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August 2018

Special Crash Investigations On-Site Driver Air Bag Inflator Rupture Crash Investigation

Vehicle: 2002 Honda Accord

Location: Florida

Crash Date: July 2017

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points 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.

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

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16. Abstract This report documents the rupture of the driver's air bag inflator in a 2002 Honda Accord involved in an intersection crash with a 1999 Pontiac Trans AM. The belted 34-year-old female driver of the Honda was fatally injured. The Honda was equipped with dual-stage air bags for the driver and front passenger, front-seat-mounted side impact air bags, and front seat belt retractor pretensioners. The Honda was eastbound on a two-lane roadway approaching a four-leg intersection. This vehicle was occupied by the 34-year-old female driver, a 55-year-old female front right passenger, and two children age 4 and 10 in the second row. The Pontiac was traveling west, operated by a 19-year-old male. As the vehicles approached the intersection, the Pontiac turned left across the path of the Honda. The front plane of the Honda struck the right plane of the Pontiac, causing air bag deployments in both vehicles. The Honda's driver air bag inflator ruptured during its deployment. Separated fragments penetrated the air bag fabric and struck the driver in the face and head. The driver was transported by ambulance to a hospital, where she was pronounced deceased.			
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OFFICE OF DEFECTS INVESTIGATION
ON-SITE DRIVER AIR BAG INFLATOR RUPTURE CRASH INVESTIGATION
VEHICLE: 2002 HONDA ACCORD
LOCATION: FLORIDA
CRASH DATE: JULY 2017

BACKGROUND

This report documents the rupture of the driver's air bag inflator in a 2002 Honda Accord (**Figure 1**) that was involved in an intersection crash with a 1999 Pontiac Trans AM. The belted 34-year- old female driver of the Honda was fatally injured. The Honda was equipped with dual-stage air bags for the driver and front passenger, front seat-mounted side impact air bags and front seat belt retractor pretensioners. The crash and inflator rupture were reported to the National Highway Traffic Safety Administration by the police investigator in July 2017. NHTSA forwarded the crash notification to the Special Crash Investigations team at Crash Research & Analysis, Inc., and assigned an on-site crash investigation. The SCI team contacted and established cooperation to conduct an inspection of the vehicle and the driver air bag assembly. The on-site investigation took place in July 2017 and was attended by the police investigators and a Honda technical representative.

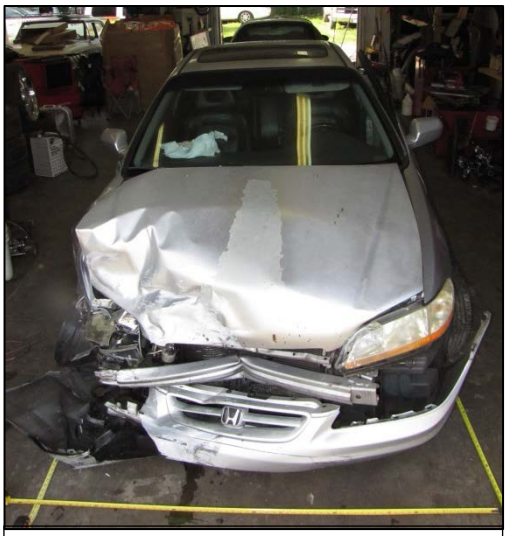


Figure 1: Front view of the Honda taken at the time of the SCI inspection.

The Honda was eastbound on a two-lane roadway approaching a four-leg intersection. This vehicle was occupied by the 34-year-old female driver, a 55-year-old female front right passenger, and two children age 4 and 10 in the second row. The Pontiac was traveling west, operated by a 19-year-old male. As the vehicles approached the mouth of the intersection, the Pontiac turned left across the path of the Honda. The front plane of the Honda struck the right plane of the Pontiac causing air bag deployments in both vehicles. The Honda's driver air bag inflator ruptured during its deployment. Separated fragments penetrated the air bag fabric and struck the driver in the head/face. The driver was transported by ambulance to a hospital, where she was pronounced deceased. The front row right and second row right occupants of the Honda and the driver of the Pontiac were also transported to nearby hospitals with police-reported possible (C-level) injuries. The 4-year-old occupant in the second row left position was not injured.

During the on-site SCI investigation, the Honda, Pontiac, and the physical plant of the intersection were documented by a Nikon total station. The inspection of the Honda included the measurement of its exterior and interior damage and intrusion, identification of the points of occupant contact, assessment of the manual restraint systems, and inspections of the supplemental restraints for deployment/actuation and rupture. Due to its age and date of manufacture, the Honda was not equipped with an event data recorder (EDR) that was supported by the Bosch Crash Data Retrieval (CDR) tool. The inspection of the Pontiac consisted of photographs and measurements to quantify its exterior damage. The EDR in the Pontiac was imaged via the Bosch CDR tool and the imaged file is included at the end of this report as an attachment.

CRASH SUMMARY

Crash Site

This two-vehicle crash occurred during the daylight in July 2017 at a four-leg intersection. The police-reported environmental conditions at the time of the crash were daylight, cloudy, and dry. The National Weather Service reported a temperature of 33 ºC (91.6 ºF), relative humidity of 59 percent, north winds at 11.1 km/h (6.9 mph), and mostly cloudy skies.

The physical environment of the crash site was documented during the SCI inspection using a Nikon Nivo 5.M+ total station. The crash occurred at the four-leg intersection of a two-lane east/west roadway and a two-lane north/south roadway in a suburban/residential setting. Traffic at the intersection was controlled by stop signs for the north and south travel directions. The posted speed limit on the primary east/west roadway was 48 km/h (30 mph). Each traffic lane of the east/west road measured 3.3 m (10.8 ft) in width and the lanes were separated by a double yellow centerline. The east approach to the intersection had a negative 3% grade. The intersection was level. The roadsides consisted of grass, trees, and residential housing. **Figures 2 and 3** depict the east and west approach views of the intersection, respectively.

Figure 2: Eastbound trajectory view of the Honda approximately 30 m (98 ft) from the intersection.

Figure 3: Westbound trajectory view of the Pontiac approximately 30 m (98 ft) from intersection.

Pre-Crash

The Honda was traveling east at a SCI-reconstructed speed of 40 to 48 km/h (25 to 30 mph). The Honda was driven by the 34-year-old female and was occupied by a 55-year-old female in the front row right position, a 4-year-old female in the second row left position and a 10-year-old male in the second row right position. All occupants were restrained by the vehicle's 3-point lap and shoulder belt systems. The 4-year-old female was seated on a Graco low-back booster child restraint system (CRS).

