CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

CALSPAN ON-SITE CHILD AIR BAG RELATED FATALITY CRASH INVESTIGATION

CALSPAN CASE NO: CA04-046

VEHICLE: 1994 DODGE CARAVAN

LOCATION: FLORIDA

CRASH DATE: OCTOBER 2004

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

DISCLAIMER

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 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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. CA04-046	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Calspan On-Site Child Air Bag Related Fatality Investigation Vehicle: 1994 Dodge Caravan Location: State of Florida		*5. Report Date*: October 2006 *6. Performing Organization Code*	
7. Author(s) Crash Data Research Center		*8. Performing Organization Report No.*	
9. Performing Organization Name and Address Crash Data Research Center Calspan Corporation P.O. Box 400 Buffalo, New York 14225		*10. Work Unit No.* C00410.0000.0247 *11. Contract or Grant No.* DTNH22-01-C-17002	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		*13. Type of Report and Period Covered* Technical Report Crash Date: October 2004 *14. Sponsoring Agency Code*	
15. Supplementary Note This on-site investigation focused on the severity of the crash and the source of injury that caused the death of an unrestrained 5-year-old female front right passenger of a 1994 Dodge Caravan.			
16. Abstract This on-site investigation focused on the severity of the crash and the source of injury that caused the death of an unrestrained 5-year-old female front right passenger of a 1994 Dodge Caravan. The Dodge was equipped with first generation frontal air bags for the driver and front right positions that deployed as a result of an intersection crash with a 1996 Ford Windstar. The Dodge was occupied by an unrestrained 38-year old female driver, the unrestrained 5-year-old female front right passenger, and a 1-year-old male rear left passenger restrained by the five-point harness system of a forward facing child safety seat. Immediately prior to the impact, the driver of the Dodge applied a rapid braking force which displaced the 5-year-old female forward into the path of the deploying front right air bag. The front right air bag cover flap and the expanding air bag contacted the child's anterior neck and chin. This contact resulted in soft tissue abrasions of the anterior neck and hyperextension of the neck resulting in an atlanto-occipital disarticulation with transection of the spinal cord. The child passenger was transported to a local hospital and transferred to a regional trauma center where she expired.			
17. Key Words Child Air Bag Related Fatality Investigation 5-year-old female front right passenger		*18. Distribution Statement* General Public	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 13	*22. Price*

TABLE OF CONTENTS

CALSPAN ON-SITE CHILD AIR BAG RELATED FATALITY INVESTIGATION
SCI CASE NO.: CA04-046
VEHICLE: 1994 DODGE CARAVAN
LOCATION: FLORIDA
DATE OF CRASH: OCTOBER 2004

BACKGROUND

This on-site investigation focused on the severity of the crash and the source of injury that caused the death of an unrestrained 5-year-old female front right passenger of a 1994 Dodge Caravan **(Figure 1)**. The Dodge was equipped with first generation frontal air bags for the driver and front right positions that deployed as a result of an intersection crash with a 1996 Ford Windstar. The Dodge was occupied by an unrestrained 38-year old female driver, the unrestrained 5-year-old female front right passenger, and a 1-year-old male rear left passenger restrained by the five-point harness system of a forward facing child safety seat. Immediately prior to the impact, the driver of the Dodge applied a rapid braking force which displaced the 5-year-old female forward into the path of the deploying front right air bag. The front right air bag cover flap and the expanding air bag contacted the child's anterior neck and chin. This contact resulted in soft tissue abrasions of the anterior neck and hyperextension of the neck resulting in an atlanto-occipital disarticulation with transection of the spinal cord. The child passenger was transported to a local hospital and transferred to a regional trauma center where she expired.

Figure 1. Subject vehicle 1994 Dodge

The crash was identified through an Internet news search by the National Highway Traffic Safety Administration (NHTSA) and assigned to the Calspan Special Crash Investigations (SCI) team for on-site investigation on October 28, 2004. Contact was made and cooperation was established with the investigating police officer to hold the vehicles for this on-site SCI investigation. The on-site inspection of the vehicles and scene was conducted on November 4, 2004.

