

CRASH DATA RESEARCH CENTER

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CALSPAN ON-SITE CHILD SAFETY SEAT CRASH INVESTIGATION

CASE NO: CA05-055

VEHICLE: 1994 PLYMOUTH VOYAGER

LOCATION: NEW YORK

CRASH DATE: OCTOBER 2005

Contract No. DTNH22-01-C-17002

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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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<p>16. Abstract This investigation focused on the performance of a forward-facing convertible Child Safety Seat (CSS) that was installed in the third row right position of a 1994 Plymouth Voyager. The Voyager was equipped with frontal air bags that deployed during the crash. The vehicle was occupied by a restrained 50-year-old female driver, an unrestrained 19-year-old male seated in the front right position, and an 18-month old female who was restrained in the convertible CSS facing forward in the third row right seating position of the vehicle. An infant CSS base was present in the second row left position and was secured to the seat with a 3-point manual lap and shoulder belt. During the crash, however, this CSS base was not in use. The driver of the Plymouth Voyager was eastbound on a two-lane roadway negotiating a right curve. Reportedly, the driver of the Plymouth had a diabetic seizure and crossed the centerline and into the path of a 1993 Chevrolet pickup truck. A witness traveling behind the Voyager related that the vehicle was driving erratically prior to the crash. The two vehicles collided in a head-on configuration on the westbound lane and came to rest near the point of impact. The Voyager sustained severe frontal damage as the result of the impact that was sufficient to deploy the frontal air bags. The CSS was installed using the manual lap and shoulder restraint that was routed through the forward facing belt path. The 18-month-old female sustained abrasions to her shoulders from loading the integrated 5-point harness, and a 2.5 cm (1") laceration above her right eye from flying glass. She was transported to a hospital by ambulance where she was treated and released. The female driver of the Voyager sustained a fractured right leg and was transported to a hospital by ambulance. The unrestrained 19-year-old male sustained fractures to both legs and was transported to a local hospital by ambulance. The driver and front right passenger of the Chevrolet sustained unspecified fractures and were transported by ambulance to the hospital. The admission status for the driver and front right passenger is not known.</p>			
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TABLE OF CONTENTS

BACKGROUND.....	1
SUMMARY.....	2
CRASH SITE.....	2
VEHICLE DATA – 1994 PLYMOUTH VOYAGER.....	2
VEHICLE DATA – 1993 CHEVROLET K-1500.....	3
CRASH SEQUENCE.....	3
PRE-CRASH.....	3
CRASH.....	3
POST-CRASH.....	4
VEHICLE DAMAGE.....	4
EXTERIOR DAMAGE - 1994 PLYMOUTH VOYAGER.....	4
INTERIOR DAMAGE - 1994 PLYMOUTH VOYAGER.....	4
EXTERIOR DAMAGE – 1993 CHEVROLET K-1500.....	6
MANUAL RESTRAINTS – 1994 PLYMOUTH VOYAGER.....	7
FRONTAL AIR BAG SYSTEM – 1994 PLYMOUTH VOYAGER.....	8
CHILD SAFETY SEAT.....	8
EVENFLO TRIBUTE.....	8
COSCO BASE.....	9
OCCUPANT DEMOGRAPHICS.....	10
DRIVER.....	10
DRIVER INJURIES.....	10
DRIVER KINEMATICS.....	10
FRONT RIGHT PASSENGER.....	11
FRONT RIGHT PASSENGER INJURIES.....	11
FRONT RIGHT PASSENGER KINEMATICS.....	11
THIRD ROW RIGHT PASSENGER KINEMATICS.....	12
THIRD ROW RIGHT PASSENGER INJURIES.....	12
THIRD ROW RIGHT PASSENGER KINEMATICS.....	12
FIGURE 19 – SCENE SCHEMATIC.....	13

CALSPAN ON-SITE CHILD SAFETY SEAT CRASH INVESTIGATION
SCI CASE NO: CA05-055
VEHICLE: 1994 PLYMOUTH VOYAGER
LOCATION: NEW YORK
CRASH DATE: OCTOBER 2005

