TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

Veridian Engineering
Buffalo, NY 14225

ON-SITE CHILD SAFETY SEAT CRASH INVESTIGATION
SCI TECHNICAL SUMMARY REPORT

VERIDIAN CASE NO. CA01-046

SUBJECT VEHICLE - 2000 HONDA ACCORD

LOCATION - STATE OF COLORADO

CRASH DATE - OCTOBER 2001

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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16. *Abstract* This on-site investigation focused on the installation and performance of a convertible child safety seat with a tray shield that was installed forward-facing in the rear right position of a 2000 Honda Accord. The Accord was occupied by a restrained 19-year-old female driver and a 2-year-old male child who was restrained in the child safety seat. The Honda Accord was struck in an offset head-on configuration by a 1990 Honda CRX that was traveling the wrong way in the same lane of a divided roadway. At impact, the Accord's frontal air bag system deployed and both occupants initiated forward trajectories. The driver loaded the manual restraint and deployed driver's air bag and sustained a sprained left wrist and a left shoulder contusion. She did not receive medical treatment. The 2-year-old child loaded the harness straps and tray shield of the child safety seat. His head flexed forward and struck the plastic tray shield with resulted in a 3.5 cm (1.4") laceration on the right mid-forehead, a 0.5 cm (.2") laceration under the left inferior lip, a pseudosubluxation of C2 and C3 anteriorly, and a probable concussion without loss of consciousness. The 2-year-old was removed from the vehicle by a passer-by and transported by ambulance to a local hospital where he was treated and released. The occupants of the CRX were transported by ambulance to a local hospital. The driver was admitted with critical injuries and transferred to a regional trauma center where he expired six days after the crash. The front right passenger expired 30 minutes following the crash.			
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BACKGROUND

This on-site investigation focused on the installation and performance of a convertible child safety seat with a tray shield that was installed forward-facing in the rear right position of a 2000 Honda Accord. The Accord **(Figure 1)** was occupied by a restrained 19-year-old female driver and a 2-year-old male child who was restrained in the child safety seat. The Honda Accord was struck in an offset head-on configuration by a 1990 Honda CRX that was traveling the wrong way in the same lane of a divided roadway. At impact, the Accord's frontal air bag system deployed and both occupants initiated forward trajectories. The driver loaded the manual restraint and deployed driver's air bag and sustained a sprained left wrist and a left shoulder contusion. She did not receive medical treatment. The 2-year-old child loaded the harness straps and tray shield of the child safety seat. His head flexed forward and struck the plastic tray shield with resulted in a 3.5 cm (1.4") laceration on the right mid-forehead, a 0.5 cm (.2") laceration under the left inferior lip, a pseudosubluxation of C2 and C3 anteriorly, and a probable concussion without loss of consciousness. The 2-year-old was removed from the vehicle by a passer-by and transported by ambulance to a local hospital where he was treated and released. The occupants of the CRX were transported by ambulance to a local hospital. The driver was admitted with critical injuries and transferred to a regional trauma center where he expired six days after the crash. The front right passenger expired 30 minutes following the crash.

Figure 1. Damaged 2000 Honda Accord

This crash was found through a local newspaper web site by the Veridian SCI team during an internet search for fatal crashes. The crash occurred in October 2001. The notification was forwarded to NHTSA and an on-site effort was assigned to the Veridian SCI team on Tuesday October 16, 2001. All field activities were completed on October 20, 2001. In addition to field data, a police crash report, driver interview, and medical records were obtained which provide the basis for this narrative report.

SUMMARY

Crash Site

This two-vehicle crash occurred during the nighttime hours of October 2001 on a hillcrest of a four-lane divided state roadway. At the time of the crash, it was dark with no roadway illumination. The asphalt roadway surface was dry and there were no adverse conditions as the weather was clear. The grades of the roadway east and west of the hillcrest were approximately - 3.0 percent. The east/west roadway consisted of two travel lanes in each direction separated by a curbed asphalt median barrier and bordered by asphalt shoulders that measured 1.5 m (4.9') in width. The inboard lanes were bordered by a solid yellow delineation line that was located 0.8 m (2.6') from the curbed median. A median crossover was located 8.9 m (29.2') west of the point of impact. The roadside environment consisted of grassy areas, a small number of private driveways, and some commercial properties. The north roadside had a positive slope and the south roadside had a negative slope. Utility poles were located on the south roadside. A three-leg intersection and three-phase traffic signal were located approximately 0.5 km (0.3 miles) west of the crash site. Approach warning signs for the traffic signal were positioned on the median and north roadside for westbound traffic and were located approximately 17.0 m (56.0') west of the point of impact. A "one way" sign facing in an east direction was located on the median for eastbound traffic and was located 26.0 m (85.0') east of the point of impact. The posted speed limit for the roadway was 89 km/h (55 mph). Approximately 0.5 km (0.3 miles) east of the crash site, the speed limit changed to 105 km/h (65 mph) for eastbound traffic.