SUMMARY

Crash Site

This crash occurred during the daylight hours of October 2004 at a four-leg intersection of two local roadways. The four-legs of the intersection were configured with one travel in each direction. The travel lanes were not separated by lane markings. The roadways were constructed of asphalt and were bordered by concrete barrier curbs. Traffic flow through the intersection was controlled by stop signs for the east and west legs. The investigating police officer stated to the SCI investigator that the stop sign for the east leg was stolen two days prior to the crash and was not replaced. The posted speed limit for

the roadways was 40 km/h (25 mph). The Scene Schematic is included as **(Figure 9)** of this report.

Vehicle Data

1994 Dodge Caravan

The subject vehicle in this crash was a 1994 Dodge Caravan. The vehicle was purchased used by the driver in February 2003. The history of the vehicle and the safety systems was unknown. The Dodge was manufactured in August 1993 and was identified by Vehicle Identification Number (VIN) 2B4GH2531RR (production number deleted). The odometer reading at the time of the SCI inspection was 304,284 kilometers (189,079 miles). The vehicle was a three-door minivan that was equipped with a 3.0-liter, V-6 engine linked to a three-speed automatic transmission with a steering column mounted transmission shifter. The service brakes were power-assisted front disc/rear drum. The vehicle was equipped with OEM steel wheels with plastic wheel covers. The Dodge was equipped with all-season tires, size P195/75R14. The front and left rear tires were Douglas Xtra-Trac A/W and the right rear tire was a Michelin Weatherwise. The vehicle manufacturer recommended tire pressure was 241 kPa (35 PSI). The specific tire data at the time of the SCI inspection was a follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	214 kPa (31 PSI)	3 mm (4/32”)	None
Left Rear	221 kPa (32 PSI)	7 mm (9/32”)	None
Right Front	207 kPa (30 PSI)	3 mm (4/32”)	None
Right Rear	55 kPa (8 PSI)	2 mm (2/32”)	None

The interior of the Dodge was equipped with cloth front bucket seats and bench seats in the second and third rows. The front seats were designed with integrated head restraints. The second row was configured as a two-passenger bench seat and the third row was a three-passenger bench seat.

1996 Ford Windstar

The struck vehicle was a 1996 Ford Windstar that was identified by VIN: 2FMDA5143TB (production number omitted). A 3.8-liter, 6-cylinder engine linked to a 4-speed automatic transmission powered the Ford. The tires on the Ford were size P215/70R15 and were mounted on multi-spoke OEM alloy wheels. The manufacturer recommended tire pressure for this vehicle was 221 kPa (32 PSI). The specific tire data at the time of the SCI inspection was a follows:

Position	Tire Manufacturer	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	Kelly Explorer	172 kPa (25 PSI)	6 mm (8/32”)	None
Left Rear	American Silver	234 kPa (32 PSI)	3 mm (4/32”)	None
Right Front	Futura 2000	221 kPa (32 PSI)	2 mm (3/32”)	None
Right Rear	Firestone FR60	28 kPa (4 PSI)	3 mm (4/32”)	None

Crash Sequence

Pre-Crash

The 38-year-old female driver was operating the 1994 Dodge Caravan in a westerly direction approaching the four-leg intersection **(Figure 2)**. A 34-year-old female was operating the 1996 Ford Windstar northbound approaching the intersection from the Caravan’s left. The east/westbound legs of the intersection were controlled by stops signs; however, the stop sign that was located on the east leg was stolen two-days prior to the crash and was not replaced. The driver of the Dodge proceeded into the intersection as though it was an uncontrolled intersection for her path of travel. As she detected the approaching Ford, the driver of the Caravan applied a braking force prior to impact. There was no pre-crash evidence (i.e. skid marks) present at the crash site

Figure 2. Pre-crash trajectory of the Dodge. Note: Stop sign was not present at the time of the crash.

