

**TRANSPORTATION SCIENCES  
CRASH RESEARCH SECTION**

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

**NASS RABSS CASE NO. 1998-12-802E**

**RABSS VEHICLE - 1998 DODGE RAM PICKUP TRUCK**

**LOCATION - STATE OF MICHIGAN**

**CRASH DATE - AUGUST, 1998**

Contract No. DTNH22-94-D-07058

Prepared for:

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

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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.

## TECHNICAL REPORT STANDARD TITLE PAGE

1. <i>Report No.</i> 98-12-802E	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 - 1998 Dodge Ram pickup truck Location - State of Michigan		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: August, 1998	
		14. <i>Sponsoring Agency Code</i>	
15. <i>Supplementary Notes</i> NASS investigation of a head-on collision that involved a 1998 Dodge Ram pickup truck equipped with redesigned frontal air bags.			
16. <i>Abstract</i> This investigation focused on a two vehicle crash involving a 1998 Dodge Ram pickup truck (subject vehicle) and a 1996 Chevrolet S-10 pickup truck. The Dodge Ram was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a head-on collision with the Chevrolet pickup. The Chevrolet driver was operating the vehicle northbound on a two lane rural roadway when he allowed the vehicle to cross the centerline into the path of the southbound Dodge. As the Chevrolet entered the southbound lane, the frontal area impacted the frontal area of the Dodge resulting in severe damage to both vehicles. The restrained 23 year old male driver of the Dodge Ram initiated a forward trajectory in response to the 12 o'clock impact force as the expanding redesigned driver air bag contacted the anterior aspect of his forearms resulting in bilateral contusions. Loading of the knee bolster resulted in bilateral contusions to the knees with no other injury reported. The Dodge driver refused treatment.			
17. <i>Key Words</i> Redesigned frontal air bag system Collision Deformation Classification (CDC): 01-FDEW-3 Proper use of the manual belt system Bilateral anterior forearm contusions		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 .....	5
NASS SCENE DIAGRAM .....	5

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***BACKGROUND***

This investigation focused on a two vehicle crash involving a 1998 Dodge Ram pickup truck (subject vehicle) and a 1996 Chevrolet S-10 pickup truck. The Dodge Ram was equipped with redesigned frontal air bags for the driver and right passenger positions which deployed as a result of a head-on collision with the Chevrolet pickup. The Chevrolet driver was operating the vehicle northbound on a two lane rural roadway when he allowed the vehicle to cross the centerline into the path of the southbound Dodge. As the Chevrolet entered the southbound lane, the frontal area impacted the frontal area of the Dodge resulting in severe damage to both vehicles. The restrained 23 year old male driver of the Dodge Ram initiated a forward trajectory in response to the 12 o'clock impact force as the expanding redesigned driver air bag contacted the anterior aspect of his forearms resulting in bilateral contusions. Loading of the knee bolster resulted in bilateral contusions to the knees with no other injury reported. The Dodge driver refused treatment.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-12-802E 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 early morning hours of August, 1998. At the time of the crash, it was dark (street not lighted) with no adverse conditions as the roads were dry. The crash occurred along the centerline of a straight two lane north/south asphalt roadway (see **Figure 7 - page 5**) with a hillcrest just north of the crash site. No traffic control was present at the scene which had a posted speed limit of 89 km/h (55 mph).

**Pre-Crash**

The 21 year old male driver of the 1996 Chevrolet S-10 was en route home and operating the vehicle northbound (**Figure 1**) when he reportedly "became lost" and allowed the vehicle to cross the centerline into the southbound lane. Upon recognition of the southbound Dodge, the driver steered right (back) towards the northbound lane. The 23 year old male driver of the 1998 Dodge Ram was operating the vehicle southbound (**Figure 2**) when he crested the hill and observed "headlights" (northbound Chevrolet) in his lane of travel. The driver steered left towards the northbound lane in anticipation of the impending crash.



**Figure 1. Northbound approach for the 1996 Chevrolet S-10 pickup truck.**



**Figure 2. Southbound approach for the 1998 Dodge Ram pickup truck.**

### **Crash**

As both vehicles steered towards the northbound lane, the frontal area of the Chevrolet impacted the frontal area of the Dodge resulting in severe damage to each vehicle. The damage algorithm of the WinSMASH program computed velocity changes of 49.7 km/h (30.9 mph) for the subject vehicle and 73.4 km/h (45.6 mph) for the struck Chevrolet. Respective longitudinal components were -46.7 km/h (-29.0 mph) and -69.0 km/h (-27.2 mph). The impact induced deceleration was sufficient to deploy the Dodge's redesigned frontal air bag system. Both vehicles came to rest in close proximity to the point of impact with the Dodge facing southeast and the Chevrolet facing east.

