

Remote Passenger Air Bag Fatality Investigation / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS04010
1997 Ford Escort
New Mexico
January, 2004

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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 crash-worthiness performance of the involved vehicle(s) or their safety systems.

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16. Abstract <p>This two-vehicle front to side, oblique crash occurred in January, 2004 at 1801 hours within a busy four-leg intersection located in an urban are of New Mexico. The north/southbound travel lanes of the intersection are controlled by tri-color traffic signals while the east/west legs of the intersection are controlled by posted stop signs. The speed limit for southbound traffic is 72 km/h (45 mph) while the posted speed limit for northbound traffic is 48 km/h (30 mph). It was dark at the time of the crash and the adjoining roadways were illuminated by the overhead street lights.</p> <p>The case vehicle was a 1997 Ford Escort four-door sedan which was driven by an unrestrained 20 year old female. The front right seat was occupied by an unrestrained 11 year old female. A 7 month old female was seated in the lap of the 11 year old front, right occupant. The left rear seat was occupied by an unrestrained 4 year old female. The second seat, right side position was occupied by an unrestrained 43 year old male. The other vehicle was a 1967 Chevrolet 3/4 ton C-20 series pickup with a camper shell and was driven by an unrestrained 57 year old female. The Ford Escort was northbound and was stopped in the left turn lane awaiting the green turn arrow. The other vehicle (Chevrolet pickup truck) was traveling southbound in the second travel lane and the traffic signal had just turned to the red signal phase when the driver entered the intersection with the intention of proceeding southbound. The driver of the Escort initiated a left turn sequence when the traffic signal changed from the red phase to the green turn arrow phase. The front of the Chevrolet pickup impacted the right side of the Ford Escort. Both the driver's and front, right passenger's air bags deployed as a result of the right side impact.</p> <p>The driver of the Ford Escort was not injured. The 11 year old female who occupied the front, right seated position sustained minor injuries while the 7 month old female occupant who was situated on the lap of the 11 year old, was severely injured and succumbed due to numerous head injuries. The 4 year old female who occupied the second seat, left side position was uninjured and the 43 year old male who occupied the second seat, right side position reportedly sustained rib (AIS-1) and pelvic fractures (AIS-2). This occupant was transported and hospitalized over night. The driver of the other vehicle was not injured.</p>					
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Dynamic Science, Inc.
Crash Investigation
Case Number: DS04010

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BACKGROUND:

Description: This Passenger Air Bag Child Fatality case was identified by the NHTSA. DSI was assigned the case on May 25, 2004. This case was conducted as a remote investigation. The following information was obtained from the police report, police photographs, and an autopsy report for the fatally injured child.

Investigation Type: Remote Passenger Air Bag Fatality Investigation
Crash Location: New Mexico
Crash Date: January, 2004
Notification Date: May 25, 2004
Field Work Completed: NA

SUMMARY

Crash Site

This two-vehicle crash occurred in January, 2004 at 1801 hours in an urban area of New Mexico. The crash occurred within the confines of a four-leg intersection. The northbound leg of the intersection is comprised of two northbound thru lanes, a left turn lane, and two southbound through lanes. The southbound leg of the intersection is comprised of two southbound through lanes, a left turn lane, and two northbound thru lanes. The weather was clear and the roadway was dry. The speed limit for southbound traffic is 72 km/h (45 mph). The speed limit for northbound traffic is 48 km/h (30 mph). North and southbound traffic is controlled by tri-color traffic signals. East and westbound traffic is controlled by stop signs. It was dark at the time of the crash and the streetlights were on.

Pre-Crash

The case vehicle was a 1997 Ford Escort four-door sedan driven by an unrestrained 20-year-old female. The case vehicle was equipped with driver and front right passenger air bags. The front right seat was occupied by an unrestrained 11-year-old female. A 7-month-old female was seated in the lap of the 11-year-old. The left rear seat was occupied by an unrestrained 4-year-

