On-Site Ambulance Investigation
Dynamic Science, Inc. (DSI), Case Number DS09019
1999 Ford E350 Econoline
Arizona
February 2009

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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16. Abstract

This on-site investigation focused on the crash dynamics and injuries sustained in a crash involving a 1999 Ford E350 Econoline van that was configured as an ambulance. The crash occurred within an intersection. The Ford was being driven by a 24-year-old male. The front right seat was occupied by a 71-year-old male who was the uncle of the patient that was being transported. There was a male Emergency Medical Technician in the rear of the ambulance who was attending to a 31-year-old female. The female was on an ambulance cot prior to the crash. The first other vehicle was a 2006 Dodge Charger that was being driven by a 20-year-old male. The second other vehicle was a 2000 GMC Sierra pickup. The Ford was traveling westbound approaching the intersection on a green light without emergency lights and sirens. The Dodge was traveling southbound on the off-ramp approaching the intersection on a red light. The GMC was stopped in the west leg of the intersection. The Dodge reportedly ran the red light and entered the intersection. The front of the Dodge struck the right front of the Ford. Both vehicles were redirected counterclockwise toward the southwest corner of the intersection. The Ford separated from the Dodge and overturned onto its right side. The Dodge continued in a southwest direction and impacted the stopped GMC. All the vehicles came to rest in the intersection. The driver of the Ford sustained moderate injuries. The front right passenger was fatally injured. The patient in transport sustained moderate injuries and the rear EMT sustained minor injuries. The Ford and the Dodge were towed due to damage.

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Dynamic Science, Inc.
Crash Investigation
Case Number: DS09019

TABLE OF CONTENTS

BACKGROUND

This on-site investigation focused on the crash dynamics and injuries sustained in a crash involving a 1999 Ford E350 Econoline van that was configured as Type III[1] ambulance (**Figure 1**). The crash occurred within an intersection formed by an east/west through roadway and north/south freeway on/off-ramps. The Ford was being driven by a 24-year-old male. The front right seat was occupied by a 71-year-old male who was the uncle of the patient that was being transported. There was a male Emergency Medical Technician (EMT) in the rear of the ambulance who was attending to a 31-year-old female. The female was on an ambulance cot prior to the crash. The first other vehicle was a 2006 Dodge Charger that was being driven by a 20-year-old male. There were three additional passengers in the Dodge. The second other vehicle was a 2000 GMC Sierra pickup that was being driven by an 18-year-old male. The Ford was traveling westbound approaching the intersection on a green light. The Ford was traveling without emergency lights and sirens. The Dodge was traveling southbound on the off-ramp approaching the intersection on a red light. The GMC was heading east and was stopped in the west leg of the intersection. The Dodge reportedly entered the intersection against a red signal. The front of the Dodge struck the right front of the Ford. Both vehicles were redirected counterclockwise toward the southwest corner of the intersection. There was a secondary impact between the two vehicles and the Ford partially overturned onto the Dodge. As the vehicles continued in a southwest direction, the Ford separated from the Dodge and overturned onto its right side. The Dodge continued in a southwest direction and impacted the stopped GMC. All the vehicles came to rest in the intersection.

Figure 1. 1999 Ford E350 Econoline Type III Ambulance

The driver of the Ford sustained moderate injuries. The front right passenger was fatally injured. The patient in transport sustained moderate injuries and the rear EMT sustained minor injuries. The driver and front right seat occupant of the Dodge were fatally injured. The two rear seat occupants were injured and were transported to a local hospital. The driver of the GMC reported a possible injury. The Ford and the Dodge were towed due to damage.

This ambulance crash investigation was identified by the National Highway Traffic Safety Administration (NHTSA) Office of Emergency Medical Services (EMS) in an online news article. The article reported that three persons were fatally injured in a three-vehicle intersection type crash. The article was forwarded to the Special Crash Investigations (SCI) office with a request to conduct an investigation. DSI was instructed to pursue this incident as an on-scene investigation. The investigating police agency was contacted and agreed to cooperate. A police report and on-site photos were obtained. The Ford ambulance was inspected on April 20, 2009. A representative from the ambulance company was present for a portion of the inspection. The Dodge was inspected

[1]Type III ambulances have a modular body built on a cut-away van chassis.

on April 21, 2009. The Ford was equipped with a video camera[2] that records 10 seconds before and 10 seconds after an incident. The police and ambulance representatives attempted to download the video but there was no data present. It was reported that the camera will not record an event if the power is cut to the camera during the event and before the camera can save the event. DSI imaged the Event Data Recorder (EDR) data from the Dodge but no events were recorded. According to a note in the Bosch report, for model year 2006 some Dodge Charger models may contain EDR data that cannot be imaged by the Crash Data Recorder (CDR) tool. This is the likely reason why no data was present. A truncated version of the Bosch report with the hexadecimal data removed is attached to this report.

Figure 2. Westbound approach

Figure 3. Southbound approach

Figure 4. Eastbound approach

SUMMARY

Crash Site

The crash occurred within an intersection formed by an east/west through roadway and north/south freeway on/off-ramps. The east leg of the intersection was comprised of two westbound through lanes, a left turn lane, a raised median, and three eastbound through lanes (**Figure 2**). The asphalt roadway was straight and level, and passed beneath the freeway. The north leg of the intersection was a freeway off-ramp that was comprised of a left turn lane, two through lanes, and a right turn lane (**Figure 3**). The concrete roadway was straight and had a 2% negative grade. The west leg of the intersection was comprised of three eastbound through lanes, a raised median, and two westbound through lanes (**Figure 4**). It was dark at the time of the crash and streetlights were illuminated. All the roadways were dry and the posted speed limit was 72 km/h (45 mph).

[2]DriveCam Video Systems

Pre-Crash

The Ford was traveling westbound in the middle lane approaching the intersection with a green light at a driver reported speed of 84 k/h (40 mph). The Ford was traveling without emergency lights and sirens. The Dodge was traveling southbound on the off-ramp approaching the intersection against a red light. The GMC was stopped in the west leg of the intersection. The Dodge reportedly entered the intersection against the red signal.

