

**TRANSPORTATION SCIENCES
CRASH RESEARCH SECTION**

Veridian
Calspan Operations
Buffalo, New York 14225

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

NASS RABSS CASE NO. 1998-08-804F

RABSS VEHICLE - 1998 DODGE NEON

LOCATION - STATE OF PENNSYLVANIA

CRASH DATE - OCTOBER, 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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<i>16. Abstract</i> <p>This investigation focused on a two-vehicle crash involving a 1998 Dodge Neon 4-door sedan (subject vehicle) and a 1992 Buick Regal Custom 4-door sedan. The Dodge Neon was equipped with redesigned frontal air bags that deployed as a result of a right angle collision with the Buick Regal. The Dodge was westbound on a four lane undivided roadway on approach to a 3-leg intersection. The Buick Regal was eastbound on the same roadway and attempted to turn left (north). Both vehicles entered the intersection where the frontal area of the Dodge struck the right side passenger area of the Buick. The impact resulted in moderate damage to both vehicles. The Dodge Neon came to rest in the westbound lanes of the intersection facing northwest. At this point, the Buick traveled into the northwest sector of the intersection where it impacted the curb initiating a one quarter turn left side rollover resulting in minor damage. The Buick came to rest on its left side facing north. The 28 year old female driver of the Dodge Neon 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. Although no injuries were reported as a result of contact by the deployed air bag, loading to the manual restraint resulted in a cervical and thoracic spine strain. The driver was transported (along with the driver of the Buick Regal) to a local hospital for treatment and released.</p>			
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TABLE OF CONTENTS

BACKGROUND	1
SUMMARY	
Crash Site	1
Pre-Crash	1
Crash	2
Post-Crash	2
RABSS VEHICLE	2
VEHICLE DAMAGE	
Exterior Damage	3
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 Neon 4-door sedan (subject vehicle) and a 1992 Buick Regal Custom 4-door sedan. The Dodge Neon was equipped with redesigned frontal air bags that deployed as a result of a right angle collision with the Buick Regal. The Dodge was westbound on a four lane undivided roadway on approach to a 3-leg intersection. The Buick Regal was eastbound on the same roadway and attempted to turn left (north). Both vehicles entered the intersection where the frontal area of the Dodge struck the right side passenger area of the Buick. The impact resulted in moderate damage to both vehicles. The Dodge Neon came to rest in the westbound lanes of the intersection facing northwest. At this point, the Buick traveled into the northwest sector of the intersection where it impacted the curb initiating a one quarter turn left side rollover resulting in minor damage. The Buick came to rest on its left side facing north. The 28 year old female driver of the Dodge Neon 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. Although no injuries were reported as a result of contact by the deployed air bag, loading to the manual restraint resulted in a cervical and thoracic spine strain. The driver was transported (along with the driver of the Buick Regal) to a local hospital for treatment and released.

This crash was initially selected for investigation by the National Automotive Sampling System (NASS) as case number 98-08-804F 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 October, 1998. At the time of the crash, it was daylight with no adverse conditions as the roads were dry. The crash occurred in the westbound lanes of a (asphalt) 3-leg intersection which consisted of four travel lanes bordered on the north side by barrier curbs. The roadway curved right for westbound traffic with a negative grade to the west. Traffic flow through the intersection was controlled by an overhead traffic signal system (see **Figure 8-page 5**) which had a posted speed limit of 40 km/h (25 mph).

Pre-Crash

The 30 year old female driver of the 1992 Buick Regal was operating the vehicle eastbound (**Figure 1**) and attempted to turn left (north) at the 3-leg intersection. The 28 year old female driver of the 1998 Dodge Neon was operating the vehicle westbound in the curb lane (**Figure 2**) and proceeding straight. Upon recognition of the impending harmful event, the driver braked in avoidance.



Figure 1. Eastbound approach for the 1992 Buick Regal.



Figure 2. Westbound approach for the 1998 Dodge Neon.

Crash

As both vehicles entered the 3-leg intersection, the frontal area of the Dodge Neon struck the right passenger area of the Buick Regal. The impact resulted in moderate damage to both vehicles. The impact induced deceleration was sufficient to deploy the Neon's redesigned frontal air bag system. The damage algorithm of the WinSMASH program computed velocity changes of 29.0 km/h (18.0 mph) for the subject vehicle and 21.9 km/h (13.6 mph) for the struck Buick. Respective longitudinal components were -28.6 km/h (-17.8 mph) and -7.5 km/h (-4.7 mph). The Collision Deformation Classification (CDC) for this impact to the Dodge was 12-FDEW-2 with a principal direction of force of (-)10 degrees. The CDC for this impact to the Buick was 02-RPEW-2 with a principal direction of force of (+)70 degrees. The Dodge Neon came to rest in the westbound lanes of the intersection facing northwest. At this point, the Buick began a clockwise rotation and traveled into the northwest sector of the intersection where the left side wheels impacted the barrier curb. The CDC for this impact to the Buick was 09-LDWW-1. This curb impact initiated a one quarter turn left side rollover (tripover) resulting in minor damage. The CDC for this third and final impact to the Buick was 00-LDAO-2. The Buick Regal came to rest (on its left side) in the northwest sector of the intersection facing north.

