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CALSPAN ON-SITE ROLLOVER CRASH INVESTIGATION
SCI CASE NO.: CA09051

VEHICLE: 2007 HONDA PILOT

LOCATION: NORTH CAROLINA

CRASH DATE: JUNE 2009

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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BACKGROUND

This on-site investigation focused on a 2007 Honda Pilot **(Figure 1)** that was involved in an intersection crash and a subsequent 4-quarter turn, collision-induced rollover. The Honda was equipped with four-wheel anti-lock brakes, Electronic Stability Control (ESC), a Certified Advanced 208-Compliant (CAC) frontal air bag system, seat-mounted side impact air bags, and Inflatable Curtain (IC) air bags with rollover sensing. The CAC system included dual-stage frontal air bags for the driver and right front passenger positions, seat track positioning sensors, retractor pretensioners, and a front right occupant weight sensor. The rear aspect of the Honda's left plane was impacted by the front of a 2003 Pontiac Sunfire at a four-leg intersection. The Honda initiated a counterclockwise (CCW) rotation as a result of the lateral impact. The right plane of the Honda then impacted the left plane of a stopped 1995 Chevrolet Monte Carlo. Subsequent to the second impact, the Honda initiated a right side leading rollover event within the intersection. Both side impact air bags and both IC air bags deployed as a result of the multiple event crash. The 35-year-old female driver of the Honda sustained minor-severity injuries. The driver was transported by ambulance to a local hospital for treatment.

Figure 1: Left front oblique view of the 2007 Honda Pilot.

The crash was identified by the National Highway Traffic Safety Administration's (NHTSA) Crash Investigation Division (CID) on July 27, 2009. Based on the rollover of the late model year vehicle this case was assigned for an on-site investigation on the same day. The on-site investigation was initiated on July 29, 2009 and involved the inspections of the Honda, the Pontiac, and the Chevrolet, and the documentation of the crash scene. The driver could not be located and did not return repeated telephone calls for an interview. Additionally, the Pontiac and the Chevrolet's Event Data Recorders (EDR) were imaged during this investigation. The imaged EDR files are included as **Attachments A and B** of this report.

SUMMARY

Crash Site

This crash occurred during the daylight hours of June 2009 at a four-leg intersection of a two-lane undivided north/south roadway and a three-lane divided east/west roadway (**Figure 2**). The east and westbound legs were controlled by stop signs and a flashing red light. The north and southbound approaches were controlled by a flashing yellow light. The weather conditions were dry and clear at the time of the crash. The north/south roadway consisted of two level travel lanes that were 2.9 m (9.5 ft) in width. The westbound approach to the intersection consisted of three travel lanes that were 3.9 m (12.8) in width. These lanes were configured as a designated right turn lane, a center-through lane and a designated left turn lane. The westbound approach had a positive grade of 3.2 percent. The eastbound approach to the intersection consisted of three lanes that measured 3.7 (12.1 ft) in width. The eastbound lanes were also configured with a right turn lane, center-through lane and a left turn lane. The eastbound approach had a positive grade of 1.6 percent and a shallow right curve. The corners of the intersection had been constructed for future widening of the north/south roadway and consisted of large paved shoulders bordered on the outboard edges by 15 cm (5.9 in) concrete curbs. The posted speed limit was 72 km/h (45 mph) for both roadways. The crash schematic is included as **Figure 12** of this report.

Figure 2: Southbound approach to the intersection.

Vehicle Data

2007 Honda Pilot

The 2007 Honda Pilot was manufactured in October of 2006 and was identified by the Vehicle Identification Number (VIN) 5FNYF28677B (production sequence deleted). The odometer reading at the time of the crash was 44,022 km (27,354 mi). The front-wheel drive Honda was powered by a 3.5-liter, V-6 engine linked to a five-speed automatic transmission. The braking system consisted of power-assisted front and rear disc brakes with four-wheel anti-lock and electronic brake force distribution. The Pilot was also equipped with Electronic Stability Control (ESC), traction control and an indirect Tire Pressure Monitoring System (TPMS). The side windows and sunroof were closed at the time of the crash. The Honda was equipped with four Goodyear Integrity tires sized at P235/70R16. The manufacturer recommended tire size was P235/70R16. The tires were mounted on OEM five-spoke alloy wheels. The manufacturer recommended cold tire pressure was 221 kPa (32 PSI), front and rear. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	186 kPa (27 PSI)	6 mm (7/32 in)	None
Left Rear	179 kPa (26 PSI)	5 mm (6/32 in)	None
Right Front	Tire Flat	6 mm (7/32 in)	De-beaded
Right Rear	172 kPa (25 PSI)	5 mm (6/32 in)	7 cm (2.8 in) bubble in sidewall

The interior of the Honda was configured with leather-surfaced seven-passenger seating. The front bucket seats were separated by a center console and equipped with adjustable head restraints. The front left head restraint was located 3 cm (1.2 in) above the full-down position. The front right head restraint was in the full-down position. The driver seat track was located in a mid-track position, 9 cm (3.5 in) forward of the full-rear at the time of the SCI inspection. Both front seat backs angles measured 24 degrees aft of vertical. The second row consisted of a 60/40 split bench with folding backs. The rear left head restraint had been removed from the seat at the time of the SCI inspection. The second row center and right adjustable head restraints were in the full-down position. The third row consisted of a three passenger bench seat with a folding back. The third row seat was folded flat and was concealed under an aftermarket rubber floor mat at the time of the SCI inspection. The interior occupant safety systems consisted of 3-point lap and shoulder belt systems for the eight designated seating positions, front seat safety belt retractor pretensioners, CAC dual-stage frontal air bags, front seat-mounted side impact air bags and roll sensing Inflatable Curtain (IC) air bags that provided protection for the six outboard seating positions.

