Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-073-111J)

1998 Dodge Caravan

Indiana

September/1998

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16. Abstract

This remote investigation focused on the redesigned air bag system deployment in a 1998 Dodge Caravan minivan. This minor injury crash occurred in September, 1998 in the afternoon. The weather was clear and the bituminous roadway was dry. The crash occurred on a two lane, undivided, straight and level roadway. The road is comprised of one northbound and one southbound travel lane. The speed limit for this road is 48 kmph (30 mph). There are no traffic controls at the area of impact. Vehicle 1, a 1997 Chrysler Concorde 4-door sedan driven by a 72 year old male (175cm/ 69 in, 70 kg/ 155 lb), was traveling north in the northbound travel lane preparing to make a left turn into a private driveway. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 1. Vehicle 2, a 1998 Dodge Caravan minivan (case vehicle) driven by a 42 year old male (183 cm/72 in, 95 kg/210 lb), was traveling south in the southbound travel lane at a driver estimated speed of 40 kmph (25 mph) approaching Vehicle 1. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in the case vehicle. The driver of Vehicle 1 initiated the left turn across the path of Vehicle 2. The driver of Vehicle 2 tried to avoid the collision by applying the brakes (with lock-up), but was unsuccessful. The front plane of Vehicle 2 (12FZEW3) struck the right plane of Vehicle 1 (02RYEW3) in the southbound travel lane. Vehicle 1 slid across the driveway after impact and came to rest on the west roadside facing west. Vehicle 2 came to rest in the southbound lane just past the area of impact facing south. A Delta V was calculated for this impact for Vehicle 1, utilizing WinSMASH, as 24.4 kmph (15.2 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 local hospital where he was hospitalized. The driver of Vehicle 2 sustained minor injuries but was not transported for medical attention. The driver sought treatment from a private physician at a later time. Both vehicles became disabled due to damage sustained in the crash and were towed from the scene.

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Summary

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Vehicle 1, a 1997 Chrysler Concorde 4-door sedan driven by a 72 year old male (175cm/ 69 in, 70 kg/ 155 lb), was traveling north in the northbound travel lane preparing to make a left turn into a private driveway. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 1.

Vehicle 2, a 1998 Dodge Caravan minivan (case vehicle) driven by a 42 year old male (183 cm/72 in, 95 kg/210 lb), was traveling south in the southbound travel lane at a driver estimated speed of 40 kmph (25 mph) approaching Vehicle 1. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in the case vehicle.

Figure 1. Exterior, Vehicle 1 (Chrysler Concorde)

Figure 2. Exterior, Vehicle 2 (Dodge Caravan)

Crash Events

The driver of Vehicle 1 initiated the left turn across the path of Vehicle 2. The driver of Vehicle 2 tried to avoid the collision by applying the brakes (with lock-up), but was unsuccessful. The front plane of Vehicle 2 (12FZEW3) struck the right plane of Vehicle 1 (02RYEW3) in the southbound travel lane.

Vehicle 1 slid across the driveway after impact and came to rest on the west roadside facing west. Vehicle 2 came to rest in the southbound lane just past the area of impact facing south.

A Delta V was calculated for this impact for Vehicle 1, utilizing WinSMASH, as 24.4 kmph (15.2 mph).

Figure 3. Crash scene, Vehicle 2 approach to impact.

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 local hospital where he was hospitalized. The driver of Vehicle 2 sustained minor injuries but was not transported for medical attention. The driver sought treatment from a private physician at a later time.

