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SPECIAL CRASH INVESTIGATIONS
CASE NO: CR14002

ON-SITE AMBULANCE CRASH INVESTIGATION

VEHICLE: 2012 FORD E-350 CUTAWAY
AMBULANCE BODY: MCCOY MILLER TYPE III

LOCATION: MASSACHUSETTS

CRASH DATE: JANUARY 2014

Contract No. DTNH22-12-C-00269

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

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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 are 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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. CR14002	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Special Crash Investigations Vehicle: 2012 Ford E-350 Cutaway Ambulance Body: McCoy Miller Type III Location: Massachusetts		*5. Report Date*: October 2014 *6. Performing Organization Code*	
7. Author(s) Crash Research & Analysis, Inc.		*8. Performing Organization Report No.*	
9. Performing Organization Name and Address Crash Research & Analysis, Inc. P.O. Box 302 Elma, NY 14059		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-12-C-00269	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		*13. Type of Report and Period Covered* Technical Report Crash Date: December 2013 *14. Sponsoring Agency Code*	
15. Supplementary Note An investigation of the intersection crash of a 2012 Ford E-350 Type III Ambulance and a 2010 Mercedes-Benz S550.			
16. Abstract This on-site investigation focused on the non-emergency transport-crash of a 2012 Ford E-350 Cutaway/McCoy Miller Type III ambulance and the injury source(s) for the restrained 58-year-old female patient that was being transported within the patient compartment, the unrestrained 40-year-old male Paramedic who was tending to her care and the 35-year-old restrained driver. The ambulance was northwest-bound returning the patient to her residence at a skilled nursing facility from an off-site dialysis clinic appointment. As the ambulance passed through a four-leg intersection, it was struck on the rear aspect of its right plane (aft of the rear axle) by a westbound 2010 Mercedes-Benz S550 sedan. The force of the impact rearward of the ambulance's center of gravity caused the vehicle to rotate clockwise (CW) as it continued along its northbound travel. The ambulance rotated approximately 90 degrees on the asphalt surfaced roadway at which time it turned-over into a left side-leading four-quarter turn rollover. The cot onboard the ambulance partially separated from its fastening system during the crash. Immediately after the ambulance came to rest, the patient went into cardiac arrest. The Paramedic and ambulance driver began to render aid to the patient as they waited for the arrival of the emergency response personnel. She was subsequently removed from the patient compartment and transported by another ambulance to a hospital that was located approximately 1.6 km (1 mile) from the crash site. The patient was pronounced deceased nine minutes after arrival at the hospital.			
17. Key Words Ambulance Intersection crash Rollover EDR Cardiac Arrest		*18. Distribution Statement* General Public	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 22	*22. Price*

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BACKGROUND

This on-site investigation focused on the non-emergency transport-crash of a 2012 Ford E-350 Cutaway/McCoy Miller Type III ambulance (**Figure 1**) and the injury source(s) for the restrained 58-year-old female patient that was being transported within the patient compartment, the unrestrained 40-year-old male Paramedic who was tending to her care and the 35-year-old restrained driver. The patient suffered a post-crash cardiac event. She was transported to the Emergency Room of a local a hospital where she expired. Notification of the crash was provided to the Crash Research & Analysis Inc. (CRA) Special Crash Investigations (SCI) team on January 21, 2014 by the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA). The SCI team initiated telephone contact and established cooperation with the investigating police department in order to conduct the on-site crash investigation. The investigation took place January 23-24, 2014 and included the inspection and documentation of the involved vehicles and the crash site, the imaging of the ambulance's Event Data Recorder (EDR) and interviews with the investigating police officers and the Chief Operating Officer (COO) of the ambulance company.

Figure 1: Front right oblique view of the Ford ambulance taken during the SCI inspection.

The ambulance was northwest-bound, operating without emergency lights or siren, returning the patient to her residence at a skilled nursing facility from an off-site dialysis clinic appointment. As the ambulance passed through a four-leg intersection, it was struck on the rear aspect of its right plane (aft of the rear axle) by a westbound 2010 Mercedes-Benz S550 sedan. The Mercedes was driven by a 61-year-old restrained female. The force of the impact rearward of the ambulance's center of gravity caused the vehicle to rotate clockwise (CW) as it continued along its northbound travel. The ambulance rotated approximately 90 degrees on the asphalt surfaced roadway at which time it turned-over into a left side-leading rollover. The ambulance

struck a W-beam guardrail and a utility pole during the four-quarter turn rollover and came to rest straddling the guardrail northwest of the intersection. The Mercedes continued across the intersection and came to a controlled stop on the opposing leg of the intersection.

The cot onboard the ambulance partially separated from its fastening system during the crash. Immediately after the ambulance came to rest, the patient went into cardiac arrest. The Paramedic and ambulance driver began to render aid to the patient as they waited for the arrival of the emergency response personnel. She was subsequently removed from the patient compartment and transported by another ambulance to a hospital that was located approximately 1.6 km (1 mi) from the crash site. The patient was pronounced deceased (police-reported K-level fatal injuries) nine minutes after arrival at the hospital. The Paramedic sustained police-reported incapacitating (A-level) injuries. The ambulance driver and Mercedes driver sustained police-reported non-incapacitating (B-level) injuries.

AMBULANCE COMPANY

The Ford E-350 Type III ambulance was owned by a medium-size, privately owned, Emergency Medical Services (EMS) agency which had been in business for over 40 years and operated from three stations. The company provides emergency and back-up services within a 650 square mile region of the state and additionally provides private and inter-hospital medical transportation as needed. This agency has approximately 150 employees and operates a fleet of approximately 40 vehicles. The ambulance fleet consists of advanced life support and basic life support vehicles, bariatric transport services, wheelchair vans and courtesy buses. The agency did not offer any type of EVOC driver training to its employees.

The driver and Paramedic were employed by this EMS agency as permanent, part time paid employees. Both individuals were also employed by another municipality as full-time Paramedic fire fighters. Fire fighters in this region of the state work two 24-hour shifts (48 duty-hours). These shifts rotate throughout the week, thus leaving additional time for these individuals to engage in additional employment. The driver had been employed as a professional Paramedic fire fighter for approximately 15 years and by this EMS agency throughout that time. The Paramedic had 8 to 10 years of professional fire fighter service and was employed by this EMS agency for approximately 3 years.

The COO of the EMS agency stated that he believed that the driver and Paramedic were coming off at least 24 hours of rest and began their 24-hour work shift at 7am on the day of the crash. The ambulance and these individuals handled one emergency-transport call prior to the focus transport. The crash occurred approximately 4 hours into their shift.

CRASH SUMMARY

Crash Site

This crash occurred during the morning, daylight hours of January 2014. The police-reported environmental conditions were clear and dry. The National Weather Service-reported data was a

temperature of 9 ˚C (16 ˚F), with overcast skies, and north winds at 9.3 km/h (5.8 mph). The crash took place at the four-leg intersection of a two-lane collector road and a two-lane local road that was situated within the urban/commercial setting of a small municipality. The collector road was oriented in a northwest/southeast direction. In the northwest travel direction, this road had a negative 2% grade along the ambulance's pre-crash approach, became level at the intersection, and transitioned to a positive 4% grade along the ambulance's post-crash trajectory (**Figure 2**). The 3.8 m (12.5 ft) wide traffic lanes of the collector road were separated by double yellow centerlines. This road was bordered by 1.0 m (3.3 ft) wide asphalt shoulders and concrete curbs. A W-beam guardrail and utility pole were located on the right roadside in the area where the ambulance came to rest. The local road was oriented in a north/south direction and intersected the collector road an acute angle of approximately 65 degrees. The intersection was controlled by stop signs for the north/south traffic. This roadway did not have pavement markings or stop bars. Two yellow warning signs alerting drivers of the intersection were posted along the southbound travel direction of the Mercedes (**Figure 3**). A "Dangerous Intersection Ahead" sign was posted 80 m (262 ft) north of the intersection and a "Stop Ahead" sign was located 40 m (131 ft) north. The total width of the roadway measured 9.0 m (29.5 ft). The posted speed limit was 48 km/h (30 mph). Commercial businesses were located in the northwest and southeast intersection quadrants.

Figure 2: Northwest trajectory view of the ambulance at the intersection.

Figure 3: Southbound trajectory view of the Mercedes 85 m (280 ft) north of the intersection depicting the two warning signs.

Pre-Crash

On the day of the crash, this ambulance crew was tasked with the round-trip transport of the 58-year-old patient from her skilled nursing home residence to a dialysis clinic appointment. The COO of the ambulance company reported that the patient was in fragile health with many underlying issues. She was bedridden and oxygen dependent. The clinic was located approximately 16 km (10 miles) from the nursing home facility. This crew had conducted this transport service approximately six times within the last several months and was familiar with the route of travel and the patient's needs.

After her clinic appointment, the patient was secured onto the cot in a semi-Fowler's position. She was restrained by shoulder harnesses and three lateral restraints located at the chest, thighs and lower legs. The cot was then placed in the ambulance and secured for transport [Position 8: Appendix N Ambulance Diagram of the MMUCC, *Model Minimum Uniform Crash Classification 4th Edition*]. The cot fastening system consisted of an antler bracket, which nested and stabilized the forward wheels of the cot, and the floor-mounted rail clamp that locked around a pin attached to the longitudinal rail of the cot.

