CRASH DATA RESEARCH CENTER
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CALSPAN ON-SITE ROLLOVER CRASH INVESTIGATION
SCI CASE NO.: CA09056

VEHICLE: 2007 JEEP PATRIOT LIMITED 4WD

LOCATION: NORTH CAROLINA

CRASH DATE: JULY 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 on-site investigation focused on the rollover crash of a 2007 Jeep Patriot Limited. The vehicle was equipped with 4-wheel anti-lock brakes, Electronic Stability Control (ESC), a Certified Advanced 208-Compliant (CAC) frontal air bag system and roll sensing Inflatable Curtain (IC) air bags mounted in the roof side rails. The manufacturer of the Jeep Patriot certified that the vehicle was compliant to the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The CAC system includes dual-stage frontal air bags for the driver and right front passenger positions, seat track positioning sensors, retractor pretensioners, safety belt buckle switch sensors, and a front right occupant presence sensor. The vehicle was impacted on the forward aspect of the right side while traveling on a 5-lane interstate highway by the front of a 2004 GMC Envoy. The Jeep was redirected to the left as the GMC crossed in front of the Jeep's path. The forward aspect of the Jeep's right side subsequently impacted the left side of the GMC. The vehicle to vehicle engagement caused the Jeep to rotate counterclockwise (CCW) and it tripped into a right side leading 2-quarter turn rollover. The Jeep's IC air bags deployed as a result of the rollover. The 52-year-old restrained male driver in the Jeep sustained unknown injuries as a result of this crash. He refused medical transport. Numerous attempts were made to contact the driver in-person. His phone number was unlisted and he did not respond to literature left at his home on two occasions. Local and regional medical facilities were contacted and no record of treatment for the driver of the Jeep was found.			
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TABLE OF CONTENTS

CALSPAN ON-SITE ROLLOVER CRASH INVESTIGATION
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BACKGROUND

This on-site investigation focused on the rollover crash of a 2007 Jeep Patriot Limited **(Figure 1)**. The vehicle was equipped with 4-wheel anti-lock brakes, Electronic Stability Control (ESC), a Certified Advanced 208-Compliant (CAC) frontal air bag system and roll sensing Inflatable Curtain (IC) air bags mounted in the roof side rails. The manufacturer of the Jeep Patriot certified that the vehicle was compliant to the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The CAC system includes dual-stage frontal air bags for the driver and right front passenger positions, seat track positioning sensors, retractor pretensioners, safety belt buckle switch sensors, and a front right occupant presence sensor. The vehicle was impacted on the forward aspect of the right side while traveling on a 5-lane interstate highway by the front of a 2004 GMC Envoy. The Jeep was redirected to the left as the GMC crossed in front of the Jeep's path. The forward aspect of the Jeep's right side subsequently impacted the left side of the GMC. The vehicle to vehicle engagement caused the Jeep to rotate counterclockwise (CCW) and it tripped into a right side leading 2-quarter turn rollover. The Jeep's IC air bags deployed as a result of the rollover. The 52-year-old restrained male driver in the Jeep sustained unknown injuries as a result of this crash. He refused medical transport. Numerous attempts were made to contact the driver in-person. His phone number was unlisted and he did not respond to literature left at his home on two occasions. Local and regional medical facilities were contacted and no record of treatment for the driver of the Jeep was found.

Figure 1: Front right oblique view of the 2007 Jeep Patriot.

The vehicle was identified through a visit to a regional salvage facility on August 24, 2009. An image of the Jeep was forwarded to the Calspan Special Crash Investigations (SCI) team for review on August 25, 2009. Based on the rollover of the vehicle and the deployment of the IC air bags, this case was assigned for an on-site investigation of August 25, 2009. The on-site investigation was initiated on August 27, 2009 and involved inspections of the Jeep and the GMC and the documentation of the crash site. Additionally, an attempt was made to image the Event Data Recorder (EDR) of the Jeep; however the EDR in this vehicle only stored data for

frontal events. No crash related data was recovered. The EDR in the GMC was imaged at the time of the inspection and the recovered data is included as **Attachment A** of this report.

