U.S. Department
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National Highway
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Administration

NHTSA

DOT HS 812 637

May 2019

Special Crash Investigations On-Site Guardrail End Treatment Investigation

Vehicle: 2016 Chevrolet K1500 Silverado

Location: Missouri

Crash Date: February 2017

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

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

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

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Technical Report Documentation Page

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16. Abstract

This report documents the on-site investigation of a Chevrolet pickup truck that struck an X-Lite guardrail end terminal, a crash of interest to the Federal Highway Administration. This crash occurred on the median roadside of a four-lane, divided interstate highway. The Chevrolet K1500 Silverado was a 4-door, double cab pickup truck equipped with frontal air bags, seat-mounted side impact air bags, rollover/side impact inflatable curtain air bags, and an event data recorder. A belted 59-year-old male driver occupied the vehicle. The Chevrolet was traveling east in the left lane when the vehicle departed the left side of the road and the front plane struck the end terminal. The end terminal penetrated the engine compartment and contacted the engine resulting in the guardrail separating from the end terminal and penetrating through the cowl and instrument panel and into the driver's seating area. The guardrail then struck the driver and displaced him and his seat out of the vehicle through the back of the cab as nine sections of guardrail penetrated through the vehicle. The driver sustained fatal injuries and was pronounced deceased at the crash scene. The Chevrolet came to final rest heading east, impaled by the guardrail. The driver The vehicle was towed from the crash scene due to damage.

17. Key Words X-Lite guardrail terminal treatment motor vehicle traffic crash moderate injury		*18. Distribution Statement* Document is available to the public from the National Technical Information Service, www.ntis.gov.	
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TABLE OF CONTENTS

Indiana University
Transportation Research Center
On-Site Guardrail End Treatment Investigation
Case Number - IN17011
Vehicle: 2016 Chevrolet K1500 Silverado
Location: Missouri
Crash Date: February 2017

BACKGROUND

The report documents the on-site investigation of a Chevrolet pick-up truck that struck an X- Lite guardrail end terminal that is of interest to the Federal Highway Administration (FHWA). This crash was identified by an engineer with the Missouri Department of Transportation (MoDOT), who submitted photographs of the damaged guardrail end treatment to the FHWA. The FHWA determined that the guardrail end treatment and crash type were of interest. This crash investigation was then initiated by the National Highway Traffic Safety Administration in February 2017 and assigned to the Special Crash Investigation team at the Indiana University Transportation Research Center. This single vehicle crash involved a 2016 Chevrolet K1500 Silverado (**Figures 1 and 2**). The crash occurred in Missouri in February 2017 during morning hours and was investigated by a local police agency. The vehicle, guardrail, and crash scene were inspected in February 2017.

Figure 1: The damaged 2016 Chevrolet K1500 Silverado

Figure 2: Back view of the guardrail penetration through the cab of the Chevrolet

This crash occurred on the median roadside of a four-lane, divided interstate highway. The Chevrolet was a four door, double cab pickup truck equipped with frontal air bags, seat-mounted side impact air bags, rollover/side impact inflatable curtain (IC) air bags, and an event data recorder (EDR). A belted 59-year-old male driver occupied the vehicle. The Chevrolet was traveling east in the left lane when the vehicle departed the left side of the road and the front plane struck the end terminal. The end terminal penetrated into the engine compartment and contacted the engine resulting in the guardrail separating from the end terminal and penetrating

through the cowl and instrument panel and into the driver's seating area. The guardrail then contacted the driver and displaced him and his seat out of the vehicle through the back of the cab as nine sections of guardrail penetrated through the vehicle. The driver sustained fatal injuries and was dismembered during the crash. The Chevrolet came to final rest heading east impaled by the guardrail. The driver was pronounced deceased at the crash scene. The vehicle was towed from the crash scene due to damage.

CRASH SUMMARY

Crash Site

This crash occurred in a rural area during daytime hours on the median roadside of a four-lane, divided interstate highway. The weather conditions were clear with 16.1 kilometers (10 miles) visibility, southerly winds at 14 km/h (9 mph), a temperature of 12.8 °C (55 °F), and a dew point of 8.9 °C (48 °F), according to local weather reports. The interstate was curved to the right for eastbound traffic and had two 3.7 m (12.1 ft) wide bituminous lanes. The calculated radius of curvature was 1,270.4 m (4,166.9 ft). The eastbound lanes were separated from the two westbound lanes by a by a grass median. A blocked-out W-beam guardrail equipped with an X- Lite telescoping guardrail end treatment system was located adjacent to the median for the eastbound lanes. The guardrail protected the approach to a bridge that traversed over a river. The bituminous median shoulder was 1.1 m (3.6 ft) wide and the bituminous right shoulder was 3.1 m (10.1 ft) wide. The roadway was level. The speed limit was 113 km/h (70 mph). The Crash Diagram is included in **Appendix A** of this report.

Figure 3: Eastbound approach of the Chevrolet

Pre-Crash

The Chevrolet was traveling east in the left lane (**Figure 3**) at an EDR-reported speed of 131 km/h (81 mph) from -5.0 sec to -1.0 sec prior to Algorithm Enable (AE). The reported speed was 129 km/h (80 mph) at -0.5 sec, which was the end of the pre-crash reporting. The service brake was reported as "Off" for the entire pre-crash reporting and the cruise control was not active from -2.0 to -0.5 sec, which was the extent of the reporting for the cruise control status. A non-involved vehicle was traveling behind the Chevrolet in the right lane. The police crash

Figure 4: Area of impact with the guardrail, which had been replaced by a Soft Stop system, view east

report stated the driver of the non-involved vehicle saw the Chevrolet drift to the left and depart the left side of the roadway.

Crash: The front plane of the Chevrolet struck the face of the end terminal (**Figure 4**) at an estimated speed of 127 km/h (79 mph).[1] The impact orientation was head-on to the end terminal, resulting in a force direction on the vehicle in the 12 o'clock sector. The EDR-reported maximum longitudinal and lateral velocity changes were -23.0 km/h (-14.3 mph) and 7.0 km/h (4.3 mph), respectively, occurring at 290 msec. The impact actuated the driver's seat belt pretensioner, stage one and two deployment of the driver's frontal air bag, and both IC air bags. Damage analysis of the vehicle and the damaged guardrail by a MoDOT engineer and the SCI investigator determined the end terminal deflected vertically up off the bumper as the bumper was crushed. The end terminal rotated counterclockwise and penetrated the vehicle's grille and radiator, and struck the left portion of the engine (**Figure 5**). Rail two then telescoped along rail one and struck the end terminal. Rail three telescoped along rail two and struck the anchor cable bracket and bolt on the slider bracket on rail two (**Figure 6**), resulting in rails two and three wedging together and separating from the end terminal and rail one. Rails two and three then penetrated the cowl and the left instrument panel, passing directly through the steering column tunnel and into the driver's seating area (**Figure 7**). The driver was struck by rails two and three as indicated by a transfer of blood and tissue on both rails. The driver and his seat were then displaced out of the vehicle through the back of the cab. Rail one also separated from the end terminal when the four mounting bolts were pulled through the bolt holes on the end terminal, and rail one followed rails two and three into the passenger

Figure 5: The end terminal entrapped in the Chevrolet's engine compartment, view from front left corner

Figure 6: Rails 2, 3, and anchor cable bracket and bolt

Figure 7: Path of guardrail penetration into the driver's seating position

[1] It was estimated that the vehicle lost 1.6 km/h (1 mph) from -0.5 sec prior to AE to AE based on the EDR-reported speed loss of km/h (1 mph) from -1.0 to -0.5 sec

compartment. Rail one struck and displaced the second-row seat, halting that rail's penetration with approximately 70 cm (27.6 in) of the rail extending out of the back of the cab. The vehicle continued down the guardrail, damaging and displacing 27 posts and nine sections [53.2 m (175.0 ft)] of guardrail with approximately 50 m (164 ft) of the guardrail penetrating through the passenger compartment. The vehicle came to final rest heading east, impaled by the guardrail. The driver was dismembered during the crash.

