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ON-SITE CHILD SAFETY SEAT INVESTIGATION

CASE NUMBER - IN07022
LOCATION - ILLINOIS
VEHICLE - 1992 HONDA ACCORD EX
CRASH DATE - July 2007

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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 be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

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

Technical Report Documentation Page

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16. *Abstract* This report covers an on-site investigation of a crash that involved a 1992 Honda Accord EX, which departed the roadway and rolled over. This crash is of special interest because the Honda's second row right passenger (5-year-old, male) was restrained in a booster child safety seat. The Honda was traveling west in a left curve and the vehicle's right side wheels departed the right side of the roadway. The driver steered left, the vehicle rotated counterclockwise across the roadway, departed the left side of the roadway and rolled over with the right side leading. During the rollover, the second row right passenger contacted his head on the intruding right C-pillar and sustained a fatal injury. The front right passenger was restrained by the lap-and-shoulder belt and sustained minor injuries. The driver was restrained by the lap-and-shoulder belt and was not injured.			
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CRASH DIAGRAM 9

This crash was brought to the National Highway Traffic Safety Administration's attention on or about July 10, 2007 by an on-line newspaper article. The crash involved a 1992 Honda Accord EX, which departed the roadway and rolled over. The crash occurred in July 2007 at 15:32 hours, in Illinois and was investigated by the applicable county sheriff's department. This crash is of special interest because the vehicle's second row right passenger (5-year-old, male) was restrained within a booster child safety seat. This contractor inspected the scene and vehicle, interviewed one of the investigating deputies, and acquired copies of the sheriff department's on-scene photographs on July 17, 2007. An interview with the front right passenger (the second row right passenger's mother) was conducted on July 20, 2007. This contractor was unable to contact the driver. This report is based on the sheriff department's crash report, inspections of the scene and vehicle, sheriff department's on-scene photographs, interviews with the front right passenger and one of the investigating sheriff's deputies, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The Honda was traveling west during daylight hours on a dry bituminous roadway. The driver was negotiating a left curve and the vehicle's right side wheels departed the right side of the roadway. The driver steered left, the vehicle rotated counterclockwise (CCW) across the roadway, departed the left side of the roadway and rolled over right side leading nine quarter turns. The vehicle came to final rest on its right side heading north. The Collision Deformation Classification (CDC) for the vehicle was **00-TDDO-3** and the severity of the rollover damage was moderate. During the rollover, the second row right passenger, who was restrained in a Century/Graco Ascend SE child safety seat (CSS) contacted his head on the intruding right C-pillar and sustained a fatal injury. The front right passenger was restrained by the lap-and-shoulder belt and sustained minor injuries. She was transported by ambulance to a hospital and was treated and released. The driver was restrained by the lap-and-shoulder belt and was not injured.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the Honda was traveling was a curved, two-lane, undivided, county roadway, traversing in a nominal east-west direction. Each travel lane was 3.6 meters (11.8 feet) in width and the roadway had a 4% superelevation in the left curve. The roadway was bordered by gravel shoulders 1.5 meters (4.9 feet) in width and embankments covered with large rocks (i.e., rip-rap). Roadway pavement markings consisted of solid white edge lines and double yellow no-passing lines. A Speed Zone Ahead warning sign was posted for westbound traffic and the posted speed limit was 88 km/h (55 mph). At the time of the crash, the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry, level bituminous. There was no other traffic and the site of the crash was rural. See the Crash Diagram at the end of this report.

Pre-Crash: The Honda was traveling west. The driver was negotiating a left curve and intended to continue westbound. The vehicle's right side wheels departed the right side of the roadway and entered the gravel shoulder (**Figure 1**). The driver told police he inadvertently ran off the

roadway in the curve. The driver steered left and the vehicle began to rotate CCW as it reentered the roadway. The vehicle continued to rotate CCW across both travel lanes (**Figure 2**). The crash occurred on the south side of the roadway.

