Remote/Combo Investigation/Vehicle to Vehicle to Vehicle/ Front to Rear-Side to Rear
Dynamic Science, Inc. / Case Number: 1997-75-085J
1997 Ford Escort LX Station Wagon
Colorado
June/1997

Technical Report Documentation Page

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16. Abstract

This collision occurred in Colorado on June 1997 at 1435 hours. The case vehicle, a 1997 Ford Escort driven by a 19-year-old male, was traveling eastbound on a four-lane divided roadway at an unknown speed. The right front seat was occupied by a 17-year-old female. A 3-month-old male was seated in an Evenflo Joyride child seat which was in the right front occupant's lap. The child was not strapped to the child seat, nor was the child seat secured to the vehicle in any way. The child seat was being held sideways so that the child would have been facing the driver. There were three male adult passengers in the rear of the case vehicle. The first other vehicle, a 1994 Chevrolet Metro driven by a 38-year-old male, was traveling in front of the case vehicle. The second other vehicle, a 1983 Chevrolet Malibu driven by a 76-year-old male, was traveling in front of the Metro. The driver of the Malibu slowed due to an traffic accident ahead. The driver of the Metro also slowed. The driver of the case vehicle started braking. The right front occupant of this vehicle was apparently aware of the impending collision and tried to protect the child by placing herself over the seat in some fashion. The front of the case vehicle struck the rear of the Metro. The case vehicle sustained a longitudinal delta V of -25 km/h (-15.5 mph). At impact both air bags deployed. The Metro was pushed in a counterclockwise direction. The right side of the Metro struck the left rear the Malibu. The Metro was redirected to the left and struck a guardrail with its left side. The child occupant in the front right of the case vehicle sustained massive head injuries. He was transported to a local hospital where he was hospitalized for six days. After that time he was taken off life support and expired.

17. Key Words	18. Distribution Statement
Air bag, deployment, injury, accident, fatal	General Public

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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.

Dynamic Science, Inc.
Crash Investigation
Case Number: 1997-75-085J

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BACKGROUND:

Description: This case was initiated in response to a report of an air bag-related, child seat involved, child fatality.

The case vehicle was a 1997 Ford Escort LX station wagon driven by a 19 year old male. A 17 year old female was seated in the right front seat with her 3-month old male son who was seated in an Evenflo Joyride that was situated on her lap. Three adult males occupied the rear seat. The first other vehicle was a 1994 Chevrolet Geo Metro four door hatchback which was driven by a 38 year old male. The right front seat was also occupied by a 38 year old male. The second other vehicle was a 1983 Chevrolet Malibu driven by a 76 year old male.

Investigation Type: Remote-NASS Team PSU75 Investigated

Crash Location: Colorado
Crash Date: June 1997
Notification Date: June 18, 1997
Field Work Completed: Specific Date Unknown

SUMMARY:

This collision occurred in the state of Colorado in June 1997 at 1435 hours. The region was experiencing a heavy rainstorm and the bituminous surfaced roadway was wet. The case vehicle, a 1997 Ford Escort LX Station Wagon, was driven by a 19[1] year old male (170 cm/ 67 in., 64 kg/141 lbs), and was traveling eastbound in lane four of a divided (positive barrier) eight lane highway. The right front seat was occupied by an unrestrained 17 year old female (170 cm/67 in., 64 kg/141 lbs.). This passenger had a 3-month old male situated in an Evenflo Joyride infant seat that was setting on her lap. The seat was held perpendicularly so that the child would have been facing the driver. The child was not buckled into the infant seat and the infant seat was not secured or buckled to the available 3-point lap and shoulder belt. There were three other adult male occupants in the rear seat.

The first other vehicle, a 1994 Chevrolet Geo Metro four-door hatchback, was traveling in front of the case vehicle at an unknown travel distance. The driver of Geo Metro was a 38 year old male and the right front seated occupant was also a 38 year old male.

The second other vehicle, a 1983 Chevrolet Malibu four-door sedan, was operated by a 76 year old male and was traveling in front of the Geo Metro. In response to an accident that occurred previously, the driver of the Malibu

applied his brakes. His avoidance maneuver initiated the highlighted chain of events. Responding to the deceleration of the Malibu, the driver of the Geo Metro applied his brakes. The driver of the case vehicle applied his brakes. Upon the pre-impact braking event, the right front seated occupant (17 year old female) of the case vehicle moved forward and reportedly leaned her upper torso over the infant seat in a protective maneuver. The front of the case vehicle impacted the rear of the Geo Metro in a slightly offset front to rear impact configuration. The case vehicle sustained a longitudinal delta v -25 km/h (-15.5 mph). Both frontal air bags deployed at this time.

