CRASH DATA RESEARCH CENTER
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CALSPAN ON-SITE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION SYSTEM CRASH INVESTIGATION SCI CASE NO: CA09035

VEHICLE: 2008 FORD FOCUS

LOCATION: VIRGINIA

CRASH DATE: APRIL 2009

Contract No. DTNH22-07-C-00043

Prepared for:

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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.

TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract This investigation focused on the deployment of the side impact air bag protection system in a 2008 Ford Focus. The Ford was involved in an intersection crash with a 2006 GMC Envoy. The Ford was equipped with side impact Inflatable Curtain (IC) air bags, front row seatback-mounted side impact air bags, Certified Advanced 208-Compliant (CAC) frontal air bags and front row safety belt pretensioners. The crash occurred when the southbound Ford was struck on the left side by the frontal area of the westbound GMC as both vehicles entered a 4-leg intersection. The crash deployed the driver's seatback-mounted side impact air bag and both IC air bags in the Ford. The Ford was driven by a 58-year-old restrained male. He sustained a left elbow laceration and was transported to a local hospital where he was treated for his injury and released. The driver of the GMC fled the crash site on foot after the GMC came to final rest and was not located or identified by the police.			
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BACKGROUND

This investigation focused on the deployment of the side impact air bag protection system in a 2008 Ford Focus (**Figure 1**). The Ford was involved in an intersection crash with a 2006 GMC Envoy. The Ford was equipped with side impact Inflatable Curtain (IC) air bags, front row seatback-mounted side impact air bags, Certified Advanced 208-Compliant (CAC) frontal air bags and front row safety belt pretensioners. The crash occurred when the southbound Ford was struck on the left side by the frontal area of the westbound GMC as both vehicles entered a 4-leg intersection. The crash deployed the driver's seatback-mounted side impact air bag and both IC air bags in the Ford. The Ford was driven by a 58-year-old restrained male. He sustained a left elbow laceration and was transported to a local hospital where he was treated for his injury and released. The driver of the GMC fled the crash site on foot after the GMC came to final rest and was not located or identified by the police.

Figure 1: Left front oblique view of the 2008 Ford Focus.

This crash was identified through the weekly sampling of Police Accident Reports (PARS) by the National Automotive Sampling System (NASS). The Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA) forwarded the PAR to the Calspan Special Crash Investigations (SCI) team on June 1, 2009 for on-site investigative follow-up. The Calspan SCI team initiated telephone follow-up and established cooperation with the insurance carriers of both vehicles. The Ford and GMC were considered total losses and were available for inspection at a regional insurance salvage yard. The on-site investigation, which included the inspection of both vehicles and the crash site, was conducted on June 3, 2009. The driver of the Ford Focus could not be located during the on-site and follow-up efforts of this investigation. Both vehicles were equipped with Event Data Recorders (EDR). The GMC's EDR was imaged during the on-site investigation. The insurance company would not authorize imaging of the Ford's EDR without consent from the driver.

SUMMARY

Crash Site

The crash occurred during nighttime hours in April 2009. At the time of the crash, the weather was clear and the bituminous roadways were dry. The crash occurred at a 4-leg intersection of two, 2-lane roads within a residential area. The intersection was controlled by stop signs for east/west traffic flow. The north/south asphalt roadway and the east/west asphalt roadway measured 6 m (19.7 ft) in width. There were no shoulders or pavement marking for the roadways. A chain link fence was located 2.6 m (8.5 ft) west of the north/south roadway and 2.9 m (9.5 ft) south of the east/west roadway, which spanned the southwest quadrant of the intersection. The posted speed limit was 40 km/h (25 mph) in all four travel directions. **Figure 2** is a southbound view of the intersection which depicts the pre-crash trajectory of the Ford. A schematic of the crash is included at the end of this report as **Figure 7**.

Figure 2: Southbound view for the Ford's pre-crash path of travel

Vehicle Data

2008 Ford Focus

The 2008 Ford Focus was a 2-door coupe that was identified by the Vehicle Identification Number (VIN): 1FAHP33N38W (production sequence deleted). The placard indicating the vehicle's date of manufacture could not be viewed as the driver's door was jammed closed. The electronic odometer display was not visible and could not be read at the time of the SCI inspection. The powertrain consisted of a 2.0-liter, I-4 transverse-mounted engine linked to a 4-speed automatic transmission with front-wheel drive. The service brakes were a front disc/rear drum system. The Ford was equipped with Hankook Optimo H725 tires; size P195/60R15 that were mounted on OEM alloy wheels with an indirect Tire Pressure Monitoring System (TPMS) The vehicle manufacturer recommended front and rear cold tire pressure was 221 kPa (32 PSI) for P195/60R15 tires. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Pressure	Tread Depth	Restricted	Damage
LF	241 kPa (35 PSI)	6 mm (8/32 in)	No	None
LR	241 kPa (35 PSI)	6 mm (7/32 in)	No	None
RF	241 kPa (35 PSI)	6 mm (7/32 in)	No	None
RR	241 kPa (35 PSI)	6 mm (7/32 in)	No	None

