

On-Site Ambulance Crash Investigation  
Case Number DS15014  
Vehicle: 2007 GMC Yukon XL Ambulance  
Location: Colorado  
Crash Date: November 2015

---

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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.

This report and associated case data are based on information available to the Special Crash Investigation team on the date this report was published.

---

## Technical Report Documentation Page

1. Report No. DS15014	2. Government Accession No.	3. Recipient Catalog No.	
4. Title and Subtitle  On-Site Ambulance Crash Investigation Vehicle: 2007 GMC Yukon XL Ambulance Location: Colorado Crash Date: November 2015		5. Report Date January 2017	6. Performing Organization Report No.
7. Author(s) Dynamic Science, Inc.		8. Performing Organization Report No.	
9. Performing Organization name and Address  Dynamic Science, Inc. 299 West Cerritos Avenue Anaheim, CA 92805		10. Work Unit No. (TRAIS)	11. Contract or Grant no. DTNH22-12-C00271
12. Sponsoring Agency Name and Address  U.S. Dept. of Transportation (NVS-411) National Highway Traffic Safety Administration 1200 New Jersey Ave, SE Washington, DC 20590		13. Type of report and period Covered	14. Sponsoring Agency Code
15. Supplemental Notes  The interest of this on-site investigation is the crash of a 2007 GMC Yukon XL Ambulance and the injuries sustained by the patient and two crew members occupying the vehicle.			
<p><b>Abstract</b></p> <p>The interest of this on-site investigation is the crash of a 2007 GMC Yukon XL Ambulance and the injuries sustained by the patient and two crew members occupying the vehicle. The GMC was transporting a 96-year-old male patient to a hospital when it impacted another vehicle in a front-to-back configuration. The crash occurred during evening hours in November 2015 on a north/south state highway in Colorado. The GMC was being driven northbound by a belted 74-year-old male at an EDR-reported speed of 138 km/h (86 mph) at Time Stamp -2.5 seconds. An unbelted 63-year-old male paramedic was seated in the second row right seat position. The 96-year-old male patient was belted on the ambulance cot in the rear compartment. The other vehicle in the crash was a 1994 Hesston 8200 Swather. The Hesston was a cab and header configured heavy farm implement that cuts hay or small grain crops and forms them into rows on the ground to dry. It was being driven northbound ahead of the GMC at a low speed by a 21-year-old male. For unknown reasons, the driver of the GMC did not brake in time and the front plane of the GMC impacted the back plane of the Hesston. Following the initial impact, the GMC departed the roadway on the left edge and overturned onto its roof. The Hesston departed the roadway on the right edge and came to rest after impacting a highway sign. The driver of the GMC and the patient sustained police-reported "B" (non-incapacitating) injuries and were transported to a local hospital for treatment. The driver was later transferred to another hospital. The patient was treated and released. The unbelted paramedic in the second row right seat sustained "K" (fatal) injuries. He was transported to a local hospital where he was pronounced deceased. The driver of the Hesston sustained "B" (non-incapacitating) injuries and was transported, treated and released. The two vehicles were towed due to damage and placed on a police hold.</p>			
17. Key Words Ambulance, Injury, Paramedic Fatality, Patient, Rollover		18. Distribution Statement General Public	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No of pages 16	22. Price

Form DOT F 1700.7 (8-72) Reproduction of this form and completed page is authorized

## Table of Contents

BACKGROUND.....	1
SUMMARY.....	2
Crash Site.....	2
Pre-Crash.....	3
Crash .....	3
Post-Crash. ....	4
2007 GMC YUKON XL AMBULANCE .....	4
Description.....	4
Vehicle Weight, Payload, and Tire Data. ....	5
Exterior Damage. ....	6
Event Data Recorder. ....	6
Interior Damage. ....	7
Manual Restraint Systems.....	7
Supplemental Restraint Systems .....	8
Ambulance Crew Data.....	8
Patient Compartment. ....	8
Patient Cot. ....	9
Rollover Mitigation. ....	9
2007 GMC YUKON XL AMBULANCE OCCUPANTS.....	11
Driver Demographics.....	11
Driver Injuries. ....	11
Driver Kinematics. ....	11
Second Row Right Occupant Demographics.....	12
Second Row Right Occupant Injuries. ....	12
Second Row Right Occupant Kinematics. ....	13
Patient Cot Occupant Demographics.....	13
Patient Cot Occupant Injuries. ....	14
Patient Cot Occupant Kinematics. ....	14
1994 HESSTON 8200 SWATHER.....	15
Description.....	15
Exterior Damage. ....	15
Occupant Data. ....	15
CRASH DIAGRAM. ....	16

Attachment A: 2007 GMC Yukon XL Ambulance Event Data Recorder (EDR) Report

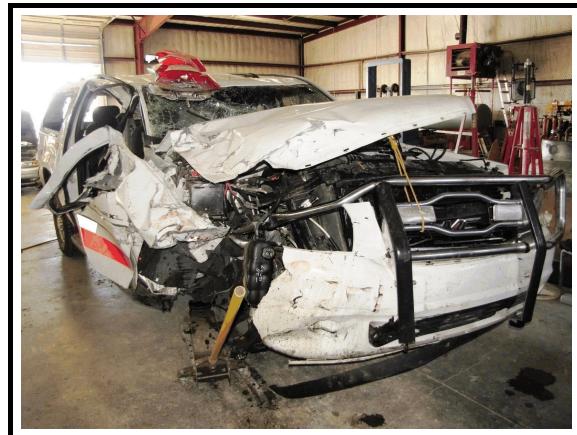
On-Site Ambulance Crash Investigation  
Case Number DS15014  
Vehicle: 2007 GMC Yukon XL Ambulance  
Location: Colorado  
Crash Date: November 2015

## BACKGROUND

The interest of this on-site investigation is the crash of a 2007 GMC Yukon XL Ambulance (**Figure 1**) and the injuries sustained by the patient and two crew members occupying the vehicle. The GMC was transporting a 96-year-old male patient to a hospital when it impacted another vehicle in a front-to-back configuration. The National Highway Traffic Safety Administration (NHTSA) Office of Emergency Medical Services (EMS) identified this crash and it was initiated by the Special Crash Investigations (SCI) group on November 12, 2015. The SCI team obtained a preliminary police report from the state police and inspections of both vehicles were completed on November 24, 2015. The GMC was supported by the Bosch Crash Data Retrieval (CDR) system and the vehicle's Event Data Recorder (EDR) was removed from the vehicle and imaged by police prior to the SCI inspection. Police provided SCI with a Portable Document Format (PDF) copy of the complete EDR report which is included in this report as Attachment A.

The crash occurred during evening hours in November 2015 on a north/south state highway in the state of Colorado. The 2007 GMC Yukon was configured as a three passenger-seat ambulance with additional capacity to transport one patient on an ambulance cot. The ambulance organization is a private company that provides 24 hour/7 days a week service to both emergency and non-emergency calls as contracted to hospitals and private agencies. According to the ambulance company, the vehicle was configured to be a transfer unit outfitted with equipment and supplies to operate an Advanced Life Support service in a mobile environment. The GMC was being driven northbound by a belted 74-year-old male first responder at an EDR-reported speed of 138 km/h (86 mph) at Time Stamp -2.5 seconds. An unbelted 63-year-old male paramedic was seated in the second row right seat position in the patient compartment. This occupant was attending to the patient prior to the crash. The 96-year-old male patient was belted on the ambulance cot in the rear compartment which occupied the space aft of the front row of seats and left of the second row right seat.

The other vehicle in the crash was a 1994 Hesston 8200 Swather (**Figure 2**). The Hesston was a cab



**Figure 1.** 2007 GMC Yukon Ambulance



**Figure 2.** 1994 Hesston 8200 Swather

and header configured heavy farm implement that cuts hay or small grain crops and forms them into rows on the ground to dry. It was being driven northbound ahead of the GMC at a low speed by a 21-year-old male. For unknown reasons, the driver of the GMC did not brake in time and the front plane of the GMC impacted the back plane of the Hesston. Following the initial impact, the GMC departed the roadway on the left edge and overturned onto its roof. It came to rest in an upside down orientation on the roadside. The Hesston departed the roadway on the right edge and came to rest after impacting a highway sign.

