TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

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GENERAL DYNAMICS ON-SITE AIR BAG RELATED CHILD FATALITY INVESTIGATION
SCI TECHNICAL SUMMARY REPORT

CASE NO. CA02-055

VEHICLE – 1995 PLYMOUTH VOYAGER

LOCATION - STATE OF OHIO

CRASH DATE – NOVEMBER 2002

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
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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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16. Abstract This on-site investigation focused on the injury mechanisms of a 5-year-old female front right passenger of a 1995 Plymouth Voyager that was involved in a crash with a curbed sidewalk. The Voyager was also occupied by an unrestrained 47-year-old female driver and a 3-year-old male passenger who was restrained in a belt-positioning booster Child Safety Seat (CSS) on the right aspect of the second seat. The driver of the Voyager was operating the vehicle diagonally across a large parking lot and did not detect the curbed sidewalk that extended into the parking lot. The 5-year-old front right passenger removed the safety belt as the vehicle traversed the parking lot, and most likely re-positioned herself forward on the seat to look out the window. In this contractor's opinion, although the driver denied pre-crash braking, it was possible that she applied the brakes prior to impact, which displaced the child further forward into the path of the front right passenger's air bag. The Voyager impacted the curbed sidewalk which resulted in the deployment of the frontal air bag system. The occupants initiated forward trajectories and the unrestrained driver loaded the deployed driver's air bag. The 3-year-old child loaded the manual safety belt and did not sustain injury. The out-of-position 5-year-old front right passenger was struck in the head by the deploying front right passenger's air bag and submarined the instrument panel. The child came to rest on the floor pan area and was removed from the vehicle by the driver. She sustained closed head injuries, facial abrasions, a left eye injury, and had severe difficulty breathing. The child was transported by ambulance to a local hospital and transferred by helicopter to a regional trauma center where she expired the following day.			
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LOCATION - STATE OF OHIO
CRASH DATE - NOVEMBER 2002

BACKGROUND

Figure 1. 1995 Plymouth Voyager at final rest

This on-site investigation focused on the injury mechanisms of a 5-year-old female front right passenger of a 1995 Plymouth Voyager that was involved in a crash with a curbed sidewalk. The Voyager was also occupied by an unrestrained 47-year-old female driver and a 3-year-old male passenger who was restrained in a belt-positioning booster Child Safety Seat (CSS) on the right aspect of the second seat. The driver of the Voyager was operating the vehicle diagonally across a large parking lot and did not detect the curbed sidewalk that extended into the parking lot. The 5-year-old front right passenger removed the safety belt as the vehicle traversed the parking lot, and most likely re-positioned herself forward on the seat to look out the window. In this contractor's opinion, although the driver denied pre-crash braking, it was possible that she applied the brakes prior to impact, which displaced the child further forward into the path of the front right passenger's air bag. The Voyager impacted the curbed sidewalk **(Figure 1)** which resulted in the deployment of the frontal air bag system. The occupants initiated forward trajectories and the unrestrained driver loaded the deployed driver's air bag. The 3-year-old child loaded the manual safety belt and did not sustain injury. The out-of-position 5-year-old front right passenger was struck in the head by the deploying front right passenger's air bag and submarined the instrument panel. The child came to rest on the floor pan area and was removed from the vehicle by the driver. She sustained closed head injuries, facial abrasions, a left eye injury, and had severe difficulty breathing. The child was transported by ambulance to a local hospital and transferred by helicopter to a regional trauma center where she expired the following day.

This crash was identified by the Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) due to the potential air bag-related child fatality. The newspaper article was forwarded to the General Dynamics SCI team by NHTSA, and an on-site investigation was initiated on November 18, 2002. Cooperation was established with the investigating police agency and the family's legal representative.

VEHICLE DATA – 1995 Plymouth Voyager

The 1995 Plymouth Voyager was identified by the Vehicle Identification Number (VIN): 2P4GH2533SR (production sequence omitted). The manufacture date was September 1994. At

the time of the vehicle inspection, the odometer read 226,314 km (140,629 miles). The vehicle was a three-door minivan equipped with a 3.0 liter, V6 engine, front wheel-drive, four-speed, automatic transmission, power steering, and a tilt steering wheel. The driver and owner were both primary operators of the vehicle and the owner stated that it had been purchased as a used vehicle seven months prior to the crash. Prior to the purchase, the buyers checked the history of the vehicle for potential problems via an online Internet service. The owner stated that the website identified various potential issues with the vehicle, however, they were never fully investigated by the owner. The owner also stated that the transmission was replaced one month after purchase.