Figure 2. Eastbound approach for the 2000 Honda Accord

Pre-Crash

The 19-year-old female driver of the Honda Accord was operating the vehicle eastbound on the inboard lane of the state roadway behind two non-contact vehicles **(Figure 2)**. The driver stated that there were no distractions within the vehicle prior to the crash. A cellular telephone was present in the Honda Accord, but was not in use prior to the crash. The driver of the Accord had reduced the speed of the vehicle as it traveled through the intersection west of the crash site, as the traffic signal cycled to the green phase for east/west traffic. She accelerated through the intersection and continued in an easterly direction behind the non-contact vehicles at an estimated speed of 72 km/h (45 mph). East of the crash site, the driver of the 1990 Honda CRX made a left turn from a driveway located on the south roadside onto the eastbound lanes of the state roadway. Prior to the crash, he was operating the vehicle at a police-reported speed of 72 km/h (45 mph) in the wrong direction on the inboard eastbound lane **(Figure 3)**. As the CRX approached the hillcrest, the vehicles in front of the Accord swerved to the right onto the outboard lane to avoid a head-on collision. The driver of the Accord did not detect the approaching

Figure 3. Westbound approach for the Honda CRX

Honda CRX traveling in the opposite direction in the same lane until the vehicle directly in front of the Accord swerved to the right. There were no avoidance maneuvers attempted by the driver of the Accord. It was not known if the driver of the CRX attempted any avoidance maneuvers. There were no pre-crash brake marks visible at the crash scene.

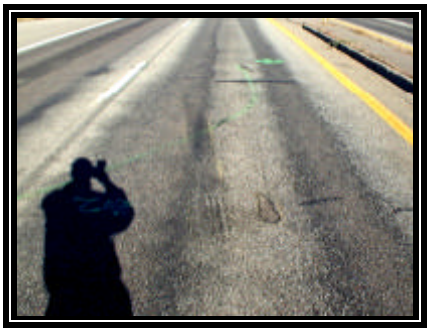

Figure 4. View looking westbound at point of impact and tire marks

Crash

The 2000 Honda Accord impacted the 1990 Honda CRX in an offset head-on configuration. The directions of force were in the 12 o'clock sectors for both vehicles. Based on police-documented impact and final rest positions, the trajectory algorithm of the WinSMASH program computed impact speeds of 63.5 km/h (39.5 mph) for the Accord and 94.9 km/h (59.0 mph) for the CRX, respectively. The damage algorithm of the WinSMASH program computed total velocity changes of 23.0 km/h (14.3 mph) for the Accord and 35.0 km/h (21.7 mph) for the CRX. The longitudinal and latitudinal components for the Accord were -23.0 km/h (-14.3 mph) and 0.0 km/h, respectively. The longitudinal and latitudinal components for the CRX were -34.5 km/h (-21.4 mph) and -6.1 km/h (-3.8 mph), respectively. The impact induced deceleration was sufficient to deploy the frontal air bag system in the Honda Accord. Both vehicles initiated a counterclockwise (CCW) rotation as they disengaged. Tire marks from both vehicles left front wheels were present on the roadway surface in their post-impact trajectories **(Figure 4)**. The Accord traveled forward and to the right approximately 10 m (33') as it rotated a total of 220 degrees in a CCW direction from impact to final rest. The Accord came to rest facing northwest in the center of the eastbound travel lanes. The CRX was redirected in a rearward direction and the vehicle rotated CCW. The right rear wheel struck the south edge of the curbed median which arrested the rearward travel and rapidly intensified the CCW rotation. The CRX rotated approximately 190 degrees in a CCW direction over the curbed median. The CRX came to rest on the opposite side of the median facing northeast and straddling the yellow delineation line of the inboard westbound lane.