BACKGROUND

This investigation focused on the performance of a forward-facing convertible Child Safety Seat (CSS) that was installed in the third row right position of a 1994 Plymouth Voyager. The Voyager (**Figure 1**) was equipped with frontal air bags that deployed during the crash. The vehicle was occupied by a restrained 50-year-old female driver, an unrestrained 19-year-old male seated in the front right position, and an 18-month old female who was restrained in the convertible CSS facing forward in the third row right seating position of the vehicle. An



Figure 1 - Damaged 1994 Plymouth Voyager.

infant CSS base was present in the second row left position and was secured to the seat with a 3-point manual lap and shoulder belt. During the crash, however, this CSS base was not in use. The driver of the Plymouth Voyager was eastbound on a two-lane roadway negotiating a right curve. Reportedly, the driver of the Plymouth had a diabetic seizure and crossed the centerline and into the path of a 1993 Chevrolet pickup truck. A witness traveling behind the Voyager related that the vehicle was driving erratically prior to the crash. The two vehicles collided in a head-on configuration on the westbound lane and came to rest near the point of impact. The Voyager sustained severe frontal damage as the result of the impact that was sufficient to deploy the frontal air bags. The CSS was installed using the manual lap and shoulder restraint that was routed through the forward facing path. The 18-month-old female sustained abrasions to her shoulders from loading the integrated 5-point harness, and a 2.5 cm (1") laceration above her right eye from flying glass. She was transported to a hospital by ambulance where she was treated and released. The female driver of the Voyager sustained a fractured right leg and was transported to a hospital by ambulance. The unrestrained 19-year-old male sustained fractures to both legs and was transported to a local hospital by ambulance. The driver and front right passenger of the Chevrolet sustained unspecified fractures and were transported by ambulance to the hospital. The admission status for the driver and front right passenger is not known.

This crash was identified by the Calspan SCI team through a television report and subsequent newspaper articles. The Voyager was located and cooperation was established with the tow facility. An on-site investigation was assigned to the Calspan SCI team by NHTSA on October 18, 2005 due to the agency's interest in child passenger safety. A Police Accident Report (PAR) was obtained from the investigating agency. The vehicle inspection was completed on October 19, 2005.

SUMMARY

Crash Site

This two vehicle crash occurred on a well traveled two-lane east/west rural roadway in October 2005. At the time of the crash, the asphalt roadway was dry and there were no adverse weather conditions. The east/west roadway was configured with one lane in each direction that was separated by a painted double-yellow centerline. The travel lanes were 3.7 m (12.1') in width and were bordered by a 2.7 m (8.9') north side and a 2.1 m (6.9') wide south side paved shoulder. The roadway was curved with a radius of curvature calculated at 288 meters (940'). The roadway experienced a 4 percent positive grade in the eastbound direction. The posted speed limit for the roadway was 89 km/h (55 mph). Physical evidence in the form of skid marks and roadway gouging was identified during the scene investigation. The skid marks were attributed to the front right tire and began 3.2 m (10.5') inboard of the east road edge and terminated 4.9 m (16.1') from the same. The total length of the tire mark was 6.9 m (22.6'). The roadway gouging was located 3.6 m (11.8') inboard of the east road edge at the area of impact. The SCI scene schematic is included as **Figure 19** at the end of this narrative report.

Vehicle Data – 1994 Plymouth Voyager

The 1994 Plymouth Voyager SE was identified by the Vehicle Identification Number (VIN): 1P4GH44RXX (production number omitted). The vehicle's mileage could not be determined because the vehicle had no power. The total GVWR was 2,359 kg (5,200 lb) and the front and rear weight distributions were 1,237 kg (2,726 lb). The minivan was designed with two front doors, a sliding right side door, and a rear lift gate. The front-wheel drive vehicle was equipped with a 6-cylinder, 3.3-liter engine linked to 3-speed automatic transmission along with power steering, power-assisted brakes, and a tilt steering wheel. The vehicle was configured with 38 cm (15") steel wheels and varied tires. The manufacturers recommended tire pressure was 241 kPa (35 PSI). The specific tire information was as follows:

Position	Tire Model/Size	Tire Pressure	Tread Depth	Damage
LF	Hankook Radial H714 P205/75R15	317 kPa (46 PSI)	5 mm (6/32")	None
RF	Dayton Quadra SE P205/75R15	0 kPa	3 mm (4/32")	Cut tread and sidewall
LR	Dayton Quadra SE P205/75R15	0 kPa	3 mm (4/32")	Tire rotted
RR	Unknown	0 kPa	6 mm (7/32")	Tire rotted

The 1994 Plymouth Voyager was configured with front box mounted seats with integral head restraints. The driver's seat ran along a 20 cm (8") track and was adjusted to the full rear position. The position of the driver's seat translated to a longitudinal distance of 76 cm (30") between the middle of the seat back and the steering wheel hub.

The second row consisted of a short-bench seat with folding backs for the second row center and left positions. The distance between the front and second row seatbacks was

71 cm (28"). The third row was equipped with a bench with folding back seat for the three positions. The second and third row seats contained no head restraints.

Vehicle Data – 1993 Chevrolet K-1500

The 1993 Chevrolet K-1500 was identified by the VIN: 1GCEK14H7PZ (production number omitted). The vehicle’s GVWR was 2,767 kg (6,100 lb) which distributed 1,520 kg (3,350 lb) to the front of the vehicle and 1,701 kg (3,750 lb) to the rear. The 4-wheel drive vehicle was powered by an 8-cylinder, 5.0-liter engine linked to a 4-speed automatic transmission. The vehicle was equipped with 41 cm (16") steel wheels and was outfitted with Hercules Terra Trac Radial A/W LT265/75R16 tires. The maximum tire pressure was 350 kPa (51 PSI). The specific tire information at the time of the inspection was as follows:

Position	Tire Pressure	Tread Depth	Damage
LF	234 kPa (34 PSI)	6 mm (8/32")	None
RF	0 kPa	6 mm (8/32")	None
LR	241 kPa (35 PSI)	6 mm (8/32")	Tire rotted
RR	241 kPa (35 PSI)	3 mm (4/32")	Tire rotted

Crash Sequence

Pre-Crash

The 50-year old female driver of the Plymouth Voyager was traveling in an easterly direction on a two-lane roadway negotiating a right curve (**Figure 2**). According to a witness the vehicle was driving erratically weaving in out of the eastbound lane. As the Plymouth was negotiating the curve it entered the westbound lane and impacted a 1993 Chevrolet K-1500 pickup truck that was westbound on the same roadway (**Figure 3**). The 43-year old male driver of the Chevrolet applied and locked up his brakes prior to the impact evidenced by a 6.9 m (22.6') long skid mark from the front right tire. Roadway gouging was also present at the point of impact (**Figure 4**).



Figure 2 - Eastbound approach of Plymouth Voyager.



Figure 3 - Westbound approach of Chevrolet K-1500.



Figure 4 - Point of impact.

Crash

The frontal area of the Plymouth impacted the frontal area of the Chevrolet in a head-on configuration. The directions of force for the Plymouth and Chevrolet were both in the 12 o'clock sector. The impact resulted in severe damage to both vehicles and was sufficient to deploy the frontal air bag system in the Plymouth. The Chevrolet was not equipped with air bags. The damage algorithm of the WinSMASH program computed a total

delta-V of 68 km/h (42 mph) for the Plymouth and 52 km/h (32 mph) for the Chevrolet based on the respective crush profiles. The specific longitudinal and lateral velocity changes were -67 km/h (-42 mph) and -12 km/h (-8 mph) for the Plymouth and -52 km/h (-32 mph) and 0 km/h for the Chevrolet. The Plymouth was displaced rearward 9 meters (29.5') and rotated clockwise approximately 20 degrees coming to rest on the north shoulder facing southeast. The Chevrolet continued westbound for a distance of 5 meters (16.4') and rotated clockwise approximately 10 degrees coming to rest straddling the north fog line facing northwest.

