TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION

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

NASS CDS CASE NO. 1998-11-208F

RABSS VEHICLE - 1998 FORD F-150 PICKUP TRUCK

LOCATION - STATE OF MICHIGAN

CRASH DATE - NOVEMBER, 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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16. *Abstract* This investigation focused on a two vehicle crash involving a 1998 Ford F-150 pickup truck (subject vehicle) and a 1993 Ford Festiva 2-door hatchback. The Ford F-150 pickup was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a right angle collision with the Ford Festiva. The driver of the Ford pickup was operating the vehicle southbound when he failed to observe the westbound Ford Festiva as he turned left (east) out of a private driveway. As the Ford pickup crossed the westbound lanes, the front left area impacted the right side surface of the Ford Festiva. The impact resulted in minor damage to the Ford pickup and moderate damage to the Ford Festiva. The restrained 73 year old male driver of the Ford F-150 pickup initiated a forward trajectory in response to the 11 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. The driver was uninjured in the collision.			
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BACKGROUND

This investigation focused on a two vehicle crash involving a 1998 Ford F-150 pickup truck (subject vehicle) and a 1993 Ford Festiva 2-door hatchback. The Ford F-150 pickup was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a right angle collision with the Ford Festiva. The driver of the Ford pickup was operating the vehicle southbound when he failed to observe the westbound Ford Festiva as he turned left (east) out of a private driveway. As the Ford pickup crossed the westbound lanes, the front left area impacted the right side surface of the Ford Festiva. The impact resulted in minor damage to the Ford pickup and moderate damage to the Ford Festiva. The restrained 73 year old male driver of the Ford F-150 pickup initiated a forward trajectory in response to the 11 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. The driver was uninjured in the collision.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as CDS case number 98-11-208F and also included in 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 afternoon hours of November, 1998. At the time of the crash, it was daylight with no adverse conditions as the roads were dry. The crash occurred in the outboard westbound lane of a straight and level five lane asphalt roadway **(see Figure 7 - page 4)** at a junction with a private driveway. No traffic control was present at the scene which had a posted speed limit of 72 km/h (45 mph).

Pre-Crash

The 73 year old male driver of the 1998 Ford F-150 pickup truck was stationary and faced south in preparation of a left turn (east) out of a private driveway **(Figure 1)**. He reportedly looked both ways and became disoriented by the sun's glare as he proceeded east onto the urban roadway at a (driver reported) speed of 16 km/h (10 mph). The 23 year old female driver of the 1993 Ford Festiva was operating the vehicle westbound in the outboard lane **(Figure 2)** of the five lane urban roadway at a (driver reported) speed of 72 km/h (45 mph) when she observed the Ford pickup cross her path of travel. Upon recognition of the impending harmful event, she steered left/ braked in avoidance and partially entered the inboard (westbound) lane prior to the collision. The front right seating position of the Ford Festiva was occupied by a 22 year old male.

Figure 1. Southbound approach for the 1998 Ford F-150 pickup truck.

Figure 2. Westbound approach for the 1993 Ford Festiva.

Crash

As the Ford F-150 crossed the westbound lanes, the front left area impacted the right side surface of the Ford Festiva. The impact resulted in minor damage to the Ford pickup and moderate damage to the Ford Festiva. The damage algorithm of the WinSMASH program computed velocity changes of 14.6 km/h (9.1 mph) for the subject vehicle and 29.5 km/h (18.3 mph) for the struck Ford Festiva. Respective longitudinal components were -12.6 km/h (-7.8 mph) and -10.1 km/h (-6.3 mph). The impact induced deceleration was sufficient to deploy the Ford pickup's redesigned frontal air bag system. The Ford F-150 pickup came to rest in close proximity to the point of impact faced southeast as the Ford Festiva came to rest in the inboard (westbound) lane faced northwest.

Post-Crash

The driver of the Ford pickup and front right passenger of the Ford Festiva exited their respective vehicles under their own power as the driver of the Ford Festiva was removed by rescue personnel with perceived serious injuries. Treatment was rendered at the scene by fire department personnel and emergency medical technicians (EMTs). The Ford pickup driver was uninjured in the collision. The driver and front right passenger of the Ford Festiva were transported by ambulance to a local hospital for treatment and released. Both vehicles were towed from the scene due to disabling damage.

RABSS VEHICLE

The 1998 Ford F-150 was identified by the Vehicle Identification Number (VIN): 1FTZX172XWN (production sequence deleted). The vehicle was a 3-door super cab pickup truck equipped with rear wheel drive and a 3.8 liter, V-6 engine. The vehicle's odometer reading was 3,507 km (2,179 miles) at the time of the crash. The police report did not specify the owner of the vehicle. The seating was configured with front (split) and rear bench seats. The driver reported no previous crashes or maintenance on the air bag system (original equipment). No cell phone was present or in-use at the time of the collision.

VEHICLE DAMAGE

Exterior Damage

The 1998 Ford F-150 pickup truck sustained minor frontal damage as a result of the impact with the Ford Festiva **(Figure 3)**. The direct contact damage began at the front left bumper corner and extended 70.0 cm (27.6 in) inboard. The impact deformed the full frontal width resulting in a combined direct and induced damage length (Field L) of 168.0 cm (66.1 in). A

Figure 3. Frontal damage to the 1998 Ford F-150 pickup truck.

maximum crush value of 6.0 cm (2.4 in) was identified at the C2 position. The Collision Deformation Classification (CDC) for this impact to the Ford was 11-FYEW-1 with a principal direction of force of (-)30 degrees. The left headlight assembly fractured with the hood deformed slightly rearward from engagement against the side surface of the Festiva. All glazing remained intact.

