

**CRASH DATA RESEARCH CENTER**  
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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT  
VEHICLE CRASH INVESTIGATION  
CALSPAN CASE NO: CA08041**

**VEHICLE: 2008 HONDA ACCORD  
LOCATION: TENNESSEE  
CRASH DATE: MAY, 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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<p>16. Abstract</p> <p>This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) safety system in 2008 Honda Accord. A CAC vehicle is certified by the vehicle manufacturer to be compliant with the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This advanced occupant protection system was comprised of dual-stage frontal air bags, seat track position sensors, front safety belt buckle switch sensors, front safety belt pretensioners and a front right occupant detection sensor. The vehicle's Air bag Control Module (ACM) tailored the deployment of the frontal air bags based the crash severity and inputs from these sensors. The Honda was also equipped with front seat back-mounted side impact air bags and roof side rail-mounted curtain air bags.</p> <p>The Honda was involved in a single vehicle run-off road frontal crash with a tree. The force of the impact resulted in deployment of the vehicle's driver frontal air bag, the left seat back-mounted side air bag and both inflatable curtain (IC) air bags. The Honda's 59-year-old female driver was restrained by the vehicle's lap and shoulder belt at the time of the crash and suffered incapacitating injuries. The Honda was towed from the crash site and was subsequently deemed a total loss.</p>			
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***BACKGROUND***

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) safety system in 2008 Honda Accord (**Figure 1**). A CAC vehicle is certified by the vehicle manufacturer to be compliant with the advanced air bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This advanced occupant protection system was comprised of dual-stage frontal air bags, seat track position sensors, front safety belt buckle switch sensors, front safety belt pretensioners and a front right occupant detection sensor. The vehicle's Air bag Control Module (ACM) tailored the deployment of the frontal air bags based the crash severity and inputs from these sensors. The Honda was also equipped with front seat back-mounted side impact air bags and roof side rail-mounted curtain air bags.



**Figure 1: Front right oblique view of the Honda Accord.**

The Honda was involved in a single vehicle run-off road frontal crash with a tree. The force of the impact resulted in deployment of the vehicle's driver frontal air bag, the left seat back-mounted side air bag and both inflatable curtain (IC) air bags. The Honda's 59-year-old female driver was restrained by the vehicle's lap and shoulder belt at the time of the crash and suffered incapacitating injuries. The Honda was towed from the crash site and was subsequently deemed a total loss.

This crash was identified by the Crash Investigation Division of the National Highway Traffic Safety Administration through an Internet search of total loss vehicles that were located at insurance salvage facilities. A list of targeted vehicles was forwarded to the Calspan Special Crash Investigations (SCI) team on September 2, 2008. Calspan SCI conducted a follow-up investigation and established cooperation with the insurance carrier to inspect the Honda. The agency subsequently assigned an on-site investigation on September 9, 2008. The on-site portion of this investigation took place on September 10, 2008. Insurance cooperation was also established to remove the Honda's ACM for the possible imaging of the vehicle's Event Data Recorder. However, the intrusion of components under the center aspect of the instrument panel prevented its removal.

## **SUMMARY**

### **VEHICLE DATA**

#### **2008 Honda Accord**

The 2008 Honda Accord four-door sedan was manufactured in February 2008 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 and rear disc with antilock. The tires were Dunlop Sport 7000, size P215/60R16 mounted on OEM alloy wheels. The vehicle manufacturer recommended cold tire pressure was 207 kPa (30 PSI) for the front and rear. The tire data at the time of the SCI inspection was as follows:

<b>Position</b>	<b>Measured Pressure</b>	<b>Measured Tread Depth</b>	<b>Damage</b>
Left Front	179 kPa (26 PSI)	8 mm (10/32 in)	None
Right Front	Tire Flat	8 mm (10/32 in)	De-beaded
Left Rear	179 kPa (26 PSI)	8 mm (10/32 in)	None
Right Rear	179 kPa (26 PSI)	8 mm (10/32 in)	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 seat surfaces were cloth. All the seating positions were equipped with adjustable head restraints. The front head restraints were in the full-down positions. The left and center rear were adjusted to 5 cm (2 in) above the seat back. The right rear head restraint was adjusted 8 cm (3 in) above the seat back.

