

CRASH DATA RESEARCH CENTER

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

CASE NO: CA04-011

VEHICLE: 2004 HONDA ACCORD

LOCATION: OHIO

CRASH DATE: MARCH 2004

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

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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.

TECHNICAL REPORT STANDARD TITLE PAGE

<p>1. <i>Report No.</i> CA04-011</p>	<p>2. <i>Government Accession No.</i></p>	<p>3. <i>Recipient's Catalog No.</i></p>	
<p>4. <i>Title and Subtitle</i> Calspan On-Site Certified Advanced 208-Compliant Vehicle Crash Investigation Vehicle: 2004 Honda Accord Location: State of Ohio</p>		<p>5. <i>Report Date:</i> December 2005</p>	
		<p>6. <i>Performing Organization Code</i></p>	
<p>7. <i>Author(s)</i> Crash Data Research Center</p>		<p>8. <i>Performing Organization Report No.</i></p>	
<p>9. <i>Performing Organization Name and Address</i> Crash Data Research Center Calspan Corporation P.O. Box 400 Buffalo, New York 14225</p>		<p>10. <i>Work Unit No.</i> C00410.0000.0192</p>	
		<p>11. <i>Contract or Grant No.</i> DTNH22-01-C-17002</p>	
<p>12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590</p>		<p>13. <i>Type of Report and Period Covered</i> Technical Report Crash Date: March 2004</p>	
		<p>14. <i>Sponsoring Agency Code</i></p>	
<p>15. <i>Supplementary Note</i> This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) safety system that was present in a 2004 Honda Accord.</p>			
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<p>17. <i>Key Words</i> Certified Advanced 208-Compliant occupant protection Inflatable Curtain Deployment. Driver Seat Bag Deployment</p>		<p>18. <i>Distribution Statement</i> General Public</p>	
<p>19. <i>Security Classif. (of this report)</i> Unclassified</p>	<p>20. <i>Security Classif. (of this page)</i> Unclassified</p>	<p>21. <i>No. of Pages</i> 10</p>	<p>22. <i>Price</i></p>

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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE CRASH
INVESTIGATION
CASE NO.: CA04-011
LOCATION: STATE OF OHIO
VEHICLE: 2004 HONDA ACCORD
CRASH DATE: MARCH, 2004**

BACKGROUND

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) safety system that was present in a 2004 Honda Accord. The manufacturer of this vehicle certified that this vehicle meets the requirements of the Advanced 208 Federal Motor Vehicle Safety Standard (FMVSS). The CAC system consisted of dual-stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, a front right occupant presence system, and an Event Data Recorder (EDR). The 2004 Accord (**Figure 1**) was configured with the EX trim package, and was equipped with side impact air bags and inflatable curtains. A 25-year-old female driver was operating the vehicle in an eastbound direction on a



Figure 1. Damaged 2004 Honda Accord

two-lane roadway on approach to an area of two 3-leg T-intersections, the north intersection separated from the south intersection by 51.6 m (169'). The driver of the Accord failed to stop at a stop sign at the termination of the west leg of the south T-intersection. She proceeded across the north/south roadway and into an agricultural field. She applied power and steered left in an attempt to re-enter the east leg of the north T-intersection. The Accord initiated a counterclockwise (CCW) yaw as it traveled through the field and returned to a tracking mode as it approached the roadway. The front of the Accord overrode a ditch and traveled onto the roadway. The driver most likely steered right in an attempt to re-enter the roadway, which induced a clockwise (CW) yaw. The resistance of the tires on the roadway tripped a rollover with the left side leading, as the Accord departed the north road edge. The Accord rolled four-quarter turns and came to rest upright on the north roadside, facing east. The rollover resulted in moderate damage to the Accord and was sufficient to deploy the left side impact air bag and left side inflatable curtain. The driver sustained minor injuries. The police report stated that she was transported by ambulance to a local hospital; however, the insurance adjuster stated she did not receive medical treatment.

This crash was identified through a list of claims from an insurance company that identified Certified Advanced 208-Complaint vehicles that had been involved in crashes. The list was forwarded to the Calspan Special Crash Investigations team for follow-up and location of the vehicles. The Honda Accord was located and cooperation was established with the insurance adjuster. An on-site investigation was assigned to the Calspan SCI team on March 10, 2004 due to the presence of the CAC system and deployment of the side impact air bag and inflatable curtain. Permission to inspect the vehicle was provided in addition to permission to retrieve the EDR, which was forwarded to Honda by NHTSA for analysis.