SUMMARY

Vehicle Data

2007 Jeep Patriot

The 2007 Jeep Patriot Limited was manufactured in June, 2007 and was identified by the Vehicle Identification Number (VIN) 1J8FF48W57D (production sequence deleted). The vehicle's odometer reading at the time of the crash was 80,438 km (49,993 mi). The 4-wheel drive Jeep was powered by a 2.4-liter inline 4-cylinder engine linked to a 5-speed automatic transmission. The braking system consisted of power-assisted front and rear disc brakes with 4-wheel antilock, brake assist and electronic brake force distribution. The Jeep was also equipped with Electronic Skid Control (ESC) and an indirect Tire Pressure Monitoring System (TPMS). All windows were closed during the crash. The Jeep was equipped with four Firestone Affinity Touring tires, size P215/60R17 that matched the manufacturer recommended tire size. The tires were mounted on OEM 5-spoke alloy wheels. The manufacturer recommended cold tire pressure was 221 kPa (32 PSI) for the front and rear. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	193 kPa (28 PSI)	5 mm (6/32 in)	None
Left Rear	186 kPa (27 PSI)	2 mm (3/32 in)	None
Right Front	Tire flat	6 mm (7/32 in)	Tire de-beaded
Right Rear	Tire flat	2 mm (3/32 in)	Tire de-beaded

The interior of the Jeep was configured with leather-surfaced five-passenger seating. The front bucket seats were separated by a center console and equipped with adjustable head restraints. The driver's head restraint was 6 cm (2.4 in) above the full-down position, and the front right head restraint was 3 cm (1.2 in) above the full down position. The driver's seat track was in the full-rear position. The front right seat track was 8 cm (3.1 in) forward of full-rear. The driver's seat back angle was 24 degrees aft of vertical and the front right seat back angle was measured at 26 degrees aft of vertical. The second row seat consisted of a split 60/40 bench with separate folding backs. The outboard second row seats had integral head restraints. The second row seat tracks were not adjustable.

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, CAC dual-stage frontal air bags and roll sensing Inflatable Curtain (IC) air bags that provided protection for the four outboard seating positions.

2004 GMC Envoy

The 2004 GMC Envoy was manufactured in July, 2003 and was identified by the VIN 1GKDT13S942 (production sequence deleted). The odometer reading was unknown. The 4-wheel drive Envoy was powered by a 4.2-liter inline 6-cylinder engine linked to a 4-speed automatic transmission. The braking system consisted of power-assisted front and rear disc brakes with 4-wheel antilock. All windows were closed at the time of the crash. The manufacturer recommended tire size was P245/65R17, with a recommended cold tire pressure of 221 kPa (31 PSI) for the front and rear. The vehicle was equipped with four Dakota Definity tires in size 245/65R17 mounted on OEM 6-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	Tire flat	8 mm (10/32 in)	Tire de-beaded
Left Rear	186 kPa (27 PSI)	7 mm (9/32 in)	None
Right Front	186 kPa (27 PSI)	8 mm (10/32 in)	None
Right Rear	193 kPa (28 PSI)	7 mm (9/32 in)	None

Crash Site

This crash occurred during daylight hours on a 5-lane divided north/south interstate highway (**Figure 2**). The environmental conditions were dry and cloudy. The roadway consisted of five travel lanes that were an estimated 4 m (13.1 ft) in width and bordered by asphalt shoulders. The outboard sides of the shoulders were bordered by W-beam guardrails. The speed limit in the area of the crash was 97 km/h (60 mph). A construction project to resurface the asphalt roadway had started during the time between the date of the crash and the SCI investigation, the number three and four lanes had been resurfaced at the time of the scene inspection. Due to heavy traffic volume and the high travel speed of vehicles on the interstate, the SCI investigator was unable to enter the roadway and conduct a thorough inspection of the crash site. The Crash Schematic is included as **Figure 11** of this report.

Figure 2: Northbound approach to the crash site.

