TRANSPORTATION SCIENCES
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VERIDIAN ON-SITE AIR BAG RELATED CHILD FATALITY INVESTIGATION

VERIDIAN CASE NO. CA03-001

SUBJECT VEHICLE – 1996 DODGE GRAND CARAVAN

LOCATION – STATE OF GEORGIA

CRASH DATE – NOVEMBER 2002

Contract No.
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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.

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BACKGROUND

Figure 1. Damaged 1996 Dodge Caravan

This on-site investigation focused on the injury mechanisms of a 6-month-old male who was restrained in a rear-facing infant child safety seat (CSS) in the front right position of a 1996 Dodge Caravan. The Caravan was also occupied by a 32-year-old female driver and a 6-year-old female who was seated on the second row bench seat. The Caravan **(Figure 1)** was involved in a frontal intersection crash with a 1990 Pontiac Grand Am and subsequent right sideslap. The frontal impact was sufficient to deploy the front right passenger's air bag in the Caravan. Although the Caravan was not equipped with an advanced occupant protection system, the driver's air bag failed to deploy. The restrained driver and 6-year-old child passenger loaded the manual restraints. The driver sustained a minor chest wall contusion and the 6-year-old sustained a left forehead contusion. They were transported by ambulance to a local hospital, treated, and released. The front right passenger's air bag expanded against the plastic shell of the rear-facing CSS and projected it upward and rearward. The force of the expanding air bag projected the plastic shell against the child's head, which resulted in numerous radiating skull fractures, cerebral and cerebellar subarachnoid hemorrhage, cerebral edema, and extensive subscalp and subgaleal hemorrhage. The child also sustained a minor contusion under the chin and a left forehead contusion. The child was unresponsive at the scene. He was removed from the CSS and the vehicle, and transported to a local hospital where he expired 30 minutes after the crash.

This crash was identified by the Fatality Analysis Reporting System (FARS). The crash occurred in November 2002. Due to the potential air bag-related child fatality, the PAR was forwarded to the Special Crash Investigations team at NHTSA. This case was assigned to the Veridian SCI team on January 2, 2003 as an on-site investigation effort. Numerous attempts were made through the police agency and an attorney representing the family, to locate and inspect the vehicle immediately after the case was assigned. Repeated attempts to gain cooperation through the attorney were unsuccessful, and the vehicle was located in May 2003 through an insurance company. At the time the vehicle was located for inspection, the family had discarded the CSS and it was not available for inspection. The 1990 Pontiac Grand Am had previously been sold at auction and could not be located for inspection.

SUMMARY

Crash Site

This two-vehicle crash occurred at the intersection of two local roadways in the state of Georgia during the month of November 2002. At the time of the crash, the weather was cloudy and the asphalt roadway surface was dry. The north/south roadway was configured with one travel lane in each direction separated by a double-yellow centerline and bordered by asphalt shoulders and 15.2 cm (6.0") concrete curbs. A curbed storm sewer was present on the west curb of the north/south roadway adjacent to the southwest corner of the intersection **(Figure 2)**. The storm sewer was capped by a large concrete slab that measured 2.3 m (7.7') in width and 7.6 cm (3.0") in thickness. The concrete slab was displaced rearward 20.3 cm (8.0") at the time of the scene inspection. The vertical height of the storm sewer opening was 33.0 cm (13.0"). The east/west roadway was unmarked and configured with one travel lane in each direction and bordered by concrete curbs. The east leg of the intersection exhibited a positive westbound grade, approximately 3 percent. Traffic flow through the intersection was controlled by stop signs for east/west traffic entering the intersection. The roadside environment consisted of residential properties. The posted speed limit for the north/south roadway was 56 km/h (35 mph) and the posted speed limit for the east/west roadway was 40 km/h (25 mph).

Figure 2. Northwest corner of the intersection showing the curbed storm sewer

Figure 3. Northbound approach for the Grand Caravan

Pre-Crash

The 32-year-old female driver of the Dodge Grand Caravan was operating the vehicle in a northbound direction on approach to the four-leg intersection **(Figure 3)**. The 66-year-old female driver of the 1990 Pontiac Grand Am was operating the vehicle westbound on approach to the four-leg intersection **(Figure 4)**. The driver of the Grand Am brought the vehicle to a controlled stop at the stop sign before entering the intersection. She initiated a right turn onto the northbound lane across the path of the Dodge Caravan. She stated to police that she did not detect the approaching Caravan in the northbound lane. The driver of the Caravan detected the Grand Am turning across its path, and the driver told police that she applied the brakes in an attempt to avoid the collision. At the time of the scene inspection, there were no pre-impact tire marks indicative of pre-crash braking.

Figure 4. Westbound approach for the Grand Am

Crash

The front right aspect of the Grand Caravan impacted the left front corner of the Grand Am. The direction of force was in the 1 o'clock sector for the Grand Caravan, and the impact resulted in moderate damage to the vehicle. The impact was sufficient to deploy the frontal air bag system in the Grand Caravan, although, the driver's air bag did not deploy. The missing vehicle routine of the WinSMASH program computed a total delta-V of 13.0 km/h (8.1 mph) based on the Grand Caravan's documented frontal crush profile. The computed delta-V appeared low, and the barrier equivalent speed of 16.9 km/h (10.5 mph) appeared more reasonable for this crash. Since the Grand Caravan was the dominant vehicle, the impact caused the Grand Am to rotate in a rapid clockwise (CW) direction as the Grand Caravan was deflected slightly to its left. A single diagonally-oriented gouge that measured 0.9 m (3.0') in length was present at the point of impact on the center aspect of the intersection. The left side aspect of the Grand Am struck the right rear side aspect of the Grand Caravan in a sideslap configuration, which resulted in minor damage to the Grand Caravan. The Caravan was redirected across the opposite lane in a tracking mode and struck the concrete curb and concrete slab sewer cover as it traveled onto the roadside. The concrete slab sewer cover was gouged at the point of impact with the left front wheel. The Caravan sustained minor undercarriage and left wheel damage as a result of the curb impact and came to rest on the front lawn of a residence with the rear axle straddling the curb. The sideslap event arrested the Grand Am's CW rotation as it was deflected in a northerly direction. The Grand Am came to rest facing northeast straddling the centerline of the roadway.