SUMMARY

Vehicle Data – 2004 Honda Accord

The 2004 Honda Accord was identified by the Vehicle Identification Number (VIN): 1HGCM81654A (production sequence omitted). The vehicle was a front-wheel-drive, two-door coupe that was equipped with a 3.0 liter, V-6 engine, a close-ratio six-speed manual transmission, cruise control, power-assisted front disc/rear drum brakes with Anti-Lock Braking System (ABS) with Electronic Brake Distribution (EBD), and a Traction Control System (TCS), which monitored front wheel slippage. The Accord was also configured with variable-assist power steering, a tilt and telescoping steering column, power windows and door locks, a power moonroof with tilt feature, and a security system. The Accord was equipped with Michelin Radial XSE P215/50R17 tires. The manufacturer's recommended tire pressure was 220 kpa (32 psi) for the front tires and 200 kpa (29 psi) for the rear tires. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	193.1 kPa (28.0 PSI)	7.1 mm (9/32")	No	None
LR	179.3 kPa (26.0 PSI)	7.1 mm (9/32")	No	None
RF	Tire flat	5.6 mm (7/32")	No	None
RR	186.0 kPa (27.0 PSI)	7.1 mm (9/32")	No	None

The 2004 Honda Accord was configured with leather-trimmed, heated front bucket seats with adjustable head restraints. The driver's head restraint was in the full-down position and the front right head restraint was located 5.1 cm (2.0") above the seat back at the time of the vehicle inspection. The driver's seat was configured with an 8-way power adjustment, adjustable lumbar support, and was located in the full-rear track position. The front right passenger's seat was also configured with a power adjustment and located in the full-rear track position. Both front seats exhibited 32.9 cm (9.0") of total track travel. The rear seating positions in the Accord were configured with a bench seat that was configured with a 60/40 split fold-down seatback and adjustable head restraints for the outboard positions. Both rear head restraints were in the full-down position.

Crash Site

This single-vehicle crash occurred during the nighttime hours of February 2002 in the state of Ohio. At the time of the crash, the weather was clear and the asphalt roadway surface was dry. It was dark and the roadway was not illuminated. The crash occurred at an area of two opposing 3-leg, T- intersections, the north intersection separated from the south intersection by 51.6 m (169'). For clarity, the T-intersections will be referred to as the north and south intersections throughout this report. The scene schematic is included as **Figure 13** of this narrative report. Each county roadway was straight and level, was configured with one travel lane in each direction, and was bordered by narrow gravel shoulders. The north/south roadway was configured with a double-yellow centerline and the east leg of the north intersection with a solid yellow centerline for eastbound traffic and a broken yellow line for westbound traffic. The west leg of the south intersection was configured with a solid yellow centerline for eastbound traffic and a broken yellow centerline for westbound traffic. The tops of both T-intersections were

configured with yellow warning signs with opposing arrows, which signaled right or left turns. Traffic flow through the intersections was controlled by stop signs on the east and west legs of the north and south intersections for westbound and eastbound traffic, respectively. The rural roadside environment consisted of fields and houses. A large agricultural field was located east of the south T-intersection and south of the east leg of the north T-intersection. The field was located 61.0 cm (24.0") below the elevation of the north/south roadway, and a gradual embankment from the north/south road edge into the field measured 4.0 m (13.1') in length. The field consisted of grass and mud. A drainage ditch was present along the south roadside of the east leg of the north T-intersection. The ditch measured 1.5 m (5.0') in width and 0.6 m (1.8') in depth. The posted speed limit for the east/west roadway was 89 km/h (55 mph).

Crash Sequence

Pre-Crash

The police report indicated that the driver of the Accord might have been operating the vehicle under the influence of alcohol. She was operating the vehicle in an eastbound direction on approach to the top of the south T-intersection (**Figure 2**). The police reported that the driver's pre-crash speed was approximately 64 km/h (40 mph). The driver disregarded the stop sign on the west leg of the intersection and continued across the north/south roadway. She steered left as the vehicle departed the roadway surface, in an attempt to cross the field and re-enter the roadway. Her left steering input caused the Accord to initiate a counterclockwise (CW) yaw as it departed the roadway, evidenced by tire furrows in the field (**Figure 3**). Four distinct tire furrows began in the field on the east roadside where the Accord departed the roadway. The furrows continued in a northeast direction and curved gradually to the left across the field. The two left side furrows and two right side furrows merged 112.3 m (368.4') east of the original roadside departure to create two furrows, which indicated the Accord had resumed a tracking mode prior to traveling onto the east leg of the north T-intersection. The furrows merged 4.7 m (15.4') outboard of the roadside. Due to the soft ground and the distance traveled, the driver applied power to the vehicle as she attempted to cross the field and reenter the roadway.



