

**TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION**

Veridian Engineering
Buffalo, New York 14225

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

NASS RABSS CASE NO. 1998-08-806F

RABSS VEHICLE - 1999 FORD TAURUS SE

LOCATION - STATE OF PENNSYLVANIA

CRASH DATE - NOVEMBER, 1998

Contract No. DTNH22-94-D-07058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

DISCLAIMER

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. <i>Report No.</i> 98-08-806F	2. <i>Government Accession No.</i>	3. <i>Recipient's Catalog No.</i>	
4. <i>Title and Subtitle</i> Redesigned Air Bag Special Study (RABSS) RABSS Vehicle - 1999 Ford Taurus SE Location - State of Pennsylvania		5. <i>Report Date:</i> July, 2000	
		6. <i>Performing Organization Code</i>	
7. <i>Author(s)</i> Crash Research Section		8. <i>Performing Organization Report No.</i>	
9. <i>Performing Organization Name and Address</i> Transportation Sciences Crash Research Section Veridian Engineering P.O. Box 400 Buffalo, New York 14225		10. <i>Work Unit No.</i> C01115.0262.(0000-0009)	
		11. <i>Contract or Grant No.</i> DTNH22-94-D-07058	
12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		13. <i>Type of Report and Period Covered</i> Technical Summary Report Crash Date: November, 1998	
		14. <i>Sponsoring Agency Code</i>	
15. <i>Supplementary Notes</i> NASS investigation of an offset frontal collision that involved a 1999 Ford Taurus SE 4-door sedan equipped with redesigned frontal air bags.			
16. <i>Abstract</i> This investigation focused on a two vehicle crash involving a 1999 Ford Taurus SE 4-door sedan (subject vehicle) and a 1993 Buick Century Special 4-door sedan. The Ford Taurus was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of an offset frontal collision with the Buick Century. The driver of the Ford was operating the vehicle westbound on a rural two lane roadway and negotiating a right curve when he allowed the vehicle to cross the centerline into the path of the eastbound Buick. As the Ford entered the eastbound lane, the front left area impacted the front left area of the Buick resulting in moderate damage to both vehicles. The unrestrained 40 year old male driver of the Ford Taurus initiated a forward trajectory in response to the 12 o'clock impact force and loaded the deployed redesigned driver air bag and knee bolster with no resulting injury reported by police. Possible injury information was limited as the NASS interview was not obtained.			
17. <i>Key Words</i> Redesigned frontal air bag system Collision Deformation Classification (CDC): 12-FYEW-1		18. <i>Distribution Statement</i> General Public	
19. <i>Security Classif. (of this report)</i> Unclassified	20. <i>Security Classif. (of this page)</i> Unclassified	21. <i>No. of Pages</i> 5	22. <i>Price</i>

TABLE OF CONTENTS

BACKGROUND 1

SUMMARY

 Crash Site 1

 Pre-Crash 1

 Crash 2

 Post-Crash 2

RABSS VEHICLE 2

VEHICLE DAMAGE

 Exterior Damage 2

 Interior Damage 3

REDESIGNED AIR BAG SYSTEM 3

DRIVER DEMOGRAPHICS 4

 Driver Injuries 4

 Driver Kinematics 4

NASS SCENE DIAGRAM 5

**REDESIGNED AIR BAG SPECIAL STUDY (RABSS)
SCI TECHNICAL SUMMARY REPORT
NASS RABSS CASE NO. 1998-08-806F
RABSS VEHICLE - 1999 FORD TAURUS SE
CRASH DATE - NOVEMBER, 1998**

BACKGROUND

This investigation focused on a two vehicle crash involving a 1999 Ford Taurus SE 4-door sedan (subject vehicle) and a 1993 Buick Century Special 4-door sedan. The Ford Taurus was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of an offset frontal collision with the Buick Century. The driver of the Ford was operating the vehicle westbound on a rural two lane roadway and negotiating a right curve when he allowed the vehicle to cross the centerline into the path of the eastbound Buick. As the Ford entered the eastbound lane, the front left area impacted the front left area of the Buick resulting in moderate damage to both vehicles. The unrestrained 40 year old male driver of the Ford Taurus initiated a forward trajectory in response to the 12 o'clock impact force and loaded the deployed redesigned driver air bag and knee bolster with no resulting injury reported by police. Possible injury information was limited as the NASS interview was not obtained.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-08-806F 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 the task of case review and final report preparation.