The Pontiac was driven westbound by a 19-year-old belted male driver. The EDR-reported speed of the Pontiac 5 seconds prior to algorithm enable (AE) was 24 km/h (15 mph). As the Pontiac approached the intersection, the driver applied the brakes. The EDR-reported brake switch circuit status was "On" from 3 seconds prior to 1 second prior to AE. During its approach to the intersection, the Pontiac slowed to a reported speed of 14 km/h (9 mph) and for undetermined reasons turned left across the path of the Honda.

Crash

The right and center aspects of the Honda's front plane struck the right plane of the Pontiac. The impact configuration resulted in force directions of 12 o'clock and 2 o'clock for the Honda and Pontiac, respectively. The Honda's impact-force directed aft of the Pontiac's center-of-mass caused both vehicles to rotate clockwise as they slid to final rest. The Pontiac was redirected to the southeast, rotated 130 degrees clockwise and came to rest 6.2 m (20.3 ft) from the point of impact (**Figure 4**). At rest the vehicle was facing north, just off the road edge in the southeast quadrant of the intersection. The Honda rotated approximately 95 degrees clockwise and came to facing south, on the east crosswalk, 8.9 m (29.2 ft) from the impact. The severity of the crash (delta-V) was calculated by the damage algorithm of the WinSMASH program. The calculated delta-V of the Honda was 24 km/h (15 mph). The delta-V of the Pontiac was 25 km/h (16 mph).

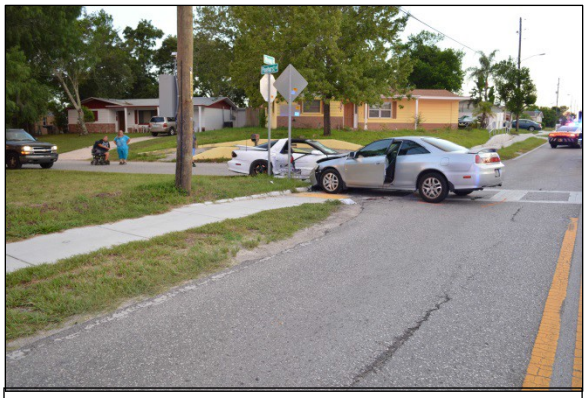


Figure 4: Southwest-looking on-scene police image depicting the vehicles at final rest. Image supplied by the police investigation.

The frontal air bags in both vehicles deployed during the crash. During the deployment of the Honda's driver's frontal air bag, the air bag inflator ruptured and separated. The cylindrical housing of Stage 2 separated from the inflator, penetrated the fabric of the air bag and struck the driver in the head/face. The housing was found on the floor of the second row left position.

Post-Crash

Police, firefighters and emergency medical service (EMS) personnel responded to the crash site. The manual seat belt securing the driver was cut and removed by an EMS responder. The driver was removed from the vehicle and transported by ambulance to a hospital located approximately 6.9 km (4.3 miles) from the crash site. The driver was pronounced deceased upon arrival. The three other occupants of the Honda and the driver of the Pontiac exited the vehicle under their own power. The Honda occupants and the Pontiac driver were transported to local hospitals for treatment.

The Honda and Pontiac were towed from the crash site by a local company and stored pending the police investigation. During the police investigation, the driver air bag assembly was removed from the steering wheel and placed into secure evidence. The separated components of the inflator assembly that were displaced into the occupant compartment were recovered and also stored in evidence. During the subsequent SCI investigation, the air bag assembly was inspected by SCI and the manufacturer's representative in the evidence room of the police headquarters.

2002 HONDA ACCORD

Description

The 2002 Honda Accord two-door coupe (**Figure 5**) was manufactured in July 2002 and was identified by Vehicle Identification Number 1HGCG22572Axxxxxx. The Honda was equipped with the EX-level trim package. The powertrain consisted of a 3.0 liter transverse-mounted six-cylinder gasoline engine linked to a 4-speed automatic transmission. Standard equipment included four-wheel power assisted disc brakes with ABS and electronic brakeforce distribution, traction control, and power-steering. The gross vehicle weight rating (GVWR) for this vehicle was 1,921 kg (4,235 lb) with gross axle weight ratings (GAWR) of 1,050 kg (2,315 lb) front and 880 kg (1,940 lb) rear. At the time of the crash, the Honda was configured with a Starfire RS-C left front tire, a Yokohama Avid S34 right front tire and Bridgestone Potenza tires at the rear axles. All the tires were the vehicle manufacturer recommended size of P205/60R16. The specific tire data at the time of the SCI inspection was as follows.

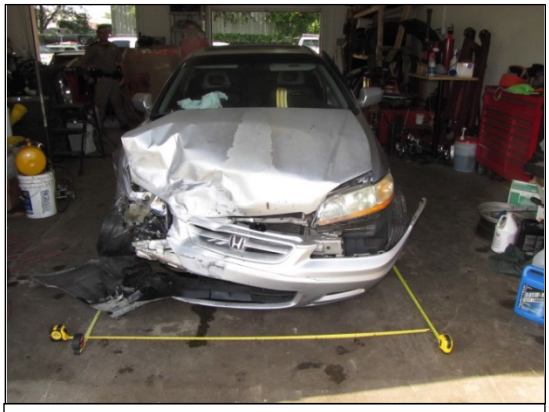


Figure 5: Front view of the Honda Accord.

Position	Tire Identification Number	Measured Tread Depth	Restriction	Damage
LF	RMXW LMU XXXX	6 mm (7/32 in)	No	None
LR	0BXV 190 XXXX	5 mm (6/32 in)	No	None
RR	0BXV 190 0610	6 mm (8/32 in)	No	None
RF	FD20 XXX XXXX	4 mm (5/32 in)	Yes	None

The interior of the Honda was configured for seating of five occupants with front row (forward folding) bucket seats and a three-passenger rear bench seat. The driver seat was adjusted in a mid-to-rear track position. The front row right seat was adjusted mid-track. All seating surfaces were leather. The head restraints in the front row were adjustable (fully down). Manual restraint was provided by 3-point lap and shoulder seat belts for the five seat positions. The front seat belts were equipped with retractor pretensioners. Supplemental restraint consisted of dual-stage frontal and seat-mounted side impact air bags for the driver and front row right positions. The Honda was not equipped with inflatable curtain (IC) air bags.

