

**TRANSPORTATION SCIENCES
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**REMOTE REDESIGNED AIR BAG DEPLOYMENT INVESTIGATION
SCI TECHNICAL SUMMARY REPORT**

VERIDIAN CASE NO. CA99- 030

RABSS VEHICLE -1998 DODGE NEON

LOCATION - STATE OF MASSACHUSETTS

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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16. <i>Abstract</i> This remote investigation focused on a two-vehicle crash involving a 1998 Dodge Neon 4-door sedan (subject vehicle) and a 1995 Ford Windstar minivan. The Dodge Neon was equipped with redesigned frontal air bags that deployed as a result of an oblique angle head-on collision. The driver of the Neon was operating the vehicle southbound on approach to a 3-leg intersection. She failed to detect the westbound Ford Windstar as she proceeded into the intersection and attempted to turn left. The vehicles impacted in an 11 o'clock/1 o'clock configuration and involved the entire frontal planes of both vehicles. The 36-year-old female driver of the Neon was restrained by the 3-point lap and shoulder belt system. She initiated a forward/lateral trajectory in response to the 11 o'clock impact force, loading the manual restraint, deployed redesigned driver's air bag, and steering column. She was transported by ambulance to a local hospital and pronounced dead on arrival. The 11-year-old female front right passenger of the Neon was also restrained by the 3-point lap and shoulder belt system and also initiated a forward/lateral trajectory. She loaded the manual restraint and deployed redesigned front right passenger's air bag, resulting in severe injuries. She was transported by helicopter to a local hospital for treatment and admitted for treatment. The 30-year-old female driver of the Ford Windstar was restrained by the 3-point lap and shoulder belt system and received minor visible injuries. The 2-year-old male rear passenger was restrained by a child restraint and safety belt, and received minor visible injuries. Both the driver and rear passenger of the Windstar were transported by ambulance to a local hospital where they were treated and released.			
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BACKGROUND

This remote investigation focused on a two-vehicle crash involving a 1998 Dodge Neon 4-door sedan (subject vehicle) and a 1995 Ford Windstar minivan. The Dodge Neon was equipped with redesigned frontal air bags that deployed as a result of an oblique angle head-on collision. The driver of the Neon was operating the vehicle southbound on approach to a 3-leg intersection. She failed to detect the westbound Ford Windstar as she proceeded into the intersection and attempted to turn left. The vehicles impacted in an 11 o'clock/1 o'clock configuration and involved the entire frontal planes of both vehicles. The 36-year-old female driver of the Neon was restrained by the 3-point lap and shoulder belt system. She initiated a forward/lateral trajectory in response to the 11 o'clock impact force, loading the manual restraint, deployed redesigned driver's air bag, and steering column. She was transported by ambulance to a local hospital and pronounced dead on arrival. The 11-year-old female front right passenger of the Neon was also restrained by the 3-point lap and shoulder belt system and also initiated a forward/lateral trajectory. She loaded the manual restraint and deployed redesigned front right passenger's air bag, resulting in severe injuries. She was transported by helicopter to a local hospital for treatment and admitted for treatment. The 30-year-old female driver of the Ford Windstar was restrained by the 3-point lap and shoulder belt system and received minor visible injuries. The 2-year-old male rear passenger was restrained by a child restraint and safety belt, and received minor visible injuries. Both the driver and rear passenger of the Windstar were transported by ambulance to a local hospital where they were treated and released.

This crash was identified through a search of the Fatality Analysis Reporting System (FARS) for fatalities that occurred in vehicles equipped with redesigned air bags. The crash occurred in October 1998 and was assigned to the Veridian Special Crash Investigation Team on September 2, 1999 as a remote investigation effort. Police photographs, reports and witness statements were obtained, which provided the basis for this narrative report.

SUMMARY

Crash Site

This two-vehicle crash occurred during the daylight hours of October 1998. At the time of the crash, it was daylight with no adverse conditions as the asphalt roads were dry. The crash occurred at an urban 3-leg (Y) intersection of two local roadways. The north/south roadway consisted of two travel lanes that were straight with a level grade. The east/west roadway also consisted of two travel lanes divided by solid double yellow lines. It was bordered on both sides by curbs and sidewalks. The north/south roadway intersected the east/west roadway at an approximate 150 degree angle. Intersection traffic control consisted of two triangular shaped channelizing islands. Traffic turning east was regulated by a "Do Not Enter" sign, which forced traffic to the right of the island. Traffic was required to stop prior to a left turn to access the

eastbound traffic lane. Traffic turning west was routed through a channel in the center island and controlled by a stop sign, forcing traffic to stop before turning right. Traffic entering the northbound travel lane from the westbound travel lane was uncontrolled. The roadside environment consisted of numerous commercial and residential properties.

