CRASH DATA RESEARCH CENTER
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CALSPAN ON-SITE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION SYSTEM CRASH INVESTIGATION
SCI CASE NO.: CA10029

VEHICLE: 2010 HYUNDAI ACCENT GLS

LOCATION: NORTH CAROLINA

CRASH DATE: JUNE 2010

Contract No. DTNH22-07-C-00043

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

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

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16. Abstract This on-site investigation focused on the side impact inflatable occupant protection system of a 2010 Hyundai Accent GLS. The Hyundai was involved in an offset frontal crash (with right side engagement) as a result of an impact with a 2008 Dodge Dakota. The Hyundai was equipped with four-wheel anti-lock brakes, a Certified Advanced 208-Compliant frontal air bag system (CAC), front seat-mounted side impact air bags, and side impact Inflatable Curtain (IC) air bags. The CAC system included dual-stage frontal air bags for the driver and right front passenger positions, seat track positioning sensors, front safety belt retractor pretensioners, and a front right occupant weight sensor. The right corner of the Hyundai's front plane was impacted by the front plane of the Dodge. The impact configuration resulted in vehicle rotation and the direct contact of the Dodge continued along the right side of the Hyundai. The crash resulted in the deployment of both frontal air bags and the left IC air bag in the Hyundai. The right IC air bag did not deploy. The frontal air bags in the Dodge also deployed. The 18-year-old female driver of the Hyundai was transported by ground ambulance to a local hospital where she was treated in the emergency department for minor severity injuries and released the same day. The 16-year-old female front right passenger of the Hyundai was transported by ground ambulance to a regional trauma center. She was hospitalized for 27 days for the treatment of serious injuries.			
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BACKGROUND

This on-site investigation focused on the side impact inflatable occupant protection system of a 2010 Hyundai Accent GLS **(Figure 1)**. The Hyundai was involved in an offset frontal crash (with right side engagement) as a result of an impact with a 2008 Dodge Dakota. The Hyundai was equipped with four-wheel anti-lock brakes, a Certified Advanced 208-Compliant frontal air bag system (CAC), front seat-mounted side impact air bags, and side impact Inflatable Curtain (IC) air bags. The CAC system included dual-stage frontal air bags for the driver and right front passenger positions, seat track positioning sensors, front safety belt retractor pretensioners, and a front right occupant weight sensor. The right corner of the Hyundai's front plane was impacted by the front plane of the Dodge. The impact configuration resulted in vehicle rotation and the direct contact of the Dodge continued along the right side of the Hyundai. The crash resulted in the deployment of both frontal air bags and the left IC air bag in the Hyundai. The right IC air bag did not deploy. The frontal air bags in the Dodge also deployed. The 18-year-old female driver of the Hyundai was transported by ground ambulance to a local hospital where she was treated in the emergency department for minor severity injuries and released the same day. The 16-year-old female front right passenger of the Hyundai was transported by ground ambulance to a regional trauma center. She was hospitalized for 27 days for the treatment of serious injuries.

Figure 1: Front right oblique view of the Hyundai Accent.

This crash was identified through a local news article on July 1, 2010. Based on the information in the news article regarding vehicle damage and occupant injury, this case was assigned by the Crash Investigation Division (CID) for an on-site investigation on July 6, 2010. The on-site investigation was initiated on July 7, 2010. The investigation involved the inspection and documentation of the Hyundai and the Dodge, a detailed interview with the driver of the Hyundai, and the documentation of the crash site. Additionally, the Event Data Recorder (EDR) of the Dodge was imaged during the inspection. The imaged EDR data file is included as **Attachment A** of this report.

SUMMARY

VEHICLE DATA

2010 Hyundai Accent

The 2010 Hyundai Accent GLS was manufactured on March 25, 2010 and was identified by the Vehicle Identification Number (VIN): KMHCN4AC9AU (production number deleted). The vehicle was a recent new purchase and had been driven 1,265 km (786 mi) prior to the time of the crash. The front-wheel drive Hyundai was powered by a 1.6-liter, inline 4-cylinder engine linked to a 4-speed automatic transmission. The braking system consisted of power-assisted front and rear disc brakes with 4-wheel antilock, electronic brakeforce distribution and brake assist. The Hyundai was also equipped with an indirect Tire Pressure Monitoring System (TPMS). The Hyundai was equipped with four Kumho Solus KH16 tires, size P185/65R14. The tires were mounted on OEM steel wheels with plastic covers. The tire size matched the vehicle manufacturer recommendation. The vehicle manufacturer recommended cold tire pressure was 221 kPa (32 PSI) for the front and rear. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Tire/Wheel Damage
Left Front	207 kPa (30 PSI)	6 mm (8/32 in)	None
Left Rear	200 kPa (29 PSI)	7 mm (9/32 in)	None
Right Front	Tire flat	6 mm (8/32 in)	De-beaded, 15x14 cm (5.9x5.5 in) cut in sidewall; wheel rim deformed
Right Rear	207 kPa (30 PSI)	7 mm (9/32 in)	None

The interior of the Hyundai was configured with cloth-surfaced, 5-passenger seating. The front bucket seats were separated by a center console and were equipped with height adjustable head restraints. At the time of the SCI inspection, both front head restraints were in the full-down position. The driver's seat track was operational and the seat was located in a mid-track position 16 cm (6.3 in) forward of full-rear. The front left seatback angle measured 23 degrees aft of vertical. The front right seat track was in the full-rearward position, and the seatback angle measured 28 degrees aft of vertical. The front right seat track was jammed and the seat had been deformed by the lateral intrusion of the front right door and B-pillar. The second row was a bench seat with split 60/40 folding backs and with integral head restraints at all three seating positions.

The interior occupant safety systems consisted of 3-point lap and shoulder belts for all five designated seating positions, front safety belt retractor pretensioners, CAC dual-stage frontal air bags, front seat-mounted side impact air bags and roof side rail-mounted side impact IC air bags that provide protection for the four outboard seat positions.

2008 Dodge Dakota

The 2008 Dodge Dakota club-cab SLT was manufactured in November 2007 and was identified by the VIN: 1D7HE48N98S (production sequence deleted). The rear-wheel drive Dodge was powered by a 4.7-liter V8 engine linked to a 5-speed automatic transmission. The braking system consisted of power-assisted front disc and rear drum brakes with 4-wheel antilock. The Dodge was also equipped with an indirect TPMS. The windshield was fractured at the lower left aspect as a result of the crash. All other windows were undamaged post-crash. The Dodge was equipped with Goodyear Wrangler SR-A tires. All tires were size P245/70R16, which matched the manufacturers recommended tire size. The manufacturer recommended cold tire pressure was 241 kPa (35 PSI) for the front and rear. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Tire/Wheel Damage
Left Front	Tire Flat	6 mm (7/32 in)	None
Left Rear	221 kPa (32 PSI)	6 mm (8/32 in)	None
Right Front	Tire Flat	5 mm (6/32 in)	De-beaded, inner sidewall cut 17x10 cm (6.7x3.9 in)
Right Rear	221 kPa (32 PSI)	6 mm (8/32 in)	None

CRASH SITE

This crash occurred during daylight hours at the Y-intersection of two rural roadways. **Figure 2** depicts the Hyundai's approach to the intersection. The environmental conditions were clear and dry at the time of the crash. The east/west primary roadway on which the Hyundai was traveling consisted of two asphalt-surfaced travel lanes that measured 3.3 m (10.8 ft) in width. The main roadway included a left curve for westbound traffic. The measured radius of curvature was 374 m (1263 ft). The road was bordered on both sides by narrow asphalt shoulders 70 cm (2.4 ft) in width. The north roadside consisted of grass terrain with a negative grade of two percent. The grade transitioned to a positive grade of 15 percent, 5 m (16.4 ft) north of the roadway. The south roadside was a grass-surfaced residential yard with a negative grade of two percent adjacent to the roadway that transitioned to a positive grade of two percent, 3.3 m (10.8 ft) south of the south road edge. In the pre-crash area for the Hyundai, the road grade was positive one percent. The intersecting roadway joined the main roadway at a 35 degree angle. This intersecting roadway consisted of two

Figure 2: Pre-crash trajectory of the Hyundai.

asphalt surfaced travel lanes that measured 3 m (9.8 ft) in width and was bordered by asphalt shoulders 40 cm (1.3 ft) in width. From the north, the intersecting roadway included a curve to the left with a radius of curvature of 216 m (709 ft). The intersecting roadway was controlled by a stop sign. The speed limit for both roadways was 89 km/h (55 mph). The Crash Schematic is included as **Figure 9** of this report.

CRASH SEQUENCE

Pre-Crash

The restrained 18-year-old female driver of the Hyundai was operating the vehicle westbound approaching the Y-intersection. The driver was traveling to the front right passenger's residence that was located approximately 10 minutes west of the crash site. As the vehicle approached the intersection, it was traveling at a driver-estimated speed of 89 km/h (55 mph). The Dodge was traveling southbound on the intersecting roadway. It was traveling at an EDR-reported speed of 84 km/h (52 mph) five seconds prior to the air bag deployment. The southbound approach to the intersection was controlled by a stop sign. Based on the EDR data, the driver of the Dodge applied the brakes 0.4 seconds prior to the air bag deployment, and slowed the Dodge from 84 km/h (52 mph) to 71 km/h (44 mph) at the time of the air bag deployment. The driver of the Hyundai stated in the interview that she did not have time to initiate an avoidance maneuver prior to the impact. There was no evidence at the scene of any avoidance maneuver by either vehicle. The Dodge entered the intersection directly into the path of the Hyundai.

Crash

The front plane of the Dodge impacted the front plane of the Hyundai (Event 1) in an offset collision. The direction of force was within the 12 o'clock sector for the Hyundai and the 11 o'clock sector for the Dodge. The force of the impact actuated the Hyundai's front retractor pretensioners, and deployed both the frontal air bags and the left IC air bag. The frontal air bags in the Dodge also deployed. The Damage Algorithm of the WinSMASH program was used to calculate the severity of the crash (delta-V). The total delta-V of the Hyundai was 42 km/h (26.1 mph). The Hyundai's longitudinal and lateral delta-V components were -41 km/h (-25.4 mph) and -7 km/h (-4.3 mph), respectively. The total delta-V for the Dodge was 28 km/h (17.4 mph) and the longitudinal and lateral delta-V components were -26 km/h (-16.2 mph) and 10 km/h (6.2 mph), respectively. The reconstruction was considered borderline, as the vehicles did not reach a common velocity in the impact.

