CRASH DATA RESEARCH CENTER
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CALSPAN ON-SITE CHILD SAFETY SEAT CRASH INVESTIGATION
COSCO COMMUTER VENTURA CHILD SAFETY SEAT

SCI CASE NO: CA08016

VEHICLE: 2005 HONDA ODYSSEY
LOCATION: NORTH CAROLINA
CRASH DATE: APRIL, 2008

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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16. Abstract

This investigation focused on the crash dynamics and injury sources for a two year old male and a two year old female (fraternal twins) restrained by the 5-point harness systems of Cosco forward facing Child Safety Seats (CSS). The CSS were secured in the third row of a 2005 Honda Odyssey by the vehicle's safety belt systems. The Honda was involved in a severe side impact crash with a loaded 1990 Freightliner tractor trailer on the inboard lane of a three-lane divided interstate highway. The crash occurred when the southbound Honda initiated a U-turn from the right shoulder of the divided interstate, across the southbound traffic lane. The southbound Freightliner was traveling in the center lane of the three-lane traffic flow and attempted an avoidance maneuver by steering left and braking. The front of the Freightliner impacted the left side of the Honda as both vehicles reached the inboard travel lane. The momentum of the Freightliner redirected the (now eastbound) Honda to the southeast, through the inboard guardrail and into the center median. Both vehicles traveled 45.7 m (150 ft) through the center median and then down a steep 16.5 m (54 ft) embankment. The Honda rolled four-quarter turns down the embankment and came to final rest on an adjacent roadway. The Freightliner traveled down the embankment, jackknifed and impacted a 1 m (3 ft) wide jersey barrier that divided the adjacent roadway. The driver of the Honda was pronounced deceased at the scene. The two adult passengers of the Honda were transported to a local hospital and pronounced deceased a short time after arrival at the hospital. The two children were removed from the vehicle while still seated in the child seats by the first responders and transported to a local hospital. The children were examined and released with police reported minor injuries.

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BACKGROUND

This investigation focused on the crash dynamics and injury sources for a two year old male and a two year old female (fraternal twins) restrained by the 5-point harness systems of Cosco forward facing Child Safety Seats (CSS). The CSS were secured in the third row of a 2005 Honda Odyssey by the vehicle's safety belt systems. The Honda (**Figure 1**) was involved in a severe side impact crash with a loaded 1990 Freightliner tractor trailer on the inboard lane of a three-lane divided interstate highway. The restrained 57 year old female driver, the restrained 37 year old female front right passenger and the restrained 28 year old female second row passenger of the Honda were fatally injured as a result of the crash. The Honda Odyssey was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system and inflatable side-impact protection. The CAC system in the Honda was comprised of dual-stage frontal air bags, seat track position sensors, front safety belt buckle switches, front safety belt buckle pretensioners, and a front right occupant detection sensor. The frontal air bags in the vehicle were certified by the vehicle manufacturer to be compliant with the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Honda's inflatable side-impact protection system consisted of front seatback mounted side impact (thorax) air bags and roof-rail mounted inflatable side curtains. Both seatback mounted side impact air bags and both side curtains deployed as a result of the impact. The frontal air bags did not deploy.

Figure 1: Front left oblique view of the Honda.

The crash occurred when the southbound Honda initiated a U-turn from the right shoulder of the divided interstate, across the southbound traffic lane. The southbound Freightliner was traveling in the center lane of the three-lane traffic flow and attempted an avoidance maneuver by steering left and braking. The front of the Freightliner impacted the left side of the Honda as both vehicles reached the inboard travel lane. The momentum of the Freightliner redirected the (now eastbound) Honda to the southeast, through the inboard guardrail and into the center median. Both vehicles traveled 45.7 m (150 ft) through the center median and then down a steep 16.5 m (54 ft) embankment. The Honda rolled four-quarter turns down the embankment and came to final rest on an adjacent roadway. The Freightliner traveled down the embankment, jackknifed and impacted a 1 m (3 ft) wide jersey barrier that divided the adjacent roadway.

The driver of the Honda was pronounced deceased at the scene. The two adult passengers of the Honda were transported to a local hospital and pronounced deceased a short time after arrival at the hospital. The two children were removed from the vehicle while still seated in the child seats by the first responders. The children were removed from the child seats, loaded into a ground ambulance and transported to a local hospital. The children were examined and released with police reported minor injuries.

This crash was identified by the Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) through an Internet news search for crashes of interest to the Agency. The notification was forwarded to the Calspan Special Crash Investigations (SCI) team on April 14, 2008 for follow-up due to the agency's interest in child passenger safety. The Calspan SCI team established cooperation with the investigating police agency, obtained the Police Crash Report and located the involved vehicles. The child safety seats were still located within the Honda. The on-site portion of the investigation took place on April 21 and 22, 2008.