Crash

The front of the Dodge impacted the right side of the Ford at the right front tire (Event 1). The WinSMASH program computed a Total Delta-V of 25 km/h (15.5 mph) for the Ford based on the right side damage profile. The longitudinal and lateral components were -23 km/h (-14.3 mph) and -9 km/h (-5.6 mph), respectively. The program computed a Total Delta-V of 53 km/h (32.9 mph) for the Dodge based on the frontal damage. The longitudinal and lateral components were -46 km/h (-28.6 mph) and 27 km/h (16.8 mph), respectively. The results were borderline because the damage to the Dodge included the damage sustained when impacting the GMC as well as the lack of vehicle separation. The frontal air bags in both vehicles deployed during the initial impact. The Ford was displaced to the left into a counterclockwise rotation. The Dodge rotated in a clockwise direction. The left side of the Dodge impacted the right side of the Ford in a sideslap type impact (Event 2). The Ford partially overturned and its right side impacted the left side of the Dodge. Both vehicles traveled in a southwest direction while still engaged with one another. As the vehicles entered the westbound travel lanes, the right front tire of the Dodge contacted the tip of the median in the east leg of the intersection, the vehicles separated and the Ford overturned onto its right side (Event 3). The Dodge continued in southwest direction and the front of the vehicle impacted the left front fender area of the stopped GMC (Event 4). The GMC was redirected in a clockwise direction. The front bumper of the Ford was displaced at some point and impacted the rear deck lid/spoiler of the Dodge (Event 5). The Ford came to rest on its right side facing west with its displaced bumper coming to rest on the rear deck lid/spoiler of the Dodge (**Figure 5**). The Dodge came to rest on its wheels facing west and in contact with the left side of the GMC. The GMC came to rest on its wheels facing south with its right front tire resting against the south curb. The Dodge caught fire shortly after coming to rest (Event 6).

Figure 5. Final rest, police photo (facing north)

Post-Crash

All of the vehicles came to rest in the west leg of the intersection. EMS was notified at 0359 hours and arrived at 0404 hours.

The driver of the Ford was extricated through the windshield by a responding police officer. He sustained a closed head injury, an unspecified muscle strain, and abrasions to his hands and forehead. He also reported a brief loss of consciousness immediately after the crash. During the interview, he stated the he was apparently awake as he exited the vehicle but he had no memory of the extrication. He was transported by ground ambulance to a local trauma center and arrived with a Glasgow Coma Score (GCS) of 15. He was treated at the hospital and then released.

The 71-year-old male front right occupant of the Ford was fatally injured. He sustained multiple blunt force injuries to the neck, thorax, and abdomen and expired on scene.

The patient-in-transport was able to exit the Ford through the rear doors with the assistance of the rear medic. She sustained liver and spleen lacerations, fractures of ribs 9-12 with pneumothorax, an eyelid abrasion, and a contusion to the right forehead. She was belligerent and combative upon her arrival at the hospital and had a GCS of 9. She tested positive for alcohol (BAC = 0.226) and cocaine. She was admitted and hospitalized for five days and then transferred to a psychiatric facility.

The rear medic was able to exit the Ford through the rear doors. He sustained bilateral abrasions to his lower legs and reported that he had a headache. He was transported to a local hospital where he was treated and released.

All the occupants of the Dodge were unconscious upon police arrival. The Dodge caught fire shortly after coming to rest. The fire began in the engine compartment and was probably caused by a fuel leak. Responding police officers contained the fire with hand-held extinguishers while one officer unsuccessfully attempted to pry open the doors. Fire department personnel arrived shortly after the crash and extinguished the fire. The 20-year-old driver and the 25-year-old front right passenger of the Dodge were fatally injured. The 19-year-old rear left and 20-year-old rear right passengers were seriously injured. They were extricated by rescue personnel and transported to a local trauma center.

The 18-year-old driver of the GMC was responsive and ambulatory after the crash. He was able to exit the vehicle under his own power.

Vehicle Data - 1999 Ford E350 Econoline

The 1999 Ford E350 Econoline was identified by the Vehicle Identification Number (VIN): 1FDSE30F8XHAxxxxxx. The Ford was a 4x2 cutaway van that was configured as a Type III ambulance. The vehicle was manufactured in August 1998. The ambulance manufacturer was the McCoy Miller Division of Warrick Industries and the year of manufacture was 1999. The vehicle mileage was 687,613 km (427,262 miles). The Ford was equipped with a 7.3-liter, 8-cylinder diesel engine, automatic transmission, and rear wheel drive. The ambulance conversion included a modular body, dual rear doors, a curb side door, and a lights and siren warning system. The Ford

was equipped with Goodyear G947 RSS Armor Max LT245/75R16 tires. The vehicle manufacturer's recommended cold tire pressure was 552 kPa (80 psi); the tire manufacturer's maximum pressure was 552 kPa (80 psi). The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	496 kPa (72 psi)	6 mm (8/32 in)	No	None
LR	414 kPa (60 psi)	5 mm (6/32 in)	No	None
RR	276 kPa (40 psi)	5 mm (6/32 in)	No	None
RF	Tire Flat	8 mm (10/32 in)	No	Debeaded

The seating in the Ford was configured with front bucket seats with integral head restraints. The body interior included one rear-facing seat, one-right facing seat, and a set of three-left facing seats arranged as a bench. On the left side of the floor there was a cot clamp and a set of antler brackets. An overview of the body interior is included as Attachment 3 to this report.

Exterior Damage -1999 Ford E350 Econoline

The Ford ambulance sustained severe right side damage from the impact with the Dodge and minor right side damage from the rollover and sideslap.

The damage from the impact with the Dodge began 241 cm (94.9 in) forward of the rear axle and extended 191 cm (75.2 in) forward along the right side of the vehicle (**Figure 6**). The damaged area included the right front bumper. Both front wheels were displaced and fractured from the vehicle, and the drive shaft was separated from the transmission (**Figure 7**). The right front tire was embedded with a 13 x 7 cm (5.1 x 2.8 in) section of plastic fascia from the Dodge. A 16 x 3 cm (6.3 x 1.2 in) section of the rim was missing. Six crush measurements were documented at the sill level as follows: C_1 = 14 cm (5.5 in), C_2 = 33 cm (12.9 in), C_3 = 43 cm (16.9 in), C_4 = 27 cm (10.6 in), C_5 = 36 cm (14.2 in), C_6 = 64 cm (25.1 in). The Collision Deformation Classification for the impact with the Dodge was 01RYEW4.

Figure 6. Right side damage (subject vehicle)

Figure 7. View of subject vehicle undercarriage (police photo)

There was direct contact damage to the ambulance body that extended from the right rear corner forward 351 cm (138.2 in) to the end of the body

(**Figure 8**). The damage also included contact to the right B-pillar. The damage included vehicle-to-vehicle sideslap damage and damage from the right side rollover. The damage extended from the bottom of the body 216 cm (85 in) vertically to the top of the body. The CDCs for the rollover and sideslap were 00RDAO2 and 03RBEW1, respectively. The front bumper was displaced during the crash and contacted the top of the Dodge.