The impact deflected the Hyundai to the left within the intersection and caused the Dodge to rotate clockwise (CW). As the Hyundai continued westward, the front plane of the Dodge engaged the right plane of the Hyundai in prolonged contact that extended to the right quarter panel. The Hyundai followed a left arcing trajectory off the south side of the roadway, depositing a 23 m (75.5 ft) fluid spill as it traveled. The Hyundai fully departed the roadway and the front wheels furrowed into the soft soil of the grass roadside evidenced by tire depressions

that measured 10 m (32.8 ft) and 12 m (39.4 ft) in length, right and left respectively. The Hyundai traveled 67.5 m (221.4 ft) from the point of impact to final rest at the end of the left front wheel furrow, facing west on the south roadside. After separation from the Hyundai, the Dodge rotated CW 150 degrees and traveled 7 m (23 ft) southwest of the point of impact, coming to rest within the intersection. The final rest location of the Dodge was documented on the roadway by the police investigation.

Post-Crash

Police, Emergency Medical Service (EMS) and tow personnel responded to the crash site. The driver of the Hyundai was assisted from the vehicle through the left front door. She was transported to a local hospital where she was treated in the emergency department for minor severity soft tissue injuries and released the same day. The front right passenger was entrapped in the vehicle by the lateral intrusion of the side panel forward of the A-pillar and the jammed right front door. Due to the possibility of a neck injury to the front right passenger, the roof was removed from the vehicle by the first responders by cutting all six support pillars. The right front door was also removed during the extrication of the front right passenger. The passenger was removed while unconscious and transported by ground ambulance to a regional trauma center where she was admitted for treatment of a closed head injury, multiple lower extremity fractures and soft tissue injuries. The Hyundai and the Dodge were towed from the scene due to disabling damage. The vehicles were both transferred from the local tow yards to a regional insurance salvage facility, where they were inspected.

2010 HYUNDAI ACCENT

Exterior Damage

The front of the Hyundai sustained moderate damage in this offset frontal/side engagement crash **(Figure 3)**. On the front plane, the direct contact damage began 40 cm (15.7 in) right of the centerline, and extended right 27 cm (10.6 in). The maximum crush was located at C5, 30 cm (11.8 in) right of center, and measured 22 cm (8.7 in). The combined direct and induced damage extended the full-width of the Hyundai's front plane. The bumper beam and front fascia separated from the vehicle during the impact. A residual crush profile was measured to the lower radiator support and was as follows: C1 = 0, C2 = 1 cm (0.4 in), C3 = 3 cm (1.2 in), C4 = 10 cm (3.9 in), C5 = 17 cm (6.7 in), C6 = 29 cm (11.4 in). Both right doors were jammed shut post-crash. The front of the Dodge traveled down the right plane of the Hyundai resulting in deformation and intrusion. The direct contact to the right

Figure 3: Frontal and right side damage to the Hyundai.

side of the Hyundai extended 280 cm (110 in) rearward from the right corner. The maximum crush along the right side was located 15 cm (5.9 in) forward of the A-pillar and measured 50 cm (19.7 in) laterally. The lateral crush to the right A-and B-pillars was 15 cm (5.9 in) and 16 cm (6.3 in), respectively. The right wheelbase was shortened by 27 cm (10.6 in) from contact with the front of the Dodge. The windshield was fractured and holed by the impact forces, and the right front, right rear and backlight were disintegrated due to impact forces. The windshield was cut from the vehicle by EMS during the extrication of the front right occupant. The left side windows and right rear quarter glass were undamaged in the impact. The Collision Deformation Classification (CDC) assigned for this impact was 12FRAE9.

Interior Damage

The Hyundai sustained moderate severity interior damage that was attributed to occupant compartment intrusion, occupant contact and air bag deployment. A 25 cm (10 in) scuff mark attributed to the driver's right knee was located 28-38 cm (11-15 in) above the floor, beginning 5 cm (2 in) left of the mid-instrument panel seam and extending right 9 cm (3.5 in). The steering wheel was rotated 120 degrees counterclockwise (CCW) at the time of the SCI inspection. The fixed steering column/assembly was not damaged in this crash. In the front right seating position, the kick panel forward of the A-pillar, the A-pillar and the right door intruded laterally into the passenger compartment. There was a scuff mark with blood evidence on the inboard side of the front left seatback attributed to the front right passenger's head. This 6 x 8 cm (2.4 x 3.1 in) contact was located on the upper inboard corner of the front left seat. The front right seat was compressed 12 cm (4.7 in).laterally by the intrusion of the front right door and B-pillar. **Figure 4** is a right lateral view of the Hyundai's occupant compartment. The occupant compartment intrusion is listed on the following table:

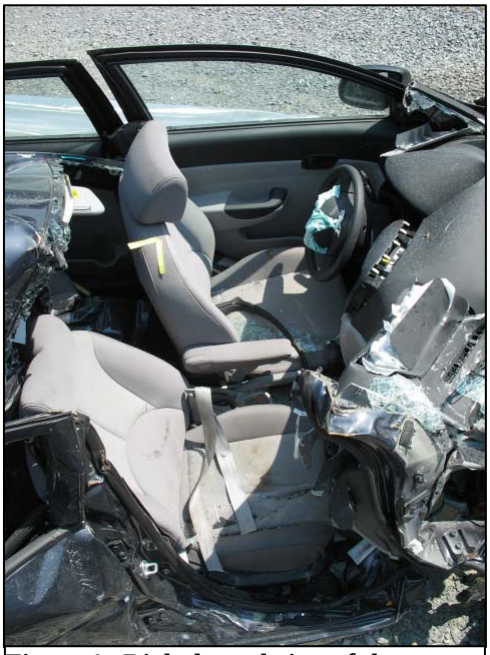


Figure 4: Right lateral view of the interior damage to the Hyundai.

Position	Component	Direction	Magnitude
Row 1 Left	Left instrument panel	Longitudinal	4 cm (1.6 in)
Row 1 Center	Center instrument panel	Longitudinal	21 cm (8.3 in)
Row 1 Right	Right instrument panel	Longitudinal	39 cm (15.4 in)
Row 1 Center	Front right seat	Lateral	6 cm (2.4 in)
Row 1 Right	Side panel, forward of A-pillar	Lateral	42 cm (16.5 in)
Row 1 Right	Toe pan	Longitudinal	24 cm (9.4 in)

Position	Component	Direction	Magnitude
Row 1 Right	Windshield header	Longitudinal	17 cm (6.7 in)
Row 1 Right	Sill	Lateral	11 cm (4.3 in)
Row 1 Right	A-pillar	Lateral	11 cm (4.3 in)
Row 1 Right	Right door, rear upper quadrant (estimated)	Lateral	8 cm (3.1 in)
Row 1 Right	B-pillar, upper – 87 cm (34.3 in) above floor	Lateral	9 cm (3.5 in)

Manual Restraint Systems

The Hyundai was equipped with 3-point lap and shoulder belts for the five designated seating positions. All belt systems utilized continuous loop webbing and sliding latch plates. The front D-rings were height adjustable. The position of the driver's D-ring was unknown (B-pillar cut during removal of the roof). The front right D-ring was in the full-down position. The driver's belt retracted onto an Emergency Locking Retractor (ELR), and the front right passenger's belt retracted onto a switchable ELR/Automatic Locking Retractor (ALR). Both front belts utilized retractor pretensioners, which actuated during the crash, and locked the belt webbing in the used/worn position. During the removal of the roof, the driver's belt webbing was cut 158 cm (62.2 in) above the lower anchor. The latchplate was missing and the belt webbing was captured between the left front door and the sill, with the upper aspect of the webbing on the ground and exposed to the elements. No contact evidence was observed on the driver's belt webbing. The front right belt webbing was gathered in the latchplate 61 cm (24 in) above the lower anchor and had been cut in two locations, 15 cm (5.9 in) and 120 cm (47.2 in) above the lower anchor. The front right belt webbing exhibited blood evidence that was located 15-65 cm (5.9-25.6 in) above the lower floor anchor.

The second row belt systems utilized a switchable ELR/ALR retractor. The second row was not occupied and the belts were not in use at the time of the crash.

Frontal Air Bag System

The Hyundai Accent 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, seat track positioning sensors, a front right occupant weight sensor, retractor pretensioners, and safety belt buckle switches. The manufacturer of this vehicle certified that the Hyundai Accent was compliant with the advanced air bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No: 208. The frontal air bags deployed as a result of the crash.

The driver's air bag was concealed within the center hub of the three-spoke steering wheel by a tri-flap design. The upper cover flap measured 14 cm (5.5 in) in width and 8 cm (3.1 in) in height. The lower flaps were triangular in shape and measured 7 cm (2.8 in) in width and 8 cm (3.1 in) in height. The air bag, **(Figure 5),** was 60 cm (23.6 in) in diameter. It contained a 15 cm (5.9 in) circular tether with two straps attached at the 12 and 6 o'clock positions. The driver's air bag was vented by two vent ports on the upper rear aspect of the air bag at the 11 and 1 o'clock positions. There was a 1 cm (0.4 in) drop of blood on the front of the air bag located 15 cm (5.9 in) above the center of the air bag and 3 cm (1.2 in) right of the center. The driver's air bag was unremarkable for further contact evidence.

Figure 5: Upper aspect of the front of the Hyundai's driver's air bag.

The front right air bag was mounted within the top aspect of the right instrument panel. The air bag was concealed under a single cover flap that measured 24 cm (9.4 in) in width and 10 cm (3.9 in) in height. The cover flap contained multiple scratches and gouge marks attributed to contact with the windshield that measured from 1 cm (0.4 in) to 4 cm (1.6 in) in length. This damage extended over the entire surface of the cover flap. The air bag **(Figure 6)** measured 52 cm (20.5 in) in width and 63 cm (24.8 in) in height. It was not tethered, but was vented by two ports on the left and right sides, at the 3 and 9 o'clock positions. There were numerous tear holes in the top of the air bag, in an area 24 cm (9.4 in) in width and 18 cm (7.1 in) in depth. These holes all measured less than 1 cm (0.4 in) in diameter and were attributed to the contact of the windshield by the deploying air bag. There was blood evidence present in several locations on the air bag. On the top aspect of the air bag, the blood evidence measured 20 cm (7.9 in) wide and 20 cm (7.9 in) in length. On the right side, there were two 10 cm (3.9 in) wide deposits of blood, located 6-10 cm (2.4-3.9 in) below and 32-56 cm (12.6-22 in) below the upper right corner.

Figure 6: View of the Hyundai's front right passenger's air bag.