Figure 8: Damaged posts 1 and 2

Post-Crash

The police were notified of the crash at 0929 hours and arrived on scene at 0945 hours. The driver was pronounced deceased at the scene by the local coroner. The driver was transported to a local funeral home. Rail nine was unbolted from the damaged guardrail and remained in the vehicle along with rail one and the end terminal. The vehicle was then towed from the crash scene.

Figure 9: Post 3; arrow shows crimp in post remains closed

END TERMINAL AND GUARDRAIL DAMAGE

The damaged X-Lite and guardrail had been replaced by MoDOT with a "Soft Stop" guardrail end treatment system prior to the SCI crash site inspection. The damaged guardrail components, including all bolts and posts, were transported to a MoDOT maintenance facility where they were inspected by the SCI investigator and MoDOT engineer. The inspection revealed that the crash damaged and displaced 27 posts and four 3.8 m (12.5 ft) long guardrail panels and five 7.6 m (25.0 ft) long guardrail panels for a total of 53.2 m (175.0 ft) of guardrail. Post 1 was bent in the downstream direction at the crimp in the post. Post 2 was similarly bent but the post was fractured just above the soil plate and was in two pieces (**Figure 8**). The dirt line on the soil plate appeared to indicate that approximately 2 cm (0.8 in) of the soil plate was above ground level.

Figure 10: Remaining damaged posts

The ground strut remained bolted to post 2. Post 3 was also bent in the downstream direction, but the bend was at ground level, not at the crimp point (**Figure 9**). Posts 4 - 13 were also bent in the downstream direction to a similar extent as posts 1 -3. The remaining posts were bent to a much lesser extent (**Figure 10**). A sheared bolt head from the yellow shear bolts was found at the crash scene at posts 12, 28, and 34 of the replacement guardrail and at the final rest location of the Chevrolet. The FHWA guardrail form is attached to the end of this report as **Appendix A**.

2016 CHEVROLET SILVERADO

Description

The Chevrolet K1500 Silverado was a 4-wheel drive, 6-occupant, 4-door, double cab pickup truck with the VIN 3GCUKNEH0GGxxxxxx. The vehicle was equipped with a 4.3-liter, V-6 engine, 6-speed automatic transmission with sport shift feature, 4-wheel antilock brakes with electronic brake force distribution, brake assist, traction control, and electronic stability control. The vehicle was equipped with multi-stage frontal air bags, seat-mounted side impact air bags, and rollover/side impact IC air bags. The vehicle was also equipped with an EDR. The specified wheelbase was 364 cm (143.3 in).

The vehicle manufacturer's recommended tire size was P255/70R17. The vehicle was equipped with Bridgestone Dueler tires of the recommended size. The manufacturer's recommended cold tire pressure for the front and rear tires was 241 kPa (35 psi). All the tires were in good condition prior to the crash.

The front row was equipped with driver and passenger cloth-covered bucket seats with adjustable head restraints and a center passenger bucket seat with folding back. The second row was equipped with a cloth-covered bench seat with folding backs and adjustable head restraints in the outboard seating positions. The driver's seat track position could not be determined since the seat was displaced out of the vehicle during the crash by the intruding guardrail.

Exterior Damage

Exterior Damage Events 1: The Chevrolet sustained direct and induced damage to the front plane during the impact with the X-Lite. The front bumper, grille, and radiator were directly damaged. Additional direct damage involved the engine, cowl, instrument panel, steering assembly, driver's seat, second row seat, back of the cab, truck bed, and tailgate that occurred as the guardrail penetrated through the vehicle. The direct damage to the front bumper began at the left corner and extended 79 cm (31.1 in) to the right. The Field L was 180 cm (70.9 in). Crush measurements were taken on the bumper bar and the maximum residual crush was 15 cm (5.9 in) occurring 56 cm (22.0 in) left of the vehicle's centerline. The crush values were: C1 = 3 cm (1.2 in), C2 = 15 cm (5.9 in), C3 = 2 cm (0.8 in), C4 = 0 cm, C5 = 0 cm, C6 = 0 cm. The crush measurements were estimated since the bumper sustained additional damage and displacement during extrication of the vehicle from the crash scene according to the driver of the tow truck.

Damage Classification Event 1: The Collision Deformation Classification (CDC) was 12FYEW9 (350 degrees). The extent zone was based on the penetration of the guardrail through the vehicle. WinSMASH could not be used to calculate delta-V since the impact was with a yielding object that also penetrated through the vehicle. The severity of the damage was severe.

Event Data Recorder

The Chevrolet's EDR was imaged via direct connection to the air bag control module (ACM) with version 17.2 of the Bosch Crash Data Retrieval software and reported with version 17.7.2. The EDR reported a deployment event. The ignition cycles at the crash and when the data were imaged were 1,478, and 1,479, respectively. The EDR report is attached at the end of this report as **Appendix B**.

The "System Status at Event Record" reported that the crash record was locked and that a complete file was recorded. OnStar deployment and velocity change data were sent and the frontal, side, rollover, and rear algorithms were all active. The driver's seat belt switch circuit was reported as "Buckled" and the driver's seat track was not in the "foremost" position. Stage one and two deployments for the driver's frontal air bag were reported and the time from time zero to the deployment command criteria being met (DCCM) were 8 and 11 msec, respectively. The time to fire for the driver's seat belt pretensioner was 5 msec. The DCCM for the IC air bags was 14 msec. The maximum reported longitudinal and lateral velocity changes were reported as -23 km/h (-14 mph) and 7 km/h (4 mph), respectively occurring at 290 and 288 msec, respectively.

Interior Damage

The interior of the Chevrolet sustained severe damage from the penetration of the guardrail. The intruding guardrail displaced the driver's seat and second row left and center seats out of the vehicle through the back of the cab. The steering assembly was also displaced from the instrument panel and was found in the second row. All the doors remained closed and operational.

Manual Restraint Systems

The front row was equipped with three-point lap and shoulder belts in the driver and front right passenger seating positions and a lap belt in the center seating position. The driver's and front right passenger's seat belts were equipped with locking latch plates, retractor-mounted pretensioners, and adjustable upper anchors that were each in the full up position. Both pretensioners actuated during the crash. The second row was equipped with lap and shoulder seat belts with sliding latch plates and fixed upper anchors.

The driver's seat belt webbing was torn and separated into two sections. The latch plate was found buckled in the buckle, indicating the driver was likely buckled at the time of the crash. The vehicle's EDR also reported the status of the driver's seat belt switch circuit as "Buckled."

Supplemental Restraint Systems

The Chevrolet was equipped with multi-stage frontal air bags, seat-mounted side impact air bags in the driver's and front row right passenger's seating positions, and rollover/side impact IC air bag. Both stages of the driver's frontal air bag deployed during the crash, as did both IC air bags. The seat-mounted side impact air bags did not deploy.

2016 CHEVROLET SILVERADO OCCUPANT

Driver Demographics

Age/Sex:	59 years/male
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat Type:	Bucket
Seat Track Position:	Unknown
Manual Restraint Usage:	Lap and shoulder belt
Usage Source:	Vehicle inspection and EDR
Air Bags	Frontal air bag and both IC air bags, deployed; seat-mounted side impact air bag, not deployed
Alcohol/Drug Involvement:	None
Egress From Vehicle:	Ejected from vehicle.
Transport From Scene:	Removed to funeral home
Medical Treatment:	None, pronounced deceased at the crash scene.

