

**CRASH DATA RESEARCH CENTER**

Calspan Corporation  
Buffalo, NY 14225

**CALSPAN ON-SITE SIDE IMPACT INFLATIBLE OCCUPANT  
PROTECTION SYSTEM CRASH INVESTIGATION  
SCI CASE NO.: CA09055**

**VEHICLE: 2009 HONDA FIT SPORT**

**LOCATION: NORTH CAROLINA**

**CRASH DATE: AUGUST 2009**

Contract No. DTNH22-07-C-00043

Prepared for:

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National Highway Traffic Safety Administration  
Washington, D.C. 20590

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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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**CALSPAN ON-SITE SIDE IMPACT INFLATIBLE OCCUPANT  
PROTECTION SYSTEM CRASH INVESTIGATION**

**SCI CASE NO.: CA09055**

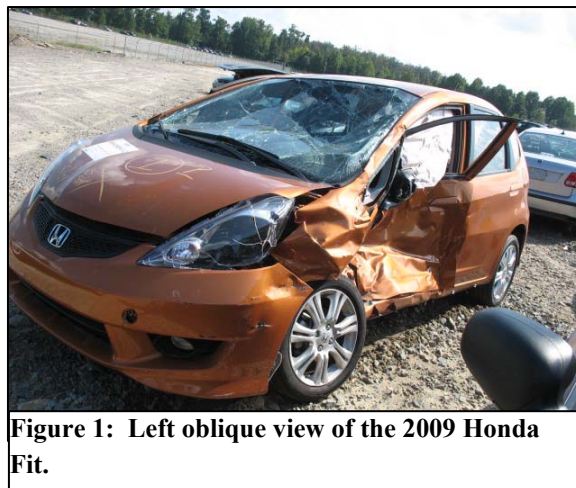
**VEHICLE: 2009 HONDA FIT SPORT**

**LOCATION: NORTH CAROLINA**

**CRASH DATE: AUGUST 2009**

***BACKGROUND***

This on-site investigation focused on the side impact inflatable occupant protection system in a 2009 Honda Fit (**Figure 1**) that was involved in an intersection crash. The vehicle 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 roof side rail-mounted side impact Inflatable Curtain (IC) air bags. The manufacturer of the Honda has certified that the vehicle is compliant to the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208.



**Figure 1: Left oblique view of the 2009 Honda Fit.**

The CAC system includes dual-stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, buckle switch sensors, retractor pretensioners, and a front right occupant presence detection sensor. The left plane of the Honda was impacted by the front plane of a 2009 Chevrolet Silverado pickup within a four-leg intersection. The driver's frontal air bag, the left seat-mounted air bag, and the left IC deployed in the Honda. The frontal air bags in the Chevrolet also deployed. The 24-year-old female driver was 33-weeks pregnant at the time of the crash. She sustained soft tissue injuries and was transported by ground ambulance to a local trauma center where she was treated in the emergency department and later admitted to the obstetrics department for observation for seven days.

The crash was identified through a visit to a regional vehicle salvage facility on August 24, 2009. An image of the Honda was forwarded to Calspan Special Crash Investigations (SCI) team for review on August 25, 2009. Based on the side impact to the Honda and the deployment of the side protection systems, this case was assigned for an on-site investigation of August 25, 2009. The on-site investigation was initiated on August 28, 2009. The investigation involved the inspection of the Honda and the Chevrolet, a detailed interview with the driver of the Honda, and the documentation of the crash site. The Event Data Recorder (EDR) of the Chevrolet was imaged during the investigation and the recovered data is included as **Attachment A** of this report.

## ***SUMMARY***

### ***Crash Site***

This crash occurred during daylight hours at the urban four-leg intersection of a two-way east/west road and a one-way southbound road. **Figure 2 and 3** are the eastbound and southbound approach views to the intersection, respectively. The intersection was controlled by overhead traffic signals. The environmental conditions were clear and dry at the time of the crash. The east/west road consisted of five lanes; three eastbound lanes and two westbound lanes. The travel directions were separated by a double yellow line. Each lane measured were 3.9 m (12.8 ft) in width. This roadway contained a shallow right curve on the approach to the intersection. The one-way southbound approach to the intersection consisted of three travel lanes. Each lane measured 4 m (13.1 ft) in width. Both roadways were surfaced with asphalt. The southbound approach had a negative grade of 1.6 percent. The eastbound approach was level. The intersection was bordered on all sides by concrete curbs 16 cm (6.3 in) in height. Beyond the curbs there was a grass strip and concrete sidewalks. A metal pole supporting the crosswalk signal was located on the southeast corner of the intersection and was involved in a secondary impact with the Chevrolet. The speed limit for both roadways was 72 km/h (45 mph). The Crash Schematic is included as **Figure 10** of this report.



