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REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN99-050
LOCATION - Illinois
VEHICLE - 1998 FORD ESCORT SE STATION WAGON
CRASH DATE - March 1998

Submitted:

October 29, 1999

Revised:
October 18, 2000

Contract Number: DTNH22-94-D-17058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
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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.

Technical Report Documentation Page

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Remote air bag deployment investigation involving a 1998 Ford Escort four-door station wagon, with manual safety belts and dual redesigned front air bags, and a 1998 International truck tractor pulling a semi-trailer

16. *Abstract*
This report covers a remote investigation of an air bag deployment crash that involved a 1998 Ford Escort SE station wagon (case vehicle) and a 1998 International 9100 truck tractor pulling a semi-trailer (vehicle #2). This crash is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of the collision events, and the case vehicle's restrained driver (33-year-old female) was killed. The case vehicle was traveling west in the westbound lane of a two-lane, undivided, state highway. Vehicle #2 was traveling east in the eastbound lane of the same roadway. The road surface was partially covered with ice and snow and the case vehicle lost control, rotating clockwise. The crash occurred in the eastbound lane. The front left half of the case vehicle impacted the front right half of vehicle #2, causing the case vehicle's driver and front right passenger air bags to deploy. Vehicle #2's right front tire rolled onto the left side of the case vehicle's engine compartment as the case vehicle contiued its clockwise rotation, such that this impact resulted in vehicle #2's oil pan being torn off. Continuing its clockwise rotation, the case vehicle's left rear door contacted the bottom metal step attached to vehicle #2's right side fuel tank. Once separated from vehicle #2, the case vehicle departed the south road edge and came to rest on the road side heading west-northwest. Vehicle #2 came to rest with its truck tractor off the south pavement edge, heading south-southwest. Its semi-trailer came to rest in a near jackknife position, heading east-southeast. There is no knowledge of the case vehicle driver's pre-crash seat adjustments, steering wheel position, or posture. She was restrained by her available, manual, three-point, lap and shoulder belt safety belt system and sustained, according to her death certificate, multiple blunt force trauma to the chest and pelvis, and other injuries detected in police photographs included an open fracture to the right tibia and contusions to her left chest. She was transported by ambulance to a medical facility and was pronounced dead 70 minutes post-crash.

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Additional photographs are available in SCI EDCS case IN99-050

BACKGROUND

IN99-050

This case was brought to the NHTSA's attention by a review of the 1998 Fatality Analysis Reporting System (FARS) in February 1999. The crash involved a 1998 Ford Escort SE station wagon (case vehicle) and a 1998 International 9100 truck tractor pulling a semi-trailer. The crash occurred in March 1998, at 1:25 p.m., in Illinois, and was investigated by the applicable sheriff's department. This case is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of collision events, and the case vehicle's driver [33-year-old female; White (Hispanic)] was fatally injured. The Police Crash Report was received in April 1999, while the death certificate and the police photographs were obtained in August. This report is based on the Police Crash Report, the death certificate, police photographs, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling west in the westbound lane of a two-lane, undivided, state roadway and was intending to continue its westerly travel path. Vehicle #2 was traveling east in the eastbound lane of the same two-lane, undivided, state roadway and intended to continue its easterly travel path (**Figure 1**). It was daylight, clear, no roadway defects, and no view obstructions. The roadway was bituminous, ice- and/or snow-covered in places, straight, and level. The posted speed limit for this stretch of roadway was not reported. The only traffic control devices present were a centerline (snow-covered; thus, type unknown) and single solid white edge lines on the north and south pavement edges. As the case vehicle entered a stretch of ice- and/or snow-covered roadway, it began to fishtail. Its driver may have successfully regained control for a moment but, unfortunately, she lost control and the case vehicle began to rotate clockwise. Vehicle #2's driver estimated that the case vehicle rotated two complete revolutions (720 degrees) pre-crash, but this contractor does not believe there was sufficient distance from the beginning of the ice/snow covering on the pavement to the point of impact for more than one rotation to have occurred. The crash occurred in the eastbound travel lane.

