TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

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ON-SITE AIR BAG RELATED ADULT DRIVER FATALITY INVESTIGATION
SCI TECHNICAL SUMMARY REPORT

VERIDIAN CASE NO. CA02-016

VEHICLE - 1996 FORD F-150 PICKUP TRUCK

LOCATION - STATE OF PENNSYLVANIA

CRASH DATE - JUNE 2001

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
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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 are coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

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

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16. *Abstract* This on-site investigation focused on a single-vehicle crash that involved a 1996 Ford F-150 pickup truck that was equipped with a driver's air bag. The Ford pickup truck was occupied by an unrestrained 41-year-old male driver who was operating the pickup truck on approach to a T-intersection during the nighttime hours. The driver apparently failed to detect the intersection on his approach and applied the brakes in full-lockup as the vehicle entered the intersection. The unrestrained driver was displaced forward by impact prior to air bag deployment into the path of the driver's air bag cover flap. The pickup truck continued across the intersecting roadway and impacted a dirt embankment that measured approximately 109.2 cm (43.0") in height with the front bumper area. The driver submarined the steering wheel as the vehicle ramped up the dirt embankment. Due to the soft dirt, the crash pulse was elongated which allowed the unrestrained driver to move forward into the path of the air bag. The driver's air bag deployed and the air bag cover flap struck the driver in the chest and neck which resulted in multiple chest contusions and a gaping anterior and bilateral neck laceration which extended to the base of the tongue. The air bag expanded against the driver's neck and chest which caused multiple bilateral rib fractures, partial transection of the proximal descending aorta, multiple lacerations of the thoracic aorta, hemopericardium, a laceration of the posterior pericardial sac, an endocardial laceration of the inferior vena cava and right atrium, and multiple crush trauma, contusions and abrasions of the anterior chest wall. The driver initiated a forward trajectory and the combination of the driver's forward loading and air bag expansion against the driver resulted in steering column compression. The air bag expansion hyper-extended his neck which resulted in a transverse hinge fracture extending through the occipital bone, crush trauma and multiple lacerations of the pons, midbrain, brainstem, and cerebellum, and subarachnoid and subdural hemorrhage at the base of the brain. The driver rebounded rearward and came to rest slumped to the right across the bench seat. He was pronounced dead at the crash scene.			
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BACKGROUND

Figure 1. On-scene photograph of the 1996 Ford F-150 pickup truck

This on-site investigation focused on a single-vehicle crash that involved a 1996 Ford F-150 pickup truck **(Figure 1)** that was equipped with a driver's air bag. The Ford pickup truck was occupied by an unrestrained 41-year-old male driver who was operating the pickup truck on approach to a T-intersection during the nighttime hours. The driver apparently failed to detect the intersection on his approach and applied the brakes in full-lockup as the vehicle entered the intersection. The unrestrained driver was displaced forward by impact prior to air bag deployment into the path of the driver's air bag cover flap. The pickup truck continued across the intersecting roadway and impacted a dirt embankment that measured approximately 109.2 cm (43.0") in height with the front bumper area. The driver submarined the steering wheel as the vehicle ramped up the dirt embankment. Due to the soft dirt, the crash pulse was elongated which allowed the unrestrained driver to move forward into the path of the air bag. The driver's air bag deployed and the air bag cover flap struck the driver in the chest and neck which resulted in multiple chest contusions and a gaping anterior and bilateral neck laceration which extended to the base of the tongue. The air bag expanded against the driver's neck and chest which caused multiple bilateral rib fractures, partial transection of the proximal descending aorta, multiple lacerations of the thoracic aorta, hemopericardium, a laceration of the posterior pericardial sac, an endocardial laceration of the inferior vena cava and right atrium, and multiple crush trauma, contusions and abrasions of the anterior chest wall. The driver initiated a forward trajectory and the combination of the driver's forward loading and air bag expansion against the driver resulted in steering column compression. The air bag expansion hyper-extended his neck which resulted in a transverse hinge fracture extending through the occipital bone, crush trauma and multiple lacerations of the pons, midbrain, brainstem, and cerebellum, and subarachnoid and subdural hemorrhage at the base of the brain. The driver rebounded rearward and came to rest slumped to the right across the bench seat. He was pronounced dead at the crash scene.