A NHTSA recall was identified for this vehicle. The recall was not applicable to this crash. The details of the recall are as follows:

NHTSA CAMPAIGN ID Number: 99V113000
Component: INTERIOR SYSTEMS: PASSIVE RESTRAINT: AIR BAG
Manufacturer: DAIMLER CHRYSLER CORPORATION

Year: 1995 Make: PLYMOUTH TRUCK
Model: VOYAGER
Recall Date: 05/12/1999
Type of Report: Vehicle
Potential Number of Units Affected: 736824
Manufactured: 03/1993 - 03/1995

Defect Summary:
VEHICLE DESCRIPTION: MINI VANS. THE WIRING THAT INITIATES THE DRIVER AND/OR PASSENGER AIR BAG COULD ELECTRICALLY SHORT CIRCUIT TO GROUND. A SHORT CIRCUIT TO GROUND THAT EXISTS IMMEDIATELY AFTER TURNING THE IGNITION KEY TO THE "ON" OR "START" POSITION CAN CAUSE THE AIR BAG(S) TO INADVERTENTLY DEPLOY.

Consequence Summary:
INADVERTENT AIR BAG DEPLOYMENT CAN INJURE A FRONT SEAT OCCUPANT.

Corrective Summary:
DEALERS WILL PERFORM AN ELECTRONIC DIAGNOSTIC CHECK. ANY SHORT CIRCUITS IDENTIFIED IN EITHER THE DRIVER'S OR PASSENGER SIDE AIR BAG INITIATOR WIRE CIRCUIT WILL BE REPAIRED.

The Plymouth Voyager was equipped with Firestone Supreme SI P195/75R14 tires on each wheel. The manufacturer's recommended tire pressure was 241 kpa (35 psi) for each tire. The specific tire information is as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	141.3 kpa (20.5 psi)	3.2 mm (4/32")	No	None
LR	172.4 kpa (25.0 psi)	6.4 mm (8/32")	No	None
RF	189.6 kpa (27.5 psi)	3.2 mm (4/32")	No	None
RR	96.5 kpa (14.0 psi)	6.4 mm (8/32")	No	None

The seating in the 1995 Plymouth Voyager was configured with box-mounted bucket seats with integral head restraints for both front seat positions. The driver's seat was positioned 3.8 cm (1.5") forward of the full-rear track position and 15.2 cm (6.0") rear of the full-forward track position. The front right seat was positioned in the full-rear track position. Both seat backs were slightly reclined. The second row was configured with a two-person bench seat and the third row was configured with a three-person bench seat.

CRASH SITE

This single-vehicle crash occurred during the daylight hours of November 2002. At the time of the crash, the weather was cloudy and the asphalt surface of the parking lot was dry. The crash occurred in the center of a large asphalt parking lot adjacent to retail stores. The store fronts were located along the east aspect of the parking lot. A long concrete sidewalk extended laterally in an east-to-west direction through the parking lot. There were no warning signs or devices present that identified the presence of the sidewalk. The police noted that vehicles drove over the sidewalk on a regular basis. The sidewalk began 10.7 m (35.1') west of the store fronts and extended 100.7 m (330.4') across the parking lot **(Figure 2)**. It measured 3.8 m (12.5') in width and the curb height averaged 10.2 cm (4.0") along the outboard edges. A storm drain was present adjacent to the south aspect of the sidewalk and was located 47.8 m (156.8') west of the east edge of the sidewalk **(Figure 3)**. The square grate measured 0.8 x 0.8 m (2.6 x 2.6') and was bordered by concrete that measured 0.4 m (1.3') in width. The outboard aspect of the concrete border was located 0.4 m (1.3') from the south curb edge. The center grate was contoured downward in the center aspect to allow for drainage and

Figure 2. View of parking lot and concrete sidewalk

Figure 3. Close up of the depressed sewer collector

was located 6.4 cm (2.5”) below the asphalt grade of the parking lot. The parking lot exhibited a level grade, pitched slightly negative around the storm drain to allow for drainage. The storm drain was the lowest point in the parking lot. The outboard perimeter of the storm drain measured 2.5 cm (1.0”) below the adjacent parking lot grade. Fragments of asphalt had been displaced around the collector due to erosion.

