Child Safety Seat Investigation
Dynamic Science, Inc. / Case Number: DS08008
2001 Jeep Grand Cherokee
California
February 2008

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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 be 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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16. Abstract

This on-site investigation focused on a booster seat that was installed in the second row left position of a 2001 Jeep Grand Cherokee. The Jeep was occupied by an unrestrained 27-year-old female and a 2-year-old female second row left passenger, restrained in the child seat. This two-vehicle crash occurred in February 2008 at 1140 hours in a rural area of California. The Jeep was traveling westbound. The other vehicle was a 2007 Chevrolet Silverado that was being driven by an unrestrained 41-year-old female. The Chevrolet was traveling eastbound and traveled partially onto the south gravel shoulder. The driver of the Chevrolet overcorrected in an attempt to get back in her lane and the vehicle began a counterclockwise rotation. The Chevrolet traveled into the westbound lane of travel. The Chevrolet and the Jeep collided in an angled head-on configuration. The Jeep subsequently struck a barbed wire fence, rolled over onto it left side, and caught fire. Both drivers were fatally injured. The second row left seated child occupant of the Jeep was transported by air to an area trauma center. She sustained a skull fracture, right leg and ankle fractures, a lung contusion, and a concussion. The driver of the Chevrolet was ejected.

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Dynamic Science, Inc.
Crash Investigation
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BACKGROUND

This on-site investigation focused on a forward facing child safety seat (CSS) that was installed in the second row left position of a 2001 Jeep Grand Cherokee (**Figure 1**). The Jeep was occupied by an unrestrained 27-year-old female and a 2-year-old female rear left passenger, restrained in the CSS. This two-vehicle crash occurred in February 2008 at 1140 hours in a rural area of California. The Jeep was traveling westbound. The other vehicle was a 2007 Chevrolet Silverado that was being driven by an unrestrained 41-year-old female (**Figure 2**). The Silverado was traveling eastbound and traveled partially onto the south gravel shoulder. The driver of the Silverado overcorrected in an attempt to get back in her lane. The Chevrolet traveled into the westbound lane of travel. The Chevrolet and the Jeep collided in a head-on configuration. The driver of the Chevrolet was ejected. Both drivers were fatally injured. The second row seated child occupant of the Jeep was transported by air to an area trauma center. She sustained a skull fracture, right leg and ankle fractures, a lung contusion, and a concussion.

Figure 1. 2001 Jeep Grand Cherokee

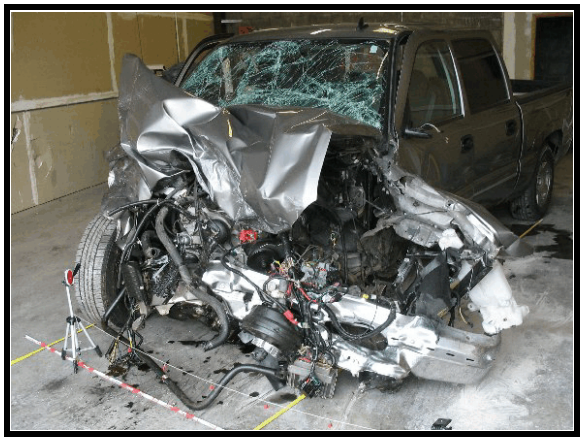


Figure 2. 2007 Chevrolet Silverado

This CSS crash was identified in an online news article. On March 6, 2008, DSI was instructed to locate the vehicle and the CSS. On March 7, 2008, DSI located the vehicle and the CSS. The vehicle was being held at a police impound lot. The CSS was in the possession of the investigating officer. On March 7, 2008, DSI obtained permission to inspect the vehicle and the CSS. The second vehicle in the crash was also inspected and its Event Data Recorder (EDR) was downloaded. The police report had not yet been completed, but a face sheet was obtained. DSI was assigned the case on March 7, 2008. Field work was completed on March 11, 2008. Two of the investigating officers were present during the vehicle and CSS inspections. The complete police report was obtained on November 26, 2008.

SUMMARY

Crash Site

This two-vehicle crash occurred on a two-lane county roadway in February 2008. At the time of the crash, there were no adverse weather conditions and the asphalt roadway surface was dry. The east/west roadway was configured with one lane in each direction that were separated by a double-yellow painted centerline. The road edges were bordered by solid white fog lines followed by gravel

shoulders. The crash occurred on a straight portion of the roadway. There was a left hand curve for the eastbound approach. The posted speed limit was 89 km/h (55 mph). The scene schematic is included as Attachment 1 to this report. A satellite image of the scene is included as Attachment 2.

Figure 3. Approach to area of impact (west)

Figure 4. Approach to area of impact (east)

Pre Crash

The 2001 Jeep Grand Cherokee was traveling westbound at an unknown speed (**Figure 3**). The 2007 Chevrolet Silverado was traveling eastbound (**Figure 4**). The EDR reported the vehicle's speed five seconds prior to impact as 143 km/h (89 mph). As the Silverado entered the left hand curve, the right side tires went off the roadway and onto the gravel shoulder. The driver began steering to the left and braking. The Silverado returned to the roadway and began a counterclockwise rotation. The EDR-reported the speed one second prior to impact as 122 km/h (76 mph). Brake application was based on the EDR pre-crash data, which showed the brake switch status as "on" two seconds prior to impact.