The interior safety systems consisted of three-point lap and shoulder safety belts for the five positions, a CAC frontal air bag system, front seat back-mounted side impact air bags, and roof side rail-mounted IC air bags.

### **CRASH SITE**

The crash occurred during the daylight hours of May 2008. At the time of the crash, the weather was not a factor. The crash occurred on the south roadside of an east/west road in a suburban setting. **Figure 2** is an eastbound trajectory view at the estimated roadside departure. There was a positive two-percent grade eastbound. The road consisted of two lanes separated by a double-yellow centerline. The width of the travel lanes measured 3.6 m (11.8 ft). Asphalt shoulders bordered the travel lanes. The south shoulder measured 1.4 m (4.6 ft) in width. The south road side sloped away from the pavement to a tree line that was located



**Figure 2: Eastbound trajectory view at the crash site.**

5.0 m (16.4 ft) south of the pavement edge. The cross slope was an estimated ten percent, negative to the south. A 30 cm (12 in) diameter tree located within the tree line was the point of impact. The speed limit in the area of the crash was 64 km/h (40 mph).

## ***CRASH SEQUENCE***

### ***Pre-Crash***

The 59-year-old restrained female was operating the Honda in an eastbound direction. She was the sole occupant of the vehicle. The driver fell asleep and allowed the vehicle to drift off the right side of the road. The Honda departed the right shoulder and travelled down the cross slope to the tree line. Due to the passage of time between the date of the crash and SCI notification there was no physical evidence of the vehicle's trajectory through the road side. A schematic of the crash is attached to the end of this report as **Figure 9**.

### ***Crash***

The right rear side plane of the Honda contacted the tree line evidenced by minor body panel abrasions and deformation to the quarter panel (Event 1). The right aspect of the front plane then impacted the 30 cm (12 in) diameter tree. The severity of the impact (delta-V) was calculated by the Damage Algorithm of the WinSMASH program. The total delta-V was 38 km/h (23.6 mph). The longitudinal and lateral delta-V components were -38 km/h (-23.6 mph) and 0 km/h (0 mph), respectively. The offset right impact configuration induced a clockwise (CW) rotation to the vehicle. The Honda rotated approximately 30 degrees and came to rest on the road side in close proximity to the tree.

### ***Post-Crash***

The police and ambulance personnel responded to the crash site. The driver was assisted from the vehicle due to her perceived injuries. She complained of knee and chest pain at the scene. She was transported by ground ambulance to a regional trauma center and admitted for a period of five days for treatment of her injuries.

## ***EXTERIOR DAMAGE***

The Honda Accord sustained impact damage to the right and front planes as a result of the multiple event crash sequence. **Figures 3 and 4** are a right rear oblique view and a front view of the damaged vehicle. The Honda sustained minor damage to the right quarter panel from the sideswiping contact to the tree line (Event 1). The direct damage for this event measured 119 cm (46.9 in) in length and began 24 cm (9.4 in) forward of the right rear axle. The maximum lateral deformation from this impact was 5 cm (2 in) located at the mid point of the quarter panel. Longitudinal abrasions were noted throughout the deformation. The Collision Deformation Classification (CDC) was 12RZES1.

Moderate severity damage was noted the frontal plane as a result of the impact with the tree (Event 2). The damaged components included but were not limited to the bumper fascia, bumper beam, hood, right fender, and the right front wheel and suspension components. The direct contact damage began 43 cm (17 in) right of the vehicle's centerline extending 34 cm (13.5 in) to the right corner of the bumper fascia. The maximum crush measured 58 cm (22.8 in) and was

located at the right corner. The crush profile documented along the bumper reinforcement beam was as follows: C1 = 0 cm, C2 = 4 cm (1.5 in), C3 = 18 cm (7 in), C4 = 35 cm (13.7 in), C5 = 55 cm (21.7 in), C6 = 58 cm (22.8 in). The impact location on the right corner resulted in an 11 cm (4.3 in) reduction of the right wheelbase. The left wheelbase lengthened 14 cm (5.5 in) due to body deformation. All four doors remained closed during the crash and were operational post-crash. The windshield was fractured by the exterior crash force. The side and rear glazing were intact. The Collision Deformation Classification (CDC) for the tree impact was 12FZEN3.