Figure 8. Right side rollover and sideslap damage (subject vehicle)

Interior Damage

The Ford ambulance sustained moderate damage from intrusion and occupant contacts (**Figure 9**). The Ford sustained lateral intrusions of the right door, right sill, right window frame, right lower kick panel, the engine cowling, and the toe pan. The right side window disintegrated during the impact and the windshield was cracked. The status of the left side window was not known. The right front door was jammed shut and was forced open by rescue personnel.

Figure 9. Overview of front seating area (subject vehicle)

There were occupant contacts located within the cab area of the ambulance. The left and right knee bolsters were deformed, the right door panel was fractured and deformed, the foot controls were deformed, the engine cowling was shifted, and there was a blood deposit to the right upper window frame. There was also a cloth transfer located on the front panel of the driver's air bag. Several possible contacts were located within the ambulance body. Slight deformation to the panel adjacent to the rear-facing seat that was located 17 cm (6.7 in) rear of the forward aspect and 74 cm (29.1 in) above the floor was identified. There was a dent to the right interior door that, based on its location and shape, may have been caused by the emergency cot. The dent was located 71 cm (27.9 in) from the bottom of the door, 40 cm (15.7 in) above the floor, and 14 cm (5.5 in) rear of the forward aspect of the door. Above the right interior door, there was an area of scuffing that measured 17 x 16 cm (6.7 x 6.3 in). Just aft of the door, damage to a plastic panel and an oxygen connector was identified.

Figure 10. Driver's safety belt (subject vehicle)

Manual Restraints

The Ford was equipped with manual 3-point lap and shoulder belts for the front row seats. The driver's safety belt shoulder anchorage was adjusted to between the mid and full down position; the front right shoulder anchorage was adjusted to the full down position. The driver's safety belt webbing exhibited loading that began 48 cm (18.9 in) from the anchor and measured 41 cm (16.1 in) in length (**Figure 10**). The front right occupant's safety belt had been cut by rescue personnel at a point 171 cm (67.3 in) from the anchor at a point near the shoulder anchorage. Both front seats were equipped with buckle pretensioners that actuated during the impact with the Dodge (**Figure 11**). All the seats in the rear of the ambulance were equipped with manual lap belts. There was evidence of historical usage to the belts at the rear-facing and right-facing seat positions.

Figure 11. Driver's safety belt pretensioner (subject vehicle)

Supplemental Restraint Systems (SRS)

The 1999 Ford Econoline was equipped with frontal air bags that deployed as a result of the impact with the Dodge.

The driver's air bag deployed from the center of the steering wheel hub through H-configuration module cover flaps (**Figure 12**). The top flap measured 15 cm (5.9 in) high by 20 cm (7.9 in) wide. The bottom flap measured 3 cm (1.2 in) high by 20 cm (7.9 in) wide. The air bag measured 50 cm (19.7 in) in diameter in its deflated state. The air bag was configured with circular 4 cm (1.6 in) vent ports at the 11 and 1 o'clock positions and a single tether strap. On the back panel of the air bag there was a 5 x 2 cm (1.9 x 0.8 in) area of melted plastic (**Figure 13**). The base of the tether strap was also melted; the strap was frangible and separated from the air bag when moved (**Figure14**). The damage at both locations was as a result of heat generated by the inflator during the air bag deployment.

Figure 12. Driver's air bag (subject vehicle)

On the front panel of the air bag there was a 16 x 6 cm (6.3 x 2.4 in) cloth transfer pattern. The transfer began 8 cm (3.1 in) lateral to the center of the bag and 7 cm (2.8 in) above the center; the transfer ended 20 cm (7.9 in) lateral to the center and 13 cm (5.1 in) above the center.

Figure 13. Melted plastic on air bag (subject vehicle)

Figure 14. Melted tether strap (subject vehicle)

The front right passenger's air bag deployed from a single rectangular module flap that was hinged at its forward aspect (**Figure 15**). The flap measured 22 cm (8.7 in) high by 38 cm (14.9 in) wide. The air bag measured 53 cm (20.9 in) wide seam to seam and was 63 cm (24.8 in) high. The maximum excursion measured 65 cm (25.5 in). There was a 4 x 5 cm (1.6 x 1.9 in) tear along the bottom edge of the module cover that was located 13 cm (5.1 in) from the left corner of the cover. There was a blood deposit located on the front panel that was located 14 cm (5.5 in) lateral from the left edge of the air bag and 20 cm (7.9 in) from the top.

Figure 15. Passenger air bag (subject vehicle)

Rollover Discussion

The Ford was not equipped with any advanced handling or stability features and the Static Stability Factor (SSF) was not known. The SSF of a vehicle is an at-rest calculation based on its rollover resistance. The Ford was equipped with an automatic transmission and rear wheel drive. The tires were in good condition and did not play a role in the rollover.

At impact with the Dodge, the Ford was displaced to the left into a counterclockwise rotation and the Dodge rotated in a clockwise direction. The left side of the Dodge impacted the right side of the Ford in a sideslap type impact. The Ford partially overturned and its right side impacted the left side of the Dodge. Both vehicles traveled in a southwest direction while still in contact with one another. As the vehicles entered the westbound travel lanes, the vehicles separated and the Ford overturned onto its right side. The estimated distance between rollover and final was 6 m (20 ft). The Ford came to rest on its right side facing west.

Vehicle Data - 2006 Dodge Charger

The 2006 Dodge Charger was identified by the VIN: 2B3KA43G96Hxxxxxx. The Dodge was a 4-door sedan equipped with a 3.5-liter, 6-cylinder engine, automatic transmission, and rear wheel drive. The Dodge was equipped with Michelin HydroEdge 215/60R17 tires for the front tires and Goodyear Integra P215/65R17 tires for the rear tires. The tire manufacturer's recommended maximum pressure was 303 kPa (44 psi). The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Tire Flat	6 mm (8/32 in)	Yes	Cut and holed
LR	Tire Flat	5 mm (6/32 in)	No	De-beaded
RR	Tire Flat	3 mm (4/32 in)	No	De-beaded
RF	Tire Flat	7 mm (9/32 in)	Yes	De-beaded

The left front tire sustained an 8 cm (3.1 in) cut that began at the bead and extended into the sidewall. A jagged 7 cm (2.8 in) cut in the outboard sidewall, and an 8 cm (3.1 in) "J" shaped cut in the inboard sidewall were present. A 3 cm (1.2 in) lug nut from the right front tire of the Dodge was embedded in the outboard sidewall (**Figure 16**).

Figure 16. Left front tire damage, 2006 Dodge Charger

Vehicle Damage - 2006 Dodge Charger

Exterior Damage

The Dodge sustained severe damage from the initial impact with the Ford and moderate damage from secondary impacts (**Figure 17**). The Dodge also sustained minor damage from an engine fire.