Post-Crash

It was not known how the driver or the 6-year-old female child exited the Grand Caravan. The police stated that bystanders removed the child from the CSS and began resuscitation efforts, although the Emergency Room Report states that EMS found the child in the CSS outside of the vehicle. Rescue personnel assumed care upon their arrival and transported the child to a local hospital located near the crash scene by ambulance. The driver and the 6-year-old child were also transported by ambulance to the hospital where they were treated for their injuries and released.

VEHICLE DATA – 1996 Dodge Grand Caravan

The 1996 Dodge Grand Caravan was identified by the Vehicle Identification Number (VIN): 1B4GP44R4TB (production sequence omitted). The vehicle's odometer was electronic and the mileage could not be determined at the time of the vehicle inspection. The Dodge Grand Caravan was a four-door minivan equipped with a 3.3 liter, V-6 engine, front wheel-drive, four-speed, automatic transmission, power front disc/rear drum four-wheel anti-lock brakes, power steering, and a tilt steering wheel.

The history of the vehicle could not be ascertained from the owners due to lack of cooperation and language barriers. It was not known if the vehicle had been purchased new or used. Several NHTSA recalls were identified for the 1996 Dodge Grand Caravan. The status of these recalls relative to this vehicle were not known. Recalls that related to the frontal air bag system, vehicle seats, and integrated child safety seats have been included in **Appendix A** at the end of this narrative report. Additional recalls that related to the fuel system were not specifically addressed in this report, as they had little relevance to the focus of this investigation. The 1996 Dodge

Grand Caravan was equipped with P215/70R15 tires on each wheel. The specific tire information is as follows:

Wheel	Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	Dunlop SP40	0.0 kpa	7.1 mm (9/32”)	No	Sidewall tears
LR	Goodyear Integrity	0.0 kpa	2.4 mm (3/32”)	No	None
RF	Dunlop SP40	193.1 kpa (28.0 psi)	6.4 mm (8/32”)	No	None
RR	Futura 875	0.0 kpa	3.2 mm (4/32”)	No	Sidewall tear

The seating in the 1996 Dodge Grand Caravan was configured with box-mounted bucket seats with integral head restraints for both front seat positions. The driver’s seat was jammed at the time of the vehicle inspection, and was located 1.3 cm (0.5”) rear of the full-forward track position. The front right seat was positioned in the mid-track position, with a total of 20.3 cm (8.0”) of fore and aft travel. The driver’s seat back was reclined at a 45-degree angle at the time of the vehicle inspection. The seat back angle was probably altered post-crash. The front right seat back was reclined to 10 degrees from vertical.

The second row was configured with a two-person bench seat with integrated CSS’s and adjustable head restraints, which were in the full-down position. Inspection of the integrated CSS’s **(Figures 5 and 6)** revealed little or no historical use, as significant dust/dirt buildup was present on the exposed aspects of the harness system and non-exposed webbing looked new in appearance. Neither of the CSS latch plates showed any abrasions suggestive of frequent use. The third row was configured with a three-person bench seat with adjustable head restraints for the outboard positions. A spare wheel/tire and a full-size wheel/tire were located in the cargo area. They were not secured at the time of the vehicle inspection.

Figure 5. Inegrated CSS's

Figure 6. Close-up of straps showing color contrast/non-use

A brightly colored beach towel **(Figure 7)** was found in the vehicle during the inspection. The towel exhibited a large longitudinal tear and minor abrasions. Based on fabric transfers within the vehicle, it appears the towel was used in some capacity with the CSS in the front right position of the vehicle. The canopy for the CSS **(Figure 8)** was also found in the vehicle, separated from the CSS. The canopy did not exhibit damage.