Driver Injuries

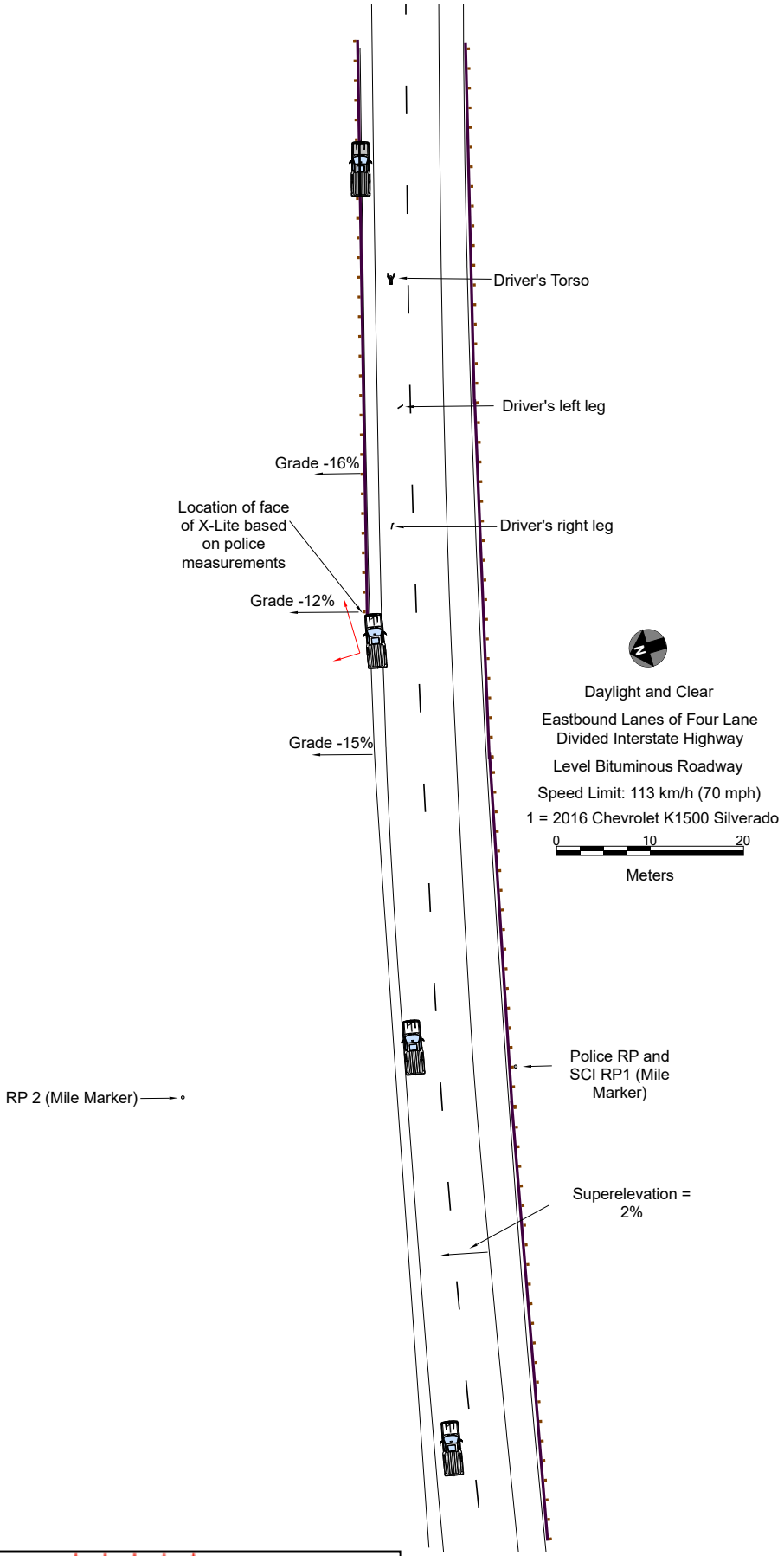
Injury No.	Injury	AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Torso transection, not further specified; torso found on roadway 35.5 m (116.4 ft) eastward of original end of guardrail	511000.6	Tandem IPC Guardrail Seat back, driver's	Certain Possible
2	Amputation, traumatic, left leg, not further specified; left leg found on roadway 22.1 m (72.5 ft) eastward of original end of guardrail	811000.3	Guardrail	Certain
3	Amputation, traumatic, right leg, not further specified; right leg found on roadway 9.3 m (30.5 ft) eastward of original end of guardrail	811000.3	Guardrail	Certain

Source: Police Crash Report.

Driver Kinematics

The driver was restrained by the lap and shoulder seat belt. The adjustment of the driver's seat track could not be determined due to the extent of damage to the seat during the crash. The front plane impact to the end terminal actuated the driver's seat belt pretensioner and stage one and two deployments of the driver's frontal air bag and deployment of both IC air bags. The driver was displaced forward by the impact and he was contacted by the intruding guardrail and displaced rearward into his seat. The guardrail also contacted the driver's seat and displaced the driver and his seat through the second row and through the back of the cab, ejecting the driver from the vehicle. He sustained fatal injuries due to torso transection from contact with the intruding guardrail and his seat back and dismemberment of both legs from contact with the intruding guardrail. The driver was pronounced deceased at the crash scene by the local coroner. The driver's next of kin were notified of his death and he was transported to a local funeral home.

Crash Diagram



	NHTSA www.nhtsa.gov
Case Number:	IN17011

APPENDIX A
FHWA GUARDRAIL FORM

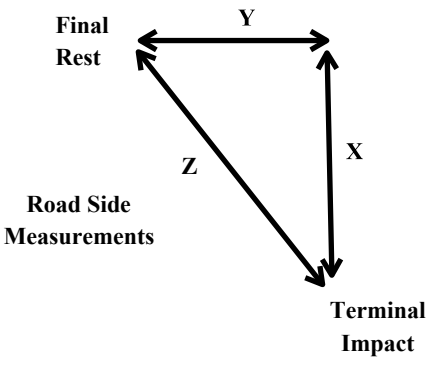
Case No.: IN17011

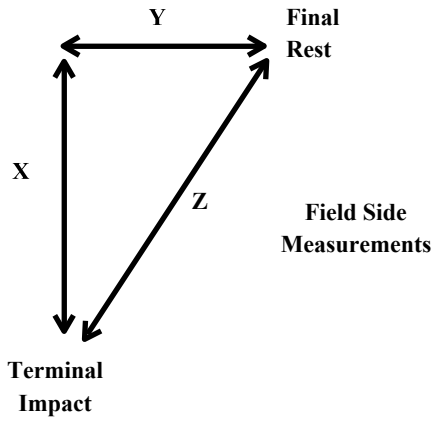
PREPOPULATED DATA (BY OTHERS)			
Date of Crash	February 2017	**TIME OF CRASH (MILITARY)**	Morning
Case Number	IN17011	**State**	Missouri
Traffic Route	Interstate	**Direction (Southbound = SB)**	EB
Ambient Conditions (at time of crash)			
Temperature (°F)	55	**Lighting**	Daylight
Atmospheric	Clear		

SCENE INFORMATION	
Type of area where crash occurred	❒Urban ☒Rural ❒Suburban
Terminal on a horizontal curve?	❒No ❒Curve/LT ☒Curve/RT
Estimated or Reconstructed Speed at Impact (MPH)	79 mph (Estimated)
Est. distance (straight line) from terminal impact to COM final rest position (ft.)	Z = 156 ft
Est. distance (longitudinal) along guardrail from terminal impact to COM final resting location (ft.)	X = 156 ft
Est. distance (normal) from either 1. the white paint line; or 2. roadway/shoulder/pavement edge to COM rest position (ft.)	Y = 4.8 ft
Super elevation	❒+2% ❒-2% ☒ NONE or FLAT
Curve Radius (ft.)	4,167 ft

KEY:

- COM - Center of Mass of Vehicle
- Distance Measurements





Case No.: IN17011

ON-SCENE INFORMATION		
End Treatment Type	❒Extruder	❒ET2000 ❒ET-PLUS 4in ❒ET-PLUS 5in ❒SKT ❒FLEAT ❒SOFT STOP
	☒ Telescope	☒X-LITE ❒X-TENSION
Curb?	❒No ❒Yes	❒AASHTO Type A ❒AASHTO Type B ❒AASHTO Type C ❒AASHTO Type D ❒AASHTO Type E ❒AASHTO Type F ❒AASHTO Type G ❒AASHTO Type H
Curb Height:		

GUARDRAIL INSTALLATION									
Post No.	Post		Offset Block		PRE-Existing Damage		Offset to post or post hole (ft.)		Spacing to next post (ft. -in.)
	Type	Dim.	Type	Dim.	Yes No Unknown	Describe	Travel way	Curb	
	Steel Wood Other	D x W (in.) or Dia. (in.)	Steel Wood Composite	D x W (in.)					
0	N/A	N/A	N/A	N/A	N/A		N/A	N/A	N/A
1	Steel	6 x 4	Composite	Unk (see note bottom page 4)	Unk		Unk		Unk
2	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk

Case No.: IN17011

Post No.	Post		Offset Block		PRE-Existing Damage		Offset to post or post hole (ft.)		Spacing to next post (ft. -in.)
	Type	Dim.	Type	Dim.	Yes No Unknown	Describe	Travel way	Curb	
	Steel Wood Other	D x W (in.) or Dia. (in.)	Steel Wood Composite	D x W (in.)					
3	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
4	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
5	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
6	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
7	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
8	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk

Case No.: IN17011

Post No.	Post		Offset Block		PRE-Existing Damage		Offset to post or post hole (ft.)		Spacing to next post (ft. -in.)
	Type	Dim.	Type	Dim.	Yes No Unknown	Describe	Travel way	Curb	
	Steel Wood Other	D x W (in.) or Dia. (in.)	Steel Wood Composite	D x W (in.)					
9	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
10	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
11	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk
12	Steel	6 x 4	Composite	Unk	Unk		Unk		Unk

Additional Comments: The offset blocks were of two types and it was not known which offset block was associated with which post. In addition, the post spacing could not be determined since the guardrail had been repaired and replaced.

Case No.: IN17011

EXTRUDER			
Feeder Channel Width at impact head	❒4inches ❒5 inches ❒Other _____		
Guide Chute Exit Height (in.)			
Connection of feeder channels to head damaged?	❒No ❒Yes	Are Welds Broken?	❒No ❒Yes
Anchor Cable Present?	❒No ❒Yes	Connected?	❒No ❒Yes
Rail Extrusion?	❒No ❒Yes	Length (ft. in.)	
Rail Extrusion Direction	❒Traffic Side ❒Field Side		
Total Length of Rail Damaged (ft.) [total length would include extruded rail plus damaged rail downstream from head.]			

TELESCOPE				
Rail Displacement	❒No	☒Yes ; Length:25 ft 6 in	No of Panels Displaced	❒1 ❒2 ☒3 ❒4 ❒5 ❒6

ALL-SYSTEM PERFORMANCE			
Railkinks Downstream of Head?	☒No	❒Yes;	No. of Kinks in Rail:
Was there intrusion into the Occupant Compartment by foreign object (guardrail)?	❒No ☒Yes Guardrail		
Did vehicle impact other objects after impact with terminal?	☒No ❒Yes		
Object Contacted			

ALL-SYSTEM PERFORMANCE ENVIRONMENT			
SIDESLOPE	**50 ft in advance of Post 1**	**At Post 1**	**50 ft Past Post 1**
Percent - %	-15%	-12%	-16%
Adjacent Lane Width (ft)	12.1 ft		
Lane Type (NAS EDS Variable: Sur. Type)	Bituminous		
Shoulder Type	Bituminous		
Shoulder Width (ft)	3.6 ft		
Guardrail Height (in)	Unknown, guardrail had been replaced		

Case No.: IN17011

VEHICLE INFORMATION			
Vehicle Type (NHTSA Input)	Full size pickup truck		
Vehicle Identification Number (VIN)	3GCUKNEHOGGxxxxxx		
Vehicle Mass (NASS var.: veh.wgt)	5,263 lbs		
Vehicle orientation upon impact	☒Case Type 1 ❒ Case Type 2 ❒Case Type 3 ❒ Case Type 4 ❒ Case Type 5 ❒ Case Type 6 ❒ Case Type 7 ❒ Case Type 8 ❒ Other		
If "Other," describe			
Collision Deformation Classification	12FYEW9		
Delta-V	-14.3 mph longitudinal, 4.3 mph lateral (EDR)		
Occupant Compartment Penetration of rail	❒No	☒Yes ;	Describe: Approximately 164 ft of guardrail penetrated through cowl and left instrument panel and directly through the steering column tunnel into the driver's seating position. The driver was directly contacted by rails 2 and 3, which displaced him and his seat out of the vehicle through the back of the cab.
Quarter Turns (NASS EDS variable: Rollover)	❒1 ❒2 ❒3 ❒4 ❒5 ❒6 ❒7 ❒8 ❒9 ❒10 ❒11 ❒12 ❒13 ❒14 ❒15 ❒16 ❒17+		
Object Precipitating Rollover, (NASS EDS variable: Rollobj)			
Rollover Type, Terhune Scale, (NASS EDS variable: rolintyp)			

APPENDIX B
2016 CHEVROLET K1500 SILVERADO EVENT DATA RECORDER REPORT[2]

[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	3GCUKNEH0GG******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN17011_V1_ACM.CDRX
Saved on	
Imaged with CDR version	Crash Data Retrieval Tool 17.2
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 17.7.2
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Deployment

Comments

No comments entered.

Data Limitations

Recorded Crash Events:

There are two types of recorded crash events for Front, Side, and Rear (FSR) Events. The first is the Non-Deployment Event. A Non-Deployment Event records data but does not deploy the air bag(s). The minimum SDM Recorded Vehicle Velocity Change, that is needed to record a Non-Deployment Event, is five MPH [8 km/h]. A Non-Deployment Event contains Pre-Crash and Crash data. The oldest Non-Deployment event can be overwritten by a Deployment Event, if all three records are full and the Non-Deployment Event is not locked. A Non-Deployment Event can be overwritten by a more recent Non-Deployment Event if all three records are full and the Non-Deployment is older than approximately 250 ignition cycles. Also, a Non-Deployment event can be recorded if one of the following occurs without the Deployment of any of the frontal air bags, side air bags, or roll bars:

-Pretensioner(s) only Deployment
-Head Rest Deployment
-Battery Cut-Off Deployment

The second type of SDM recorded crash event for FSR Events is the Deployment Event. It also contains Pre-Crash and Crash data. Deployment Events cannot be overwritten or cleared by the SDM.
Rollover Events contains Pre-Crash and Crash data. Rollover event follow the same rules as FSR Deployment events.
The SDM can store up to three Events.

Data:

For FSR Events, SDM Recorded Vehicle Velocity Change reflects the change in velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. For Deployment and Non-Deployment Events, the SDM will record up to 300 milliseconds of data after time zero. The SDM will also record up to 300 milliseconds of Vehicle Acceleration data after time zero.
For Rollover Events, the SDM may record Lateral Acceleration, Vertical Acceleration, and Roll Rate data, if the SDM is rollover capable. This data reflects what the sensing system experienced during the recorded portion of the event. For Rollover Deployment Events, the SDM will record up to 700 milliseconds of data before the Deployment criteria is met and 290 milliseconds after the Deployment criteria is met.
-Deployment loops may be displayed as being deployed in a Non-Deployment event record, if a Deployment event is qualified during the Non-Deployment event. That is, if two or more events are occurring at the same time and one is a Non-Deployment event and one of the others is a Deployment event, and the Deployment event is qualified while the Non-Deployment is still active, the deployed loops may be recorded in the Non-Deployment event record.
-Time between events is recorded in 10 msec intervals and is displayed in seconds for a maximum time of 655.33 seconds. The counter measures the time from the start of one event to the start of the next event if both events occur within the same ignition cycle.
-The Maximum SDM Recorded Vehicle Velocity Change may occur between the recorded 10 millisecond sample points of the SDM Recorded Vehicle Velocity Change. The SDM will only record Maximum SDM Recorded Vehicle Velocity Change for the first 300 milliseconds of the event.
-Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.