Crash: The Honda departed the left side of the roadway, tripped and rolled over with the right side leading across the rock-covered embankment and a gravel field access roadway. The vehicle rolled over 9 quarter turns traversing a distance of approximately 27 meters (89 feet). The most severe ground impacts occurred to the left and right quarter panels, right C-pillar, and the backlight header **Figures 3** and **4**). The vehicle came to final rest on its right side (**Figure 5**) heading north.

Post-Crash: Sheriff deputies, emergency medical and rescue personnel responded to the scene. The front right passenger stated during the interview that the driver exited the vehicle by climbing out of the left front window, which had been broken during the rollover. She released her safety belt and stood up with her feet on the ground through the right front window and her head out the left front window until rescue arrived. Rescue personnel cut the windshield out and extricated her from the vehicle. Rescue personnel also cut the left side pillars, bent the roof down to the ground and removed the second row right passenger from the vehicle. The county coroner was called to the scene and pronounced the second row right passenger deceased. The front right passenger was transported by ambulance to a hospital. The driver was not injured and was not transported to a hospital. The Honda was towed from the scene.

Figure 1: Approach of Honda, orange mark shows where the vehicle's right side tires entered the shoulder, arrow shows location of final rest

Figure 2: Approach of Honda in CCW rotation to roadway departure and rollover; left arrow shows right front tire mark, right arrow shows right rear tire mark

Figure 3: Right side view of damage to the Honda

CASE VEHICLE

The 1992 Honda Accord EX was a front wheel drive, two-door coupe (VIN: 1HGCB7277NA------) equipped with a 2.2 liter, 4-cylinder engine, automatic transmission and anti-lock brakes. The front row was equipped with bucket seats with adjustable head restraints, a driver air bag and lap-and-shoulder seat belts. The second row was equipped with a bench seat with integral head restraints and lap-and-shoulder seat belts in the outboard position and a lap belt

in the center position. The vehicle's specified wheelbase was 272 centimeters (107.1 inches) and the odometer reading at the time of the inspection was 549,535 kilometers (341,475 miles).

CASE VEHICLE DAMAGE

Exterior Damage: The Honda sustained damage to its top, both sides and the undercarriage as a result of the rollover. The direct damage on the top plane began 60 centimeters (23.6 inches) forward of the right front axle and extended 390 centimeters (153.5 inches) rearward along the top. The direct damage also extended across the full width of the top plane. The maximum vertical crush occurred to the backlight header 60 centimeters (23.6 inches) inboard of the left C-pillar and was measured as 14 centimeters (5.5 inches, **Figure 6**). The maximum lateral crush occurred to the right C-pillar and was measured as 5 centimeters (2 inches). The induced damage involved the front bumper, right headlamp, both turn signal assemblies, the hood, roof, windshield glazing, left fender and back bumper.

Figure 4: Back left view of damage to the Honda

Figure 5: Sheriff department's on-scene photo of Honda's final rest; windshield cut out by rescue to extricate front right passenger

Damage Classification: The CDC for the Honda Accord was **00-TDDO-3**. The WinSMASH reconstruction program could not be used to reconstruct the Honda's Delta V because rollovers are out of scope of the program. The severity of the rollover damage was moderate based on the extent of the roof crush.

The manufacturer's recommended tire size was P195/60R15. The Honda was equipped with this size tire on the right front and a P205/60R15 size tire on the right rear. The size of the left front and left rear tires could not be determined because the side wall of the tire was against the ground and the tire size was not be visible. The vehicle's tire data are shown in the table below.

Figure 6: Overview of crush to the Honda's roof, backlite header and right C-pillar; each increment on the measurement rod is 5 cm (2 in)

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	Flat	Flat	221	32	4	5	Bead separation	No	Yes
LR	Flat	Flat	221	32	2	2	Sidewall split, bead separation	Yes	Yes
RR	172	25	221	32	2	3	None	No	No
RF	200	29	221	32	5	6	Sidewall abraded	Yes	No

