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ON-SITE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION INVESTIGATION

CASE NUMBER - IN09020
LOCATION - MISSOURI
VEHICLE - 2008 CADILLAC STS
CRASH DATE - June 2009

Submitted:

December 15, 2009

Contract Number: DTNH22-07-C-00044

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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

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

Technical Report Documentation Page

1. *Report No.* IN09020	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Side Impact Inflatable Occupant Protection Investigation Vehicle - 2008 Caddillac STS Location - Missouri		5. *Report Date:* December 15, 2009 6. *Performing Organization Code*	
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.*	
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 501 South Madison, Suite 105 Bloomington, Indiana 47403-2452		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-07-C-00044	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NVS-411) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. *Type of Report and Period Covered* Technical Report Crash Date: June 2009 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site side impact inflatable occupant protection investigation involving a 2008 Cadillac STS and a 2005 Dodge 1500 Ram Quad Cab pickup truck.			
16. *Abstract* This on-site investigation focused on the side impact air bag system of a 2008 Cadillac STS and the sources of the injuries for the driver and front passenger. The Cadillac was involved in a crash with a 2005 Dodge 1500 Ram Quad Cab pickup truck that occurred within an intersection of a divided U.S. highway and the business route for the U.S. highway. The Cadillac was occupied by a restrained 72-year-old female driver and a restrained 74-year-old male front passenger. The driver was in the process of crossing the eastbound lanes of the U.S. highway to the crossover when the vehicle was impacted on the left side plane by the front plane of the Dodge. The force direction on the Cadillac was within the 10 o'clock sector and the impact force was sufficient to trigger the deployment of the driver's seat-mounted side impact air bag and the left side impact inflatable curtain (IC) air bag. The right IC air bag also deployed. The driver and front passenger were transported to a hospital and admitted. The driver sustained serious injuries and was hospitalized for 10 days and released to a long term care facility. The front passenger sustained minor injuries. He was hospitalized for 5 days for mental evaluation due to Alzheimer's disease and released to a long term care facility. The driver and front passenger of the Dodge were not injured.			
17. *Key Words* Side Impact Air Bag Air Bag Deployment Motor Vehicle Traffic Crash Injury Severity		18. *Distribution Statement* General Public	
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 17	22. *Price*

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

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This on-site investigation focused on the side impact air bag system of a 2008 Cadillac STS and the sources of the injuries for the driver and front passenger. The Cadillac was equipped with front seat-mounted side impact air bags and side impact inflatable curtain (IC) air bags. This crash was brought to the attention of the National Highway Traffic Safety Administration (NHTSA) on June 18, 2009 by this contractor. This investigation was assigned on July 7, 2009. The crash involved the Cadillac and a 2005 Dodge Ram 1500 Quad Cab pickup truck. The crash occurred in June, 2009, at 1030 hours, in Missouri and was investigated by the Missouri Highway Patrol. The crash scene and the Cadillac were inspected on July 8 and 9, 2009. The Dodge was in the process of being repaired and was not inspected. A questionnaire was completed for the driver and front passenger of the Cadillac by their son and returned on September 15, 2009. This report is based on the police crash report, scene and vehicle inspections, exemplar vehicle inspection, interview information, occupant kinematic principles, and evaluation of the evidence.

Figure 1: The damaged 2008 Cadillac STS

CRASH CIRCUMSTANCES

Crash Environment: The trafficway that the Cadillac was traveling on was a 2-lane business route for a U.S. highway. The trafficway traversed in a generally east-west direction, but this specific road segment traversed in a north-south direction near the 4-leg intersection which the Cadillac was approaching. On the southern leg of the intersection the roadway had one through lane in each direction and the lanes were divided near the intersection. The lane the Cadillac was traveling on was 4.8 m (15.7 ft) in width and had a positive 2% grade. The lane was bordered by a bituminous shoulder that was 3.2 m (10.5 ft) in width. The concrete median was 2 m (6.6 ft) in width. The roadway pavement markings consisted of a solid white outside edge line, a solid yellow median line, and a solid white stop bar at the intersection. The roadway was controlled by a flashing red traffic signal and a stop sign at the intersection. The trafficway that the Dodge was traveling on was a 4-lane, divided, U.S. highway, traversing in an east-west direction. The Dodge was approaching the same 4-leg intersection. On the western leg of the intersection, both the east and west roadways had two through lanes that were each approximately 3.6 m (11.8 ft) in width. The grass median was 15.7 m (51.5 ft) in width. The shoulders were bituminous and the inside shoulder was 1.8 m (5.9 ft) in width, while the outside shoulder was 3.2 m (10.5 ft) in width. The roadway pavement marking consisted of solid white edge lines, broken white lane lines, and solid yellow median edge lines. The roadway had a positive 3.6% grade and was controlled by a flashing yellow traffic signal at the intersection. The speed limit for the Cadillac was 72 km/h (45 mph) and the speed limit for the Dodge was 105 km/h (65 mph). At the time of the crash, the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry bituminous. The traffic density was moderate and the site of the crash was rural. The Crash Diagram can be seen on page 10 of this report.

