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ON-SITE ROLLOVER INVESTIGATION

CASE NUMBER - IN08039
LOCATION - MICHIGAN
VEHICLE - 2008 CHEVROLET K1500 SILVERADO Z71 4X4 CREW CAB
CRASH DATE - September 2009

Submitted:

June 16, 2009

Contract Number: DTNH22-07-C-00044

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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.

Technical Report Documentation Page

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15. *Supplementary Notes* On-Site Rollover Investigation involving a 2008 Chevrolet K1500 Silverado Z71 4x4 Crew Cab.			
16. *Abstract* This report covers an on-site Rollover Investigation that involved a 2008 Chevrolet K1500 Silverado Z71 4x4 Crew Cab, which rolled over on the roadway. The focus of this investigation was the Chevrolet's rollover. The Chevrolet was traveling south and was occupied by a restrained 23-year-old male driver. The vehicle departed the right side of the roadway and the driver initiated a left steering maneuver. The vehicle reentered the roadway and the driver steered right. The vehicle rotated clockwise and rolled over left side leading on the roadway. There was insufficient evidence to determine the distance traversed during the rollover or the total number of quarter turns. The driver sustained a police reported B (non-incapacitating) injury and was transported by ambulance to a hospital. The police reported hospital had no record of treatment for the driver, and his injuries and treatment status could not be determined.			
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The focus of this on-site investigation was the rollover of a 2008 Chevrolet K1500 Silverado Z71 4x4 Crew Cab pickup truck. This crash was brought to National Highway Traffic Safety Administration's attention on October 17, 2008 by the sampling activities of the National Automotive Sampling System-General Estimates System. This investigation was assigned on October 29, 2008. This crash involved a 2008 Chevrolet K1500 Silverado Z71 4x4 Crew Cab pickup truck (**Figure 1**), which rolled over on the roadway. The crash occurred in September 2008, at 1632 hours, in Michigan and was investigated by the Michigan State Police. This contractor inspected the crash scene on October 29 and 30, 2008, and inspected the Chevrolet on October 30, 2008. The driver was not at home when an in-person interview was attempted and would not return calls. This report is based on the police crash report, scene and Chevrolet inspections, inspection of an exemplar vehicle, an interview with the investigating police officer and tow truck operator, occupant kinematic principles, and this contractor's evaluation of the evidence.

Figure 1: The damaged 2008 Chevrolet K1500 Silverado Z71 4x4 Crew Cab pickup truck

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the Chevrolet was traveling was a 2-lane, undivided, county roadway, traversing in a north-south direction. The roadway had one travel lane in each direction and was bordered by gravel and grass shoulders. Each travel lane was 3.3 m (10.8 ft) in width. The east and west shoulders were 2 m (6.6 ft) and 1.4 m (4.5 ft) in width, respectively. The roadway surface was level bituminous and the speed limit was 88 km/h (55 mph). At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the roadway was dry. Traffic density was light and the site of the crash was rural.

Pre-Crash: The Chevrolet was traveling south (**Figure 2**) and was occupied by a restrained 23-year-old male driver. The police crash report indicated that the driver had been consuming alcoholic beverages and his blood alcohol test result was 0.06. It is not known if the driver took any actions to avoid the crash.

Figure 2: Approach of the Chevrolet southbound to area of the rollover

Crash: The police crash report stated that as the vehicle traveled south it departed the west (right) side of the roadway. The driver initiated a left steering maneuver and the vehicle reentered the roadway. The driver steered right and the vehicle began to rotate clockwise. While the vehicle was

equipped with Electronic Stability Control (ESC), the driver was unable to regain control of the vehicle and it rolled over on the roadway. The direction that abrasions were formed on the damaged vehicle components (**Figures 3** and **4**) indicated that it rolled over with the left side leading. There was insufficient evidence at the crash scene to determine the area of rollover initiation, and an estimation of the number of quarter turns that occurred during the rollover could not be determined. Based on the police crash schematic, the vehicle came to final rest on its top in the center of the roadway heading southwest.

