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January 2025

Special Crash Investigations:

On-Site Ambulance Crash Investigation;

Vehicle: 2011 Ford F-450, Type I Ambulance;

Location: Kentucky;

Crash Date: October 2022

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

16. Abstract

This on-site investigation documents the side impact/rollover of a 2011 Ford F-450 Type I ambulance struck by the front of a 2001 Dodge Ram in Kentucky in October 2022. The crash occurred at the intersection of two four-lane highways, which was controlled by overhead tri-color traffic signals. The ambulance had its emergency lights and siren engaged and entered the intersection on the red phase of the traffic signal. The Dodge entered the intersection on green. The ambulance driver said during the SCI interview that she slowed the vehicle as it entered the intersection and changed the siren tone. The ambulance attempted to cross the path of the Dodge, and its right plane was struck by the Dodge's front plane. The ambulance rotated clockwise, tripped, and rolled over one-quarter turn coming to final rest on its left side. The Dodge rotated clockwise approximately 90° and came to final rest in the intersection. The ambulance driver was a belted 61-year-old female, and the patient compartment was occupied by an unbelted 49-year-old female EMT and a 77-year-old male patient who was secured by the ambulance's patient cot. The Dodge driver was a belted 49-year-old male with a belted 44-year-old female in the right-front seat. The ambulance driver was transported to a hospital where she was treated and released. The EMT was flown to an urban medical center and was hospitalized for 4 days. The patient was transported to the original intended medical facility and was hospitalized for 2 days. Both Dodge occupants sustained police-reported C-level (possible) injuries and were transported to a hospital.

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Special Crash Investigations
On-Site Ambulance Crash Investigation
SCI Case No: CR22016
Vehicle: 2011 Ford F-450 Type I Ambulance
Location: Kentucky
Crash Date: October 2022

Background

This on-site investigation documents the right-side impact/rollover of a 2011 Ford F-450 Type I ambulance (Figure 1) that was struck by the front of a 2001 Dodge Ram. The ambulance was traveling with its active emergency lights and siren engaged. The crash resulted in serious injuries to the emergency medical technician (EMT), and moderate injuries to the driver and patient. The crash was identified by the Office of Emergency Medical Services of the National Highway Traffic Safety Administration in October 2022 and an investigation of the crash was assigned to the Special Crash Investigations team at Crash Research & Analysis Inc. in the same month. The investigating police agency and ambulance service were contacted in October 2022 and authorization was given to inspect both vehicles. Inspections of the ambulance, Dodge, and crash scene were completed in November 2022. The ambulance driver was also interviewed in November 2022.

Figure 1. Ford F-450 Type I Ambulance

The crash occurred at the intersection of two four-lane, undivided State highways controlled by overhead tri-color traffic signals. The ambulance was traveling northeast with its emergency lights and siren engaged and entered the intersection on the red phase of the traffic signal. The ambulance driver said during the SCI interview that she slowed the vehicle as it entered the intersection and changed the siren's tone. The Dodge was traveling northwest and entered the intersection on a green light. As the ambulance crossed the Dodge's path, the front plane of the Dodge struck the right plane of the ambulance (Event 1). The ambulance rotated clockwise as it separated from the impact, tripped, and rolled over one-quarter turn (Event 2), coming to final rest on its left side in the travel lane, facing west. The Dodge rotated clockwise approximately 90° after impact and came to final rest in the intersection, facing east.

The ambulance driver was a belted 61-year-old female, and the patient compartment was occupied by an unbelted 49-year-old female EMT and a 77-year-old male patient secured by the ambulance's patient cot/restraints. The Dodge driver was a belted 49-year-old male with a belted 44-year-old female in the right-front seat.

The ambulance driver was transported by a private vehicle to a hospital where she was treated and released. The EMT was flown to an urban medical center and was hospitalized for 4 days. The patient was transported by ambulance to the original intended medical facility and was hospitalized for 2 days. Both Dodge occupants sustained police-reported C-level (possible) injuries and were transported by ambulance to a hospital where their level of treatment is not known.

On-site investigation included documentation and measurement of the ambulance's exterior and interior damage, identification of occupant contact points, assessment of its manual and supplemental restraint systems, and the inspections of the patient compartment and cot. The Dodge's exterior was inspected to document its damage. The ambulance had an event data recorder (EDR) and was imaged by the Bosch Crash Data Retrieval tool. Additional activities included documentation of the crash site's physical environment using photographs and a total station mapping system.

Ambulance Service Information

The ambulance service was given a questionnaire about its operation and was completed by company personnel. Its service was part of a county and municipal operation that provided emergency medical services as well as non-emergency transfers. The ambulance service covered an area of 1,035 square km (400 square miles) with a fleet of eight ambulances.

The ambulance service required its employees who operated vehicles to complete the classroom emergency vehicle operations (CEVO-4) training. This consisted of a 4- to 6-hour class that included classroom instruction, as well as actually driving the emergency vehicle. The training/certification was renewed every 2 years. The involved driver was a part-time employee and a certified driver for 19 years and an EMT for 20 years. Her normal work schedule was a 16- or 24-hour shift every other Saturday. On the day of the crash, she had been working approximately 8 hours. She did not work the day prior to the crash.

The EMT was a part-time employee and had been an EMT for the ambulance service for 6 years. Her normal work schedule was a 16- to 24-hour shift every other Saturday. She had been working approximately 9 hours prior to the crash. She did not work the day prior to the crash.

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Crash Summary

Crash Site

The crash occurred during the day at a four-leg intersection of two four-lane, undivided State highways. The environmental conditions were 22 °C (72 °F) with wind from the northeast at 32 km/h (20 mph). The ambulance's roadway was oriented northeast-southwest and had one through lane in each direction, separated by a double yellow center line. It also had designated left and right turn lanes separated from the through lane by solid white lines. All lanes were 3.8 m (12.5 ft) wide, and each side of the roadway had solid white edge lines. The Dodge's roadway was oriented northwest-southeast with one through lane on each side separated by a double yellow center line. It also had designated left and right turn lanes that were separated from the through lane by solid white lines. All lanes were 3.5 m (11.5 ft) wide, and each side of the roadway had solid white edge lines. Both roadways were level bituminous, and the posted speed limit was 89 km/h (55 mph) and the intersection was controlled by overhead tri-color traffic signals. A crash diagram is included at the end of this report.