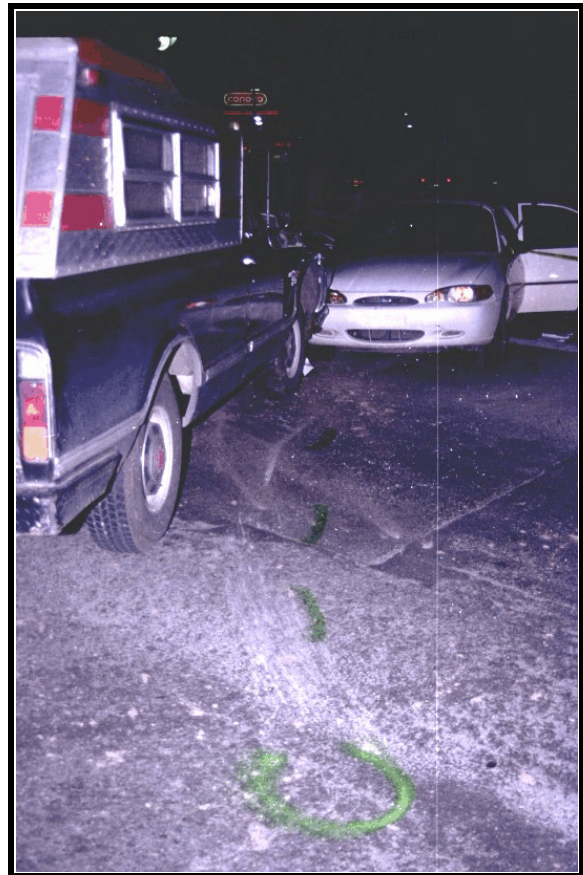


Figure 1. Final rest, facing west

old female. The rear right seat was occupied by an unrestrained 43-year-old male.

The other vehicle was a 1967 Chevrolet 3/4 ton C-20 series pickup with a camper shell driven by an unrestrained 57-year-old female.

The Ford Escort had been traveling northbound and was in the left hand turn lane. The Escort was stopped with a red light. The Chevrolet pickup was traveling southbound. The traffic signal was red for southbound traffic. As the turn arrow came on for northbound traffic, the driver of the Escort began a left hand turn to go west.

Crash

The Escort continued its turn and had reached a speed of approximately 23.9 km/h (14.9 mph)¹ when it was struck in the right side (02RPAW3) by the front of Chevrolet pickup (11FZEW1). The total velocity change as calculated by the WinSmash² program was 25.6 km/h (15.9 mph). The longitudinal and lateral delta V components were -12.8 km/h (-8.0 mph) and -22.2 km/h (-13.8 mph), respectively. Both front air bags in the Escort deployed at this time. The Ford Escort was pushed into a clockwise rotation and came to rest in the western leg of the intersection facing northeast. The Chevrolet pickup was redirected in a clockwise direction and came to rest in the intersection facing southwest. There was additional damage to the front left of the Escort that may have come from the front of the pickup at some point near final rest.

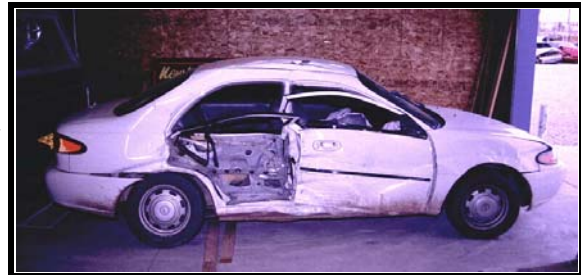


Figure 2. Right side, Ford Escort



Figure 3. Front, Chevrolet pickup

Post-Crash

The driver of the Ford Escort was not injured. The 7-month-old front right occupant was seriously injured with head and chest injuries. She was removed by the driver and placed in the hands of a witness. The witness then placed the infant on the floor of his vehicle. EMS personnel removed her from this vehicle and transported her by ambulance to a local trauma center where she eventually died. The 11-year-old front right occupant sustained minor head injuries. She was transported to a local trauma center where she was treated and released.

The 4-year-old rear left seat occupant was not injured. She was removed from the vehicle by paramedics and turned over to a relative who arrived later on the scene.

¹Calculated using an acceleration rate of 4.8 ft/s/s

²CDC only. Borderline reconstruction.

The 43-year-old rear right occupant sustained rib and pelvic fractures. He was transported by ambulance to a local trauma center where he was hospitalized overnight.

The driver of the Chevrolet pickup was not injured.

Both vehicles were towed from the scene and placed on police holds. During the inspection of the Ford Escort, police investigators removed both front air bags and several of the seat belts.