2003 Pontiac Sunfire

The 2003 Pontiac Sunfire coupe was manufactured in March 2003 and was identified by the VIN 1G2JB12F937 (production sequence deleted). The front-wheel drive Pontiac was powered by a 2.2-liter, inline four-cylinder engine linked to a four-speed automatic transmission. The service brakes were front disc and rear drum with four-wheel antilock. The manufacturer recommended tire size was P195/65R15, with a recommended cold tire pressure of 207 kPa (30 PSI) for the front and rear. The vehicle was equipped with a Barum Bravuris tire on the left front, Falken Sincera SN828 tires on the rear, and a Kumho 732 Touring Plus tire on the right front. All tires were size P195/65R15 and were mounted on OEM steel wheels with plastic wheel covers. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	186 kPa (27 PSI)	6 mm (7/32 in)	None
Left Rear	207 kPa (30 PSI)	8 mm (10/32 in)	None
Right Front	186 kPa (27 PSI)	3 mm (4/32 in)	None
Right Rear	200 kPa (29 PSI)	7 mm (9/32 in)	None

1995 Chevrolet Monte Carlo

The 1995 Chevrolet Monte Carlo Z34 coupe was manufactured in January 1995 and was identified by the VIN 2G1WX12X2S9 (production sequence deleted). The front-wheel drive Chevrolet Carlo was powered by a 3.4-liter V-6 engine linked to a four-speed automatic transmission. The service brakes were front disc and rear drum with four-wheel antilock. The manufacturer recommended tire size was P225/60R16, with a recommended cold tire pressure of 207 kPa (30 PSI) for the front and rear. The vehicle was equipped with Kumho Solus HP4 tires on both front wheels, a Futura 2000 Radial on the left rear wheel, and a Michelin Symmetry Radial XSE on the right rear wheel. All tires were size P225/60R16 and were mounted on OEM five-spoke alloy wheels. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	186 kPa (27 PSI)	4 mm (5/32 in)	None
Left Rear	179 kPa (26 PSI)	5 mm (6/32 in)	None
Right Front	186 kPa (27 PSI)	5 mm (6/32 in)	None
Right Rear	186 kPa (27 PSI)	6 mm (8/32 in)	None

Crash Sequence

Pre-Crash

The restrained 35-year-old female driver of the Honda Pilot was operating the vehicle on a southbound approach to the four-leg intersection **(Figure 2)**. The direction of her approach was straight and level and was controlled by a yellow caution light. The Honda was traveling at a police estimated speed of 72 km/h (45 mph). It was the intent of the Honda to travel straight through the intersection. The 48-year-old male driver of the Pontiac was operating the vehicle westbound approaching the intersection. The Pontiac's direction of travel was controlled by a stop sign. The driver of the Pontiac was operating the vehicle at an EDR recorded speed of 72 km/h (45 mph) five seconds prior to Algorithm Enable (AE), and applied his brakes three seconds prior to AE. The Pontiac decelerated to an EDR recorded speed of 60 km/h (37 mph) two seconds prior to AE. The EDR-reported speed one second prior to AE was 10 km/h (6 mph). This data point under-reported the actual speed of the Pontiac. The data may have been a post-impact value. Based on the crash reconstruction and EDR data analysis, the reconstructed minimum speed of the Pontiac, one second prior to the impact, was approximately 31 km/h (19 mph). The reconstructed minimum speed calculation assumed locked-wheel braking. The Pontiac entered the intersection coincident with the Honda. The Chevrolet was stopped in the eastbound left turn waiting to initiate a left turn.

Crash

Figure 3 is an image, cropped from the crash schematic, depicting the crash sequence. The front plane of the Pontiac impacted the rear aspect of the Honda's left plane within the intersection

(Event 1). The directions of force were within the 11 o'clock sector for the Honda and within the 2 o'clock sector for the Pontiac. The damage algorithm of the WinSMASH program was used to calculate the severity of the crash. The total delta-V of the Honda was 7 km/h (4.3 mph). The longitudinal and lateral delta-V components were -6.1 km/h (-3.8 mph) and 3.5 km/h (2.2 mph). The total delta-V of the Pontiac was 13.0 km/h (8.1mph) with longitudinal and lateral components of -6.5 km/h (-4.0 mph) and -11.3 km/h (-7.0 mph), respectively.

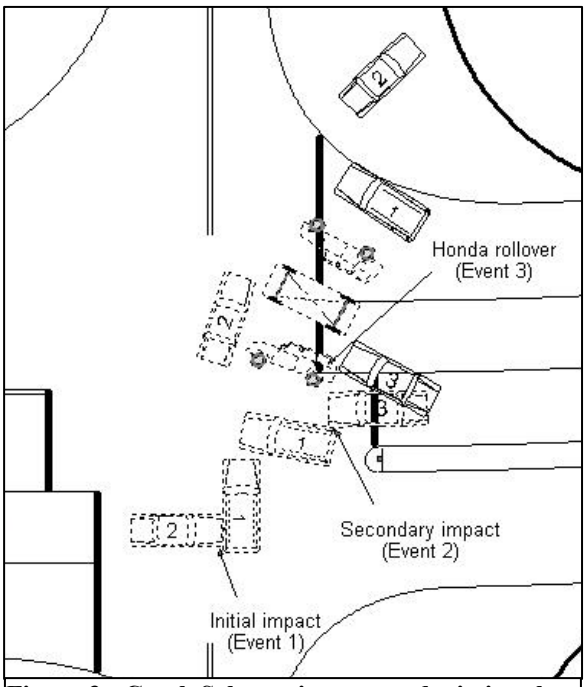


Figure 3: Crash Schematic excerpt depicting the crash sequence.