The direct damage from the initial impact with the Ford began at the left front bumper corner and extended 80 cm (31.4 in) laterally to the right. Six crush measurements were documented along the bumper backing bar as follows: C_1 = 101 cm (39.7 in), C_2 = 82 cm (32.2 in), C_3 = 62 cm (24.4 in), C_4 = 43 cm (16.9 in), C_5 = 26 cm (10.2 in), C_6 = 4 cm (1.6 in). The CDC for the initial impact with the Ford was 11FYEW5.

Figure 17. Frontal damage, 2006 Dodge Charger

The wheelbase on the left side was shortened by 53

cm (20.9 in). All the doors were jammed shut and had to be pried open. The left and right A-pillars were cut by rescue personnel.

There were patterns of direct contact along the entire left side of the Dodge from the secondary impact with the Ford which partially overturned onto the Dodge. Contact to left A-pillar that extended 31 cm (12.2 in) laterally along the windshield frame was located. This was likely caused by the forward edge of the ambulance body. Direct contact to the left front door was located that measured 43 cm (16.9 in) in height by 90 cm (35.4 in) in width.

Figure 18. Left and rear damage to Dodge Charger (police photo)

There was direct contact along the B-pillar and a 45 cm (17.7 in) section of contact along the upper left rear door window frame and direct contact to the left rear door that measured 64 cm (25.1 in) in height by 27 cm (10.6 in) in width. Scratches that extended from the left rear door to the rear of the vehicle were located. The maximum lateral crush was located at the A-pillar and was estimated to be 57 cm (22.4 in) to the right. The damage was altered by extrication efforts. The lateral crush at the B-pillar measured 34 cm (13.4 in) to the right. The CDC for the secondary impact was 09LDAW3.

The Dodge continued forward and impacted the left side of the GMC. The estimated CDC for this impact was 12FDEW1.

There was 143 cm (56.2 in) of direct red paint contact to the trunk lid and the rear spoiler. The spoiler was deformed downward. This damage was caused by the front bumper of the Ford which had become partially separated from the vehicle (**Figure 18**). The CDC for this event was 00TBDW1.

Vehicle Data - 2000 GMC Sierra pickup

The 2000 GMC Sierra 1500 pickup was identified by the VIN: 1GTEC14V9YZxxxxxx. The GMC was a 2-door pickup that was equipped with a 4.8-liter, 8-cylinder engine, automatic transmission, 4-wheel anti-lock brakes, 4-wheel disc brakes, and rear-wheel drive. The vehicle manufacturer recommended P235/75R16 tires. The vehicle sustained minor left side damage from the impact with the Dodge (**Figure 19**). The direct damage began at the front left bumper corner and extended rearward an estimated 382 cm (150.3 in) to the left rear tire. The CDC for this impact was 10LDAW2. The right front tire contacted the curb, but there did not appear any residual damage. The vehicle was towed from the scene despite there being little visible damage.

Figure 19. 2000 GMC Sierra pickup (police photo)

OCCUPANT DEMOGRAPHICS

	Driver	**Front Right Occupant (02)**
Age/Sex:	24/Male	71/Male
Seated Position:	Front left	Front right
Seat Type:	Bucket	Bucket
Seat track position:	Rear-most. Seat located 43 cm (16.9 in) forward of B-pillar.	Between forward most and middle track. Seat located 64 cm (25.1 in) forward of B-pillar.
Height:	173 cm (68 in)	157 cm (62 in)
Weight:	77 kg (170 lbs)	66 kg (145 lbs)
Alcohol/Drug Involvement:	None	None
Body Posture:	Upright	Upright
Hand Position:	Both on steering wheel, unknown clock position	Unknown
Foot Position:	Left on floor, right on accelerator	Unknown
Restraint Usage:	Lap and shoulder belt	Lap and shoulder belt
Air bags:	Driver's air bag deployed	Front right passenger air bag deployed

	Rear of Vehicle, Patient (03)	**Rear of Vehicle, Medic (04)**
Age/Sex:	31/Female	23/Male
Seated Position:	Row three, left	Row three, right
Seat Type:	None	Bench
Seat track position:	N/A	N/A
Height:	Unknown	191 cm (75 in)
Weight:	Unknown	68 kg (150 lbs)
Alcohol/Drug Involvement:	Unknown	None
Body Posture:	Lying on back on gurney	Seated, facing left side
Hand Position:	Unknown	Unknown

Foot Position:	N/A	Both presumed to be on floor
Restraint Usage:	Leg, torso, and shoulder harness used.	Lap belt available. Not used.

OCCUPANT INJURIES

Driver Injuries: Injuries obtained from emergency room records and radiology report.

Injury	OIC Code	Injury Mechanism	Confidence Level
Closed head injury	115099.7,0	Unknown	Unknown
Musculoskeletal strain	Not codeable	N/A	N/A
Abrasion, forehead	290202.1,7	Unknown	Unknown
Abrasions, dorsal aspect of both hands	790202.1,3	Windshield	Possible
Self-reported brief loss of consciousness	Not codeable	N/A	N/A

Front Right Occupant Injuries (02): Injuries obtained from autopsy report.

Injury	OIC Code	Injury Mechanism	Confidence Level
Laceration, right anteriolateral inferior vena cava, approximately 1 cm (0.5 in) from the anastomosis with the right atrium	421802.3,4	Door, rear upper quadrant	Probable
Liver, pulpified	541828.5,1	Door, rear upper quadrant	Probable
Bilateral pulmonary contusions	441410.4,3	Door, rear upper quadrant	Probable
Rib fractures, right, ribs 4-12	450230.3,1	Door, rear upper quadrant	Certain
Fracture, right pubis	852600.2,1	Door, rear lower quadrant	Certain
Focal subarachnoid hemorrhage, deep to the subdural hemrrorhages	140684.3,9	Unknown	N/A

Subdural hemorrhage, right and left parietal lobes with 20 ml blood on the right and 10 ml on the left	140650.4,1 140650.4,2	Unknown	N/A
Mild atlanto-occipital dislocation	650208.2,6	Door, forward upper quadrant	Possible
Laceration, cervical vertebra	650299.2,6	Door, forward upper quadrant	Probable
Abrasion, right forehead, 6-4 cm (2.5 x 1.5 in)	290202.1,7	Passenger air bag	Possible
Abrasion, right cheek extending to right neck, 20 x 13 cm (8.0 x 5.0 in)	290202.1,1	Passenger air bag	Possible
Laceration, occipital scalp, 10 cm (4.0 in)	190600.1,6	Right window frame	Possible
Abrasion, anterior chest	490202.1,9	Seat belt webbing	Probable
Contusions, right dorsal hand	790402.1,1	Right door panel, forward upper quadrant	Possible
Abrasions, left wrist and hand	790202.1,2	Unknown	N/A
Contusions/laceration, dorsum of left middle finger	790402.1,2 790600.1,2	Unknown	N/A
Abrasions/contusions, right knee	890202.1,1 890402.1,1	Lower instrument panel	Probable
Abrasions/contusions, right lower leg	890202.1,1 890402.1,1	Door, forward lower quadrant	Probable
Laceration, left heel	890600.1,2	Unknown	N/A
Contusion, left anterior thigh	890402.1,2	Wooden storage unit	Possible
Contusion, left calf	890402.1,2	Unknown	N/A

Rear of Vehicle, Patient Injuries (03): Injuries obtained from emergency room records, radiology reports, and discharge summary.