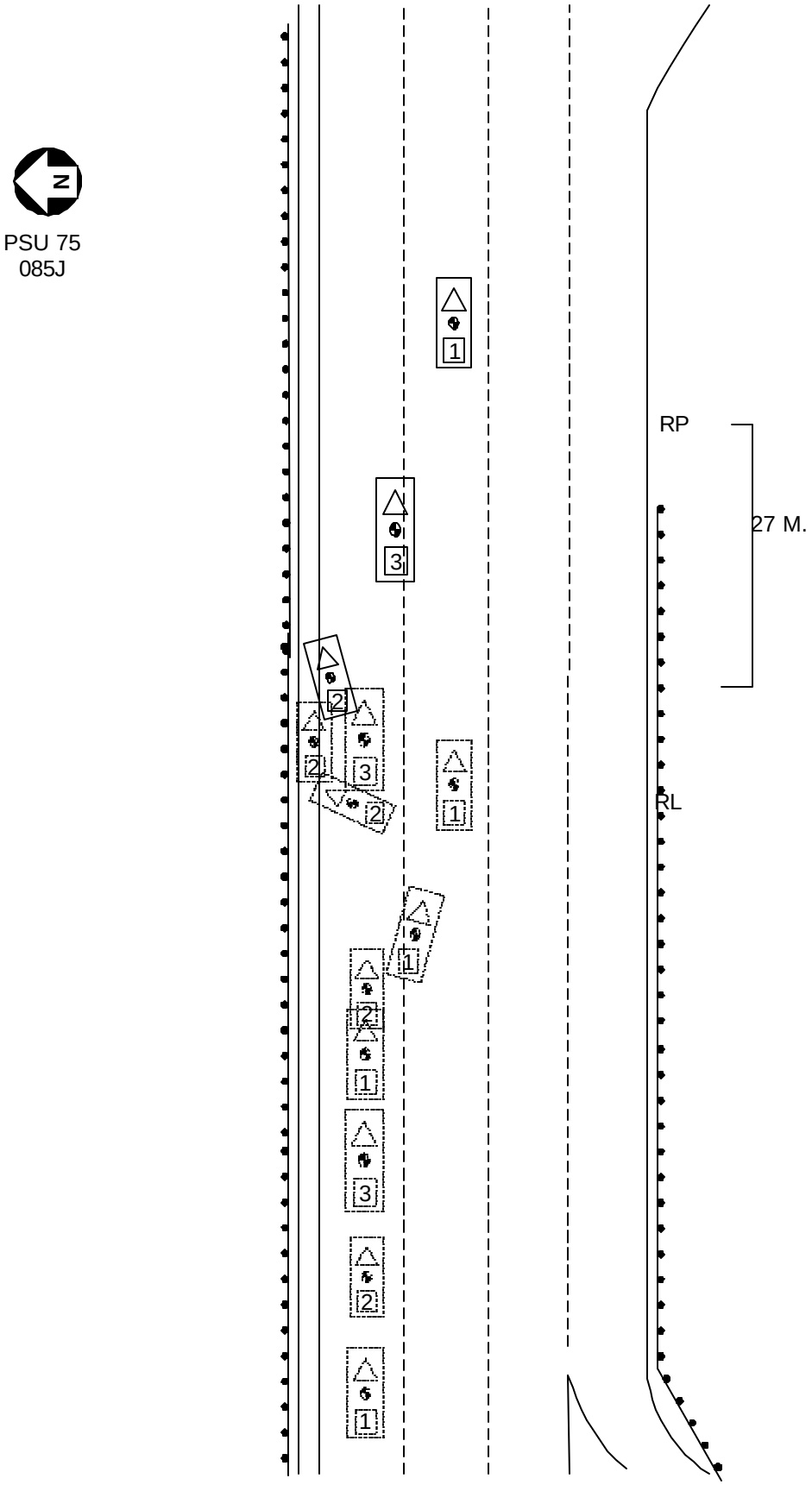
The Geo Metro was pushed into a counterclockwise rotation. The right side of the Geo Metro contacted the left rear corner of Malibu. The Metro was redirected to the left and its left side came into contact with a guardrail on the left side of the roadway.

Upon the pre-impact braking event, the right front seated occupant (17 year old female) of the case vehicle moved forward and reportedly leaned her upper torso over the infant seat in a protective maneuver. At impact, the right front seated occupants moved forward. The right front seat was also being heavily loaded by an unrestrained adult rear seated occupant. The infant seat impacted the instrument panel (right side) and the glove box door as evidenced by a straight edged vertical white mark 6 x 2 cm (2.4 x 0.8 in.) left residually. This impact occurred simultaneously with the airbag deployment.

The child sustained numerous skull fractures with associated subdural and subarachnoid hemorrhage and cerebral edema.