Figure 3: Front to rear view of top of right front door; arrow shows direction abrasions were formed

Figure 4: Arrow shows direction that abrasions were formed on the left side of the truck bed based on displacement of the bed liner material; view from back

Post-Crash: The police and emergency medical services were notified and responded to the crash scene. The driver was transported by ambulance to a hospital and the vehicle was towed from the crash scene due to damage.

ROLLOVER DISCUSSION

The Chevrolet was equipped with ESC, but was not equipped with a rollover sensor or side curtain air bags. The NHTSA has given the vehicle a four star rollover rating on a five star scale and a Static Stability Factor (SSF) of 1.20[1]. A four star rating indicates that the vehicle has a 10%-20% chance of a rollover when involved in a single vehicle crash. The specific chance of rollover for this vehicle model was given as 18%. The SSF is a calculation based on the vehicle's track width and height of its center of gravity. The result of the calculation is a measure of a vehicle's resistence to rollover. A higher SSF indicates a more stable vehicle. Most passenger vehicles have an SSF of 1.30 to 1.50[2]. The tested vehicle also did not tip-up during the dynamic steering maneuver test in which the test vehicle is put through a fish-hook shaped steering maneuver (i.e., hard left and hard right steer) at between 56 km/h-80km/h (35-50 mph).

In this crash, following a right side roadway departure to a gravel and grass shoulder, the Chevrolet's driver initiated a left steering maneuver and the vehicle reentered the roadway. He then apparently steered hard right, which caused the vehicle to rotate clockwise. This was supported by the tow truck operator's statement that yaw marks were visible on the roadway,

[1] www.safercar.gov, 6/10/09

[2] "Trends in the Static Stability Factor of Passenger Cars, Light Trucks, and Vans", NHTSA Technical Report, DOT HS 809 868, June 2005

though they had disappeared by the time the crash scene inspection was conducted. While the vehicle was equipped with ESC, the rotation was apparently significant and the driver did not regain control of the vehicle. As the vehicle rotated clockwise the friction force between the roadway surface and the left side tires induced a roll moment and the vehicle rolled over, left side leading. There was insufficient evidence to determine the location of rollover initiation, total number of quarter turns, or the distance traversed during the rollover. However, a series of four gouge marks were found on the roadway that indicated the probable area of the final rest position. The close proximity of the gouge marks to each other indicated that they were probably formed during the final phase of the rollover as the vehicle was approaching the final rest position. The distance between two of the gouge marks and their curved shape indicated that they were probably formed due to loading by wheel rims. The extent of bituminous material deposited on the left front and left rear wheel rims indicated that the gouges were probably formed by the left side wheels. Please see the crash diagram on page 7 of this report.

CASE VEHICLE

The 2008 Chevrolet K1500 Silverado Z71 was a 4-wheel drive, 4-door, crew cab pickup truck VIN: 3GCEK13388G------) equipped with a 5.3L, V8 engine, automatic transmission, ESC, traction control, 4-wheel anti-lock brakes, a tire pressure monitoring system, and an Event Data Recorder (EDR). The front row was equipped with bucket seats, manual head restraints, dual stage driver and front right passenger frontal air bags, and lap-and-shoulder belts with adjustable upper anchors. The second row was equipped with a split bench seat with folding seat cushion, adjustable head restraints in the outboard seating positions, and lap-and-shoulder belts in all three seating positions. The second row was also equipped with Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions. The vehicle's specified wheelbase was 365 cm (143.7 in).

CASE VEHICLE DAMAGE

Exterior Damage: The damage from the rollover (**Figures 1** and **5**) involved the Chevrolet's top plane and both side planes. The direct damage involved the hood, roof, windshield, fenders, doors and the truck bed on both sides of the vehicle. The direct damage on the left side began 97 cm (38.2 in) rear of the left rear axle and extended 496 cm (195.3 in) forward. The direct damage on the top began 77 cm (30.3 in) forward of the right front axle and extended 340 cm (133.9 in) rearward and involved the full width of the roof, 116 cm (45.6 in). There was also a small area of direct damage on the top left corner at the back of the truck bed. The maximum vertical and lateral crush occurred on the left A-pillar (**Figure 6**) and were 21 cm (8.3 in) and 19 cm (7.7 inches), respectively. The induced damage involved the roof, truck bed, back bumper, and the

Figure 5: Front right view of the damage Chevrolet

left and right side doors. The right side wheelbase was reduced 12 cm (4.7 in) while the left side wheelbase was extended 2 cm (0.8 in).