Post-Crash

The driver and front right passenger of the Plymouth sustained fractures to their legs and were unable to exit the vehicle under their own power. Emergency personnel arrived on scene and extricated the occupants from the vehicle. The left side A- and B-pillars and right side A-pillar were cut and the front left and front right doors were removed from the vehicle. The shoulder portion of the driver's 3-point lap and shoulder restraint was cut to free her from the vehicle. The driver and front right occupant were transported to a local hospital by ambulance for treatment. Their admission status was not available. The 18-month old child seated within the CSS in the third row right position was removed from the vehicle by emergency personnel and transported to a local hospital. She was treated for soft-tissue injuries and released under the care of family members. The driver and 38-year old male seated in the front right position of the Chevrolet were both transported by ambulance to a local hospital. Both vehicles were towed from the scene due to damage.

Vehicle Damage

Exterior Damage - 1994 Plymouth Voyager

The 1994 Plymouth Voyager sustained severe frontal damage as a result of the impact with the Chevrolet (**Figure 5**). The direct contact damage began 29 cm (11.6") left of the vehicle's centerline and extended 80 cm (31.5") to the front right bumper corner. The combined direct and induced damage encompassed the entire width of the bumper beam and measured 113 cm (44.5"). The maximum crush was located at the front right bumper corner and measured 84 cm (33.1") in depth. The crush profile consisted of six equidistant crush measurements taken along the bumper beam and was as follows: C1 = 12 cm (4.7"), C2 = 50 cm (19.7"), C3 = 66 cm (26"), C4 = 75 cm (29.5"), C5 = 73 cm (28.7"), C6 = 84 cm (33.1"). The Collision Deformation Classification (CDC) for the impact with the Chevrolet was 12-FDEW-4.



Figure 5 - Crush profile of 1994 Plymouth Voyager.

Interior Damage - 1994 Plymouth Voyager

The 1994 Plymouth Voyager sustained moderate interior damage as a result of passenger compartment intrusion and occupant contact. The left rigid plastic knee bolster exhibited prominent scuff marks under the steering column on the left side due to probable contact

of the driver's knees (**Figure 6**). The first scuff mark attributed to the driver's left knee was located 10 cm (3.9") inboard of the left aspect and 13 cm (5.1") above the bottom edge of the instrument panel and was 8 cm (3.1) in length. The second scuff mark attributed to the driver's right knee was located 44 cm inboard of the left edge and 13 cm (5.1") above the bottom edge of the instrument panel and measured 11 cm (4.3") in length. Body fluid transfers were also present on the lower knee bolster and on the underside of the steering column. The brake pedal was bent probably due to a combination of toe pan intrusion accompanied with foot placement and loading force due to the kinematics of the driver (**Figure 7**). The steering wheel rim was also deformed as the driver loaded through the air bag and her abdomen contacted the lower aspect of the rim (**Figure 8**). The bottom half of the steering wheel rim bent forward 3 cm. (1.2"). The steering column completely separated from the shear capsules (**Figure 9**).



Figure 6 - Damaged knee left bolster.



Figure 7 - Bent brake pedal.



Figure 8 - Bent steering wheel rim.



Figure 9 - Left shear capsule separation.

The right side knee bolster exhibited well-defined deformation from contact with the knees of the 19-year old male seated in the front right position. The deformation bowed the glove compartment door and was located inboard of the outer right edge and above the bottom edge of the instrument panel in two locations. The left knee contact (**Figure 10**) was located 44 cm (17.3") inboard and 11 cm (4.3") above the panel and the right

knee contact (**Figure 11**) was located 25 cm (9.8”) inboard and 14 cm (5.5”) above the bottom aspect. Both contacts were linear and measured approximately 5 cm (2”).



Figure 10 - Left knee contact evidence on front right glove compartment door.



Figure 11 - Right knee contact evidence on glove compartment door.

The toe pan in the driver’s and front right positions and the front right instrument panel intruded longitudinally. The front right floor pan intruded vertically. It is likely that the lower extremities of both front seat occupants loaded the toe pan area; however, no discernable contact evidence could be identified.