Pre-Crash: The Cadillac was occupied by a restrained 72-year-old female driver and a restrained 74-year-old male front passenger. The driver was traveling north (**Figure 2**) approaching the intersection and intended to travel through the crossover of the U.S. highway. The pre-crash data from the Cadillac's Event Data Recorder (EDR) recorded that the vehicle was traveling 10 km\h (6 mph) 5 seconds prior to Algorithm Enable (AE) increasing to 19 km/h (12 mph) at 1 second prior to AE. The EDR also recorded the brake switch on at 1 second prior to AE. The Dodge's restrained 21-year-old female driver was traveling east in the outside lane and intended to continue east. The Dodge's driver steered left and applied full braking in an attempt to avoid the crash, which occurred within the intersection.

Figure 2: Approach of the Cadillac to the intersection with the U.S. highway; arrow shows approach of the Dodge; number shows feet to the area of impact

Figure 3: Approach of the Dodge to the intersection; arrow show approach of the Cadillac

Crash: The front plane of the Dodge impacted the left side plane of the Cadillac (**Figure 4**). The force direction on the Cadillac was within the 10 o'clock sector and the impact force was sufficient to trigger the deployment of the driver's seat-mounted side impact air bag and the IC air bag. The right IC air bag also deployed. The impact caused the Cadillac to rotate counterclockwise 100 degrees as it traversed 13 m (42.6 ft) in a northeast direction to its final rest position in the median heading west (**Figure 5**). The Dodge rotated counterclockwise approximately 15 degrees as it traversed 14 m (45.9 ft) in a northeast direction to its final rest position partially on the inside shoulder and inside eastbound lane heading northeast (**Figure 5**).

Figure 4: Damage to the left side plane of the Cadillac from the impact with the front of the Dodge

Post-Crash: The police were notified of the crash at 1039 hours and arrived on scene at 1043 hours. Rescue personnel mechanically removed the left front and left rear doors of the Cadillac, cut the driver's seat belt and extricated her through the left front door. The driver was transported by ambulance to a hospital. The front passenger of the Cadillac was also removed from the vehicle by rescue personnel and transported to a hospital. The Dodge's driver and front passenger sustained

no police-reported injury and were not transported to a medical facility. Both vehicles were towed from the crash scene due to damage.

Figure 5: View back to impact area; arrow on left shows area of final rest of the Dodge; arrow on right shows area of final rest of the Cadillac

CASE VEHICLE

The 2008 Cadillac was a rear wheel drive, 4-door sedan (VIN: 1G6DW67V380------), equipped with a 3.6-liter, V6 engine, automatic transmission, 4-wheel anti-lock brakes. The front row was equipped with bucket seats, adjustable head restraints, lap-and-shoulder safety belts, a tilt and telescoping steering column, dual stage driver and front right passenger frontal air bags, seat-mounted side impact air bags, and side impact IC air bags, which provided coverage for the front and second row outboard seating positions. The second row was equipped with a bench seat and lap-and-shoulder safety belts. The second row outboard seating positions were also equipped with adjustable head restraints and Lower Anchors and Tethers for Children (LATCH). The vehicle's specified wheelbase was 296 cm (116.5 in).

Figure 6: Arrow shows the string representing the crush on the Cadillac's left front and left rear doors

CASE VEHICLE DAMAGE

Exterior Damage: The impact with the Dodge involved the left side plane of the Cadillac. The left front and left rear doors were directly damaged. The direct damage began 74 cm (29.1 in) rear of the left front axle and extended 199 cm (78.3 in) along the left side. The crush profile (**Figures 6** and **7**) was based on measurements taken on the removed left front and left rear doors as well as comparison measurements taken on the vehicle's undamaged right side. The maximum residual crush was determined to be 32 cm (12.6 in) occurring at C_3. The height of the maximum door crush was 71 cm (28 in) and the Door Sill Differential was 25 cm (9.8 in) The Cadillac's left wheelbase was reduced 5 cm (2 in) while the right wheelbase was extended 1 cm (0.4 in). The induced damage involved the left A-pillar, left roof side rail, sill, and the left quarter panel. The left fender was deformed during the removal of the left side doors. Rescue personnel also cut the left and right A-, B-, and C-pillars. The table below shows the vehicle's right side crush profile.

