TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION

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

NASS RABSS CASE NO. 1998-43-806E

RABSS VEHICLE - 1998 FORD TAURUS SE

LOCATION - STATE OF NORTH CAROLINA

CRASH DATE - SEPTEMBER, 1998

Contract No. DTNH22-94-D-07058

Prepared for:

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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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16. *Abstract* This investigation focused on a two vehicle crash involving a 1998 Ford Taurus SE 4-door sedan (subject vehicle) and a 1992 Yamaha FZR1000 motorcycle. The Ford Taurus was equipped with redesigned frontal air bags that deployed as a result of a frontal collision with the Yamaha motorcycle. The driver of the Ford was operating the vehicle eastbound exiting a shopping center parking lot when she failed to notice the southbound motorcycle as she attempted to turn left (north). As the Ford crossed the southbound lane the front left area struck the frontal area of the motorcycle resulting in moderate damage to both vehicles. The Ford was redirected in an easterly direction coming to rest perpendicular to the northbound lane facing east. The driver of the Yamaha was thrown from the motorcycle and came to rest off the east shoulder as the motorcycle came to rest in close proximity to the point of impact. The 46 year old female driver of the Ford Taurus was presumed to be seated in an upright posture and was restrained by the available 3-point manual lap and shoulder belt system. At impact, she initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. She was reported by police as sustaining only minor injuries and was not transported to a local hospital for treatment. Injury information was unknown as the NASS interview was not obtained. The driver of the Yamaha motorcycle was transported by ambulance to a local hospital for an unknown level of treatment.			
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BACKGROUND

This investigation focused on a two vehicle crash involving a 1998 Ford Taurus SE 4-door sedan (subject vehicle) and a 1992 Yamaha FZR1000 motorcycle. The Ford Taurus was equipped with redesigned frontal air bags that deployed as a result of a frontal collision with the Yamaha motorcycle. The driver of the Ford was operating the vehicle eastbound exiting a shopping center parking lot when she failed to notice the southbound motorcycle as she attempted to turn left (north). As the Ford crossed the southbound lane the front left area struck the frontal area of the motorcycle resulting in moderate damage to both vehicles. The Ford was redirected in an easterly direction coming to rest perpendicular to the northbound lane facing east. The driver of the Yamaha was thrown from the motorcycle and came to rest off the east shoulder as the motorcycle came to rest in close proximity to the point of impact. The 46 year old female driver of the Ford Taurus was presumed to be seated in an upright posture and was restrained by the available 3-point manual lap and shoulder belt system. At impact, she initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. She was reported by police as sustaining only minor injuries and was not transported to a local hospital for treatment. Injury information was unknown as the NASS interview was not obtained. The driver of the Yamaha motorcycle was transported by ambulance to a local hospital for an unknown level of treatment.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-43-806E 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 September, 1998. At the time of the crash, it was daylight with no adverse conditions as the roads were dry. The crash occurred at a junction of a parking lot and north/south three lane city roadway **(see Figure 7 - page 5)**. The parking lot exit/entrance consisted of three lanes with a negative grade to the west. The level (asphalt) north/south roadway consisted of two travel lanes and a center turn lane with a posted speed limit of 72 km/h (45 mph). Traffic control at the scene included a stop sign for eastbound traffic. The roadside environment featured barrier curbs, a pedestrian sidewalk and a wooded area to the east.

Pre-Crash

The 46 year old female driver of the 1998 Ford Taurus was eastbound and exiting a shopping center parking lot **(Figure 1)** when she stopped at the stop sign and failed to notice the southbound motorcycle

as she attempted to turn left (north) at a police reported speed of 16 km/h (10 mph). The 30 year old male driver of the 1992 Yamaha motorcycle was operating the vehicle southbound **(Figure 2)** at a police reported speed of 72 km/h (45 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 1992 Yamaha motorcycle.

Crash

As the Ford Taurus crossed the southbound lane of the urban three lane roadway, the front left area impacted the frontal area of the motorcycle resulting in moderate damage to both vehicles. The impact induced deceleration was sufficient to deploy the Ford's redesigned frontal air bag system. Although the impact was classified as out of scope (non-CDS applicable vehicle involved) the damage algorithm of the WinSMASH program computed a (barrier equivalent) velocity change of 25.7 km/h (16.0 mph). The specific longitudinal component was -25.3 km/h (-15.7 mph). Although incorrectly identified in the NASS case file as a full frontal impact, the Collision Deformation Classification (CDC) for this impact to the Ford Taurus was 12-FYEW-2. At this point, the Ford was redirected in an easterly direction and came to rest perpendicular to the northbound lane facing east. The driver of the Yamaha was thrown from the motorcycle and came to rest in a grassy area off the east shoulder as the motorcycle came to rest in close proximity to the point of impact.