Pre-Crash

The ambulance was traveling northeast and was approaching the intersection (Figure 2) at an EDR-reported speed of 46 km/h (29 mph) at 5 seconds prior to algorithm enable (AE). According to witness statements in the police crash report, the stoplight was red and the ambulance was operating in emergency mode with lights and siren engaged. Witness statements said the ambulance driver sounded the horn and changed the siren tone as the vehicle entered the intersection. The EDR report indicated that the ambulance's speed had dropped slightly to 44 km/h (27 mph) at 3.0 seconds prior to AE but then increased to 53 km/h (33 mph) at AE. The EDR further indicated the driver's seat belt was buckled and there were no braking or steering inputs immediately prior to the crash. Meanwhile, the Dodge was traveling northwest in its through lane and was also entering the intersection on a green (Figure 3). Witness statements in the police crash report said the Dodge did not slow down as it entered the intersection.

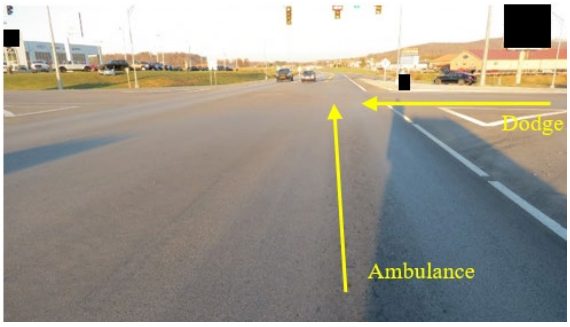

Figure 2. Northeast view of Ford and Dodge approaches to the intersection

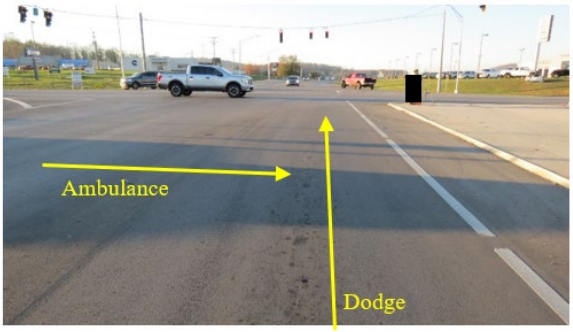

Figure 3. Northwest view, Ford and Dodge approaches to the intersection

The ambulance driver said during the SCI interview that from what she could see in the rearview mirror, the EMT had been attending to the patient and was about to sit down in the rear-facing captain's chair. She said the patient was lying on his back, fully horizontal on the patient cot, with all restraints engaged.

Crash

The Dodge's front plane struck the right side of the ambulance's patient compartment at the rear axle (Event 1). The impact induced the ambulance into a clockwise rotation where it tripped and rolled over one-quarter turn onto its left side (Event 2), coming to final rest approximately 34 m (112 ft) east of the impact point, facing west. The impact also induced the Dodge into a clockwise rotation of approximately 90°, based on media photography. It came to its final rest in the southeast corner of the intersection, facing east.

Post-Crash

Police and emergency services were dispatched to the crash scene. The driver said during the SCI interview that she was assisted out of the vehicle through the right front door. She was transported by a private vehicle to a hospital where she was treated and released. The EMT was removed from the ambulance by rescue personnel due to perceived serious injury. She was flown to an urban medical center where she was hospitalized for 4 days. The patient was removed from the ambulance due to perceived serious injury by rescue personnel. He was transported by ambulance to the original destination hospital. Both Dodge occupants sustained police-reported C-level injuries and were transported by ambulance to a hospital where their treatment status is not known. Both vehicles were towed due to damage.

2011 Ford F-450 Type I Ambulance

Description

The ambulance was a 4-wheel drive, 5-passenger, 4-door, chassis cab/incomplete vehicle, manufactured in August 2010 with the VIN 1FD0X4HT2BExxxxxx. It had a 6.7-liter 8-cylinder engine and configured on a 353 cm (139.0 in) wheelbase. The cab had multi-stage frontal air bags, seatback-mounted side impact air bags, and inflatable curtain (IC) air bags. There were no air bags in the patient compartment. The vehicle manufacturer recommended tire size was 225/70R19. The ambulance had Toyo M154 tires of the recommended size. All tires were in good condition with a minimum of 6 mm (7/32 in) tread.

According to information placards, the ambulance had a gross vehicle weight rating of 7,484 kg (16,500 lb) and gross axle weight ratings of 3,175 kg (7,000 lb) front and 5,443 kg (12,000 lb) rear. The total usable payload of the vehicle (weight capacity of occupants and cargo user may add) was 1,784 kg (3,932 lb). Based on occupant weight and estimated cargo, the ambulance was operating within its gross vehicle weight limits.

Ford Ambulance Patient Compartment

The Ford was outfitted as a Type 1 ambulance with a patient compartment manufactured by SJC Industries in September 2010. A placard confirmed that the ambulance compartment was certified as a Star of Life vehicle and conformed to Federal Specifications KKK-A-1822 in effect on the date of manufacture. This refers to the United States General Services Administration standard for minimum specifications, test parameters, and criteria for design, performance, equipment, and appearance.

The patient compartment had a right-side door and double rear doors for patient loading/unloading. Medical supplies and roadside safety equipment were kept in exterior and interior cabinets. A rear-facing, high back, pedestal-mounted seat at the forward aspect of the patient compartment featured a visible lap belt, but also had a 4-point harness behind a removable seatback cushion. There was a single occupant bench seat on the left side of the patient compartment, equipped with a lap belt. There was also a long bench seat on the right side of the patient compartment, equipped with lap belts for three occupants. This seat could also be used to transport a second patient. A motorized patient loading system was mounted to the floor of the patient compartment that was used with the patient cot.