The interior of the Ford was configured with front bucket seats and a split, forward folding 3-passenger rear seat. The manual safety systems consisted of 3-point lap and shoulder safety belts located in all five seat positions. The front row safety belts were equipped with buckle mounted pretensioners. The Ford was equipped with CAC frontal air bags, front row seatback-mounted side impact air bags and IC air bags that provided protection to the four outboard positions. The vehicle manufacturer has certified that the frontal air bags in the Ford were compliant to the advanced air bag requirements of the Federal Motor Vehicle Safety Standard No. 208.

2006 GMC Envoy

The 2006 GMC Envoy, 4-door utility vehicle was identified by the VIN: 1GKES16S566 (production sequence deleted). The placard indicating the vehicle's date of manufacture, GVWR and GAWRs had been removed from the GMC's B-pillar or driver's door. The powertrain consisted of a 4.2-liter, V-6 engine linked to a 4-speed automatic transmission with rear-wheel drive. The service brakes were a 4-wheel disc system with ABS. The GMC was equipped with Maxxis Bravo H/T P245/65R17 (manufacturer recommended size) tires mounted on OEM alloy wheels. The vehicle manufacturer recommended front and rear cold tire pressures were 207 kPa (30 PSI) and 241 kPa (35 PSI), respectively. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Pressure	Tread Depth	Restricted	Damage
LF	262 kPa (38 PSI)	7 mm (9/32 in)	No	None
LR	262 kPa (38 PSI)	6 mm (8/32 in)	No	None
RF	269 kPa (39 PSI)	7 mm (9/32 in)	No	None
RR	269 kPa (39 PSI)	6 mm (8/32 in)	No	None

Crash Sequence

Pre-Crash

The Ford was southbound driven by the 58-year-old restrained male. The GMC was westbound driven by an unknown hit and run driver. The EDR imaged speed of the GMC was 56 km/h (35 mph) at -5 seconds of Algorithm Enable (AE). The EDR recorded the brake switch circuit status was "On" for the -5 to -3 seconds of EA and off at -2 to the -1 second recorded times. Both drivers were traveling on straight trajectories into the intersection. The hit and run driver of the GMC did not stop for the regulatory stop sign and entered the intersection on a crossing path from left side of the Ford. There was no physical evidence at the crash site to support the level of braking by the driver of the GMC. Avoidance actions by the driver of the Ford were unknown. Physical scene evidence indicative of pre-crash evasive actions were not present at the time of this SCI scene inspection.

Crash

The frontal area of the GMC impacted the forward aspect of the Ford's left side (Event 1). The directions of force were within the 10 o'clock sector for the Ford and the 1 o'clock sector for the GMC. The Damage Algorithm of the WinSMASH program was used to calculate vehicular velocity changes of 25 km/h (15.5 mph) for the Ford with longitudinal and lateral components of -16 km/h (-9.9 mph) and 19 km/h (11.8 mph), respectively. The GMC's total delta-V was 15 km/h (9.3 mph) with longitudinal and lateral components of -11 km/h (-6.8 mph) and -10 km/h (-6.2 mph), respectively.

The impact resulted in the actuation of the driver safety belt pretensioner in the Ford and the deployment of the vehicle's driver seatback-mounted side impact air bag and both IC air bags. The frontal CAC air bags in the Ford and the GMC did not deploy.

The impact was located forward of the Ford's center of gravity and caused the vehicle to rotate clockwise (CW) approximately 30 degrees. The lateral component of the 1 o'clock impact force rotated the GMC counterclockwise (CCW) approximately 55 degrees. The left quarter panel and trailing edge of the left door of the Ford contacted the right front fender and wheel of the GMC in a secondary side slap configuration (Event 2). The vehicles subsequently separated and traveled forward to their respective trajectories. The Ford departed the west side of the roadway and impacted a chain link fence before coming to rest off-road at the south leg of the intersection, facing southwest, approximately 19 m (62 ft) from the initial point of impact. The GMC came to rest facing southwest on the south leg of the intersection at the road edge The GMC's final rest location was approximately 11 m (36 ft) from the initial impact point.