A pre-existing semi-circular gouge was present on the south aspect of the concrete sidewalk curb at the point of impact. The gouge measured 2.0 m (6.5’) in width and 0.5 m (1.6’) in depth at the center aspect. A second pre-existing gouge was present on the north aspect of the sidewalk, opposite the south pre-existing gouge. The faces of both concrete curbs in the gouged areas were crumbling away. The scene schematic is included as **Figure 17** of this report.

CRASH SEQUENCE

Pre-Crash

Figure 4. Northbound trajectory of Voyager through parking lot

The 47-year-old female driver was operating the 1995 Plymouth Voyager northbound through the large parking lot **(Figure 4)**. The driver stated she had not driven in the lot for a number of years. She had entered the parking lot through the south entrance adjacent to the north/south roadway. After entering the driveway, she proceeded to turn left and traveled in a northeast direction diagonally across the parking lot. As the Plymouth Voyager was crossing the lot, the front right child passenger inquired if they were close to their destination. The driver told her that they were almost to the destination, at which time the 5-year-old released the buckle on the safety belt and removed the manual restraint. The driver did not detect the concrete sidewalk, which was present in the parking lot. The Voyager traveled over the depression leading into the storm drain and the left wheel traveled over the left aspect of the storm drain grate. The driver stated that the vehicle hit a “hole” prior to impact and denied pre-crash braking. Based on the direct contact damage to the lower radiator support and the Voyager’s exemplar distance of 19.1 cm (7.5”) between the lower radiator support and the ground compared to the combined vertical distance of 16.5 cm (6.5”) between the top of the curb and the center of the storm drain, it was possible that she applied the brakes prior to impact. Pre-crash braking would have allowed the front of the vehicle to pitch farther downward as the Voyager traveled over the storm collector. The increased downward pitch compressed the front suspension and exposed the lower aspect of the bumper fascia and lower radiator support to the curb edge. Based on the driver’s post-impact stopping distance, the pre-crash speed was estimated to be between 32 - 48 km/h (20 – 30 mph). In addition, the trajectory algorithm of the WinSMASH program computed a pre-impact vehicle speed of 40.2 km/h (25.0 mph) based on the impact location and the documented final rest position.

Crash

The 1995 Plymouth Voyager impacted the concrete sidewalk curb **(Figure 5)**. The principal direction of force was in the 12 o'clock sector and approximately 350 degrees. Initial engagement with the concrete curb began at the front left aspect of the lower bumper fascia and lower radiator support and continued across the lower radiator support as the Voyager continued to engage the curb. The impact-induced deceleration from the impact to the lower radiator support was sufficient to deploy the frontal air bag system in the Voyager. The damage algorithm of the WinSMASH program computed a total delta-V of 18.0 km/h (11.2 mph) based on the documented frontal crush profile. Additional undercarriage contact resulted as the Voyager continued forward. The oil pan, transmission oil pan, and steering components impacted the curb as the vehicle continued forward. The left front wheel struck the edge of the curb face, evidenced by minor deformation to the left front wheel rim and both front wheels rolled over the curb edge and onto the sidewalk. The vehicle traveled over the concrete sidewalk and the north curb edge. The driver stated that she brought the vehicle to a controlled stop after the vehicle cleared the sidewalk. Based on post-crash measurements from the police, the Voyager came to rest 18.5 m (60.1') north of the point of impact and 14.7 m (48.2') north of the north curb edge. **Figure 6** is an on-scene view of the Voyager's final rest position in relation to the struck curb.

Figure 5. Close-up of concrete curb edge at impact point

Figure 6. Final rest position of the Voyager

Post-Crash

The driver stated that after she brought the vehicle to a controlled stop, she observed the 5-year-old front right child passenger on the floor of the right front seat area. The driver exited the vehicle through the driver's door and removed the injured 5-year-old from the vehicle through the front right door. The driver stated that the child was having severe respiratory distress and sustained an obvious eye injury. The child was placed on the ground adjacent to the vehicle and initially treated by a passer-by who was a nurse. The child was subsequently transported by ambulance to a local hospital and transferred by helicopter to a regional trauma center where she expired the following day. The driver was transported by ambulance to a local hospital and refused treatment at the hospital. The 3-year-old male child was removed from the CSS and from the vehicle and did not receive medical treatment.

