

CRASH DATA RESEARCH CENTER

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**CALSPAN ON-SITE CHILD RESTRAINT SYSTEM CRASH INVESTIGATION
SCI CASE NO: CA10015**

VEHICLE: 2001 CHRYSLER TOWN & COUNTRY MINIVAN

LOCATION: MARYLAND

CRASH DATE: APRIL 2010

Contract No. DTNH22-07-C-00043

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points are coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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BACKGROUND

This investigation focused on the Child Restraint System (CRS) that was used to restrain a 2-year-old male in the second row right position of a 2001 Chrysler Town & Country minivan (**Figure 1**). The Chrysler was involved in a left road side departure crash with a utility pole. The front right impact deployed the redesigned frontal air bags in the Chrysler and produced significant intrusion of the front right passenger space. The Chrysler was driven by a 73-year-old restrained male with a 63-year-old female restrained in the front right position and the child passenger restrained in a Cosco/Dorel forward facing CRS in the second row right position. The driver sustained police reported non-incapacitating injuries and was transported to a regional trauma center by ambulance. The front right passenger was transported to the trauma center where she expired approximately 4.5-hours post-crash. The child passenger was transported to a regional pediatric trauma center where he was treated and released.



Figure 1: Front right oblique view of the 2001 Chrysler Town & Country.

This crash was identified by the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA) through an Internet media search. The notification was forwarded to the Calspan Special Crash Investigation (SCI) team on April 15, 2010. Calspan SCI initiated follow-up research of the crash the same day. Cooperation was established with the investigating police agency and the Chrysler was located at a regional vehicle salvage yard. The on-site portion of this investigation occurred on April 29, 2010 and involved the inspection of the Chrysler, the CRS and the crash site.

SUMMARY

Vehicle Data - 2001 Chrysler Town & Country

The 2001 Chrysler Town & Country Limited minivan was identified by the Vehicle Identification Number (VIN): 2C8GP64L61R (production sequence deleted). The date of manufacturer was unknown. The electronic odometer reading at the time of the crash was 252,147 km (156,681 miles). The powertrain consisted of a 3.8-liter, V-6 engine linked to a 4-

speed automatic transmission with front wheel drive. The Chrysler was equipped with a 4-wheel ABS, disc brake system. The Chrysler's OEM multi-spoke alloy wheels were with equipped with Tempest Touring TR, P215/65R16 tires on the left front, right front and right rear wheel positions. A Sumitomo Touring LST P215/65/R16 tire was mounted on the left rear wheel. The vehicle manufacturer recommended tire size was 215/65R16 with a front and rear cold tire pressure of 248 kPa (36 PSI). The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Pressure	Tread Depth	Restricted	Damage
LF	Flat	2 mm (3/32 in)	No	De-beaded, 2 punctures in outer sidewall
LR	Flat	7 mm (9/32 in)	No	Cut in outer sidewall
RR	172 kPa (25 PSI)	6 mm (8/32 in)	No	None
RF	Flat	2 mm (3/32 in)	Yes	None (inner bead de-beaded)

The interior of the Chrysler was configured for seven passenger seating with front and second row captain's chairs and a third row bench seat with split, forward-folding seatbacks. All seating positions were leather-surfaced and the six outboard positions were equipped with adjustable head restraints. The manual restraint systems consisted of 3-point lap and shoulder safety belts in the six outboard positions. The third row center position was equipped with a lap belt. The front safety belts were equipped with buckle pretensioners. The Chrysler was equipped with redesigned frontal air bags and front seat-mounted side impact air bags. The frontal air bags deployed in this crash.

