CRASH DATA RESEARCH CENTER

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CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE CRASH INVESTIGATION

SCI CASE NO.: CA08018

VEHICLE: 2007 HONDA ACCORD

LOCATION: NEW JERSEY

CRASH DATE: MARCH 2008

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

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

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BACKGROUND

This on-site investigative effort focused on the Certified Advanced 208-Compliant (CAC) safety system in 2007 Honda Accord **(Figure 1)** and the injury sources for the restrained 79-year-old female driver. A CAC vehicle is certified by the manufacturer to be compliant to the Advanced Air Bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Honda's CAC system consisted of dual stage frontal air bags, seat track position sensors, safety belt buckle switch sensors, and an occupant detection sensor for the front right seat. In addition to the CAC system, the Honda was equipped with retractor mounted safety belt pretensioners for the front seats, seat back mounted side impact air bags, and curtain air bags for the outboard seating positions. The Honda was involved in a single vehicle road-side departure crash with a utility pole that resulted in the deployment of the driver's frontal air bag, right seat back mounted side impact air bag, and the right curtain air bag. Additionally, the driver's safety belt pretensioner actuated. The driver sustained soft tissue face and chest injuries and was transported to a local hospital where she was treated for her injuries and released.

Figure 1. 2007 Honda Accord.

This crash was identified by the National Highway Traffic Safety Administration (NHTSA) through a review of Police Accident Reports (PARs) that were submitted by the General Estimates System (GES). The PAR was forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up investigation. The Honda was located and cooperation was established with the salvage yard to inspect the vehicle. The Honda was equipped with an Air bag Control Module (ACM) that had Event Data Recording (EDR) capabilities. The removal of the ACM was denied by the insurance company due to an alleged brake failure and a follow-up investigation by Honda. An on-site investigation was assigned to the Calspan SCI team on May 16, 2008. The vehicle and crash site were inspected on May 20, 2008.

SUMMARY

Crash Site

The crash occurred on the west road side of a two-lane north/southbound roadway during daytime hours. The southbound lane measured 3.8 m (12.5') in width and the northbound lane measured 3.7 m (12.1') in width. The travel lanes were separated by a painted yellow centerline that permitted passing in the northbound direction. Paved

shoulders were adjacent to the travel lanes and were 2.3 and 2.6 m (7.5 and 8.5') in width for the east and west shoulders, respectively. Concrete barrier curbs bordered the shoulders. Grass, gravel, and sidewalks were located outboard of the curb lines with utility poles positioned 0.3-0.6 meters (1-2 feet) beyond the curbs. The posted speed limit was 72 km/h (45 mph). At the time of the crash, the weather conditions were clear and the road surface was dry.

Vehicle Data

The involved vehicle in this crash was a 2007 Honda Accord LX four-door sedan. The Honda was manufactured in 06/07 and was identified by Vehicle Identification Number (VIN) 1HGCM56167A (production number deleted). The Honda was powered by a 2.4-liter, transverse mounted four-cylinder engine linked to a five-speed automatic transmission with a console mounted shift lever. The service brakes were power-assisted front disc/rear drum with antilock. The tires were Bridgestone Turanza, size P195/65R16 mounted on OEM steel wheels. The vehicle manufacturer recommended tire pressure was 221 kPa (32 PSI) front and 207 kPa (30 PSI) rear. The tire data at the time of the SCI inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Damage
Left Front	193 kPa (28 PSI)	7 mm (9/32")	None
Right Front	Tire Flat	6 mm (8/32")	Cut sidewall
Left Rear	193 kPa (28 PSI)	8 mm (10/32")	None
Right Rear	193 kPa (28 PSI)	8 mm (10/32")	None

The interior of the Accord was configured for five-passenger seating with front bucket seats and a rear bench with split folding backs. The four outboard positions were equipped with adjustable head restraints that were in the full down positions. The seat surfaces were cloth. The vehicle was equipped with power windows, power door locks, and a tilt steering column that was located in the full-up position at the time of the SCI inspection. The steering wheel was configured with four spokes at the 3/9 and 4/8 o'clock positions.