Side Impact Air Bag System

The Hyundai was equipped with front seat-mounted side impact air bags, located in the upper outboard aspect of the front seatbacks, and roof side rail-mounted side impact IC air bags. Only

the left IC deployed during this crash. The right IC did not deploy and neither of the seat-mounted air bags deployed during this crash. The cause of the asymmetrical deployment could not be determined.

The deployed left IC measured 134 cm (52.7 in) in length. It measured 48 cm (18.9 in) in height at the front and rear seating positions and was tethered to the left A-pillar by a webbing strap 38 cm (15 in) in length. Vertically, the IC air bag extended below the belt line at the front and rear outboard positions. The left IC provided head protection from the left C-pillar forward to a location 48 cm (18.9 in) forward of the left B-pillar. The left IC was labeled with the identification "MC4DR PA66", and was free from occupant contact points or damage. **Figure 7** depicts the inboard side of the front left IC.

Figure 7: View of the forward interior aspect of the Hyundai's left IC air bag.

Driver Demographics/Data

Driver Age/Sex:	18-year-old/Female
Height:	163 cm (64 in)
Weight:	75 kg (165 lb)
Eyewear:	None
Seat Track Position:	Mid-track
Manual Safety Belt Use:	Lap and shoulder
Usage Source:	SCI vehicle inspection
Egress from Vehicle:	Exited through LF door with assistance from EMS
Mode of Transport from Scene:	Ground ambulance
Type of Medical Treatment:	Treated in the emergency department of a local hospital and released the same day.

Driver Injuries

Injury	Injury Severity (AIS 2005/08)	Injury Source
Laceration on inside upper lip, 10 sutures to close	Minor (210600.1,8)	Frontal air bag
Small laceration on anterior neck	Minor (310602.1,5)	Flying glass
Small laceration on left neck	Minor (310602.1,2)	Safety belt webbing
Abrasion of the anterior left shoulder	Minor (710202.1,2)	Safety belt webbing
Abrasion to left anterior forearm	Minor (710202.1,2)	Frontal air bag
Multiple small lacerations to the anterior surface of the bilateral thighs	Minor (810602.1,3)	Flying glass
15 cm long right lower leg contusion, knee to shin, width of the extremity	Minor (810402.1,1)	Driver knee bolster

Source: Driver interview. Medical records were not available.

Driver Kinematics

The 18-year-old female driver was seated in a mid-track position; the seat track was adjusted 16 cm (6.3 in) forward of full-rear. She indicated that she had her left hand on the steering wheel rim and her right arm resting on the armrest. She was restrained by the manual 3-point lap and shoulder belt system. The driver reported in the interview that she was wearing denim shorts, a short-sleeve shirt and sandals. The driver did not attempt any avoidance maneuver prior to the impact.

At impact, the driver's retractor pretensioner actuated and the frontal air bags and left IC deployed. The driver initiated a forward and slightly right trajectory within the front left seating position in response to the 10 degree Direction of Force (DOF). The driver loaded the locked safety belt, resulting in the abrasion to the anterior left shoulder. The deploying air bag contacted the anterior aspect of the driver's forearm, resulting in an abrasion. The driver contacted and loaded the deployed air bag resulting in the laceration to the inside of her lip. The combination of the intruding left instrument panel and the driver's forward motion resulted in a contact of the right knee into the knee bolster. This contact resulted in a contusion. Disintegrated glass from the windows struck the driver in the neck and thighs resulting in small lacerations. The restrained driver came to rest within the front left seating position. She

believed she may have lost consciousness for a brief length of time, as she recalled that she "woke up" and EMS was present.

The driver was assisted from the vehicle through the left front door by EMS. She was transported by ground ambulance to a local hospital where she was treated in the emergency department for soft tissue injuries and released the same day.

Front Right Occupant Demographics/Data

Age/Sex:	16-year-old/Female
Height:	160 cm (63 in)
Weight:	63 kg (139 lb)
Eyewear:	None
Seat Track Position:	Full-rear
Manual Safety Belt Use:	Lap and shoulder
Usage Source:	SCI vehicle inspection
Egress from Vehicle:	Removed while unconscious, EMS cut off the roof and right front door to extricate the front right passenger.
Mode of Transport from Scene:	Ground ambulance
Type of Medical Treatment:	Admitted to a regional trauma center and hospitalized 27 days

Front Right Occupant Injuries

Injury	Injury Severity (AIS 2005/Update 08)	Injury Source
Closed head injury, NFS	Severity Unknown (100099.9,0)	Front surface of the Dodge
Right grade III open femur shaft fracture (comminuted and segmental with overlying 10 cm large laceration of the anterior aspect of the right thigh)	Serious (853272.3,1)	Intruding right lower instrument panel, indirect
Left mid shaft femur fracture	Serious (853221.3,2)	Intruding right lower instrument panel, indirect
Bilateral mandible fractures (comminuted parasymphyseal and right angle fractures)	Moderate (250614.2,3)	Front surface of the Dodge
Left lung contusion NFS	Moderate (441406.2,2)	Deployed front right air bag
Right L2 transverse process fracture	Moderate (650620.2,8)	Seatback
Right L3 transverse process fracture	Moderate (650620.2,8)	Seatback

Injury	Injury Severity (AIS 2005/Update 08)	Injury Source
Right hand metacarpal fractures (2nd and 3rd transverse mid shaft, and 4th and 5th base fractures)	Moderate (752553.2,1)	Intruding right door panel, rear upper quadrant
Right ulnar styloid fracture	Moderate (752353.2,1)	Intruding right door panel, rear upper quadrant
Right comminuted transverse patellar fracture	Moderate (854561.2,1)	Intruding right lower instrument panel
Right mid shaft tibia fracture (transverse and minimally displaced)	Moderate (854251.2,1)	Intruding right lower instrument panel
Pelvic ring fractures (right iliac crest, right sacral body and left sacral ala)	Moderate (856100.2,4)	Intruding right lower instrument panel, indirect
Right quadriceps tendon rupture	Moderate (840801.2,1)	Intruding right lower instrument panel, indirect
Nasal bone fracture (nasal septum and right lateral pterygoid plate fractures)	Minor (251000.1,4)	Front surface of the Dodge
Right cheek abrasion	Minor (210202.1,1)	Front surface of the Dodge
Right upper lip laceration (large through and through)	Minor (2106001.8)	Front surface of the Dodge
Tooth avulsion (1st and 2nd molars and left lateral incisor)	Minor (251406.1,8)	Front surface of the Dodge
Right lateral proximal thigh laceration (7cm)	Minor (810602.1,1)	Intruding right instrument panel

Source: Hospital Records

Front Right Occupant Kinematics

The 16-year-old female front right passenger was seated in a full-rear track position and was restrained by the manual 3-point lap and shoulder belt system. At impact, the retractor pretensioner actuated and the frontal air bag deployed. The passenger initiated a forward and right trajectory in response to the 10 DOF. The passenger loaded the locked safety belt system with her chest and pelvis and loaded the deployed front right air bag with her head and torso. Coincident to her forward kinematic pattern, the right instrument panel intruded rearward into her occupant space. The front right passenger's lower extremities contacted and loaded the lower aspect of the instrument panel. This loading resulted in the right patella and tibia (direct) fractures and the indirect fractures of both femurs and the pelvis. The instrument panel intrusion displaced the front right passenger bag inboard. This resulted in the passenger separating from the outboard aspect of the air bag, toward the right door area.

The engagement of the Dodge along the right side of the Hyundai resulted in lateral intrusion of the Hyundai's side panel and right door. The passenger responded by loading the right door with her right flank and right arm. This contact resulted in a fracture of the right styloid process. The passenger's head was partially ejected through the disintegrated window glazing and was

contacted by the front surface of the Dodge. This contact resulted in the closed head injury, mandible fractures, tooth avulsion and associated soft tissue injuries. The passenger then rebounded to the left and contacted the inboard aspect of the driver's seatback with her head as evidenced by the observed scuff and blood transfer.

The front right passenger was mechanically entrapped within the vehicle by the intrusion of the right instrument panel, the right kick panel, the A-pillar and the door. EMS workers cut the roof and the front right door off the Hyundai to extricate the passenger. She was removed from the vehicle while unconscious and transported by ground ambulance to a regional trauma center. The passenger was hospitalized 27 days for treatment of her injuries.

2008 DODGE DAKOTA

Exterior Damage

The front plane of the Dodge sustained moderate severity damage as a result of the impact with the Hyundai **(Figure 8)**. The direct contact damage from the initial interaction between the vehicles began 3 cm (1.3 in) right of the vehicle centerline and extended right 78 cm (20.5 in) to the right corner. The combined width of the direct and induced damage extended the across full end-width of the vehicle. The forward aspects of the vehicle's frame rails were shifted to the right. The right frame rail shift measured 29 cm (11.4 in) and the left frame rail shift measured 18 cm (7.1 in). The bumper had also shifted downward 20 cm (7.9 in). The maximum crush was located 49 cm (19.3 in) right of the vehicle centerline and measured 43 cm (17 in). The residual crush profile was measured at the level of the bumper and was as follows: C1 = 21 cm (8.3 in), C2 = 28 cm (11 in), C3 = 33 cm (13 in), C4 = 41 cm (16.1 in), C5 = 40 cm (15.7 in), C6 = 35 cm (13.8 in). The CDC assigned for this impact was 71FZEW2.

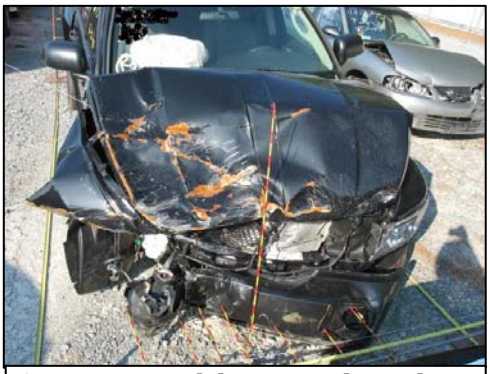


Figure 8: Frontal damage to the Dodge.

Event Data Recorder

The EDR of the Dodge Dakota was imaged during the SCI inspection through the use of the Bosch Crash Data Retrieval hardware and software version 3.3 via a direct connection to the vehicle's Diagnostic Link Connector. The imaged data was reanalyzed with software version 3.5.1 and is attached to the end of this technical report.