Vehicle Interior: The CSS was found in the second row right seat position and a large deposit of blood and brain matter were on the intruded right C-pillar (**Figure 7**) indicating the second row right passenger contacted his head on the C-pillar during the rollover. The deposit of blood and brain matter extended across the roof to the left C-pillar (**Figure 8**). The second row right passenger's seat belt retractor was jammed and a length of seat belt extended out of the retractor consistent with usage of the belt in the crash. Examination of the front row area revealed a bent right front door arm rest, displaced door handle frame, and that the door panel was bowed outward. The contact evidence indicated that the front right passenger had impacted the door during the rollover. Scuff marks were present on the left instrument panel due to contact by the driver's left knee, and there were scuff marks on the left front arm rest from contact by the driver's left hip. The front right passenger's shoulder belt was twisted and wedged tightly into the front corner of the D-ring, and the seat belt retractor was jammed with a length of the belt extended out of the retractor consistent with usage of the seat belt in the crash. Several passenger compartment intrusions were documented, all of which occurred in the second row. The most severe intrusions that occurred within the second row right passenger's occupant space involved the backlight header, roof and right C-pillar. The backlight header and roof intruded 16 centimeters (6.3 inches) vertically. The dominate intrusion of the C-pillar was 8 centimeters (3.1 inches) forward, but it was also displaced 5 centimeters (2 inches) laterally and 4 centimeters (1.6 inches) vertically.

Figure 7: The CSS as found; second row right passenger contacted his head on the intruded right C-pillar causing the passenger's fatal injury

The Honda's driver air bag was located within the steering wheel hub. The driver's air bag did not deploy in this crash because it was not designed to deploy in a rollover crash.

Figure 8: Blood and brain matter sprayed across roof from right "C"-pillar

CHILD SAFETY SEAT

The Honda's second row right passenger was seated in a hi-back booster seat (**Figures 9** and **10** below) designed with a 5-point harness and rear tether strap. The CSS was manufactured by Century/Graco Products November 27, 2001 and the model name was Ascend SE. The model number had worn off the identification label and could not be read. The CSS was designed to be used either as a belt positioning booster seat or with the harness system. There were two sets of slots to thread the harness straps through and they were threaded through the top slots. There was also a belt guide on the back of the CSS and a shoulder belt clip on each side of the seat back. The CSS was used as a belt positioning booster in this crash. The manufacturer's information label indicated that usage of the CSS without the harness was intended for children who weigh between 13.6 to 36.3 kilograms (30 to 80 pounds) and are 89 to 127 centimeters (35 to 50 inches) in height. The second row right passenger was 97 centimeters (38 inches) tall and weighed 19 kilograms (42 pounds).

Figure 9: The second row right passenger's CSS, a Century /Graco Ascend SE

The CSS was constructed of a one piece plastic shell and was designed with arm rests. The shell was fitted with a single cloth covered foam pad. Inspection of the CSS revealed no crash induced damage.

CASE VEHICLE DRIVER KINEMATICS

The front right passenger stated during the interview that the Honda's driver (18-year-old, unknown height and weight) was seated in an upright position with his back against the seat back, both hands on the steering wheel (clock positions unknown), his right foot on the accelerator and his left foot on the floor. The seat track was adjusted to the full rear position, the seat back was

slightly reclined, and the tilt steering column was adjusted to its full down position. The driver was not wearing glasses or contact lenses.

The driver was restrained by the lap-and-shoulder belt. Inspection of the seat belt assembly showed evidence of historical usage and the belt appeared to be slightly stretched. The front right passenger stated that the driver was wearing the seat belt snug, low across his hips, and over his left shoulder across the collarbone.

After the Honda departed the roadway to the right, the driver steered left and the Honda began to rotate CCW across the roadway. Based on SCI experience, the seat belt retractor probably locked. As the Honda departed the roadway and began to roll over with the right side leading, the driver was displaced toward the roof and loaded the seat belt. During the rollover, his left knee contacted and scuffed the lower instrument panel. The driver's left hip also contacted the left front door and scuffed the arm rest. The driver remained restrained in his seat throughout the rollover. He came to final rest leaning to the right against the front right passenger.

Figure 10: Left side view of the CSS

CASE VEHICLE DRIVER INJURIES

The driver was not transported to a hospital. The front right passenger stated that the driver was not injured.

CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS

The front right passenger [21-year-old, female; 163 centimeters and 101 kilograms (64 inches, 223 pounds)] was seated in an upright position with her back against the seat back, both feet on the floor and reading a magazine. The seat track was adjusted to between its middle and rear most position and the seat back was slightly reclined. The passenger was not wearing glasses or contact lenses.

The front right passenger was restrained by the lap-and-shoulder belt. Inspection of the seat belt assembly revealed that the shoulder belt was twisted and wedged tightly into the front corner of the D-ring. The seat belt retractor was jammed with a length of the belt extended out of the retractor consistent with usage of the belt in the crash. The passenger was wearing the seat belt snug, low across the hips, and over the right shoulder across the collarbone.

Figure 11: Right front door slightly bowed outward from contact by front right passenger

As the Honda rotated CCW across the roadway, the front right passenger's seat belt retractor probably locked and the passenger was displaced to the right and against the door. As the vehicle rolled over, the passenger was displaced toward the roof and loaded the seat belt. She was also displaced to the right during the rollover, and the right side of her body contacted the right front door and deformed the door outward (**Figure 11**). The contact caused an abrasion and contusion on her right forearm. Based on occupant kinematics principles, she also probably contacted her head on the grip handle located on the right roof side rail, which caused a laceration on the back of her head. The front right passenger remained restrained in the seat throughout the rollover. She came to rest against the right front door.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The front right passenger sustained minor injuries and was treated and released from the emergency room. She received one follow-up visit to the doctor and no other injuries were diagnosed. The table below shows the front right passenger's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Laceration, "U"-shaped, back of head, not further specified	minor 190600.1,6	Roof, right front side rail (i.e., grip handle)	Probable	Emergency room records
2	Abrasion {wound}, circular, 0.2 cm (0.1 in) inner right forearm	minor 790202.1,1	Right side interior surface, excluding hardware and/or armrest	Probable	Emergency room records
3	Contusion {bruising}, 3.8 cm (1.5 in) inner right forearm	minor 790402.1,1	Right side interior surface, excluding hardware and/or armrest	Probable	Emergency room records

CASE VEHICLE SECOND ROW RIGHT PASSENGER KINEMATICS

The second row right passenger [5-year-old, male; 97 centimeters and 19 kilograms (38 inches, 42 pounds)] was seated in the CSS in an upright position with his back against the CSS seat back and his hands in his lap.

Based on the vehicle inspection, interview information, and the sheriff department's on-scene photographs, the second row right passenger was sitting on the CSS harness and was restrained by the Honda's lap-and-shoulder belt. The front right passenger stated during the interview that the lap belt was low across his hips, the shoulder belt was across his collarbone and over his right shoulder and was not routed through the clip on the right side of the CSS.