Figure 6: The maximum vertical and lateral crush occurred on the left A-pillar

Damage Classification: The Collision Deformation Classification for the rollover damage was **00-TDDO-3**. The severity of the rollover damage was moderate based on the extent of the roof crush.

The manufacturer's recommended tire size was P265/65R18 and the vehicle was equipped with tires of this size. The Chevrolet's tire data are shown in the table below.

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	221	32	241	35	9	11	Abrasion on sidewall	No	No
LR	234	34	241	35	8	10	Abrasion on sidewall	No	No
RR	76	11	241	35	8	10	Abrasion on sidewall	No	Yes
RF	214	31	241	35	9	11	Abrasion on sidewall	No	No

Vehicle Interior: Inspection of the Chevrolet's interior revealed a 15 x 12 cm (5.9 x 4.7 in) area of scuffing on the roof above and to the right of the driver's seat (**Figure 7**), which was probably the result of loading by the driver's head. There was also a scuff mark that extended 72 cm (28.3 in) across the roof from the roof console to the front right seating area (**Figure 8**). There were fluid stains within and adjacent to this area of scuffing that appeared to be from a spilled drink. The vehicle's right rear door was jammed shut and the other doors remained closed and operational. All the vehicle's window glazing were either closed or fixed. The left front, left rear, right front, and backlight glazing were disintegrated due to impact forces. The windshield glazing was in place and cracked by impact forces. The glazing

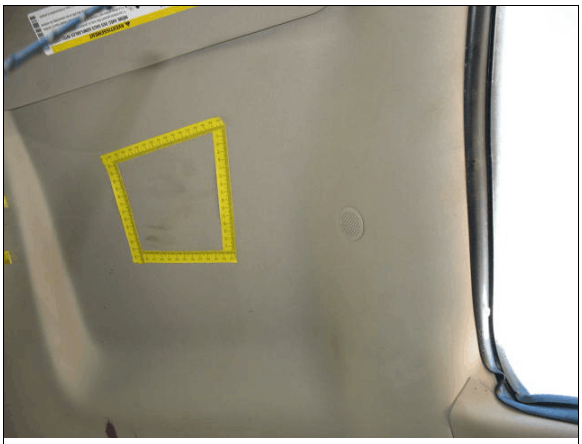


Figure 7: Area of scuffing on the roof above the driver's seat; photo taken from driver's seat cushion

had sagged due to the passage of time and the laminate separated along approximately half of the windshield header.

The Chevrolet sustained 15 intrusions into the passenger compartment. The most severe intrusions into the driver's occupant space (**Figure 8**) all occurred along the vertical axis and involved the left A-pillar, roof, windshield header, and the left roof side rail. The A-pillar and roof intruded 22 cm (8.7 in) while the windshield header and roof side rail intruded 21 cm (8.3 in) and 19 cm (7.5 in), respectively.

Figure 8: Intrusion into front row and scuff marks on roof (highlighted in yellow tape)

EVENT DATA RECORDER

The Chevrolet's EDR was imaged with version 3.0 of the Bosch Crash Data Retrieval tool via connection to the diagnostic link connector. The EDR file was subsequently read using version 3.2. The EDR recorded a non-deployment event. The data indicated that an event followed the recorded event and one associated event was not recorded.

The EDR recorded the SIR warning lamp as off and the driver's seat belt switch circuit as buckled. The driver's seat position switch circuit was recorded as rearward and the driver's pretensioner was not commanded to actuate consistent with the non-deployment of the driver's frontal air bag. The maximum recorded velocity change was reported on page 4 of the EDR report as 8.46 km\h (5.26 mph) occurring 80 msec following AE. The EDR report indicated that the recorded pre-crash data was not associated with the recorded event. The EDR report is attached at the end of this report[3].