Crash Sequence

Pre-Crash

The restrained 52-year-old male driver of the Jeep was operating his vehicle northbound in lane four of the five-lane interstate highway. The 26-year old female driver of the GMC was operating her vehicle northbound in lane two of the same roadway. Witnesses to the crash reported to the police investigator that the driver of the GMC overcorrected her vehicle to the left during a maneuver to avoid a non-contact vehicle. The GMC departed its lane to the left and approached the Jeep's path of travel.

Crash

The left aspect of the GMC's front plane impacted the forward aspect of the Jeep's right plane (Event 1). This initial impact damaged the right front fender, wheel/suspension, and the front bumper beam of the Jeep. The direction of force to the Jeep was within the 5 o'clock sector with a direction of force within the 12 o'clock sector for the GMC. The Jeep was redirected to the left approximately 10 degrees and the GMC initiated a CCW rotation as it crossed in front of the Jeep. The Damage Algorithm of the WinSMASH program was used to the severity of the crash (delta-V). The total delta-V of Jeep was 12 km/h (7.5 mph). The longitudinal and lateral delta-V components of the Jeep were 10 km/h (6.5 mph) and -6 km/h (-3.7 mph). The delta-V of the GMC was 8 km/h (5 mph) with a longitudinal and lateral component of -8 km/h (-4.9 mph) and -1 km/h (0.9 mph), respectively.

The left side of the GMC was then impacted by the forward right corner area of the Jeep (Event 2). This damage pattern on the Jeep overlapped the initial impact damage. The GMC sustained impact damage to the left rear door and rear quarter panel area. The Missing Vehicle Algorithm of the WinSMASH program was used to calculate a total delta-V of 14 km/h (8.7 mph) for the Jeep and 10 km/h (6.2 mph) for the GMC.

The offset impact and lateral momentum of the GMC induced a CCW yaw to the Jeep on the roadway. **Figure 3** is a northbound trajectory view of the area of the crash. The Jeep rotated approximately 100 degrees CCW and tripped into a right side leading rollover on the roadway. The Jeep rolled two-quarter turns to the right and slid to rest on its roof. The rollover was uninterrupted. The roll distance was unknown. The Jeep came to rest inverted facing south straddling the number four and five lanes on the northbound roadway. The GMC came to rest on the inboard shoulder facing southwestward.

Figure 3: Northbound trajectory view of the area of the initial impact and rollover of the Jeep.

Post-Crash

Police, emergency medical and tow personnel responded to the crash site. The driver of the Jeep sustained police-reported unknown injuries. He declined medical attention in the field. The driver and three passengers of the GMC were transported to a regional trauma center with non-life threatening injuries. The Jeep and the GMC were towed from the scene due to disabling damage. The Jeep was transferred to a regional vehicle salvage facility for auction, where it was inspected. The GMC remained at the local tow yard until it was inspected.

2007 Jeep Patriot

Exterior Damage

The exterior of the Jeep sustained moderate-severity damage to the right and top planes as a result of this multiple impact crash. The forward aspect of the right plane sustained damage as a result of Events 1 and 2 **(Figure 4)**. A crush profile combining the overall residual crush from the overlapping impacts was documented along the length of the right front fender. The direct damage length measured 23 cm (9.1 in) and began 310 cm (122 in) forward of the right rear axle, ending at the right front bumper corner. The maximum crush measured 24 cm (9.4 in) and was located 324 cm (127.5 in) forward of the right rear axle. The combined direct and induced damage length began 216 cm (85 in) forward of the right rear axle and extended forward 117 cm (46.1 in). The crush profile was as follows: C1 = 0 cm, C2 = 1 cm (0.4 in), C3 = 4 cm (1.6 in), C4 = 7 cm (2.8 in), C5 = 13 cm (5.1 in), C6 = 10 cm (3.9 in). The Collision Deformation Classification (CDC) assigned for the Event 1was 05RFEE2. The estimated CDC of Event 2 was 02RF9999.

Figure 4: Initial and secondary impact damage to the Jeep from front right.

