TRANSPORTATION SCIENCES
Crash Data Research Center

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VERIDIAN ON-SITE AIR BAG RELATED CHILD PASSENGER FATALITY INVESTIGATION
VERIDIAN CASE NO. CA97-028
VEHICLE: 1994 JAGUAR XJ6
LOCATION: NORTH CAROLINA
CRASH DATE: AUGUST 1997

Contract No.
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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 the injury severity, injury mechanisms, and cause of death of an eight year old female front right passenger in a 1994 Jaguar XJ6. The Jaguar was equipped with frontal air bags for the driver and front right passenger positions. The front right air bag deployed as a result of a front-to-rear impact sequence with a 1996 Chevrolet Impala SS. The driver of the Jaguar was traveling in a northerly direction on a two lane state route, following the Chevrolet Impala. The driver of the Impala noted a slow moving non-contact vehicle traveling northbound ahead of his path of travel, and slowed to avoid contact. The Impala driver checked his rear view mirror and noted that the driver of the Jaguar failed to slow for the northbound traffic. He immediately accelerated the Impala and steered left in an attempt to avoid impact from the Jaguar. The driver of the Jaguar detected the impending harmful event and braked with sufficient force to activate the anti-lock braking system as the vehicle continued forward to impact against the rear of the Impala. The front right child passenger of the Jaguar was improperly restrained by the manual belt system. She was displaced forward by the pre-crash braking into the path of the front right passenger air bag. The leading edge of the mid mount module cover flap impacted the child's submental area followed by the expansion of the air bag membrane against her anterior neck. The combination of these components hyper-extended her neck resulting in a atlanto-occipital fracture/dislocation with probable cord damage. She was transported by ambulance to a local hospital then transferred by helicopter to a regional trauma center where she was diagnosed with brain death. She expired within 18 hours of the crash.			
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BACKGROUND

Figure 1. Overall view of the crash site and final rest positions of the vehicles.

This on-site investigation focused on the injury severity, injury mechanisms, and cause of death of an eight year old female front right passenger in a 1994 Jaguar XJ6. The Jaguar was equipped with frontal air bags for the driver and front right passenger positions. The front right air bag deployed as a result of a front-to-rear impact sequence with a 1996 Chevrolet Impala SS **(Figure 1)**. The driver of the Jaguar was traveling in a northerly direction on a two lane state route, following the Chevrolet Impala. The driver of the Impala noted a slow moving non-contact vehicle traveling northbound ahead of his path of travel, and slowed to avoid contact. The Impala driver checked his rear view mirror and noted that the driver of the Jaguar failed to slow for the northbound traffic. He immediately accelerated the Impala and steered left in an attempt to avoid impact from the Jaguar. The driver of the Jaguar detected the impending harmful event and braked with sufficient force to activate the anti-lock braking system as the vehicle continued forward to impact against the rear of the Impala. The front right child passenger of the Jaguar was improperly restrained by the manual belt system. She was displaced forward by the pre-crash braking into the path of the front right passenger air bag. The leading edge of the mid mount module cover flap impacted the child's submental area followed by the expansion of the air bag membrane against her anterior neck. The combination of these components hyper-extended her neck resulting in a atlanto-occipital fracture/dislocation with probable cord damage. She was transported by ambulance to a local hospital then transferred by helicopter to a regional trauma center where she was diagnosed with brain death. She expired within 18 hours of the crash.

The Crash Investigation Division of NHTSA was notified of this crash by a news reporter on August 12, 1997. The notification was forwarded to the Veridian SCI team on the day of notification and assigned as an on-site investigative effort. The Veridian SCI team departed on August 12 and initiated the on-site investigation on August 13. The vehicle was secured by the police in an impound facility pending this investigation.

SUMMARY

Crash Site

This crash occurred on a state route that consisted of two undivided travel lanes delineated by a solid double yellow center line with solid white roadway edge lines. All lane markings were in good condition. The roadway geometry involved a right curve on a negative 2.6 percent slope (with respect to the vehicle's

path of travel) that transitioned to a straight segment near the point of impact. The asphalt surface was dry with a surface friction coefficient estimated at 0.8. The sight distance from the hillcrest preceding the crash was estimated at 198 m (650'). The ambient condition was clear. The posted speed limit was 89 km/h (55 mph).