The EDR had one stored event termed the "Most Recent Event". This stored data was related to the offset frontal crash and appeared to have been completely written. The EDR recorded five seconds of pre-crash parameters for multiple vehicle systems to include: Vehicle Speed, Engine RPM, Brake Status, and Throttle Position. The signal for the Steering Wheel Angle data was not available. The pre-crash speed of the Dodge was 81 km/h (50 mph) two seconds (T-2.0) prior to

the air bag deployment. The data indicated the driver applied the brakes 0.4 seconds (T-0.4) prior to the air bag deployment and the vehicle decelerated to 71 km/h (44 mph) at the time -0.1 (T-0.1). T0 (Time zero) was defined as the time of air bag deployment.

The EDR also recorded the bi-directional acceleration pulse of the crash. The crash pulse data was 250 milliseconds in length and was broken into pre-deployment and post-deployment as defined by the time line. The pre-deployment data was 100 milliseconds in length and the post-deployment data was 149 milliseconds in length. Again, T0 (Time zero) was defined as the time of air bag deployment. Independent SCI analysis of the crash pulse determined the maximum longitudinal and lateral delta-V components of the Dodge were -45.5 km/h (-28.3 mph) and +14.0 km/h (+8.7 mph), respectively. A review of the crash pulse data indicated the air bag deployed 15 milliseconds after the time of the initial vehicle-to-vehicle contact.

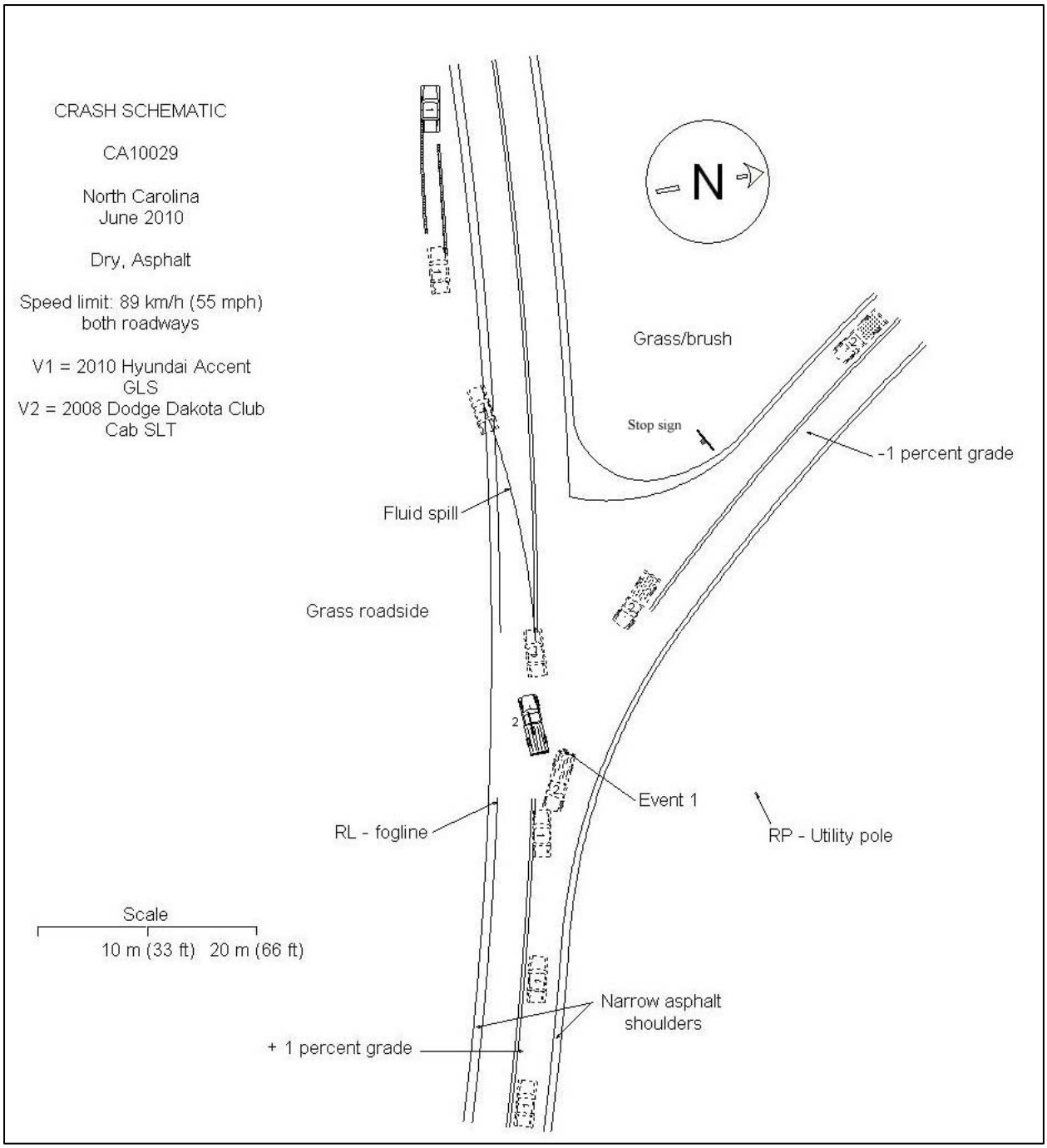


Figure 9: Crash Schematic

ATTACHMENT A:

2008 Dodge Dakota EDR DATA

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	1D7HE48N98S******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CA10029 CDR DODGE.CDR
Saved on	Wednesday, July 7 2010 at 08:55:55 AM
Collected with CDR version	Crash Data Retrieval Tool 3.3
Reported with CDR version	Crash Data Retrieval Tool 3.5.1
EDR Device Type	airbag control module
Event(s) recovered	Most Recent Event

Comments

No comments entered.

Data Limitations

AIRBAG CONTROL MODULE (ACM) DATA LIMITATIONS:

GENERAL INFORMATION:

CAUTION: During Bench top imaging, make sure the ACM is not moved, tilted or turned over while connected to and powered by the CDR Interface Module. Also, after a CDR imaging process, wait 2 minutes after power is removed from the ACM before attempting to move the module. Not following these general ACM guidelines for bench top imaging could cause new events to be recorded in the ACM.

The ACM current fault status will be altered if the ACM is powered-up without having all of the other vehicle inputs connected (e.g., bench top imaging). This situation will occur when the CDR tool is connected directly to the ACM. This will not affect the stored fault data information in any of the Event Records. Always make a note in the CDR case comments section when an ACM bench top imaging process is being performed.

The recorded Deployment Event will contain Pre-Crash data.

- T0 (where '0' is subscript) (-.01 sec.) is defined as the last sample point in the vehicle data buffer when the ACM commanded a deployment for all vehicles except the 2008 - 2010 Dodge Grand Caravan, 2008-2010 Chrysler Town and Country and 2009-2010 Dodge Journey. In these vehicles, T0 (where '0' is subscript) is defined as the algorithm wakeup. Please note that the algorithm wakeup may be different for front, side, and roll-over events and their associated parameters.
- The VIN is captured by the ACM and then recorded as the Original VIN after 10 consecutive ignition cycles of capturing the same number. Once it has been recorded, this number can not be modified.

CDR FILE INFORMATION:

Event(s) Recovered definitions:

- None - There are no stored events in the Airbag Control Module (ACM)
- Not Retrievable - Event Data is stored in the ACM but is not retrievable by the CDR tool.
- For Continental ACMs:
  - Event Record 1 - Data from an event is stored in the ACM (not necessarily in chronological order)
  - Event Record 2 - Data from another event is stored in the ACM (not necessarily in chronological order)
  - Event Record 3 - Data from another event is stored in the ACM (not necessarily in chronological order)
- For all other ACMs:
  - Most Recent Event - Data of the most recent event is displayed in the report
  - 1st Prior Event - Two events are stored in the ACM, Data displayed is of the first prior event.
  - 2nd Prior Event - Three events are stored in the ACM, Data displayed is of the second prior event.
  - Etc., (for modules with 3 to 5 stored events)

CDR RECORD INFORMATION:

- If power to the ACM is lost during a deployment event, all or part of the event data record may not be recorded. Two scenarios may be recorded under this condition:
  - "None" may be displayed in the "Event(s) Recovered" section of the report indicating no pre-crash vehicle data.
  - An event may be displayed in the "Event(s) Recovered" section of the report and "Interrupted" will be displayed for Vehicle Event Recorder Status.
- The Airbag Control Module Configuration indicates the inputs and outputs that the ACM for a particular vehicle monitors and/or controls.
- "Event Number" in the System Status at Event section of the report:
  - Indicates the event number per vehicle ignition cycle for:
    - 2010 - 2011 Sebring, Avenger, Caliber, Nitro, Compass, Liberty, Patriot, Wrangler, and Ram
  - Indicates the overall order of the events for all other applicable vehicles.
- "Total Number of Events Recorded" in the System Status at Event section of the report:
  - Stops incrementing when each event record is recorded by the ACM for:
    - 2010 - 2011 Sebring, Avenger, Caliber, Nitro, Compass, Liberty, Patriot, Wrangler, and Ram
  - Indicates the total number of events that the ACM has recorded for all other applicable vehicles.
- Active Head Restraint (AHR) - This refers to the active head restraint systems that are electronically controlled by the ACM.
- For applicable vehicles, a "Yes" for a particular item in the Deployment Command Data section of the report indicates that the ACM commanded the deployment of the associated device. Note: For 2010 MY vehicles equipped with AHR, the AHR deployment will not be recorded in the EDR.
- Vehicle Data (Pre-Crash) is transmitted to the Airbag Control Module, by various vehicle control modules, via the vehicle's communication network.
- On 2006-2009 Ram 2500/3500, the Engine RPM recorded is limited to a maximum of 4080 RPM. On the 2008 - 2010 Dodge Grand Caravan, 2008-2010 Chrysler Town and Country and 2009-2010 Dodge Journey, the engine RPM resolution is 256 rpm. On all other vehicles, the resolution is 32 rpm.
- If a recorded event has Engine RPM equal to SNA and Speed, Vehicle Indicated equals SNA for each time stamp, then the data is default data and the event stored in the ACM is not valid.
  - The accuracy of the recorded Speed, Vehicle Indicated will be affected if the vehicle had the tire size or the final drive axle ratio changed from the factory build specifications.
  - Speed, Vehicle Indicated is reported as an average of the drive wheels.
- On the 2008 - 2010 Dodge Grand Caravan, 2008-2010 Chrysler Town and Country and 2009-2010 Dodge Journey, the vehicle speed resolution is 2 kph. On all other vehicles, the resolution is 1 kph.
- The MIL (Malfunction Indicator Lamp) Status for the various recorded systems indicates the state of the applicable malfunction indicator lamp at the time that the data was captured. Note: Some fault codes could be stored due to component/system damage from the accident.

