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**Special Crash Investigations:
On-Site Child Restraint System
Crash Investigation;
Vehicle: 2007 Mitsubishi
Outlander;
Location: Indiana;
Crash Date: January 2023**

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Special Crash Investigations
On-Site Child Restraint System Crash Investigation
Case Number: CR23004
Vehicle: 2007 Mitsubishi Outlander
Location: Indiana
Crash Date: January 2023

Background

This report documents the on-site investigation of a side-impact crash of a 2007 Mitsubishi Outlander (Figure 1) and a 2002 Ford F-250 (Figure 2), which resulted in fatal injuries to the Mitsubishi's second-row right passenger (belted 8-month-old male) who was seated in a rear-facing child restraint system (CRS). The Mitsubishi was driven by a 31-year-old belted female and was also occupied by a belted 5-year-old female in a booster seat in the second-row left seat position. The driver sustained police reported incapacitating (A-Level) injuries and the second-row left passenger sustained police-reported non-incapacitating (B-level) injuries. Both were transported to a local hospital where they were treated. The extent of treatment for the driver and second-row left passenger is unknown. The Ford was occupied by a restrained 38-year-old male driver who was not injured.



Figure 1. Right oblique view of the 2007 Mitsubishi Outlander



Figure 2. Left oblique view of the 2002 Ford F-250

The crash occurred when the Mitsubishi and Ford entered an intersection at the same time. The Ford's front struck the right side of the Mitsubishi. The Mitsubishi and Ford departed the roadway, rotating clockwise, southwest of the intersection where they both came to final rest facing northeast.

The crash was identified by Crash Research & Analysis, Inc., through an online search of police crash reports (PCRs) and the PCR was forwarded to NHTSA's Special Crash Investigations (SCI) Group for review in January 2023. NHTSA assigned the crash for on-site investigation in January 2023. Cooperation with the Mitsubishi's insurer and the Ford's insurer's attorney was obtained, and the vehicles were inspected in January 2023.

The rear-facing CRS, which was in the second-row right seating position, was held by the police and the SCI team obtained cooperation to inspect the CRS in January 2023. At the time of this report the make and model of the CRS in Mitsubishi's second-row left position was unknown.

The key for the Mitsubishi was not available at the time of the inspection and the attorney did not

want to disassemble the vehicle to access the module due to pending litigation; therefore the event data recorder (EDR) was not able to be downloaded at the time of the inspection. Local law enforcement has a copy of the EDR and a request was made by the SCI Investigator. The Mitsubishi's EDR report has not been made available to SCI. The EDR for the Ford was imaged during the SCI inspection and is attached at the end of this report as Appendix A.

Summary

Crash Site

The crash occurred during the day on a two-lane, undivided county roadway at a four-leg intersection. The intersection had stop signs for the east and westbound travel lanes (Figure 3) that were upright and visible. There were no traffic controls for the north and southbound (Figure 4) lanes. The weather was cloudy skies, a temperature of -2.7 °C (27 °F), 75 percent humidity, light rain, and winds from the southeast at 10 km/h (6 mph). Travel lanes were 3 m (9.8 ft) wide and were separated by a double yellow centerline. The bituminous road surface had no paved shoulders, and the speed limit was 89 km/h (55 mph). On approach to the intersection, the westbound travel lane had a positive grade of 4 percent while the southbound travel lane had a positive grade of 3 percent. A crash diagram is included at the end of this report.



Figure 3. Westbound view of the Mitsubishi's approach to the crash site



Figure 4. Southbound view of the Ford's approach to the crash site

Pre-Crash

The Mitsubishi was traveling west and stopped at the intersection. The Mitsubishi driver accelerated and intended to pass through the intersection. The Ford was traveling south at an unknown speed approaching the intersection. EDR data for the Ford did not provide any pre-crash speeds. Both vehicles entered the intersection at the same time.

Crash

The Ford's front struck the right side of the Mitsubishi (Event 1). The impact induced a clockwise rotation to the Mitsubishi. It rotated 100° and departed the intersection's southwest corner. The front bumper fascia came in contact with the ground (Event 2) causing the bumper fascia to be torn off as it came to final rest facing northeast. The Ford rotated clockwise 180° and exited the roadway just south of the intersection's southwest corner where it came to final rest, facing northeast, approximately 6 m (20 ft) southeast of the Mitsubishi.

Post-Crash

The Mitsubishi driver exited the vehicle through the driver's door under her own power, was treated on scene by emergency personnel, and then was transported to a local hospital by ambulance. The extent of her treatment is unknown. Emergency personnel removed the second-row left passenger from the vehicle and transported her to a local hospital by ambulance.

Medical records were requested for the driver and second-row left passenger, but were denied. The extent of their treatment is unknown. The second-row right passenger was removed from the vehicle and transported to a level II trauma center by ambulance where he was pronounced deceased the next day. The CRS for the male passenger was taken into police custody and placed into evidence. The Ford driver exited his vehicle under his own power. He was taken to a hospital by a family member, at the request of local law enforcement, but denied any injuries.

2007 Mitsubishi Outlander

Description

The 2007 Mitsubishi Outlander (Figure 5) was identified by the VIN JA4MT41X57Zxxxxxx. The Mitsubishi was an all-wheel drive SUV powered by a 3.0-liter, 6-cylinder, gasoline engine linked to a 6-speed automatic transmission. Its service brakes were power-assisted 4-wheel disc with antilock (ABS). The gross vehicle weight rating was 2,350 kg (5,181 lb). The manufacturer's recommended tire size was P225/55R18 and the vehicle had Hankook Kinergy PT tires of the recommended size. All tires were in good condition prior to the crash with tread greater than 6 mm (8/32 in).



Figure 5. Left oblique view of the 2007 Mitsubishi Outlander

The Mitsubishi interior had seating for seven occupants (2/3/2), with front-row bucket seats, second-row adjustable split-bench seats with folding backs, and a stowable third-row bench seat. All seating positions had adjustable head restraints. Manual restraint systems had 3-point lap and shoulder belts for all seating positions except the second-row center position that had an integrated lap and shoulder belt that came from the top of its back support. Supplemental restraint systems included front-seat belt pretensioners, six air bags consisting of driver's and passenger's frontal, front outboard seat-mounted side impact, and inflatable curtain (IC) air bags.