Post-Crash

Police and ambulance personnel responded to the crash site. The driver of the Ford was assisted from his vehicle through the right front door by emergency personnel. He was transported by ground ambulance to a local hospital where he was treated for left shoulder pain and a laceration to his left elbow. Following treatment, the driver of the Ford was released. The driver of the GMC exited the vehicle unassisted and fled the crash scene on foot. He was not located or identified by the investigating police agency. The Ford and the GMC sustained disabling damage and were towed from the crash site. The vehicles were subsequently deemed total losses by their respective insurance companies and transferred to a regional vehicle salvage facility where they were inspected for this investigation.

2008 Ford Focus

Exterior Damage

The exterior of the Ford sustained two separate impacts to the left side plane (**Figure 3)**. The initial impact damage was located on the left front fender and door while the secondary side slap was located on the left rear quarter panel. The direct contact damage for the initial impact event began 104 cm (40.9 in) forward of the left rear axle and extended 195 cm (76.8 in) forward to the left front corner. The impact resulted in deformation to the left front fender, left door panel, A-pillar and sill areas. The Ford's left wheelbase was reduced by 2 cm (0.8 in). The combined induced and direct contact damage began 77 cm (30.3 in) forward of the left rear axle position and extended 222 cm (87.4 in) forward to the left front corner. The crush profile was measured at the mid-door level and was as follows: C1 = 3 cm (1.2 in), C2 = 3 cm (1.2 in), C3 = 11 cm (4.3 in), C4 = 23 cm (9.1 in), C5 = 10 cm (3.9 in), C6 = 15 cm (5.9 in). The maximum crush was located at C4. The Collision Deformation Classification (CDC) for this impact event was 10LYEW2.

Figure 3: View of the crush profile on the left side of the Ford (Event 1).

The Ford rotated CW as a result of the initial impact and was involved in a secondary side slap with the GMC (Event 2). The direct contact damage began on the trailing edge of the left door 97 cm (38.2 in) forward of the left rear axle and extended 127 cm (50 in) rearward. The direct contact damage consisted of black rubber transfers and isolated dents. The residual crush profile yielded 0 cm of crush at all six "C" measurement locations. The maximum crush was 5 cm (2 in) and was located between C1 and C2. The CDC for this side slap was 09LZEW1.

The windshield was fractured due to lateral displacement of the left lower A-pillar and the driver's door glazing was disintegrated from damage to the door. The left door was jammed closed and overlapped the left B-pillar 2 cm (0.8 in). The right door remained closed during the crash sequence and was operational at the time of the SCI inspection.

The Ford's third impact event with the chain link fence resulted in minor severity damage to the front, top surfaces, and the right side of the vehicle. The damage was limited to surface abrasions with separation of the right side mirror. The CDCs by protocol were 12FDEW1 (lower frontal), 12FDGS9 (upper frontal), and 12RDAS2 (right side).

Interior Damage

The interior damage to the Ford was limited to the deployment of the vehicle's air bag systems and the intrusions into the vehicle's occupant space. The only occupant related evidence within the interior was a body fluid transfer of the inboard aspect of the seatback-mounted side impact air bag. The Ford's measured intrusions are listed in the following table:

Position	Component	Intrusion	Direction
Front Row/Left	Floor pan inclusive of the sill	10 cm (3.9 in)	Lateral
	Left roof side rail	5 cm (2 in)	Lateral
	Left door panel, forward lower quadrant	2 cm (0.8 in)	Lateral
	Left B-pillar	2 cm (0.8 in)	Lateral
Second Row/Left	Side panel aft of the B-pillar	2 cm (0.8 in)	Lateral

Manual Restraint Systems

The driver's safety belt consisted of continuous loop webbing, a sliding latch plate, a fixed D-ring, and an Emergency Locking Retractor (ELR). The driver's belt buckle was equipped with a pretensioner that actuated during the crash resulting in 5 cm (2 in) of downward travel. The safety belt was retracted into the ELR retractor at the time of the SCI inspection. Inspection of the latch plate revealed frictional abrasions to the full-width of the plastic surface as a result of loading by the occupant. Corresponding frictional abrasions to the webbing were located 90 cm (35.4 in) from the lower anchor and measured 8 cm (3.1) in length. Based upon the evidence on the belt system, the driver was restrained at the time of this crash.