The force of the impact located rearward of the Honda's center of gravity resulted in a counterclockwise (CCW) rotation of the vehicle. The Honda rotated approximately 80 degrees CCW and traveled 5 m (16.4 ft) across the intersection to the southwest. The rear aspect of the Honda's right plane impacted the forward aspect of the Chevrolet's left plane (Event 2). The left corner of the Chevrolet's bumper beam made a 9 cm (3.5 in) rectangular cut to the right side of the Honda's rear bumper fascia. This cut was 51 to 60 cm (20.1 to 23.6 in) above the ground on the Honda consistent with the 52 to 61 cm (20.5 to 24 in) Chevrolet's bumper height. The directions of force were within the 3 o'clock sector for the Honda and within the 9 o'clock sector for the Chevrolet. The total Event 2 delta-V of the Honda calculated by the Damage Algorithm of the WinSMASH program was 8 km/h (5 mph). The longitudinal and lateral components of the delta-V were 0 km/h and -8 km/h (-5 mph). The total delta-V of the Chevrolet was 10 km/h (6.2 mph) with longitudinal and lateral components of -1.7 km/h (-1 mph) and 9.8 km/h (6.1 mph). The impact momentum of the Honda deflected the stopped Chevrolet to the southwest, partially into the adjacent lane to its right. The Honda initiated a right side leading rollover as a result of the impact with the Chevrolet. As the Honda rolled up onto the hood of the Chevrolet, the weight transfer to the right front tire caused an air-out and the rim contacted the pavement. A large asphalt deposit was noted to the rim during the SCI inspection. The right front tire debeaded. The Honda rolled with minimal ground contact to right plane during the first quarter turn. The vehicle contacted the ground during the second quarter turn landing on its roof and left A-pillar area. In total the vehicle rolled over four quarter turns to the right over a distance of 15 m (49.2 ft) and came to rest on its wheels in the roadway at the southwest corner of the intersection. The rollover was not interrupted.

The Pontiac had separated from the initial impact with a CCW rotation and southwest trajectory. The vehicle rotated approximately 70 degrees and traveled 26 m (85 ft) coming to rest facing southwest on the paved corner shoulder of the southwest intersection quadrant.

It should be noted that as the SCI investigator was arriving at the crash scene for the scene documentation, another 3-vehicle crash of similar configuration had occurred earlier that day. The tire marks and visible fluid spills leading to the southwest corner of the intersection were attributed to the second crash and were discounted as related to this investigation.

Post-Crash

Police, emergency medical and tow personnel responded to the crash site. The driver of the Honda exited her vehicle under her power and was ambulatory at the scene upon the arrival of the EMS. She was transported by ground ambulance to a regional trauma center for evaluation of possible injuries. The driver of the Pontiac was transported by ground ambulance with police-reported possible injuries. The Chevrolet driver was not injured. The Honda, Pontiac and Chevrolet were all towed to a local tow yard and then transferred to a regional vehicle salvage facility for auction. The inspection of all three vehicles took place at the regional salvage facility.

2007 Honda Pilot

Exterior Damage

The exterior of the Honda sustained moderate severity damage to the left, right, and top planes as a result of this multiple impact crash. The rear aspect of the left plane sustained damage from the initial impact **(Figure 4)**. The combined length of the direct and induced damage measured 216 cm (85.0 in). The damage began 173 cm (68.1 in) aft of the left front axle and extended rearward to the left rear bumper corner. The maximum crush measured 9 cm (3.5 in) and was located at C4, 271 cm (106.7 in) aft of the left front axle. The crush profile was documented at the lower door level for the impact and was as follows: C1 = 0 cm, C2 = 5 cm (2 in), C3 = 5 cm (2 in), C4 = 9 cm (3.5 in), C5 = 3 cm (1.2 in), C6 = 0 cm. The Collision Deformation Classification (CDC) assigned for this impact was 11LZEW1.

Figure 4: Event 1 damage to the left side of the Honda.

The rear aspect of the Honda's right plane sustained minor damage as a result of the Event 2 impact **(Figure 5)**. The combined direct and induced damage (Field L) measured 99 cm (39 in) and began 4 cm (1.6 in) rear of the right rear axle and extended to the right rear bumper corner. The direct damage measured 45 cm (17.7 in) and began 58 cm (22.8 in) rear of the right rear axle and extended rearward to the right rear bumper corner. The maximum crush measured 9 cm (3.5 in) and was located at C2, 83 cm (32.7 in) aft of the right rear axle. The residual crush profile measured at the lower door elevation was as follows: C1 = 7 cm (2.8 in), C2 = 9 cm (3.5 in), C3 = 7 cm (2.8 in), C4 = 3 cm (1.2 in), C5 = 1 cm (0.4 in), C6 = 0 cm. The CDC assigned for this impact was 03RBEW1.

Figure 5: Secondary (Event 2) damage to the right rear of the Honda.