As a result of the rollover event, the Jeep sustained moderate-severity damage to the right and top planes. **Figures 5 and 6** depict the rollover damage sustained by the Jeep. The body panels of the right and top planes were abraded by ground contact plane. The abrasions on the roof were oriented longitudinally, indicating the vehicle had continued slid on its top northward after rolling over. The direct contact damage to the roof extended 116 cm (45.7 in) laterally from roof side rail to roof side rail. The longitudinal direct contact damage extended 190 cm (74.8 in) from the windshield header to near the backlight header. The maximum vertical crush was located on the roof, 71 cm (28 in) inboard of the right A-pillar and 6 cm (2.4 in) aft of the windshield header. The maximum vertical crush measured 7 cm (2.8 in). The maximum lateral crush was located on the right roof side rail 8 cm (3.1 in) aft of the windshield header. The maximum lateral crush was 2 cm (0.8 in). The CDC assigned to the rollover was 00TZDO2.

The windshield glazing was 50 percent fractured, with greater damage to the upper aspect of the windshield. There was a 25 cm (9.8 in) laminate tear along the windshield header at the upper left corner of the windshield. The right rear quarter glass in the right rear door, the right rear window adjacent to the cargo area and the front left window disintegrated in the rollover. The right front, right rear door window, left rear door windows, left rear cargo area window and backlight were not damaged in the crash. All doors remained latched during the crash. The right rear door was jammed shut post-crash. The right front, left front, left rear and back hatch all remained operational post-crash. The right front wheel separated from the suspension during the multiple event crash sequence and was the probable source of the tripping mechanism.

Figure 5: Overall view of the damage to the Jeep's top plane.

Figure 6: Rollover damage to the right side of the Jeep from front right.

Interior Damage

The Jeep Patriot sustained moderate-severity interior damage that was attributed to passenger compartment intrusion, occupant contact and deploying air bags. There was a 12 x 11 cm (4.7 x 4.3 in) scuff mark on the driver's door located above the armrest. The mark began at the rear aspect of the door extending forward and upward from the armrest. This scuff was attributed to the driver's left elbow. There was a 7 cm (2.8 in) wide scuff on the left side of the center console that began 7 cm (2.8 in) aft of the console's front edge and extended rearward. This scuff was attributed to the driver's right hip. The steering wheel rim was not deformed but had shifted upward, evidenced by a difference in the gap where the steering wheel met the steering column. This contact was attributed to the driver's hands applying pressure to the steering wheel rim. The vertical intrusion of the roof was uniform across the width of the front row and measured 2 cm (0.8 in).

Manual Restraint Systems

The Jeep Patriot was equipped with 3-point lap and shoulder belts for the five designated seating positions. All systems utilized continuous loop webbing. The driver's belt system utilized a sliding latch plate and a retractor-mounted pretensioner which actuated during the crash. The

front left upper D-ring was height adjustable and found in the full-up position. The driver's belt retracted onto an Emergency Locking Retractor (ELR). The driver was using the safety belt at the time of the crash, which was supported by loading evidence on the belt webbing. This evidence consisted of two frictional abrasions attributed to the D-ring and latch plate. The latch plate abrasion was located 68-71 cm (26.8-28 in) above the lower seat anchor and the D-ring abrasion was located 151-157 cm (59.4 -61.8 in) above the lower seat anchor. Additionally, the retractor pretensioner locked the driver's safety belt in the extended/used position. The total length of spooled out and locked webbing was 191 cm (75.2 in).

The front right and all second row safety belt systems utilized a switchable ELR/Automatic Locking Retractor (ALR) and a sliding latch plate. In addition, the front right belt system utilized a retractor pretensioner. The retractor mounted pretensioner actuated during the crash, pulling the belt webbing taut against the B-pillar.

Frontal Air Bag System

The Jeep Patriot was equipped with a CAC frontal air bag system. The manufacturer of the Jeep certified that the vehicle was compliant to the advanced air bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The CAC system included dual-stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, retractor pretensioners, a front right occupant weight sensor, and safety belt buckle switch sensors. The driver's air bag was concealed within the center hub of the four-spoke steering wheel. The front right passenger's air bag was concealed within the top aspect of the right instrument panel. The frontal air bags did not deploy in this crash.