Post-Crash

The exit status of the Ford driver was unknown, but was reported by police as sustaining only minor injuries. Treatment was rendered at the scene by emergency medical technicians (EMT). The driver of the motorcycle was transported by ambulance to a local hospital for an unknown level of treatment. Both vehicles were towed from the scene.

RABSS VEHICLE

The 1998 Ford Taurus SE was identified by the Vehicle Identification Number (VIN): 1FAFP52SXWA (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 15,799 km (9,817 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 bucket and rear (folding back) bench seats. The NASS interview was not obtained, therefore, previous crashes or maintenance on the air bag system were unknown.

VEHICLE DAMAGE

Exterior Damage

The 1998 Ford Taurus SE sustained moderate frontal damage as a result of the impact with the motorcycle **(Figures 3 & 4)**. The direct contact damage began at the front left bumper corner and extended 78.6 cm (30.9 in) inboard. The impact deformed the full frontal width resulting in a combined direct and induced damage length (Field L) of 131.0 cm (51.6 in). Six crush measurements were documented at the level of the reinforcement bar (bumper cover protrusion): C1= 4.0 cm (1.6 in), C2= 30.0 cm (11.8 in), C3= 29.0 cm (11.4 in), C4= 18.0 cm (7.1 in), C5= 7.0 cm (2.8 in), C6= 3.0 cm (1.2 in). An indentation was noted to the front left area from the front wheel/tire of the motorcycle. The hood was displaced up and rearward from the impact force. No reduction in the vehicle's wheelbase was identified. The right mid-windshield area fractured from the interior passenger air bag module cover flap (only).

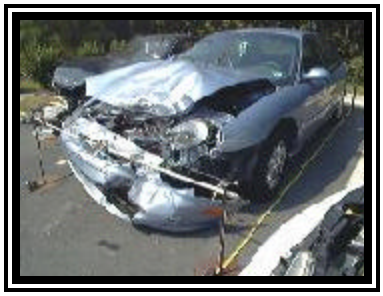

Figure 3. Frontal damage to the 1998 Ford Taurus SE.

Figure 4. Frontal damage to the 1992 Yamaha FZR1000 motorcycle.

Interior Damage

Interior damage to the Ford Taurus identified through the NASS vehicle inspection was minimal and was attributed to occupant contact. The lap belt webbing was stretched. A scuff mark was noted to the left knee bolster. The rear-view mirror was displaced forward (not fractured). No intrusions were found in the vehicle. No deformation was documented to the knee bolsters (rigid plastic type) or steering wheel rim/column (tilt column set to the full down position).

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 single cover flap design hinged at the top aspect. The flap measured 12.5 cm (4.9 in) in width along the top portion, 9.5 cm (3.7 in) along the lower portion and 5.0 cm (2.0 in) height. Although no contact evidence was identified on the exterior surface of the module cover flap, brown spots were documented to the upper and lower portions of the air bag along with black vinyl transfers from expansion within the module. The NASS researcher measured the diameter of the driver air bag at 62.0 cm (24.4 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.

Figure 5. 1998 Ford Taurus SE redesigned driver 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 top aspect. The cover flap was asymmetrical in shape and measured 40.0 cm (15.7 in) in width and 23.0 cm (9.1 in) in height along the left edge and 21.0 cm (8.3 in) in height along the right edge. The windshield was fractured by the module cover flap. Although no contact evidence was identified on the exterior surface of the module cover flap, gray powder marks were documented to the upper right quadrant of the air bag. The NASS researcher measured the passenger air bag at 60.0 cm (23.6 in) in width and 52.0 cm (20.5 in) in height in its deflated state **(Figure 6)**. 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 passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex:	46 year old female
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Mid-to-rear position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	NASS vehicle inspection, police report
Eyeware:	Unknown
Type of Medical Treatment:	None reported