Crash

The right front of the Chevrolet struck the left front of the Jeep. The impact was severe, and resulted in the deployment of the frontal air bags in the Chevrolet and the Jeep. The EDR recorded the velocity change from the Chevrolet as -54 km/h (-33.5 mph), 97.5 milliseconds into the crash. The Damage Only algorithm of the WinSmash program computer the total delta V as 64 km/n (39.7 mph) for the Jeep and 62 km/h (38.5 mph) for the Chevrolet. The longitudinal and lateral components for the Jeep were -60 km/h (-37.2 mph) and 22 km/h (13.6 mph), respectively. The longitudinal and lateral components for the Chevrolet were -40 km/h (-24.8 mph) and -47 km/h (-29.2 mph), respectively.

The Jeep rotated counterclockwise and departed the roadway. The vehicle struck a barbed wire fence, and overturned left side leading, coming to rest off the roadway on its left side. Witnesses reported that the Jeep caught fire near the engine compartment and they were able to throw dirt on the vehicle and put out the fire. The Chevrolet rotated counterclockwise approximately 440 degrees and came to rest on the north side of the roadway facing northwest. The driver of the Chevrolet was ejected through the right front side glass and came to rest north of the roadway.

Post Crash

The driver of the Jeep was fatally injured. She sustained skull fractures, upper and lower extremity fractures, an aortic transection, multiple rib fractures, bilateral lung contusions, and multiple contusions, abrasions, and lacerations. Passersby checked the driver and could not find a pulse. The roof of the Jeep was removed by emergency personnel in order to extricate the driver. The driver was pronounced dead at 1151 hours. The cause of death was attributed to multiple blunt injuries.

The child occupant of the Jeep sustained a skull fracture, a right leg and ankle fracture, a concussion, and a lung contusion. A passerby entered the vehicle through the hatch. She related that she stayed with the child until another passerby who was a nurse entered the vehicle. Emergency personnel arrived shortly after. The child was transported by helicopter to a local trauma center where she was hospitalized for an unknown number of days.

The driver of the Chevrolet was fatally injured. She sustained a partial transection of the brainstem, a partial atlanto-occipital dislocation, a skull fracture, rib contusions and fractures, a spleen laceration, a humerus fracture, and multiple contusions, abrasions, and lacerations. She was pronounced dead at the scene.

Both vehicles were towed from the scene due to damage and were placed on a police hold.

VEHICLE DATA - 2001 Jeep Grand Cherokee

The 2001 Jeep Grand Cherokee 4x4 was identified by the Vehicle Identification Number (VIN):1J4GW48S31Cxxxxxx. The Jeep was a four-door sport utility vehicle that was equipped with a 4.0 liter, 6-cylinder engine, four wheel drive, an automatic transmission, power steering and a tilt steering wheel. The Jeep was configured with Goodyear Wrangler RT/S P255/70R16 tires. The tire manufacturer's maximum tire pressure was 303 kPa (44 psi). The vehicle manufacturer's recommended tire size was P225/75R16. The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	8 mm (10/32 in)	Yes	Torn
LR	207 kPa (30 psi)	9 mm (11/32 in)	No	None
RR	214 kPa (31 psi)	10 mm (12/32 in)	No	None
RF	228 kPa (33 psi)	8 mm (10/32 in)	No	None

The seating in the Jeep Grand Cherokee was configured with front bucket seats with adjustable head restraints and a rear bench seat with folding backs. The driver's seat track position was not known.

Vehicle Damage - 2001 Jeep Grand Cherokee

Exterior Damage

The 2001 Jeep Grand Cherokee sustained severe front end and left side damage as a result of the impact with the Chevrolet Silverado (**Figures 5-6**). The direct damage began at the left front bumper corner and extended laterally 73 cm (28.7 in) along the front end. Six crush measurements were documented at the bumper level as follows: C1 = 95 cm (37.4 in), C2 = 55 cm (21.6 in), C3 = 49 cm (19.3 in), C4 = 28 cm (11.0 in), C5 = 15 cm (5.9 in), C6 = 15 cm (5.9 in). The Collision Deformation Classification (CDC) for the impact with the Silverado was 11FYEW4.

Figure 5. Front left damage to Jeep Cherokee

The direct damage extended from the left bumper corner 224 cm (88.1 in) rearward down the left side plane. The direct damage on the left side began 15 cm (5.9 in) forward of the rear axle. Both left side doors were jammed shut. The left wheelbase was shortened by 87 cm (34.2 in). The left front tire was torn and the rim was fractured (**Figure 7**). The roof was cut off by rescue personnel.

Figure 6. Left side damage to Cherokee

The CDC for the left side rollover was 00LDAO2. The lateral and vertical crush from the rollover was overlapping. The CDC for the fence impact was unknown.