An autopsy was conducted on the 7-month-old front right occupant of the Ford Escort. It has been reported that she sustained right side skull fractures with extruded brain tissue and brain contusions. She also sustained brush-type abrasions to her left cheek and chin. The cause of death was stated to be "... severe blunt trauma to brain."

VEHICLE DATA - 1997 Ford Escort

The 1997 Ford Escort four-door sedan was designed to seat five persons. It was equipped with a four-speed automatic transmission, front wheel drive, front disc brakes/drum rear brakes, child safety rear door locks, variable intermittent wipers, automatic battery shutdown, AM/FM radio, and air conditioning.

VIN:	1FLAP10P4VWxxxxxx
Odometer:	Unknown
Engine:	4 cylinder, 2.0 L (122 CID)
Reported Defects:	None
Cargo:	Miscellaneous clothes and papers, per police. Propane tank and child seat visible in photos.

The 1997 Ford Escort was equipped with P185/65SR-14 tires. The specific tire data is unknown.

The front seating positions in the 1997 Ford Escort were configured with cloth covered bucket seats with adjustable head restraints that were not damaged. The rear seating positions were configured with cloth covered bench seats with a folding back.

VEHICLE DAMAGE

Exterior Damage - 1997 Ford Escort

Damage Description: Moderately Severe/ Right Side Impact: Primarily lateral displacement of the right side doors. Lateral deformation noted to the right A-pillar, B-Pillar and C-Pillar. Deformation was also noted to the right quarter-panel, and right roof side rail. The tempered right side glazing disintegrated due to the impact forces and the laminated windshield glazing was cracked due to the impact forces and the deployment of the front right passenger air bag.

CDC: 02RPAW3

Delta V:	Total	25.6 km/h (15.9 mph)
	Longitudinal	-12.8 km/h (-8.0 mph)
	Latitudinal	-22.2 km/h (-13.8 mph)
	Energy	3,750 joules (2,765 ft lbs)

Interior Damage - 1997 Ford Escort

The Ford Escort sustained moderate interior damage from the impact with Chevrolet pickup. There was lateral intrusion to both right side seats from the front door, B pillar, and rear door. The glazing for both doors was disintegrated. There was damage to the right side of the windshield from the deploying front right passenger air bag.



Figure 4. Right rear, Ford Escort

MANUAL RESTRAINT SYSTEMS - 1997 Ford Escort

The front seating positions of the Ford Escort were equipped with three-point lap and shoulder belts that were configured with adjustable shoulder belt anchorages. The left and right anchorages were in the mid position. Neither front seat belt was in use. The rear outboard seating positions were equipped with three-point lap and shoulder belts. The rear middle seat was equipped with a lap belt.

FRONTAL AIR BAG SYSTEM - 1997 Ford Escort

The 1997 Ford Escort Four-Door Sedan was equipped with 1st generation air bag systems which consisted of two front air bag sensors that are mounted on the left and right sides of the front upper radiator support bracket. The air bag diagnostic module is located at the fire wall along with a safing sensor. The air bag diagnostic monitor continually checks all air bag system components and wiring connections for possible faults. If the diagnostic monitor detects a fault in the system, then a light will be illuminated in the instrument cluster. The air bag diagnostic monitor does not deploy the air bags in the event of a crash. The radiator primary crash front air bag sensors are “hard wired” to the air bags. The front air bag sensors and the safing sensor determine when to deploy the air bag modules.

The drivers air bag is housed in the steering wheel hub and encases the nylon air bag, inflator unit, mounting plate, retainer ring and the air bag sliding contact. These components are concealed by the steering wheel trim cover which is equipped with standard horizontal tear seams. The circular air bag was tethered by two straps and two exhaust vent ports are present.



Figure 5. Driver's seated position/driver's air bag



Figure 6. Front right passenger air bag, side view

The lower instrument panel is equipped with a rigid plastic knee bolster which did not appear to be damaged due to occupant contact.

The front, right passenger air bag was located on the instrument panel (mid-mount type). The module deployment door is rectangular in shape and equipped with a tear seam that is designed to allow the door to hinge outward during deployment. The nylon air bag is inflated with nitrogen after a chemical reaction of sodium azide and copper oxide combusts. The inflator unit is supported by a metal reaction housing unit. There was no noted residual damage to the air bag and the module cover deployment door opened at the designated tear point. The deployment door cover opened with enough force to break the laminated windshield in front of the front, right seated position. Blood stains were noted to the nylon air bag surface.

