CRASH DATA RESEARCH CENTER

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CALSPAN ON-SITE CHILD AIR BAG RELEATED FATALITY INVESTIGATION

CALSPAN CASE NO: CA06-004

VEHICLE: 1996 PLYMOUTH VOYAGER

LOCATION: NORTH CAROLINA

CRASH DATE: FEBRUARY 2006

Contract No. DTNH22-01-C-17002

Prepared for:

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

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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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. CA06-004	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Calspan On-Site Child Air Bag Related Fatality Investigation Vehicle: 1996 Plymouth Voyager Location: State of North Carolina		*5. Report Date*: April 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.* C00410.0000.0342 *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: February 2006 *14. Sponsoring Agency Code*	
15. Supplementary Note On-site investigation focused on the on the severity of the crash and the source of injury that caused the death of a restrained 6-year-old male front right occupant of a 1996 Plymouth Voyager.			
16. Abstract This on-site investigation focused on the severity of the crash and the source of injury that caused the death of a restrained 6-year-old male front right occupant of a 1996 Plymouth Voyager. The Plymouth was equipped with first generation frontal air bags for the driver and front right positions that deployed as a result of the crash. The Plymouth was occupied by a restrained 23-year old female driver, a restrained 6-year-old male front right occupant, a restrained 4-year-old male rear left occupant, and a 2-week-old male rear right occupant restrained in an infant child safety seat. The Plymouth was involved in a minor severity intersection crash with a 2004 Jeep Grand Cherokee. The driver of the Plymouth was operating the vehicle southbound on a local roadway approaching the intersection. The driver of the Jeep was turning left across the path of the Plymouth at the intersection. The driver of the Plymouth applied braking force in an attempt to avoid the impact. This pre-impact braking displaced the 6-year-old male right front occupant forward in the path of the deploying air bag. The mid-mount front right air bag expanded and struck the 6-year-old male front right occupant's head, which resulted in a 5 mm left subdural hematoma of the frontal temporal and parietal region with significant left to right shift, massive cerebral edema/cisterns obliterated, multiple abrasions to the left side of the face, nose abrasion, and a left eyelid contusion. The 6-year-old male was transported by ambulance to a local hospital where expired one day post-crash. The driver of the Plymouth sustained minor severity injuries and was transported by ambulance to a local hospital where she was treated and released. The 2-week-old male infant and the 4-year-old male were not injured; however, they were transported by ambulance to a local hospital for observation.			
17. Key Words Frontal Air Bag Deployment 6-year-old male right front occupant		*18. Distribution Statement* General Public	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 14	*22. Price*

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CASE NO.: CA06-004
VEHICLE: 1996 PLYMOUTH VOYAGER
LOCATION: NORTH CAROLINA
DATE OF CRASH: FEBRUARY 2006

BACKGROUND

This on-site investigation focused on the severity of the crash and the source of injury that caused the death of a restrained 6-year-old male front right occupant of a 1996 Plymouth Voyager **(Figure 1)**. The Plymouth was equipped with first generation frontal air bags for the driver and front right positions that deployed as a result of the crash. The Plymouth was occupied by a restrained 23-year old female driver, a restrained 6-year-old male front right occupant, a restrained 4-year-old male rear left occupant, and a 2-week-old male rear right occupant restrained in an infant child safety seat. The Plymouth was involved in a minor severity intersection crash with a 2004 Jeep Grand Cherokee. The driver of the Plymouth was operating the vehicle southbound on a local roadway approaching the intersection. The driver of the Jeep was turning left across the path of the Plymouth at the intersection. The driver of the Plymouth applied braking force in an attempt to avoid the impact. This pre-impact braking displaced the 6-year-old male right front occupant forward in the path of the deploying air bag. The mid-mount front right air bag expanded and struck the 6-year-old male front right occupant's head, which resulted in a 5 mm left subdural hematoma of the frontal temporal and parietal region with significant left to right shift, massive cerebral edema/cisterns obliterated, multiple abrasions to the left side of the face, nose abrasion, and a left eyelid contusion. The 6-year-old male was transported by ambulance to a local hospital where expired one day post-crash. The driver of the Plymouth sustained minor severity injuries and was transported by ambulance to a local hospital where she was treated and released. The 2-week-old male infant and the 4-year-old male were not injured; however, they were transported by ambulance to a local hospital for observation.