Crash Sequence

Pre-Crash

The 79-year old female driver of the 2007 Honda Accord was traveling in a southerly direction on the two-lane road approaching a four-leg intersection **(Figure 2)**. The driver stated to the SCI investigator that as she neared the intersection, she applied the brakes for a slowing vehicle ahead. However, when she applied the brakes, she felt like the vehicle was not slowing. As she closed in on traffic ahead, she applied a right steering input and departed the right travel lane and entered the shoulder. The vehicle traversed the

Figure 2. Honda's southbound pre-crash travel.

shoulder and mounted the west curb and entered the gravel landscaped area. The Scene Schematic is included as **Figure 11** of this report.

Crash

The front right corner of the Honda impacted a 26 cm (10.2") diameter wooden utility pole that was located on the gravel landscaped area **(Figure 3)** 0.5 meters (1.6") outboard of the curb. The area of contact was outboard of the front right frame rail. The corner of the frontal structure crushed as the vehicle continued forward. The right side of the Honda engaged the pole involving the front right wheel, suspension components, and right A-pillar. The pole pocketed at the area of the A-pillar which induced a clockwise rotation. The Honda rotated approximately 140 degrees clockwise as it separated from the pole prior to coming rest on the west shoulder facing a northwesterly direction. The direction of force was 12 o'clock for this fixed object impact. The front of the vehicle yielded 3 cm (1") of crush at the right corner of the bumper beam. No crush was present along the remainder of the bumper beam. A common velocity was not obtained between the front and right side engagements; therefore this crash was outside the scope of the WINSMASH program. Based on SCI experience, this contractor estimates that the delta-V was approximately 25 km/h (15 mph).

Figure 3. Area of impact with the utility pole.

The impact actuated the driver's retractor pretensioner and deployed the driver's frontal air bag. The right side engagement resulted in the deployment of the right seat back mounted air bag and the right curtain air bag.

Post-Crash

The driver unbuckled her safety belt and opened the left front door and exited the vehicle post-crash. She waited at the scene for emergency personnel to arrive. She sustained soft tissue injuries to her face and chest and was transported by ground ambulance to a local hospital. The driver was treated and released from the hospital. The Honda was deemed a total loss by the insurance company and was transferred to a salvage facility where it was inspected for this investigation.

Vehicle Damage

Exterior

The 2007 Honda Accord sustained moderate damage to the front and right side planes as a result of the impact with the utility pole **(Figure 4)**. The damaged components included, but were not limited to, the bumper fascia, bumper beam, hood, right fender, right

Figure 4. Resultant front damage.

front door, and the right front wheel and suspension components. The impact occurred outboard of the front right frame rail with the direct contact damage beginning 42 cm (16.5") right of the vehicle's centerline, extending 23 cm (9") to the right corner of the bumper fascia. Direct contact damage was also present on the bumper beam. The direct contact measured 6 cm (2.3"), beginning 55 cm (21.6") right of the centerline and extended to the right corner. The maximum crush measured 3 cm (1") and was located on the right corner of the bumper beam. A crush profile was documented along the bumper which was as follows: C1 = 0 cm, C2 = 0 cm, C3 = 0 cm, C4 = 0 cm, C5 = 0 cm, C6 = 3 cm (1").

Figure 5. Damage to the right side of the Honda.

Due to the corner impact, the direct contact damage extended down the right plane of the vehicle **(Figure 5)**. The direct contact damage began on the leading edge of the right fender and extended down the right side 142 cm (56") onto the right front door. Lateral deformation was present to the right fender which was approximately 13 cm (5") in depth. This deformation occurred as the vehicle continued its forward momentum while engaged with the pole. As the vehicle reached maximum engagement, the pole pocketed at the area of the A-pillar. The Collision Deformation Classification (CDC) for the pole impact was 12-FREE-6.

All four doors remained closed during the crash. Post-crash the right side doors were jammed shut and the left side doors were operational. The windshield was fractured at the right aspect and the right front glazing disintegrated. The remaining side and rear glazing were intact. The Honda was not equipped with a sunroof. The left rear corner area exhibited damage and the left rear tail light was removed from the vehicle. This damage was not crash related.