Injury	OIC Code	Injury Mechanism	Confidence Level
Liver laceration, with associated small hemoperitoneum.	541820.2,1	Emergency cot belt webbing	Probable
Splenic laceration, with hemoperitoneum	544220.2,2	Emergency cot belt webbing	Probable
Rib fractures 9-12, right side, with pneumothorax	450222.3,1	Emergency cot belt webbing	Probable
Hematoma, right side of forehead	290402.1,7	Unknown	N/A
Abrasion, under right eyelid	297202.1,1	Unknown	N/A

Rear of Vehicle, Medic Injuries (04): Injuries obtained from emergency room report and radiology records.

Injury	OIC Code	Injury Mechanism	Confidence Level
Bilateral abrasions, anterior lower legs	890202.1,3	Emergency cot	Probable
Minor head injury (headache)	Not codeable	N/A	N/A

OCCUPANT KINEMATICS

Driver Kinematics

The 24-year-old male driver of the Ford was seated in an upright posture and was wearing the manual lap and shoulder belt. His right foot was on the accelerator and his left was on the floor. Just prior to impact, the driver saw the other vehicle and moved his foot from the accelerator to try to brake but the impact occurred before he had a chance to brake. At impact with the Dodge, the driver's air bag deployed and the seat belt pretensioner actuated. The driver was displaced forward and to the right. He engaged and loaded the safety belt webbing and contacted the deployed air bag with his face, causing a forehead abrasion and a closed head injury. Both hands were displaced from the steering wheel and contacted the windshield, causing abrasions to the dorsal aspects of both hands. He sustained minor injuries of an unknown nature. He was extricated through the windshield by a responding police officer and was transported by ground ambulance to a local trauma center where he was treated and released after approximately five hours.

Front Row Right Occupant Kinematics (02)

The 71-year-old front right occupant was seated in an unknown posture in a bucket seat. He was using the manual lap and shoulder belt. At impact with the Dodge, the front right passenger's air bag deployed and the safety belt pretensioner actuated. This occupant was displaced forward and to the right. He engaged and loaded the seat belt webbing and contacted the deployed air bag. His right hip, abdomen, and torso engaged the intruding right front door (**Figure 20**). He sustained blunt force injuries to the neck, including an atlanto-occipital dislocation and a fracture of the cervical vertebra, due to impact with door. He sustained blunt force injuries to the thorax and abdomen, including multiple rib fractures, a pelvic fracture, an inferior vena cava laceration, and liver pulpification, due to contact with the interior door surface. He was declared dead at the scene.

Figure 20. Plastic fascia from front right door

Rear of Vehicle, Patient (03) Kinematics

The 31-year-old female patient was being transported from her home to the hospital for behavioral reasons. The interviewee indicated that she was suicidal. She was restrained with her head toward the front of the vehicle to a Rugged brand ambulance cot using the leg, torso, and shoulder harnesses. The cot was anchored to the left side floor rail. The forward aspect of the cot was in the semi-reclined position. At impact with the Dodge, the tubular portion of the cot that was anchored to the floor rail fractured and the cot broke away. As the Ford overturned to the right, the cot was displaced to the right and came to rest on the right side of the ambulance (**Figure 21)**. The forward aspect was resting against the right interior side surface, the aft aspect was resting against the base of the right side bench seat. The patient loaded the cot harness and sustained liver and spleen lacerations and fractures of right side ribs 9-12. She also sustained an eyelid abrasions and a forehead contusion. The patient was extricated through the rear doors with the assistance of the EMT. She was belligerent and combative upon her arrival at the hospital and had a GCS of 9. She was admitted, hospitalized for five days, and then transferred to a psychiatric facility.

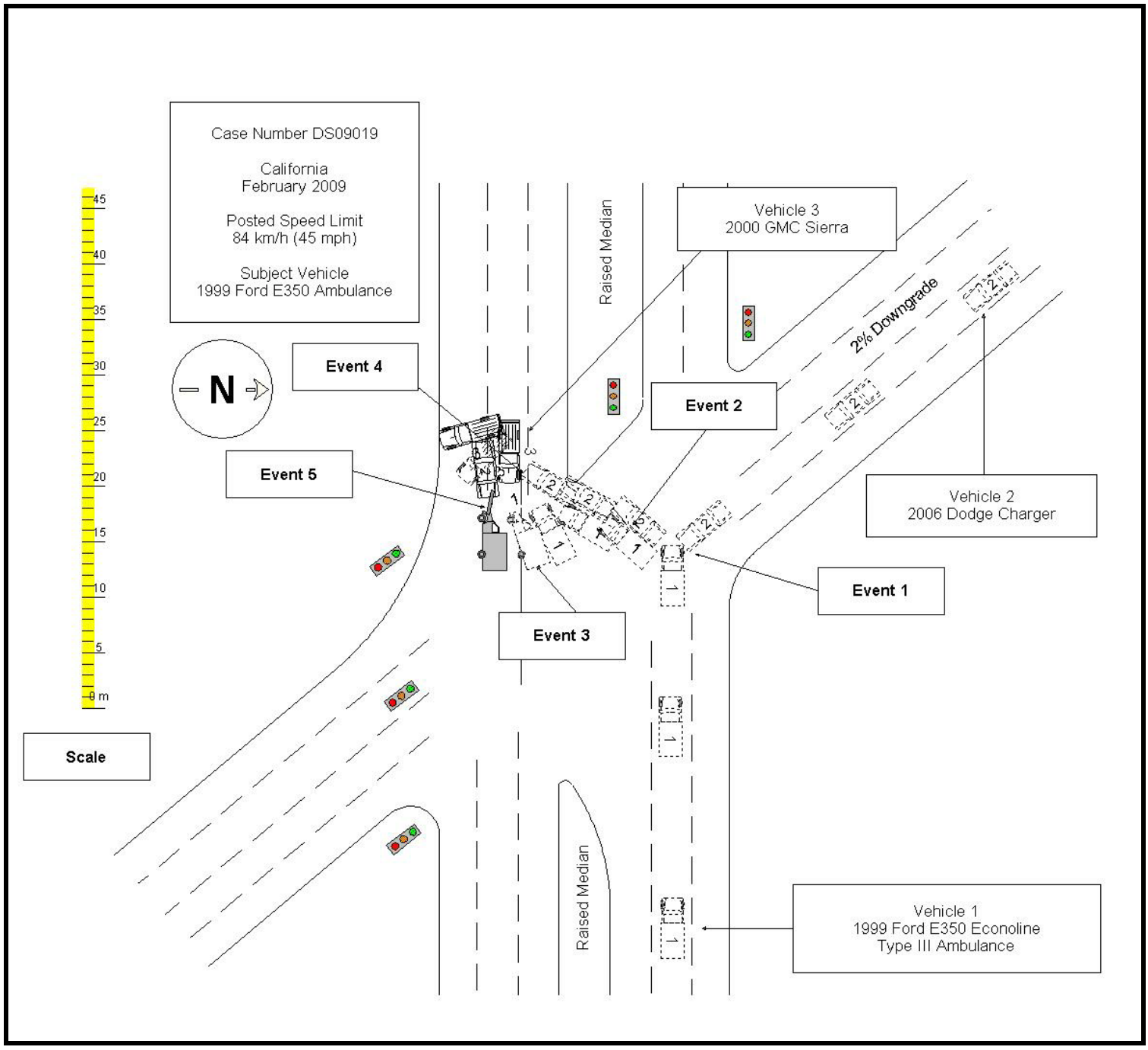
Figure 21. Final rest position of ambulance cot (police photo)