The specific passenger compartment intrusions are identified by their magnitude in the following table:

Position	Intruded Component	Magnitude	Direction
Front right	Toe pan	36 cm (14.3”)	Longitudinal
Front left	Toe pan	33 cm (13”)	Longitudinal
Front right	Instrument panel right	17 cm (6.5”)	Longitudinal
Front right	Floor pan	10 cm (3.9”)	Vertical

The third row seatback exhibited a small tear and indentations to the fabric from contact with the back aspect of the forward-facing CSS. The entire seatback measured 117 cm (46”) horizontally and 51 cm (20”) vertically. The tear was approximately 1 cm (.5”) in diameter and was located 33 cm (13”) below the top and 5 cm (2”) inboard of the right aspects of the seatback. The area of indentation on the seatback was 30 cm (12”) x 48 cm (19”) and was located 15 cm (6”) below the top and 38 cm (15”) inboard of the right aspect. The right aspect of the second row seatback revealed a fluid transfer of what appeared to be milk. A surrogate interview confirmed that the child seated in this location was drinking a bottle, which was splattered during the crash.

Exterior Damage – 1993 Chevrolet K-1500

The 1993 Chevrolet K-1500 pickup truck sustained severe frontal damage as a result of the impact with the Plymouth (**Figures 12 and 13**). The direct contact damage began 38 cm (14.8”) left of the vehicle’s centerline and extended 116 cm (45.8”) to the front right bumper corner. The combined direct and induced encompassed the entire front bumper and measured 156 cm (61.5”). The maximum crush was located at the front right bumper

corner and measured 82 cm (32.3") in depth. The crush profile was measured along the damaged bumper and was as follows: C1 = 5 cm (2"), C2 = 28 cm (11"), C3 = 51 cm (20.1"), C4 = 69 cm (27.2"), C5 = 81 cm (31.9"), C6 = 82 cm (32.3"). The CDC for the impact with the Plymouth was 12-FDEW-4.



Figure 12 - Damaged 1993 Chevrolet K-1500.



Figure 13 - Crush profile of 1993 Chevrolet K-1500.

As a result of the impact, the front right door of the Chevrolet was jammed shut and the front right window disintegrated. The front right tire was cut and restricted by the crushed front right bumper. The front right axle position was deformed rearward compressing the wheelbase 29 cm (11.4"). The bed of the Chevrolet contained an industrial tool box weighing an estimated of 91 kg (200 lbs.) at the time of the inspection. At impact, the tool box engaged the bed of the pickup resulting in minor damage.

Manual Restraints – 1994 Plymouth Voyager

The 1994 Plymouth Voyager was configured with manual 3-point lap and shoulder belts for the five outboard positions and the second row center position. Both front seats were configured with Emergency Locking Retractors (ELR), cinching latch plates, and adjustable D-rings that were in the full down position at the time of the inspection. The driver's belt revealed loading marks consistent with usage and the shoulder portion of the belt was cut by



Figure 14 - Driver's 3-point lap and shoulder restraint.

emergency personnel to remove the driver from the vehicle (Figure 14). The webbing of the belt was roped inside the hardware of the cinching latch plate. Due to the roping of the webbing, the latch plate was in a fixed position 72 cm (28.5") above the anchor point. Occupant loading in the form of fiber transfers was present on the lap portion of the belt that began 23 cm (9") above the anchor point and terminated 71 cm above the same. The total length of the fiber transfer was 47 cm (18.5"). The incision on the shoulder belt was 19 cm (7.5") above the latch plate. There was no loading evidence on the front right seatbelt which is indicative of non-usage. Typically, in high severity crashes such as this,

the belt system will reveal distinctive loading evidence, and with the absence of such evidence, it was determined that the front right passenger was unrestrained.

The second and third row 3-point lap and shoulder belts were configured with ELR's, cinching latch plates, and fixed D-rings. The second row was not occupied; however, the base for an infant CSS was secured to the second row left seat. The lap and shoulder belt was routed through the channels on the back aspect of the base. The third row right lap and shoulder belt was used to secure a forward-facing convertible CSS. Loading evidence was present on the webbing and the fixed D-ring. Rippling was identified on the shoulder portion of the belt and a fabric transfer was present. The fabric was brownish in color and was located 112 cm (44") above the anchor point. The unoccupied third row center seat was equipped with only a lap belt.