Figure 1: Reverse view of case vehicle's westbound approach; Note: beginning of snow-covered pavement this side of overpass (case photo #02)

The front left half of the case vehicle impacted the front right half of vehicle #2, causing the case vehicle's driver and front right passenger air bags to deploy. Vehicle #2's right front tire rolled onto the left side of the case vehicle's engine compartment as the case vehicle continued its clockwise rotation, such that this impact resulted in vehicle #2's oil pan being torn off. Continuing its clockwise rotation, the case vehicle's left rear door contacted the metal step under vehicle #2's right side fuel tank. Once separated from vehicle #2, the case vehicle departed the south road edge and came to rest on the road side heading west-northwest, with total clockwise rotation pre-crash to final rest of nearly 750 degrees. Vehicle #2 came to rest with its truck tractor off the south pavement edge, heading south-southwest. The semi-trailer

was in a near jackknife position, with the right side dual tires of the trailer's two axles either on the south pavement edge or just off it. The semi-trailer was heading east-southeast at final rest (**Figure 2**). The crash severity for the case vehicle was high [greater than 40 km.p.h. (25 m.p.h.)].

Figure 2: East view of final rest positions; Note: south white edge line and vehicle #2's near jackknife (case photo #03)

CASE VEHICLE

The case vehicle was a front wheel drive, 1998 Ford Escort SE, five-passenger, four-door station wagon (VIN: 3FAFP15P3WR------) equipped with a 2.0 liter, I-4 gasoline engine and a four-speed automatic transmission with an unknown shift lever location. Four-wheel anti-lock brakes were an option for this vehicle, but it is not known if the case vehicle was so equipped. The case vehicle's wheelbase was 250 centimeters (98.4 inches). No odometer reading was reported. The case vehicle was towed from the scene due to disabling damage.

Figure 3: Case vehicle's frontal damage; Note: left roof rail pushed inward (case photo #04)

The case vehicle sustained direct contact damage to the left half of the front plane (**Figure 3**). Damaged components included: front fascia pulled off bumper to the right, front bumper pulled to the left, left side of front frame rail depressed downward (on ground), front grille and engine compartment brackets missing, both headlamp assemblies missing, left side of radiator shoved right and rearward, the hood was shoved to the right and tented longitudinally, the left front fender was missing, the left front wheel and tire were laid over at a 45 degree angle (top out, bottom in), left upper A-pillar shoved inward (severed roof rail connection may have been by extrication efforts), the splintered windshield shoved right and folded, front of left side roof rail angled to the right, left B-pillar shoved inward (also damaged by extrication), and the bottom rear corner of left rear door's sheet metal was holed. The left front door may have been torn from the lower A-pillar hinge points, with its top door frame pushed inward and the glazing shattered. The left rocker panel at the lower A-pillar weld may have become separated. Based on police photographs, CDCs for the case vehicle were estimated as: **10-FYAW-6**, with a principal direction of force of 300 (-60) degrees, for the frontal contact and **09-LPEW-2**, with a principal direction of force of 270 (-90) degrees, for the contact of the case vehicle's left rear door with vehicle #2's metal step below the right side fuel tank. This crash is out of scope for the WinSMASH reconstruction program.

Interior damage to the case vehicle is difficult to assess with available photographs (**Figure 4**). The driver's seating area was reduced by intrusion of the left rocker panel, the left front door, the left end of the instrument panel, the steering column and wheel, the toe pan and floor well. The driver's seat back was reclined, possibly by medical personnel during extrication efforts.

Figure 4: Case vehicle's interior damage; Note: left front door frame placed in driver's seat and position of steering wheel, possibly moved by extrication efforts (case photo #11)

CASE VEHICLE DRIVER

The case vehicle's driver (33-year-old female; White (Hispanic); height and weight unknown) was restrained by her available, manual, three-point, lap and shoulder safety belt system. There were no other occupants in the case vehicle. The driver's pre-crash seat adjustments, steering wheel position, and posture are not known. She was pronounced dead, 70 minutes post-crash, at the medical facility to which she had been transported. The following discussion of the driver's injuries is based on a death certificate, police photographs, and occupant kinematic principles.