SUMMARY

VEHICLE DATA

2005 Honda Odyssey

The 2005 Honda Odyssey was identified by the Vehicle Identification Number (VIN): 5FNRL38785B (production number deleted). The manufacturer's label located on the driver's door was inaccessible. The date of manufacture was unknown. The power train consisted of a 3.5 liter, V-6 engine linked to a five-speed automatic transmission. The Odyssey was also equipped with Vehicle Stability Assist, Traction Control and four-wheel anti-lock brakes. The odometer reading was unknown. The front-wheel drive, four-door minivan was configured to seat seven passengers (2/2/3) at the time of the crash. The leather trimmed interior consisted of front row bucket seats, second row captain chairs and a third row 60/40 split bench seat (right side wide). All the seat positions had adjustable head restraints. Each seat position was equipped with a manual three-point safety belt. The front safety belts were equipped with retractor pretensioners. The outboard positions in rows 2 and 3 were equipped with Lower Anchors and Tethers for Children (LATCH). The LATCH system was not in use during the crash. The Honda was equipped with CAC frontal air bags, front seatback mounted side impact (thorax) air bags and inflatable side curtains mounted in the respective roof rails. The vehicle was equipped with Michelin Energy LX4 P235/65R16 tires on OEM alloy wheels. The vehicle manufacturer's recommended cold tire pressure was 228 kPa (33 PSI) front and 241 kPa (35 PSI) rear. The specific measured tire data at the time of the SCI inspection is identified in the following table:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	Tire Flat	3 mm (4/32 in)	No	Debeaded
LR	Tire Flat	4 mm (5/32 in)	No	Separated during impact, debeaded
RF	Tire Flat	3 mm (4/32 in)	No	Debeaded
RR	Tire Flat	3 mm (4/32 in)	No	Debeaded

1990 Freightliner Tractor Trailer

The 1990 Freightliner Tractor was identified by the Vehicle Identification Number (VIN): 1FUYDXYB4LP (production sequence deleted). The 6x4 conventional tractor chassis cab was powered by a six cylinder, 14.6 liter diesel engine. The 305 cm (120 in) aluminum cab and 152 cm (60 in) sleeper were mounted on a steel ladder frame that measured 838 cm (330 in) in length. The estimated curb weight of the tractor was 6,400 to 6,800 kg (14,000 to 15,000 lb). The tractor was towing a 12 m (40 ft) box trailer loaded with fresh produce at the time of the crash. The estimated total weight of the combined tractor and trailer unit was 27,200 to 36,300 kg (60,000 to 80,000 lb).

CRASH SITE

This two-vehicle crash occurred during the daylight hours of April 2008. At the time of crash, the weather was not a factor; the asphalt road surface was dry. The crash occurred on the southbound inboard lane of a three-lane divided interstate highway, **Figure 2**. A grass median (estimated 23 m (75 ft) in width) separated the northbound and southbound traffic flow. A gravel crossover, through the center median, was located immediately north of the area of impact. South of the impact site, the interstate traffic traversed a concrete bridge that spanned a local roadway. This local road was oriented in a northeast/southwest direction at a 45 degree angle relative to the interstate traffic and consisted of two travel lanes separated by a 1 m (3 ft) wide concrete (Jersey style) barrier. Its elevation was approximately 9 m (30 ft) below the interstate. South of the crash site, the center median terrain elevation descended to the local roadway along a 16.5 m (54 ft) long 60 degree embankment. A 55 m (180 ft) long W-beam guardrail, along the east side of the southbound interstate, protected the center median along the entry to the bridge. **Figures 3 and 4** are trajectory views along the post-impact path of the Honda and Freightliner. **Figure 5** is a look back view from the vehicle's final rest area toward the embankment.

Figure 2: Southbound trajectory view.

Figure 3: Post-impact trajectory view.

Figure 4: Post-impact trajectory view at the embankment.

Figure 5: Look back view from final rest toward the embankment.

CRASH SEQUENCE

Pre-Crash

Prior to the crash, the 2005 Honda Odyssey was initially traveling southbound on the interstate. The occupants of the Honda were traveling to a family gathering located in another part of the state, missed their exit, and had become lost. The driver stopped the vehicle on the interstate's right shoulder and determined that they had to change direction and travel north on the interstate. A gravel crossover through the center median was located to the driver's left. Coincident to this, a Freightliner tractor trailer was southbound in the center lane of the interstate driven by a 68 year old male. The Honda turned left and accelerated from the right shoulder across the southbound lanes in an attempt to reach the crossover. The driver of the Freightliner reacted to the Honda's encroachment by steering left and braking. The trajectory of the Freightliner was evidenced by multiple skid marks, both prior to and after the impact.