Frontal Air Bag System – 1994 Plymouth Voyager

The 1994 Plymouth Voyager was equipped with frontal air bags for the driver and front right passenger positions (**Figure 15**). The driver's air bag was housed in the center of the steering wheel hub. The driver's air bag deployed from the steering wheel hub through symmetrical H-configuration module cover flaps. The cover flaps measured 18 cm (7") in width and 6 cm (2.5") in height. The driver's air bag measured 56 cm (22") in its deflated state and had an excursion of 33 cm (13"). The air bag was vented by two circular ports located in the 11 and 1 o'clock sectors on the back of air bag. The air bag was not tethered. There was no contact evidence on the air bag membrane. The following nomenclature was stamped on the bag of the air bag:



Figure 15 - Deployed frontal air bags.

PVT 11446-02E
TAC 038 H21029

The front right passenger's air bag deployed from a top-mount module configured with a single rectangular vinyl cover flap hinged at the top aspect. The cover flap measured 32 cm (12.5") in width and 15 in (5.75) height. The air bag measured 47 cm (18.5") in width and 56 cm (22") in height in its deflated state. The total excursion of the air bag was 57 cm (22.5"). The air bag was internally vented and was tethered by a single strap measuring 29 cm (11.5") in length. There was a body fluid transfer on the upper middle right aspects passenger's air bag.

Child Safety Seat

Evenflo Tribute

A convertible Evenflo Tribute CSS (**Figure 16**) was installed forward-facing in the third row right position of the Plymouth Voyager. The CSS was removed from the vehicle and located at the home of a family member where it was inspected. The model number was

3792098 P1 and the date of manufacture was 26 February 2004. The convertible CSS was configured with a 5-point harness system and a two-piece retainer clip. The CSS was rated for children weighing between 9 kg (20 lbs) and 18 kg (40 lbs) and are less than 101 cm (40") in height. According to a family member who was interviewed, the child weighed 11 kg (25 lbs) and was within the manufacturer's recommended weight guidelines. A determination on the child's height was not made by the family member. A label (**Figure 17**) on the CSS outlined the recommended use of the CSS as follows:

Rear-facing 5-30 lbs (2-14 kg)

- Infants who weigh less than 20 lbs (9 kg) must be rear-facing.

Forward-facing 20 – 40 lbs (9-18 kg)

- Toddlers who weigh between 20 and 30 lbs (9-14 kg) and are at least one year old may be forward facing.
- Toddlers who weigh between 30 and 40 lbs (14-18 kg) and up to 40 in (102 cm) tall must be forward facing.



Figure 16 - Evenflo Tribute convertible CSS.

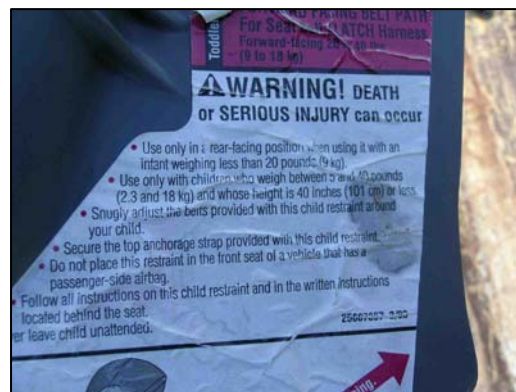


Figure 17 - CSS labeling.

At the time of the CSS inspection, the harness straps were routed through the top slots consistent with forward facing use. The harness retainer clip was positioned 24 cm (9.5") below the harness slots. There left harness webbing exhibited loading evidence located 32 cm (12.5") below the harness slots where the webbing was roped within the left latch plate. There were no discernable stress marks on the seat or shell of the CSS.

The CSS was equipped with the Lower Anchors and Tethers for Children (LATCH) system; however, the vehicle was not equipped with lower anchors or a top tether hook. The family purchased the CSS used at a garage sale and had it installed by a New York State Trooper CPS technician at a CSS checkpoint approximately 6 months prior to the crash. Since being installed, it was unknown whether the CSS had been removed and reinstalled.

