

Remote, Redesigned Air Bag Special Study
FOR NHTSA'S INTERNAL USE ONLY
Dynamic Science, Inc., Case Number (DS99043)
1998 Ford Escort station wagon
Oregon
October/1998

Technical Report Documentation Page

1. Report No. DS99043	2. Government Accession No.	3. Recipient Catalog No.	
4. Title and Subtitle		5. Report Date November 3, 2000	6. Performing Organization Report No.
		7. Author(s) Dynamic Science, Inc.	
9. Performing Organization name and Address Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401		10. Work Unit No. (TRAIS)	
		11. Contract or Grant no. DTNH22-94-D-27058	
12. Sponsoring Agency Name and Address U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590		13. Type of report and period Covered [Report Month, Year]	
		14. Sponsoring Agency Code	
15. Supplemental Notes			
<p>16. Abstract</p> <p>This remote investigation was initiated in response to a possible redesigned air bag deployment. The case was selected from the FARS data files. The redesigned air bag was installed in a 1998 Ford Escort. This crash occurred in October, 1998 at 0920 hours. The crash occurred on a curved, two way undivided state highway. At the time of the crash the asphalt surface of the roadway was ice covered with some light sanding. The posted speed limit is 89 km/h (55 mph).</p> <p>The case vehicle, a 1998 Ford Escort station wagon driven by a restrained 66-year-old female, was traveling eastbound at a driver reported speed of 64-80 km/h (40-50 mph). The front right seat was occupied by a restrained 67-year-old female. The other vehicle, a 1996 Volvo conventional cab tractor trailer driven by a 55-year-old male, was traveling westbound. This vehicle had a 45 ft flat bed trailer that had been loaded with steel. The front right seat of this vehicle was occupied by a female of unknown age.</p> <p>As the case vehicle negotiated the curve, the driver lost control of the vehicle. The case vehicle slid across the center line with its wheels turned hard to the right. The driver of the other vehicle steered to the left to avoid a head-on crash. The case vehicle entered the westbound shoulder area. The driver regained steering and returned to the roadway. At this point the front of the case vehicle first struck the right rear drive wheel of the other vehicle, then continued down the side of the trailer until it struck the right front trailer wheel and axle. Both frontal air bags deployed at this time. The case vehicle rotated violently in a clockwise direction and departed the roadway—coming to rest on the north shoulder facing west. The other vehicle came to rest on the north side of the roadway facing west several hundred feet west of the crash site.</p> <p>The driver of the case vehicle was transported from the scene by ground ambulance. She sustained a right forearm fracture and some minor abrasions. The front right occupant of the case vehicle was found in her seated position with the lap and shoulder belt still on. Local fire department emergency medical technicians arrived on the scene at 0942 hours and this occupant was found to have died. The driver and front right occupant of the other vehicle did not report any injuries.</p>			
17. Key Words Redesigned, air bag, fatality, FARS		18. Distribution Statement	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Remote, Redesigned Air Bag Special Study
FOR NHTSA'S INTERNAL USE ONLY
Dynamic Science, Inc., Case Number (DS99043)
1998 Ford Escort station wagon
Oregon
October/1998

Summary

This remote investigation was initiated in response to a possible redesigned air bag deployment. The case was selected from the FARS data files. The redesigned air bag was installed in a 1998 Ford Escort.

This crash occurred in October, 1998 at 0920 hours. The crash occurred on a curved, two way undivided state highway. There is one eastbound and two westbound lanes. The highway sweeps gradually to the right, and slopes uphill for westbound traffic. The east and west lanes are separated by broken painted lines. The east and west lanes are separated by a solid and broken painted line—indicating that eastbound traffic is permitted to pass. There are paved shoulders on both sides of the highway. The south shoulder is bordered by a steel guardrail. The north shoulder is bordered by an additional gravel shoulder and a drainage ditch. At the time of the crash the asphalt surface of the roadway was ice covered with some light sanding. The posted speed limit is 89 km/h (55 mph).

The case vehicle, a 1998 Ford Escort station wagon driven by a restrained 66-year-old female, was traveling eastbound at a driver reported speed of 64-80 km/h (40-50 mph). The front right seat was occupied by a restrained 67-year-old female (175 cm/69 in., 63 kg/140 lbs.).

The other vehicle, a 1996 Volvo conventional cab tractor trailer driven by a 55-year-old male, was traveling westbound at a driver reported speed of 56 km/h (35 mph). This vehicle had a 45 ft flat bed trailer that had been loaded with steel. The front right seat of this vehicle was occupied by a female of unknown age.