AUTOMATIC RESTRAINT SYSTEM

The Chevrolet was equipped with a frontal air bag system that was certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The system consisted of dual stage driver and front right passenger frontal air bags, an occupant weight sensor for the front right passenger seating position, seat belt buckle switch sensors, driver seat position sensor, and retractor mounted pretensioners. Neither of the front air bags deployed in this crash. The frontal air bag system is not designed to deploy during a rollover crash. The vehicle was not equipped with front seat back-mounted side impact air bags or side curtain air bags.

[3]Pages 7-10 of the EDR report have been deleted for confidentiality purposes.

The Chevrolet was equipped with lap-and-shoulder belts for the driver and front right passenger seating positions and a lap belt for the center seating position. The second row was equipped with lap-and-shoulder belts for all three seating positions. The driver's seat belt consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), sliding latch plate, and an adjustable upper anchor that was adjusted to the middle position. The front right seat belt was equipped with a switchable ELR/Automatic Locking Retractor (ALR), sliding latch plate, and adjustable upper anchor that was located in the full-down position. The front center seat belt was equipped with a locking latch plate. The driver and front right seat belts were equipped with retractor-mounted pretensioners and neither pretensioner actuated in this crash. The second row seat belts consisted of continuous loop belt webbing, switchable ELR/ALRs, sliding latch plates and fixed upper anchors.

The inspection of the driver's seat belt system revealed no evidence of loading. There were, however, historical usage scratch marks on the latch plate. The EDR recorded the driver's seat belt circuit switch as buckled. While there was no physical evidence on the restraint system to substantiate restraint usage by the driver, the available information indicated that the driver was probably restrained. The remaining seat positions were unoccupied.