Exterior Damage

The right plane of the ambulance (Figure 4) was damaged during the impact with the front of the Dodge (Event 1). Direct damage began 89 cm (35.0 in) aft of the right rear axle and extended 222 cm (87.4 in) forward. The crush measurements were taken at the mid-door level of the patient compartment. The maximum residual crush was 3 cm (1.2 in) and was located 21 cm (8.3 in) rear of the right rear axle. The WinSMASH program could not calculate the velocity change for this impact since the vehicle was out of scope for the program. The truck deformation classification (TDC) for this damage pattern was 01RTEW1 (30°).

The entire left plane of the ambulance was superficially damaged during the rollover (Figure 5). There was no vertical or lateral crush. The TDC for this damage pattern was 33LDAO1.

Figure 4. Right plane damage to Ford

Figure 5. Left side rollover damage

Event Data Recorder

The Ford chassis had a restraint control module with EDR capabilities. The EDR was imaged with version 23.0.1 of the Bosch Crash Data Retrieval software and reported with version 24.3.357. The SCI imaging was completed via the diagnostic link connector with power supplied through the fuse panel. The EDR was capable of recording deployment and non-deployment events. Deployment events cannot be overwritten or cleared from the restraints control module (RCM). Non-deployment events can be overwritten by subsequent events. The RCM could store up to two deployment events. The EDR recorded one locked rollover event. No fault codes were recorded.

The EDR recorded the right plane impact and rollover as one continuous long-duration event. The right plane impact (SCI Event 1) was the source of AE. The rollover (SCI Event 2) was sensed and recorded approximately 1.2 seconds later. The EDR report is included at the end of this report.

Pre-Crash Data (First Record): The frontal air bag warning lamp was "Off" and the driver's safety belt status was "Buckled."

Deployment Data (First Record): The maximum longitudinal and lateral delta Vs were reported as -9.01 km/h (-5.60 mph) and -5.11 km/h (-3.18 mph). These occurred at 300 msec and 60 after AE. Both side curtain air bags deployed and the seat belt pretensioners actuated at 1,269.5 msec after AE. The maximum roll angle was 112.51 degrees to the left consistent with one-quarter turn.

Interior Damage

The ambulance cab's interior did not sustain any damage during the crash. A scuff was noted on the left IC air bag, but this likely occurred post-crash. There was no significant damage to the ambulance patient compartment, but there was a blood splatter on the bulkhead at the forward aspect of the right bench seat. The EMT likely contacted the metal rail with her head (Figure 6). Blood was also noted on the ceiling and wall above the left side seat (Figure 7).

Figure 6. Railing contact on right side of patient compartment

Figure 7. Contacts/blood stains on patient compartment, left side contact area/final rest

Manual Restraint Systems

The driver's seat of the ambulance's cab had a lap and shoulder seat belt with a sliding latch plate, an emergency locking retractor (ELR), retractor-mounted pretensioner, and an adjustable D-ring that was in the full-down position. The driver was restrained by the lap and shoulder seat belt as evidenced by load abrasions on the latch plate belt guide and 9 cm (3.5 in) and 5 cm (2.0 in) load marks on the belt webbing 203 cm (79.9 in) and 109 cm (42.9 in), respectively from the floor anchor. The webbing remained extended from the locked retractor consistent with usage.

The patient compartment's captain's chair featured a lap belt as well as a 4-point harness that could be used if the seatback pad were removed. There was also a 2-point lap belt available for the single bench seat on the left side and each of the three bench seat positions on the right side of the patient compartment. None of these belts were used during the crash.

Supplemental Restraint Systems

The ambulance cab had dual stage frontal air bags, front row outboard seat-mounted side impact air bags, and IC air bags. There were no air bags in the patient compartment. Both IC air bags deployed during the crash. Each deflated air bag was 130 cm (51.2 in) in length and 54 cm (21.3 in) in height. There was a scuff to the inboard side of the left IC air bag, which likely occurred post-crash. Otherwise, no contacts or damage were noted.

Patient Cot System

The 6506 Power Pro XT ambulance cot (Figure 8) was manufactured by Stryker. It was constructed with a tubular aluminum frame with an X-frame supporting the mattress and was able to raise and lower the patient by a battery-powered motor. The cot could be adjusted in height from 36 cm (14 in) to 105 cm (41.5 in) and the backrest articulated from 0 to 73°. Nylon webbing strap restraints secured to the cot frame were located at the lower leg, hip, chest, and shoulder positions. During this transport, the backrest was set fully horizontal, and all restraints

were in use on the patient. The patient cot remained secured to the floor mount during the crash and the patient remained in the cot restraints.

Figure 8. Stryker 6506 Power Pro XT patient cot

Cot Fastening System

The Stryker cot was secured to the floor of the patient compartment via a Stryker Power-Load 6390 system (Figure 9). The fastening system consisted of a bracket/assembly that attached to the cot and a continuous bracket that mounted to the floor. Manufacture specifications indicated that the complete system weighed 96.5 kg (211.5 lb) and its maximum lifting capacity was 395 kg (870 lb). The cot was secured to the fastening system with two latches, one at the head and one at the foot. The floor-mounted bracket guided the cot into and out of the patient compartment, eliminating lifting by emergency personnel. The fastening system remained mounted to the floor throughout the crash sequence.

