Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1999-075-132K)

1998 Dodge Neon

Colorado

September/1999

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16. Abstract

This remote investigation focused on the redesigned air bag system deployment of a 1998 Dodge Neon 4-door sedan. This serious injury crash occurred in September, 1999 in the morning. The weather was clear and the bituminous roadway was dry. The crash occurred in a four-leg intersection. The eastbound leg of the intersection is a two-way divided roadway and is comprised of eight travel lanes; one eastbound right-turn lane, three eastbound thru-lanes, one eastbound left-turn lane, and three westbound lanes. Eastbound traffic is separated from westbound traffic by a raised concrete median strip. The speed limit for this road is 56 km/h (35 mph). It is controlled by overhead traffic signals. There was a >2% eastbound downhill grade at this location. The westbound leg of the intersection is a two-way divided roadway and is comprised of seven travel lanes; three westbound thru-lanes, one westbound left-turn lane, and three eastbound lanes. Westbound traffic is separated from eastbound traffic by a raised concrete median strip. The speed limit for this road is 56 km/h (35 mph). It is controlled by overhead traffic signals. There was a >2% westbound uphill grade at this location. Vehicle 1, a 1989 Chevrolet Celebrity 4-door sedan driven by an unrestrained 40 year old female, was traveling east in the eastbound left-turn lane approaching the intersection at a police estimated speed of 24 km/h (15 mph). The driver was preparing to make a left turn at the intersection. The overhead traffic signal was in the green phase at this time. There were no other occupants in Vehicle 1. Vehicle 2, a 1998 Dodge Neon 4-door sedan (case vehicle) driven by a 63 year old female (163 cm/64 in, 58 kg/127 lbs), was traveling west in westbound lane three approaching the intersection at a police estimated speed of 56 km/h (35 mph). The driver was preparing to travel straight through the intersection. The overhead traffic signal was in the green phase at this time. The driver was restrained by the available manual lap and shoulder restraint at the time. There were no other occupants in Vehicle 2. The driver of Vehicle 1 initiated the left turn in the path of Vehicle 2 and was struck. The front plane of Vehicle 1 (81FDEW3) struck the front plane of Vehicle 2 (11FYAW6) in the intersection. Both vehicles came to rest in the center of the intersection next to each other facing northwest. A Delta V was calculated for Vehicle 2, utilizing the Damage Only Algorithm of WinSMASH, as 35 km/h (22 mph). As a result of the frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed. The driver of Vehicle 1 was transported from the scene to a trauma center where she was hospitalized for six days. The driver of Vehicle 2 was transported from the scene to a trauma center where she was treated and released. Both vehicles were disabled due to damage sustained in the crash and were towed from the scene.

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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1998 Dodge Neon 4-door sedan. This serious injury crash occurred in September, 1999 in the morning. The weather was clear and the bituminous roadway was dry. The crash occurred in a four-leg intersection. The eastbound leg of the intersection is a two-way divided roadway and is comprised of eight travel lanes; one eastbound right-turn lane, three eastbound thru-lanes, one eastbound left-turn lane, and three westbound lanes. Eastbound traffic is separated from westbound traffic by a raised concrete median strip. The speed limit for this road is 56 km/h (35 mph). It is controlled by overhead traffic signals. There was a >2% eastbound downhill grade at this location. The westbound leg of the intersection is a two-way divided roadway and is comprised of seven travel lanes; three westbound thru-lanes, one westbound left-turn lane, and three eastbound lanes. Westbound traffic is separated from eastbound traffic by a raised concrete median strip. The speed limit for this road is 56 km/h (35 mph). It is controlled by overhead traffic signals. There was a >2% westbound uphill grade at this location.

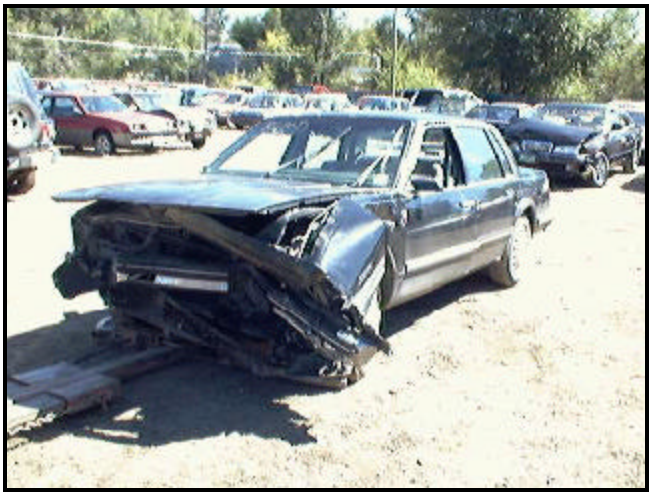

Figure 1. Exterior, Vehicle 1 (Chevrolet Celebrity)

