On-Site Ambulance Crash Investigation
SCI Case Number DS13021
Vehicle: 2000 Ford F-350/Type I Ambulance
Location: Idaho
Crash Date: October 2013

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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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15. Supplemental Notes

The focus of this investigation is the head-on crash of a 2000 Ford F-350 chassis with an American Emergency Vehicles (AEV) Type I ambulance body.

16. Abstract

The Ford F-350 ambulance was traveling southbound while transporting a 34-year-old male patient who had seized due to alcohol withdrawal. The vehicle was utilizing its emergency warning lights and siren. The crash occurred in October 2013 on a two-lane north/south undivided state highway. The ambulance was being driven by a restrained 66-year-old male. Two unrestrained EMTs, a 62-year-old female and a 70-year-old male, were assisting the patient in the back of the ambulance. A 1998 Mitsubishi was being driven by a restrained 36-year-old male. The Mitsubishi was traveling northbound. A 1999 Audi A8 driven by a 61-year-old male was initially traveling northbound and had moved to the right shoulder in response to the approaching emergency vehicle. The driver of the Mitsubishi braked and swerved into the southbound lane to avoid impacting the Audi. As the Mitsubishi entered the southbound lane it impacted the ambulance in an offset head-on configuration. The ambulance was displaced to the right, departed the roadway, and impacted the breakaway end treatment of a metal guardrail with its front plane. The guardrail end collapsed and the ambulance traveled down an embankment. The left front of the ambulance impacted the ground and vehicle rotated in a counterclockwise direction. The ambulance came to rest on its wheels facing north. The Mitsubishi was displaced rearward and began a counterclockwise rotation. The rear of the Mitsubishi impacted the left side of the Audi. The Mitsubishi departed the east edge of the roadway and came to rest in a ditch facing southeast. The driver of the ambulance sustained minor injuries. Both EMTs sustained serious injuries and were hospitalized. There were no injuries reported for the patient.

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BACKGROUND

The focus of this investigation is the head-on crash of a 2000 Ford F-350 chassis with an American Emergency Vehicles (AEV) Type I ambulance body (**Figure 1**). All four occupants of the ambulance were injured. The crash was identified by the National Highway Traffic Safety Administration's (NHTSA) Office of Emergency Medical Services (OEMS), which provided notification to the Crash Investigation Division (CID). The CID forwarded notification to the Special Crash Investigations (SCI) team on October 25, 2013. SCI initiated contact with the state EMS director and the investigating police agency, and cooperation was established on October 28, 2013, to perform an on-site inspection of the ambulance on October 31, 2013. Cooperation was also established to inspect the 1998 Mitsubishi Eclipse involved in the crash.

Figure 1. 2000 Ford F-350 with ambulance body

The Ford F-350 chassis was configured with a forward cab and a rear patient compartment equipped for the treatment of medical emergencies in a mobile environment. It was traveling southbound while transporting a 34-year-old male patient who had gone into a seizure due to alcohol withdrawal. The vehicle was utilizing its emergency warning lights and siren. The crash occurred in October 2013 on a two-lane north/south undivided state highway. The ambulance was being driven by a restrained 66-year-old male. Two unrestrained EMTs, a 62-year-old female and a 70-year-old male, were assisting the patient in the back of the ambulance. A 1998 Mitsubishi was being driven by a restrained 36-year-old male. There was a second occupant in the Mitsubishi, a restrained 37-year-old female. The Mitsubishi was traveling northbound. A 1999 Audi A8 driven by a 61-year-old male was initially traveling northbound and had moved to the right shoulder in response to the approaching emergency vehicle. The driver of the Mitsubishi braked and swerved into the southbound lane to avoid impacting the Audi. As the Mitsubishi entered the southbound lane it impacted the ambulance in an offset head-on configuration. The ambulance was displaced to the right, departed the roadway, and impacted the breakaway end treatment of a metal guardrail with its front plane. The guardrail end collapsed and the ambulance traveled down an embankment. The left front of the ambulance impacted the ground and vehicle rotated in a counterclockwise direction. The ambulance came to rest in an upright position facing north. The Mitsubishi was displaced rearward and began a counterclockwise rotation. The rear of the Mitsubishi impacted the left side of the Audi. The Mitsubishi departed the east edge of the roadway and came to rest in a ditch facing southeast.

The driver of the ambulance sustained possible injuries. He was transported by ambulance to a local hospital where he was treated and released. The 70-year-old male EMT sustained incapacitating

injuries. He was transported by Medevac to an area trauma center where he was hospitalized for 28 days. The 62-year-old female EMT sustained incapacitating injuries. She was transported by Medevac to an area trauma center where she was hospitalized for 13 days. There were no reported injuries to the patient. The driver and front right passenger of the Mitsubishi sustained possible injuries. They were transported by private vehicle to a local hospital for treatment. The driver of the Audi did not sustain any injuries.

The ambulance and Mitsubishi were towed from the scene due to damage. The ambulance was being held under police custody. It was towed to its base of operations so that some equipment on board could be moved to a spare ambulance. The Mitsubishi was located a local tow facility. The Audi was driven from the scene.