The front right belt system utilized a switchable ELR/Automatic Locking Retractor with a buckle pretensioner. The buckle pretensioner did not actuate in this unoccupied seat position.

Frontal Air Bag System

The frontal air bag system in the Ford consisted of CAC air bags for the driver and front right passenger positions. The CAC system consisted of dual stage air bags, seat track positioning sensors, safety belt buckle switches and a front right occupant presence sensor. The manufacturer of the Ford has certified that the frontal air bags were complaint to the advanced air bag requirements of Federal Motor Vehicle Safety Standard No. 208. The frontal air bags did not deploy as a result of the crash.

Inflatable Curtain Air Bags

The Ford was equipped with IC air bags (**Figure 4**) mounted in the roof side rails. Both IC air bags deployed as a result of the crash sequence. The IC air bags measured 150 cm x 36 cm (59.1 in x 14.2 in) length x height in overall dimensions and provided coverage from the upper aspect of the A- to C-pillar area. A non-inflatable sail panel was sewn to the forward aspect of the curtain to fill the triangular void at the forward aspect of front glazing formed by the slope of the A-pillars. This area measured 20 cm x 29 cm (7.9 in x 11.4 in) length x height. A 12 cm (4.7 in) long tether extended from the lower portion of the A-pillar and was sewn to the forward aspect of the sail panel. The vertical coverage of the curtain extended to 5 cm (2 in) above the beltline within the front row. However, the second row coverage extended to the beltline. There was no contact evidence or damage to the deployed IC air bags.

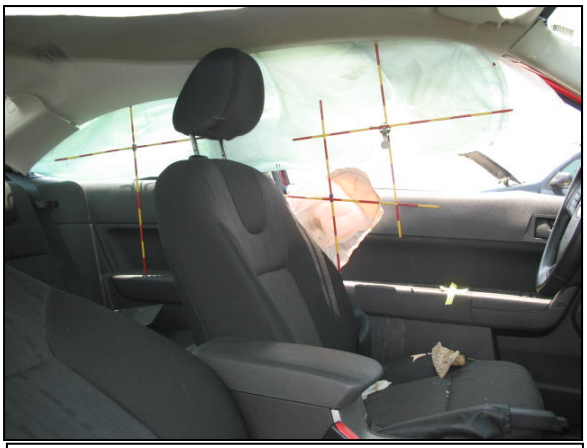


Figure 4: View of the left side (IC) air bag and the driver seatback mounted air bag in the Ford.

Seatback Mounted Air Bags

The Ford was also equipped with front row seatback-mounted side impact air bags. The driver's seatback air bag deployed as a result of the crash. This air bag was trapezoidal in shape with overall measured dimensions of 37 cm x 28 cm (14.6 in x 11 in) length x height. This air bag deployed from a stitched seam within the seat back that measured 35 cm (13.8 in) in height. A reddish brown discoloration of body fluid was found on the inboard aspect of the air bag. It was located 22cm to 27 cm (8.7 in to 10.6 in) inboard of the leading edge and 7 cm to 17 cm (2.8 in to 6.7 in) below the top of the air bag. A 9cm (3.5 in) overlap existed between the deployed seatback air bag and IC air bag curtain.

Event Data Recorder

The air bag systems in the Ford were controlled by a Restraints Control Module (RCM) that was mounted under the center console. The RCM controlled the sensing, deployment, and diagnostic functions of the air bag systems. In addition, the RCM had Event Data Recording (EDR) capabilities. The Ford's EDR was not imaged at the time of this SCI vehicle inspection as the insurance company required driver approval. The SCI team was unable to locate the driver during the on-site investigation or through follow-on attempts.

2006 GMC Envoy

Exterior Damage

The GMC sustained front and right side damage as a result of the crash sequence. The first event produced frontal damage **(Figure 5)** which consisted of deformation to the front bumper fascia, bumper reinforcement beam, right head lamp assembly and the hood. The direct contact damage began 62 cm (24.4 in) left of the bumper beam centerline and extended 142 cm (55.9 in) to the right front bumper corner. The crush profile measured along the bumper fascia was as follows: C1 = 15 cm (5.9 in), C2 = 1 cm (0.4 in), C3 = 2 cm (0.8 in), C4 = 3cm (1.2 in), C5 = 0 cm, C6 = 37 cm (14.6 in). The CDC for this damage was 01FDEW2.

