TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION

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

NASS RABSS CASE NO. 1998-11-809E

RABSS VEHICLE - 1998 DODGE STRATUS

LOCATION - STATE OF MICHIGAN

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 Dodge Stratus 4-door sedan (subject vehicle) and a 1998 Mercury Tracer LS 4-door sedan. The Dodge Stratus and Mercury Tracer were equipped with redesigned frontal air bags for the driver and right passenger positions. The Dodge Stratus was westbound on the inboard lane of a multi-lane urban roadway when the driver maneuvered the vehicle into the center turning lane and observed the northbound Mercury Tracer turn left (west) across his path of travel. As the Mercury entered the center turning lane, the rear right area was impacted by the front left area of the Dodge resulting in moderate damage to both vehicles. The impact deployed the Dodge's redesigned frontal air bag system. At this point, the Mercury was re-directed into the eastbound lanes where the front right area struck the front left area of a 1998 Dodge Ram pickup truck which resulted in moderate damage to both vehicles. This impact deployed the Mercury's redesigned frontal air bag system. The SCI investigation focused on the deployment of the Dodge's redesigned frontal air bag system as no additional data was collected on the Mercury Tracer by the NASS researcher. The restrained 25 year old male driver of the Dodge Stratus initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. He sustained an abrasion of the left posterior thumb from contact to the deployed driver air bag with no other injury or treatment reported.			
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BACKGROUND

This investigation focused on a two vehicle crash involving a 1998 Dodge Stratus 4-door sedan (subject vehicle) and a 1998 Mercury Tracer LS 4-door sedan. The Dodge Stratus and Mercury Tracer were equipped with redesigned frontal air bags for the driver and right passenger positions. The Dodge Stratus was westbound on the inboard lane of a multi-lane urban roadway when the driver maneuvered the vehicle into the center turning lane and observed the northbound Mercury Tracer turn left (west) across his path of travel. As the Mercury entered the center turning lane, the rear right area was impacted by the front left area of the Dodge resulting in moderate damage to both vehicles. The impact deployed the Dodge's redesigned frontal air bag system. At this point, the Mercury was re-directed into the eastbound lanes where the front right area struck the front left area of a 1998 Dodge Ram pickup truck which resulted in moderate damage to both vehicles. This impact deployed the Mercury's redesigned frontal air bag system. *The SCI investigation focused on the deployment of the Dodge's redesigned frontal air bag system as no additional data was collected on the Mercury Tracer by the NASS researcher.* The restrained 25 year old male driver of the Dodge Stratus initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. He sustained an abrasion of the left posterior thumb from contact to the deployed driver air bag with no other injury or treatment reported.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-11-809E 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 evening hours of September, 1998. At the time of the crash, it was daylight with intermittent rain as the roads were wet. The crash occurred in the center turn lane of a straight (asphalt) five lane east/west urban roadway **(see Figure 9 - page 5)** with a positive grade for westbound traffic. The roadway was bordered by barrier curbs and private driveways. No traffic control was present at the scene which had a posted speed limit of 72 km/h (45 mph).

Pre-Crash

The 25 year old male driver of the 1998 Dodge Stratus was operating the vehicle westbound on the inboard lane of the five lane urban roadway at a (driver reported) speed of 56 km/h (35 mph) when he maneuvered the vehicle into the center turn lane **(Figure 1)** and observed the northbound Mercury exit a private drive to proceed west. Upon recognition of the impending harmful event, the Dodge driver braked in avoidance remaining in the center turn lane prior to the collision. The 29 year old female driver of the 1998 Mercury

Tracer exited the private driveway **(Figure 2)** in a northerly direction and proceeded to turn left (west) onto the multi-lane roadway when she entered the center turn lane (across the path of the westbound Dodge) and came to a complete stop. The front right seating position of the Mercury was occupied by a 35 year old female.

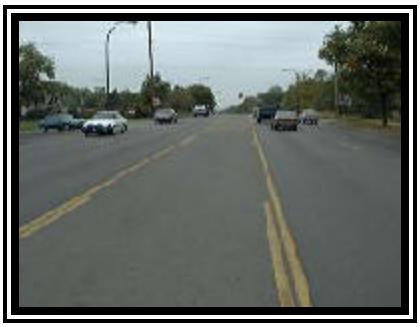

Figure 1. Westbound approach for the 1998 Dodge Stratus.

Figure 2. Northwest approach for the 1998 Mercury Tracer LS.

