

**TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION**

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**REDESIGNED AIR BAG SPECIAL STUDY (RABSS)
SCI TECHNICAL SUMMARY REPORT**

NASS RABSS CASE NO. 1998-11-802G

RABSS VEHICLE - 1998 FORD TAURUS SE

LOCATION - STATE OF MICHIGAN

CRASH DATE - JUNE, 1998

Contract No. DTNH22-94-D-07058

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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 are 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.

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<p>16. <i>Abstract</i> This investigation focused on a two vehicle crash involving a 1998 Ford Taurus SE 4-door sedan (subject vehicle) and a 1993 Ford Escort LX 2-door hatchback. The Ford Taurus was equipped with redesigned frontal air bags that deployed as a result of an acute angle collision with the Ford Escort. The driver of the Ford Taurus was operating the vehicle eastbound exiting a parking lot when he failed to observe the southbound Ford Escort as he attempted to turn left (north). As the Ford Taurus crossed the southbound lanes the left front area struck the front right area of the Ford Escort resulting in moderate damage to each vehicle. Both vehicles came to rest in the southbound lanes with the Ford Taurus facing north and the Ford Escort facing south. The 49 year old male driver of the Ford Taurus was seated in an upright posture and restrained by the available 3-point manual lap and shoulder belt system. At impact, he initiated a lateral/forward trajectory in response to the 10 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. The driver was uninjured in the collision. The driver of the Ford Escort sustained unspecified soft tissue injuries and was transported to a local hospital for treatment and released.</p>			
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TABLE OF CONTENTS

BACKGROUND 1

SUMMARY

 Crash Site 1

 Pre-Crash 1

 Crash 2

 Post-Crash 2

RABSS VEHICLE 2

VEHICLE DAMAGE

 Exterior Damage 3

 Interior Damage 3

REDESIGNED AIR BAG SYSTEM 3

DRIVER DEMOGRAPHICS 4

 Driver Injuries 4

 Driver Kinematics 4

NASS SCENE DIAGRAM 5

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CRASH DATE - JUNE, 1998**

BACKGROUND

This investigation focused on a two vehicle crash involving a 1998 Ford Taurus SE 4-door sedan (subject vehicle) and a 1993 Ford Escort LX 2-door hatchback. The Ford Taurus was equipped with redesigned frontal air bags that deployed as a result of an acute angle collision with the Ford Escort. The driver of the Ford Taurus was operating the vehicle eastbound exiting a parking lot when he failed to observe the southbound Ford Escort as he attempted to turn left (north). As the Ford Taurus crossed the southbound lanes the left front area struck the front right area of the Ford Escort resulting in moderate damage to each vehicle. Both vehicles came to rest in the southbound lanes with the Ford Taurus facing north and the Ford Escort facing south. The 49 year old male driver of the Ford Taurus was seated in an upright posture and restrained by the available 3-point manual lap and shoulder belt system. At impact, he initiated a lateral/forward trajectory in response to the 10 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. The driver was uninjured in the collision. The driver of the Ford Escort sustained unspecified soft tissue injuries and was transported to a local hospital for treatment and released.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-11-802G for the Redesigned Air Bag Special Study. The Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) assigned the Special Crash Investigation (SCI) team at Veridian/Calspan the task of case review and final report preparation.

SUMMARY

Crash Site

This two vehicle crash occurred during the afternoon hours of June, 1998. At the time of the crash, it was daylight with no adverse conditions as the roads were dry. The crash occurred in the southbound lanes (see **Figure 8 - page 5**) of a straight and level 5-lane north/south asphalt roadway which was divided by a center traffic island. Traffic control at the scene included a stop sign for eastbound traffic which had a posted speed limit of 64 km/h (40 mph).

Pre-Crash

The 49 year old male driver of the 1998 Ford Taurus was operating the vehicle eastbound and exiting a parking lot (**Figure 1**) when he failed to observe the southbound Ford Escort as attempted to turn left (north). The NASS interview revealed that the driver was watching northbound traffic in anticipation of the left turn, and didn't notice the Ford Escort. The 16 year old female driver of the Ford Escort was operating the vehicle southbound (**Figure 2**) in the center lane at a driver reported

speed of 56 km/h (35 mph). There were no brake marks within either vehicle's trajectory indicative of driver avoidance maneuvers.



Figure 1. Eastbound approach for the 1998 Ford Taurus SE.



Figure 2. Southbound approach for the 1993 Ford Escort LX.

Crash

As the Ford Taurus crossed the southbound lanes of the 5-lane roadway, the left front area struck the front right area of the Ford Escort resulting in moderate damage to each vehicle. The impact induced deceleration was sufficient to deploy the Ford Taurus' redesigned frontal air bag system. The SCI investigator re-ran the WinSMASH program given erroneous inputs in the NASS case file (size factors/dimensions/principal direction of forces). The damage algorithm of the WinSMASH program computed velocity changes of 16.1 km/h (10.0 mph) for the subject vehicle and 23.7 km/h (14.7 mph) for the struck Ford Escort. The specific longitudinal components were -10.4 km/h (-6.5 mph) and -22.3 km/h (-13.9 mph). The Collision Deformation Classification (CDC) for this impact to the Ford Taurus was 10-LFEW-2 with a principal direction of force of (-)50 degrees. The CDC for this impact to the Ford Escort was 01-FZEW-2 with a principal direction of force of (+)20 degrees. At this point, the Ford Taurus rotated clockwise approximately 260 degrees and came to rest in the southbound curb lane facing north. The Ford Escort was redirected to the southeast and came to rest adjacent to the grass median facing south.