Both vehicles became 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	24.4	15.2	28.4	17.6
Longitudinal	-24.0	-14.9	-14.2	-8.8
Lateral	4.2	2.6	-24.6	-15.3
Barrier speed	29.0	18	23.5	14.6

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Dodge Caravan
VIN	1B4GP44G8WB
CDC	12FZEW3

Figure 4. Exterior, Vehicle 2 (1998 Dodge Caravan)

Figure 5. Exterior, Vehicle 2 (1998 Dodge Caravan)

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	153	5	10	15	24	30	43
	60.2	2	3.9	5.9	9.4	11.8	16.9

Interior of Case Vehicle

The interior of the Dodge Caravan sustained minor damage from passenger compartment intrusion. There was a moderate amount of intrusion of the toe pan on the right side of the vehicle. The intruded values are reported in Table 4. There was occupant contact evidence to the driver side air bag only.

The case vehicle was equipped with box mounted (van type) seats in the front left and front right seating positions. The front left seat was adjusted between the middle and rear most track positions. The front right seat was not adjustable. Both front seats were equipped with integral head restraints which were not damaged. The second and third rows of the vehicle were equipped with bench seats with folding backs with adjustable head restraints in the outboard seating positions.

Table 4. Intrusions

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Toe pan	Front right	10	3.9	Longitudinal

Case Vehicle Occupant Protection Systems

The Dodge Caravan minivan 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 rectangular shaped cover flap which was not damaged. The circular air bag was equipped with two tether straps and no vent ports. The bag was not damaged in the crash.

Figure 6. Interior, case vehicle. Driver side air bag.

The front right air bag was housed in the mid-instrument panel position. The cover flaps were in the shape of a bisected rectangle and were not damaged. The rectangular air bag was not equipped with tether straps or vent ports. The air bag was not damaged in the crash.

Case Vehicle Occupant Demographics

Table 5. Case Vehicle Occupant Demographics

	Occupant 1	
Age/Sex:	42/Male	
Seated Position:	Front left	
Seat Type:	Box mounted van type - cloth covered	
Height (cm/in:):	183	72
Weight (kg/lbs).:	95	210
Pre-existing Medical Condition:	None noted	
Body Posture:	Normal, upright facing forward	
Hand Position:	Both on steering wheel	
Foot Position:	On floor or foot controls	
Restraint Usage:	Manual lap & shoulder restraint	
Air bag:	Deployed redesigned air bag system	

Occupant Injuries

Table 6. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Chest contusion	1	Shoulder belt
Bilateral wrist abrasions	1	Air bag
Toe fracture, right foot	1	Foot controls

Occupant Kinematics

The driver (case occupant) of the Dodge Caravan was seated in a normal upright posture in the front left position of the vehicle. He was wearing the manual lap/shoulder restraint. Seat belt usage was determined by visual inspection by the researcher, examination of injury patterns, and the lack of frontal contact evidence in the vehicle. The driver reported that prior to impact he applied the brakes (with lock-up) which caused him to move forward and load the lap/shoulder restraint.

At impact, the case occupant reacted to the 350 degree principle direction of force by sharply loading the locked shoulder belt-causing the chest contusion. As the air bag inflated, the outer edges struck the inside of the driver's arms-causing the bilateral wrist contusions. The case occupant fractured a toe on his right foot while applying hard pressure to the brake pedal in an attempt to avoid the collision. The occupant was not transported from the scene but later visited a private physician for medical treatment.