Cosco Base

The base for a Cosco infant CSS was found installed in the second row left position during the SCI inspection (**Figure 18**). The model number for the CSS base was 4359

3340. No information was available on the model name or the date of manufacture. The base was 53 cm (20.75”) in length and 36 cm (14”) in width. It was secured in the vehicle by a manual 3-point lap and shoulder belt with a cinching latch plate. The base had a side-to-side excursion of approximately 5 cm (2”) there was minor rippling to the belt. The base was not used during the crash. The occupancy status of the second row left seating position was confirmed through a surrogate interview.



Figure 18 - Base for Cosco infant CSS.

Occupant Demographics

Driver

Age/Sex: 50-year old/Female
 Height: Not available
 Weight: Not available
 Seat Track Position: Full-rear
 Manual Restraint Use: Manual 3-point lap and shoulder belt.
 Usage Source: Vehicle inspection.
 Eyewear: Not available.
 Type of Medical Treatment: Transported by ambulance to a local hospital; unknown level of treatment.

Driver Injuries

Injury	Injury Severity (AIS90/Update 98)	Injury Source
Fractured right leg, NFS	Moderate (852002.2,1)	Undetermined

Source: Interview.

Driver Kinematics

The 50-year old driver was seated in the front left seat; however, her posture could not be determined due to the reported diabetic seizure she was experiencing. Nevertheless, at impact she probably initiated a forward and slightly right trajectory responding to the 12 o'clock direction of force. As the driver traveled forward, she loaded the 3-point lap and shoulder belt evidenced by the stretching of the webbing and loading marks. Thereafter, she loaded through the expanding driver's air bag and contacted the steering wheel rim. The bottom aspect of the steering rim was deformed 3 cm (1.2”) and the steering column was separated from the shear capsules. The brake pedal was likely deformed from the loading of the driver's right foot while she was possibly attempting to brake. The left knee bolster was scuffed in two locations. The driver sustained an unspecified right leg fracture, the source of which cannot be determined. It likely resulted from the loading of the brake pedal or the knee bolster. The driver was extricated from the vehicle due to her injuries and the jamming of the front doors. Emergency personnel removed the front left door and mechanically severed the A- and B-pillars to access the driver. She was

transported by ambulance to a local hospital for treatment. Her admission status was not available.

Front Right Passenger

Age/Sex: 19-year old/Male
 Height: Not available
 Weight: Not available
 Seat Track Position: Between forward and mid-track; 7 cm rear of full-forward and 13 cm forward of full-rear.
 Manual Restraint Use: None.
 Usage Source: Vehicle inspection.
 Eyewear: Not available.
 Type of Medical Treatment: Transported by ambulance to a local hospital; unknown level of treatment.

Front Right Passenger Injuries

Injury	Injury Severity (AIS90/Update 98)	Injury Source
Fractured right leg, NFS	Moderate (852002.2,1)	Undetermined
Fractured left leg, NFS	Moderate (852002.2,2)	Undetermined

Source: Interview.

Front Right Passenger Kinematics

The 19-year old passenger was seated in a presumed upright posture in the front right seat. At impact, he initiated a forward and slightly right trajectory responding to the direction of force. No loading evidence was identified on the front right safety belt, which is indicative of non-usage. As he moved forward, his knees loaded the right knee bolster, evidenced by two distinct areas of deformation on the component. As a result of this loading, the glove compartment door was bowed but remained closed. The toe and floor pans, and the right instrument panel intruded into the front right area reducing occupant space. The front right passenger sustained unspecified fractures to both of his legs. The source of these fractures cannot be conclusively determined; however, it is probable that the source is a combination of the intruded toe and floor pans, and the intruded knee bolster. The front right passenger was extricated from the vehicle following the crash. The front right door was removed by emergency personnel and the right A-pillar mechanically severed. He was transported to a local hospital by ambulance. His admission status is not known.

Third Row Right Passenger Kinematics

Age/Sex: 18-month old/Female
Height: Unknown
Weight: 11 kg (25 lbs)
Seat Track Position: Not adjustable
Manual Restraint Use: Forward-facing convertible CSS with 5-point harness, installed with 3-point lap and shoulder belt.
Usage Source: Vehicle inspection, CSS inspection
Eyewear: None.
Type of Medical Treatment: Transported by ambulance to a local hospital; treated and released.