Crash

As the Mercury Tracer entered the center turn lane of the five lane urban roadway, the rear right area was impacted by the front left area of the Dodge resulting in moderate damage to both vehicles. The damage algorithm of the WinSMASH program computed velocity changes of 18.0 km/h (11.2 mph) for the subject vehicle and 20.2 km/h (12.6 mph) for the struck Mercury. Respective longitudinal components were -18.0 km/h (-11.2 mph) and 20.2 km/h (12.6 mph). The impact induced deceleration was sufficient to deploy the Dodge's redesigned frontal air bag system. At this point, the Dodge came to rest in the center turn lane as the Mercury was re-directed into the eastbound lanes where the front right area struck the front left area of an eastbound 1998 Dodge Ram pickup truck which resulted in moderate damage to both vehicles. The impact induced deceleration was sufficient to deploy the Mercury's redesigned frontal air bag system *(no WinSMASH computations due to insufficient data)*.

Post-Crash

Both drivers exited their respective vehicles under their own power. The front right passenger of the Mercury 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 Dodge driver was reported by police as uninjured as the driver and front right passenger of the Mercury were transported to a local hospital (by private vehicle and ambulance, respectively) for treatment of minor facial soft tissue injuries and released. The Dodge Stratus and Mercury Tracer were towed from the scene due to disabling damage while the Dodge Ram pickup was driven from the scene.

RABSS VEHICLES

1998 Dodge Stratus

The 1998 Dodge Stratus was identified by the Vehicle Identification Number (VIN): 1B3EJ46X1WN (production sequence deleted). The vehicle was a 4-door sedan equipped with front wheel drive and a 2.4 liter, 4-cylinder engine. The vehicle's odometer reading was 6,437 km (4,000 miles) at the time of the crash.

The police report did not specify the owner of the vehicle. The seating was configured with front bucket and rear bench seats (with folding backs). 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

Figure 3. Front left damage to the 1998 Dodge Stratus.

The 1998 Dodge Stratus sustained moderate frontal damage as a result of the impact with the Mercury Tracer **(Figure 3)**. The direct contact damage began at the front left bumper corner and extended 62.0 cm (24.4 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= 7.0 cm (2.8 in), C2= 6.0 cm (2.4 in), C3= 2.0 cm (0.8 in), C4= 2.0 cm (0.8 in), C5= 4.0 cm (1.6 in), C6= 5.0 cm (2.0 in). The Collision Deformation Classification (CDC) for this impact to the Dodge was 12-FYEW-1 with a principal direction of force of 0 degrees. Direct contact damage was documented to the hood and left fender areas (left front wheel deflated not restricted) attributed to the trunk hatch and right quarter panel of the Mercury. Reduction in the left side wheelbase measured 18.0 cm (7.1 in). All glazing remained undamaged.

The 1998 Mercury Tracer sustained moderate rear damage as a result of the impact with the Dodge Stratus **(Figure 4)**. The direct contact damage began at the rear right bumper corner and extended 91.0 cm (35.8 in) inboard. The impact deformed the full end width resulting in a combined direct and induced damage length (Field L) of 107.0 cm (42.1 in). A maximum crush value of 43.0 cm (16.9 in) was documented at the C6 position. The Collision Deformation Classification (CDC) for this impact to the Mercury was 06-BZEW-4 with a principal direction of force of 180 degrees. The right quarter panel was deformed forward which restricted/deflated the right rear wheel/tire. The trunk hatch was displaced up and rearward from the impact force. Induced buckling was noted to the roof area at the right B and C-pillars. Reduction in the right side wheelbase measured 11.0 cm (4.3 in). Direct contact damage was also noted to the front right area attributed to the secondary impact **(Figure 5)**. Post-crash extrication damage was identified at the right front door. The windshield was fractured from (exterior) impact forces and the (interior) front right air bag module cover flap.

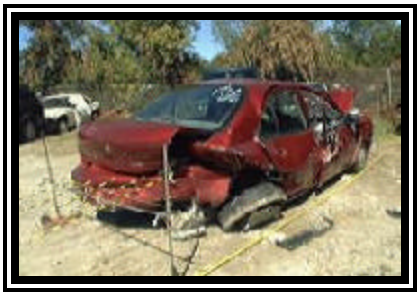

Figure 4. Rear right damage to the 1998 Mercury Tracer LS.

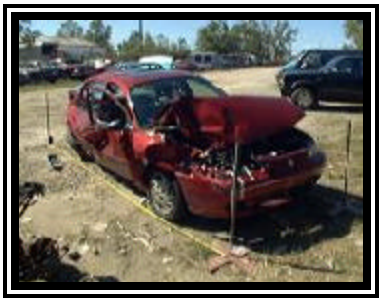

Figure 5. Front right damage to the 1998 Mercury Tracer LS.