Figure 5: View of the crush profile on the front plane of the GMC (Event 1)

The right plane of the GMC sustained direct contact damage that started 65 cm (25.6 in) aft of the right front axle and extended 100 cm (39.4 in) forward to the right front bumper corner. This damage was related to the secondary side slap (Event 2). This damaged region consisted of contact abrasions to the leading edge of the right front door, right front fender and corresponding wheel rim and tire. The maximum deformation was 1 cm (0.4 in) located at the C2 designation. All remaining "C" locations within this profile measured 0 cm. The doors and tailgate of the GMC remained closed during the impact and were operational at the time of the SCI inspection. The windshield was not fractured and all the window glazing was intact. There was no change in the wheelbase dimensions. The CDC for this damage pattern was 03RFEW1.

Event Data Recorder

The air bag system in the GMC consisted of CAC driver and front right passenger air bags that were monitored and controlled by a Sensing Diagnostic control Module (SDM) located under the center console. The SDM had Event Data Recording (EDR) capabilities. The EDR was imaged via the diagnostic link connector with the Bosch Crash Data Retrieval tool and software version 3.2. The imaged data was re-read with version 3.4 and is reported below. The imaged data report is attached to the end of this report as *Attachment A*.

The GMC's EDR recorded a single Non-Deployment Event. The event recording was complete. The crash data was recorded on ignition cycle 9,392 and the data was imaged on ignition cycle 9,407. The EDR data indicated that the driver's belt switch status was "Unbuckled" and that the right front passenger's safety belt buckle switch circuit status was, "Buckled" at the time of the crash. There was no police data or vehicle related evidence to confirm a front right passenger

was seated in the GMC at the time of the crash event. The EDR had memory capacity to record 300 milliseconds of delta-V data. The maximum EDR recorded longitudinal delta-V was -7.2 km/h (-4.5 mph) 80 milliseconds after AE. The maximum lateral delta-V was -8.2 km/h (-5.1 mph), also at 80 milliseconds after AE. The EDR also recorded five seconds (5 sec) of pre-event Speed, RPM, Throttle Percentage and Brake Switch status data. Time "Zero" (0 sec) was assumed to indicate the impact event and AE. The data imaged from this EDR is listed in the following tables:

Time (sec)	Vehicle Speed	Engine Speed (RPM)	Throttle Percentage (%)	Brake Switch Circuit Status
-5	56 km/h (35 mph)	1216	0	On
-4	55 km/h (34 mph)	896	0	On
-3	43 km/h (27 mph)	768	0	On
-2	34 km/h (21 mph)	704	9	Off
-1	34 km/h (21 mph)	2688	0	Off

2008 Ford Focus

Driver Demographics/Data

Age/Sex:	58-year-old/Male
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Full-rear
Safety Belt Usage:	3-point lap and shoulder
Usage Source:	SCI vehicle inspection
Egress from Vehicle:	Removed by emergency personnel
Type of Medical Treatment:	Transported to a local hospital where he was treated and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
5 cm (2 in) irregular laceration of the left posterior elbow; containing glass foreign body	Minor (790602.1,2)	Other interior object - elbow engaged glass fragments against door panel

Source: Emergency room records

Driver Kinematics

The 58-year-old male driver of the Ford was seated in the rear track position and was restrained by the 3-point safety belt system. Safety belt usage was confirmed by frictional abrasions on the

sliding latch plate surface from interaction against the belt webbing. The seatback was reclined 20 degrees aft of vertical. The 3-spoke tilt steering wheel was in the full-up position The horizontal distance from the seatback to the driver air bag module measured 68 cm (26.8 in). There was no deformation of the steering wheel rim and no displacement of the shear capsules. The left front door glazing was closed pre-crash. Glass fragments were found embedded in the weather stripping at the top of the door window frame.

During the initial engagement between the vehicles, the left front door of the Ford deformed and the glazing disintegrated. The crash forces were sufficient to deploy the side impact sensing left seatback-mounted air bag and the IC air bags, and actuate the driver's buckle pretensioner. The actuated pretensioner removed slack from the belt system and tightened the webbing around the driver as the driver responded to the 10 o'clock direction of force by initiating a left and slightly forward trajectory. He loaded the safety belt system, evidenced by the frictional abrasions on the latch plate. The driver's left elbow impacted the presumed left rear upper quadrant of the left front door panel. As the elbow struck the panel, glass fragments were captured between the elbow and the door panel resulting in an irregular 5 cm (2 in) laceration of the posterior aspect of the elbow with glass embedded into the laceration. There was no contact evidence on the interior surfaces with the exception of a body fluid stain on the inboard aspect of the deployed seatback-mounted airbag (**Figure 6**).