SUMMARY

Crash Site

The crash occurred in the mid-afternoon hours on a two-lane undivided state highway. The north/south designated roadway was oriented in a northeast to southwest direction at the crash site and was of asphalt construction (**Figure 2**). There was a negative 1.2 percent grade in the southbound direction. The travel lanes were 3.6 m (12.0 ft) in width and were divided by solid/dashed yellow center lines. The roadway was bordered on both sides by asphalt shoulders and metal guardrails that were configured with energy absorbing end treatments. The guardrails provided separation from the roadway and an east/west drainage ditch that ran beneath the roadway. The area behind the guardrails was level for 1.5 m (5.0 ft) then descended at a 65 percent grade for 3.0 m (10.0 ft) before generally leveling out. This area was grass-covered with numerous bushes and grass. The weather at the nearest reporting station was 17° C (62° F), humidity 37 percent, visibility 16 km (10 miles), and the winds were calm. The speed limit was 105 km/h (65 mph). A Crash Diagram is included at the end of this technical report on page 16.

Figure 2. Northbound approach

Pre-Crash

The Ford ambulance was traveling southbound at an unknown speed while operating in an emergency mode (with its warning lights and siren activated). The ambulance was transporting a patient who had gone into an alcohol withdrawal seizure at his parent's home. The driver was a volunteer with 19 years of ambulance driver experience in total, and 15 years for this organization. The driver was a volunteer and had no EMT training. He is called in as needed. He had responded to the emergency from his home to the ambulance barn. The driver did attend an Emergency Vehicle Operator's Course (EVOC) but the dates of attendance are not known. The organization does screen the driver records for their drivers. The organization is primarily volunteer. The two EMTs on board work part-time and are the only career staff for this company. The male EMT had more than 30 years of EMT experience; the female EMT had 15 years of EMT experience.

The Mitsubishi was traveling northbound. The Audi was initially traveling northbound and had

moved to right shoulder in response to the approaching emergency vehicle. The driver of the Mitsubishi braked and swerved into the southbound lane to avoid impacting the Audi. The driver of the ambulance saw the Mitsubishi and started steering to the right.

Crash

As the Mitsubishi entered the southbound lane it impacted the ambulance in an offset head-on configuration (Event 1). Both frontal air bags in the Ford ambulance deployed. Delta-V results for this vehicle could not be calculated due to this vehicle being out of the scope of the WinSMASH program. Both frontal air bags deployed in the Mitsubishi. The WinSMASH program calculated a Barrier Equivalent Speed (BES) of 34 km/h (21 mph) for the Mitsubishi.

The Mitsubishi was displaced rearward and began a counterclockwise rotation. During rotation, the rear of the Mitsubishi impacted the left rear quarter panel of the Audi. The Mitsubishi then departed the east edge of the roadway and came to rest in a ditch facing southeast (**Figure 3**).

Figure 3. Final rest, looking north, 1998 Mitsubishi Eclipse (police photo)

The ambulance was displaced to the right, departed the roadway, and impacted the energy-absorbing breakaway end treatment of a metal guardrail with its front plane (Event 3). The guardrail end collapsed and the ambulance traveled down an embankment. The left front of the ambulance impacted the ground (Event 4) and vehicle rotated in a counterclockwise direction. The ambulance came to rest in an upright orientation facing north (**Figure 4**).

Figure 4. Impact with guardrail end and final rest for 2000 Ford ambulance, looking south (police photo)

Post-Crash

Emergency medical services were dispatched at 1308 hours and arrived at 1320 hours.

The driver of the ambulance was able to exit the vehicle under his own power. He sustained minor injuries and was transported to a local hospital. He arrived with a Glasgow Coma Scale (GCS) score of 15 at 1430 hours (approximately 1.5 hours post-crash). He was treated and was released after approximately 1.5 hours of treatment

The 70-year-old male EMT sustained serious injuries. He lost consciousness after the crash but was not amnesic to the event. He was extricated by emergency personnel and was transported by Medevac to an area trauma center where he arrived with a GCS score of 15. He was admitted and then hospitalized for 28 days.

There were no reported injuries to the patient.

The 62-year-old female EMT sustained serious injuries. She was extricated by emergency personnel and was transported by Medevac to an area trauma center. She arrived with a GCS score of 14 (eyes closed but opens them and follows commands) and was hospitalized for 13 days.

The ambulance and Mitsubishi were towed from the scene due to damage. The ambulance was being held under police custody. It was towed to its base of operations so that some equipment on board could be moved to a spare ambulance. The Mitsubishi was located a local tow facility. The Audi was driven from the scene.

2000 FORD F-350/TYPE I AMBULANCE

Description

The ambulance was a 2000 Ford F-350 Super Duty chassis manufactured in March 2000 and identified by the Vehicle Identification Number (VIN): 1FDWF37F6YExxxxxx. The vehicle mileage was 103,688 km (64,429 miles). The chassis was completed during secondary manufacturing in July 2000 with a Type I ambulance body. The chassis was a four-wheel drive platform powered by a 7.2-liter 8-cylinder diesel engine linked to an automatic transmission. The vehicle was configured with dual rear wheels.