The 1993 Ford Festiva 2-door hatchback sustained moderate right side surface damage as a result of the impact with the Ford pickup **(Figure 4)**. The direct contact damage began at the front right bumper corner and extended 299.0 cm (117.7 in) rearward. A maximum crush value of 23.0 cm (9.1 in) was documented along the right door. The CDC for this impact to the Festiva was 02-RDAW-2 with a principal direction of force of (+)70 degrees. Direct contact damage was noted to the right A-pillar which was displaced rearward with associated induced contact damage noted to the roof area at the B-pillar. The right fender was deformed laterally to the left which restricted the left front wheel/tire (not deflated). The windshield fractured as the right front window tempered glazing disintegrated from the impact force.

Figure 4. Right side surface damage to the 1993 Ford Festiva.

Interior Damage

There was no damage to the interior surfaces of the Ford F-150 pickup from intrusions or occupant contact.

REDESIGNED AIR BAG SYSTEM

The 1998 Ford F-150 pickup truck 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 and rectangular in shape. Although no contact evidence was identified on the exterior surface of the module cover flaps, a scuff mark was documented to the right mid-portion of the air bag face. The NASS researcher measured the diameter of the driver air bag at 60.0 cm (23.6 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 F-150 redesigned driver air bag.

The front right passenger air bag deployed from the right mid-instrument panel area with a single cover flap design hinged at the top aspect. No contact evidence was identified on the air bag or exterior surface of the rectangular module cover flap. The NASS researcher measured the passenger air bag at 50.0 cm (20.0 in) in width and 60.0 cm (23.6 in) in height in its deflated state. No vent ports or internal tether straps **(Figure 6)** were present. A cutoff switch was found at the center mid-instrument panel area and was set to the "on" position.

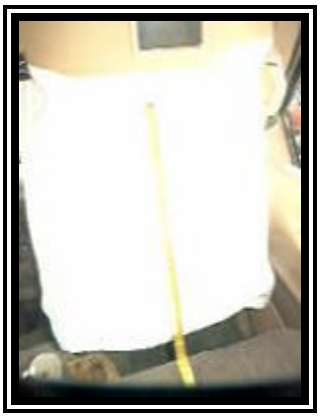

Figure 6. 1998 Ford F-150 redesigned passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex:	73 year old male
Height:	178 cm (70 in)
Weight:	79 kg (175 lb)
Seat Track Position:	Mid-to-rear position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	NASS vehicle inspection, driver interview, police report
Eyeware:	None
Type of Medical Treatment:	None

Driver Injuries

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

Driver Kinematics

The 73 year old male driver of the 1998 Ford F-150 pickup was restrained by the available 3-point manual lap and shoulder belt system, seated in an upright posture with the seat track adjusted to the mid-to-rear position. His hands were placed at the 10 o'clock and 2 o'clock positions on the steering wheel rim. Belt usage was confirmed by the lack of significant interior contacts and injury. At impact, the driver initiated a forward trajectory in response to the 11 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. Contact to the deployed driver air bag was confirmed by the scuff mark documented to the right mid-portion of the air bag face. He was uninjured in the collision. The combination of restraint options provided protection against further contact to the steering wheel hub/rim and potential serious injury.

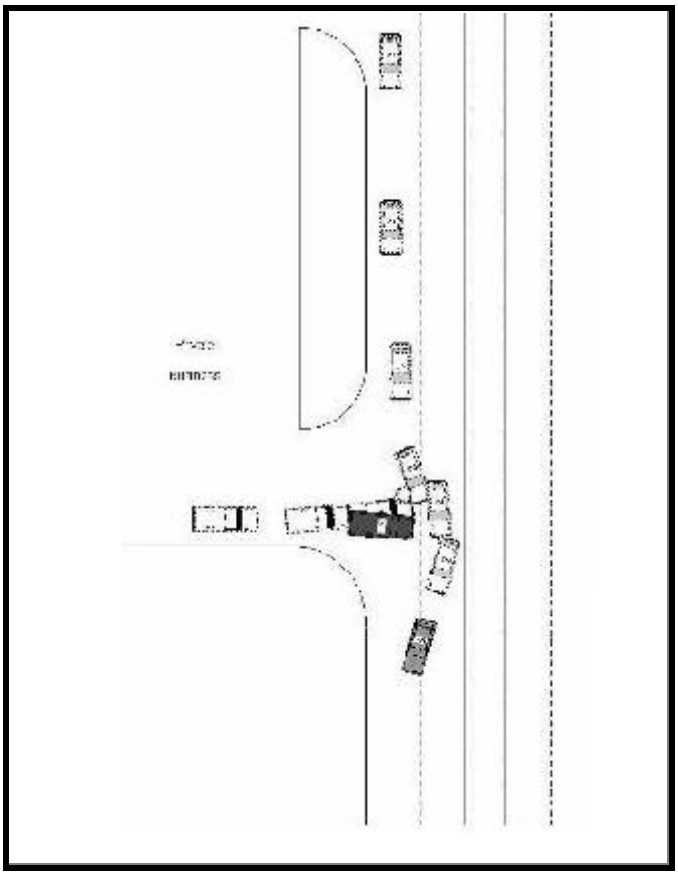

Figure 7. NASS Scene Diagram.