

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1999-79-122J)

1998 Ford Taurus station wagon

California

September/1999

Technical Report Documentation Page

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<p>16. Abstract</p> <p>This remote investigation focused on the redesigned air bag system deployment of a 1998 Ford Taurus station wagon. This serious injury crash occurred in September, 1999 during the middle of the afternoon. The weather was clear at the time of the crash and the curved bituminous roadway was dry and free of defects. The crash occurred on a level two-lane, undivided residential roadway. The speed limit is 40 km/h (25 mph).</p> <p>Vehicle 1, a 1998 Ford Taurus station wagon driven by a restrained 36-year-old female (168 cm/66 in., 79 kg/174 lbs.), was traveling eastbound in a left hand curve at an unknown rate of speed. The front right seat was occupied by an unrestrained 9-year-old female (127 cm/50 in., 30 kg/66 lbs.).</p> <p>For reasons not known, as Vehicle 1 was negotiating the curve the driver veered to the left, overrode the curb and struck a large tree with its front end (12FCEN3).</p> <p>A Barrier Equivalent Speed was calculated for the case vehicle, utilizing the Damage Only Algorithm of WinSMASH, as 40 km/h (25 mph). As a result of the frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed.</p> <p>The driver of Vehicle 1 sustained contusions to her left neck, left shoulder, across her chest, across her abdomen, both hips, both inner arms, and both knees. She was able to exit the vehicle with some assistance. She was transported by ambulance to a local trauma center where she was hospitalized for two days. She was out of work for 15 days. The front right occupant sustained a cornea abrasion, a right distal radius fracture, a right wrist dislocation, a right femur fracture, and a left femur fracture. She was removed from the vehicle by a witness due to her serious injuries. She was transported by ambulance to a local trauma center where she was hospitalized for three days.</p> <p>Vehicle 1 was towed from the scene due to damage.</p>			
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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1998 Ford Taurus station wagon. This serious injury crash occurred in September, 1999 during the middle of the afternoon. The weather was clear at the time of the crash and the curved bituminous roadway was dry and free of defects. The crash occurred on a level two-lane, undivided residential roadway. The speed limit is 40 km/h (25 mph).



Figure 1. Impact area with tree

Vehicle 1, a 1998 Ford Taurus station wagon driven by a restrained 36-year-old female (168 cm/66 in., 79 kg/174 lbs.), was traveling eastbound in a left hand curve at an unknown rate of speed. The front right seat was occupied by an unrestrained 9-year-old female (127 cm/50 in., 30 kg/66 lbs.).

Crash Events

For reasons not known, as Vehicle 1 was negotiating the curve the driver veered to the left, overrode the curb and struck a large tree with its front end (12FCEN3).

A Barrier Equivalent Speed was calculated for the case vehicle, utilizing the Damage Only Algorithm of WinSMASH, as 40 km/h (25 mph).

As a result of the frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed.

The driver of Vehicle 1 sustained contusions to her left neck, left shoulder, across her chest, across her abdomen, both hips, both inner arms, and both knees. She was able to exit the vehicle with some assistance. She was transported by ambulance to a local trauma center where she was hospitalized for two days. She was out of work for 15 days. The front right occupant sustained a cornea abrasion, a right distal radius fracture, a right wrist dislocation, a right femur fracture, and a left femur fracture. She was removed from the vehicle by a witness due to her serious injuries. She was transported by ambulance to a local trauma center where she was hospitalized for three days.

Vehicle 1 was towed from the scene due to damage.



Figure 2. Left front corner view of Vehicle 1

Table 1. Delta V

	Case Vehicle	
	km/h	mph
Total	40	24.9
Longitudinal	-40	-24.9
Lateral	0	0

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Ford Taurus station wagon	
VIN	1FAFP57S9WGxxxxxx	
		
Figure 3. Front view	Figure 4. Close-up, front view	Figure 5. Left rear quarter view
CDC	12FCEN3	

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	152	12	24	53	56	28	9
	59.8	4.7	9.4	20.9	22	11	3.5

Interior of Case Vehicle

The interior of the Ford Taurus sustained minor damage from occupant contact. There was minor intrusion to the toe pan area on the driver’s side, and some seat back intrusion on the passenger’s side. There was occupant contact evidence to the seat belt, lower instrument panels, center instrument panel, and the glove compartment door.

