

CRASH DATA RESEARCH CENTER

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

CASE NO: CA05-025

VEHICLE: 2005 HONDA ACCORD

LOCATION: PENNSYLVANIA

CRASH DATE: MARCH 2005

Contract No. DTNH22-01-C-17002

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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 investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) frontal air bag system in a 2005 Honda Accord EX. The CAC system consisted of dual-stage frontal air bags for the driver and front right passenger positions, front seat track sensors, safety belt buckle switches and retractor pretensioners, and a front right occupant presence system. The manufacturer of this vehicle has certified the 2005 Accord as meeting the advanced air bag requirements for Federal Motor Vehicle Safety Standard (FMVSS) 208. The Honda was involved in a moderate severity front left corner impact (**Figure 1**) with a 1988 Pontiac Grand Prix that resulted in the firing of the driver's safety belt pretensioner and deployment of the driver's air bag. The belted 46-year old male driver of the Honda sustained a minor severity injury; however, he refused medical treatment. Both vehicles sustained disabling damage and were towed from the scene.



Figure 1. Frontal damage to the 2005 Honda Accord.

The crash was identified from a list of claims that was provided to NHTSA by a major insurance carrier. The Calspan Special Crash Investigations team located the Honda Accord at an insurance salvage yard and was granted permission by the insurance adjustor to inspect the vehicle and remove the Accord's Event Data Recorder (EDR) for download by American Honda. The EDR was forwarded to Honda by NHTSA and the results of the output are summarized in this narrative report. The Honda was inspected on April 22, 2005. The Pontiac was removed from the tow yard prior to the assignment of this case. It could not be located or inspected for this investigation.

SUMMARY

Crash Site

The crash occurred on a two-lane roadway in a posted 40 km/h (25 mph) speed zone during daylight hours. The 3 m (9.8') wide travel lanes were delineated by double yellow centerlines. In the vicinity of the crash site, the roadway was



Figure 2. Eastbound view of the crash site; Honda Accord's approach view.

curved and bordered by a positive

embankment at the south edge and a W-beam guardrail at the north road edge. The radius of curvature was measured at 81.6 m (268'). The roadway had a positive grade to the east of 4 percent. At the time of the crash, the asphalt road surface was police reported as wet. There was no physical evidence remaining at the crash site at the time of the SCI investigation. **Figure 2** is an overall view of the crash site from the Honda's direction of travel. The Scene Schematic is included as **Figure 10** of this report.

Vehicle Data – 2005 Honda Accord EX

The subject vehicle in this crash was a 2005 Honda Accord EX, four-door sedan. The Accord was manufactured on 12/04 and was identified by Vehicle Identification Number (VIN) 1HGCM56825A (production number deleted). The Honda was powered by a transverse mounted 2.4 liter, I4 cylinder engine linked to a five-speed automatic transmission with a console mounted selector lever. The service brakes were power-assisted four-wheel disc with anti-lock (ABS) and Electronic Brake Distribution (EBD). The Accord was equipped with OEM five-spoke alloy wheels and Michelin Energy MXV4 all season tires, size P205/60R16. The specific tire and wheel data at the time of this SCI inspection is identified in the following table:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	214 kPa (31 PSI)	7 mm (9/32")	None
Left Rear	207 kPa (30 PSI)	7 mm (9/32")	None
Right Front	221 kPa (32 PSI)	7 mm (9/32")	None
Right Rear	200 kPa (29 PSI)	7 mm (9/32")	Wheel rim gouged by impact

The interior of the Accord was configured with the optional leather seats and door panels. The seating consisted of front bucket seats with adjustable head restraints and a three-passenger rear bench with forward folding seat backs. The outboard rear positions were equipped with adjustable head restraints. All head restraints were adjusted to the full down positions. Aftermarket seat covers were installed on the front bucket seats that wrapped around the sides and face of the seat cushions and seat backs. In addition to the aftermarket seat covers, the driver's seat had a plastic garbage bag placed over the seat back. Both front seats were adjusted to the full rear track positions. The driver's seat was power adjusted while the front right passenger seat was manually adjustable.