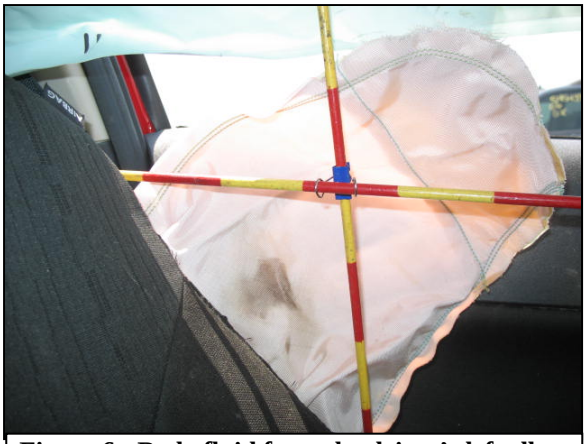


Figure 6: Body fluid from the driver's left elbow laceration in the Ford.

The minor severity of the secondary side slap impact did not significantly displace the driver. He rebounded right and came to rest in the front right seat. The Ford subsequently impacted the chain link fence. This impact did not displace the driver or result in additional injury.

Following the crash, the driver was assisted from the vehicle by rescue personnel and was transported to a local hospital where he was treated for his elbow laceration (sutured) and released.

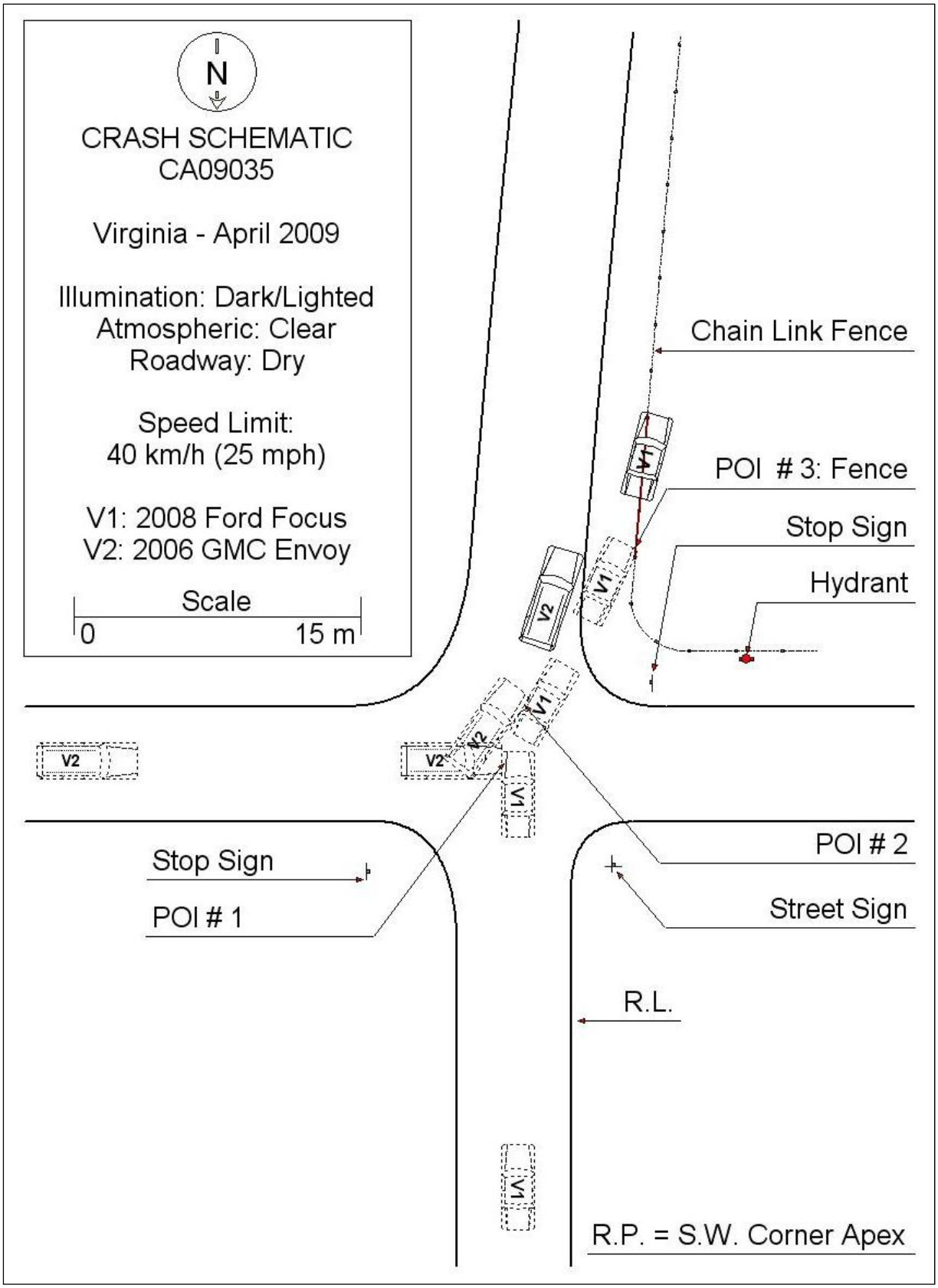


Figure 7: Crash Schematic

ATTACHMENT A

2006 GMC Envoy 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	1GKES16S566******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CA09035 V2.CDR