Crash Site

The crash occurred during daylight hours in April 2010. At the time of the crash, the weather was clear and the bituminous roadway was dry. The crash sequence occurred within an undivided section of roadway that consisted of two northbound travel lanes, two southbound travel lanes and a center left turn lane. This segment of roadway maintained a straight alignment with a four percent grade, negative to the north. The outboard travel lanes measured 3.4 m (11.2 ft) in width and the inboard lane measured 3.2 m (10.5 ft) wide. The left turn lane measured 3.2 m (10.5 ft) in width. The west edge of the roadway was bordered by an 8 cm (3 in) concrete curb with a 1.2 m (4.0 ft) wide concrete sidewalk that paralleled the curb line. A commercial driveway that measured 7.4 m (24.3 ft) in width was located on the west side of the roadway. A 38 cm (15 in) diameter wooden utility pole was located 1.2 m (4 ft) west of the west side curb line and 5.4 m (17.7 ft) north of the driveway. The posted speed limit for this portion of roadway was 64 km/h (40 mph). **Figure 2** is a northbound view of the section of roadway which depicts the pre-crash travel path of the Chrysler. **Figure 3** is a look back view from the utility pole (the

point of impact) along the Chrysler's pre-crash trajectory. A schematic of the crash is included at the end of this report as **Figure 11**.



Figure 2: Northbound trajectory view of the Chrysler.



Figure 3: Look back view from the point of impact along the Chrysler's path of travel.

Crash Sequence

Pre-Crash

The Chrysler was traveling in a northerly direction within an unknown travel lane on the straight segment of roadway. For reasons unknown, the driver relinquished directional control of the vehicle. He did have a medical history of diabetes and sleep apnea. The investigating officer suspected he suffered a medical episode as he had no recollection of the crash and he did not sustain a head injury from the crash events. The Chrysler crossed the center left turn lane and traversed the southbound lanes in a tracking mode. The vehicle continued on a straight-line trajectory and departed the west road edge at the mouth of the driveway at a shallow departure angle. There was no physical evidence to support avoidance actions by the driver.

Crash

The Chrysler's left front tire and wheel impacted the tapered north curb for the driveway that intersected the roadway. The tire and wheel curb impact fractured the alloy wheel and produced a cut in the tread of the tire (Event 1). This impact did not alter the trajectory of the Chrysler as it continued forward onto the sidewalk. The left rear tire and wheel subsequently struck the same curb area resulting in a dent with a fracture line of the outer bead of the alloy wheel and de-beding of the radial tire (Event 2). The curb was gouged and scuffed by these 12 o'clock directions of force impacts.

The right side tires of the Chrysler overrode the wheelchair access curb cutout without causing damage to the vehicle. The front right corner area of the Chrysler subsequently impacted the utility pole that was located at the outboard edge of the sidewalk (Event 3). The direction of force for this impact event was within the 12 o'clock sector and crushed the frontal structure to a maximum depth of 91 cm (35.8 in). The impact displaced the 38 cm (15 in) diameter utility pole

8 cm (3 in) in a northerly direction and 5 cm (2 in) in a westerly direction. The pole was not fractured. The Barrier Algorithm of the WinSMASH program was used to calculate the delta-V of the pole impact. The total delta-V for the Chrysler's third event was 39 km/h (24.2 mph). The longitudinal and lateral delta-V components were -39 km/h (-24.2 mph) and 0 km/h, respectively. The results of the WinSMASH program were characterized with a borderline reconstruction confidence level. The delta-V appeared to be under-estimated based on SCI field experience. This impact event (Event 3) resulted in the actuation of the Chrysler's safety belt pretensioners and the deployment of the frontal air bag system.

During the Chrysler's impact with the utility pole, the offset right impact rotated the vehicle in a clockwise (CW) direction of approximately 25 degrees. During this rotation, the left side of the vehicle impacted a guy wire attached to the utility pole as the vehicle came to final rest. The Chrysler came to rest fully engaged against the struck utility pole.

Post-Crash

Police and ambulance personnel responded to the crash site. All three occupants of the Chrysler remained in the vehicle post-crash and required extrication. Rescue personnel used hydraulic tools to cut open both front doors. The left front door was completely removed from the vehicle while the right front door remained attached to the vehicle by the lower hinge assembly. The driver and front right passenger were transported by ground ambulance to a regional trauma center for treatment of their injuries. The driver was hospitalized for three days. The front right passenger expired approximately 4.5 hours following the crash.