Secondary manufacturing of the vehicle consisted of installation of the AEV patient compartment module and installation of emergency services operational equipment (warning lights, sirens, and radio communications). Completed as a Type I certified ambulance, the vehicle was configured with a forward cab and rear patient compartment equipped for the treatment of medical emergencies in a mobile environment. A placard confirmed that the AEV Type I ambulance conformed to Federal Specifications KKK-A-1822 in effect on its date of manufacture. This refers to the United States General Services Administration's (GSA) standard for minimum specifications, test parameters, and criteria for design, performance, equipment, and appearances of ambulances in order to display the six-pointed blue star with Rod of Asclepius (Star of Life).

The Ford's cab was configured for the seating of two occupants, with forward-facing box-mounted seats that featured manual seat track and seat back recline adjustments integrated into the seat backs. Three-point lap and shoulder safety belts were available for manual restraint and head restraints were integrated into the seat backs. The cab's seats were divided by a center console that integrated communications equipment and an array of switches related to the ambulance's emergency response and operational activities. Within the patient compartment module was seating for up to five crew members as well as the patient. These included one position on the left plane, one position on the forward plane, a three-passenger bench seat on the right plane, and a centrally located single occupant cot. Various configurations of manual restraint were available for all six positions.

The AEV TraumaHawk patient compartment module had overall dimensions of length x width x height of 366 x 241 x 235 cm (145 x 95 x 93 in). There was a single step at the rear of the ambulance that measured 31 cm (12 in) in width. There were six exterior compartments (three on both side planes) and three occupant access doors (one right, two rear). The exterior compartments served for the storage of and curbside access to large emergency medical equipment and supplies.

Double-wide rear doors (122 cm/48 in) served for the loading and unloading of the cot, as well as entry for the crew. There was also an occupant access door at the forward aspect of the right side.

Vehicle Weight, Payload, and Tire Data

The Ford chassis was placarded with a Gross Vehicle Weight Rating (GVWR) of 5,669 kg (12,500 lbs). This was distributed as Gross Axle Weight Ratings (GAWR) of 2,358 kg (5,200 lbs) front and 4,422 kg (9,750 lbs) rear. A weight/payload certification sticker was located on the inner surface of the left forward most exterior compartment. It declared that the curb weight of the overall vehicle after secondary manufacturing was 4,177 kg (9,209 lbs). The curb weight at the axle locations was 1,436 kg (3,168 lbs) front and 2,740 kg (6,041 lbs) rear. At the ambulance's date of manufacture, the minimum available payload allowed was 793 kg (1,750 lbs). According to the vehicle's placard, the calculated actual payload of the completed vehicle was 1,492 kg (3,291 lbs).

The vehicle manufacturer's recommended tire size was LT235/85R16 with recommended cold tire pressures of 448 kPa (65 psi) front and 482 kPa (70 psi) rear. At the time of the SCI inspection, the vehicle was equipped with Toyo H/T Open Country tires of the manufacturer's recommended size for all six axle positions. The tires were mounted on OEM steel wheels. Specific tire data was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Tire Flat	10 mm (13/32 in)	No	Sidewall cut, de-beaded
LR inner	Unknown	9 mm (11/32 in)	No	None
LR outer	Tire Flat	9 mm (11/32 in)	No	None
RR inner	Unknown	9 mm (11/32 in)	No	None
RR outer	413 kPa (60 psi)	10 mm (13/32 in)	No	None
RF	379 kPa (55 psi)	10 mm (13/32 in)	No	None

Exterior Damage

Damage to the exterior of the ambulance from the multiple event crash was present on the frontal and left planes. The ambulance sustained multiple impacts to the frontal plane (**Figure 5**). During the crash sequence the ambulance impacted the other vehicle, a guardrail end, and the ground. The direct damage from the guardrail and ground impact began at the left front bumper corner and extended approximately 113.0 cm (44.4 in) to the right. The damage from the vehicle-to-vehicle impact began at the left front bumper corner and extended approximately 12.0 cm (4.7 in) to right. The crush

Figure 5. Frontal damage, 2000 Ford F-350 ambulance

damage from the three impacts could not be separated and the crush profile is based on the final appearance of the damage. The Field L extended from bumper corner to bumper corner and measured 169.0 cm (44.4 in). Six crush measurements were taken at the bumper level as follows: C_1 = 28.0 cm (11.0 in), C_2 = 18.0 cm (7.0 in), C_3 = 22.0 cm (8.7 in), C_4 = 12.0 cm (4.7 in), C_5 = 0 cm, C_6 = 0 cm. The maximum crush was located at C_1. The overall Truck Deformation Classification (TDC) for the frontal impacts was 12FYEW2. At impact with the Eclipse, the left front tire was damaged and the wheel was displaced from the vehicle. The rim was deformed and the sidewall cut (**Figure 6**). The direct damage from the impacts with the guardrail and ground extended as body surface abrasions and minor deformation along the lower edge of the left side of the cab. The guardrail damage continued along the left side of the ambulance module. There was damage caused by an unknown source to the right rear and upper right areas of the ambulance body.