**Figure 2: Eastbound trajectory view of the Honda into the intersection**



**Figure 3: Southbound trajectory view of the Chevrolet into the intersection.**

### ***Vehicle Data***

#### ***2009 Honda Fit***

The 2009 Honda Fit Sport was identified by the Vehicle Identification Number (VIN) JHMGE88439S (production sequence deleted). The vehicle was purchased new in March 2009. The driver stated during the interview that the odometer reading was approximately 7,240 km (4,500 mi) at the time of the crash.

The front-wheel drive Honda was powered by a 1.5-liter, inline four-cylinder engine linked to a five-speed automatic transmission. The braking system consisted of power-assisted front disc

and rear drum brakes with four-wheel antilock. The Honda was also equipped with an indirect Tire Pressure Monitoring System (TPMS). The Honda was equipped with Bridgestone Turanza EL 470 tires mounted on OEM seven-spoke alloy wheels. The tire size was P185/55R16. The vehicle manufacturer recommended tire size was P185/55R16 with a recommended cold tire pressure of 32 PSI (221 kPa) for the front and rear. The specific tire data at the time of the SCI inspection was as follows:

<b>Position</b>	<b>Measured Tire Pressure</b>	<b>Measured Tread Depth</b>	<b>Tire/Wheel Damage</b>
Left Front	207 kPa (30 PSI)	6 mm (7/32 in)	None
Left Rear	207 kPa (30 PSI)	6 mm (8/32 in)	None
Right Front	200 kPa (29 PSI)	6 mm (8/32 in)	None
Right Rear	193 kPa (28 PSI)	6 mm (7/32 in)	None

The interior of the Honda was configured with cloth-surfaced five-passenger seating. The front bucket seats were separated by a center console and equipped with height adjustable active head restraints. At the time of the SCI inspection, the driver's head restraint was located 12 cm (4.7 in) above the full-down position. The front right head restraint measured 11 cm (4.3 in) above the full-down position. The driver's seat track was in a mid-track position 11 cm (4.3 in) forward of the full-rear position. The seat back angle was measured at 24 degrees aft of vertical. The front right seat track was in the full-rear position with a seat back angle that measured 20 degrees aft of vertical. The second row seat was a split bench seat (60/40) with forward-folding seat cushions and seat backs that formed a flat cargo floor from the hatch to the rear of the front seats. The second row seat was equipped with three adjustable head restraints that were in the full-down position at the time of the SCI inspection.

The interior occupant safety systems consisted of 3-point lap and shoulder belt systems for the five designated seating positions, front safety belt retractor pretensioners, a CAC frontal air bag system, front seat track position sensors, buckle switch sensors, front seat-mounted side impact air bags, and IC air bags that provide protection for the four outboard seating positions.

### ***2009 Chevrolet Silverado***

The 2009 Chevrolet Silverado Crew Cab was manufactured in October 2008 and was identified by the VIN 3GCEK23M19G (production number deleted). The 4-wheel drive Chevrolet was powered by a 5.3-liter, V-8 engine linked to a six-speed automatic transmission. The braking system consisted of power-assisted front disc and rear drum brakes with four-wheel antilock and electronic brake force distribution. The Chevrolet was also equipped with an indirect TPMS, traction control, and Electronic Stability Control (ESC). The Chevrolet was equipped with Goodyear Eagle LS-2 tires in size P275/55R20. The tires were mounted on Chevrolet five-spoke alloy wheels. The recommended tire size was P265/65R18 with a recommended cold tire

pressure of 35 PSI (241 kPa) for the front and rear. The specific tire data at the time of the SCI inspection was as follows:

<b>Position</b>	<b>Measured Tire Pressure</b>	<b>Measured Tread Depth</b>	<b>Damage</b>
Left Front	221 kPa (32 PSI)	8 mm (10/32 in)	None
Left Rear	228 kPa (33 PSI)	8 mm (10/32 in)	None
Right Front	221 kPa (32 PSI)	8 mm (10/32 in)	None
Right Rear	221 kPa (32 PSI)	8 mm (10/32 in)	None

### ***Crash Sequence***

#### ***Pre-Crash***

The restrained 24-year-old driver of the Honda was operating the vehicle on an eastbound approach to the intersection. The driver was traveling in the center lane. The police determined via witness statements that the traffic signal was on the red phase. The 29-year-old restrained male driver of the Chevrolet was operating the vehicle on the center southbound lane to the same intersection on the green signal phase. The Honda entered the intersection directly across the path of the Chevrolet. Both vehicles attempted to travel on a straight path through the intersection.

The EDR data imaged during the inspection of the Chevrolet indicated that the speed of the vehicle was 55 km/h (34 mph) 2.5 seconds prior to Algorithm Enable (AE) and increased to 61 km/h (38 mph) 0.5 seconds prior to AE. The imaged data is included as **Attachment A** at the end of this report.