Crash

The impact occurred with the front of the Freightliner impacting the left side of the Honda within the inboard southbound lane, adjacent to the crossover. The point of impact was evidenced by a 1.7 m (5.6 ft) long gouge mark in the mid-aspect of the lane. Additionally, a tire mark attributed to the Honda's right rear tire began adjacent to the end of the gouge and was directed to the southeast, indicative of the Honda's post-impact trajectory. Refer to **Figure 6**. The character and orientation of this mark was different from the skid marks of the braking tractor trailer. The front seatback mounted air bags and respective side curtains deployed as a result of the severe impact.

Figure 6: View of the POI and skid marks at the crash site.

The momentum of the Freightliner redirected the (initially eastbound) Honda to the southeast. Due to the magnitude of the crash, the tractor penetrated to the centerline of the Honda and the Honda remained engaged with the front of the tractor. The delta V of the Honda based on the Barrier Algorithm of the WINSMASH model was 109 km/h (67.7 mph). The longitudinal and lateral components of the delta V were 19 km/h (11.8 mph) and 107 km/h (66.5 mph), respectively. The combined vehicles left the interstate, penetrated through the W-beam guardrail and entered the center median. At the time of the SCI inspection, it was noted that 31.5 m (103 ft) of the guardrail had been replaced.

The vehicles traveled 45.7 m (150 ft) in a southeast trajectory through the center median and then down the embankment to the adjacent roadway. At the embankment, the Honda separated from the tractor. The vehicle fell over the embankment edge and rolled right side leading down the incline four quarter turns. The Honda came to rest on the adjacent road facing northeast at an undetermined location. The Freightliner traveled down the embankment, impacted the center barrier and rotated clockwise (jackknifed). The contents of the trailer penetrated the trailer's forward wall and then impacted the tractor which resulted in catastrophic damage to both units. There was no separation of the 5th wheel and trailer. **Figure 7** is a view of the final rest area of the vehicles taken from the embankment. A schematic of the crash is attached to the end of this narrative report as **Figure 22**.

Figure 7: Final rest area of the vehicles.

Post-Crash

The police and ambulance personnel responded to the crash site. The driver of the Honda was pronounced deceased at the scene. The Honda's remaining adult passengers were removed from the vehicle and transported by ground ambulance to a local hospital; however, due to the severity of their injuries, medical intervention proved unsuccessful and both occupants died prior to admission. The safety belts restraining the CSS's in the third row of the Honda were cut by the first responders and the twins were removed from the vehicle while still seated in the safety seats. They were removed from the seats and transported to a local hospital. The twins were treated for police reported minor injuries and released. The driver of the tractor was found in the sleeper compartment with unknown minor injuries.

EXTERIOR DAMAGE

2005 Honda Odyssey

The left side plane, right side plane and top plane of the Honda Odyssey were damaged in the multiple event crash sequence. The left side sustained severe damage as a result of the impact with the front of the Freightliner. Refer to **Figures 8 and 9**. The direct contact damage began on the left fender 5 cm (2 in) forward of the front axle and extended 391 cm (154 in) to the D-pillar area. The Field L measured 432 cm (170 in) and began 46 cm forward of the axle. The left doors and B-pillar were crushed inboard to the approximate centerline of the vehicle resulting in extensive damage. The front door hinges were intact and still attached to the left A-pillar. The

front door striker remained engaged at the B-pillar. The forward aspect of the left rear door remained engaged with the B-pillar. The left side structure separated from the rear aspect of the door at the C-pillar area. This section of the left side peeled rearward and overlapped the D-pillar area. The left rear wheel and suspension separated during the impact. The residual crush profile of the left side measured at the mid door elevation was as follows: C1 = 3 cm (1.3 in), C2 = 50 cm (19.7 in), C3 = 87 cm (34.3 in), C4 = 87 cm (34.3 in), C5 = 18 cm (7.0 in), C6 = 5 cm (2.0 in). The maximum crush was located at the left B-pillar (between C3 and C4) and measured 106 cm (41.7 in). The Door Sill Differential (DSD) was 86 cm (34 in). The elevation of the maximum crush was approximately 102 cm (40 in). This elevation was consistent with the bumper height of the Freightliner. The left roof rail deformed laterally and bucked the roof into an inverted U-pattern along its entire length. The Collision Deformation Classification (CDC) of this impact was 09-LDAW5.

Figure 8: Overall left side view.

Figure 9: Left oblique view of the maximum crush at the B-pillar.

The entire right side of the Honda sustained direct contact damage attributed to the impact with the W-beam guardrail. The direct damage began at the right front corner in the area of the headlamp and extended to the D-pillar. The elevation of the damage was approximately 81 to 91 cm (32 to 36 in) above the ground consistent with the height of the guardrail. The maximum crush within the direct damage was an estimated 5 cm (2 in). The right front door was open at the time of the SCI inspection and could not be latched closed due to body deformation. There was no measureable change in the right wheelbase. The CDC of the guardrail impact was 03-RDEW1.

