

Remote Investigation / Vehicle to Vehicle  
Dynamic Science, Inc. / Case Number: DS98015  
1998 Chevrolet van  
Connecticut  
December 1997

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

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

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16. Abstract This collision occurred in Connecticut in December 1997 at 1815 hours. The crash took place on a bituminous, two-lane state highway near a T-intersection. The case vehicle, a 1998 Chevrolet 3/4 ton van driven by a 39-year-old male, was traveling westbound on the highway at a police calculated speed of 74-90 km/h (46-56 mph). The front right of the case vehicle was occupied by a 5-year-old male. The driver and front right occupant were seated in captain's chairs. The driver placed the front right occupant into the seat and put the lap and shoulder belt on him. There was a third occupant in the case vehicle. This was a 7-year-old male. He was seated in an unrestrained, unknown type, child seat that had been placed backwards on the floor in between the two front captain's chairs. The child was not restrained in the child seat nor was the child seat anchored to the vehicle in any fashion. The other vehicle, a 1991 Ford Escort driven by a 17-year-old female, was traveling eastbound on the roadway, just coming out of the curve at a police calculated speed of 56-64 km/h (35-40 mph). As the other vehicle came out of the curve it appears that the vehicle drifted into the on-coming lane of travel. The front of Vehicle 2 struck the front of Vehicle 1 in a head-on configuration. The case vehicle sustained a longitudinal delta V of -43.6 km/h (-27.2 mph) using a CDC of 12FYEW6. The other vehicle sustained a longitudinal delta V of -77.0 km/h (-47.8 mph) using a CDC of 12FYAW6. The case vehicle rotated counterclockwise and came to rest in the southbound leg of the intersection. The other vehicle was redirected to the right and came to rest nearly parallel to the right hand shoulder at some point east of the intersection. The driver of the case vehicle was pinned against the driver's door and the instrument panel until emergency crews could release him. He was able to see the child in the right front seat, but not the 7-year-old. He sustained a fractured right foot, a pelvis fracture, and an injury to his spleen. Post-crash, the unrestrained 7-year-old was found under the right side IP unresponsive with no movement or respiration. He was transported to a local hospital in a coma from the scene. There was a large occipital scalp laceration. A CT scan revealed severe general cerebral edema with mass effect and evidence of herniation with downward brain shift. There was also evidence of subdural bleeding. He was transferred from the hospital to an area trauma center, arriving at 2059 hours. He remained comatose in the center until he was declared brain dead at 1842 hours, approximately 24 hours after the crash. The body was transferred to a transplant service for organ donation. The right front occupant sustained abrasions and contusions. The driver of the other vehicle was fatally injured. She sustained the following injuries: blunt trauma of head with fracture of the skull and lacerations and transection of the brain and midbrain, blunt trauma to chest with bilateral rib fractures, heart/aorta lacerations, and liver and spleen lacerations; fracture/dislocation of pubic symphysis, left upper/lower arms, left upper/lower leg, right lower leg; and fracture/dislocation of the first thoracic vertebra with transection of the spinal cord.					
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**Dynamic Science, Inc.**  
**Accident Investigation**  
**Case Number: DS98015**

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**BACKGROUND:**

Description: This case was initiated in response to a report of a depowered air bag deployment. There was a child fatality in this case with an air bag deployment. This case is being conducted as a remote investigation. NHTSA was notified by FARS.

Investigation Type: Remote

Crash Location: Connecticut  
 Crash Date: December 1997  
 Notification Date: April 29, 1998  
 Field Work Completed: NA

**SUMMARY:**

This collision occurred in Connecticut in December 1997 at 1815 hours. The crash took place on a bituminous, two-lane state highway near a T-intersection. The roadway curves to the south 18 m (60 ft) west of the intersection. The roadway is comprised of two travel lanes; these lanes are separated by solid double-yellow lines and are bordered on either side by painted white fog lines. The speed limit is 64 km/h (40 mph) in both directions. There is a 3% grade in this area that is negative for westbound traffic and positive for eastbound traffic. There is a -4% superelevation for the westbound lane and a +5% superelevation for the eastbound lane. The weather was clear and the roadway was dry and free of defects. The roadway has a coefficient of friction of 0.83<sup>1</sup>.