The National Highway Traffic Safety Administration (NHTSA) was notified of this crash by an attorney who faxed a notification form to the Special Crash Investigations Office in April 2002. The crash occurred in June 2001 in the State of Pennsylvania. NHTSA subsequently assigned an on-site investigation to the Veridian SCI team in May 2002.

SUMMARY

Crash Site

This crash occurred during the nighttime hours in June 2001 at a T-intersection of two rural roadways **(Figure 2)**. At the time of the crash, there were no adverse weather conditions and the asphalt roadway was dry. The unmarked north/south roadway consisted of one travel lane in each direction that were bordered by gravel shoulders. The roadway was straight and had a 2 percent negative southbound grade. The unmarked east/west roadway consisted of one travel lane in each direction and was bordered by gravel shoulders. A dirt embankment was present on the south side of the roadway opposite the mouth of the intersection and was offset to the west aspect. The embankment consisted of moderately packed dirt and rocks and was located 2.1 m (6.9') from the south road edge. It measured 8.6 m (28.2') in width and 110 cm (43") in height. The slope of the embankment was approximately 50 degrees from vertical, front-to-rear. The east/west roadway was straight at the intersection and had a 3 percent positive westbound grade. The roadway curved to the left west of the intersection. Shallow drainage ditches were present on both sides of the east/west roadway and on the west side of the north/south roadway. Traffic control at the intersection consisted of a stop sign on the northwest corner for southbound traffic. A yellow warning sign with opposing arrows was present on the south roadside for southbound traffic, but it appeared to have been installed after the crash. The posted speed limit for the east/west roadway was 48 km/h (30 mph) and there was no posted speed limit for the north/south roadway. The roadside environment consisted of various trees and wooded areas with private driveways and residential properties. There was no roadway illumination. The scene schematic is included as **Figure 10** of this report.

Figure 2. View of T-intersection looking south

Pre-Crash

The driver of the 1996 Ford F-150 was operating the vehicle southbound on approach to the T-intersection. At the time of the crash, the stop sign located on the northwest corner of the intersection had been displaced from a prior unrelated event, and was lying on the ground. It appeared that the driver did not detect the T-intersection as he approached it. Based on skid marks **(Figure 3)** documented by the investigating officer, the driver became aware of the intersection and applied the brakes in full-lockup approximately 10.0 m (32.8') north of the intersection. The F-150 pickup truck traveled across the intersection and rotated approximately 10 degrees in a clockwise yaw as a result of a probable right steering input. The pickup truck departed the south roadside at the top of the T-intersection and traveled across the shallow drainage ditch onto the roadside.

Figure 3. On-scene photograph showing pre-impact skid marks

Crash

The 1996 Ford F-150 pickup truck impacted the dirt embankment with the front bumper area **(Figure 4)**. Impact resulted in moderate damage to the pickup truck. The principal direction of force was in the 12 o'clock sector, and the impact was sufficient to deploy the frontal air bag system in the vehicle. The damage algorithm of the WinSMASH program computed a barrier equivalent speed of 18.7 km/h (11.6 mph) based on crush measurements along the front bumper. The longitudinal delta-V component was -18.7 km/h (-11.6 mph) and the lateral delta-V component was 3.3 km/h (2.1 mph). Based on the direct contact damage to the bumper, it appeared that the bottom aspect of the bumper struck a moderately-sized rock with the center aspect as it impacted the embankment. The pickup truck appeared to have partially ramped up the front aspect of the embankment and may have slid rearward slightly to final rest. The front wheels came to rest in the shallow drainage ditch which measured 15.2 cm (6.0") in depth.

Figure 4. View showing final rest of the pickup truck relative to the dirt embankment

Post-Crash

The 41-year-old driver was fatally injured and expired at the scene. First responders found the driver in the front left position, slumped across the bench seat with no vital signs. The driver was pronounced dead at the scene and removed from the vehicle by the coroner.

VEHICLE DATA - 1996 Ford F-150 Pickup Truck

The 1996 Ford F-150 4 x 2 pickup truck was identified by the Vehicle Identification Number (VIN): 1FTEF15Y6TL (production sequence omitted). The vehicle was owned by a private company and driven by various employees. The current milage was unknown, as the odometer was electronic and there was no power to the vehicle. The pickup truck was configured with a regular cab and a 249 cm (98") long box. The Ford F-150 was equipped with a 4.9 liter, 6-cylinder engine, four-speed automatic transmission, front disc brakes and rear drum brakes with rear anti-lock system, dual fuel tanks (centered fore and aft of the rear axle), and power steering.