Figure 7. View of colored beach towel

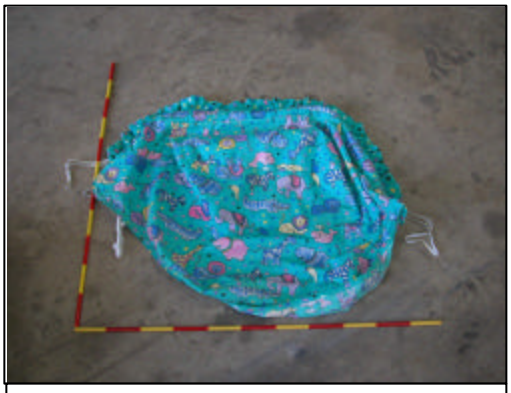

Figure 8. CSS canopy

VEHICLE DAMAGE

Exterior Damage – *1996 Dodge Grand Caravan*

Figure 9. Frontal damage to the 1996 Dodge Grand Caravan

The 1996 Dodge Grand Caravan sustained moderate frontal damage as a result of the impact with the Pontiac Grand Am **(Figure 9)**. The direct contact damage on the hood began 26.7 cm (10.5”) to the right of the centerline and extended 50.2 cm (19.8”) along the leading edge of the hood to the front right corner. The front right aspect of the hood was crushed rearward and abraded. The leading edge of the hood and leading aspect of the right front fender exhibited grey paint transfers from contact with the Grand Am. The right headlamp was fractured and the right aspect of the radiator was crushed rearward. The front bumper fascia was separated from the vehicle and was not available for inspection. The grille was displaced and the left headlamp was separated. The bumper beam was crushed rearward on the right side, which caused the displacement of the entire bumper beam. The left front fender was displaced rearward and outward at the forward aspect. The right front fender was crushed rearward and inward at the forward aspect. The frontal crush resulted in the reduction of the right wheelbase by 9.0 cm (3.5”). The hood was displaced slightly to the left. The combined direct and induced damage involved the entire frontal width of the Grand Caravan and measured 134.0 cm (52.8”) across the bumper beam. Six crush measurements were documented along the front bumper beam and were as follows: C1 = 4.4 cm (1.8”), C2 = 2.2 cm (0.9”), C3 = 3.2 cm (1.3”), C4 = 6.4 cm (2.5”), C5 = 11.7 cm (4.6”), C6 =

15.9 cm (6.3”). The Collision Deformation Classification (CDC) for the frontal impact with the Grand Am was 01-FREW-1.

The Dodge Grand Caravan sustained moderate right rear side damage **(Figure 10)** as a result of the secondary sideslap impact with the Grand Am. The direct contact damage began 48.9 cm (19.3”) rear of the right rear axle and measured 110.5 cm (43.5”) forward along the right side plane of the vehicle. The maximum lateral crush measured 11.4 cm (2.5”) and was located 27.5 cm (10.8”) rear of the right rear axle. Direct contact abrasions were present on the right rear quarter panel and grey paint transfers were present on the right D-pillar, located 14.0 cm (5.5”) above the beltline. The right rear wheel cover was abraded and the right rear tire exhibited a sidewall tear. Six crush measurements were documented along the right side plane and were as follows: C1 = 0.0 cm, C2 = 1.0 cm (0.4”), C3 = 2.9 cm (1.1”), C4 = 4.8 cm (1.9”), C5 = 8.3 cm (3.3”), C6 = 0.0 cm. The CDC for the sideslap impact was 03-RZEW-2.

Figure 10. View of right rear side damage from the sideslap

The Dodge Grand Caravan sustained minor left front wheel damage as a result of the impact with the curb and the concrete slab sewer cover. The left front wheel was deformed from striking the concrete slab, which resulted in an air-out of the left front tire. The undercarriage exhibited dirt and grass debris from the roadside. The CDC for the left front wheel impact to the curb was 12-FLWN-3.

A diagonal black scuff/rubber transfer that measured 40.6 cm (16.0”) in length and 12.7 cm (5.0”) in height was present on the forward aspect of the left front fender. Given the lack of potential sources of the scuff and the vehicle’s pre- and post-impact paths of travel, the scuff did not appear to be related to this crash.

Interior Damage - *1996 Dodge Grand Caravan*

The 1996 Dodge Grand Caravan sustained minor interior damage as a result of the frontal impact **(Figure 11)**. All of the doors on the vehicle were operational. The windshield sustained fractures on the right aspect from impact forces. The right rear glazing disintegrated from impact forces associated with the sideslap event. The steering column-mounted transmission selector arm was fractured from the column. It was not known if it was the result of occupant contact, although the steering column was not compressed. The right tow pan intruded longitudinally 4.4 cm (1.8”). The right rear side panel adjacent to the third bench seat intruded 3.2 cm (1.3”) laterally. The plastic clip for the inboard aspect of the driver’s sun visor was fractured. The rear-view mirror was separated. The plastic arm for the front right sun visor was fractured 6.0 cm

Figure 11. View of front seating positions and contacts

(2.3”) inboard of the elbow. The sun visor was found on the front right floor during the vehicle inspection. The front right sun visor exhibited colored fabric transfers and fibers **(Figure 12)**, consistent with the colored fabric of the beach towel that was present in the vehicle. The leading edge of the sun visor was also abraded from contact with the expanding front right passenger’s air bag. A small amount of fluid spatter was noted on the headliner aft of the sun visor. The pattern of the spatter measured 6.4 cm (2.5”) in width and 16.5 cm (6.5”) in length. The source of the spatter was unknown, as the child passenger did not sustain any open soft-tissue injuries. Two dark linear scuffs were present on the headliner adjacent to the right B-pillar trim that measured 11.0 cm (4.3”) in length and were spaced 7.0 cm (2.8”) apart. The third seat back exhibited marks from the tires located in the cargo area, which struck the seat back during the frontal impact.

Figure 12. View of damaged front right sun visor, fabric transfers, and fibers

MANUAL RESTRAINT SYSTEMS – 1996 Dodge Grand Caravan

The 1996 Dodge Caravan was equipped with manual 3-point lap and shoulder belts for all outboard seating positions. Both front safety belts were designed with Emergency Locking Retractors (ELR’s) and adjustable D-rings that were positioned in the full-down positions. The driver’s restraint was configured with a sliding latch plate and front right restraint was configured with a cinching latch plate. The driver’s safety belt webbing **(Figure 13)** exhibited minor stretching that began 78.1 cm (30.5”) above the lower anchor and extended 27.9 cm (11.0”). A section of the inboard aspect of the webbing that measured 2.5 x 1.6 cm (1.0 x 0.6”) was gathered in the latch plate at the top end of the stretched area. A plastic transfer was present on the inboard face of the webbing on the left B-pillar from engagement against the D-ring as the webbing was loaded by the driver. The driver’s D-ring was moderately abraded from the loading of the webbing. The transfer measured 5.1 cm (2.0”) in height and extended across the full-width of the webbing. The front right safety belt webbing exhibited minor stretching which began 81.3 cm (32.0”) above the lower anchor and extended 38.1 cm (15.0”). There were no plastic transfers or abrasions on the webbing from the CSS.

