

On-Scene / Vehicle to Vehicle / Front to Left Side
Dynamic Science, Inc. / Case Number: DS97001
1995 Dodge Caravan
Colorado
January, 1997

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be 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.

1. Report No. DS97001		2. Government Accession No.		3. Recipient Catalog No.	
4. Title and Subtitle In-Depth Accident Investigation				5. Report Date February/1998	
				6. Performing Organization Report No.	
7. Author(s) Dynamic Science, Inc.				8. Performing Organization Report No.	
9. Performing Organization name and Address Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401				10. Work Unit No. (TRAVIS)	
				11. Contract or Grant no. DTNH22-94-D-27058	
12. Sponsoring Agency Name and Address U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590				13. Type of report and period Covered [Report Month, Year]	
				14. Sponsoring Agency Code	
15. Supplemental Notes					
16. Abstract <p>This collision occurred at 1318 hours in the state of Colorado. At the area of impact, the roadway was a four-leg intersection that was controlled by standard tri-signals. Vehicle 1, a 1995 Dodge Caravan van driven by a 25-year-old female, was traveling northbound approaching a four-leg intersection. The right front seat was occupied by a properly restrained 7-year-old male. The second left seat was occupied by a 4-year-old male restrained in an unknown booster child seat. Vehicle 2, a 1986 Oldsmobile Cutlass Cierra LS 4-door driven by an unrestrained 58-year-old female, was initially traveling westbound, and attempting a left turn to head south.</p> <p>Vehicle 2 was in the middle of the intersection attempting the left turn when the front of Vehicle 1 struck its left side. On impact, the longitudinal forces exceeded the threshold of the air bag system and both air bags in Vehicle 1 deployed. Vehicle 1 rotated approximately 95 degrees in a counterclockwise direction and came to rest facing west approximately 4.6 m (15 ft) north and 2.4 m (8 ft) west of the impact. Vehicle 2 initially rotated in a clockwise direction and then counterclockwise, and came to rest facing west approximately 12.5 m (41 ft) north and 1 m (3 ft) west of the impact.</p> <p>The right front occupant was seated in an upright position with the lap and shoulder restraints properly worn. The small laceration to the right side of his neck and the blood stains on the lap and shoulder belts are clear indications that the restraints were used and that he had come to rest slumped over the restraints in the center of the seat. The driver asserts that the right front occupant was in a normal seated position and that he is very attentive to properly wearing the lap and shoulder restraints. Paramedics arrived on the scene and noted that he was unconscious. The mother stated that he was conscious for about thirty seconds after the collision, and then lost consciousness. Later, as first aid was being given, the right front occupant became combative, and was posturing. He was transported from the scene via helicopter to a local hospital. His Glasgow coma score on arrival was 8, and he was medically paralyzed. His injuries consisted of blunt head trauma, which was considered life threatening. He had a concussion with memory loss. There were superficial burns, and abrasions to his chin, nose, and lips as a result of contact with the air bag. The contact with the air bag caused an excessive nose bleed, which was the blood that was on the air bag and seat belts. He had a small laceration to the right side of his neck, which was caused by the shoulder belt. He was hospitalized for seven days and during that time he was confused and unable to speak. After his release from the hospital, he has been on intensive speech and motor skills therapy.</p> <p>There were no injuries to the 4-year-old male second left seat occupant. He was restrained in an unknown booster child seat.</p>					
17. Key Words Air bag, deployment, child, head injury, collision			18. Distribution Statement		
19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price		

**Dynamic Science, Inc.
Accident Investigation
Case Number: DS97001**

TABLE OF CONTENTS

Background	1
Description	1
Investigation Type	1
Crash Location	1
Crash Date	1
Notification Date	1
Field Work Completed	1
Summary	1
Scene Diagram	4
Detailed Information	5
Vehicles	5
Occupants	8
Injuries and Injury Mechanisms	11
Occupant Kinematics	13
Photo Index	14

BACKGROUND:

Description: This case was initiated in response to a report of air bag-related serious head injuries to a child who was properly wearing the lap and shoulder restraints in the right front passenger seat.

Vehicle 1, was a 1995 Dodge Caravan van driven by a 25-year-old female. The right front seat was occupied by a properly restrained 7-year-old male. The second left seat was occupied by a 4-year-old male restrained in an unknown booster child seat. Vehicle 2, was a 1986 Oldsmobile Cutlass 4-door driven by an unrestrained 58-year-old female.

Investigation Type: On-Scene, the case vehicle was inspected by a NASS investigator.