SUMMARY

Crash Site

This two vehicle crash occurred during the evening hours of November, 1998. At the time of the crash, it was dark (street not lighted) with rainy conditions as the roads were wet. The crash occurred in the eastbound lane of a two lane east/west asphalt roadway (**see Figure 7 - page 5**) which curved right (with a positive grade) for westbound traffic. Curve warning signs were present at the scene which had a posted speed limit of 56 km/h (35 mph).

Pre-Crash

The 40 year old male driver of the 1999 Ford Taurus SE was operating the vehicle westbound (**Figure 1**) and negotiating a right curve when he reportedly looked down to read some directions and allowed the vehicle to cross the centerline into the eastbound lane. The 64 year old male driver of the 1993 Buick Century was operating the vehicle eastbound (**Figure 2**) and negotiating a left curve when he observed the westbound Ford enter his lane of travel. No brake marks were documented at the scene indicative of driver avoidance maneuvers.



Figure 1. Westbound approach for the 1999 Ford Taurus SE.



Figure 2. Eastbound approach for the 1993 Buick Century.

Crash

As the Ford Taurus entered the eastbound lane of the two lane rural roadway, the front left area impacted the front left area of the Buick resulting in moderate damage to both vehicles. The (*SCI revised*) damage algorithm of the WinSMASH program computed velocity changes of 19.1 km/h (11.9 mph) for the subject vehicle and 21.6 km/h (13.4 mph) for the struck Buick. Respective longitudinal components were -19.1 km/h (-11.9 mph) and -21.3 km/h (-13.2 mph). The impact induced deceleration was sufficient to deploy the Ford's redesigned frontal air bag system. At this point, both vehicles rotated counterclockwise and came to rest in close proximity to the point of impact with the Ford faced southwest and the Buick faced northeast.

Post-Crash

All occupants exited their respective vehicles under their own power. Treatment was rendered at the scene by fire department personnel and emergency medical technicians (EMTs). The Ford driver was reported by police as uninjured and was subsequently arrested for suspicion of driving under the influence. The driver of the Buick was also reported by police as uninjured as the front right passenger was transported by ambulance to a local hospital for an unknown level of treatment (*complaint of stomach/chest pain*). Both vehicles were towed from the scene due to disabling damage.

RABSS VEHICLE

The 1999 Ford Taurus SE was manufactured on 8/98 and identified by the Vehicle Identification Number (VIN): 1FAFP53S2XA (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 8,212 km (5,103 miles) at the time of the crash. The police report listed the driver as the owner of the vehicle. The seating was configured with front split and rear bench seats (with folding backs). The NASS interview was not obtained, therefore, cell phone usage and previous crashes or maintenance on the air bag system were unknown.

VEHICLE DAMAGE

Exterior Damage

The 1999 Ford Taurus SE sustained moderate frontal damage as a result of the impact with the Buick Century (**Figure 3**). The (*SCI revised*) direct contact damage began at the front left bumper corner and extended 74.0 cm (29.1 in) inboard. The impact deformed the full frontal width resulting in a combined direct and induced damage length (Field L) of 148.0 cm (58.3 in). Six crush measurements were documented at the

level of the bumper: C1= 18.0 cm (7.1 in), C2= 8.0 cm (3.1 in), C3= 2.0 (0.8 in), C4= 1.0 cm (0.4 in), C5=0 cm, C6= 0 cm. The Collision Deformation Classification (CDC) for this impact to the Ford was 12-FYEW-1 with a principal direction of force of 0 degrees. The hood was displaced slightly up and rearward from the impact force. The left fender was deformed rearward which restricted the left front wheel/tire (not deflated). Reduction in the right side wheelbase measured 3.0 cm (1.2 in). The windshield sustained no damage from exterior impact forces. All tempered glazing remained undamaged.