Figure 13. View of driver's safety belt

The second row bench seat was configured with manual 3-point lap and shoulder belts for both seating positions. Both safety belts were configured ELR's, cinching latch plates, and adjustable D-rings that were located in the full-down positions. The left safety belt showed latch plate abrasions consistent with historical use. The right safety belt was roped along the entire lap belt section **(Figure 14)**. A total of eight complete twists were present in the webbing between the latch plate and the lower anchor. One half-twist was present between the latch plate and the D-ring, and one additional twist was present between the D-ring and the retractor. There was no loading evidence on the safety belt webbing, and the latch plate showed abrasions consistent with historical use.

Figure 14. Close-up of roped lap belt

The third bench seat was equipped with manual 3-point lap and shoulder belts for both outboard positions. Each lap and shoulder belt was configured with an ELR, fixed D-ring, and a cinching latch plate. The right safety belt webbing was restricted in a semi-retracted position due to damage from the right rear side panel impact. There was no evidence of occupant loading to the webbing. The right side safety belt was undamaged. The center position of the third bench seat was configured with a lap belt with a locking latch plate.

CHILD SAFETY SEAT

The specific CSS model information was unknown. The CSS was discarded by the family and was not available for inspection. Photographs of the CSS have been requested from the police department.

***FRONTAL AIR BAG SYSTEM – 1996 Dodge Grand* Caravan**

The 1996 Dodge Caravan was equipped with frontal air bags for the driver and front right passenger positions. Although the 1996 Caravan was not equipped with an advanced safety system, only the front right passenger's air bag deployed. The driver's air bag was housed in the center of the steering wheel and did not deploy in this crash. Prior maintenance on the air bag system was unknown and it was not known if the recall relating to the frontal air bag system (NHTSA CAMPAIGN ID Number: 02V293000, Appendix A) was addressed by the owner of the vehicle.

Figure 15. Front right passenger's air bag

The front right passenger's air bag **(Figure 15)** deployed as a result of the frontal impact with the 1990 Grand Am. The air bag deployed from a mid-mount module configured with vinyl cover flaps. The top flap measured 12.1 cm (4.8") in height and the bottom flap measured 6.4 cm (2.5") in height. The lateral tear seam measured 27.9 cm (11.0") in width. The air bag measured 66.0 cm (26.0") in height and 40.6 cm (16.0") in width in its deflated state. The horizontal distance from the face of the air bag

module cover flaps (instrument panel face) to the mid-point of the front right seat back measured 68.6 cm (27.0”).

Figures 16, 17, and 18 show still shots of a New Car Assessment Program (NCAP) high-speed film of a 1996 Dodge Caravan crash test. The bottom of the front right passenger’s air bag deployed first. Without a CSS present in the front right seat, the top aspect was projected outward toward the occupant as the air bag inflated. As the air bag continued to inflate, the top aspect of the face of the air bag was redirected in a vertical motion and the entire air bag pivoted upward toward the windshield header. At maximum inflation, the top panel of the air bag was engaged with the windshield and windshield header.

Figure 16. View 4 milliseconds after deployment begins, approximately 20 milliseconds after barrier impact

Figure 17. View of air bag inflation showing the top aspect projecting outward

Figure 18. View 21 milliseconds after deployment begins, showing air bag pivoting and engaging the windshield

Multiple transfers were present on the air bag from interaction with the colored beach towel. An area of faint green/red fabric transfer **(Figure 19)** was present on the top aspect of the air bag. The transfer began at the forward seam on the top aspect of the air bag and was centered between the side aspects. The transfer area measured 24.1 cm (9.5”) in length and 10.2 cm (4.0”) in width. Faint diagonal abrasions were present on the outboard aspect of the transfer that may have resulted from interaction with the plastic shell of the CSS. The abrasions measured 11.0 cm (4.3”) in length and were located 16.5 cm (6.5”) inboard of the right side aspect of the air bag. A small tear in the air bag membrane was located 3.8 cm (1.5”) from the right side aspect and 10.2 cm (4.0”) from the air bag module. The tear measured 1.3 cm (0.5”) in length and resulted from snagging the bottom right corner of the top cover flap as the air bag deployed against the CSS.

Figure 19. View of top of front right passenger air bag showing area of transfers and membrane tear

Black vinyl transfers from probable interaction with the cover flap were present on the top aspect of the face of the air bag, left of the centerline. The transfers measured 7.6 cm (3.0”) in width and 8.9 cm (3.5”) in height. The right aspect of the air bag exhibited dirt from post-crash handling.

Green fabric fibers from the beach towel were present on the rear bottom left corner of the air bag **(Figure 20)**. They were located 7.0 cm (2.8") forward of the bottom seam and 11.4 cm (4.5") inboard of the left side aspect.