Driver Injuries

Injury	***Severity (AIS 90)***	***Injury Mechanism***
None reported	N/A	N/A

Driver Kinematics

The 46 year old female driver of the 1998 Ford Taurus SE was presumed to be seated in an upright posture with the seat track adjusted to the mid-to-rear position. She was restrained by the available 3-point manual lap and shoulder belt system. Belt usage was confirmed by the stretched webbing documented during the NASS inspection and lack of significant contact points within the vehicle. At impact, she initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual belt and redesigned driver air bag. Injury information was unknown as the NASS interview was not obtained. The redesigned driver air bag provided additional restraint against further contact to the steering wheel hub/rim. She was reported by police as sustaining only minor injuries and was not transported to a local hospital for treatment.

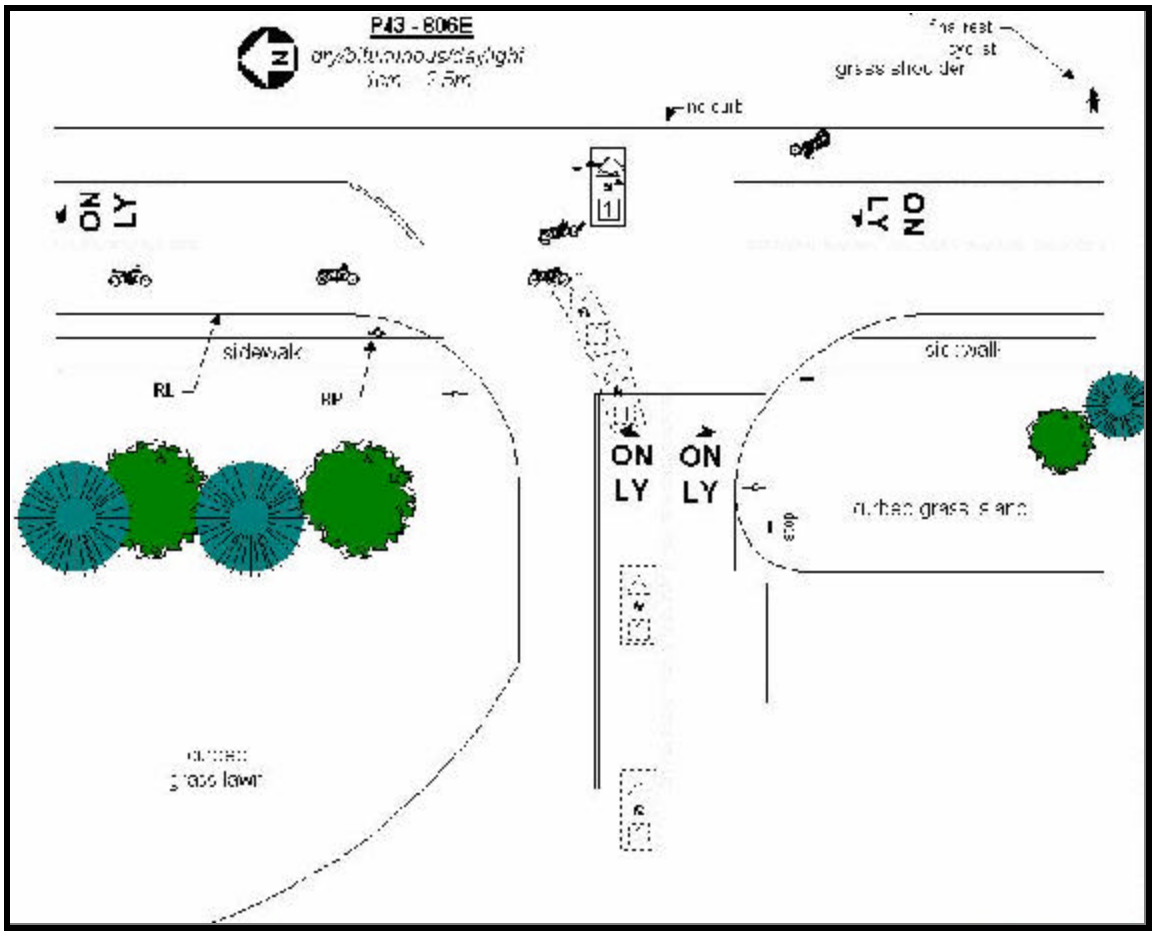

Figure 7. NASS Scene Diagram.