Crash Sequence

Pre-Crash

The 26 year old female driver of the Jaguar had departed a social function and was traveling to her residence with her eight year old daughter seated in the front right position and her five year old son seated in the left rear of the XJ6. She was traveling in a northerly direction on the two lane state route at a police reported speed of 80 km/h (50 mph). She was following her husband who was driving a 1996 Chevrolet Impala SS. Traveling ahead of the Impala was a non-contact vehicle that was proceeding at a police and driver reported slow rate of speed. The driver of the Impala braked for the non-contact vehicle. As he decelerated, the driver of the Impala checked his rear view mirror and noted that the driver of the Jaguar failed to detect his braking actions for the non-contact vehicle. The Impala driver, aware of an impending impact, accelerated his vehicle and steered to the left in an attempt to avoid the crash. The driver of the Jaguar steered to her right and braked with sufficient force to activate the ABS braking system of the Jaguar in an attempt to avoid impact with the Impala. The crash schematic is attached as **Figure 14**, Page 12.

Crash

The frontal area of the Jaguar impacted the rear of the Chevrolet Impala in a slight angled configuration due to the avoidance actions by both drivers. The crash resulted in impact forces of 12 o'clock for the striking Jaguar and 6 o'clock for the struck Impala. The damage algorithm of the WinSMASH program computed total velocity changes of 19.0 km/h (11.8 mph) for the Jaguar and 20.0 km/h (12.4 mph) for the struck Impala. The longitudinal components were -19.0 km/h (-11.8 mph) and 20.0 km/h (12.4 mph) respectively for the XJ6 and the Impala. As a result of the crash induced deceleration, the Jaguar's front right air bag module deployed.

Figure 2. Post-impact skid marks from the Jaguar.

Figure 3. Final rest position of the Jaguar.

The driver of the Jaguar maintained a sufficient braking force throughout the crash event to activate the ABS of the XJ6. The front tires marked on the asphalt road surface following impact which evidenced her level of braking and the trajectory of the vehicle **(Figure 2)**. The Jaguar came to rest approximately 15.25

m (50.0') north of the point of impact, straddling the east edge line. At rest, the vehicle was facing in a slightly skewed attitude from it's initial pre-crash trajectory **(Figure 3)**.

Due to the pre-crash acceleration and the CCW steering input by the driver of the Impala, the Impala was deflected across the roadway by the impact. The vehicle crossed the southbound travel lane and traversed the mouth of a private driveway, prior to entering a lawn area. The Impala traveled 49 m (161') north of the point of impact before coming to rest 11 m (36') west of the west edge line of the state route. Approximately 33 m (108') of rotating tire prints evidenced the vehicle's trajectory to final rest.

Post-Crash

The front right passenger of the Jaguar came to rest in a reported fetal position on the front right seat of the vehicle. The driver exited the Jaguar and proceeded to the right side of the vehicle. The driver of the Impala exited his vehicle and ran back to the crash site and removed the front right child passenger from the Jaguar. He placed the child on the ground adjacent to the vehicle and initiated CPR activities. Local emergency personnel arrived on-scene and continued the CPR activities. The child was transported by ambulance to a local hospital where she was evaluated and prepared for helicopter transport to a regional trauma center. She expired approximately 18 hours following the crash.

Vehicle Data

1994 Jaguar XJ6

The 1994 Jaguar XJ6 was a four-door sedan, rear wheel drive platform. The Jaguar was powered by a 4.0 liter, in-line 6 cylinder engine linked to a 4-speed automatic transmission with a console mounted transmission selector lever. Braking was achieved by four-wheel power-assisted disc brakes with anti-lock (ABS) and a yaw control system. The interior was configured with leather clad front bucket seats and a three passenger rear bench seat. The front bucket seats were power adjustable with adjustable head restraints. The manual restraint systems for the four outboard seated positions consisted of continuous loop 3-point lap and shoulder belt systems with sliding latch plates and emergency locking retractors. The front seat D-rings were adjustable with the left side adjusted to the full-up position and the right adjusted 1.9 cm (0.75") above the full-down position. Although the belt systems yielded evidence of routine usage indicators (i.e., wear marks on the latch plates), there was no evidence to support belt use at the time of the crash. The Jaguar was equipped with a Breed Inc., independent frontal air bag system for the driver and right passenger positions. The front right passenger air bag deployed as a result of the crash. The Jaguar was identified by vehicle identification number SAJKX1749RC (production number deleted) and had a recorded odometer reading of 90,676 km (56,345 miles). The XJ6 was purchased as a used vehicle by the driver and her husband on April 15, 1997. The service and crash history of the Jaguar was not reported.