The case vehicle was equipped with bucket seats with adjustable head restraints (which were not damaged) in the front left and front right seating positions. The front left seat was adjusted to the middle track position. The front right seat was adjusted to the middle track position. The rear of the vehicle was equipped with split bench seats with no head restraints in all three seating positions. The back seats were not adjustable.



Figure 6. Driver’s seated position



Figure 7. Front right occupant’s seated position

Table 4. Intrusions

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Toe pan	Front left	3	1.2	Longitudinal
Seat back	Front right	3	1.2	Longitudinal

Case Vehicle Occupant Protection Systems

Vehicle 1 was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units.

The front left air bag was housed in the steering wheel hub and was concealed by H-configuration cover flaps that were not damaged in the crash. The circular air bag was equipped with four tether straps and two vent ports. Some evidence of scuffing/occupant contact was found on the air bag.

The front right air bag was located in the top-instrument panel position. The single air bag module cover flap was an irregularly shaped rectangular configuration. The module cover is held in place by two tethers.



Figure 8. Driver's frontal air bag



Figure 9. Module cover, passenger's frontal air bag

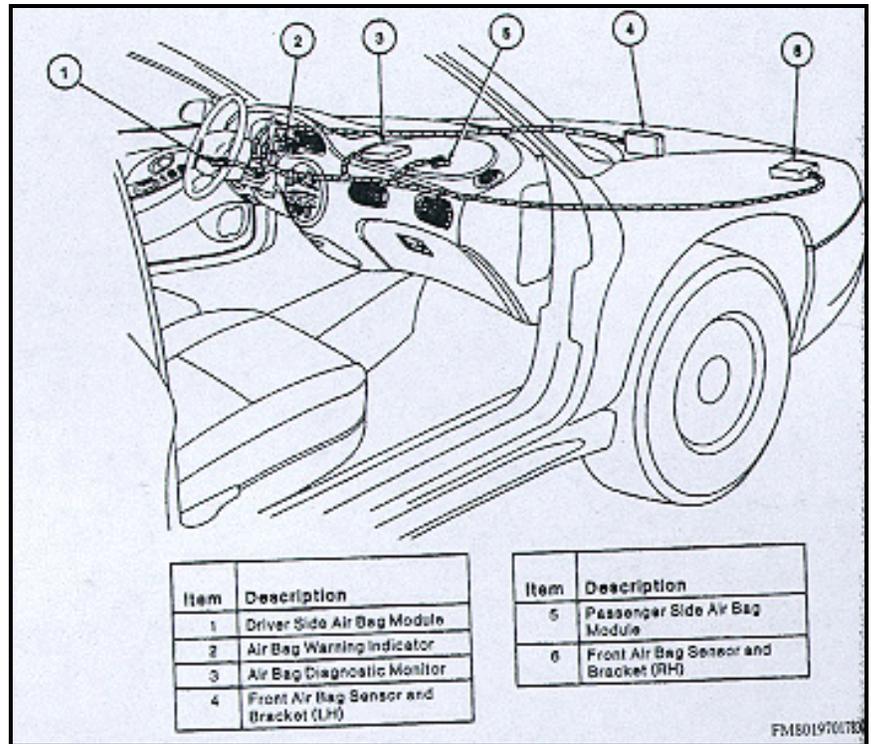


Figure 10. Passenger's frontal air bag

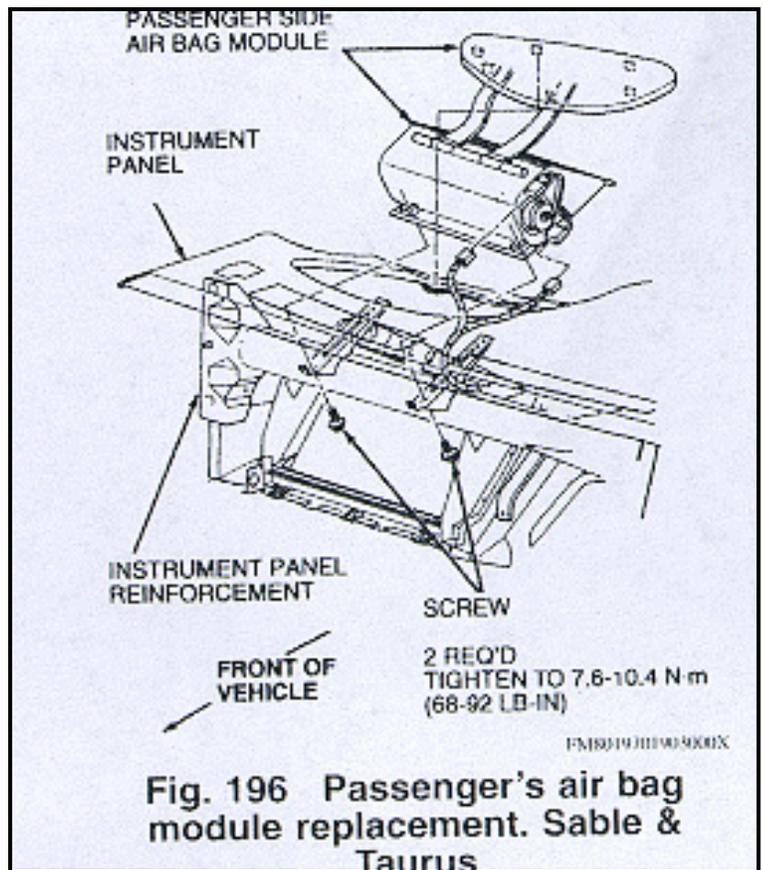


Figure 11. Passenger's frontal air bag

Case Vehicle Occupant Demographics

	Occupant 1	Occupant 2
Age/Sex:	36/Female	9/Female
Seated Position:	Front left	Front right
Seat Type:	Bucket, cloth covered	Bucket, cloth covered
Height (cm/in):	168 66.1	127 50
Weight (kg/lbs):	79 174	30 66.1
Pre-existing Medical Condition:	Ovarian cysts	None noted
Body Posture:	Normal, upright	Normal, upright
Hand Position:	Both on steering wheel, 10-2 o'clock positions	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used	None used
Air bag:	Deployed	Deployed

Occupant Injuries

Table 5. Injuries (Occ. #1)

Injury	Injury Severity (AIS)	Injury Mechanism
Contusion, left neck	1	Seat belt
Contusion, left shoulder	1	Seat belt
Abrasion, left shoulder	1	Seat belt
2 in. diagonal contusion/abrasion across chest	1	Seat belt
Bilateral breast contusion	1	Air bag
2 in. contusion/abrasion across abdomen	1	Seat belt
Left hip contusion	1	Seat belt
Bilateral forearm contusions	1	Air bag