Side Impact Air Bag System

The Jeep was equipped with roll sensing Inflatable Curtain (IC) air bags. Both IC air bags deployed during the crash. The IC air bags deployed from their respective roof side rails at the on-set of the rollover. The air bags measured 170 cm (66.9 in) in length. At the front and rear seating positions, the IC measured 54 cm (21.3 in) in height. Vertically, the air bags extended 9 cm (3.5 in) below the belt line at each outboard position.

At the front of each curtain was a non-inflating sail panel that measured 29 cm (11.4 in) in height, 33 cm (13 in) along the upper edge and 35 cm (13.8 in) along the lower edge. The air bags were tethered to their respective D-pillars by a 37 cm (14.6 in) long strap. The air bags provided complete longitudinal coverage of the side glazing from the C-pillars to the A-pillars. **Figures 7 and 8** depict the curtain air bags.

The front aspect of the outboard side of the left curtain air bag contained a scuff mark attributed to contact with the front left door. This scuff mark was located 8-20 cm (3.1-7.9 in) above the lower edge of the air bag and 18-38 cm (7.1-15 in) aft of the front edge of the air bag. This was

consistent with a scuff on the upper aspect of the driver's door panel located 4-11 cm (1.6-4.3 in) below the window sill and 14-34 cm (5.5-13.4 in) forward of the rear of the door. The left curtain was free from damage.

The front aspect of the inboard side of the right curtain air bag was covered with numerous drops of soda from an open container at the time of the crash. The residue was located from the front edge of the air bag extending rearward 47 cm (18.5 in). The right curtain was free from occupant contacts or damage.

Figure 7: View of the Jeep's left curtain air bag.

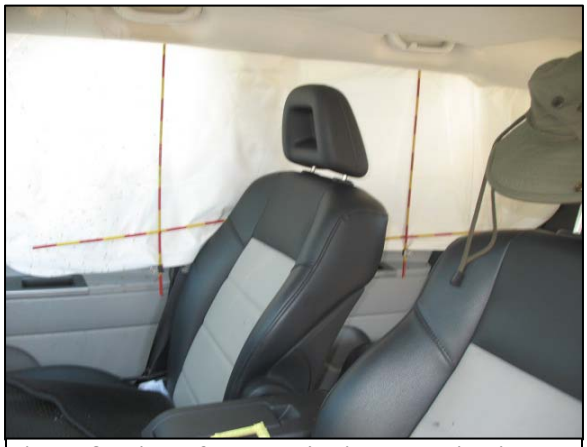


Figure 8: View of the Jeep's right curtain air bag.

2004 GMC Envoy

Exterior Damage

The front and left side of the GMC sustained moderate-severity damage in this multiple impact crash. The direct contact damage from the initial impact measured 44 cm (17.3 in) in width and began 32 cm (12.6 in) left of the vehicle centerline and extended left. The combined direct and induced damage (field L) from the initial impact extended the full width of the front bumper. The maximum crush measured 7 cm (2.8 in) and was located at the front left bumper corner. A crush profile was documented across the front bumper and was as follows: C1 = 7 cm (2.8 in), C2 = 6 cm (2.4 in), C3 = 3 cm (1.2 in), C4 = 1 cm (0.4 in), C5 = 0 cm, C6 = 0 cm. The CDC assigned for this impact was 12FLEW1. The initial impact damage to the GMC is depicted in **Figure 9**.

Figure 9: Initial impact damage to the GMC.

The left side of the GMC sustained moderate damage in the secondary impact. The damaged area began 125 cm (49.2 in) forward of the left rear axle and extended rearward a distance of 219 cm (86.2 in) to the left rear bumper corner **(Figure 10)**. The maximum crush measured 18 cm (7.1 in) and was located at C5, 81 cm (31.9 in) forward of the left rear axle. A crush profile was taken at the lower door level of the GMC and was as follows: C1 = 0 cm, C2 = 6 cm (2.4 in), C3 = 0 cm, C4 = 4 cm (1.6 in), C5 = 18 cm (7.1 in), C6 = 0 cm. The CDC assigned for the secondary impact was 10LZEW2.