The child was transported by ground fire/rescue ambulance to a local hospital. The initial CT scans showed the variety of head injuries stated above. The child was subsequently transported via helicopter to a local trauma center. The child was sustained for six days until it was determined that he was brain dead.

Scene Diagram



DETAILED INFORMATION

VEHICLES

Case vehicle

Description:	1997 Ford Escort LX Sation Wagon	
VIN:	3FALP15P1VRxxxxxx	
Odometer:	16,962 km (10,540 miles)	
Engine:	2.0 liter (122 cu. inches)/ 4 cylinder	
Reported Defects:	None	
Cargo:	34 kg (75 lbs) reported	
Damage Description:	Minor/moderate, maximum rearward crush was 14 cm (5.5 in.) located at the left front bumper corner. Direct contact damage began at the left front bumper corner and extended 130 cm (51 in.) to the right.	
CDC:	12FDEW1	
Delta V (Damage Only Routine):	Total	25 km/h (15.5mph)
	Longitudinal	-25 km/h (-15.5 mph)
	Lateral	0.0 km/h (0.0 mph)
	Energy	16,811 joules (12,398 ft-lbs)

This vehicle is designed with two front bucket seats and one rear bench seat. The case vehicle is designated as a five passenger vehicle. The driver's side seat track was adjusted to its middle position. The front right seat track was reported to be adjusted to its rear most position.

Figure 1. 1997 Ford Escort LX Station Wagon

The driver's air bag was mounted in the steering wheel hub. It had dual rectangular module covers. The passenger side air bag was enclosed in a top mount and had one modular cover flap that opened from its leading edge.

Upon deployment, the dual module flaps of the driver's air bag opened. The air bag had two vent ports at the 11 and 1 o'clock positions. There were several small post-deployment blood fluid spatters noted to the right lower quadrant of the air bag. Upon deployment, the single modular flap opened with enough force to contact and crack the windshield. The passenger air bag had two vent ports located at 10 and 2 o'clock positions. There were several small post-deployment blood fluid spatters noted to the right lower quadrant of the air bag. A larger blood fluid spot (3 x 2 cm / 1.2 x 0.8 in.) was located at the lower left quadrant of the bag. There was no integrity loss and intrusion was isolated to the forward deformation of both front seatbacks due to rear occupant loading.

Other vehicle

Description:	1994 Chevrolet Geo Metro 4 door/hatchback
VIN:	2C1MR6463R6xxxxxx
Odometer:	56,602 km (35,172 miles)
Engine:	1.0 liter (61 cu. inches) / L3
Reported Defects:	None
Cargo:	23 kg (50.7 lbs.) reported

Damage Description: Primary impact -moderate, maximum rear crush was 59 cm (23.2 in) located 36 cm(14 in.) right of the left rear bumper corner. Direct contact damage involved the entire rear plane.
Secondary Impact -moderate, maximum right side crush was 32 cm (12.6 in.) located 128.5 cm(50.6 in.) forward of the rear axle.
Secondary Impact -minor, maximum left side crush was 9 cm (3.5 in.) located 7 cm(2.8 in.) forward of the left rear axle.

CDC: Primary (Highest Delta V) 06BDEW02
Secondary (Second Highest Delta V) 02RDEW03

Delta V (Highest):		
	Total	40 km/h (24.8 mph)
	Longitudinal	40 km/h (24.8 mph)
	Lateral	0.0 km/h (0.0 mph)
	Energy	81,778 joules (60,312 ft-lbs)

Other vehicle

Description:	1983 Chevrolet Malibu 4 door sedan
VIN:	1G1AW69H4DRxxxxxx
Odometer:	Unknown
Engine:	3.8 liter (232 cu. inches)/ 6 cylinder
Reported Defects:	None
Cargo:	None reported
Damage Description:	Minor (vehicle under repair at time of inspection). Direct contact damage began at the left rear bumper corner and extended 123 cm (48.4 in) to the right.
CDC:	Unknown
Delta V:	Unknown

OCCUPANTS

Case vehicle

	Occupant 1	Occupant 2	Occupant 3
Age/Sex:	19/Male	17/Female	3 month/Male
Seated Position:	Front left	Front right	Front right, Sitting on lap of Occupant 2
Seat Type:	Bucket	Bucket	Infant Seat/Evenflo Joyride
Height:	170 cm (67 in.)	170 cm (67 in.)[2]	Unknown
Weight:	63.5 kg. (140 lbs.)	63.5 kg. (140 lbs.)	Unknown
Occupation:	Unknown	Unknown	None
Pre-existing Medical Condition:	Unknown	Unknown	Unknown
Alcohol/Drug Involvement:	None	None	N/A
Driving Experience:	Unknown	N/A	N/A
Body Posture:	Upright, Specifics Unknown	Upright, Specifics Unknown	In Infant Seat, facing driver
Hand Position:	Unknown	Unknown	Unknown
Foot Position:	Right foot on brake	Both feet on floor pan	Unknown
Restraint Usage:	None used	None used	None used

OCCUPANTS (Cont.)