Figure 7. Left front tire/rim damage to Cherokee

Interior Damage - 2001 Jeep Grand Cherokee

The 2001 Jeep Grand Cherokee sustained moderate interior damage as a result of passenger compartment intrusion. There was longitudinal intrusion into the driver's area from the steering wheel, left instrument panel, left kick panel, and the left toe pan. There was lateral intrusion of the left door panel. There was longitudinal intrusion into the second row left seat position from the driver and passenger seat backs. There was left side lateral door panel intrusion into the second row. The distance between the back of the driver's seat and the front of the second row left seat back was 33 cm (12.9 in) (**Figure 8**). There was blood found along the entire left B-pillar. The specific passenger compartment intrusions were documented as follows:

Figure 8. Overhead view of driver's seat back and second row seating

Position	**Intruded Component**	**Magnitude of Intrusion**	**Direction**
Front seat left	Side panel -forward of A pillar	28 cm (11.0 in)	Longitudinal
Front seat left	Toe pan	28 cm (11.0 in)	Longitudinal
Front seat left	Instrument panel	25 cm (9.8in)	Longitudinal
Second seat left	Door panel	18 cm (7.0 in)	Lateral
Second seat left	Seat back	19 cm (7.5 in)	Longitudinal
Front seat left	Door panel	7 cm (2.8 in)	Longitudinal
Front seat left	Steering assembly	>= 15 < 30 cm (>= 5.9 < 11.8 in)	Longitudinal
Front seat left	A-pillar	Unknown	Longitudinal

Manual Restraints - 2001 Jeep Grand Cherokee

The 2001 Jeep Grand Cherokee was configured with 3-point manual lap and shoulder belts for each outboard seating position. All the outboard safety belts were equipped with adjustable D-rings that were in the full up position. The second row center seat was equipped with a lap belt. The driver's safety belt was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). The driver's seat belt was not used and was locked in the stowed position due to damage.

Figure 9. Second row left safety belt latch

The second row left seat safety belt was configured with a light weight locking/cinching latch plate and an ELR (**Figure 9**). The safety belt was being used to secure a forward facing CSS. There was a 25 cm (9.8 in) area of scuffing found on the seat belt webbing that began at the latchplate and extended toward the D-ring as a result of belt loading (**Figure 10**).

Figure 10. Second row left safety belt loading to belt webbing

Supplemental Restraint System - 2001 Jeep Grand Cherokee

The 2001 Jeep Grand Cherokee was equipped with frontal air bags for the driver and front right passenger positions. The frontal air bags deployed as a result of the longitudinal deceleration of the Jeep during the impact with the Chevrolet.

The driver's air bag deployed from the center of the steering wheel hub through H-configuration module cover flaps (**Figure 11**). The top flap measured 11 cm (4.3 in) in height and 17 cm (6.7 in) in width; the bottom flap measured 7 cm (2.8 in) in height and 17 cm (6.7 in) in width. The deployed driver's air bag measured 56 cm (22.0 in) in diameter in its deflated state. The air bag was tethered by a single internal strap. There were no vent ports. There were make-up transfers documented on the upper right quadrant of the air bag face.

The front right passenger's air bag deployed from a mid mount module with a rectangular cover that was hinged at the top aspect (**Figure 12**). The module cover flap measured 40 cm (15.7 in) in width and 18 cm (7.0 in) in height. The deployed front right passenger's air bag measured 64 cm (25.1 in) in width and 40 cm (15.7 in) in height. There was no damage to the air bag or module cover.

Figure 11. Deployed driver's air bag

Figure 12. Deployed front right passenger's air bag

Child Safety Seat

A forward facing Cosco Eddie Bauer High Back Booster CSS was positioned in the left rear of the Jeep (**Figures 13-14**). The model number was 22-859 HML and the date of manufacture was July 30, 2003. The child seat was configured with a five-point harness system and a harness retainer clip. At the time of the CSS inspection, the harness straps were routed through the top set of harness slots. A label on the child seat outlined the recommended use of the seat as follows:

> When used with the internal car seat harness, this CSS was designed for use only by children who weigh between 10 and 18 kg (22 and 40 lbs) and whose height is 74-102 cm (29-40 in) and who are capable of sitting up alone. As a belt positioning seat, this CSS was designed for use only by children who weigh between 13.6 and 36.3 kg (30 and 80 lbs) and whose height is up to 132 cm (52 in) as long as the midpoint of the child's seat is not above the seat back.

Figure 13. Cosco booster seat

There was crazing found along the left seat back and along the base that was a result of contact with the intruding left rear door. The seat was initially pinned in place between the driver's seat back and the front of the left rear seat. During the vehicle inspection, an effort to place the CSS back into the original position was not possible due to the reduced space between the two seat backs.

The CSS was installed in a forward facing orientation and secured by the vehicle's lap and shoulder safety belt. No locking clip was being used. At the time of the vehicle inspection, the safety belt was locked in the used position.

Figure 14. Left side damage to Cosco booster seat

Vehicle Data - 2007 Chevrolet Silverado

The 2007 Chevrolet C1500 Silverado crew pickup was identified by the VIN: 2GCEC13Z171xxxxxx. The Silverado was equipped with a 5.3 liter, 8-cylinder engine, an automatic transmission, rear wheel drive, and front disc/rear drum brakes with 4-wheel ABS and dynamic rear proportioning. The Silverado was configured with Maxxis B760 Bravo H/T P245/70R17 tires. The tire manufacturer's maximum tire pressure was 241 kPa (35 psi). The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	6 mm (8/32 in)	Yes	Holed
LR	193 kPa (28 psi)	7 mm (9/32 in)	None	None
RR	207 kPa (30 psi)	4 mm (5/32 in)	None	None
RF	207 kPa (30 psi)	6 mm (7/32 in)	None	None

The seating in the Silverado was configured with a 40/20/40 split-bench front seat and a 60/40 flip up split-bench rear seat.