The second row right child passenger was removed from the vehicle while seated in the CRS through the right sliding door window opening. He sustained police-reported possible injuries. He was removed from the CRS and transported to a regional pediatric trauma center by ground ambulance where he was evaluated. Further details regarding the child's injuries were unknown. The Chrysler sustained disabling damage and was towed from the crash site.

2001 Chrysler Town & Country Exterior

Exterior Damage

The exterior of the Chrysler sustained four separate areas of direct contact damage during the multiple event vehicle-to-objects crash sequence. The initial impact with the raised concrete curb produced deformation to the leading edge of the left front alloy wheel. The impact force was sufficient to de-bead the left front tire and produce two puncture holes within the outer sidewall, measuring 1 cm (0.4 in) and 3 cm (1.2 in). The Collision Deformation Classification (CDC) for this event was 12FLWN4.

The second impact with the raised concrete curb produced deformation to the leading edge of the left rear wheel. This impact force was sufficient to produce a small tear within the outer sidewall measuring 4 cm (1.6 in) in length. The CDC for this event was 12FLWN9.

The front right area of the Chrysler impacted the utility pole resulting in an impact force of 12 o'clock. **Figures 5 and 6** are views of the impact damage. Maximum crush was 91 cm (35.8 in) located at the right corner of the bumper beam. The direct contact damage began 43 cm (16.9 in) right of the vehicle's centerline and extended 38 cm (15 in) to the front right corner. The combined induced and direct damage length was 84 cm (33 in) and involved the full (deformed) width of the bumper beam. The impact resulted in deformation to the front bumper fascia, reinforcement bar, right headlight, hood, grille, radiator components, and the left front fender. The front tire and wheel engaged the struck utility pole which displaced the axle position rearward 42 cm (16.5 in). The crush profile was measured at the level of the bumper beam and was as follows: C1 = 5 cm (2 in), C2 = 5 cm (2 in), C3 = 14 cm (5.5 in), C4 = 27 cm (10.6 in), C5 = 44 cm (17.3 in), C6 = 91 cm (35.8 in). The CDC for this impact was 12FREE5.



Figure 4: View of the Chrysler's front plane damage from event 3.



Figure 5: Right side view of the pole impact damage.

During the Chrysler's CW rotation against the pole, the left side area impacted the guy wire (Event 4). This impact produced a narrow vertical indentation in the left rear door which spanned diagonally from the level of the sill to the upper door area. The CDC for this for this lateral impact event was 09LPEN1.

Rescue personnel used hydraulic equipment to open and remove the left front door and open and partially removed the right front door. The right front door was still connected to the vehicle by the lower forward hinge. The rear sliding doors were jammed closed by vehicle deformation and forced open by rescue personnel. The post crash condition of the Chrysler's windshield was in place and cracked from impact forces. It appeared that rescue personnel cut the laminated glazing along the header to aid in the treatment and extrication of the front seat occupants. The right front, right rear, left front, and left rear glazing either were disintegrated or time of the SCI inspection. The remaining window glazing were in place and undamaged.

Interior Damage

The interior damage to the Chrysler (**Figure 6**) consisted of the deployment of the vehicle’s air bag systems, actuation of the pretensioners, occupant contact points and passenger compartment intrusion. The maximum intrusion involved 49 cm (19.3 in) of rearward displacement of the right toe pan. The right instrument panel intruded 24 cm (9.4 in) rearward into the front right occupant space. The measured intrusions are listed by component, magnitude and direction front left to right in the following table:



Figure 6: Right interior view of the Chrysler's front row.