Post-Crash

After the vehicles came to rest, a passer-by assisted the occupants of the Honda Accord. The driver of the Accord unlocked the doors with the electronic switch, but the left front door was jammed shut due to rearward displacement of the left front fender. The passer-by was successful in opening the door and the driver exited the vehicle under her own power. The 2-year-old child was removed from the child safety seat and removed from the vehicle by the passer-by. The driver of the Accord attempted to call for help on her cellular telephone, but she stated that the cellular telephone did not function properly. The 2-year-old child was transported by ambulance to a local hospital where he was treated and released. The driver accompanied the child in the ambulance, but did not receive medical treatment. Both occupants of the CRX were removed from the vehicle by rescue personnel and were transported by ambulance to a local hospital. The front right passenger expired 30 minutes after the crash. The driver was admitted for his injuries and expired 6 days after the crash.

VEHICLE DATA - 2000 Honda Accord V-6, EX

The 2000 Honda Accord was identified by the Vehicle Identification Number (VIN): 1HGCG1652YA (production sequence omitted). The Accord was equipped with a 3.0 liter, 6 cylinder, VTEC engine, automatic four-speed transmission, four-wheel power disc brakes with anti-lock, and power steering. The Accord was equipped with the EX trim package which included: air conditioning, an alarm system, aluminum/alloy wheels, cruise control, a keyless entry system, leather seats, a leather steering wheel, power door locks, a power driver's seat, power mirrors, a power moonroof, power windows, steering wheel radio controls, a tilt steering wheel, and tinted glazing. The Accord was configured with a digital odometer and the vehicle's mileage was not known. The Accord was equipped with Michelin Energy P205/65R15 radial tires. All tires exhibited adequate treads and uniform wear patterns with the exception of the left front tire which was restricted, deflated, and partially debeaded from the left front wheel.

The Honda Accord was configured with front bucket seats with adjustable head restraints and a rear bench seat with an integrated arm rest and folding back. The rear seat integrated arm rest also incorporated a locking center pass-through space for long cargo items. The electronic front left seat was adjusted 10.2 cm (4.0") forward of full rear and 15.2 cm (6.0") rear of full forward with a total travel distance of 25.4 cm (10.0"). The front right seat was adjusted to 8.9 cm (3.5") forward of full rear and 16.5 cm (6.5") rear of full forward with a total travel distance of 25.4 cm (10.0"). Both front seat backs were reclined 30 degrees from a vertical of zero, and retained their pre-crash orientation. The front left adjustable head restraint was in the full-down position and the front right head restraint was raised 3.8 cm (1.5") above the top aspect of the seat back at the time of the vehicle inspection. A raised center console with an armrest was located between the front bucket seats.

The Honda Accord was equipped with dual-stage frontal air bags for the driver and front right passenger positions and side impact air bags that were located in the outboard aspects of the front seat backs.

The driver of the Accord stated that the vehicle had been involved in a previous minor crash six months earlier. The Accord impacted and underrode the rear aspect of a stopped pickup truck which resulted in longitudinal abrasions on the Accord's hood. This damage was not repaired and did not result in deployment of the frontal air bag system.

VEHICLE DAMAGE

Exterior Damage - *2000 Honda Accord*

The 2000 Honda Accord sustained moderate damage as a result of the frontal impact with the Honda CRX **(Figure 5)**. The direct damage along the leading edge of the hood began 6.4 cm (2.5") left of center and extended 63.5 cm (25.0") to the left corner. The direct damage on the grille area began 14.0 cm (5.5") left of center and extended 66.0 cm (26.0") to the left corner. The combined direct and induced damage involved the entire frontal width of the vehicle and measured 104.1 cm (41.0"). The maximum crush measured 53.7 cm (21.2") and was located at the front left corner of the bumper beam. The front bumper fascia and grille assembly were separated and displaced to the left under the front bumper beam. The left aspect of the bumper fascia was distorted and fractured. The bumper beam was crushed rearward with the most severe crush located at the left corner. The Styrofoam filler was displaced under the bumper beam, however, there was no damage to the filler **(Figure 6)**. The upper and lower radiator supports and the radiator core were crushed and displaced rearward on the left side. The hood was buckled and abraded on the leading edge and longitudinal abrasions from the previous crash were noted on the center aspect of the hood. The leading left corner of the hood was crushed from direct contact damage evidenced by white paint transfers and multiple abrasions. The front left head lamp assembly was fractured and separated. The left front fender was buckled outward and crushed rearward which caused the rear edge of the fender to overlap the leading edge of the left front door. The rearward displacement of the fender also contributed to the rearward displacement of the left front door which prevented the door from closing completely. The left rear door was also displaced rearward and the rear edge of the door overlapped the left C-pillar approximately 2.5 cm (1.0"). The front aspect of the right front fender was pulled toward the centerline which resulted in a gap between the leading edge of the right front door and the rear edge of the right front fender. The right frame rail was also displaced laterally toward the centerline. Induced buckling was located on the left A-pillar 53.3 cm (21.0") from the top of the instrument panel at the upper left corner of the windshield. Induced buckling was also located on the left roof side rail forward of the left B-pillar. The left front tire was deflated and the left front wheel was displaced rearward and restricted against the rear aspect of the left front fender **(Figure 7)**. The rearward displacement of the left front wheel resulted in a 23.7 cm (9.3") reduction of the left wheelbase. The left side mirror was displaced, however, it was not fractured and was still positioned in the mirror frame. The Collision Deformation Classification for the impact with the CRX