1996 Chevrolet Impala SS

The struck vehicle in this two vehicle crash was a 1996 Chevrolet Impala SS, four-door sedan. The Impala was equipped with a 5.7 liter V-8 gasoline engine linked to a four-speed automatic overdrive transmission with a console mounted transmission selector lever. The rear wheel drive Impala was equipped with four-wheel disc brakes with anti-lock (ABS). The interior was configured with leather wrapped front bucket seats and a three passenger rear bench seat. The four outboard seated positions

were equipped with 3-point lap and shoulder belt system. Additional restraint was provided to the front seated positions by frontal air bags. The air bag system did not deploy as a result of the rear impact sequence. The Impala was manufactured in May 96, and was identified by vehicle identification number 1G1BL52P7TR (production number deleted). At the time of the crash, the vehicle's odometer reading was 37,175 km (23,100 miles).

Vehicle Damage

Exterior - 1994 Jaguar XJ6

The Jaguar sustained moderate frontal damage **(Figure 4)** from it's impact sequence with the 1996 Chevrolet Impala. The direct contact damage began 37.5 cm (14.75") right of the vehicle's centerline and extended 113.0 cm (44.5") to the left bumper corner. The combined direct and induced damage length was 152.4 cm (60.0") which extended across the full frontal width of the vehicle. Maximum crush was 18.4 cm (7.25") located at the left corner of the front bumper **(Figure 5)**. The Jaguar's crush profile at bumper level was as follows: C1 = 18.4 cm (7.25"), C2 = 15.9 cm (6.25"), C3 = 13.3 cm (5.25"), C4 = 10.8 cm (4.25"), C5 = 11.4 cm (4.5"), C6 = 11.4 cm (4.25").

The initial contact involved the front bumper of the Jaguar against the rear bumper of the Impala. As the vehicles crushed to maximum engagement, the front bumper of the Jaguar partially underrode the Impala's bumper resulting in minimal crush to the Jaguar's grille, left headlamp assembly, and hood. The impact buckled the hood and both front fenders of the XJ6 **(Figure 6)**. The Collision Deformation Classification (CDC) for the Jaguar was 12-FDEW-1.

Figure 4. Frontal damage to the Jaguar.

Figure 5. Profile view documenting the extent of crash at the front left corner.

Figure 6. Three-quarter view of the Jaguar's frontal damage.

Interior - 1994 Jaguar XJ6

The interior of the Jaguar XJ6 sustained moderate damage that was associated with deployment of the front right air bag and occupant contact. There was no interior damage associated with exterior deformation or intrusion of interior components.

The improperly restrained front right child passenger was displaced forward by the pre-crash braking into the path of the deploying front right air bag module. The single cover flap opened in an upward trajectory and contacted the anterior aspect of the child's chin. This contact sequence was evidenced by a tissue transfer located on the trim panel of the leading edge of the cover flap, deformation of the trim, and

deflection and cracking of the woodgrain trim face panel of the cover flap. The tissue transfer was located 23.2 cm (9.125") inboard of the left edge of the flap and extended 7.6 cm (3.0") laterally to the right. The deflection of the cover flap was semi-circular in shape and began 18.1 cm (7.125") inboard of the left edge and extended to the right 21.6 cm (8.5) along the leading edge. The deflection extended 6.4 cm (2.5") vertically onto the face of flap. It should be noted that the trim panel at the leading edge of the flap was partially separated and bowed in a rearward direction.

The expanding air bag membrane contacted the anterior aspect of the child passenger's neck and chest. Several fabric transfers were noted to the air bag membrane from this expansion sequence. A small tear of the fabric was noted from probable snagging within the module assembly during deployment.

The right lower aspect of the windshield was fractured 30.5 cm (12.0") right of center and 14.6 cm (5.75") above the upper instrument panel from probable contact from the deformed trim on the leading edge of the mid mount cover flap. A vinyl transfer extended 5.1 cm (2.0") below the fracture point. The right side of the rear view mirror was scuffed from air bag expansion and separated from it's mounting point.

Two distinct skin oil transfers were noted to the inside surface of the tempered right front door glazing. The first was located 17.8 cm (7.0") rearward of the right A-pillar while the second was centered 56.2 cm (22.125") rear of the referenced pillar. The transfers were circular in shape and were 8.9 cm (3.5") and 10.2 cm (4.0") in diameter. These transfers probably resulted from the rebound trajectory of the front right child passenger.