Figure 6. Inner aspect, left front tire

Interior Damage

The interior of the ambulance, including the Ford chassis' cab and patient compartment module, were inspected for crash-related and occupant contact damage. The interior of the Ford chassis' cab sustained minor damage as a result of the crash. The left door was jammed shut. There was 7.0 cm (2.7 in) intrusion to the left toe pan. The windshield glazing sustained two distinct star-type fractures that appear to have been caused by objects within the cab. There was contact evidence documented to the driver's air bag and forward upper quadrant of the left door.

Figure 7. Contact to cabinet, 2000 Ford F-350 ambulance

Minimal damage was sustained by the interior of the patient compartment module as a result of the crash. At the time of the SCI inspection, supplies and materials normally located in the module had been removed for use in another ambulance. Occupant contacts were documented to the left edge of a rear-facing cabinet located in the forward aspect of the module (**Figures 7-8**) and the cabinet doors.

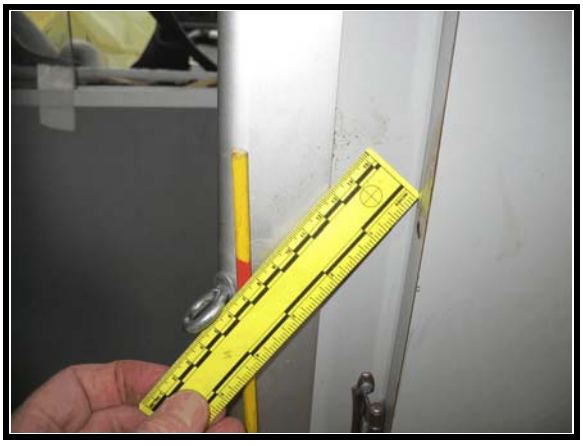


Figure 8. Contact to cabinet, 2000 Ford F-350 ambulance

There was pooled blood located on the floor and the steps leading to the right forward aspect door. The left inner-facing seat cushion was displaced.

Manual Restraint Systems

The cab of the Ford chassis was equipped with manual restraint systems for both seating positions. Each was a 3-point lap and shoulder safety belt system that consisted of continuous loop webbing with sliding latch plate, and was fixed at its respective B-pillar mounted D-ring anchor position. The anchorages were adjusted to the mid-position. The driver's safety belt was configured with an Emergency Locking Retractor (ELR). At the time of the inspection, both belt systems were operational and exhibited evidence of historical usage. There was a slight amount of loading evidence located on the seat belt webbing at the D-ring at the driver's position.

Figure 9. Driver's air bag, 2000 Ford F-350 ambulance

The interior of the patient compartment module was equipped with Beams two-point retractable manual safety belt systems at all five seating position. There was evidence of historical usage for the rear-facing seat position and the two outboard inner-facing bench seat positions.

Figure 10. Passenger frontal air bag, 2000 Ford F-350 ambulance

Supplemental Restraint Systems

The Ford was equipped with two air bags for supplemental restraint. The driver's position steering wheel hub-mounted air bag deployed as a result of the front impact into the Mitsubishi (**Figure 9**). In its deflated state, the air bag was circular in shape with a seat-to-seam diameter of 64.0 cm (25.1 in). The air bag was configured with two circulate vent ports and a single internal tether. One area of occupant contact was documented on the air bag face. It was located at the bottom right quadrant and measured 4.0 x 11.0 cm (1.6 x 4.3 in). The mid-instrument panel mounted passenger air bag also deployed during the crash (**Figure 10**). In its deflated state, the air bag was rectangular in shape and measured 50.0 cm (19.6 in) in height and 64.0 cm (25.1 in) in width. It had a maximum excursion of 68.0 cm (26.7 in).

Patient Cot

The patient cot was a Rugged MX-PRO Ambulance Cot that was manufactured by Stryker in June 2003 (**Figure 11**).

The serial number for the cot was 3006-39239. The cot was constructed of a tubular aluminum frame with circumferential weld joints and steel hardware fasteners. The X-frame supporting the mattress platform featured manual raise/lower capabilities and the mattress platform featured 0-73 degrees of backrest articulation. Its length was 203 cm (80 in) and the width was 58 cm (23 in). Labeling declared that the load capacity limit of the cot was a maximum of 227 kg (500 lbs). The cot was secured in place within the passenger compartment via a Stryker antler design floor-mount cot fastener system. The serial number was partially rubbed away by use. The last seven digits were 139579. The system consisted of a forward antler bracket and rearward locking-clamp mechanism. The antler bracket cradled the forward portion (location of the patient's head area) of the cot's frame, while the vertically-oriented locking mechanism clamped around a pin protruding from the cot's lower frame rail (**Figure 12**). Combined, these two components restricted the lateral and longitudinal movement of the cot. During the crash, the lower frame rail fractured (**Figure 13**). The fracture was located 31.0 cm (12.2 in) forward of the rear wheel at the point vertically oriented pin (**Figure 14**) clamps to the rail.