VEHICLE DATA - 1967 Chevrolet C20 series pickup

Description: 1967 Chevrolet C20 series pickup
 VIN: CE247Zxxxxxx
 Odometer: Unknown
 Engine: Unknown, equipped with manual transmission
 Reported Defects: Unknown
 Cargo: None Reported
 Damage Description: Moderate Frontal Impact Damage:
 Longitudinal displacement to the front bumper, hood and radiator/grille area. Minor damage noted to the right fender and front, right headlight damaged.
 CDC: 11FZEW1
 Delta V:
 Total 15.0 km/h (9.3 mph)
 Longitudinal -14.1 km/h (-8.8 mph)
 Latitudinal 5.1 km/h (3.2 mph)
 Energy 49,695 joules
 (36,653 ft lbs)



Figure 7. Front right, Chevrolet C20 pickup

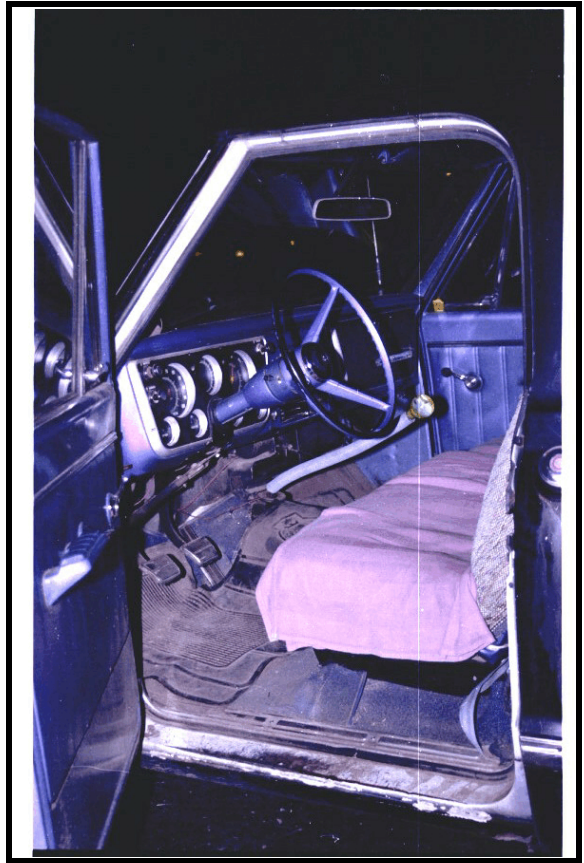


Figure 8. Interior, Chevrolet pickup

OCCUPANT DEMOGRAPHICS - 1997 Ford Escort

	Driver	Occupant 2	Occupant 3
Age/Sex:	20/Female	11/Female	7 month/Female
Seated Position:	Front, left	Front, right	Front right, on lap of Occupant 2
Seat Type:	Bucket, cloth covered	Bucket, cloth covered	N/A
Height:	Unknown	Unknown	64.5 cm (25.4 in) ³
Weight:	Unknown	Unknown	5.46 kg (12.04 lbs)
Occupation:	Unemployed	NA	NA
Pre-existing Medical Condition:	Unknown	Unknown	None
Alcohol/Drug Involvement:	None	N/A	None
Driving Experience:	Unknown	N/A	N/A
Body Posture:	Unknown	Front seat, holding 7 month old female (occupant 3) in lap	Situated on lap of 11 year old female (occupant 2)
Hand Position:	Unknown	Unknown	Unknown
Foot Position:	Right foot depressing accelerator pedal, left foot on floor surface	Unknown	In lap of 11 year old Occupant 2
Restraint Usage:	Unrestrained	Unrestrained	Unrestrained
Air bag:	Driver's front air bag	Front right Passenger air bag	Front right Passenger air bag

³Additional measurements: crown-rump = 39.5 cm (15.5 in) , head circumference = 43.0 cm (16.9 in), abdominal circumference = 37.0 cm (14.6 in)

OCCUPANT DEMOGRAPHICS

	Occupant 4	Occupant 5
Age/Sex:	4/Female	43/Male
Seated Position:	Rear left	Rear right
Seat Type:	Bench, cloth covered	Bench, cloth covered
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Occupation:	N/A	Unknown
Pre-existing Medical Condition:	Unknown	Unknown
Alcohol/Drug Involvement:	N/A	None reported
Driving Experience:	N/A	N/A
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Unrestrained	Unrestrained

