren activated when it impacted another vehicle in a head-on crash. The National Highway Traffic Safety Administration's (NHTSA) Office of Emergency Medical Services (EMS) identified this crash on July 14, 2015, and requested further research of the crash through NHTSA's Special Crash Investigations (SCI) group. SCI determined the patient's death following the crash likely resulted from injuries sustained in the crash, and the case was assigned on July 16, 2015. Inspections of both vehicles involved in the crash were completed on July 16, 2015. The Ford 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 at 1540 hours in July 2015 on a north/south roadway in the state of California. The Ford E-350 chassis was configured with a forward cab and rear patient compartment equipped for the treatment of medical emergencies in a mobile environment. It was being driven by a belted 20-year-old male Emergency Medical Technician (EMT). A second EMT, an unbelted 27-year-old male, was seated in the rear-facing captain's chair attending to the patient in the rear compartment. The 79-year-old male patient was restrained on the ambulance cot in the rear compartment. Initially, he was restrained by the chest belt and leg belt. During the trip, the chest belt was removed by the EMT attending to the patient.

The other vehicle in the crash was a 2014 Jaguar XF 3.0 (**Figure 2**) being driven northbound by a 68-year-old female. For unknown reasons, the Jaguar crossed over the center line, entered the southbound lanes, and the two vehicles impacted in a head-on configuration.



Figure 1. 2009 Ford E-350 Type II ambulance

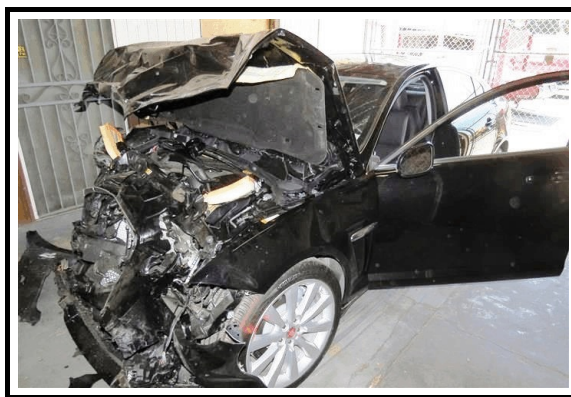


Figure 2. 2014 Jaguar XF 3.0

The patient in the ambulance was displaced from the cot restraints and sustained a serious head injury which was followed by cardiac arrest. Police reported this occupant as having sustained “K” (fatal) injuries. He was transported to a local hospital where he was pronounced deceased. The police reported the driver of the Ford as having sustained “B” (other visible) injuries and the rear-compartment EMT as having sustained a “C” (complaint of pain) injury. Both EMTs were transported by ambulance to a local hospital. The driver of the Jaguar sustained police-reported “A” (severe) injuries and was transported to a local hospital. Both vehicles came to rest on the roadway near the area of impact. They were towed due to damage and placed on a police hold.

SUMMARY

Crash Site

The crash occurred on an undivided four-lane north/south roadway in the state of California (**Figure 3**). The roadway consisted of two lanes for each direction delineated by white painted dashed stripes and separated by a double yellow painted stripe. The roadway measured 18.3 m (60.0 ft) in total width. The two curb lanes each measured 5.8 m (19.0 ft) in width and the second lanes from the right each measured 3.4 m (11.0 ft) in width. Curb parking was allowed beginning just north of the area of impact and extending south. The roadway was straight, and in the southbound direction had a negative slope of 2.5 percent with a super-elevation of positive 1.2 percent. It was paved with asphalt in fair condition and was bordered by raised curbs and sidewalks. The roadside was lined with mature trees.



Figure 3. Crash site, looking south

Scene evidence at the area of impact included police paint markings identifying the Point Of Impact (POI) and the vehicles' final rest positions. Dried vehicle fluid residue was present on the roadway surface. The posted speed limit was 56 km/h (35 mph). Conditions at the time of the crash as reported by the nearest weather station were as follows: temperature 27.2 °C (81.0 °F), 16.0 km (10.0 mi) visibility, variable winds south at 16.7 km/h (10.4 mph) and clear skies. It was daylight without street lamp illumination and dry. No unusual conditions were reported at the time of the crash. A Crash Diagram is included on page 14 of this report.

Pre-Crash

The ambulance organization is a private company that provides 24 hour/7 days a week service to both emergency and non-emergency calls as contracted to private agencies. At the time of the crash, the vehicle was transporting the patient from his home to a non-emergency medical appointment without emergency lights or siren activated. The intended destination was approximately 17.5 km (10.9 mi) from the point of departure. The estimated drive time in afternoon traffic was 30 minutes. The crash site was located approximately 0.5 miles from the point of departure and occurred approximately 30 minutes after the ambulance arrived at the patient's home. The actual departure time from the patient's home was not known. The driver of the Ford possessed a state “C” driver's license and an ambulance driver's certificate. Efforts to obtain data pertaining to the driver's and

passenger's EMT certifications or other specialized training were unsuccessful. The ambulance company and their attorney refused to provide data pertaining to the EMTs shift schedule and sleep schedule.

The Ford was traveling southbound in the second lane from the right at an EDR-reported speed of 31.1 mph (50.0 km/h) with Accelerator Pedal 6 percent, Engine RPM 1,300 and Service Brake "Off" at Time -1.5 seconds to Algorithm Enable (AE). At Time -1.0 the Service Brake was "On", and at Time 0.0 Vehicle Speed was 21.1 mph (34.0 km/h). The EDR indicated ABS, ESC and Traction Control activity were non-engaged, suggesting the vehicle was tracking to the POI.

The Jaguar was traveling northbound a police-estimated speed of 40 km/h (25 mph) when for unknown reasons, it departed the lane crossing over the centerline on the left edge and entering the southbound lanes. The Ford was equipped with forward and rearward video cameras. According to the police report, the forward camera indicated that, at approximately 2.0 seconds prior to impact, the Jaguar crossed center line the entered the southbound lane and the driver of the Ford reacted by braking and sounding the vehicle's steering wheel mounted horn. At approximately 1.0 second prior to impact, the Jaguar was completely in the southbound lane and located approximately 30.0 m (100.0 ft) south of the Ford. Scene evidence and vehicle damage suggested both vehicles continued on a relatively straight head-on path in the southbound lane to the POI.