The Ford F-150 pickup truck was equipped with Ameriway XT General P235/75R15 tires. The tire information was as follows:

Tire	Tread	Pressure
Left front	7.1 mm (9/32")	213.7 kpa (31.0 psi)
Left rear	2.4 mm (3/32")	227.5 kpa (33.0 psi)
Right front	6.4 mm (8/32")	224.1 kpa (32.5 psi)
Right rear	3.2 mm (4/32")	203.4 kpa (29.5 psi)

The recommended tire pressures on the manufacturer's sticker were 2.5 kg/cm^2 (35 psi) for all tires. A second sticker was affixed to the forward aspect of the left B-pillar that stated, "Important Tire Pressure Notice: The tire pressure shown on the adjacent certification label is not correct for the rear tires. The correct tire pressures for this vehicle are: Front 2.5 kg/cm^2 (35.0 psi), rear 2.9 kg/cm^2 (41.0 psi)."

The Ford F-150 was transporting various cargo in the pickup bed. An aftermarket full-width tool box was positioned at the forward aspect of the pickup truck box. The tool box measured 179.1 cm (70.5") in width, 53.3 cm (21.0") in depth, and 48.3 cm (19.0") in height. Two tires and approximately 10 steel rebar dowels that measured 40.6 cm (16.0") in length and 2.5 cm (1.0") in diameter were present in the pickup bed at the time of the vehicle inspection. According to the owner of the vehicle, various shovels and brooms were also present in the pickup bed at the time of the crash.

The seating in the Ford F-150 was configured with a bench seat with a folding back. The seat back recline was 20 degrees from vertical and both outboard head restraints were in the full-down position at the time of the vehicle inspection. The seat track was jammed at the time of the inspection, and was in the full-rear position.

VEHICLE DAMAGE

Exterior Damage - *1996 Ford F-150 Pickup Truck*

The Ford F-150 sustained moderate frontal damage as a result of the impact with the dirt embankment **(Figure 5)**. Numerous longitudinal abrasions were present on the lower aspect of the front bumper. The direct damage was concentrated on the lower aspect of the front bumper and involved the entire width of the bumper. The entire bumper was displaced vertically and rearward, and the bottom right corner was rotated slightly outward. The left frame rail was protruding forward from the bumper 3.8 cm (1.5"). Moderate deformation was present slightly right of the center aspect of the bumper from probable contact with a rock. The direct damage

Figure 5. View of frontal damage to the Ford F-150 pickup truck

from the rock contact began 41.3 cm (16.3") left of center and extended 77.5 cm (30.5") across the bumper. The maximum crush was located 7.6 cm (3.0") right of the centerline on the bumper and measured 24.1 cm (9.5"). The combined direct and induced damage measured 179.7 cm (70.8") and involved the entire width of the bumper and extended vertically to the grille area. The vertical and rearward displacement of the front bumper resulted in slight induced buckling on the left front fender and left front corner. The Collision Deformation Classification (CDC) for the impact with the dirt embankment was 12-FDLW-1. Six crush measurements were taken along the bumper and were as follows: C1 = 7.0 cm (2.8"), C2 = 7.0 cm (2.8"), C3 = 12.1 cm (4.8"), C4 = 18.4 cm (7.3"), C5 = 2.5 cm (1.0"), C6 = 2.5 cm (1.0").

Interior Damage - *1996 Ford F-150 Pickup Truck*

The 1996 Ford F-150 pickup truck sustained moderate interior damage as a result of occupant contact **(Figure 6)**. There was no damage to the windshield laminate, side glazing, or backlight glazing. There was no passenger compartment intrusion. The knee bolster was scuffed from the driver's left knee. The scuff was located 5.1 cm (2.0") to the left of the center of the steering column and extended 11.4 cm (4.5") to the left at an upward angle. Although there was no deformation to the steering wheel rim, the steering column was compressed as a result of occupant loading **(Figure 7)**. The left shear capsule displacement measured 6.5 cm (2.5") and the right shear capsule displacement measured 7.0 cm (2.8"). Two pronounced body fluid (blood) spatters were present on the interior roof. The first was located 27.9 cm (11.0") left of center and 20.3 cm (8.0") rear of the windshield header. It extended 30.5 cm (12.0") rearward and measured 7.6 cm (3.0") wide at the rear aspect. The second was located 24.1 cm (9.5") left of center and 43.2 cm (17.0") rear of the windshield header. It measured 12.7 cm (5.0") in width at the rear aspect. Clear body fluid spatter was noted on the driver's sun visor, the left aspect of the windshield header, and on the top aspect of the windshield to the right of the steering column. A large amount of body fluid (blood) was present on the left and center aspects of the bench seat where the driver came to rest. Lateral abrasions were present on the forward aspect of the driver's head restraint, but did not appear to be related to this crash.

