

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number ( 1999-76-082E)

1998 Dodge Neon

Arizona

July/1999

**Technical Report Documentation Page**

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<p>16. Abstract</p> <p>This remote investigation focused on the redesigned air bag system deployment of a 1998 Dodge Neon. This moderate injury crash occurred in July, 1999 in the late afternoon. The weather was clear and the bituminous roadways were dry. The crash occurred at the intersection of a two-lane undivided roadway and a five-lane undivided roadway. The two-lane road runs north-south and is controlled by a stop sign. The speed limit for north-south traffic is not known. The speed limit for east-west traffic is 56 km/h (35 mph).</p> <p>Vehicle 1, 1989 Ford compact pickup truck driven by a 20-year-old male, was initially stopped at the intersection facing south. Vehicle 2 (case vehicle), a 1998 Dodge Neon 4-door sedan driven by a restrained 49-year-old female (165 cm/65 in., 70 kg/154 lbs.), was traveling westbound approaching the intersection at a minimum travel speed of 39.4 km/h (24.5 mph). The front right seat was occupied by a restrained 13-year-old male (155 cm/61 in., 41 kg/90 lbs.). The rear left seat was occupied by a restrained 52-year-old male (173 cm/68 in., 75 kg/165). The rear middle seat was occupied by a restrained 9-year-old male (135 cm/53 in., 27 kg/60 lbs.). The rear right seat was occupied by a restrained 25-year-old male (170 cm/67 in., 66 kg/146 lbs.). As Vehicle 2 approached the intersection, Vehicle 1 pulled out from the stop at a speed estimated to be 16 km/h (10 mph). The driver of Vehicle 2 saw Vehicle 1 and began braking, leaving 9 m (30 ft) of locked wheel skids, but was unable to stop in time. The front of Vehicle 2 (01FDEW1) struck the right side of Vehicle 1. Vehicle 2 sustained a longitudinal delta v of -15.2 km/h (-9.4 mph). Both frontal air bags in Vehicle 2 deployed at this time. Vehicle 2 was pushed in a counterclockwise direction and came to rest in the intersection facing southeast. Vehicle 1 was pushed into a clockwise direction and came to rest in the intersection facing southeast.</p> <p>The driver of Vehicle 1 did not report any injuries. The driver of Vehicle 2 sustained abrasions to her face and both inner forearms; she also sustained contusions to the left shoulder, left wrist, and left knee. She was transported to a local hospital where she was treated and released. The front right occupant of Vehicle 2 sustained a minor abrasion to the tip of the nose and an upper lip laceration. He was treated at the scene by the responding ambulance unit. The rear left occupant of Vehicle 2 sustained contusions to the left chest and to the left side of his neck. His injuries were listed as "Incapacitating" by the police. He was complaining of chest pain, neck pain, and upper abdominal pain. He was transported by ground ambulance to a local hospital where he was treated and released. The rear middle occupant of Vehicle 2 sustained a contusion to the nose. He was treated at the scene. The rear right occupant did not sustain any injuries.</p>			
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**Summary**

This remote investigation focused on the redesigned air bag system deployment of a 1998 Dodge Neon. This moderate injury crash occurred in July, 1999 in the late afternoon. The weather was clear and the bituminous roadways were dry. The crash occurred at the intersection of a two-lane undivided roadway and a five-lane undivided roadway. The two-lane road runs north-south and is controlled by a stop sign. The speed limit for north-south traffic is not known. The speed limit for east-west traffic is 56 km/h (35 mph).

Vehicle 1, 1989 Ford compact pickup truck driven by a 20-year-old male, was initially stopped at the intersection facing south.



**Figure 1.** Left front quarter view of Vehicle 2 (Dodge Neon)

Vehicle 2 (case vehicle), a 1998 Dodge Neon 4-door sedan driven by a restrained 49-year-old female (165 cm/65 in., 70 kg/154 lbs.), was traveling westbound approaching the intersection at a minimum travel speed of 39.4 km/h (24.5 mph)<sup>1</sup>. The front right seat was occupied by a restrained 13-year-old male (155 cm/61 in., 41 kg/90 lbs.). The rear left seat was occupied by a restrained 52-year-old male (173 cm/68 in., 75 kg/165). The rear middle seat was occupied by a restrained 9-year-old male (135 cm/53 in., 27 kg/60 lbs.). The rear right seat was occupied by a restrained 25-year-old male (170 cm/67 in., 66 kg/146 lbs.).