Figure 7: Top view of the Cadillac's left side crush profile represented by the string (arrow)

Units	Event	Direct Damage		Field L	C_1	C_2	C_3	C_4	C_5	C_6	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	1	199	32	274	0	4	32	24	30	0	-27	-47
in		78.3	12.6	107.9	0.0	1.6	12.6	9.4	11.8	0.0	-10.6	-18.5

Damage Classification: The Collision Deformation Classification was **10-LPAW-3** (**290** degrees) for the left side impact. The Missing Vehicle algorithm of the WinSMASH program calculated the Cadillac's total Delta V as 25 km/h (16 mph). The longitudinal and lateral velocity changes were -8.6 km/h (-5.3 mph) and 23.5 km/h (14.6 mph), respectively. The results were based only on the Cadillac's crush profile and should be considered as a borderline reconstruction of the vehicle's Delta V. The Cadillac's EDR recorded the maximum longitudinal and lateral Delta Vs as 5.46 km\h (3.39 mph) and 27.28 km\h (16.95 mph), respectively.

The vehicle manufacturer's recommended tire size was P235/50R17. The Cadillac was equipped with tires of the recommended size. The vehicle's tire data are shown in the table below.

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	200	29	207	30	7	9	None	No	No
LR	207	30	207	30	7	9	None	No	No
RR	Flat	Flat	207	30	7	9	None	No	Yes
RF	234	34	207	30	7	9	None	No	No

Vehicle Interior: The inspection of the Cadillac's interior revealed no discernable evidence of occupant contact and no steering rim deformation or compression of the energy absorbing steering column. Both left side doors were jammed shut and the right side doors remained closed and operational. The pre-crash status of all of the window glazings was either fixed or closed. The left and right front window glazings were laminated and the left front window glazing was in place and cracked from impact forces. The left rear window and backlight glazings were disintegrated from impact forces. The windshield had been cut out of the vehicle. Based on the damage to the left A-pillar from the impact, the windshield was probably in place and cracked from impact forces during the crash.

The passenger compartment sustained 15 intrusions. The most severe intrusions into the driver's occupant space involved the forward lower quadrant of the left front door, the left B-pillar, and the driver's seat back (**Figures 8** and **9**). These components intruded laterally 18 cm (7.1 in), 16 cm (6.3 in), and 16 cm (6.3 in), respectively. Due to the removal of the left front door and B-pillar, the intrusion values of these two components were estimated from measurements taken on the removed components and the undamaged right side.

Figure 8: Lateral displacement of the driver's seat back

Figure 9: The left side curtain air bag and the deformed driver's seat

EVENT DATA RECORDER

The EDR was imaged using version 3.2 of the Bosch Crash Data Retrieval software via connection to the vehicle's diagnostic link connector. The file was subsequently read and printed using version 3.3 of the software. The EDR recorded a deployment event. The imaged data indicated that the event recording was complete and the SIR warning lamp was off. The driver and front passenger's safety belt switch circuits were recorded as "buckled" and both pretensioners were commanded to actuate. The time from AE to the deployment command criteria being met for the driver's seat-mounted side impact air bag and IC air bag was 2.5 msec. The longitudinal Delta V reached a maximum value of 5.46 km/h (3.39 mph) at 100 msec after the deployment criteria was met, and the lateral Delta V reached a maximum value of 27.28 km\h (16.95 mph) at 90 msec after the deployment criteria was met. The EDR's pre-crash data was discussed in the pre-crash section on page 2 above. The EDR report is attached at the end of this report[1].

AUTOMATIC RESTRAINT SYSTEM

The Cadillac was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system that consisted of dual stage driver and front right passenger air bags, driver seat position sensor, seat belt usage sensors, buckle-mounted pretensioners, and a front passenger pattern recognition sensor. The manufacturer has certified that the vehicle is compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The frontal air bags did not deploy in this crash.

1. Please note that for confidentiality purposes, pages 8-11 are not included with the EDR report

The Cadillac was also equipped with front seat-mounted side impact air bags and side impact IC air bags. Based on the Holmatro Rescuer's Guide to Vehicle Safety Systems, the vehicle's side impact sensors were located within the lower B-pillars and the IC air bag inflators were located within the C-pillars. Both IC air bags and the driver's seat-mounted side impact air bag deployed in this crash.

Figure 10: The right side curtain air bag

Figure 11: The driver's seat back-mounted side impact air bag was cut out of the vehicle

The left IC air bag (**Figure 9**) was located along the left roof side rail inside the headliner and extended from the A- to the C-pillar. The IC air bag was designed with inflation chambers adjacent to the driver and second row left seat positions. There were no visible external vent ports. The deployed IC air bag was 140 cm (55.1 in) in width and 40 cm (15.7 in) in height. A triangular fabric panel 37 cm (14.6 in) in width and 33 cm (13 in) in height was present at the front of the air bag and closed the gap between the air bag and the A-pillar. The front and back portions of both the left and right IC air bags had been cut and damaged during rescue operations. The fold creases on the air bag indicated that it had been folded in accordion fashion within the headliner. The right IC air bag (**Figure 10**) had the same dimensions and features as the left IC air bag. Inspection of the deployed left and right IC air bags revealed no discernable evidence of occupant contact or crash related damage.