VEHICLE DAMAGE

Exterior Damage – 1995 Plymouth Voyager

The 1995 Plymouth Voyager sustained moderate damage as a result of the sidewalk impact. Direct contact damage began on the lower aspect of the front bumper fascia at the front left corner and extended laterally across the bottom aspect **(Figure 7)**. The lower aspect of the bumper fascia was fractured from direct contact, which began 64.8 cm (25.5") left of the centerline and extended 143.5 cm (56.5") laterally to the front right corner. The lower radiator

Figure 7. Frontal view of the Plymouth Voyager

Figure 8. Frontal view of damage to bumper and lower radiator support

support sustained longitudinal crush and direct contact abrasions from the concrete curb edge **(Figure 8)**. The direct damage on the lower radiator support began 20.2 cm (8.0") to the right of the centerline and extended laterally 82.6 cm (32.5") to the front left corner. The combined direct and induced damage measured 118.1 cm (46.5") across the entire lower radiator support. The maximum crush on the lower radiator support measured 12.3 cm (4.9") and was located 22.3 cm (8.8") to the left of the centerline. Six crush measurements were documented along the lower radiator support and were as follows: C1 = 0.6 cm (0.3"), C2 = 10.8 cm (4.3"), C3 = 8.9 cm (3.5"), C4 = 6.4 cm (2.5"), C5 = 3.8 cm (1.5"), C6 = 0.0 cm. There was no measurable crush to the front bumper beam.

Undercarriage components also sustained direct contact damage as they impacted the concrete curb edge **(Figure 9)**. The transmission oil pan was abraded, crushed and dented. The entire frontal width of the transmission oil pan was abraded. The front right corner of the oil pan sustained an area of crush that measured 7.6 cm (3.0") in width and 6.4 cm (2.5") in height. The maximum longitudinal crush to the transmission oil pan measured 4.5 cm (1.8"). The rear left aspect of the transmission oil pan was split at the seam from contact with the leading edge of the front cross member. The opening measured 4.5 cm (1.8") in width and 2.5 cm (1.0") in height. The engine oil pan also sustained lateral abrasions along the entire frontal width. The engine oil pan deformation began at the front right corner and extended 24.8 cm (9.8") laterally. The crush depth to the front lower aspect of the engine oil pan was 7.6 cm (3.0"). The right lower control arm was abraded and exhibited a moderate amount of concrete dust from direct contact with the concrete curb. The front engine mount that was located on the center aspect of the vehicle was

crushed rearward. The rear aspect of the right side fractured at the bolt and separated from the engine. The forward aspect of the left side showed deformation to the bracket around the bolt head which illustrated rearward displacement with some restitution. The rear aspect of the right lower control arm was crushed rearward which resulted in a weld separation located 33.0 cm (13.0”) outboard of the centerline.

The left front steel wheel rim exhibited minor deformation which was consistent with a curb impact, although it could not be confirmed as being a result of this crash.

The CDC for the impact with the curbed sidewalk was 12-FYLW-1.

Figure 9. Undercarriage view showing damaged components and crushed lower radiator support

Interior Damage - 1995 Plymouth Voyager

Interior damage to the 1995 Plymouth Voyager was minor **(Figure 10)** and attributed to occupant contact. There was no damage to the laminated windshield or vehicle glazing. There was no passenger compartment intrusion. There were no identifiable occupant contacts with the exception of the frontal air bags. A scuff mark was identified on the right front door handle, however, it appeared to be pre-existing.

Figure 10. Interior view

MANUAL RESTRAINT SYSTEMS – 1995 Plymouth Voyager

The 1995 Plymouth Voyager was configured 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 one detent above 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. Neither safety belt showed any signs of usage in this crash.

