

**TRANSPORTATION SCIENCES  
CRASH RESEARCH SECTION**

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

**NASS RABSS CASE NO. 1998-43-807G**

**RABSS VEHICLE - 1999 FORD F-250 SUPER CAB PICKUP TRUCK**

**LOCATION - STATE OF NORTH CAROLINA**

**CRASH DATE - SEPTEMBER, 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. <i>Abstract</i> <p>This investigation focused on a single vehicle crash involving a 1999 Ford F-250 Super Cab pickup truck. The Ford pickup was equipped with a redesigned driver air bag that deployed as a result of a frontal collision with a utility pole. The Ford was eastbound in the curb lane of a 4-lane urban roadway when a (non-contact) vehicle turned left (south) in front of the Ford pickup. The driver steered left in avoidance and entered the #2 curb lane where he encountered a (non-contact) vehicle that was stationary and facing east waiting to make a left turn. He steered right/braked in avoidance and subsequently exited the right (south) pavement edge where the front area struck a utility pole. The impact resulted in moderate damage to the Ford pickup truck. The Ford rebounded off the pole coming to rest in close proximity to the point of impact facing northeast. The 38 year old male driver was properly 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. At impact, he initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint and deployed driver air bag. Although no injuries resulted from loading the belt system, contact by the expanding air bag resulted in a contusion to the anterior aspect of his right forearm. The 41 year old male front right passenger was also restrained by the 3-point manual lap and shoulder belt system and initiated a forward trajectory in response to the 12 o'clock impact force. He sustained a contusion to the forehead from contact to the right instrument panel. Neither occupant was transported to a local hospital for treatment.</p>			
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NASS RABSS CASE NO. 1998-43-807G  
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CRASH DATE - SEPTEMBER, 1998**

***BACKGROUND***

This investigation focused on a single vehicle crash involving a 1999 Ford F-250 Super Cab pickup truck. The Ford pickup was equipped with a redesigned driver air bag that deployed as a result of a frontal collision with a utility pole. The Ford was eastbound in the curb lane of a 4-lane urban roadway when a (non-contact) vehicle turned left (south) in front of the Ford pickup. The driver steered left in avoidance and entered the #2 curb lane where he encountered a (non-contact) vehicle that was stationary and facing east waiting to make a left turn. He steered right/braked in avoidance and subsequently exited the right (south) pavement edge where the front area struck a utility pole. The impact resulted in moderate damage to the Ford pickup truck. The Ford rebounded off the pole coming to rest in close proximity to the point of impact facing northeast. The 38 year old male driver was properly 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. At impact, he initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint and deployed driver air bag. Although no injuries resulted from loading the belt system, contact by the expanding air bag resulted in a contusion to the anterior aspect of his right forearm. The 41 year old male front right passenger was also restrained by the 3-point manual lap and shoulder belt system and initiated a forward trajectory in response to the 12 o'clock impact force. He sustained a contusion to the forehead from contact to the right instrument panel. Neither occupant was transported to a local hospital for treatment.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-43-807G for the Redesigned Air Bag Special Study. The Field Operations Branch 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 single vehicle crash occurred during the evening 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 off the south pavement edge of an east/west 4-lane undivided asphalt roadway (see **Figure 6 - page 5**). The roadway was straight and level with a posted speed limit of 56 km/h (35 mph).

**Pre-Crash**

The 38 year old male driver of the 1999 Ford F-250 pickup truck was operating the vehicle eastbound in the curb lane (**Figure 1**) and proceeding straight when a non-contact vehicle traveling in the opposite direction made an abrupt left turn (in front of the Ford) to enter a private driveway. The driver of the Ford steered left in avoidance and entered the #2 curb lane where he encountered another non-contact vehicle that was stationary and facing east waiting to make a left turn (north). The driver steered right/braked and subsequently exited the right (south) pavement edge (**Figure 2**).