The case vehicle, a 1998 Chevrolet 3/4 ton van driven by a 39-year-old male, was traveling westbound on the highway at a police calculated speed of 74-90 km/h (46-56 mph)<sup>2</sup>. The front right of the case vehicle was occupied by a 5-year-old male. The driver and front right occupant were seated in captain's chairs. The driver placed the front right occupant into the seat and put the lap and shoulder belt on him. There was a third occupant in the case vehicle. This was a 7-year-old male. He was seated in an unrestrained, unknown type, child seat that had been placed backwards on the floor in between the two front captain's chairs. The child was not restrained in the child seat nor was the child seat anchored to the vehicle in any fashion.

The other vehicle, a 1991 Ford Escort was driven by a 17-year-old female who was restrained by an

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<sup>1</sup>Obtained via Vericom

<sup>2</sup>Calculated using a derivation of the conservation of linear momentum formula

automatic shoulder belt. It is unknown if the separate lap belt was used. The vehicle was traveling eastbound on the roadway, just coming out of the curve at a police calculated speed of 56-64 km/h (35-40 mph). As the other vehicle came out of the curve it appears that the vehicle drifted into the on-coming lane of travel. The front of the other vehicle struck the front of the case vehicle in a head-on configuration. The case vehicle sustained a longitudinal delta V of -43.6 km/h (-27.2 mph)<sup>3</sup> using a CDC of 12FYEW6. The other vehicle sustained a longitudinal delta V of -77.0 km/h (-47.8 mph) using a CDC of 12FYAW6. The case vehicle rotated counterclockwise and came to rest in the southbound leg of the intersection. The other vehicle was redirected to the right and came to rest nearly parallel to the right hand shoulder at some point east of the intersection.

The driver of the case vehicle was pinned against the driver's door and the instrument panel until emergency crews could release him. He was able to see the child in the right front seat, but not the 7-year-old. The driver sustained a fractured right foot, a pelvis fracture, and an injury to his spleen. Post-crash, the unrestrained 7-year-old was found under the right side instrument panel unresponsive with no movement or respiration. He was transported to a local hospital in a coma from the scene. There was a large occipital scalp laceration. A CT scan revealed severe general cerebral edema with mass effect and evidence of herniation with downward brain shift. There was also evidence of subdural bleeding. He was transferred from the hospital to an area trauma center, arriving at 2059 hours. He remained comatose in the center until he was declared brain dead at 1842 hours, approximately 24 hours after the crash. The body was transferred to a transplant service for organ donation. The 5-year-old front right occupant sustained abrasions and contusions.

EMS personnel were notified at 1814 hours, arrived at 1821 hours, and arrived at hospital at 1920 hours.

The driver of the other vehicle was fatally injured. She sustained the following injuries: blunt trauma of head with fracture of the skull and lacerations and transection of the brain and midbrain, blunt trauma to chest with bilateral rib fractures, heart/aorta lacerations, and liver and spleen lacerations; fracture/dislocation of pubic symphysis, left upper/lower arms, left upper/lower leg, right lower leg, and fracture/dislocation of the first thoracic vertebra with transection of the spinal cord.