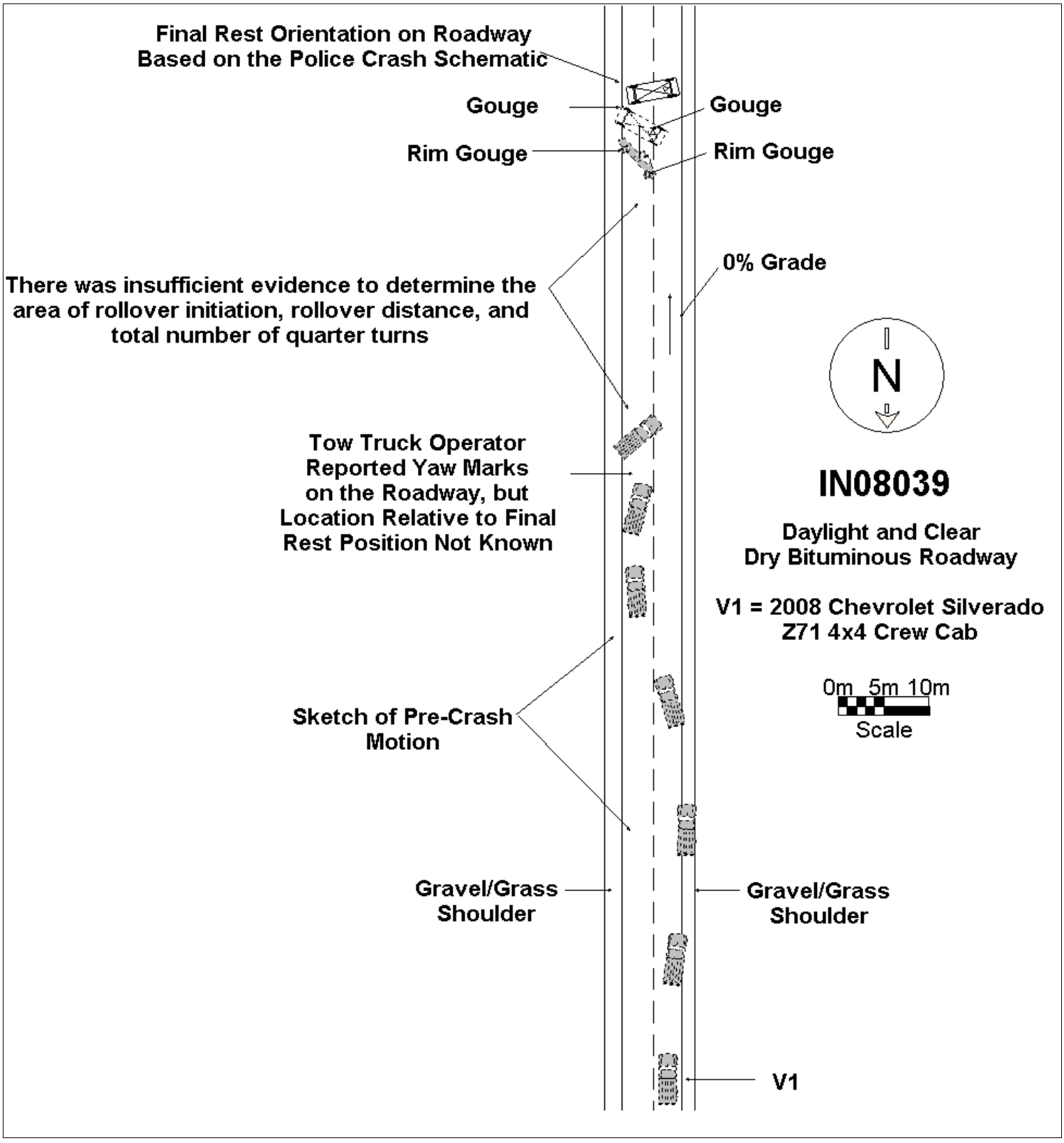
CASE VEHICLE DRIVER KINEMATICS

The Chevrolet's driver [23-year-old, male (unknown height and weight)] was seated in an unknown posture. At the time of the inspection, the driver's seat track was located between the middle and rear-most positions, 15 cm (5.9 in) rear of the full-forward position, and the seat back was slightly reclined. The tilt steering column was located in the full-down position.

Occupant kinematic principles indicate that as the vehicle rolled over, the driver was displaced toward the roof within his seat belt. The occupant contact scuff mark on the roof above the driver's seat indicated that the driver probably loaded his head on the intruding roof structure during the rollover.

CASE VEHICLE DRIVER INJURIES

The driver sustained a police reported B (non-incapacitating) injury and was transported by ambulance to a hospital. The police reported treating hospital had no record of treatment for the driver, and his injuries and treatment status could not be determined.


Final Rest Orientation on Roadway
Based on the Police Crash Schematic
Gouge
Gouge
Rim Gouge
Rim Gouge
0% Grade
There was insufficient evidence to determine the area of rollover initiation, rollover distance, and total number of quarter turns
N
Tow Truck Operator Reported Yaw Marks on the Roadway, but Location Relative to Final Rest Position Not Known
IN08039
Daylight and Clear
Dry Bituminous Roadway
V1 = 2008 Chevrolet Silverado Z71 4x4 Crew Cab
0m 5m 10m
Scale
Sketch of Pre-Crash Motion
Gravel/Grass Shoulder
Gravel/Grass Shoulder
V1

CDR File Information

User Entered VIN	3GCEK13388G******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN08039EDR.CDR
Saved on	Thursday, October 30 2008 at 08:36:08 AM
Collected with CDR version	Crash Data Retrieval Tool 3.00
Reported with CDR version	Crash Data Retrieval Tool 3.2
EDR Device Type	airbag control module
Event(s) recovered	Non-Deployment

IMPORTANT NOTICE: Robert Bosch LLC recommends that the latest production release of Crash Data Retrieval software be utilized when viewing, printing or exporting any retrieved data from within the CDR program. This ensures that the retrieved data has been translated using the most recent information including but not limited to that which was provided by the manufacturers of the vehicles supported in this product.