Figure 6. Left side interior view of the Ford F-150 pickup truck

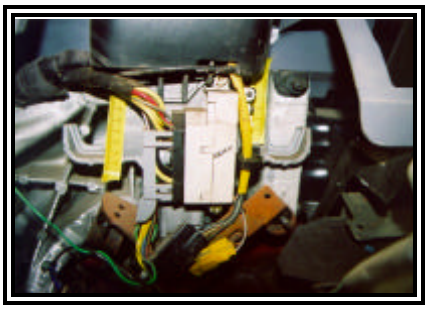

Figure 7. View of shear capsule displacement

MANUAL RESTRAINT SYSTEMS - 1996 Ford F-150 Pickup Truck

The 1996 Ford F-150 pickup truck was equipped with manual 3-point lap and shoulder belts for the driver and front right passenger positions and a 2-point manual lap belt with a locking latch plate for the center position. The center 2-point restraint was found behind the seat and not accessible from the center seat position at the time of the vehicle inspection. Each outboard manual restraint was configured with a fixed D-ring and sliding latch plate. The driver's seat belt utilized an emergency locking retractor (ELR) and the front right passenger's seat belt utilized a switchable/automatic locking retractor (ALR) retractor. A patch was affixed to the front right passenger's lap belt webbing with instructions for use of the belt with a child safety seat. The driver's manual restraint did not show any signs of usage in the crash. There were no abrasions on the D-ring or latch plate, and no stretch marks on the webbing indicative of belt usage. The retractor showed no signs of damage and the webbing was not restricted. At the time of the vehicle inspection, the driver's buckle assembly was found wedged under the seat back. In the on-scene police photographs, the buckle was extended forward from the seat bight, but not engaged with the seat belt.

FRONTAL AIR BAG SYSTEM ***- 1996 Ford F-150 Pickup Truck***

The 1996 Ford F-150 was equipped with a frontal air bag for the driver's position **(Figure 8)**. The air bag was housed in the center of the steering wheel with asymmetrical H-configuration module cover flaps. The top flap measured 12.7 cm (5.0") in height and 20.3 cm (8.0") in width. The bottom flap measured 3.8 cm (1.5") in height and 20.3 cm (8.0") in width. The post-crash longitudinal distance between the steering wheel hub and the seat back measured 56.0 cm (22.0").

Figure 8. Driver's air bag

Due to the yielding nature of the soft soil, the air bag deployed late in the crash sequence as the front bumper engaged the embankment. The driver's air bag was circular in shape and measured 67.3 cm (26.5") in diameter. The air bag was vented by two circular ports at the 12 o'clock sector that measured 3.8 cm (1.5") in diameter. The air bag was tethered by two internal straps that measured 11.4 cm (4.5") in width and were located at the 12 and 6 o'clock aspects. The air bag excursion measured 27.9 cm (11.0"). Body fluid (blood) transfers were present on the upper right quadrant on the face of the air bag. Green fabric transfers from the driver's shirt were present on the bottom rear aspect of the air bag. The fabric transfer was offset slightly to the left and measured 11.4 cm (4.5") in height and 6.4 cm (2.5") in width. A large tissue transfer from the driver's neck was also present on the bottom rear aspect of the air bag **(Figure 9)**. The transfer was located in the center aspect and measured 24.1 cm (9.5") in height and 10.2 cm (4.0") in width.