NOTE: A StarScan Tool should be used to read any stored Diagnostic Trouble Codes (DTC's) in the various electronic modules (ACM, PCM, ABS, TCM, etc., where applicable) for use in interpretation of some vehicle specific recorded data.

VEHICLE DATA DEFINITIONS:

Vehicle Event Recorder Status definitions:

- For additional definitions, please refer to the CDR Help File Glossary
- ABS MIL (if equip.) - This indicates the ABS fault indicator lamp status. It will only be "On" when there is a fault in the ABS system. The Electronic brake module DTC's should be read and recorded for final system interpretation.
- ESP MIL (if equip.) - This indicates the ESP/BAS fault indicator lamp status. It will only be "On" when there is a fault or thermal model shutdown in the ESP system. The ESP module DTC's should be read and recorded for final system interpretation.
- ESP Lamp (if equip.) - This is the status of the ESP symbol - "car with squiggly lines" indicator lamp. "On" indicates ESP has been turned off by the driver or has reduced performance and is not an indication of a fault in the system.
- ESP Lamp Flashing Requested (if equip.) - If "Yes", then an ESP, Traction Control or Trailer Sway Control (if equipped) event was active at the time of data capture.
- ESP Disabled (if equip.)- "Yes" indicates that ABS & ESP have been disabled by the driver or due to system performance.
- Traction Control Button (if equip.)- When the button is "ON", (driver has pushed the button), the Traction Control system is "Disabled". When the button is "OFF", the Traction Control system is "Enabled".
- ESP Functional/Active (if equip.)- "YES" indicates that the ESP system is functional and has no faults.
- Panic Brake Assist Active (if equip.)- "Yes" indicates that all four of the brake circuits are under going ABS control.
- Steering Input (deg) (if equip.):
  - Steering Input polarity is positive for right turns on:
    - 2005 - 2007 Grand Cherokee
    - 2006 - 2007 Commander
    - 2005 - 2010 300, Magnum, and Charger
    - 2008 - 2010 Challenger
  - Steering Input polarity is negative for right turns on:
    - All other vehicles and model years not specified above
- Yaw Rate (deg/sec) (if equip.): All vehicles have negative yaw rate when making a right turn.
- ETC Lamp - Lamp "ON "indicates there is an active Electronic Throttle DTC.
- ETC Lamp Flashing - If "Yes", then the ETC is in the limp-in mode.
- Engine Torque Applied - If "No", then no engine torque output was applied (as in Park/Neutral for Automatic transmissions or clutch depressed on manual or during an ESP/Traction Control event). If "Yes", then engine torque output was applied.

- Tire 1 (2) Location (if equip.)- This indicates the location of the tire pressure sensor data. Default is used to indicate that the location of the tire pressure sensor is unknown or there is no tire pressure sensor in the wheel. Vehicles with Base Tire Pressure Monitoring systems will display SNA for both Tire Locations as these vehicles do not send actual pressure values across the communication bus.
- Tire 1 (2) Pressure Status (if equip.)- This indicates the actual pressure status of the Tire Location defined in the previous column. Possible values are LOW, NORMAL, HIGH, or SNA for this parameter. Vehicles with Base Tire Pressure Monitoring systems will display NORMAL even though these vehicles do not send actual pressure values across the communication bus.
- Tire 1 (2) Pressure (psi) (if equip.)- This indicates the actual tire pressure value of the Tire Location defined. Vehicles with Base Tire Pressure Monitoring systems will display N/A for this parameter as these vehicles do not send actual pressure values across the communication bus.
- Cruise Control System - "On" indicates that the Cruise Control system is turned on.
  Cruise Control Active - "Yes" indicates the Cruise Control system is actively controlling vehicle speed. "No" indicates the system is NOT controlling vehicle speed.
- (if equip.) - If a parameter name is followed by the words (if equip.), then the parameter is only valid for vehicles equipped the associated parameter/vehicle system.

APPLICATION INFORMATION:

- 2005 - 2009 Durango's equipped with side airbags have EDR data that can be imaged by the CDR tool. Durango's not equipped with side airbags have EDR Data that might be imaged by the CDR tool and can always be imaged by the supplier.
- For 2005 & 2006 MY, some Chrysler 300, Dodge Magnum, Dodge Charger, Jeep Grand Cherokee, and Jeep Commander models may contain EDR data that can not be imaged by the CDR tool.
- For 2006 & 2007 MY, some PT Cruiser models may contain EDR data that can not be imaged by the CDR tool.
- EDR Data is only recorded for frontal deployments in the following vehicles:
  - 2005-2007 Durango
  - 2006-2007 Ram 1500
  - 2006-2009 Ram 2500/3500 Heavy Duty
  - 2007 Aspen, Caliber, Compass, Patriot, Nitro, Sebring, Wrangler

03001_Chrysler_r005

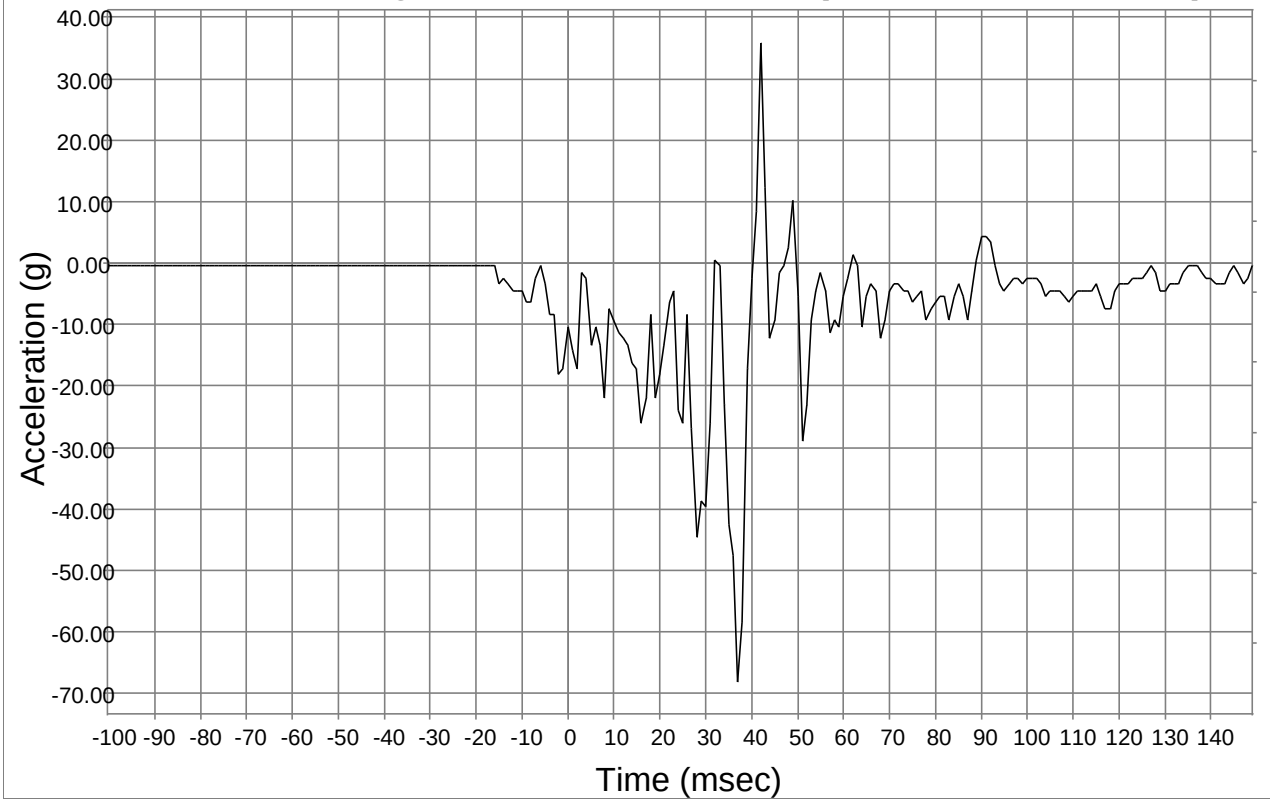
System Status at Retrieval

Original VIN	1D7HE48N98S******
Airbag Control Module Part Number	04896176AE
Airbag Control Module Serial Number	T52MD2977G0583
Airbag Control Module Supplier	Bosch