The Paramedic entered the patient compartment of the ambulance and sat unrestrained in the inward-facing CPR seat [Position 7: Ambulance Diagram of the MMUCC] located on the left side of the patient compartment. He began his duties of monitoring the patient's vital signs. He reported to the police investigator that he only had sufficient time to place a blood pressure cuff on the patient and turn on the monitor when the crash occurred.

The driver entered the ambulance cab, buckled the 3-point lap and shoulder safety belt and started the engine. The ambulance departed the dialysis clinic by turning left to proceed northwest on the collector roadway. This non-emergency transport did not require the use of the emergency lights or siren. The intersection where the crash occurred was approximately 0.8 km (0.5 mi) from the clinic. The "Key-on Timer" data field of the EDR indicated that the vehicle's ignition was energized 140 seconds prior to the impact. This short duration was consistent with the pre-crash travel distance. During its operation, the ambulance was traveling at an EDR-reported speed of 60.0 km/h (37.3 mph) five seconds prior to Algorithm Enable (AE). The speed of the ambulance increased to 63.0 km/h (39.1 mph) at 2.5 seconds prior to AE and remained constant until one second prior to AE. The imaged EDR data indicated the driver released the accelerator. Brakes were engaged at the time of AE (Time Zero). At AE, the speed of the ambulance was 43.0 km/h (26.7 mph).

During the ambulance's northwest approach to the intersection, the 2010 Mercedes-Benz S550 was southbound on the intersecting roadway. The Mercedes was driven by the 61-year-old restrained female at an unknown speed. The vehicle entered the intersection encroaching into the path of the ambulance. A security camera located within the parking lot of the business at the southeast intersection quadrant captured the events of the crash. A copy of that video was obtained by the police investigator and shared with the SCI investigator during the on-scene activities. A copy of the video was not available due to the open status of the police investigation

Crash

The front plane of the Mercedes struck the right plane of the ambulance aft of its rear axle (Event 1). The directions of force were in the 12 o'clock sector for the Mercedes and the 2 o'clock sector for the ambulance. The force of the lateral impact caused the ambulance to rotate CW as

it continued northwestward through the intersection. The physical evidence at the crash site consisted of a yaw mark attributed to the left rear tire of the ambulance. This mark was documented by the police and evidenced the vehicle's trajectory. As the ambulance rotated approximately 90 degrees relative to its original travel direction, the increasing forces at the tire/road interface, coupled with the higher center-of-gravity of the vehicle, caused the ambulance to turn-over into a left side-leading rollover (Event 2). The ambulance rolled one-quarter turn at which time the left fender struck the guardrail (Event 3) located along the right side of the collector road. Blue paint was transferred onto the guardrail in the region of the impact. At the third-quarter turn of the ambulance, the left front tire and suspension impacted the utility pole located immediately beyond the guardrail (Event 4). This impact was evidenced by a tire scuff and an abraded/gouged section on the face of the pole located approximately 1.5 m (5 ft) above the ground. This impact decelerated and interrupted the rollover of the ambulance. The ambulance completed four-quarter turns and came to rest straddling the guardrail facing southeast 31 m (102 ft) from the initial impact. The vehicle's final rest position is depicted in the on-scene police photo **Figure 4**.

Figure 4: Right side view depicting the final rest position of the ambulance. (Image obtained from the police investigator).

The force of the crash caused the actuation of the Mercedes' safety belt buckle pretensioner and the deployment of the driver's frontal air bag. The Mercedes separated from the impact along a straight path and passed through the intersection. It came to a controlled stop on the opposing leg of the intersection at the right edge of the road facing south, 15 m (49 ft) from the point of impact. A Crash Diagram is included at the end of this technical report on Page 22.

Post-Crash

The driver of the ambulance immediately called his dispatcher and provided crash notification. The police, fire and ambulances services responded to the crash site. The forces of the crash and rollover displaced the unrestrained Paramedic from the CPR seat. He was disoriented and unable to describe where he came to rest. The patient remained secured to the cot; however, the forward aspect of the cot was displaced from the antler bracket. At final rest, the forward aspect of the cot was resting in the squad bench, as the padded seat cushion had rotated open. The locking pin remained secured within the locked jaws of the rail clamp; however, the longitudinal cast-aluminum tube, to which the locking pin was attached, fractured. After regaining his composure, the Paramedic immediately began to render aid (cardio pulmonary resuscitation) to the patient who was suffering a cardiac event. The driver exited the cab of the vehicle and entered the patient compartment to assist. The patient was removed from the cot onto a backboard and

transferred to another ambulance. She was transported to the Emergency Room of a hospital that was located within 1.6 km (1 mi) of the crash site. At arrival the patient was unresponsive with a Glasgow Coma Score of 3. Resuscitation procedures were unsuccessful and the patient was pronounced deceased nine minutes after arrival.

The ambulance driver, Paramedic and Mercedes' driver were also transported by ambulances. The ambulance driver, who complained of generalized pain, was evaluated and released without specific injury. The Paramedic sustained a contusion of the coccyx, a contusion of the left lower extremity (shin), a contusion of the right elbow and a neck strain. The driver of the Mercedes sustained unknown police-reported non-incapacitating (B-level) injuries.

2012 FORD E-350 CUTAWAY/MCCOY MILLER TYPE III AMBULANCE

Figure 5: Front view of the 2012 Ford E-350.

The Ford E-350 Cutaway (**Figure 5**) was identified by the Vehicle Identification Number (VIN): 1FDWE3FS3CDxxxxxx. It was manufactured as an incomplete vehicle in April 2012 and was equipped with Ford's Ambulance Prep Package. The digital odometer read 49,083 km (30,499 miles). The rear-wheel drive Ford was built on a 351 cm (138 in) wheelbase with a Gross Vehicle Weight Rating (GVWR) of 5,216 kg (11,500 lb). The front axle and rear axle ratings were 2,087 kg (4,600 lb) and 3,538 kg (7,800 lb), respectively. The vehicle's powertrain consisted of a 6.8-liter, V-10 gasoline engine linked to a 4-speed automatic transmission. The police investigator had the ambulance transported from the tow yard and weighed at a certified scale. The ambulance weighed 4,155 kg (9,160 lb) post-crash. The manufacturer's recommended tire size was LT225/75R16 front and rear, with cold tire pressures of 448 kPa (65 PSI) front and 414 kPa (60 PSI) rear. All tires were Michelin LTX M/S of the recommended size. Specific tire data measured at the time of the SCI inspection was as follows:

Position		Measured Pressure	Measured Tread Depth	Restriction	Damage
LF		441 kPa (64.0 PSI)	6 mm (8/32 in)	No	No
LR	Outer	441 kPa (64.0 PSI)	7 mm (9/32 in)	No	No
	Inner	434 kPa (63.0 PSI)	7 mm (9/32 in)		
RR	Outer	441 kPa (64.0 PSI)	6 mm (8/32 in)	No	No
	Inner	434 kPa (63.0 PSI)	7 mm (9/32 in)		
RF		414 kPa (60.0 PSI)	6 mm (7/32 in)	No	No

The front interior of the Ford was equipped with box-mounted seats with integral head restraints. Occupant protection features included 3-point lap and shoulder safety belts with buckle pretensioners and driver and front right passenger frontal air bags.

Patient Compartment

The patient compartment of the ambulance (**Figure 6**) was manufactured by McCoy Miller, a Division of SJC Industries of Elkhart, Indiana in February 2012. The Medic 142 patient compartment had length x width x height dimensions of 361 cm x 269 cm x 168 cm (142 in x 90 in x 66 in) and was of all-aluminum construction. The modular unit was attached the frame of the Ford chassis. The vehicle was delivered and entered into service in May 2012 and was the newest vehicle in the ambulance company's fleet. The interior layout included: double-rear entry doors for cot loading, a three-passenger squad bench seat along the right side, a right side entry door, an open pass-through to the forward occupant compartment of the van, a rear-facing captain's seat against the forward wall, an inward-facing CPR seat at the mid-left side, and multiple cabinets for storage.

Figure 6: Right side view of the McCoy Miller Type III patient compartment.

At the time of the crash, a cardiac monitor was attached to a swivel base on a counter along the left side of the patient compartment. This unit remained in place and was removed by the company post-crash. The COO of the ambulance company also reported that a "first in duffle bag" located in the patient compartment was also removed. This bag weighed approximately 9 kg (30 lb) and contained the required equipment and supplies to efficiently respond to a call. The bag was unrestrained within the patient compartment for ease of access.

Exterior Damage

The SCI inspection of the ambulance identified multiple regions of impact and rollover damage which were directly related to the multiple events of this crash. The Mercedes' impact to the right plane of the ambulance aft of the rear axle (Event 1) resulted in a combined region of direct and induced damage that measured 139 cm (54.5 in) (**Figure 7**). The direct contact damage began 18 cm (7 in) aft of the rear axle on the 9 to 10 o'clock sector of the rear wheel.

Figure 7. Right side view depicting the Event 1 damage to the patient compartment.