Figure 11. Stryker Rugged MX-PRO cot. Arrow highlights fractured lower rail.

Figure 12. Exemplar view of vertical connection to locking mechanism

Figure 13. Fractured lower rail, Rugged MX-PRO Ambulance Cot

Figure 14. Locking pin separated from lower rail, Rugged MX-PRO Ambulance Cot

2000 FORD F-350/TYPE I AMBULANCE OCCUPANTS

Driver Demographics

Age/Sex:	66 years/Male
Height:	178 cm (70 in)
Weight:	102 kg (225 lbs)
Eyewear:	Prescription glasses
Seat type:	Box-mounted seat
Seat track position:	Middle track position
Manual restraint usage:	Lap and shoulder belt
Usage source:	Vehicle inspection
Air bags:	Driver's air bag available, deployed
Alcohol/Drug Data:	None present
Egress from vehicle:	Exited vehicle under own power
Transport from scene:	Ground ambulance to a local hospital
Type of medical treatment:	Transported, treated and released

Driver Injuries

Inj. No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Abdominal abrasion	510202.1,4	Safety belt webbing	Certain
2	Contusion, right elbow	710402.1,1	Center console	Possible
3	Contusion, right knee	810402.1,1	Lower IP	Probable

Source: Assessment reports

Driver Kinematics

The restrained 66-year-old male driver was seated in an upright posture. Both hands were on the steering wheel and he was steering to the right prior to impact. The seat was adjusted to the mid-track position and the seat back was slightly reclined. At impact with the Mitsubishi, the driver was displaced forward and slightly to the left in response to the 350 degree direction of force. The driver loaded the safety belt and contacted the deployed frontal air bag. The driver remained in his original position as the Ford ambulance impacted the guardrail rail end. He was displaced forward in response to this frontal impact. As the vehicle continued forward it began to rotate in a counterclockwise direction. The driver remained in place throughout the crash sequence.

Rear-Facing Seat Occupant Demographics

Age/Sex:	70 years/Male
Height:	183 cm (72 in)
Weight:	125 kg (276 lbs)
Eyewear:	Prescription eyeglasses
Seat type:	Rear facing, captain's chair
Seat track position:	Not adjustable

Manual restraint usage: Lap belt available, not used
Usage source: Vehicle inspection, police statements
Air bags: None available
Alcohol/Drug Data: Not tested
Egress from vehicle: Removed from vehicle due to serious injuries
Transport from scene: Air ambulance to trauma center
Type of medical treatment: Hospitalization

Rear-Facing Seat Occupant Injuries

Inj. No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Subdural hematoma, bilateral, 3mm at left parietal convexity subdura hemorrhage 3 mm	140438.3,6	Seat back	Probable
2	Rib fractures: Right 3-9 (inferior, posterior) Bilateral 10-12	450203.3,3	Interior surface	Probable
3	Right pneomothorax, small right hemothorax	442205.3,1	Interior surface	Probable
4	Liver laceration, right	541820.2,1	Interior surface	Possible
5	Spleen laceration	544220.2,2	Second cot	Possible
6	Acute kidney injury, right	541699.2,1	Interior surface	Possible
7	Liver contusions, NFS	541810.2,1	Interior surface	Possible
8	Scalp laceration, large, flap-like to back of head, 8 cm by 4 cm	110602.1,6	Interior surface	Probable
9	Abrasions, left forehead	210202.1,7	Unknown	Unknown
10	Abrasions, right lower leg	810202.1,1	Cot	Probable
11	Abrasions, bilateral knees	810202.1,3	Cot	Probable
12-19	Right thoracic 3-10 transverse process fractures	650420.2,7	Seat back	Probable
	Retroperitoneal hematoma, right (not codeable)			

Source: History and Physical reports, Emergency Room notes, Radiology reports

Rear-Facing Seat Occupant Kinematics

The 70-year-old male EMT was seated in the rear-facing seat at the forward end of the patient compartment (**Figure 15**). An overview of a loaded exemplar patient compartment is provided in **Figure 16**. It is unknown if he was actively engaged in assisting with patient care. He did not utilize the available lap belt for manual restraint. At impact with the Mitsubishi, he was displaced forward toward the front of the vehicle in response to the 350 degree direction of force. He loaded the seat back causing the spinal fractures and the brain injury. The right side of his body probably contacted the hard interior surface to his right, causing the rib fractures and internal injuries. His lower legs probably contacted the center cot as he rebounded from the initial contact. A printer located on the left side of the vehicle was displaced during the crash sequence and may have contacted this occupant based on its post-impact trajectory. The vehicle continued forward and engaged the barrier end and the ditch. During the crash sequence he was displaced to the vehicle's right as the vehicle rotated and may have been airborne as the vehicle pitched into the ditch. This occupant came out of his seat at some point and came to rest on the floor forward of the center cot.