Position	Component	Magnitude	Direction
Front Row/Left	Instrument Panel	19 cm (7.5 in)	Longitudinal
	Toe Pan	14 cm (5.5 in)	Longitudinal
	Floor Pan	5 cm (2 in)	Vertical
	Center instrument panel	8 cm (3.1 in)	Lateral
Front Row/Center	Instrument Panel	15 cm (5.9 in)	Longitudinal
Front Row/Right	Instrument Panel	24 cm (9.4 in)	Longitudinal
	Toe Pan	49 cm (19.3 in)	Longitudinal
	Floor Pan	8 cm (3.1 in)	Vertical

The interior damage related to occupant contact was limited to the front seat occupants. The driver’s left knee impacted and scuffed the rigid plastic knee bolster 36-43 cm (14-17 in) left of the center and 30-38 cm (12-15 in) below the top brow of the instrument panel. His right knee contacted the left side of the mid instrument panel adjacent to the radio unit. This contact consisted of a blue fabric transfer that was located 20-28 cm (8-11 in) below the top of the center instrument panel. The driver loaded though the deployed air bag and his loading force deformed the steering wheel flange. The gap between the wheel and the hub was closed on the bottom and opened 0.7 cm (0.3 in) at the top position. There was no bending or deformation of the steering wheel rim. The energy absorbing steering column and shear capsules could not be inspected as the backer panel for the knee bolster was jammed in position by intrusion and could not be removed without causing additional damage to the vehicle.

The front right passenger's knees impacted the glove box door and loaded the sub-instrument panel components as they intruded rearward into the front right position. The glove box door was fractured from its hinge points and abraded at the lower corner areas. There was no distinct contact evidence from the passenger's lower extremities.

Both front seats were adjusted to a rear-track position and were displaced by deformation of the floor. The driver's seat back was rotated forward and the entire front right seat was displaced vertically and rotated in a counterclockwise direction.

Manual Restraint Systems

The driver's safety belt system consisted of continuous loop webbing, a sliding latch plate, an adjustable D-ring, an Emergency Locking Retractor (ELR), and a seat frame-mounted buckle pretensioner. The D-ring was adjusted to the full-down position. The SCI inspection of the safety belt system revealed no frictional abrasions to the plastic surface of the latch plate; however, a 6 cm (2.5 in) frictional abrasion was identified on the shoulder belt webbing located at the position of the D-ring. The length of belt webbing measured 208 cm (82 in) in length from the beginning of the abrasion to the floor anchor. The buckle housing measured 4 cm (1.5 in) below the height of the seat cushion due to the actuation of the pretensioner. The loading evidence on the safety belt webbing supported driver belt use at the time of the crash.

The front right safety belt system consisted of continuous loop webbing, a light-weight locking latch plate, an adjustable D-ring, a buckle pretensioner system and an ELR. The D-ring was adjusted 4 cm (1.5 in) above the full-down position. The safety belt webbing was cut by the first responders 109 cm (43 in) above the floor anchor. Belt loading evidence consisted of a 14 cm (5.5 in) D-ring related frictional abrasion located 132 cm (52 in) above the cut point. This loading pattern suggested that a large amount of webbing was spooled out of the retractor at the time of the crash. There was no loading evidence at the latch plate or on the corresponding area of the belt webbing. The shoulder belt webbing was locked/jammed at the retractor resulting in a total length of webbing of 241 cm (95 in) from the D-ring to the floor anchor. The buckle housing was located 3 cm (1.25 in) below the level of the seat cushion due to the actuation of the buckle pretensioner. Based on the loading evidence and the cut section of webbing, the front right occupant was restrained at the time of the crash.

The second row captain's chairs were equipped with 3-point continuous loop lap and shoulder belts with locking latch plates, ELR retractors, and adjustable D-rings. The rear left D-ring was adjusted 2 cm (0.75 in) below the full-up position while the rear right was adjusted to the full-down position. The rear left safety belt system was routed through the forward-facing belt path of the unused Cosco (blue) CRS. The belt did not hold the CRS secure as the CRS had approximately 20 cm (8 in) of lateral movement at the belt path at the time of the SCI inspection.

At the on-set of the SCI inspection, the pink CRS was found on the floor forward of the second row left position. It was determined that this CRS was removed from the vehicle post-crash and placed back into the Chrysler prior to its removal from the crash site. The pink CRS was re-positioned in its pre-crash placement in the second row right. **Figure 7** is a right interior view of the Chrysler depicting the reconstructed positions of the CRS's.



Figure 7: Right interior view of the Chrysler and the reconstructed positions of the CRS's.