Braking System

The Honda was equipped with front disc/rear drum brakes with four wheel Anti-lock. The driver stated to the SCI investigator that during her pre-crash travel, she applied the brakes in order to avoid traffic ahead. At this point, she thought the vehicle did not respond to the braking force. Due to this statement, a visual inspection was performed on the braking system. Pressure was applied to the brake pedal. This pressure yielded no resistance which is indicative of a compromised brake system. The SCI investigator traced the steel brake lines from

Figure 6. Separated right front brake line.

the master cylinder and brake booster, to the Anti-lock Brake System (ABS) control unit, and to the wheels. The brake lines for the left front, left rear, and the right rear brakes were unremarkable. At the right front wheel, the steel brake line transitioned to a flexible hose for connection to the brake caliper. During the right plane engagement with the pole, the right front wheel and suspension components separated, thus separating the brake hose from the caliper **(Figure 6)**.

The brake fluid reservoir was inspected for adequate fluid level and was found to be in the lower third of the reservoir. The visual inspection did not reveal a malfunction of the braking system. A mechanical malfunction did not appear likely for this late model vehicle; however, it could not be ruled out.

Interior

The interior of the Honda Accord sustained moderate severity damage as a result of passenger compartment intrusion and driver contact.

Figure 7. Overall view of the driver's area.

The driver's contact points consisted of a red colored transfer on the face of the air bag membrane at the six o'clock position and a black colored transfer on the air bag membrane immediately right of center. A possible contact point was noted to the rear view mirror. The mirror was located facing downward which may have resulted from contact with the driver's right hand. The restraint usage by the driver prevented her from possible further contact with interior components of the vehicle.

The passenger compartment intrusions are listed in the table below:

Location	Component	Magnitude	Direction
Front Right	Toe pan	10 cm (3.9")	Longitudinal
Front Right	Floor	2 cm (0.8")	Vertical
Front Right	Side panel forward of A-pillar	6 cm (2.4")	Lateral
Front Right	Sill	6 cm (2.4")	Lateral
Front Right	Door	4 cm (1.6")	Lateral
Rear Right	Floor	5 cm (2")	Vertical

Certified Advanced 208-Compliant Frontal Air Bag System

The 2007 Honda Accord was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system for the driver and front right passenger positions. This system consisted of dual-stage air bags, seat track position sensors, safety belt buckle switch sensors, a front right passenger weight sensor, and front safety belt retractor pretensioners.

The driver's air bag was concealed in the center hub of the four-spoke steering wheel by asymmetrical cover flaps. The top flap was 12 cm (4.7") in width at the horizontal tear seam and 8 cm (3.1") in height. The lower flap was 12 cm (4.7") in width and 6 cm (2.4") in height. The air bag membrane was 55 cm (21.7") in diameter in its deflated state and was tethered internally by two straps at the 12 and 6 o'clock positions. The air bag was vented by two ports located at the 11 and 1 o'clock positions. The maximum excursion of the bag (deflated) was 23 cm (9.1").

Figure 8. Deployed driver's air bag (contact points in yellow tape).

The driver's face contacted the air bag membrane as evidenced by two transfers. A reddish colored (possible make-up) transfer was located on the face of the air bag 11-14 cm (4.3-5.5") below the center and 1-6 cm (0.4-2.4") right of the centerline. A second transfer that was black in color was present on the face of the membrane. This transfer was either contact from the driver or an expansion transfer from the cover flap. The transfer was located 1-2 cm (0.4-0.8") above the center and 1-5 cm (0.4-1.9") right of the centerline. **Figure 8** is an overall view of the driver's air bag and contact points.

The front right air bag was a top mount design incorporated into the instrument panel. The front right seat was not occupied during the crash; therefore the CAC system suppressed the deployment of the air bag and the front right retractor pretensioner actuation.

Event Data Recorder

The Honda was equipped with an air bag control module that had Event Data Recording (EDR) capabilities. Permission to remove the EDR from the vehicle for download by Honda was denied by the insurance company.

Side Impact Air Bag System

The Honda was equipped with front seat back mounted side impact air bags and roof side rail mounted curtain air bags. The right side impact air bag and the right curtain air bag deployed during the crash.