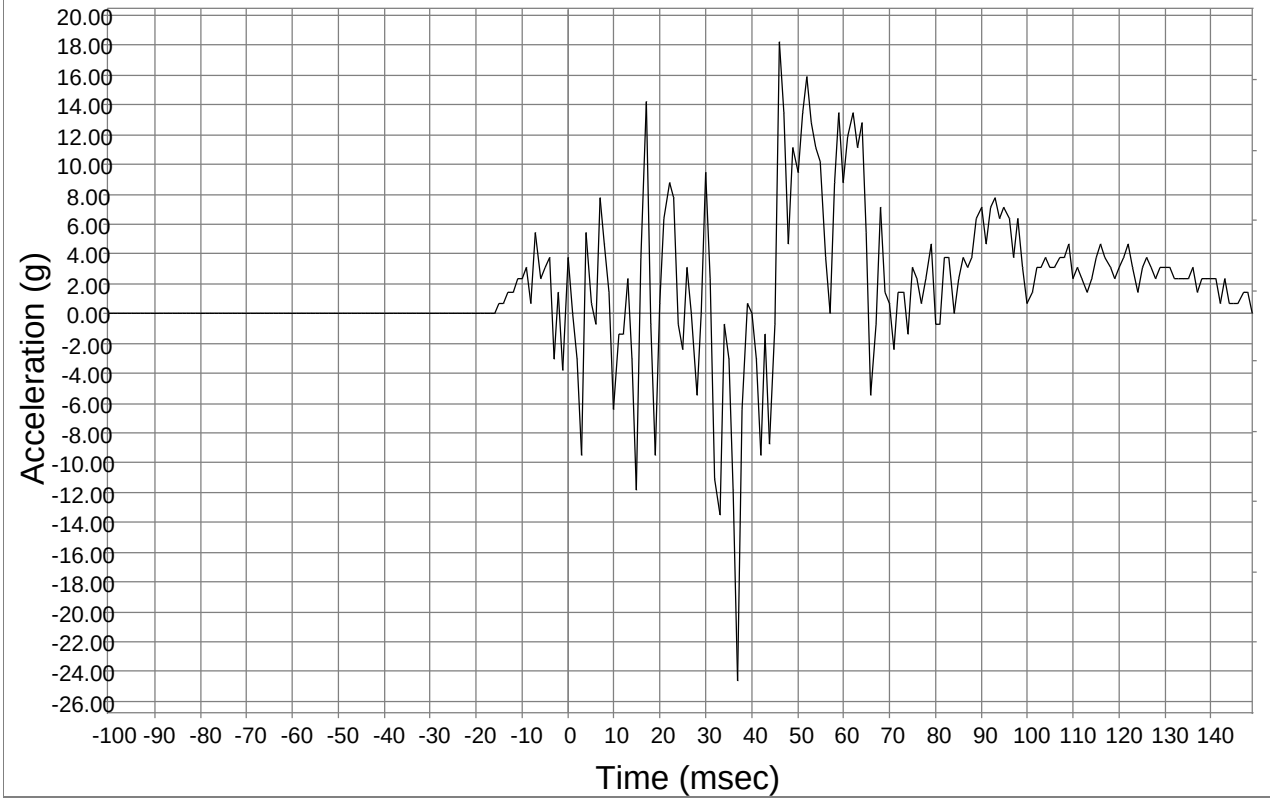
System Configuration at Retrieval

Configured for Driver Seatbelt Switch	No
Configured for Front Center Seatbelt Switch	No
Configured for Front Passenger Seatbelt Switch	No
Configured for 2nd Row Left Seatbelt Switch	No
Configured for 2nd Row Center Seatbelt Switch	No
Configured for 2nd Row Right Seatbelt Switch	No
Configured for 3rd Row Left Seatbelt Switch	No
Configured for 3rd Row Center Seatbelt Switch	No
Configured for 3rd Row Right Seatbelt Switch	No
Configured for Driver Knee Airbag	No
Configured for Left Curtain #1	No
Configured for Right Curtain #1	No
Configured for Left Curtain #2	No
Configured for Right Curtain #2	No
Configured for Front Driver Seatbelt Pretensioner	Yes
Configured for Front Center Seatbelt Pretensioner	No
Configured for Front Passenger Seatbelt Pretensioner	Yes
Configured for 2nd Row Left Seatbelt Pretensioner	No
Configured for 2nd Row Center Seatbelt Pretensioner	No
Configured for 2nd Row Right Seatbelt Pretensioner	No
Configured for 3rd Row Left Seatbelt Pretensioner	No
Configured for 3rd Row Center Seatbelt Pretensioner	No
Configured for 3rd Row Right Seatbelt Pretensioner	No
Configured for Left Side Sensor #1	No
Configured for Left Side Sensor #2	No
Configured for Left Side Sensor #3	No
Configured for Right Side Sensor #1	No
Configured for Right Side Sensor #2	No
Configured for Right Side Sensor #3	No
Configured for Left Up Front Sensor	Yes
Configured for Right Up Front Sensor	Yes
Configured for Front Driver Digressive Load Limiter	No
Configured for Front Passenger Digressive Load Limiter	No
Configured for Driver Seat Track Position Sensor	Yes
Configured for Front Passenger Seat Track Position Sensor	No
Configured for Driver Airbag Disable Switch	No
Configured for Passenger Airbag Disable Switch	No
Configured for Front Passenger Occupant Classification System	No
Configured for Right Side Thorax	No
Configured for Left Side Thorax	No
Configured for Passenger Knee Airbag	No
Configured for Passenger Belt Tension Sensor	No
Configured for Driver Belt Tension Sensor	No
Configured for Occupant Detection Sensor	No
Configured for DOC Disable Switch	No

Longitudinal Crash Pulse (Most Recent Event)



Lateral Crash Pulse (Most Recent Event)



Longitudinal Crash Pulse (Most Recent Event)

Time (msec)	Longitudinal Acceleration (g)
-100	-0.49
-99	-0.49
-98	-0.49
-97	-0.49
-96	-0.49
-95	-0.49
-94	-0.49
-93	-0.49
-92	-0.49
-91	-0.49
-90	-0.49
-89	-0.49
-88	-0.49
-87	-0.49
-86	-0.49
-85	-0.49
-84	-0.49
-83	-0.49
-82	-0.49
-81	-0.49
-80	-0.49
-79	-0.49
-78	-0.49
-77	-0.49
-76	-0.49
-75	-0.49
-74	-0.49
-73	-0.49
-72	-0.49
-71	-0.49
-70	-0.49
-69	-0.49
-68	-0.49
-67	-0.49
-66	-0.49
-65	-0.49
-64	-0.49
-63	-0.49
-62	-0.49
-61	-0.49
-60	-0.49
-59	-0.49
-58	-0.49
-57	-0.49
-56	-0.49
-55	-0.49
-54	-0.49
-53	-0.49
-52	-0.49
-51	-0.49

Time (msec)	Longitudinal Acceleration (g)
-50	-0.49
-49	-0.49
-48	-0.49
-47	-0.49
-46	-0.49
-45	-0.49
-44	-0.49
-43	-0.49
-42	-0.49
-41	-0.49
-40	-0.49
-39	-0.49
-38	-0.49
-37	-0.49
-36	-0.49
-35	-0.49
-34	-0.49
-33	-0.49
-32	-0.49
-31	-0.49
-30	-0.49
-29	-0.49
-28	-0.49
-27	-0.49
-26	-0.49
-25	-0.49
-24	-0.49
-23	-0.49
-22	-0.49
-21	-0.49
-20	-0.49
-19	-0.49
-18	-0.49
-17	-0.49
-16	-0.49
-15	-3.43
-14	-2.45
-13	-3.43
-12	-4.41
-11	-4.41
-10	-4.41
-9	-6.37
-8	-6.37
-7	-2.45
-6	-0.49
-5	-3.43
-4	-8.33
-3	-8.33
-2	-18.14
-1	-17.16

Time (msec)	Longitudinal Acceleration (g)
0	-10.30
1	-14.22
2	-17.16
3	-1.47
4	-2.45
5	-13.24
6	-10.30
7	-13.24
8	-22.06
9	-7.35
10	-9.31
11	-11.28
12	-12.26
13	-13.24
14	-16.18
15	-17.16
16	-25.98
17	-22.06
18	-8.33
19	-22.06
20	-18.14
21	-13.24
22	-6.37
23	-4.41
24	-24.02
25	-25.98
26	-8.33
27	-26.96
28	-44.61
29	-38.73
30	-39.71
31	-25.98
32	0.49
33	-0.49
34	-23.04
35	-42.65
36	-47.55
37	-68.14
38	-58.33
39	-17.16
40	-2.45
41	8.33
42	35.78
43	12.25
44	-12.26
45	-9.31
46	-1.47
47	-0.49
48	2.45
49	10.29

Longitudinal Crash Pulse (Most Recent Event)

Time (msec)	Longitudinal Acceleration (g)
50	-5.39
51	-28.92
52	-23.04
53	-9.31
54	-4.41
55	-1.47
56	-4.41
57	-11.28
58	-9.31
59	-10.30
60	-5.39
61	-2.45
62	1.47
63	-0.49
64	-10.30
65	-5.39
66	-3.43
67	-4.41
68	-12.26
69	-9.31
70	-4.41
71	-3.43
72	-3.43
73	-4.41
74	-4.41
75	-6.37
76	-5.39
77	-4.41
78	-9.31
79	-7.35
80	-6.37
81	-5.39
82	-5.39
83	-9.31
84	-5.39
85	-3.43
86	-5.39
87	-9.31
88	-4.41
89	0.49
90	4.41
91	4.41
92	3.43
93	-0.49
94	-3.43
95	-4.41
96	-3.43
97	-2.45
98	-2.45
99	-3.43

Time (msec)	Longitudinal Acceleration (g)
100	-2.45
101	-2.45
102	-2.45
103	-3.43
104	-5.39
105	-4.41
106	-4.41
107	-4.41
108	-5.39
109	-6.37
110	-5.39
111	-4.41
112	-4.41
113	-4.41
114	-4.41
115	-3.43
116	-5.39
117	-7.35
118	-7.35
119	-4.41
120	-3.43
121	-3.43
122	-3.43
123	-2.45
124	-2.45
125	-2.45
126	-1.47
127	-0.49
128	-1.47
129	-4.41
130	-4.41
131	-3.43
132	-3.43
133	-3.43
134	-1.47
135	-0.49
136	-0.49
137	-0.49
138	-1.47
139	-2.45
140	-2.45
141	-3.43
142	-3.43
143	-3.43
144	-1.47
145	-0.49
146	-1.47
147	-3.43
148	-2.45
149	-0.49

Lateral Crash Pulse (Most Recent Event)

Time (msec)	Lateral Acceleration (g)
-100	0.00
-99	0.00
-98	0.00
-97	0.00
-96	0.00
-95	0.00
-94	0.00
-93	0.00
-92	0.00
-91	0.00
-90	0.00
-89	0.00
-88	0.00
-87	0.00
-86	0.00
-85	0.00
-84	0.00
-83	0.00
-82	0.00
-81	0.00
-80	0.00
-79	0.00
-78	0.00
-77	0.00
-76	0.00
-75	0.00
-74	0.00
-73	0.00
-72	0.00
-71	0.00
-70	0.00
-69	0.00
-68	0.00
-67	0.00
-66	0.00
-65	0.00
-64	0.00
-63	0.00
-62	0.00
-61	0.00
-60	0.00
-59	0.00
-58	0.00
-57	0.00
-56	0.00
-55	0.00
-54	0.00
-53	0.00
-52	0.00
-51	0.00

Time (msec)	Lateral Acceleration (g)
-50	0.00
-49	0.00
-48	0.00
-47	0.00
-46	0.00
-45	0.00
-44	0.00
-43	0.00
-42	0.00
-41	0.00
-40	0.00
-39	0.00
-38	0.00
-37	0.00
-36	0.00
-35	0.00
-34	0.00
-33	0.00
-32	0.00
-31	0.00
-30	0.00
-29	0.00
-28	0.00
-27	0.00
-26	0.00
-25	0.00
-24	0.00
-23	0.00
-22	0.00
-21	0.00
-20	0.00
-19	0.00
-18	0.00
-17	0.00
-16	0.00
-15	0.71
-14	0.71
-13	1.42
-12	1.42
-11	2.36
-10	2.36
-9	3.07
-8	0.71
-7	5.44
-6	2.36
-5	3.07
-4	3.79
-3	-3.08
-2	1.42
-1	-3.79