Figure 3. Front left damage to the 1999 Ford Taurus SE.



Figure 4. Front left damage to the 1993 Buick Century Special.

The 1993 Buick Century Special 4-door sedan sustained moderate frontal damage as a result of the impact with the Ford Taurus (**Figure 4**). The direct contact damage began at the front left bumper corner and extended 73.0 cm (28.7 in) inboard. The impact deformed the full frontal width resulting in a combined direct and induced damage length (Field L) of 146.0 cm (57.5 in). The (*SCI revised*) CDC for this impact to the Buick was 12-FYEW-2 with a principal direction of force of (-)10 degrees. The hood was deformed up and rearward from the impact force. The left fender was deformed rearward which restricted the left front wheel/tire (not deflated). No reduction in the vehicle's wheelbase was found.

The windshield was fractured from (exterior) impact forces and (interior) occupant contact.

Interior Damage

Damage to the interior surfaces of the Ford Taurus were minor and attributed to occupant contact. A small spider-web type fracture pattern was identified to the left upper windshield area with the rear-view mirror found bent to the left (undamaged). The left sunvisor was slightly abraded and out-of-place. Scuff marks were documented on the left knee bolster (rigid plastic type). The left door side mirror adjustment arm was fractured with cover panel separation. No intrusions, steering rim deformation or column compression were found in the vehicle.

REDESIGNED AIR BAG SYSTEM

The 1999 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 16.0 cm (6.3 in) in width and 6.0 cm (2.4 in) in height while the lower flap measured 16.0 cm (6.3 in) in width and 5.0 cm (2.0 in) in height along the flap tear seam. Although no contact evidence was identified on the exterior surface of the module cover flaps, blood spattering was noted across the face of the air bag and rear upper portion. The NASS researcher measured the diameter of the driver air bag at 50.0 cm (19.7 in) in its deflated state (**Figure 5**). 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 (*right mid-windshield area fractured by the module cover flap*). No contact evidence was identified on the air bag or exterior surface of the module cover flap. The oval shaped cover flap measured 42.0 cm (16.5 in) in width along the lower edge, 27.0 cm (10.6 in) along the upper edge and 30.0 cm (11.8 in) in height along the left edge and 22.0 cm (8.7 in) along the right edge. The NASS researcher measured the passenger air bag at 45.0 cm (17.7 in) in width and 50.0 cm (19.7 in) in height in its deflated state (**Figure 6**). No internal tether straps were present. The bag was vented by two ports located at the 9 o'clock and 3 o'clock sectors on the side aspect of the air bag. No cutoff switch was found for the front right air bag.



Figure 5. 1999 Ford Taurus SE redesigned driver air bag.



Figure 6. 1999 Ford Taurus SE redesigned passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex: 40 year old male
 Height: Unknown
 Weight: Unknown
 Seat Track Position: Middle position
 Manual Restraint Use: None
 Usage Source: NASS vehicle inspection
 Eyeware: None
 Type of Medical Treatment: None

Driver Injuries

<i>Injury</i>	<i>Severity (AIS 90)</i>	<i>Injury Mechanism</i>
None reported	N/A	N/A

Driver Kinematics

The unrestrained 40 year old male driver of the 1999 Ford Taurus SE was presumed to be seated in an upright posture with the seat track adjusted to the middle position. At impact, the driver initiated a forward trajectory in response to the 12 o'clock impact force and loaded the deployed redesigned air bag and knee bolster. He was reported by police as uninjured. *Although the driver was coded as unrestrained in the NASS case file*, he may have been belted and sustained air bag fling-type injuries to the arms/hands as evidenced by the spider-web type fractures to the upper windshield area and light abrading to the sunvisor.

This trajectory was further evidenced by police reported belt use and lack of subsequent hospital treatment. Any possible injury information was limited as the NASS interview was not obtained. The driver was subsequently arrested for suspicion of driving under the influence.