#### ***Crash***

The front plane of the Chevrolet impacted the Honda's left plane at the A-pillar area (Event 1). The directions of force were within the 10 o'clock sector for the Honda and the 1 o'clock sector for the Chevrolet. The lateral momentum of the Chevrolet and the impact force forward of the Honda's center of gravity induced a clockwise (CW) rotation to the Honda. The Honda rotated approximately 180 degrees CW and came to rest facing west at the southeast corner of the intersection facing west. The Chevrolet separated from the impact with a southeasterly trajectory and departed the roadway at the southeast corner of the intersection. The front plane of the Chevrolet impacted and displaced the metal pole supporting the cross walk signal (Event 2).

The Chevrolet was dismantled prior to the SCI inspection; therefore crush measurements were not available. This necessitated an analysis of the crash severity (delta-V) via the Missing Vehicle Algorithm of the WinSMASH program. The total delta-V of the Honda was 31 km/h (19.3) mph. The Honda's longitudinal and lateral delta-V component were -20 km/h (-12.4 mph)



and 24 km/h (14.9 mph). The total delta-V of the Chevrolet was 16 km/h (9.9 mph) with a longitudinal and lateral component of -12 km/h (-7.5 mph) and -10 km/h (-6.2 mph).

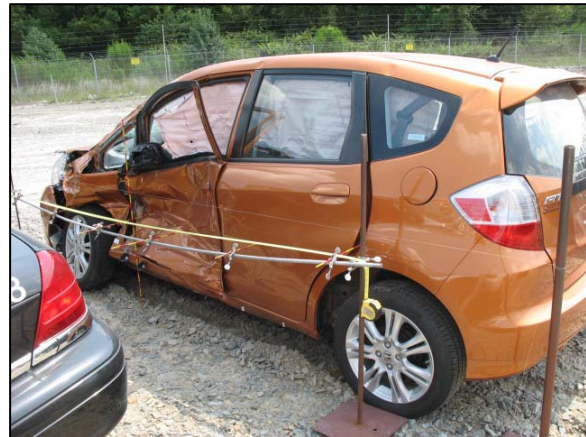
### ***Post-Crash***

Police, emergency medical, and tow personnel responded to the crash site. The driver of the Honda was unable to exit the vehicle due to a jammed front left door, and was removed by EMS through the front right door due to her perceived serious injuries and pregnancy. The driver of the Honda sustained minor-severity soft tissue injuries and was transported from the scene by ground ambulance to a regional trauma center where she was treated in the emergency department. The 33-week pregnant driver was then admitted to the Obstetrics Department for observation and management of pre-term labor for seven days. Both vehicles were towed from the scene due to disabling damage. The Honda and the Chevrolet were transferred from the local tow yards to a regional vehicle salvage facility, where they were inspected.

### ***2009 Honda Fit***

#### ***Exterior Damage***

The left plane of the Honda Fit sustained moderate-severity damage in this intersection crash. **Figures 4 and 5** depict the left side damage to the Honda. The combined direct and induced damage (Field L) began 13 cm (5.1 in) forward of the left rear axle and extended forward 291 cm (114.6 in). The direct contact damage began 105 cm (41.3 in) forward of the left rear axle and extended forward 179 cm (70 in) to the left front bumper corner. Lateral crush was present to the left front fender, left A-pillar, left front door, and left B-pillar. The maximum crush measured 32 cm (12.6 in) and was located at C4, 187 cm (73.6 in) forward of the left rear axle. The elevation of the maximum crush measured 61 cm (24 in) above ground level. The Door Sill Differential (DSD) was 21 cm (8.3 in) and was located at the forward aspect of the left front door. A residual crush profile was measured at the mid door level and was as follows: C1 = 0 cm, C2 = 0 cm, C3 = 23 cm (9.1 in), C4 = 32 cm (12.6 in), C5 = 17 cm (6.7 in), C6 = 1 cm (0.4 in). The left front and rear door hinges were intact and remained attached to



**Figure 4: Overall view of the left side damage to the Honda.**



**Figure 5: Image depicting the direct contact damage to the left side of the Honda.**

the A- and B-pillars, respectively. Both left side doors remained closed during the crash. The left front door was jammed shut post-crash. The windshield was completely fractured by the impact forces; no laminate tears were present. The left side quarter glass at the A-pillar and the left front door glazing disintegrated. The left rear door glazing, left rear glazing adjacent to the cargo area, backlight and all right side glazing were undamaged. The Collision Deformation Classification (CDC) assigned for this impact was 10LYEW3.