Figure 7. Interior, case vehicle

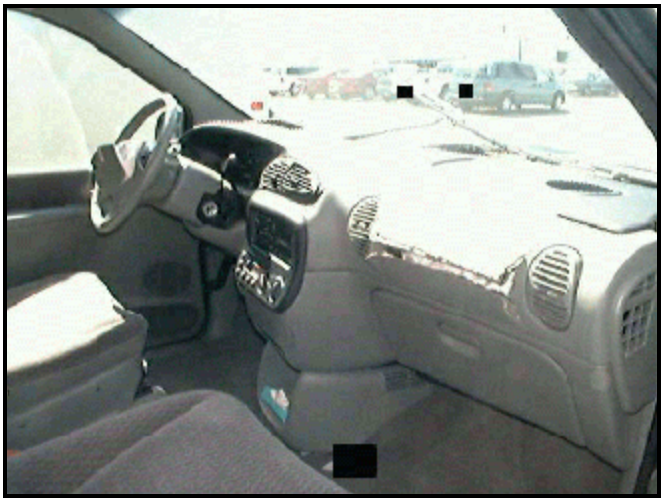
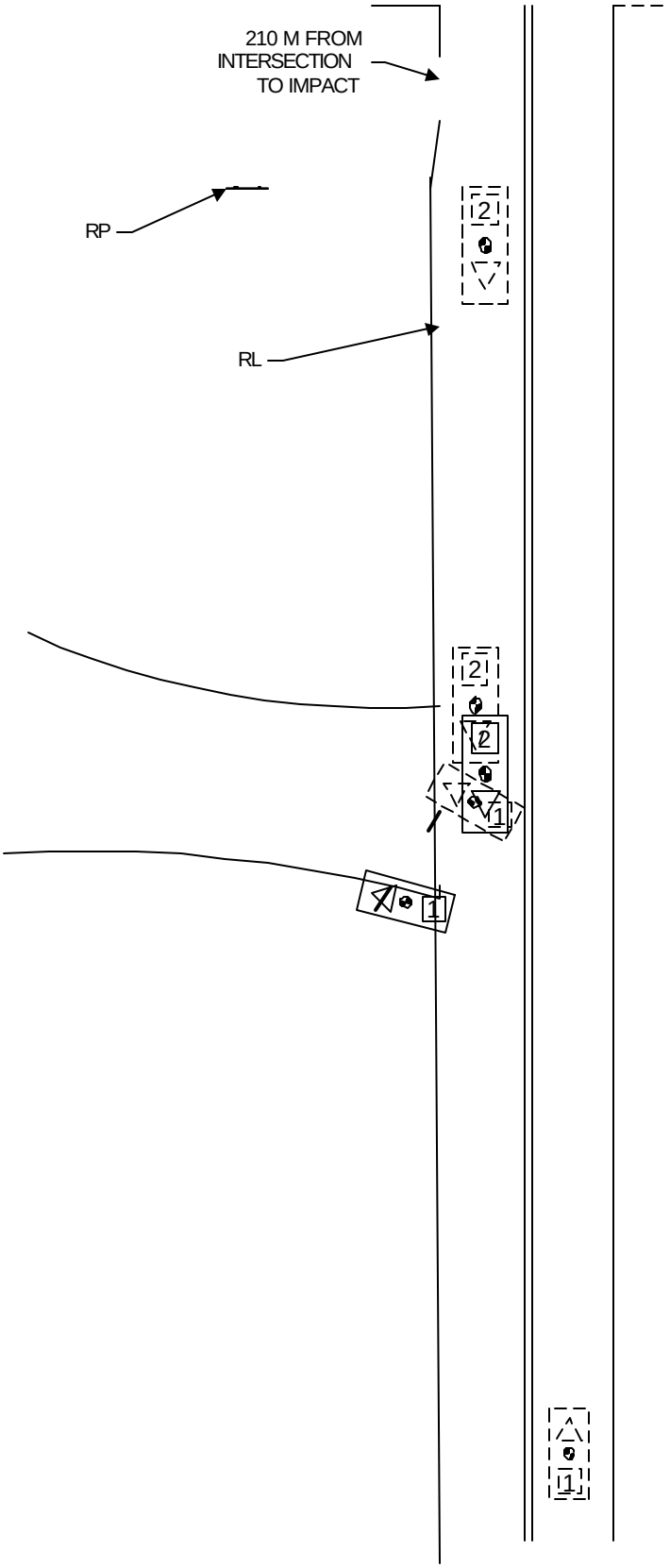


Figure 8. Interior, case vehicle

Scene Diagram



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PSU 73 CASE 111 J

SCALE 1CM = 2.5M

CONDITIONS:

ASPHALT
DAYLIGHT
DRY