Crash

The front left area of the Dodge impacted the right front side area of the Ford Windstar. The resultant directions of force were 11 o’clock for the Caravan and within the 2 o’clock sector for the Ford. The damage algorithm of the WINSMASH program computed total velocity changes of 18 km/h (11.2 mph) for the Dodge and 16 km/h (9.9 mph) for the Ford. The specific longitudinal and lateral components were -16 km/h (-9.7 mph) and 9 km/h (5.6 mph) for the Dodge and -8 km/h (-5 mph) and -14 km/h (-8.6 mph) for the Ford. As a result of the crash, the frontal air bag system in the Dodge deployed.

As the vehicles crushed to maximum engagement, the lateral components of the velocity vectors rotated the Caravan in a clockwise direction and the Ford rotated counterclockwise. During the rotation, the vehicles began to travel on a northwest trajectory and the left rear of the Dodge impacted the right rear of the Ford in a side slap configuration. This impact resulted in directions of force of 9 o’clock for the Dodge and 3 o’clock for the Ford. The damage algorithm of the WINSMASH program was used to calculate a delta-V for this impact. The total delta-V for the Dodge was 6 km/h (3.7 mph) with longitudinal and lateral components of 0 km/h and 6 km/h (3.7 mph), respectively. The total delta-V for the Ford was 5 km/h (3.1 mph) with longitudinal and lateral components of 0 km/h and -5.0 km/h (-3.1 mph), respectively.

Following the side slap, the Dodge came to rest within the intersection facing a northerly direction. The Ford traveled in a northwest trajectory and departed the northwest quadrant of the intersection, coming to rest on the north roadside. A tire mark and a fluid trail evidenced the trajectory path of the Ford to final rest.

Post-Crash

Immediately following the crash, a passerby removed the 5-year-old child passenger from the Dodge and placed her on the grass adjacent to the crash site. Paramedics arrived at the scene and evaluated the child's injuries. She was transported by ambulance to a local hospital and was transferred by helicopter to a regional trauma center where she expired within one hour of arrival. The driver of the Dodge sustained possible injuries (police reported) and the 1-year-old male passenger was reported as not injured.

Vehicle Damage

Exterior – 1994 Dodge Caravan

The 1994 Dodge Caravan sustained moderate severity frontal damage as result of the initial impact with the Ford **(Figure 3)**. The damaged components included the hood, bumper fascia and bumper beam, left headlamp assembly, upper radiator support, and the front fenders. Additionally, the front structure of the vehicle was shifted to the right. The left frame rail was displaced 14 cm (5.5") to the right while the right rail was displaced 17 cm (6.5"). Maximum crush was 15 cm (5.9"), and was located at the left corner of the bumper beam. The direct contact damage began 10 cm (3.9) right of the vehicle's centerline and extended 89 cm (35.2") to the left bumper corner. A crush profile was documented along the full width of the deformed bumper beam which measured 130 cm (51.25"). The crush profile consisted of six equidistant crush measurements that were as follows: C1 = 11 cm (4.3"), C2 = 12 cm (4.7"), C3 = 15 cm (5.9"), C4 = 12 cm (4.7"), C5 = 4 cm (1.6"), C6 = 2 cm (0.8"). The Collision Deformation Classification (CDC) for this impact was 71-FYEW-1 with an incremented shift value of 60 added to the 11 o'clock direction of force.

Figure 3. Frontal damage to the 1994 Dodge Caravan.

Figure 4. Left rear damage from the secondary impact.

The secondary side slap impact with the Ford resulted in minor damage to left rear aspect of the Dodge **(Figure 4)**. The direct contact damage began 15 cm (5.75") aft of the left rear axle and extended 67 cm (26.25") forward. The maximum crush measured 15 cm (5.75") and was located 8 cm (3.25") forward of the left rear axle position on the wheel opening. The crush profile for this impact was as follows: C1 = 0 cm, C2 = 5 cm (2"), C3 = 11 cm (4.4"), C4 = 6 cm (2.25"), C5 = 2 cm (0.75"), C6 = 0 cm. The CDC for this impact was 09-LZEW-2.