### **Post-Crash**

The driver of the Dodge Ram exited the vehicle under his own power. The exit status of the Chevrolet driver was unknown. Treatment was rendered at the scene by fire department personnel and emergency medical technicians (EMTs). The police reported a strong odor of alcohol on both drivers. The Dodge driver refused treatment as the Chevrolet driver was transported by ambulance to a local trauma center for an unknown level of treatment. Both vehicles were towed from the scene due to disabling damage.

### ***RABSS VEHICLE***

The 1998 Dodge Ram was identified by the Vehicle Identification Number (VIN): 1B7HF16Y0WS (production sequence deleted). The vehicle was a conventional cab pickup truck equipped with 4-wheel drive and a 5.2 liter, V-8 engine. The vehicle's odometer reading was unknown at the time of the crash. The police report did not specify the owner of the vehicle. The seating was configured with a front split bench (with folding backs). The surrogate interview 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 Dodge Ram pickup truck sustained severe frontal damage as a result of the impact with the Chevrolet pickup (**Figure 3**). The direct contact damage encompassed the full frontal width resulting in a combined direct and induced damage length (Field L) of 159.0 cm (62.6 in). Six crush measurements were

documented at the level of the bumper: C1= 47.0 cm (18.5 in), C2= 60.0 cm (23.6 in), C3= 66.0 cm (26.0 in), C4= 70.0 cm (27.6 in), C5= 48.0 cm (18.9 in), C6= 36.0 cm (14.2 in). The Collision Deformation Classification (CDC) for this impact to the Dodge was 01-FDEW-3 with a principal direction of force of (+)20 degrees. The grille and headlight assemblies fractured and separated from the vehicle during the collision sequence. The hood was displaced up and rearward from the impact force. Both fenders were deformed rearward which restricted the front wheels/tires (not deflated). Induced left side bed/cab contact was noted along with buckling to the roof area at the left B-pillar. Reduction in the left side wheelbase measured 23.0 cm (9.1 in) while the right wheelbase was elongated 5.0 cm (2.0 in). All glazing remained undamaged.



**Figure 3. Frontal damage to the 1998 Dodge Ram pickup truck.**



**Figure 4. Frontal damage to the 1996 Chevrolet S-10 pickup truck.**

The 1996 Chevrolet S-10 pickup truck sustained severe frontal damage as a result of the impact with the Dodge Ram (**Figure 4**). The direct contact damage encompassed the full frontal width resulting in a combined direct and induced damage length (Field L) of 104.0 cm (40.9 in). A maximum crush value of 90.0 cm (35.4 in) was documented at the front left bumper corner area. The CDC for this impact to the Chevrolet was 11-FDEW-4 with a principal direction of force of (-)20 degrees. The hood was displaced up and rearward from the impact force. The left fender was deformed rearward which restricted/deflated the left front wheel/tire. Induced left side bed/cab contact was noted along with buckling to the roof area

at the left A and B-pillars. Reduction in the left side wheelbase measured 28.0 cm (11.0 in) while the right wheelbase was elongated 11.0 cm (4.3 in). The windshield was fractured from (exterior) impact forces and (interior) occupant contact.

### **Interior Damage**

Damage to the interior surfaces of the Dodge Ram were minimal and attributed to occupant contact. Scuff marks were documented on the left knee bolster (rigid plastic type). The ashtray located at the center mid-instrument panel area was fractured and out-of-place. A longitudinal toepan intrusion of 16.0 cm (6.3 in) was documented to the driver space.

### **REDESIGNED AIR BAG SYSTEM**

The 1998 Dodge Ram 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). No contact evidence was identified on the air bag or exterior surface of the module cover flaps. The flaps were asymmetrical in shape as the upper flap measured 14.0 cm (5.5 in) in width and 10.0 cm (3.9 in) in height while the lower flap

measured 14.0 cm (5.5 in) in width and 3.0 cm (1.2 in) in height. 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 four internal straps and vented by one port located at the 12 o'clock sector on the rear aspect of the 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 forward aspect. No contact evidence was identified on the air bag or exterior surface of the module cover flap. The cover flap was rectangular in shape and measured 29.0 cm (11.4 in) in width and 20.0 cm (7.9 in) in height. The NASS researcher measured the passenger air bag at 92.0 cm (36.2 in) in width and 61.0 cm (24.0 in) in height in its deflated state (**Figure 6**). No vent ports or internal tether straps were present. A cutoff switch was found on the center mid-instrument panel area and was set to the “on” position.