Figure 3: Right rear oblique view of the Honda.



Figure 4: View of the Honda's frontal damage.

### ***INTERIOR DAMAGE***

The interior of the Honda Accord (**Figure 5**) sustained minor severity damage as a result of passenger compartment intrusion, deployment of the safety systems and driver contact. The six-way power driver seat was located in a mid-to-rear track position that measured 5 cm (2 in) forward of full-rear. The total seat track travel measured 24 cm (9.5 in). The seat back angle measured 28 degrees aft of vertical. The horizontal distance from the seat back to the driver air bag module measured 73 cm (28.7 in). The four-spoke steering wheel was rotated 90 degrees counterclockwise. The adjustable steering wheel was in the full-down position. There was no steering wheel rim deformation. Examination of the steering column shear capsules revealed minor evidence of movement. The right shear capsule was displaced 6 mm (0.25 in). The left shear capsule was unchanged.



Figure 5: Interior view of the driver's position.

The driver contacted the knee bolster evidenced by two areas of stress marks to the plastic bolster panel. The left stress mark spanned an area that measured 6 cm (2.5 in) in height and width. This contact area was located 8 cm (3.0 in) left of the steering column and 36 cm (14 in) above the floor. The right contact area measured 6 cm x 9 cm (2.5 in x 3.5 in), height x width.



This contact was located 11 cm (4.5 in) right of the steering column and 38 cm (15 in) above the floor. The right instrument panel and the right toe pan intruded 3 cm (1 in).

### ***MANUAL SAFETY BELT SYSTEMS***

The driver's manual safety belt system consisted of continuous loop webbing, a sliding latch plate an adjustable D-ring, an Emergency Locking Retractor (ELR), and a retractor-mounted pretensioner. The driver's D-ring was adjusted to the full-down position. 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. A 6 cm (2.5 in) abrasion from friction contact with the D-ring was located 164 cm (64.5 in) above the floor anchor. The latch plate exhibited full-width frictional abrasions across the plastic surface. The driver loading resulted in creasing to the lap belt section of the webbing at the latch plate. The creasing was located 77 cm (30.5 in) above the above the floor anchor.

### ***CERTIFIED ADVANCED 208-COMPLIANT FRONTAL AIR BAG SYSTEM***

The 2008 Honda Accord was equipped with a 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 (**Figure 6**) was concealed within a module located in the center hub of the four-spoke steering wheel. The air bag module cover flaps had a tri-flap design. The top flap was 13 cm (5 in) in width at the horizontal tear seam and 8 cm (3 in) in height. The lower flaps each measured 6 cm (2.5 in) in width and 5 cm (2 in) in height. The air bag was 58 cm (23 in) in diameter in its deflated state and was tethered internally by two straps. The air bag was vented by two ports located at the 11 and 1 o'clock positions. The driver's air bag contained body fluid spatter at the top aspect. There were no occupant contact points or damage to the frontal air bag.



**Figure 6: Deployed air bags in the driver's position.**

The front right air bag was a mid-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 right frontal air bag.

### ***SIDE IMPACT AIR BAG SYSTEMS***

The Honda was equipped with front seat back-mounted side impact air bags and roof side rail-mounted IC air bags. The left seat back-mounted side impact air bag and both curtains deployed as a result of the crash.