Vehicle Damage - 2007 Chevrolet Silverado

Exterior Damage

The Chevrolet Silverado sustained severe front end damage as a result of the impact with the Jeep Grand Cherokee (**Figures 15-16**). The direct damage began at the right front bumper corner and extended laterally 74 cm (29.1 in) across the front end. The entire end structure was shifted to the left 91 cm (35.8 in). There was contact damage to the left fender, hood and grille. The left front tire was holed and restricted. Both front doors were jammed shut. The right front door was bowed outward due to occupant loading from the ejected driver (**Figure 17**). The door/window frame was bowed outward 35 cm (13.8 in) near the B-pillar and 22 cm (8.7 in) near the A-pillar. The windshield was cracked due to impact damage. The front right side window was disintegrated. Six crush measurements were documented at the bumper level as follows: C1 = 100 cm (39.4 in), C2 = 89 cm (35.0 in), C3 = 81 cm (31.9 in), C4 = 64 cm (25.2 in), C5 = 49 cm (19.3 in), C6 = 29 cm (11.4 in). The CDC for the impact with the Jeep Cherokee was 82FZEW3 due to end shift to the left.

Figure 15. Front end damage, Chevrolet Silverado

Figure 16. Side view of front end damage

Figure 17. Front right door outward bowing

Interior Damage

The Chevrolet Silverado sustained moderate interior damage as a result of passenger compartment intrusion and occupant contacts. There was longitudinal intrusion to the left instrument panel and the toe pan (**Figure 18**). There was lateral intrusion to the left kick panel and the left lower door. The folded down center seat back was contacted by the driver and pushed laterally to the right 13 cm (5.1 in) (**Figure 19-20**). As the driver was projected to the right, the driver struck the right interior door and deformed it outward. The driver fractured the right side window glass and was fully ejected from the vehicle.

Figure 18. Left kick panel/toe pan intrusion

Figure 19. Movement of center fold down seat to right

Figure 20. Contact to center fold down seat and right door

Manual Restraints - 2007 Chevrolet Silverado

The Chevrolet Silverado was configured with 3-point manual lap and shoulder belts for each outboard seating position. Both front seat integral safety belts were equipped with pretensioners. The driver's safety belt was equipped with a sliding latch plate and an Emergency Locking Retractor. The driver's safety belt was not used in this crash.

Supplemental Restraint System - 2007 Chevrolet Silverado

The 2007 Chevrolet Silverado was equipped with an advanced occupant protection system. The system consisted of a Sensing and Diagnostic Module (SDM), dual-stage driver and front right passenger air bags, a front right passenger sensing system, and driver's and front right passenger's seat belt latch usage detectors. The system was controlled by the SDM. The primary function of the SDM was to control the deployment of the occupant protection systems. The system records the vehicle's velocity change. For Deployment Events and Deployment Level Events, the SDM will record 100 milliseconds of data after deployment criteria is met and up to 50 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record the first 150 milliseconds after Algorithm Enable (AE). AE, or wakeup, occurs when the control module observes sufficient negative acceleration and begins running a series of steps within its programming.

The Silverado's EDR was downloaded by the SCI investigator and the Vetronix report is included as Attachment 3 at the end of this narrative report.

Two events were recorded by the SDM, a Deployment Event and a Non-Deployment Event. The Deployment Event occurred as a result of the impact with Jeep Grand Cherokee. A Vetronix tool was used to download the data from the SDM. The Vetronix system status at deployment report indicated that:

1. SIR warning lamp status was OFF.
2. The driver's belt switch status was UNBUCKLED.
3. Ignition cycles at deployment 5064.
4. Ignition cycles at investigation 5065.
5. Maximum SDM recorded longitudinal velocity change was -54.2 km/h (-33.74 mph) at 97.5 milliseconds.
6. Driver first stage time AE to deployment command criteria met was 5 milliseconds.
7. Driver second stage time AE to deployment command criteria met was 7.5 milliseconds.
8. The front right air bag as suppressed.
9. Time between non-deployment and deployment events was not recorded.
10. Event recording complete YES.
11. The vehicle speed was 143 km/h (89 mph) five seconds before AE and had decelerated to 122 km/h (76 mph) at 1 second before AE.
12. The brake switch status was OFF from 8 through 3 seconds before AE, and switched on 2-1 seconds prior to impact.

Figure 21. Side view of deployed driver's air bag

Figure 22. Front view of deployed driver's air bag

The Vetronix system status at non deployment report indicated the following:

1. SIR warning lamp status was ON.
2. The driver's belt switch status was UNBUCKLED.
3. The passenger's belt switch status was UNBUCKLED.
4. Ignition cycles at deployment 5064.
5. Ignition cycles at investigation 5065.
6. Maximum SDM recorded longitudinal velocity change was -7.6 km/h (-4.75 mph) at 220 milliseconds.
7. Driver first stage time algorithm enabled to deployment command criteria met
8. Time between non-deployment and deployment events was not recorded.
9. Event recording complete YES.

The driver's air bag deployed during the impact with the Jeep Grand Cherokee (**Figures 21-22**). The front right passenger's air bag was suppressed. The driver's air bag deployed from the center of the steering wheel hub through symmetrical I-configuration module cover flaps. Each flap measured 12 cm (4.7 in) in height and 7 cm (2.8 in) in width. The deployed air bag measured 50 cm (19.7 in) in its deflated state. The air bag was tethered by a single internal strap. There were two circular vent ports on the rear of the air bag. There was no damage to the air bag or the module covers.