Crash

The crash consisted of one event in which the front plane of the Ford impacted the front plane of the Jaguar (Event 1). Contact damage to both vehicles was distributed across their front planes. The POI was located in the second southbound lane from the right, mid-block and 7.4 m (24.2 ft) east of the west curb line. Following the impact, both vehicles rebounded rearward. The Ford traveled rearward approximately 2.3 m (7.5 ft) and rotated slightly counterclockwise, and came to rest facing southeast in the same lane as the impact. The Jaguar traveled rearward approximately 1.7 m (5.6 ft) and rotated slightly clockwise, and came to rest facing northeast in the same lane as the impact (**Figure 4**). During the crash, the patient in the Ford was displaced from his cot belt restraints and his head impacted a cabinet surface located at the forward aspect of the patient compartment. He came to rest on the compartment floor. The cot remained attached to the ambulance at the floor and left panel fastening points. Additional details regarding the patient cot and restraints usage are discussed in the Patient Cot section of this report.

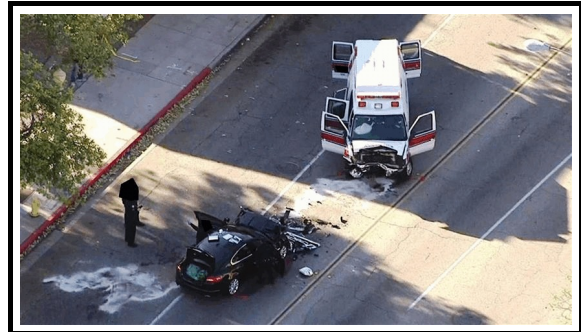


Figure 4. Final rest positions 2009 Ford E-350 Type II ambulance and 2014 Jaguar XF 3.0 (news photo)

The impact with the Jaguar was captured by the Ford's EDR as a deployment event. At impact, both frontal air bags deployed and both safety belt pretensioners actuated in the Ford. The Time to Algorithm Enable for the air bag deployments was 27.5 milliseconds (ms). For the Ford in this event, the WinSMASH program Damage only algorithm calculated a Total Delta-V of 25.0 km/h (16.0 mph) with Longitudinal and Lateral components of -25.0 km/h (-16.0 mph) and -4.0 km/h (-2.0 mph), respectively, and a Barrier Equivalent Speed (BES) of 32.0 km/h (20.0 mph). The Ford's

EDR-reported maximum longitudinal Delta-V was -31.04 km/h (-19.29 mph), the maximum lateral Delta-V was -4.98 km/h (-3.09 mph) and the calculated Total Delta-V was 31.5 km/h (19.6 mph). The WinSMASH results appear low when compared to the EDR-reported velocity changes.

For the Jaguar in this event, WinSMASH program calculated a Total Delta-V of 59.0 km/h (37.0 mph) with Longitudinal and Lateral components of -59.0 km/h (-37.0 mph) and 0 km/h, respectively, and a Barrier Equivalent Speed (BES) of 49.0 km/h (30.0 mph). The WinSMASH results fit the model and appear reasonable.

Post-Crash

Following the crash, the driver of the Ford exited the vehicle with assistance from a passerby through the left side door and the other EMT exited without assistance through the right side door of the patient compartment. The EMTs observed the patient lying on the floor of the patient compartment. Due to the patient's apparent serious head trauma, they removed him from the vehicle through a side door and positioned him on the ground. Police and fire were dispatched approximately three minutes after the crash and arrived on-scene four minutes after the crash. The driver of the Jaguar stayed in her vehicle until she was assisted into an ambulance.

All occupants from both vehicles including the patient were transported by ambulance to local hospitals. The two EMTs sustained minor injuries and were treated and released. The patient in the Ford sustained fatal injuries and was pronounced deceased in the emergency room 46 minutes after the crash. The driver of the Jaguar sustained incapacitating injuries and was hospitalized for an unknown length of time. Both vehicles were towed due to damage and placed on a police hold. Following the SCI inspections they were released to their respective owners.

2009 FORD E-350 TYPE II AMBULANCE

Description

The ambulance was a 2009 Ford E-350 cargo van type chassis manufactured in May 2009 and identified by the Vehicle Identification Number (VIN): 1FDSS34P49Dxxxxxx. The vehicle was configured with an electronic odometer and the mileage was unknown. The chassis was completed during secondary manufacturing in September 2009 by Custom Truck & Body Works, Inc. as a Type II ambulance. It was a rear-wheel drive platform powered by a Ford 6.0-liter 8-cylinder diesel engine linked to an automatic transmission. Secondary manufacturing of the vehicle consisted of installation of the patient compartment module and installation of emergency services operational equipment (warning lights, sirens, and radio communications). Completed as a Type II certified ambulance, the vehicle was configured with a forward cab and rear patient compartment equipped for the treatment of medical emergencies in a mobile environment (Figure 5).



Figure 5. Patient compartment, 2009 Ford E-350 Type II ambulance

The Ford's front cab was configured for the seating of two occupants, with forward-facing box-mounted seats that featured manual seat track and seat back recline adjustments. The seats were configured with three-point lap and shoulder safety belts and integral head restraints. The driver's seat cushion was set between the mid and forward track positions. The front right seat was unoccupied. The front row seats were divided by a center console that integrated communications equipment and an array of switches related to the ambulance's emergency response and operational activities. Seating within the patient compartment module accommodated up to three crew members and one patient cot. This configuration included a rear-facing, high-back attendant seat at the forward wall, an inward facing, two-passenger bench seat on the right side wall, and a centrally located single occupant cot secured to the left side wall and floor. The attendant seat was configured with a lap and shoulder belt, and an integral head restraint. The squad bench seat was configured with three lap belts. A cargo safety net was located at the forward end of the squad bench.

The patient compartment had interior dimensions of 285.0 cm (112.2 in) in length, 147.0 cm (57.9 in) in width, and 165.1 cm (65.0 in) in height. A metal open-grade design step was located below the rear bumper. Double-wide rear doors served for the loading and unloading of the cot, as well as entry for the crew. Another set of double doors on the right side forward of the bench seat provided additional occupant access.

Vehicle Weight, Payload, and Tire Data

The Ford chassis was placarded with a Gross Vehicle Weight Rating (GVWR) of 4,309 kg (9,500 lb). This was distributed as Gross Vehicle Weight Rating (GAWR) front 2,087 kg (4,600 lb) and GAWR rear 2,760 kg (6,084 lb). The vehicle had a total usable payload (total remaining weight capacity of occupants and cargo a user may add) of 367 kg (810 lb). Using an ambulance payload calculation, the vehicle curb weight as built was 3,942 kg (8,691 lb). The vehicle manufacturer's recommended tire size was LT245/75R16 with recommended cold tire pressures of 414 kPa (60 psi) front and 552 kPa (80 psi) rear. At the time of the SCI inspection, the vehicle was equipped with Nexen Roadian HT tires of the recommended size. Specific tire data was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	469 kPa (68 psi)	3 mm (4/32 in)	No	None
LR	469 kPa (68 psi)	5 mm (6/32 in)	No	None
RR	469 kPa (68 psi)	5 mm (6/32 in)	No	None
RF	441 kPa (64 psi)	3 mm (4/32 in)	Yes	None

Exterior Damage

The Ford sustained moderate severity damage to the front plane caused during the impact with the Jaguar in Event 1. The direct damage was distributed across the front end extending from bumper corner to bumper corner and measured 162.0 cm (63.8 in). Six crush measurements were taken at bumper level as follows (**Figure 6**): $C_1 = 14.0$ cm (5.5 in), $C_2 = 13.0$ cm (5.1 in), $C_3 = 43.0$ cm (16.9 in), $C_4 = 48.0$ cm (18.9 in), $C_5 = 31.0$ cm (12.2 in), $C_6 = 31.0$ cm (12.2 in). Maximum crush was located at C_4 and the Collision Deformation Classification (CDC) for the Ford in this event was 12FDEW3.