Figure 5. Frontal view of the damaged 2000 Honda Accord

Figure 6. View of the undamaged Styrofoam filler

Figure 7. Left side view showing maximum crush and displaced left front wheel

was 12-FYEW-3. Six crush measurements were documented along the front bumper beam and were as follows: C1 = 53.7 cm (21.2"), C2 = 39.4 cm (15.5"), C3 = 26.7 cm (10.5"), C4 = 17.8 cm (7.0"), C5 = 7.0 cm (2.3"), C6 = 0.0 cm.

Interior Damage - ***2000 Honda Accord***

Interior damage to the 2000 Honda Accord **(Figure 8)** was moderate and attributed to compartment intrusion and occupant contact. The windshield laminate sustained fractures as a result of the impact forces and the remaining glazing did not sustain damage. The top aspect of the molding was separated from the left A-pillar. A laterally oriented dark linear scuff was located on the left A-pillar molding 30.5 cm (12.0") above the top of the left instrument panel, possibly a result of the driver's left hand or jewelry. The rear view mirror was displaced forward on the left aspect against the windshield and the roof-mounted sunglass holder was rotated open. Scuffs on the rigid plastic knee bolster were located on the far left aspect and under the steering column as a result of contact from the driver's knees. The lower aspect of the steering column adjacent to the toe pan was collapsed from the toe pan intrusion **(Figure 9)**. There was no evidence of steering column compression by the driver. The accelerator pedal was displaced to the right against the lower aspect of the center console from the driver's right foot. The rear seat back was intruded as a result of loading from items in the trunk. Two bottles of radiator coolant and two bottles of motor oil were found in the trunk during the vehicle inspection. The driver stated that a large suitcase weighing approximately 14 kg (30 lb) and a stroller were also in the trunk at the time of the crash. The loading of the items in the trunk caused the rear seat back to intrude into the rear seat area **(Figure 10)**. The maximum longitudinal intrusion was located at the rear center position on the lower aspect of the seat back and measured 5.1 cm (2.0"). There was no intrusion of the rear seat cushion. The rear right seat cushion exhibited depressions in the leather from the child safety seat and longitudinal scuff marks from the forward motion of the child safety seat across the cushion at impact. Longitudinal blood spattering was noted on the center aspect of the head liner, on the interior center dome light, and on the right aspect of the head liner adjacent to the right B-pillar. The interior aspects of both C-pillars were abraded in a semi-circular pattern, and appeared to be a result of the child safety seat tray shield contacting the plastic molding of the C-pillars as the shield was raised and lowered.

Figure 8. Left side interior view

Figure 9. Collapsed lower aspect of steering column

Figure 10. View of rear seat showing intruded seat back

Multiple intrusions were documented and were as follows:

Position	Intruded Component	Intruded Value	Direction
11	Left foot rest	1.3 cm (0.5")	Longitudinal
11	Left toe pan	1.3 cm (0.5")	Longitudinal
21	Rear left seat back	3.2 cm (1.3")	Longitudinal
22	Rear center seat back	5.1 cm (2.0")	Longitudinal
23	Rear right seat back	3.8 cm (1.5")	Longitudinal

Exterior Damage - ***1990 Honda CRX***

The 1990 Honda CRX was a three-door hatchback equipped with a 1.5 liter, 4-cylinder engine, 5-speed manual transmission, power assisted, front disc and rear drum brakes, and a tilt steering column. The CRX was also configured with Firestone F-570 165/70R13 tires for both front wheels and Cooper Sportsmaster GLT 165/70R13 tires for both rear wheels.