The seat-mounted side impact air bags were located within the outboard side of the front seat backs (**Figure 11**). The driver's seat-mounted side impact air bag deployed in this crash. It had been cut out of the vehicle prior to the inspection.

MANUAL RESTRAINT SYSTEM

The Cadillac was equipped with lap-and-shoulder safety belts in the front and second row seating positions. The driver's safety belt consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), sliding latch plate, and an adjustable upper anchor. The front passenger safety belt was similarly equipped but had a switchable ELR/Automatic Locking Retractor (ALR). The positions of both front row adjustable upper anchors could not be determined due to damage to the B-pillar's from rescue activities. Both front row safety belts were equipped with buckle-mounted pretensioners that actuated during the crash. The second row seat belts were equipped similarly as the front passenger safety belt but had fixed upper anchors.

The inspection of the driver's safety belt assembly revealed that the belt webbing had been cut by rescue personnel, and the latch plate was found latched in the buckle. A light load abrasion was present on the safety belt webbing located 41 cm (16.1 in) above the stop button. Load abrasions were also present on the latch plate belt guide (**Figure 12**), and the EDR recorded the driver's safety belt switch circuit as buckled. The buckle stalk was shortened approximately 3 cm (1.2 in) due to pretensioner actuation. These findings confirmed that the driver was restrained at the time of the crash.

Figure 12: Load abrasions on the driver's latch plate belt guide

Inspection of the front passenger's safety belt assembly revealed that the belt webbing had been cut by rescue personnel, and the latch plate was found latched in the buckle. The EDR recorded the front passenger's safety belt switch circuit as buckled and the pretensioner actuated. The buckle stalk could not be accessed for measurement of pretensioner movement. The passenger's medical records described a contusion on the driver's chest consistent with safety belt usage. These findings confirmed that the front passenger was restrained at the time of the crash.

CASE VEHICLE DRIVER KINEMATICS

The driver of the Cadillac [72-year-old, female; 165 cm (65 in) and 68 kg (150 lbs)] was seated in an unknown posture. The driver's seat track was adjusted between the middle and full forward position. The seat back recline position could not be determined due to the deformation of the seat back. The adjustable head restraint was located in the full-down position and was tilted full-forward. The distance from the top of the seat back to the top of the head restraint was 16 cm (6.3 in). The tilt steering wheel was located in the full-up position, while the telescoping steering column was adjusted 4 cm (1.6 in) rear of the full-forward position. The driver was wearing glasses at the time of the crash.

The impact on the left side plane of the Cadillac displaced the driver to the left and forward opposite the 10 o'clock direction of force. While there was no discernable evidence of occupant contact, occupant kinematic principles suggest that the driver's head loaded the left IC air bag, which caused a nonanatomic brain injury with loss of consciousness. Her left torso probably loaded through the deployed seat-mounted side impact air bag into the rear lower quadrant of the left front door arm rest, which caused displaced fractures of L_2 through L_5, displaced fractures of the bilateral sacral ala, and fractures of the bilateral sacroiliac joints. The driver remained restrained within her seat position throughout the crash. Rescue personnel mechanically removed the left front and left rear doors, cut the driver's safety belt and extricated her through the left front door.

The driver was transported by ambulance to a hospital. She was hospitalized for 10 days and transferred to a long care facility. The table below shows the driver's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Nonanatomic brain injury with loss of consciousness, not further specified	moderate 160406.2,0	Air bag, driver's side inflatable curtain	Probable	Hospitalization records
2 3 4 5	Fractures, minimally displaced, left transverse processes L_2 through L_5	moderate 650620.2,8 650620.2,8 650620.2,8 650620.2,8	Left front hardware/armrest, rear lower quadrant	Probable	Hospitalization records
6	Fractures bilateral and superior and inferior pubic rami and medial pubis	moderate 852602.2,5	Left front hardware/armrest, rear lower quadrant	Probable	Hospitalization records
7	Fractures, minimally displaced, bilateral sacral ala with hematoma related to pelvic fractures	serious 852604.3,6	Left front hardware/armrest, rear lower quadrant	Probable	Hospitalization records
8	Fracture, diastasis, of bilateral sacroiliac joints	serious 852800.3,6	Left front hardware/armrest, rear lower quadrant	Probable	Hospitalization records
9	Abrasion over left anterior knee, not further specified	minor 890202.1,2	Left front door panel, forward lower quadrant	Probable	Emergency room records
10	Contusion (ecchymosis) of right anterior knee, not further specified	minor 890402.1,1	Left lower instrument panel	Probable	Emergency room records

CASE VEHICLE FRONT ROW PASSENGER KINEMATICS

The front passenger of the Cadillac [74-year-old, male; 173 cm (68 in) and 77 kg(169 lbs)] was seated in an unknown posture. The passenger's seat track was adjusted to the full-rear position and the seat back was slightly reclined. The adjustable head restraint was located in the full-down position and was tilted full forward. The distance from the top of the seat back to the top of the head restraint was 16 cm (6.3 in). The passenger was wearing glasses at the time of the crash.