Figure 9. Rear bottom view of the driver's air bag showing the tissue and fabric transfers

OCCUPANT DEMOGRAPHICS - 1996 Ford F-150 Pickup Truck

Driver

Age/Sex:	41-year-old male
Height:	170.0 cm (67.0")
Weight:	77.1 kg (170.0 lb)
Seat Track Position:	Full-rear
Manual Restraint Use:	Unrestrained
Usage Source:	Vehicle inspection, injury mechanisms, police report
Eyewear:	Unknown
Type of Medical Treatment:	Pronounced dead at the scene

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Crush trauma of the pons and transection of the pons from the cerebrum and multiple traumatic injuries to the brainstem	Maximum (140214.6,8)	Indirect - driver's air bag expansion
Avulsion of the Circle of Willis (anterior cerebral artery laceration) (internal carotid artery laceration) (posterior cerebral artery laceration)	Critical (120202.5,5) Critical (121002.5,9) Critical (121802.5,6)	Indirect - driver's air bag expansion
Basilar artery avulsion	Critical (120402.5,8)	Indirect - driver's air bag expansion
Crush trauma and near total destruction of bilateral cerebellar hemispheres	Severe (140474.4,6)	Indirect - driver's air bag expansion
Transverse basilar skull fracture extending through the bilateral petrous ridges and sella turcica, contiguous with fractures of the bilateral posterior cranial fossa. Lacerations associated with the skull fracture extend to the posterior pharynx	Severe (150206.4,8)	Indirect - driver's air bag expansion

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Partial transection of the proximal descending aorta with hemorrhage into the posterior mediastinum and multiple intimal lacerations of the thoracic aorta	Severe (420208.4,4)	Driver's air bag expansion
Fracture of right lateral ribs 2-5, left lateral ribs 2-5, and right 2nd posterior rib	Severe (450240.4,3)	Driver's air bag expansion
Pituitary gland loose within the sella turcica and the stalk has been severed	Serious (140799.3,8)	Indirect - driver's air bag expansion
Endocardial laceration of inferior vena cava and right atrium	Serious (421802.3,4) Serious (441008.3,4)	Driver's air bag expansion
3.0 cm (1.2") laceration of left posterior pericardial sac at the area of the left pulmonary vein	Moderate (441602.2,4)	Driver's air bag expansion
Slight abrasion of the inferior left margin of the neck laceration	Minor (390202.1,2)	Top cover flap of driver's air bag
36.8 x 22.9 cm (14.5 x 9.0") diffuse superficial abrasion of the lower neck and bilateral chest wall consistent with air bag trauma and 2 parallel abrasions 7.6 cm (3.0") in length on the left upper chest with 1.6 cm (0.6") separation contiguous with parallel abrasions of the left mid chest measuring 5.1 cm (2.0") in length with 2.5 cm (1.0") separation	Minor (390202.1,5) Minor (490202.1,0)	Driver's air bag expansion

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Gaping 17.8 cm (7") laceration of the anterior and bilateral neck with multiple lacerations of anterior neck musculature at the base of the chin, exposure of the base of the mandible bilaterally, and fragments of green fabric present in the wound. Neck lacerations extend to the base of the tongue	Minor (390602.1,0)	Top cover flap of driver's air bag
7.6 x 6.4 cm (3.0 x 2.5") area of contusions with linear components on the left lower anterior chest	Minor (490402.1,2)	Top cover flap of driver's air bag
Contusion and crushing of the adipose tissue of the upper anterior chest	Minor (490402.1,3)	Driver's air bag expansion
1.9 x 1.9 cm (0.8 x 0.8") contusion of the right medial knee	Minor (890402.1,1)	Knee bolster
7.6 x 2.5 cm (3.0 x 1.0") contusion of the left lateral mid thigh, and a 1.9 x 1.3 cm (0.8 x 0.5") contusion of the proximal medial left anterior tibial crest	Minor (890402.1,2)	Left lower instrument panel
7.6 x 3.8 cm (3.0 x 1.5") contusion of the proximal anteromedial left thigh	Minor (890402.1,2)	Steering wheel rim

Injury source: Autopsy report

Driver Kinematics

The 41-year-old driver of the 1996 Ford F-150 pickup truck was presumed to have been seated in an upright posture with the seat track adjusted to the full-rear position. He was not restrained by the available manual 3-point lap and shoulder system. When the driver detected the intersection, he applied the brakes in full-lockup and was most likely bracing. His arms were most likely extended outward with his hands positioned on the steering wheel rim. As the pickup truck departed the roadway and traveled into the shallow drainage ditch, the unrestrained driver was displaced forward in close proximity against the driver's air bag module. As the pickup truck ramped up the dirt embankment, the driver began to submarine the fixed steering column and remained in the forward position as the pickup truck engaged the dirt embankment. Due to the soft dirt, the crash pulse was elongated and the driver's air bag deployed late in the crash. The driver was out of position against the module cover flap at the time of deployment.