Figure 10: Front right oblique view of the Honda.

The roof and right side body panels exhibited surface abrasions. The abrasions were oriented in a single direction indicative of a four-quarter turn rollover. There was no measurable vertical crush or lateral shift due to the forces of the roll. The CDC of this event was 00-RDAO2.

1990 Freightliner Tractor Trailer

The Freightliner tractor sustained catastrophic damage as a result of the impact with the center barrier (**Figures 11 and 12**). The loaded trailer remained engaged with the tractor's fifth wheel through the crash sequence. The trailer had to be cut open and separated from the fifth wheel post-crash. Its contents were manually unloaded.

The components of the tractor were spread out over a 56 square meter (600 ft^2) area. Only the sleeper compartment was still attached to the frame. The aluminum cab of the tractor was intact but had separated. All the tractor's axles had separated from the frame at their respective mounting points.

Figure 11: View of the damaged Freightliner.

Figure 12: Left side view of the sleeper and 5th wheel.

The left aspect of the Freightliner's front bumper exhibited a blue paint transfer indicative of the impact with the Honda. The transfer measured 25 cm (10 in) in width and began 70 cm (27.5 in) left of center. Refer to **Figure 13**. The bumper measured 244 cm (96 in) in width and had sustained overlapping damage during its impact with the center barrier. The Truck Deformation Classification (TDC) was 12-FDEWA.

Figure 13: Paint transfer to the Freightliner's front bumper.

INTERIOR DAMAGE

2005 Honda Odyssey

The Honda Odyssey sustained severe left side intrusion in rows one and two as a result of the impact. The driver seat was laterally compressed, forced over the center console and into the front right position. The front right seat was also laterally compressed 20 cm (8 in) and deformed. The outboard aspect of the front right seat was in contact with the right B-pillar and front door panel. The lower rear aspect front right door panel was fractured from contact with the front right seat. The center aspect of the door panel was scuffed at the arm rest elevation and immediately below the window sill as a result of contact with the right flank of the passenger. An 18 cm x 13 cm (7 in x 5 in) area of body fluid was

noted on the back side of the front right head restraint. This transfer resulted due to a probable contact from the second row left passenger. **Figure 14** is a right view of the front interior.

The second row left seat position was eliminated by the force of the impact and had disengaged from the floor. The seat was found loose within the interior, **Figure 15**. The safety belt was still latched to the receiver; the sheet metal surrounding the safety belt's outboard floor anchor had torn away from the floor pan. The second row right seat was not damaged.

Figure 14: Interior view of front row.

Figure 15: Second row left seat.

The third row of the Honda is depicted in **Figure 16**. The center and right aspects of the 60/40 spilt bench seat were (relatively) undamaged. The seat back angle measured 30 degrees rearward of vertical. The right aspect of the right side panel exhibited evidence of contact from the child safety seat. A beige colored transfer was noted at the junction of the seat back and the side panel.

The forward 15 cm (6 in) portion of the left seat cushion was deformed vertically 13 to 15 cm (5 to 6 in). The seat back was forced rearward and measured 80 degrees. The seat back was jammed in this position due to the deformation and intrusion of the left side panel.

Figure 16: Third row seat.

The lateral intrusion of the Honda is listed in the following table:

Position	***Component***	***Magnitude***
Row 1 Left	Steering Assembly	23 cm (9.1 in)
Row 1 Left	Left A-Pillar	45 cm (17.7 in)
Row 1 Left	Driver Seat	48 cm (18.9 in)
Row1 Middle	Driver Seat	38 cm (15.0 in)

Position	*Component*	*Magnitude*
Row 1 Left	Left Door Panel - forward upper quadrant	33 cm (13.0 in)
Row 1 Left	Left Door Panel – rear upper quadrant	48 cm (18.9 in)
Row 1 Middle	Left Door Panel – rear upper quadrant	18 cm (7.1 in)
Row 1 Left	Left Roof Rail	48 cm (18.9 in)
Row 1 Middle	Left Roof Rail	5 cm (2.0 cm)
Row 1 Left	Left B-Pillar	48 cm (18.9 in)
Row 1 Middle	Left B-Pillar	26 cm (10.2 in)
Row 2 Left	Left Door Panel – forward upper quadrant	53 cm (20.9 in)
Row 2 Middle	Left Door Panel – forward upper quadrant	19 cm (7.5 in)
Row 2 Left	Left Door Panel – rear upper quadrant	53 cm (20.9 in)
Row 2 Middle	Left Door Panel – rear upper quadrant	13 cm (5.1 in)
Row 2 Left	Left Roof Rail	53 cm (20.9 in)
Row 2 Middle	Left Roof Rail	14 cm (5.5 in)
Row 3 Left	Left C-Pillar	41 cm (16.9 in)
Row 3 Middle	Left C-Pillar	2 cm (0.8 in)
Row 3 Left	Side Panel – rear of pillar	33 cm (13.0 in)