### ***Interior Damage***

The Honda Fit sustained moderate-severity damage that was attributed to occupant contact, passenger compartment intrusion and airbag deployment. The driver loaded the left door resulting in two scuff marks on the door panel. The first was located near the window sill 15 to 27 cm (5.9 to 10.6 in) forward of the B-pillar and 5 to 15 cm (2 to 5.9 in) below the window sill attributed to the driver’s left arm. The second was located on the left armrest 30 to 35 cm (11.8 to 13.8 in) below the window sill and 40 to 48 cm (15.7 to 18.9 in) rear of the front edge of the door panel. The front left door, A- and B-pillars and side panel forward of the front left door intruded laterally. The left front door and B-pillar engaged and compressed the front left seat, but the seat did not intrude laterally. The intrusion to the Honda is listed in the following table:

<b>Position</b>	<b>Component</b>	<b>Direction</b>	<b>Magnitude</b>
Row 1 Left	Door Forward Lower Quadrant (FLQ)	Lateral	20 cm (7.9 in)
Row 1 Left	Side panel forward of the A-pillar	Lateral	20 cm (7.9 in)
Row 1 Left	A-pillar (lower)	Lateral	20 cm (7.9 in)
Row 1 Left	Door Forward Upper Quadrant (FUQ)	Lateral	19 cm (7.5 in)
Row 1 Left	Door sill	Lateral	8 cm (3.1 in)
Row 1 Left	B-pillar	Lateral	9 cm (3.5 in)
Row 1 Left	Roof side rail	Lateral	3 cm (1.2 in)

### ***Manual Restraint Systems***

The Honda was equipped with manual 3-point lap and shoulder belt systems for the five designated seating positions. All belt systems utilized continuous loop webbing with sliding latch plates. The driver’s belt retracted onto an Emergency Locking Retractor (ELR) and was equipped with a retractor pretensioner. The upper D-ring was height adjustable and set to the full-up position. The driver was using the safety belt at the time of the crash which was supported by evidence on the belt webbing. This evidence consisted of two frictional abrasions. The first abrasion was attributed to the latch plate and was located 58 to 61 cm (22.8 to 24 in) above the floor anchor. The second abrasion was attributed to the D-ring and was located 104 to 121 cm (40.9 to 47.6 in) above the floor anchor. There was body fluid on the belt webbing located 84 to 98 cm (33.1 to 38.6 in) above the floor anchor. The retractor pretensioner had actuated but had relaxed by the time of the SCI inspection.

The front right and all second row safety belt systems utilized a switchable ELR/Automatic Locking Retractor. Additionally, the front right belt system utilized a retractor pretensioner which did not actuate during the crash. The front right belt webbing was cut post-crash for unknown reasons 71 cm (28 in) above the floor anchor.

### ***Frontal Air Bag System***

The Honda Fit was equipped with a 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 presence detection (weight) sensor, safety belt pretensioners, and safety belt buckle switches. The manufacturer of this vehicle certified that the Honda Fit was compliant with the advanced air bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) Number 208.

The driver's air bag was concealed within the center hub of a three-spoke steering wheel by a tri-flap design. The upper flap measured 13 cm (5.1 in) in width at the horizontal tear seam and 7 cm (2.8 in) in height. The dimensions of the two lower flaps were symmetrical. The upper aspects measured 8 cm (3.1 in) in width at the horizontal tear seam, the sides measured 7 cm (2.8 in) in height at the vertical tear seam and the lower aspects measured 3 cm (1.2 in) horizontally. The air bag (**Figure 6**) measured 50 cm (19.7 in) in diameter in its deflated state. It was vented by two ports located at the eleven and one o'clock positions on the rear of the air bag and was tethered by two straps located at the twelve and six o'clock positions on a 15 cm (5.9 in) circular seam sewn to the center of the face of the air bag. There were no occupant contacts to the driver's frontal air bag. The left half of the face of the air bag contained multiple deployment transfers and there were small droplets of body fluid on the face of the air bag at the 6 o'clock position.



**Figure 6: Deployed driver's frontal air bag.**

The front right air bag was mounted within the top aspect of the right instrument panel. The front right seat was not occupied during the crash; therefore, the CAC system suppressed the deployment of the air bag.

### ***Side Impact Air Bag System***

The Honda was equipped with front seat-mounted side impact air bags and roof side rail-mounted side impact IC air bags. The left seat-mounted side impact air bag and the left IC air bag deployed during this crash. The left seat-mounted air bag (**Figure 7**) deployed from a 30 cm (11.8 in) long seam in the outboard aspect of the front left seat back. The air bag measured 30

cm (11.8 in) in height and 25 cm (9.8 in) in width. The air bag had one vent port on the outboard aspect at the three o'clock position. There were small droplets of body fluid on the outboard side of the air bag located 9 to 15 cm (3.5 to 5.9 in) below the upper edge of the air bag and 7 to 11 cm (2.8 to 4.3 in) aft of the front edge of the air bag.