Figure 1. Exterior, case vehicle (1998 Ford Escort)



Figure 2. Exterior, other vehicle (1996 Volvo tractor trailer)

Crash Events

As the case vehicle negotiated the curve, the driver lost control of the vehicle. The case vehicle slid across the center line with its wheels turned hard to the right. The driver of the other vehicle steered to the left to avoid a head-on crash. The case vehicle entered the westbound shoulder area. The driver regained steering and returned to the roadway. At this point the front of the case vehicle (12FZEW4) first struck the right rear drive wheel of the other vehicle, then continued down the side of the trailer until it struck the right front trailer wheel and axle. Both frontal air bags deployed at this time. The case vehicle rotated violently in a clockwise direction and departed the roadway—coming to rest on the north shoulder facing west. The other vehicle came to rest on the north side of the roadway facing west several hundred feet west of the crash site.



Figure 3. Other vehicle, right side of tractor

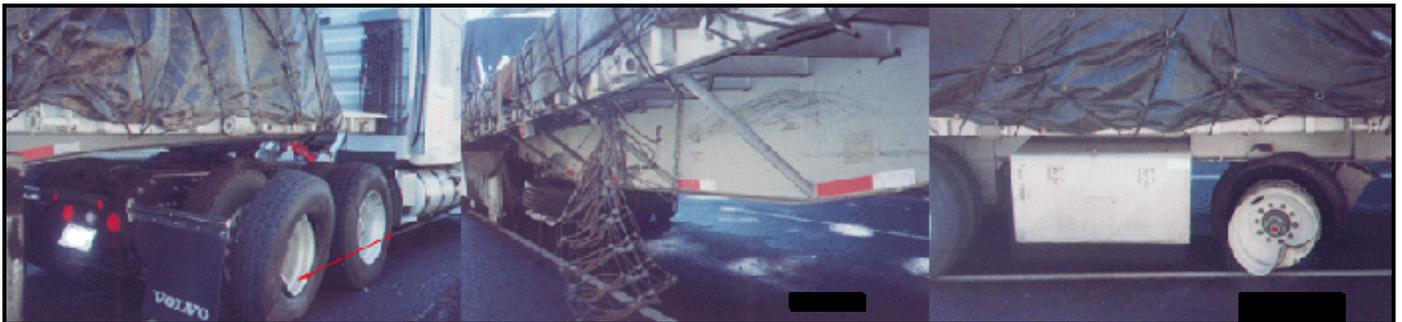


Figure 4. Other vehicle, shows view of damage to rear drive axle, trailer, and front trailer wheel

The driver of the case vehicle was transported from the scene by ground ambulance. Transport times are shown below. She sustained a right forearm fracture and some minor abrasions.

Crash time	0919
EMS notified:	0920
EMS arrived at scene:	0935
EMS arrived at hospital:	1114

The front right occupant of the case vehicle was found in her seated position with the lap and shoulder belt still on. Local fire department emergency medical technicians arrived on the scene at 0942 hours and this occupant was found to have died. The medical examiner indicated that she sustained two three-inch lacerations to the right temple with a fracture of the right temporal bone, a crushed chest, numerous small lacerations about the face, compound fractures of both legs, the left arm, and hand.

The driver and front right occupant of the other vehicle did not report any injuries.

The case vehicle had sustained heavy front contact damage to the right half of the front end and hood. The right side “A” pillar had been pushed back to a point about half the width of the door opening on the right side. The instrument panel, on the passenger side, was even with the front edge of the front right passenger seat. The vehicle was later towed from the scene due to disabling damage.