Figure 22. Overview of ambulance interior

Rear of Vehicle, Medic (04) Kinematics

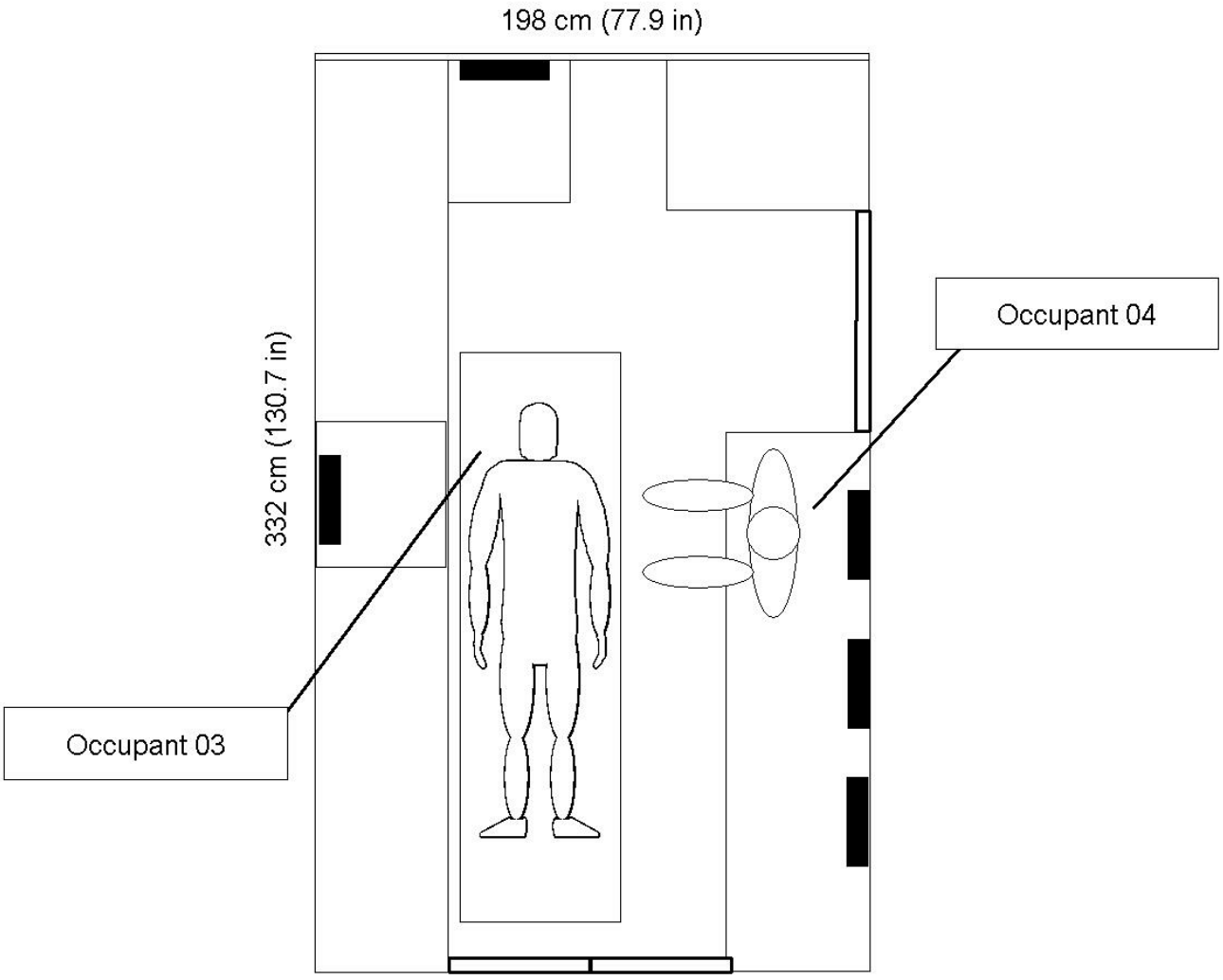
The 23-year-old male EMT was seated on the left facing right side bench seat (**Figure 22**). He was not wearing the available lap belt. He was beginning his evaluation of the patient. At impact with the Dodge, he was displaced forward and to the right. He sustained bilateral lower leg abrasions from contact with the ambulance cot as it was displaced to the right. He was able to assist the patient and they both exited the vehicle through the rear doors.

Attachment 1. Scene Diagram



Attachment 2. Satellite Image

Attachment 3. Ambulance Interior Configuration



Attachment 4. Bosch Report

CDR File Information

User Entered VIN	2B3KA43G96H******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	09019 WO SEQUENTIAL NUMBER.CDR
Saved on	Tuesday, April 21 2009 at 08:44:04 AM
Collected with CDR version	Crash Data Retrieval Tool 3.1
Reported with CDR version	Crash Data Retrieval Tool 3.1
EDR Device Type	airbag control module
Event(s) recovered	None

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

AIRBAG CONTROL MODULE (ACM) DATA LIMITATIONS:

GENERAL INFORMATION:

CAUTION: During Bench top imaging, make sure the ACM is not moved, tilted or turned over while connected to and powered by the CDR Interface Module. Also, after a CDR imaging process, wait 2 minutes after power is removed from the ACM before attempting to move the module. Not following these general ACM guidelines for bench top imaging could cause new events to be recorded in the ACM.