The doors remained closed during the crash and were operational post-crash. The windshield was fractured from contact by the driver and the 5-year-old female front right passenger. The third row left glazing was disintegrated as result of the secondary side slap impact with the Ford. The remaining side and rear glazing was intact.

Interior – 1994 Dodge Caravan

The interior of the Caravan sustained moderate damage that was attributed to occupant contact points. The moderate severity crash did not result in a reduction of the passenger compartment. The driver's contact points consisted of a strike to the windshield that was evidenced by a spider web fracture pattern with hair embedded into the glass. The laminated windshield was bowed outward 3 cm (1") at the contact area. This contact point was centered 48 cm (19") left of center and 10 cm (4") below the windshield header. The hair was removed by the investigating police officer and retained as evidence. The driver contacted and loaded through the deploying air bag which resulted in bending of the steering wheel flange at the 10 o'clock sector.

The front right child passenger contacted the glove box door with her lower extremities. A fabric transfer was present on the lower left aspect that extended 31-34 cm (12.25-13.5") right of center and 34-41 cm (13.5-16") below the top of the upper Instrument Panel (IP). A scuff mark was present below the transfer that extended 29-31 cm (11.5-12.25") left of center and 47-50 cm (18.5-19.5") below the referenced IP. A patterned scuffmark/fabric transfer was present on the upper mid panel at the protrusion of the right instrument panel. The contact point was located 11-14 cm (4.25-5.5") right of center and 10-15 cm (4-6") below the top surface of the IP. A white scuff mark was present on the upper left aspect of the glove box door that extended onto the mid instrument panel. This contact point was located 27-30 cm (10.75-11.75") right of center and 14-23 cm (5.5-9") below the top surface of the instrument panel. The vertical face of the mid-to-upper instrument panel at the locations of the corners of the air bag module opening was split. The left tear was 7 cm (2.75") in length and the right tear was 7 cm (2.6") in length. These splits occurred by the air bag as it expanded against the module and the out-of-position child passenger. Additionally, this panel contained vertically oriented scuff marks and tissue transfers from contact with the front right passenger. A triangular area of tissue and scuff marks was present on the mid panel immediately below the air bag module. This contact occupied an area that was 15 cm (5.75") horizontally and 8 cm (3.25") vertically.

The air bag cover flap was bowed 6mm (0.25") at the leading edge from contact with the child passenger during the initial deployment phase. A single strand of hair was noted on

the center aspect of the leading edge of the cover flap. Diagonally oriented tissue transfers were noted to the leading edge of the cover flap and located 19-26 cm (7.5-10.25") right of the left edge of the flap, extending 4 cm (1.75") forward of the leading edge.

The child passenger was displaced vertically, contacting and fracturing the upper aspect of the windshield with her head. The windshield was cracked and bowed outward over a large area that extended from the rear view mirror to the right A-pillar. This contact extended onto the windshield header which was deformed. These areas were evidenced by hair which was removed by the investigating officer. A white air bag transfer was noted on the windshield 21-43 cm (8.25-17") right of center and 17 cm (6.5") above the top of the instrument panel.

Additional occupant contact points were documented to the front right air bag. These are described in the Air Bag Section of the report**. Figures 5 and 6** are overall views of the occupant contact points to the front right area.

Figure 5. Occupant contact points to the air bag module cover, mid panel, and the glove box door.

Figure 6. Front right passenger contacts to the windshield.

Exterior – 1996 Ford Windstar

The 1996 Ford Windstar sustained moderate severity damage to the right side from the impacts with the Dodge **(Figure 7)**. The initial impact involved the right side with the direct contact damage beginning 29 cm (11.5") forward of the rear axle and extended 371 cm (146.0") forward to the right front bumper corner. The maximum crush was 19 cm (7.6") and was located on the fender 45 cm (17.75") forward of the left A-pillar. The crush profile was documented at the mid-level and was as follows: C1 = 0 cm, C2 = 5 cm

Figure 7. Overall view of the right side damage.