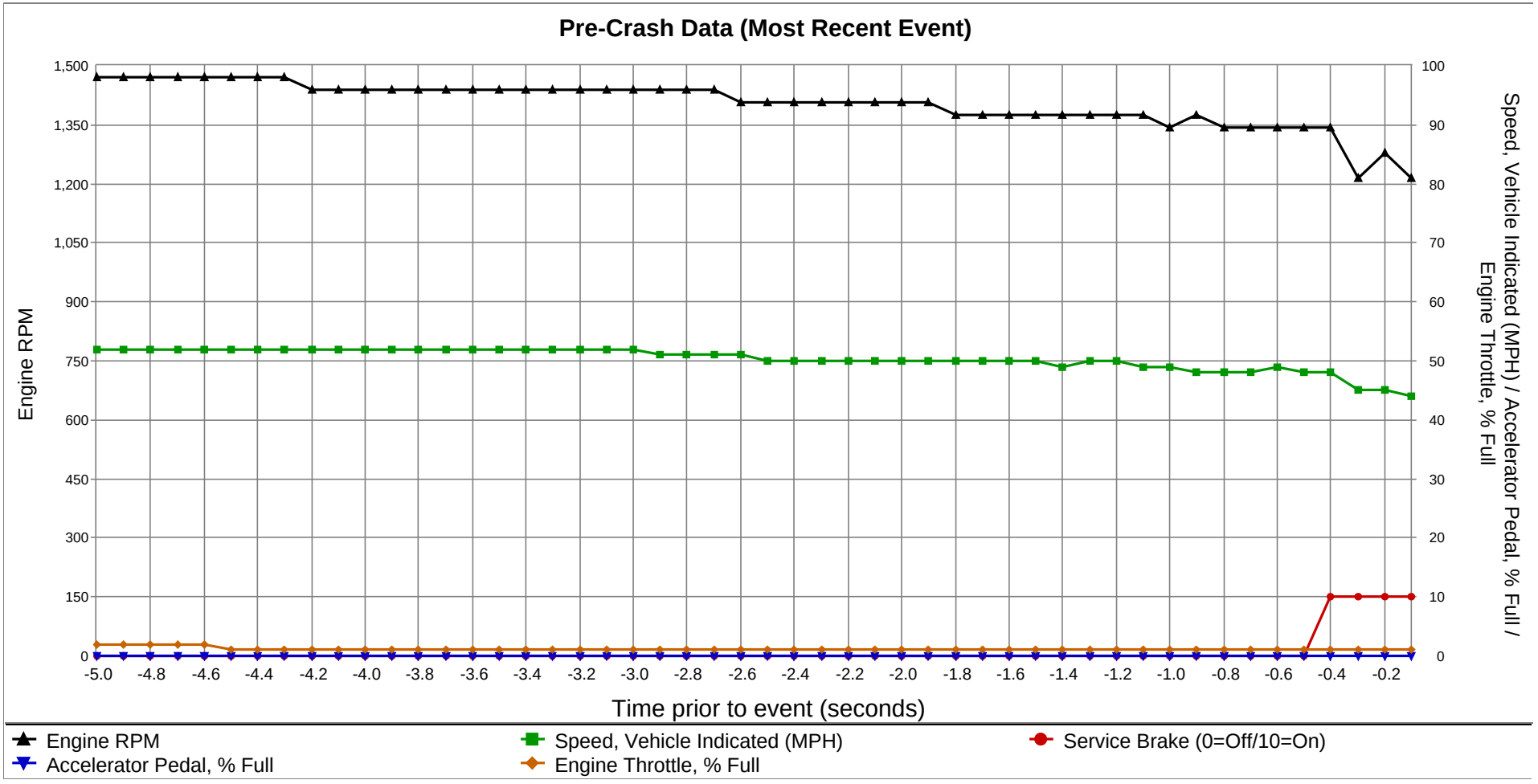
Time (msec)	Lateral Acceleration (g)
0	3.79
1	0.00
2	-3.08
3	-9.47
4	5.44
5	0.71
6	-0.71
7	7.81
8	4.73
9	1.42
10	-6.39
11	-1.42
12	-1.42
13	2.36
14	-3.08
15	-11.84
16	3.79
17	14.20
18	-0.71
19	-9.47
20	0.71
21	6.39
22	8.76
23	7.81
24	-0.71
25	-2.37
26	3.07
27	0.00
28	-5.45
29	0.00
30	9.47
31	2.36
32	-11.13
33	-13.50
34	-0.71
35	-3.08
36	-11.84
37	-24.62
38	-6.39
39	0.71
40	0.00
41	-3.08
42	-9.47
43	-1.42
44	-8.76
45	-0.71
46	18.23
47	13.49
48	4.73
49	11.12

Lateral Crash Pulse (Most Recent Event)

Time (msec)	Lateral Acceleration (g)
50	9.47
51	13.49
52	15.86
53	12.78
54	11.12
55	10.18
56	3.79
57	0.00
58	8.76
59	13.49
60	8.76
61	11.83
62	13.49
63	11.12
64	12.78
65	5.44
66	-5.45
67	-0.71
68	7.10
69	1.42
70	0.71
71	-2.37
72	1.42
73	1.42
74	-1.42
75	3.07
76	2.36
77	0.71
78	2.36
79	4.73
80	-0.71
81	-0.71
82	3.79
83	3.79
84	0.00
85	2.36
86	3.79
87	3.07
88	3.79
89	6.39
90	7.10
91	4.73
92	7.10
93	7.81
94	6.39
95	7.10
96	6.39
97	3.79
98	6.39
99	3.07

Time (msec)	Lateral Acceleration (g)
100	0.71
101	1.42
102	3.07
103	3.07
104	3.79
105	3.07
106	3.07
107	3.79
108	3.79
109	4.73
110	2.36
111	3.07
112	2.36
113	1.42
114	2.36
115	3.79
116	4.73
117	3.79
118	3.07
119	2.36
120	3.07
121	3.79
122	4.73
123	3.07
124	1.42
125	3.07
126	3.79
127	3.07
128	2.36
129	3.07
130	3.07
131	3.07
132	2.36
133	2.36
134	2.36
135	2.36
136	3.07
137	1.42
138	2.36
139	2.36
140	2.36
141	2.36
142	0.71
143	2.36
144	0.71
145	0.71
146	0.71
147	1.42
148	1.42
149	0.00

Pre-Crash Data (Most Recent Event)



Pre-Crash Data (Most Recent Event - table 1 of 5)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Vehicle Event Recorder Status	Engine RPM	Speed, Vehicle Indicated (MPH [km/h])	Engine Throttle, % Full	Accelerator Pedal, % Full	Raw Manifold Pressure (kPa)	Service Brake	Brake Switch #2 Status	Brake Lamps On
-5.0	Complete	1,472	52 [84]	1.6	0.0	18	Off	Open	No
-4.9	Complete	1,472	52 [84]	1.6	0.0	18	Off	Open	No
-4.8	Complete	1,472	52 [84]	1.6	0.0	17	Off	Open	No
-4.7	Complete	1,472	52 [84]	1.6	0.0	17	Off	Open	No
-4.6	Complete	1,472	52 [84]	1.6	0.0	17	Off	Open	No
-4.5	Complete	1,472	52 [84]	1.2	0.0	17	Off	Open	No
-4.4	Complete	1,472	52 [84]	1.2	0.0	17	Off	Open	No
-4.3	Complete	1,472	52 [84]	1.2	0.0	17	Off	Open	No
-4.2	Complete	1,440	52 [84]	1.2	0.0	17	Off	Open	No
-4.1	Complete	1,440	52 [84]	1.2	0.0	17	Off	Open	No
-4.0	Complete	1,440	52 [84]	1.2	0.0	17	Off	Open	No
-3.9	Complete	1,440	52 [84]	1.2	0.0	17	Off	Open	No
-3.8	Complete	1,440	52 [84]	1.2	0.0	16	Off	Open	No
-3.7	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-3.6	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-3.5	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-3.4	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-3.3	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-3.2	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-3.1	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-3.0	Complete	1,440	52 [83]	1.2	0.0	16	Off	Open	No
-2.9	Complete	1,440	51 [82]	1.2	0.0	16	Off	Open	No
-2.8	Complete	1,440	51 [82]	1.2	0.0	16	Off	Open	No
-2.7	Complete	1,440	51 [82]	1.2	0.0	16	Off	Open	No
-2.6	Complete	1,408	51 [82]	1.2	0.0	16	Off	Open	No
-2.5	Complete	1,408	50 [81]	1.2	0.0	16	Off	Open	No
-2.4	Complete	1,408	50 [81]	1.2	0.0	16	Off	Open	No
-2.3	Complete	1,408	50 [81]	1.2	0.0	16	Off	Open	No
-2.2	Complete	1,408	50 [81]	1.2	0.0	16	Off	Open	No
-2.1	Complete	1,408	50 [81]	1.2	0.0	16	Off	Open	No
-2.0	Complete	1,408	50 [81]	1.2	0.0	16	Off	Open	No
-1.9	Complete	1,408	50 [81]	1.2	0.0	16	Off	Open	No
-1.8	Complete	1,376	50 [80]	1.2	0.0	16	Off	Open	No
-1.7	Complete	1,376	50 [80]	1.2	0.0	16	Off	Open	No
-1.6	Complete	1,376	50 [80]	1.2	0.0	16	Off	Open	No
-1.5	Complete	1,376	50 [80]	1.2	0.0	16	Off	Open	No
-1.4	Complete	1,376	49 [79]	1.2	0.0	16	Off	Open	No
-1.3	Complete	1,376	50 [80]	1.2	0.0	16	Off	Open	No
-1.2	Complete	1,376	50 [80]	1.2	0.0	16	Off	Open	No
-1.1	Complete	1,376	49 [79]	1.2	0.0	16	Off	Open	No
-1.0	Complete	1,344	49 [79]	1.2	0.0	16	Off	Open	No
-0.9	Complete	1,376	48 [78]	1.2	0.0	16	Off	Open	No
-0.8	Complete	1,344	48 [78]	1.2	0.0	16	Off	Open	No
-0.7	Complete	1,344	48 [78]	1.2	0.0	16	Off	Open	No
-0.6	Complete	1,344	49 [79]	1.2	0.0	16	Off	Open	No
-0.5	Complete	1,344	48 [78]	1.2	0.0	16	Off	Open	No
-0.4	Complete	1,344	48 [78]	1.2	0.0	16	On	Closed	Yes
-0.3	Complete	1,216	45 [73]	1.2	0.0	17	On	Closed	Yes
-0.2	Complete	1,280	45 [73]	1.2	0.0	18	On	Closed	Yes
-0.1	Complete	1,216	44 [71]	1.2	0.0	18	On	Closed	Yes