The driver of the GMC and the patient sustained police-reported “B” (non-incapacitating) injuries and were transported to a local hospital for treatment. The driver was later transferred to another hospital and the patient was treated and released. The paramedic seated in the second row of the GMC sustained “K” (fatal) injuries and was transported to a local hospital where he was pronounced deceased. The driver of the Hesston sustained “B” (non-incapacitating) injuries and was transported, treated and released. Both vehicles were towed due to damage and placed on a police hold.

## SUMMARY

### ***Crash Site***

The crash occurred on an undivided two-lane north/south state highway in the state of Colorado (**Figure 3**). The roadway was configured with one northbound and one southbound travel lane with paved shoulders bordering each side. The travel lanes each measured 3.7 m (12.0 ft) in width and the paved shoulders each measured 2.9 m (9.5 ft) in width. The travel lanes were separated by a dashed yellow painted stripe and bordered by solid white painted fog lines. The roadway was paved with grooved concrete tining and the shoulders were paved with smooth concrete and configured with rumble strips. The roadway measured 13.1 m (43.0 ft) in total width. It was straight with a level profile. The posted speed limit was 105 km/h (65 mph).



**Figure 3.** Crash site looking north

The roadside on the left and right edges of the roadway consisted of unpaved ground that descended away from the shoulders at a slope of 14 percent. This ground was uneven and covered with grass. One traffic sign of an unknown purpose was posted on the right edge of the northbound travel lane near the area of the vehicle-to-vehicle impact. This sign was subsequently impacted and damaged by the Hesston following the initial impact. Additional scene evidence from the crash included police paint markings identifying the Point of Impact (POI), tire skid and yaw marks, scrape marks, and the vehicles’ final rest positions. Other evidence from the crash included vehicle fluid residue on the roadway surface, tire impressions on the roadside and debris fields consisting of fractured glass from the ambulance. Conditions at the time of the crash as reported by the nearest weather station were as follows: temperature 2.2 °C (36.0 °F), winds northeast at 9.3 km/h (5.8 mph), clear and dry. It was dark without street lamp illumination. The rural location did not provide any significant ambient lighting. No unusual conditions were reported at the time of the crash. A Crash

Diagram is included on page 16 of this report.

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

At the time of the crash, the GMC was transporting the patient from a local hospital to another hospital located in a different city with its emergency lights and siren activated at a speed exceeding the posted speed limit. The distance from departure to their intended destination was 341.0 km (212.0 mi). The ambulance crew had traveled approximately 3.2 km (2.0 mi) from their original point of departure when the crash occurred. The GMC was traveling in a northbound direction with its cruise control system switched off at an EDR-reported speed of 138.4 km/h (86.0 mph) at Time Stamp -2.5 seconds. The EDR-reported pre-crash vehicle speed indicated distance traveled in 0.5-second increments to AE was as follows:

Time Stamp (seconds)	Vehicle Speed km/h (mph)	Approximate Incremental Distance Traveled m (ft)	Approximate Cumulative Distance Traveled m (ft)
-2.5	138 (86)	NA	NA
-2.0	138 (86)	19.2 (63.1)	19.2 (63.1)
-1.5	138 (86)	19.2 (63.1)	38.4 (126.2)
-1.0	130 (81)	18.6 (61.2)	57.1 (187.4)
-0.5	109 (68)	16.6 (54.6)	73.8 (242.0)

The GMC's EDR report indicated the driver braked at Time Stamp -1.5 seconds to AE. Scene evidence and the calculated direction of force to the front plane of the GMC suggested the GMC driver steered left just prior to impact with the Hesston. The maneuver caused the GMC to initiate a right side leading yaw. At Time Stamp -0.5 seconds, the GMC had slowed to an impact speed of 109.4 km/h (68.0 mph). The driver of the GMC indicated he was not distracted prior to the crash. His observation of the Hesston came too late to allow sufficient time to brake and avoid contact.

The Hesston was traveling northbound ahead of the GMC at a police-estimated speed of 11.3 km/h (7.0 mph). According to the police report, the Hesston's flashing lamps were off and the remaining lamps were on in the field position. The configuration of lighting in the field position was dual headlamps in front and a single white lamp in the rear. The driver of the Hesston observed the GMC's lights and heard the siren prior to impact.

### ***Crash***

The crash consisted of three events, including the front-to-rear vehicle-to-vehicle impact (Event 1), the GMC rollover (Event 2), and the Hesston impacting a traffic sign on the roadside (Event 3). Initially, the driver of the GMC was steering left and braking when the front plane of the GMC impacted the back plane of the Hesston at the location of the Hesston's left rear tire. A tire skid mark deposited by the GMC and measuring 2.3 m (7.5 ft) was documented at the POI (**Figure 4**), which was located in the northbound lane 2.2 m (7.3 ft) left of the east fog line. Direct contact to the GMC was located on front plane with damage also extending down the right plane including displacement of the vehicle's right front tire. Direct contact to the Hesston was located on the back

and left planes.

Following the initial impact, the GMC was displaced to the left and rotated counterclockwise. The vehicle crossed over the southbound lane, departed the left edge of the roadway and traveled onto unpaved ground. The right side tires furrowed into the ground causing sufficient opposing lateral forces to cause the right side leading trip rollover. The GMC rolled two quarter turns before coming to rest on its roof in an upside down orientation on the roadside facing southwest. The distance traveled from Event 1 to final rest was 42.7 m (140 ft) and the estimated roll distance was 8 m (26 ft).



**Figure 4.** Point of Impact, northbound lane

Following the initial impact, the Hesston was displaced to the right, partially departed the roadway on the right edge and impacted a traffic sign. This traffic sign was mounted to a steel post measuring less than 10.0 cm (3.9 in) in diameter located 12.5 m (41.0 ft) southeast of the first POI. The damage consisted of bending the post above ground. The Hesston then traveled another 16.5 m (54.0 ft) before coming to a controlled stop facing south on the shoulder.

For the GMC in Event 1, WinSMASH Barrier algorithm calculated a Total Delta-V of 22 km/h (14 mph) with Longitudinal and Lateral components of -21 km/h (-13 mph) and -4 km/h (-2 mph), respectively, and a Barrier Equivalent Speed (BES) of 22 km/h (14 mph). The reconstruction was considered to be borderline because the Hesston was beyond scope for WinSMASH. The GMC's EDR reported a maximum longitudinal Delta-V of -33.8 km/h (-21.0 mph) at Time 160 ms and a maximum lateral Delta-V of -6.1 km/h (-3.82 mph) at Time 130 ms. The calculated direction of force to the GMC using the EDR reported velocity change was 10 degrees.

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

Police arrived at the scene first followed by EMS who arrived on-scene approximately 30 minutes after the crash. The driver of the GMC exited the vehicle with some assistance from responders. The second row right position occupant and patient in the GMC required extrication lasting approximately twenty minutes. The driver of the Hesston exited the vehicle without assistance. All occupants from both vehicles were transported by ambulance to a local hospital located 2.9 km (1.8 mi) from the crash site. The 63-year-old male paramedic traveling in the GMC died from his injuries a short time after the crash. The driver and patient of the GMC sustained police-reported non-incapacitating injuries. The driver of the Hesston also sustained non-incapacitating injuries. Both vehicles were towed due to damage and placed on a police hold.

## **2007 GMC YUKON AMBULANCE**

### ***Description***

The 2007 GMC Yukon XL (**Figure 5**) was manufactured in January 2007 and identified by the Vehicle Identification Number (VIN): 1GKGK26K07Rxxxxxx. The vehicle mileage was unknown. The vehicle interior and exterior was configured to be a transfer unit outfitted with equipment and

supplies to operate an Advanced Life Support service in a mobile environment. The chassis was a rear-wheel drive platform powered by a Ford 6.0-liter 8-cylinder diesel engine linked to an automatic transmission. The vehicle was equipped with standard all-wheel disc brakes, all-wheel ABS and tilt steering functionality.

Secondary manufacturing of the vehicle consisted of installation of emergency services operational equipment (patient cot, medical cabinets and supplies, warning lights, sirens, and radio communications). The front end of the vehicle was equipped with an aftermarket brush guard constructed of steel tubing. The ambulance conversion was performed by an unknown source.