Figure 20. View of green fabric fibers on bottom aspect of the air bag

OCCUPANT DEMOGRAPHICS – 1996 Dodge Grand Caravan

Driver

Age/Sex:	32-year-old female
Height:	Not reported
Weight:	Not reported
Seat Track Position:	Between mid-track and full-forward
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection, injury data
Eyewear:	Unknown
Type of Medical Treatment:	Transported by ambulance to a local hospital and treated and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Left upper chest wall contusion	Minor (490402.1,2)	Safety belt webbing

Injury source: Emergency Room Records

Driver Kinematics

The 32-year-old driver was presumed to have been seated in an upright posture. The seat track position was near full-forward and the seat back recline angle was 45 degrees aft of vertical at the time of the vehicle inspection. It was unknown if the seat track was in this position and it was unlikely that the seat back was reclined 45 degrees at the time of the crash. The driver was restrained by the manual 3-point lap and shoulder belt. At impact with the Pontiac Grand Am, the driver initiated a forward trajectory and loaded the safety belt. The loading to the safety belt produced a significant D-ring abrasion and a plastic transfer on the webbing and resulted in a left chest wall contusion. The front right passenger's air bag deployed, but the driver's air bag failed to deploy. Due to the possible close proximity of the driver to the steering wheel and lack of the driver's air bag deployment, the driver may have contacted the steering wheel, although the steering column was not compressed and the rim was not deformed. The transmission selector arm was fractured from the steering column. Although there were no associated injuries to suggest occupant contact, it was possible that the driver's right hand struck the transmission lever. The driver rebounded rearward and was redirected to the right in response to the sideslap event. She was redirected forward as the Grand Caravan struck the concrete curb. Her head may have contacted the driver's sun visor, which displaced it forward, fracturing the plastic inboard clip. It was not known how the driver exited the vehicle. She was transported by ambulance to a local hospital where she was treated for her injuries and released.

Front Right Child Passenger

Age/Sex:	6-month-old male
Height:	70 cm (27.6")
Weight:	7.6 kg (16.8 lb)
Seat Track Position:	Mid-track
Manual Restraint Use:	Rear-facing infant CSS (without the detachable base)
Usage Source:	Injuries, police photographs
Eyewear:	None
Type of Medical Treatment:	Transported by ambulance to a local hospital where he expired

Front Right Child Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Near circular displaced fracture that involved the right posterior parietal occipital region. Extending leftward from this fracture was a diastatic fracture that extended through the lambdoid suture. Hemorrhage brain parenchyma exuded through the circular fracture. Another linear fracture from the circular fracture extended to the left and connected to a fracture through the sagittal suture in the midline.	Severe (150406.4,1)	Expanding air bag against the rear aspect of CSS shell
Extending downward from the circular fracture was a linear fracture that involved the left occipital bones and extended to the base of the skull.	Moderate (150402.2,6)	Expanding air bag against the rear aspect of CSS shell
A semi-circular fracture was located posteriorly, partially encircling the foramen ovale. On the left middle cranial fossa was a U-shaped fracture that extended from the previously described diastatic fracture involving the lambdoid suture.	Serious (150200.3,8)	Expanding air bag against the rear aspect of CSS shell
Associated with the head injury was mild patchy subarachnoid hemorrhage that was distributed over the cerebral convexities and cerebellum.	Serious (140466.3,6) Serious (140684.3,1) Serious (140684.3,2)	Expanding air bag against the rear aspect of CSS shell
Cerebral edema, NFS	Serious (140660.3,9)	Expanding air bag against the rear aspect of CSS shell
Extensive occipital and posterior parietal subscalp and subgaleal hemorrhage	Minor (190402.1,6)	Expanding air bag against the rear aspect of CSS shell

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
1.0 x 0.5 cm contusion under the chin	Minor (290402.1,8)	Flexing head resulting in chin-to-chest contact
2.5 x 1.0 cm left forehead contusion	Minor (290402.1,7)	Outboard plastic edge of CSS

Injury source: Autopsy report

Front Right Child Passenger Kinematics

The 6-month-old child passenger was restrained in a rear-facing infant CSS that was installed in the front right passenger's seat without the detachable base. It was not known how the child was restrained within the CSS or how tight the CSS was installed in the vehicle. A brightly colored beach towel was present somewhere on, or under the CSS. The longitudinal tear to the towel and the fabric transfers to the sun visor and air bag suggested that the towel may have been placed in the CSS under the child, however, the child did not exhibit injuries consistent with the towel placement under him.

At impact, the front right passenger's air bag deployed. The top aspect of the air bag deployed outward into the passenger compartment under the top aspect of the CSS shell. The vertical and longitudinal expansion of the air bag projected the CSS rearward and snagged the beach towel. The beach towel was carried with the top aspect of the air bag as it expanded vertically against the windshield and windshield header, evidenced by the colored fabric transfers on the air bag and fabric fiber deposits on the front right sun visor. The CSS pivoted rearward as the air bag expanded against the plastic shell. The CSS shell was deflected against the rear aspect of the child's head as a result of the air bag expansion. The child sustained a near circular displaced fracture that involved the right posterior parietal occipital region. Extending leftward from that fracture was a diastatic fracture that extended through the lambdoid suture. Hemorrhage brain parenchyma exuded through the circular fracture. Another linear fracture from the circular fracture extended to the left and connected to a fracture through the sagittal suture in the midline. Extending downward from the circular fracture was a linear fracture that involved the left occipital bones and extended to the base of the skull. A semi-circular fracture was located posteriorly, partially encircling the foramen ovale. On the left middle cranial fossa was a U-shaped fracture that extended from the previously described diastatic fracture involving the lambdoid suture. Associated with the head injury was mild patchy subarachnoid hemorrhage that was distributed over the cerebral convexities and cerebellum. Cerebral edema and extensive occipital and posterior parietal subscalp and subgaleal hemorrhage were also present. The nature of the head injuries suggests a concentrated impact to the right occipital aspect of the head, which radiated forward through the skull. The CSS pivoted against the front right seat back as the air bag inflated to capacity and his head flexed forward which caused his chin to compress against his chest, resulting in a contusion under the chin. As the air bag began to deflate, the CSS and child initiated a lateral trajectory toward the right sideslap impact. The left aspect of the child's head struck the outboard aspect of the plastic CSS shell, which resulted in a left forehead contusion. The child was further displaced in the CSS as the Grand Caravan struck the curb and came to rest on the roadside.