The impact on the left side plane of the Cadillac displaced the front passenger to the left and forward opposite the 10 o'clock direction of force and he loaded the safety belt. He sustained a contusion on the chest below the left breast from loading the safety belt and a small laceration on

the left cheek, probably from flying glass fragments from the disintegrated left front window glazing. He also sustained contusions on both arms from an unknown injury source. The passenger remained restrained in his seat position throughout the crash. He was removed from the vehicle by rescue personnel.

CASE VEHICLE FRONT ROW PASSENGER INJURIES

The front passenger was transported to a hospital by private conveyance and treated in the emergency room for minor injuries related to the crash. He was hospitalized for 5 days for mental evaluation due to Alzheimer's disease and released to a long term care facility. The table below shows the passenger's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Laceration, small, left cheek, not further specified	minor 290602.1,2	Noncontact injury: flying glass, left front glazing	Probable	Interviewee (same person)
2	Contusion (bruising) on chest beneath left breast	minor 490402.1,2	Torso portion of safety belt system	Probable	Hospitalization records
3	Contusions (bruising) on arms, not further specified	minor 790402.1,3	Unknown injury source	Unknown	Hospitalization records

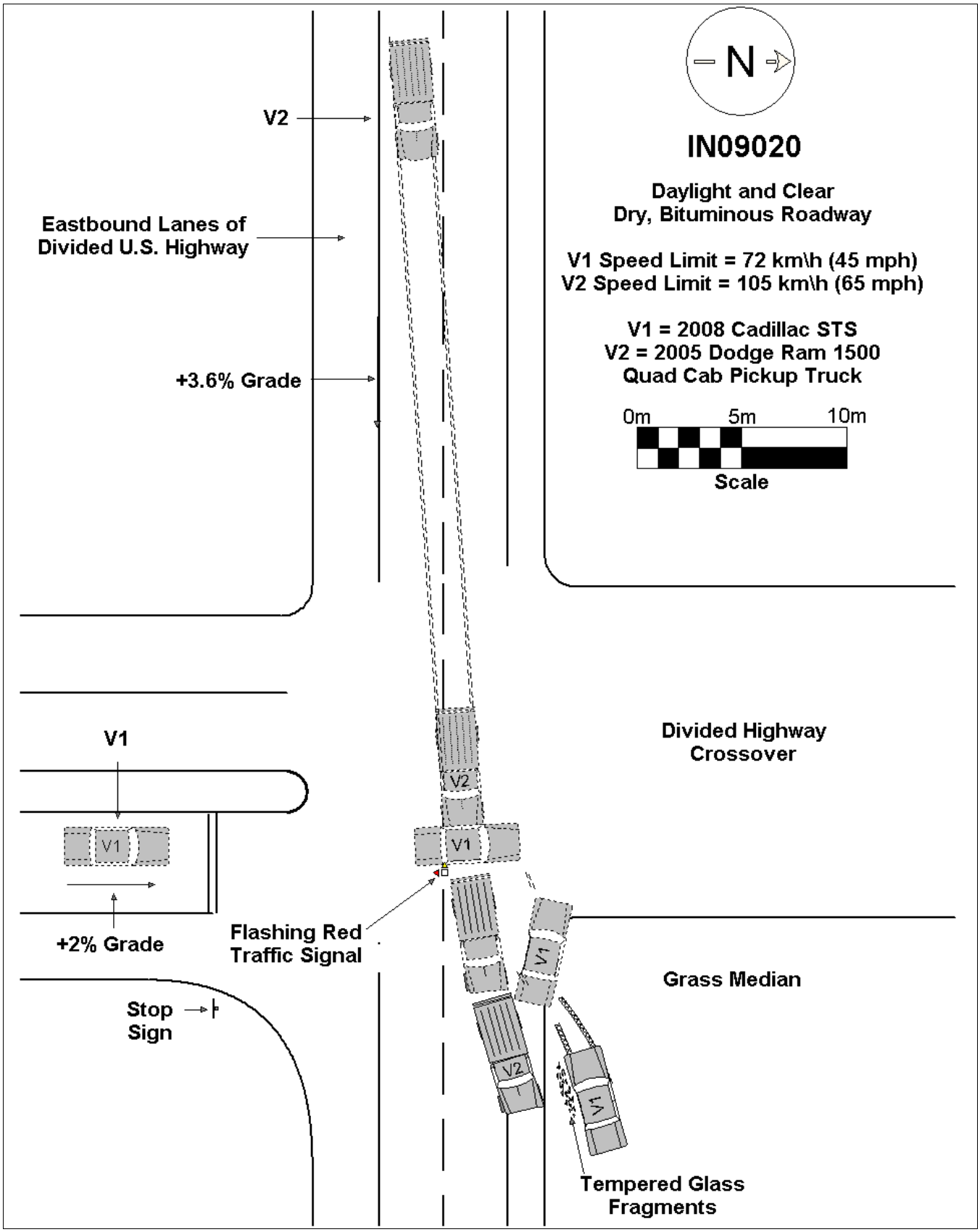
OTHER VEHICLE

The 2005 Dodge Ram was a 4-wheel drive, 4-door pickup truck (VIN: 1D7HU18D65S------) equipped with a 5.7L, V8 engine, 4-wheel anti-lock brakes, and dual stage driver and front right passenger frontal air bags.

Exterior Damage: The Dodge was in the process of being repaired and was not inspected.

The Missing Vehicle algorithm of the WinSMASH program calculated the Dodge's total Delta V for the front impact as 19 km/h (12 mph). The longitudinal and lateral velocity changes were –17.9 km/h (-11.1 mph) and -6.5 km/h (-4.0 mph), respectively. The results were based only on the Cadillac's crush profile and should be considered as a borderline reconstruction of the Dodge's Delta V.

Other Vehicle's Occupants: The police crash report indicated that the driver of the Dodge (21-year-old, female) was restrained by the lap-and-shoulder safety belt and her frontal air bag did not deploy. The driver sustained no police reported injuries and was not transported to a medical facility. The front passenger (51-year-old, female) was restrained by the lap-and shoulder safety belt and her frontal air bag did not deploy. She sustained no police reported injuries and was not transported to a medical facility.


N
IN09020
Daylight and Clear
Dry, Bituminous Roadway
V1 Speed Limit = 72 km\h (45 mph)
V2 Speed Limit = 105 km\h (65 mph)
V1 = 2008 Cadillac STS
V2 = 2005 Dodge Ram 1500
Quad Cab Pickup Truck
0m
5m
10m
Scale
V2
Eastbound Lanes of
Divided U.S. Highway
+3.6% Grade
V1
Divided Highway
Crossover
V1
+2% Grade
Flashing Red