The GMC's interior was configured for the seating of three seated occupants and one patient cot. The front row was configured with two forward-facing seats and the second row was configured with one forward-facing seat at the right position. The front row seats featured manual seat track and seat back recline adjustments. The seats were configured with three-point lap and shoulder safety belts and adjustable head restraints. The driver's seat track was adjusted between middle and rearmost and the seat back was upright. A front center console included integrated communications equipment and an array of switches related to the ambulance's emergency response and operational activities. The second row seat featured a three-point lap and shoulder safety belt and adjustable head restraint. The seat track was non-adjustable and the seat back was upright.

#### ***Vehicle Weight and Tire Data***

The GMC was placarded with a Gross Vehicle Weight Rating (GVWR) of 3,901 kg (8,600 lb). This was distributed as GAWR front 1,896 kg (4,180 lb) and GAWR rear 2,495 kg (5,500 lb). The vehicle manufacturer's recommended tire size was LT245/75R16 with recommended cold tire pressures of 345 kPa (50 psi) front and 490 kPa (71 psi) rear. At the time of the SCI inspection, the vehicle was equipped with Cooper Discover A/T tires of the recommended size. The right rear tire pressure measurement was 54 percent of its recommended pressure. The inspection occurred approximately two weeks after the crash and it was not determined whether the tire was under-inflated prior to the crash, lost pressure during the crash or lost pressure after the crash. Specific tire data was as follows:

<b>Position</b>	<b>Measured Pressure</b>	<b>Measured Tread Depth</b>	<b>Restricted</b>	<b>Damage</b>
LF	421 kPa (61 psi)	13 mm (16/32 in)	No	None
LR	400 kPa (58 psi)	10 mm (13/32 in)	No	None
RR	262 kPa (38 psi)	10 mm (13/32 in)	No	None
RF	414 kPa (60 psi)	12 mm (15/32 in)	No	De-beaded



**Figure 5.** 2007 GMC Yukon Ambulance

### **Exterior Damage**

The GMC sustained moderate severity damage to the front and right planes caused during the impact with the Hesston in Event 1. Direct damage began at the front right bumper corner and extended 110.0 cm (43.3 in) to the left. The field L was distributed from bumper corner to bumper corner and measured 170.0 cm (66.9 in). Six crush measurements were taken at bumper level as follows (**Figure 6**):  $C_1 = 0 \text{ cm}$ ,  $C_2 = 0 \text{ cm}$ ,  $C_3 = 6.0 \text{ cm}$  (2.4 in),  $C_4 = 11.0 \text{ cm}$  (4.3 in),  $C_5 = 14.0 \text{ cm}$  (5.5 in),  $C_6 = 43.0 \text{ cm}$  (16.9 in). Maximum crush was located at  $C_6$  and the Collision Deformation Classification (CDC) for the GMC in Event 1 was 92FZEW2 which included frame shift of both rails to the left.

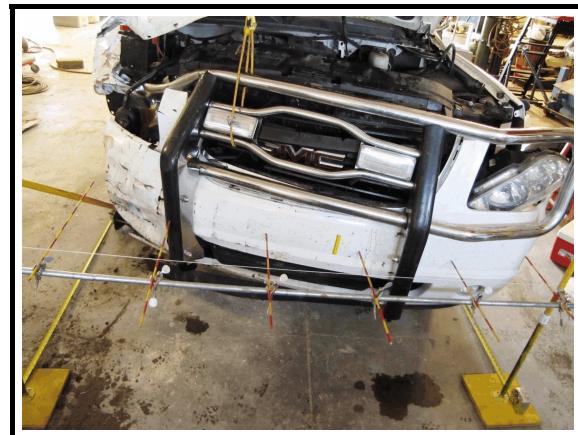
The vehicle sustained severe crush damage to the right and top planes caused during the rollover event. Direct damage extended from roof side rail to roof side rail and measured 116.0 cm (45.7 in). Maximum lateral crush was located at the right B-pillar and measured 12.0 cm (4.7 in). Maximum vertical crush was located on the right roof and measured 36.0 cm (14.2 in) (**Figure 7**). The CDC for the GMC in Event 2 was 00TDDO4.

Both side view mirrors were displaced from the doors and the roof-mounted emergency lights were displaced from the roof. The right front wheel assembly was displaced from the axle. The fuel system was not damaged.

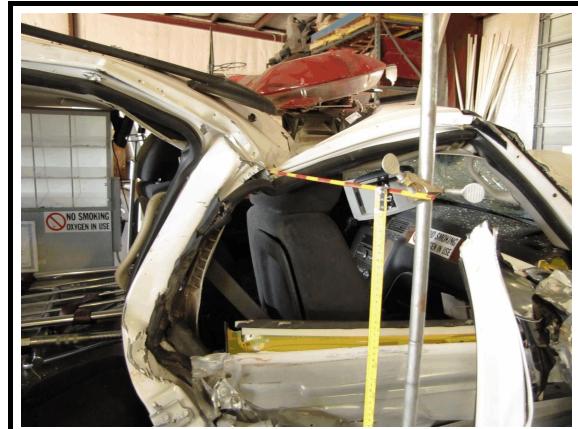
### **Event Data Recorder**

The GMC's Event Data Recorder (EDR) was removed from the vehicle by police and imaged at another site prior to the SCI inspection. Police provided SCI with a PDF copy of the report. The Event Data Recorder (EDR) was imaged by police using the direct-to-module, bench top method. Bosch CDR Tool version 16.2.1 was used to image the data and report the data since the raw file (CDRx) was not provided. The GMC's complete EDR report is included in this report as Attachment A and it is summarized below.

The EDR captured one locked deployment event which was the front to back impact with the other vehicle. The EDR was not configured to capture rollover events and the GMC's subsequent rollover was not included in the report. For the deployment event, the report included Multiple Event Data, System Status at AE, Pre-Crash Data (table), System Status at Deployment, and Longitudinal and Lateral Axis Deployment Data (graphs and tables).



**Figure 6.** Front plane crush measurement, 2007 GMC Yukon Ambulance



**Figure 7.** Maximum vertical roof crush measurement, 2007 GMC Yukon Ambulance

Pre-Crash data indicated the following values at Time Stamp -0.5 seconds: Cruise Control Active was "No," Engine Torque (foot pounds) was -12.72, Accelerator Pedal Position (percent) was 0, Vehicle Speed (MPH) was 68, Engine Speed (RPM) was 2,048, Percent Throttle was 19 and Brake Switch Circuit State was Off.

System Status at Deployment indicated the following: SIR (Supplemental Inflatable Restraint) Warning Lamp Status was Off, Ignition Cycles Since DTCs (Diagnostic Trouble Codes) Were Last Cleared was 255, Driver's Belt Switch Circuit Status was Buckled, Driver's Seat Position Switch Circuit Status was Rearward, Driver 1<sup>st</sup> Stage Time From AE to Deployment Command Criteria Met was 32.5 ms, Driver 2<sup>nd</sup> Stage Time From AE to Deployment Command Criteria Met was 35 ms, Driver 1<sup>st</sup> Stage Deployment Loop Commanded was Yes, Driver Pretensioner Deployment Loop Commanded was Yes and Passenger Pretensioner Deployment Loop Commanded was Yes. The number of ignition cycles that the SIR warning lamp was Off continuously for this ignition cycle was 58, which appeared low. According to the Data Limitations, once the counter reaches 99 it is reset to 0 and begins the count again. The EDR reported a maximum longitudinal Delta-V of -33.8 km/h (-21.0 mph) at Time 160 ms and a maximum lateral Delta-V of -6.1 km/h (-3.82 mph) at Time 130 ms. The calculated direction of force to the GMC using the EDR reported longitudinal and lateral velocity changes was 10 degrees.

### ***Interior Damage***

The GMC's interior revealed damage from impact deformation, a deployed air bag, an actuated safety belt pretensioner and occupant contacts. The windshield glazing was fractured and in place and the remaining windows were disintegrated. Both right side doors were jammed shut and the second row right door sustained post-impact damage during extrication efforts. Occupant loading evidence was present on the driver's safety belt. The second row interior revealed contact evidence including blood and tissue transfers found on right B-pillar and roof header. Lateral intrusion into the front row was documented at the front right door panel (15.0 cm [5.9 in]) and right A-pillar (2.0 cm [0.8 in]). Vertical intrusion into the front row was documented at the right windshield header (2.0 cm [0.8 in]), right roof header (10.0 cm [3.9 in]) and right roof side rail (16.0 cm [6.3 in]). Lateral intrusion into the second row was documented at the right roof side rail (4.0 cm [1.6 in]) and right B-pillar (20.0 cm [7.9 in]). Vertical intrusion into the second row was documented at the right roof (15.0 cm [5.9 in]) and right roof side rail (4.0 cm [1.6 in]).