Third Row Right Passenger Injuries

Injury	Injury Severity (AIS90/Update 98)	Injury Source
Semi-circular laceration above right eye.	Minor (290602.1,7)	Flying glass.
Bilateral shoulder abrasions	Minor (790202.1,3)	Internal harness straps

Source: Interview.

Third Row Right Passenger Kinematics

The 18-month old child passenger was seated in forward-facing convertible CSS and was restrained by a 5-point harness. The CSS was installed in the third row right position of the Plymouth Voyager and secured with the 3-point lap and shoulder belt routed through the forward facing belt path. The CSS was installed six months prior to the crash by a CPS technician at a checkpoint. The CSS was removed from the vehicle following the crash and was inspected at the home of a family member. At impact, the child and CSS initiated a forward and slightly right trajectory responding to the 12 o'clock direction of force. The CSS loaded the 3-point lap and shoulder belt evidenced by loading marks on the belt webbing. As the child loaded the internal 5-point harness, she sustained abrasions to both of shoulders. Flying glass from the disintegrating front right glazing contacted the child above the right eye resulting in a 1 cm (0.5") semi-circular laceration above her right eye. The child was removed from the vehicle through the rear right sliding door. She was transported to a local hospital by ambulance where she was treated and released to the care of a family member.

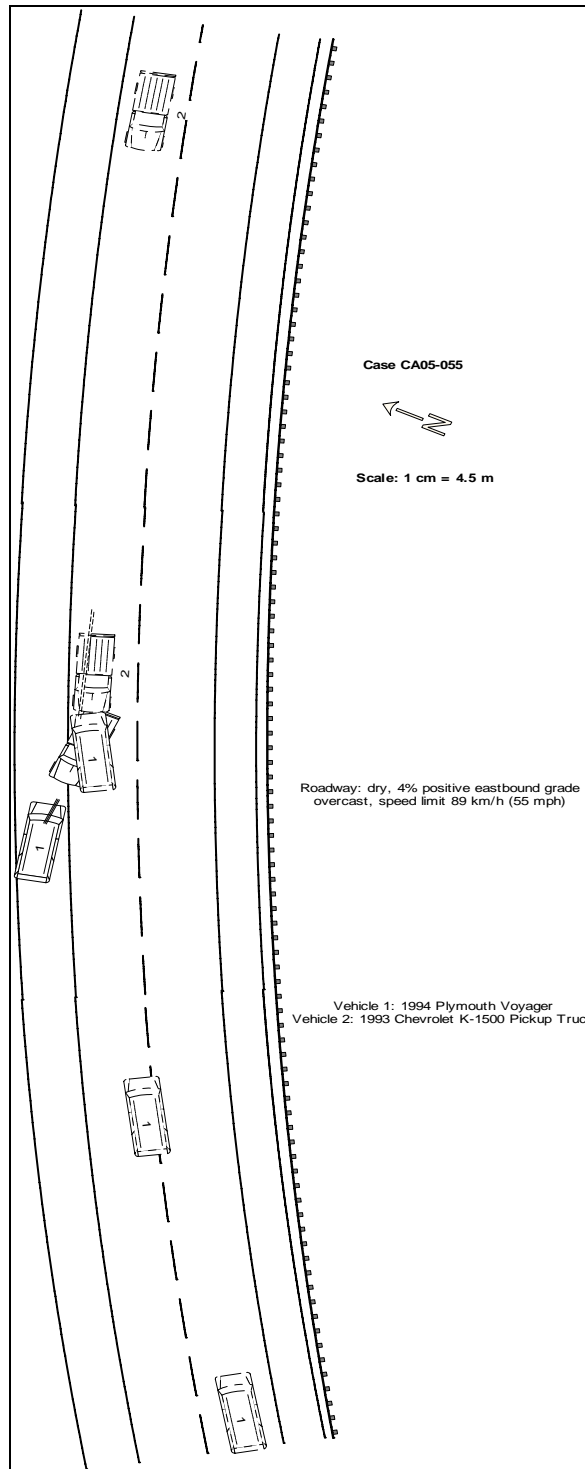


Figure 19 – Scene Schematic