As a result of the rollover event, the Honda sustained moderate-severity damage to the left and top planes consisting of surface abrasions and roof deformation. The windshield glazing was completely fractured with two laminate tears emanating from the upper center aspect. The first tear extended down and right to the base of the right A-pillar. The second tear extended down and left to the base of the left A-pillar. The left front window disintegrated as a result of the rollover sequence. The left rear, left rear quarter, left third row, backlight and all right side glazing was undamaged subsequent to the crash. The sunroof was intact and closed at the time of the inspection. The scratches on the roof were oriented in a single direction. The direct contact damage to the roof extended 132 cm (52 in) laterally from the left roof side rail to the right roof side rail. The longitudinal direct contact damage extended 377 cm (148.4 in) from the leading edge of the hood to the backlight header. The maximum vertical crush was located on the windshield header 17 cm (6.7 in) inboard of the left A-pillar. The maximum vertical crush measured 17 cm (6.7 in). The maximum lateral crush measured 8 cm (3.1 in) and was located on the left A-pillar at the junction with the roof side rail. All four passenger compartment doors remained closed during the crash sequence and were operational post-crash. The rear hatch was jammed shut post-crash. **Figures 6 and 7** depict the rollover damage sustained by the Honda. The CDC assigned for the rollover was 00TDDO3.

Figure 6: Honda rollover damage from above, left front.

Figure 7: Honda rollover damage from the front right corner.

Interior Damage

The Honda sustained moderate-severity damage that was attributed to passenger compartment intrusion, occupant contact, and air bag deployment. The fractured windshield sagged over time and was lying over the steering wheel rim. A possible windshield contact was identified during the inspection; however it was discounted after a review of the injury data within the medical records. There was a scuff mark attributed to the driver's right knee on the left knee bolster located 5 to 11 cm (2 to 4.3 in) right of the right side of the steering assembly and 6 to 19 cm (2.4 to 7.5 in) above the lower edge of the knee bolster. This contact did not result in an injury. The intrusion to the Honda is listed on the following table:

Position	Component	Direction	Magnitude
Row 1 Left	Windshield header	Vertical	8 cm (3.1 in)
Row 1 Left	Roof	Vertical	12 cm (4.7 in)
Row 1 Left	Roof side rail	Vertical	6 cm (2.4 in)
Row 2 Left	Roof	Vertical	12 cm (4.7 in)
Row 2 Left	Roof side rail	Vertical	4 cm (1.6 in)

Manual Restraint Systems

The Honda was equipped with 3-point manual lap and shoulder belts for the eight designated seating positions. All belt systems utilized continuous loop webbing. The front left belt system utilized a sliding latch plate and a retractor-mounted pretensioner that actuated during the crash. The front left upper D-ring was height adjustable and was located in the full-down position. The driver's belt retracted onto an Emergency Locking Retractor (ELR). The driver used the safety belt at the time of the crash which was supported by loading evidence on the belt webbing. This evidence consisted of a frictional abrasion on the belt webbing near the latch plate. The latch plate abrasion was located 89 to 92 cm (35 to 36.2 in) above the lower seat anchor. Additionally,

the actuated retractor pretensioner locked the safety belt in the used position. The total length of spooled out and locked webbing measured 183 cm (72 in).

The front right, second row, and third row safety belt systems utilized a switchable ELR/Automatic Locking Retractor (ALR) with sliding latch plates. In addition, the front right belt system utilized a retractor pretensioner which did not actuate during the crash. The second and third row center belt systems utilized detachable shoulder belts mounted in the roof of the Honda.

Frontal Air Bag System

The Honda 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, front seat retractor pretensioners, and safety belt buckle switches. The manufacturer of the Honda certified that this vehicle was compliant with the advanced air bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The driver's frontal air bag was concealed within the center hub of the four-spoke steering wheel. The front right passenger's frontal air bag was mounted within the upper aspect of the right instrument panel. The frontal air bags did not deploy in this crash.

Side Impact and Rollover Air Bag System

The Honda was equipped with front seat-mounted side impact air bags and roof side rail Inflatable Curtain (IC) air bags with rollover sensing. Both IC air bags and both side impact air bags deployed during the multiple impact crash sequence.

The IC air bags deployed from their respective roof side rails. The curtain air bags were rectangular in shape and measured 220 cm (86.6 in) in length. At the front seating positions, the air bag was 56 cm (22 in) in height, and 52 cm (20.5 in) in height at the second and third row seating positions. Vertically, the curtain air bags extended below the beltline at each outboard seating position. The curtains provided head protection from the roof side rail to the beltline and from the D-pillar to a point 51 cm (20 in) forward of the B-pillar. At the front of each curtain air bag was a triangular void that measured 28 cm (11 in) in length along the window sill, 32 cm (12.6 in) high at the rear edge and 20 cm (7.9 in) in height at the forward edge. The air bag was tethered to the A-pillar by a 28 cm (11 in) long strap. There were no occupant contacts to the left IC air bag. The left IC had a scuff mark attributed to contact with the ground on the outboard side. This scuff mark was located 21 to 57 cm (8.3 to 22.4 in) aft of the front edge of the membrane and 16 to 32 cm (6.3 to 12.6 in) above the lower edge of the membrane. Both curtains were labeled with the identification number *6082140A SI/PA 6.6*. There was no contact evidence or damage to the right IC air bag. **Figures 8 and 9** depict the IC air bags.

Both side impact air bags deployed from the outboard aspects of the front seat backs. The side air bags measured 22 cm (8.7 in) in width and 31 cm (12.2 in) in height in their deflated state. They were not tethered and contained one vent port at the front edge of the air bag. There was no damage or contact evidence to either side impact air bag.

Figure 8: Left IC air bag of the Honda.

Figure 9: Right IC air bag of the Honda.

2003 Pontiac Sunfire

Exterior Damage

The front plane of the Pontiac Sunfire sustained moderate-severity damage from the Event 1 impact with the Honda (**Figure 10**). The direct damage extended across the entire 142 cm (56 in) frontal end width of the vehicle. The maximum crush measured 10 cm (3.9 in) and was located at C6, the front right bumper corner. A crush profile was documented along the full width of the front bumper beam and was as follows: C1 = 7 cm (2.8 in), C2 = 5 cm (2 cm), C3 = 3 cm (1.2 in), C4 = 5 cm (2 in), C5 = 8 cm (3.2 in), C6 = 10 cm (3.9 in). The CDC assigned for this impact was 02FDEW1.