OCCUPANT DEMOGRAPHICS - Chevrolet C20 pickup

	Driver
Age/Sex:	57/Female
Seated Position:	Front, left
Seat Type:	Bench
Height:	Unknown
Weight:	Unknown
Occupation:	Disabled
Pre-existing Medical Condition:	Unknown
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Unrestrained

OCCUPANT INJURIES -1997 Ford Escort

	Injury	OIC Code	Injury Mechanism	Confidence Level
Driver:	Uninjured	N/A	N/A	N/A
RF Occupant:	Reportedly sustained minor head injuries	Unknown	Unknown	Unknown
2 nd RF Occupant:	Gaping "L" shaped forehead laceration to the right upper forehead, extending into the hairline 6.3 x 3.2 cm (2.5 x 1.3 in)	290604.2	Passenger air bag module door cover	Probable
	Multiple upper left forehead abrasions measuring 0.6 cm (0.25 in) each	290202.1	Passenger air bag	Certain
	Left cheek abrasion 3.1 x 0.6 cm (1.25 x 0.25 in) partially patterned resembling a stitched seam	290202.1	Passenger air bag	Certain
	3.8 x 2.5 cm (1.5 x 1 in) abrasion to right side of mouth	290202.1	Passenger air bag	Certain
	Skull fracture beginning on the right posterior portion of the anterior frontanelle extending laterally and posteriorly 8.0 cm (3.1 in)	150402.2	Passenger air bag module door cover	Probable
	Skull fracture begins at the left posterior anterior frontanelle and extends laterally and posteriorly 12.0 cm (4.7 in)	150402.2	Passenger air bag module door cover	Probable
	Brain laceration 11.0 x 2.0 cm (4.3 x 0.8 in) over the frontoparietal and partially onto the occipital lobe.	140688.4	Passenger air bag module door cover	Probable

Multiple brain contusions to the right inferior frontal tip, right anterior-superior frontal portion, left inferior frontal brain and left lateral parietal brain	140614.3	Passenger air bag module door cover	Probable
Multiple brain lacerations to the right inferior frontal tip, right anterior-superior frontal portion, left inferior frontal brain and left lateral parietal brain	140688.4	Passenger air bag module door cover	Probable
Scattered diffuse subarachnoid hemorrhage over the convexities	140466.3	Passenger air bag module door cover	Probable

Second Seat, Left Side Occupant: Uninjured N/A N/A N/A

Second Seat, Right Side Occupant:	Rib fractures	450220.2	Right rear interior door surface	Probable
	Pelvic fractures	850699.1	Right rear interior door surface	Probable

OCCUPANT INJURIES - other vehicle

	Injury	OIC Code	Injury Mechanism	Confidence Level
Driver:	Uninjured	N/A	N/A	N/A

OCCUPANT KINEMATICS - 1997 Ford Escort

The 20 year old female driver of the Ford Escort was seated forward facing fashion. She was unrestrained. Her right foot was depressing the accelerator pedal; her left foot was on the floor. Upon impact, the driver responded to the 2 o'clock impact force by moving forward and to the right. There were no indications of contact and the driver was not injured.

The 7 month old female occupant was situated or seated on the lap of the 11 year old female who occupied the front, right seated position. The 11 year old female was unrestrained and the 7 month old female was also unrestrained. The front, right bucket seat appears to have been adjusted to between the mid and rear most seat track position. Upon impact, the 7 month old female responded to the 2 o'clock impact force by moving forward and to the right. Initially, the "free moving" infant moved toward the right A-pillar. The case vehicle (1997 Ford Escort) underwent a rapid post-crash clockwise rotation (rotation approximately 128 degrees CW). With consideration of the clockwise rotational dynamics, it is suspected that the right side of the child's forehead contacted the deploying passenger air bag module cover. This contact resulted in a gaping "L" shaped forehead laceration to the right upper forehead, extending into the hairline 6.3 x 3.2 cm (2.5 x 1.3 in), a skull fracture beginning on the right posterior portion of the anterior frontanelle extending laterally and posteriorly 8.0 cm (3.1 in), a skull fracture begins at the left posterior anterior frontanelle and extends laterally and posteriorly 12.0 cm (4.7 in) , a brain laceration 11.0 x 2.0 cm (4.3 x 0.8 in) over the frontoparietal and partially onto the occipital lobe, multiple brain contusions to the right inferior frontal tip, right anterior-superior frontal portion, left inferior frontal brain and left lateral parietal brain, multiple brain lacerations to the right inferior frontal tip, right anterior-superior frontal portion, left inferior frontal brain and left lateral parietal brain and scattered diffuse subarachnoid hemorrhage over the convexities.