Exterior Damage

The crash resulted in damage to the Mitsubishi's right side (Figure 6). The direct damage began 145 cm (57.1 in) aft of the right front axle extending rearward 193 cm (75.9 in). The field-L started 127 cm (50.0 in) aft of the right front axle and extended 215 cm (84.6 in) rearward. The crush measurements, taken at mid-door level, were C1 = 9 cm (3.5 in), C2 = 6 cm (2.4 in), C3 = 13 cm (5.1 in), C4 = 13 cm (5.1 in), C5 = 6 cm (2.4 in), and C6 = 0 cm. Maximum crush was 25 cm (9.8 in) located 322 cm (126.8 in) rear of the right front axle. The WinSMASH program's damage algorithm calculated the Mitsubishi's total delta V as 25 km/h (15.5 mph). The longitudinal and lateral velocity changes were -9 km/h (-5.5 mph) and -23 km/h (-14.2 mph). The collision fits model, results appear low. The collision deformation classification (CDC) for this profile was 02RZEW3.



Figure 6. View of the right-side damage of the 2007 Mitsubishi Outlander

Damage to the Mitsubishi's front bumper was observed during the SCI inspection. This damage was attributed to the ground pulling on the fascia as it rotated off the road in a rearward direction. The CDC for this profile was 00UFR999.

Event Data Recorder

The Mitsubishi had an air bag control module (ACM) that performed diagnostic, sensing, and deployment command functions for the supplemental restraint systems. Attempts to image the EDR component with the Bosch Crash Data Retrieval tool using the Data Link Connector (DLC) port and then the fuse block method was unsuccessful due to not having the vehicle's key. A request was made to the Ford insurer's attorney present at inspection to directly connect to the module. The Ford insurer's attorney advised the SCI investigator that they cannot disassemble the vehicle in any way due to potential litigation. The SCI investigator contacted the police to confirm they imaged the EDR and how they completed it. The police advised they had the key at the time and were able to image the EDR through the DLC port. A request for a copy of the EDR data was made and the police advised that they would provide the data once their incident report was closed, typically in 30 to 60 days. Several attempts were made, over several months, to obtain a copy of the EDR. The investigating officer stated that he would speak with the prosecuting attorney's office and would "get back" to the SCI investigator. Several attempts to obtain a copy of the EDR data have been made with no success.

Interior Damage

No contact evidence was observed during the SCI inspection of the interior. The Mitsubishi's interior sustained damage that included lateral intrusions (Figure 7) due to impact with the Ford. In the second row, the maximum lateral intrusion was 20 cm (7.8 in) located at the right door rear upper quadrant. Lateral intrusion at the C-pillar was 16 cm (6.2 in). The bottom of the right seat separated from the seat track mount (Figure 8) during the crash sequence. This resulted in the seat cushion deforming 7 cm (2.7 in) laterally and the seatback shifting laterally, to the left, 20 cm (7.8 in). The second-row left floor pan also intruded vertically an estimated 3 to 8 cm (1 to 3 in).



Figure 7. View of the interior of the Mitsubishi depicting the intrusion of the right rear door and shifting of the right seating position



Figure 8. View of the interior of the Mitsubishi depicting the second-row right seating position track mount

Manual Restraint System

The Mitsubishi had manual 3-point lap and shoulder seat belts for all seven seating positions. All the 3-point lap and shoulder belt systems had continuous loop webbing with sliding latch plates. The driver's and front passenger's seat belt systems had retractor pretensioners. All seat belt systems retracted onto an emergency locking retractors.

The driver's seat belt was used during the crash sequence. It is unknown if the driver's seat belt pretensioner actuated. EDR data has not been obtained at the time of this report and the seat belt extended and retracted from the B-pillar freely. The buckle showed signs of historical use. Light abrasions on the buckle plastic indicated loading that correlates with the crash.

The second-row left seating position seat belt system was used during the crash sequence with an unknown booster seat. The evidence on the buckle and abrasions on the belt indicated the seat belt was being used to secure a CRS to the seat. The buckle showed signs of historical use on the plate itself and loading on the buckle plastic that correlates with the crash.

The second-row right seat belt was not used during the crash sequence. At the time of the inspection the seat belt was jammed between interior components that intruded. The passenger was secured in a rear-facing CRS secured to the seat by its base using the Lower Anchors and Tethers for Children (LATCH) system.

Supplemental Restraint System

The Mitsubishi had several supplemental restraints for the occupants. These included dual-stage driver's and passenger's frontal air bags, front outboard seat-mounted side impact air bags, and IC air bags. The owner's manual¹ states that the side impact and IC air bags would deploy for moderate to severe side impacts to the middle of the passenger compartment. They would not always deploy in every rollover or offset side impact to the vehicle's front or rear. Deployment would be determined by the severity of the impact.

The driver's frontal, right seat-mounted, and right IC air bags deployed during the incident.

No frontal impact occurred that would result in the deployment of the driver's frontal air bag (Figure 9). The driver's frontal air bag deployment was due to the deceleration from the side impact. No contact evidence was noted on the driver's frontal air bag.



Figure 9. View of the driver's deployed frontal air bag in the Mitsubishi

The right IC air bag (Figure 10) deployed during the crash sequence. The right IC air bag extended downward 55 cm (21.7 in) in its deflated state. No contact evidence was noted on the right IC air bag.

¹ Mitsubishi. (2007) 2007 Mitsubishi Outlander: Owner's Manual.



Figure 10. View of the right IC air bag deployed in the Mitsubishi

Child Restraint Systems

The CRS for the second-row left passenger was a booster seat of unknown manufacture. Evidence on the bottom seat cushion, indicated by the yellow arrow in Figure 11, and seat belt usage indicate that a CRS was in this seating position. There was no booster seat in the vehicle at the time of the SCI inspection. An interview with the Ford driver resulted in confirmation that the child in this seating position was secured to a combination CRS using a 5-point harness.