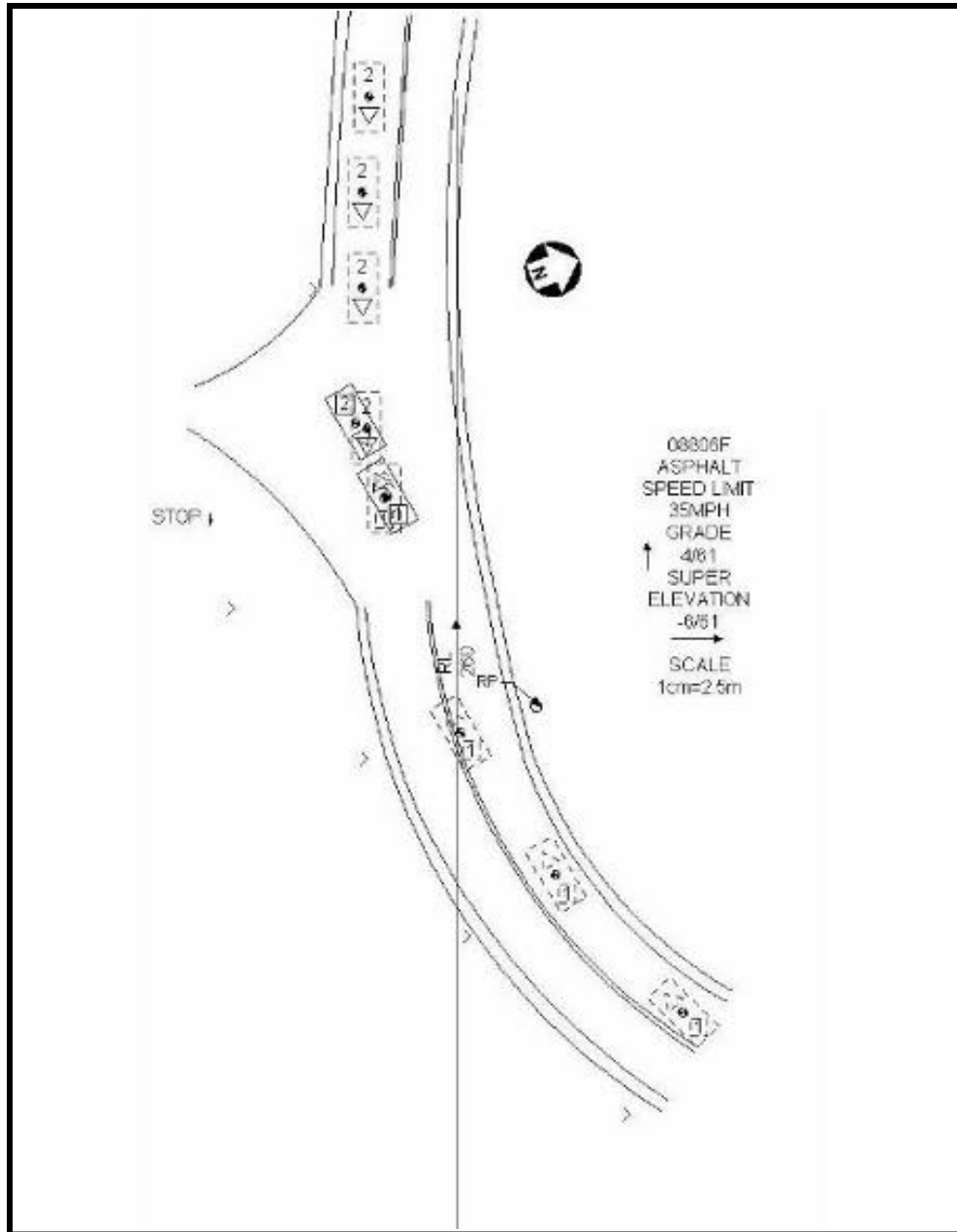


Figure 7. NASS Scene Diagram.