The second row two-person bench seat was configured with manual 3-point lap and shoulder belts for each seating position. Both had fixed D-rings, ELR's, and cinching latch plates. The right side safety belt was configured with a steel spring clasp on the lower anchor of the lap belt portion. A plastic sleeve that measured 25.4 cm (10.0") in length and 5.1 cm (2.0") in width was located adjacent to the clasp on the webbing. The clasp engaged with one of two steel mounting anchors labeled "A" and "B" **(Figure 11)**. The "A" mounting anchor was located on the floor on the rear right corner aspect of the second row bench seat. The "B" mounting anchor was located on the forward aspect of the interior lower C-pillar, which is where the manual restraint was anchored at the time of the vehicle inspection. The owner's manual stated the following information regarding the anchor placement:

Figure 11. View of second row right safety belt anchor

> "If the vehicle has a two passenger seat in the second row, the anchor must be installed in the floor mounting position marked with an "A", next to the seat. If the vehicle has a three passenger seat or bucket seat in the second row, the seat belt must be installed in the side mounting position. This position is on the lower part of the trim panel, marked with a "B", just rearward of the side door opening."

The second row right safety belt was used by the 3-year-old male child who was positioned in a high-back belt-positioning booster CSS. Minor stretch marks were present on the lap and shoulder belt webbing, although it could not be confirmed if they were pre-existing at the time of the crash.

CHILD SAFETY SEAT – Gerry Guardian High Back Belt Positioning Booster

The 3-year-old child in the second seat right position was restrained in a Gerry Guardian high back belt-positioning booster CSS **(Figure 12)**. The CSS was purchased used by the family from a second-hand store. The owner of the vehicle stated that they did not know the history of the CSS, nor did it come equipped with an owner's manual. There was no model number found on the CSS, and the manufacture date was July 27, 1996. The CSS was configured with two plastic shoulder belt positioners that were located on the top outboard aspects. The CSS was not configured for use with a harness system.

Figure 12. Gerry Guardian High Back Belt Positioning Booster CSS

The label affixed to the rear aspect of the CSS stated that it was designed for use by children that weighed 14 - 27 kg (30 – 60 lbs). The seat was configured with a "Lower Position" and "Upper Position" for the seat base. According to the label, children weighing between 14 - 20 kg (30 – 45 lb), or whose seated height is less than 53 cm (21"), should be seated on the "Upper Position" of the seat base, and children weighing between 20 – 27 kg (40 – 65 lb) or whose seated height is less than 59.7 cm (23.5") should be seated on the "Lower Position" of the seat base. The CSS was inspected during the interview with the driver, and adjustments for the seating positions were not clear without the owner's manual. The seat was not adjusted by the driver post-purchase.

The child was restrained in the CSS with the vehicle's manual 3-point lap and shoulder belt system. The driver stated that she put the child in the seat on the day of the crash and buckled the manual restraint. She said that once the restraint was buckled, she tugged on the shoulder belt portion of the webbing to remove the slack in the lap belt. She subsequently routed the shoulder belt through the right side plastic positioning tab.

The CSS did not sustain visible damage as a result of the crash.

FRONTAL AIR BAG SYSTEM – 1995 Plymouth Voyager

The 1995 Plymouth Voyager was equipped with frontal air bags for the driver and front right positions that deployed as a result of the frontal impact with the curbed sidewalk. Air bag warning labels were present on each sun visor that read:

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 OF 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'S MANUAL FOR FURTHER INFORMATION AND EXPLANATIONS

The driver's air bag was housed in the center of the steering wheel. The air bag was circular in shape and measured 63.5 cm (25.0") in diameter in its deflated state **(Figure 13)**. The H-configuration vinyl cover flaps were symmetrical in shape and measured 16.5 cm (6.5") in width at the top and bottom aspects, 6.7 cm (2.6") in height, and 17.1 cm (6.8") in width at the tear seam. The air bag was not tethered and was vented by two circular ports located at the 12 o'clock position on the rear aspect of the air bag 6.4 cm (2.5") aft of the peripheral seam. Each vent port measured 2.5 cm (1.0") in diameter.

Figure 13. Driver's air bag

The air bag exhibited minor body fluid spatter on the upper right and lower right quadrants of the face of the air bag. The upper right quadrant body fluid contacts measured an area of 10.2 cm (4.0") in height and 8.9 cm (3.5") in width and the lower right quadrant body fluid contacts measured an area of 16.5 cm (6.5") in height and 10.2 cm (4.0") in width. A small body fluid transfer was present 2.5 cm (1.0") to the right of the centerline and vertically located at the center aspect of the air bag.