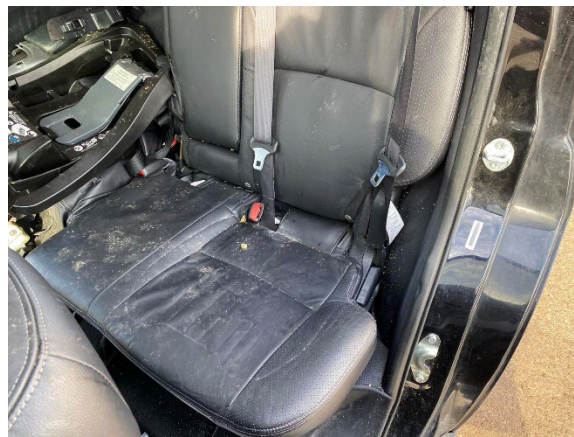


Figure 11. View of CRS impressions on the second-row left seating position in the Mitsubishi

Local law enforcement had possession of the second-row right CRS as evidence and would not allow the SCI investigator to reconstruct the CRS's position at the time of the crash during the vehicle's inspection. The CRS for the second-row right passenger was an Evenflo Litemax Omni (Figure 12). The CRS was designed to be used only as rear-facing with a 5-point harness to secure the child. The harness webbing was routed through the third highest of four slots in the shell's back. In this crash, the CRS was secured within the base that was secured to the seat by the LATCH system, which was routed through the carrier base and each end was attached to the vehicle's lower anchors at the second-row right seat position. According to medical records, the infant weighed 9 kg (19 lb) and was within the manufacturer's recommended weight of 1.8 – 16

kg (4 to 35 lb) for using the CRS. The manufacturer label (Figure 13) indicated that it was produced on December 24, 2020, with an expiration date of December 24, 2026.

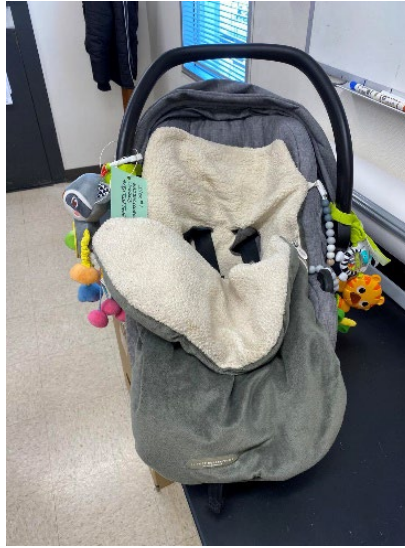


Figure 12. CRS that was secured in the second-row right seating position of the Mitsubishi



Figure 13. Manufacturer label on CRS

The child was seated within a JJ Cole Collections Bundleme (Figure 14) aftermarket (non-approved) padding. The Bundleme was designed to eliminate blankets in the CRS while allowing the Bundleme padding to not interfere with the belt system of a CRS. At the time of the SCI inspection, there were stains on the Bundleme that were located on the top right and middle right of the interior padding (Figure 15). It should be noted that these were on the opposite side of where the force of the impact initially occurred.

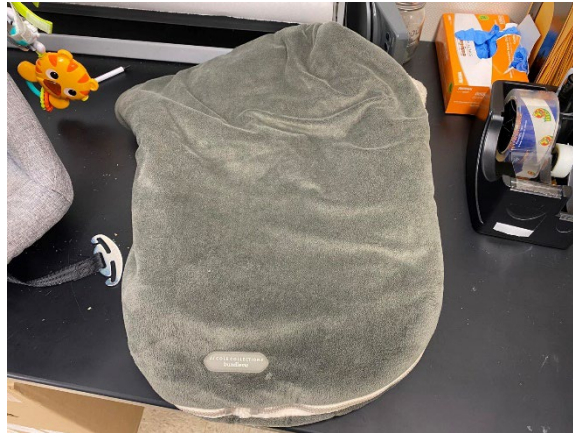


Figure 14. JJ Cole Collections Bundleme padding that was secured in the CRS located in the second-row right seating position of the Mitsubishi

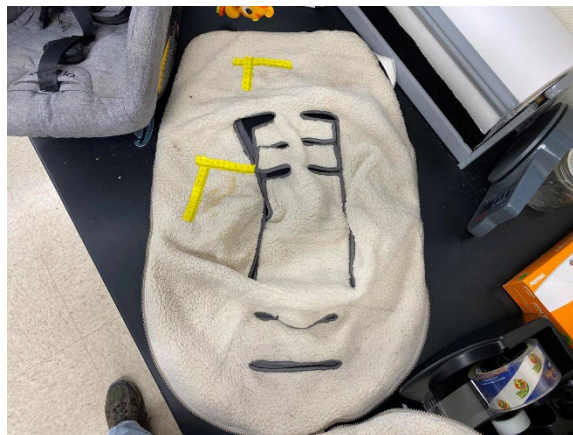


Figure 15. Stains located within the JJ Cole Collections Bundleme padding at the time of SCI inspection

During the SCI inspection, the grey manufacturer padding was removed from the CRS and polystyrene foam (Figure 16) was found to be damaged. The inboard surface of the CRS polystyrene foam was cracked vertically due to the compression of the intruding door. The CRS's left side had two indentions (Figure 17) within the polystyrene foam indicative of an object or occupant contacting the polystyrene foam.