Crash Location: Colorado

Crash Date: January, 1997

Notification Date: February 27, 1997

Field Work Completed: March 15, 1997

SUMMARY:

This collision occurred at 1318 hours in the state of Colorado. The weather was clear and the bituminous roadway had snow/slush on it. At the area of impact, the roadway was a four-leg intersection that was controlled by standard tri-signals.

Vehicle 1, a 1995 Dodge Caravan van driven by a 25-year-old female (183 cm/72 in, 57 kg/125 lb), was traveling northbound approaching a four-leg intersection. The right front seat was occupied by a properly restrained 7-year-old male (very tall, approximately 27 kg/60 lb). The second left seat was occupied by a 4-year-old male (approximately 16 kg/35 lb) restrained in an unknown booster child seat. Vehicle 2, a 1986 Oldsmobile Cutlass Cierra LS 4-door driven by an unrestrained 58-year-old female, was initially traveling westbound, and attempting a left turn to head south.

The driver of Vehicle 1 became distracted by the activity of the child in the second seat behind her. She did not turn to speak to him, as is stated in the police report since he was directly behind her, but rather the driver spoke back towards him. She remembers seeing that the tri-signal was green, witnesses however stated that she entered the intersection on a red light. The driver of Vehicle 1 has little recollection of the collision, but she is sure she did not brake or steer away from the collision. Vehicle 2 was in the middle of the intersection attempting the left turn when the front of Vehicle 1

struck its left side. On impact, the longitudinal forces exceeded the threshold of the air bag system and both air bags in Vehicle 1 deployed.

Vehicle 1 rotated approximately 95 degrees in a counterclockwise direction and came to rest facing west approximately 4.6 m (15 ft) north and 2.4 m (8 ft) west of the impact. Vehicle 2 initially rotated in a clockwise direction and then counterclockwise, and came to rest facing west approximately 12.5 m (41 ft) north and 1 m (3 ft) west of the impact.

The driver of Vehicle 1 sustained abrasions about her face, nose, and chin as a result of contact with the air bag. There was a lipstick imprint on the air bag. She sustained a small laceration to the left side of her neck caused by the shoulder belt. She sustained a paravertebral strain, and the driver stated that she had sustained a concussion with memory loss which was not verified by CT scan. The driver was transported via ambulance to a local hospital for ER treatment and released.

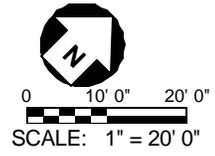
The right front occupant was seated in an upright position with the lap and shoulder restraints properly worn. The small laceration to the right side of his neck and the blood stains on the lap and shoulder belts are clear indications that the restraints were used and that he had come to rest slumped over the restraints in the center of the seat. The driver asserts that the right front occupant was in a normal seated position and that he is very attentive to properly wearing the lap and shoulder restraints. Paramedics arrived on the scene and noted that he was unconscious. The mother stated that he was conscious for about thirty seconds after the collision, and then lost consciousness. Later, as first aid was being given, the right front occupant became combative, and was posturing. He was transported from the scene via helicopter to a local hospital. His Glasgow coma score on arrival was 8, and he was medically paralyzed. His injuries consisted of blunt head trauma, which was considered life threatening. He had a concussion with memory loss. There were superficial burns, and abrasions to his chin, nose, and lips as a result of contact with the air bag. The contact with the air bag caused an excessive nose bleed, which was the blood that was on the air bag and seat belts. He had a small laceration to the right side of his neck, which was caused by the shoulder belt webbing. He was hospitalized for seven days and during that time he was confused and unable to speak. After his release from the hospital, he has been on intensive speech and motor skills therapy.

There were no injuries to the 4-year-old male second left seat occupant. He was restrained in an unknown booster child seat.

The police report indicated that the driver of Vehicle 2 was not wearing the

lap and shoulder restraints. She sustained a long scalp laceration and a fractured left pelvis. She was transported via ambulance to the hospital.

DS9701



Vehicle 2, 1986
Oldsmobile Cutlass
4-door

V2 final rest

V1 final rest

V2

V1

Vehicle 1, 1995
Dodge Caravan



DETAILED INFORMATION

Vehicles

Vehicle 1

Description:	1995 Dodge Caravan van	
VIN:	2B4GH45RXXSRXXXXXX	
Odometer:	29,5888 km (18,386 mi)	
Engine:	3.3 L V6	
Reported Defects:	None	
Cargo:	None	
Damage Description:	Moderate damage across the front bumper, hood, grille area, left front quarter panel, and the windshield (see Figure 1).	
CDC:	12FDEW1	
Delta V: ¹	Total	16.7 km/h (10.4 mph)
	Longitudinal	-16.4 km/h (-10.2 mph)
	Latitudinal	-2.9 km/h (-1.8 mph)
	Energy	19,057 joules (14,065 ft-lbs)



Figure 1. Exterior damage to Vehicle 1.