Linear faint orange-colored transfers were located along the outboard fold points of the air bag, on the face and rear aspects. It appeared that they may have resulted from contact with the interior surface of the air bag module within the steering wheel as it deployed.

The front right passenger's air bag **(Figure 14)** deployed from a top-mount module configured with a rectangular cover flap hinged at the forward aspect. The vinyl cover flap measured 32.4 cm (12.8") in width, 14.6 cm (5.8") in height on the left aspect and 14.3 cm (5.6") in height on the right aspect. "SRS Airbag" was embossed on the lower right corner of the air bag cover flap **(Figure 15)**. The air bag measured 45.7 cm (18.0") in width and 66.0 cm (26.0") in height. The air bag was vented back through the module and exhibited two lateral stitch seams on the face of the air bag that measured 29.8 cm (11.8") in width.

Figure 14. Front right passenger's air bag

There was no damage or occupant contact noted on the air bag cover flap, however, the outboard corners of the module perimeter near the face of the instrument panel were torn diagonally as a result of the air bag deployment. The left corner tear measured 3.0 cm (1.2") in length and the right corner tear measured 1.0 cm (0.4") in length. A faint transfer was present on the right aspect of the top instrument panel adjacent to the leading edge of the cover flap from interaction with the deploying air bag **(Figure 16)**. The air bag module housing did not sustain damage.

Figure 15. Front right passenger's air bag cover flap

The top aspect of the front right passenger's air bag exhibited a black vinyl transfer from contact with the cover flap that measured 12.7 cm (5.0") in width and 6.4 cm (2.5") in height. The transfer was located 20.3 cm (8.0") inboard of the left side seam and 16.5 cm (6.5") rearward of the forward-most lateral stitching on the top of the air bag. An area of body fluid (blood) transfers was present on the bottom aspect of the air bag. The transfers began 11.4 cm (4.5") inboard of the left side seam of the air bag and measured 15.2 cm (6.0") in width and 17.8 cm (7.0") in height. The transfers were vertically located on the bottom aspect of the air bag 30.5 cm (12.0") from the inflator and 16.5 cm (6.5") above the lower-most lateral stitching.

The face of the air bag did not exhibit any transfers or damage.

Figure 16. View of corner tears and faint transfer on the instrument panel adjacent to the leading edge of the cover flap

OCCUPANT DEMOGRAPHICS – 1995 Plymouth Voyager

Driver

Age/Sex:	47-year-old female
Height:	170 cm (67”)
Weight:	79 kg (175 lb)
Seat Track Position:	3.8 cm (1.5”) forward of full-rear and 15.2 cm (6.0”) rear of full-forward
Manual Restraint Use:	Unrestrained
Usage Source:	Vehicle inspection, interview
Eyewear:	None
Type of Medical Treatment:	Transported by ambulance to a local hospital and refused treatment

Driver Kinematics

The 47-year-old female driver was seated in an upright posture with the seat positioned 3.8 cm (1.5”) forward of the full-rear track position and 15.2 cm (6.0”) rear of the full-forward track position. She was not restrained by the available manual 3-point lap and shoulder belt which was supported by lack of loading evidence and the driver’s statement regarding non-use. At impact with the curbed sidewalk, the frontal air bag system deployed. The unrestrained driver initiated a forward trajectory and contacted the deploying air bag. She rebounded rearward into the seat back. She stated that she did not sustain any injury. She further stated that she brought the Voyager to a controlled stop and exited the vehicle through the driver’s door to assist the front right child passenger. The driver was transported by ambulance to a local hospital where she refused additional treatment.

Front Right Child Passenger

Age/Sex:	5-year-old female
Height:	Unknown
Weight:	20 kg (45 lb)
Seat Track Position:	Full-rear
Manual Restraint Use:	Unrestrained
Usage Source:	Vehicle inspection, injuries, driver interview
Eyewear:	None
Type of Medical Treatment:	Transported by ambulance to a local hospital and transferred by helicopter to a regional trauma center where she expired the following day

Front Right Child Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Central transtentorial herniation	Critical (140202.5,8)	Indirect – deploying front right passenger’s air bag
Intracranial hemorrhage	Severe (140629.4,9)	Deploying front right passenger’s air bag