Exterior - 1996 Chevrolet Impala SS

The back plane of the Chevrolet Impala sustained moderate damage **(Figure 7)** as a result of the front-to-rear impact sequence with the 1994 Jaguar XJ6. Maximum crush was 19.8 cm (10.8") located on the rear bumper, 10.0 cm (4.0") inboard of the left bumper corner. The direct contact damage began at the left rear bumper corner and extended 142.2 cm (56.0") to the right, terminating 12.7 cm (5.0") inboard of the right corner. The direct damage was located exclusively to the rear bumper fascia. The combined direct and induced damage length was 154.9 cm (61.0") that involved the full end-width of the vehicle. The crush profile at bumper level was as follows: C1 = 16.0 cm (6.3"), C2 = 14.7 cm (5.8"), C3 = 18.0 cm (7.1"), C4 = 16.5 cm (6.5"), C5 = 13.5 cm (5.3"), C6 = 11.2 cm (4.4").

The rear impact crushed the end plane of the Impala forward and buckled the quarter panels at the base of the upper D-pillars and C-pillars **(Figure 8)**. This resulted in a downward displacement of the rear structure. The right front and both rear doors of the Impala were jammed closed by the exterior deformation. Minor reductions of the wheelbases were noted with 2.3 cm (0.9") on the left and 3.6 cm (1.4") on the right. There was no glazing damage to the vehicle and no intrusion of the passenger compartment. The CDC for this event was 46-BDLW-2. The 06 o'clock direction of force was incremented by a value of 40 to reflect the downward vertical displacement of the end structure.

Figure 7. Back damage to the struck Impala.

Figure 8. Induced damage to the right rear quarter panel area.

Frontal Air Bag System - 1994 Jaguar XJ6

Figure 9. Overall view of the Jaguar's frontal air bag system.

The frontal air bag system in the Jaguar XJ6 consisted of driver and front right passenger air bags designed and developed by *Breed Inc*. This system was an independent system in which the driver and passenger air bags were actuated independently by mechanical ball-in-tube sensors located in the respective modules. There was no central control module or safing sensor in the design of this system. As a result of this front-to-rear crash sequence, the front right passenger air bag of the Jaguar deployed and the driver air bag did not deploy.

The driver air bag was mounted in the typical configuration within the center hub of the four spoke steering wheel rim. The spokes were located at the 5 and 7, and 2:30 and 9:30 o'clock sectors **(Figure 9)**. The air bag was concealed by symmetrical H-configuration cover flaps. There was no damage or contact evidence noted to the non-deployed driver air bag module.

Figure 10. Deployed mid mount front right passenger air bag.

The front right passenger air bag was a mid-mount design located in the right aspect of the instrument panel **(Figure 10)**. The module was concealed by a single cover flap that opened in an upward direction. The cover flap was hinged by two arms that attached forward of the face of the mid panel, thus allowing the cover flap to partially retract into the instrument panel at deployment. This garage door-type design reduced the risk of contact to out-of-position occupants. The overall dimensions of the cover flap were 13.7 cm (5.375") vertically and 44.8 cm (17.625") horizontally. The left edge of the cover flap was located 18.4 cm (7.25") right of the vehicle's center line. The cover flap consisted of a wood grain outer skin with a rigid plastic trim affixed to the bottom edge of the flap. This trim panel protruded 2.5 cm (1.0") below the wood grain face panel of the flap. The padded upper instrument panel protruded 2.2 cm (0.875") over the mid panel. The lower right corner of the cover flap was printed with the acronym SRS (Supplemental Restraint System).

The child passenger was contacted by the mid mount cover flap as the passenger air bag system deployed. Her contact with the flap deformed the mid aspect of the flap in a semi-circular pattern. The contact was evidenced by a tissue transfer on the trim panel at the leading edge of the flap. This trim panel partially separated from the cover flap and was bowed from contact against the child passenger.

The power of the inflator was first generation and designed with two stages. Approximately one-third of the bag's deployed travel occurred during the first stage of inflation. The inflator's second stage fired after a fixed delay of 15 ms completing the air bag's expansion.