Post-Crash

The driver of the Dodge Neon exited the vehicle under her own power as the driver of the Buick Regal exited with some assistance from rescue personnel. Treatment was rendered at the scene by fire department personnel and emergency medical technicians (EMT). The driver of the Dodge was transported to a local hospital for treatment and released. The driver of the Buick complained of unspecified neck pain and was transported to a local hospital for an unknown level of treatment. Both vehicles were towed from the scene.

RABSS VEHICLE

The 1998 Dodge Neon was identified by the Vehicle Identification Number (VIN): 1B3ES47C0WD (production sequence deleted). The vehicle was a 4-door sedan equipped with front wheel drive and a 2.0 liter, 4 cylinder engine. The vehicle's odometer reading was 11,447 km (7,113 miles) at the time of the crash. The police report listed an unspecified individual (other than the driver) as the owner of the vehicle. The seating was configured with front bucket seats and a rear bench (with folding backs). The NASS researcher reported no cutoff switch for the redesigned passenger air bag. The driver

reported no previous crashes or maintenance on the Neon's air bag system (original equipment). There was no cell phone present or in use at the time of the collision.

VEHICLE DAMAGE

Exterior Damage

The Dodge Neon sustained moderate frontal damage as a result of the impact with the Buick Regal (**Figure 3**). The direct contact damage encompassed the full frontal width resulting in a combined direct and induced damage length (Field L) of 121.0 cm (47.6 in). Six crush measurements were documented at the level of the reinforcement bar (bumper cover separation): C1 = 8.0 cm (3.1 in), C2 = 13.0 cm (5.1 in), C3 = 21.0 cm (8.3 in), C4 = 24.0 cm (9.4 in), C5 = 26.0 cm (10.2 in), C6 = 29.0 cm (11.4 in). Damage was noted to the hood which was displaced up and rearward from engagement against the side surface of the Buick. Induced damage was identified at the right fender which restricted the right front door opening. The windshield was undamaged.



Figure 3. Frontal damage to the 1998 Dodge Neon.



Figure 4. Right side damage to the 1992 Buick Regal.

The Buick Regal sustained moderate right side damage as a result of the impact with the Dodge Neon (**Figure 4**). The direct contact damage began 63.0 cm (24.8 in) aft of the right front axle and extended rearward 168.0 cm (66.1 in). Damage was noted to both right side doors which were jammed with the tempered glazing disintegrated. Induced damage was identified at the right side pillars which were displaced laterally with associated buckling to the roof area. The right upper windshield area was fractured from exterior forces (only). Minor damage was documented to the left side wheels from the curb impact.

Interior Damage

Interior damage to the Dodge Neon identified through the NASS vehicle inspection was minimal and was attributed to occupant contact (**Figure 5**). A makeup transfer was documented on the upper left quadrant of the driver redesigned air bag. No loading was noted to the knee bolsters (rigid plastic type) or steering wheel rim (fixed column type). No intrusion of interior components were found in the vehicle.



Figure 5. Interior view of the 1998 Dodge Neon.

REDESIGNED AIR BAG SYSTEM

The 1998 Dodge Neon was equipped with redesigned frontal air bags for the driver and front right passenger positions. The air bags deployed as a result of the crash. Air bag warning labels were affixed to each front visor. The driver air bag was housed in the center of the steering wheel with a single cover flap design hinged at the top aspect of the hub. The asymmetrical flap opened in an upward direction and measured 20.0 cm (7.9 in) in width along the upper/lower portion, 23.0 cm (9.1 in) in width along the midline and 15.0 cm (5.9 in) in height. Although no

contact evidence was identified on the exterior surface of the module cover flap, a makeup transfer was documented at the upper left quadrant of the air bag. The NASS researcher measured the diameter of the driver air bag at 50.0 cm (19.7 in) in its deflated state (**Figure 6**). 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.

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. There was no contact evidence identified on the redesigned passenger air bag or exterior surface of the module cover flap. The cover flap was rectangular in shape and measured 35.0 cm (13.8 in) in width and 16.0 cm (6.3 in) in height. The NASS researcher measured the passenger air bag at 55.0 cm (21.7 in) in width and 54.0 cm (21.3 in) in height in its deflated state (**Figure 7**). No tether straps were present. The bag was vented by one port at the 12 o'clock sector on the rear aspect of the air bag.



Figure 6. 1998 Dodge Neon redesigned driver air bag.



Figure 7. 1998 Dodge Neon redesigned passenger air bag.