Vehicle History

A CarFax history report indicated that the Honda had been registered in Florida since its initial sale in 2002. Any record of maintenance was routine. There were no reported crashes. The involved driver was the third owner of the vehicle and reportedly purchased the car in February 2016 from a third-party private person.

NHTSA Recalls and Investigations

A query of the NHTSA website www.safercar.gov using the Honda's VIN in July 2017 determined that there was one open (incomplete) recall and investigation. Specifically, this recall (dated May 27, 2015) addressed the potential rupture of the driver air bag module (NHTSA Recall Number: 15V-320). The NHTSA number EA15001 identified this investigation.

Exterior Damage

The exterior damage to the Honda (**Figure 6**) was consistent with the front-to-side impact of the crash (Event 1). The direct contact damage began on the vehicle's centerline and extended 74 cm (29.0 in) to the right front corner. The direct contact then wrapped around the corner and extended down to the right plane ending 11 cm (4.5 in) forward of the right front axle. The combined width of the direct contact and induced damage extended across the entire 147 cm (58.0 in) end width of the front plane. A black scuff mark on the fractured bumper

Figure 6: Overhead view of the Honda's frontal deformation.

at the centerline of the Honda was attributed to direct contact with the right rear tire of the Pontiac. The crush profile was measured along the bumper reinforcement bar and after adjustment for freespace was as follows: C1 = 0, C2 = 12 cm (4.7 in), C3 = 28 cm (11.0 in), C4 = 29 cm (11.4 in), C5 = 20 cm (8.0 in), C6 = 11 cm (4.3 in). The maximum crush was located 5 cm (2.0 in) left of center and measured 34 cm (13.4 in). The right fender was compressed and buckled. The right wheelbase was shortened 10 cm (4.0 in). The left wheelbase was unchanged. The left door was open at the time of the inspection and would not latch shut due to body deformation. The right door remained closed during the crash and was operational post-crash. The delta-V calculated by the WinSMASH damage algorithm was 24 km/h (15 mph) with longitudinal and lateral components of -23 km/h (-14 mph) and 4 km/h (2 mph), respectively. These results appeared reasonable based on SCI experience.

Event Data Recorder

The Honda was equipped with an air bag control module that monitored the air bag system's diagnostics and controlled its deployment. It was determined through previous SCI research that Honda vehicles of this time frame were equipped with rudimentary EDR that had very limited capabilities. It did not have the capabilities to record pre-crash data. The EDR was not supported by Bosch Crash Data Retrieval (CDR) tool; therefore, EDR data was not available.

Interior Damage

The Honda's interior damage was limited to the deployment of the frontal air bags and occupant contact to the interior components. The driver seat (**Figure 7**) was adjusted to a mid-to-rear track position that measured 17 cm (6.5 in) aft of full forward. The total seat track travel measured 24 cm (9.3 in). The seatback was reclined 20 degrees. The adjustable head restraint was fully down. Blood evidence was observed on the seat cushion and the lower portion of the seatback. A large pooling of blood was depicted on the driver seat cushion in the on-scene police images of the interior. A pair of sunglasses attributed to the driver was observed in the front interior. The left frame of the sunglass was fractured (**Figure 8**). The fracture was attributed to likely contact with the separated inflator.

Figure 7: Left interior view of the Honda depicting the driver seat.

Figure 8: Image depicting the fractured sunglasses in the Honda.

A scuff mark attributed to the right lower extremity of the driver was observed on the driver bolster. The mark was located 10 cm (4 in) right of the steering wheel centerline and 36 cm (14.0 in) above the floor. An irregular area of body matter was observed on the headliner above the driver seat and along the left roof side rail. This area measured approximately 38 cm x 20 cm (15.0 in x 8.0 in), length by width, respectively. The body matter evidence then extended down onto the interior surfaces of the left window glazing and door panel. A tooth was observed in the floor pan forward of the driver seat during the SCI inspection.

The front row right seat was adjusted to a mid-track position that measured 12 cm (4.8 in) aft of full forward. The seatback was reclined 15 degrees. The horizontal distance from the seatback to the vertical face of the instrument panel measured 70 cm (27.5 in). A Graco Turbobooster CRS was positioned at the second row left position. There was no evidence of occupant contact to the interior componentry at the front row right or second row seat positions.

Manual Restraint Systems

The Honda was equipped with manual 3-point lap and shoulder seat belts for the five designated seating positions. Each seat belt consisted of continuous loop webbing, a sliding latch plate, and a fixed D-ring. The driver's seat belt used an emergency locking retractor (ELR). The four other retractors were switchable automatic locking retractors (ALR/ELR). The retractors in the front row were equipped with pretensioners.

The driver was restrained by the seat belt based on the observations of the SCI vehicle inspection. The seat belt webbing was cut immediately below the D-ring by the EMS providers during the on-scene activities to remove the driver from the vehicle. The cut length of the webbing was lying on the driver seat cushion at inspection and was blood-soaked. The latch plate was missing. The retractor was locked due to pretensioner actuation. At inspection, the front

row right seat belt webbing was extended and this retractor was also locked due to the actuation of the pretensioner. The length of the extended webbing measured 196 cm (77 in) from the lower anchor to the D-ring. The latch plate exhibited indicators of historical use. The friction surface was abraded due to occupant loading at the time of the crash. The front row right occupant was belted at the time of the crash based on the observations of the SCI inspection.

The 4-year-old female was seated on a backless booster CRS in the second row left position and restrained by the seat belt. At examination, the seat belt webbing was roped and gathered in the latch plate due to occupant loading. The location of the latch plate was consistent with its buckled position at the time of the crash.

The second row right seat belt was retracted and stowed. The latch plate examination revealed indicators of historical use. There was no crash related evidence on either the latch plate or the webbing. It was probable that this seat belt was in use by the 10-year-old considering the other occupants in the vehicle were all belted.

Supplemental Restraint Systems

The Honda was equipped with dual-stage frontal air bags and front seat-mounted side impact air bags. Both front air bags deployed in the intersection crash. The driver's frontal air bag inflator module ruptured during the deployment sequence. The passenger's frontal air bag deployed as designed.