**Figure 1. Eastbound approach for the 1999 Ford F-250 pickup truck.**



**Figure 2. Impact location (pole replaced).**

### **Crash**

As the Ford pickup truck departed the right (south) pavement edge of the 4-lane undivided roadway, the front area struck a 30.5 cm (12.0 in) utility pole resulting in moderate damage. The impact induced deceleration was sufficient to deploy the Ford's redesigned driver air bag system. Although the impact was classified as a yielding object (out of scope), the damage algorithm of the WinSMASH program computed a (barrier equivalent) velocity change of 31.1 km/h (19.3 mph). The specific longitudinal component was -31.1 km/h (-19.3 mph). The Collision Deformation Classification (CDC) for this impact to the Ford was 12-FYEN-2. The vehicle rebounded off the utility pole coming to rest in close proximity to the point of impact facing northeast.

### **Post-Crash**

Both occupants of the Ford pickup truck exited the vehicle under their own power. An ambulance was summoned to the crash site but neither occupant was transported to a local hospital for treatment. The driver was arrested for careless/reckless driving and suspicion of driving while intoxicated. The vehicle was towed from the scene.

### ***RABSS VEHICLE***

The 1999 Ford F-250 Super Cab pickup truck was identified by the Vehicle Identification Number (VIN): 1FTNX20L6XE (production sequence deleted). The vehicle was an extended cab pickup truck (4-door model) equipped with rear wheel drive and a 5.4 liter, V-8 engine. The police report listed the driver's employer as the owner of the vehicle. The vehicle's odometer reading was 30,899 km (19,201 miles) at the time of the crash. The seating was configured with front and rear bench seats. This heavy duty pickup was ordered by the owner with a delete option for the front right air bag, therefore, only the driver air bag was available. The right instrument panel was formed with the shape of a mid-mount cover flap and a cut-out for the cut-off switch. The interviewee reported no previous crashes or maintenance on the Ford's driver air bag system (original equipment). An unspecified cell phone was present but not in-use at the time of the collision.

## **VEHICLE DAMAGE**

### **Exterior Damage**

The Ford pickup truck sustained moderate frontal damage as a result of the impact with the utility pole (**Figure 3**). The direct contact damage was centered 10.0 cm (3.9 in) to the left of the end plane center point. The impact deformed the full frontal width resulting in a combined direct and induced damage length (Field L) of 103.0 cm (40.6 in). Six crush measurements were documented at the level of the bumper: C1 = 0 cm, C2 = 0 cm, C3 = 33.0 cm (13.0 in), C4 = 64.0 cm (25.2 in), C5 = 18.0 cm (7.1 in), C6 = 0 cm. The hood was displaced up and rearward from engagement against the utility pole. No induced damage was noted to the fenders or roof area. No bed to cab contact was identified. No wheels were restricted or deflated. The windshield was undamaged.



**Figure 3. 1999 Ford F-250 Super Cab pickup truck.**

### **Interior Damage**

Interior damage to the Ford pickup truck identified through the NASS vehicle inspection was minimal and was attributed to occupant contact (**Figure 4**). No transfers or loading marks were noted to the available 3-point manual lap and shoulder belt systems. No contacts were found on the driver air bag or exterior surface of the module cover flaps. A scuff mark was documented to the front right instrument panel (air bag cavity panel). No deformation was noted to the fixed steering column or knee bolsters (rigid plastic type). No intrusions were identified to the vehicle.



**Figure 4. Interior view**

### **REDESIGNED AIR BAG SYSTEM**

The 1999 Ford F-250 Super Cab pickup truck was equipped with a redesigned driver air bag (the vehicle had a delete option for the passenger side air bag). The air bag deployed as a result of the crash. The air bag was housed in the center of the steering wheel with a horizontally oriented flap tear seam (H-configuration). There was no contact evidence on the air bag or exterior surface of the module cover flaps. The flaps were asymmetrical in shape as the upper flap measured 19.5 cm (7.7 in) in width and 15.0 cm (5.9 in) in height. The NASS researcher measured the diameter of the air bag at 64.0 cm (25.2 in) in its deflated state (**Figure 5**). The bag was tethered by four 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. 1999 Ford F-250 pickup truck redesigned driver air bag.**

**DRIVER DEMOGRAPHICS**

Age/Sex:	38 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
Eyewear:	None
Type of Medical Treatment:	None