The left IC deployed from the left roof side rail (**Figure 8**). The air bag measured 176 cm (69.3 in) in length. The IC measured 50 cm (19.7 in) in height at the front and rear seating positions. Vertically, the IC extended below the belt line at the front and rear outboard positions. The air bag provided full-coverage head protection from the roof side rail to the belt line and from the A-pillar to the C-pillar. The inboard side of the left curtain air bag was free from occupant contact points and damage. The outboard side contained a scuff mark attributed to contact with the front of the Chevrolet. This scuff mark was located 6 to 18 cm (2.4 to 7.1 in) above the lower edge of the air bag and 30 to 46 cm (11.8 to 18.1 in) aft of the front edge of the airbag. The following identification number was stamped onto the IC: *1066953 46T08913LF20 031008-P >PA66,VMQ<*



**Figure 7: Deployed left side impact air bag.**



**Figure 8: Deployed left IC air bag.**

## ***2009 Chevrolet Silverado***

### ***Exterior Damage***

The front plane of the Chevrolet Silverado (**Figure 9**) sustained moderate-severity damage in the impact with the Honda. The front bumper, hood, right front fender and multiple engine compartment components were disassembled and removed from the Chevrolet prior to the inspection. The hood, fender and engine compartment components were in the cargo bed of the Chevrolet. The front bumper was missing and not available for inspection. The initial impact damage was estimated to extend from the front left bumper corner to the front right bumper corner. The frame rail ends were shifted to the left. The right frame rail shift measured 26 cm

(10.2 in); the left frame rail shift measured 31 cm (12.2 in). The Event 1 frontal damage was overlapped by the secondary impact damage with the signal pole. Due to the missing components and the overlapping damage, only a partial CDC could be assigned to the damage. The CDC assigned to the Event 1 damage was 81F99999. The Event 2 CDC was 99F99999.



**Figure 9: Frontal damage to the Chevrolet.**

### ***Event Data Recorder***

The CAC frontal air bag system in the Chevrolet was controlled by a Sensing and Diagnostic control Module (SDM) that had EDR data recording capabilities. The EDR data was imaged through the Diagnostic Link Connector (DLC) utilizing the Bosch Crash Data Retrieval hardware, software version 3.2 and external 12-volt electrical power. The imaged electronic file was reanalyzed and reported with software version 3.4. A text summary of some key data points are listed below. The imaged data file is attached to the end of this technical report as Attachment A.

The imaged data indicated the EDR had recorded a Deployment Event that was related to the intersection crash. The ignition cycle at the time of the event was 472 and 487 at the time of the investigation. At crash, the driver seat belt was “Buckled” and a Stage 1 driver air bag deployment was commanded 22.5 milliseconds after AE. The maximum recorded longitudinal velocity change (delta-V) was 23.0 km/h (-14.29 mph) 160 milliseconds after AE. The maximum recorded lateral delta-V was -15.6 km/h (-9.70 mph) 130 milliseconds after AE. The recorded pre-crash data parameters were associated with the Deployment Event. A field within the data indicated that the recording was complete.

### ***2009 Honda Fit Occupant Demographics/Data***

Driver Age/Sex:	24-year-old/Female – 33-weeks pregnant
Height:	168 cm (66 in)
Weight:	75 kg (165 lb)
Eyewear:	None
Seat Track Position:	Mid-track, 11 cm (4.3 in) fwd. of full-rear
Manual Safety Belt Use:	Lap and shoulder belt
Usage Source:	SCI vehicle inspection
Egress from Vehicle:	Removed by EMS through front right door
Mode of Transport from Scene:	Ground ambulance
Type of Medical Treatment:	Treated in emergency department of a regional trauma center and admitted to obstetrics department for seven days for observation and management of pre-term labor.