DRIVER DEMOGRAPHICS

Age/Sex:	28 year old female
Height:	155 cm (61 in)
Weight:	44 kg (97 lb)
Seat Track Position:	Mid-to-forward position
Manual Restraint Use:	3-point lap and shoulder belt system
Usage Source:	NASS vehicle inspection, driver interview, police report
Eyewear:	Contact lenses
Type of Medical Treatment:	Transported to a local hospital and released

Driver Injuries

<i>Injury</i>	<i>Severity (AIS 90)</i>	<i>Injury Mechanism</i>
Cervical spine strain	Minor (640278.1,6)	Non-contact injury (flexion)
Thoracic spine strain	Minor (640478.1,7)	Non-contact injury (flexion)

Driver Kinematics

The 28 year old female driver of the 1998 Dodge Neon was restrained by the available 3-point manual lap and shoulder belt system with the anchorage adjustment placed to the full down position. She was seated in an upright posture with the seat back slightly reclined and the seat track adjusted to the mid-to-forward position. The police report noted that she was belted, further evidenced by the lack of substantial interior contacts and injury. At impact, she initiated a forward trajectory in response to the 12 o'clock impact force and loaded the manual belt which restrained her body as the head flexed forward resulting in the cervical/thoracic strain. Her face contacted the fully deployed redesigned driver air bag as evidenced by the makeup transfers documented to the upper left quadrant of the air bag. No injuries were reported as a result of loading to the redesigned air bag which provided additional restraint against further contact to the steering wheel hub/rim. The driver was transported to a local hospital for treatment and released.

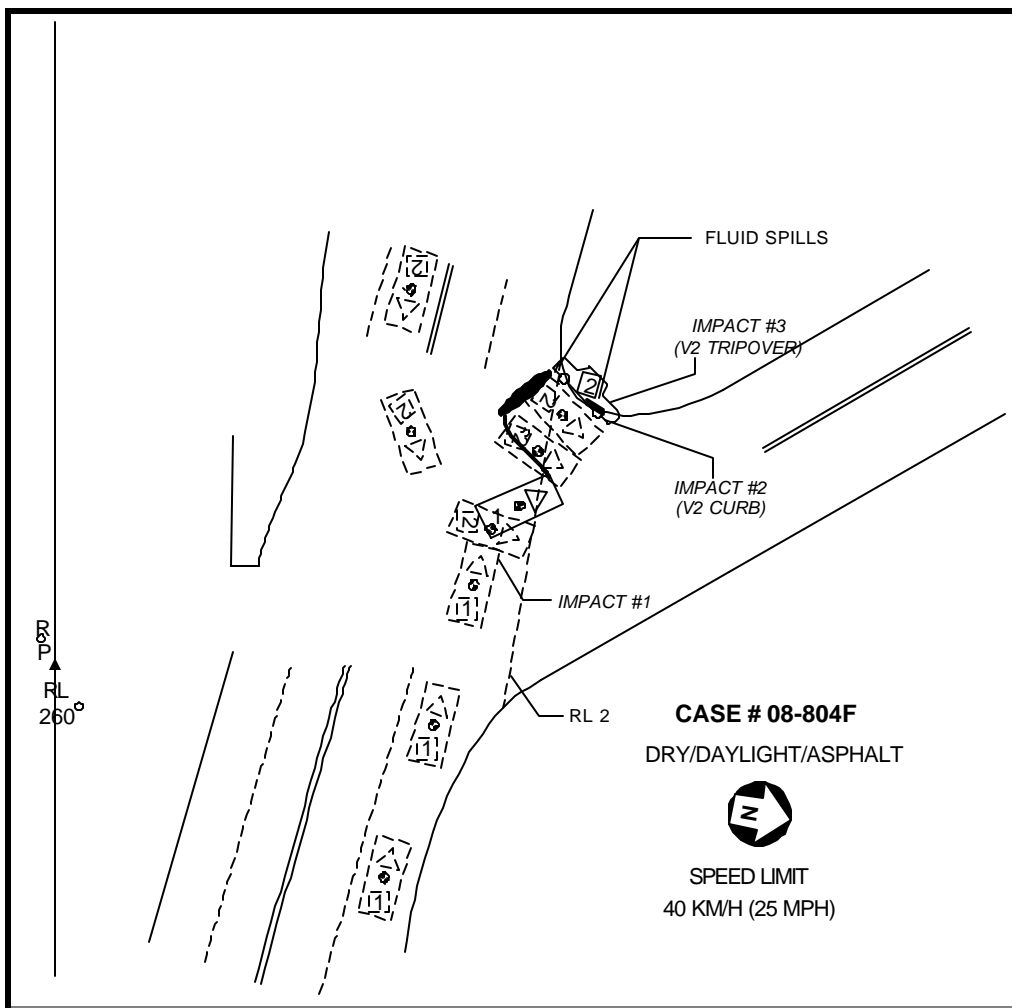


Figure 8. NASS Scene Diagram