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Small right temporal subdural hematoma	Severe (140652.4,1)	Deploying front right passenger's air bag
Cerebral swelling and diffuse cerebral edema	Serious (140660.3,9)	Deploying front right passenger's air bag
Subarachnoid hemorrhage	Severe (140660.3,9)	Deploying front right passenger's air bag
Left subconjunctival hemorrhage	Minor (240416.1,2)	Deploying front right passenger's air bag
Hyphema in left pupil	Minor (240604.1,2)	Deploying front right passenger's air bag
Right facial abrasion	Minor (290202.1,1)	Deploying front right passenger's air bag
Left eye abrasion	Minor (297202.1,2)	Deploying front right passenger's air bag
Left facial abrasions	Minor (290202.1,2)	Deploying front right passenger's air bag
Ecchymosis and edema on right eyelid	Minor (297402.1,1)	Deploying front right passenger's air bag
Ecchymosis and edema on left eyelid	Minor (297402.1,2)	Deploying front right passenger's air bag

Injury source: Hospital records

Front Right Child Passenger Kinematics

The driver stated that although the child had a habit of sitting forward on the seat, she was seated with her back against the seat back on the initial approach to the crash site.

The 5-year-old female was seated in an upright position at the time of the crash. The driver stated that prior to the impact, she was restrained by the manual 3-point lap and shoulder belt. Upon entering the parking lot, the child unfastened the manual restraint. After removing the safety belt, the 5-year-old probably re-positioned herself forward to look out the window in anticipation of arriving at the destination. In this contractor's opinion, although the driver denied pre-crash braking, based on the height of the damage to the Voyager, it was possible that she applied the brakes prior to impact which allowed the front of the vehicle to pitch farther downward as the Voyager traveled over the storm drain, and displaced the child further forward into the path of the front right passenger's air bag. At impact with the sidewalk curb, the child was out-of-position forward in the deployment path of the front right passenger's air bag and initiated a forward trajectory. The frontal air bag system deployed and the unrestrained child was struck in the face by the bottom aspect of the front right passenger's air bag as it deployed outward and downward from the top-mount module. She sustained an intracranial hemorrhage, a small right temporal subdural hematoma, cerebral swelling and diffuse cerebral edema, a subarachnoid hemorrhage, a left subconjunctival hemorrhage, hyphema in the left pupil, a right facial abrasion,

left facial abrasions, a left eye abrasion, and ecchymosis and edema on both eyelids. The expansion of the air bag resulted in a probable hyperextension of her neck which resulted in a central transtenorial herniation. The direct facial contact with the air bag membrane produced body fluid (blood) transfers on the bottom aspect of the air bag. She was redirected slightly rearward and downward, and her forward trajectory and facial contact with the air bag allowed her to submarine the right instrument panel. She came to rest on the right front floor pan area. The child was removed from the vehicle by the driver and had severe difficulty breathing. She was transported by ambulance to a local hospital and transferred by helicopter to a regional trauma center. She expired the following day.

Rear Right Child Passenger

Age/Sex:	3-year-old male
Height:	Unknown
Weight:	11 kg (25 lb) estimated by driver
Seat Track Position:	Fixed
Manual Restraint Use:	Forward-facing, high back, belt-positioning CSS
Usage Source:	Vehicle inspection, interview
Eyewear:	None
Type of Medical Treatment:	Did not sustain injury and did not receive medical treatment

Rear Right Child Passenger Kinematics

The 3-year-old child was seated in the Gerry Guardian high back, belt-positioning booster CSS that was positioned on the right side of the second bench seat. The CSS label stated that the CSS was rated for children that weighed between 14 to 27 kg (30 – 65 lb), and given the child's estimated weight of 11 kg (25 lb), he was outside of the recommended weight parameters for this CSS. He was restrained by the vehicle's manual 3-point lap and shoulder belt. As stated previously, per owner's manual of the Plymouth Voyager, the lower anchor for the 3-point safety belt should have been anchored in the floor mounting position marked with an "A." Since it was anchored in the mounting position marked with a "B", it allowed considerably more excess webbing between the outboard edge of the bench seat and the anchor point.

The driver stated that she put the child into the seat and buckled the vehicle's safety belt prior to operating the vehicle. She stated that she inserted the latch plate into the buckle and tugged on the shoulder belt webbing to ensure a snug fit on the child. She routed the shoulder belt webbing through the right side plastic positioner on the CSS. During the interview, the driver commented on how the shoulder belt may have been a "little loose" after the child was restrained. The driver also stated that prior to the crash, the 3-year-old male child was awake and seated in an upright posture.