OCCUPANT DEMOGRAPHICS - 2001 Jeep Cherokee

	Driver	Second Row Left Occupant
Age/Sex:	27/Female	2/Female
Seated Position:	Front left	Second row left
Seat Type:	Bucket	Bench with folding back
Height:	175 cm (69 in)	Unknown
Weight:	64 kg (140 lbs)	Unknown
Alcohol/Drug Involvement:	None	N/A
Body Posture:	Unknown	Seated in CSS
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt available, not used	Lap and shoulder belt used with child safety seat
Air bag:	Steering wheel mounted frontal air bag, deployed.	N/A

OCCUPANT KINEMATICS

Driver Kinematics

The 27-year-old female driver was seated in an unknown posture and was not restrained by the 3-point manual lap and shoulder belt. This was evidenced by the lap and shoulder belt being locked in the stowed position due to damage. The driver's seat track position was not known. At impact, the frontal air bags deployed. The driver initiated a forward and slightly left trajectory. The driver engaged the deployed air bag and loaded the steering wheel, causing the torso and abdominal injuries. The steering wheel rim was deformed forward. Her head likely contacted the intruding A-pillar, causing the left temporal skull fracture. Both of the driver's knees engaged the knee bolster. Her left torso likely engaged the door side panel.

Second Row Left Occupant Kinematics

The 2-year-old female child was restrained in the High Back Booster CSS by the 5-point harness. The child seat was installed the second row left seat position in the Jeep using the vehicle's lap and shoulder belt. At impact, the child and CSS initiated a forward and slightly left trajectory. She loaded the child seat belt harness, possibly causing a lung contusion. Her head engaged the left B-pillar which intruded laterally, causing the skull fracture and concussion. Her right leg engaged the driver's seat back which intruded longitudinally. The second row seat cushion was compressed longitudinally by the front and rear seat backs. The child was transported by air to an area trauma center and hospitalized.

OCCUPANT INJURIES - 2001 Jeep Cherokee

Driver: Injuries obtained from autopsy report.

Injury	AIS Code	Injury Mechanism	Confidence Level
Open left temporal skull fracture with hinge fracture of skull base	150404.3,2	A-pillar	Probable
Mild to moderate subarachnoid hemorrhage, left cerebral hemisphere, with focal cortical contusion and laceration	140629.4,2	A-pillar	Probable
Lacerations, anterior to left ear	290600.1,2	A-pillar	Probable
Abrasion, anterior right temple, 1 cm x 0.5 cm	290202.1,1	Unknown	Unknown
Abrasion, below left ear lobe	290202.1,2	A-pillar	Probable
Abrasion, center and left side of chin, 4 cm x 1.5 cm	290202.1,8	Air bag	Probable
Abrasion, forehead	290202.1,7	Air bag	Probable
Contusion, forehead	290402.1,7	Air bag	Probable
Rib fractures: right anterior, 3rd through 7th, right posterior-lateral, 8th and 9th	450230.3,1	Steering wheel rim	Probable
Bilateral pulmonary contusions, with bilateral hemothoraces	441410.4,3	Steering wheel rim	Probable
Transection of distal aortic arch	420208.4,4	Steering wheel rim	Probable
Mild hemopericardium	441604.3,4	Steering wheel rim	Probable
Liver laceration	541820.2,1	Steering wheel rim	Probable
Spleen laceration	544220.2,2	Steering wheel rim	Probable
Sigmoid mesocolon laceration (coded as mesentery laceration)	542020.2,8	Steering wheel rim	Probable
Right pubic pelvic fracture	852600.2,1	Instrument panel	Possible
Open fracture, right forearm	751900.2,1	Instrument panel	Possible

Closed fracture, right femur	851800.3,1	Lower instrument panel	Probable
Closed fracture, right tibia-fibula	853404.2,1 851605.2,1	Toe pan	Probable
Open fracture, left ankle	850299.1,2	Toe pan	Probable
Open tibia fibula fracture, left	853405.3,2 851605.2,2	Toe pan	Probable
Bilateral abrasion, breasts	490202.1,3	Driver air bag	Probable
Abrasions, abdomen	590202.1,9	Driver air bag	Probable
Contusion, right 2nd, 3rd and 4th fingers, right hand	790402.1,1	Instrument panel	Possible
Contusions, right and right elbows	790402.1,3	Unknown	Unknown
Abrasions, dorsal surface of left forearm, left shoulder	790202.1,2	Unknown	Unknown
Abrasion, posterior left shoulder	790202.1,2	Seat back	Possible
Contusion, left foot, ankle, shin	890402.1,2	Kick panel	Probable
Abrasions, right and left knees	890202.1,3	Instrument panel	Certain
Contusion left knee	890402.1,2	Instrument panel	Certain
Abrasion, right ankle	890202.1,1	Unknown	Unknown
Contusions/abrasions right thigh	890202.1,1 890402.1,1	Center console	Probable

Second Row Left Occupant: Injuries obtained from police report.