Vehicle Data - 1988 Pontiac Grand Prix

The 1988 Pontiac Grand Prix involved in this crash was identified by VIN 1G2WK14W0JF (production number deleted). The vehicle was a two-door coupe powered by a transverse mounted 2.8 liter V-6 engine with front wheel drive. The Pontiac was removed from the tow yard prior to this SCI case assignment. It could not be located for inspection.

Crash Sequence

Pre-Crash

The driver of the 2005 Honda Accord was traveling in an easterly direction on the two-lane roadway, negotiating the right curve with a positive grade. The driver of the 1988 Pontiac Grand Prix was westbound on the roadway and was traveling at a police reported high-rate of speed for the conditions and the curvature of the roadway (**Figure 3**). As the driver of the Pontiac attempted to negotiate the left curve, he lost control on the wet asphalt. The vehicle initiated a counterclockwise yaw and crossed into the opposing travel lane, into the path of the Honda Accord. The driver of the Honda steered right and applied the brakes in an attempt to avoid the impact.



Figure 3. Westbound trajectory view of the Pontiac Grand Prix.

Crash

The front right corner area of the Pontiac impacted the front left corner area of the Honda Accord. Based on this configuration, the Pontiac probably rotated beyond 90 degrees CCW prior to impact. The directions of force for this impact were within the 12 o'clock sector for the Honda and probably within the 3 o'clock sector for the Pontiac. The Honda's EDR recorded a longitudinal velocity change of -21 km/h (-12.8 mph). The Missing Vehicle algorithm of the WinSMASH program computed a total velocity change of 10 km/h (6.2 mph) for the Honda with longitudinal and lateral components of -10 km/h (-6.2 mph) and 2 km/h (0.8 mph) respectively. As a result of this impact, the Honda's CAC driver's air bag deployed.

The lateral impact to the Pontiac, located forward of its center of gravity, accelerated its CCW rotation. The right rear quarter area of the Pontiac impacted the left rear side area of the Honda in a side slap configuration. Although this impact was a side slap, the Pontiac snagged the left rear tire of the Honda, deflecting the axle position CCW to a steer angle of approximately 12 degrees. The maximum crush was 13 cm (5") located on the rear quarter panel of the Honda. The direction of force for this impact was 9 o'clock. This impact triggered the deployment of the left side impact air bag and the left side curtain air bag. Due to the minor severity of damage and the snagging of the left rear tire, this crash event was outside the scope of the WinSMASH reconstruction program.

Post-Crash

The Honda came to rest near the point of impact, straddling the south edge line. The Pontiac continued to rotate CCW before coming to rest diagonal to the westbound travel lane, east of the point of impact. At rest, the Pontiac was facing in a southeasterly direction. Both drivers exited their respective vehicles unassisted and refused medical treatment. The involved vehicles sustained disabling damage and were towed from the scene.

Vehicle Damage

Exterior – 2005 Honda Accord

The 2005 Honda Accord sustained moderate severity front right damage as a result of the initial engagement with the Pontiac Grand Prix and moderate severity left side damage from the subsequent side slap. The vehicle was considered a total loss by the insurance company for the Pontiac.

The direct contact damage on the frontal plane began 21 cm (8.25”) left of center and extended 56 cm (22”) to the front left corner (**Figure 4**). The impact involved the bumper system, hood, left headlamp assembly and the left front fender. The leading edge of the left front fender was contacted and crushed. The large headlamp assembly consumed the majority of this area. Maximum bumper crush was 8 cm (3”) located on the bumper beam 24 cm (9.5”) left of center (**Figure 5**). At this location, the beam buckled from the corner impact sequence. The crush profile was documented at the level of the bumper beam over its width of 112 cm (44”). The crush profile was as follows: C1 = 5 cm (2”), C2 = 6 cm (2.25”), C3 = 2 cm (0.75”), C4 = 0 cm, C5 = 0 cm, C6 = 0 cm. The Collision Deformation Classification (CDC) for this event was 12-FYEW-1.



Figure 4. Frontal view of the front right corner damage to the Honda Accord.



Figure 5. Lateral view identifying the extent of frontal crush and left side contact.