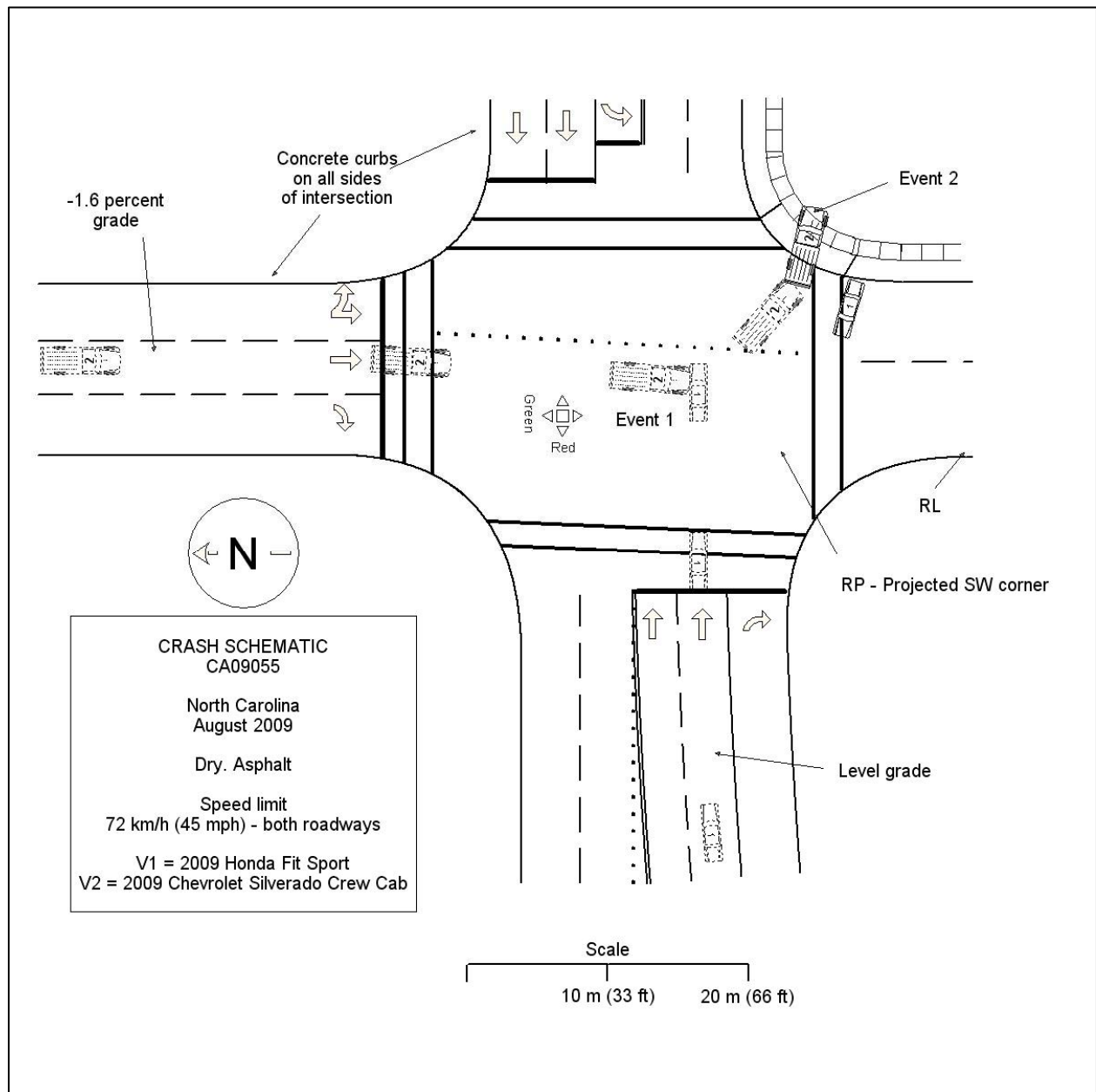
### ***Driver injuries***

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Source</b>
Posterior left arm contusion from shoulder to wrist (1)	Minor (790402.1,2)	Left door rear upper quadrant
15 cm contusion on left hip (1)	Minor (890402.1,2)	Left door arm rest rear lower quadrant
Contusion across lower abdomen, under pregnancy (1)	Minor (590402.1,8)	Safety belt
Contusion, location not specified in medical record (2)	Minor (990400.1,9)	Unknown

*Source of Injury Information:* (1) – Driver Interview;  
(2) – Emergency Room records

### ***Driver Kinematics***

The 24-year-old female driver was seated in a mid-track position and was restrained by the manual 3-point lap and shoulder belt. The driver was 33-weeks pregnant at the time of the crash. At impact, the driver's safety belt pretensioner actuated and the driver's frontal air bag, the left seat-mounted side impact air bag and the left IC air bag deployed. The driver initiated a forward and left trajectory within the front left seating position in response to the 10 o'clock direction of the impact force. The driver loaded the locked safety belt system resulting in the abdominal contusion. During her left trajectory, the driver's left arm contacted the rear upper quadrant of the left door panel evidenced by a scuff mark on the door panel slightly below the window sill. This contact resulted in the contusion to her left arm. Her left hip contacted the left front door armrest as the door intruded, evidenced by a scuff mark on the side aspect of the armrest. The contact resulted in the contusion to the driver's left hip. The driver then initiated a rebound trajectory to the right within the front left seating position. The driver came to rest in the driver's seat. Due to the jammed front left door, her perceived injuries and pregnancy, the driver was removed from the vehicle by EMS. She was transported by ground ambulance to a local trauma center where she was treated in the emergency department and later admitted to the obstetrics department for seven days for observation and management of pre-term labor. The driver carried her baby to within a few days of full-term and the baby was born healthy and without complications related to the crash.



**Figure 10: Crash Schematic**

**ATTACHMENT A**

2009 Chevrolet Silverado 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	3GCEK23M19G*****
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	
Saved on	Thursday, August 27 2009 at 02:17:47 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

## 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 minimum SDM Recorded Vehicle Velocity Change, that is needed to record a Non-Deployment Event, is five MPH. A Non-Deployment Event may contain Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle velocity change. This event will be cleared by the SDM, after approximately 250 ignition cycles. This event can be overwritten by a second Deployment Event, referred to as Deployment Event #2, if the Non-Deployment Event is not locked. The data in the Non-Deployment Event file will be locked, if the Non-Deployment Event occurred within five seconds of a Deployment Event. A locked Non Deployment Event cannot be overwritten or cleared by the SDM.