**Driver Injuries**

<i>Injury</i>	<i>Severity (AIS 90)</i>	<i>Injury Mechanism</i>
Contusion anterior right forearm (12.0 cm)	Minor (790402.1,1)	Air bag

**Driver Kinematics**

The 38 year old male driver of the Ford F-250 pickup truck was properly restrained by the 3-point manual lap and shoulder belt system, seated in an upright posture with the seat track adjusted to the mid-to-rear position. The police report noted that he was belted, further evidenced by the lack of significant occupant contact damage and injury. Given the active steering involved prior to the collision, both hands were presumed to be placed on the steering wheel rim. At impact, he initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. Although no injuries were reported as a result of loading to the manual belt system, contact by the expanding air bag resulted in a 11.4 cm (4.5 in) contusion to the anterior aspect of the right forearm. This was evidenced by the presumed pre-crash hand placement on the steering wheel rim relative to the location of the injury. The air bag provided additional restraint against further contact to the steering wheel hub/rim. The driver was not transported to a local hospital for treatment.

**FRONT RIGHT PASSENGER DEMOGRAPHICS**

Age/Sex:	41 year old male
Height:	175 cm (69 in)
Weight:	73 kg (160 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
Eyewear:	None
Type of Medical Treatment:	None

## Front Right Passenger Injuries

*Injury*  
Contusion forehead

*Severity (AIS 90)*  
Minor (290402.1,7)

*Injury Mechanism*  
Right instrument panel

## Front Right Passenger Kinematics

The 41 year old male passenger of the Ford F-250 pickup truck was restrained by the available 3-point lap and shoulder belt system, seated in an upright posture with the seat track adjusted to the mid-to-rear position. The police report noted that he was belted, further evidenced by the lack of significant occupant contact damage and injury. The belt placement was presumed to be loose given the occupant's height relative to the seat track position. At impact, he initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint. His forehead contacted the right mid-instrument panel resulting in a small contusion to the forehead as evidenced by the scuff mark documented to this component. Had the vehicle been equipped with a passenger air bag, it would have provided restraint from contact to the instrument panel. The front right passenger was not transported to a local hospital for treatment.

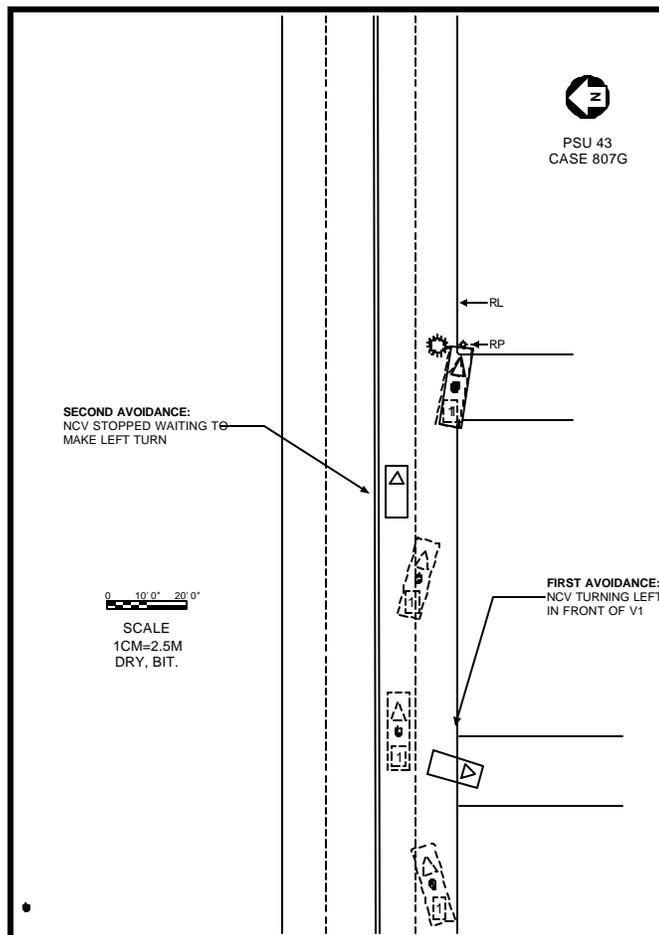


Figure 6. NASS Scene Diagram