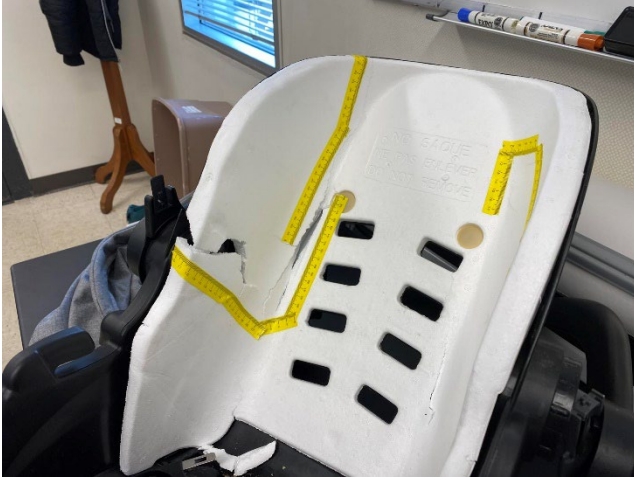


Figure 16. View of the polystyrene foam padding on the seat back of the CRS



Figure 17. View of contact points on the left side of the CRS

At the time of the inspection, the CRS base (Figure 18) appeared to have been secured properly to the anchor points located in the second-row right seating position. Due to the extent of the damage to the interior, it cannot be determined if the CRS base was level at the time of installation or not. The manufacturer label (Figure 19) stated that it was produced on September 20, 2021, with an expiration date of September 20, 2027.



Figure 18. CRS base that was secured in the second-row right seat of the Mitsubishi

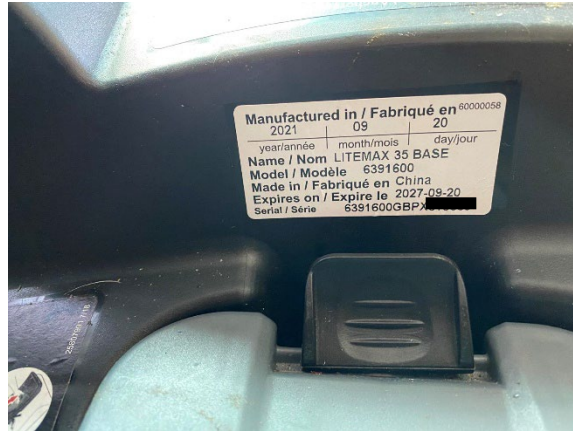


Figure 19. Manufacturer label on CRS base

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2007 Mitsubishi Outlander Occupants

Driver Demographics

Age/sex: 31 years/female
Height: Unknown
Weight: Unknown
Eyewear: Unknown
Seat type: Forward-facing bucket seat with adjustable head restraint
Seat track: Rear-most track position
Manual restraint usage: Lap and shoulder belt
Usage source: Vehicle inspection, PCR
Air bags: Frontal, seat-mounted side impact, and IC bag available; frontal deployed
Alcohol/drug involvement: Unknown
Egress from vehicle: Exited vehicle under own power
Transport from scene: Ambulance to local hospital
Type of medical treatment: Unknown

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Unknown	N/A	N/A	N/A

Source: Medical request rejected (no medical release).

Driver Kinematics

At the time of the crash the driver was restrained by the lap and shoulder seat belt and the driver's seat was at the rearmost track position. The impact with the Ford displaced the driver laterally to the right. As the vehicle rotated clockwise after impact, she remained secured in her seat by the seat belt until the vehicle came to final rest.

The driver exited the vehicle through the driver's door under her own power. The driver sustained police-reported A-level injuries and was transported to a local hospital where the extent of her treatment is unknown. Medical records were requested but denied by the local hospital. The driver failed to respond to interview attempts.

Second-Row Left Passenger Demographics

Age/sex: 5 years/female
Height: Unknown
Weight: Unknown
Eyewear: Unknown
Seat type: Combination CRS on a split bench with folding back
Seat track position: Rear-most track position
Manual restraint use: Lap and shoulder belt with combination CRS
Usage source: Vehicle inspection
Air bags: IC bag available; not deployed

Egress from vehicle: Removed by rescue personnel/bystanders
 Transport from scene: Transported by land to local hospital
 Type of medical treatment: Unknown

Second-Row Left Passenger Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Unknown	N/A	N/A	N/A

Source: Medical request denied (no medical release).

Second-Row Left Passenger Kinematics

The 5-year-old female passenger was secured in the vehicle by the harness straps of a combination CRS. The passenger's seat was at the rear-most track position at the time of inspection. The impact with the Ford displaced the child to the right. As the vehicle rotated clockwise after impact, she remained secure in her seat until the vehicle came to final rest.

The child sustained police reported B-level injuries and was transported by ambulance to a local hospital where the extent of treatment is unknown. Medical records were requested but denied by the local hospital.

Second-Row Right Passenger Demographics

Age/sex: 8 months/male
 Height: Unknown
 Weight: 9 kg (19 lb)
 Eyewear: Unknown
 Seat type: Rear-facing CRS secured by LATCH on a split bench with folding back
 Seat track position: Rear-most track position
 Manual restraint use: None used
 Usage source: Vehicle inspection
 Air bags: IC bag available; deployed
 Egress from vehicle: Removed by rescue personnel/bystanders
 Transport from scene: Transported by land to Level II trauma center
 Type of medical treatment: Hospitalized for 1 day; fatal

Second-Row Right Passenger Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Subarachnoid hemorrhage extending from bilateral cerebral hemispheres to fourth ventricle and premedullary cisterns	140677.4	Tandem IPC Primary: Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle)	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
			Secondary: Right Door Panel – Right forward upper quadrant	Possible
2	Extensive subarachnoid hemorrhage throughout right cerebral hemisphere	140695.3	Tandem IPC Primary: Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle) Secondary: Right Door Panel – Right forward upper quadrant	Certain Possible
3	Extensive subarachnoid hemorrhage throughout left cerebral hemisphere	140695.3	Tandem IPC Primary: Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle) Secondary: Right Door Panel – Right forward upper quadrant	Certain Possible
4	Cerebral edema, NFS	140668.3	Tandem IPC Primary: Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle) Secondary: Right Door Panel – Right forward upper quadrant	Certain Possible
5	At least one small 4 mm spleen laceration with active perisplenic bleeding; OIS III-IV	544224.3	Tandem IPC Primary: Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle) Secondary: Right Door Panel – Right forward upper quadrant	Certain Possible
6	Bruising to forehead	210402.1	Isolated Interior – Child safety seat shell (i.e., interior, exterior, base, cup holder, padding, head restraint, handle)	Certain
7	Bruising to right proximal medial thigh	810402.1	Isolated Interior – Child safety seat harness system (i.e., straps,	Probable

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
			retainer clip, latchplate, buckle)	
8	Bruising to left proximal medial thigh	810402.1	Isolated Interior – Child safety seat harness system (i.e., straps, retainer clip, latchplate, buckle)	Probable

Source: Hospital records.