The 7 month old female infant's face was significantly contacted by the deploying passenger air bag which resulted in numerous facial injuries. As a result of air bag contact, she sustained multiple upper left forehead abrasions measuring 0.6 cm (0.25 in) each, a left cheek abrasion 3.1



Figure 9. Front right passenger air bag, front view



Figure 10. Front right passenger air bag module cover

x 0.6 cm (1.25 x 0.25 in) partially patterned resembling a stitched seam, and a 3.8 x 2.5 cm (1.5 x 1 in) abrasion to right side of mouth.

The air bag deployment probably thrust the child in an upward trajectory and she may have contacted the roof panel, sun visor area. The sun visor was dislodged and there appear to be a vertical scuff along the A pillar (see Fig. 11). The driver removed the child from the car and placed the child in the arms of a motorist that had stopped to assist. The witness/motorist placed the injured infant on the center seat of his van. Paramedics that responded to the scene, removed the injured infant from the rear seat of the van and subsequently transported her to a hospital where she was pronounced deceased at 1915 hours (1 hour and 16 minutes post-impact).

The 4 year old female rear left seat occupant was seated forward facing fashion. She was unrestrained. Upon impact, the she responded to the 2 o'clock impact force by moving forward and to the right. There were no indications of contact and this occupant was not injured.

The 43 year old male rear right seat occupant was seated forward facing fashion. He was unrestrained. Upon impact, he responded to the 2 o'clock impact force by moving forward and to the right. He engaged the right interior door surface with his right side causing pelvic and rib fractures. He was transported by ambulance to a local trauma center where he was hospitalized overnight.