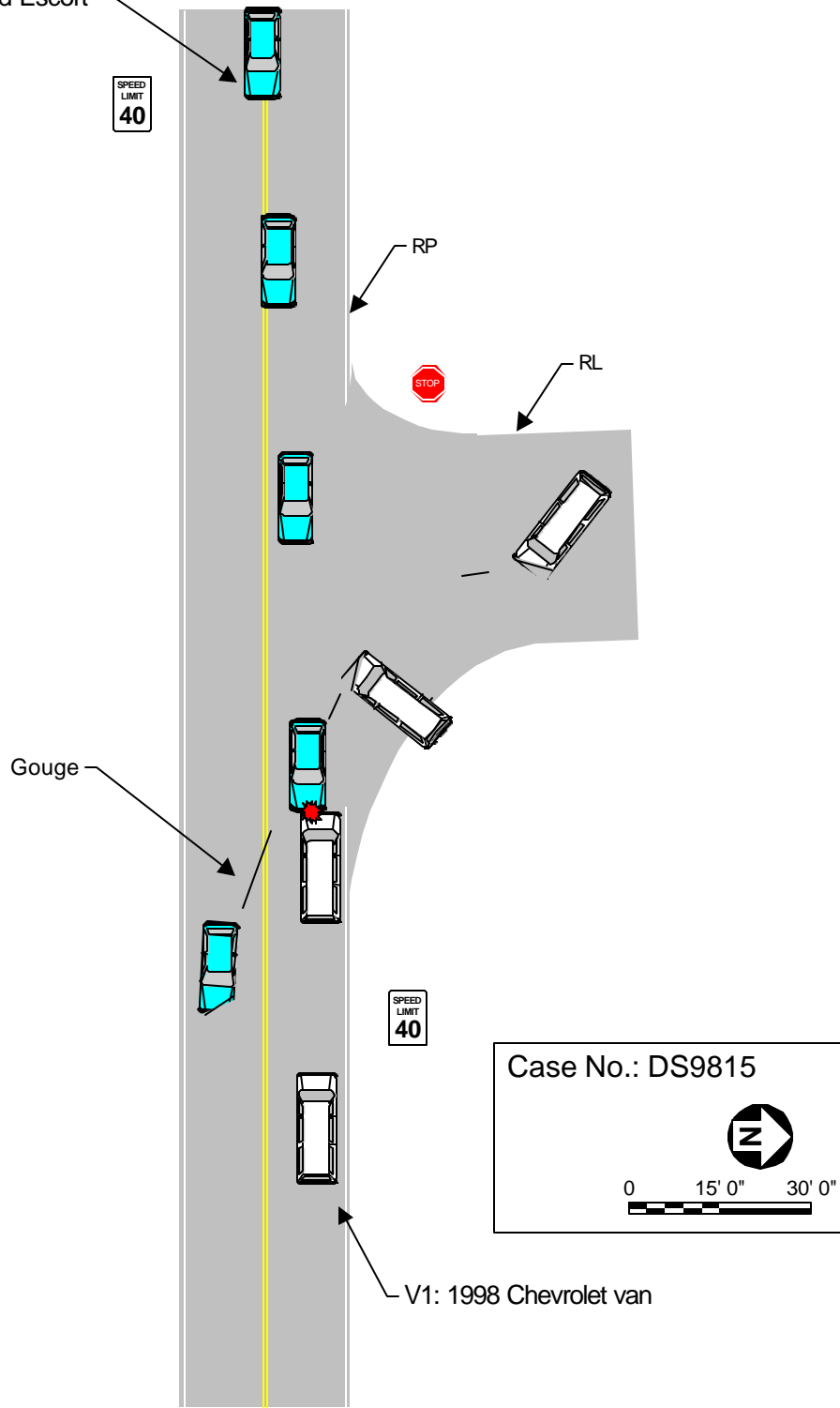
Both vehicles were towed from the scene due to damage.