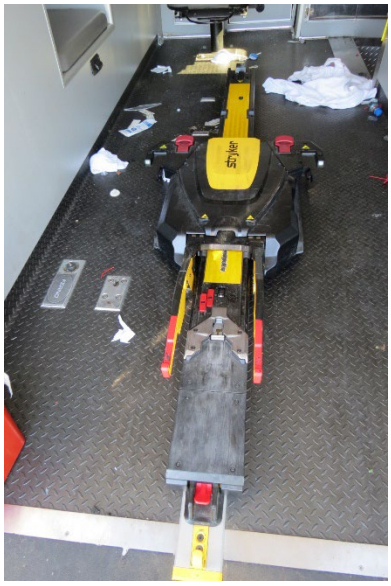

Figure 9. Stryker patient cot loading system

2011 Ford F-450 Ambulance Occupants

Driver Demographics

Age/sex:	61 years/female
Height:	170 cm (67 in)
Weight:	83 kg (182 lb)
Eyewear	Glasses
Seat type:	Forward-facing bucket seat with adjustable head restraint
Seat track:	Middle
Manual restraint usage:	Lap and shoulder belt
Usage source:	Vehicle inspection
Air Bags:	Frontal, seat-mounted, and IC air bags available; IC deployed
Alcohol/drug involvement:	None
Egress from vehicle:	Assisted from vehicle
Transport from scene:	Private vehicle to local hospital
Type of medical treatment:	Treated and released

Driver Injuries

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Contusion behind right ear	110402.1	Isolated Interior – Interior loose objects (specify): Aftermarket lamp	Possible

Source: Driver interview

Driver Kinematics

The driver said she was seated in an upright position with the seat track at the middle position and that she was restrained by the lap and shoulder seat belt. The seat track was in the rearmost position at SCI inspection. The seatback was upright, and the bottom of the head restraint was 7 cm (2.8 in) above the top of the seatback. The right plane impact from the Dodge displaced the driver forward and right. She remained secure in the seat belt as the vehicle rotated clockwise and rolled over, left-side-leading. She stated in the interview she sustained a 2.5 cm contusion behind the right ear. This may have been caused by a portable spotlight in the right-front seat. She further stated she sustained upper and lower back strains during the crash sequence. She was driven in a private vehicle to a hospital where she was treated and released.

EMT Demographics

Age/sex:	49 years/female
Height:	165 cm (65 in)
Weight:	94 kg (208 lb)
Eyewear	Glasses
Seat type:	Rear-facing pedestal, EMT seat
Seat track:	Not adjustable
Manual restraint usage:	None
Usage source:	SCI interview
Air Bags:	None
Egress from vehicle:	Removed due to perceived serious injury
Transport from scene:	Air to Level 1 trauma center
Type of medical treatment:	Hospitalized 4 days

EMT Injuries

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Small subarachnoid hemorrhage, left posterior parietal	140693.2	Isolated IPC ICS #1: Interior – Other interior object(s) (specify): Handrail on right side of patient compartment ICS #2: Interior – Other interior object(s): Left wall of patient compartment	Probable Possible
2	T12 superior end plate fracture (mild)	650432.2	Isolated IPC ICS #1: Interior – Other interior object(s) (specify): Left wall of patient compartment ICS #2: Handrail on right side of patient compartment	Possible Possible
3	L1 endplate fracture (mild-to-moderate)	650632.2	Isolated IPC ICS #1: Interior – Other interior object(s)	Possible

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
			(specify): Left wall of patient compartment ICS #2: Handrail on right side of patient compartment	Possible
4	L2 transverse process fracture, left	650620.1	Isolated Interior – Other interior object(s) (specify): Left wall of patient compartment	Possible
5	Left proximal clavicle fracture	750511.2	Isolated IPC Interior – Other interior object(s) (specify): Left wall of patient compartment	Possible
6	Left occipital scalp laceration, 6 cm	110602.1	Isolated Interior – Other interior object(s) (specify): Handrail on right side of patient compartment	Probable
7	Left scalp hematoma	110402.1	Isolated Interior – Other interior object(s) (specify): Handrail on right side of patient compartment	Probable
8	Bruising to abdominal wall	510402.1	Isolated Interior – Other interior object(s) (specify): Left wall cabinetry	Possible
9	Small superficial laceration to right calf	810602.1	Isolated Interior – Other interior object(s) (specify): Left wall cabinetry	Possible
10	Left knee abrasion	810202.1	Isolated	Possible

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
			Interior – Other interior object(s) (specify): Left wall cabinetry	

Source: Hospital record

EMT Kinematics

The ambulance driver stated during the SCI interview that she could see the EMT was facing rearward and about to sit down in the rear-facing chair in the patient compartment. The impact from the Dodge displaced the EMT primarily toward the right side of the patient compartment. Her head probably struck the handrail at the forward end of the right bench, and she sustained a hematoma and laceration to the left posterior scalp and a small left-side subarachnoid hemorrhage. She sustained end plate fractures to T12 and L1 vertebrae. These injuries could have been from contact to the handrail or left side wall and/or cabinets of the patient compartment as the ambulance rolled over. She also sustained a transverse process fracture to L2, a left proximal clavicle fracture, a right calf laceration, and left knee abrasion from contacts to the left wall/cabinets. She was flown to a Level 1 trauma center and was hospitalized for 4 days.

Patient Demographics

Age/sex:	77 years/male
Height:	183 cm (72 in)
Weight:	94 kg (207 lb)
Eyewear	Unknown
Seat type:	Patient cot
Seat track:	None
Manual restraint usage:	Foot, knee, hip, chest/shoulder restraints
Usage source:	Driver interview
Air Bags:	None
Egress from vehicle:	Removed due to perceived serious injury
Transport from scene:	Air to Level 1 trauma center
Type of medical treatment:	Hospitalized for 2 days

Patient Injuries

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Left posterior 1st rib	450201.1	Isolated Interior – Other restraint system component (specify): Cot restraint shoulder strap	Probable

Inj. No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
2	Bruising, NFS	910400.1	Injured, Unknown Source	Unknown

Source: Hospital record

Patient Kinematics:

The patient was lying on his back and was secured by the lower leg, hip, chest, and shoulder restraints from the cot. He remained in the cot restraints during the crash sequence. The driver stated during the SCI interview that the patient sustained an undisclosed left rib injury, possibly from one of the restraints. He was enroute to an urban medical center at the time of the crash and was eventually transported there after spending two days at the trauma center.