Pre-Crash Data (Most Recent Event - table 2 of 5)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Panic Brake Assist Active (if equip.)	ABS MIL (if equip.)	ESP MIL (if equip.)	ESP Lamp (if equip.)	ESP Lamp Flashing Requested (if equip.)	ESP Disabled (if equip.)	ESP Active (if equip.)
-5.0	No	Off	Off	Off	No	No	Yes
-4.9	No	Off	Off	Off	No	No	Yes
-4.8	No	Off	Off	Off	No	No	Yes
-4.7	No	Off	Off	Off	No	No	Yes
-4.6	No	Off	Off	Off	No	No	Yes
-4.5	No	Off	Off	Off	No	No	Yes
-4.4	No	Off	Off	Off	No	No	Yes
-4.3	No	Off	Off	Off	No	No	Yes
-4.2	No	Off	Off	Off	No	No	Yes
-4.1	No	Off	Off	Off	No	No	Yes
-4.0	No	Off	Off	Off	No	No	Yes
-3.9	No	Off	Off	Off	No	No	Yes
-3.8	No	Off	Off	Off	No	No	Yes
-3.7	No	Off	Off	Off	No	No	Yes
-3.6	No	Off	Off	Off	No	No	Yes
-3.5	No	Off	Off	Off	No	No	Yes
-3.4	No	Off	Off	Off	No	No	Yes
-3.3	No	Off	Off	Off	No	No	Yes
-3.2	No	Off	Off	Off	No	No	Yes
-3.1	No	Off	Off	Off	No	No	Yes
-3.0	No	Off	Off	Off	No	No	Yes
-2.9	No	Off	Off	Off	No	No	Yes
-2.8	No	Off	Off	Off	No	No	Yes
-2.7	No	Off	Off	Off	No	No	Yes
-2.6	No	Off	Off	Off	No	No	Yes
-2.5	No	Off	Off	Off	No	No	Yes
-2.4	No	Off	Off	Off	No	No	Yes
-2.3	No	Off	Off	Off	No	No	Yes
-2.2	No	Off	Off	Off	No	No	Yes
-2.1	No	Off	Off	Off	No	No	Yes
-2.0	No	Off	Off	Off	No	No	Yes
-1.9	No	Off	Off	Off	No	No	Yes
-1.8	No	Off	Off	Off	No	No	Yes
-1.7	No	Off	Off	Off	No	No	Yes
-1.6	No	Off	Off	Off	No	No	Yes
-1.5	No	Off	Off	Off	No	No	Yes
-1.4	No	Off	Off	Off	No	No	Yes
-1.3	No	Off	Off	Off	No	No	Yes
-1.2	No	Off	Off	Off	No	No	Yes
-1.1	No	Off	Off	Off	No	No	Yes
-1.0	No	Off	Off	Off	No	No	Yes
-0.9	No	Off	Off	Off	No	No	Yes
-0.8	No	Off	Off	Off	No	No	Yes
-0.7	No	Off	Off	Off	No	No	Yes
-0.6	No	Off	Off	Off	No	No	Yes
-0.5	No	Off	Off	Off	No	No	Yes
-0.4	No	Off	Off	Off	No	No	Yes
-0.3	No	Off	Off	Off	No	No	Yes
-0.2	No	Off	Off	Off	No	No	Yes
-0.1	No	Off	Off	Off	No	No	Yes

Pre-Crash Data (Most Recent Event - table 3 of 5)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Steering Input (deg) (if equip.)	Yaw Rate (deg/sec) (if equip.)	Wheel Speed LF (RPM) (if equip.)	Wheel Speed RF (RPM) (if equip.)	Wheel Speed LR (RPM) (if equip.)	Wheel Speed RR (RPM) (if equip.)
-5.0	SNA	SNA	626	626	628	628
-4.9	SNA	SNA	627	627	627	627
-4.8	SNA	SNA	627	627	626	626
-4.7	SNA	SNA	628	628	625	625
-4.6	SNA	SNA	625	625	623	623
-4.5	SNA	SNA	625	625	624	624
-4.4	SNA	SNA	628	628	623	623
-4.3	SNA	SNA	622	622	623	623
-4.2	SNA	SNA	623	623	622	622
-4.1	SNA	SNA	625	625	622	622
-4.0	SNA	SNA	625	625	622	622
-3.9	SNA	SNA	624	624	621	621
-3.8	SNA	SNA	619	619	620	620
-3.7	SNA	SNA	616	616	619	619
-3.6	SNA	SNA	619	619	616	616
-3.5	SNA	SNA	617	617	615	615
-3.4	SNA	SNA	613	613	614	614
-3.3	SNA	SNA	613	613	613	613
-3.2	SNA	SNA	614	614	613	613
-3.1	SNA	SNA	614	614	613	613
-3.0	SNA	SNA	611	611	613	613
-2.9	SNA	SNA	611	611	611	611
-2.8	SNA	SNA	608	608	610	610
-2.7	SNA	SNA	606	606	609	609
-2.6	SNA	SNA	608	608	607	607
-2.5	SNA	SNA	605	605	602	602
-2.4	SNA	SNA	605	605	603	603
-2.3	SNA	SNA	603	603	603	603
-2.2	SNA	SNA	603	603	602	602
-2.1	SNA	SNA	601	601	600	600
-2.0	SNA	SNA	600	600	599	599
-1.9	SNA	SNA	598	598	598	598
-1.8	SNA	SNA	598	598	597	597
-1.7	SNA	SNA	595	595	594	594
-1.6	SNA	SNA	590	590	594	594
-1.5	SNA	SNA	596	596	592	592
-1.4	SNA	SNA	593	593	590	590
-1.3	SNA	SNA	594	594	591	591
-1.2	SNA	SNA	589	589	590	590
-1.1	SNA	SNA	582	582	584	584
-1.0	SNA	SNA	582	582	582	582
-0.9	SNA	SNA	584	584	582	582
-0.8	SNA	SNA	586	586	581	581
-0.7	SNA	SNA	583	583	580	580
-0.6	SNA	SNA	578	578	582	582
-0.5	SNA	SNA	575	575	578	578
-0.4	SNA	SNA	551	551	575	575
-0.3	SNA	SNA	542	542	547	547
-0.2	SNA	SNA	524	524	535	535
-0.1	SNA	SNA	478	478	520	520

Pre-Crash Data (Most Recent Event - table 4 of 5)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	ETC Lamp (if equip.)	ETC Lamp Flashing (if equip.)	Engine Torque Applied	Shift Gear Position (if equip.)	Cruise Control System	Cruise Control Active
-5.0	Off	No	Yes	Drive	Off	No
-4.9	Off	No	Yes	Drive	Off	No
-4.8	Off	No	Yes	Drive	Off	No
-4.7	Off	No	Yes	Drive	Off	No
-4.6	Off	No	Yes	Drive	Off	No
-4.5	Off	No	Yes	Drive	Off	No
-4.4	Off	No	Yes	Drive	Off	No
-4.3	Off	No	Yes	Drive	Off	No
-4.2	Off	No	Yes	Drive	Off	No
-4.1	Off	No	Yes	Drive	Off	No
-4.0	Off	No	Yes	Drive	Off	No
-3.9	Off	No	Yes	Drive	Off	No
-3.8	Off	No	Yes	Drive	Off	No
-3.7	Off	No	Yes	Drive	Off	No
-3.6	Off	No	Yes	Drive	Off	No
-3.5	Off	No	Yes	Drive	Off	No
-3.4	Off	No	Yes	Drive	Off	No
-3.3	Off	No	Yes	Drive	Off	No
-3.2	Off	No	Yes	Drive	Off	No
-3.1	Off	No	Yes	Drive	Off	No
-3.0	Off	No	Yes	Drive	Off	No
-2.9	Off	No	Yes	Drive	Off	No
-2.8	Off	No	Yes	Drive	Off	No
-2.7	Off	No	Yes	Drive	Off	No
-2.6	Off	No	Yes	Drive	Off	No
-2.5	Off	No	Yes	Drive	Off	No
-2.4	Off	No	Yes	Drive	Off	No
-2.3	Off	No	Yes	Drive	Off	No
-2.2	Off	No	Yes	Drive	Off	No
-2.1	Off	No	Yes	Drive	Off	No
-2.0	Off	No	Yes	Drive	Off	No
-1.9	Off	No	Yes	Drive	Off	No
-1.8	Off	No	Yes	Drive	Off	No
-1.7	Off	No	Yes	Drive	Off	No
-1.6	Off	No	Yes	Drive	Off	No
-1.5	Off	No	Yes	Drive	Off	No
-1.4	Off	No	Yes	Drive	Off	No
-1.3	Off	No	Yes	Drive	Off	No
-1.2	Off	No	Yes	Drive	Off	No
-1.1	Off	No	Yes	Drive	Off	No
-1.0	Off	No	Yes	Drive	Off	No
-0.9	Off	No	Yes	Drive	Off	No
-0.8	Off	No	Yes	Drive	Off	No
-0.7	Off	No	Yes	Drive	Off	No
-0.6	Off	No	Yes	Drive	Off	No
-0.5	Off	No	Yes	Drive	Off	No
-0.4	Off	No	Yes	Drive	Off	No
-0.3	Off	No	Yes	Drive	Off	No
-0.2	Off	No	Yes	Drive	Off	No
-0.1	Off	No	Yes	Drive	Off	No

Pre-Crash Data (Most Recent Event - table 5 of 5)

(the most recent sampled values are recorded prior to the event)

Time Stamp (sec)	Tire Pressure Monitor Faults (if equip.)	Tire 1 Location (if equip.)	Tire 1 Pressure Status (if equip.)	Tire 1 Pressure (psi) (if equip.)	Tire 2 Location (if equip.)	Tire 2 Pressure Status (if equip.)	Tire 2 Pressure (psi) (if equip.)
-5.0	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.9	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.8	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.7	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.6	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.5	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.4	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.3	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.2	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.1	No	SNA	Normal	SNA	SNA	Normal	SNA
-4.0	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.9	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.8	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.7	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.6	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.5	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.4	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.3	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.2	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.1	No	SNA	Normal	SNA	SNA	Normal	SNA
-3.0	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.9	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.8	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.7	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.6	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.5	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.4	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.3	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.2	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.1	No	SNA	Normal	SNA	SNA	Normal	SNA
-2.0	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.9	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.8	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.7	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.6	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.5	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.4	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.3	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.2	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.1	No	SNA	Normal	SNA	SNA	Normal	SNA
-1.0	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.9	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.8	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.7	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.6	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.5	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.4	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.3	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.2	No	SNA	Normal	SNA	SNA	Normal	SNA
-0.1	No	SNA	Normal	SNA	SNA	Normal	SNA