Injury	AIS Code	Injury Mechanism	Confidence Level
Skull fracture	150400.2,9	B-pillar	Possible
Fracture, right leg	852002.2,1	Driver seat back	Probable
Fracture, right ankle	852002.2,1	Driver seat back	Probable
Concussion	115099.7,0	B-pillar	Possible
Lung contusion	441499.3,9	CSS webbing	Probable

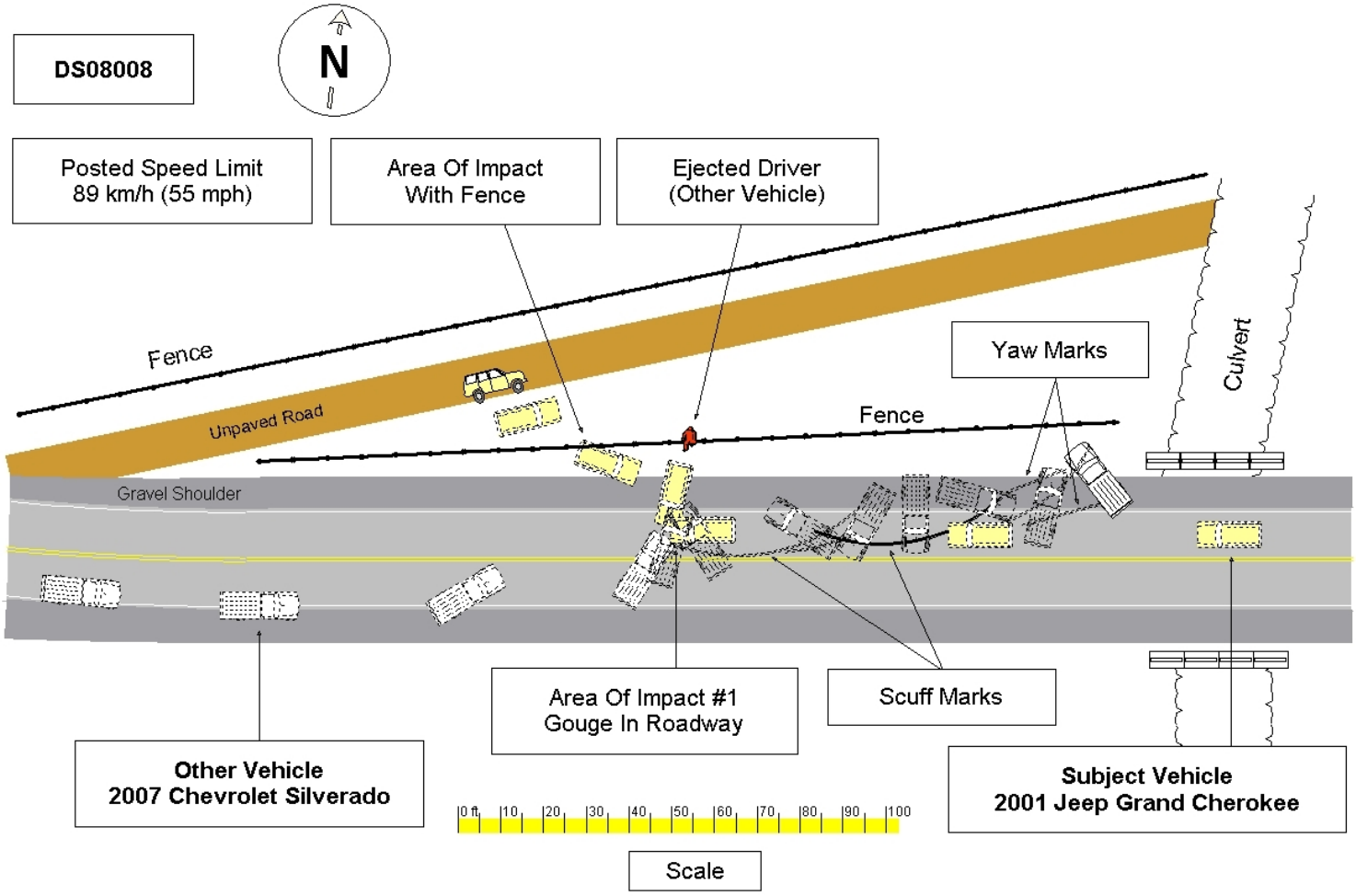
OCCUPANT INJURIES - 2007 Chevrolet Silverado

Driver: Injuries obtained from autopsy report.

Injury	AIS Code	Injury Mechanism	Confidence Level
Right frontal subgaleal hemorrhage	190401.1,1	Door panel	Probable
Moderate subdural and subarachnoid hemorrhages of the cerebrum	140652.4,1 140884.3,1 140678.4,1	Door panel	Possible
Partial transection, brainstem, at mid brain level	140212.6,8	Door panel	Probable
Partial atlanto occipital dislocation	650204.2,6	Door panel	Probable
Focal basal skull fracture, right petrous ridge	150200.3,8	Door panel	Probable
Multiple rib contusions, left	450202.1,2	Ground	Possible
Rib fracture, right, 10th and 11th	450220.2,1	Door panel	Probable
Spleen laceration	544220.2,2	Ground	Possible
Moderate hemoperitoneum	543800.3,8	Unknown	Unknown
Fracture, left humerus, closed	752602.2,2	Ground	Possible
Laceration, right frontal scalp, 7 cm (2.8 in)	190602.1,1	Side window	Possible