The case vehicle's driver was probably seated in a normal driving posture with her back against the seat back, at least one hand on the steering wheel, and her feet on a foot control and the floor. She was most likely attempting to stop the clockwise rotation with steering input, but the direction of her steering input and her possible use of the braking system are not known. The clockwise rotation produced a left lean to her body. The vehicle-to-vehicle impact caused the case vehicle's driver and front right passenger air bags to deploy. She moved forward, loading her safety belt and sustaining a bruise to her left chest, and to the left at impact. She likely contacted her deploying air bag and deflated it. The left side of the instrument panel, the steering column and wheel, the toe pan, the foot well, the left front door panel, the left rocker panel, and the left side roof rail all intruded into the driver's seating area, resulting in an open fracture of the right tibia. Other specific injuries are not known, but her death certificate lists multiple blunt force trauma to the chest and pelvis as the immediate causes of death. She was transported from the scene by ambulance to a medical facility. Her time of death was 70 minutes post-crash.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Blunt force trauma to chest (Blunt chest injury, NFS)	415099.7 unknown	unknown	unknown	death certificate
2.	Blunt force trauma to pelvis (Blunt abdominal injury, NFS)	515099.7 unknown	unknown	unknown	death certificate
3.	Compound fracture, right tibia	853422.3 serious	foot controls	possible	police photographs
4.	Contusion, left chest	490402.1 minor	safety belt webbing	probable	police photographs

VEHICLE #2

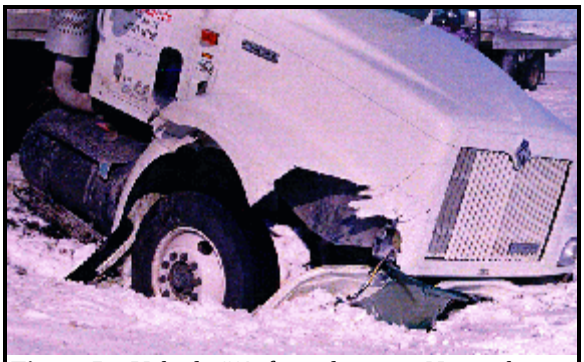

Figure 5: Vehicle #2's front damage; Note: sheet metal from the case vehicle at the front bumper (case photo #09)

Vehicle #2 was a 1998 International 9100, 6x4, truck tractor (VIN: 2HSFRAMR2WC------) towing a box semi-trailer. The box semi-trailer had hazardous materials cargo placarding with class code number 3 (flammable liquids, assorted farm chemicals; no spillage or breakage of any packages). It was equipped with a 774 CID Detroit diesel engine. Transmission type and shift lever location (probably floor-mounted) are not known. It was equipped with air brakes and an all-wheel anti-lock brake system. An odometer reading was not reported. Vehicle #2 was towed from the scene due to disabling damage (**Figure 5**). Direct damage to vehicle #2 included its oil pan being dislodged by the case vehicle. The right half of the front bumper was displaced rearward, the right corner of the grille lost three metal strips, the right front headlamp assembly was separated from the right front fender, the front section of the fiberglass right front fender is missing, the right front tire has a scrub mark, and the forward end of the metal step attached to the right side fuel tank is bent downward. Based on police photographs, TDCs for vehicle #2 were estimated to be: **10-FZEW-1**, with a principal direction of force of 310 degrees, for the front contact with the case vehicle and **03-RPEW-1**, with a principal direction of force of 90 degrees, for the sideslap contact by the metal step attached to the lower portion of the right side fuel tank and the case vehicle's left rear door. This crash is outside the scope of the WinSMASH reconstruction program. The driver [67-year-old male; White (unknown if Hispanic); height and weight unknown] was the only occupant in vehicle #2. His pre-crash seat adjustments, steering wheel location, and posture are not known. He claimed to be uninjured but was transported to a medical facility by the investigating officer for a precautionary check.