Figure 10: Frontal damage to the Pontiac.

Event Data Recorder

The Event Data Recorder (EDR) of the Pontiac was imaged at the time of the inspection by applying power to the vehicle and imaging the data through the Diagnostic Link Connector (DLC) located under the left instrument panel with the Bosch Crash Data Retrieval tool. The data was collected with version 3.2 of the software and has been reported with version 3.4. The

imaged data had two stored event; a Deployment event and a Deployment Level event. The two stored events were 0.5 seconds apart. The Deployment event was related to the intersection impact (Event 1). The source of the Deployment Level event could not be determined. The reported time between the events was 0.5 seconds.

At deployment, the number of ignition cycles was 14676 (14680 at investigation) and the driver's safety belt was buckled. The maximum recorded longitudinal delta-V was -9.0 km/h (-5.59 mph). The data reported for the Deployment Level event was identical to that reported for the Deployment event. **Attachment A,** at the end of this report, is the data file imaged from the EDR of the Pontiac.

1995 Chevrolet Monte Carlo

Exterior Damage

The forward aspect of the Chevrolet's left plane sustained moderate-severity damage as a result of the impact with the Honda (Event 2). **Figure 11** is a left front oblique view of the Chevrolet. The combined direct and induced damage length measured 132 cm (52 in) and began 45 cm (17.7 in) aft of the left front axle extending forward. The direct contact damage measured 46 cm (18.1 in) and began 41 cm (16.1 in) forward of the left front axle. The maximum crush measured 27 cm (10.6 in) and was located at C6, 86 cm (33.9 in) forward of the left front axle. The residual crush profile measured at the mid door elevation was as follows: C1 = 0 cm, C2 = 4 cm (1.6 in), C3 = 12 cm (4.7 in), C4 = 16 cm (6.3 in), C5 = 21 cm (8.3 in), C6 = 27 cm (10.6 in). The front end of the Chevrolet was shifted to the right by 18 cm (7.1 in). The CDC assigned for this impact was 69LFEW2.

Figure 11: Left side damage to the Chevrolet.

Event Data Recorder

The Chevrolet's EDR was imaged during the on-site investigation. External power was applied to the Chevrolet and the EDR data was imaged through the DLC port. The data was collected with version 3.2 of the software and has been reported with version 3.4. The EDR recorded a Non-deployment event that was related to the impact with the Honda.

At impact, the number of ignition cycles was 31080 (31081 at investigation). The driver's safety belt was buckled. The maximum recorded longitudinal velocity change was -5.5 km/h (-3.4 mph). The EDR did not record pre-crash data. **Attachment B** at the end of this report is the Chevrolet's imaged EDR data.

2007 Honda Pilot Occupant Demographics/Data

Driver Age/Sex:	35-year old/Female
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Mid-track, 9 cm (3.5 in) forward of full-rear
Manual Safety Belt Use:	Lap and shoulder belt
Usage Source:	Vehicle Inspection
Egress from Vehicle:	Unknown
Mode of Transport from Scene:	Ground ambulance to a local hospital
Type of Medical Treatment:	Treated and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Left upper arm and hand abrasion	Minor (790202.1,2)	Left IC air bag (possible)

Source of injury data = Emergency room records

Driver Kinematics

The restrained 35-year-old female driver of the Honda was positioned in the left front seating position with the seat adjusted to a mid-track position and the seat back reclined 24 degrees aft of vertical. At the Event 1 impact, the left seat-mounted side impact air bag and IC air bags deployed. Additionally, the driver's safety belt pretensioner actuated. The driver responded to the 11 o'clock direction of force by initiating a left and forward trajectory. The driver loaded the safety belt system and most likely contacted the left seat-mounted side impact air bag and the left IC with her left arm and flank. The vehicle rotated CCW and impacted the Chevrolet with the right rear aspect (Event 2). This impact deployed the right seat-mounted side impact air bag. The driver was displaced to the right and where she loaded the belt system and possibly the center console.

The Honda subsequently initiated a right side leading rollover (Event 3). Due to her restrained status, the driver was minimally displaced with the front left seat. The deployed side impact air bag and left IC provided additional protection mitigating the driver's potential interior contact. The driver exited the Honda under her own power and was ambulatory at the scene. She sustained minor soft tissue injuries to her left arm and hand was transported by ambulance to a local hospital for treatment. The driver was not interviewed.