MANUAL RESTRAINT SYSTEMS

2005 Honda Odyssey

The manual restraint systems in the Honda Odyssey consisted of three-point lap and shoulder belts in the seven seat positions. The driver's restraint consisted of continuous loop webbing, an Emergency Locking Retractor (ELR), a sliding latch plate and an adjustable D-ring. This restraint utilized a retractor pretensioner that actuated due to the force of the impact. At the time of the SCI inspection, the webbing was extended from the retractor and the retractor was locked. The webbing had been cut by the first responders 11 cm (4.5 in) below the D-ring. The webbing leading to the retractor was heavily abraded and jammed in the D-ring. The cut webbing section measured 198 cm (78 in). The outboard end of this section was torn and shredded. Fabric was embedded in the weave of the cut webbing section over a 23 cm (9 in) length and the webbing was abraded over a 46 cm (18 in) length. The driver was restrained at the time of the crash based on the observations of the SCI inspection.

The front right passenger's manual restraint consisted of continuous loop webbing, a switchable ELR/Automatic Locking Retractor (ALR), a sliding latch plate and an adjustable D-ring. The retractor was equipped with a pretensioner that had actuated at the time of the crash. The retractor was locked and the webbing was extended in the worn position. The exposed length of the webbing measured 141 cm (55.5 in). The webbing was jammed within the latch plate from occupant loading. The location of the latch plate measured 75 cm (29.5 in) above the outboard anchor. The buckle attached to the inboard aspect of the seat was fractured due to contact from the intruding center console and driver seat. The front right passenger was restrained at the time of the crash based on the observed condition of the safety belt.

The manual restraint in second row left position consisted of continuous loop webbing, a switchable ELR/ALR retractor, a sliding latch plate and a fixed D-ring. The safety belt webbing had been cut by the first responders 48 cm (19 in) below the D-ring. The webbing was twisted

and jammed in the D-ring from occupant loading. The latch plate was still buckled in the receiver that was attached to the inboard aspect of the seat. Refer to **Figure 14** above. At the latch plate, the webbing was shredded and frayed due to occupant loading. The second row left passenger was restrained at the time of the crash based on the observations of the SCI inspection.

The manual restraints in the outboard positions of the Honda's third row were used to restrain the Cosco forward facing child safety seats. These restraints consisted of continuous loop webbing, a switchable ELR/ALR retractor, a sliding latch plate and a fixed D-ring. The restraint in the third row left was cut by the first responders 38 cm (15 in) above the lower outboard anchor. The retractor was jammed with 142 cm (56 in) of exposed webbing. The webbing in the area of the D-ring exhibited 19 cm (7.5 in) of abrasions. The latch plate was still buckled in the receiver. The restraint in the left position of the third row was also cut by the first responders. This webbing was cut 135 cm (53 in) above the lower outboard anchor. A crease in the belt caused by its interaction with the latch plate was identified and was located 56 cm (22 in) above the anchor. The location of the crease appeared to be consistent with the belt routed through the forward facing belt path in the back of the CSS. The balance of the webbing had spooled back into the retractor. The fact that the webbing spooled into the retractor indicated that the retractor was not switched into the automatic mode to restrain the CSS. The latch plate was still buckled into the receiver. During the rescue operations, the safety belts were cut and pulled from the belt path of the CSS in order to facilitate the removal of the seats. Greater detail regarding the child seats can be found in the *CHILD SAFETY SEAT* Section of this report.

AIR BAG SYSTEMS

2005 Honda Odyssey

The front seatback mounted side impact air bags and roof rail mounted inflatable curtains deployed during the crash. The seat back air bags deployed from a module that was located in the outboard bolster of the seat. The bolster seam tore open over a 38 cm (15 in) length. The air bag deployed forward approximately 23 cm (9 in) and expanded vertically approximately 30 cm (12 in). The air bag was vented and tethered. There was no contact evidence on either the driver's or the front right passenger's air bag.