Post-Crash

The driver of the Ford Taurus exited the vehicle under his own power while the driver of the Ford Escort exited the vehicle with some assistance. No ambulance was summoned to the crash site. The driver of the Ford Taurus was uninjured. The driver of the Ford Escort was transported by her mother to a local hospital for treatment and released. Both vehicles were towed from the scene due to disabling damage.

RABSS VEHICLE

The 1998 Ford Taurus SE was identified by the Vehicle Identification Number (VIN): 1FAFP52UXWG (production sequence deleted). The vehicle was a 4-door sedan equipped with front wheel drive and a 3.0 liter, V-6 engine. The vehicle's odometer reading was 17,016 km (10,574 miles) at the time of the crash. The police report listed the driver's employer as the owner of the

vehicle. The seating was configured with front bucket and rear (folding back) bench seats. The driver reported no previous crashes or maintenance on the air bag system (original equipment). A cellular “flip” phone was present but not in-use at the time of the collision.

VEHICLE DAMAGE

Exterior Damage

The 1998 Ford Taurus SE sustained moderate left side damage as a result of the impact with the Ford Escort (**Figure 3**). The direct contact damage began at the front left bumper corner and extended 89.0 cm (35.0 in) rearward. The combined direct and induced damage length (Field L) began at the front left bumper corner and extended 114.0 cm (44.9 in) rearward. Six crush measurements were documented at the level of the mid-door: C1= 0 cm, C2= 8.0 cm (3.1 in), C3= 10.0 cm (3.9 in), C4= 22.0 cm (8.7 in), C5= 13.0 cm (5.1 in), C6= 9.0 cm (3.5 in). Minor lateral displacement was noted to the hood. The windshield fractured at the right mid-windshield area from the interior passenger air bag module cover flap (only).



Figure 3. Left side damage to the 1998 Ford Taurus SE.



Figure 4. Frontal damage to the 1993 Ford Escort LX.

The 1993 Ford Escort LX sustained moderate frontal damage as a result of the impact with the Ford Taurus (**Figure 4**). The direct contact damage began at the front right bumper corner and extended 73.0 cm (28.7 in) inboard. An indentation was documented to the center section of the front bumper from the left front wheel of the Taurus. The hood was displaced up and rearward from engagement against the side surface of the Taurus. Induced buckling was noted to the right fender. The windshield was undamaged.

Interior Damage

There was no damage to the interior surfaces of the Ford Taurus from intrusions or occupant contact (**Figure 5**).

REDESIGNED AIR BAG SYSTEM

The 1998 Ford Taurus SE was equipped with redesigned frontal air bags for the driver and front right passenger positions. The air bags had deployed as a result of the crash. The driver air bag was housed in the center of the steering wheel with a horizontally oriented flap tear seam (H-configuration). The flaps were asymmetrical in shape as the upper flap measured 14.0 cm (5.5 in) in width and 8.5 cm (3.3 in) in height while the lower flap measured 14.0 cm (5.5 in) in width and 6.5 cm (2.6 in) in height. Although no contact evidence was identified on the exterior surface of the module cover flaps, gray vinyl transfers were documented to the upper portion of the air bag from expansion within the module. The

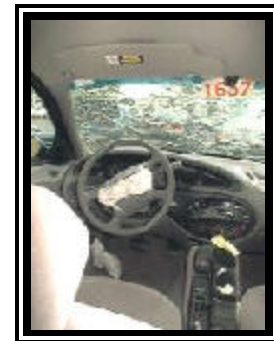


Figure 5. Interior view.

NASS researcher measured the diameter of the driver air bag at 49.0 cm (19.3 in) in its deflated state (**Figure 6**). The bag was tethered by two internal straps and vented by two ports located at the 11 o'clock and 1 o'clock sectors on the rear aspect of the air bag.

The front right passenger air bag deployed from the right top instrument panel area with a single cover flap design hinged at the forward aspect. The right windshield area was fractured by the cover flap during the air bag deployment. No contact evidence identified on the air bag or exterior surface of the module cover flap. The cover flap was rectangular in shape and measured 43.0 cm (16.9 in) in width and 30.0 cm (11.8 in) in height. The NASS researcher measured the passenger air bag at 63.0 cm (24.8 in) in width and 54.0 cm (21.3 in) in height in its deflated state (**Figure 7**). The bag was tethered by two internal straps. No vent ports were present. No cutoff switch was reported for the front right redesigned passenger air bag.