The second type of SDM recorded crash event is the Deployment Event. It also may contain Pre-Crash and Crash data. The SDM can store up to two different Deployment Events. If a second Deployment Event occurs any time after the Deployment Event, the Deployment Event #2 will overwrite any non-locked Non-Deployment Event. Deployment Events cannot be overwritten or cleared by the SDM. Once the SDM has deployed an air bag, the SDM must be replaced.

### Data:

-SDM Recorded Vehicle Velocity Change reflects the change in velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. For Deployment Events, the SDM will record 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM can record up to the first 300 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.

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

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

-Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.

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

- significant changes in the tire's rolling radius
- final drive axle ratio changes
- wheel lockup and wheel slip

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

-Pre-Crash data is recorded asynchronously.

-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:

- the SDM receives a message with an "invalid" flag from the module sending the pre-crash data
- no data is received from the module sending the pre-crash data

- no module is present to send the pre-crash data
- Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit.
- The Time Between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than five seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.
- If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
- The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition cycle counter.
- All data should be examined in conjunction with other available physical evidence from the vehicle and scene

**Data Source:**

All SDM recorded data is measured, calculated, and stored internally, except for the following:

- Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle's communication network.
- The Belt Switch Circuit is wired directly to the SDM.

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### Multiple Event Data

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

### System Status At AE

Low Tire Pressure Warning Lamp (If Equipped)	OFF
Vehicle Power Mode Status	Run
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Active

### Pre-crash data

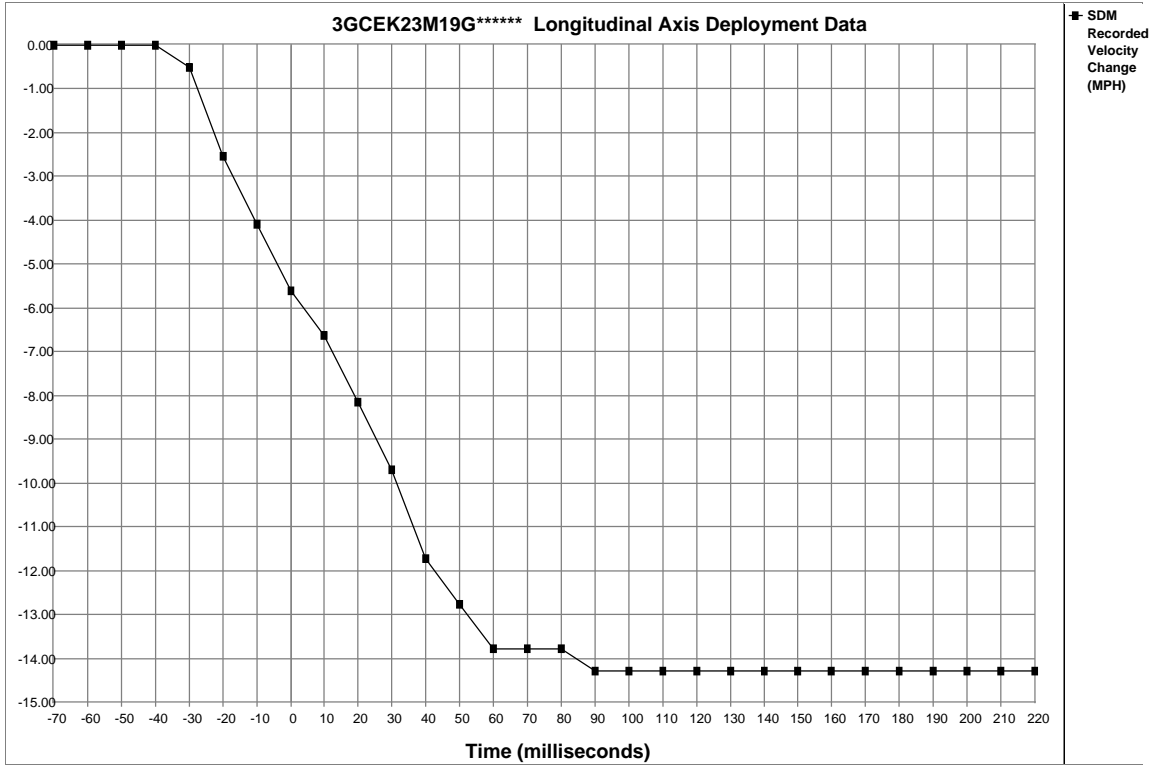
Parameter	-1.0 sec	-0.5 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No
Engine Torque (foot pounds)	264.06	66.02