Figure 1. Subject vehicle 1996 Plymouth Voyager.

The crash was identified through an Internet news search by NHTSA and assigned to the Calspan Special Crash Investigations team for on-site investigation on February 7, 2006. The Plymouth and Jeep were located at two local salvage facilities were cooperation was established to inspect the vehicles. The inspections of the vehicles, crash site, and driver interview of the Plymouth were conducted during the week of March 13, 2006.

SUMMARY

Crash Site

The crash occurred on a five-lane 19.9 m (65.3 ft) wide north/south roadway that was intersected by two business driveways at the east and west road edges. The north/south roadway consisted of two travel lanes in each direction with a center two-way left turn lane. A solid yellow line with a broken yellow line adjacent delineated the turn lane. The 12.3 m (40.4 ft) wide driveway that intersected the roadway from the east roadside was configured with three lanes; a single westbound lane, a left turn lane, and a right turn only lane. The 7.5 m (24.6 ft) wide driveway on the west road edge consisted single lane for two-way traffic. There were no traffic control devices for the west driveway. The posted speed limit was 72 km/h (45 mph) for the north/south roadway. The scene schematic is included as **Figure 15** of this report.

Vehicle Data

1996 Plymouth Voyager

The subject vehicle in this crash was a 1996 Plymouth Voyager. The vehicle was purchased used by the driver in September 2005. The history of the vehicle and safety systems was unknown. The 1996 Plymouth Voyager was manufactured on September 1995 and was identified by Vehicle Identification Number (VIN) 2P4FP2537T (production number deleted). The odometer reading at the time of the SCI inspection was unknown due to the expended vehicle battery and electronic odometer. The driver stated to the SCI investigator that vehicle had more than 160,900 kilometers (100,000 miles) on the odometer. The vehicle was a three-door minivan that was equipped with a 3.0-liter, V-6 engine linked to a four-speed automatic transmission with a steering column mounted transmission shifter. The service brakes were hydraulic front disc/rear drum. The vehicle was equipped with OEM plastic wheel covers over steel rims. The Voyager was configured with P205/75R14 steel belted radial tires. The front tires were Steel Belted Radial and the rear tires were Goodyear Weather Handler LS. The 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	248 kPa (36 PSI)	6 mm (8/32”)	None
Left Rear	207 kPa (30 PSI)	4 mm (5/32”)	None (dry rot between treads and bead)
Right Front	Unknown stem was inaccessible	6 mm (7/32”)	None
Right Rear	145 kPa (21 PSI)	4 mm (5/32”)	None (dry rot between treads and bead)

The interior of the Voyager was configured with cloth surfaced front bucket seats and bench seats in the second and third rows. The front seats were designed with integrated head restraints. The second and third rows were equipped with height adjustable head

restraints for the outboard seats; however, they were not with the vehicle at the time of the SCI inspection. Additionally, the vehicle was equipped with a tilt steering wheel that was adjusted to the full-up position at the time of the SCI inspection. The Voyager's interior options included power door locks, cruise control, air conditioning, power mirrors, and manually operated windows.

2004 Jeep Grand Cherokee

The non-subject vehicle was a 2004 Jeep Grand Cherokee that was identified by VIN: 1J4GW48S34 (production number omitted). A 4.0-liter, inline 6-cylinder engine linked to a 4-speed automatic transmission with a console-mounted shifter powered the Jeep. The Jeep was equipped with General AmeriTrac SUV tires on the front and Goodyear Wrangler ST tires on the rear all four tires were size P225/75R16. The tires were mounted on OEM five-spoke alloy wheels. The vehicle placard was located on the left door; however, the left side doors were jammed in the closed position and manufacturer recommended tire pressure for this vehicle was unknown.