The Pontiac disengaged the Honda as it continued to rotate in a counterclockwise (CCW) direction. The right rear quarter panel area side slapped the left rear side area of the Honda (**Figure 6**). The direct contact damage began on the left rear door, 34 cm (13.5”) aft of the B-pillar and extended 173 cm (68”) rearward onto the left rear quarter panel and the side of the rear bumper fascia. The impact also involved the left rear tire and wheel as the axle position was deflected in a CCW direction resulting in a steer angle of approximately 12 degrees. The total length of direct and induced damage was 173 cm (68”).



Figure 6. Left rear side damage to the Honda Accord.

The majority of the side slap impact was absorbed by the left rear axle. Maximum lateral crush was 13 cm (5") located at the trailing edge of the left rear wheel opening. The crush profile at the level of the rub strip was as follows: C1 = 0 cm, C2 = 4 cm (1.5"), C3 = 13 cm (5"), C4 = 5 cm (2"), C5 = 0 cm, C6 = 0 cm. The 0 cm points involved paint transfers. The CDC for this event was 09-LZEW-1.

Interior – 2005 Honda Accord

The interior of the Honda Accord sustained minor severity damage as a result of air bag deployment and minimal driving loading evidence. There was no intrusion of the interior compartment. The driver's space was muddy from pre-crash activity by the driver. A plastic garbage bag was placed over the aftermarket seat cover on the driver's seat. As the left front side impact air bag deployed, the bag deployed through the aftermarket seat cover and plastic bag. The headliner was deformed from the deployment of the left side curtain air bag. The driver's frontal air bag deployed as designed through the air bag module cover flaps.



Figure 7. Lateral view of the driver's compartment and the deployed air bags.

The driver loaded the manual safety belt during the crash. Additional loading of the belt was applied by the firing of the retractor pretensioner. The latch plate was abraded from his loading against the belt webbing. There was no other interior contact evidence within the vehicle.

Certified Advanced 208-Compliant Frontal Air Bag System

The CAC frontal air bag system consisted of dual stage air bags for the driver and front right passenger positions, seat track positioning sensors, safety belt retractor pretensioners with buckle switches, and a front right occupant presence sensor incorporated into the seat cushion. The manufacturer of this vehicle has certified that the Accord meets the advanced air bags requirements for FMVSS 208. The driver was the sole occupant of the vehicle, therefore the driver's air bag deployed and the front right air bag was suppressed due to the unoccupied position. The driver's air bag deployed from an H-configuration module cover. Both rectangular flaps measured 12 cm (4.75") in width at the horizontal tear seam. The vertical height of the upper flap was 8 cm (3") while the lower flap was 6 cm (2.5"). The driver's air bag measured 58 cm (23") in diameter (**Figure 8**) in its deflated state and was tethered by two internal straps at the 2 and 6 o'clock positions. The air bag was vented by



Figure 8. Deployed front left CAC air bag.

two 4 cm (1.75") diameter ports located at the top of the bag, 15 cm (6") forward of the peripheral seam. The driver's air bag was stamped with the following nomenclature:

2401994
PE04827J05T
23 11 04
S
Assembled in Mexico
of USA Components

Side Impact Air Bag System

The Honda Accord was equipped with seat mounted side impact air bags in the front positions and Inflatable Curtain (IC) air bags that offered protection to the four outboard seated positions. The left side impact air bag and the left IC deployed as a result of the secondary left side impact (**Figure 9**). The seat mounted side impact air bag deployed through the OEM leather seat cover, plus through the side surface of the aftermarket seat cover and the plastic garbage bag that was placed over the aftermarket cover. The latter two covers were torn in the area of deployment and did not impede the deployment of the air bag. The OEM seat cover was torn vertically 36 cm (14.25").



Figure 9. Deployed left side impact air bag and IC.

The left side impact air bag was a thoracic bag that measured 25 cm (10") in length and 37 cm (14.75") in height (deflated). Two 6 mm (0.25") diameter vent ports were located on the inboard face of the bag and circled with a stitch pattern. The torso side air bag was not tethered. There was no driver contact evidence on the air bag or damage associated with deployment.