¹WinSmash damage only run

This vehicle is equipped with three rows of seats. The front seats are both bucket seats, and the driver's seat was adjusted to the rear most seat track position (10 notches rearward) and the seatback was upright. The right front seat was adjusted to the rear most seat track position (ten notches rearward) and the seatback was upright. The second row seats are both bucket seats which are not adjustable, and the seatbacks were both upright. The third row seat was a bench type.

Vehicle 1 was equipped with factory installed driver's and right front side air bags. The driver's air bag measured approximately 55 cm (21.7 in) in diameter, and had eight folds across that were 7.5 cm (3.0 in) apart. The driver's side air bag had two tethers and two vents ports. There was a lipstick imprint on the lower right quadrant of the air bag. The passenger side air bag was enclosed in a top-mount module, and had no tethers or vents. It measured 78 cm (30.7 in) by 80 cm (31.5 in) and had approximately twelve folds across that were between 4.5 cm (1.8 in)-5 cm (2.0 in) apart. There were small blood drops splattered all over the air bag. The passenger side air bag contacted the windshield near the windshield header cracking the glazing. The passenger side air bag also contacted the rear view mirror, pushing it into the windshield causing cracking to the glazing, and knocking the rear view mirror off. Neither air bag sustained any damage. There was no intrusion nor any integrity loss.

Vehicle 2

Description:	1986 Oldsmobile Cutlass Cierra LS	
VIN:	1G3AJ19X9GDXXXXXX	
Odometer:	Unknown	
Engine:	2.8 L V6	
Reported Defects:	None	
Cargo:	None	
Damage Description:	<p>Vehicle 2 was not inspected. CDC was estimated from photographs taken by police at the scene of the accident.</p> <p>Moderate damage to the left side, beginning just aft of the left front wheel well and ending just forward of the left rear wheel well. Maximum crush .</p> <p>Extent zone 3 (see Figure 2).</p>	
CDC:	11LYEW3	
Delta V: ²	Total	19.5 km/h (12.1 mph)
	Longitudinal	-14.9 km/h (-9.3 mph)
	Latitudinal	12.5 km/h (7.8 mph)
	Energy	19,193 joules (14,168 ft-lbs)



Figure 2. Exterior damage to Vehicle 2.

²WinSmash damage only run

Occupants

<u>Vehicle 1</u>	Occupant 1 (Driver)	Occupant 2
Age/Sex:	25/Female	7/Male
Seated Position:	Left front	Right front
Seat Type:	Bucket	Bucket
Height:	183 cm (72 in.)	Unknown, very tall per mother
Weight:	57 kg (125 lbs)	. 27 kg (60 lb)
Occupation:	Cashier	NA
Pre-existing Medical Condition:	Allergies	None
Alcohol/Drug Involvement:	None	NA
Driving Experience:	. 9 years	NA
Body Posture:	Normal, upright	Normal, upright
Hand Position:	Both hands back on wheel, unknown positions.	Unknown
Foot Position:	Right foot on the accelerator, and the left foot on the floorboard.	Unknown
Restraint Usage:	Lap and shoulder belts used properly	Lap and shoulder belts used properly

Occupants (Cont.)

<u>Vehicle 1</u>	Occupant 3
Age/Sex:	4/Male
Seated Position:	Second seat left
Seat Type:	Bucket
Height:	Unknown by mother
Weight:	. 16 kg (35 lbs)
Occupation:	NA
Pre-existing Medical Condition:	None
Alcohol/Drug Involvement:	NA
Driving Experience:	NA
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Unknown booster child seat used with lap and shoulder belts

Occupant

<u>Vehicle 2</u>	Occupant 1 (Driver)
Age/Sex:	58/Female
Seated Position:	Left front
Seat Type:	Bench with separate back cushions
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	Unknown
Alcohol/Drug Involvement:	None
Driving Experience:	. 42 years
Body Posture:	Seated upright
Hand Position:	On the steering wheel, unknown positions
Foot Position:	Right foot on the accelerator
Restraint Usage:	None as indicated on police report

Injuries and Injury Mechanisms

Vehicle 1

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Abrasion to face	290202.1,4	910.0	Air bag
	Abrasion to nose	290202.1,4	910.0	Air bag
	Abrasion to chin	290202.1,8	910.0	Air bag
	Small laceration to left side of neck	390602.1,2	874.8	Shoulder belt
	Paravertebral strain	640478.1,7	847.9	Inertial motion
Occupant 2:	Concussion	161000.2,0	850.1	Air bag
	Severe closed head injury/blunt head trauma	115099.7,0	854.0	Air bag
	Abrasion to nose	290202.1,4	910.0	Air bag
	Abrasion to lip	290202.1,8	910.0	Air bag
	Abrasion to chin	290202.1,8	910.0	Air bag
	Small laceration to right side of neck	390602.1,1	874.8	Shoulder belt webbing
Occupant 3:	Not injured			

Injuries and Injury Mechanisms (Cont..)