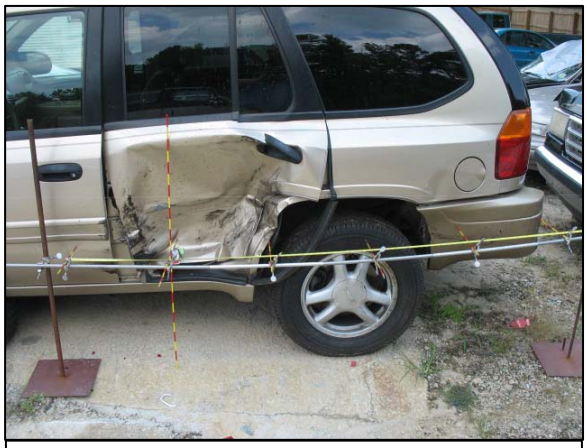


Figure 10: Secondary impact damage to the left side of the GMC.

Event Data Recorder

At the time of the SCI inspection, the EDR in Chevrolet GMC was imaged via the use of the Bosch Crash Data Retrieval tool and software version 3.2. The data was imaged through the Diagnostic Link Connector located under the left instrument panel. The EDR had recorded a Non-Deployment Event that was related to the initial impact (Event 1). The imaged data was reanalyzed with software version 3.51 and is included at the end of this report as Attachment A.

2007 Jeep Patriot Driver Demographics/Data

Driver Age/Sex:	52-year-old/Male
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Full-rear
Manual Safety Belt Use:	Lap and Shoulder Belt
Usage Source:	Vehicle inspection
Egress from Vehicle:	Unknown
Mode of Transport from Scene:	None
Type of Medical Treatment:	Unknown

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Unknown	Unknown	Unknown

Source = Police Report

Driver Kinematics

The 52-year-old male driver of the Jeep was seated in a full-rear track position and was restrained by the manual 3-point lap and shoulder belt system. At impact the emergency mode of the safety belt retractor locked the belt system. The driver responded to the closely spaced impacts of Event 1 and 2 with a lateral and forward trajectory. He loaded the center console with his right flank and the safety belt webbing with his chest and pelvis.

The Jeep was deflected to the left and initiated a CCW rotation. The Jeep then tripped and began a right side leading roll over. The initiation of the rollover event actuated the safety belt pretensioners and deployed the left and right side IC air bags. The vehicle rolled 2-quarter turns about the driver. During the roll event, the driver remained in contact with and continued to load the belt system. The driver's left elbow loaded and scuffed the left door panel.

The vehicle came to rest inverted. The driver was not reported as entrapped within the vehicle. It was unknown how he exited the vehicle. The driver was sustained police-reported unknown injuries. He was not transported from the scene by the first responders. Numerous attempts to contact or locate the driver were unsuccessful. All local and regional hospitals were contacted and no record was found of the driver of the Jeep having been treated in those facilities.