Figure 2. Eastbound approach for the Honda Accord



Figure 3. Roadside departure and furrows through the field

Crash

The Honda Accord traveled into the roadside drainage ditch in a tracking mode and ramped up onto the east leg of the roadway (**Figure 4**). The undercarriage struck the ditch bank and the south road edge as the Accord traveled onto the roadway, evidenced by gouges on the asphalt

road edge. The impact was sufficient to fire the driver's pretensioner, evidenced by the restriction of the safety belt in the used position. The driver steered right as the Accord traveled onto the eastbound travel lane, in an attempt to resume her eastbound direction of travel on the roadway. Due to the right steering input, the Accord initiated a CW yaw in the roadway and the resistance of wheels on the roadway surface induced a four quarter-turn trip over with the left side leading (**Figure 5**). The left side aspect of the Accord, traveled across the westbound travel lane, evidenced by heavy longitudinal abrasions on the left side aspect of the Accord and gouges on the north road edge. The trip over onto the left side was sufficient to deploy the driver's side air bag and the left side IC. As the Accord departed the north roadside, it continued in a forward direction and rolled onto its roof, right side, and landed upright in the roadside field 7.2 m (23.6') from the north road edge.



Figure 4. Impact with the roadside ditch and entrance to the roadway



Figure 5. Area of trip-over and related roadway gouge

Post-Crash

It was not known how the driver exited the vehicle. The police report indicated that the driver was transported by ambulance to a local hospital; however, the insurance adjuster stated that the driver was not transported to a medical facility and had complaints of pain and stiffness. All attempts to contact the driver have been unsuccessful.

Vehicle Damage

Exterior Damage – 2004 Honda Accord

The 2004 Honda Accord sustained minor undercarriage damage as a result of the ditch impact prior to the rollover (**Figure 6**). The bottom aspect of the plastic bumper fascia was fractured from the centerline to the front left corner. Contact to the undercarriage did not extend above the lower radiator support and did not involve the bumper beam. The Collision Deformation Classification for the minor undercarriage impact was 00-UFYW-1.



Figure 6. View showing damage to the front left area of the undercarriage beneath the bumper

The Accord also sustained moderate damage as a result of the rollover event. The entire left side of the Accord sustained longitudinal abrasions from contact with the asphalt roadway surface (**Figure 7**). The abrasions began on the front left corner of the headlamp and left front bumper corner, extended rearward 418.0 cm (164.6”), and terminated 11.4 cm (4.5”) forward of the left rear bumper corner. The abrasions involved the entire vertical height of the left front fender, began 10.2 cm (4.0”) above the sill and extended 50.8 cm (20.0”) to the beltline on the left front door. The left A-pillar sustained abrasions, which terminated 45.7 cm (18.0”) above the beltline. Minor longitudinal deflection was present on the leading edge of the left front door and leading edge of the left rear quarter panel. The left front fender, left door, and left rear quarter panel exhibited minor lateral deformation. The sheet metal on the left front fender above the left front wheel was deflected upward and inward from direct vertical contact with the left front tire/wheel. The lateral deflection measured 6.4 cm (2.5”) above the wheel. The left front wheel was displaced rearward, and the rearward displacement resulted in the reduction of the left wheelbase by 5.1 cm (2.0”). The left side mirror was separated.



Figure 7. View of left side abrasions and damage to the left front fender

The Accord sustained moderate damage from the rollover (**Figure 8**). The hood was crushed vertically and buckled at the forward aspect from direct contact with the ground. The vertical crush began 16.5 cm (6.5”) left of the centerline and extended to the front right corner. The vertical hood deformation at the front aspect resulted in a 6.4 cm (2.5”) upward deflection of the right rear corner of the hood. The outboard aspects of the front bumper fascia were partially separated. The leading edge of the right front fender was deflected slightly inward. The roof sustained moderate deformation as a result of the rollover. The windshield was fractured, the left door glazing was partially open, the right door glazing was disintegrated, and the right side door was jammed shut. There were no direct contact abrasions on the roof. The right front corner of the roof and the windshield header were crushed vertically and deformed laterally inboard. The vertical displacement of the roof and windshield header resulted in the vertical and lateral deflection of the right A-pillar. The area around the moon roof was slightly buckled, and the windshield header also sustained lateral buckling. The moon roof was partially retracted but was not fractured. Minor lateral deformation and buckling was present on the right front fender, right door, and right rear quarter panel. The right exterior mirror was separated. The right side sill trim was partially separated at the rear aspect. The right side of the Accord exhibited mud and vine fragments from the field. The CDC for the rollover event was 00-TDDO-3.