As part of their investigation the police investigators cut the fabric of the driver's frontal air bag away from the module, removed the module from the steering wheel and recovered the separated components of the inflator from the vehicle. This process was documented by police photographs and the photos were shared with the SCI investigator.

Figure 9: Interior image depicting the steering wheel of the Honda (driver's frontal air bag module removed).

At inspection, the steering wheel assembly below the driver's frontal air bag module revealed chemical residue and indicators of a ruptured deployment (**Figure 9**).

The air bag components were then placed into secure police evidence. During the SCI investigation, the police investigator removed the items from evidence and allowed a visual inspection of the air bag components. The rules of evidence handling dictated that only a visual in-

spection was allowed and that the components could only be manipulated by the police investigator. The air bag fabric and inflator components are shown in **Figures 10-15** below.

The air bag fabric was holed in the 5 o'clock sector (**Figure 10**). The irregular shaped hole measured approximately 8 cm x 8 cm (3.0 in x 3.0 in) and was located approximately 13 cm (5.0 in) from the center of the fabric. An area of blood evidence was observed at the 9 o'clock sector. Scattered areas of the interior surfaces of the air bag fabric (**Figure 11**) exhibited chemical residue released from the ruptured inflator. A deformed metallic disk had adhered itself to the tether strap in the 6 o'clock sector. The disk was used as a separator in the construction of the inflator and had separated during the rupture. The following nomenclature was stamped in the 12 o'clock sector: *Honda 0008414 19 06 02*.

Figure 10: Honda driver's frontal air bag fabric face.

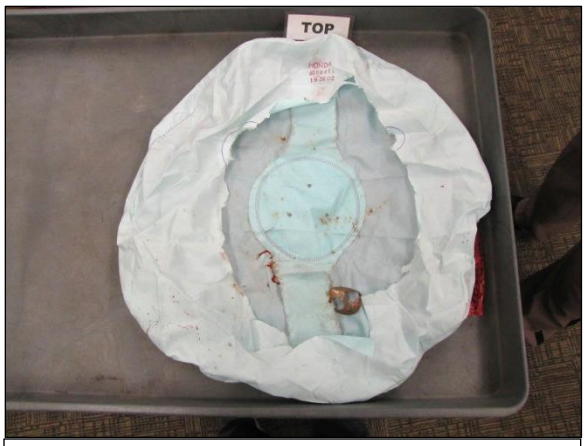


Figure 11: Honda driver's frontal air bag fabric interior.

Figures 12 and 13 are views of the ruptured inflator housing. The interior surface of the inflator housing was contaminated by chemical reaction either prior to and/or by the air bag deployment. The casing was ruptured, split and deformed. There were four symmetrically spaced holes or ports around the perimeter ring of the casing that allowed the generated inflation gas to flow and inflate the air bag. It was observed that all four holes were clear of contaminants. The labels included the following.

Gasgenerator Inflation Systems Inc.

LaGrange, GA Takata

JBAN5269111 ??? ?TI 1085 HERST 2002.

Figure 12: Interior surface of the ruptured Honda driver's frontal air bag inflator housing.

Figure 13: Back view of the ruptured Honda driver's frontal air bag inflator housing.

The separated Stage 2 cap is depicted in **Figures 14 and 15.** The Stage 1 squib had detonated. The Stage 2 squib was intact, but separated. The top surface of the cap was also labeled *JBAN5269111*. The exterior surfaces exhibited possible blood and human body matter. The police investigator found the cap on the floor behind the driver seat during his inspection (**Figure 16**). The separated wire mesh filter of the inflator was found adhered to the vinyl trim along the left door sill (**Figure 17**). The wire mesh, heated from the deployment, had melted and adhered to the vinyl. The police investigator cut the trim in order to remove the wire mesh from the vehicle.

Figure 14: Back view of the separated Stage 2 housing of the Honda driver's frontal air bag inflator.

Figure 15: Side view of the separated Stage 2 housing of the Honda driver's frontal air bag inflator.

Figure 16: Interior view of the second row left floor area and the separated inflator cap. Image supplied by the police investigation.

Figure 17: Interior image of the separated wire mesh filter of the inflator. It was adhered to the left sill trim of the Honda. Police investigation image.

Based on a preponderance of the evidence, the SCI Investigator determined that the driver's frontal air bag inflator ruptured during its Stage 1 deployment and projected the Stage 2 cap of the inflator rearward toward the driver. The cap penetrated through the air bag's fabric and struck the 34-year-old driver in the face/head resulting in fatal injuries.

The passenger's frontal air bag was a top-mount installation that deployed as designed from the right aspect of the instrument panel. The fabric of this air bag was also cut away from the module during the police investigation. In its deflated state, the air bag fabric (**Figure 18**) measured 64 cm (25.0 in) by 81 cm (32.0 in), width by height. The only evidence on the fabric was a single blood stain at the central left aspect. The manufacturer's label affixed to the fabric declared the following nomenclature: *5204414-00BB?? ?HANN520A0-??*. The right glove box was removed by the Honda representative in order to visually inspect the air bag module (**Figure 19**).

Figure 18: View of the Honda passenger's frontal air bag at the of the SCI inspection.

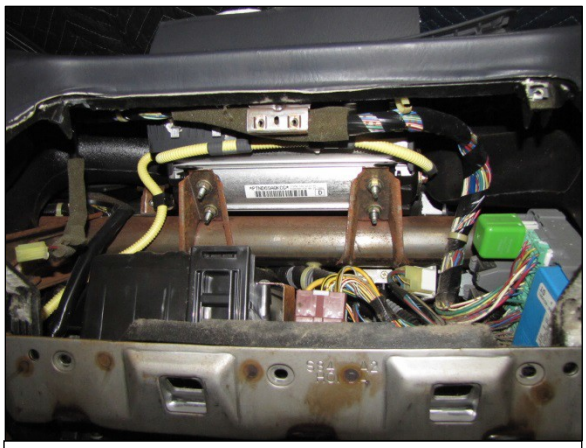


Figure 19: Interior view of the disassembled right instrument panel and the passenger's frontal air bag module in the Honda.

The manufacturer's label on the module indicated the following: *PTND6SAQKCG 77850-S82-A121-M1 5204408-03E 06/25/2002.* Although the actual manufacturer was unknown to him, the Honda representative stated that it was not a Takata module.