Pre-Crash

The 36-year-old female driver of the Dodge Neon was operating the vehicle southbound at a high rate of speed on an approach to the 3-leg intersection (**Figure 1**) when the driver violated the “Do Not Enter” sign and traveled into the northbound travel lane, through the intersection and into the path of the Windstar. Her daughter, seated in the front right position, stated that it appeared the driver had suffered a seizure. The 30-year-old female driver of the Ford Windstar was operating the vehicle westbound on approach to the same intersection. There were no skid marks within either vehicle’s trajectory indicative of any driver avoidance maneuvers. The Neon was reported by police as traveling approximately 80-96 km/h (50-60 mph) prior to the crash.



Figure 1. Southbound approach for 1998 Dodge Neon

Crash

As the Dodge Neon entered the intersection, the entire frontal plane impacted the entire frontal plane of the Ford Windstar. Impact resulted in severe damage to both vehicles. The impact induced deceleration was sufficient to deploy the frontal air bag system in both vehicles. The damage algorithm of the WinSMASH program computed velocity changes of 57 km/h (35 mph) for the Neon, and 41 km/h (26 mph) for the Windstar based on the CDC values and estimated crush profiles. The principal direction of force was in the 11 o’clock sector for the Neon, and in the 1 o’clock sector for the Windstar. The Neon rotated counterclockwise (CCW) approximately 90 degrees and came to rest in the eastbound travel lane facing northeast. The Windstar rotated CCW approximately 90 degrees and came to rest in the westbound travel lane facing south.



Figure 2. Point of impact and final rest positions

Post-Crash

The occupants of the Dodge Neon and Ford Windstar were removed from the vehicle by rescue personnel. The driver of the Neon was transported by ambulance to a local hospital and pronounced dead on arrival. The front right passenger of the Neon was transported by helicopter to a local hospital for severe injuries and admitted for treatment. The driver and rear passenger of the Windstar were transported by ambulance to a local hospital for minor visible injuries where they were treated and released. Both vehicles were towed from the scene.

RABSS VEHICLE - 1998 Dodge Neon

The 1998 Dodge Neon was a 4-door sedan equipped with front wheel drive and a 2.0 liter, 4 cylinder engine. There was no VIN (Vehicle Identification Number) reported by the police for this vehicle. The police report listed the driver as the owner of the vehicle. The seating was configured with bucket seats with adjustable head restraints for the front, and a rear bench seat with a folding (60/40) back. The 3-point lap and shoulder belt system had adjustable D-rings for both front seating positions.

VEHICLE DAMAGE

Exterior Damage - 1998 Dodge Neon

The 1998 Dodge Neon sustained severe frontal damage as a result of the impact with the Ford Windstar (**Figure 3**). The Collision Deformation Classification (CDC) for the impact to the Neon was 11-FDEW-6. The direct contact damage began at the left bumper corner and extended approximately 150 cm (59") laterally across the entire frontal plane. The contact damage was concentrated mainly on the front of the vehicle forward of the passenger area. The hood and engine compartment were displaced rearward from engagement against the front of the Windstar. The windshield was cracked and out of place, and the left front window was shattered from impact forces. The left sill was buckled from the extensive crush. Both front wheels were restricted, and the left front tire was deflated. The right front wheel had separated from the axle. The right front door was sprung open from impact forces and displacement rearward. The left rear door was jammed and unable to be opened. The backlight was shattered from impact forces. Six crush measurements were estimated at the level of the bumper and were as follows: C1 = 112 cm (44"), C2 = 96 cm (38"), C3 = 82 cm (32"), C4 = 62 cm (24"), C5 = 36 cm (14"), C6 = 12 cm (5").

Interior Damage - 1998 Dodge Neon

Interior damage to the Dodge Neon was severe and attributed to exterior deformation and passenger compartment intrusion. Severe longitudinal component intrusion included the upper and lower instrument panel, toepan, and left A-pillar (**Figure 4**). The left side upper instrument panel and steering column were displaced vertically, most likely a combination of occupant loading and rescue efforts. The steering wheel hub/rim was deformed from occupant loading on the top and bottom aspects. Scuff marks were visible on the left knee bolster (rigid plastic type) and left aspect of the center console. The left knee bolster was cracked and out of place from probable occupant loading (**Figure 5**). The center instrument panel was also cracked and out of



Figure 3. Frontal damage to Dodge Neon



Figure 4. Interior damage to Dodge Neon



Figure 5. Knee bolster deformation in Dodge Neon

place due to the severe crush forces and resulting intrusion. The right upper instrument panel was displaced rearward and slightly lateral due to the extensive crush forces. The glove compartment door was displaced vertically into the upper instrument panel and surrounding plastic deformed from probable occupant loading.