(1.9”), C3 = 19 cm (7.6”), C4 = 18 cm (7.1”), C5 = 16 cm (6.3”), C6 = 8 cm (3.25”). The CDC for this impact was 02-RFEW-2.

The right rear quarter panel sustained minor severity damage from the secondary side slap impact. The maximum crush was 1 cm (0.5”), located above the right rear wheel area. The direct contact damage began 18 cm (7”) rearward of the right rear axle and extended 57 cm (22.5”) to the right rear bumper corner. The crush profile for this impact was as follows: C1 = 0 cm, C2 = 0 cm, C3 = 1 cm (0.5”), C4 = 1 cm (0.25”), C5 = 1 cm (0.1”), C6 = 0 cm. The CDC for this side slap was 03-RBEW-1.

Frontal Air Bag System – 1994 Dodge Caravan

The Dodge Caravan was equipped with first generation air bags for the driver and front right positions. The history of the safety system was unknown as the driver purchased the vehicle used in February 2003. The system deployed as a result of the fontal impact sequence with the Ford Windstar.

The driver’s air bag was contained within the four-spoke steering wheel and concealed by two H-configuration cover flaps. Both flaps were 19 cm (7.3”) wide at the horizontal tear seam. The upper and lower flaps measured at 6 cm (2.4”) in width and 7 cm (2.6”) in height. The air bag membrane measured 64 cm (25”) in diameter in its deflated state and was not tethered. The air bag was vented by two 3 cm (1”) diameter vent ports at the 12 o’clock position. The maximum rearward excursion of this bag was 55 cm (21.5”). There was no damage or evidence of driver contact on the deployed air bag. The following nomenclature was on the air bag membrane:

PUT11446-02
TBX3181B4983

The front right passenger air bag was a top-mount design incorporated into the right instrument panel. A single cover flap concealed the bag. The cover flap was 33 cm (12.8”) wide and 14 cm (5.4”) in height. The air bag cover flap was bowed 6 mm (0.25”) at the leading edge from contact with the child passenger during the deployment. Tissue transfers were present on the leading edge of the flap.

Figure 8. Front right air bag and contact evidence.

The right front air bag membrane measured 48 cm (19”) in width and 55 cm (21.5”) in height **(Figure 8)**. The bag was tethered by two 32 cm (12.5”) wide band tethers that were sewn to the face of the membrane and spaced 28 cm (11”) apart. The air bag membrane was cut from the module by the investigating police officer prior to this SCI investigation. The bag was repositioned by the SCI investigator for proper documentation. Blue fabric transfers from the front right passenger were present on the face of the membrane. These

blue clothing transfers began 11 cm (4.3”) below the top seam and extended 44 cm (17.3”) to the bottom seam. Tissue transfers were present within the lower aspect of this fabric transfer. The tissue transfers began at the bottom seam and extended 20 cm (8”) to the lower tether and were 5 cm (2”) wide at the lower aspect and 18 cm (7”) wide at the tether. The sun visors of the Dodge were equipped with air bag warning labels on the inner sides.

Manual Safety Belt Systems – 1994 Dodge Caravan

The 1994 Dodge Caravan was equipped with manual three-point lap and shoulder belt systems for the six outboard-seated positions. The driver’s belt was equipped with continuous loop webbing, sliding latch plate and a height adjustable D-ring that was in the full-up position at the time of the SCI inspection. The driver’s safety belt retracted onto an Emergency Locking Retractor (ELR). The driver did not use the safety belt in this crash, which was supported by the driver’s forward motion, loading of the steering wheel flange, and windshield contact.

The front right safety belt consisted of a light weight locking latch plate, height adjustable D-ring that was in the full-down position at the time of the SCI inspection, and an ELR. This safety belt was not used by the 5-year-old female front right passenger, which was supported by her interaction with front right air bag, instrument panel and windshield.

The remaining outboard belt systems utilized light weight locking latch plates and ELR’s. The second row right safety belt was used to install a forward facing child safety seat that was occupied by the 1-year-old male. The third seat contained a center seating position that was equipped with a lap belt with a locking latch plate and no retractor.