Second-Row Right Passenger Kinematics

At the time of the crash the 8-month-old passenger was seated in his rear-facing CRS and secured by the CRS's 5-point harness. The seat was at the rear-most track position at the time of inspection. The impact with the Ford displaced the infant right, toward the right rear door. As the vehicle rotated clockwise after impact, he remained secured in his CRS until the vehicle came to final rest. His left side struck the CRS's left side during the initial impact. He sustained severe brain injuries from contact with the CRS shell, and by the intruding right rear door. He also sustained a spleen laceration caused by his abdomen/torso contacting the CRS shell, and by the door. In addition to these injuries, the infant sustained a left hemopneumothorax and buckle fractures to his right third and fourth anterior ribs; however, these injuries were determined to be caused by resuscitation efforts. He was transported by ambulance to a level II trauma center where he was hospitalized for one day before being pronounced deceased.

2002 Ford F-250

Description

The 2002 Ford F-250 (Figure 20) was identified by the VIN 1FTNX21LX2Exxxxxx. The Ford was a 4-door, 4-wheel drive pickup truck powered by a 5.4-liter 8-cylinder gasoline engine linked to a continuously variable transmission. Its service brakes were power-assisted 4-wheel disc with ABS. The Ford had a Firestone Steelex Radial A/T tire, size LT265/75R16, on the left front wheel and Cooper Discover A/T3 tires, size LT265/75R16, on the left rear, right rear, and right front wheels. No damage was discovered to any of the tires. The Ford had driver's and front-row passenger's frontal air bags. The driver's frontal air bag deployed during the crash sequence.



Figure 20. Front right oblique view of the 2002 Ford F-250

Exterior Damage

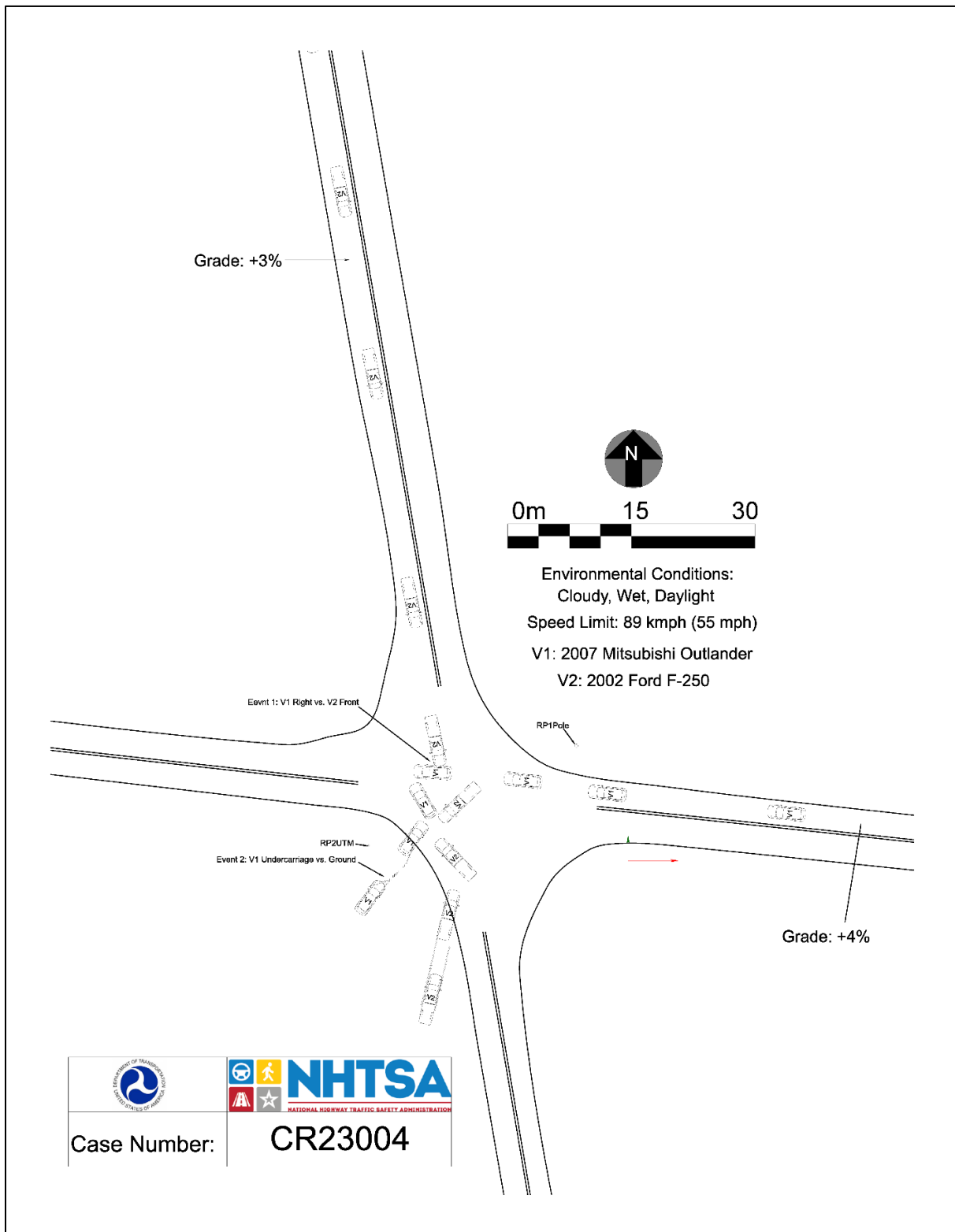
The Ford sustained direct damage to the front during the crash with the Mitsubishi. The direct damage started 88 cm (34.6 in) left of center extending right 176 cm (69.3 in). The field-L started 88 cm (34.6 in) left of center extending right 176 cm (69.3 in) rearward. The crush measurements, taken at bumper level, were C1= 1 cm (0.4 in), C2 = 8 cm (3.1 in), C3 = 18 cm (7.1 in), C4 = 32 cm (12.6 in), C5 = 19 cm (7.5 in), and C6 = 32 cm (12.6 in). Maximum crush was 32 cm (12.5 in) located 15 cm (5.9 in) right of the front center point. The damage algorithm of the WinSMASH program calculated the Ford's total delta V as 16 km/h (9.9 mph). The longitudinal and lateral velocity changes were -16 km/h (-9.9 mph) and 3 km/h (1.8 mph). The analysis fit the collision model and the results appeared low. The CDC for this damage profile was 12FDEW2.