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

Data:

-SDM Recorded Vehicle Velocity Change reflects the change in velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. For Deployment Events, the SDM will record 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM can record up to the first 300 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.
-Maximum Recorded Vehicle Velocity Change is the maximum square root value of the sum of the squares for the vehicle's combined "X" and "Y" axis change in velocity.
-Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.
-SDM Recorded Vehicle Speed accuracy can be affected by various factors, including but not limited to the following:
    -significant changes in the tire's rolling radius
    -final drive axle ratio changes
    -wheel lockup and wheel slip
-Brake Switch Circuit Status indicates the open/closed state of the brake switch circuit.
-Pre-Crash data is recorded asynchronously.
-Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if:
    -the SDM receives a message with an "invalid" flag from the module sending the pre-crash data
    -no data is received from the module sending the pre-crash data
    -no module is present to send the pre-crash data
-Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit.

-The Time Between Non-Deployment to Deployment Events is displayed in seconds. If the time between the two events is greater than five seconds, “N/A” is displayed in place of the time. If the value is negative, then the Deployment Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition cycle counter.
-All data should be examined in conjunction with other available physical evidence from the vehicle and scene

Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle’s communication network.
-The Belt Switch Circuit is wired directly to the SDM.

Multiple Event Data

Associated Events Not Recorded	1
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)	Yes
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	Yes

System Status At AE

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

Pre-crash data

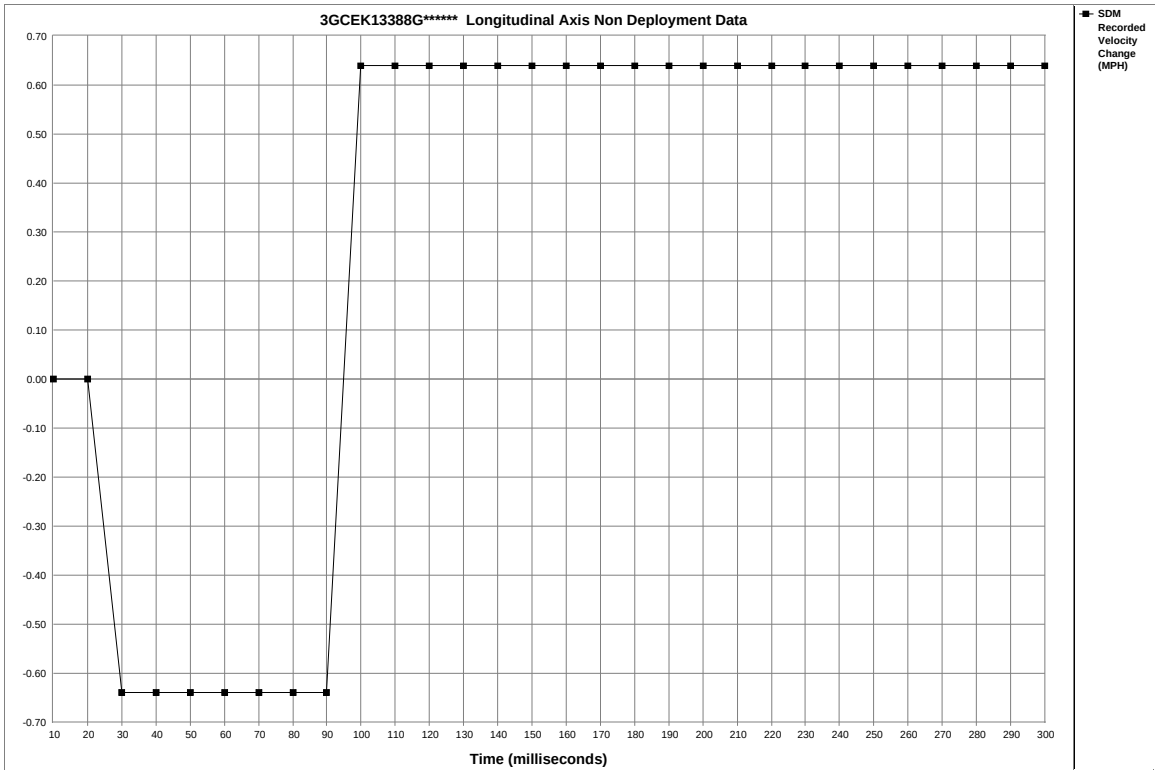
Parameter	-1.0 sec	-0.5 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No
Engine Torque (foot pounds)	98.47	236.03