At impact, the child initiated a forward trajectory and loaded the manual restraint. He rebounded rearward into the CSS and did not sustain injury. He was removed from the vehicle by a non-specified individual at the scene, and did not receive medical treatment.

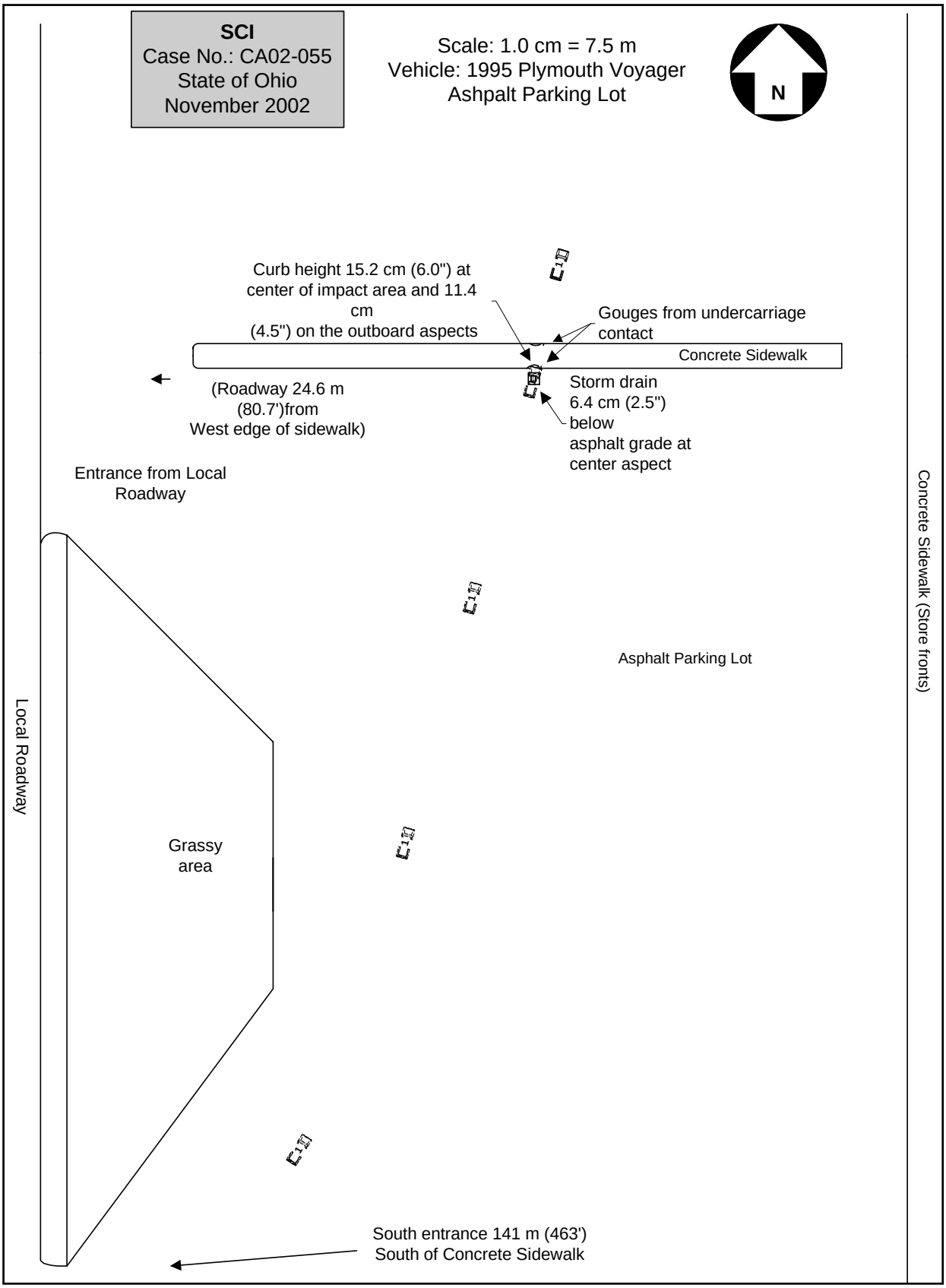

Figure 17. Scene schematic