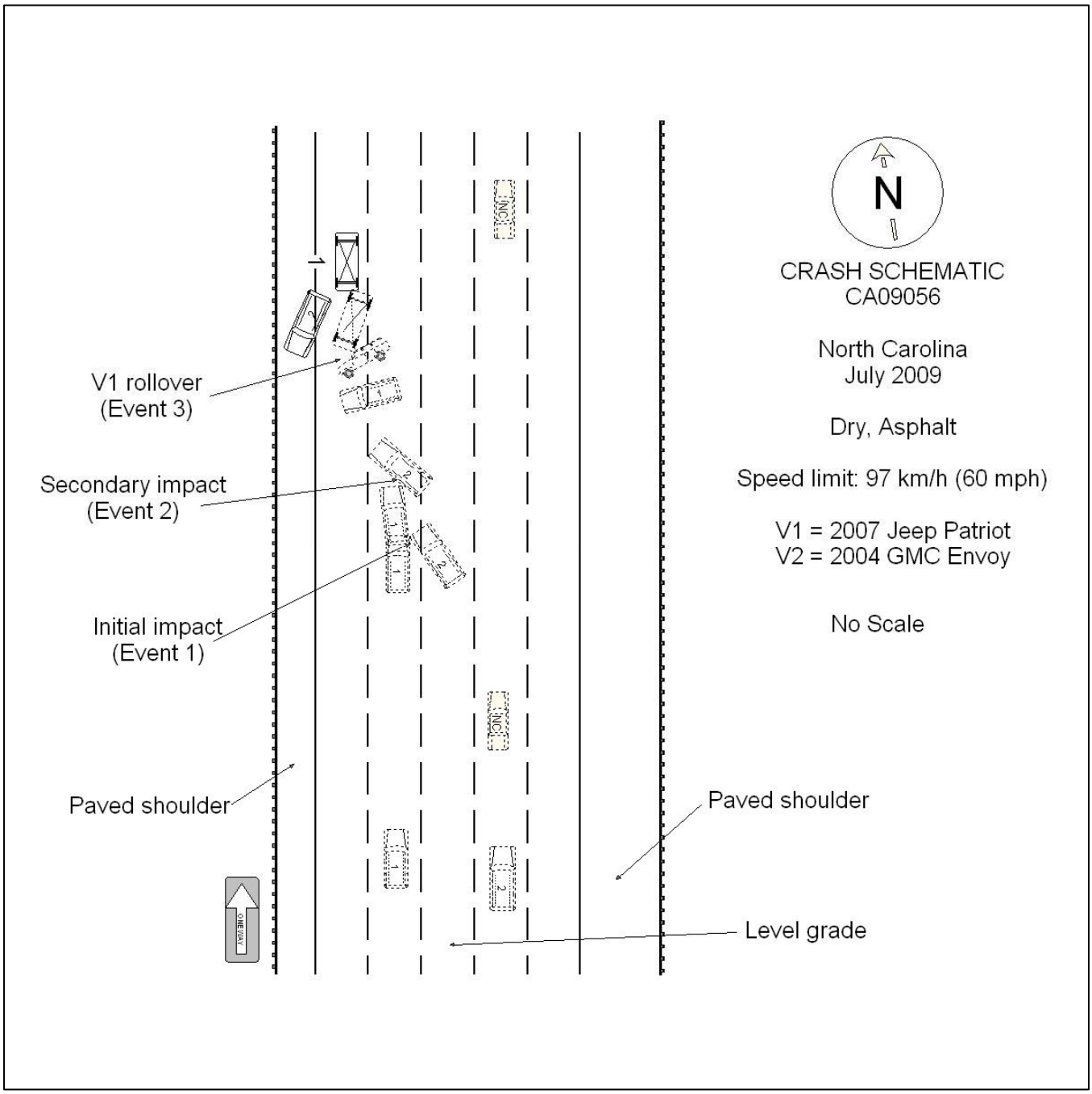


Figure 11: Crash Schematic

ATTACHMENT A:

2004 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	1GKDT13S942******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	
Saved on	
Collected with CDR version	Crash Data Retrieval Tool 3.2
Reported with CDR version	Crash Data Retrieval Tool 3.5.1
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). It contains 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 longitudinal 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 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 multiple Non-Deployment Events occur within five seconds prior to a Deployment Event, then the most severe Non-Deployment Event will be recorded and locked. If multiple Non-Deployment Events precede a Deployment Event, and occur within five seconds of each other (but not necessarily all within five seconds of the Deployment Event), then the most severe of the Non-Deployment Events (which may have occurred more than five seconds prior to the Deployment Event) will be recorded and locked. 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. If multiple Non-Deployment Events occur within five seconds prior to a Deployment Event, and one or more of those events was a Pretensioner Deployment Event, then the most recent Pretensioner Deployment Event will be recorded and locked. 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 can record up to the first 150 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.
-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 present to send the pre-crash data

-Driver's Belt Switch Circuit Status indicates the status of the driver's seat belt switch circuit. If the vehicle's electrical system is compromised during a crash, the state of the Driver's Belt Switch Circuit may be reported other than the actual state.
-The Time Between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than 25.4 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.
-Multiple Events will indicate whether one or more associated events preceded the recorded event.
-Multiple Events Not Recorded can be used in the following senieos:
    -If a single event is recorded, this parameter will indicate whether one or more associated events prior to the recorded event was not recorded due to insufficient record space (because there were more events than there were available event records).
    -If two associated events are recorded, this parameter for the first event will indicate whether one or more associated events prior to the first event was not recorded due to insufficient record space.
    -If two associated events are recorded, this parameter for the second event will indicate whether one or more associated events between the first and second events was not recorded due to insufficient record space.
-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 Belt Switch Circuit is wired directly to the SDM.