The left seat back mounted air bag (**Figure 7**) was concealed within the outboard aspect of the seat back. The air bag deployed through a tear seam at the forward aspect of the seat back. The air bag measured 46 cm (18 in) in height and 28 cm (11 in) in width at the top and 20 cm (8 in) in width at the bottom. The air bag consisted of two panels sewn together at the forward edge with a single 3 cm (1 in) diameter vent port at the top forward aspect. The membrane contained a square-shaped cut out that measured 10 cm (4 in) in and width. This cut-out was located 18 cm (7 in) above the bottom and 9 cm (3.5 in) aft of the forward edge. The air bag membrane was designed to inflate around the cut-out forming two chambers. The air bag membrane was not damaged and did not contain evidence of occupant contact.

The left and right IC air bags deployed from the roof side rails. **Figure 8** is an overall view of the left IC. The deployed IC air bag measured 203 cm (80 in) in length. At the front seating positions, the air bag measured 38 cm (15 in) in height extending 3 cm (1 in) below the beltline. The height of the air bag at the second row position was 33 cm (13 in) and extended 3 cm (1 in) below the top of the door panel. The curtains provided full longitudinal and vertical coverage across the side glazing. There was no identified damage or occupant contact points to the curtains.



**Figure 7: View of the left IC and left side impact air bag.**



**Figure 8: Overall view the left IC air bag.**

### ***EVENT DATA RECORDER***

The Honda was equipped with an Air bag Control Module (ACM) that was believed to have Event Data Recording (EDR) capabilities. The ACM was located under the center aspect of the instrument panel. Permission to remove the EDR from the vehicle for download by Honda was obtained by the insurance company. However, the intrusion and deformation under the center instrument panel prevented the removal of the ACM.

### ***DRIVER DEMOGRAPHICS***

	<b><i>Driver</i></b>
Age / Sex:	59-year-old / Female
Height:	173 cm (68 in)
Weight:	63 kg (138 lb)
Seat Track Position:	Rear-track, 5 cm (2 in) forward of full-rear
Restraint Use:	3-point lap and shoulder safety belt
Usage Source:	SCI interior inspection
Medical Treatment:	Five day hospitalization

### ***DRIVER INJURY***

<b><i>Injury</i></b>	<b><i>Injury Severity (AIS 90/Update 98)</i></b>	<b><i>Injury Source</i></b>
Non-displaced lateral fractures of the 4 <sup>th</sup> – 7 <sup>th</sup> ribs	Serious (450230.3,1)	Safety belt
Non-displaced fracture of the sternum	Moderate (450804.2,4)	Safety belt
Right 4 <sup>th</sup> metacarpal fracture	Moderate (750220.2,1)	Instrument panel (probable)
Right forearm abrasion	Minor (790202.1,1)	Instrument panel (probable)
Right knee contusion	Minor (890402.1,1)	Knee bolster
Left knee contusion	Minor (890402.1,2)	Knee bolster
Left lower leg abrasion	Minor (890202.1,2)	Foot controls

*Source: Hospital Discharge Summary*

### ***DRIVER KINEMATICS***

The driver was seated in a rear-track position and was restrained by the vehicle's safety belt. She fell asleep and the Honda drifted of the right side of the road and sideswiped the tree line (Event 1) located south of the pavement. The driver did not respond to this minor impact.

At the frontal impact with the tree (Event 2), the safety belt pretensioner actuated, and removed the belt slack from the system, tightening the webbing about the driver. The driver air bag, the left seat back-mounted side impact air bag and both IC air bags deployed. The driver responded to the 12 o'clock direction of the impact force by initiating a forward trajectory. The driver loaded the safety belt system and then the deployed driver air bag. The safety belt loading was evidenced by frictional abrasions at the D-ring and latch plate, and creasing to the webbing. The driver's belt loading resulted in a non-displaced sternum fracture and fractures of the right fourth through seventh rib. The driver's right hand was displaced forward into probable contact with the instrument panel resulting in a forearm abrasion and fracture of the fourth metacarpal. Her

knees contacted the knee bolster resulting in contusions and the driver's left lower leg was abraded by contact with the foot controls.

During the later stage of the impact sequence, the vehicle rotated clockwise about the tree. The driver responded with a right lateral displacement into the center console. She then rebounded back into her seat and came to rest. She remained within the vehicle until the arrival of the first responders. She was transported by ground ambulance to a regional trauma center and hospitalized for treatment of her injuries.