Crash Sequence

Pre-Crash

The crash occurred on a straight segment of road with a downgrade for southbound travel. Located at the bottom of the grade was a business driveway that intersected the roadway from the west roadside. The driver of the Plymouth stated to the SCI investigator that she was retuning home from picking up the 6-year-old right front occupant from an after school program. She was operating the vehicle southbound in the left lane approaching the driveway **(Figure 2)**. She stated that the 6-year-old male was describing the events that occurred at school to the driver. The driver of the Plymouth indicated that a non-contact vehicle (large van) was traveling southbound adjacent to the Voyager. The 46-year-old female driver of the 2004 Jeep Grand Cherokee was traveling eastbound approaching the mouth of the driveway **(Figure 3)**. It was unknown if the driver of the Jeep intended to turn left or continue her eastbound travel direction. As the Plymouth approached the driveway, the driver observed the van accelerate which created some distance between the vehicles. The driver stated that as the van passed the driveway she observed the Jeep travel into the southbound lanes. Additionally, she stated that she applied the brakes in an attempt to avoid an impact. Although the driver of the Plymouth did not indicated that she applied a steering input, it appears that she probably steered left prior to the impact.

Figure 2. Plymouth's southbound approach.

Figure 3. Jeep's eastbound pre-crash travel.

Crash

The front right area of the Plymouth impacted the left side of the Jeep within the left southbound travel lane **(Figure 4)**. Based on the area of contact to the vehicles, it appears that the driver of the Plymouth probably steered left. Resultant directions of force were 1 o'clock for the Plymouth and 10 o'clock for the Jeep. The damage algorithm of the WinSMASH program computed total velocity changes of 15 km/h (9.3 mph) for the Plymouth and 13 km/h (8.1 mph) for the Jeep. The specific longitudinal and lateral components were -13 km/h (-8 mph) and -8 km/h (-4.7 mph) for the Plymouth and -7 km/h (-4.0 mph) and 11 km/h (7.0 mph) for the Jeep. As a result of the crash, the frontal air bag system in the Plymouth deployed.

Figure 4. Area of impact from the southbound lane.

The Voyager continued its forward and slight left travel and came to final rest approximately 10 m (33 feet) south of the driveway straddling the center two-way left turn lane and the inboard southbound lane **(Figure 5)**. The driver of the Jeep did not stop post-crash and fled the crash site. Police stopped the Jeep approximately 10 minutes post-crash on an interstate where it struck a sign post with the front right corner.

Figure 5. Plymouth's final rest.

Post-Crash

Immediately following the crash, the driver of the Plymouth observed the right front occupant slumped in the right front seat and bleeding from the mouth. The driver of a non-contact vehicle that was traveling behind the Plymouth came to the aid of the right front occupant. The driver of the Plymouth stated that the driver of the non-contact vehicle was an off-duty nurse and she proceeded to unbuckle the 6-year-old male and removed him from the vehicle. She placed him on the roadway beside the vehicle and began checking for vital signs. She stated to the driver of the Plymouth that she could hear the occupant gurgling blood and then began resuscitative efforts until Emergency Medical Technicians (EMT) arrived. The 6-year-old male right front occupant was transported by ambulance to a local hospital where he treated for his injuries; however, he expired one day post-crash. The driver and remaining two occupants were transported by ambulance to a local hospital. The driver was treated for minor injuries and subsequently released. The two rear male occupants were not injured.

Vehicle Damage

Exterior – 1996 Plymouth Voyager

The 1996 Plymouth Voyager sustained minor severity damage as result of the crash with the Jeep **(Figure 6)**. The damage was contained to the front right area of the vehicle, involving the hood, bumper fascia and support beam, headlight, upper radiator support, and the right front fender. Maximum crush was 5 cm (1.9”), and was located 7 cm (2.8”) right of the centerline. The direct contact damage began 3 cm (1.0) right of the vehicle’s centerline and extended 70 cm (27.5”) to the right. A crush profile was documented along the full width of the bumper beam, which measured 141 cm (55.5”). The crush profile consisted of six equidistant crush measurements that were as follows: C1 = 0 cm, C2 = 0 cm, C3 = 3 cm (1.2”), C4 = 5 cm (1.9”), C5 = 4 cm (1.6”), C6 = 3 cm (1.2). The Collision Deformation Classification (CDC) for this impact was 01-FZEW-1.

Figure 6. Overhead view of the bumper crush to the Voyager.