The ACM current fault status will be altered if the ACM is powered-up without having all of the other vehicle inputs connected (ex: bench top imaging). This situation will occur when the CDR tool is connected directly to the ACM. This will not affect any of the stored fault data information. Always make a note in the CDR case comments page when an ACM bench top imaging process is performed.

The recorded Deployment Event will contain Pre-Crash data.
• T0 (where '0' is subscript) (-.01 sec.) is defined as the last sample point in the vehicle data buffer when the ACM commanded a deployment for all vehicles except the 2008 - 2009 Dodge Grand Caravan, 2008-2009 Chrysler Town and Country and 2009 Dodge Journey. In these vehicles, T0 (where '0' is subscript) is defined as the algorithm wakeup.
• The VIN is captured by the ACM and then recorded as the Original VIN after 10 consecutive ignition cycles of capturing the same number. Once it has been recorded, this number can not be modified.

CDR FILE INFORMATION:

Event(s) Recovered definitions:
- None - There are no stored events in the Airbag Control Module (ACM)
- Not Retrievable - Event Data is stored in the ACM but is not retrievable by the CDR tool.
- Most Recent Event - Data of the most recent event is displayed in the report
- 1st Prior Event - Two events are stored in the ACM, Data displayed is of the first prior event.
- 2nd Prior Event - Three events are stored in the ACM, Data displayed is of the second prior event.
- Etc., (for modules with 3 to 5 stored events)

CDR RECORD INFORMATION:

- If power to the ACM is lost during a deployment event, all or part of the event data record may not be recorded. "Interrupted" will be displayed for Vehicle Event Recorder Status.
- The Airbag Control Module Configuration indicates the inputs and outputs that the ACM for a particular vehicle monitors and/or controls.
- Vehicle Data (Pre-Crash) is transmitted to the Airbag Control Module, by various vehicle control modules, via the vehicle's communication network. (For example: Vehicle Speed, Engine RPM, Percent throttle, and brake switch status are transmitted by the PCM. ESP data is from the electronic brake module.)
- On 2006-2009 Dodge Ram 2500/3500, the Engine RPM recorded is limited to a maximum of 4080 RPM.
- On the 2008 - 2009 Dodge Grand Caravan, 2008-2009 Chrysler Town and Country and 2009 Dodge Journey, the engine RPM resolution is 256 rpm. On all other vehicles, the resolution is 32 rpm.
- If a recorded event has RPM equal to 8160 or 4080 and vehicle speed equals 158 for each time stamp, then the data is default data and the event stored in the ACM is not valid.
- The accuracy of the recorded Vehicle Speed will be affected if the vehicle had the tire size or the final drive axle ration changed from the factory build specifications.
- Vehicle Speed is reported as an average of the drive wheels.
- On the 2008 - 2009 Dodge Grand Caravan, 2008-2009 Chrysler Town and Country and 2009 Dodge Journey, the vehicle speed resolution is 2 mph. On all other vehicles, the resolution is 1 mph.
- The MIL (Malfunction Indicator Lamp) Status for the various recorded systems indicates the state of the applicable malfunction indicator

lamp at the time that the data was captured. Note: Some fault codes could be stored due to component/system damage from the accident.

NOTE: A StarScan Tool should be used to read any stored Diagnostic Trouble Codes (DTC's) in the various electronic modules (ACM, PCM, ABS, TCM, etc., where applicable) for use in interpretation of some vehicle specific recorded data.

VEHICLE DATA DEFINITIONS:

• N/A - Not Applicable is used to show default values. This indicates that no data exists or that the data parameter is not applicable for vehicle configuration.
• SNA - Signal Not Available indicates that a defective sensor or system fault condition exists that is not allowing the data parameter to be sent across the vehicle communication bus.
• Not Retrievable - This indicates that the CDR tool was not able to retrieve that data for that particular vehicle data parameter.

Vehicle Event Recorder Status definitions:

- Interrupted - Contains Event, but was interrupted during recording; indicates data from the captured event was not fully recorded
- Complete - Contains Complete Data from an Event; indicates data from the captured event has been fully recorded
- No data - Contains No Event Data
- Relative Throttle (%) - This is the percentage of throttle blade opening (0 - 100%)
- Relative Pedal (%) - This is the percentage of accelerator pedal depressed (0 - 100%)
- Brake Switch #1 Status - This is the brake switch status of Service Brake (Open/Closed); Open = Brake not depressed; Closed = Brake depressed
- Brake Switch #2 Status - This is the brake switch status for Cruise Control (Open/Closed): Open = Brake not depressed; Closed = Brake depressed
- ABS MIL status - This indicates the ABS fault indicator lamp status. It will only be illuminated when there is a fault in the ABS system. The Electronic brake module DTC's should be read and recorded for final system interpretation.
- ESP MIL status - This indicates the ESP/BAS fault indicator lamp status. It will only be illuminated when there is a fault or thermal model shutdown in the ESP system. The ESP module DTC's should be read and recorded for final system interpretation. This is only valid for vehicles equipped with ESP.
- ESP Lamp Steady State Requested - This is the status of the ESP symbol - "car with squiggly lines" indicator lamp. "Yes" indicates ESP has been turned off by the driver or has reduced performance and is not an indication of a fault in the system. This is only valid for vehicles equipped with ESP.
- ESP Lamp Flashing Requested - If "Yes", then an ESP, Traction Control or Trailer Sway Control (if equipped) event was active at the time of data capture. This is only valid for vehicles equipped with ESP.
- ESP Disabled - "Yes" indicates that ABS & ESP have been disabled by the driver or due to system performance. This is only valid for vehicles equipped with ESP.
- Traction Control On/Off Button Status - Enabled means the system is functional and not turned off by the driver. On equipped vehicles.
- ESP Active - "YES" indicates that the ESP system is intervening with wheel specific braking/engine control. This is only valid for vehicles equipped with ESP.
- Panic Brake Assist Active - "Yes" indicates that all four of the brake circuits are under going ABS control. This is only valid for vehicles equipped with ESP.
- Steering Angle (Degrees) if equipped: Valid range is -2048 degrees to +2047 degrees;
  - Steering Angle polarity is positive for right turns on:
    - 2005 - 2007 Grand Cherokee
    - 2006 - 2007 Commander
    - 2005 - 2009 300, Magnum, and Charger
    - 2008 - 2009 Challenger
  - Steering Angle polarity is negative for right turns on:
    - 2008 - 2009 Grand Cherokee and Commander
    - All other vehicles not specified
- Yaw Rate (Degrees) if equipped: Valid range is -327.68 degrees/second to +327.67 degrees/second. All vehicles use negative yaw rate when making a right turn.
- Wheel Speed (stored for some vehicles equipped with ABS/ESP); value is revolutions per minute:
    - LF = Left Front Tire
    - RF = Right Front Tire
    - LR = Left Rear Tire
    - RR = Right Rear Tire
- ETC Lamp Status - Lamp "ON " indicates there is an active Electronic Throttle DTC. This is only valid for vehicles equipped with ETC.
- ETC Lamp Flashing - If "Yes", then the ETC is in the limp-in mode. This is only valid for vehicles equipped with ETC.
- Engine Torque Applied - If "No", then no engine torque output was applied (as in Park/Neutral for Automatic transmissions or clutch depressed on manual or during an ESP/Traction Control event), If "Yes", then engine torque output was applied.
- Tire 1 (2,3) Location - This indicates the location of the tire pressure sensor data. Default is used to indicate that the location of the tire pressure sensor is unknown or there is no tire pressure sensor in the wheel. Vehicles with Base Tire Pressure Monitoring systems will display SPARE for all 3 Tire Locations as these vehicles do not send actual pressure values across the communication bus.
- Tire 1 (2,3) Pressure Status - This indicates the actual pressure status of the Tire Location defined in the previous column. Possible values are LOW, NORMAL, HIGH, or SNA for this parameter. Vehicles with Base Tire Pressure Monitoring systems will display NORMAL even though these vehicles do not send actual pressure values across the communication bus.
- Tire 1 (2,3) Pressure (psi) - This indicates the actual tire pressure value of the Tire Location defined. Vehicles with Base Tire Pressure