Inspection of the second row right safety belt webbing found that it was fully stowed within the ELR. Examination of the extended webbing determined that there was no loading evidence on the belt system. The latch plate examination was unremarkable.

Frontal Air Bag System

The Chrysler was equipped with redesigned frontal air bags for the driver and front right passenger positions. The driver's air bag module was located within the center hub of the steering wheel and concealed by an "H" cover flap configuration. The deployed driver air bag measured 66 cm (26 in) in its deflated state. The air bag contained two internal tether straps located at the 3 and 9 o'clock sectors. The tethers were sewn to the face of the air bag with a 24 cm (9.5 in) tether reinforcement with three rows of stitching. The air bag excursion in its deflated state was 15 cm (6 in) at the tether locations and 30 cm (12 in) between the tether locations. The driver air bag was not directly vented into the passenger compartment. There was no occupant contact evidence to the cover flaps or the air bag.

The front right passenger air bag was a mid-mount design located within the center of the right instrument panel. The vinyl cover flap was reinforced with a sheet metal hinge at the top aspect of the flap. The single cover flap was 32 cm (12.5 in) in width and 19 cm (7.5 in) in height. The deployed front right air bag measured 46 x 66 cm (18 x 26 in) width by height. The front right air bag was not tethered or directly vented via ports. The excursion of the air bag at the mid portion of the bag from the module was 36 cm (14 in). There was no occupant contact evidence to either the deployed front right air bag or the top mounted cover flap. The Chrysler was not equipped with an Event Data Recorder (EDR).

Side Impact Air Bags

The Chrysler was also equipped with front seatback-mounted side impact air bags. The side impact air bags did not deploy during this crash sequence.

Child Restraint Systems

Two identical child safety seats, one pink and the other blue, were installed within the second row of the Chrysler at the time of the crash. Both CRS were manufactured by Cosco/Dorel. The PAR listed the pink CRS as the CRS that restrained the 2-year-old male at the time of the crash.

The blue CRS (**Figure 8**) was installed in the rear left position and was loosely secured by the vehicle's 3-point lap and shoulder belt system. The safety belt system was routed through the forward facing belt path. The CRS was identified as a Cosco/Dorel Highback Booster, with a Model No. of 22277-CPL and a Date of Manufacturer of 10/09/2009. The CRS was stamped with an expiration date of 2015. The CRS was designed for use as a forward-facing CRS or as a highback belt positioning booster seat. As a forward facing CRS, the manufacturer recommended size limits were 10-18 kg (22-40 lbs) and 86-109 cm (34-43 in). The size requirements for use as a forward-facing booster seat were 18-36 kg (40-80 lb) and 109-132 cm (43-52 in). The CRS was also equipped with Lower Anchors and Tethers for CHildren (LATCH). The LATCH system was not used for this installation.

The pink Cosco CRS (**Figure 9**) was manufactured on 12/22/2008 and was identified by Model No. 22233-PDP. The expiration date posted on this CRS was 2015. The manufacturer size requirements were the same for this CRS as the blue CRS. The CRS was equipped with LATCH, but this system was not used in this crash. The CRS was secured by the vehicle's safety belt system routed through the forward facing belt path. There was no loading evidence at the belt path or stress to the shell of this CRS.

The integral 5-point harness system was intact in the CRS at the time of the SCI inspection. The shoulder straps were routed through the lowest of two sets of slots. The straps were folded in half at the level of the chest clip. There was no loading evidence on the harness straps or at the position slots for the harness.



Figure 8: View of the Cosco Highback that was located in the second row left seat position



Figure 9: View of the Cosco Highback that was located in the second row right seat position

Occupant Demographics/Data

Driver

Age/Sex: 73-year-old/Male
Height: Unknown
Weight: Unknown
Seat Track Position: 4 cm (1.5 in) forward of full-rear
Safety Belt Usage: 3-point lap and shoulder belt
Usage Source: SCI vehicle inspection
Egress from Vehicle: Removed by EMS
Type of Medical Treatment: Transported to regional trauma center where he was admitted for three days