The aluminum wheel cover at that location was deformed over a 13 cm (5 in) length. The direct contact damage to the patient compartment began immediately above and adjacent to the aft aspect of the wheel and extended rearward to the rear corner of the compartment. The residual crush profile, measured at the 51 cm (20 in) bumper elevation of the Mercedes, was as follows: C1 = 6 cm (2.5 in), C2 = 5 cm (2.0 in), C3 = 9 cm (3.5 in), C4 = 8 cm (3.0 in), C5 = 5 cm (2.0 in), C6 = 0. A non-structural aluminum step/bumper that was attached to, and extended from, the back plane of the patient compartment was deformed at the right corner. The Collision Deformation Classification (CDC) assigned to this damage pattern was of the 02RZEW1. A WinSMASH analysis of this impact was not possible, as the impact involved the patient compartment and was beyond the algorithm's scope.

The Event 2 rollover damage consisted of localized crush and abrasions to the four corners of the patient compartment (**Figure 8**). The longitudinal side rails, at the junctions of the side and top planes were abraded. The forward wall of the patient compartment deformed vertically down an estimated 5 cm (2 in) and was buckled above the occupant compartment of the cab. The aluminum corner post at the forward right corner of the patient compartment was partially separated. The equivalent CDC assigned to the rollover damage was 00TDDO2.

A third zone of damage was noted at the left front fender of the ambulance. The fender was deformed over a 61 cm (24 in) wide region from its non-horizontal impact with the guardrail during the first-quarter turn of the rollover (Event 3). The nature of this damage pattern was consistent with guardrail contact (**Figure 9**). The fender deformed rearward 17 cm (6.5 in) and buckled outward 18 cm (7 in). The residual deformation was located 8 cm (3 in) forward of the left front axle and extended forward. The downward crush of the fender measured 14 cm (5.5 in) at its mid-point. The CDC of this damage was 00LFMW2. The CDC of the undercarriage impact (Event 4) was 00UFLN1. There was no identifiable damage to the undercarriage.

Figure 8: Overhead front left view of the ambulance depicting the rollover damage to the patient compartment.

Figure 9: Left front oblique view depicting the Event 3 guardrail damage to the ambulance.

Event Data Recorder

The 2012 Ford E-350 Cutaway was equipped with a Restraints Control Module (RCM) designed for the diagnostics, sensing and control of the vehicle's restraint and air bag systems. The RCM also had EDR capabilities. The EDR data was accessed at the time of the SCI inspection through the use of the Bosch Crash Data Retrieval (CDR) tool and software version 12.2. The data is reported with version 14.2 and included at the end of this report as **Attachment A**. The data was imaged via a direct connection to the Diagnostic Link Connector (DLC) located under the left instrument panel directly below the steering column. The vehicle's electrical system was intact and the on-board 12-volt battery supplied the required power.

This RCM monitored bi-directional acceleration (longitudinal and lateral) data. It did not have roll-sensing capabilities. The EDR component within this RCM had the capacity to store two events and the capability to distinguish two event types. These events were termed Deployment and Non-Deployment. Deployment events by definition were events which met the threshold required to deploy an air bag. Deployment events were locked within the module's memory and could not be overwritten. Non-Deployment events were events which met the threshold to record data, but the severity of the event was not large enough to require an air bag deployment. Non-Deployment events were unlocked events and could be overwritten. A 5-second pre-crash data buffer, populated with vehicle performance and operational data, was linked to each recorded event.

The imaged EDR data contained two unlocked Non-Deployment events designated the "First Record" and "Second Record." The Non-Deployment events were separated in time by 1.4 seconds. Analysis of the recorded events was consistent with the circumstances of the intersection crash (SCI Event 1) and ground contact during the rollover sequence (SCI Event 2). The EDR data was imaged on Ignition Cycle 4215.

<u>First Record</u>

The imaged data indicated that this event was recorded on Ignition Cycle 4200. At the time of this Non-Deployment event, no Diagnostic Trouble Codes were present. The Air Bag Warning Lamp within the instrument cluster was not illuminated (Off). The driver's safety belt was "Buckled." The maximum recorded longitudinal and lateral delta V's were -8.26 km/h (-5.13 mph) and -2.11 km/h (-1.31 mph), respectively. A field within the data labeled the Key-On Timer represented the length of time that the vehicle's electrical system was energized (i.e. Ignition On). The Key-on Timer value was 140 seconds. This value was consistent with the short duration of the ambulance's travel from the Dialysis Clinic to the crash site. The EDR data was completely written to memory. The pre-crash data associated with the First Record is listed in the following table:

Time Sec	Speed km/h (mph)	Engine RPM	Accelerator Pedal Percentage	Service Brake Status	ABS Activity
-5.0	60.0 (37.3)	1,500	19	Off	Not-engaged
-4.5	60.0 (37.3)	1,500	20	Off	Not-engaged
-4.0	61.0 (37.9)	1,600	24	Off	Not-engaged
-3.5	61.0 (37.9)	1,700	27	Off	Not-engaged
-3.0	62.0 (38.5)	1,700	27	Off	Not-engaged
-2.5	63.0 (39.1)	1,700	28	Off	Not-engaged
-2.0	63.0 (39.1)	1,800	28	Off	Not-engaged
-1.5	63.0 (39.1)	1,800	28	Off	Not-engaged
-1.0	63.0 (39.1)	1,600	0	Off	Not-engaged
-0.5	55.0 (34.2)	1,100	0	Off	Not-engaged
0	43.0 (26.7)	800	0	On	Engaged

The pre-crash data indicated that the driver released the accelerator and applied the brakes immediately prior to the crash. His actions are represented by the change in status of the Accelerator Pedal Percentage at the -1.0-second time interval and the "On" status of the service brakes with ABS Activity Engaged at the 0-second interval. The vehicle's speed reduction and the reduction in Engine RPM were consistent with the driver's actions.

Second Record

The Non-Deployment data recorded within this event was consistent with the First Record data. The data was recorded on Ignition Cycle 4200, the Driver Safety Belt was "Buckled," there were no Diagnostic Trouble Codes and the Air Bag warning Lamp was "Off." The Key-On Timer value was 145 seconds. This data set was a complete recording. The maximum longitudinal and lateral delta V's were -0.68 km/h (-0.42 mph) and -18.95 km/h (-11.77 mph), respectively. The negative polarity of the lateral delta V was indicative of a right plane to ground impact, as the ambulance was rolling through the third-quarter turn.

The pre-crash data associated with the Second Record is listed below:

Time sec	Speed km/h (mph)	Engine RPM	Accelerator Pedal Percentage	Service Brake Status	ABS Activity
-5.0	61.0 (37.9)	1,700	27	Off	Not-engaged
-4.5	62.0 (38.5)	1,700	27	Off	Not-engaged
-4.0	63.0 (39.1)	1,700	28	Off	Not-engaged
-3.5	63.0 (39.1)	1,800	28	Off	Not-engaged
-3.0	63.0 (39.1)	1,800	28	Off	Not-engaged
-2.5	63.0 (39.1)	1,600	0	Off	Not-engaged
-2.0	55.0 (34.2)	1,100	0	Off	Not-engaged
-1.5	43.0 (26.7)	800	0	On	Engaged
-1.0	18.0 (11.2)	600	0	On	Engaged

Time sec	Speed km/h (mph)	Engine RPM	Accelerator Pedal Percentage	Service Brake Status	ABS Activity
-0.5	12.0 (7.5)	500	0	On	Engaged
0	12.0 (7.5)	400	0	On	Engaged

Interior Damage – Cab

Inspection of the forward occupant compartment of the ambulance was unremarkable for damage or intrusion (**Figure 10**). There was no observed evidence of interior occupant contact points. The absence of contact points was attributed to the driver's use of the available manual safety belt system. A fluid spill was observed across the forward center aspect of the headliner. The fluid spill had the appearance and the odor of coffee. The two-spoke tilt steering wheel was adjusted to the center position. There was no steering wheel rim deformation. There was no separation of the steering column's shear capsules. The at-crash position of the driver seat was unknown. The seat's position had been altered between the time of the crash and the SCI vehicle inspection by multiple employees of the tow company as the vehicle was moved about the yard.

Figure 10: Left view of the undamaged interior of the Ford cab.

Manual Restraint Systems – Cab

The manual restraints for the driver and front right passenger positions consisted of 3-point lap and shoulder safety belts with buckle pretensioners. The belt systems consisted of continuous loop webbing, sliding latch plates, and adjustable D-rings. The driver's restraint was equipped with an Emergency Locking Retractor (ELR). The front right restraint was equipped with a switchable ELR/Automatic Locking Retractor (ELR/ALR). Both adjustable D-rings were in a mid-position.

The driver's restraint was stowed within the retractor at initial observation. The webbing freely extended from the retractor. Examination of the latch plate revealed surface indicators of historical use and the overall condition of the webbing also displaced signs of repeated use. There was no direct evidence that could be related to the forces of the crash. The buckle pretensioner was not actuated. The driver stated that he was restrained by the safety belt at the time of the crash. The imaged EDR data also indicated that the driver was restrained. The absence of interior points of contact and driver injury was consistent with his use of the manual restraint.

Supplemental Restraint Systems - Cab

The ambulance was equipped with driver and front right passenger air bags. The frontal air bags did not deploy during the crash. It was not equipped with seat-mounted side impact air bags or Inflatable Curtain air bags. The Ford did not have roll sensing capabilities.