Additionally, the right side of the upper radiator support was displaced longitudinally as result of the crash **(Figure 7)**. A crush profile was documented along the upper radiator support and was as follows: C1 = 0 cm, C2 = 0 cm, C3 = 0 cm, C4 = 0 cm, C5 = 3 cm (1.0”), C6 = 3 cm (1.3”).

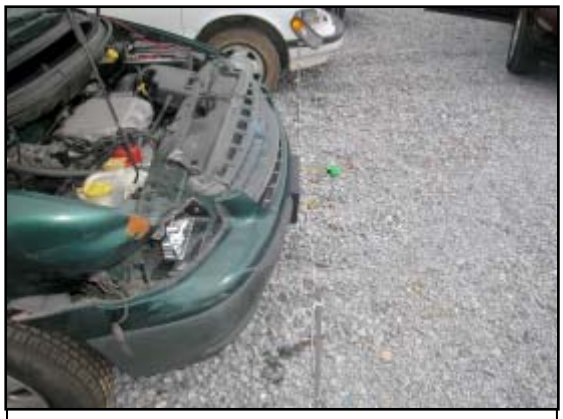

Figure 7. Lateral view of the upper radiator crush profile.

The doors remained closed and operational post-crash and there was no damage to the side and rear glazing. A fracture pattern was noted to the base of the windshield from contact with the hood edge. This fracture pattern radiated to the top of the windshield. Two spider-web fractures were also noted. These fractures occurred from the inside of the vehicle from contact by the deploying front right air bag.

Interior – 1996 Plymouth Voyager

The interior of the Voyager sustained minor damage that was attributed to air bag deployment and occupant contact points. The minor severity crash did not produce intrusion to the passenger compartment. The damage from the deploying front right air bag consisted of two spider-web pattern fractures to the right side of the windshield. The first area of contact was located 11 cm (4.5”) inboard of the right A-pillar and 13 cm (5.0”) below the windshield header. The second windshield contact was located 36 cm

(14.3”) inboard of the right A-pillar and 21 cm (8.3”) below the windshield header. The occupant contact points consisted of a scuffmark to the driver’s knee bolster from contact with her left knee. Additionally, the driver loaded the steering wheel rim during the crash, which deformed the steering wheel rim 1 cm (0.4”) forward.

Figure 8. Overall view of right side windshield and headliner damage.

Two tears were documented on the headliner forward of the right sun visor. All four occupants of the vehicle were restrained; therefore this damage was probably pre-existing. The 1 cm (0.3”) laceration was located 9 cm (3.5”) inboard of the right A-pillar and 1 cm (0.5”) rear of the windshield header. The 5 cm (2.0”) laceration was located 48 cm inboard of the right A-pillar and 9-14 cm (3.5-5.5”) rear of the windshield header. **Figure 8** is an overall of the right side damage to the windshield and headliner.

Exterior – 2004 Jeep Grand Cherokee

The Jeep sustained moderate severity left damage as result of the impact with the Plymouth **(Figure 9)**. This impact resulted in lateral deformation the left side doors, fender, and quarter panel. The maximum crush measured 29 cm (11.3”) and was located 75 cm (29.5”) forward of the left rear axle on the left rear door. The direct contact damage began 39 cm (15.3”) forward of the left axle and extended 149 cm (58.5”) forward onto the left front door. The lateral deformation was documented at the mid-door level using a combined direct and induced damage width of 196 cm (77.3”) and were as follows: C1 = 1 cm (0.4”), C2 = 22 cm (8.7”), C3 = 22 cm (8.7”), C4 = 15 cm (5.9”), C5 = 7 cm (2.8”), C6 = 0 cm. The CDC for this impact was 10-LPEW-2.

Figure 9. Impact damage to the left side 2004 Jeep Grand Cherokee.

Frontal Air Bag System – 1996 Plymouth Voyager

The Plymouth was equipped with first generation air bags for the driver and front right occupant positions. The history of the safety system was unknown; the driver purchased the vehicle used in September 2005. The system deployed as a result of the impact sequence with the Jeep **(Figure 10)**.