Event Data Recorder

The Ford had an ACM that performed diagnostic, sensing, and deployment command functions for the vehicle's supplemental restraint systems. The EDR data was limited and did not record vehicle speed, throttle position, brake on-off, and additional data that may be recorded in other Fords within the same manufacturer year. This data was limited to crash pulse and deployment status of air bags and pretensioners. The maximum recorded longitudinal delta V was -24.4 km/h

(-15.46 mph) at 116 msec. The EDR data was imaged with the Bosch Crash Data Retrieval tool and software version 23.0.2 via the DLC port. The imaged data is reported with version 26.0.1693. The imaged EDR data is included at the end of this report as an Appendix.

Crash Diagram



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Appendix A: The 2002 Ford F-250 Event Data Recorder Report²

² 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	1FTNX21LX2E*****
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CR23004_V2_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 23.0.2
Imaged with Software Licensed to (Company Name)	Company Name information was removed when this file was saved without VIN sequence number
Reported with CDR version	Crash Data Retrieval Tool 26.0.1693
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Deployment

Comments

No comments entered.

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

Data Limitations

Important Limitations on Bosch Crash Data Retrieval (CDR) Tool Capabilities.

Disclaimer: This Restraint Control Module (RCM) records longitudinal deceleration data for the purpose of understanding the input data the Restraint Control Module used to determine whether or not to deploy restraint devices. This module does not record vehicle speed, throttle position, brake on-off, and other data, which may be recorded in some 1999 model year and later General Motors modules. The deceleration data recorded by Ford's module during a crash can subsequently be mathematically integrated into a longitudinal Delta-V. Delta-V is the change in velocity during the recording time and is NOT the speed the vehicle was traveling before the accident, and is also not the Barrier Equivalent Velocity. The Bosch CDR Tool will read and interpret both acceleration in G's and Delta-V in mph. RCM's in Ford vehicles that can be read by the Bosch CDR tool are listed in the Bosch Help Files.

Important

If there is any question that the restraint system did not perform as it was designed to perform, please read the system only through the diagnostic link connector. The Bosch CDR kit provides an RCM interface cable to plug directly into the restraint control module. The Bosch CDR RCM Interface Cable connects only power, ground, and memory read pins to the relevant vehicle restraint control module. The other RCM pins normally connect to inputs, such as sensors, and outputs, such as airbags, are not connected when you use the RCM Interface Cable to plug directly into the module. Since the vehicle restraint control module is constantly monitoring airbag system readiness (when powered), it will detect that the sensors and airbags are not connected. The restraint control module may record a new diagnostic trouble code into memory for each device that is not connected. These new diagnostic trouble codes may record over previously written diagnostic trouble codes present prior to the accident and spoil evidence necessary to determine if the restraint system performed in the accident as it was designed to perform. Not only could this prevent Ford from being able to determine if the system performed as it was designed to perform, but, regardless of innocent inadvertence, you could raise issues of evidence spoliation in any litigation that may arise out of the accident. If you cannot read the module via the diagnostic link connector, and if you suspect improper system performance, contact Ford Motor Company and request their assistance to read the module with a proper vehicle simulator attached.

While data stored in RCM's is accurate, accident reconstructionists must be aware of the limitations of the data recorded in Ford's control modules and should compare the recorded data with the physical evidence at the accident scene using professional accident reconstruction techniques (i.e. vehicle crush characteristics, skid marks, etc) before making any assumptions about the import and validity of the data recorded in the module with respect to the crash event being analyzed. The following describes specific limitations that must be considered when analyzing recorded data. Investigators should obtain permission of the vehicle owner or have sufficient legal authority prior to reading any data.

1. There may be no deceleration data recorded in the module.

1FTNX21LX2E*****

Loss of power (cut wires, damaged battery, crushed fuse box) to the module during or immediately after the crash may prevent the crash data from being recorded. A backup power supply within the module has sufficient power to continue to analyze the deceleration data and deploy restraint devices if needed, but there is no backup power for recording.

If the deceleration input does not create a vehicle longitudinal Delta-V above 4 mph within 100 milliseconds, there may not be any data recorded.

2. In unusual circumstances, deceleration data stored in the module may be from a crash other than the one you are currently analyzing.

The module will record data from some non-deploy events. If, after the module has recorded data from a non-deploy event, and there is a subsequent event in which there is a loss of power and no new recording is made for that subsequent event, the deceleration data in the module's memory may be from the prior event. If the new, subsequent event is a deploy event and recording has occurred, the deployment times should be recorded. If there are no deployment times recorded, but airbags or other restraint devices are observed to have deployed, the recorded data that you read are most likely from a prior event.

Once an airbag or other restraint device has been commanded to deploy, the data recorded in connection with that deployment are "locked", and subsequent crashes cannot be recorded.

If a vehicle is being repaired, the RCM should be replaced after any crash in which restraint devices deploy. Early printed shop manuals refer to re-using modules by clearing the "crash data memory full" code, but this is no longer true and the latest on-line electronic shop manual directs that modules be replaced.

Crashes that involve multiple impacts will record only one of the impacts. If there is a deployment, the deployment event will be recorded and locked. If no restraint device is commanded to deploy, the recorded data are not "locked", and subsequent impacts may record over any previous recorded data. Further analysis will be required to determine which of the events was actually recorded.