The police stated that bystanders removed the child from the CSS and began resuscitation efforts, although the Emergency room report states that EMS found the child in the CSS outside of the vehicle. The child was found to be in cardiac arrest with no life signs. Rescue personnel assumed care and transported the child by ambulance to a local hospital. The child expired 30 minutes following the crash.

Rear Right Child Passenger

Age/Sex:	6-year-old female
Height:	Not reported
Weight:	17.8 kg (39.2 lb)
Seat Track Position:	Fixed
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Lack of serious injury, police report
Eyewear:	Unknown
Type of Medical Treatment:	Transported by ambulance to a local hospital and treated and released

Rear Right Child Passenger Kinematics

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
2 cm (1") left forehead contusion	Minor (290402.1,7)	Unknown

Injury source: Emergency Room Records

Rear Right Child Passenger Kinematics

The 6-year-old female passenger was listed on the PAR as seated in position "6" of the Grand Caravan. However, given the injury to the left aspect of her head, and the status of the safety belt webbing (roped) on the right aspect of the second bench seat, it is possible that she was seated on the left side of the second bench seat. It was unlikely that she was seated on the third bench seat adjacent to the sideslap area, as the right safety belt was restricted in a semi-retracted position, and the child had no soft tissue injuries consistent with flying glass. Her exact position could not be confirmed.

At impact, the 6-year-old child initiated a forward trajectory and loaded the manual restraint. She was redirected to the right and rebounded to the left during the sideslap event. She sustained a minor contusion on the left aspect of her forehead, from possible contact with the left C-pillar, assuming she was seated on the left aspect of the second bench seat. She was redirected forward as the Grand Caravan struck the curb and came to rest. It was not known how she exited the vehicle. She was transported by ambulance to a local hospital where she was treated for her injuries and released.

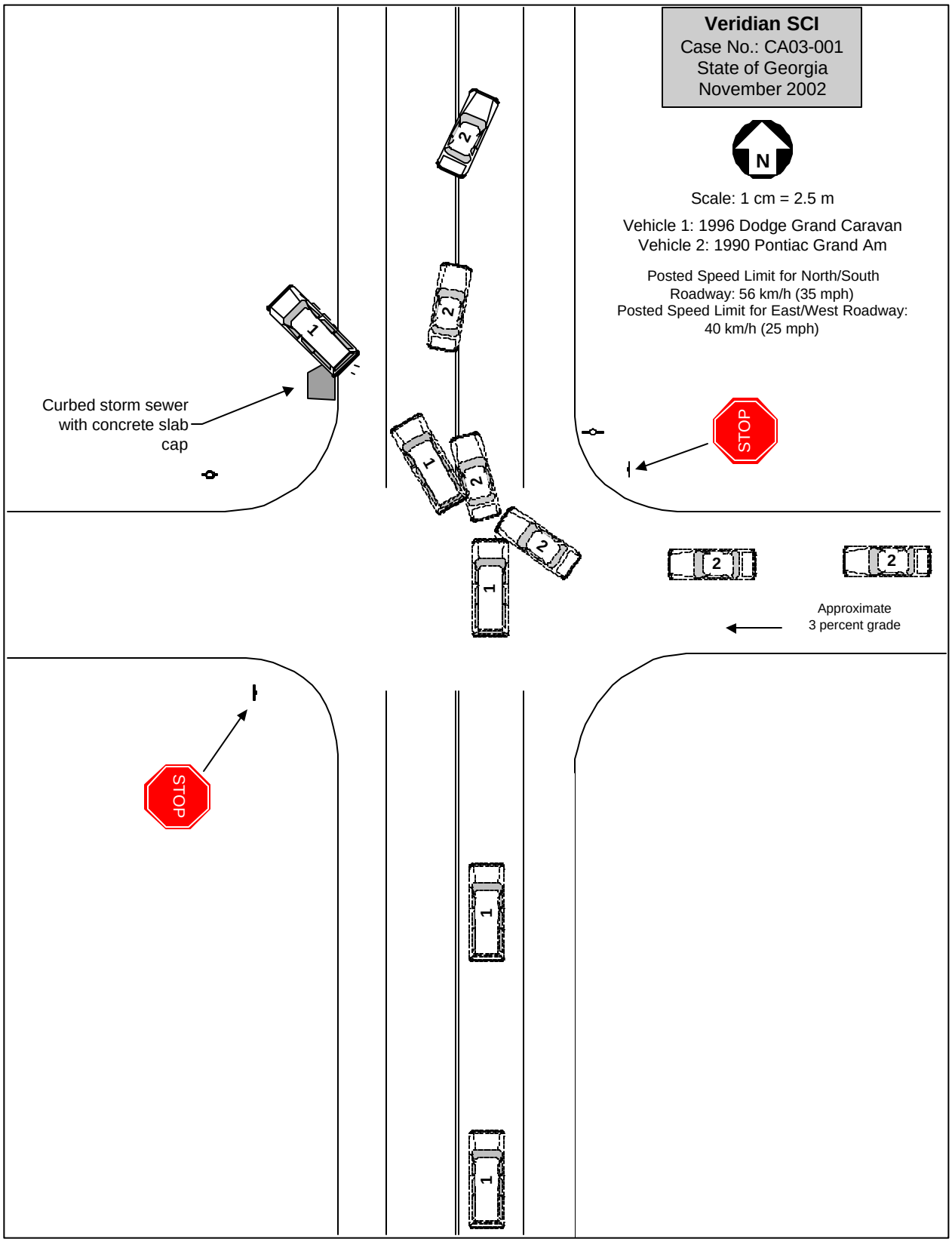

Figure 21. Scene schematic

APPENDIX A

Make : DODGE **Model :** CARAVAN **Year :** 1996

NHTSA CAMPAIGN ID Number : 02V293000 **Recall Date :** NOV 04, 2002

Component: AIR BAGS:FRONTAL

Potential Number Of Units Affected : 1500521

Summary:
ON CERTAIN MINI VANS, THE CLOCKSPRING ASSEMBLY MAY HAVE BEEN WOUND INCORRECTLY DURING THE VEHICLE ASSEMBLY PROCESS.