The driver’s air bag was contained within the three-spoke steering wheel and concealed by two H-configuration cover flaps. Both flaps were 18 cm (7.0”) wide at the horizontal

tear seam. The upper and lower flaps were measured at 3 cm (1.0”) and 8 cm (3.3”) in height respectively. The air bag membrane measured 66 cm (26.0”) in diameter in its deflated stated and was tethered by two internal tethers at the 3/9 o’clock sectors and was internally vented. The maximum rearward excursion of this bag at the tether locations was 25 cm (9.3”). There was no damage or evidence of driver contact on the deployed air bag; however, dirt was present of the air bag membrane from post-crash handling.

Figure 10. Deployed frontal air bags.

The front right passenger air bag was a mid-mount design, incorporated into the right instrument panel. Two H-configuration cover flaps concealed the bag. The top cover flap was 28 cm (11.0”) wide at the horizontal tear seam and 10 cm (4.0”) in height. The lower cover flap measured 28 cm (11.0”) in width and 6 cm (2.3”) in height. There was no damage or contact evidence to the cover flaps. Although the history of the safety system was unknown to the driver, the following nomenclature suggests that the air bag system was original equipment:

NS UPPER SIR DOOR 09/08/1995-1 15:32:27 DU416010251510555P9AC

NS LOWER SIR DOOR 09/01/1995-1 10:06:17 DL416011244515092P8AC

The right front air bag membrane measured 48 cm (18.8”) in width and 83 cm (32.5”) in height **(Figure 11)**. The bag was not tethered and was internally vented. The maximum rearward excursion of this air bag was 71 cm (28.0”) from the instrument panel and terminated 8 cm (3.0”) from the right front seat back **(Figure 12)**. The air bag membrane extended and additional 28 cm (11.0”) into the instrument panel to the inflator.

Figure 11. Deployed front right air bag.

Figure 12. Lateral view of the maximum excursion of the front right air bag.

No damage was noted to the air bag; however, several areas of the membrane contained body fluid. The largest area of body fluid was located 38-52 cm (15.0-20.3”) below the top peripheral seam and 23-29 cm (9.0-11.3”) inboard of the left peripheral seam near the center aspect of the air bag membrane. Additionally, three smaller areas of body fluid were located at the 3, 5, and 7 o’clock regions on the air bag membrane. A 46 x 46 cm (18 x 18”) area of body fluid spatter was noted on the top panel of the air bag membrane.

The sun visors of the Plymouth were equipped with warning labels on the exposed side that advised the following:

AIR BAG
SEE OTHER SIDE

The top side (Other Side) visor label provided the following:

Caution To Avoid Serious Injury:

- For maximum safety protection in all types of crashes, you must always wear your safety belt.
- Do not install rearward-facing child restraints in any front passenger seat position.
- Do not sit or lean unnecessarily close to the air bag.
- Do not place any objects over the air bag or between the air bag and yourself.

See the Owner manual for further information and explanation.

Manual Safety Belt Systems – 1996 Plymouth Voyager

The 1996 Plymouth Voyager was equipped with manual three-point lap and shoulder belt systems for the six outboard-seated positions.

The driver’s belt was configured with continuous loop webbing, sliding latch plate and a height adjustable D-ring that was in the full down position at the time of the SCI inspection. The driver’s safety belt retracted onto an Emergency Locking Retractor (ELR). The driver utilized the safety belt in the subject crash, which supported by the loading abrasion on the webbing. The abrasion was approximately 3 cm (1.0”) in height and 1 cm (0.5”) in width. This loading abrasion was located 113 cm (44.5”) above the floor anchor.

The remaining outboard belt systems utilized light weight locking latch plates and belt sensitive ELR’s. The front right and second row seats were equipped with height adjustable D-rings that were in the full down position at the time of the SCI inspection. The third seat contained a center seating position that was configured with a fixed length lap belt with a locking latch plate and no retractor.

Figure 13. Front right safety belt, body fluid highlighted by calibrated tape.

The front right safety belt was used in the subject crash; however, no loading evidence was present on the belt system. Although the belt system was free of loading, body fluid was present on the webbing. The first area body fluid was located 80-86 cm (31.3-33.3") above the stop button. In the buckled position, the body fluid was located near the center of the seatback, which was consistent with the right occupant using the safety belt in the crash **(Figure 13)**. The second area of body fluid was located 10-16 cm (4.0-6.3") above the floor anchor.