Figure 11. Frontal view of damaged 1990 Honda CRX

Figure 12. Left side view of damaged 1990 Honda CRX

The CRX sustained moderate damage as a result of the frontal impact with the Honda Accord **(Figures 11 and 12)**. The direct damage along the leading edge of the hood began at the centerline and extended 50.8 cm (20.0") laterally to the left front corner. The direct damage on the front bumper fascia began 48.3 cm (19.0") to the left of the centerline and extended to the front left corner. The left corner of the front bumper fascia was fractured and separated from the direct contact. The combined direct and induced damage involved the entire frontal width of the CRX and measured 88.9 cm (35.0"). The maximum crush measured 41.9 cm (16.5") and was located at C1 at the front left corner of the lower radiator support. The entire front bumper fascia was separated from the vehicle. The left aspect of the hood was buckled rearward and semi-circular abrasions were present on the left aspect from direct contact with the Honda Accord. The upper and lower radiator supports were crushed rearward on the left side. The left head lamp assembly was separated form the vehicle, and the left front fender was crushed rearward. The left front wheel was displaced rearward and was deflated and restricted. The outer edge of the left front wheel rim was bent outward in two places. The rearward displacement of the left front wheel resulted in a 31.9 cm (12.6") reduction in the left wheelbase and a 3.0 cm (1.2") elongation of the right wheelbase. The left A-pillar was displaced rearward which resulted in the buckling of the left roof side rail. The displacement of the left A-

pillar also caused the windshield laminate to fracture and separate from the seal along the left A-pillar and lower left corner. Slight buckling was present on the forward aspect of the left sill and the plastic trim piece below the sill was partially separated at the forward aspect. The left side door was separated from the vehicle from rescue efforts. The left rear tire was deflated. The CDC for this impact was 12-FYEW-2. Six crush measurements were taken along the lower radiator support and were as follows: C1 = 41.9 cm (16.5"), C2 = 29.8 cm (11.8"), C3 = 21.0 cm (8.3"), C4 = 10.8 cm (4.3"), C5 = 5.1 cm (2.0"), C6 = 0.0 cm.

MANUAL RESTRAINT SYSTEM - 2000 Honda Accord

The front seat positions in the 2000 Honda Accord were equipped with manual 3-point lap and shoulder belts with sliding latch plates and inertial lock/belt sensitive retractors (ELR). The front right lap and shoulder belt was also equipped with a switchable (ELR)/automatic locking retractor (ALR). Both adjustable D-rings had a total of 6.4 cm (2.5") of vertical travel and were in the full down position. The driver's D-ring was abraded on the inboard aspect from occupant loading of the manual restraint webbing. Both front latch plates exhibited routine wear marks consistent with frequent usage. The driver's sliding latch plate also exhibited abrasions on the rear aspect that were consistent with occupant loading. The driver's shoulder belt webbing showed signs of loading approximately 20.0 cm (8.0") below the D-ring and at the position of the latch plate. The 2000 Honda Accord was not equipped with seat belt pretensioners, and both front seat belts were fully operational at the time of the vehicle inspection.

All of the rear seat positions in the Honda Accord were equipped with manual 3-point lap and shoulder belts with sliding latch plates and switchable ELR/ALR, inertial lock/belt sensitive retractors **(Figure 13)**. The rear right and rear center manual restraint webbing both exhibited signs of loading, however, the loading to the rear center restraint was not related to this crash.

Figure 13. View of rear left and rear center lap and manual restraints

The manual 3-point lap and shoulder belt was used to secure the forward-facing Evenflo Trooper in the rear right position of the Honda Accord. The child safety seat was not in the vehicle at the time of the vehicle inspection. The driver of the Accord was previously instructed by a hospital physician to place her knee into the seat while securing the child safety seat in the vehicle. She had installed the child safety seat in a forward facing orientation in the Accord three days prior to the crash. The driver had compressed the child safety seat into the vehicle's seat cushion with her knee and routed the manual restraint through the rear aspect of the child safety seat. She did not extend the manual restraint webbing to engage the ALR and did not install a locking clip on the manual restraint, but she stated that the manual restraint was holding the child safety seat securely in the vehicle. The leather seat cushion exhibited a deep impression from the child safety seat **(Figure 14)** which suggests it was initially secured tightly in the vehicle. The child safety seat was not equipped with a tether strap.

Figure 14. View of the impression in the leather seat from the child safety seat

CHILD SAFETY SEAT - Evenflo Trooper

The Evenflo Trooper convertible child safety seat **(Figure 15)** was installed in the rear right position of the Honda Accord. The model number was 2191JP1 and the manufacture date was March 2, 1999. There were no NHTSA recalls associated with this child safety seat. The seat was configured with a 3-point harness system and an adjustable rigid plastic tray shield. The tray shield was attached to pivoting arms on the outboard sides of the seat which allowed it to move upward and downward. The tray shield also moved forward and rearward along the plastic arms and was held in position by spring-loaded plastic buttons. The seat was designed for forward-facing use by children who weigh between 9.1 - 18.1 kg (20.0 - 40.0 lb) and measure 66.0 to 101.6 cm (26.0 - 40.0") in height. The Evenflo Trooper convertible seat was occupied by a 2-year-old male child who weighed 15.9 kg (35.0 lb) and measured 96.5 cm (38.0") in height. The child was within the range of the manufacturer's recommended weight and height limits, outlined in the instruction manual for use of the convertible seat in the forward facing orientation.