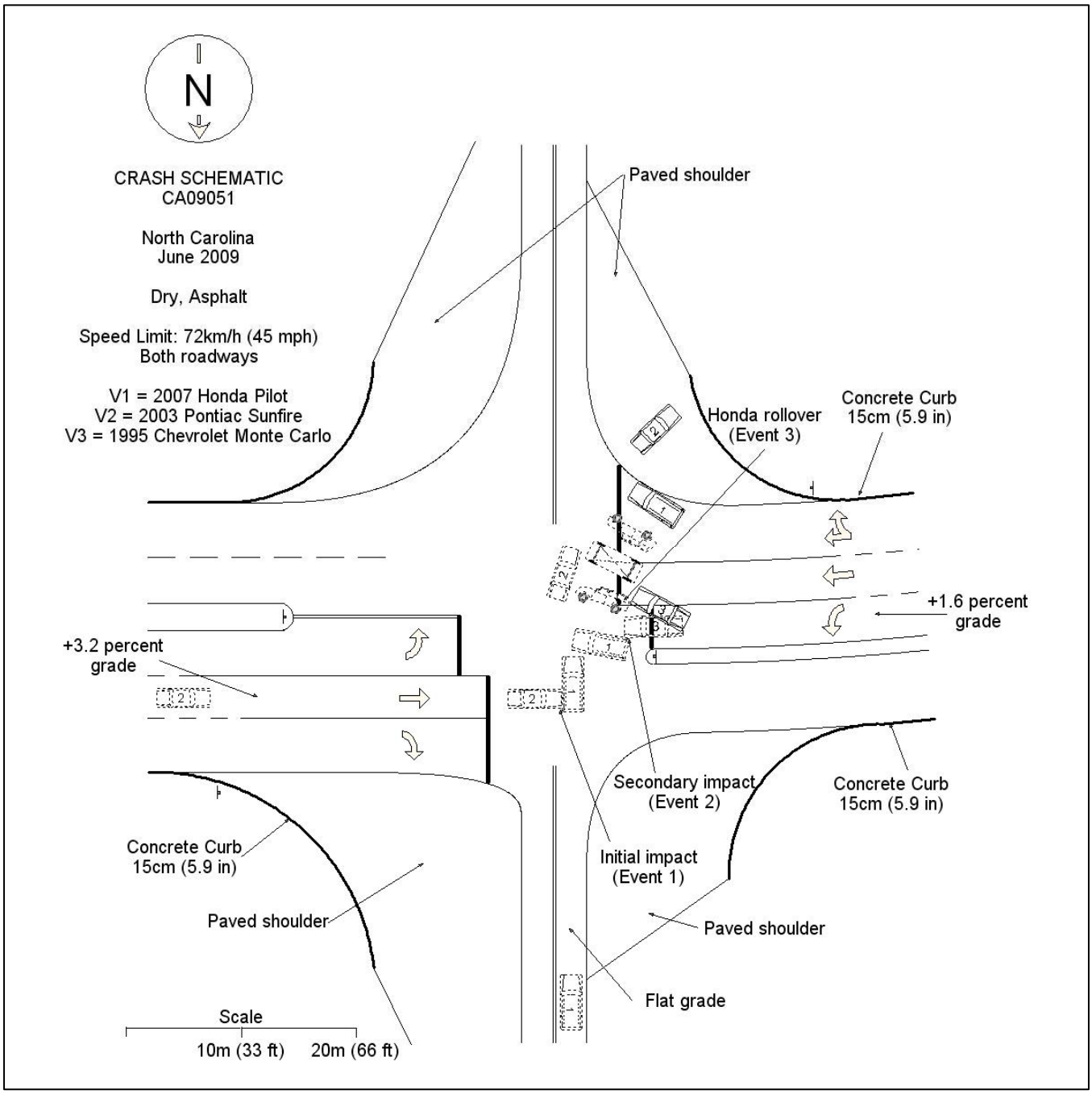


Figure 12: Crash Schematic

ATTACHMENT A:

2003 Pontiac Sunfire 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	1G2JB12F937******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	
Saved on	Wednesday, July 29 2009 at 01:30:36 PM
Collected with CDR version	Crash Data Retrieval Tool 3.2
Reported with CDR version	Crash Data Retrieval Tool 3.4
EDR Device Type	airbag control module
Event(s) recovered	Deployment Deployment Level

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 cycle. 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 Recorded Vehicle Longitudinal Velocity Change reflects the change in longitudinal velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Longitudinal Velocity Changeis the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. For Deployment Events, the SDM will record 100 milliseconds of data after deployment criteria is met and up to 50 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record up to the first 150 milliseconds of data after algorithm enable. 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.

-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

-Engine Speed is reported at two times the actual value in the following vehicles, if the vehicle is equipped with a 6.6L Duramax diesel engine (RPO LB7, LBZ, LLY, or LMM):

- -2001-2006 Chevrolet Silverado
- -2007 Chevrolet Silverado Classic
- -2001-2006 GMC Sierra
- -2007 GMC Sierra Classic
- -2006-2007 Chevrolet Express
- -2006-2007 GMC Savana
- -2003-2009 Chevrolet Kodiak
- -2003-2009 GMC Topkick

-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 This Event and the Previous 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.
-If the vehicle is a 2000 - 2002 Chevrolet Cavalier Z24 or a Pontiac Sunfire GT, with a manual transmission (RPO MM5) and a 2.4L engine (RPO LD9), the Brake Switch Circuit Status data will be reported in the opposite state than what actually occurred, e.g. an actual brake switch status of "ON" will be reported as "OFF".
-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.