The 4-year-old male was seated in the second row left and was restrained by the lap and shoulder belt. No loading evidence was present on the safety belt system.

The 2-week-old male occupied the second row right seat. The lap and shoulder belt was used to secure the rear facing child safety seat to the vehicle. Due to the minor crash forces, the belt system did not exhibit loading evidence.

The third row of the vehicle was not occupied during the crash; however, a red colored fluid transfer was present on the left side webbing. The transfer did not appear to be body fluid and was located 109-203 cm (43.0-80.0") above the stop button.

Child Safety Seats – 1996 Plymouth Voyager
Graco Rear-Facing Infant Seat

The Plymouth was occupied by a 2-week-old infant child occupant that was restrained in a rear facing child safety seat. The 2-week-old infant male was positioned in a Graco Snug Ride infant child restraint. This unit was designed exclusively and installed as a rear-facing child safety seat (RFCSS). The unit consisted of a child safety seat with an integral three-point harness system, a pivoting carrying handle, and a detachable base. Additionally, the RFCSS was equipped with a Graco head cushion to position the head of the child and comfort sleeves over the harness straps. The unit was identified by Model Number 732OUVB with a Manufacture Date of 07/22/04. The RFCSS was placarded with manufacturer specified size limits of 0-9 kgs (0-20 lb) and less that 66 cm (26") in height.

The RFCSS was installed in the second row right position of the Plymouth and was used without the detachable base **(Figure 14)**. The driver stated during the SCI interview that the detachable base was located in the cargo area and she could not remove it due her recent caesarian section childbirth. Additionally, she stated that the lap and shoulder safety belt was routed across the top of the RFCSS through the belt path. The driver indicated that she set the retractor in the ALR mode. However, upon inspecting the RFCSS in the replacement vehicle, the retractor was not set in the ALR

Figure 14. Graco infant seat.

and the driver stated the she was unaware that the safety belt could be locked. Furthermore, the Plymouth was not equipped with ALR's for the rear seating positions. A small stress mark was noted on the carry handle from contact with the front left seat back. The stress mark was approximately 3 cm (1.0") in diameter was located left of the centerline. The remainder of the RFCSS and detachable base exhibited no damage.

Occupant Demographics/Data

Driver

Age/Sex:	23- year-old/Female
Height:	163 cm (64")
Weight:	107 kg (235 lb)
Seat Track Position:	Mid-track position
Eyewear:	None
Manual Safety Belt Usage:	3-point lap and shoulder belt
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
Fractured fifth finger on right hand	Minor (752404.1,1)	Expanding air bag
Contusion right of the umbilicus area	Minor (590402.1,1)	Expanding air bag
Three diagonally oriented contusions across chest	Minor (490402.1,0)	Shoulder belt
Contusion to left hand between thumb and index finger	Minor (790402.1,2)	Steering wheel

Source – Driver interview and medical records

Driver Kinematics

The 23-year-old female driver of the 1996 Plymouth Voyager was seated in an upright driving posture with both hands positioned on the steering wheel rim. The driver's seat was set in a mid-track position. She was restrained by the manual safety belt system, which was supported by the loading abrasion on the webbing and both her hands were located on the top aspect of the steering wheel rim.

Prior to the impact, the driver applied the brakes, which displaced her slightly forward. The driver braced herself with her hands and her forward movement was translated to the steering wheel rim, which was consequently deformed it 1 cm (0.5") and resulted in the contusion to left hand between the thumb and index finger. Furthermore, she loaded the shoulder belt, which resulted in three diagonally oriented contusions across the chest. At

impact, the frontal air bag system deployed. The deploying air bag contacted the driver's right hand and her abdomen. This contact resulted in the fractured fifth finger on her right hand and the contusion right of the umbilicus area. The driver was transported to a local hospital where she was treated and released.