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<sup>3</sup>Computed using CDCs and estimated crush--CDCs generated from police photos

Scene Diagram

V2: 1991 Ford Escort



Case No.: DS9815

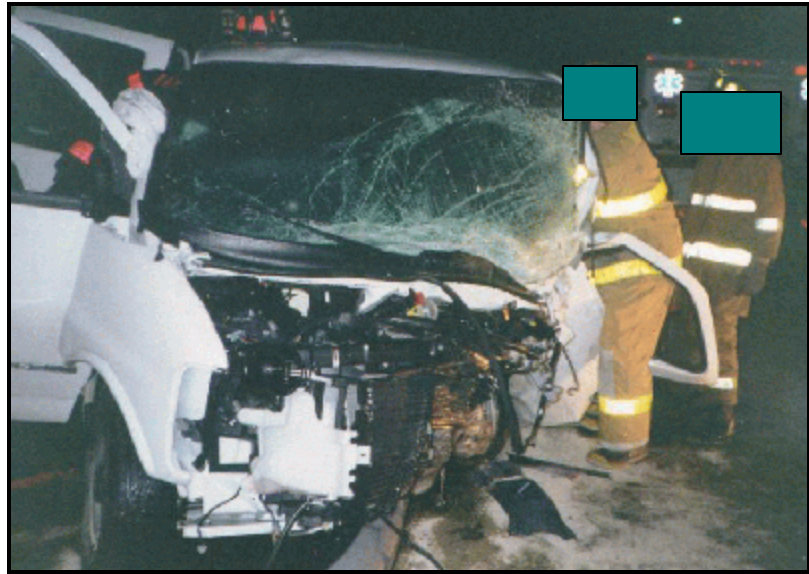
0 15' 0" 30' 0"

V1: 1998 Chevrolet van

**DETAILED INFORMATION****Vehicles**Case vehicle

Description:	1998 Chevrolet 3/4 ton van	
VIN:	1GCGG25ROW1XXXXXX	
Odometer:	Unknown	
Engine:	5.7L V8	
Reported Defects:	None noted	
Cargo:	None	
Damage Description:	Extensive front end and left side damage. Direct contact extends from the middle right to the left of the bumper. Crush extends to a point below the A-pillar. There is human tissue on the brackets below the A-pillar (this came from the driver of Vehicle 2). There is extensive intrusion to the left front along the toe pan and the left side instrument panel.	
CDC:	12FYEW6	
Delta V:	Total	43.8 km/h (27.2 mph)
	Longitudinal	-43.6 km/h (-27.1 mph)
	Latitudinal	3.8 km/h (2.4 mph)
	Energy	221,586 joules (163,539 ft-lbs)





**Figure 2.** Exterior, case vehicle



**Figure 3.** Exemplar vehicle, case vehicle

**DETAILED INFORMATION**

**Vehicles**

Other vehicle

Description:	1991 Ford Escort	
VIN:	1FAPP14JGMWXXXXXX	
Odometer:	Unknown	
Engine:	1.9L EFI I4	
Reported Defects:	None noted	
Cargo:	None noted	
Damage Description:	Vehicle totaled. Extensive rearward crushing through front. Damage extends to A-pillar and includes direct contact to the A-pillar area.	
CDC:	12FYAW6	
Delta V:	Total	77.3 km/h (48.0 mph)
	Longitudinal	-77.0 km/h (-47.8 mph)
	Latitudinal	6.7 km/h (4.2 mph)
	Energy	236,163 joules (174,317 ft-lbs)



**Figure 4.** Exterior, other vehicle



**Figure 5.** Exemplar vehicle, other vehicle

**Occupants**

<u>Case vehicle</u>	Driver	Occupant 2	Occupant 3
Age/Sex:	39/Male	5/Male	7/Male
Seated Position:	Left front	Right front	Between captain's chairs
Seat Type:	Pedestal	Pedestal	Seated in an unknown type child seat. Not secured to vehicle.
Height:	Unknown	Unknown	130.5 cm (51.3 in.) <sup>4</sup>
Weight:	Unknown	Unknown	29 kg (64 lbs)
Occupation:	Hardware sales	NA	NA
Pre-existing Medical Condition:	None noted	None noted	None noted
Alcohol/Drug Involvement:	None	NA	NA
Driving Experience:	Presumed >20 years	NA	NA
Body Posture:	Normal, upright	Normal, upright	Presumed to be slightly inclined with back to front of vehicle.
Hand Position:	Unknown	Unknown	Unknown
Foot Position:	Unknown	Unknown	Unknown
Restraint Usage:	Lap and shoulder used properly	Lap and shoulder used properly	None used
Air bag:	Air bag deployed	Air bag deployed	None