Event Data Recorder

The Ford's Event Data Recorder (EDR) was imaged during the vehicle inspection using the Direct to Module method using the Air Bag Control Module (ACM) adaptor with power supplied by a portable power pack/jump box. Bosch CDR Tool version 16.1.1 was used to image the data and version 16.6 was used to report it. The complete EDR report is included in this report as Attachment A.

The EDR report contained system status, deployment data, pre-crash data, longitudinal and lateral crash pulse at 10 ms intervals beginning at 10 ms and ending at 250 ms. The EDR captured one deployment event which was a locked record with the complete file recorded. No faults were present at the start of this recorded event. The voltage reading at time zero was 13.608. The EDR reported an ignition cycle of 16,382 at crash and a cycle of 17,333 at download. The probable reason for the unusually high difference in cycle count at download was attributed to compromises in the vehicle's electrical system caused by impact damage. This theory was supported by the investigator's unsuccessful attempts to image the EDR using the DLC method. Additionally, similar examples have been cited in EDR user group discussions.



Figure 6. Front end crash measurements, 2009 Ford E-350 Type II ambulance

The EDR file reported a frontal air bag deployment and pretensioner deployment time of 27.5 ms. The EDR-reported Maximum longitudinal Delta-V was -31.04 km/h (-19.29 mph) at 95 ms, and Maximum longitudinal Delta-V was -4.98 km/h (-3.09 mph) at 66 ms. The EDR indicated the driver's seat cushion was set in a forward track position and both front row safety belts were buckled. The front right passenger seat was unoccupied. The Pre-Crash table was as follows:

Pre-Crash Data -5.0 to -0 sec [2 samples/sec] (First Record)

Times (sec)	Speed Vehicle Indicated MPH [km/h]	Accelerator Pedal, % full	Service Brake on/off	Engine RPM
-5.0	25.5 [41.0]	26	Off	2,000
-4.5	26.7 [43.0]	25	Off	2,100
-4.0	28.0 [45.0]	24	Off	2,100
-3.5	28.6 [46.0]	25	Off	2,100
-3.0	29.2 [47.0]	24	Off	1,700
-2.5	30.4 [49.0]	22	Off	1,700
-2.0	31.1 [50.0]	17	Off	1,600

-1.5	31.1 [50.0]	6	Off	1,300
-1.0	30.4 [49.0]	0	On	700
-0.5	26.7 [43.0]	0	On	600
0.0	21.1 [34.0]	0	On	600

Interior Damage

The Ford's cab interior revealed minor damage from air bag deployments and occupant contacts. Minor occupant loading was documented on the driver's safety belt. There was no intrusion into the occupant compartment and no deformation of the steering wheel rim or compression of the column. There were no deformations to any of the seats. The doors remained closed and operational. The windshield was fractured in the lower right corner. The patient compartment revealed contact evidence including loading marks to the manual lap belt on the cot, and blood and skin transfers on the cabinet surface where the patient's head contacted the cabinet.

Manual Restraint Systems

The cab of the Ford was equipped with manual restraint systems for both front seat positions. Each was a 3-point lap and shoulder belt system consisting of continuous loop webbing with sliding latch plates. The shoulder anchorages were adjusted to the full-down position on the driver's side and full-up on the passenger's side. The driver was restrained by the vehicle's lap and shoulder belt at the time of the crash. The belt revealed loading evidence on the webbing and latch plate. The front row belts were configured with buckle pretensioners and vehicle's EDR indicated both belts were buckled and both pretensioners actuated at 27.5 ms. The front right seat position was unoccupied at the time of the crash and on-scene police images show the belt unbuckled following the crash. The likely explanation is that the belt was buckled at impact and unbuckled during post-crash activities.

In the patient compartment, the rearward-facing seat was equipped with a lap and shoulder belt and the squad bench seat was configured with three lap belts. The EMT seated in the rear-facing seat was unbelted and the squad bench was unoccupied so none of the safety belts in the patient compartment were in use at the time of the crash. A safety net was located at the forward end of the squad bench seat. The webbing of the net was cut at the upper aspect. The source of this damage was unknown.

Manual restraints for the patient cot included two lap-style safety belts with locking latch plates. The manual restraints for the patient are discussed in greater detail in the Patient Cot section of this report.

Supplemental Restraint Systems

The Ford's Supplemental Restraint Systems (SRS) included an Air Bag Control Module (ACM), dual-stage frontal air bags for the front row seat positions and safety belt buckle pretensioners. At impact with the Jaguar, both frontal air bags deployed and both pretensioners actuated at an EDR-reported time of 27.5 ms.

The driver's frontal air bag deployed from the steering wheel hub. It was round in shape and the front panel from seam to seam measured 42.0 cm (16.5 in) in diameter. The air bag was configured with two vent ports on the upper aspect, and two internal tethers. It was not damaged and no occupant contact evidence was documented. The front right occupant's frontal air bag deployed from an H-configured cover flap from the top right instrument panel. It was rectangular measuring 38.0 cm (15.0 in) in width with an excursion length of 54.0 (21.3 in). The air bag was configured with two vent ports on the upper aspect and two internal tethers. This air bag was unremarkable.

Patient Compartment

The Type II van-based patient compartment was an Endeavor model manufactured by Custom Truck & Body Works, Inc. in September 2009. The standard layout of the interior featured a rear-facing attendant's seat, an inward-facing squad bench along the right wall, a backboard, and multiple storage shelving and cabinetry consisting of Formica surfaces, sliding plexiglass access doors and fixed aluminum shelving.

An M-size oxygen cylinder was stored in an upright orientation within a recessed cabinet located at the right rear aspect of the patient compartment. The cylinder was secured using two 5.0 cm (2.0 in) band straps and appeared to have remained in place during the crash.

