

Remote, Redesigned Air Bag Special Study
Dynamic Science, Inc., Case Number (1999-79-056E)
1998 Ford Escort four-door sedan
California
May/1999

Technical Report Documentation Page

1. Report No. 1999-79-056E	2. Government Accession No.	3. Recipient Catalog No.	
4. Title and Subtitle		5. Report Date April 14, 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 focused on the redesigned air bag system deployment of a 1998 Ford Escort four-door sedan. This two-vehicle front to front crash occurred during the late morning hours of a spring day in May, 1999. The crash took place in a four-leg intersection. The southern leg of the intersection is comprised of two northbound travel lanes, two southbound travel lanes, and a left hand turn lane. The northern leg of the intersection is comprised of two northbound travel lanes, two southbound travel lanes, and a left hand turn lane. The intersection is controlled by tri-color traffic signals. The speed limit is 56 km/h (35 mph) in both directions. The bituminous roadway was dry, level, and free of any defects. Vehicle 1, a 1998 Ford Escort four-door sedan driven by a 34-year-old female, was traveling northbound in the left hand turn lane approaching the intersection. Vehicle 2, a 1994 Toyota Tercel driven by a 39-year-old female, was traveling southbound in the #2 travel lane approaching the intersection. The front right seat was occupied by a restrained 11-year-old female. The rear middle seat was occupied by a restrained 12-year-old male. The rear right seat was occupied by a 14-year-old male. As the vehicles reached the intersection, the driver of Vehicle 1 attempted to make a left hand turn to go to the west. The driver of Vehicle 2 was unable to stop and the front (71FLEE3) of Vehicle 2 struck the right front of Vehicle 1 (01FZEW2). Upon the significant frontal impact, the air bags in Vehicle 1 deployed. The driver of Vehicle 1 sustained a contusion to her right knee. She was transported by ground ambulance to a local hospital where she was treated. She was subsequently detained in the hospital by police and placed under arrest for driving under the influence. The driver of Vehicle 2 complained of pain to her back and sustained a minor contusion to her left arm. The front right occupant of Vehicle 2 complained of pain to her left knee; she was treated and released at the scene. The rear middle occupant of Vehicle 2 complained of pain to his right knee; it was indicated that he would seek his own medical attention. The rear right occupant of Vehicle 2 sustained a minor abrasion to his forehead; he was transported from the scene by ground ambulance to a local hospital where he was treated and released. Both vehicles were subsequently removed from the crash location by two separate towing agencies.</p>			
17. Key Words Redesigned air bag system		18. Distribution Statement	
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

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Summary

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Ford Escort four-door sedan. This two-vehicle front to front crash occurred during the late morning hours of a spring day in May, 1999. The crash took place in a four-leg intersection. The southern leg of the intersection is comprised of two northbound travel lanes, two southbound travel lanes, and a northbound left hand turn lane. The northern leg of the intersection is comprised of two northbound travel lanes, two southbound travel lanes, and a left hand turn lane. The intersection is controlled by tri-color traffic signals. The speed limit is 56 km/h (35 mph) in both directions. The bituminous roadway was dry, level, and free of any defects.



Figure 1. Path of Vehicle 1 to area of impact (north)

Crash Events

Vehicle 1, a 1998 Ford Escort four-door sedan driven by a 34-year-old female, was traveling northbound in the left hand turn lane approaching the intersection. Vehicle 2, a 1994 Toyota Tercel driven by a 39-year-old female, was traveling southbound in the #2 travel lane approaching the intersection. The front right seat was occupied by a restrained 11-year-old female. The rear middle seat was occupied by a restrained 12-year-old male. The rear right seat was occupied by a 14-year-old male.



Figure 2. Path of Vehicle 2 to area of impact (south)

As the vehicles reached the intersection, the driver of Vehicle 1 attempted to make a left hand turn to go to the west. The driver of Vehicle 2 was unable to stop and the front (71FLEE3) of Vehicle 2 struck the right front of Vehicle 1 (01FZEW2). Upon the significant frontal impact, the air bags in Vehicle 1 deployed. The calculated Delta V for Vehicle 1 was 17.0 km/h (10.6 mph) with a longitudinal Delta V of -16 km/h (9.9 mph) which was of sufficient force to deploy both the frontal air bags. The delta V for Vehicle 2 was calculated at 19 km/h (11.8 mph) with a longitudinal delta V of -16 km/h (-9.9 mph)¹.