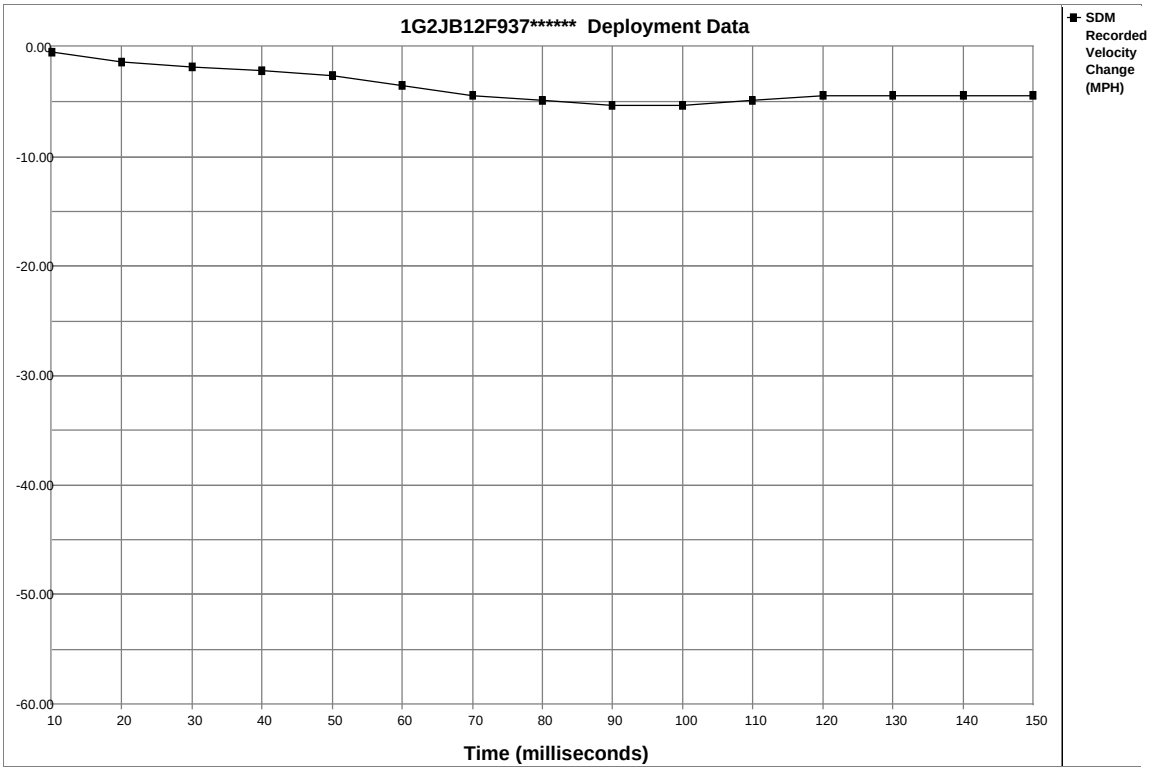
01025_SDMG-99JXZ09-10_r002

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	14676
Ignition Cycles At Investigation	14680
Maximum SDM Recorded Velocity Change (MPH)	-5.59
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	85
Time Between Non-Deployment And Deployment Events (sec)	N/A
Time From Algorithm Enable to Deployment Command Criteria Met (msec)	47.5

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	45	1600	0
-4	43	1536	0
-3	40	1216	0
-2	37	1152	0
-1	6	768	0

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



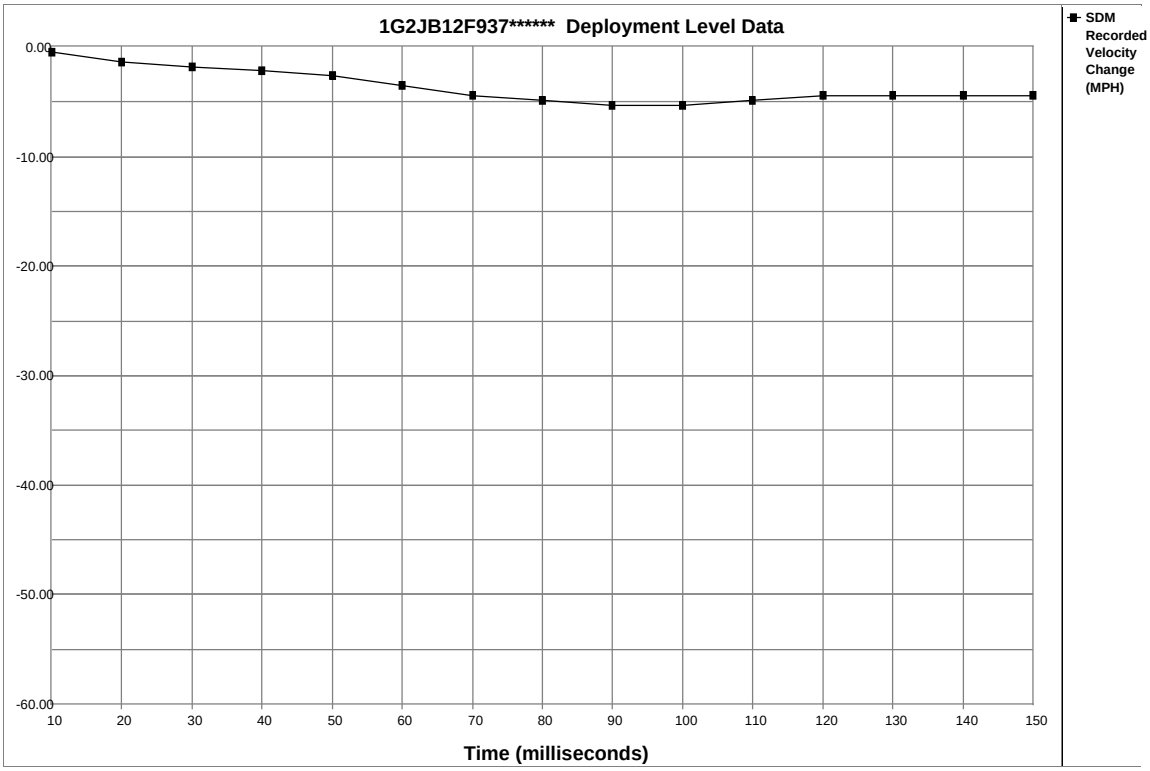
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Recorded Velocity Change	-0.44	-1.32	-1.76	-2.19	-2.63	-3.51	-4.39	-4.83	-5.27	-5.27	-4.83	-4.39	-4.39	-4.39	-4.39

System Status At Deployment Level

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 Level	14676
Ignition Cycles At Investigation	14680
Maximum SDM Recorded Velocity Change (MPH)	-5.59
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	85
Time From Algorithm Enable to Deployment Command Criteria Met (msec)	47.5
Time Between Deployment And Deployment Level Events (sec)	.5