Figure 15. Occupant 2 seated position, 2000 Ford F-350

Figure 16. Exemplar view of identical ambulance interior

Squad Seat Occupant Demographics

Age/Sex:	62 years/Female
Height:	170 cm (67 in)
Weight:	92 kg (203 lbs)
Eyewear:	Prescription glasses
Seat type:	Left facing, bench seat
Seat track position:	Not adjustable
Manual restraint usage:	Lap belt available, not used
Usage source:	Vehicle inspection, police statements
Air bags:	None available
Alcohol/Drug Data:	Not tested
Egress from vehicle:	Removed from vehicle due to serious injuries
Transport from scene:	Air ambulance to trauma center
Type of medical treatment:	Hospitalization

Squad Seat Occupant Injuries

Inj. No.	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Rib fractures: Right, 1-7, 10 and 11 Left, 1-8 Fractures, costovertebral junctions at C7, T1, and T2[1]	450203.3,3	Bulkhead cabinet	Probable
2	Left hemopneumothorax	442205.3,2	Bulkhead cabinet	Probable
3	Multiple pulmonary contusions - left upper lobe of lung	441408.3,2	Bulkhead cabinet	Probable
4	Subarachnoid hemorrhage	140693.2,9	Bulkhead cabinet	Probable
5	C1 comminuted, Jefferson[2] fracture	650224.2,6	Bulkhead cabinet	Probable
6	L4-L5 endplate fracture	650630.2,8	Bulkhead cabinet	Probable
7	Sternal fracture	450804.2,4	Bulkhead cabinet	Probable
8	15.0 cm (5.9 in) arcing complex forehead and cheek laceration	210604.2,1	Unknown	Unknown
9	Temporal branch of facial nerve severed	130204.2,9	Unknown	Unknown
10	Ecchymosis around right eye	210402.1,1	Bulkhead cabinet	Probable
11	Displaced, distal fibula fracture	854441.2,1	Center cot	Possible
12	Tibia fracture, right	854000.2,1	Center cot	Possible

[1]Costal cartilage fractures are coded as rib fractures.

[2]Fracture of the anterior and posterior arches of the C1 vertebra. Source: Wikipedia.

13	Ankle fracture, right	857400.2,1	Center cot	Possible
14	2.0 cm (0.8 in)right orbital rim laceration, 3.5 cm (1.4 in) right brow laceration, 2.0 cm (0.8 in) right tragal[3] laceration	210602.1,0	Unknown	Unknown
15-16	C6-C7 spinous process fractures	650218.2,6	Bulkhead cabinet	Probable

Source: Discharge summary, History and Physical reports, Emergency Room notes, Radiology reports

Squad Seat Occupant Kinematics

The 62-year-old female EMT was seated in the left-facing squad/bench seat on the right plane of the patient compartment. She was not wearing the available lap safety belt. It is not known if she was actively engaged in assisting with patient care. During the interview, she indicated that she had no memory of her activities before the crash. At impact with the Mitsubishi, this occupant was displaced from her seat and likely impacted the cabinet and cabinet edge in front of the patient compartment with the right side of her body, causing the rib fractures, and the lung, head, and spinal injuries. Her lower legs may have engaged the center cot while being displaced, causing the lower leg and ankle fractures. She possibly impacted an eye-bolt located along the left edge of the cabinet 63.5 cm (25.0 in) above the floor. After impact she came to rest on the floor and probably remained there throughout the remainder of the crash sequence.

Cot Occupant

Age/Sex:	34 years/Male
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat type:	Immobilized longitudinally in supine position on cot
Seat track position:	N/A
Manual restraint usage:	Restrained by two lateral straps and two shoulder straps
Usage source:	Vehicle inspection
Air bags:	None available
Alcohol/Drug Data:	Unknown
Egress from vehicle:	Removed from vehicle on cot
Transport from scene:	Ground ambulance to a local hospital
Type of medical treatment:	Unknown

[3]The prominence in front of the external opening of the outer ear. Merriam-Webster

Cot Occupant Injuries
According to police sources, this occupant did not sustain any injuries related to this crash.

Cot Occupant Kinematics
Prior to the crash, the 34-year-old male patient was being transported due to seizures related to alcohol withdrawal. According to an EMS source, he was restrained in place using two lateral straps and two shoulder straps. Due to his restraint status, he remained in his initial supine position on the cot throughout the entire crash sequence. Due to the fracture at the locking clamp, the cot was probably displaced laterally due to the rotational forces. This displacement did not result in injury to the occupant.

1998 MITSUBISHI ECLIPSE

Description
The 1998 Mitsubish Eclipse three-door hatchback was identified by the VIN: 4A3AK34Y5WExxxxxx. The Mitsubishi was equipped with a 2.0-liter 4-cylinder engine coupled to a 5-speed manual transmission and front-wheel drive.

Exterior Damage
The Mitsubishi sustained severe damage to the front plane caused by the impact with the Ford ambulance in Event 1 (**Figures 17-18**). Direct damage began at the left corner and extended 78.0 cm (30.7 in) to the right. The Field L dimension was 97.0 cm (38.1 in). Six crush measurements were taken at the bumper level along the backing bar as follows: C_1 = 61.0 cm (24.0 in), C_2 = 48.0 cm (18.9 in), C_3 = 29.0 cm (11.4 in), C_4 = 27.0 cm (10.6 in), C_5 = 30.0 cm (11.8 in), C_6 =24.0 cm (9.4 in). The maximum crush was located at C_1. The Collision Deformation Classification (CDC) was 01FYEW3.