Traffic Signal
Grass Median
Stop
Sign
Tempered Glass
Fragments

CDR File Information

User Entered VIN	1G6DW67V380******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN09020EDR.CDR
Saved on	Thursday, July 9 2009 at 08:41:51 AM
Collected with CDR version	Crash Data Retrieval Tool 3.2
Reported with CDR version	Crash Data Retrieval Tool 3.3
EDR Device Type	airbag control module
Event(s) recovered	Deployment

IMPORTANT NOTICE: Robert Bosch LLC recommends that the latest production release of Crash Data Retrieval software be utilized when viewing, printing or exporting any retrieved data from within the CDR program. This ensures that the retrieved data has been translated using the most recent information including but not limited to that which was provided by the manufacturers of the vehicles supported in this product.

Data Limitations

Recorded Crash Events:

There are two types of recorded crash 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. A Non-Deployment Event may contain Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle velocity change. This event will be cleared by the SDM, after approximately 250 ignition cycles. This event can be overwritten by a second Deployment Event, referred to as Deployment Event #2, if the Non-Deployment Event is not locked. The data in the Non-Deployment Event file will be locked, if the Non-Deployment Event occurred within five seconds of a Deployment Event. A locked Non Deployment Event cannot be overwritten or cleared by the SDM.
The second type of SDM recorded crash event is the Deployment Event. It also may contain Pre-Crash and Crash data. The SDM can store up to two different Deployment Events. If a second Deployment Event occurs any time after the Deployment Event, the Deployment Event #2 will overwrite any non-locked Non-Deployment Event. Deployment Events cannot be overwritten or cleared by the SDM. Once the SDM has deployed an air bag, the SDM must be replaced.

Data:

-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 Events, the SDM will record 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM can record up to the first 300 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.

-The CDR tool displays time from Algorithm Enable (AE) to time of deployment command in a deployment event and AE to time of maximum SDM recorded vehicle velocity change in a non-deployment event. Time from AE begins when the first air bag system enable threshold is met and ends when deployment command criteria is met or at maximum SDM recorded vehicle velocity change. Air bag systems such as frontal, side, or rollover, may be a source of an enable. The time represented in a CDR report can be that of the enable of one air bag system to the deployment time of another air bag system.

-Maximum Recorded Vehicle Velocity Change is the maximum square root value of the sum of the squares for the vehicle's combined "X" and "Y" axis change in velocity.

-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.