Patient Compartment Damage

The interior damage within the patient compartment consisted primarily of the fracturing the cabinetry at the forward right aspect of the compartment and the displacement of the heater/air conditioner unit located at its upper aspect (**Figure 11**). This damage probably occurred during ground impact at the second to third-quarter turn of the rollover. This cabinet measured 66 cm x 53 cm x 168 cm (26 in x 21 in x 66 in) width x depth x height and was constructed of 19 mm (3/4 in) plywood. The right French-type door of the cabinet had separated. During the rollover, the displacement of its interior contents contacted the door and separated wood screw fasteners that secured the piano hinge of the door to the plywood construction of the cabinet. The heater/air conditioner unit originally fastened into the upper aspect of the cabinet was dislodged. The formed sheet metal vent cover was also displaced free and had become an interior loose object.

Numerous supplies were stored within the compartment beneath the squad bench. The padded split-cushion bench seat was hinged along the right wall of the compartment and was secured closed by a slam lock. During the second to third-quarter turn of the rollover, the enclosed supplies loaded the underside of the bench seat, which in turn then rotated open.

The ambulance supplies housed along the left wall of the patient compartment remained within the storage cabinets. The horizontal sliding doors remained closed. The cardiac monitor remained in its secured position on the left counter. The oxygen supply system, radio and accessories at the counter forward of the CPR seat were not damaged (**Figure 12**).

Figure 11: View of the fractured cabinet at the forward right side of the patient compartment of the ambulance

Figure 12: View of the CPR seat and the undamaged left side of the compartment of the ambulance.

Several points of occupant contact were observed on the roof of the patient compartment (**Figures 13 and 14**). These contact points were attributed to the unrestrained Paramedic. Three small scuffs marks, each measuring less than 5 cm (2 in) in length, were observed on the roof above the CPR seat. The marks were located between the longitudinal grab bar and the padded center area of roof. A left footprint was observed on the roof adjacent to the aft-most recessed light fixture. Dimensionally, the footprint was centered 56 cm (22 in) forward of the back wall, 69 cm (27 in) from the right wall and 102 cm (40 in) from the left wall. A 6 cm (2.5 in) laterally oriented scuff was located 89 cm (35 in) from the back wall, 66 cm (26 in) from the right wall and 104 cm (41 in) from the left wall.

Figure 13: View of the roof of the patient compartment from the back plane looking forward. The locations of the scuff marks and foot print are highlighted in red.

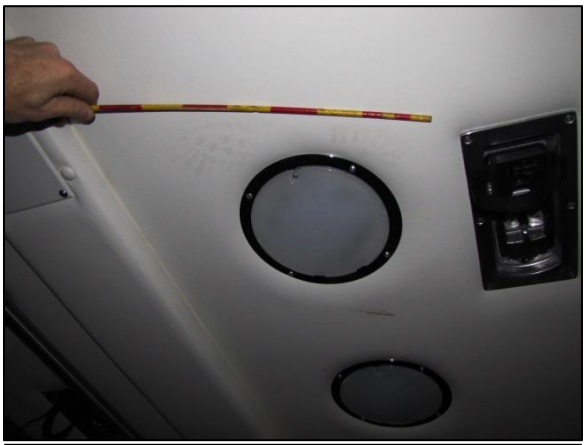


Figure 14: Close-up view of the foot print on the roof of the patient compartment.

Patient Cot and Cot Fastening System

A Stryker cot, Model Number: 6082 MX-PRO R3 (Figure XX); Serial Number: 080540919, was used to transport the patient involved in this crash (**Figure 15**). This cot was constructed of powder-coated, cast aluminum tubing and was designed for a maximum patient weight of 295 kg (650 lb). The lower frame of the cot incorporated a scissor design which allowed for height adjustment. The overall dimensions of the cot measured 203 cm (80 in) in length and 58 cm (23 in) in width. The cushion measured 185 cm x 46 cm (73 in x 18 in). The angle of the back rest was set via a pneumatic adjustment. The patient was being transported in a semi-Fowler's position with the back rest elevated 35 degrees above horizontal. The lower portion of the cot was elevated 15 degrees referenced to horizontal.

Figure 15: View of the right side of the Stryker cot and fractured longitudinal rail at the locking pin.

The cot was equipped with a shoulder harness and three lateral restraint straps. All of the cot restraints were in use at the time of the crash as mandated by state regulations. The lateral restraints consisted of adjustable length webbings with locking latch plates. The fixed ends of the webbing were attached to the side frame of the cot. The lateral restraints were positioned across the legs, hips and chest of the patient. The shoulder harness buckled into the chest restraint. Examination of the webbing straps revealed significant evidence of historical use and wear. There was no observable crash-related evidence on the cot's restraints.

When secured in the ambulance for transport, the forward lower frame work, supporting the cot's auxiliary set of front wheels and oxygen tank, nested in the antler bracket that was attached to the floor of the patient compartment. **Figure 16** is an image of an exemplar cot nested into the antler bracket. The antler bracket was secured to the floor of the patient compartment by two knurled-head 10 mm (3/8 in) cap screws at the time of the inspection. The bracket was not damaged or deformed.

Figure 16: View of an exemplar cot nested into an antler bracket for transport.

The right rear aspect of the cot was secured by a floor-mounted rail clamp. The rail clamp was a Stryker Model 6370 Cot Fastening System; Serial No. 121241439. This rail clamp was the manufacturer's recommended fastener. The spring-loaded clamp was mounted to a 15 cm (6 in) tall steel bracket assembly secured to the floor of the ambulance by two 10 mm (3/8 in) cap screws. A locking pin that was attached to the lower right tubular frame of the cot, adjacent to the right rear wheel, was secured in the jaw of the clamp for transport. At initial inspection, the clamp mechanism was jammed in the locked position (**Figure 17**). The jaw of the clamp was forced open during the SCI inspection in order to release the cot. During the crash, the rail clamp was loaded and deformed which restricted the internal movement of the clamp and impeded its operation.

Figure 17: View of the jammed rail clamp and cot locking pin within the patient compartment.

During the crash, while the ambulance was inverted and rolling over, the forward aspect of the

cot disengaged from its position within the antler bracket. The forward aspect of the cot pitched toward the ceiling. The non-horizontal rollover forces caused the cot to yaw about the locking pin at the floor rail clamp toward the right side of the ambulance. As the cot yawed, the applied bending moment caused the longitudinal rail at the right side of the cot to fracture and deformed the rail clamp. The cot came to rest in an elevated position its front left wheel inside the opened squad bench as the ambulance returned to an upright orientation (**Figures 18 and 19**).

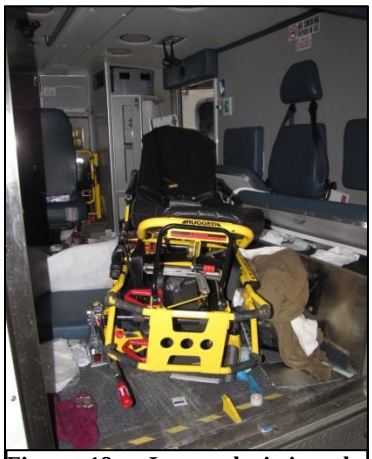


Figure 18: Image depicting the post-crash position of the cot looking forward through the rear doors of the ambulance.

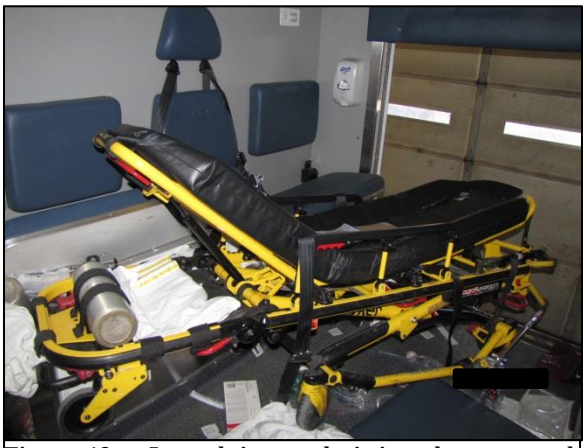


Figure 19: Lateral image depicting the post-crash position of the cot within the ambulance.

The locking pin was positioned on the cot's longitudinal tubular frame rail 24 cm (9.5 in) forward of the right rear wheel and was fastened to the cot frame via two half-moon shaped components secured together to form a friction clamp. The locking pin was positioned along the longitudinal rail by a drilled hole and a threaded fastener that passed through the bottom side of the friction clamp assembly and into the longitudinal rail. The cast tube sheared through the drilled positioning hole due to the overload force (**Figures 20 and 21**).

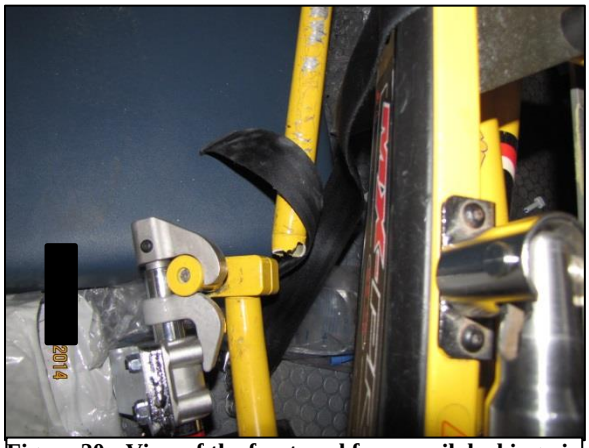


Figure 20: View of the fractured frame rail, locking pin and jammed rail clamp prior to the removal of the cot from the patient compartment.

Figure 21: Close-up view of the fractured frame rail and locking pin after its removal from the patient compartment.