The Mitsubishi sustained minor rear plane damage during the impact with the Audi **(Figure 19**). The estimated CDC was 09BYLS1.

Figure 17. Frontal damage, 1998 Mitsubishi Eclipse

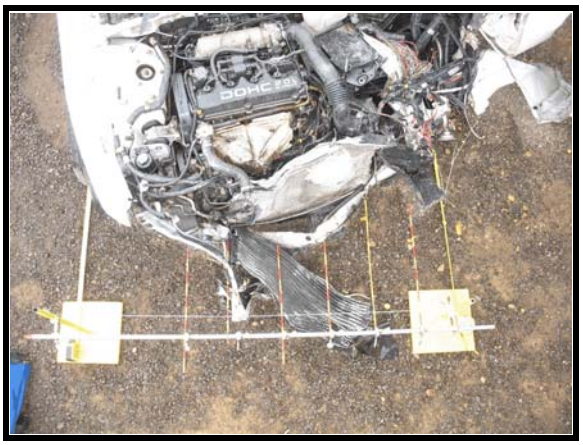


Figure 18. Crush profile, 1998 Mitsubishi Eclipse

Occupant Data

The Mitsubishi was being driven by a restrained 36-year-old male. There was a second occupant in the Mitsubishi, a restrained 37-year-old female, seated in the front right seat. Both occupants sustained moderate injuries and were transported by private vehicle to a local hospital for treatment.

Figure 19. Rear plane contact, 1998 Mitsubishi Eclipse

1999 AUDI A8 QUATTRO

Description

The 1999 Audi A8 Quattro four-door sedan was identified by the VIN: WAUBG34D7XNxxxxxx. The Audi was equipped with 4.2-liter 8 cylinder engine coupled to an automatic transmission and all-wheel-drive.

Exterior Damage

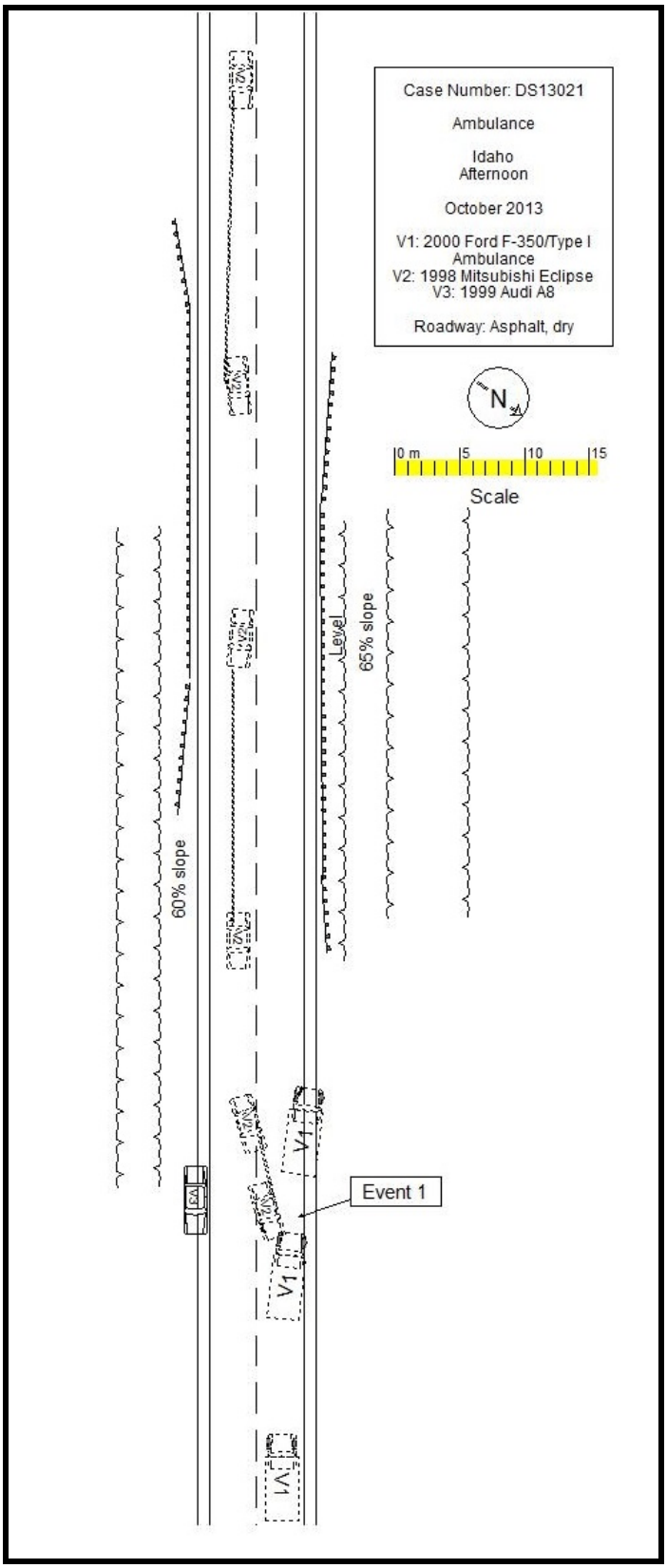
The Audi sustained minor sideswipe damage to the left rear door and wheel well area cause by the impact with the Mitsubishi in Event 2 (**Figure 20**). The estimated CDC was 11LPES1.