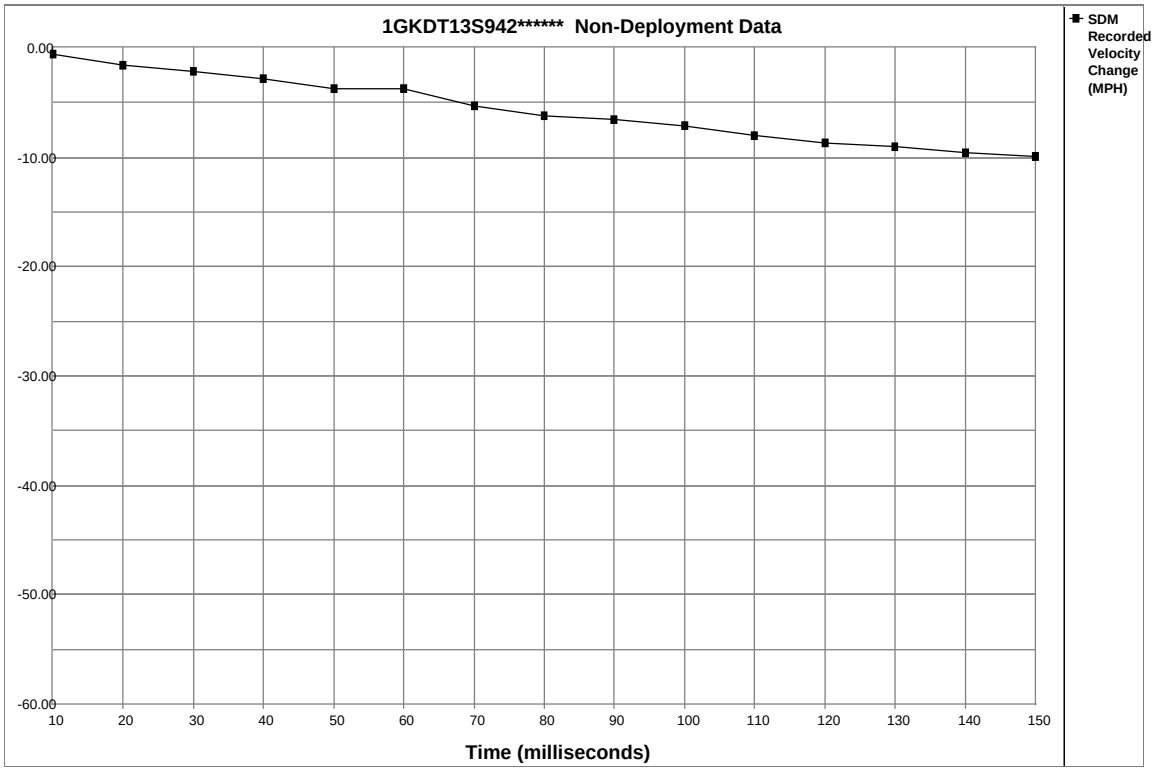
01030_SDMGT-2002_r002

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Non-Deployment	15928
Ignition Cycles At Investigation	15930
Maximum SDM Recorded Velocity Change (MPH)	-12.05
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	232.5
Crash Record Locked	No
Event Recording Complete	Yes
Multiple Events Associated With This Record	Yes
One Or More Associated Events Not Recorded	Yes

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	62	1856	0
-4	57	1856	0
-3	56	1792	10
-2	47	2432	45
-1	21	1216	0

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



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.62	-1.55	-2.17	-2.79	-3.72	-3.72	-5.27	-6.20	-6.51	-7.13	-8.06	-8.68	-8.99	-9.61	-9.92