**Crash Events**

As Vehicle 2 approached the intersection, Vehicle 1 pulled out from the stop at a speed estimated to be 16 km/h (10 mph)<sup>2</sup>. The driver of Vehicle 2 saw Vehicle 1 and began braking, leaving 9 m (30 ft) of locked wheel skids, but was unable to stop in time. The front of Vehicle 2 (01FDEW1) struck the right side of Vehicle 1. Vehicle 2 sustained a longitudinal delta v of -15.2 km/h (-9.4 mph). Both frontal air bags in Vehicle 2 deployed at this time.

Vehicle 2 was pushed in a counterclockwise direction and came to rest in the intersection facing southeast. Vehicle 1 was pushed into a clockwise direction and came to rest in the intersection facing southeast.

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<sup>1</sup>Minimum pre-braking travel speed based on pre-impact skids and delta v

<sup>2</sup>Calculated using acceleration rate of 4 ft/sec/sec

The driver of Vehicle 1 did not report any injuries.

The driver of Vehicle 2 sustained abrasions to her face and both inner forearms; she also sustained contusions to the left shoulder, left wrist, and left knee. She was transported to a local hospital where she was treated and released. The front right occupant of Vehicle 2 sustained a minor abrasion to the tip of the nose and an upper lip laceration. He was treated at the scene by the responding ambulance unit. The rear left occupant of Vehicle 2 sustained contusions to the left chest and to the left side of his neck. His injuries were listed as “Incapacitating” by the police. He was complaining of chest pain, neck pain, and upper abdominal pain. He was transported by ground ambulance to a local hospital where he was treated and released. The rear middle occupant of Vehicle 2 sustained a contusion to the nose. He was treated at the scene. The rear right occupant did not sustain any injuries.

**Table 1. Delta V**

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	16.2	10.1	15.7	9.8
Longitudinal	-15.2	-9.4	-5.4	-3.4
Lateral	-5.5	-3.4	-14.8	-9.2

**Exterior of Case Vehicle**

**Table 2. Vehicle Information**

Model year, make and model	1998 Dodge Neon
VIN	1B3ES47C9WDxxxxxx
CDC	01FDEW1



**Figure 2.** Exterior, Vehicle 1



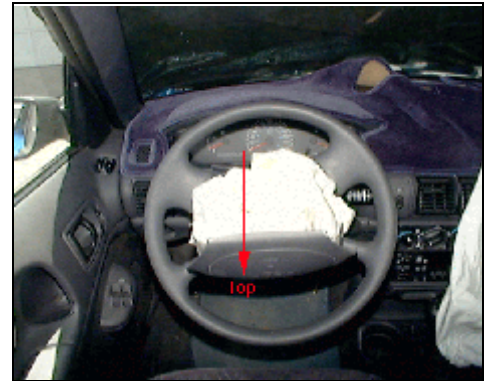
**Figure 3.** Right front quarter view of frontal damage

**Table 3. Crush Measurements**

Plane of Impact	Field L cm/in.	C1 cm/in.	C2 cm/in.	C3 cm/in.	C4 cm/in.	C5 cm/in.	C6 cm/in.
Bumper	158	0	4	4	4	4	9
	62.2	0	1.6	1.6	1.6	1.6	3.5

### *Interior of Case Vehicle*

The case vehicle was equipped with bucket seats with adjustable head restraints in the front left and front right seating positions. The front left seat was adjusted to the middle track position; the front right seat was adjusted to between the forward most and middle track position. The rear of the vehicle was equipped with split bench seats with folding backs with no head restraints in all three seating positions. There was no intrusion or integrity loss.



**Figure 4.** Driver's seated position

### *Case Vehicle Occupant Protection Systems*

The 1998 Dodge Neon four-door was equipped with driver and passenger frontal redesigned air bags. The driver's air bag was mounted in the steering wheel and was concealed by a single cover flap that was not damaged. The circular air bag was equipped with two tethers and two vent ports. No contact evidence was found on the air bag and the air bag was not damaged.