Driver Injuries

Injury	Injury Severity (AIS 2005/Update 08)	Injury Source
Right rib fractures (4 th - 9 th) lateral aspect and minimally displaced	Serious (450203.3,1)	Safety belt loading

Source - Medical Records

Driver Kinematics

The 73-year-old male driver of the Chrysler was seated in a rear track position with the seat track adjusted 4 cm (1.5 in) forward of the full-rear. The seatback angle was deformed forward by the crash. The adjustable head restraint was in the full-down position. The driver was restrained by the available 3-point safety belt system, evidenced by frictional loading abrasions on the webbing at the locations of the D-ring and the latch plate. The driver was possibly out of position due to a medical episode. There was no documentation of an event in the medical records. He did have a documented history of diabetes and sleep apnea.

At impact, the ELR safety belt retractor locked, the buckle-mounted pretensioner actuated, and the driver air bag deployed. The driver responded to the 12 o'clock direction of force by initiating a forward trajectory. He loaded the safety belt system with his left shoulder, chest and pelvis. His loading force on the belt system produced a frictional D-ring transfer to the webbing. He loaded the deployed air bag and compressed the air bag against the steering wheel. Although the wheel rim was not deformed, the steering wheel flange was deformed at the 6 o'clock position. It should be noted that the steering wheel was rotated approximately 180 degrees at the time of the SCI inspection. Due to the pre-crash CCW steering maneuver, the wheel was probably in this position at the time of the crash and during the driver loading of the air bag and wheel rim. As a result of safety belt loading, the driver sustained fractures of right ribs 4-9.

The driver's left knee contacted the knee bolster left of the steering column. A scuff mark evidenced the contact area. His right knee contacted the left aspect of the center instrument

panel. This contact was evidenced by a blue fabric transfer. There were no medically documented injuries associated with these contacts.

The driver rebounded into his seatback where he came to final rest within his original seating position. The left door was removed from the vehicle to extricate the driver from the Chrysler. He was transported by ground ambulance to a regional trauma center where he was admitted for three days for treatment of his rib fractures.

Front Right Passenger

Age/Sex: 63-year-old/Female
 Height: Unknown
 Weight: Unknown
 Seat Track Position: 6 cm (2.5 in) forward of full-rear
 Safety Belt Usage: 3-point lap and shoulder belt
 Usage Source: SCI vehicle inspection
 Egress from Vehicle: Removed by EMS
 Type of Medical Treatment: Transported to a regional trauma center where she expired approximately 4.5 hours following the crash

Front Right Passenger Injuries

Injury	Injury Severity (AIS 2005/Update08)	Injury Source
Liver laceration (Grade 4, several large stellate lacerations)	Critical (541828.5,1)	Safety belt webbing
Inferior vena cava laceration (long linear laceration at the junction with the right atrium)	Serious (421802.3,4)	Safety belt webbing
Right open supracondylar femoral fracture	Serious (853352.3,1)	Intruding glove box and the sub-instrument panel
Left open supracondylar femoral fracture	Serious (853352.3,2)	Intruding glove box and the sub-instrument panel
Pelvic Ring fractures (right superior inferior pubic rami, left superior pubic rami, and left sacro-iliac joint fracture)	Serious (856161.3,4)	Induced fracture from loading the intruding glove box and the sub-instrument panel
Hemoparicardium	Serious (441604.3,4)	Safety belt webbing
Right side rib fractures (4 th -10 th) mild displacement	Serious (450203.3,1)	Safety belt webbing

Small right side hemo/pneumothorax	Serious (442205.3,1)	Safety belt webbing
Right pulmonary contusions	Moderate (441406.2,1)	Safety belt webbing
L1 transverse process fracture	Moderate (650620.2,8)	Safety belt webbing
L2 transverse process fracture	Moderate (650620.2,8)	Safety belt webbing

Source - Medical Records

Front Right Passenger Kinematics

The 63-year-old female front right passenger of the Chrysler was seated in a rear track position with the seat track adjusted 6 cm (2.5 in) forward of the full-rear position. The seatback angle was altered by the deformation of the floor as the entire seat assembly was displaced upward and rotated in a counterclockwise direction with respect to the interior. The adjustable head restraint was in the full-down position. The passenger was restrained by the manual safety belt system. Safety belt used was determined from the cut status of the belt webbing during the extrication of the passenger and from a 14 cm (5.5 in) D-ring transfer.