Interior Damage

There was no damage to the interior surfaces of the Dodge Stratus from intrusions or occupant contact.

REDESIGNED AIR BAG SYSTEM

The 1998 Dodge Stratus 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 23.0 cm (9.1 in) in width and 10.0 cm (3.9 in) in height while the lower flap measured 23.0 cm (9.1 in) in width and 6.8 cm (2.7 in) in height. Multiple black vinyl transfers were noted to the upper left quadrant of the air bag face from expansion within the module. The NASS researcher measured the diameter of the driver air bag at 52.0 cm (20.5 in) in its deflated state **(Figure 6)**. The bag was tethered by two internal straps (vent ports unknown).

Figure 6. 1998 Dodge Stratus 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 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 39.0 cm (15.4 in) in width and 22.0 cm (8.7 in) in height. The NASS researcher measured the passenger air bag at 38.0 cm (15.0 in) in width and 48.0 cm (18.9 in) in height in its deflated state **(Figure 7)**. The bag was tethered by two internal straps. No vent ports were present. No cutoff switch was found for the front right air bag. The right mid-instrument panel area fractured from the air bag deployment **(Figure 8)**.

Figure 7. 1998 Dodge Stratus redesigned passenger air bag.

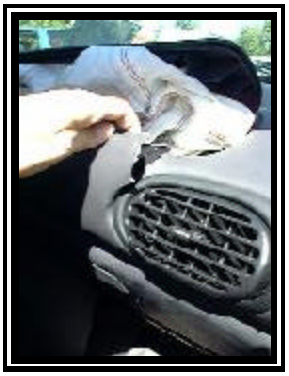

Figure 8. Damage to the right instrument panel from the passenger air bag deployment.

DRIVER DEMOGRAPHICS

Age/Sex:	25 year old male
Height:	178 cm (70 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, driver interview, police report
Eyeware:	Prescription glasses
Type of Medical Treatment:	None

Driver Injuries

Injury	*Severity (AIS 90)*	*Injury Mechanism*
Left posterior thumb abrasion	Minor (790202.1,2)	Front left air bag

Driver Kinematics

The 25 year old male driver of the 1998 Dodge Stratus 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. His left hand was placed at the 10 o'clock sector 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 12 o'clock impact force and loaded the manual restraint and deployed redesigned driver air bag. He sustained an abrasion of the left thumb from contact to the deployed driver air bag, evidenced by the location of the injury relative to the driver's stated pre-crash placement of the left hand on the steering wheel rim. No other injury or treatment was reported. The combination of restraint options provided protection against further contact to the steering wheel hub/rim and potential serious injury.

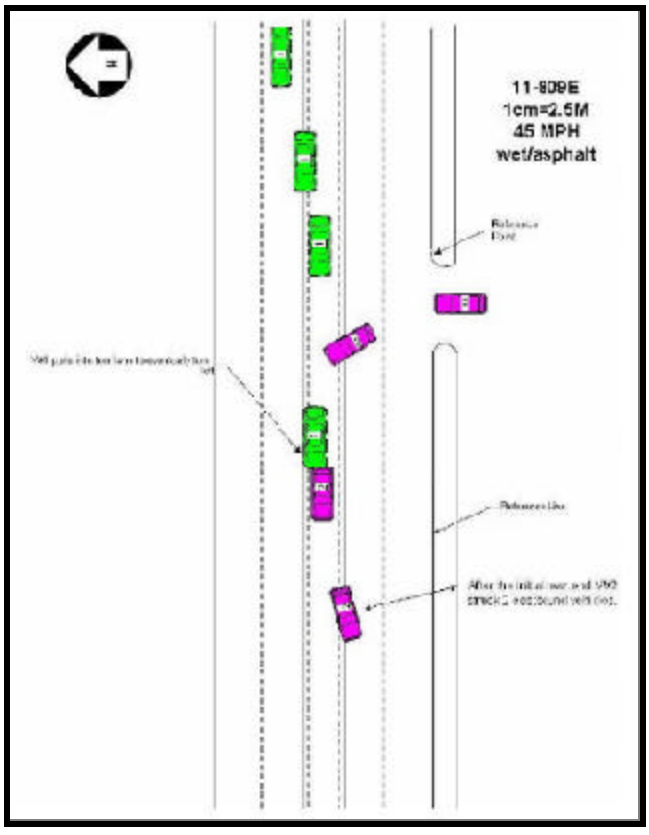

Figure 9. NASS Scene Diagram.