-SDM Recorded Vehicle Speed accuracy can be affected by various factors, including but not limited to the following:
    -Significant changes in the tire's rolling radius
    -Final drive axle ratio changes
    -Wheel lockup and wheel slip
-Brake Switch Circuit Status indicates the open/closed state of the brake switch circuit.
-Pre-Crash data is recorded asynchronously. The 0.5 second Pre-crash data value (most recent recorded data point) is the data point last sampled before Time Zero. That is to say, the last data point may have been captured just before Time Zero but no more than 0.5 second before Time Zero. All subsequent Pre-crash data values are referenced from this data point.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:
    -The SDM receives a message with an "invalid" flag from the module sending the pre-crash data
-Pre-Crash Electronic Data Validity Check Status indicates "Data Not Available" if:
    -No data is received from the module sending the pre-crash data
-For diesel powered vehicles, the data displayed as Throttle Position (%) is actually the data for the Air Inlet Flap Position. This is not the same as the throttle position for a gasoline powered engines.
-Belt Switch Circuit Status indicates the status of the seat belt switch circuit.
-The ignition cycle counter will increment when the power mode cycles from OFF/Accessory to RUN. Applying and removing of battery power to the module will not increment the ignition cycle counter.
-Ignition Cycles Since DTCs Were Last Cleared can record a maximum value of 253 cycles and can only be reset by a scan tool.
-Dynamic Deployment Event Counter tracks the number of Deployment events that have occurred during the SDM's lifetime.
-Dynamic Event Counter tracks the number of qualified events (either Deployments, Non-deploy, or Rollover events) that have occurred during the SDM's lifetime.
-For Deployment Events, DTC B0052 (Deployment commanded) shall be recorded with the remainder of the data for this event even though it occurred after Event Enable.
-Once a firing loop has been commanded to be deployed, it will not be commanded to be deployed again during the same ignition cycle. Firing loop times for subsequent deployment type events, during the same ignition cycle, will record the deployment times as N/A.
-In an event where the module is operating on energy reserve, the Dynamic counters may report a value that is less than the actual value. If the stored values in the Dynamic counters are less than the counter values in the event records or if more than one event record has the same counter value as another, the module may have been operating on its energy reserve.
-The GM parameter name is displayed in parentheses after the NHTSA Part 563 parameter name.
-The reported range of the longitudinal and lateral acceleration values is approximately ± 105 g.
-All data should be examined in conjunction with other available physical evidence from the vehicle and scene.

Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Status Data (Pre-Crash) is transmitted by the Body Control Module, via the vehicle's communication network.
-The Belt Switch Circuit is wired directly to the SDM.

Data Element Sign Convention:
The following table provides an explanation of the sign notation for data elements that may be included in this CDR report. Directional references to sign notation are all from the perspective of the driver when seated in the vehicle facing the direction of forward vehicle travel.

Data Element Name	Positive Sign Notation Indicates
Longitudinal Acceleration	Forward
Longitudinal Velocity Change	Forward
Lateral Acceleration	Left to Right
Lateral Velocity Change	Left to Right
Vertical Acceleration	Downward
Roll Rate	Clockwise Rotation

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 tool.

01050_SDM30-delphi_r013

System Status at Time of Retrieval

Dynamic Deployment Event Counter	1
Multi-Event, Number of Events (Dynamic Event Counter)	1
Dynamic OnStar Notification Event Counter	1
Vehicle Identification Number (VIN)	3GCUKNEH0GG******
Ignition Cycle, Download (Ignition Cycles at Investigation)	1479
End Model Part Number	00CF6F22
System Type	N/A
Software Module Identifier 1	00CF6F21
Software Module Identifier 2	05021307
Software Module Identifier 3	01621D42
Manufacturing Traceability Data, LineID	K
Manufacturing Traceability Data, ShiftID	2
Manufacturing Traceability Data, Year	16
Manufacturing Traceability Data, DayOfTheYear	036
Manufacturing Traceability Data, Serial/Lot/BatchNumber	3M22UG100
ESS # 1 Traceability Data, Component Identifier	AU
ESS # 1 Traceability Data, Part Number/Broadcast Code	8677
ESS # 1 Traceability Data, Supplier Code	D
ESS # 1 Traceability Data, Traceability Number	P00000000
ESS # 2 Traceability Data, Component Identifier	AT
ESS # 2 Traceability Data, Part Number/Broadcast Code	8677
ESS # 2 Traceability Data, Supplier Code	D
ESS # 2 Traceability Data, Traceability Number	P00000000
ESS # 3 Traceability Data, Component Identifier	AH
ESS # 3 Traceability Data, Part Number/Broadcast Code	8676
ESS # 3 Traceability Data, Supplier Code	D
ESS # 3 Traceability Data, Traceability Number	A00000000
ESS # 4 Traceability Data, Component Identifier	AJ
ESS # 4 Traceability Data, Part Number/Broadcast Code	8676
ESS # 4 Traceability Data, Supplier Code	D
ESS # 4 Traceability Data, Traceability Number	A00000000
ESS # 5 Traceability Data, Component Identifier	DA
ESS # 5 Traceability Data, Part Number/Broadcast Code	8678
ESS # 5 Traceability Data, Supplier Code	D
ESS # 5 Traceability Data, Traceability Number	A00000000
ESS # 6 Traceability Data, Component Identifier	DB
ESS # 6 Traceability Data, Part Number/Broadcast Code	8678
ESS # 6 Traceability Data, Supplier Code	D
ESS # 6 Traceability Data, Traceability Number	A00000000
ESS # 7 Traceability Data, Component Identifier	??
ESS # 7 Traceability Data, Part Number/Broadcast Code	0000
ESS # 7 Traceability Data, Supplier Code	D
ESS # 7 Traceability Data, Traceability Number	A00000000
ESS # 8 Traceability Data, Component Identifier	??
ESS # 8 Traceability Data, Part Number/Broadcast Code	0000
ESS # 8 Traceability Data, Supplier Code	D
ESS # 8 Traceability Data, Traceability Number	A00000000

System Status at Event (Event Record 1)

Event Record Type	Deployment
OnStar Deployment Status Data Sent	Yes
Complete file recorded (Event Recording Complete)	Yes
Crash Record Locked	Yes
OnStar SDM Recorded Vehicle Velocity Change Data Sent	Yes
Deployment Event Counter	1
Multi-Event, Number of Events (Event Counter)	1
OnStar Notification Event Counter	1
Time From Event 1 to 2 (Time Between Events) (seconds)	Data Not Available
Ignition Cycle, Crash (Ignition Cycles at Event)	1478
Algorithm Active: Frontal	Yes
Algorithm Active: Side	Yes
Algorithm Active: Rollover	Yes
Algorithm Active: Rear	Yes
Concurrent Event Flag Set	No
Event Severity Status: Frontal Pretensioner	Yes
Event Severity Status: Frontal Stage 1	Yes
Event Severity Status: Frontal Stage 2	Yes
Event Severity Status: Left Side	Yes
Event Severity Status: Right Side	No
Event Severity Status: Rear	No
Event Severity Status: Rollover	No
Safety Belt Status, Driver (Driver Belt Switch Circuit Status)	Buckled
Safety Belt Status, Right Front Passenger (Passenger Belt Switch Circuit Status)	Not Buckled
Center Front Row Belt Switch Circuit Status (If Equipped)	Data Not Available
Left Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Center Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Right Row 3 Belt Switch Circuit Status (If Equipped)	Data Not Available
Seat Track Position Switch, Foremost, Status, Driver (Driver Seat Position Status)	No (Rearward)
Passenger Seat Occupancy Status	Empty
Occupant Size Right Front Passenger Child (Passenger Classification Status)	No (Not Applicable)
Passenger Air Bag ON Indicator Status	Off
Passenger Air Bag OFF Indicator Status	On
Low Tire Pressure Warning Lamp Status 0.5 Seconds Prior to Time Zero	Off
Frontal Air Bag Warning Lamp (SIR Warning Lamp Status 0.5 Seconds Prior to Time Zero)	Off
SIR Warning Lamp ON/OFF Time Continuously (seconds)	655330
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	1440
Ignition Cycles Since DTCs Were Last Cleared 0.5 Seconds Prior to Time Zero	253
Maximum Delta-V, Longitudinal (Maximum Longitudinal SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	-14 [-23]
Time, Maximum Delta-V (Time From FSR Time Zero to Maximum Longitudinal SDM Recorded Vehicle Velocity Change)(msec)	290
Maximum Delta-V, Lateral (Maximum Lateral SDM Recorded Vehicle Velocity Change for FSR Event) MPH [km/h]	4 [7]
Time Maximum Delta-V, Lateral (Time From FSR Time Zero to Maximum Lateral SDM Recorded Vehicle Velocity Change)(msec)	288
High Voltage Disable Notification Sent	Yes
Deployment Commanded in Energy Reserve Mode	No