Figure 8. Overall view of rollover damage

Interior Damage – 2004 Honda Accord

The 2004 Honda Accord sustained moderate interior damage as a result of the crash. The entire interior surface of the Accord was coated with mud and debris. There were no occupant contacts. The rollover resulted in minor passenger compartment intrusion due to the vertical displacement of the windshield header and right A-pillar. The specific intrusions are as follows:

Position	Intruded Component	Magnitude of Intrusion	Direction
FL	Windshield header	1.3 cm (0.5")	Vertical
FR	Windshield header	4.4 cm (1.8")	Vertical
FR	Right A-pillar	4.4 cm (1.8")	Vertical
FR	Right A-pillar	3.2 cm (1.3")	Lateral
FR	Right roof side rail	3.8 cm (1.5")	Lateral
FR	Roof	3.8 cm (1.5")	Vertical

Manual Restraint Systems – 2004 Honda Accord

The 2004 Honda Accord was configured with manual 3-point lap and shoulder belts for each seating position. The driver’s safety belt (**Figure 9**) was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). The D-ring was fixed. The safety belt was found restricted in the used position at the time of the vehicle inspection, and partially gathered in the forward aspect of the D-ring. A total length of 189.2 cm (74.5") of the webbing was extended between the D-ring and the anchor. The plastic-coated latch plate exhibited minor abrasions consistent with loading, and the webbing exhibited minor rippling that began 92.7 cm (36.5") above the anchor and extended 45.7 cm (18.0") up the webbing.



Figure 9. View of driver's safety belt

The remaining seating positions were configured with manual 3-point lap and shoulder belts with switchable ELR/Automatic Locking Retractors (ALR) and sliding latch plates.

Certified Advanced 208 Compliant Safety System – 2004 Honda Accord

The 2004 Honda Accord was equipped with a Certified Advanced 208-Compliant Compliant Safety System which included dual stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, a front right weight sensor, retractor-mounted safety belt pretensioners, and an Event Data Recorder (EDR). The manufacturer of this vehicle certified that this vehicle meets the requirements of the Advanced 208 Federal Motor Vehicle Safety Standard (FMVSS). An indicator light was present on the upper center instrument panel indicating the active/suppressed status of the front right passenger’s air bag. The frontal air bags did not deploy in this crash. The restricted nature of the driver’s safety belt suggested that the driver’s retractor-mounted pretensioner fired during the crash.

Event Data Recorder

The SRS was removed from the Accord during the vehicle inspection and forwarded to NHTSA for analysis by Honda. The data was sent to NHTSA and was forwarded to the SCI team for inclusion in this report. The Event Data Recorder EDR data indicated that the driver's pretensioner fired during the crash events. The safing sensors noted a crash pulse at 1.0 millisecond but it was not significant to deploy the frontal air bags. The EDR recorded an on time of 146 milliseconds for the inflatable curtain (IC) and the seat back mounted side air bag. Due to the long crash pulse, the data indicated that the 146.0 milliseconds was not from time 0.0 of the crash event and could have been anytime through the roll event.

Side Impact Occupant Protection System – 2004 Honda Accord

The 2004 Honda Accord was equipped with seatback mounted side impact air bags for the driver and front right passenger positions. The side impact sensors were located on the left and right sills near the B-pillars. The front right passenger seat was equipped with a sensor that was linked to a "Side Air Bag" light on the instrument panel. Honda's Occupant Position Detection System (OPDS) utilizes the sensor in the front right seat back to detect the height and seating position of the occupant. If a child of small-statured adult is leaning into the deployment path of the side impact air bag, the system deactivates the air bag. The front right seat was not occupied in this crash. The Accord was also equipped with left and right side Inflatable Curtains (IC's). The IC's utilized low-temperature compressed helium gas (versus nitrogen), and were designed to deploy from the roof side rail and inflate within 15.0 milliseconds. The inflators for each IC were located in the upper aspects of the left and right C-pillars.

The driver's side impact air bag and left IC deployed as a result of the rollover event (**Figure 10**). The driver's side air bag deployed from the outboard aspect of the driver's seat back. The tear seam began at the air bag identifier tab located 5.1 cm (2.0") below the top aspect of the seat back. The tear seam measured 38.1 cm (15.0") in height. A plastic module cover flap was located behind the seatback fabric on the outboard plane of the seat back that measured 20.3 cm (8.0") in height and 7.6 cm (3.0") in width.