Laceration, lateral corner right orbital area, 3.5 cm (1.4 in)	290602.1,1	Side window	Possible
Abrasion, right cheek, 2 cm (0.8 in)	290202.1,1	Window frame	Probable
Contusion, right lower face, 1.5 x 1 cm (0.6 x 0.4 in)	290402.1,1	Window frame	Probable
Abrasion, right upper neck, 1.5 cm (0.6 in)	390202.1,1	Unknown	Unknown
Abrasions, left abdomen, 7 x 6 cm (2.8 x 2.4 in)	590202.1,2	Ground	Probable
Abrasions, right lower back to posterior right hip, 25 cm in length and 4 cm in average width	890202.1,1	Door panel	Probable
Abrasion, right forearm and shoulder	790202.1,1	Door panel	Probable
Contusion, left upper arm, 11 x 5.5 cm (4.3 x 2.2 in)	790402.1,2	Ground	Probable
Abrasion, left shoulder, upper arm, and hand	790202.1,2	Ground	Probable
Lacerations, left upper arm, elbow, and left hand	790600.1,2	Ground	Probable
Contusion, right thigh, 6 x 8 cm (2.4 x 3.1 in)	890402.1,1	Center console	Certain
Abrasion, right knee	890202.1,1	Unknown	Unknown
Contusion, right shin, 10 x 7 cm (3.9 x 2.8 in)	890402.1,1	Ground	Probable
Laceration, left knee	890600.1,2	Ground	Probable
Abrasions, left lateral ankle	890202.1,2	Foot control	Probable

Attachment 1. Scene Diagram



Attachment 2. Satellite Image of Scene

Attachment 3. Vetronix Report

CDR File Information

Vehicle Identification Number	2GCEC13Z171******
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	08008 W O VIN.CDR
Saved on	Tuesday, March 11 2008 at 08:08:54 AM
Collected with CDR version	Crash Data Retrieval Tool 2.900
Reported with CDR version	Crash Data Retrieval Tool 2.900
Event(s) recovered	Deployment Non-Deployment

SDM Data Limitations

SDM Recorded Crash Events:
There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to 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 forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.
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 25.4 seconds of one another. Deployment Events cannot be overwritten or cleared from the SDM. Once the SDM has deployed the air bag, the SDM must be replaced.
The data in the Non-Deployment Event file will be locked after a Deployment Event, if the Non-Deployment Event occurred within 5 seconds before the Deployment Event. If multiple Non-Deployment Events occur within 5 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 multiple Non-Deployment Events occur within 5 seconds of each other (but not necessarily all within 5 seconds of the Deployment Event), and subsequent Non-Deployment Events are less severe than prior Non-Deployment Events, and the last of the multiple Non-Deployment Events occurs within 5 seconds of a Deployment Event, then the most severe of the Non-Deployment Events (which may have occurred more than 5 seconds prior to the Deployment Event) will be recorded and locked.

SDM Data Limitations:
-SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Forward 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. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change. For Deployment Events and Deployment Level Events, the SDM will record 100 milliseconds of data after deployment criteria is met and up to 50 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record the first 150 milliseconds of data after algorithm enable.
-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 if the vehicle has had the tire size or the final drive axle ratio changed from the factory build specifications.
-Brake Switch Circuit Status indicates the status of the brake switch circuit.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if the SDM receive an invalid message from the module sending the pre-crash data.
-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. If the vehicle's electrical system is compromised during a crash, the state of the Belt Switch Circuit may be reported other than the actual state.
-The Time Between Non-Deployment and 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 Associated with this Record: This parameter will indicate whether one or more associated events preceded the recorded event.
-One or More Associated Events Not Recorded: If a single event is recorded, this parameter will indicate whether one or more associated events, prior to the recorded event, was not recorded.
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.
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.

SDM 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 once a second by the Powertrain Control Module (PCM), via the vehicle's communication network, to the SDM.
-Brake Switch Circuit Status data is transmitted once a second by either the ABS module or the PCM, via the vehicle's

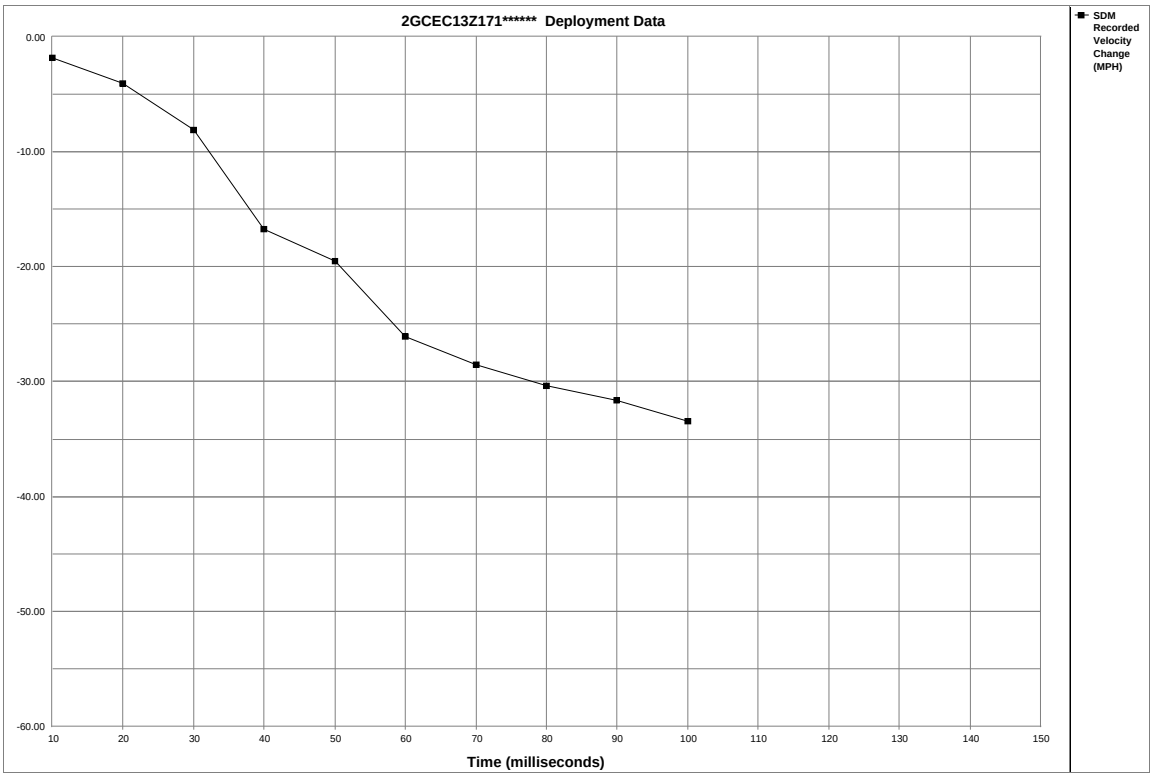
communication network, to the SDM.
-The SDM may obtain Belt Switch Circuit Status data a number of different ways, depending on the vehicle architecture. Some switches are wired directly to the SDM, while others may obtain the data from various vehicle control modules, via the vehicle's communication network.