At impact, the ELR safety belt retractor locked, the buckle mounted pretensioner actuated and the front right air bag deployed. She responded to the 12 o'clock direction of force by initiating a forward trajectory. The passenger loaded the safety belt system and the deployed air bag. The air bag prevented her from possible contact with the upper aspect of the intruding instrument panel. Her loading of the belt system in this high delta-V crash resulted in right rib fractures 4-10, a small right hemo/pneumothorax, right pulmonary contusions, an inferior vena cava laceration and hemoparicardium. The lap belt segment of the belt system produced a Grade 4 stellate liver laceration. The front right passenger also sustained transverse process fractures of L1 and L2 from loading the safety belt system.

The passenger's knees engaged the glove box door and the sub-instrument panel as they intruded rearward into her position. **Figure 10** depicts the front right occupant's lower extremity contact points within the Chrysler. The glove box door was fractured and the sub-instrument panel components intruded into the glove box space. As a result of contact, the passenger sustained bilateral open fractures of the supracondylar femurs. The energy from this loading was transmitted through the femurs into the pelvis. She sustained a pelvic ring fracture that included the bilateral superior inferior pubic rami and the left sacro-iliac joint.

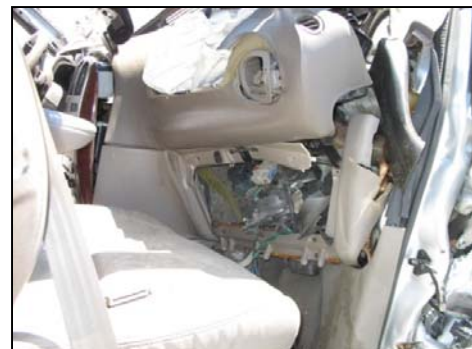


Figure 10: View of the Chrysler's lower right instrument panel.

The passenger came to rest in the front right seat position. Rescue personnel used hydraulic tools to open the front right door. The safety belt webbing was cut (43 in) above the floor anchor point and the passenger was removed from the vehicle. She was transported by ground ambulance to a regional trauma center where she underwent surgery for her lower extremity and pelvic fractures. During these procedures, the surgical team discovered the laceration of the vena cava and liver. She was administered eleven units of blood and entered into cardiac arrest. The front right passenger succumbed to her injuries approximately 4.5 hours following the crash.

Rear Right Passenger

Age/Sex: 2-year-old/Male
 Height: Unknown
 Weight: Unknown
 Seat Track Position: Fixed
 Safety Belt Usage: Restrained in a forward-facing CRS by the 5-point harness system
 Usage Source: SCI inspection of the CRS and the vehicle
 Egress from Vehicle: Removed by EMS
 Type of Medical Treatment: Transported to regional pediatric trauma center where he was evaluated for police reported possible injury

Rear Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Unknown, police reported possible injury	Unknown	Unknown

Rear Right Passenger Kinematics

The 2-year-old male passenger was secured in a forward-facing CRS in the rear right position of the Chrysler. He was restrained in the CRS by the integrated 5-point harness system and the CRS was secured to the vehicle by the Chrysler’s 3-point lap and shoulder belt system. The vehicle’s safety belt was routed though the forward facing belt path of the CRS.

At impact with the utility pole, the child passenger responded to the 12 o’clock direction of force by initiating a forward trajectory. He loaded the CRS 5-point harness system and rode down the forces of the crash. There was no loading evidence to the integral harness system or to the interior of the vehicle, forward of his position. The child passenger rebounded into the CRS where he came to final rest.

The child was removed from the vehicle while still seated in the CRS. He was subsequently removed from the CRS and transported by ground ambulance to a regional pediatric trauma center where he was evaluated for injury. The investigating officer listed his injury level as

possible. The SCI team was unable to establish contact with a family member to conduct an interview. The treating hospital would not release the child's records without a signed authorization; therefore the medical data for this passenger was unknown.