2002 HONDA ACCORD OCCUPANTS

Driver Demographics

Age/Sex:	34 years/female
Height:	155 cm (61 in)
Weight:	90 kg (198 lb)
Eyewear:	Sunglasses
Seat Type:	Forward-folding bucket seat with adjustable head restraint
Seat Track Position:	Mid-to-rear track
Manual Restraint Usage:	3-point lap and shoulder seat belt
Usage Source:	Vehicle inspection
Air Bags:	Frontal and seat-mounted side impact air bags available; driver's frontal air bag deployed
Alcohol/Drug Involvement:	No involvement per autopsy
Egress From Vehicle:	Removed by EMS due to perceived serious injury
Transport From Scene:	Ambulance to a hospital
Type of Medical Treatment:	Pronounced deceased shortly after arrival

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Inferior left frontal and left temporal lobes have an 11.0 x 6.0 cm area of lacerations	140686.4	Ruptured driver air bag inflator	Certain
2	Inferior left frontal and left temporal lobes have an 11.0 x 6.0 cm area of contusions	140608.4	Ruptured driver air bag inflator	Certain
3	Left anterior and middle cranial fossa fractured	150200.3	Ruptured driver air bag inflator	Certain
4	Cerebral hemisphere has diffuse subarachnoid hemorrhage	140693.2	Ruptured driver air bag inflator	Certain
5	Cerebellar hemisphere has diffuse subarachnoid hemorrhage	140466.2	Ruptured driver air bag inflator	Certain
6	Left frontal aspect of calvarium has a linear fracture	150402.2	Ruptured driver air bag inflator	Certain

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
7	Gaping 15.0 x 7.0 cm laceration from left temporal scalp towards mouth	210604.2	Ruptured driver air bag inflator	Certain
8	Facial bones fractured under gaping laceration	250400.1	Ruptured driver air bag inflator	Certain
9	Aspirated blood in lungs	Consequence of above injuries, not able to code per AIS rules		

Source – Medical Examiner Report (internal)

Driver Kinematics

The 34-year old female driver of the Honda was seated in an upright posture with the seat adjusted to a mid-to-rear track position. She was restrained by the vehicle's 3-point lap and shoulder seat belt. As the Honda approached the intersection, the Pontiac traveling in the opposite direction turned across its path. The driver most likely turned the steering wheel clockwise in an avoidance maneuver. The front plane of the Honda struck the right plane of the Pontiac.

Rotation of the steering wheel would have placed the 5 o'clock sector of the wheel in a relative 9-to-10 o'clock position at the time of the impact. The severity of the crash resulted in the deployment of the Honda's frontal air bag system. During deployment of Stage 1, the Takata driver's frontal air bag inflator ruptured with a separation of the inflator cap. As the air bag was inflating, the separated cap penetrated through the air bag fabric and impacted the left aspect of driver's face and head. The impact of the separated cap resulted in the above injuries that proved to be fatal. The driver was removed from the vehicle by the responding medical professionals and transported by ambulance to a hospital, where she was pronounced deceased.

Front Row Right Occupant Demographics

Age/Sex:	55 years/female
Height:	Unknown
Weight:	Unknown
Eyewear:	None
Seat Type:	Forward-folding bucket seat with adjustable head restraint
Seat Track Position:	Mid-track
Manual Restraint Usage:	3-point lap and shoulder seat belt
Usage Source:	Vehicle inspection
Air Bags:	Frontal and seat-mounted side impact air bags available; passenger's frontal air bag deployed
Alcohol/Drug Involvement:	Not reported
Egress From Vehicle:	Exited under her own power
Transport From Scene:	Ambulance to a hospital
Type of Medical Treatment:	Treated and released

Front Row Right Occupant Injuries

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

Medical record request refused

Front Row Right Occupant Kinematics

The 55-year old female was seated in the front row right position with her seat adjusted to a mid- track position. She was restrained by the vehicle's 3-point lap and shoulder seat belt. At impact, the frontal air bag deployed. The occupant initiated a forward trajectory and loaded the seat belt and deployed air bag with her torso. The loading of these safety devices allowed her to ride down the force of the crash. The occupant then rebounded back into her seat to final rest. She was able to exit the vehicle under her own power and was then transported by ambulance to a hospital for examination.

Second Row Left Occupant Demographics

Age/Sex:	4 years/female
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat Type:	Booster CRS on a fixed bench seat
Seat Track Position:	Not adjustable
Manual Restraint Usage:	3-point lap and shoulder seat belt
Usage Source:	Vehicle inspection
Air Bags:	None
Alcohol/Drug Involvement:	Not reported
Egress From Vehicle:	Exited under her own power
Transport From Scene:	None
Type of Medical Treatment:	None

Second Row Left Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	None	N/A	N/A	N/A

Source: PAR

Second Row Left Occupant Kinematics

The 4-year-old female was seated on a Graco Turbobooster CRS and was restrained by the vehicle's 3-point lap and shoulder seat belt. At impact, the child initiated a forward trajectory and loaded the seat belt. Evidence of occupant loading to the seat belt was denoted by the gathering

of the webbing in the seat belt's latch plate. The use of the seat belt allowed the child to ride down the force of the crash. She was not injured in the crash.

Second Row Right Occupant Demographics

Age/Sex:	10 years/male
Height:	Unknown
Weight:	35 kg (78 lb)
Eyewear:	Unknown
Seat Type:	Fixed bench
Seat Track Position:	Not adjustable
Manual Restraint Usage:	3-point lap and shoulder seat belt
Usage Source:	Vehicle inspection
Air Bags:	None
Alcohol/Drug Involvement:	Not reported
Egress From Vehicle:	Exited under own power
Transport From Scene:	Ambulance to a hospital
Type of Medical Treatment:	Examined and released

Second Row Right Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Abrasions to lower abdomen	510202.1	Safety belt webbing	Certain
2	Minor abrasion to right side of neck	310202.1	Safety belt webbing	Certain
3	Right lower extremity contusion, NFS	810402.1	Unknown	N/A

Source: Emergency room records

Second Row Right Occupant Kinematics

The 10-year-old male was seated in the second row right position and was restrained by the vehicle's 3-point lap and shoulder seat belt. At impact, the child initiated a forward trajectory and loaded the seat belt. The child rode down the force of the impact and rebounded back into his seat. There was no evidence of his contact to the interior of the Honda. He exited the vehicle and was transported by ambulance where he was examined, treated and released.