Figure 2. Exterior, Vehicle 2 (Dodge Neon)

Vehicle 1, a 1989 Chevrolet Celebrity 4-door sedan driven by an unrestrained 40 year old female, was traveling east in the eastbound left-turn lane approaching the intersection at a police estimated speed of 24 km/h (15 mph). The driver was preparing to make a left turn at the intersection. The overhead traffic signal was in the green phase at this time. There were no other occupants in Vehicle 1.

Vehicle 2, a 1998 Dodge Neon 4-door sedan (case vehicle) driven by a 63 year old female (163 cm/64 in, 58 kg/127 lbs), was traveling west in westbound lane three approaching the intersection at a police estimated speed of 56 km/h (35 mph). The driver was preparing to travel straight through the intersection. The overhead traffic signal was in the green phase at this time. The driver was restrained by the available manual lap and shoulder restraint at the time. There were no other occupants in Vehicle 2.

Crash Events

The driver was preparing to make a left turn at the intersection. The overhead traffic signal was in the green phase at this time. There were no other occupants in Vehicle 1. Vehicle 2, a 1998 Dodge Neon 4-door sedan (case vehicle) driven by a 63 year old female (163 cm/64 in, 58 kg/127 lbs), was traveling west in westbound lane three approaching the intersection at a police estimated speed of 56 km/h (35 mph). The driver was preparing to travel straight through the intersection. The overhead traffic signal was in the green phase at this time. The driver was restrained by the available manual lap and shoulder restraint at the time. There were no other occupants in Vehicle 2. The driver of Vehicle 1 initiated the left turn in the path of Vehicle 2 and was struck. The front plane of Vehicle 1 (81FDEW3) struck the front plane of Vehicle 2 (11FYAW6) in the intersection. Both vehicles came to rest in the center of the intersection next to each other facing northwest.

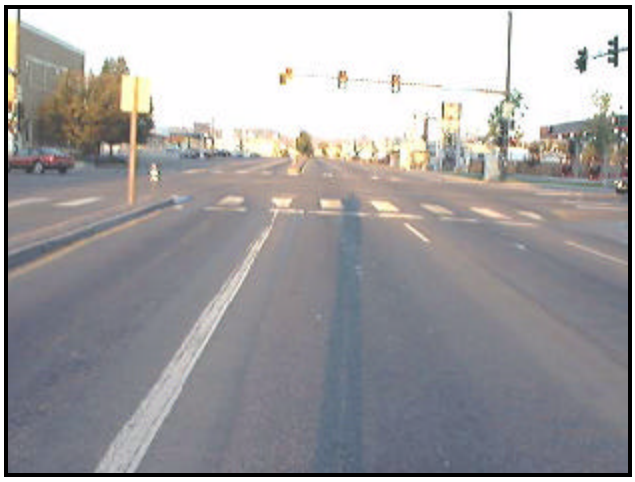

Figure 3. Crash scene. Vehicle 2 approach path.

A Delta V was calculated for Vehicle 2, utilizing the Damage Only Algorithm of WinSMASH, as 35 km/h (22 mph).

As a result of the frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed.

The driver of Vehicle 1 was transported from the scene to a trauma center where she was hospitalized for six days. The driver of Vehicle 2 was transported from the scene to a trauma center where she was treated and released.

Both vehicles were disabled due to damage sustained in the crash and were towed from the scene.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	35	21.7	29	18
Longitudinal	-32	-19.9	-22	-13.7
Lateral	12	7.5	-19	-11.8
Barrier speed	21	13	35	21.7

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Dodge Neon
VIN	1B3ES47C9WD
CDC	11FYAW6

Figure 4. Exterior, Vehicle 2 (1998 Dodge Neon 4-door sedan)

Figure 5. Exterior, Vehicle 2 (1998 Dodge Neon 4-door sedan)

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	131	21	19	15	11	2	0
	51.6	8.3	7.5	5.9	4.3	0.8	0

Interior of Case Vehicle

The interior of the Dodge Neon sustained minor damage from occupant contact. There was a minimal amount of intrusion of the A-pillar and windshield in the front left section of the vehicle. The intruded values are reported in Table 4. There was occupant contact evidence present to the windshield and driver's frontal air bag.