Bilateral knee contusions	1	Left IP/ knee bolster
Left dorsum hand contusion	1	Side interior surface
Neck strain	1	Impact forces

Table 6. Injuries (Occ. #2)

Injury	Injury Severity (AIS)	Injury Mechanism
Right distal radius fracture (closed)	2	Instrument panel
Right femur fracture	2	Lower instrument panel
Right wrist dislocation	2	Instrument panel
Left femur fracture	2	Lower instrument panel
Cornea abrasion	1	Air bag

Occupant Kinematics

The driver was seated in a normal, upright fashion. She was wearing contacts at the time of the crash. She had her hands at the 10-2 o'clock positions on the steering wheel. She was wearing the available lap and shoulder belt. Seat belt usage was determined through visual inspection by the researcher and seat belt related injuries. There was no indication of pre-impact braking before the crash. The driver was apparently speaking to the front right occupant just prior to the crash. The front right seat occupant was seated in a normal, upright fashion. She was not wearing the available lap and shoulder belt.

At impact, the driver reacted to the 0 degree principal force direction by pitching forward and loading the seat belt—causing the “seat-belt” injuries. The driver slid forward and struck the lower instrument panel with both knees—contusing both knees. As the air bag deployed it contacted both inner arms—causing bilateral contusions. The left arm was flung outward and contacted the door side panel—causing a contusion to the dorsal aspect of the left hand.



Figure 12. Contacts to the left lower instrument panel



Figure 13. Passenger side frontal air bag



Figure 14. Front right passenger seating area

At impact, the front right occupant reacted to the 0 degree principal force direction by sliding forward then striking the lower instrument panel/glove box area with both knees. This impact loaded and then fractured both femurs. This occupant likely realized that an impact was imminent and tried to stop herself with her right hand. As she pitched forward, her right hand likely struck the instrument panel—causing the wrist dislocation and fracture of the distal radius. As the impact continued, this occupant slid below the instrument panel and came to rest on the floor. This occupant also sustained a corneal abrasion. The investigator attributed this to flying glass, but a more likely source is the deploying air bag that she engages as she submerges below the instrument panel.

Scene Diagram