A storage cabinet configured with a hinged drop-down access door was located at the front right aspect of the patient compartment. This cabinet was set on the floor and against the forward wall panel. The front surface of this cabinet measured 35.0 cm (13.7 in) in height and 44.0 cm (17.3 in) in width, and it protruded 34.0 cm (13.4 in) rearward of the front wall. It was positioned forward and to the right of the ambulance cot. The linear distance measured diagonally from cot to cabinet was approximately 1.0 m (3.3 ft). The front panel of this cabinet exhibited occupant contact evidence including blood and skin deposits (**Figures 7 and 8**), indicating that the patient's head contacted this cabinet during the crash.

Patient Cot

The patient cot was a Stryker EMS Model 6082 MX-PRO R3 Ambulance Cot, serial number 40xxx. It was constructed of a tubular aluminum frame with circumferential weld joints and steel hardware fasteners. The X-frame supporting the mattress platform featured manual height adjustment capabilities and the mattress platform featured 2-73 degrees of backrest articulation and



Figure 7. Patient compartment, cabinet at forward aspect was an injury source for the patient, 2009 Ford E-350 ambulance



Figure 8. Stryker EMS Model 6082 MX-PRO R3 Ambulance Cot (foreground), patient contact evidence (background/arrow)

a 14-degree shock position. At the time of the SCI inspection, the head of the cot was elevated to 17 degrees and the foot was 15 degrees. The cot measured 205.0 cm (80.5 in) in length and 58.0 cm (23.0 in) in width. Labeling declared that the maximum load capacity was 295 kg (650 lb). It was secured in place within the patient compartment using a Stryker model 6371 antler design floor-mount cot fastener system, serial number on the fastening system was 090840xxx. The system consisted of a forward antler bracket and rearward side mounted locking-clamp mechanism (**Figure 9**). The antler bracket cradled the forward portion (location of the patient's head area) of the cot's frame, while the vertically-oriented locking mechanism clamped around a pin protruding from the cot's lower frame rail.

The specifications sheet for the MX-PRO R3 indicate standard features include a four-point shoulder restraint which would typically be installed at the head of the frame, in addition to the two lap belts. During the inspection, no shoulder restraints were found installed either on the cot or within the patient compartment of the vehicle. The ambulance driver stated in the police report that this cot was not configured with shoulder straps. He stated further that it is common practice to secure the belts whenever transporting patients but that he did not remember specifically buckling the straps when preparing the patient for transport on the day of the crash.

At the time of the SCI inspection, the ambulance cot was secured in place by the fastening system. The investigator released the mechanism for inspection and it was determined to be functional and undamaged. The cot was equipped with a manual restraint system consisting of two lap type belts with locking latch plates (**Figure 10**), the lower of which was used to restrain the legs and the upper which was used to restrain the chest. The webbing, latch plates and buckles were examined by the investigator and found to be functioning properly. The chest belt revealed occupant loading evidence in the form of scuff marks to the webbing (**Figure 11**). The leg



Figure 9. Stryker model 6371 cot fastening system



Figure 10. Manual leg and chest belt restraints, Stryker EMS Model 6082 MX-PRO R3 Ambulance Cot, looking rearward



Figure 11. Occupant loading of chest belt, Stryker EMS Model 6082 MX-PRO R3 Ambulance Cot

restraint was unremarkable. The police noted in their report that, after reviewing their on-scene photos, they determined the leg belt was definitely buckled following the crash. They could not determine with certainty whether the upper belt was buckled although it did not appear to be so. During the subsequent police vehicle inspection, the officer noted the upper chest belt was unbuckled.



Figure 12. On-scene image showing chest belt in buckled position (police image)

There was no visible damage to the cot's metal frame or fastening system. The mattress revealed possible patient loading evidence in the form of scuff marks. These scuff marks were linear in nature and located within the vinyl on the middle to upper aspects of the mattress. The longest of these scuff marks measured 25.0 cm (9.8 in) in length and was oriented similarly to the probable at-impact trajectory of the patient. An on-scene police image shows the chest belt was buckled (**Figure 12**). The investigation concluded that the chest belt was either buckled but loosened by the EMT prior to the crash, or unbuckled prior to the crash.

2009 FORD E-350 TYPE II AMBULANCE OCCUPANTS

Driver Demographics

Age/Sex:	20 years/Male
Height:	173 cm (68 in)
Weight:	93 kg (205 lb)
Eyewear:	None
Seat type:	Box-mounted with integral head restraint
Seat track position:	Between middle and forward
Manual restraint usage:	Lap and shoulder safety belt used
Usage source:	Vehicle inspection, EDR report
Air bags:	Frontal air bag deployed
Alcohol/Drug data:	None
Egress from vehicle:	Exited with assistance through side door
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Treated and released

Driver Injuries

Inj. No.	Injury	AIS 2010	Injury Source	Confidence Level
1	Abrasion, left hand	710202.1,2	Left IP	Possible

Source: Medical records

Driver Kinematics

The belted 20-year-old male driver of the Ford was seated in a normal upright posture and was actively steering and braking the vehicle. At impact with the Jaguar, the driver's frontal air bag

deployed, and his safety belt pretensioner actuated. He was displaced forward in response to the 12 o'clock direction of force and loaded the safety belt, and possibly loaded the deployed frontal air bag. Following the impact, the Ford was displaced rearward and the driver remained in his seated position by the pretensioned safety belt. The vehicle came to rest near the point of impact and the driver exited without assistance through the left side door. He was transported to a local hospital emergency department where his Glasgow Coma Score (GCS) was 15. He was treated and released the same day.

Rear Left Patient Compartment Occupant Demographics

Age/Sex:	27 years/Male
Height:	175 cm (69 in)
Weight:	75 kg (165 lb)
Eyewear:	None
Seat type:	Rear-facing box-mounted high-back attendant seat with integral head restraint
Seat track position:	Not adjustable
Manual restraint usage:	Lap and shoulder safety belt not used
Usage source:	Vehicle inspection, police report
Air bags:	None
Egress from vehicle:	Exited through side door
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Treated and released

Rear Left Patient Compartment Occupant Injuries

Inj. No.	Injury	AIS 2010	Injury Source	Confidence Level
1	Cerebral concussion NFS	161000.1,0	Head restraint	Possible

Source: Medical records

Rear Left Patient Compartment Occupant Kinematics

The 27-year-old second row left male occupant of the Ford was seated in an upright and forward posture while he administered medical assistance to the cot-restrained patient. This occupant was unbelted and not using the manual restraints. He was attempting to take the patient's pulse and was facing rearward in the patient compartment. He heard the vehicle's horn sound and felt the vehicle slow as a result of braking prior to impact. The occupant turned his head to the right and, at impact with the other vehicle, the back of his head possibly contacted the seat-back or head restraint. Following the impact, the Ford was displaced rearward and the occupant remained in his seated position. His next recollection following the crash was awaking while still seated in the captain's chair. The vehicle came to rest near the point of impact and he exited through the right side door of the patient compartment. He was transported to a local hospital emergency department where his GCS was 15. He was treated and released the same day.