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2001 Dodge Ram

Description

The Dodge was a four-wheel drive, 5-occupant, 4-door pickup truck. According to the VIN placard, the vehicle was manufactured in February 2000 with the VIN 3B7HF13Z31Gxxxxxx. It had a 5.9-liter, 8-cylinder engine and configured on a 353 cm (139.0 in) wheelbase. The Dodge had dual frontal air bags, which deployed as a result of the crash. Due to its date of manufacture, this vehicle was not equipped with an EDR.

Exterior Damage

The entire front plane of the Dodge (Figure 10) was damaged during the crash with the ambulance. The Field L was 160 cm (63.0 in). Crush measurements were taken along the front bumper and the maximum residual crush was 39 cm (15.4 in) which occurred 30 cm (11.8 in) right of the center line. The WinSMASH program could not calculate velocity change for this impact since large trucks (Ford ambulance) are out of scope for the program. However, a barrier equivalent speed was calculated at 21 km/h (13.0 mph). The CDC for this damage pattern was 10FDEW2 (300°).

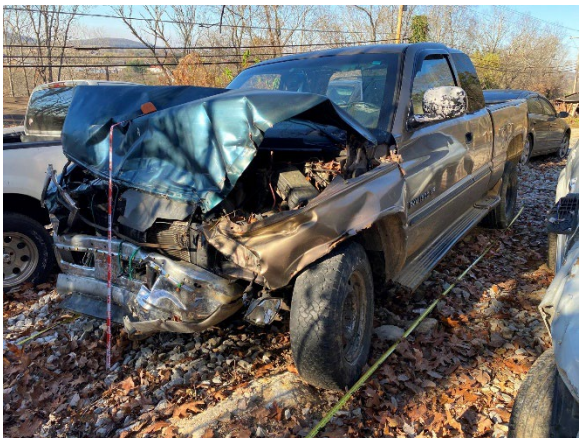

Figure 10. Front/left of Dodge

Occupant Data

The driver and front passenger of the Dodge both sustained police-reported C-level injuries and were transported by ambulance to a hospital. Their specific injury and treatment information is unknown.

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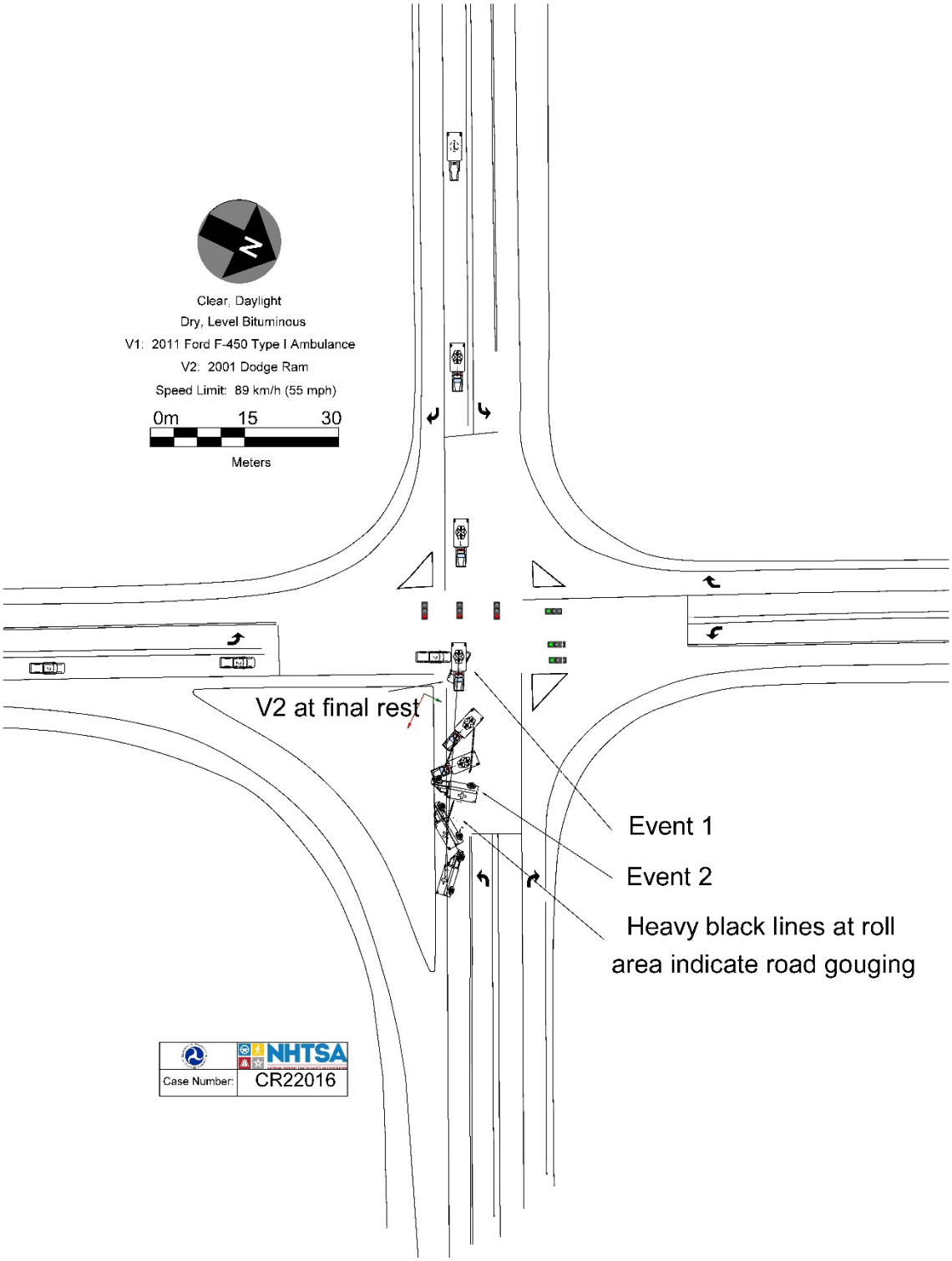
Crash Diagram



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Appendix A. 2011 Ford F-450 Event Data Recorder Report

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

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

CDR File Information

User Entered VIN	1FD0X4HT2BE******
User	
Case Number	
EDR Data Imaging Date	11/08/2022
Crash Date	
Filename	CR22016_V1_ACM.CDRX
Saved on	Tuesday, November 8 2022 at 10:59:52
Imaged with CDR version	Crash Data Retrieval Tool 23.0.1
Imaged with Software Licensed to (Company Name)	NHTSA
Reported with CDR version	Crash Data Retrieval Tool 24.2.357
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
ACM Adapter Detected During Download	No
Event(s) recovered	locked rollover 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 Tuesday, November 8 2022 at 10:59:52.