The inflatable side curtains deployed vertically downward during the crash and provided coverage across the side windows from the roof rail to the beltline. In overall dimensions, the curtain measured approximately 282 cm x 51 cm (111 in x 20 in). The left curtain was torn in two pieces at its mid-aspect due to intrusion. A possible contact from the driver's head was identified on the curtain in the area of the deformed left B-pillar. The contact measured 9 cm x 9 cm (3.5 in x 3.5 in) and was located 81 cm (32 in) aft of the curtain's forward edge and 23 cm (9 in) below the roof rail (**Figure 17**). An 18 cm x 15 cm (7 in x 6 in) beige colored area on the extreme lower rear aspect of the curtain was identified as a possible

Figure 17: Possible driver contact to the left curtain.

contact with the left CSS. The right curtain was cut in multiple places by the first responders. A 74 cm (29 in) section of the curtain at the third row was missing. No occupant contacts to the right curtain could be identified.

CHILD SAFETY SEAT DATA

The two year old fraternal twins were restrained in the third row of the Honda within identical Cosco Commuter Ventura Child Safety Seats (CSS), Model No: 22-209-RDO (**Figure 18**). The left seat was manufactured in 12/29/05 and identified by Serial No: B258886. The right seat was manufactured in 12/20/05 with Serial No: B232893. The seats were designed to be used either as a forward facing seat utilizing the five-point harness or as a belt positioning booster seat with the harness removed. In the forward facing mode, the seats were rated for use by children that weighed between 10 to 18 kg (22 to 40 lb) with a height of 86 to 110 cm (34 to 43 in). As a booster seat, the CSS was rated for children that weighed 18 to 36 kg (40 to 80 lb) with a height of 110 cm to 132 cm (43 to 52 in). At the time of the crash, the CSS were secured within the Honda by the use of the vehicle's three-point lap and shoulder belt that was routed through the forward facing belt path. The children were restrained by the seat's five-point harness system. The CSS's were equipped with a lower anchor strap and a tether compatible with the Lower Anchors and Tethers for Children (LATCH) system. Both seats were found lying randomly within the vehicle at the time of the SCI inspection.

Figure 18: View of the third row child safety seats.

Left CSS

The harness straps of left CSS were routed through the lowest slots. Both straps were twisted. The chest retainer clip was present and operational. Inspection of the CSS revealed that the shell completely fractured due to its interaction with the intruding left side panel. Refer to **Figures 19 and 20** below. The shell was highly stressed and fractured along the right side, through the back, and across the base. The shell surrounding the harness strap adjuster, at the forward aspect of the base, fractured and adjuster was free. The tether strap and lower anchor strap were attached to the seat. Neither strap appeared to have been in use at the time of the crash.

Right CSS

The harness straps of the right seat were routed through the lowest slots. The left strap was twisted a single run. The strap had roped and was jammed in the left crotch clip. The right crotch clip was free. The chest retainer clip was in place and operational. The right side of the shell was fractured along the length of the back rest. Refer to **Figure 21**. The fracture resulted from its contact with the vehicle's right side panel. The lower anchors strap was attached to the seat. The tether strap had been removed from the seat for unknown reasons. It was found within the area of the third row.

Figure 19: View of the fractured child safety seats.

Figure 20: View of the complete fracturing of the right CSS.

Figure 21: View of the right outboard fracture of the left CSS.

OCCUPANT DEMOGRAPHICS

2005 Honda Odyssey

	Driver	***Front Right Passenger***
Age/Sex:	57 year old / Female	37 year old / Female
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Seat Track Position:	Unknown position	Unknown position
Restraint Use:	Three-point lap and shoulder belt	Three-point lap and shoulder belt
Usage Source:	SCI inspection	SCI inspection
Medical Treatment:	None, fatally injured	Transported via ground ambulance and pronounced deceased at the hospital
	Second Row Left	***Second Row Right***
Age/Sex:	28 year old / Female	Seat Position Not Occupied
Height:	Unknown	
Weight:	Unknown	
Seat Track Position:	Unknown position	
Restraint Use:	Three-point lap and shoulder belt	
Usage Source:	SCI inspection	
Medical Treatment:	Transported via ground ambulance and pronounced deceased at the hospital	
	Third Row Left	***Third Row Right***
Age/Sex:	2 year old / Female	2 year old / Male
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Seat Track Position:	Fixed bench	Fixed Bench
Restraint Use:	Restrained by the CSS's five-point harness and chest retainer clip	Restrained by the CSS's five-point harness and chest retainer clip
Usage Source:	SCI inspection	SCI inspection
Medical Treatment:	Transported via ground ambulance, treated and released	Transported via ground ambulance, treated and released

DRIVER INJURY

Injury	***Injury Severity (AIS 98 Update)***	***Injury Source***
Blunt Force Trauma, NFS	Injured details unknown	Crash force

DRIVER KINEMATICS

The 57 year old restrained female driver initiated a left turn across the interstate traffic lanes directly into the path of the southbound Freightliner. At impact, the safety belt retractor locked and the pretensioner actuated. The force of the impact caused the inflatable side-impact protection system to deploy. The driver responded to the lateral direction of the impact force by loading the safety belt system, the left door panel and the deployed seat back mounted air bag and side curtain. Her (probable) head contact to the side curtain was identified by SCI inspection and was located at the left B-pillar area. Concurrent with her motion, the left side structures intruded due to the severity of the impact. The force of the intrusion displaced the driver to the right. She sustained unknown blunt force trauma due to the severity of the impact and intrusion. The driver was pronounced deceased at the scene of the crash. Her medical records were not available.