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	45	1600	0
-4	43	1536	0
-3	40	1216	0
-2	37	1152	0
-1	6	768	0

Seconds Before AE	Brake Switch Circuit Status
-8	OFF
-7	OFF
-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
SDM Recorded Velocity Change	-0.44	-1.32	-1.76	-2.19	-2.63	-3.51	-4.39	-4.83	-5.27	-5.27	-4.83	-4.39	-4.39	-4.39	-4.39

ATTACHMENT B:

1995 Chevrolet Monte Carlo 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	2G1WX12X2S9******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	
Saved on	Wednesday, July 29 2009 at 01:46:24 PM
Collected with CDR version	Crash Data Retrieval Tool 3.2
Reported with CDR version	Crash Data Retrieval Tool 3.4
EDR Device Type	airbag control module
Event(s) recovered	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). The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded longitudinal velocity change. This event will be cleared by the SDM, after approximately 125 ignition cycles. The data in the Non-Deployment Event file will be locked, if the Non-Deployment Event occurred within 7.65 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. The SDM can store up to two different Deployment Events. The first Deployment Event will be stored in the #1 Deployment Event file and the second Deployment Event will be stored in the #2 Deployment Event file. Deployment Events cannot be overwritten or cleared by the SDM. Once the SDM has two Deployment Events recorded, the SDM must be replaced.

Data:

-SDM Recorded Vehicle Longitudinal Velocity Change reflects the change in longitudinal velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Longitudinal Velocity Changeis the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. The SDM records the first 300 milliseconds of Vehicle Longitudinal Velocity Change after Algorithm Enable. The maximum value that can be recorded for Vehicle Longitudinal Velocity Change is 28 MPH. Velocity Change data is displayed in SAE sign convention.
-Driver's Belt Switch Circuit Status indicates the status of the driver's seat belt switch circuit.
-The Time between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than five seconds, "N/A" is displayed in place of the time.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded. An indication of a loss of power would be if the ignition cycles at the event is recorded as zero. Data recorded after that may not be reliable, such as Time Between Non-Deployment and Deployment Events and Driver Belt Switch Circuit Status.
-All data should be examined in conjunction with other available physical evidence from the vehicle and scene.

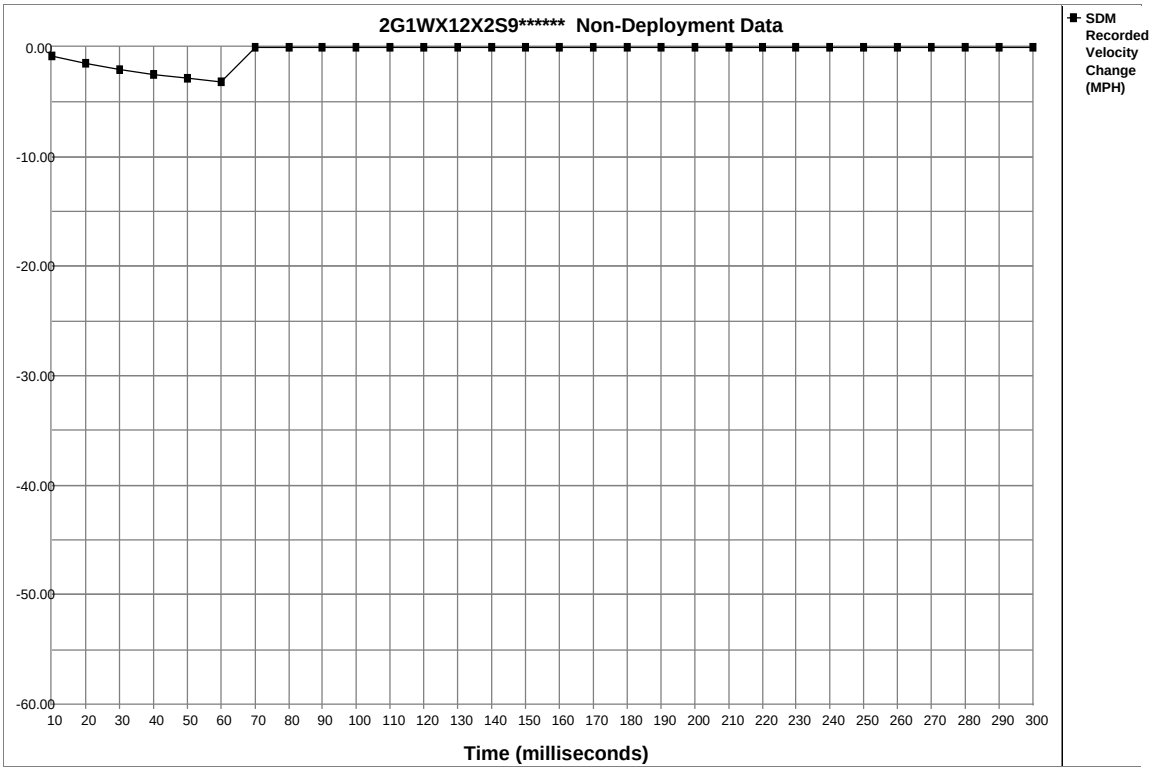
Data Source:

All SDM recorded data is measured, calculated, and stored internally, except for the following:
-The Driver's Belt Switch Circuit is wired directly to the SDM.

01001_SDMA_r001

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Non-Deployment	31080
Ignition Cycles At Investigation	31081
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	65
Maximum SDM Recorded Velocity Change (MPH)	-3.40
A Deployment was Commanded Prior to this Event	No



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.77	-1.43	-1.97	-2.52	-2.85	-3.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00