Consequence:
THIS CONDITION WILL MANIFEST ITSELF THROUGH ILLUMINATION OF THE AIR BAG WARNING LAMP, AND COULD EVENTUALLY RESULT IN A DRIVER'S AIR BAG OPEN CIRCUIT, IF THE PART IS NOT REPLACED IN A REASONABLE AMOUNT OF TIME.

Remedy:
DEALERS WILL REPLACE THE CLOCKSPRING ASSEMBLY ON ALL VEHICLES WITH 70,000 MILES OR LESS. AN EXTENDED LIFETIME WARRANTY WILL ALSO BE PLACED ON THIS COMPONENT FOR ALL AFFECTED VEHICLES, REGARDLESS OF MILEAGE. DAIMLERCHRYSLER WILL ALSO REIMBURSE OWNERS WHO HAVE PAID TO HAVE THE CLOCKSPRING REPLACED ON THEIR VEHICLES. OWNER NOTIFICATION BEGAN NOVEMBER 18, 2002. OWNERS WHO TAKE THEIR VEHICLES TO AN AUTHORIZED DEALER ON AN AGREED UPON SERVICE DATE AND DO NOT RECEIVE THE FREE REMEDY WITHIN A REASONABLE TIME SHOULD CONTACT DAIMLERCHRYSLER AT 1-800-853-1403.

Notes:
ALSO, CUSTOMERS CAN CONTACT THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S AUTO SAFETY HOTLINE AT 1-888-DASH-2-DOT (1-888-327-4236).

Make : DODGE **Model :** CARAVAN **Year :** 1996

NHTSA CAMPAIGN ID Number : 98V185000 **Recall Date :** AUG 06, 1998

Component: CHILD SEAT

Potential Number Of Units Affected : 157000

Summary:
VEHICLE DESCRIPTION: MINI VANS EQUIPPED WITH INTEGRATED CHILD SEATS. THE SHOULDER HARNESS RESTRAINT ON THE INTEGRATED CHILD SEAT CAN BECOME DIFFICULT TO EXTRACT WHEN THE SAFETY BELT LATCH PLATE BECOMES CONTAMINATED.

Consequence:
THIS CAN CAUSE DIFFICULTY IN RELEASING A CHILD FROM THE RESTRAINT.

Remedy:
DEALERS WILL CLEAN THE LATCH MECHANISM. AN EXTENDER WILL BE ADDED TO THE EMERGENCY RELEASE ANCHOR FOR THE CHILD SEAT SAFETY BELTS SO THAT THE RELEASE CLIPS ARE MORE VISIBLE AND ACCESSIBLE TO THE OPERATOR IN THE EVENT THAT THE RETRACTOR MECHANISM CAN NOT BE UNLOCKED. IN ADDITION, AN INSTRUCTIONAL OWNER'S MANUAL SUPPLEMENT CARD WILL BE PROVIDED.

Notes:
OWNER NOTIFICATION IS EXPECTED TO BEGIN NOVEMBER 30, 1998. OWNERS WHO TAKE THEIR VEHICLES TO AN AUTHORIZED DEALER ON AN AGREED UPON SERVICE DATE AND DO NOT RECEIVE THE FREE REMEDY WITHIN A REASONABLE TIME SHOULD CONTACT CHRYSLER AT 1-800-992-1997. ALSO CONTACT THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S AUTO SAFETY HOTLINE AT 1-888-DASH-2-DOT (1-888-327-4236).

Make : DODGE **Model :** CARAVAN **Year :** 1996

NHTSA CAMPAIGN ID Number : 95I004000 **Recall Date :** SEP 15, 1995

Component: SEAT BELTS:INTEGRATED CHILD SEAT

Potential Number Of Units Affected : 5224

Summary:

Consequence:

Remedy:
CHRYSLER DEALERS WILL REPLACE BOTH CHILD SEAT ASSEMBLIES WITH REVISED SEATS CONTAINING RETRACTOR IMPROVEMENTS. THE REVISED SEATS WILL ALSO INCREASE CHILD COMFORT BY INCORPORATING PROTECTIVE SEAT BELT WRAPS TO PREVENT BELT CHAFE.

Notes:
SYSTEM: EQUIPMENT; CHILD SEAT; INTEGRAL PART OF SEAT.VEHICLE DESCRIPTION: PASSENGER MINI-VANS EQUIPPED WITH INTEGRATED CHILD SEATS.DESCRIPTION OF PROBLEM: THIS IS NOT A SAFETY RECALL IN ACCORDANCE WITH FEDERALREGULATION 573. HOWEVER, IT IS DEEMED A SAFETY IMPROVEMENT CAMPAIGN BY THE AGENCY. THE CAMPAIGN WILL REPLACE BOTH CHILD SEAT ASSEMBLIES WITH REVISED SEATS CONTAINING RETRACTOR IMPROVEMENTS. CONSEQUENCE OF PROBLEM: IN AN EMERGENCY SITUATION, IT WOULD BE DIFFICULT TO REMOVE A CHILD FROM THE SEAT. NOTE: THIS IS NOT A SAFETY RECALL. THERE HAS BEEN NO DETERMINATION THAT A SAFETY DEFECT EXISTS WITH THE CHILD SEATS. OWNERS CAN CONTACT CHRYSLER AT 1-800-853-1403.