The deployed front right passenger air bag membrane was tethered, however, the bag was not directly vented into the passenger compartment. The air bag back-vented into the module and into the mid instrument panel. The internal tethering of the front right air bag consisted of two wide band tethers that were sewn to the face of the bag. The air bag membrane was stamped with the following nomenclature: 7133R. The air bag membrane measured approximately 43.8 cm (17.25") horizontally and 50.8 cm (20.0") vertically in the deflated state. Additionally, the maximum rearward excursion of the air bag membrane was 5.2 cm (21.75") from the face of the mid instrument panel.

The air bag membrane expanded against the forward positioned child passenger. Several faint yellow and purplish color transfers were noted to the upper right quadrant of the air bag. These transfers were possibly related to the clothing worn by the child passenger. Additional purplish transfers were noted in a horizontally oriented pattern on the lower aspect of the bag. These transfers were approximately 14.0 cm (5.5") in width and 7.0 cm (2.75") in height. Blood stains were present on the mid face of the bag. A small tear was noted to the bag membrane that measured approximately 1.9 cm (0.75") in length. The tear was attributed to snagging of the membrane during the impeded deployment of the system.

Occupant Data - 1994 Jaguar XJ6

Driver Demographics

Age/Sex:	26 year old female
Height:	167.6 cm (66.0")
Weight:	56.7 kg (125.0 lb)
Adjusted Seat Track Position:	Mid-to-rear most track position [5.4 cm (2.2") forward of full rear]
Manual Restraint Usage:	3-point lap and shoulder belt
Usage Source:	Interview data
Mode of Transport From Scene:	Rode in ambulance with injured daughter
Type of Medical Treatment:	None

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Complaint of pain	N/A	N/A

Driver Kinematics

The driver of the Jaguar was seated in a presumed normal driving posture with her seat adjusted to a mid track position and the seat back reclined to a measured angle of 24 degrees. In this adjusted position, the horizontal distance between the non-deployed driver air bag module and the seat back **(Figure 11)** was 55.9 cm (22.0"). The driver was restrained by the manual 3-point lap and shoulder belt system. The belt system did yield evidence of occasional usage, however, there was no loading evidence to support usage at the time of the crash.

Figure 11. Driver's seated position and trajectory.

Prior to impact, the driver braked with sufficient force to lock the front wheels of the Jaguar. The driver of the Jaguar stated that she extended her right arm in an attempt to restrain the front right child occupant. Based on the lack of injury to the driver's arm, her arm was not positioned between the child and the front right passenger air bag.

At impact, the driver initiated a forward trajectory in response to the 12 o'clock impact force. She loaded the manual belt system and braced against the steering wheel. Although there was no loading evidence to these components, the driver complained of pain to the neck, mandible, chest, and abdominal regions from loading the manual belt system and the impact force.

As the vehicle came to rest, the driver of the Jaguar opened the left front door and exited the vehicle unassisted. At the scene, she waited for rescue personnel to arrive, while her husband performed CPR on the injured front right child passenger.

Front Right Child Passenger Demographics

Age/Sex:	8 year old female
Height:	134.6 cm (53.0")
Weight:	38 kg (83 lb)
Adjusted Seat Track Position:	Rear track position (0.6 cm forward of full rear)
Manual Restraint Usage:	Improper use of the 3-point lap and shoulder belt
Usage Source:	Passenger trajectory, contact points, injury patterns
Mode of Transport From Scene:	Ambulance
Type of Medical Treatment:	Transported to a local hospital and transferred by helicopter to a regional trauma center where she expired approximately 18 hours following the crash

Front Right Child Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Atlanto-occipital fracture/dislocation	Moderate (650208.2,6)	Front right air bag module cover flap and expanding air bag membrane
Cerebral subarachnoid hemorrhage	Serious (140684.3,9)	Front right air bag module cover flap and expanding air bag membrane
Cerebral swelling	Serious (140660.3,9)	Front right air bag module cover flap and expanding air bag membrane
Submental bands of abrasions that extend ear-to-ear across anterior neck	Minor (390202.1,0)	Front right air bag module cover flap and expanding air bag membrane
6.0 x 14.2 mm (0.25 x 9/16") perforation of the left anterior neck	Minor (390602.1,2)	Front right air bag module cover flap
1.9 x 0.6 cm (0.75 x 0.25") laceration of the right submental region	Minor (290602.1,8)	Front right air bag module cover flap
Faint blue contusion over the right lateral neck	Minor (390402.1,1)	Front right air bag module cover flap and expanding air bag membrane
Contusion over right upper chest	Minor (490402.1,1)	Expanding front right air bag membrane
Small area of contusion over left mid chest	Minor (490402.1,2)	Expanding front right air bag membrane
Scattered abrasions over the extensor aspect of the left arm and shoulder	Minor (790202.1,2)	Expanding front right air bag membrane
Multiple abrasions left upper chest	Minor (490202.1,2)	Expanding front right air bag membrane
Contusion left upper arm	Minor (790402.1,2)	Expanding front right air bag membrane