Patient Cot Occupant Demographics

Age/Sex:	79 years/Male
Height:	168 cm (66 in)
Weight:	84 kg (185 lb)

Eyewear:	Unknown
Seat type:	Immobilized longitudinally in supine position on cot
Seat track position:	N/A
Manual restraint usage:	Leg belt used, chest belt used improperly, no shoulder restraints available
Usage source:	Vehicle inspection, police report
Air bags:	None available
Egress from vehicle:	Removed through side door due to perceived injuries
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Declared deceased in ER

Patient Cot Occupant Injuries

No.	Injury	AIS 2010	Injury Source	Confidence Level
1	Lacerations, bilateral lungs	441450.4,3	Interior cabinet	Probable
2	Flail chest NFS	450209.3,9	Interior cabinet	Probable
3	Laceration, major, upper scalp	110604.2,6	Interior cabinet	Certain
4	Subarachnoid hemorrhage, cerebrum	140693.2,9	Interior cabinet	Certain
5	Fracture, sternum	450804.2,4	Interior cabinet	Probable
6	Pneumothorax, bilateral lungs	442202.2,3	Interior cabinet	Probable
7	Fracture, open, left ankle NFS	852002.2,2	Patient cot belt restraint	Possible
8	Lacerations, minor, scalp	110602.1,7	Interior cabinet	Certain
9	Subgaleal hemorrhage, scalp	110402.1,0	Interior cabinet	Certain
10	Hemorrhage, neck	310402.1,9	Interior cabinet	Possible
11	Hematoma, adrenal gland	540210.1,1	Interior cabinet	Possible
12	Contusions, right abdomen	510402.1,1	Floor	Possible
13	Contusion, right forearm	710402.1,1	Floor	Possible
14	Contusions, bilateral hands	710402.1,3	Floor	Possible

Sources: Autopsy report, medical records

Patient Cot Occupant Kinematics

Prior to the crash, the 79-year-old male patient was being transported to a non-emergency medical appointment. He was in a supine position on the cot and his leg and chest safety belt restraints had been loosened for the purpose of obtaining a blood pressure reading. The patient was asleep and the forward section of the cot was in a flat position instead of an inclined position, which would typically be used for a patient who was awake. At impact, the occupant was displaced forward in response to the direction of force. His left lower ankle and foot contacted the leg belt restraint causing an open fracture of the lower leg. The patient continued to be displaced forward, loading and scuffing the chest safety belt. He continued to be displaced forward departing the cot in a forward trajectory causing the superior aspect of his scalp to impact an interior cabinet at the forward end of the patient compartment. There was no evidence to suggest the cot moved from its stationary position within the vehicle. The contact caused a full thickness laceration measuring 3.9 cm (4.0 in) in length to his scalp, multiple smaller lacerations to his scalp, and subgaleal and subarachnoid hemorrhages. The patient's neck and torso continued to be displaced forward contacting the cabinet and causing a hemorrhage to the neck, multiple fractures to the rib cage (chest flail), fracture to the sternum, bilateral lacerations to the lungs, bilateral pneumothoraces to the lungs and hematoma to the adrenal gland. The patient's arms and hands contacted the floor causing contusions to the right forearm and bilateral hands. Following the crash, when observed by the rear-compartment EMT the patient was found to be in a state of cardiac arrest. He was removed from the vehicle by the EMTs and transported by ambulance to a local hospital where his GCS was 3. The patient was in full cardiac arrest for more than 20 minutes prior to his arrival to the hospital. Resuscitative efforts in the ER were unsuccessful and the patient was pronounced deceased 46 minutes after the crash. The autopsy report indicated the cause of death was multiple traumatic injuries.

2014 JAGUAR XF 3.0

Description

The 2014 Jaguar XF 3.0 sedan was identified by the VIN: SAJWA0EX7E8xxxxxx. The date of manufacture and the odometer reading were unknown. The vehicle was equipped with a 3.0-liter 6-cylinder gasoline engine linked to an automatic transmission, rear-wheel drive, ABS brakes and daytime running lights.

Exterior Damage

The Jaguar sustained moderate severity damage to the front plane caused during the impact with the Ford in Event 1. The direct damage was distributed across the front end extending from bumper corner to bumper corner and measured 75.0 cm (29.5 in). The front bumper fascia was displaced from the vehicle and the backing bar was used to obtain crush measurements. Six crush measurements (**Figure 13**) were taken at bumper level as follows: $C_1 = 27.0$ cm (10.6 in), $C_2 = 55.0$ cm (21.7 in), $C_3 = 48.0$ cm (18.9 in), $C_4 = 38.0$ cm (15.0 in), $C_5 = 38.0$ cm (15.0 in), $C_6 = 37.0$ cm (14.6 in). Maximum crush was located at C_2 and the CDC for the Jaguar in Event 1 was 12FDEW3.