Figure 15. Evenflo convertible child safety seat

The driver had not been to any child safety seat checkpoints and had not obtained any additional child safety seat information or literature. The driver admitted that she never read the owner's manual for the child safety seat, and the manual was not attached to the seat at the time of inspection.
The locking clip was not attached to the child safety seat.

A warning label was affixed to the rear aspect of the seat which read: "Use of a top tether kit requires installation of an Evenflo tether tube in the recess below." At the time of the vehicle inspection, the tether tube was not installed. The driver indicated that the seat was not equipped with a tether kit when it was purchased, nor was a tether attached.

The Evenflo Trooper was configured for forward-facing use. Upon inspection, the harness straps were routed through the top harness slots and were free of any twists or folds **(Figure 16)**. The harness retainer clip was affixed to the harness straps per the manufacturer's instructions, but was found on the lower aspects of the harness straps near the tray shield. The three-position adjustable tray shield was located in the full forward position. The kick stand was engaged for forward facing use. The child safety seat latch plate was abraded which suggested frequent usage, and the buckle was operational.

Figure 16. View of the harness straps and retainer clip

The Evenflo Trooper sustained damage as a result of the crash and occupant loading. The left arm was fractured and separated 1.3 cm (0.5") forward of the apex **(Figure 17)** and the right arm was fractured 0.6 cm (.3") forward of the apex from occupant loading against the tray shield. Both harness straps showed signs of loading and subtle abrasions were present on the rear aspect of the plastic harness slots. The bottom aspect of the child safety seat and bottom aspect of the kick stand were abraded. The fabric cover on the tray shield exhibited blood stains. The outboard edges of the tray shield and tray shield arms exhibited abrasions and paint transfers, most likely from frequent installations. They did not appear to be related to this crash.

Figure 17. View of the fractured left arm of the child safety seat

FRONTAL AIR BAG SYSTEM - 2000 Honda Accord

The 2000 Honda Accord was equipped with dual stage air bags for the driver and front right passenger positions that deployed as a result of the impact with the Honda CRX. The driver's air bag was housed in the center of the steering wheel with asymmetrical H-configuration module cover flaps. The top flap measured 17.8 cm (7.0") in width at the top aspect, 13.3 cm (5.3") in width at the tear seam, and 8.3 cm (3.3") in height. The bottom flap measured 13.3 cm (5.3") in width at the tear seam, 7.6 cm (3.0") in width at the bottom aspect, and 4.4 cm (1.8") in height. The driver's air bag **(Figure 18)** measured 53.3 cm (21.0") in diameter in its deflated state. Makeup transfers and lateral mascara transfers were present on the left aspect of the air bag membrane from the driver's face **(Figure 19)**. The air bag was vented by two external ports that measured 3.8 cm (1.5") in diameter and were located at the 11 and 1 o'clock positions on the rear aspect of the air bag and 17.8 cm (7.0") inboard of the outer seam. The air bag was tethered by one internal strap that was located at the 12 o'clock aspect.

Figure 18. 2000 Honda Accord driver's air bag

Figure 19. Close-up of driver's air bag, mascara transfer is circled

The dual stage front right passenger's air bag **(Figure 20)** deployed from a top-mount module configured with symmetrical H-configuration cover flaps. The module measured 35.6 cm (14.0") in width and 16.5 cm (6.5") in height. The tear seam was vertically located in the center of the module, located 5.1 cm (2.0") inboard of the sides and measured 25.4 cm (10.0") in width. The front right passenger's air bag measured 66.0 cm (26") in width and 66.0 cm (26") in height. The air bag was vented by two circular ports that measured 5.1 cm (2.0") in diameter and were located at the 9 and 3 o'clock positions and 7.6 cm (3.0") forward of the front outboard seams. The front right passenger's air bag was not tethered.

Figure 20. Front right passenger's air bag

SIDE IMPACT OCCUPANT PROTECTION SYSTEM - 2000 Honda Accord

The 2000 Honda Accord was equipped with side impact air bags for the driver and right front passenger positions. The side impact air bags were located in the outboard aspects of the driver and front right passenger seat backs. The side impact air bags did not deploy in this crash.