Figure 11. Dislodged sun visor and scuff to A pillar

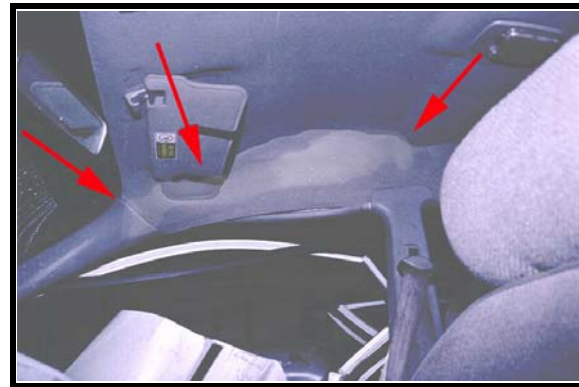


Figure 12. Scuff along roof side rail

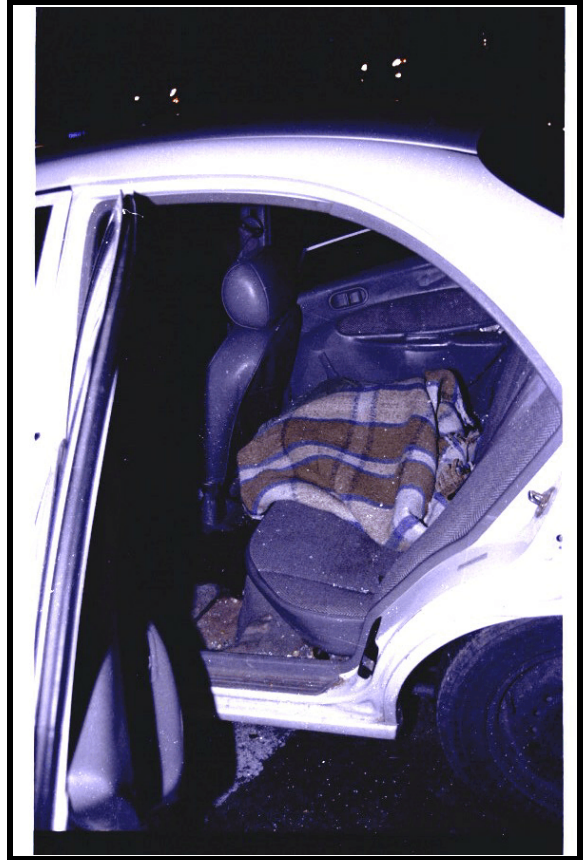


Figure 13. Second row seating

Attachment 1. Scene Diagram

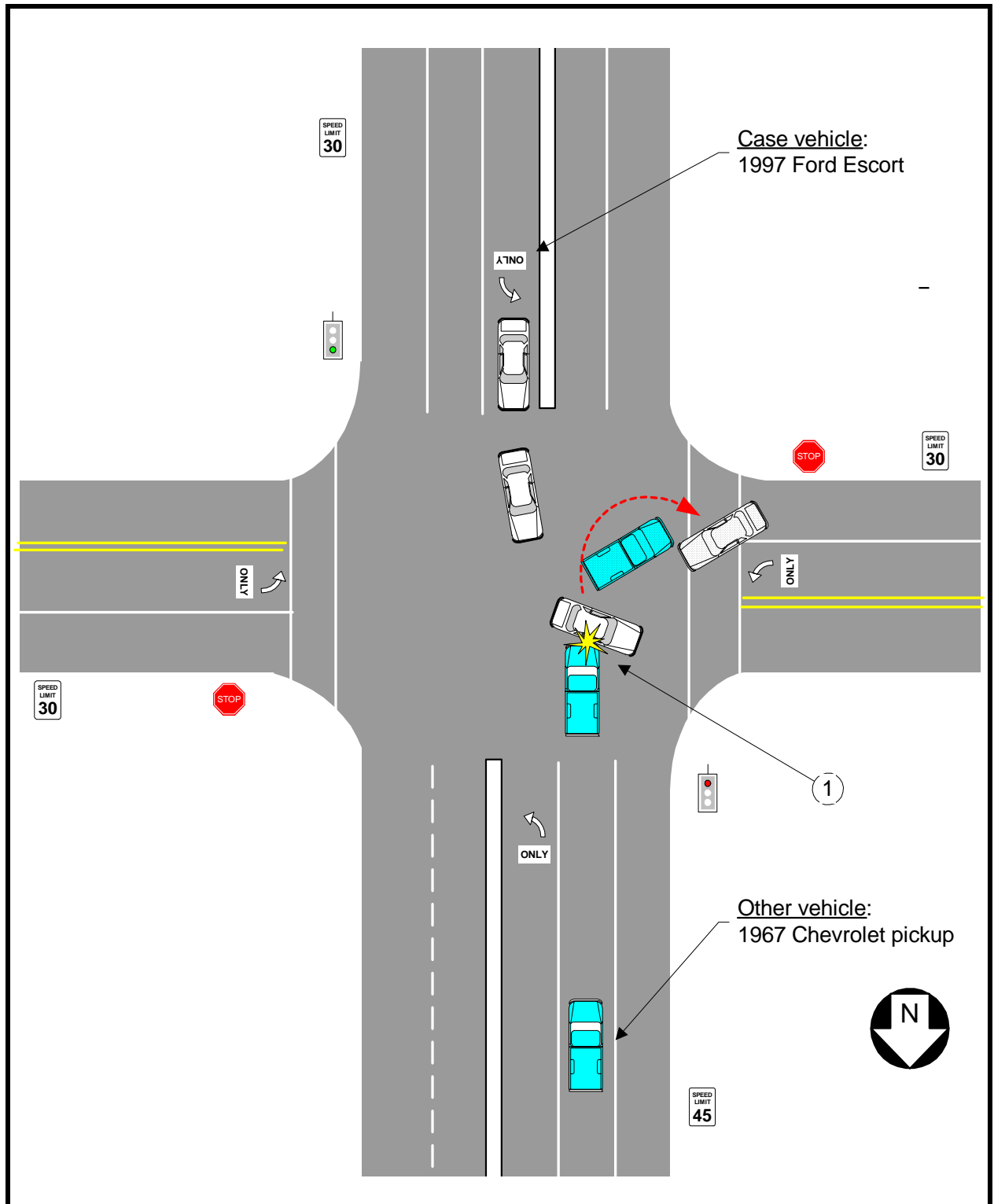


Figure 14. Scene diagram