1999 PONTIAC TRANS AM

Description

The 1999 Pontiac Trans Am two-door coupe (**Figure 20**) was identified by VIN 2G2FV22G2X2xxxxxx and was manufactured in December 1998. The odometer reading was 201,798 km (125,395 miles) at inspection. The Pontiac's powertrain consisted of a 5.7 liter V8 gasoline engine linked to a 3-speed automatic transmission with rear-wheel drive. Standard equipment included four-wheel power assisted disc brakes with ABS, traction control, and power-steering. The GVWR for this vehicle was 1,941 kg (4,280 lb) with GAWR of 980 kg (2,161 lb) front and 961 kg (2,119 lb) rear. At the time of the crash, the Pontiac was configured with Primewell Valera Sport AS tires on the front axles and BF Goodrich G-Force Sport tires on the rear axles. All the tires were the vehicle manufacturer recommended size of P245/50R16. The specific tire data at the time of the SCI inspection was as follows.

Figure 20: Front right oblique view of the Pontiac.

Position	Tire Identification Number	Measured Tread Depth	Restriction	Damage
LF	9UBD JMA 3114	3 mm (4/32 in)	No	None
LR	BEX1 3P11 2712	2 mm (3/32 in)	No	None
RR	BEX1 3P11 2712	2 mm (2/32 in)	No	None
RF	9UBD JMA 3114	3 mm (4/32 in)	No	None

The interior of the Pontiac was manufactured for the seating of four occupants with front row (forward folding) bucket seats and a second row bench seat. At the time of the crash and SCI inspection the second row seats had been removed. The head restraints in the front row were adjustable (fully down). Manual restraint was provided by 3-point lap and shoulder seat belts. Supplemental restraint consisted of frontal air bags for the driver and front row right positions.

Exterior Damage

Exterior damage was present on the right plane of the Pontiac consistent with the intersection crash (**Figures 21 and 22**). The combined width of the induced and direct contact damage measured 180.0 cm (70.8 in). The induced damage region began at the lead edge of the right door and extended rearward ending on the right quarterpanel 11 cm (4.3 in) forward of the right rear axle. The direct contact damage measured 118 cm (46.5 in) wide and began at the mid-aspect of the right door 144 cm (56.8 in) forward of the right rear axle extending rear-

ward. The direct contact region ended 25 cm (10.0 in) forward of the right rear axle and included direct contact to the right rear tire. The fiberglass door panel was fractured and the door beam was exposed. The right door was jammed closed. The right door latch remained secure despite its involvement in the direct contact. The crush profile was measured along the mid door elevation and after adjustment for freespace was as follows: C1 = 0, C2 = 8 cm (3.1 in), C3 = 17 cm (6.7 in), C4 = 30 cm (11.8 in), C5 = 10 cm (3.9 in), C6 = 4 cm (1.6 in). The total delta-V calculated by the WinSMASH damage algorithm was 25 km/h (16 mph) with longitudinal and lateral components of -16 km/h (-10 mph) and -19 km/h (-12 mph), respectively. These results appeared reasonable based on SCI experience.

Figure 21: Right front oblique view of the Pontiac's impact damage.

Figure 22: Overhead view of the Pontiac's impact damage.

Event Data Recorder

The Pontiac Trans AM was equipped with an ir bag control module that performed the diagnostic, sensing and deployment command functions for the vehicle's supplemental restraint systems. This module had EDR capabilities. The EDR component was imaged with the Bosch Crash Data Retrieval tool and software version 17.4 via a connection to the Diagnostic Link Connector located under the left instrument panel and on-board 12-volt power. The imaged data is reported with version 17.7.1 and is included at the end of this report as an attachment.

The data limitations reported that this EDR was capable of recording two event types, namely Non-Deployment events and Deployment events and had the capacity to store two events. It could store one Non-Deployment event. The Non-Deployment event could be overwritten if it was not locked. A Non-Deployment event was considered to be locked if it occurred in a 5-second window of a Deployment event. Deployment events were considered to be locked events and could not be overwritten. The EDR could store two Deployment events. A 5-second pre- crash buffer that described various vehicle performance parameters (including vehicle speed, throttle percentage, brake switch status, and engine rpm) was recorded for each event record. These performance parameters were recorded asynchronously in 1-second intervals.

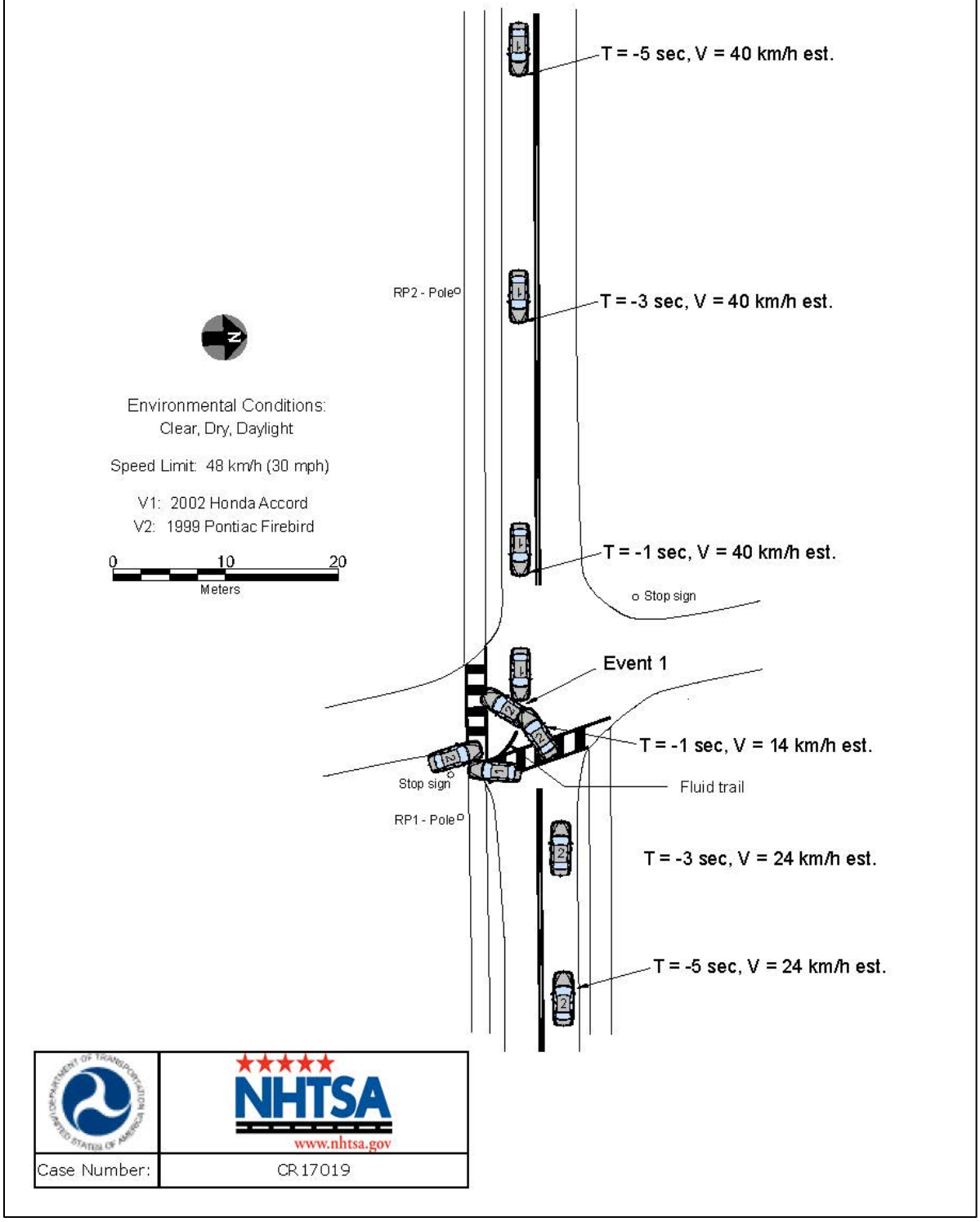
The imaged data report indicated that the EDR had recorded one Deployment and one Non-Deployment event. The Deployment event was consistent with Event 1 of the SCI reconstruction. The Non-Deployment event was considered to be an unrelated historical event. Although both events occurred on the same ignition cycle (33,289), the time relationship between the events was unknown (beyond the 5-second window in order to consider them related).