Pre-Crash Data

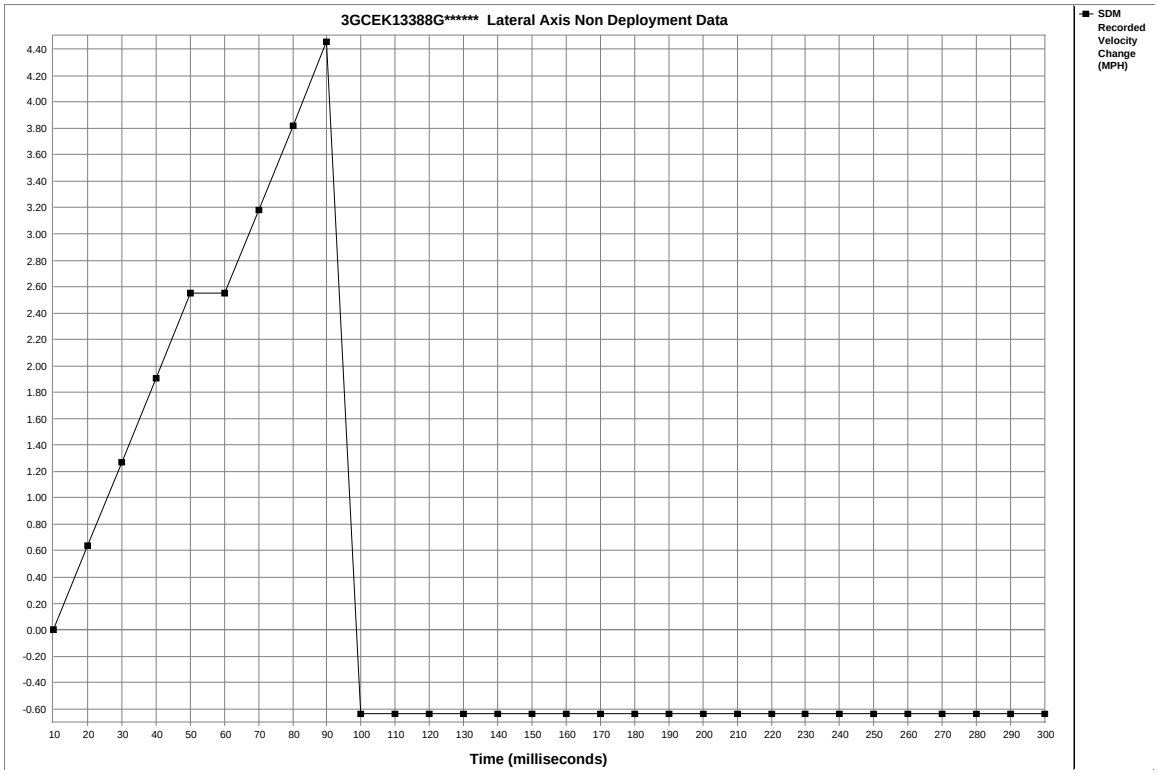
Parameter	-2.5 sec	-2.0 sec	-1.5 sec	-1.0 sec	-0.5 sec
Accelerator Pedal Position (percent)	14	15	15	8	58
Vehicle Speed (MPH)	59	59	59	60	60
Engine Speed (RPM)	1792	1792	1856	1664	1856
Percent Throttle	32	32	34	26	68
Brake Switch Circuit Status	OFF	OFF	OFF	OFF	OFF

System Status At Non-Deployment

Ignition Cycles At Investigation	1410
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	1404
Ignition Cycles At Event	1407
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Driver Seat Position Switch Circuit Status	Rearward
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)	5.26
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	80
Crash Record Locked	No
Deployment Event Recorded in the Non-Deployment Record	No
Vehicle Event Data (Pre-Crash) Associated With This Event	No
SDM Synchronization Counter	1407
Event Recording Complete	Yes
Driver First Stage Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	No
Passenger Second Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Driver Pretensioner Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No



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



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	0.64	1.27	1.91	2.55	2.55	3.18	3.82	4.46	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
SDM Lateral Axis Recorded Velocity Change (MPH)	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64	-0.64