2012 FORD AMBULANCE OCCUPANTS

Driver Demographics

Age / Sex:	35 years / Male
Height:	173 cm (68 in)
Weight:	79 kg (175 lb)
Eyewear:	Unknown
Seat Type:	Box-mount
Seat Track Position:	Unknown
Manual Restraint Usage:	3-point lap and shoulder safety belt
Usage Source:	SCI inspection
Air Bags:	Frontal available, not deployed
Alcohol/Drug Involvement:	None
Egress from Vehicle:	Exited vehicle under own power
Transport from Scene:	Ambulance to a hospital
Medical Treatment:	Evaluated and released

Driver Injuries

The 35-year-old restrained driver was not injured in the crash. He had a generalized complaint of pain without specific injury, was examined in the emergency room and released. The police-report incorrectly coded him as having non-incapacitating (B-level) injuries.

Driver Kinematics

At the time of the crash, the driver was seated in an upright posture and was restrained by the manual 3-point lap and shoulder safety belt. As the ambulance approached and entered the intersection, the driver recognized the impending crash and released the accelerator and applied the brakes. These actions were confirmed by the EDR's pre-crash data.

At impact, the emergency mode of the safety belt retractor locked the belt system. The driver responded to the 2 o'clock direction of force from the intersection impact with a right/forward trajectory and loaded the locked safety belt webbing. The force of the impact aft of the vehicle's center-of-gravity caused it to rotate CW. Lateral forces developed at the interface of the left tires and the surface of the asphalt road. The combination of the lateral forces and the vehicle's higher center-of-gravity resulted in a left side-leading turn-over. The driver responded to the vehicle's deceleration and rollover with a probable forward and then leftward trajectory. He remained in contact with the locked safety belt and rode-down the force of the rollover and subsequent secondary events. The lack of interior points of occupant contact suggests that the driver had little or no interaction with the interior components of the cab. He came to rest in an upright position and was not injured. He immediately notified his dispatcher of the crash initiating the emergency response.

The driver's condition (impairment) at the time of the crash was coded as None/Apparently Normal [Fatality Analysis Reporting System (FARS) D23).

Paramedic Demographics

Age / Sex:	40 years / Male
Height:	173 cm (68 in)
Weight:	86 kg (190 lb)
Eyewear:	Unknown
Seat Type:	Inward-facing CPR seat (Position 7 MMUCC 4th Edition Appendix N)
Seat Track Position:	Not adjustable
Manual Restraint Usage:	None
Usage Source:	SCI inspection
Air Bags:	None available
Alcohol/Drug Involvement:	None
Egress from Vehicle:	Exited under own power
Transport from Scene:	Ambulance to a hospital
Medical Treatment:	Treated and released from the Emergency Room

Paramedic Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Neck sprain	640278.1,6	Right side wall	Possible
2	Contusion of the right elbow	710402.1,1	Right side wall	Possible
3	Contusion of the coccyx	* 810402.1,1	Right side wall	Possible
4	Contusion left lower leg (shin)	810402.1,2	Cot frame	Probable

Source: Emergency room records

** The coccyx contusion was identified by interview. This injury is not listed in AIS. The default soft tissue lower extremity code was used.*

Paramedic Kinematics

The Paramedic was seated on the inward-facing CPR seat that was located on the left side of the patient compartment (Position 7). He was not restrained by the available manual 2-point lap safety belt. He reported that he had just placed the blood pressure cuff on the patient and was just beginning to monitor her condition when the impact occurred.

At impact, he responded to the force of the intersection crash with a forward trajectory (with respect to his seated position facing the right side of the patient compartment). He contacted the cot with his left lower leg evidenced by a contusion. During the rollover, he was displaced from the seat due to a combination of gravitational and centrifugal forces. He contacted the roof of the ambulance evidenced by the scuff marks and the left foot print. The Paramedic was not able to describe where he came to rest. The trajectory of the occupant contact points suggests that he may have come to rest in the right rear corner area of the patient compartment. He possibly sustained the coccyx contusion and neck strain as he contacted the bench seat and/or right patient compartment wall. It is probable that the Paramedic interacted with the patient (in an unknown manner) during his kinematics, given the close proximity of their positions and relative sizes.

Patient Demographics

Age / Sex:	58 years / Female
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat Type:	Rear-facing cot (Position 8 MMUCC 4th Edition Appendix N)
Seat Track Position:	Not-adjustable
Manual Restraint Usage:	Shoulder harness and three lateral restraints
Usage Source:	Interview, transport protocol
Air Bags:	None available
Alcohol/Drug Involvement:	None
Egress from Vehicle:	Removed from vehicle in cardiac arrest
Transport from Scene:	Ambulance to a hospital
Medical Treatment:	Unsuccessful resuscitation procedures, fatal outcome

Patient Injuries

Injury No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Heart injury with cardiac arrest, NFS	441089.9,4	Unknown	Unknown
2	Right forearm laceration, NFS	710602.1,1	Unknown	Unknown
3	Abdomen contusion, NFS	510402.1,2	Lateral restraint	Certain

Source: Emergency room records. Autopsy record not available due to the open status of the police investigation.

Patient Kinematics

The 58-year-old patient reportedly was a medically-fragile individual living in a skilled nursing facility. She was bedridden and oxygen dependent with multiple health risks. At the time of the crash, she was being transported from a medical clinic back to her residence. She was restrained on the cot by the three lateral restraints and the shoulder harness per the mandated state transport protocol. The patient was loaded and the cot was secured into the ambulance and, based on the EDR "Key-On Timer" data, the transport began approximately 140 seconds prior to the intersection impact.

The patient and cot responded to the 2 o'clock direction of the impact force as a combined-mass with a right lateral trajectory. The forward-frame of the cot loaded the antler bracket and the locking pin loaded the floor rail clamp. As the vehicle rolled over, the forward-frame separated from the antler bracket and pitched vertically. The acceleration of the patient and cot resulted in bending moment in the cot's right longitudinal rail due the fixed position of the locking pin and rail clamp. The resultant overload force fractured the rail, thus allowing the cot to rotate to the right. As the ambulance returned to an upright position, the cot came to rest with its forward aspect on the opened squad bench. The patient loaded the restraints through the crash sequence evidenced by the abdomen contusion and remained on the cot at final rest.

During the rollover sequence and in consideration of their close proximity, the unrestrained Paramedic probably interacted with the cot and patient in an unknown manner as he was displaced from the left side to the right side of the patient compartment. The Paramedic reported that after he regained his composure, he immediately went to aid of the patient. The Paramedic indicated that she was in immediate distress and having a cardiac event. He initiated CPR, which continued during transport to and within the Emergency Room of the hospital that was located approximately 1.6 km (1 mi) from the crash site. Those efforts were unsuccessful and the patient was pronounced deceased nine minutes after arrival at the hospital. The cause of the patient's cardiac event was not determined.

2010 MERCEDES-BENZ S550

Description

The 2010 Mercedes-Benz S550 was identified by the VIN: WDDNG8GB6AAxxxxxx and was manufactured in March 2010. The 4-door sedan (**Figure 22**) was equipped with a 5.5 liter, V-8 gasoline engine linked to an all-wheel drive powertrain with a 7-speed automatic transmission. The service brakes were an all-wheel disc system with 4-wheel anti-lock. Additional features included daytime running lights, adaptive headlights, adaptive suspension, Electronic Stability Control (ESC), Traction Control, and a direct Tire Pressure Monitoring System (TPMS). The Mercedes was equipped with a parking assist system consisting of four ultra-sonic sensors that were mounted across both the front and rear bumpers and a rear view camera. A Lane Departure Warning System was mounted to the windshield adjacent to the rear view mirror. The vehicle did not appear to be equipped with the optional Driver Assist Package which included a forward-looking radar system. The mounting bracket for the radar head was observed on the vehicle's centerline without the necessary radar system installed. The police investigator had the vehicle weighed by a certified scale. The post-crash weight of the Mercedes was 2087 kg (4600 lb). The Mercedes was equipped with four Continental Conti-Pro Contact 225/45R18 tires. The tires were the manufacturer's recommended size. The recommended cold tire inflation pressure was 260 kPa (38 PSI) front and rear. Specific measured tire data was as follows:

Figure 22: Front view of the Mercedes depicting the impact damage.

Position	Measured Pressure	Measured Tread Depth	Restriction	Damage
LF	241 kPa (35.0 PSI)	6 mm (7/32 in)	No	No
LR	248 kPa (36.0 PSI)	5 mm (6/32 in)	No	No
RR	248 kPa (36.0 PSI)	6 mm (7/32 in)	No	No
RF	248 kPa (36.0 PSI)	6 mm (8/32 in)	No	No

The interior of the Mercedes was equipped with front bucket seats with active, adjustable head restraints and a three passenger second row bench. The driver seat track position had been altered post-crash by several different drivers moving the vehicle at the tow company. Safety features included 3-point lap and shoulder safety belts with buckle pretensioners for the front and rear outboard occupants. The Mercedes was equipped with Certified Advanced-208 Compliant (CAC) frontal air bags, front and rear seat-mounted side impact air bags and Inflatable Curtain air bags. The Mercedes was also equipped with its trademark Pre Safe® system. The manufacturer's literature stated that the Pre Safe® System monitors the sensor data from the ESC and brake systems to detect possible imminent crash situations. In the event of an imminent crash, the Pre Safe® system can take the following actions:

- The driver and front passenger safety belts are tensioned
- The front passenger seat and powered second row seats are automatically moved to a more favorable position for occupant protection, if the seat was adjusted in an unfavorable pre-crash position
- The system increases the air pressure in the air pockets (on the sides of the seat cushion and backrest) of the multi-contour front seats and powered second row seats
- The side windows and sunroof are closed in the event of an imminent rollover crash to minimize the risk of ejection

The manufacturer's literature further stated that the Pre Safe® actions are reversible in the case where the crash is successfully avoided.