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<sup>4</sup>95<sup>th</sup> percentile, Anthropometry of Infants, Children, and Youths to Age 18 for Product Safety Design, SAE SP-450

**Occupants**

<u>Other vehicle</u>	Driver
Age/Sex:	17/Female
Seated Position:	Front left
Seat Type:	Bucket
Height:	165 cm (65 in.)
Weight:	86 cm (190 lbs.)
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None
Driving Experience:	Est. 1-2 years
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Right presumed on accelerator
Restraint Usage:	Unknown if lap belt used
Safety Systems:	Automatic torso harness used

**Injuries and Injury Mechanisms**

Case vehicle

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Pelvis fracture (police)	8526002,9	808.8	Toe pan
	Fractured right foot (police)	852000.2,1	827.0	Toe pan
	Severe spleen injuries (police)	544299.2,2	865.0	Seat belt
RF Occupant:	Misc. contusions	990400.1,9	919.0	Unknown
	Misc. abrasions	990200.1,9	924.9	Unknown
Middle Occupant (Not in a seated position)	Severe closed head injury CT: -severe general cerebral edema - herniation with downward shift - subdural bleed - unconscious / non-responsive	140650.4,9 140672.4,9	348.5 432.1	Center IP
	Large occipital scalp laceration	190600.1,6	873.0	Center IP

## Other vehicle

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Laceration inferior vena cava and right atrium	441016.6,4	861.03	Steering wheel
	Transection of ascending aorta	420210.5,4	901.0	Steering wheel
	Transection of thoracic aorta	420210.5,4	901.0	Steering wheel
	Fracture/dislocation 1 <sup>st</sup> vertebra with transection of spinal cord	640440.5,7	806.21	Exterior, V1
	Transection of right and left lobes of liver (8-10 cm deep)	541826.4,1	864.04	Steering wheel
	Macerating injury of spleen	544220.2,2	865.00	Steering wheel
	Blunt trauma to chest - Laceration to left lung	441414.3,2	861.22	Steering wheel
	Blunt trauma of head with fracture of the skull and lacerations and transection of the brain and midbrain	150400.2,9 140474.4,6 140688.4,9	801.15	Exterior, V1
	Fracture, left orbit	251202.2,2	802.8	Exterior, V1
	Fracture, right orbit	251202.2,1	802.8	Exterior, V1
	Nose fracture	251000.1,4	802.0	Exterior, V1
	Maxilla fracture	250804.2,8	802.5	Exterior, V1
	Mandible fracture	250602.1,9	802.2	Exterior, V1
	Knee fracture dislocation	852400.2,1	822.0	Left IP
	Fracture/dislocation right lower leg	852610.2,1	823.8	Left IP
	Fracture/dislocation right ankle	850210.2,1	824.8	Unknown