The driver of Vehicle 1 sustained a contusion to her right knee. She was transported by ground ambulance to a local hospital where she was treated. She was subsequently detained in the hospital by police and placed under arrest for driving under the influence. The driver of Vehicle 2 complained of pain to her back and sustained a minor contusion to her left arm. The front right occupant of Vehicle 2 complained of pain to her left knee; she was treated and released at the scene. The rear middle occupant of Vehicle 2 complained of pain to his right knee; it was indicated that he would seek his own medical attention. The rear right occupant of Vehicle 2 sustained a minor abrasion to his forehead; he was transported from the scene by ground ambulance to a local hospital where he was treated and released.



Figure 3. Exterior, Vehicle 1



Figure 4. Exterior, Vehicle 2

Both vehicles were subsequently removed from the crash location by two separate towing agencies.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	17	10.6	19	11.8
Longitudinal	-16	-9.9	-16	-9.9
Lateral	-6	-3.7	9	5.6

¹ Calculated utilizing the Damage Only Routine of the WinSmash 1.2.1 program

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Ford Escort four-door sedan
VIN	1FAFP10P9WWxxxxxx
CDC	01FZEW2



Figure 5. Exterior, Vehicle 1

Table 3. Crush Measurements

Plane of Impact	Field L cm/in.	C1 cm/in.	C2 cm/in.	C3 cm/in.	C4 cm/in.	C5 cm/in.	C6 cm/in.
Bumper	147	1	1	6	10	14	34
	57.9	0.4	0.4	2.4	3.9	5.5	13.4

Interior of Case Vehicle

The interior of the 1998 Ford Escort did not sustain any integrity loss or any intrusion. The laminated windshield glazing was damaged from the impact forces.

This vehicle was equipped with front bucket seats and adjustable head restraints. The front, left seat track was adjusted between the middle and rear most tracking position. The front, right seat was adjusted to the middle tracking position. The second row was equipped with a split bench seat with folding backs. There were adjustable head restraints at the outboard positions.



Figure 6. Interior, Vehicle 1

Case Vehicle Occupant Protection Systems

The 1998 Ford Escort was equipped with redesigned air bag systems.

The driver's air bag is housed in the fixed column steering wheel hub and encases the nylon air bag unit. The double, horizontal module cover flaps are asymmetric in design and opened at their designated tear points. The circular air bag is equipped with two tether straps and two exhaust vent port holes. The vent ports are located at the 11 and 1 o'clock positions.

The front, right passenger's air bag is located on the instrument panel (top mounted). The module cover was rectangular. The air bag is equipped with two vent ports and does not have any tethers.



Figure 7. Driver air bag



Figure 8. Passenger frontal air bag

Case Vehicle Occupant Demographics

Occupant 1

Age/Sex: 34/Female

Seated Position: Front left

Seat Type: Bucket, seat adjusted to between rear most and middle track position

Height (cm/in.): 175 68.9

Weight (kg/lbs): 54 119

Pre-existing Medical Condition: None noted

Body Posture: Normal, upright

Hand Position: Both presumed to be on steering wheel—left below right

Foot Position: Right foot on accelerator, left on floor

Restraint Usage: Lap and shoulder belt used properly

Air bag: Deploy at impact

Occupant Injuries

Table 4. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Contusion to right knee	1	Knee bolster

Occupant Kinematics

The 34-year-old female driver of Vehicle 1 was seated in a normal, upright fashion in a bucket seat. The seat was adjusted to a track position between the middle and rear most position. She was wearing the available lap and shoulder belt. The driver was negotiating a left hand turn. Her right hand was likely above the left. Her right foot was on the accelerator.

She responded to the 20E direction of force by moving forward and to the right. She was restrained by the lap and shoulder belt, but did move forward enough to engage the lower instrument panel/knee bolster with her right knee and sustained a minor contusion (AIS-1). As the driver's air bag deployed, she engaged it but did not sustain any related injuries.

The driver of Vehicle 1 was maintained in her respective seated position and did not sustain any fractures or internal injuries.



Figure 9. Lower instrument panel/knee bolster

Scene Diagram