**Figure 5.** Module cover for driver's frontal air bag (picture has been rotated)

The passenger's frontal air bag was mounted in the top of the instrument panel. The rectangular air bag was equipped with a single vent port and had no tethers.



**Figure 6.** Front right passenger seated position

### *Case Vehicle Occupant Demographics*

	Occupant 1		Occupant 2		Occupant 3		Occupant 4		Occupant 5	
Age/Sex:	49/Female		13/Male		52/Male		9/Male		25/Male	
Seated Position:	Front left		Front right		Rear left		Rear middle		Rear right	
Seat Type:	Bucket		Bucket		Bench with folding back		Bench with folding back		Bench with folding back	
Height (cm/in.):	165	65	155	61	173	68	135	53	170	67
Weight (kg/lbs):	70	154	41	90.4	75	165	27	60	66	146
Pre-existing Medical Condition:	None noted		None noted		None noted		None noted		None noted	
Body Posture:	Normal, upright		Normal, upright		Normal, upright		Normal, upright		Normal, upright	
Hand Position:	Both hands on wheel (10-2 o'clock positions)		Unknown		Unknown		Unknown		Unknown	
Foot Position:	Right on brake, left on floor board		Unknown		On floor		On floor		On floor	
Restraint Usage:	Lap and shoulder belts used		Lap and shoulder belts used		Lap and shoulder belts used		Lap belt used		Lap and shoulder belts used	
Air bag:	Deployed		Deployed		NA		NA		NA	

## Occupant Injuries

**Table 4. Injuries**

Injury	Injury Severity (AIS)	Injury Mechanism
<u>Occupant 1</u>		
Abrasion, bridge of nose	1	Air bag
Contusion, left shoulder	1	Seat belt
Bilateral inner forearm abrasions	1	Air bag
Contusion, left knee	1	Left lower instrument panel / knee bolster
Contusion, left wrist	1	Left door
Abrasion, right elbow	1	Center console
<u>Occupant 2</u>		
Abrasion, bridge of nose	1	Air bag
Laceration, upper lip	1	Air bag
<u>Occupant 3</u>		
Contusion, left chest	1	Seat belt
Contusion, left neck	1	Seat belt
<u>Occupant 4</u>		
Contusion, nose	1	Seat back

## Occupant Kinematics

The driver of Vehicle 1 was seated in a normal, upright manner and was wearing the available lap and shoulder belt. Both hands were on the fixed column steering wheel. The driver's right foot was on the brake. The driver was wearing contact lenses and was also wearing sunglasses. The front left seat was adjusted to the middle track position. The front right occupant was seated in a normal, upright manner and was wearing the available lap and shoulder belt. The front right seat was adjusted to the between forward most and middle track position. The rear occupants were all seated in a normal, upright manner. The two outboard occupants were wearing the available lap and shoulder belts. The middle rear occupant was



**Figure 7.** Deployed driver's air bag

wearing the available lap belt.

Prior to impact, the driver began braking. All the occupants began shifting forward and loading the seat belts. At impact, the front left occupant pitched forward and to the right. The driver loaded the torso belt, causing the contusion to her left shoulder. As the driver slid forward, her left knee came into contact with the lower instrument panel. As the steering wheel mounted air bag deployed, the deploying air bag contacted both inner forearms, causing minor abrasions. The driver's arms were flung outward and the left wrist contacted the interior door surface and the right elbow contacted the center console. As the driver pitched forward into the deploying air bag, her face contacted the air bag causing her eyeglasses to interact with air bag and causing an abrasion to the bridge of her nose.



**Figure 8.** Deployed passenger's frontal air bag

The front right occupant pitched forward to some degree in response to vehicle braking. At impact, his face came into contact with the deploying air bag, causing an abrasion to the nose and a lip laceration.

The rear left occupant pitched forward to some degree in response to vehicle braking. At impact, he loaded the torso belt, causing a neck contusion. This occupant also sustained a contusion to the left side of the chest; this contact is also likely related to seat belt loading.

The rear middle occupant pitched forward about the lap belt during both the pre-impact braking and at impact. According to the interviewee, he contacted the seat back with his nose, causing a nose contusion.

The right rear occupant did not sustain any injuries.



*Scene Diagram*