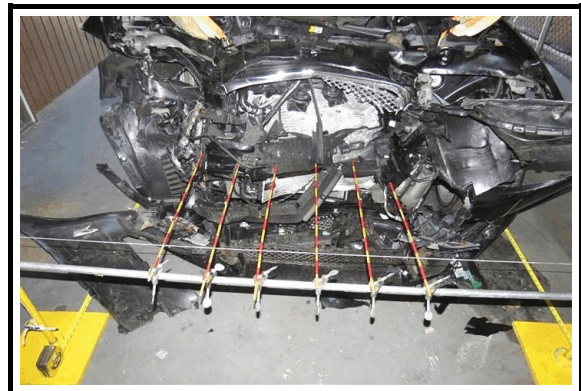
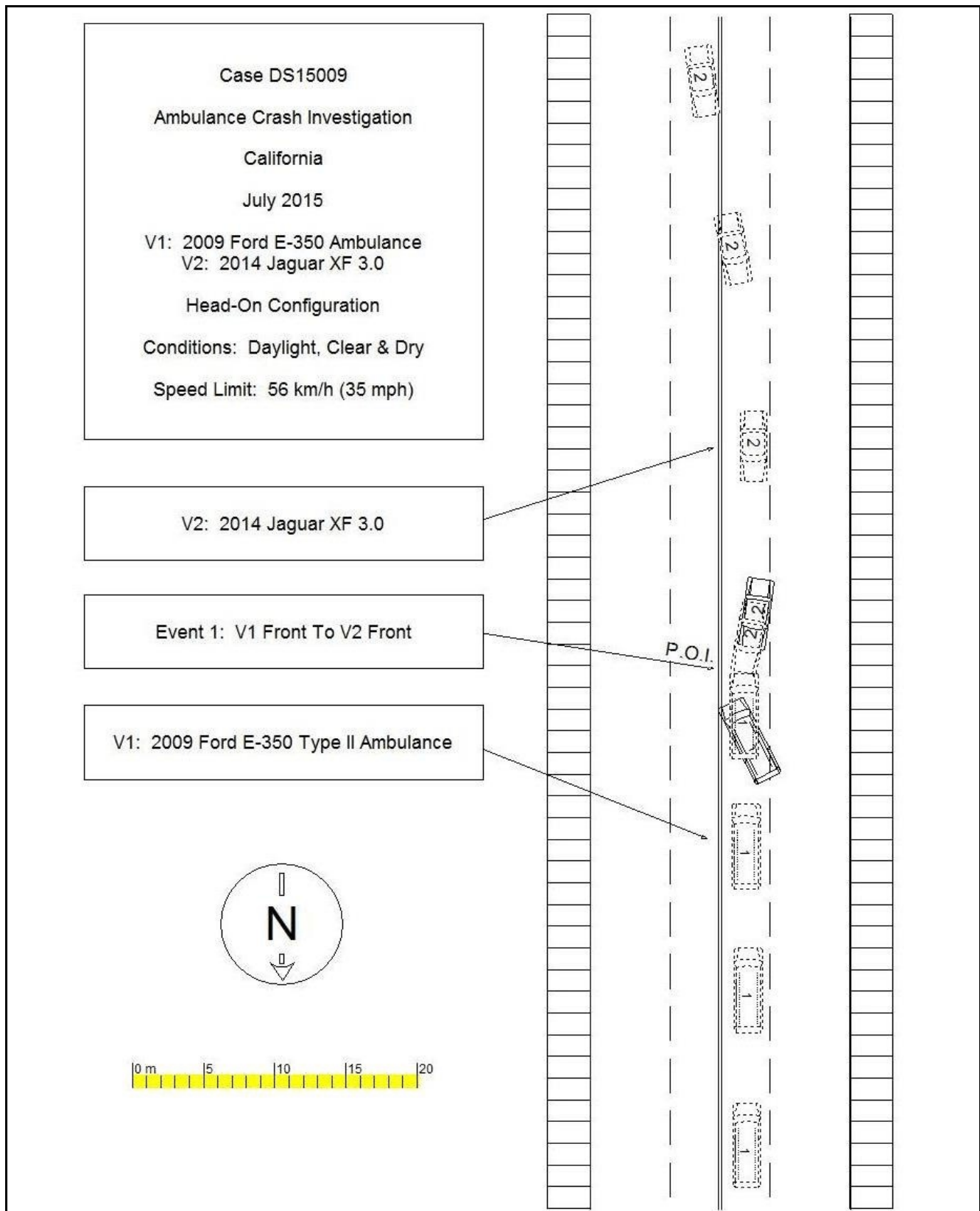


Figure 13. Front end crush measurements, 2014 Jaguar XF 3.0

Occupant Data

According to the police report, the 68-year-old female driver of the Jaguar was belted at the time of the crash. She sustained multiple serious injuries including a fracture to the left clavicle, fractures to ribs, fractures to left and right lower legs (ankles), and lacerations to the left wrist and right knee. Following the crash, she was transported by ambulance to a local hospital and admitted for an unknown number of days. The driver was then transferred to a convalescent hospital for the purpose of rehabilitation. Her last known day of treatment in this hospital was nineteen days after the crash.

CRASH DIAGRAM

Attachment A: 2009 Ford E-350 Type II Ambulance
Event Data Recorder (EDR) 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	1FDSS34P49D*****
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS15009 V1_ACM.CDRX
Saved on	
Collected with CDR version	Crash Data Retrieval Tool 16.1.1
Reported with CDR version	Crash Data Retrieval Tool 16.6
EDR Device Type	Airbag Control Module
ACM Adapter Detected During Download	Yes
Event(s) recovered	locked frontal event

Comments

No comments entered.

The retrieval of this data has been authorized by the vehicle's owner, or other legal authority such as a court order or search warrant, as indicated by the CDR tool user on .

Data Limitations

Restraints Control Module Recorded Crash Events:

Deployment Events cannot be overwritten or cleared from the Restraints Control Module (RCM). Once the RCM has deployed any airbag device, the RCM must be replaced. The data from events which did not qualify as deployable events can be overwritten by subsequent events. The RCM can store up to two deployment events.

Airbag Module Data Limitations:

- Restraints Control Module Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced from the point of algorithm wake up. It is not the speed the vehicle was traveling before the event. Note that the vehicle speed is recorded separately five seconds prior to algorithm wake up. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change.
- Event Recording Complete will indicate if data from the recorded event has been fully written to the RCM memory or if it has been interrupted and not fully written.
- If power to the Airbag Module is lost during a crash event, all or part of the crash record may not be recorded.
- For 2011 Ford Mustangs, the Steering Wheel Angle parameter indicates the change in steering wheel angle from the previously recorded sample value and does not represent the actual steering wheel position.

Airbag Module Data Sources:

- Event recorded data are collected either INTERNALLY or EXTERNALLY to the RCM.
 - INTERNAL DATA is measured, calculated, and stored internally, sensors external to the RCM include the following:
 - > The Driver and Passenger Belt Switch Circuits are wired directly to the RCM.
 - > The Driver's Seat Track Position Switch Circuit is wired directly to the RCM.
 - > The Side Impact Sensors (if equipped) are located on the side of vehicle and are wired directly to the RCM.
 - > The Occupant Classification Sensor is located in the front passenger seat and transmits data directly to the RCM on high-speed CAN bus.
 - > Front Impact Sensors (right and left) are located at the front of vehicle and are wire directly to the RCM.
 - EXTERNAL DATA recorded by the RCM are data collected from the vehicle communication network from various sources such as Powertrain Control Module, Brake Module, etc.