Make : DODGE **Model :** CARAVAN **Year :** 1996

NHTSA CAMPAIGN ID Number : 97I001000 **Recall Date :** OCT 23, 1996

Component: SEAT BELTS:INTEGRATED CHILD SEAT

Potential Number Of Units Affected : 150000

Summary:
VEHICLE DESCRIPTION: MULTIPURPOSE PASSENGER VEHICLES EQUIPPED WITH INTEGRAL CHILD SEATS. THIS IS NOT A SAFETY RECALL IN ACCORDANCE WITH FEDERAL REGULATION 573. HOWEVER, IT IS DEEMED A SAFETY IMPROVEMENT CAMPAIGN BY THE AGENCY. ON THE INTEGRAL CHILD SEAT, THE SHOULDER BELTS RESTRAINING THE CHILD RETRACT AND LOCK IN PLACE AFTER THE BELT BUCKLE IS CONNECTED TO THE LATCH PLATE. THE LATCH PLATE MOVEMENT LOCKS THE BELTS TO MAKE SURE THE CHILD IS RESTRAINED IN THE CASE OF A VEHICLE CRASH.

Consequence:
THE LATCH PLATE LOCATED IN THE SEAT CUSHION AREA MUST BE FREE TO MOVE BACK AGAINST ITS STOP AFTER THE BUCKLE IS REMOVED TO ALLOW THE SHOULDER BELTS TO BE PULLED OUT. ALWAYS BE SURE THE AREA AROUND THE LATCH PLATE IS FREE OF FOOD OR OTHER ITEMS THAT MIGHT PREVENT THE LATCH PLATE FROM MOVING BACK.

Remedy:
OWNERS ARE BEING PROVIDED WITH A VIDEO TAPE AND 2 HARNESS CLIPS. THE VIDEO TAPE INSTRUCTS OWNERS ON THE PROPER USE AND MAINTENANCE OF THE CHILD SEATS.

Notes:
NOTE: CHRYSLER HAS DECIDED TO CONDUCT A SAFETY IMPROVEMENT CAMPAIGN TO MAKE THE VEHICLE OWNER AWARE OF HOW THE INTEGRAL CHILD SEAT LATCHING SYSTEM WORKS. OWNERS CAN CONTACT CHRYSLER AT 1-800-853-1403.

Make : DODGE **Model :** CARAVAN **Year :** 1996

NHTSA CAMPAIGN ID Number : 96V136000 **Recall Date :** JUL 17, 1996

Component: SEAT BELTS:INTEGRATED CHILD SEAT

Potential Number Of Units Affected : 200

Summary:
THE BOLTS WHICH SECURE THE INTEGRATED CHILD SEAT MODULES TO THE SEAT FRAME CAN BREAK.

Consequence:
IN THE EVENT OF A VEHICLE ACCIDENT, THE CHILD SEAT MAY NOT PROVIDE ADEQUATE PROTECTION TO THE OCCUPANT.

Remedy:
DEALERS WILL REPLACE THE INTEGRATED CHILD SEAT MODULE BOLTS.

Notes:
SYSTEM: EQUIPMENT; CHILD SEAT; INTEGRAL PART OF SEAT. VEHICLE DESCRIPTION: MINI-VANS EQUIPPED WITH CHILD SEAT MODULES. OWNER NOTIFICATION: OWNER NOTIFICATION IS EXPECTED TO BEGIN DURING AUGUST 1996. NOTE: OWNERS WHO TAKE THEIR VEHICLES TO AN AUTHORIZED DEALER ON AN AGREED UPON SERVICE DATE AND DO NOT RECEIVE THE FREE REMEDY WITHIN A REASONABLE TIME SHOULD CONTACT CHRYSLER AT 1-800-853-1403. ALSO CONTACT THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S AUTO SAFETY HOTLINE AT 1-800-424-9393.

Make : DODGE **Model :** CARAVAN **Year :** 1996

NHTSA CAMPAIGN ID Number : 95V225000 **Recall Date :** NOV 28, 1995

Component: SEATS

Potential Number Of Units Affected : 20000

Summary:
THE BOLTS WHICH SECURE THE REAR BENCH SEATS TO THE SEAT RISERS MAY BE EMBRITTLED AND FRACTURE.

Consequence:
IN CASE OF AN ACCIDENT, THE BOLT MAY FAIL AND CAN CAUSE THE SEAT TO BREAK AWAY FROM THE SEAT RISERS, WHICH INCREASES THE POTENTIAL OF INJURY TO ITS OCCUPANTS.

Remedy:
DEALERS WILL REPLACE THE REAR BENCH SEAT TO RISER BOLTS.

Notes:
SYSTEM: INTERIOR; SEAT TRACKS AND ANCHORS. VEHICLE DESCRIPTION: PASSENGER MINI-VANS EQUIPPED WITH BENCH SEATS AND MANUFACTURED AT THE WINDSOR ASSEMBLY PLANT ("R" IN THE 11TH VIN POSITION). NOTE: OWNERS WHO TAKE THEIR VEHICLES TO AN AUTHORIZED DEALER ON AN AGREED UPON SERVICE DATE AND DO NOT RECEIVE THE FREE REMEDY WITHIN A REASONABLE TIME SHOULD CONTACT CHRYSLER AT 1-800-853-1403. ALSO CONTACT THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION'S AUTO SAFETY HOTLINE AT 1-800-424-9393.