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	1FD0X4HT2BE******
Current VIN from PCM	1FD0X4HT2BE******
Ignition cycle, download (first record)	14,688
Ignition cycle, download (second record)	N/A
Restraints Control Module Part Number	BC3T-14B321-AH
Restraints Control Module Serial Number	7101151100000000
Restraints Control Module Software Part Number (Version)	BC3T-14C028-AB
Left/Center Frontal Restraints Sensor Serial Number	12BE7A6E
Left Side Restraint Sensor 1 Serial Number	BF2121D1
Left Side Restraint Sensor 2 Serial Number	0CCE0C7F
Right Frontal Restraints Sensor Serial Number	00000000
Right Side Restraint Sensor 1 Serial Number	74A241D1
Right Side Restraints Sensor 2 Serial Number	0CCE5B49

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)	31,174,930
Key-on Timer at event time zero (seconds)	1,805
Vehicle voltage at time zero (Volts)	13.608
Energy Reserve Mode entered during event (Y/N)	No

Faults Present at Start of Event (First Record)

No Faults Recorded

Deployment Data (First Record)

Side curtain airbag deployment, time to deploy, driver side (msec)	1,269.5
Pretensioner (retractor) deployment, time to fire, driver (msec)	1,269.5
Side curtain airbag deployment, time to deploy, right side (msec)	1,269.5
Pretensioner (retractor) deployment, time to fire, right front passenger (msec)	1,269.5
Maximum delta-V, longitudinal (MPH [km/h])	-5.60 [-9.01]
Time, maximum delta-V longitudinal (msec)	300
Maximum delta-V, lateral (MPH [km/h])	-3.18 [-5.11]
Time, maximum delta-V lateral (msec)	60
RCM, rollover sensor discriminating deployment	Yes
RCM, vertical sensor safing	Yes
Longitudinal Delta-V Time Zero Offset	3.5 ms
Lateral Delta-V Time Zero Offset	3.5 ms
Roll Angle Time Zero Offset	3.5 ms

Pre-Crash Data -1 sec (First Record)

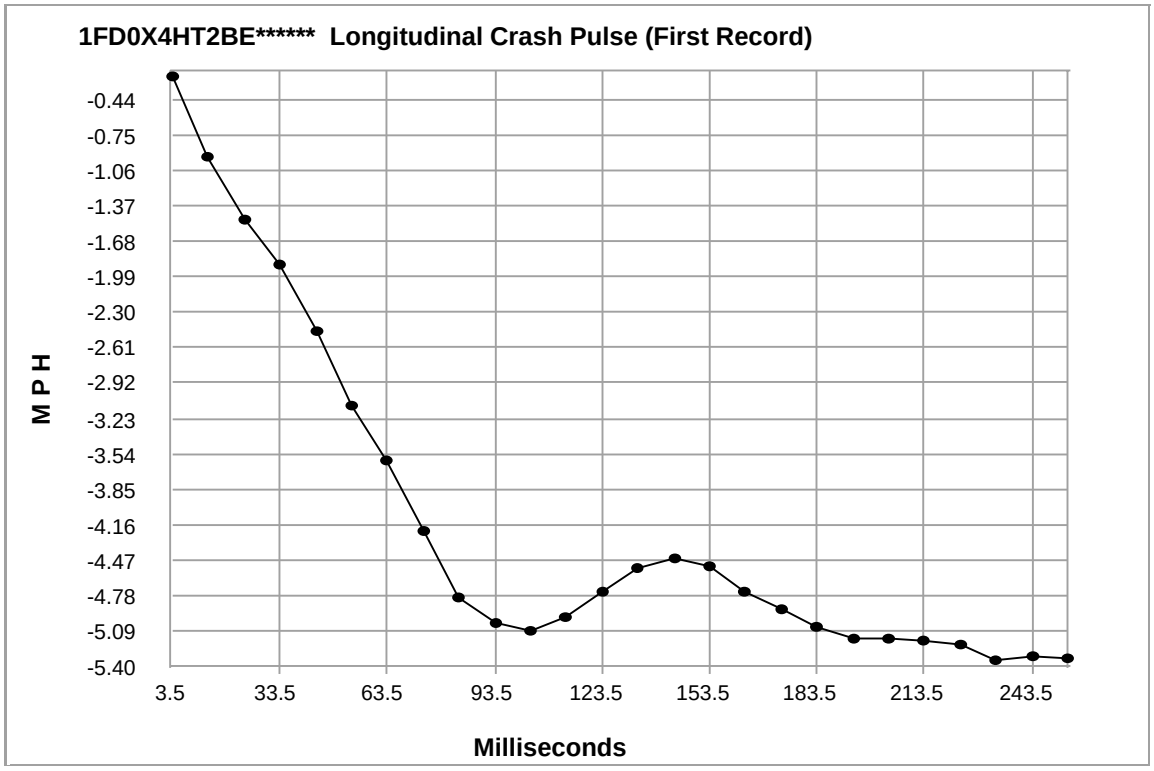
Ignition cycle, crash	14,687
Frontal air bag warning lamp, on/off	Off
Frontal air bag suppression switch status, front passenger	Not Active
Safety belt status, driver	Driver Buckled
Brake Telltale	Off
ABS Telltale	Off
Powertrain Wrench Telltale	Off
Speed Control Telltale	Off
MIL Telltale	Off