The right seat back mounted air bag was concealed within the outboard aspect of the seat back. The air bag deployed through a 30 cm (11.8") tear seam at the forward aspect of the seat back. The air bag membrane measured 37 cm (14.6") in height and 31 cm (12.2") in width and consisted of two panels sewn together at the forward edge. The air bag was internally vented and contained two circular tethers that were sewn to the panels. The tethers were located at the 12 and 6 o'clock positions. The top tether was 6 cm (2.4") in diameter and the lower tether measured 8 cm (3.1") in diameter. Both tethers contained a small circular cut out located centered within the tethers. The air bag membrane was not damaged and did not contain occupant contact evidence.

The right curtain air bag deployed from the roof side rail. The air bag membrane measured 167 cm (65.7”) in length. At the right front seating position, the membrane measured 39 cm (15.4”) in height extending 8 cm (3.1”) below the top of the door panel. The height of the curtain air bag membrane at the left rear position was 37 cm (14.6”) and extended 2 cm (0.9”) below the top of the door panel. The height of the curtain air bag membrane provided head protection from the roof side rail to the belt line of the vehicle. The curtain air bag overlapped the seat back mounted air bag by 7 cm (2.8”) in the deflated state. The curtain air bag was not tethered to the A- and C-pillars. Longitudinally, the coverage area of this curtain air bag did not completely span across the right front glazing. A triangular shaped void was present between the curtain air bag and the A-pillar. The maximum length of the void was 41 cm (16.1”). In its deflated state, the air bag membrane overlapped the C-pillar approximately 10 cm (4”) providing protection beyond the rear glazing area. Occupant contact points or damage did not occur to the curtain air bag. **Figure 9** depicts the deployed seat back and curtain air bags.

Figure 9. Seat back mounted and curtain air bag.

Manual Safety Belt Systems

The safety belt systems consisted of continuous loop webbing and sliding latch plates for all five positions. The front belts were equipped with adjustable D-rings and retractor mounted pretensioners. The driver’s D-ring was adjusted to the full-down position. The driver’s restraint was equipped with an Emergency Locking Retractor (ELR).

The driver utilized the safety belt during the crash which was supported by loading evidence on the lap and shoulder portions of the webbing and the latch plate. As a result of the crash, the retractor pretensioner actuated which retracted a portion of the safety belt as the driver loaded the belt system. The combination of the driver loading and the actuation of the pretensioner resulted in frictional abrasions on the webbing near the D-ring, and latch plate. The driver loading also resulted in two creases to the belt webbing near the latch plate 67-71 cm (23.4-28”) above the outboard anchor and near the driver’s shoulder, 140 cm (55.1”) above the anchor.

Figure 10. Driver's safety belt.

Driver Demographics/Data

Age/Sex:	79-year old/Female
Height:	157 cm (62”)
Weight:	56 kg (123 lb)
Seat Track Position:	Mid track position
Eyewear:	None
Manual Safety Belt Use:	3-point lap and shoulder belt system
Usage Source:	SCI vehicle inspection
Driver Egress from Vehicle:	Unassisted
Mode of Transport From Scene:	Ground ambulance
Type of Medical Treatment:	Treated and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Contusion to the nose	Minor (290402.1,4)	Air bag membrane
Abrasions to the nose	Minor (290202.1,4)	Air bag membrane
Contusion to the front and under the right breast	Minor (490402.1,1)	Shoulder belt

Driver Kinematics

The 79-year-old female driver of the Honda was seated in a mid-track position with the seat back reclined 25 degrees aft of vertical and the head restraint adjusted to the full-down position. The seat track was adjusted 11 cm (4.3”) aft of full-forward and 12 cm (4.7”) forward of the full rear position. She was restrained by the manual safety belt system. Belt usage was supported by the actuated status of the retractor pretensioner and the loading evidence on the system’s components.

At impact, the driver’s pretensioner actuated and the frontal air bag deployed. The driver initiated a forward trajectory in response to the 12 o’clock direction of force. She loaded the safety belt system which arrested the forward motion of her torso. Her loading force against the belt webbing resulted in the contusion to the right breast. The driver’s face contacted the deploying air bag which resulted in the contusion and abrasions to the nose. As a result of her injuries, she was transported by ambulance to a local hospital where she treated and released.