Table 4. Intrusions

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
A-pillar	Front-left	2	0.8	Longitudinal
Windshield	Front-left	1	0.4	Longitudinal

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 forward most track position. The front right seat was adjusted to the rear most track position. The rear of the vehicle was equipped with bench seats with folding backs in all three seating positions. The outboard rear seats were equipped with integral head restraints while the center rear seat was not equipped with a head restraint system.

Case Vehicle Occupant Protection Systems

The Dodge Neon 4-door sedan was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units.

The front left air bag was housed in the steering wheel hub and was concealed by a single hexagonal shaped cover flap which was not damaged in the crash. The circular air bag was equipped with one tether strap and two vent ports. No contact evidence was found on the air bag and the bag was not damaged.

Figure 6. Passenger's frontal air bag damage.

The front right air bag was housed in the mid-instrument panel position and was concealed by a single rectangular cover flap which was not damaged in the crash. The rectangular air bag was equipped with one vent port and no tether straps. No contact evidence was found on the bag but a large tear was evident to the top half of the back of the bag from an unspecified source.

Case Vehicle Occupant Demographics

Table 5. Case Vehicle Occupant(s) Demographics

	Occupant 1
Age/Sex:	63/Female
Seated Position:	Front-left
Seat Type:	Bucket - cloth covered
Height (cm/in:):	163 64
Weight (kg/lbs).:	58 127
Pre-existing Medical Condition:	None noted
Body Posture:	Normal - upright facing forward, not bracing
Hand Position:	On steering wheel at 10 and 2 o'clock positions
Foot Position:	On floor or foot controls
Restraint Usage:	Manual lap and shoulder restraint
Air bag:	Deployed redesigned air bag system

Occupant Injuries

Table 6. Case Vehicle Occupant(s) Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Left radius fracture	3	Windshield
Left arm skin contusion	1	Windshield
Right knee skin contusion	1	Knee bolster
Left chest skin contusion	1	Driver's air bag
Facial skin contusion	1	Driver's air bag
Left knee skin contusion	1	Knee bolster

Occupant Kinematics

The driver (case occupant) of the Dodge Neon was seated in a normal upright posture in the front left position of the vehicle. She was wearing the manual lap and shoulder restraint. Seat belt usage was determined through visual inspection by the researcher, the lack of prominent frontal contact evidence in the vehicle, and observations by the investigating police officer at the scene of the crash. The driver reported that no pre-impact avoidance maneuvers were performed.

At impact, the case occupant responded to the 340 degree principle direction of force by moving forward and to the left, loading the lap/shoulder restraints. As the restraints locked, further forward movement of the case occupant was prevented. Due to sitting at the seat's forward most track position, the driver's knees struck the knee bolster-causing left and right knee skin contusions. The driver engaged the deploying driver's frontal air bag-causing facial and chest skin contusions. As the bag deployed, the driver's left arm was projected upward into the windshield-causing the left radius fracture and left arm skin contusion (see Figure 7). The case occupant was transported from the scene to a trauma center where she was treated and released.

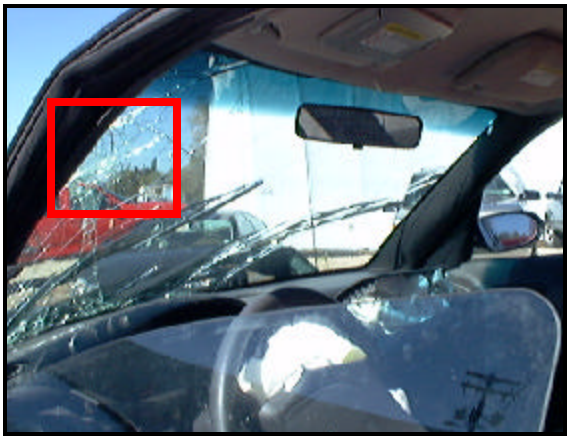

Figure 7. Interior, case vehicle. Box shows location of left arm contact.

Scene Diagram