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)	Brake Powertrain Torque Request	Driver Gear Selection
- 5.0	29 [46]	0.0	On	832	non-engaged	No	Drive
- 4.5	27 [44]	0.0	Off	882	non-engaged	No	Drive
- 4.0	27 [44]	38.7	Off	996	non-engaged	No	Drive
- 3.5	27 [44]	40.5	Off	1,262	non-engaged	No	Drive
- 3.0	27 [44]	46.4	Off	1,592	non-engaged	No	Drive
- 2.5	28 [45]	47.2	Off	1,818	non-engaged	No	Drive
- 2.0	29 [46]	51.4	Off	2,102	non-engaged	No	Drive
- 1.5	29 [47]	53.0	Off	2,184	non-engaged	No	Drive
- 1.0	30 [49]	48.7	Off	2,280	non-engaged	No	Drive
- 0.5	32 [51]	49.1	Off	2,372	non-engaged	No	Drive
0.0	33 [53]	53.1	Off	2,438	non-engaged	No	Drive

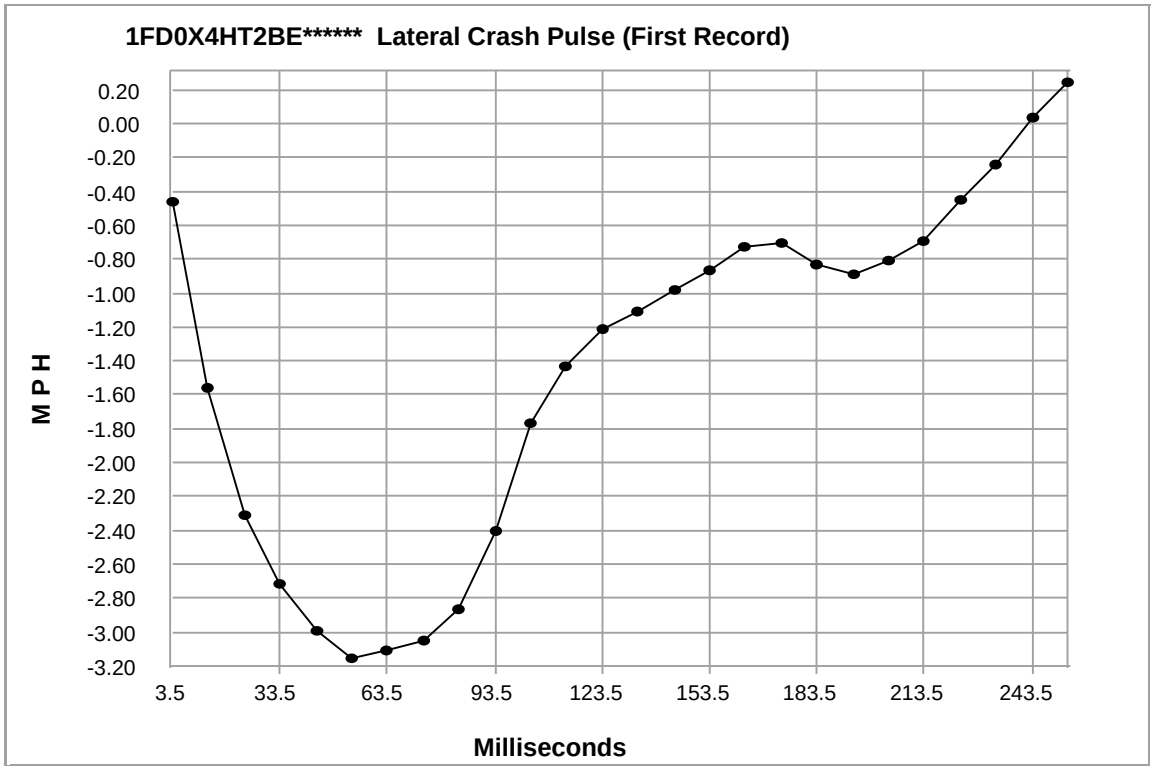
Pre-Crash Data -5 to 0 sec [10 samples/sec] (First Record)

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



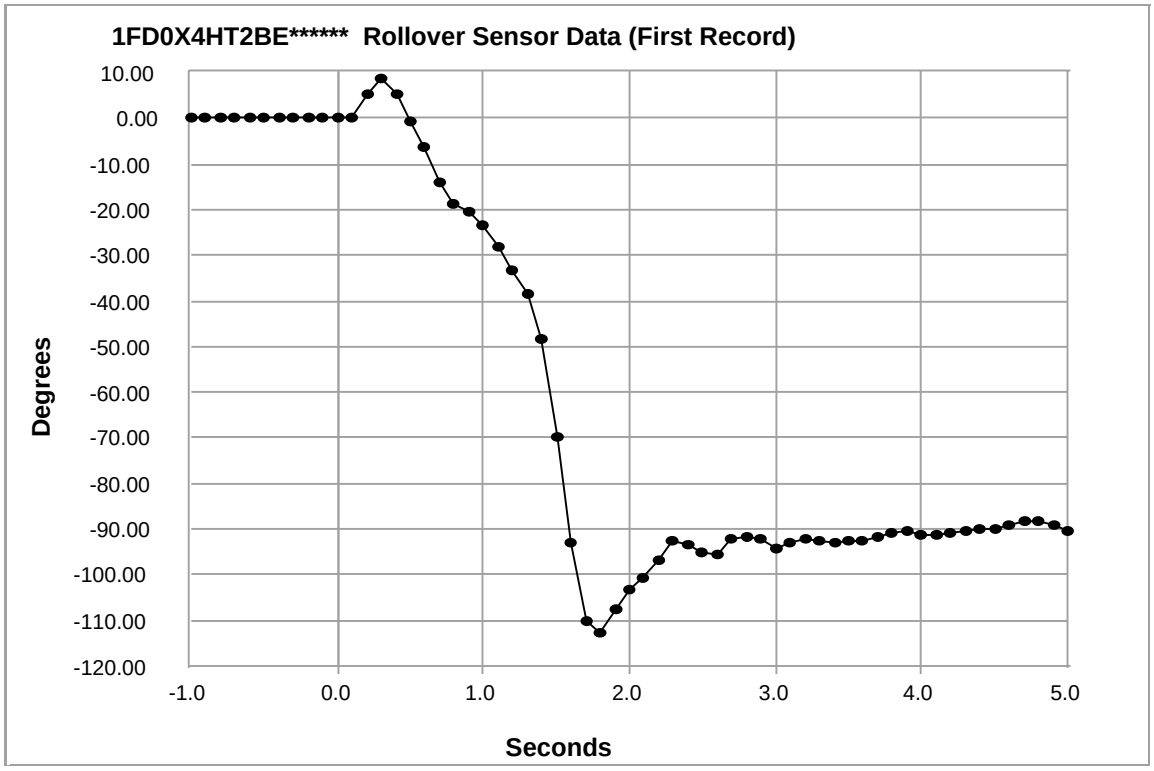
Longitudinal Crash Pulse (First Record)