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

The GMC's interior was equipped with forward seating for three occupants and all seats were configured with three-point lap and shoulder safety belts. The front row belts were equipped with dual retractor/buckle pretensioners, sliding latch plates and adjustable D-rings. Both D-rings were adjusted to the full-up positions. The driver's lap and shoulder belt was used during the crash and revealed evidence of occupant loading on the webbing beginning 22.0 cm (8.7 in) above the stop button (**Figure 8**). During the crash, the driver's belt pretensioners actuated locking the webbing in the used position and reducing the buckle stalk to



**Figure 8.** Driver's safety belt loading evidence, 2007 GMC Yukon Ambulance

a length of 5.0 cm (2.0 in). The front right seat was unoccupied.

The second row right seat belt was equipped with sliding latch plate and non-adjustable D-ring. The EMT seated at this position was unrestrained and the belt was not used. Examination of the belt revealed evidence of historical usage and normal functionality with no apparent damage.

Manual restraints for the patient cot included three lap-style safety belts with locking latch plates. The manual restraints for the patient are discussed in greater detail in the Patient Cot section of this report.

### ***Supplemental Restraint Systems***

The Ford's Supplemental Restraint Systems (SRS) included an Air Bag Control Module (ACM), dual-stage frontal air bags for the front row seat positions and dual retractor/buckle pretensioners. According to the driver of the GMC, the vehicle had no history of prior crashes and the air bags were original equipment. They had no history of prior service or recalls.

During the crash, the driver's frontal air bag deployed and both front row pretensioners actuated. The driver's frontal air bag deployed from the steering wheel hub (**Figure 9**). It was round in shape and measured 53.0 cm (20.1 in) in diameter. The air bag was configured with two vent ports on the upper aspect, and two internal tethers. It was not damaged and appeared to have deployed normally. The air bag exhibited slight and scattered blood deposits on the top and left aspects. The front right passenger air bag did not deploy during the crash.

### ***Ambulance Crew Data***

The driver of the GMC was classified by the hospital ambulance service as a Per Diem or Volunteer First Responder. By definition, the First Responder is the EMS provider who is notified for initial response to a victim of sudden illness or injury. His duties included driving the ambulance, assisting the EMT and his certification included forty hours of training. At the time of the crash, the driver was training in EMT-Basic classes. He had not received Emergency Vehicle Operator Course (EVOC) training. The driver was retired from full-time work and served the ambulance company on an on-call status as needed. On the day of the crash, he was notified to report for service while at home. He had not worked during the day of the crash prior to being called in. His exact call-in time was not determined but it was sometime after 5:00 p.m.

The second row occupant of the GMC was classified by the hospital ambulance service as a Full-Time Staff Paramedic and EMS Director. This occupant held past certifications as an EMT-Intermediate/85 and EMT-Intermediate/99, and currently held certification as a Paramedic. He held certifications to teach CPR and EMT-related classes. He had served in this capacity for several years. This occupant also served on the State Advisory Council on Emergency Medical Services and was a member of the Regional Emergency Trauma Advisory Council. At the time of the crash, he



**Figure 9.** Driver's deployed frontal air bag, 2007 GMC Yukon Ambulance

was nearing completion of training for certified flight paramedic. His typical work schedule was day shift as well as on-call as needed. On the day of the crash this occupant had worked a full day shift and had gone home afterward. He was called back to service from his home to transport the patient. His exact call-in time was not determined but it was sometime after 5:00 p.m.

### **Patient Compartment**

The patient compartment consisted of a single occupant cot secured to the left side wall and floor. The patient cot was anchored on the left aspect beginning behind the driver's seat and extending to the rear hatch. The patient compartment had interior maximum dimensions of 260.0 cm (102.4 in) in length, 160.0 cm (63.0 in) in width, and 100.0 cm (39.4 in) in height. A top-hinged rear hatch served for the loading and unloading of the cot. The rear hatch, and left and right side doors were original to the vehicle.

The patient compartment (**Figure 10**) was equipped with after-market cabinetry storage units located on the left wall, right wall and forward center console areas. These cabinets were constructed of plastic-laminate covered particle board. The left cabinet was the largest of the three units, extended to the roof and was configured with plexiglass shelving on the upper aspect. This cabinet covered the second row door side glass. It had broken away from its floor mounted hardware but remained near its original location inside the vehicle. The right cabinet was next largest in size and was primarily a large open box with hinged lid, probably used to store larger equipment. No oxygen tank was present and most of the medical supplies had been removed prior to the SCI inspection. This cabinet was still mounted in place to the floor. The forward center cabinet was the smallest unit of the three and fit between the front row seats. It was within arms reach of the second row right occupant and was used to hold the heart monitoring equipment needed by the paramedic and patient during patient transport. According to the driver of the GMC, the paramedic seated in the second row was possibly attending to the heart monitoring equipment at the time of the crash. This cabinet was fractured at the lower aspect and was found loose within the vehicle at the time of the inspection. It was probably damaged by contact with the paramedic during the crash.

### **Patient Cot**

At the time of the SCI inspection, a Ferno Model 93ES Squadmate ambulance cot was secured in place along the left wall using a floor-mounted Ferno Model 175-3 Fastening System. The Squadmate cot was identified by Serial No. 06xxxxxx. The cot (**Figure 11**) measured 205 cm (81.0 in) in length, 59.0 cm (23.0 in) in width and maximum 77.0 cm (30.0 in) in height. It weighed 35.0 kg (77.0 lb) and had a 227.0 kg (500.0 lb) load limit. The cot was configured with swing-down side arms, eight-position (0 - 75%) back angles, three belt restraints and a mattress. At the time of the inspection, the mattress had been removed and was missing. The cot was equipped with a manual



**Figure 10.** Patient compartment, 2007  
GMC Yukon Ambulance

restraint system consisting of three lap-type belts with locking latch plates. The webbing, latch plates and buckles were examined by the investigator and found to be functioning properly. No evidence of occupant loading on the belts was noted.

The 175-3 Fastening System consisted of a floor-mounted antler and rail configuration identified by the Serial No. 06xxxxxx. The antler bracket cradled the forward portion (location of the patient's head area) of the cot frame, while the vertically-oriented locking mechanism clamped around the cot frame rail. The aluminum antler and rail were mounted to an aftermarket floor constructed from composition board encased in aluminum trim. The mounting hardware used was detachable. Inspection of the fastening system with the cot in place revealed no discernable movement or play. The rail release mechanism functioned normally and no damage was present.



**Figure 11.** Ferno 93ES Squadmate Ambulance Cot, 2007 GMC Yukon Ambulance

## ROLLOVER MITIGATION

Based on dynamic (moving) test results, the GMC had a rollover rating of three stars (out of a possible five) and a 23.7 percent chance of rollover in a single-vehicle crash. According to a vehicle report generated by Expert AutoStats, the vehicle had a Tip-over Vehicle Stability Ratio of 1.10, which is considered to be "Reasonably Stable" (A value greater than or equal to 1.0 and less than 1.25 is considered Reasonably Stable). The ratio is the tangent of the lean angle, which if exceeded, will result in a rollover. The vehicle was equipped with standard four-wheel drive and ABS.

The GMC rollover was caused by a combination of several destabilizing factors. These factors included traveling too fast for conditions, impact with the other vehicle, traction and control loss, rotational forces, roadway departure and change of surface types from paved and level to unpaved and downward sloping. Initially, the GMC was traveling at an EDR-reported vehicle speed of 109.4 km/h (68.0 mph) at Time Stamp -0.5 seconds to AE. The driver of the GMC braked hard and steered left just prior to impact but the relatively high vehicle speed limited the driver's ability to maneuver the GMC away from the other vehicle. The GMC's stability was further compromised at impact with the Swather and the subsequent counterclockwise rotation it sustained while changing trajectory to the left. The vehicle initiated a right side leading yaw and departed the roadway on the left edge where the surface changed from a level roadway to uneven ground which descended at a 14 percent slope. The vehicle rotated approximately 140 degrees counterclockwise and its right side tires furrowed into to the ground with sufficient opposing lateral force as to cause a right side leading trip rollover. The GMC rolled two quarter-turns and came to rest on its roof in an upside down orientation facing southwest on the roadside. The estimated rollover distance was 8 m (26 ft).