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Abrasions left anterior elbow region	Minor (790202.1,2)	Expanding front right air bag membrane
Contusion at base of right anterior thumb	Minor (790402.1,1)	Container held by passenger
Faint contusion over lumbar back	Minor (690402.1,8)	Probable rebound into the right seat back
Small blue contusion over left mid anterior thigh	Minor (890402.1,2)	Lower instrument panel/knee bolster

**Source of Medical Data - Autopsy report*

Front Right Passenger Kinematics

The front right child passenger was seated forward on the leather bucket seat, reportedly holding and eating from a tray of food on her lap. The power-adjusted front right seat was set to a rear track position with the seat back reclined approximately 30 degrees aft of vertical. In this adjusted position, the horizontal distance between the leading edge of the front right passenger air bag module cover flap and the seat bight was 62.5 cm (24.625"). The child passenger had a reported history of belt usage. There was routine usage wear marks on the belt system, however, no evidence was visible on the system components to support belt usage in this crash. Based on historical use, the trajectory of the child passenger, and interview data, the child passenger was wearing the manual belt system improperly with the shoulder belt positioned under her right arm.

The child passenger responded to the driver's pre-crash braking actions by moving forward on the leather seat **(Figure 12)**. The leather surface provided a lower frictional coefficient between the child and the seat cushion. As she moved forward in response to the braking force, her pelvic region engaged the lap belt webbing and due to the improper placement of the shoulder belt, her upper torso and head pitched downward. This pre-crash motion placed the child's face in close proximity to the mid mount passenger air bag module cover flap.

Figure 12. Forward trajectory of the child passenger into the path of the mid mount air bag.

Figure 13. Cover flap damage front contact with the forward positioned child passenger.

At impact, the front right passenger air bag deployed. The leading edge of the cover flap impacted the submental and anterior neck regions of the out-of-positioned child passenger. This contact was evidenced by tissue transfers to the trim panel of the flap and severe bowing of the trim with a semi-circular depression of the face of the woodgrain cover flap **(Figure 13)**. This flap contact initiated a hyper-extension of the neck as the air bag membrane began to expand from the module. The combination of flap and membrane contact produced band-like abrasions across the submental and anterior neck regions that extended from ear-to-ear of the child. In addition, she sustained two lacerations of this region from the trim on the leading edge of the flap. The continued upward motion of the flap and the subsequent bag expansion resulted in a fracture/dislocation of the atlanto-occipital joint, cerebral subarachnoid hemorrhage, and cerebral swelling. Although unconfirmed, the child passenger probably sustained a cervical cord/brain stem injury. The non-invasive autopsy reported an impression of a lethal injury from a CT scan.

The air bag membrane subsequently expanded against the chest and left arm of the child passenger. Fabric transfers were present on the surface of the bag. The child sustained multiple contusions and scattered abrasions of the chest and upper extremity. She also sustained a contusion to the base of the right thumb from probably contact with the upper instrument panel.

The child passenger was displaced vertically and rearward by the expanding air bag into the front right seat back. She sustained a faint contusion of the lumbar region from the seat back contact sequence. In addition, the child passenger sustained a contusion of the anterior right thigh from possible involvement with the container that was positioned on her lap. She reportedly came to rest in a fetal position on the front right seat and was removed from the vehicle by her father, the driver of Impala.

Medical Treatment

The front right child passenger was removed from the 1994 Jaguar by her father, the driver of the Chevrolet Impala. He placed the child on the ground adjacent to the roadway and initiated CPR activities. The local volunteer fire department responded to the scene within 15 minutes of the crash, followed by the paramedics. The CPR activities were continued by the paramedics as they prepared the child for ambulance transport to a local hospital. The child was evaluated at the local hospital and transferred by helicopter to a regional trauma where she was placed on life support systems. Following diagnosis of her injuries, organ donation was discussed with the parents. The parents consented to the donation and the life support systems were withdrawn approximately 18 hours following the crash. The child expired and her heart, liver, pancreas, and corneas were harvested for donation.