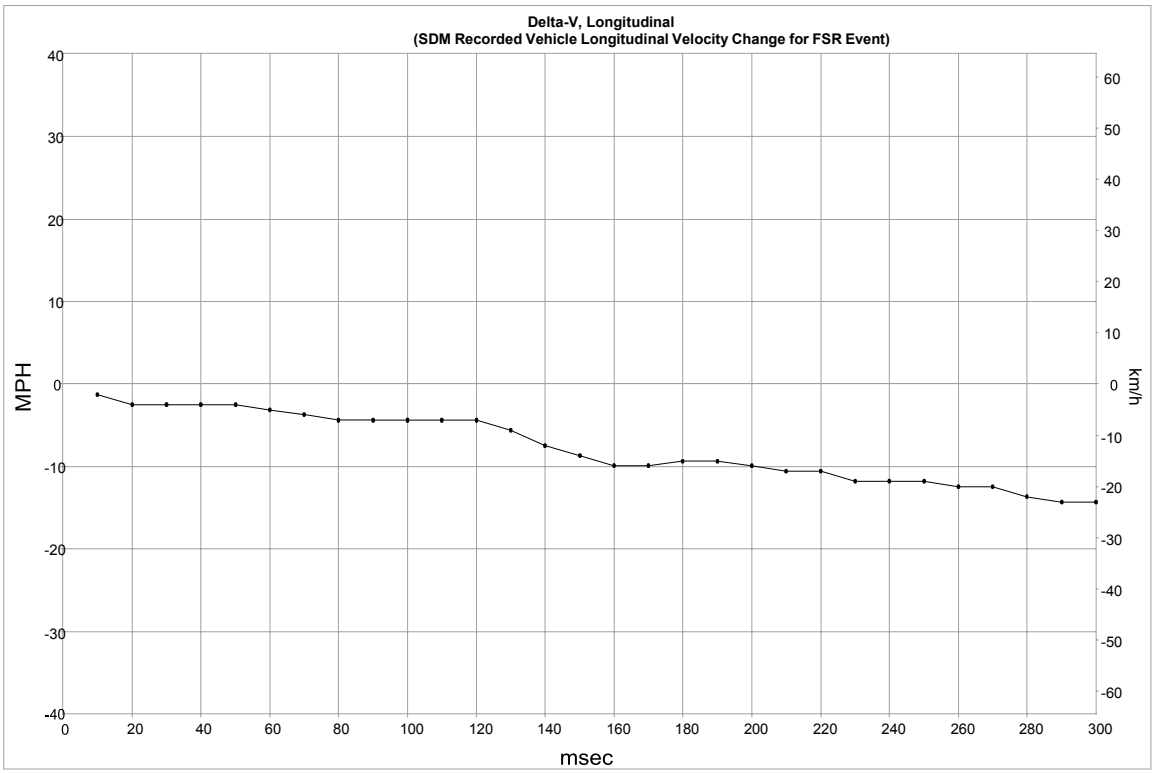
DTCs Present at Time of Event (Event Record 1)

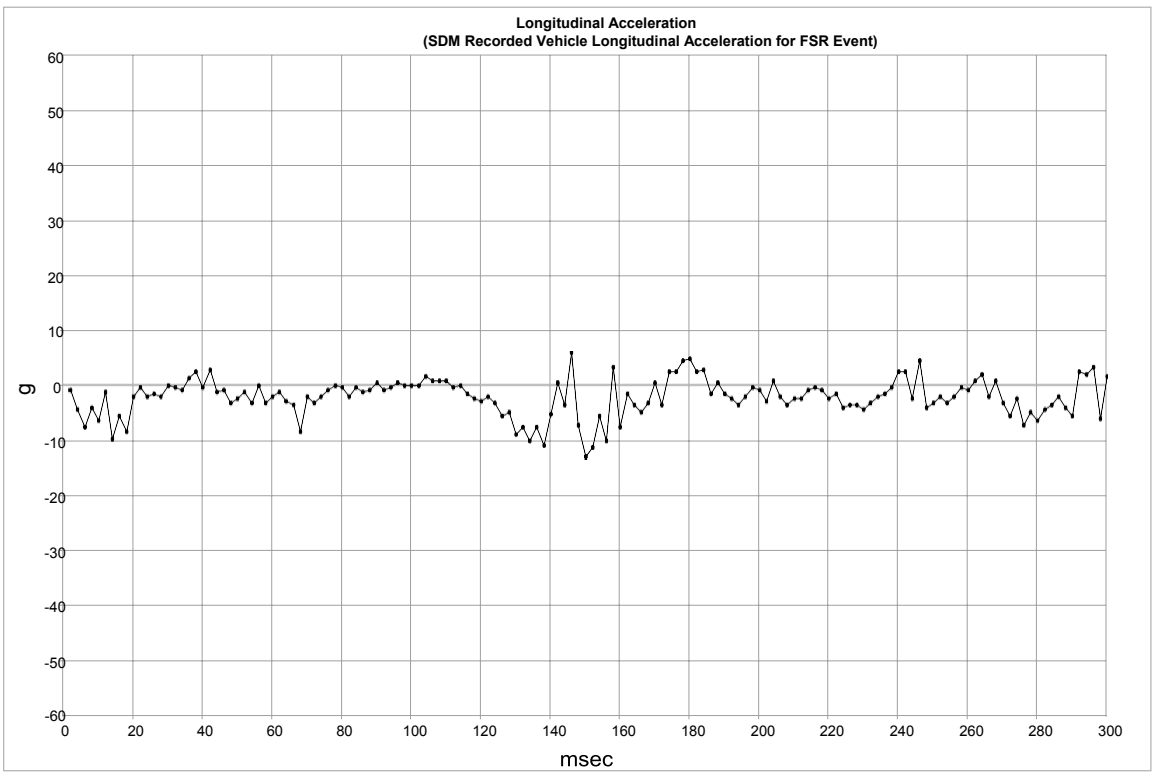
B0052-00

Event Data (Event Record 1)

Driver 1st Stage Deployment Loop Commanded	Yes
Passenger 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	Yes
Passenger 2nd Stage Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop #1 Commanded	Yes
Passenger Pretensioner Deployment Loop #1 Commanded	Yes
Driver Pretensioner Deployment Loop #2 Commanded	Yes
Passenger Pretensioner Deployment Loop #2 Commanded	Yes
Driver Thorax Loop Commanded	Yes
Passenger Thorax Loop Commanded	No
Left Row 1 Roof Rail/Head Curtain Loop Commanded	Yes
Right Row 1 Roof Rail/Head Curtain Loop Commanded	Yes
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Driver (Driver 1st Stage Time From Time Zero to Deployment Command Criteria Met)(msec)	8
Frontal Air Bag Deployment, Time to 2nd Stage, Driver (Driver 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	11
Frontal Air Bag Deployment, Time to 1st Stage Deployment, Right Front Passenger (Passenger 1st Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Frontal Air Bag Deployment, Time to 2nd Stage, Right Front Passenger (Passenger 2nd Stage Time From Time Zero to Deployment Command Criteria Met) (msec)	Data Not Available
Side air bag deployment, time to deploy, driver (Driver Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	14
Side air bag deployment, time to deploy, right front passenger (Passenger Thorax/Curtain Time From Time Zero to Deployment Command Criteria Met) (msec)	14
Pretensioner Deployment, Time to Fire, Driver (Driver Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	5
Pretensioner Deployment, Time to Fire, Right Front Passenger (Passenger Pretensioner Time From Time Zero to Deployment Loop #1 or Loop #2 Command Criteria Met) (msec)	5

Longitudinal Crash Pulse (Event Record 1)