Front Right Occupant

Age/Sex:	6-year-old/Male
Height:	135 cm (53")
Weight:	23 kg (48 lb)
Seat Track Position:	Mid-track position
Manual Safety Belt Usage:	3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Egress from Vehicle:	Removed from vehicle by a witness to the crash
Mode of Transport from Scene:	Transported by ambulance
Type of Medical Treatment:	Expired one day post crash

Front Right Occupant Injuries

Injury	Injury Severity (AIS 90, Update 98)	Injury Source
Multiple abrasions to the left side of the face	Minor (290202.1,2)	Expanding right front air bag
Nose abrasion	Minor (290202.1,4)	Expanding right front air bag
Left eyelid contusion	Minor (297402.1,2)	Expanding right front air bag
5 mm left subdural hematoma of the frontal temporal and parietal region with significant left to right shift. Cisterns are completely effaced.	Severe (140652.4,2)	Expanding right front air bag
Massive cerebral edema/cisterns obliterated	Critical (140666.5,9)	Expanding right front air bag

Source – Driver interview and medical records

Front Right Occupant Kinematics

The 6-year-old male front right occupant was seated in a mid-track position and was restrained by the 3-point lap and shoulder belt. Based on his 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. At impact with the Jeep, the front right air bag deployed. Due to the restraint usage and pre-impact braking, the occupant was minimally displaced forward; however, his head flexed over the shoulder belt webbing. The deploying air bag contacted his head during this forward movement. This contact resulted in the 5 mm left subdural hematoma of the frontal temporal and parietal region with significant left to right shift, massive cerebral edema/cisterns

obliterated, and multiple abrasions to the left side of the face, nose, and a left eyelid contusion.

The driver stated to the SCI investigator that the 6-year-old male came to rest on the front right seat with his head slumped forward. She noted that he was bleeding from the mouth. The driver of a non-contact vehicle that was traveling behind the Plymouth came to the aid of the right front occupant. The driver of the non-contact vehicle was an off-duty nurse. She proceeded to unbuckle the 6-year-old male and removed him from the vehicle. She placed him on the roadway beside the vehicle and began checking for vital signs. She stated to the driver of the Plymouth that she could hear the occupant gurgling blood and then began resuscitative efforts until Emergency Medical Technicians (EMT) arrived. The occupant was transported by ambulance to a local hospital where he was treated for his injuries; however, he expired one-day post crash.

Second Row Left Child Occupant

Age/Sex:	4-year old/Male
Height:	102 cm (40”)
Weight:	20 kg (45 lb)
Seat Track Position:	N/A, fixed
Eyewear:	None
Child Restraint Use:	3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Egress from Vehicle:	Exited under own power
Mode of Transport from Scene:	Ambulance to a trauma center with driver and sibling
Type of Medical Treatment:	Observation and released

Second Row Left Child Occupant Injuries

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

Source - Driver interview

Second Row Left Child Occupant Kinematics

The 4-year-old male occupant was seated in the second row left seat and was restrained by the 3-point lap and shoulder belt system. The child responded to the frontal crash forces by initiating a forward and slight right trajectory and loading the manual belt system. This occupant was not injured in the crash; however, he was transported to a local hospital for observation.

Second Row Right Child Occupant

Age/Sex:	2-week-old/Male
Height:	53 cm (21”)
Weight:	4 kg (8 lb)
Seat Track Position:	N/A, fixed
Eyewear:	None
Child Restraint Use:	Rear facing child safety seat with 3-point harness system
Usage Source:	Vehicle inspection
Egress from Vehicle:	Removed by the driver
Mode of Transport from Scene:	Ambulance to a trauma center with driver and sibling
Type of Medical Treatment:	Observation and released

Second Row Right Child Occupant Injuries

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

Source – Driver interview and medical records

Second Row Right Child Occupant Kinematics

The 2-week-old male was positioned in the second row left seat in a RFCSS and was restrained by the integrated 3-point harness system. The RFCSS was installed with the vehicle lap and shoulder belt and used without the detachable base. The driver of the Plymouth stated that the lap and shoulder safety belt was routed across the top of the RFCSS through the belt path. The driver indicated that she set the retractor in the ALR mode. However, upon inspecting the RFCSS in the replacement vehicle, the retractor was not set in the ALR and the driver stated the she was unaware that the safety belt could be locked. Furthermore, the Plymouth was not equipped with ALR’s for the rear seating positions. The minor severity frontal impact forces minimally displaced this infant. The crash forces were distributed over wide body area due to his rear-facing position in the RFCSS. He was removed from the vehicle by the driver and was transported to a hospital. The driver stated that this occupant was observed at the hospital where it was determined that he was not injured as a result of the crash.