The GMC was equipped with tires of the recommended size, each having a minimum tread of 10 mm (13/32 in). The front tire pressures were higher and the rear tire pressures were lower than recommended. However, it was determined that tire pressure was not a primary contributor to this rollover. The EDR System Status at AE indicated the Low Tire Pressure Warning Lamp was "Off."

## 2007 GMC YUKON AMBULANCE OCCUPANTS

### ***Driver Demographics***

Age/Sex:	74 years/Male
Height:	150 cm (59 in)
Weight:	82 kg (181 lb)
Eyewear:	None
Seat type:	Bucket seat with adjustable head restraint
Seat track position:	Between middle and rearmost
Manual restraint usage:	Lap and shoulder safety belt used
Usage source:	Vehicle inspection
Air bags:	Frontal air bag deployed
Alcohol/Drug data:	None
Egress from vehicle:	Exited with assistance through right side door
Transport from scene:	Ambulance to hospital, then transferred by helicopter
Type of medical treatment:	Admitted one day and released

### ***Driver Injuries***

Inj. No.	Injury	Injury Severity AIS 2005	Injury Source	Confidence Level
1	Abrasions, face, forehead	210202.1,1	Frontal air bag	Certain
2	Abrasions and contusions, chest	410202.1,4	Safety belt webbing	Certain
3		410402.1,4		
4	Abrasions, abdomen	510202.1,4	Safety belt webbing	Certain

Source: Medical records

### ***Driver Kinematics***

The belted 74-year-old male driver of the GMC was seated in an upright posture and was actively steering and braking the vehicle. At impact with the Hesston, the driver's frontal air bag deployed and his safety belt pretensioner actuated. He was displaced forward and right in response to the direction of force and loaded the safety belt and the deployed frontal air bag. He sustained abrasions to his chest and abdomen caused by loading of the belt, and abrasions to his face and forehead caused by loading of the air bag. Following the impact, the GMC rotated counterclockwise and initiated a right side leading trip rollover. The driver was displaced first to the right and then toward the roof. He remained held in his seated position by the pretensioned belt but came to rest in an upside down orientation.

The driver of the GMC unbuckled the safety belt and exited the vehicle with assistance from responders through the front row right side door. He then went to the patient compartment to render aid to the other occupants. Police arrived first followed by EMS who arrived on-scene 30 minutes after the crash. The driver was transported by ambulance to a local hospital where he arrived 50 minutes after the crash. He was examined and exhibited a Glasgow Coma Score (GCS) of 15. The driver was then transferred by air transport to another hospital in a distant city which could offer a higher level of care, primarily due to concerns about his labored breathing. He was discharged from

the second hospital following one day of treatment.

### ***Second Row Right Occupant Demographics***

Age/Sex:	63 years/Male
Height:	183 cm (72 in)
Weight:	88 kg (194 lb)
Eyewear:	Eyeglasses
Seat type:	Bucket seat with adjustable head restraint
Seat track position:	NA
Manual restraint usage:	Lap and shoulder safety belt not used
Usage source:	Vehicle inspection
Air bags:	None available
Alcohol/Drug data:	None
Egress from vehicle:	Removed due to serious injury
Transport from scene:	Ambulance to hospital
Type of medical treatment:	Declared deceased at hospital

### ***Second Row Right Occupant Injuries***

Inj. No.	Injury	Injury Severity AIS 2005	Injury Source	Confidence Level
1	Injury involving hemorrhage, brain stem (midbrain)	140210.5,8	Right B-pillar	Probable
2	Diffuse axonal injury, bilateral cerebrum (frontal lobes)	140628.4,3	Right B-pillar	Probable
3	Fractures, distal right radius	752311.2,1	Front row right seat back	Probable
4	and ulna	752313.2,1		
5	Fractures NFS, ribs	450210.2,9	Front row right seat back	Probable
6	Hemorrhage, retroperitoneum	543800.2,8	Front row right seat back	Probable
7	Subgaleal hematoma, bilateral scalp	110402.1,3	Right B-pillar	Probable
8				
9	Abrasions and laceration, scalp	110202.1,0	Right B-pillar	Probable
10		110602.1,0		
11	Laceration, right neck (6.4 x 1.3 cm)	310602.1,1	Right B-pillar	Probable
12	Abrasions, face and neck	210202.1,7	Right B-pillar	Probable
13		310202.1,5		
14	Fracture NFS, sternum	450899.1,4	Right B-pillar	Probable

15	Contusions and abrasions of bilateral legs NFS	810202.1,3 810402.1,3	Cabinet, second row center	Probable
16				

Source: Autopsy, medical records

### ***Second Row Right Occupant Kinematics***

The unbelted 63-year-old male second row right occupant of the GMC was seated in an unknown posture. It is presumed the occupant was unbelted for the purpose of attending to the patient and applying the heart rate monitor and other medical devices used during transport. The seating configuration in the ambulance patient compartment was such that the occupant could not sit in a belted, forward-facing posture while attending to the patient at the same time.

At impact with the Hesston, the occupant was displaced forward and right in response to the direction of force. He was displaced completely from his seated position and contact evidence in the vehicle interior, as well as the occupant's injuries, suggest this occupant's body contacted three primary components within the second row. His head likely contacted the right B-pillar causing the most severe of his injuries. The right B-pillar intruded 20.0 cm (7.9 in) laterally significantly reducing the occupant compartment. Blood was present on the right B-pillar and roof header, where the occupant's head came to rest. This contact caused injury involving hemorrhage to the brain stem, diffuse axonal injury to the bilateral cerebrum (frontal lobes), subgaleal hematomas of the bilateral scalp, laceration to the right neck, fracture to the sternum, and abrasion, contusion and laceration to the scalp. The occupant's autopsy indicated his cause of death was blunt force head trauma.

The occupant's arms, torso and pelvis likely contacted the front row right seat back. This contact caused fractures to the distal right radius and ulna, fractures to unspecified ribs and hemorrhage to the retroperitoneum. It is likely the occupant's lower extremities contacted a built-in cabinet located between the front row seats which housed the heart monitoring equipment. This cabinet was located close to the occupant's seated position, and was fractured into pieces and displaced from its floor-mounted anchors during the crash. The occupant sustained abrasions and contusions to the both legs.

Following the impact, the GMC rotated counterclockwise and initiated a right side leading trip rollover. The occupant was displaced first to the right and then toward the roof. His head contacted the roof header, depositing blood. The vehicle came to rest in an upside down orientation and this occupant came to rest in an unknown position on the roof header. According to the driver, this occupant required fifteen to twenty minutes of extrication, primarily due to the jammed second row door but also because of the upside down orientation of the vehicle and the serious injuries sustained by the occupant. He was then removed by responders and transported by ambulance to a local hospital. He was examined and determined to have a GCS of 3. This occupant was declared deceased approximately one hour after the crash.