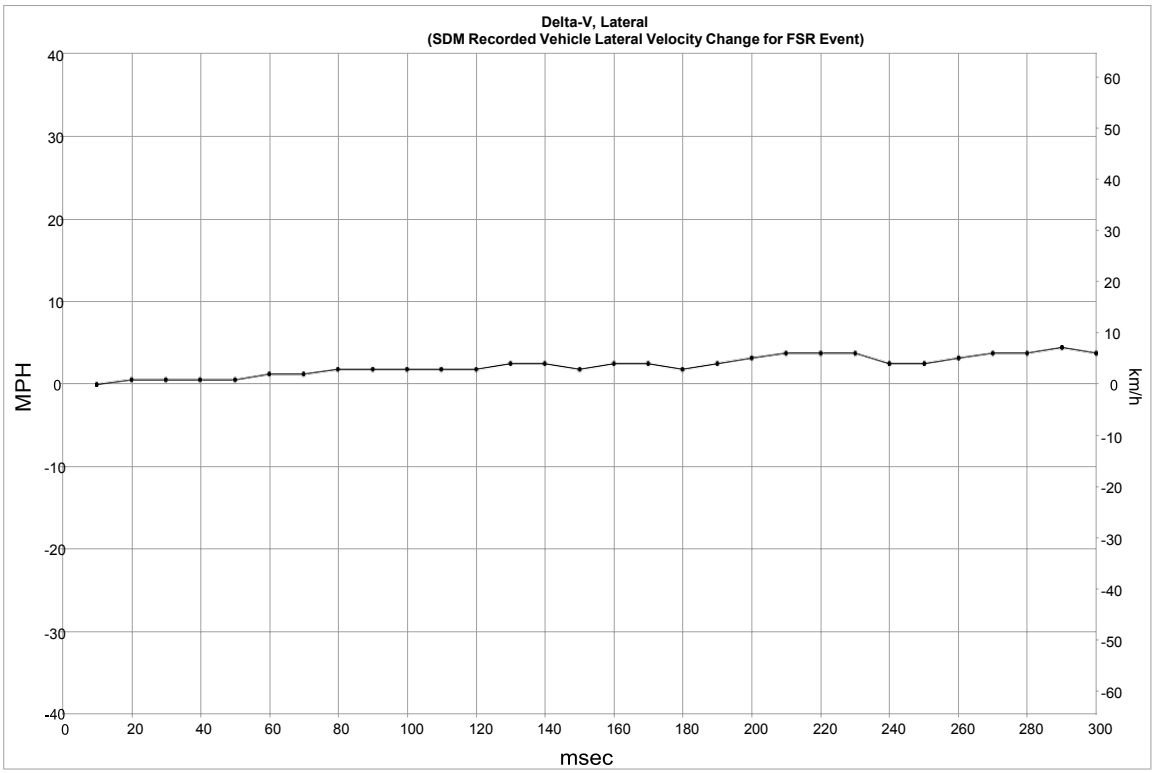
Longitudinal Crash Pulse (Event Record 1)

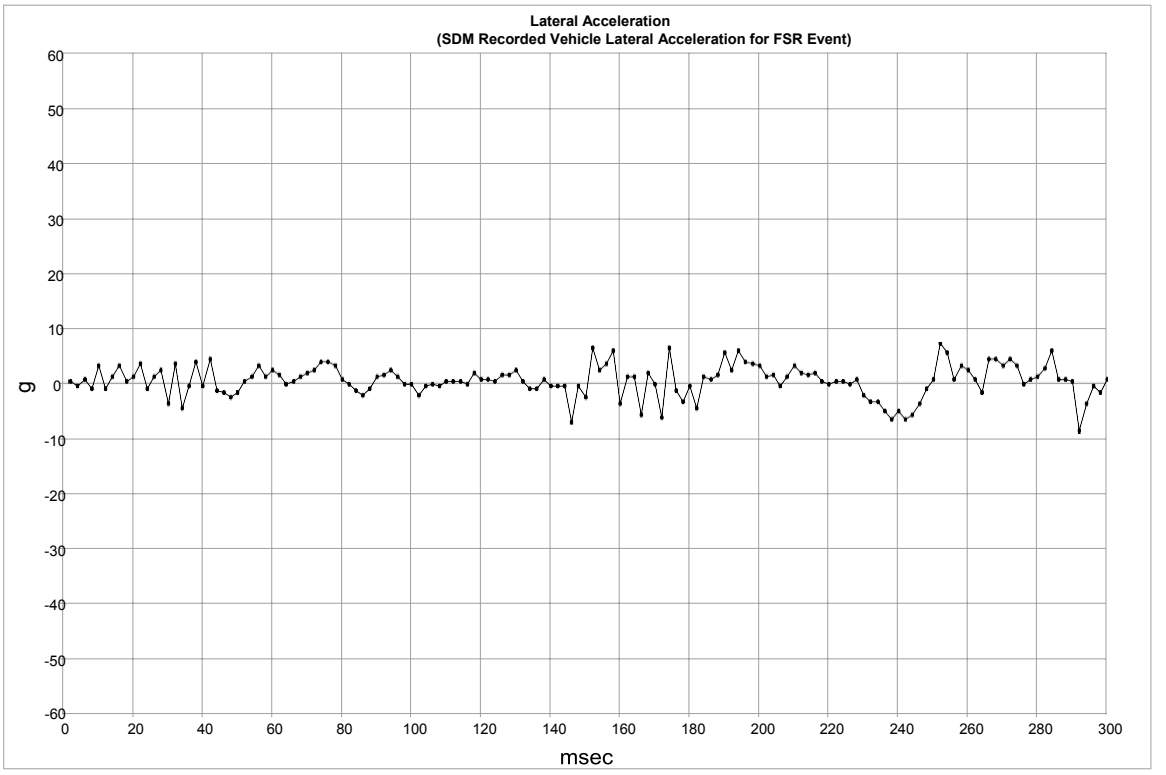
Time (msec)	Delta-V, Longitudinal (SDM Recorded Vehicle Longitudinal Velocity Change for FSR Event) (MPH)	Delta-V, Longitudinal (SDM Recorded Vehicle Longitudinal Velocity Change for FSR Event) (km/h)
10	-1.2	-2.0
20	-2.5	-4.0
30	-2.5	-4.0
40	-2.5	-4.0
50	-2.5	-4.0
60	-3.1	-5.0
70	-3.7	-6.0
80	-4.3	-7.0
90	-4.3	-7.0
100	-4.3	-7.0
110	-4.3	-7.0
120	-4.3	-7.0
130	-5.6	-9.0
140	-7.5	-12.0
150	-8.7	-14.0
160	-9.9	-16.0
170	-9.9	-16.0
180	-9.3	-15.0
190	-9.3	-15.0
200	-9.9	-16.0
210	-10.6	-17.0
220	-10.6	-17.0
230	-11.8	-19.0
240	-11.8	-19.0
250	-11.8	-19.0
260	-12.4	-20.0
270	-12.4	-20.0
280	-13.7	-22.0
290	-14.3	-23.0
300	-14.3	-23.0

Longitudinal Crash Pulse (Event Record 1)

Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)	Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)	Time (msec)	Longitudinal Acceleration (SDM Recorded Vehicle Longitudinal Acceleration for FSR Event) (g)
2	-1.0	102	-0.2	202	-3.0
4	-4.6	104	1.4	204	0.6
6	-7.8	106	0.6	206	-2.2
8	-4.2	108	0.6	208	-3.8
10	-6.6	110	0.6	210	-2.6
12	-1.4	112	-0.6	212	-2.6
14	-9.8	114	-0.2	214	-1.0
16	-5.8	116	-1.8	216	-0.6
18	-8.6	118	-2.6	218	-1.0
20	-2.2	120	-3.0	220	-2.6
22	-0.6	122	-2.2	222	-1.8
24	-2.2	124	-3.4	224	-4.2
26	-1.8	126	-5.8	226	-3.8
28	-2.2	128	-5.0	228	-3.8
30	-0.2	130	-9.0	230	-4.6
32	-0.6	132	-7.8	232	-3.4
34	-1.0	134	-10.2	234	-2.2
36	1.0	136	-7.8	236	-1.8
38	2.2	138	-11.0	238	-0.6
40	-0.6	140	-5.4	240	2.2
42	2.6	142	0.2	242	2.2
44	-1.4	144	-3.8	244	-2.6
46	-1.0	146	5.8	246	4.2
48	-3.4	148	-7.4	248	-4.2
50	-2.6	150	-13.0	250	-3.4
52	-1.4	152	-11.4	252	-2.2
54	-3.4	154	-5.8	254	-3.4
56	-0.2	156	-10.2	256	-2.2
58	-3.4	158	3.0	258	-0.6
60	-2.2	160	-7.8	260	-1.0
62	-1.4	162	-1.8	262	0.6
64	-3.0	164	-3.8	264	1.8
66	-3.8	166	-5.0	266	-2.2
68	-8.6	168	-3.4	268	0.6
70	-2.2	170	0.2	270	-3.4
72	-3.4	172	-3.8	272	-5.8
74	-2.2	174	2.2	274	-2.6
76	-1.0	176	2.2	276	-7.4
78	-0.2	178	4.2	278	-5.0
80	-0.6	180	4.6	280	-6.6
82	-2.2	182	2.2	282	-4.6
84	-0.6	184	2.6	284	-3.8
86	-1.4	186	-1.8	286	-2.2
88	-1.0	188	0.2	288	-4.2
90	0.2	190	-1.8	290	-5.8
92	-1.0	192	-2.6	292	2.2
94	-0.6	194	-3.8	294	1.8
96	0.2	196	-2.2	296	3.0
98	-0.2	198	-0.6	298	-6.2
100	-0.2	200	-1.0	300	1.4