Child Safety Seat – 1994 Dodge Caravan

A1-year-old male passenger was positioned in the second row, right position of the Dodge Caravan in a forward facing child safety seat that was installed using the manual safety belt system. The 1-year-old male was positioned in the forward facing Evenflo Chase child safety seat and was restrained by the integral five-point harness system. The unit was identified by Model Number 3241315 P1 with a Manufacture Date of 08/29/03. The safety seat was placarded with manufacturer specified size limits of 9-18 kgs (20-40 lb) and 74-185 cm (29-43”) with the five-point harness system and 14-27 kgs (30-60 lbs) and up to 137 cm (54.0”) as a belt positioning booster seat. The safety seat and harness system were soiled and exhibited no loading evidence or damage associated with this crash.

A Fisher Price belt positioning booster seat was placed in the rear left position of the Dodge. This seat was not occupied at the time of the crash and no damage was noted to the safety seat.

Occupant Demographics/Data

Driver

Age/Sex:	38-year-old/Female
Height:	170 cm (67”)
Weight:	100 kg (220 lb)
Seat Track Position:	Full rear
Eyewear:	Unknown
Manual Safety Belt Usage:	None used
Usage Source:	Vehicle inspection
Egress from Vehicle:	Unassisted through left door
Mode of Transport from Scene:	Transported by ambulance to a hospital
Type of Medical Treatment:	Treated and released

Driver Injuries

Injury	Injury Severity AIS90/Update 98	Injury Source
*Unknown injuries	Unknown	Unknown

**Police reported “possible injuries”*

Driver Kinematics

The 38-year-old female driver of the 1994 Dodge Caravan was seated in a presumed upright driving posture with the seat adjusted to a full-rear track position. The seat back was reclined to a measured angle of 19 degrees. In this position, the horizontal distance between the center of the driver’s air bag module and the seat back was 66 cm (26”). She was not restrained by the manual belt system. The frontal contact points and the lack of loading evidence supported the non-use status of the belt system.

Prior to the impact, the driver applied the brakes in an attempt to avoid the crash. At impact, the frontal air bag system deployed and the driver initiated a forward trajectory and loaded the deploying air bag. Her loading force was transmitted through the air bag into the steering wheel which deformed the steering wheel flange. Her continued forward motion allowed her head to contact and fracture the windshield near the header area.

The secondary side slap impact displaced the driver to her left. She probably loaded the left door panel and came to rest in an upright position in the driver’s seat. The driver sustained police reported possible injuries and was transported to a local hospital for treatment.

Front Right Passenger

Age/Sex:	5-year old/Female
Height:	117 cm (46”)
Weight:	30 kg (66 lb)
Seat Track Position:	Rear-track position
Manual Safety Belt Usage:	None used
Usage Source:	Vehicle inspection
Egress from Vehicle:	Removed from vehicle by a passerby
Mode of Transport from Scene:	Transported by ambulance to a local hospital and transferred by helicopter to a regional trauma center
Type of Medical Treatment:	Expired one-hour post-crash

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90, Update 98)	Injury Source
Transection of the upper cervical spinal cord with atlanto-occipital disarticulation	Maximum (640274.6,6)	Hyperextension of the neck by the expanding right front air bag
Intraventicular hemorrhage	Severe (140678.4,9)	Expanding right front air bag
Focal splinter cortical contusions left inferior temporal lobe and parahippocampal tissue	Moderate (140614.3,2)	Expanding right front air bag
Mild subarachnoid hemorrhage of the inferior cerebellum	Moderate (140466.3,6)	Expanding right front air bag
Brain swelling with flattening of the cerebral gyri	Moderate (140660.3,9)	Expanding right front air bag
Lateral left eye contusion	Minor (297402.1,2)	Expanding right front air bag
Tear of the upper frenulum	Minor (290602.1,8)	Expanding right front air bag
3 cm (1.0”) abrasion to the left eye	Minor (297202.1,2)	Expanding right front air bag
Extensive abrasions extending across entire underside of chin and anterior neck	Minor (390202.1,5)	Expanding right front air bag
Purple ecchymosis of the anterior neck	Minor (390402.1,5)	Expanding right front air bag
Extensive abrasions to the lower right face, lower left face, and across chin	Minor (290202.1,8)	Expanding right front air bag
Scattered abrasions on the left upper cheek	Minor (290202.1,2)	Expanding right front air bag