The driver's side air bag (**Figure 11**) was semi-circular in shape and measured 34.3 cm (13.5") in height and 30.5 cm (12.0") in length. A 7.6 cm (3.0") diameter circular stitch was present on the air bag, which acted as a tether between both side panels of the air bag. The center of the circular stitch was located 19.1 cm (7.5") rear of the leading edge of the air bag. A small non-inflatable tab that measured 3.8 cm (1.5") in length and 7.6 cm (3.0") in height was attached to the forward aspect of the air bag. The driver's side air bag was located 19.1 cm (7.5") above the driver's seat cushion and the forward excursion from the driver's seat back tear seam measured 26.0 cm (10.3"). There was no



Figure 10. Overall view of the driver's side impact air bag and left side IC



Figure 11. Close-up of deployed driver's side impact air bag

occupant contact evidence on the side impact air bag.

The left side IC deployed downward from the left roof side rail. The separation of the roof side rail trim measured 121.9 cm (48.0”) between the left A-pillar and left C-pillar. The left IC measured 121.9 cm (48.0”) in length and 35.6 cm (14.0”) in height. A 1.3 cm (0.5”) diameter tether was located 12.7 cm (5.0”) below the top of the A-pillar and measured 7.6 cm (3.0”) in length between the left A-pillar and the leading edge of the left IC. A fabric liner that measured 8.9 cm (3.5”) in circumference began at the leading edge of the IC and continued along the headliner. The fabric liner housed the non-deployed IC, and the IC deployed through a tear seam in the bottom aspect of the liner. **Figure 12** illustrates how the IC deployed along the entire height of the left side glazing, and the distance between the bottom of the IC, and the top of the driver’s side impact air bag measured 2.5 cm (1.0”). There was no occupant contact evidence on the left side IC.

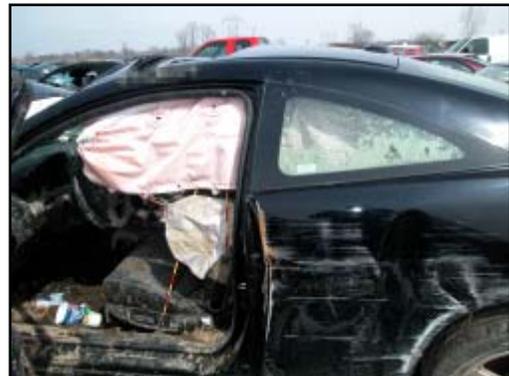


Figure 12. Exterior view of coverage area of the left side IC and driver's side impact air bag

Occupant Demographics

Driver

Age/Sex:	25-year-old female
Height:	Unknown
Weight:	Unknown
Seat Track Position:	Full rear
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	Unknown
Type of Medical Treatment:	PAR indicated transport by ambulance to a local hospital; however, the insurance company stated that she was not treated at a medical facility

Driver Kinematics

The 25-year-old female driver was restrained by the manual 3-point lap and shoulder belt. She was seated in a semi-reclined posture with the seat track adjusted to the full-rear track position. She remained in position after the vehicle’s initial roadside departure, and as the Accord traversed the field. At impact with the ditch bank, the safety belt pretensioner fired, the driver initiated a forward trajectory, and loaded the safety belt. As the Accord began the CW yaw on the roadway surface, she initiated a lateral trajectory to the left. As the Accord rolled over, the driver’s side impact air bag deployed and the left IC deployed. The driver was further displaced to the left and loaded the safety belt and deployed driver’s side impact air bag with her torso. The safety belt exhibited minor abrasions on the plastic-covered latch plate and faint rippling on the shoulder belt webbing as a result of the driver loading throughout the crash sequence. The side impact air bag prevented contact with the interior door and armrest. Her head contacted the deployed IC, which mitigated contact with the left side glazing. She was further displaced as the Accord completed the four quarter-turn rollover, and rebounded to the right as the vehicle came

to rest. The use of the safety belt prevented significant displacement in the interior of the vehicle during the rollover. It was unknown how the driver exited the vehicle. The police report indicated that she was transported by ambulance to a local hospital. However, the insurance company stated that she was not transported to a medical facility, and had complaints of pain and stiffness. All attempts to gain cooperation with the driver have been unsuccessful.

Figure 13 - Scene Schematic.