Lateral Crash Pulse (Event Record 1)





Lateral Crash Pulse (Event Record 1)

Time (msec)	Delta-V, Lateral (SDM Recorded Vehicle Lateral Velocity Change for FSR Event) (MPH)	Delta-V, Lateral (SDM Recorded Vehicle Lateral Velocity Change for FSR Event) (km/h)
10	0.0	0.0
20	0.6	1.0
30	0.6	1.0
40	0.6	1.0
50	0.6	1.0
60	1.2	2.0
70	1.2	2.0
80	1.9	3.0
90	1.9	3.0
100	1.9	3.0
110	1.9	3.0
120	1.9	3.0
130	2.5	4.0
140	2.5	4.0
150	1.9	3.0
160	2.5	4.0
170	2.5	4.0
180	1.9	3.0
190	2.5	4.0
200	3.1	5.0
210	3.7	6.0
220	3.7	6.0
230	3.7	6.0
240	2.5	4.0
250	2.5	4.0
260	3.1	5.0
270	3.7	6.0
280	3.7	6.0
290	4.3	7.0
300	3.7	6.0

Lateral Crash Pulse (Event Record 1)

Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)	Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)	Time (msec)	Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for FSR Event) (g)
2	0.2	102	-2.2	202	1.0
4	-0.6	104	-0.6	204	1.4
6	0.6	106	-0.2	206	-0.6
8	-1.0	108	-0.6	208	1.0
10	3.0	110	0.2	210	3.0
12	-1.0	112	0.2	212	1.8
14	1.0	114	0.2	214	1.4
16	3.0	116	-0.2	216	1.8
18	0.2	118	1.8	218	0.2
20	1.0	120	0.6	220	-0.2
22	3.4	122	0.6	222	0.2
24	-1.0	124	0.2	224	0.2
26	1.0	126	1.4	226	-0.2
28	2.2	128	1.4	228	0.6
30	-3.8	130	2.2	230	-2.2
32	3.4	132	0.2	232	-3.4
34	-4.6	134	-1.0	234	-3.4
36	-0.6	136	-1.0	236	-5.0
38	3.8	138	0.6	238	-6.6
40	-0.6	140	-0.6	240	-5.0
42	4.2	142	-0.6	242	-6.6
44	-1.4	144	-0.6	244	-5.8
46	-1.8	146	-7.0	246	-3.8
48	-2.6	148	-0.6	248	-1.0
50	-1.8	150	-2.6	250	0.6
52	0.2	152	6.2	252	7.0
54	1.0	154	2.2	254	5.4
56	3.0	156	3.4	256	0.6
58	1.0	158	5.8	258	3.0
60	2.2	160	-3.8	260	2.2
62	1.4	162	1.0	262	0.6
64	-0.2	164	1.0	264	-1.8
66	0.2	166	-5.8	266	4.2
68	1.0	168	1.8	268	4.2
70	1.8	170	-0.2	270	3.0
72	2.2	172	-6.2	272	4.2
74	3.8	174	6.2	274	3.0
76	3.8	176	-1.4	276	-0.2
78	3.0	178	-3.4	278	0.6
80	0.6	180	-0.6	280	1.0
82	-0.2	182	-4.6	282	2.6
84	-1.4	184	1.0	284	5.8
86	-2.2	186	0.6	286	0.6
88	-1.0	188	1.4	288	0.6
90	1.0	190	5.4	290	0.2
92	1.4	192	2.2	292	-8.6
94	2.2	194	5.8	294	-3.8
96	1.0	196	3.8	296	-0.6
98	-0.2	198	3.4	298	-1.8
100	-0.2	200	3.0	300	0.6

Rollover Crash Pulse (Event Record 1)
SDM Recorded Vehicle Roll Rate

Contains No Recorded Data

Rollover Crash Pulse (Event Record 1)
Lateral Acceleration (SDM Recorded Vehicle Lateral Acceleration for Rollover Event)

Contains No Recorded Data

Vertical Crash Pulse (Event Record 1)
Normal Acceleration (SDM Recorded Vehicle Vertical Acceleration for Rollover Event)

Contains No Recorded Data

Pre-Crash Data -5.0 to -0.5 sec (Event Record 1)

Times (sec)	Accelerator Pedal, % Full (Accelerator Pedal Position)	Service Brake (Brake Switch Circuit State)	Engine RPM (Engine Speed)	Engine Throttle, % Full (Throttle Position)	Speed, Vehicle Indicated (Vehicle Speed) (MPH [km/h])
-5.0	26	Off	2048	39	81 [131]
-4.5	25	Off	2048	39	81 [131]
-4.0	25	Off	2048	38	81 [131]
-3.5	25	Off	2048	38	81 [131]
-3.0	25	Off	2048	38	81 [131]
-2.5	25	Off	2048	38	81 [131]
-2.0	25	Off	2048	39	81 [131]
-1.5	25	Off	2048	39	81 [131]
-1.0	19	Off	2048	35	81 [131]
-0.5	0	Off	1984	6	80 [129]

Pre-Crash Data -2.0 to -0.5 sec (Event Record 1)

Times (sec)	Cruise Control Active	Cruise Control Resume Switch Active	Cruise Control Set Switch Active	Engine Torque (lb-ft [N-m])	Reduced Engine Power Mode Indicator
-2.0	No	No	No	164 [222]	Off
-1.5	No	No	No	164 [223]	Off
-1.0	No	No	No	162 [219]	Off
-0.5	No	No	No	18 [24]	Off

Hexadecimal Data

```
DPID $11
FF F0 00 FC C4 7C 04

DPID $15
01 02 03 04 05 06 07

DPID $16
08 09 0A 0D 0E 27 27

DPID $17
27 27 27 27 27 27 00

DPID $32
00 FF 05 C7 00 00 00

DPID $35
78 00 00 00 00 00 00

DID $01
41 55 38 36 37 37 44 50 30 30 30 30 30 30 30 30

DID $03
41 54 38 36 37 37 44 50 30 30 30 30 30 30 30 30

DID $05
41 48 38 36 37 36 44 41 30 30 30 30 30 30 30 30

DID $07
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DID $09
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DID $0B
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DID $90
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DID $9A
0B 11

DID $B4
4B 32 31 36 30 33 36 33 4D 32 32 55 47 31 30 30

DID $C1
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DID $C2
05 02 13 07

DID $C3
01 62 1D 42

DID $CB
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00 CF 6F 22

DID $31

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0050	20	20	20	20	20	06	D0	08	56	08
0060	5E	08	5D	06	23	27	27	26	26	26
0070	26	27	27	81	83	83	83	83	83	83
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0090	52	00	FF	FF	FF	FF	FF	FF	FF	FF
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0140	79	81	78	82	78	82	78	82	78	82
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0170	6E	85	6C	85	6C	83	6C	83	6B	84
0180	6B	85	69	85	68	86	68	85	7D	80
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DOT HS 812 637
May 2019

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

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