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Passenger Seat Position Switch Circuit Status	Rearward
Ignition Cycles At Deployment	5064
Ignition Cycles At Investigation	5065
Maximum SDM Recorded Velocity Change (MPH)	-33.74
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	97.5
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	5
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	7.5
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
Time Between Non-Deployment And Deployment Events (sec)	N/A
Frontal Deployment Level Event Counter	1
Event Recording Complete	Yes
Multiple Events Associated With This Record	No
One Or More Associated Events Not Recorded	No

Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle
-5	89	2240	40
-4	89	2240	40
-3	89	2240	28
-2	85	2176	0
-1	76	1728	0

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



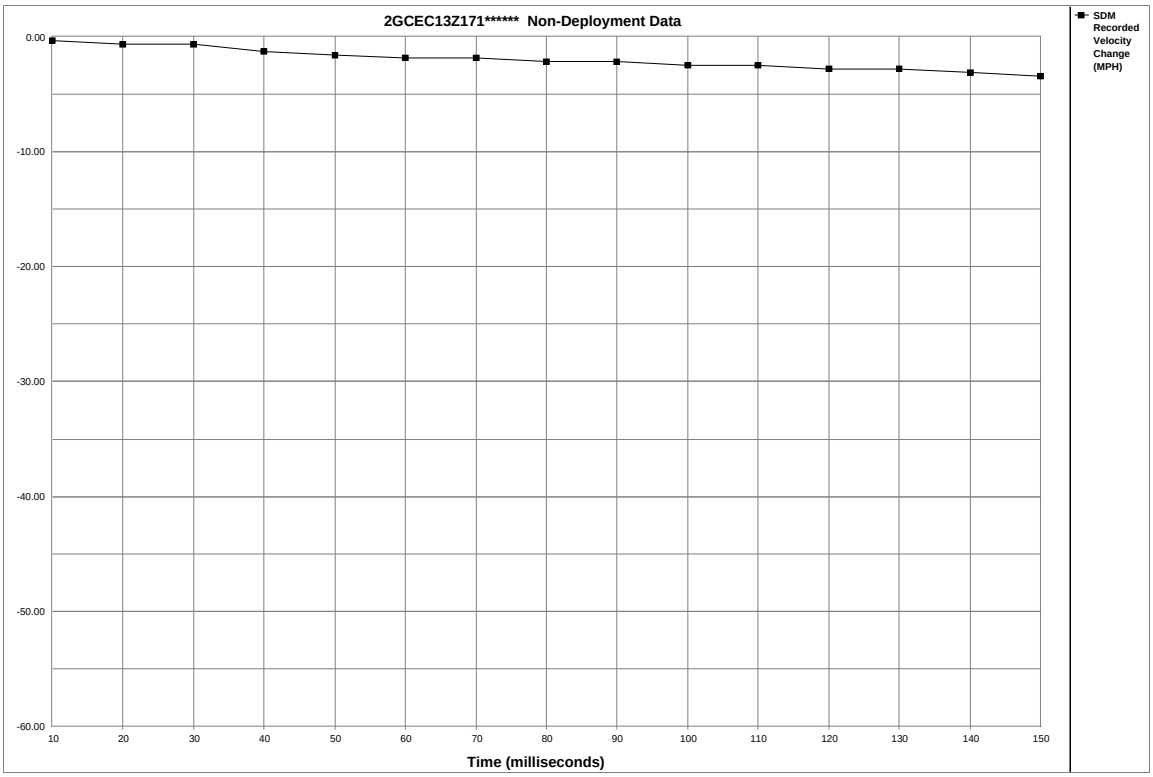
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-1.86	-4.03	-8.06	-16.74	-19.53	-26.04	-28.52	-30.38	-31.62	-33.48	N/A	N/A	N/A	N/A	N/A

System Status At Non-Deployment

SIR Warning Lamp Status	ON
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Passenger Seat Position Switch Circuit Status	Rearward
Ignition Cycles At Non-Deployment	5064
Ignition Cycles At Investigation	5065
Maximum SDM Recorded Velocity Change (MPH)	-4.75
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	220
Crash Record Locked	No
Event Recording Complete	No
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	89	2240	40
-4	89	2240	40
-3	89	2240	28
-2	85	2176	0
-1	76	1728	0

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



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.31	-0.62	-0.62	-1.24	-1.55	-1.86	-1.86	-2.17	-2.17	-2.48	-2.48	-2.79	-2.79	-3.10	-3.41