### Pre-Crash Data

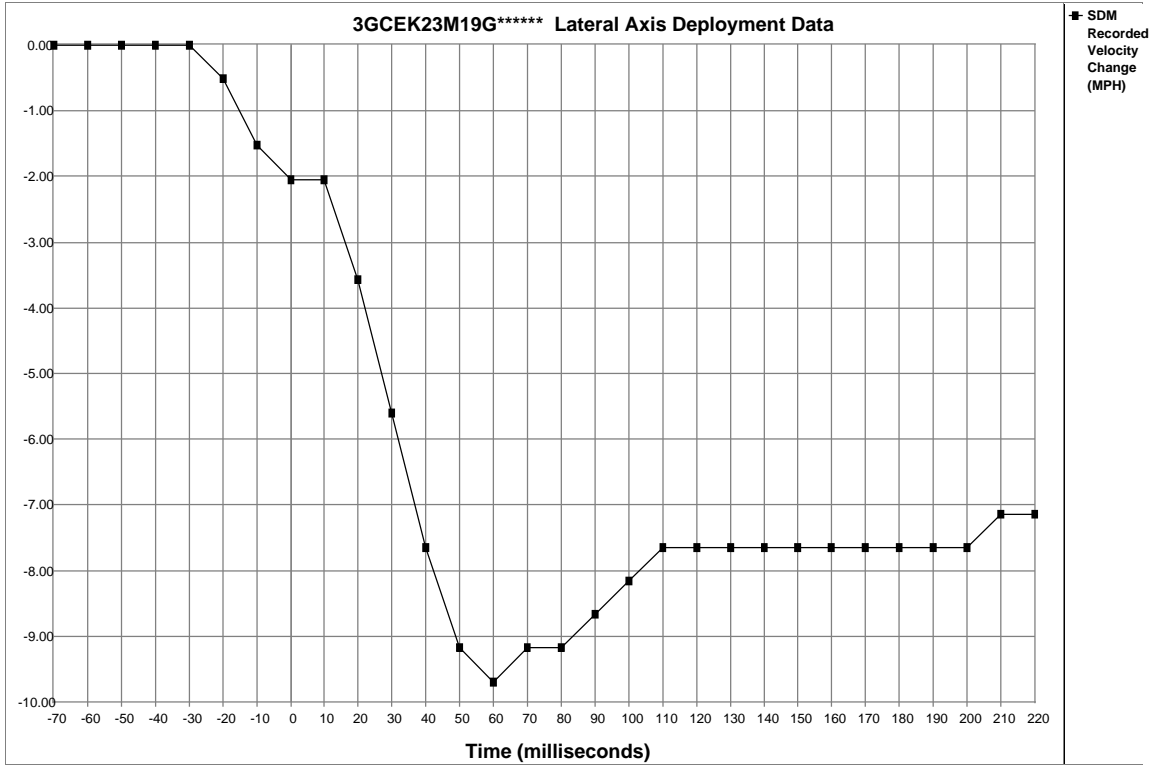
Parameter	-2.5 sec	-2.0 sec	-1.5 sec	-1.0 sec	-0.5 sec
Accelerator Pedal Position (percent)	30	52	56	56	0
Vehicle Speed (MPH)	34	35	35	37	38
Engine Speed (RPM)	1536	1792	2304	2368	2176
Percent Throttle	33	48	53	56	24
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF

## System Status At Deployment

Ignition Cycles At Investigation	487
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time Continuously (seconds)	374260
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	472
Ignition Cycles At Event	476
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Driver Seat Position Switch Circuit Status	Rearward
Passenger Classification Status at Event Enable	Passenger Seat Empty
Current Passenger Position Status at Event Enable	Unknown
Previous Passenger Position Status at Event Enable	Unknown
Passenger Air Bag Indicator Status at Event Enable	OFF
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Diagnostic Trouble Codes at Event, fault number: 7	N/A
Diagnostic Trouble Codes at Event, fault number: 8	N/A
Diagnostic Trouble Codes at Event, fault number: 9	N/A
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	22.5
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Disposal
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Suppressed
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Suppressed
Driver Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
SDM Synchronization Counter	476
Time Between Events (sec)	N/A
Event Recording Complete	Yes
Driver First Stage Deployment Loop Commanded	Yes
Passenger First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	Yes
Passenger Second Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Driver Pretensioner Deployment Loop Commanded	Yes
Passenger Pretensioner Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No



Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	-0.51	-2.55	-4.08	-5.61	-6.63	-8.16	-9.69	-11.74	-12.76	-13.78	-13.78
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-13.78	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29	-14.29



Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	-0.51	-1.53	-2.04	-2.04	-3.57	-5.61	-7.65	-9.18	-9.69	-9.18
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Lateral Axis Recorded Velocity Change (MPH)	-9.18	-8.67	-8.16	-7.65	-7.65	-7.65	-7.65	-7.65	-7.65	-7.65	-7.65	-7.65	-7.65	-7.14	-7.14