Monitoring systems will display N/A for this parameter as these vehicles do not send actual pressure values across the communication bus.

- Note: Not all vehicle TPM systems have a tire pressure sensor located in the spare tire.
- Cruise Control System Status - "Yes" indicates that the Cruise Control system is turned on.
- Cruise Control System Active - "Yes" indicates the Cruise Control system is actively controlling vehicle speed. "No" indicates the system is NOT controlling vehicle speed.

GENERAL DEFINITIONS:

§ Capture - The process of buffering data into a temporary, volatile storage medium where it is continuously updated at regular time intervals.
§ Ignition Cycle - Ignition power applied to and removed from the ACM.
§ Matured - Diagnostic Trouble Code has met criteria to be stored in module.
§ Powered-Up - The act of applying a 10V - 16V dc power source to the appropriate pins on a specific module.
§ Record - The process of saving captured data into a non-volatile device for subsequent retrieval.

ACRONYMS:

ABS	Anti-Lock Brake System
ACM	Air Bag Control Module
BAS	Brake Assist System
DTC	Diagnostic Trouble Code
EBD	Electronic Brake Distribution
ESP	Electronic Stability Program
ETC	Electronic Throttle Control
MIL	Malfunction Indicator Lamp
PCM	Power Train Control Module
PVS	Pedal Voltage Sensor
RPM	Revolution per Minute
Service Brake	Brake Pedal
TCM	Transmission Control Module
TPM	Tire Pressure Monitoring
TPS	Throttle Position Sensor
VIN	Vehicle Identification Number

APPLICATION INFORMATION:

§ Only 2004 - 2009 Durango's equipped with side airbags have EDR data that can be imaged by the CDR tool. Durango's not equipped with side airbags have EDR Data that can be imaged by the supplier, but not by the CDR tool.
§ For 2006 MY, some Chrysler 300, Dodge Magnum, Dodge Charger, Jeep Grand Cherokee, and Jeep Commander models may contain EDR data that can not be imaged by the CDR tool.
§ For 2007 MY, some PT Cruiser models may contain EDR data that can not be imaged by the CDR tool.
§ EDR Data is only recorded for frontal deployments in the following vehicles:

2004 - 2007	Durango - with side airbags
2007	Aspen
2006 - 2007	Ram 1500
2006- 2009	Ram 2500/3500 Heavy Duty
2007	Caliber, Compass, Patriot
2007	Sebring
2007	Nitro
2007	Wrangler

Airbag Control Module Identification

Airbag Control Module Part Number	04896371AA
Airbag Control Module Serial Number	[redacted]
Airbag Control Module Supplier	Robert Bosch Corporation

Airbag Control Module Configuration

Configured for Front Driver Seatbelt Switch	No
Configured for Front Center Seatbelt Switch	No
Configured for Front Passenger Seatbelt Switch	No
Configured for 2nd Row Left Seatbelt Switch	No
Configured for 2nd Row Center Seatbelt Switch	No
Configured for 2nd Row Right Seatbelt Switch	No
Configured for 3rd Row Left Seatbelt Switch	No
Configured for 3rd Row Center Seatbelt Switch	No
Configured for 3rd Row Right Seatbelt Switch	No
Configured for Driver Inflatable Knee Bolster	No
Configured for Left Curtain #1	No
Configured for Right Curtain #1	No
Configured for Left Curtain #2	No
Configured for Right Curtain #2	No
Configured for Front Driver Seatbelt Pretensioner	Yes
Configured for Front Center Seatbelt Pretensioner	No
Configured for Front Passenger Seatbelt Pretensioner	Yes
Configured for 2nd Row Left Seatbelt Pretensioner	No
Configured for 2nd Row Center Seatbelt Pretensioner	No
Configured for 2nd Row Right Seatbelt Pretensioner	No
Configured for 3rd Row Left Seatbelt Pretensioner	No
Configured for 3rd Row Center Seatbelt Pretensioner	No
Configured for 3rd Row Right Seatbelt Pretensioner	No
Configured for Left Side Sensor #1	No
Configured for Left Side Sensor #2	No
Configured for Left Side Sensor #3	No
Configured for Right Side Sensor #1	No
Configured for Right Side Sensor #2	No
Configured for Right Side Sensor #3	No
Configured for Left Up Front Sensor	Yes
Configured for Right Up Front Sensor	Yes
Configured for Front Driver Digressive Load Limiter	No
Configured for Front Passenger Digressive Load Limiter	No
Configured for Driver Seat Track Position Sensor	Yes
Configured for Passenger Seat Track Position Sensor	No
Configured for Passenger Airbag Disable Switch	No
Configured for Passenger Occupant Classification System	Yes
Configured for Right Side Thorax	No
Configured for Left Side Thorax	No

System Status at Time of Retrieval

Original VIN	2B3KA43G96H******