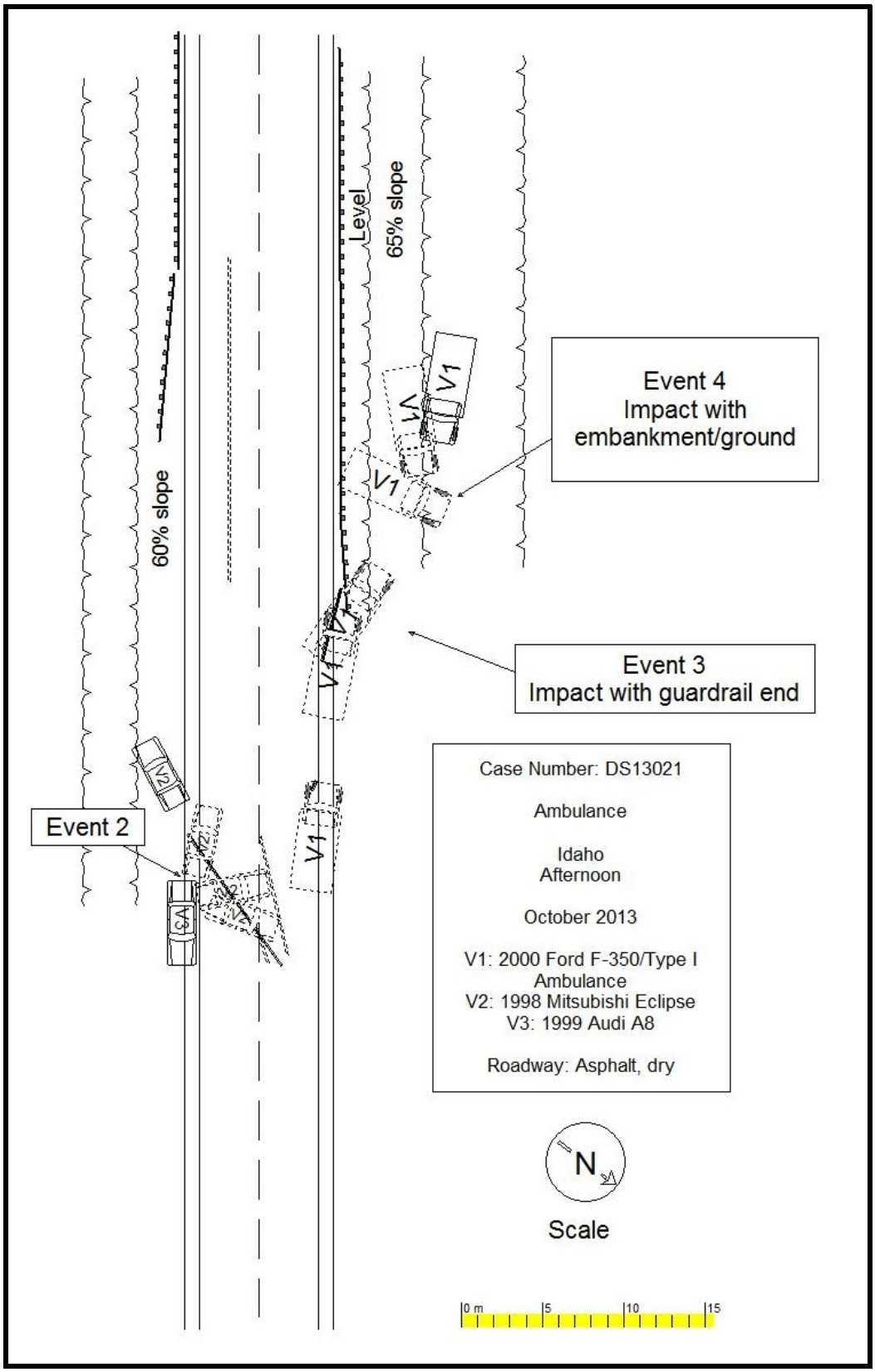
Occupant Data

The Audi was being driven by a restrained 61-year-old male. There were no reported injuries.

Figure 20. 1999 Audi A8 Quattro (police photo)

CRASH DIAGRAM




60% slope
Level
65% slope
V1
V2
V3
Event 2
Event 3
Impact with guardrail end
Event 4
Impact with
embankment/ground
Case Number: DS13021
Ambulance
Idaho
Afternoon
October 2013
V1: 2000 Ford F-350/Type I
Ambulance
V2: 1998 Mitsubishi Eclipse
V3: 1999 Audi A8
Roadway: Asphalt, dry
N
Scale
0 m
5
10
15