Source of Data – Autopsy

Front Right Passenger Kinematics

The 5-year-old female front right passenger was seated in a rear-track position. The seat back was reclined to a measured angle of 19 degrees. In this position, the horizontal distance between the seat back and the leading edge of the front right air bag module cover was 88 cm (34.5”). The child passenger was not restrained by the 3-point lap and shoulder belt system. The lack of belt use was supported by her trajectory and contact points that extended vertically to the windshield header. Based on her age and demographics, this occupant should have been in a belt positioning booster seat and restrained by the manual lap and shoulder belt in the second or third row of the vehicle. The child was dressed in kaki shorts, and a dark blue cotton two-button pull over shirt. This clothing was inspected during the SCI investigation. The lower right chest area of the shirt contained a probable air bag transfer. Body fluids were present on the left collar and the majority of the fabric.

Immediately prior to the impact, the driver of the Dodge applied the brakes which displaced the 5-year-old female forward. She was positioned in close proximity to the top mount air bag with her chin extending over the top of the module cover.

At impact with the Ford, the front right air bag deployed and the child passenger continued her forward trajectory. The cover flap contacted the lower chin area of the child as evidenced by tissue transfers on the flap and slight bowing of the component. The tissue transfers resulted in the removal of skin and a probable abrasion of the chin. The expanding air bag engaged her anterior neck, chin, and face resulting in a lateral left eye contusion, a tear of the upper frenulum, a 3 cm (1”) abrasion of the left eye, extensive abrasions extending across entire underside of chin and anterior neck, purple ecchymosis of the anterior neck, extensive abrasions to the lower right face, lower left face, and across chin, and the scattered abrasions on the left upper cheek. The expanding air bag masked the chin abrasion from the cover flap.

The child passenger contacted the glove box door and the mid instrument panel with her lower extremities and chest as evidenced by tissue and fabric transfers and scuff marks. This contact did not result in reportable injury to the child.

The expanding air bag hyperextended her neck which resulted in the transection of the upper cervical spinal cord with atlanto-occipital disarticulation, intraventicular hemorrhage, focal splinter with cortical contusions and left inferior temporal lobe and parahippocampal tissue, mild subarachnoid hemorrhage inferior cerebellum, brain swelling with flattening of the cerebral gyri. The expanding air bag displaced the child vertically into the windshield and windshield header.

She rebounded into the front right seat where she came to rest in a slumped position. A passing motorist stopped at the crash site to offer assistance. He removed the child from the vehicle and placed her on the ground adjacent to the crash site. The child passenger was transported by ambulance to a local hospital and transferred by helicopter to a regional trauma center where she expired within one hour of arrival.

Second Row Left Child Passenger

Age/Sex:	1-year old/Male
Height:	Unknown
Weight:	Unknown
Seat Track Position:	N/A, fixed
Eyewear:	Unknown
Restraint Use:	Forward facing child safety seat with five-point harness system
Usage Source:	Vehicle inspection
Egress from Vehicle:	Unknown
Mode of Transport from Scene:	Ambulance to a hospital
Type of Medical Treatment:	Not injured

Second Row Left Child Passenger Injuries

Injury	Injury Severity AIS90/Update 98	Injury Source
Not injured	N/A	N/A

Second Row Left Child Passenger Kinematics

The 1-year-old male passenger was seated in the second row right position and restrained by the five-point integral harness system of a forward facing child safety seat. The child responded to the frontal crash forces by initiating a forward trajectory and loading the harness system. The secondary impact resulted in minor crash forces and probably resulted in minimal displacement of this passenger. This occupant was not injured in the crash; however, he was transported to a local hospital.