02007_RCM-RC6_r002

System Status at Time of Retrieval

VIN as programmed into RCM at factory	1FDSS34P49D*****
Current VIN from PCM	1FDSS34P49D*****
Ignition cycle, download (first record)	17.333
Ignition cycle, download (second record)	N/A
Restraints Control Module Part Number	9C24-14B321-BJ
Restraints Control Module Serial Number	3101489200000000
Restraints Control Module Software Part Number (Version)	9L34-14C028-AN
Left/Center Frontal Restraints Sensor Serial Number	0C22937F
Left Side Restraint Sensor 1 Serial Number	00000000
Left Side Restraint Sensor 2 Serial Number	00000000
Right Frontal Restraints Sensor Serial Number	00000000
Right Side Restraint Sensor 1 Serial Number	00000000
Right Side Restraints Sensor 2 Serial Number	00000000

System Status at Event (First Record)

Recording Status	Locked Record
Complete file recorded (yes,no)	Yes
Multi-event, number of events (1,2)	1
Time from event 1 to 2 (msec)	N/A
Lifetime Operating Timer at event time zero (seconds)	40,760,275
Key-on Timer at event time zero (seconds)	640
Vehicle voltage at time zero (Volts)	13.608
Energy Reserve Mode entered during event (Y/N)	No
Time Driver Front Satellite Sensor Lost Relative to Time Zero (msec)	41.0

Faults Present at Start of Event (First Record)

No Faults Recorded

Deployment Data (First Record)

Frontal airbag deployment, time to first stage deployment, driver (msec)	27.5
Pretensioner (buckle) deployment, time to fire, driver (msec)	27.5
Frontal airbag deployment, time to first stage deployment, front passenger (msec)	27.5
Pretensioner (buckle) deployment, time to fire, right front passenger (msec)	27.5
Maximum delta-V, longitudinal (MPH [km/h])	-19.29 [-31.04]
Time, maximum delta-V longitudinal (msec)	95
Maximum delta-V, lateral (MPH [km/h])	-3.09 [-4.98]
Time, maximum delta-V lateral (msec)	66
Left or center front, satellite Sensor discriminating deployment	Yes
Left or center, front satellite Sensor safing	Yes
Right, front satellite sensor discriminating deployment	Yes
RCM, front sensor discriminating deployment	Yes
RCM, front sensor safing	Yes

Pre-Crash Data -1 sec (First Record)

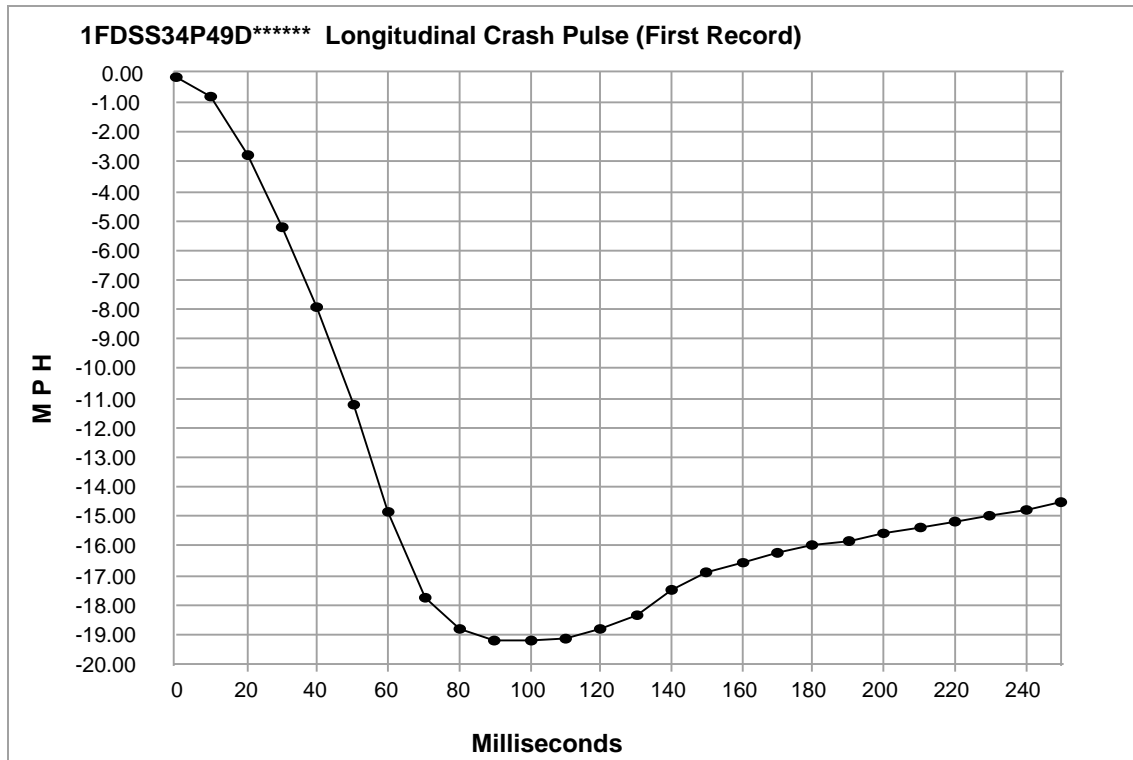
Ignition cycle, crash	16.382
Frontal air bag warning lamp, on/off	Off
Occupant size classification, front passenger (Child size Yes/No [Hex value])	No [\$04]
Frontal air bag suppression switch status, front passenger	Not Active
Safety belt status, driver	Driver Buckled
Seat track position switch, foremost, status, driver	Forward
Safety belt status, front passenger	Passenger Buckled
Brake Telltale	Off
ABS Telltale	Off
Stability Control Telltale	Off
Speed Control Telltale	Off
Powertrain Wrench Telltale	Off
Powertrain Malfunction Indicator Lamp (MIL) Telltale	Off

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

Times (sec)	Speed vehicle indicated MPH [km/h]	Accelerator pedal, % full	Service brake, on/off	Engine rpm	ABS activity (engaged, non-engaged)	Stability control (engaged, non-engaged)	Traction Control via Brakes (engaged, non-engaged)	Traction Control via Engine (engaged, non-engaged)
- 5.0	25.5 [41.0]	26	Off	2,000	non-engaged	non-engaged	non-engaged	non-engaged
- 4.5	26.7 [43.0]	25	Off	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 4.0	28.0 [45.0]	24	Off	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 3.5	28.6 [46.0]	25	Off	2,100	non-engaged	non-engaged	non-engaged	non-engaged
- 3.0	29.2 [47.0]	24	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 2.5	30.4 [49.0]	22	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 2.0	31.1 [50.0]	17	Off	1,600	non-engaged	non-engaged	non-engaged	non-engaged
- 1.5	31.1 [50.0]	6	Off	1,300	non-engaged	non-engaged	non-engaged	non-engaged
- 1.0	30.4 [49.0]	0	On	700	non-engaged	non-engaged	non-engaged	non-engaged
- 0.5	26.7 [43.0]	0	On	600	non-engaged	non-engaged	non-engaged	non-engaged
0.0	21.1 [34.0]	0	On	600	non-engaged	non-engaged	non-engaged	non-engaged