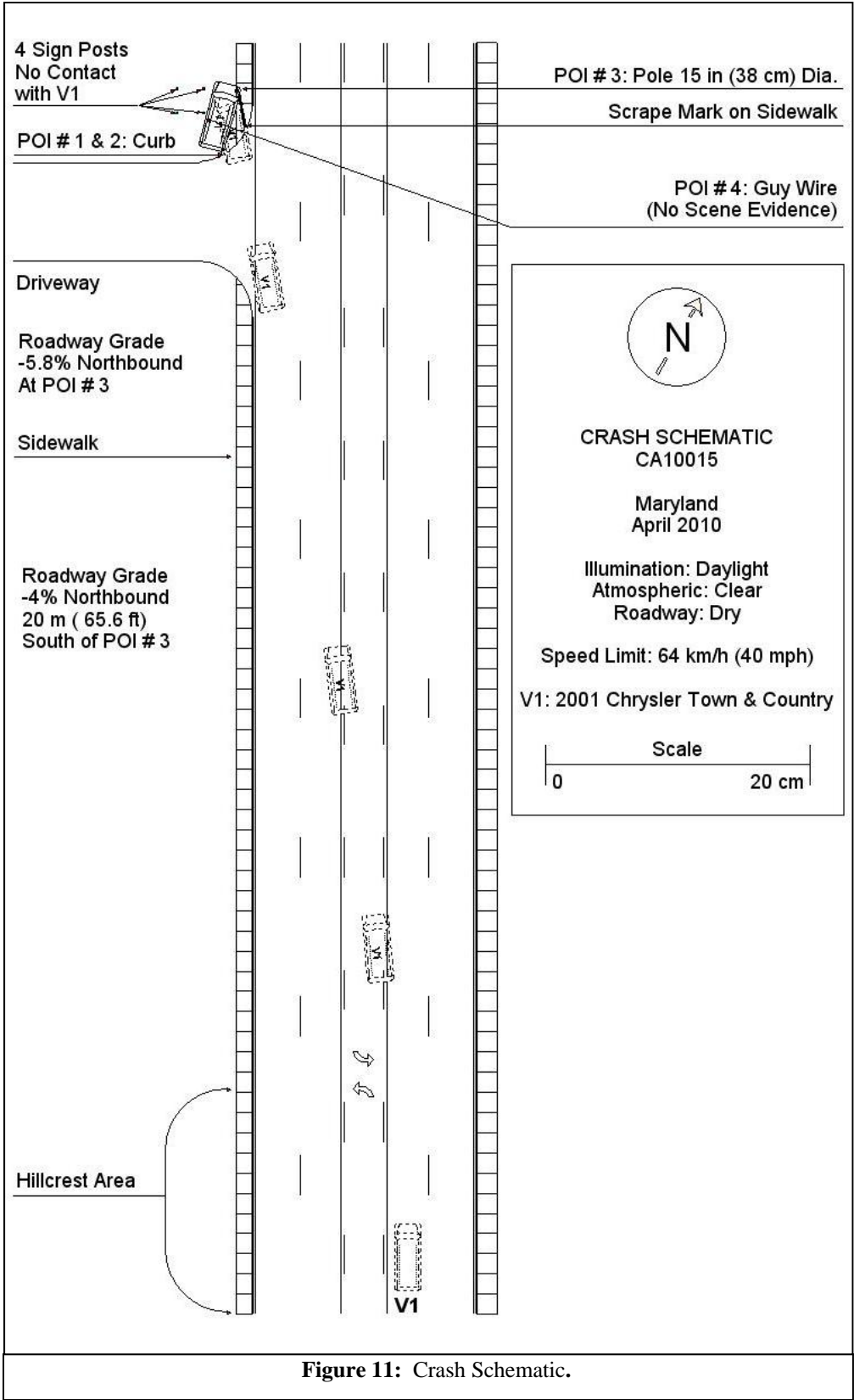


Figure 11: Crash Schematic.