-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
- -no data is received from the module sending the pre-crash data
- -no module is present to send the pre-crash data

-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit, except: The Passenger Belt Switch Circuit Status for 2005 vehicles is available only on the Cadillac STS. The Passenger Belt Switch Circuit Status for 2006 Chevrolet Cobalt Sport Coupe (AP) model vehicles, with the option package that includes Recaro brand seats (RPO ALV), always reports a default value of "Buckled," because there is no passenger belt switch with the Recaro seat option.
-The Time Between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than five seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition counter.
-Steering Wheel Angle data is displayed as a positive value when the steering wheel is turned to the right and a negative value when the steering wheel is turned to the left, except for Cadillac STS model vehicles with StabiliTrak 3.0 systems (RPO JL7). For Cadillac STS model vehicles with StabiliTrak 3.0 systems (RPO JL7), when the steering wheel is turned to the right, a negative value will be displayed and when the steering wheel is turned to the left, a positive value will be displayed. The Steering Wheel Angle data is reported in 16 degree increments.

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

Multiple Event Data

Associated Events Not Recorded	0
An Event(s) Preceded the Recorded Event(s)	No
An Event(s) was in Between the Recorded Event(s)	No
An Event(s) Followed the Recorded Event(s)	No
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	No

System Status At AE

Vehicle Identification Number	**6DW67V*8*******
Low Tire Pressure Warning Lamp (If Equipped)	OFF
Vehicle Power Mode Status	Run
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Active
Brake System Warning Lamp (If Equipped)	OFF

System Status At 1 second

Transmission Range (If Equipped)	Second Gear
Transmission Selector Position (If Equipped)	Sixth Gear
Traction Control System Active (If Equipped)	No
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	75
Left Front Door Status (If Equipped)	Closed
Right Front Door Status (If Equipped)	Closed
Left Rear Door Status (If Equipped)	Closed
Right Rear Door Status (If Equipped)	Closed
Rear Door(s) Status (If Equipped)	Closed

Pre-crash data

Parameter	-2 sec	-1 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No

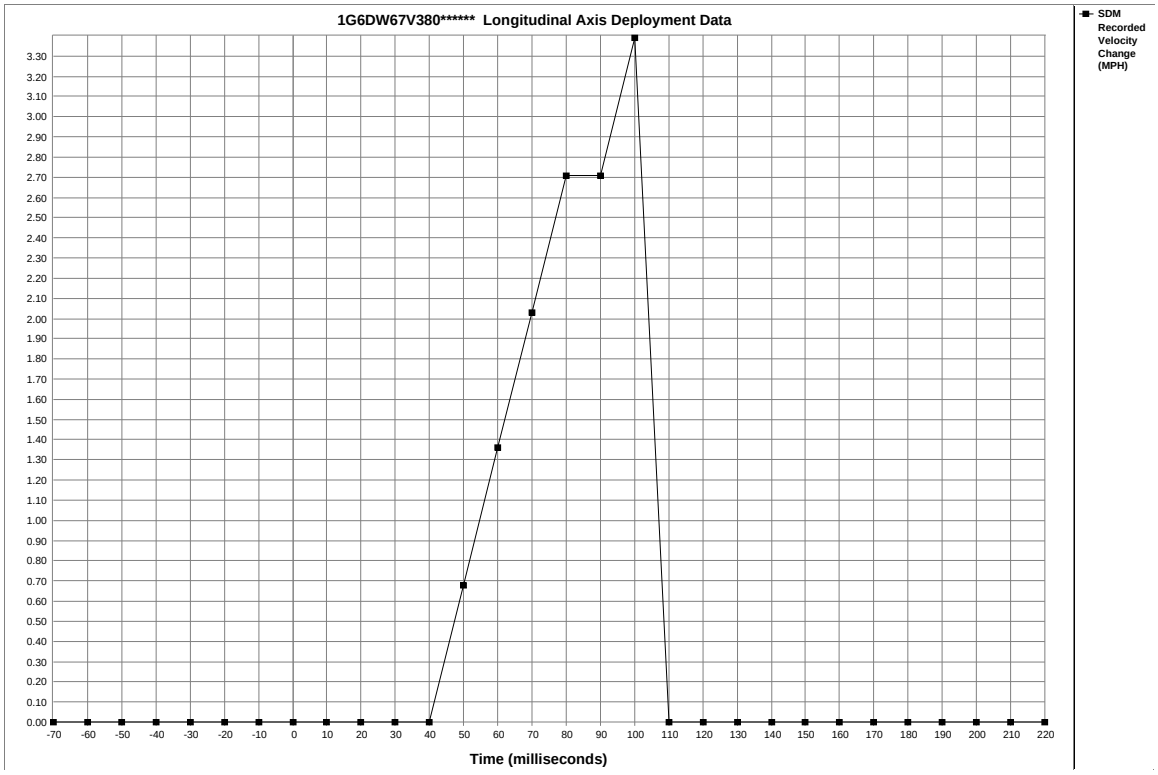
Pre-Crash Data

Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	6	10	12	12	12
Engine Speed (RPM)	1536	1920	1600	1280	1088
Percent Throttle	28	29	29	13	10
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	ON
Accelerator Pedal Position (percent)	15	15	14	0	0
Antilock Brake System Active (If Equipped)	No	No	No	No	No
Lateral Acceleration (feet/s²)(If Equipped)	2.46	2.46	1.64	3.28	2.46