### ***Cot Occupant Demographics***

Age/Sex:	96 years/Male
Height:	Unknown
Weight:	58 kg (128 lb)
Eyewear:	None
Seat type:	Immobilized longitudinally in supine position on cot
Seat track position:	N/A

Manual restraint usage: Three lap belts  
 Usage source: Vehicle inspection, interview  
 Air bags: None available  
 Egress from vehicle: Removed by responders  
 Transport from scene: Ambulance to hospital  
 Type of medical treatment: Treated and released

### ***Cot Occupant Injuries***

Inj. No.	Injury	Injury Severity AIS 2005	Injury Source	Confidence Level
1	Contusion, left scalp	110402.1,2	Cot frame	Possible
2	Contusion, left temple and forehead	210402.1,2	Cot frame	Possible
3	Laceration, minor, forehead	210602.1,1	Cot frame	Possible
4	Laceration, minor, dorsal left upper arm	710602.1,2	Cabinet	Possible
5	Laceration, minor, right forearm	710602.1,1	Cabinet	Possible
6	Contusions, right thigh, hip and buttock	810402.1,1	Cot mattress	Possible
7	Skin tear, right buttock	810602.1,1	Cot mattress	Possible
	Pre-existing condition		Alzheimer's disease	

Sources: Medical records

### ***Cot Occupant Kinematics***

Prior to the crash, the 96-year-old male patient was being transported from one hospital to another for a non-emergency purpose. He was in a supine position on the cot and restrained using the three available lap-style belts. The cot was not configured with shoulder belts. The driver and second row occupant of the ambulance assisted in belting the patient prior to transport. At impact, the patient was displaced forward and right in response to the direction of force. He remained held to the cot by the restraints and the cot remained held in place by the fastening system. During the rollover, the patient remained in place on the cot. This occupant's face and scalp possibly contacted the cot frame causing contusions to the left scalp, left temple and forehead, and a minor laceration to the right forehead. It is likely his lower extremities contacted the cot mattress causing contusions to the right thigh, right hip and right buttock. The occupant sustained minor lacerations to his left and right arms possibly caused when contacting cabinets located on both sides of the patient cot. He sustained two minor lacerations to his left forearm during post-crash activities when IV insertions were pulled from his arm.

At final rest, the patient was facing downward in an upside down orientation. According to the driver, this occupant required approximately twenty minutes of extrication, primarily due to the upside

down orientation of the vehicle, patient cot and patient. His extrication time was lengthened due to the limited space in which responders had available to remove both the patient and backboard through the rear doors of the ambulance at the same time. Additionally, the patient was reported to be somewhat combative and uncooperative toward responders. The patient seemed confused and could not answer questions asked of him by the responders. He was finally removed by responders and transported by ambulance to a local hospital, where the patient was determined to have a GCS of 14. This patient was treated and released.

## **1994 HESSTON 8200 SWATHER**

### ***Description***

The 1994 Hesston 8200 Swather was a cab and header configured heavy farm implement that cuts hay or small grain crops and forms them into rows on the ground for drying. The cab was identified by the Serial No. 820Txxxxx and the header was identified by the Serial No. 820Hxxxxx. The date of manufacture and the odometer reading were unknown. The vehicle was equipped with a Cummins diesel engine. Maximum width of the header measured 4.3 m (14.0 ft) in width. The operating weight of the Swather without the header attachment was approximately 3,628 kg (8,000 lb). The weight of the header was unknown.

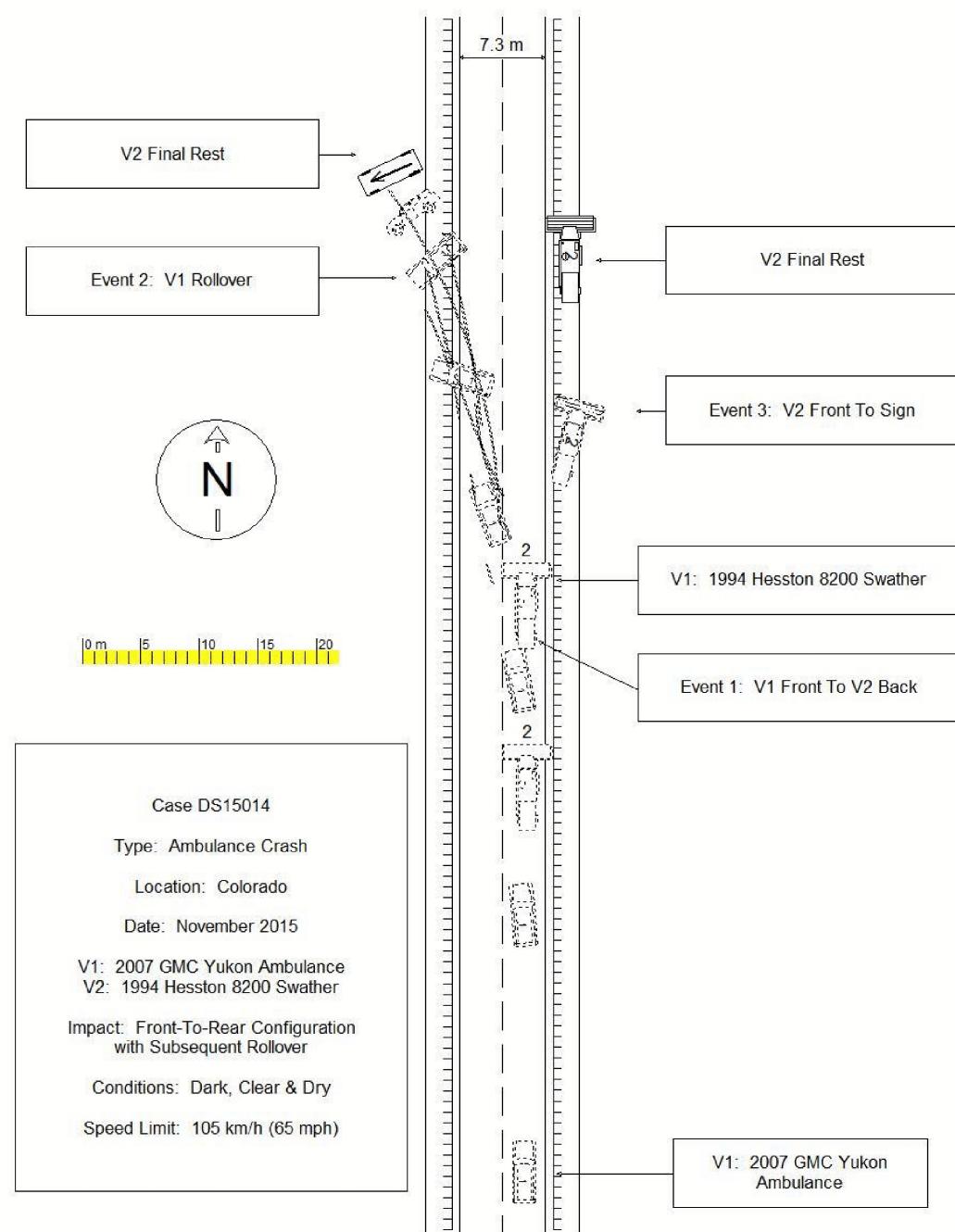
### ***Exterior Damage***

The Hesston sustained moderate severity damage to the back and left planes caused during the impact with the GMC in Event 1. No damage to the vehicle was identified in the Event 3 traffic sign impact. Both left side wheel and tire assemblies were displaced from the vehicle entirely. This damage caused the vehicle's left aspect to collapse to the ground, causing further deformation of the sheet metal and other components.

### ***Occupant Data***

The 21-year-old male driver of the Hesston sustained a minor laceration to his right eyelid during the crash. He was transported by ambulance to a local hospital where he was treated and released.

## CRASH DIAGRAM



Case Number: DS15014

Attachment A: 2007 GMC Yukon XL Ambulance  
Event Data Recorder (EDR) Report

Imaged by police and provided to SCI in PDF format

**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	1GKGK26K07Rxxxxxx
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	DS15014_V1_ACM.PDF
Saved on	
Collected with CDR version	Crash Data Retrieval Tool 16.2.1
Reported with CDR version	Crash Data Retrieval Tool 16.2.1
EDR Device Type	Airbag Control Module
Event(s) recovered	Deployment

## Comments

Search Warrant  
Desktop download

## 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 NonDeployment Event may contain PreCrash 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 B, if the Non-Deployment Event is not locked. The data in the Non Deployment Event file will be locked, if the NonDeployment Event occurred within five seconds of a Deployment Event A. A locked Non Deployment Event cannot be overwritten or cleared by the SDM.

The second type of SDM recorded crash event is the Deployment Event. It also may contain PreCrash 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 B will overwrite any nonlocked 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 800 milliseconds of data after algorithm enable. Velocity Change data is displayed in SAE sign convention.

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

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

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

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

- Significant changes in the tire's rolling radius
- Final drive axle ratio changes
- Wheel lockup and wheel slip

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

-Pre-Crash data is recorded asynchronously. The 0.5 second Pre-crash data value (most recent recorded data point) is the data point last sampled before AE. That is to say, the last data point may have been captured just before AE but no more than 0.5 second before AE. All subsequent Precrash data values are referenced from this data point.