FRONT RIGHT PASSENGER INJURY

Injury	***Injury Severity (AIS 98 Update)***	***Injury Source***
Brain stem compression, transtentorial herniation	Critical (140202.5,8)	Unknown
Displaced left 1st rib fracture with left hemothorax	Severe (450252.4,2)	Driver seat, probable
Diffuse subarachnoid hemorrhage	Serious (140684.3,9)	Occupant to occupant contact, possible
Left C7 cervical transverse process fracture, NFS	Moderate (650220.2,6)	Driver seat, probable
Left T1 thoracic transverse process fracture, NFS	Moderate (650420.2,7)	Driver seat, probable
Complex fracture of the head of the left clavicle	Moderate (752200.2,2)	Driver seat, probable
Left supra-clavicular hematoma	Minor (790402.1,2)	Driver seat, probable
Large posterior scalp laceration, NFS	Minor (190602.1,6)	Occupant to occupant contact, possible
Multiple scalp contusions, NFS	Minor (190402.1,9)	Unknown
Multiple scalp lacerations, NFS	Minor (190600.1,9)	Unknown

Note: The above injuries were documented by Emergency Room records.

FRONT RIGHT PASSENGER KINEMATICS

The 37 year old female passenger was restrained at the time of the crash by the vehicle's three-point lap and shoulder belt system. At impact, the seat belt retractor locked and the retractor pretensioner actuated. Due to the magnitude of the impact force, the right seat back mounted air bag and side curtain probably deployed at this time. The passenger was displaced in a left trajectory in response to the lateral impact force. Concurrent with her motion, the left side

structure, driver and driver's seat intruded into her occupant space. The intruding driver seat impacted the left flank of the passenger resulting in the left 1st rib fracture, transverse process fractures at C7 and T1, the left clavicle fracture and the soft tissue shoulder injury. The passenger head possibly contacted the driver's head resulting in the subarachnoid hemorrhage and posterior scalp laceration. The passenger was forced to the right and into contact with the right door panel. The cause of the brain stem compression was unknown. The passenger was removed from the vehicle, transported to a local hospital and died approximately 5 ½ hours post-crash.

SECOND ROW LEFT PASSENGER INJURY

Injury	***Injury Severity (AIS 98 Update)***	***Injury Source***
Left forearm fracture, NFS	Moderate (751900.2,2)	Left door panel (rearward upper quadrant)
Open left posterior ankle fracture, NFS	Moderate (852002.2,2)	Left door panel (forward lower quadrant)
Open right upper extremity fracture, NFS	Moderate (751800.2,1)	Front right seat back
Open right lower extremity fracture, NFS	Moderate (852002.2,1)	Front right seat back
Left posterior scalp laceration, NFS	Minor (190600.1,6)	Left C-pillar
Unresponsive at scene with agonal respirations, GCS = 3, Unresponsive to CPR at hospital		

Note: The above injuries were documented by Emergency Room records.

SECOND ROW LEFT PASSENGER KINEMATICS

The 28 year old female passenger in the second row left position was reportedly the mother of the twins seated in the third row. She was restrained at the time of the crash by the vehicle's three-point lap and shoulder belt. At impact, the seat belt retractor locked and the left side curtain deployed. The passenger initiated a left lateral trajectory in response to the impact. The left side structures immediately began to intrude impacting the passenger resulting in the left extremity fractures. The passenger's head likely contacted the C-pillar resulting in the posterior laceration. The force of the intruding components (backed by the Freightliner) deformed her seat and caused it to separate from the floor. The seat was displaced to the right side of the vehicle. A probable head contact was noted to the head restraint of the front right seat. The right flank of the passenger was driven into contact with the front right seat. This contact resulted in the right extremity fractures. She was transported to a local hospital and did not respond to resuscitation at the hospital. She died 25 minutes after arrival in the emergency department.