OCCUPANT DEMOGRAPHICS - 2000 Honda Accord

Driver

Age/Sex:	19-year-old female
Height:	165 cm (65")
Weight:	57 kg (125 lb)
Seat Track Position:	Between the mid-track and full-rear positions
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection, driver interview
Eyewear:	None
Type of Medical Treatment:	Did not receive medical treatment

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
Left wrist sprain	Minor (751420.1,2)	Loading against the steering wheel rim
Left shoulder contusion	Minor (790402.1,2)	Loading against shoulder belt webbing

Injury source: Interview

Driver Kinematics

The 19-year-old female driver was seated in an upright posture with the driver's seat adjusted between the mid-track and full-rear positions and the seat back reclined 30 degrees. She was restrained by the manual 3-point lap and shoulder belt. The driver stated that her right foot was positioned on the accelerator pedal and her left foot was on the plastic foot rest on the left aspect of the toe pan. She also stated that both of her hands were placed on the steering wheel rim, but she could not recall the exact positions. At impact with the CRX, the driver's air bag deployed from the steering wheel and the driver initiated a forward trajectory. The driver stated that she sustained a left wrist sprain, which resulted from loading against the steering wheel rim as a result of bracing. She loaded the manual restraint which resulted in a left shoulder contusion. Her face struck the deployed driver's air bag, evidenced by makeup and mascara transfers on the left aspect of the air bag. She was redirected to the left as the Accord rotated CCW, but the manual restraint mitigated further movement throughout the occupant compartment.

When the vehicle came to final rest, the driver unlocked the doors with the electronic switch. She was assisted out of the vehicle by a passer-by. The driver attempted to call for help on a cellular telephone after the crash, but she stated that the telephone did not work. She refused medical treatment at the scene and accompanied the 2-year-old child passenger to the hospital in the ambulance. The driver stated that she lost one day from school due to the crash.

Rear Right Child Passenger

Age/Sex:	2-year-old male
Height:	97 cm (38")
Weight:	16 kg (35 lb)
Seat Track Position:	Fixed
Manual Restraint Use:	Evenflo Trooper convertible child safety seat, forward-facing
Usage Source:	Vehicle inspection, injury data, driver interview
Eyewear:	None
Type of Medical Treatment:	Transported by ambulance to a local hospital and treated and released

Rear Right Child Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanism
3.5 cm (1.4") laceration on the right mid-forehead	Minor (290602.1,7)	Plastic tray shield on the child safety seat
0.5 cm (0.2") laceration under the left aspect of the inferior lip	Minor (290602.1,8)	Plastic tray shield on the child safety seat
Pseudosubluxation of C2 and C3	Not codable under AIS 90/Update 98	Head flexion between the harness straps of the child safety seat

Injury source: Emergency Room report

Rear Right Child Passenger Kinematics

The 2-year-old male child passenger was restrained in an Evenflo Trooper convertible child safety seat with a tray shield and 3-point harness system. The seat was installed forward-facing in the rear right position of the Honda Accord. The manual restraint's switchable lock feature/ALR was not engaged to secure the child safety seat. This may have allowed additional forward travel of the child safety seat as it was displaced forward slightly from the rear seat back intrusion. The driver stated that the child knew how to remove his upper body from the harness system while seated in the child safety seat, and had done so on previous occasions. The child's ability to twist himself out of the harnesses suggested that the harness straps were not tight (based on the NHTSA "one finger" recommendation), and that he was able to slide the harness retainer clip down the webbing, or the retainer clip was positioned low on the harness straps. The driver stated that the harness retainer clip was usually positioned near the child's armpits and that the harness straps were relatively tight. The driver was not aware if the child had removed himself from the harness system prior to the crash. Moderate loading was present on the child safety seat harness straps which suggest that the child may have been restrained by loose harness straps.

At impact, the child initiated a forward trajectory. The cargo in the trunk also initiated a forward trajectory and loaded the rear seat back which resulted in 3.8 cm (1.5") of longitudinal intrusion into the rear right

position and slight forward displacement of the child safety seat. The slack in the child safety seat's harness system allowed additional forward movement of the 2-year-old's upper body toward the plastic tray shield. The child's torso loaded the harness system and the tray shield which caused the tray shield to fracture and separate at the apex of the left arm. The child's head flexed between the harness straps which resulted in a pseudosubluxation of C2 and C3. His face struck the plastic tray shield which resulted in a 3.5 cm (1.4") laceration on the right mid-forehead and a 0.5 cm (0.2") laceration under the left aspect of the inferior lip. The emergency room report stated that he also sustained a probable concussion without loss of consciousness as a result of the head strike. The child rebounded rearward and to the left as the vehicle rotated CCW, evidenced by blood spatter in a longitudinal orientation on the head liner of the Accord from the child's facial lacerations.