Figure 6. 1998 Ford Taurus SE redesigned driver air bag.



Figure 7. 1998 Ford Taurus SE redesigned passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex:	49 year old male
Height:	180 cm (71 in)
Weight:	79 kg (175 lb)
Seat Track Position:	Full rearward position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	NASS vehicle inspection, driver interview, police report
Eyewear:	None
Type of Medical Treatment:	None

Driver Injuries

<i>Injury</i>	<i>Severity (AIS 90)</i>	<i>Injury Mechanism</i>
Not injured	N/A	N/A

Driver Kinematics

The 49 year old male driver of the 1998 Ford Taurus SE was seated in an upright posture with the seat track adjusted to the full rearward position. He was restrained by the available 3-point lap and shoulder belt system. The NASS interview reported that he was belted, further evidenced by the lack of significant injury and contact points within the vehicle. At impact, he initiated a lateral and forward trajectory in response to the 10 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. The driver was uninjured in the collision. The combination of restraint options provided protection against further contact to the steering wheel hub/rim and potential injury.

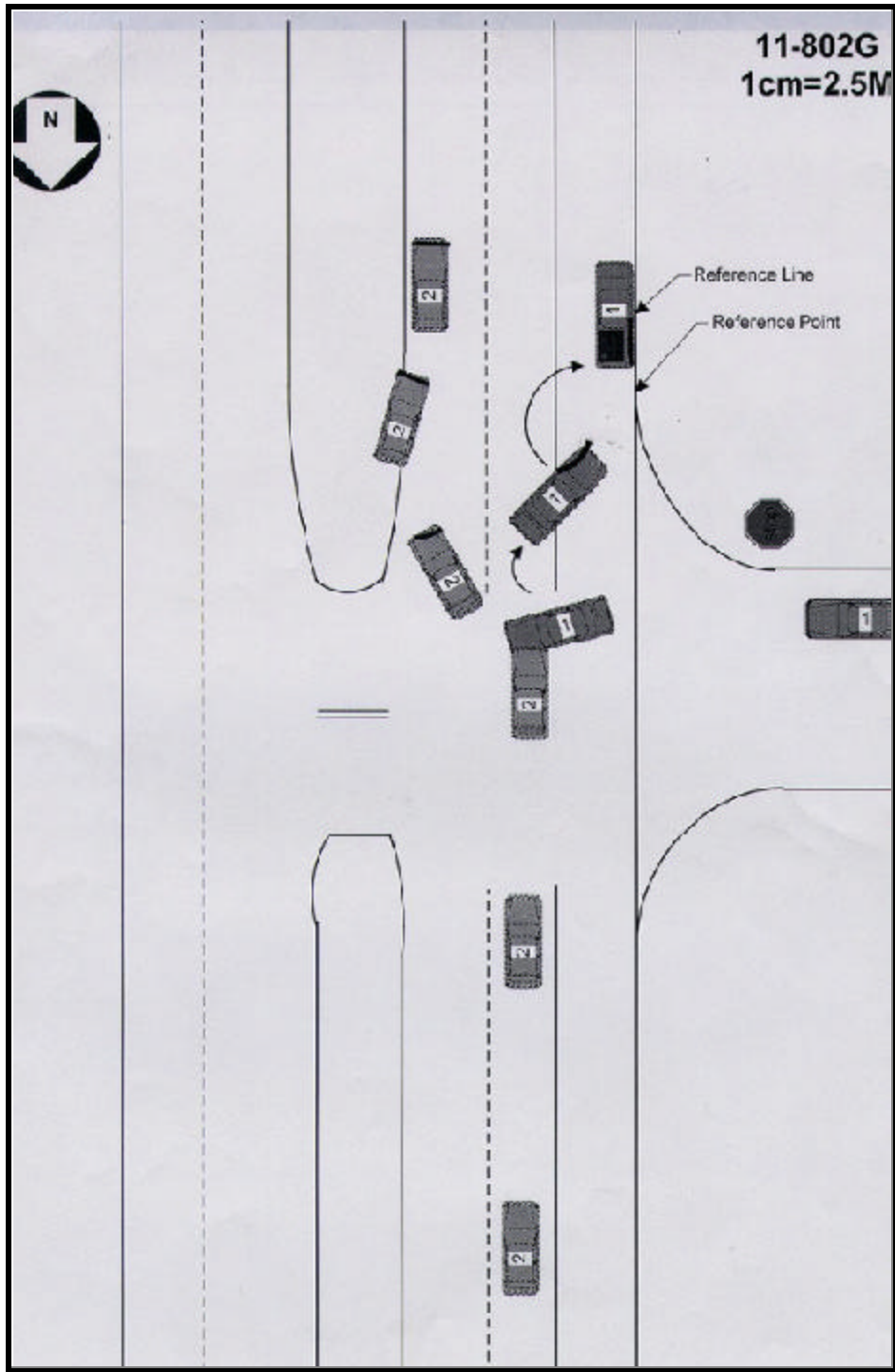


Figure 8. NASS Scene Diagram.