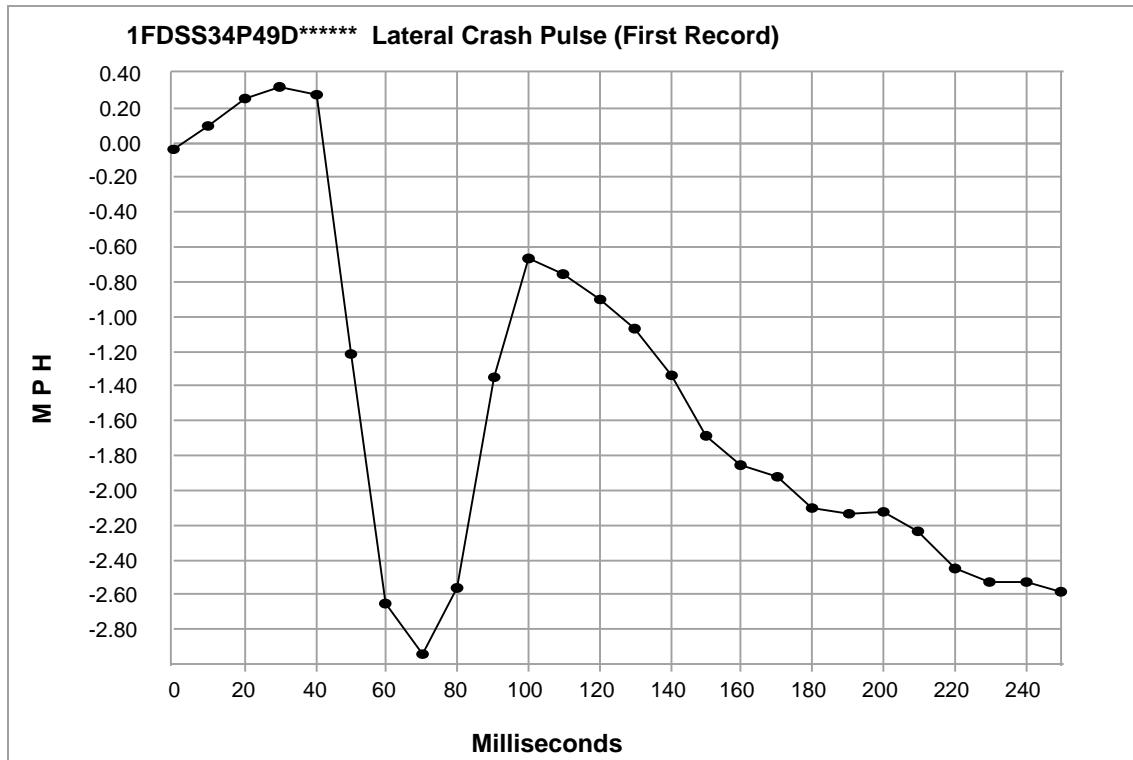
Pre-Crash Data -5 to 0 sec [10 samples/sec] (First Record)

Times (sec)	Steering Wheel Angle (degrees)
- 5.0	Invalid
- 4.9	Invalid
- 4.8	Invalid
- 4.7	Invalid
- 4.6	Invalid
- 4.5	Invalid
- 4.4	Invalid
- 4.3	Invalid
- 4.2	Invalid
- 4.1	Invalid
- 4.0	Invalid
- 3.9	Invalid
- 3.8	Invalid
- 3.7	Invalid
- 3.6	Invalid
- 3.5	Invalid
- 3.4	Invalid
- 3.3	Invalid
- 3.2	Invalid
- 3.1	Invalid
- 3.0	Invalid
- 2.9	Invalid
- 2.8	Invalid
- 2.7	Invalid
- 2.6	Invalid
- 2.5	Invalid
- 2.4	Invalid
- 2.3	Invalid
- 2.2	Invalid
- 2.1	Invalid
- 2.0	Invalid
- 1.9	Invalid
- 1.8	Invalid
- 1.7	Invalid
- 1.6	Invalid
- 1.5	Invalid
- 1.4	Invalid
- 1.3	Invalid
- 1.2	Invalid
- 1.1	Invalid
- 1.0	Invalid
- 0.9	Invalid
- 0.8	Invalid
- 0.7	Invalid
- 0.6	Invalid
- 0.5	Invalid
- 0.4	Invalid
- 0.3	Invalid
- 0.2	Invalid
- 0.1	Invalid
0.0	Invalid



Longitudinal Crash Pulse (First Record)

Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
0	-0.12	-0.20
10	-0.81	-1.30
20	-2.76	-4.44
30	-5.22	-8.40
40	-7.93	-12.77
50	-11.23	-18.08
60	-14.85	-23.90
70	-17.75	-28.56
80	-18.84	-30.32
90	-19.23	-30.95
100	-19.23	-30.94
110	-19.15	-30.82
120	-18.83	-30.30
130	-18.35	-29.54
140	-17.52	-28.20
150	-16.91	-27.22
160	-16.55	-26.64
170	-16.24	-26.13
180	-15.99	-25.74
190	-15.82	-25.46
200	-15.60	-25.10
210	-15.39	-24.77
220	-15.18	-24.43
230	-14.97	-24.10
240	-14.76	-23.76
250	-14.49	-23.33



Lateral Crash Pulse (First Record)

Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
0	-0.04	-0.06
10	0.10	0.16
20	0.25	0.41
30	0.32	0.52
40	0.28	0.45
50	-1.21	-1.95
60	-2.66	-4.28
70	-2.94	-4.74
80	-2.57	-4.13
90	-1.35	-2.18
100	-0.66	-1.07
110	-0.76	-1.22
120	-0.90	-1.46
130	-1.07	-1.72
140	-1.33	-2.15
150	-1.69	-2.71
160	-1.86	-2.99
170	-1.93	-3.10
180	-2.10	-3.38
190	-2.13	-3.43
200	-2.13	-3.42
210	-2.23	-3.59
220	-2.45	-3.94
230	-2.53	-4.08
240	-2.53	-4.07
250	-2.59	-4.17

Hexadecimal Data

Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR system.

02 00 00 00

39 43 32 34 2D 31 34 42 33 32 31 2D 42 4A 00 00 00 00 00 00 00 00 00 00

33 31 30 31 34 38 39 32 30 30 30 30 30 30 30

39 4C 33 34 2D 31 34 43 30 32 38 2D 41 4E 00 00 00 00 00 00 00 00 00 00

0C 22 93 7F 00 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

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00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00

31 46 44 53 53 33 34 50 34 39 44 2A 2A 2A 2A 2A 2A

31 46 44 53 53 33 34 50 34 39 44 2A 2A 2A 2A 2A 2A 00 00 00 00 00 00 00

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