The 2-year-old was removed from the child safety seat and removed from the vehicle by a passer-by. He was transported by ambulance to a local hospital where he received sutures for the facial lacerations. He was released 3.5 hours following the crash.

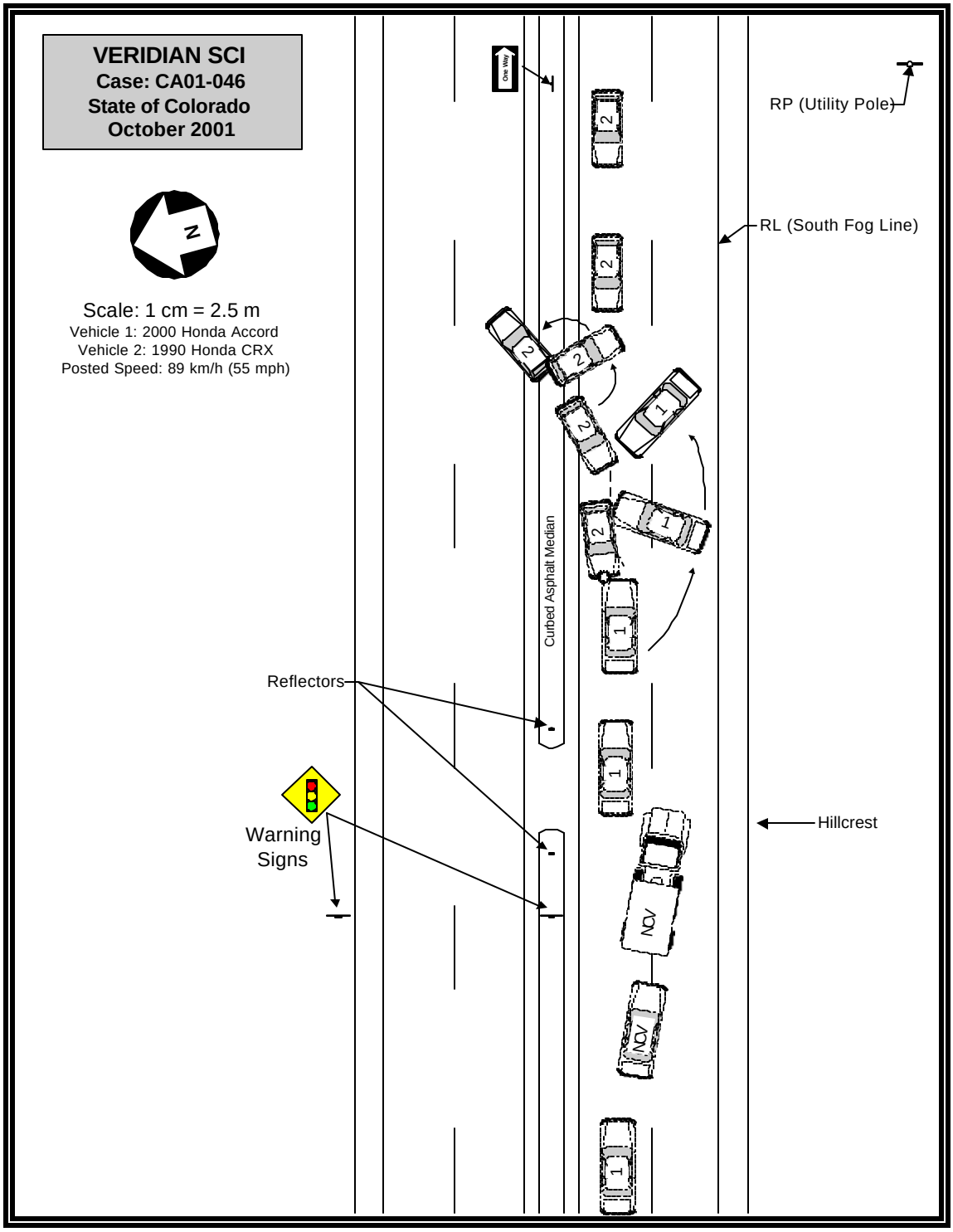

Figure 21. Scene schematic