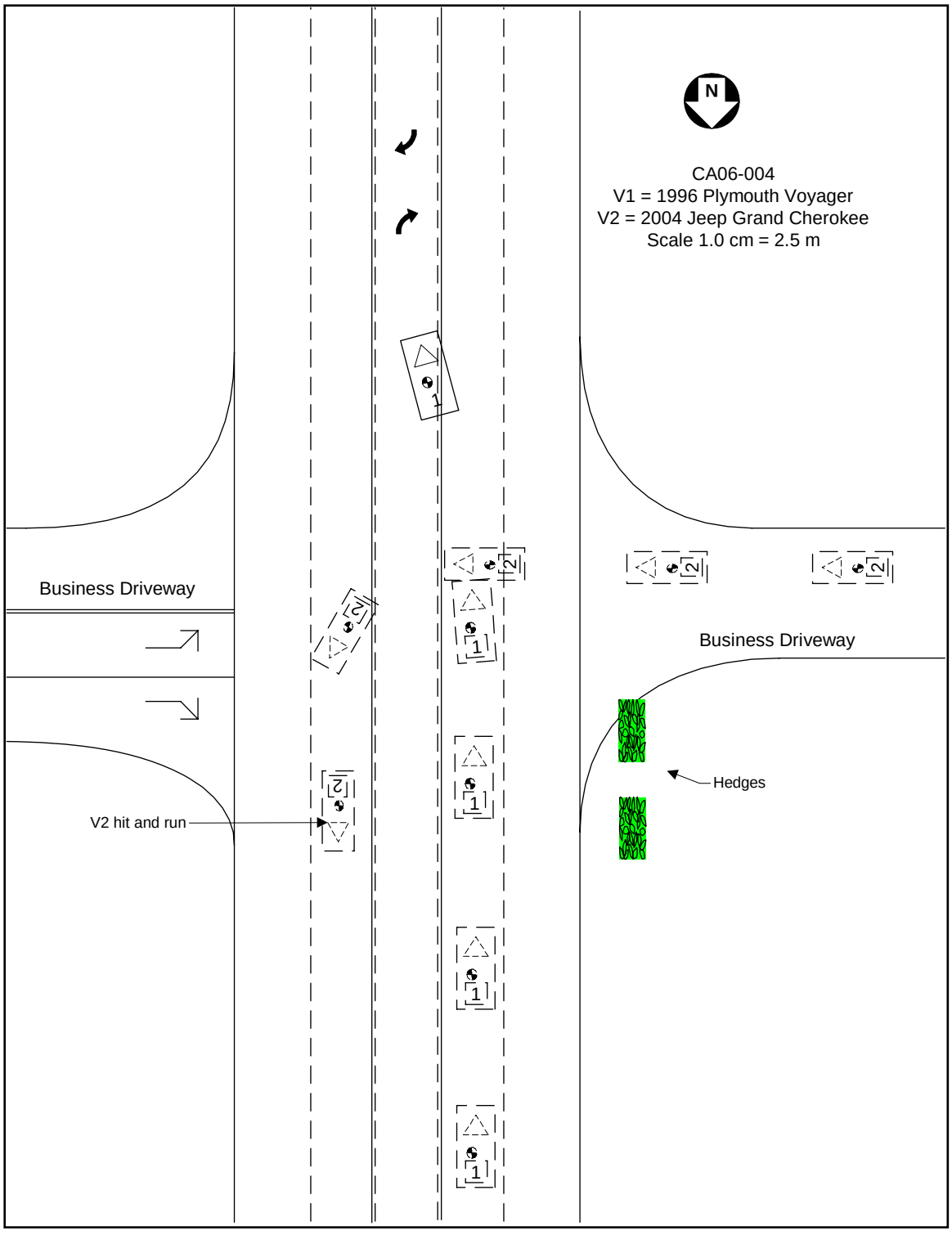

Figure 15: Scene Schematic