The left IC deployed from the left roof side rail area by expanding and separating the headliner from the side rail. The overall dimensions of the left IC air bag were 38 cm (15") vertically and 163 cm (64") in length. Based on the inspection of the IC, the rectangular IC had three inflation chambers, one in the area of the driver's position that measured approximately 41x43 cm (16x17") vertically x horizontally; a second that was 15 cm (6") wide located aft of the B-pillar; and a third at the area of the rear seat position. This chamber was 24 cm (9.5") in height and 33 cm (13") in length. There was no damage or driver contact evidence to this IC bag. It was stamped with the following nomenclature:

2404275
Honda
22 11 04 G
S
Assembled in Mexico of US Components

Event Data Recorder

The 2005 Honda Accord was equipped with an Event Data Recorder (EDR) that was incorporated in the vehicle’s air bag control module. This unit was located on the center tunnel forward of the transmission shifter within the passenger compartment of the vehicle. The Calspan SCI team obtained permission from the insurance company to remove the EDR for download purposes. The unit was removed from the Accord and forwarded to NHTSA for download by American Honda. The output data was provided to the Calspan SCI team and is summarized as follows:

The driver’s seat belt status was belted as the front right position was classified as empty. The driver’s pretensioner was commanded to fire. The driver’s frontal CAC air bag deployed as a Stage 2 deployment at 11 ms of Algorithm Enable. The left side crash sensor was activated to “On” during the side engagement event which deployed the side impact air bag and left IC. The Honda reported corrected delta V was 33 km/h (12.8 mph). A single delta V was recorded by the EDR which was associated with the frontal event.

Manual Safety Belt Systems – 2005 Honda Accord

The Honda Accord was equipped with continuous loop 3-point lap and shoulder belts with sliding latch plates for the five designated positions. The two front positions were equipped with adjustable D-rings. The driver’s side D-ring was adjusted to the full-up position while the front right was in the full-down position. The driver’s belt retracted onto an Emergency Locking Retractor (ELR) while the remaining belts were equipped with switchable ELR/Automatic Locking Retractors (ALR). All retractors had the belt sensitive feature which locked the webbing during rapid spool-out. The front safety belt systems were also equipped with retractor pretensioners. The driver’s pretensioner fired as a result of the crash. The driver loaded the manual safety belt system during the frontal engagement. Belt loading evidence consisted of frictional abrasions on both side of the sliding latch plate.

Driver Demographics/Data

Age/Sex:	46-year old/Male
Height:	Not reported
Weight:	Not reported
Seat Track Position:	Full rear track
Manual Safety Belt Usage:	3-point lap and shoulder belt system
Usage Source:	Vehicle inspection
Eyewear:	None
Egress from Vehicle:	Exited vehicle unassisted through left front door
Mode of Transport from Scene:	Private vehicle
Type of Medical Treatment:	None, refused treatment

Driver Injuries

Injury	Injury Severity (AIS90/Update 98)	Injury Source
Unknown minor injury	Unknown	Unknown

Source – Police Accident Report

Driver Kinematics

The driver of the 2005 Honda Accord was muddy as he entered the vehicle prior to this crash. He attempted to protect the interior by installing an aftermarket seat cover which fit over the cushion, seat back, and the side surfaces. In addition, he placed a plastic garbage bag over the seat back and the aftermarket cover. He was seated in a rear track position with the head restraint adjusted to a full-down position. The driver was restrained by the manual 3-point lap and shoulder belt system. Belt usage was determined by the fired retractor pretensioner and loading abrasions on the latch plate.

The CAC driver’s frontal air bag deployed as a result of the initial impact event. In response to this impact, the driver initiated a forward trajectory and loaded the manual safety belt webbing. This was evidence by frictional abrasions on both sides of the latch plate from belt tensioning. The combination of deployed air bag and safety belt use prevented the driver from contact with frontal components.

The secondary side slap impact deployed the left side impact air bag and the left IC. The driver responded to this impact by moving laterally to his left and contacting the left side impact air bag and IC during the event. He complained of a minor injury to the investigating officer, but declined medical treatment. The combination of safety belt usage and the deployment of multiple air bags offered the driver maximum crash protection.

Figure 10 – Scene Schematic