Exterior Damage

The front plane of the Mercedes sustained moderate damage which was related to the intersection crash with the ambulance. The combined width of the direct and induced damage extended across the entire 157 cm (62 in) end width of the vehicle. The direct contact damage began 19 cm (7.5 in) left of center and extended 98 cm (38.5 in) to the right corner of the front bumper. The residual crush profile was measured to the aluminum reinforcement bar and was as follows: C1 = 0, C2 = 6 cm (2.4 in), C3 = 10 cm (4.0 in), C4 = 14 cm (5.5 in), C5 = 14 cm (5.5 in), C6 = 16 cm (6.3 in). The right wheelbase was reduced 1 cm (0.5 in). The left wheelbase measurement was unchanged from the vehicle's specifications. All doors remained closed during the crash and were operational based on the post-crash inspection. There was no damage to the windshield, backlight or glazing of the side windows. The CDC assigned to this damage pattern was 12FZEW1. The force of the impact caused the driver air bag to deploy. The driver's safety belt pretensioner was actuated.

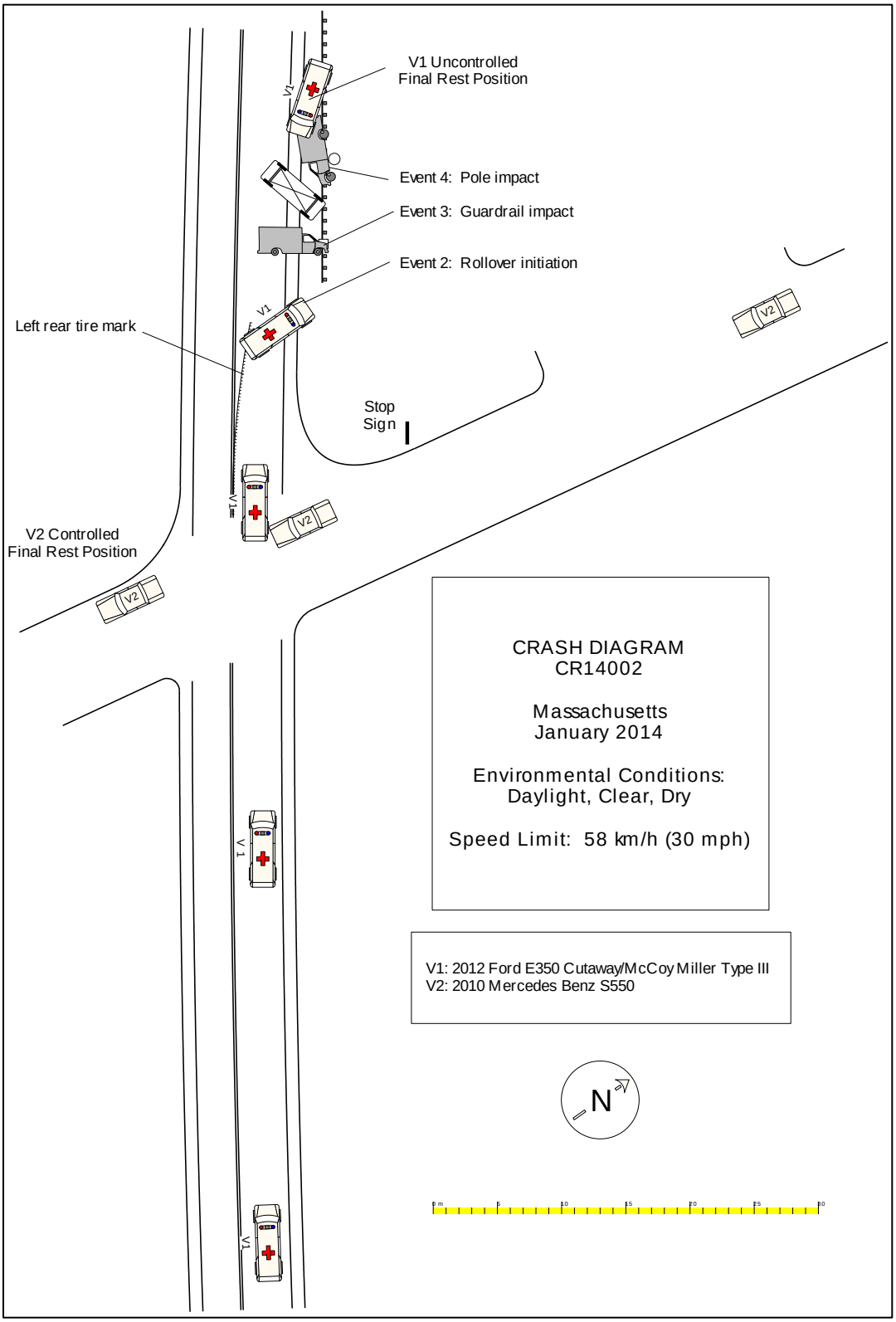
Event Data Recorder

This vehicle was not equipped with an EDR that was compatible with the Bosch Crash Data Retrieval tool and the software available at the time of the SCI inspection.

Mercedes Occupants

The 61-year-old female driver of the Mercedes was restrained by the vehicle's 3-point lap and shoulder safety belt at the time of the crash. At-impact, the safety belt retractor locked, the safety belt buckle pretensioner actuated and the driver air bag deployed. The driver responded to the 12 o'clock direction of the impact force with a forward trajectory. She loaded the looked safety belt system and deployed driver air bag with her chest. The investigating police officer recalled that her upper chest appeared red and abraded by the air bag. The driver complained of chest pain and was coded with police-reported non-incapacitating (B-level) injuries. She was transported by ambulance to a local hospital where she was examined and released.

CRASH DIAGRAM



ATTACHMENT A:

2012 Ford E-350 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	1FDWE3FS3CD******
User	
Case Number	
EDR Data Imaging Date	01/23/2014
Crash Date	
Filename	CR14002_V1_ACM.CDRX
Saved on	Thursday, January 23 2014 at 09:38:19
Collected with CDR version	Crash Data Retrieval Tool 12.2
Reported with CDR version	Crash Data Retrieval Tool 14.2
EDR Device Type	Airbag Control Module
ACM Adapter Detected During Download	No
Event(s) recovered	unlocked events

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 Thursday, January 23 2014 at 09:38:19.

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	1FDWE3FS3CD******
Current VIN from PCM	1FDWE3FS3CD******
Ignition cycle, download (first record)	4,215
Ignition cycle, download (second record)	4,215
Restraints Control Module Part Number	BC24-14B321-BD
Restraints Control Module Serial Number	3117272300000000
Restraints Control Module Software Part Number (Version)	BL84-14C028-AB
Left/Center Frontal Restraints Sensor Serial Number	15F2826A
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	Unlocked 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)	4,361,530
Key-on Timer at event time zero (seconds)	140
Vehicle voltage at time zero (Volts)	13.689
Energy Reserve Mode entered during event (Y/N)	No

Faults Present at Start of Event (First Record)

No Faults Recorded

Deployment Data (First Record)

Maximum delta-V, longitudinal (MPH [km/h])	-5.13 [-8.26]
Time, maximum delta-V longitudinal (msec)	146
Maximum delta-V, lateral (MPH [km/h])	-1.31 [-2.11]
Time, maximum delta-V lateral (msec)	154
Longitudinal Delta-V Time Zero Offset	7.0 ms
Lateral Delta-V Time Zero Offset	7.0 ms

Pre-Crash Data -1 sec (First Record)