<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Fracture/dislocation left ankle	850210.2,2	824.8	Unknown
Fracture/dislocation left lower leg	852610.2,2	823.8	Left IP
Fracture/dislocation left femur	851800.3,2	821.0	Left IP
Fracture/dislocation pubic symphysis	852600.2,5	808.2	Left IP
Fracture/dislocation left lower arm	752804.3,2	813.08	Unknown
Fracture/dislocation left humerus	752604.3,2	812.20	Unknown
Fractured ribs, 5-7 on right, 3-12 on left)	450240.4,3	807.08	Steering wheel
Gaping laceration, left thigh, 12 x 14 in.	890604.2,2	890.1	Unknown
Gaping laceration, right thigh	890604.2,1	890.1	Unknown
Abrasion, right hand	790202.1,1	914.0	Unknown
Abrasion, right hand	790202.1,1	914.0	Unknown
Gaping laceration, left upper arm, 8 x 1-1/2 in.	790604.2,2	880.1	Unknown
Multiple superficial abrasions, torso	590202.1,0	911.0	Unknown
Multiple superficial contusions, torso	590402.1,0	922.0	Unknown
Bilateral breast contusions	490402.1,1 490402.1,2	922.0 922.0	Steering wheel
Puncture wound to right chest	790800.1,1	875.0	Unknown
“L” shaped laceration to forehead, 4 x 2-1/2 in.	290604.2,7	873.42	Exterior, V1
Abrasion, left hand	790202.1,2	914.0	Unknown
Extensive facial lacerations	290600.1,0	873.49	Exterior, V1



**Figure 6.** Driver, other vehicle



**Figure 7.** Contact between exterior of case vehicle and driver of the other vehicle



**Figure 8.** Contact between exterior of case vehicle and driver of the other vehicle (closeup)



## Occupant Kinematics

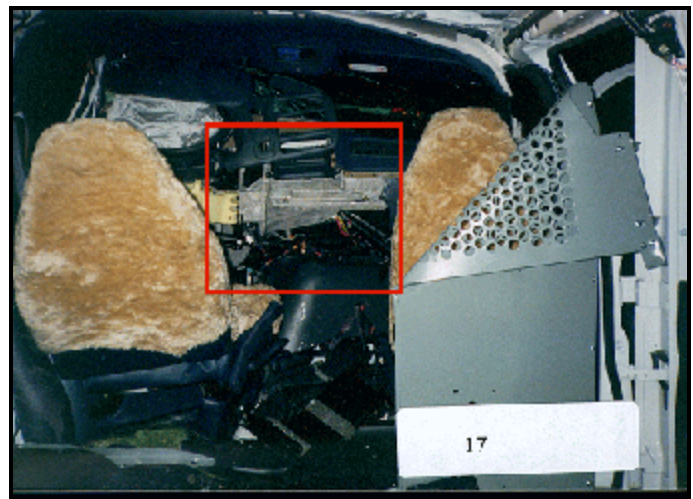
The driver of the case vehicle was seated in an upright fashion in the front left seat position. The seat was covered with fur-type seat cover. The driver was wearing his lap and shoulder belt prior to the crash. At impact, this occupant was pitched forward and to the left and came into contact with the deploying air bag early in the crash and then came into contact with the lower instrument panel as it intruded into the passenger compartment. The driver was entrapped by the instrument panel.

The second occupant of the case vehicle was seated in an upright fashion in the front right seat position. The seat was covered with a fur-type seat cover. Occupant 2 was wearing his lap and shoulder belt prior to the crash. At impact, this occupant was pitched forward and to the left and came into contact with the deploying air bag early in the crash. He sustained some type of minor contusions and abrasions.

The center occupant of the case vehicle, a 7-year-old male, was seated in a child seat which had been placed in a rear-facing position between the two front seats. The seat was not attached to the vehicle. The child was not restrained in the child seat. Even though the type of child seat is not known, it should be noted that there are no child seats which would be appropriate for a child of this age and likely size (29 kg, 64 lbs./130.5 cm, 51.3 in.). At impact, the child and the child seat were projected forward and slightly to the left. Given the size characteristics and weight distribution of a larger child in the child seat, the child seat likely would have tipped toward the front of the vehicle. It is likely that this occupant's head struck the center portion of the instrument panel. The case vehicle rotated violently in a counterclockwise direction and was airborne for a short time. This occupant was flung toward the front right of the vehicle and he engaged the right lower side of the instrument panel—where he came to rest.



**Figure 9.** Interior Vehicle 1, damage to center instrument panel



**Figure 10.** Interior Vehicle 1, damage to center instrument panel