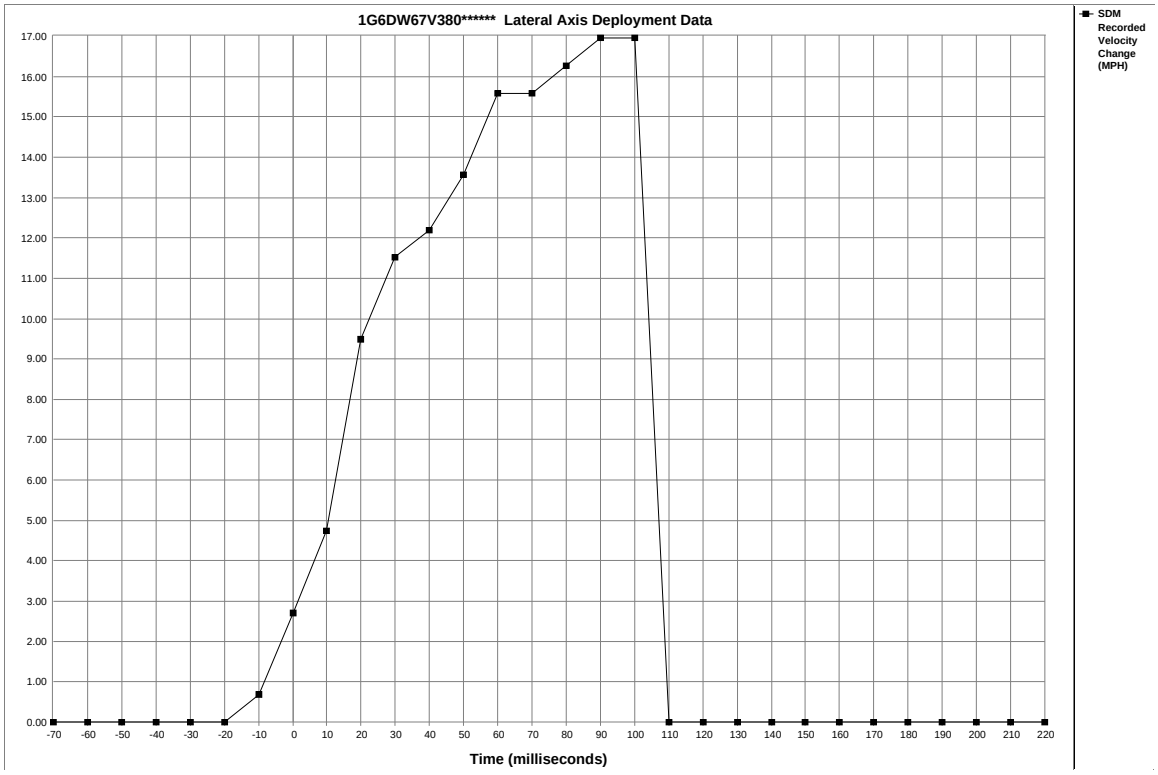
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Yaw Rate (degrees per second) (If Equipped)	1	2	0	0	3
Steering Wheel Angle (degrees) (If Equipped)	32	32	-16	16	32
Vehicle Dynamics Control Active (If Equipped)	No	No	No	No	No

System Status At Deployment

Ignition Cycles At Investigation	2194
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	655200
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	2188
Ignition Cycles At Event	2189
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Automatic Passenger SIR Suppression System Validity Status at AE	Valid
Automatic Passenger SIR Suppression System Status at AE	Air Bag Not Suppressed
Automatic Passenger SIR Suppression System Validity Status at First Deployment Command	Valid
Automatic Passenger SIR Suppression System Status at First Deployment Command	Air Bag Not Suppressed
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Driver Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	2.5
Passenger Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Time Between Events (sec)	N/A
Driver First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	Yes
Driver Pretensioner Deployment Loop Commanded	Yes
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	Yes
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	Yes
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Driver Anchor Pretensioner Deployment Loop Commanded (If Equipped)	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Passenger Anchor Pretensioner Deployment Loop Commanded (If Equipped)	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes



Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	1.36	2.03
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Longitudinal Axis Recorded Velocity Change (MPH)	2.71	2.71	3.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00



Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.68	2.71	4.74	9.49	11.52	12.20	13.56	15.59	15.59
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Lateral Axis Recorded Velocity Change (MPH)	16.27	16.95	16.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00