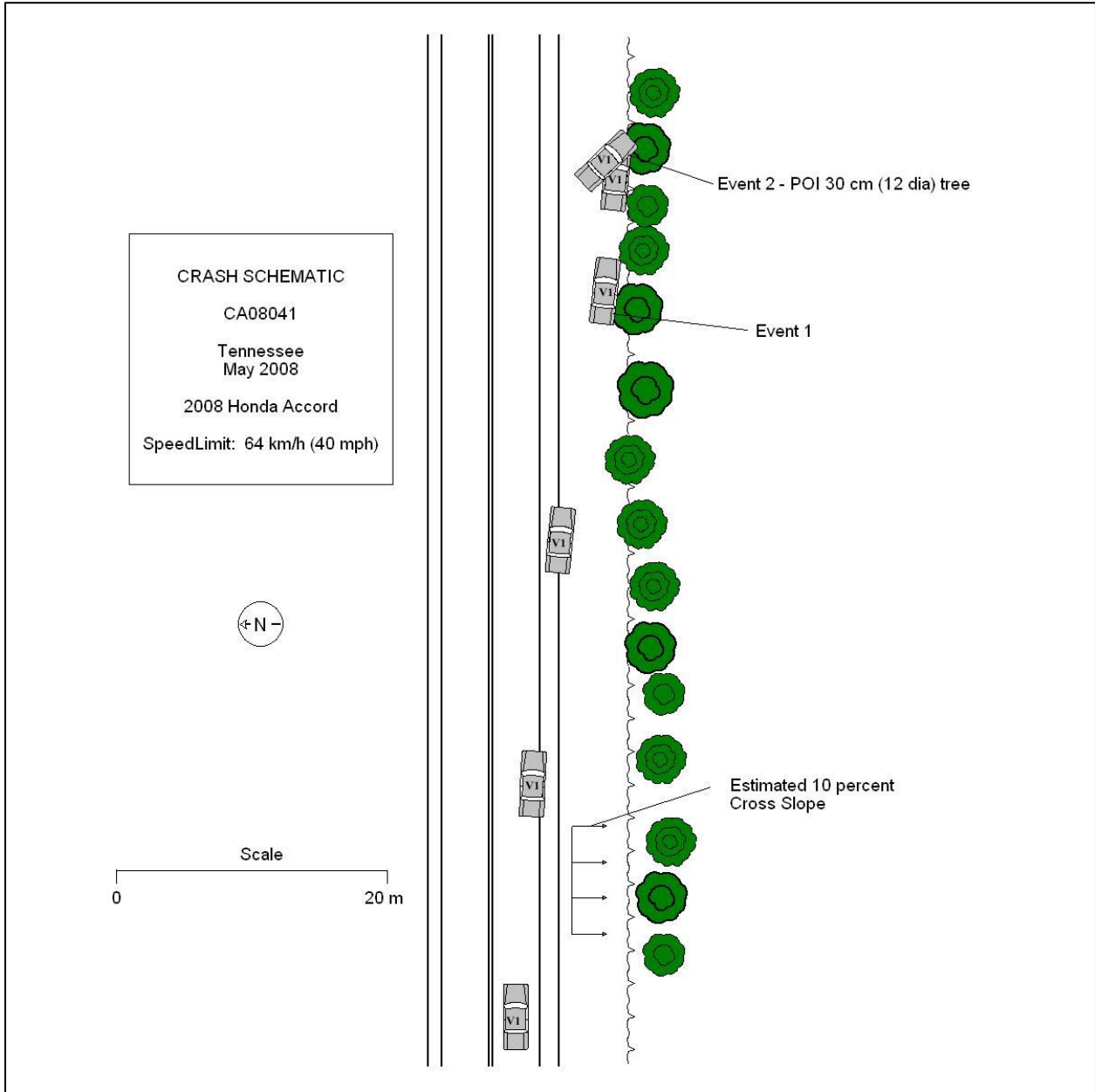


Figure 9: Crash schematic.