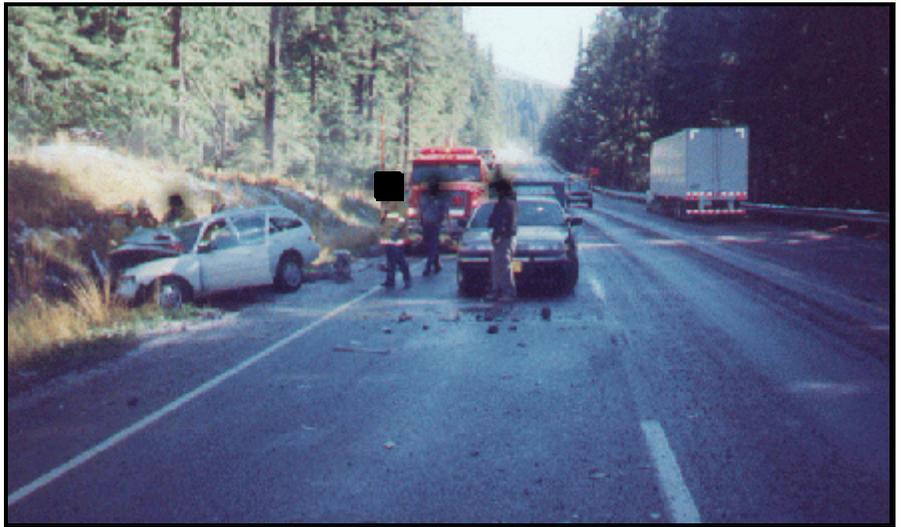


Figure 5. Final rest for case vehicle

The other vehicle sustained light contact damage to the right side of the cab immediately forward of the drive axle. There was contact damage to the right front drive tire and heavy contact damage to the right rear drive tire. There was light contact damage down the frame rail of the trailer and heavy contact damage to the front right trailer tire—the outside tire was torn off the rim, the rim was heavily damaged, and the axle was broken from the frame.

Table 1. Delta V¹

	Case Vehicle	
	km/h	mph
Total	40.9	25.4
Longitudinal	-40.3	-25
Lateral	-7.1	-4.4



Figure 6. Case vehicle, right side view



Figure 7. Case vehicle, frontal view

¹Calculated using WinSmash, CDC only versus barrier run. Borderline reconstruction. Results not coded in EDCS since other vehicle is beyond the scope of the program.

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Ford Escort station wagon
VIN	3FAFP15P8WRxxxxxx
CDC	12FZEW4



Figure 8. Case vehicle, left side view

Interior of Case Vehicle

The Ford Escort was equipped with bucket seats in the front outboard seating positions. The rear seat was a folding bench. The track locations and seat back angles are not known.

The case vehicle sustained substantial longitudinal intrusion of the right instrument panel, toe pan, and A-pillar. There was intrusion along the entire right side. There was integrity loss through the windshield and right front side window.

Case Vehicle Occupant Protection Systems

The Ford Escort was equipped with a redesigned steering wheel mounted driver's air bag and front right passenger's air bag. Both air bags deployed as a result of the initial impact with the tractor trailer. The case vehicle was equipped with lap and shoulder belts at all the outboard seat locations. There was a lap belt available in the middle of the third seat.



Figure 9. Driver's position, case vehicle

Case Vehicle Occupant Demographics

	Occupant 1	Occupant 2
Age/Sex:	66/Female	67/Female
Seated Position:	Front left	Front right
Seat Type:	Bucket	Bucket
Height (cm/in):	Unk Unk	175 68.9
Weight (kg/lbs):	Unk Unk	73 161
Pre-existing Medical Condition:	Unknown, but vehicle licensed to a person with some unknown disability	Unknown
Body Posture:	Leaning slightly to left in response to right steering input	Leaning slightly to left in response to right steering input
Hand Position:	Both on wheel	Unknown
Foot Position:	Right (presumably) foot on brake	Unknown
Restraint Usage:	Lap and shoulder belt used properly	Lap and shoulder belt used properly
Air bag:	Deployed	Deployed

Occupant Injuries

Table 3. Injuries (Driver)

Injury	Injury Severity (AIS)	Injury Mechanism
Right forearm fracture	751900.2,1	Unknown/possibly loading through the steering wheel
Minor abrasions	990200.1,9	Unknown

Table 4. Injuries (Front right occupant)

Injury	Injury Severity (AIS)	Injury Mechanism
Crushed rib cage	413000.6,0	Right instrument panel (intrusion)
2 - 3 inch lacerations on right temple with fracture of right temporal bone	150404.3,1	A-pillar
Compound fractures - both legs	852002.2,1 852002.2,2	Toe pan/lower instrument panel
Compound fracture - left arm	751800.2,2	Unknown
Compound fracture - left hand	752500.2,2	Unknown

Occupant Kinematics

The driver of the case vehicle was seated in a normal upright fashion. She was wearing the available lap and shoulder belt. The front right occupant was seated in a normal upright fashion. She was wearing the available lap and shoulder belt. Prior to the impact, the case vehicle had departed the roadway on the left side. The driver steered to the right which likely caused some leftward leaning. At impact, both occupants pitched forward and loaded the seat belts and engaged the deploying air bags. This was an extended collision that actually involved several impacts as the case vehicle engaged various structures on the other vehicle. The air bag may have deployed during the early part of the crash (the impact with the rear drive wheel) or toward the end of the crash (the impact with front trailer wheel). The latter impact would seem most likely. The driver was gripping the steering wheel at impact and her fractured forearm may have been a result of loading through the steering wheel. The front right occupant engaged the intruding right side instrument panel with her chest—causing the chest injuries—and likely struck the right A-pillar with the right side of her head—causing the skull fracture. As the case vehicle fully engaged the front trailer wheel, the case vehicle was rotated violently in a clockwise direction—causing the occupants to shift leftward.

Scene Diagram