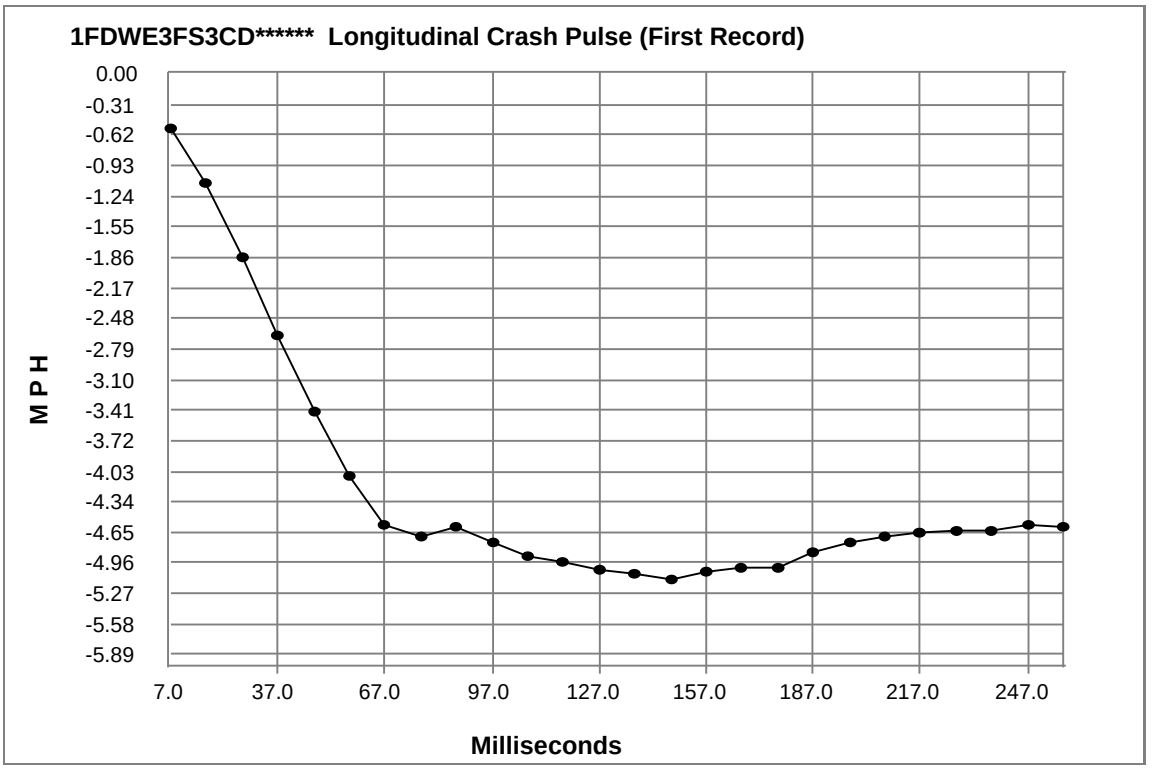
Ignition cycle, crash	4,200
Frontal air bag warning lamp, on/off	Off
Frontal air bag suppression switch status, front passenger	Not Active
Safety belt status, driver	Driver Buckled
Brake Telltale	Off
ABS Telltale	Off
Stability Control Telltale	Off
Speed Control Telltale	Off
Powertrain Wrench Telltale	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	37.3 [60.0]	19	Off	1,500	non-engaged	non-engaged	non-engaged	non-engaged
- 4.5	37.3 [60.0]	20	Off	1,500	non-engaged	non-engaged	non-engaged	non-engaged
- 4.0	37.9 [61.0]	24	Off	1,600	non-engaged	non-engaged	non-engaged	non-engaged
- 3.5	37.9 [61.0]	27	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 3.0	38.5 [62.0]	27	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 2.5	39.1 [63.0]	28	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 2.0	39.1 [63.0]	28	Off	1,800	non-engaged	non-engaged	non-engaged	non-engaged
- 1.5	39.1 [63.0]	28	Off	1,800	non-engaged	non-engaged	non-engaged	non-engaged
- 1.0	39.1 [63.0]	0	Off	1,600	non-engaged	non-engaged	non-engaged	non-engaged
- 0.5	34.2 [55.0]	0	Off	1,100	non-engaged	non-engaged	non-engaged	non-engaged
0.0	26.7 [43.0]	0	On	800	engaged	non-engaged	non-engaged	non-engaged

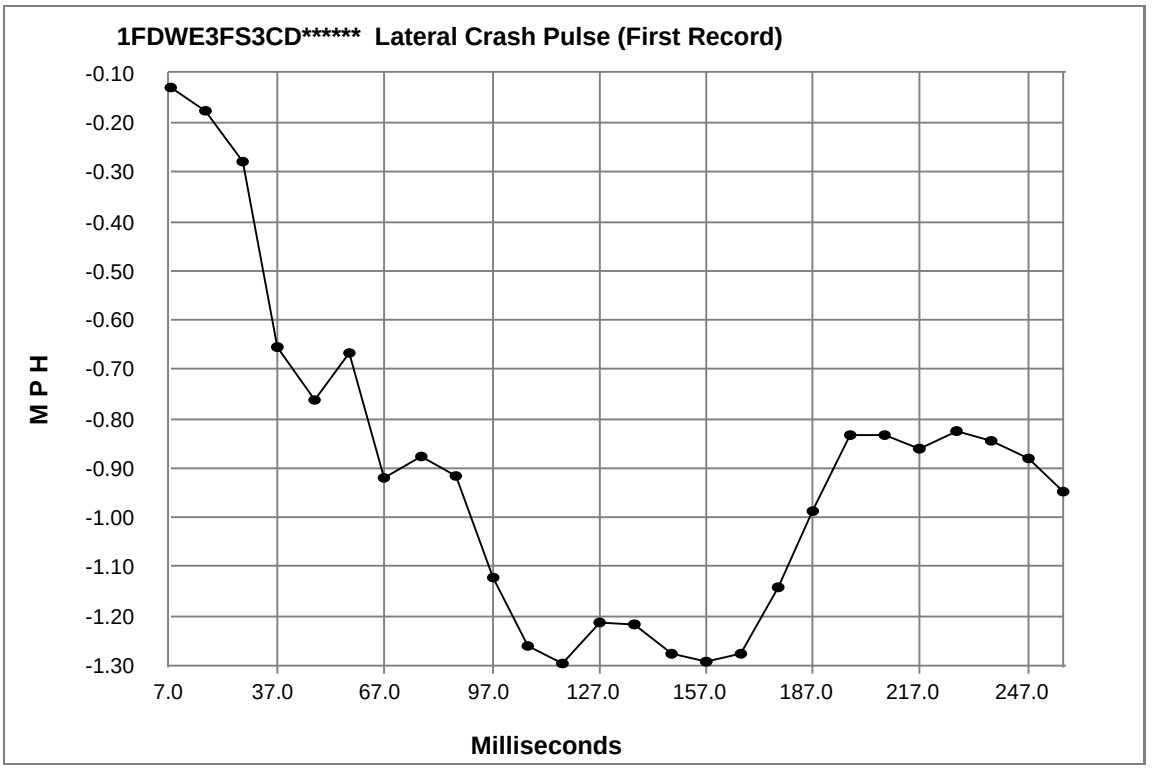
Pre-Crash Data -5 to 0 sec [10 samples/sec] (First Record)

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)
7.0	-0.56	-0.89
17.0	-1.10	-1.77
27.0	-1.87	-3.00
37.0	-2.65	-4.26
47.0	-3.43	-5.51
57.0	-4.07	-6.55
67.0	-4.58	-7.37
77.0	-4.70	-7.56
87.0	-4.59	-7.39
97.0	-4.76	-7.66
107.0	-4.90	-7.88
117.0	-4.94	-7.96
127.0	-5.02	-8.09
137.0	-5.07	-8.15
147.0	-5.12	-8.24
157.0	-5.06	-8.14
167.0	-5.01	-8.07
177.0	-5.01	-8.07
187.0	-4.85	-7.81
197.0	-4.75	-7.64
207.0	-4.69	-7.56
217.0	-4.66	-7.50
227.0	-4.64	-7.47
237.0	-4.63	-7.45
247.0	-4.58	-7.36
257.0	-4.60	-7.40



Lateral Crash Pulse (First Record)

Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
7.0	-0.13	-0.20
17.0	-0.17	-0.28
27.0	-0.28	-0.45
37.0	-0.65	-1.05
47.0	-0.76	-1.23
57.0	-0.67	-1.08
67.0	-0.92	-1.48
77.0	-0.87	-1.41
87.0	-0.91	-1.47
97.0	-1.12	-1.80
107.0	-1.26	-2.03
117.0	-1.30	-2.09
127.0	-1.21	-1.95
137.0	-1.22	-1.96
147.0	-1.28	-2.05
157.0	-1.29	-2.08
167.0	-1.28	-2.06
177.0	-1.14	-1.84
187.0	-0.99	-1.59
197.0	-0.83	-1.34
207.0	-0.83	-1.34
217.0	-0.86	-1.38
227.0	-0.83	-1.33
237.0	-0.84	-1.36
247.0	-0.88	-1.42
257.0	-0.95	-1.53

System Status at Event (Second Record)

Recording Status	Unlocked Record
Complete file recorded (yes,no)	Yes
Multi-event, number of events (1,2)	2
Time from event 1 to 2 (msec)	1,400
Lifetime Operating Timer at event time zero (seconds)	4,361,535
Key-on Timer at event time zero (seconds)	145
Vehicle voltage at time zero (Volts)	12.798
Energy Reserve Mode entered during event (Y/N)	No

Faults Present at Start of Event (Second Record)

No Faults Recorded

Deployment Data (Second Record)

Maximum delta-V, longitudinal (MPH [km/h])	-0.42 [-0.68]
Time, maximum delta-V longitudinal (msec)	217
Maximum delta-V, lateral (MPH [km/h])	-11.77 [-18.95]
Time, maximum delta-V lateral (msec)	300
Longitudinal Delta-V Time Zero Offset	1.0 ms
Lateral Delta-V Time Zero Offset	1.0 ms

Pre-Crash Data -1 sec (Second Record)