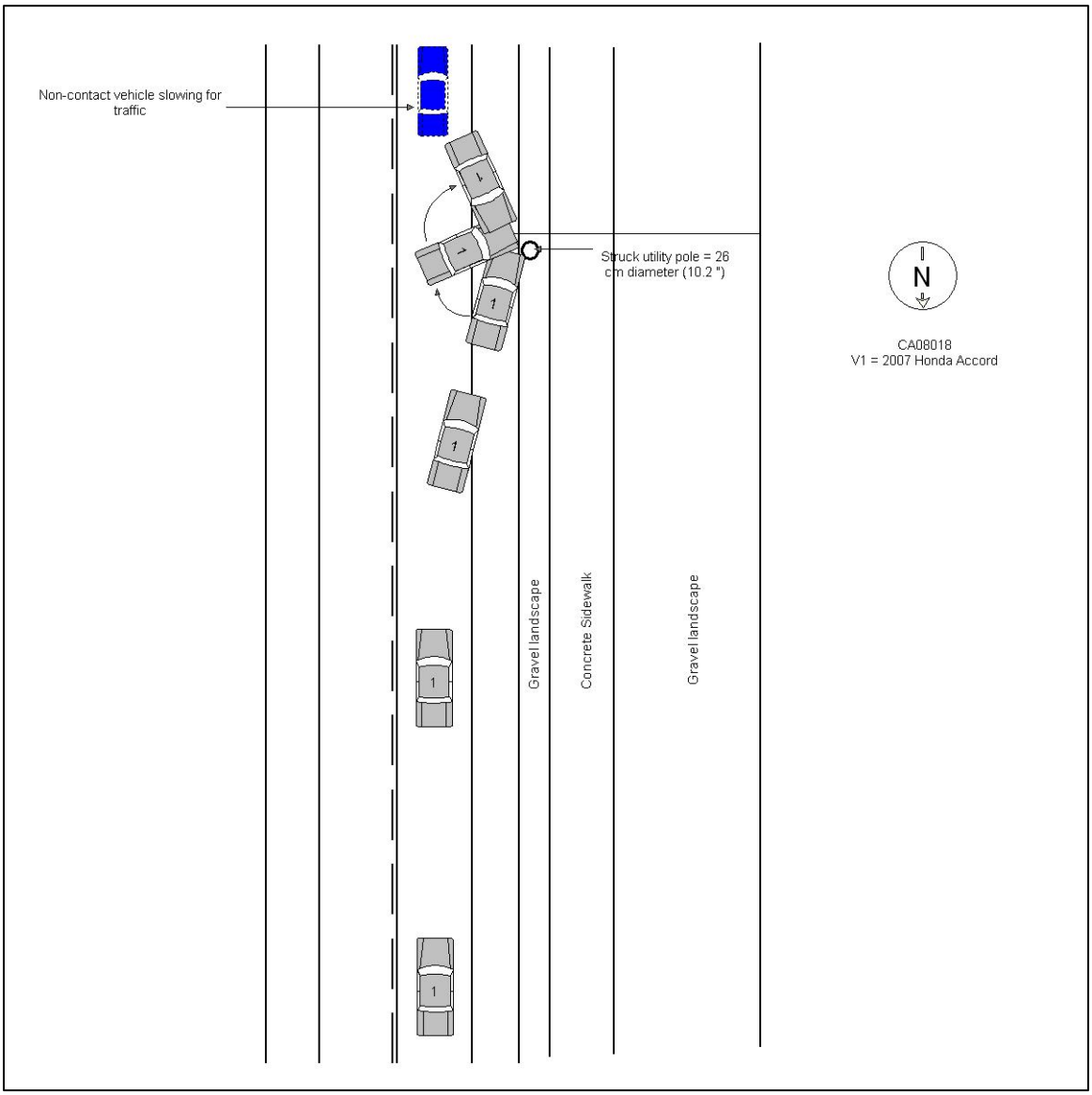

Figure 11: Scene Schematic