**Figure 5. 1998 Dodge Ram redesigned driver air bag.**



**Figure 6. 1998 Dodge Ram redesigned passenger air bag.**

***DRIVER DEMOGRAPHICS***

Age/Sex:	23 year old male
Height:	183 cm (72 in)
Weight:	84 kg (185 lb)
Seat Track Position:	Mid-to-rear position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	NASS vehicle inspection, surrogate interview, police report
Eyewear:	Contact lenses
Type of Medical Treatment:	Refused treatment

**Driver Injuries**

<i>Injury</i>	<i>Severity (AIS 90)</i>	<i>Injury Mechanism</i>
Bilateral contusions anterior forearms (proximal to elbow)	Minor (790402.1,3)	Expanding front left air bag
Bilateral knee contusions	Minor (890402.1,3)	Left knee bolster



### Driver Kinematics

The 23 year old male driver of the 1998 Dodge Ram was restrained by the available 3-point manual lap and shoulder belt system, presumed to be seated in an upright posture with the seat track adjusted to the mid-to-rear position. ***Although the driver was coded as unrestrained in the NASS case file***, belt usage was confirmed by the lack of significant interior contacts and injury in conjunction with the extent of damage to the vehicle exterior. At impact, he initiated a forward trajectory in response to the 12 o'clock impact force as the expanding air bag contacted the anterior aspect of his forearms resulting in bilateral contusions, evidenced by the size and location of the injury relative to the driver's stated placement of the hands on the steering wheel rim during pre-crash avoidance maneuvers. Loading of the knee bolster resulted in bilateral contusions to the knees as evidenced by the scuff marks documented to this component (*injury sourced to the instrument panel in the NASS case file*). No other injury was reported. The driver refused treatment. His field sobriety test revealed a blood alcohol level of .028. The combination of restraint options provided protection against further contact to the steering wheel hub/rim and potential serious injury.

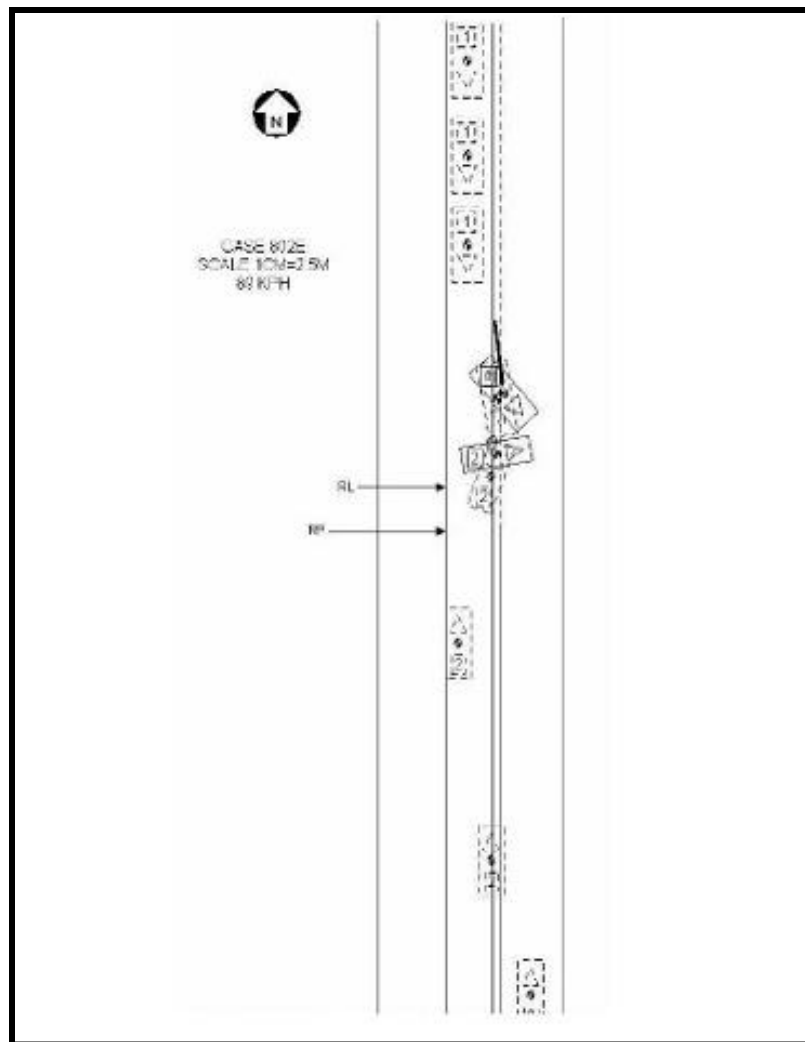


Figure 7. NASS Scene Diagram.