-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 precrash data
- No data is received from the module sending the precrash data
- No module is present to send the precrash data
- Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit.
- The Time Between NonDeployment 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 NonDeployment 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 OFFRUN->CRANK power-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing battery power to the module will not increment the ignition cycle counter.
- Once a firing loop has been commanded to be deployed, it will not be commanded to be deployed again during the same ignition cycle. Firing loop times for subsequent deployment type events, using the same ignition cycle, will record the deployment times as N/A.
- Number of ignition cycles SIR Warning Lamp was ON/OFF Continuously. Counter can increment up to 99 cycles before resetting to zero. Thereafter, the counter represents the lamp on/off conditions for the ignition cycle in which a qualified crash event occurs.
- If more than one event is recorded, use the following to determine which event the Multiple Event Data is associated with:
  - If a Deployment event and not locked NonDeployment event are recorded, the Multiple Event Data is associated with the Deployment event.
  - If a Deployment event and a locked NonDeployment event are recorded, then the Multiple Event Data is associated with both events.
  - If a Deployment event and Deployment event are recorded, then the Multiple Event Data is associated with both events.
- 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 (PreCrash) 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.

**Hexadecimal Data:**

Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR tool.

01005\_SDMC-delphi\_004

### Multiple Event Data

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

### System Status At AE

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

### Pre-crash data

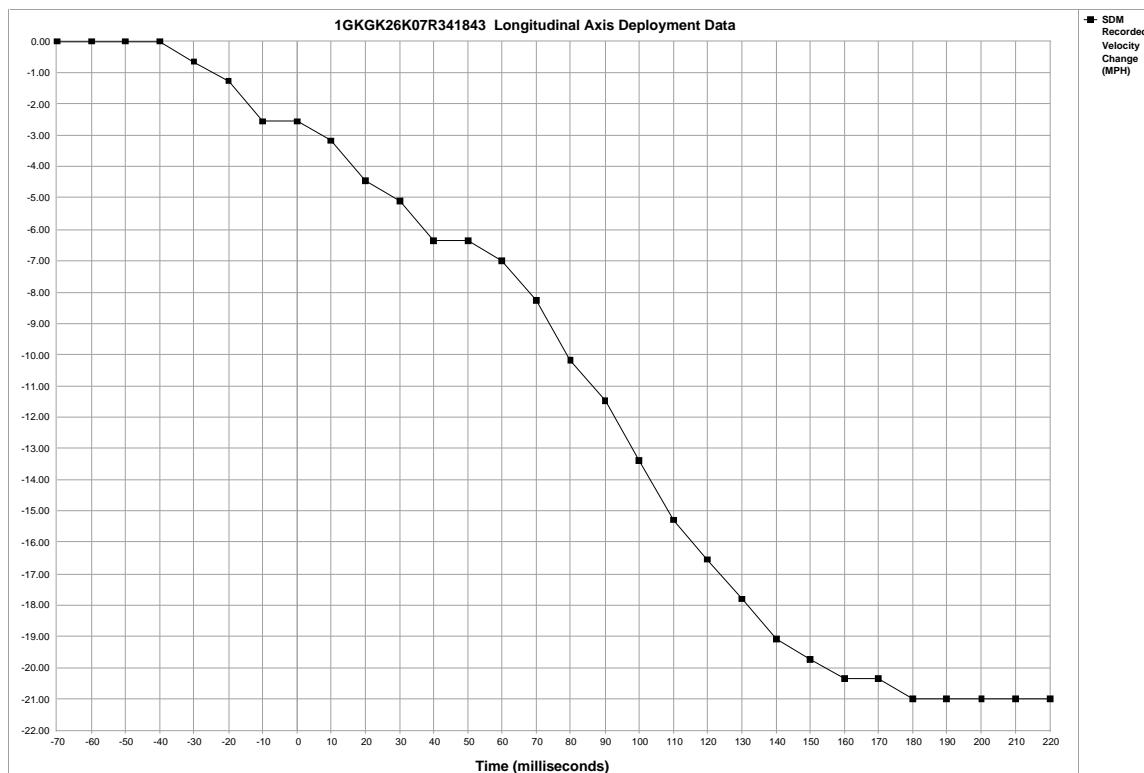
Parameter	-1.0 sec	-0.5 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No
Engine Torque (foot pounds)	-8.67	-12.72

### Pre-Crash Data

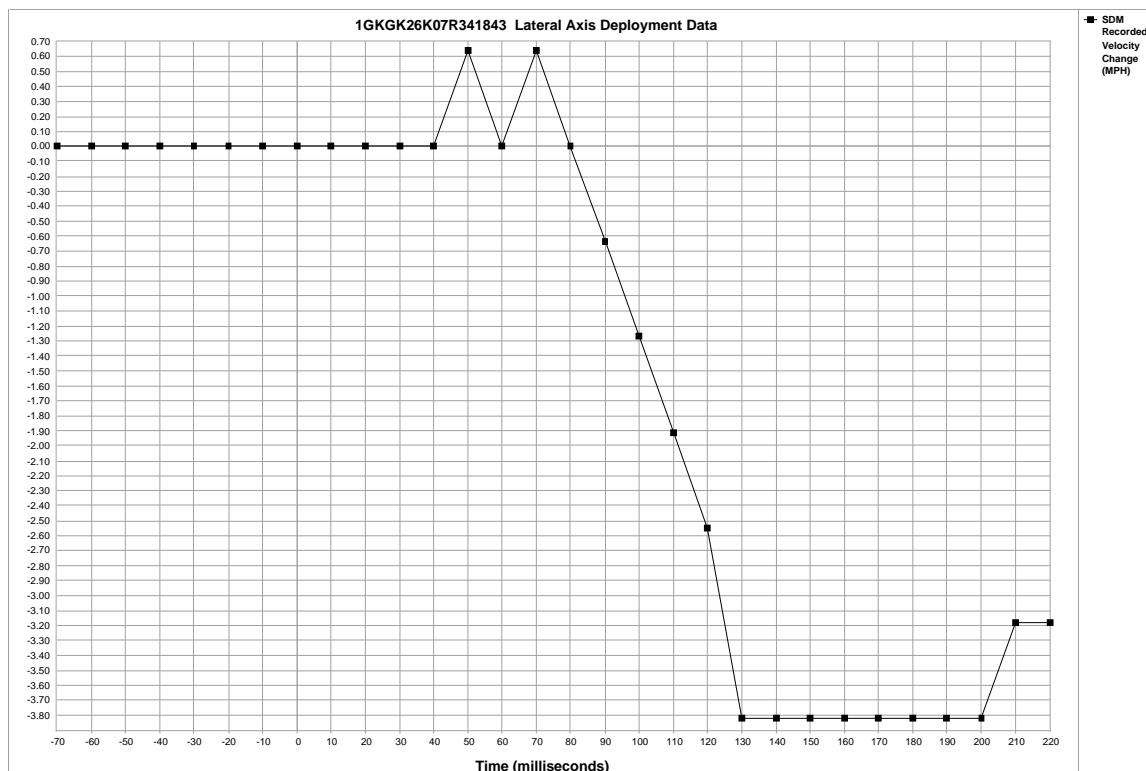
Parameter	-2.5 sec	-2.0 sec	-1.5 sec	-1.0 sec	-0.5 sec
Accelerator Pedal Position (percent)	0	0	0	0	0
Vehicle Speed (MPH)	86	86	86	81	68
Engine Speed (RPM)	2688	2688	2688	2368	2048
Percent Throttle	41	41	25	20	19
Brake Switch Circuit State	OFF	OFF	ON	ON	ON