Time (msec)	Delta-V, longitudinal (MPH)	Delta-V, longitudinal (km/h)
3.5	-0.23	-0.38
13.5	-0.94	-1.52
23.5	-1.49	-2.40
33.5	-1.88	-3.02
43.5	-2.47	-3.97
53.5	-3.12	-5.02
63.5	-3.60	-5.80
73.5	-4.22	-6.79
83.5	-4.80	-7.73
93.5	-5.03	-8.10
103.5	-5.10	-8.20
113.5	-4.96	-7.99
123.5	-4.74	-7.63
133.5	-4.54	-7.31
143.5	-4.46	-7.19
153.5	-4.52	-7.28
163.5	-4.75	-7.64
173.5	-4.90	-7.89
183.5	-5.06	-8.14
193.5	-5.17	-8.31
203.5	-5.16	-8.30
213.5	-5.18	-8.34
223.5	-5.21	-8.39
233.5	-5.35	-8.60
243.5	-5.31	-8.55
253.5	-5.34	-8.59



Lateral Crash Pulse (First Record)

Time (msec)	Delta-V, lateral (MPH)	Delta-V, lateral (km/h)
3.5	-0.47	-0.75
13.5	-1.56	-2.51
23.5	-2.31	-3.72
33.5	-2.71	-4.36
43.5	-3.00	-4.82
53.5	-3.15	-5.07
63.5	-3.11	-5.00
73.5	-3.05	-4.91
83.5	-2.87	-4.62
93.5	-2.41	-3.88
103.5	-1.77	-2.84
113.5	-1.43	-2.31
123.5	-1.22	-1.96
133.5	-1.11	-1.78
143.5	-0.98	-1.57
153.5	-0.87	-1.39
163.5	-0.73	-1.17
173.5	-0.71	-1.14
183.5	-0.83	-1.33
193.5	-0.89	-1.43
203.5	-0.81	-1.31
213.5	-0.69	-1.11
223.5	-0.45	-0.73
233.5	-0.25	-0.40
243.5	0.03	0.05
253.5	0.24	0.39



Rollover Sensor Data (First Record)

Time (sec)	Vehicle roll angle (degrees)
-1.0	-0.01
-0.9	-0.01
-0.8	-0.03
-0.7	-0.02
-0.6	-0.02
-0.5	0.0
-0.4	0.0
-0.3	0.0
-0.2	0.0
-0.1	0.0
0.0	0.0
0.1	0.01
0.2	5.16
0.3	8.9
0.4	5.26
0.5	-0.81
0.6	-6.11
0.7	-13.94
0.8	-18.81
0.9	-20.59
1.0	-23.58

Time (sec)	Vehicle roll angle (degrees)
1.1	-28.35
1.2	-33.33
1.3	-38.63
1.4	-48.5
1.5	-69.77
1.6	-93.13
1.7	-110.12
1.8	-112.51
1.9	-107.61
2.0	-103.14
2.1	-100.85
2.2	-97.02
2.3	-92.75
2.4	-93.23
2.5	-95.28
2.6	-95.41
2.7	-92.3
2.8	-91.74
2.9	-92.26
3.0	-94.19
3.1	-93.02

Time (sec)	Vehicle roll angle (degrees)
3.2	-92.3
3.3	-92.57
3.4	-93.09
3.5	-92.73
3.6	-92.42
3.7	-91.58
3.8	-90.96
3.9	-90.3
4.0	-91.31
4.1	-91.34
4.2	-90.85
4.3	-90.48
4.4	-89.76
4.5	-89.79
4.6	-88.9
4.7	-88.22
4.8	-88.15
4.9	-89.2
5.0	-90.2

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 33 54 2D 31 34 42 33 32 31 2D 41 48 00 00 00 00 00 00 00 00 00 00

37 31 30 31 31 35 31 31 30 30 30 30 30 30 30 30

42 43 33 54 2D 31 34 43 30 32 38 2D 41 42 00 00 00 00 00 00 00 00 00 00

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0C CE 0C 7F 00 00 00 00 00 00 00 00 00 00 00 00

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74 A2 41 D1 00 00 00 00 00 00 00 00 00 00 00 00

0C CE 5B 49 00 00 00 00 00 00 00 00 00 00 00 00

31 46 44 30 58 34 48 54 32 42 45 2A 2A 2A 2A 2A 2A

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Event Record 1

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FF 44 F1 32 F1 90 F2 9C F3 9D F5 87 F5 06 F8 EC F9 22 FA 30 F7 61 F4 EF F0 EE F0
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A5 C3 2A D0 8F D6 4D E1 3C ED E4 EB 2C E6 C9 E5 83 EE 0F F0 9F EE 37 E9 7A EC 82
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Event Record 2

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DOT HS 813 677
January 2025

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

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