THIRD ROW TWIN PASSENGER'S INJURY

Injury	*Injury Severity (AIS 98 Update)*	*Injury Source*
Unknown Minor Injuries, NFS	Injured details unknown	Unknown

THIRD ROW TWIN PASSENGER'S KINEMATICS

The two year old fraternal twin passengers were restrained by the five-point harness system in identical Cosco forward facing CSS's. The CSS's were each secured within the Honda by the vehicle's three-point safety belt routed through the forward facing belt path. The switchable retractors were not set to the automatic locking mode. At impact, the retractor locked (due to the acceleration) and the side curtains deployed. The children began a left lateral trajectory and loaded the harness straps of the CSS. Coincident to this, the left side structure intruded and contacted the right CSS. The force of the contact fractured the CSS and also displaced the seat to the right. The left CSS contacted the right CSS and displaced that seat into contact with the right side panel/structure. The right outboard aspect of the (right) CSS fractured from this contact.

Throughout the multiple event crash sequence, the children remained restrained within their respective CSS and rode down the force of the impact. The children were removed from the vehicle by the first responders while still seated in the CSS. The children were transported to a local hospital. They were examined, treated and released with police reported minor injuries. There was no record of treatment at the reported hospital for either child.

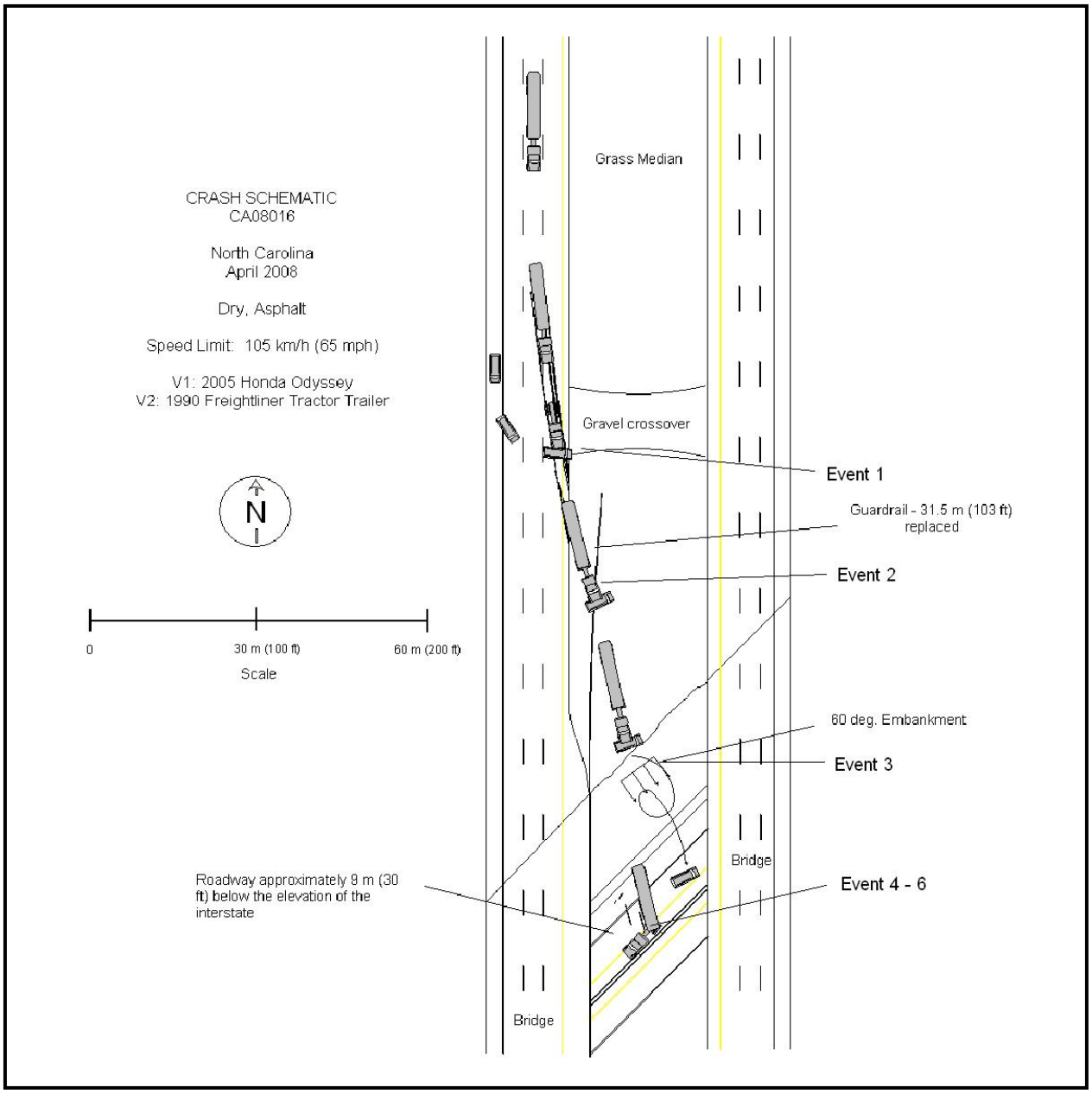

Figure 22: Crash Schematic.