Ignition cycle, crash	4,200
Frontal air bag warning lamp, on/off	Off
Frontal air bag suppression switch status, front passenger	Not Active
Safety belt status, driver	Driver 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] (Second 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	37.9 [61.0]	27	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 4.5	38.5 [62.0]	27	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 4.0	39.1 [63.0]	28	Off	1,700	non-engaged	non-engaged	non-engaged	non-engaged
- 3.5	39.1 [63.0]	28	Off	1,800	non-engaged	non-engaged	non-engaged	non-engaged
- 3.0	39.1 [63.0]	28	Off	1,800	non-engaged	non-engaged	non-engaged	non-engaged
- 2.5	39.1 [63.0]	0	Off	1,600	non-engaged	non-engaged	non-engaged	non-engaged
- 2.0	34.2 [55.0]	0	Off	1,100	non-engaged	non-engaged	non-engaged	non-engaged
- 1.5	26.7 [43.0]	0	On	800	engaged	non-engaged	non-engaged	non-engaged
- 1.0	11.2 [18.0]	0	On	600	engaged	non-engaged	non-engaged	non-engaged
- 0.5	7.5 [12.0]	0	On	500	engaged	non-engaged	non-engaged	non-engaged
0.0	7.5 [12.0]	0	On	400	engaged	non-engaged	non-engaged	non-engaged

Pre-Crash Data -5 to 0 sec [10 samples/sec] (Second 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
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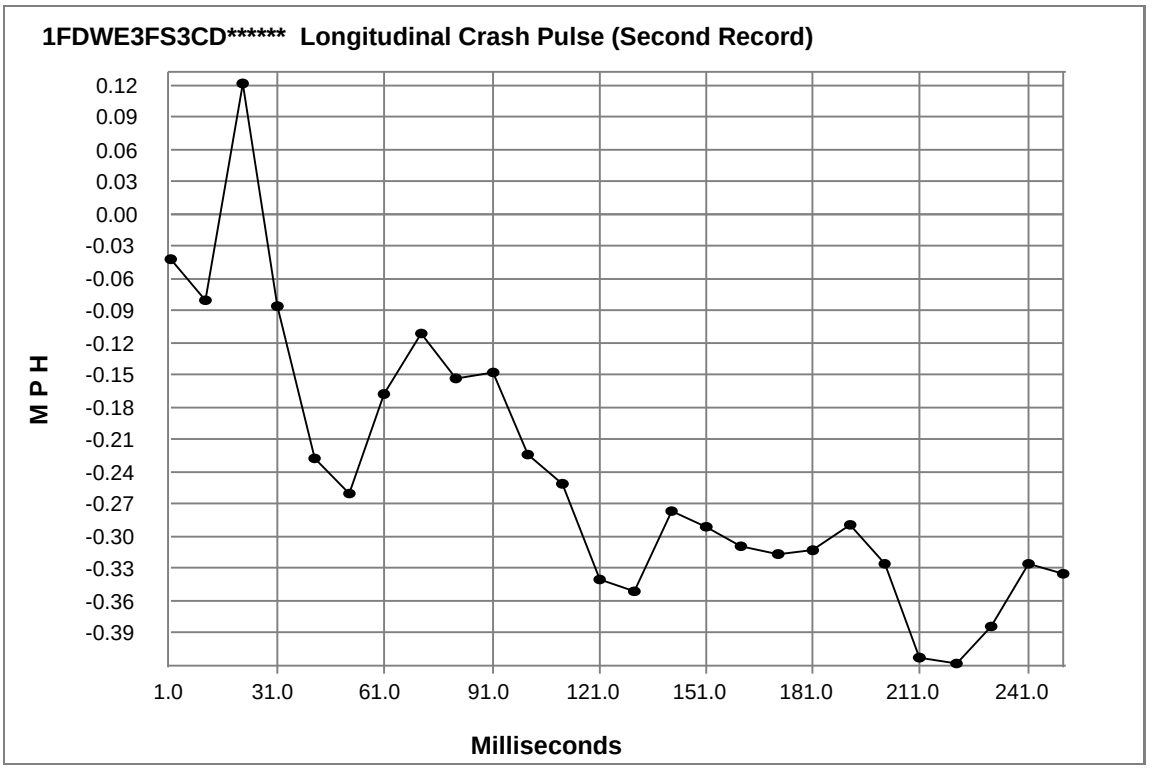
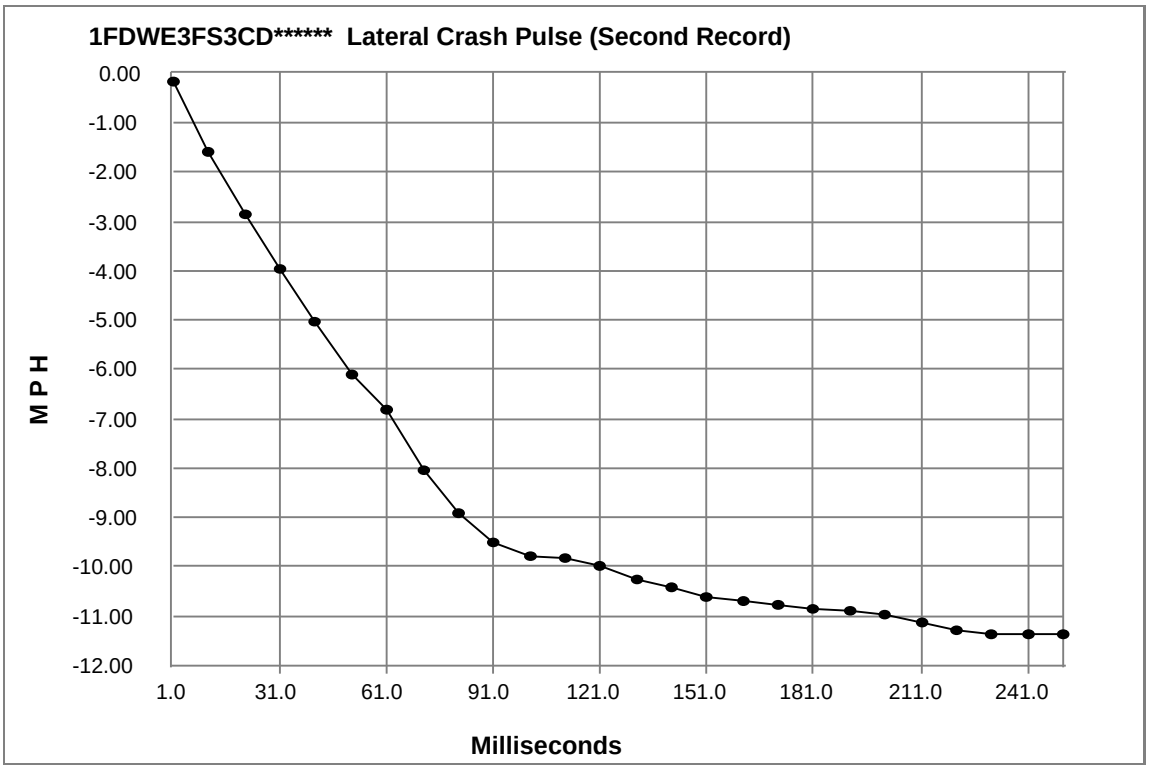
- 0.3	Invalid
- 0.2	Invalid
- 0.1	Invalid
0.0	Invalid



Longitudinal Crash Pulse (Second Record)

Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
1.0	-0.04	-0.07
11.0	-0.08	-0.13
21.0	0.12	0.19
31.0	-0.09	-0.14
41.0	-0.23	-0.37
51.0	-0.26	-0.42
61.0	-0.17	-0.27
71.0	-0.11	-0.18
81.0	-0.15	-0.25
91.0	-0.15	-0.24
101.0	-0.22	-0.36
111.0	-0.25	-0.40
121.0	-0.34	-0.55
131.0	-0.35	-0.57
141.0	-0.28	-0.44
151.0	-0.29	-0.47
161.0	-0.31	-0.50
171.0	-0.32	-0.51
181.0	-0.31	-0.50
191.0	-0.29	-0.46
201.0	-0.33	-0.52
211.0	-0.41	-0.67
221.0	-0.42	-0.67
231.0	-0.38	-0.62
241.0	-0.33	-0.52
251.0	-0.33	-0.54



Lateral Crash Pulse (Second Record)

Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
1.0	-0.17	-0.27
11.0	-1.59	-2.55
21.0	-2.85	-4.58
31.0	-3.94	-6.34
41.0	-5.02	-8.07
51.0	-6.10	-9.82
61.0	-6.81	-10.95
71.0	-8.03	-12.92
81.0	-8.92	-14.36
91.0	-9.51	-15.30
101.0	-9.77	-15.72
111.0	-9.83	-15.83
121.0	-9.98	-16.06
131.0	-10.25	-16.49
141.0	-10.43	-16.79
151.0	-10.62	-17.09
161.0	-10.71	-17.23
171.0	-10.76	-17.32
181.0	-10.85	-17.46
191.0	-10.88	-17.50
201.0	-10.98	-17.67
211.0	-11.12	-17.90
221.0	-11.28	-18.16
231.0	-11.37	-18.30
241.0	-11.37	-18.30
251.0	-11.36	-18.29

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.

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42 43 32 34 2D 31 34 42 33 32 31 2D 42 44 00 00 00 00 00 00 00 00 00 00

33 31 31 37 32 37 32 33 30 30 30 30 30 30 30 30

42 4C 38 34 2D 31 34 43 30 32 38 2D 41 42 00 00 00 00 00 00 00 00 00 00

15 F2 82 6A 00 00 00 00 00 00 00 00 00 00 00 00

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Event Record 1

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FE FF 5B 35 FE FF 84 35 FE FF 61 35 FE FF AA 34 FE FF 2D 34 FE FF 0C 34 FE FF 58
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Event Record 2

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