3. The computed longitudinal Delta-V may understate the total Delta-V

Many real-world crashes can last longer than the memory has the capacity to record. Therefore, the actual Delta-V of the event may be higher than the Delta-V calculated and displayed by the Bosch CDR System output. Review the end of the longitudinal acceleration/deceleration pulse - if it has not settled to zero G's by the end of the recording, the vehicle longitudinal Delta-V is most likely understated. If there is a clear decaying trend line you may choose, at your own risk, to estimate the total Delta-V by extrapolating the decay trend to zero and to calculate the additional Delta-V not captured.

Under some circumstances where power is interrupted, during the recording of data, or the module re-sets during the recording of data, a partial recording may occur. This will be shown as "no data" in the data table and will not be plotted on the graph of acceleration. When some portion of the acceleration data is not recorded, the Delta-V during that time cannot be calculated. A Delta-V will be calculated for the points that are valid, but the user must be aware that the partial Delta-V calculated will further underestimate the actual event total Delta-V.

4. This module records only longitudinal acceleration/deceleration of the vehicle. You must compute lateral or resultant total acceleration based on your estimated Principal Direction of Force (PDOF).

5. Vertical acceleration/decelerations are not recorded. Vehicle spin about a point not centered on the Restraints Control Module sensor may add or subtract from bulk vehicle motion.

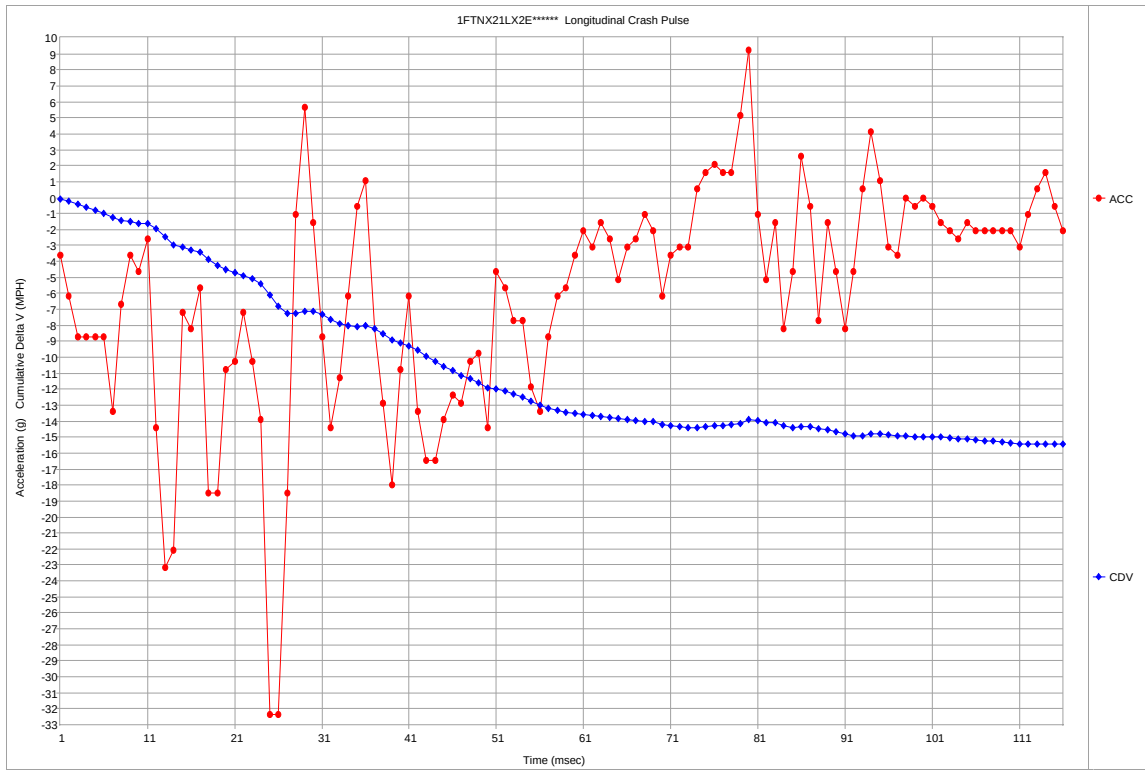
6. This module is not intended to record acceleration/deceleration in a side-impact event. If the side impact generates a longitudinal deceleration component sufficient to wake up the frontal deployment algorithm, there may be a recording of longitudinal deceleration in a side impact event.

Any Longitudinal Delta-V determined by using data read from the air bag module should be verified with physical evidence from the crash (such as vehicle crush, skid marks) and assumed accident sequence. Multiple impacts, angular collisions, side impacts, vehicle spin, etc should be considered in addition to the data read from the air bag module.

02001_RCM-1_r002

System Status At Deployment

Diagnostic codes active when event occurred	0
Passenger Airbag Switch Position During Event	Deactivated
Time From Side Safing Decision to Left (Driver) Side Bag Deployment (msec)	Not Deployed
Frontal and Pretensioner Fire time (ms)	26



Crash Pulse Data

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
1	-3.60	-0.08
2	-6.17	-0.21
3	-8.74	-0.41
4	-8.74	-0.60
5	-8.74	-0.79
6	-8.74	-0.98
7	-13.36	-1.28
8	-6.68	-1.42
9	-3.60	-1.50
10	-4.63	-1.60
11	-2.57	-1.66
12	-14.39	-1.97
13	-23.13	-2.48
14	-22.10	-2.97
15	-7.20	-3.13
16	-8.22	-3.31
17	-5.65	-3.43
18	-18.50	-3.84
19	-18.50	-4.24
20	-10.79	-4.48
21	-10.28	-4.71
22	-7.20	-4.86
23	-10.28	-5.09
24	-13.88	-5.39
25	-32.38	-6.11
26	-32.38	-6.82
27	-18.50	-7.22
28	-1.03	-7.24
29	5.65	-7.12
30	-1.54	-7.15
31	-8.74	-7.35
32	-14.39	-7.66
33	-11.31	-7.91
34	-6.17	-8.05
35	-0.51	-8.06
36	1.03	-8.03
37	-8.22	-8.22
38	-12.85	-8.50
39	-17.99	-8.89
40	-10.79	-9.13
41	-6.17	-9.26
42	-13.36	-9.56
43	-16.45	-9.92
44	-16.45	-10.28
45	-13.88	-10.59
46	-12.34	-10.86
47	-12.85	-11.14
48	-10.28	-11.36
49	-9.77	-11.58
50	-14.39	-11.89
51	-4.63	-12.00
52	-5.65	-12.12
53	-7.71	-12.29