Saved on	Wednesday, June 3 2009 at 02:30:05 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 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 230 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 from the module sending the pre-crash data
- -no data is received from the module with an "invalid" flag sending the pre-crash data
- -no module 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.
-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.

01013_SDMDS_r001

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 1 second

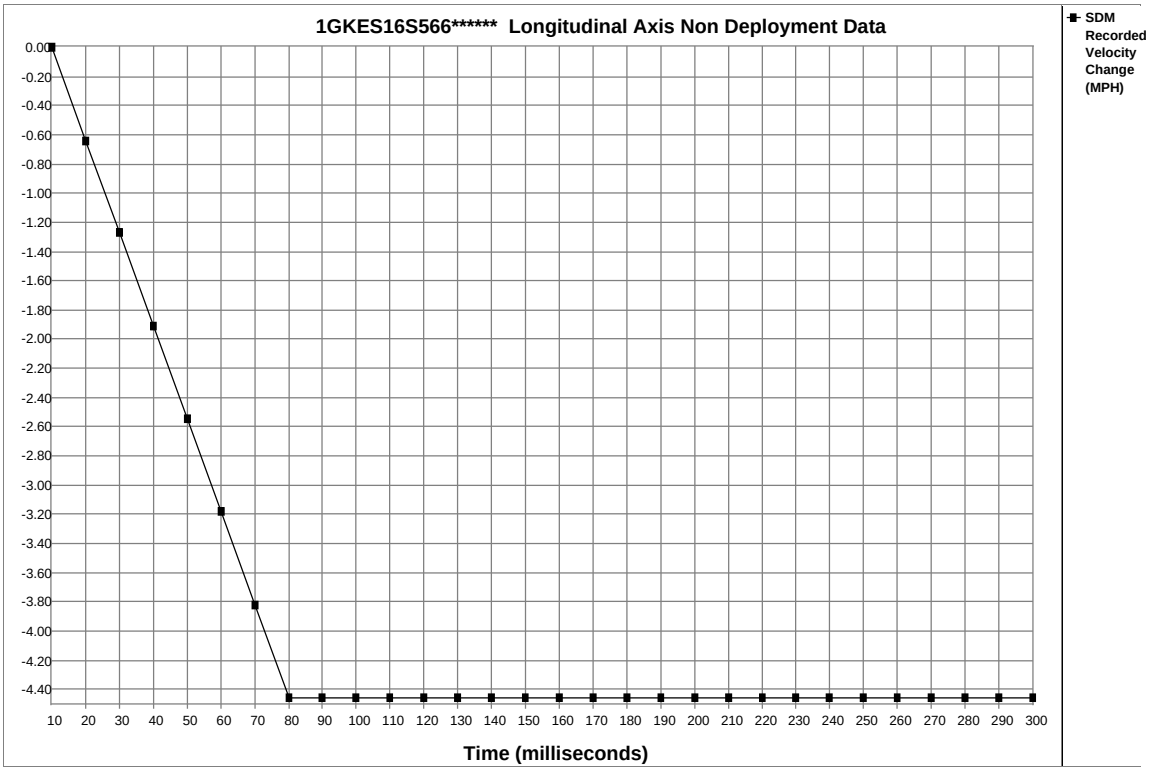
Left Front Door Ajar	No
Right Front Door Ajar	No
Left Rear Door Ajar	No
Right Rear Door Ajar	No