At impact, the driver's air bag deployed and the air bag module cover flaps contacted the driver's chest. The horizontal edge of the asymmetrical upper module cover flap and the expanding air bag impacted the upper thoracic area and neck area. The top cover flap opened in an upward direction against the driver's shirt and the leading edge of the flap shredded and abraded the fabric on the front chest area of his shirt. The cover flap continued to open against the driver's chest and neck. The driver sustained a gaping 17.7 cm (7.0") laceration of the anterior and bilateral neck extending to the base of the tongue with multiple lacerations of anterior neck musculature at the base of the chin, and exposure of the base of the mandible bilaterally. Fragments of green fabric were present in the wound. The initial impact from the upper module cover flap also resulted in an 7.6 x 6.4 cm (3.0 x 2.5") area of contusions with linear components on the left lower anterior chest. The driver initiated a forward trajectory in response to the frontal impact force. He loaded against the module cover and steering assembly. The driver's knees struck the knee bolster, evidenced by a scuff mark left of the steering column. He sustained a 1.9 x 1.9 cm (0.8 x 0.8") contusion of the right medial knee as a result of contact with the knee bolster. His left leg contacted the lower instrument panel which resulted in a 1.9 x 1.3 cm (0.8 x 0.5") contusion of the proximal medial left anterior tibial crest and an 7.6 x 2.5 cm (3.0 x 1.0") contusion of the left lateral mid thigh. His left thigh contacted the steering wheel rim which caused an 7.6 x 3.8 cm (3.0 x 1.5") contusion of the proximal anteromedial left thigh. His forward position restricted the normal deployment of the driver's air bag.

The driver's loading force against the steering wheel assembly and the air bag module, in combination with the deploying air bag against his chest, produced compression of the energy-absorbing steering column. The compression of the steering column resulted in complete separation of the shear capsules. The left side separation measured 6.4 cm (2.5") and the right side separation measured 7.0 cm (2.8").

The fold pattern of the air bag was such that the bottom rear aspect deployed first. A large tissue transfer which measured 24.1 cm (9.5") in height and 10.2 cm (4.0") in width was present in the center of the bottom rear aspect of the air bag from expansion against the driver's neck. The air bag also expanded against the driver's shirt which resulted in a faint green transfer on the bottom rear aspect of the air bag to the left of the tissue transfer which measured 11.4 cm (4.5") in height and 6.4 cm (2.5") in width. The expansion of the driver's air bag produced a 36.8 x 22.9 cm (14.5 x 9.0") diffuse superficial abrasion of the lower neck and bilateral chest wall, two parallel abrasions 7.6 cm (3.0") in length on the left upper chest with 1.6 cm (0.6") separation contiguous with parallel abrasions of the left mid chest measuring 5.1 cm (2.0") in length with 2.5 cm (1.0") separation, fractures of the right lateral ribs 2-5, fractures of the left lateral ribs 2-5, fracture of the right 2nd posterior rib, a contusion and crushing of the adipose tissue of the upper anterior chest, a 3.0 cm (1.2") laceration of left posterior pericardial sac at the area of the left pulmonary vein, a partial transection of the proximal descending aorta with hemorrhage into the posterior mediastinum, multiple intimal lacerations of the thoracic aorta, and an endocardial laceration of inferior vena cava and right atrium. The vertical expansion of the air bag hyper-extended the driver's neck which produced a transverse basilar skull fracture which extended through the bilateral petrous ridges and sella turcica, contiguous with fractures of the bilateral posterior cranial fossa. The fracture and associated lacerations extended to the posterior pharynx. The vertical expansion of the air bag also caused the driver to sustain crush trauma and transection of the pons from the cerebrum, crush trauma and near total

destruction of the bilateral cerebellar hemispheres, multiple traumatic injuries to the brain stem, avulsion of the Circle of Willis and the basilar artery, and subdural and subarachnoid hemorrhage at the base of the brain.