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
54	-7.71	-12.46
55	-11.82	-12.72
56	-13.36	-13.01
57	-8.74	-13.20
58	-6.17	-13.34
59	-5.65	-13.46
60	-3.60	-13.54
61	-2.06	-13.59
62	-3.08	-13.65
63	-1.54	-13.69
64	-2.57	-13.74
65	-5.14	-13.86
66	-3.08	-13.93
67	-2.57	-13.98
68	-1.03	-14.00
69	-2.06	-14.05
70	-6.17	-14.19
71	-3.60	-14.26
72	-3.08	-14.33
73	-3.08	-14.40
74	0.51	-14.39
75	1.54	-14.35
76	2.06	-14.31
77	1.54	-14.28
78	1.54	-14.24
79	5.14	-14.13
80	9.25	-13.93
81	-1.03	-13.95
82	-5.14	-14.06
83	-1.54	-14.09
84	-8.22	-14.28
85	-4.63	-14.38
86	2.57	-14.32
87	-0.51	-14.33
88	-7.71	-14.50
89	-1.54	-14.53
90	-4.63	-14.64
91	-8.22	-14.82
92	-4.63	-14.92
93	0.51	-14.91
94	4.11	-14.82
95	1.03	-14.79
96	-3.08	-14.86
97	-3.60	-14.94
98	0.00	-14.94
99	-0.51	-14.95
100	0.00	-14.95
101	-0.51	-14.96
102	-1.54	-15.00
103	-2.06	-15.04
104	-2.57	-15.10
105	-1.54	-15.13
106	-2.06	-15.18
107	-2.06	-15.22
108	-2.06	-15.27
109	-2.06	-15.31

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
110	-2.06	-15.36
111	-3.08	-15.43
112	-1.03	-15.45
113	0.51	-15.44
114	1.54	-15.40
115	-0.51	-15.42
116	-2.06	-15.46

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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0800: A6 42 40 5F 14 A2 58 2D 0D 23 0F 2D 38 4C C8 FF
0810: 10 FF ED 13 3C 78 F1 9E 08 A2 F9 EF 19 99 52 49
0820: 2D 03 B3 43 1E 0A F5 0A A1 5E 03 0E 1D 1E 00 25
0830: 3C 3C 80 28 05 28 B4 07 28 18 20 0C 03 84 B7 09
0840: 04 05 0B 05 AD 42 0A 06 5E 00 64 00 B4 0B B8 03
0850: E8 09 60 11 30 05 78 09 60 01 4A 00 C2 00 C9 0B
0860: B8 11 94 03 20 00 08 00 0F 00 12 02 8A 05 78 75
0870: 30 00 32 00 C8 01 B7 07 D0 03 20 00 C8 04 45 01
0880: DC 00 2A 00 C8 00 DC 04 51 32 1E 40 40 01 FA 3C
0890: 32 2D 14 0A 82 17 55 C8 32 1E 02 18 31 03 FF 52
08A0: 14 FF 50 41 6E DC 43 FF FF FF FF FF FF FF FF 29
08B0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
08C0: 04 FF FF FF FF FF FF 57 09 63 31 43 33 41 02 03 13
08D0: 0F 40 3F 11 41 3F 02 F5 80 21 F5 80 09 F5 80 FF
08E0: 00 FF 79 11 FE 00 0F FE 00 00 FF 00 32 FF 00 FF
08F0: 05 82 02 00 0A 00 04 FF FF FF FF FF FF FF FF 00 00
0900: 06 31 41 29 69 26 FF FF FF 03 44 AA AA FF FF AA
0910: AA 90 08 76 25 FF FF 04 60 44 19 91 21 45 FF 02
0920: 95 90 8B 8B 8B 8B 82 8F 95 93 97 80 6F 71 8E 8C
0930: 91 78 78 87 88 8E 88 81 5D 5D 78 9A A7 99 8B 80
0940: 86 90 9B 9E 8C 83 79 87 90 82 7C 7C 81 84 83 88
0950: 89 80 93 91 8D 8D 85 82 8B 90 91 95 98 96 99 97
0960: 92 96 97 9A 98 90 95 96 96 9D 9F A0 9F 9F A6 AE
0970: 9A 92 99 8C 93 A1 9B 8D 99 93 8C 93 9D A4 9E 96
0980: 95 9C 9B 9C 9B 99 98 97 99 98 98 98 98 98 96 9A
0990: 9D 9F 9B 98 9C CA 00 00 D8 9D 00 6A 00 00 00 00
09A0: 00 00 00 67 00 00 00 40 00 39 00 51 00 00 00 03
09B0: 00 68 00 00 00 68 00 C8 02 88 00 00 00 00 00 00
09C0: 00 00 68 FF 00 FF FF 03 D6 00 FF FF FF FF FF FF
09D0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
09E0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
09F0: FF FF FF FF FF FF FF FF FF FF FF FF FF FF FF
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Disclaimer of Liability

The users of the CDR product and reviewers of the CDR reports and exported data shall ensure that data and information supplied is applicable to the vehicle, vehicle's system(s) and the vehicle ECU. Robert Bosch LLC and all its directors, officers, employees and members shall not be liable for damages arising out of or related to incorrect, incomplete or misinterpreted software and/or data. Robert Bosch LLC expressly excludes all liability for incidental, consequential, special or punitive damages arising from or related to the CDR data, CDR software or use thereof.

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