Exterior Damage - 1995 Ford Windstar

The 1995 Ford Windstar sustained severe damage as a result of the impact with the 1998 Dodge Neon (**Figure 6**). The CDC for this impact to the Ford Windstar was 01-FDEW-5. The damage extended across the entire frontal plane. The windshield was crushed from impact forces. The sheet metal in the hood was separated from the hood frame and the front bumper was separated from the vehicle. The left A-pillar was displaced rearward and the roof buckled above the left front door. The left front wheel was restricted from the rearward displacement of the left fender.

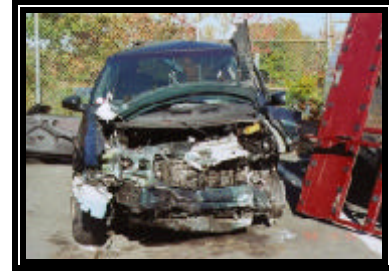


Figure 6. Frontal damage to 1995 Ford Windstar

REDESIGNED AIR BAG SYSTEM 1998 Dodge Neon

The 1998 Dodge Neon 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 impact with the Ford Windstar. Air bag warning labels were affixed to each sun visor. The driver's air bag was housed in the center of the steering wheel with a single cover flap design (**Figure 7**). No contact evidence was visible on the air bag or exterior surface of the module cover flap. The air bag was vented by two ports located at the 11 o'clock and 1 o'clock sectors on the rear aspect of the air bag. The air bag was tethered, evidenced by the circular stitching on the center of the air bag.



Figure 7. Dodge Neon driver's air bag

The front right passenger air bag deployed from the right upper-instrument panel area with a single cover flap design hinged at the top aspect (**Figure 8**). The module cover flap was rectangular in shape. No contact evidence was identified on the air bag or exterior surface of the module cover flap. It was not known if the air bag was tethered or vented by external ports.



Figure 8. Dodge Neon front right passenger's air bag

OCCUPANT DEMOGRAPHICS - 1998 Dodge Neon

Driver

Age/Sex:	36-year-old female
Height:	Not reported
Weight:	Not reported
Seat Track Position:	Mid-track (on-scene police photographs)
Manual Restraint Use:	3-point lap and shoulder belt
Usage Source:	Police report
Eyewear:	Not reported
Type of Medical Treatment:	Transported by ambulance to local hospital and pronounced dead on arrival

Driver Kinematics

Detailed injury data was not available from the police, and could not be obtained from other sources. The 36-year-old female driver of the 1998 Dodge Neon was presumed to be seated in an upright posture with seat track adjusted to the mid-track position. Police reported that she was restrained by the available 3-point manual lap and shoulder belt system.

At impact with the Ford Windstar, the redesigned frontal air bags deployed, and the driver initiated a forward and slightly lateral trajectory in response to the 11 o'clock impact force. She loaded the manual restraint system and deployed redesigned driver's air bag. There was gross intrusion of the front left interior components which significantly reduced the driver's compartment. Her forward trajectory and mid-track seat position combined with the intrusion into the driver's space allowed her to load the frontal components. She loaded the knee bolster, steering wheel/hub, loaded through the driver's air bag, and compressed the rim in a forward direction as a result of the severity of the crash and intrusion into the driver's space. Post-crash, the steering column was in the near vertical position. The driver was transported by ambulance to a local hospital, where she was pronounced dead on arrival.

Front Right Passenger

Age/Sex:	11-year-old female
Height:	Not reported
Weight:	Not reported
Seat Track Position:	Mid-track (on-scene police photographs)
Manual Restraint Use:	3-point lap and shoulder belt
Usage Source:	Police report
Eyewear:	Not reported
Type of Medical Treatment:	Transported by helicopter to local hospital with severe injuries and admitted for treatment

Front Right Passenger Kinematics

The 11-year-old female front right passenger of the Dodge Neon was presumed to be seated in an upright posture with the seat track adjusted to the mid-track position. She was restrained by the available 3-point manual lap and shoulder belt system. Restraint usage was reported by the police. At impact with the Ford Windstar, the redesigned frontal air bags deployed and she initiated a forward and slightly lateral trajectory in response to the 11 o'clock impact force. She loaded the manual restraint and the deployed redesigned front right passenger's air bag which offered additional protection from the frontal crash forces. Based on police on-scene photographs, she most likely loaded the lower instrument panel and glove compartment as evidenced by scuffs and displacement of the plastic components. She was transported by helicopter to a local hospital with unspecified severe injuries and admitted for treatment.