Rear Left Child Passenger

The rear left occupant space was occupied by a 5 year old male. The child was reportedly restrained by the 3-point lap and shoulder belt system. It was unknown if the restraint system was properly worn by the child passenger. He sustain soft tissue injuries from probable contact with the back surface of the front right seat back. There was no contact evidence to the rear interior surfaces.

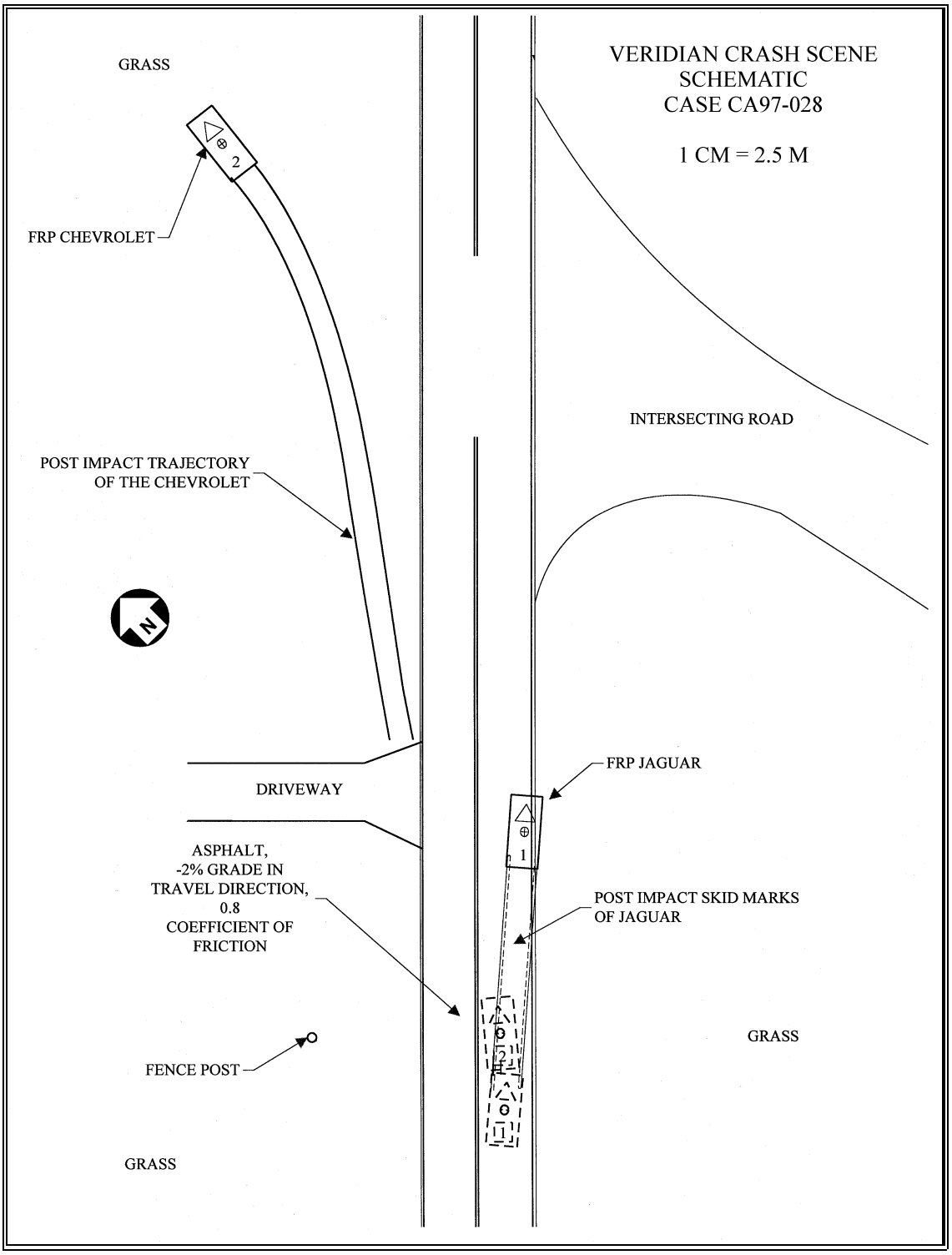

Figure 14. Crash Scene Schematic