Vehicle 2

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Fractured left pelvis	852600.2,2	808	Possibly struck the instrument panel and upward force caused fracture
	Long scalp laceration	190602.1,2	873.0	Possibly striking the glazing left side door

Occupant Kinematics

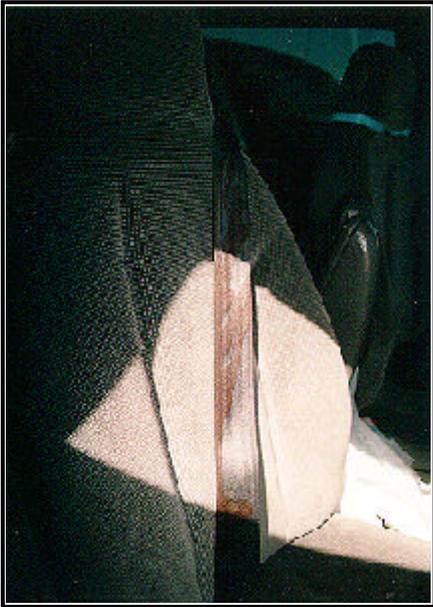


Figure 3. Blood on shoulder belt.



Figure 4. Blood on lap belt.

The right front seat was occupied by a 7-year-old male. He was seated in an upright position with the lap and shoulder restraints properly worn. A small laceration to the right side of his neck and the blood stains on the lap and shoulder belts are clear indications that the restraints were used and that he had come to rest slumped over the restraints in the center of the seat (see Figures 3 & 4). The driver asserts that the right front occupant was in a normal seated position and that he is very attentive to properly wearing the lap and shoulder restraints. The bucket seat was adjusted to the rear most seat track position.

There was no pre-impact braking prior to the collision with Vehicle 2. On impact, the right front occupant moved forward, while at the same time the air bag deployed and struck the right front occupant about the front of his face.

Paramedics arrived on scene and noted that he was unconscious, the mother stated that he was conscious for about thirty seconds after the collision, and then lost consciousness. Later as first aid was being given, the right front occupant became combative, and was posturing. He was transported from the scene via helicopter to a local hospital. His Glasgow coma score on arrival was 8, and he was medically paralyzed. His injuries consisted of blunt head trauma, which was considered life threatening. He had a concussion with memory loss. There were superficial burns, and abrasions to his chin, nose, and lips as a result of contact with the air bag. The contact with the air bag caused an excessive nose bleed, which was the blood that was splattered about the air bag and seat belts. He had a small laceration to the right side of his neck, which was caused by the shoulder belt. He was hospitalized for seven days and during that time he was confused and unable to speak. After being released from the hospital, he has been on intensive speech and motor skills therapy.

Photo Index

PHOTO NO.	VEHICLE NO.	DIRECTION	SUBJECT MATTER
The following photographs were taken by the police at the scene of the collision.			
DS97001-01- DS97001-02	1 & 2	South	Final rest positions of both vehicles.
DS97001-03- DS97001-09	1	North	External damage to vehicle. **Photo #09 damage made to hood by exterior rear view mirror of Vehicle 2.
DS97001-10- Ds97001-13	1	North	Final rest position at scene.
DS97001-14- DS97001-15	1	West	Final rest position at scene.
DS97001-16- DS97001-17	1	South	Final rest position at scene.
DS97001-18- DS97001-19	1		Interior, deployed air bags.
DS97001-20- DS97001-36	2		Exterior vehicle damage.
Ds97001-37- DS97001-39	2		Interior of vehicle.
The following photographs were taken by the NASS investigator of the inspection of Vehicle 1			
DS97001-40- DS97001-57	1		Exterior damage to vehicle.
DS97001-58- DS97001-97	1		Interior of vehicle.
DS97001-73- DS97001-74	1		Interior rear view mirror. Probably damaged by air bag.
DS97001-75- DS97001-78	1		Front right seat. Lap/Shoulder restraints in front right seat position with blood stains.

DS97001-79- DS97001-80	1		Windshield probably cracked by air bag and rearview mirror.
DS97001-81- DS97001-99	1		Front right air bag.
DS97001-100- DS97001-118	1		Front of Vehicle, includes dash, head liner, instrument panel.
DS97001-119- DS97001-120	1		Second row seats.
DS97001-121- DS97001-122	1		Third row bench seats.