The driver was displaced rearward due to the air bag expansion and rebounded rearward, evidenced by two large body fluid (blood) spatters on the interior roof. Although not supported by direct contact evidence, he probably struck the top/rear aspect of his head against the top of the seat back or the head restraint. He came to rest slumped to the right in the front left seat position.

The driver was found slumped to the right on the bench seat by first responders and was unresponsive with no vital signs. He was pronounced dead at the scene by the coroner approximately one half hour following the crash.

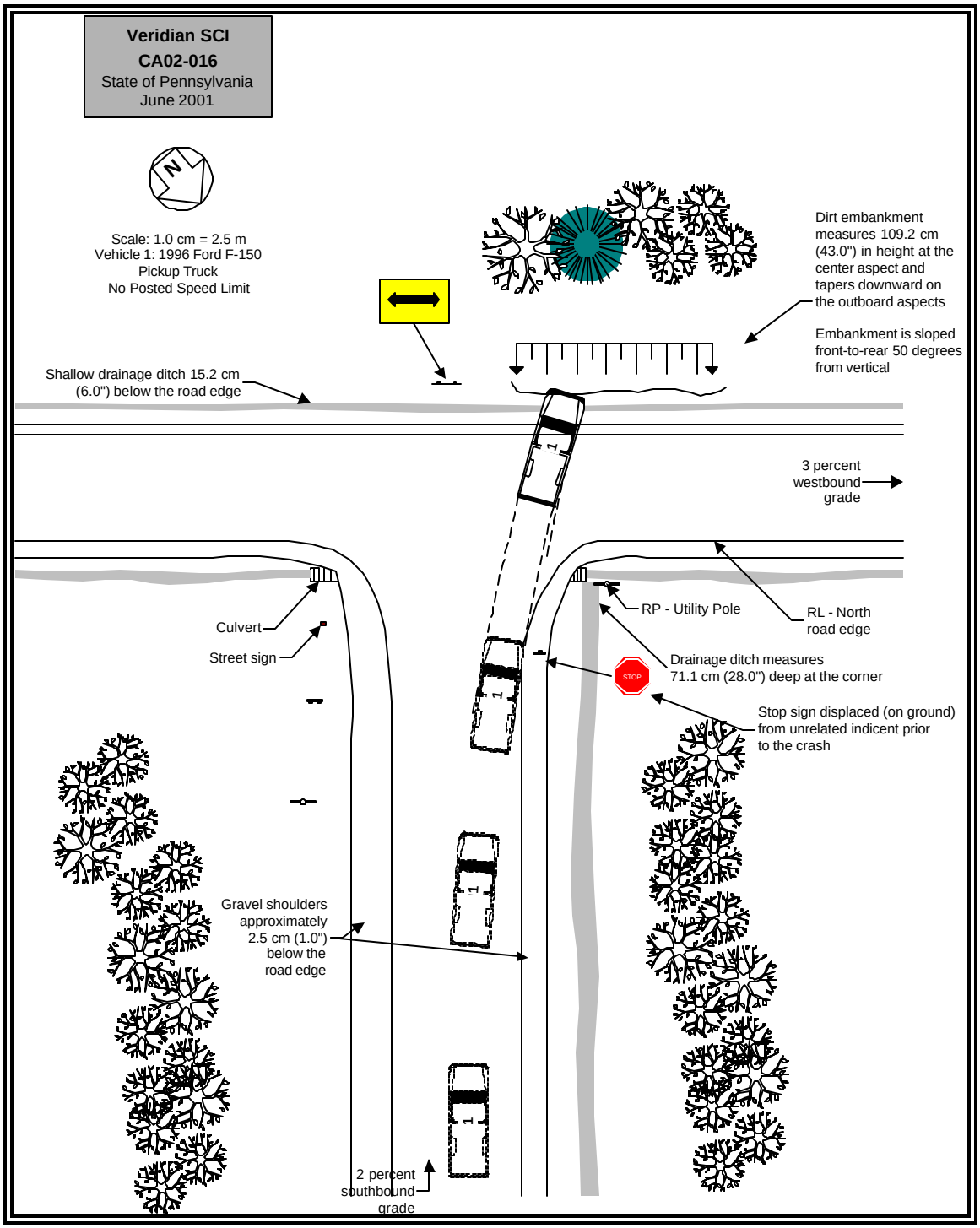

Figure 10. Scene schematic