## System Status At Deployment

Ignition Cycles At Investigation	4860
SIR Warning Lamp Status this Ignition Cycle	OFF
SIR Warning Lamp ON/OFF Time Continuously (seconds) this Ignition Cycle	175960
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously this Ignition Cycle	58
Ignition Cycles At Event	4859
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Driver Seat Position Switch Circuit Status	Rearward
Passenger Classification Status at Event Enable	Passenger Seat Empty
Current Passenger Position Status at Event Enable	Unknown
Previous Passenger Position Status at Event Enable	Unknown
Passenger Air Bag Indicator Status at Event Enable	OFF
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Diagnostic Trouble Codes at Event, fault number: 7	N/A
Diagnostic Trouble Codes at Event, fault number: 8	N/A
Diagnostic Trouble Codes at Event, fault number: 9	N/A
Driver 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	32.5
Driver 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	35
Passenger 1st Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Suppressed
Passenger 2nd Stage Time From Algorithm Enable to Deployment Command Criteria Met (msec)	Suppressed
Driver Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Passenger Side or Roof Rail/Head Curtain Time From Algorithm Enable to Deployment Command Criteria Met (msec)	N/A
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
SDM Synchronization Counter	4859
Time Between Events (sec)	N/A
Event Recording Complete	Yes
Driver First Stage Deployment Loop Commanded	Yes
Passenger First Stage Deployment Loop Commanded	No
Driver Second Stage Deployment Loop Commanded	Yes
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	Yes
Passenger Pretensioner Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 3) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No



Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Longitudinal Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	-0.64	-1.27	-2.55	-2.55	-3.18	-4.46	-5.09	-6.37	-6.37	-7.00	-8.28
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Longitudinal Axis Recorded Velocity Change (MPH)	-10.19	-11.46	-13.37	-15.28	-16.55	-17.82	-19.10	-19.73	-20.37	-20.37	-21.01	-21.01	-21.01	-21.01	-21.01



Time (milliseconds)	-70	-60	-50	-40	-30	-20	-10	0	10	20	30	40	50	60	70
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.64	0.00	0.64
Time (milliseconds)	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220
SDM Lateral Axis Recorded Velocity Change (MPH)	0.00	-0.64	-1.27	-1.91	-2.55	-3.82	-3.82	-3.82	-3.82	-3.82	-3.82	-3.82	-3.82	-3.18	-3.18

## Hexadecimal Data

```
$01 00 00 00 00 00 00 00 00 00  
$02 00 00 00 00 00 00 00 00 00  
$03 00 00 00 00 00 00 00 00 00  
$04 00 00 00 00 00 00 00 00 00  
$05 00 00 00 00 00 00 00 00 00  
$06 C5 00 00 00 00 00 00 00 00  
$0A 00 00 00 00 00 00 00 00 00  
$0B 00 00 00 00 00 00 00 00 00  
$0C 00 00 00 00 00 00 00 00 00  
$0D 00 00 00 00 00 00 00 00 00  
$0E 00 00 00 00 00 00 00 00 00  
$0F 00 00 00 00 00 00 00 00 00  
$10 00 00 00 00 00 00 00 00 00  
$11 2B FF FF 80 7F 00 00 00 00  
$12 FF 00 F0 F0 C0 00 00 00 00  
$13 F3 00 C0 B0 40 00 00 00 00  
$14 F3 00 C0 B0 40 00 00 00 00  
$15 01 02 03 04 00 00 00 05 00  
$16 06 00 00 00 00 00 00 00 00  
$17 00 00 00 00 00 00 00 00 00  
$18 01 03 00 00 00 00 00 00 00  
$19 07 07 07 07 00 00 00 07 00  
$1A 07 00 00 00 00 00 00 00 00  
$1B 00 00 00 00 00 00 00 00 00  
$1C 00 00 00 00 00 00 00 00 00  
$1D 00 00 00 00 00 00 00 00 00  
$1E 01 00 00 00 00 00 00 00 00  
$1F 00 00 00 00 00 00 00 00 00  
$20 00 00 00 00 00 00 00 00 00  
$21 00 00 00 00 00 00 00 00 00  
$22 00 00 00 00 00 00 00 00 00  
$23 00 00 00 00 00 00 00 00 00  
$24 00 00 00 00 00 00 00 00 00  
$25 00 00 00 00 00 00 00 00 00  
$26 00 48 42 5E 18 56 06 00 00  
$27 03 50 00 00 00 00 00 00 00  
$28 00 00 00 00 00 00 00 00 00  
$29 00 00 00 00 00 00 00 00 00  
$2A 00 8B 00 00 00 00 00 00 00  
$2B 21 20 50 00 00 00 00 00 00  
$2C 7F 7F 7E 7F 7F 7E 00 00 00  
$2D FF FF FF FF FF 80 00 00 00  
$2E 00 80 00 80 00 00 00 00 00  
$2F FF FF FF FF FF 80 00 00 00  
$30 OF FF OF FF 80 00 00 00 00  
$31 FF FF FF FF FF 80 00 00 00  
$32 FF FF FF FF FF 80 00 00 00  
$33 00 00 00 00 00 00 00 00 00  
$34 00 00 00 00 00 00 00 00 00  
$35 00 00 00 00 00 00 00 00 00  
$36 00 00 00 00 00 00 00 00 00  
$37 00 00 00 00 00 00 00 00 00  
$38 00 00 00 00 00 00 00 00 00  
$39 00 00 00 00 00 00 00 00 00  
$3A 00 00 00 00 00 00 00 00 00
```

\$3B	80	00	07	00	01	00	00
\$3C	00	FF	12	FC	00	12	FC
\$3D	82	C0	00	00	00	00	00
\$40	00	00	00	00	00	00	00
\$41	E0	00	00	00	00	00	90
\$42	20	25	2A	2A	2A	00	00
\$43	02	DB	02	F1	00	00	00
\$44	30	34	40	68	69	00	00
\$45	6E	83	8A	8A	8A	00	00
\$46	00	82	C0	00	00	00	00
\$50	00	00	00	00	00	00	00
\$51	00	00	00	00	00	00	00
\$52	00	00	00	00	00	00	00
\$53	00	00	00	00	00	00	00
\$54	00	00	00	00	00	00	00
\$55	00	00	00	00	00	00	00
\$56	00	00	00	00	00	00	00
\$57	00	00	00	00	00	00	00
\$58	00	00	00	00	00	00	00
\$59	00	00	00	00	00	00	00
\$5A	00	00	00	00	00	00	00
\$5B	00	00	00	00	00	00	00
\$5C	00	00	00	00	00	00	00
\$5D	00	00	00	00	00	00	00
\$5E	00	00	00	00	00	00	00
\$5F	00	00	00	00	00	00	00
\$60	00	00	00	00	00	00	00
\$61	00	00	00	00	00	00	00
\$62	00	00	00	00	00	00	00
\$63	00	00	00	00	00	00	00
\$64	00	00	00	00	00	00	00
\$65	00	00	00	00	00	00	00
\$66	00	00	00	00	00	00	00
\$90	E0	A5	00	00	00	00	00
\$91	A3	00	00	00	00	00	00
\$92	00	44	BC	00	3A	00	00
\$93	FF	12	FB	12	FB	00	00
\$94	00	00	00	00	00	00	00
\$95	00	00	00	00	00	00	00
\$96	00	00	00	00	00	00	00
\$97	00	00	00	00	00	00	00
\$98	00	00	00	00	00	00	00
\$99	00	00	00	00	00	00	00
\$9A	00	00	01	00	02	00	00
\$9B	04	00	04	00	05	00	00
\$9C	07	00	08	00	0A	00	00
\$9D	0A	01	0B	00	0D	01	00
\$9E	10	00	12	FF	15	FE	00
\$9F	18	FD	1A	FC	1C	FA	00
\$A0	1E	FA	1F	FA	20	FA	00
\$A1	20	FA	21	FA	21	FA	00
\$A2	21	FA	21	FB	21	FB	00
\$A3	8F	FF	FF	10	00	00	00
\$A4	00	00	01	20	01	00	00
\$A5	0D	0E	00	00	00	00	00
\$01	41	48	00	00	00	00	00
\$02	00	00	00	C2			
\$03	41	4A	00	00	00	00	00
\$04	00	00	00	C2			

## **Disclaimer of Liability**

**Disclaimer of Liability**  
The users of the CDR product and reviewers of the CDR reports and exported data shall ensure that data and information supplied is applicable to the vehicle, vehicle's system(s) and the vehicle ECU. Robert Bosch LLC and all its directors, officers, employees and members shall not be liable for damages arising out of or related to incorrect, incomplete or misinterpreted software and/or data. Robert Bosch LLC expressly excludes all liability for incidental, consequential, special or punitive damages arising from or related to the CDR data, CDR software or use thereof.