Case vehicle

	Occupant 4	Occupant 5	Occupant 6
Age/Sex:	20/Male	28/Male	23/Male
Seated Position:	Rear seat/unknown position	Rear seat/unknown position	Rear seat/unknown position
Seat Type:	Bench with folding back	Bench with folding back	Bench with folding back
Height:	175 cm (69 in.)	175 cm (69 in.)	175 cm (69 in.)
Weight:	63.5 kg. (140 lbs.)	63.5 kg. (140 lbs.)	Unknown
Occupation:	Unknown	Unknown	Unknown
Pre-existing Medical Condition:	Unknown	Unknown	Unknown
Alcohol/Drug Involvement:	None	None	None
Driving Experience:	N/A	N/A	N/A
Body Posture:	Unknown	Unknown	Unknown
Hand Position:	Unknown	Unknown	Unknown
Foot Position:	Unknown	Unknown	Unknown
Restraint Usage:	None used	None used	None used

INJURIES AND INJURY MECHANISMS

Case vehicle

	INJURY	OIC CODE	ICD-9	SOURCE
Driver	Chest wall contusion[3]	490402.1	922.1	Airbag[4]
	Right hand contusion	790402.1	923.2	Windshield
	Right hand abrasion[5]	790202.1	914.0	Windshield
Occupant 2	Abrasion of the left cornea	240699.1	918.1	Passenger air bag
Occupant 3	Loss of consciousness upon arrival	160604.3	850.5	Child safety seat / air bag
	Non-displaced right occipital skull fracture	150402.2	803.2	Child safety seat / air bag
	Right parieto temporal skull fracture	150402.2	803.2	IP / air bag
	Right cerebral brain contusions	140616.4	851.0	Child safety seat / air bag
	Intraventricular hemorrhage, right side	140678.4	772.1	Child safety seat / air bag
	Contusion, right side of scalp	190402.1	920.0	Child safety seat / air bag
	Contusion, left side of scalp	190402.1	920.0	Child safety seat
	Cerebral diffuse axonal injury	140628.5	--	Child safety seat / air bag
	Subdural hematoma	140652.4	852.2	Child safety seat / air bag
Occupant 4	None			

	INJURY	OIC CODE	ICD-9	SOURCE
Occupant 5	Narrow 10 cm (4 in.) scrape of left cheek	290202.1	959.0	Seat back
	Contusion, left cheek	290402.1	920.0	Seat back
Occupant 6	None			

Occupant Kinematics:

The unrestrained right front seated occupant was a17 year old female. This passenger had a 3 month old male situated in an Evenflo Joyride infant seat that was sitting on her lap. The seat was held perpendicularly so that the child would have been facing the driver. The child was not secured in the infant seat nor was the infant seat anchored or secured in any fashionto the vehicle. The infant seat handle was in the "UP" position.

Figure 2. View of cracked infant seat due to instrument panel and air bag contact

Upon vehicle braking, the right front occupant (17 year old female) moved forward and reportedly leaned her upper torso over the infant seat in a protective maneuver. This pre-impact occupant movement placed the right front occupant and the infant seat in a closer proximity to the instrument panel and air bag module. The infant seat pitched laterally and moved forward due to this pre-impact occupant movement.

Figure 3. Closeup of instrument panel contact with infant seat (white mark)

At impact, both right front seat occupants moved forward. The right front seat back was also being heavily loaded by a rear seat occupant. The infant seat impacted the instrument panel and glove box door. This impact occurred simultaneously with the air bag deployment.

The right side of child pitched forward and struck the right sidewall of the child seat–causing the right side head injuries. The deploying air bag pushed the child seat backwards (left side leading) where in came to a stop as a result of contact with the front right passenger who was now being loaded from the rear by the rear seat occupant. The child essentially then pitched rearward and struck the left interior sidewall of the infant seat. The child sustained numerous skull fractures bilaterally with associated subdural, subarachnoid, intraventricular hemorrhage and cerebral edema. There were no soft tissue injuries that would normally be associated with air bag interaction (i.e., facial abrasions). The combination of air bag forces in conjunction with instrument panel loading may account for the numerous injuries sustained to the right side of the child's head. The left side (head) injuries are probably due to a rebound impact back into the infant seat.

Notes:

1. EDCS indicates that occupant is 20 years old. Crash occurred 6 months prior to his 20th birthday.

2. Coded as Unknown in EDCS. Height and weight were on the interview form. Some of the data on the interview form came from an investigating officer and may have come after case submission.

3. Coded as rib contusion in EDCS

4. Injury attributed to seat back in EDCS

5. Not included in EDCS