Pre-Crash Data

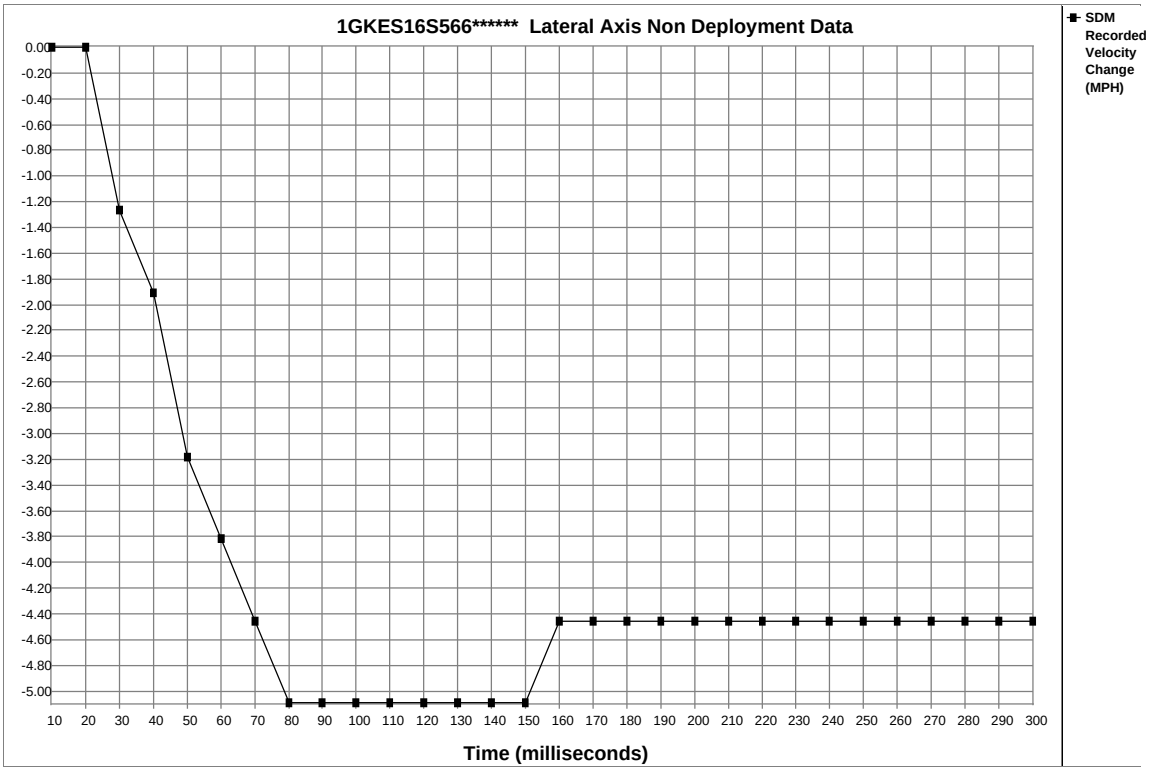
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	35	34	27	21	21
Engine Speed (RPM)	1216	896	768	704	2688
Percent Throttle	0	0	0	9	0
Brake Switch Circuit Status	ON	ON	ON	OFF	OFF

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time Continuously (seconds)	655350
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	1600
Ignition Cycles At Investigation	9407
Ignition Cycles At Event	9392
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Driver Seat Position Switch Circuit Status	Rearward
Passenger Seat Position Switch Circuit Status	Rearward
Automatic Passenger SIR Suppression System Status at AE	Air Bag Not Suppressed
Rollover Sensor Status	No Rollover Event
Number of Consecutive Error Free Messages Received From Rollover Sensor	Last 128 Consecutive Message Were Error Free
SDM Synchronization Counter	14811
Side Air Bag(s) Were First Commanded to Deploy Due to Side Impact Event	No
Side Air Bag(s) Were First Commanded to Deploy Due to Rollover Event	No
Driver 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	No
Driver Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #1 Commanded (If Equipped)	No
Passenger 1st Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
Passenger Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #2 Commanded (If Equipped)	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #3 Commanded (If Equipped)	No
Second Row Right Side Deployment Loop Commanded (If Equipped)	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Supplemental Deployment Loop #4 Commanded (If Equipped)	No
Second Row Center Pretensioner Deployment Loop Commanded	No
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
Maximum SDM Recorded Velocity Change (MPH)	6.77
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	70
Crash Record Locked	No
Deployment Event Recorded in the Non-Deployment Record	No
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Event Recording Complete	Yes



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	-0.64	-1.27	-1.91	-2.55	-3.18	-3.82	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	-1.27	-1.91	-3.18	-3.82	-4.46	-5.09	-5.09	-5.09	-5.09	-5.09	-5.09	-5.09	-5.09
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Lateral Axis Recorded Velocity Change (MPH)	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46	-4.46