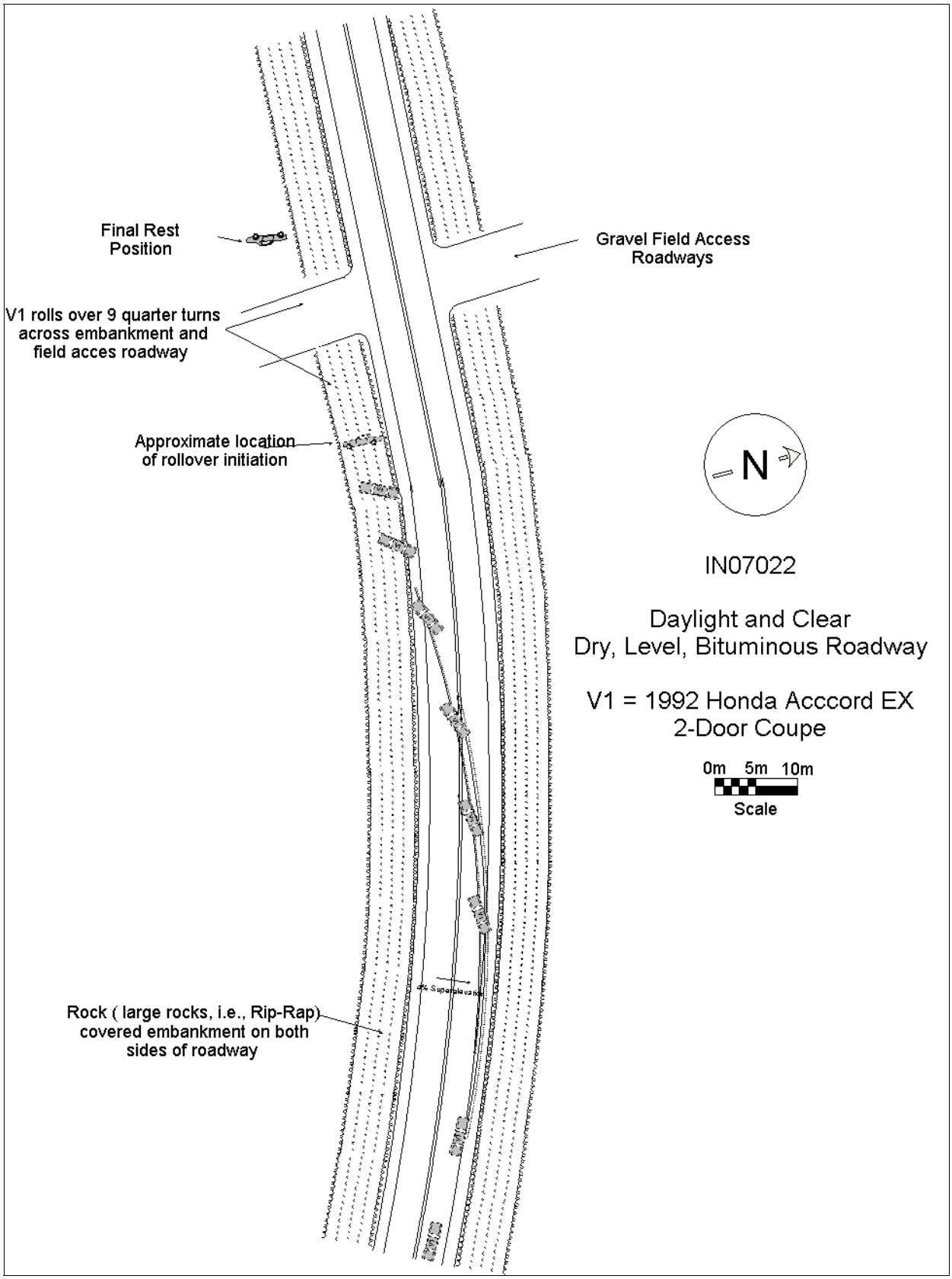
As the Honda rotated CCW across the roadway, the second row right passenger's seat belt retractor probably locked and the passenger was displaced to the right within the CSS. As the Honda rolled over, the passenger was displaced toward the roof and loaded the seat belt. When the vehicle landed on the right C-pillar and roof area, the passenger contacted his head on the intruded right C-pillar (**Figure 12**). As a result of the contact, the passenger sustained a crushed skull and extrusion of brain matter. The sheriff department's on-scene photographs showed the passenger in the CSS at final rest. Due to the crash forces, the lap belt had ridden up on his abdomen and the CSS was slightly off the seat cushion. The on-scene photographs also showed that the passenger's right arm and right leg had been ejected out of the vehicle's right rear window, and his left foot had been ejected out of the right front window. The glazing in both windows had disintegrated during the rollover.

Figure 12: The second row right passenger contacted his head on the intruded right C-pillar

CASE VEHICLE SECOND ROW RIGHT PASSENGER INJURIES

The second row right passenger sustained a fatal injury. The table below shows the injury and injury source.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Crushed skull including extrusion of brain matter with skull fractures and brain laceration	maximum 113000.6,0	"C"-pillar {intruded}	Certain	Post-mortem examination


Final Rest Position
Gravel Field Access Roadways
V1 rolls over 9 quarter turns across embankment and field acces roadway
Approximate location of rollover initiation
N
IN07022
Daylight and Clear
Dry, Level, Bituminous Roadway
V1 = 1992 Honda Acccord EX
2-Door Coupe
0m 5m 10m
Scale
Rock (large rocks, i.e., Rip-Rap) covered embankment on both sides of roadway