The System Status data of the Deployment event reported that the air bag warning lamp was off and that the driver seat belt was buckled. The maximum recorded longitudinal delta-V was -15.6 km/h (-9.7 mph) at 100 milliseconds. The recorded Pre-Crash data speed of the Pontiac 5 seconds prior to AE was 24 km/h (15 mph). The vehicle then slowed through braking over the next 4 seconds to a recorded speed of 14 km/h (9 mph) at 1 second prior to AE. The recorded speeds were considered to be consistent with a vehicle that was approaching and then turning at an intersection.

Occupant Data

The 19-year-old male driver of the Pontiac was police-reported as restrained by the manual seat belt system. The driver's frontal air bag deployed during the crash that provided additional protection. He sustained police reported C-level (possible injuries) and was transported by ambulance to a local hospital for examination.

CRASH DIAGRAM



APPENDIX A:
1999 Pontiac Trans AM Event Data Recorder Report[1]

[1] The EDR report published as part of this technical report is the latest software version of the Bosch CDR Tool at the time of publication. The CDR report contained in the associated CISSWEB application may be of an earlier software version of the Bosch CDR Tool and may differ relative to this report.

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

CDR File Information

User Entered VIN	2G2FV22G2X2******
User	
Case Number	
EDR Data Imaging Date	07/26/2017
Crash Date	
Filename	CR17019_V2_ACM.CDRX
Saved on	Wednesday, July 26 2017 at 10:19:34
Imaged with CDR version	Crash Data Retrieval Tool 17.4
Imaged with Software Licensed to (Company Name)	NHTSA
Reported with CDR version	Crash Data Retrieval Tool 17.7.1
Reported with Software Licensed to (Company Name)	NHTSA
EDR Device Type	Airbag Control Module
Event(s) recovered	Deployment Non-Deployment

Comments

No comments entered.

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). It contains Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event may be overwritten by another Non-Deployment Event. 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 a Deployment Level Event, 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 before 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 contains Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. If a Deployment Level Event occurs within five seconds after the Deployment Event, the Deployment Level Event 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 Adjusted Algorithm Longitudinal Velocity Change:

Once the crash data is downloaded, the CDR tool mathematically adjusts the recorded algorithm longitudinal velocity data to generate an adjusted algorithm longitudinal velocity change that may more closely approximate the longitudinal velocity change the sensing system experienced during the recorded portion of the event. The adjustment takes place within the downloading tool and does not affect the crash data stored in the SDM, which is displayed in hexadecimal format. The SDM Adjusted Algorithm Longitudinal Velocity Change may not closely approximate what the sensing system experienced in all types of events. For example, if a crash is preceded by other common events, such as rough road, struck objects, or off-road travel, the SDM Adjusted Algorithm Longitudinal Velocity Change may be less than and sometimes significantly less than the actual longitudinal velocity change the sensing system experienced. For Deployment Events, the SDM will record 100 milliseconds of data after Deployment criteria is met and up to 50 milliseconds before Deployment criteria is met. Velocity Change data is displayed in SAE sign convention.

-SDM Recorded Vehicle Speed accuracy can be affected by various factors, including but not limited to the following:

- -Significant changes in the tire's rolling radius
- -Final drive axle ratio changes
- -Wheel lockup and wheel slip

-Brake Switch Circuit Status indicates the open/closed state of the brake switch circuit.

-Pre-Crash data is recorded asynchronously. The 1.0 second Pre-crash data value (most recent recorded data point) is the data point last sampled before AE. That is to say, the last data point may have been captured just before AE but no more than 1.0 second before AE. All subsequent Pre-crash data values are referenced from this data point.

-Some of the Pre-Crash data may be recorded after Algorithm Enable (AE). If this occurs, it may affect the reported pre-crash data values, but does not affect other data such as SDM Adjusted Algorithm Longitudinal Velocity Change.
-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 present to send the pre-crash data
-Driver’s Belt Switch Circuit Status indicates the status of the driver’s seat belt switch circuit. If the vehicle’s electrical system is compromised during a crash, the state of the Driver’s Belt Switch Circuit may be reported other than the actual state.
-Passenger Front Air Bag Suppression Switch Circuit Status indicates the status of the suppression switch circuit.
-The Time Between 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 power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-All data should be examined in conjunction with other available physical evidence from the vehicle and scene.

Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted by the Powertrain Control Module (PCM), via the vehicle’s communication network, to the SDM.
-Brake Switch Circuit Status data is transmitted by either the ABS module or the PCM, via the vehicle’s communication network, to the SDM.
-The SDM may obtain Belt Switch Circuit Status data a number of different ways, depending on the vehicle architecture. Some switches are wired directly to the SDM, while others may obtain the data from various vehicle control modules, via the vehicle’s communication network.
-The Passenger Front Air Bag Suppression Switch Circuit is wired directly to the SDM.

Hexadecimal Data:
Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR tool.

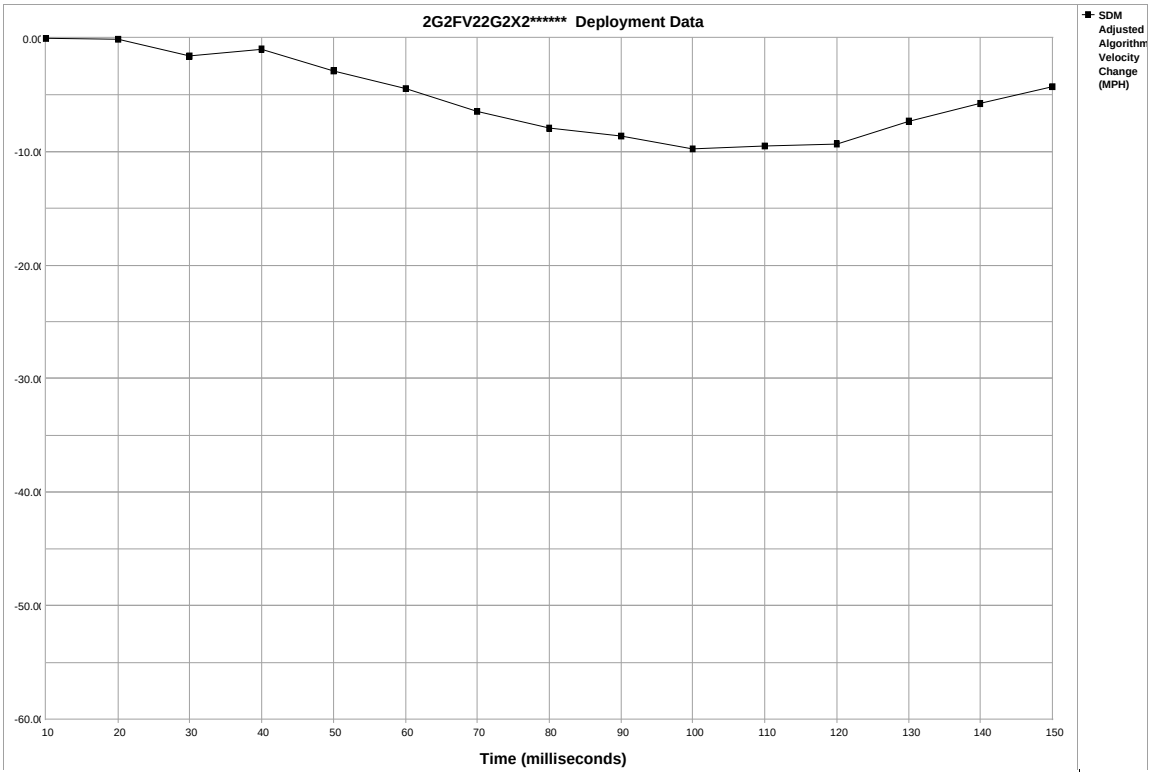
01021_SDMG-99FXZ04_r004

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger SIR Suppression Switch Circuit Status (if equipped)	Air Bag Not Suppressed
Ignition Cycles At Deployment	33289
Time Between this Event and the Previous Event (sec)	N/A

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	15	896	0
-4	15	1024	0
-3	15	832	0
-2	11	704	0
-1	9	512	0

Seconds Before AE	Brake Switch Circuit State
-8	ON
-7	ON
-6	OFF
-5	OFF
-4	OFF
-3	ON
-2	ON
-1	ON



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Adjusted Algorithm Velocity Change	0.00	-0.05	-1.59	-0.93	-2.91	-4.45	-6.42	-7.96	-8.62	-9.71	-9.49	-9.28	-7.30	-5.77	-4.23

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger SIR Suppression Switch Circuit Status (if equipped)	Air Bag Not Suppressed
Ignition Cycles At Non-Deployment	33289
Maximum SDM Algorithm Longitudinal Velocity Change (MPH)	-0.05
Time Between this Event and the Previous Event (sec)	N/A

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	29	832	0
-4	29	832	0
-3	29	832	0
-2	29	896	0
-1	22	704	0

Seconds Before AE	Brake Switch Circuit State
-8	OFF
-7	OFF
-6	OFF
-5	OFF
-4	OFF
-3	OFF
-2	ON
-1	ON

Hexadecimal Data

```
$01  7C 05 00 00
$02  8A 11
$03  41 53 38 33 33 37
$04  4B 30 55 41 48 31
$05  00
$06  16 24 31 31
$11  86 02 87 FD 8D 00
$14  03 04 B4 00
$18  82 82 84 C8 FF 00
$1C  31 32 46 50 50 50
$1D  50 32 32 46 53 56
$1E  56 56
$1F  FF 02 00 00
$20  80 00 00 FF 47 F8
$21  FF FF FF FF FF FF
$22  FF FF 03 00 04 03
$23  00 00 00 00 FF FF
$24  FF FF FF FF FF FF
$25  FF FF FF 04 24 2E
$26  2E 2E 2E 00 C0 00
$27  00 00 00 00 00 00
$28  0B 0E 0D 0D 0D 00
$29  EF BE FE FE 7B 85
$2A  7B 5C 7B 84 00 00
$2B  00 00 00 00 00
$30  80 00 00 FF 47 F8
$31  FF FF FE FF FF FF
$32  FF FF 1A 03 03 00
$33  00 03 01 05 08 0C
$34  0F 10 12 11 10 0B
$35  07 03 00 43 02 4B
$36  0E 11 18 18 18 00
$37  E3 00 00 00 00 00
$38  00 00 08 0B 0D 10
$39  0E 00 EF BE FE 00
$3A  00 00 40 00
$40  FF FF FF FF FF FF
$41  FF FF FF FF FF FF
$42  FF FF
```

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DOT HS 812 567
August 2018

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

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