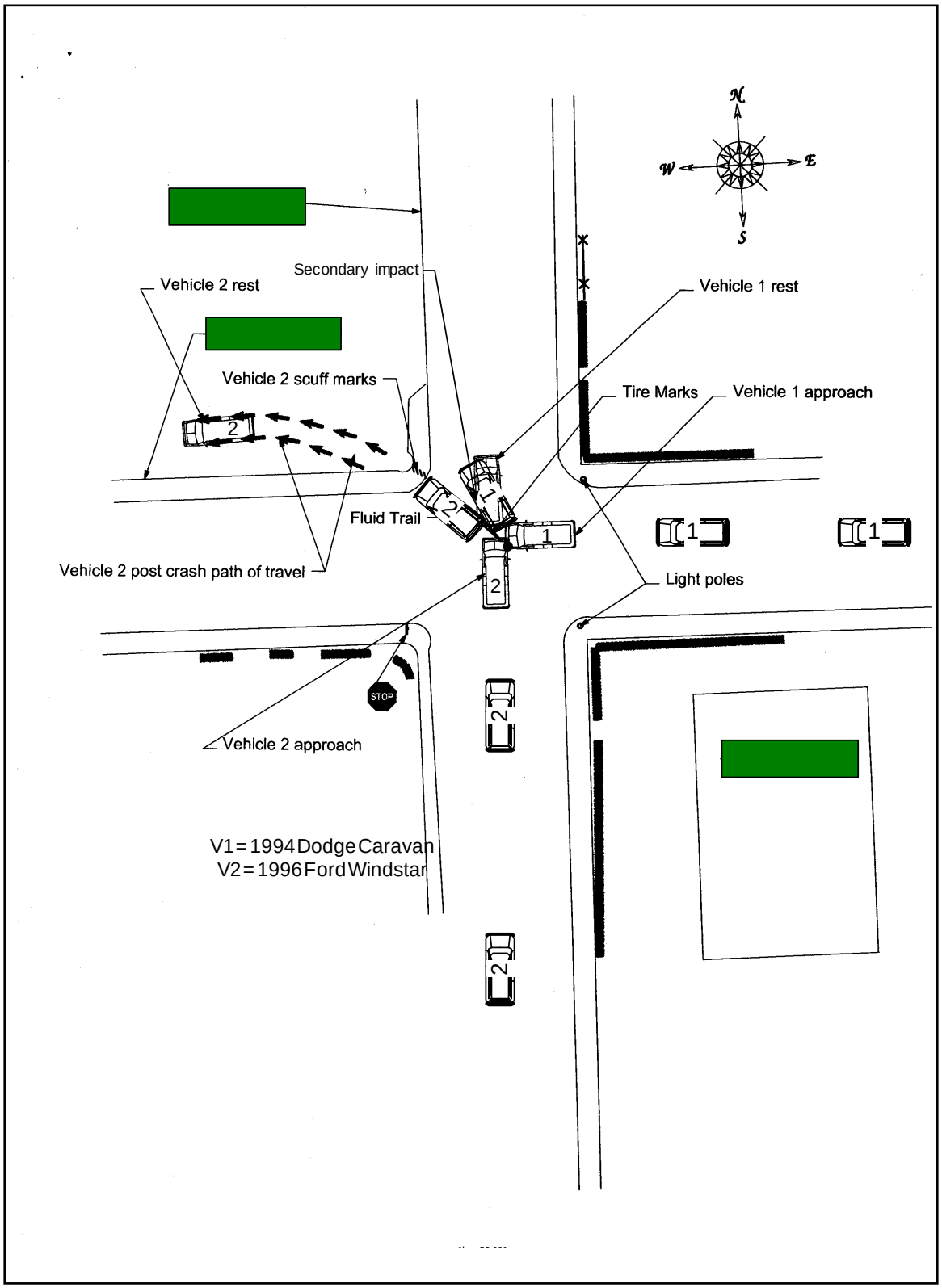

Figure 9: Scene Schematic