CRASH DATA RESEARCH CENTER

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

CASE NO.: CA04-019

LOCATION: STATE OF GEORGIA

VEHICLE: 2004 HONDA ACCORD

CRASH DATE: MARCH 2004

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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 on-site investigative effort focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system that was present in a 2004 Honda Accord sedan. The 2004 Honda Accord was equipped with dual stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, a front right weight sensor, safety belt buckle switches, retractor-mounted safety belt pretensioners, and an Event Data Recorder (EDR). The Accord was occupied by a 21-year-old restrained female driver. The driver was operating the Accord on the outboard southbound lane of an eight-lane divided highway during daylight hours. The police reported that the driver initiated a lane change maneuver and lost control of the vehicle. The Accord traveled across the four southbound travel lanes and struck an extended-height Jersey median barrier with the front aspect of the vehicle. The impact was sufficient to deploy the driver's air bag and safety belt pretensioner in the Accord. The driver of the Accord sustained a police-reported complaint of pain, but did not receive medical treatment and was not transported to a medical facility.			
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BACKGROUND

This on-site investigative effort focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system that was present in a 2004 Honda Accord sedan **(Figure 1)**. The 2004 Honda Accord was equipped with dual stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, a front right weight sensor, safety belt buckle switches, retractor-mounted safety belt pretensioners, and an Event Data Recorder (EDR). The Accord was occupied by a 21-year-old restrained female driver. The driver was operating the Accord on the outboard southbound lane of an eight-lane divided highway during daylight hours. The police reported that the driver initiated a lane change maneuver and lost control of the vehicle. The Accord traveled across the four southbound travel lanes and struck an extended-height Jersey median barrier with the front aspect of the vehicle. The impact was sufficient to deploy the driver's air bag and safety belt pretensioner in the Accord. The driver of the Accord sustained a police-reported complaint of pain, but did not receive medical treatment and was not transported to a medical facility.

Figure 1. Damaged 2004 Honda Accord

This crash was identified through a list of claims from an insurance company that identified Certified Advanced 208-Compliant vehicles that had been involved in crashes. The list was forwarded to the General Dynamics Special Crash Investigations team for follow-up and location of the vehicles. The 2004 Honda Accord was located and cooperation was established with the insurance adjuster. An on-site investigation was assigned to the General Dynamics SCI team on April 20, 2004 due to the presence of the Certified Advanced 208-Compliant system and the deployment of the driver's frontal air bag. The EDR was retrieved during the vehicle inspection and was forwarded to Honda by NHTSA for analysis. The EDR summary information was received from NHTSA on May 10th.

VEHICLE DATA – 2004 HONDA ACCORD

The 2004 Honda Accord was identified by the Vehicle Identification Number (VIN): 3HGCM56394G (production sequence omitted). The vehicle was a front-wheel-drive, four-door sedan that was equipped with a 2.4 liter, 4-cylinder engine, a five-speed automatic transmission, cruise control, and power-assisted front disc/rear drum brakes with Anti-Lock Braking System (ABS). The Accord was also configured with variable-assist power steering, a tilt steering column, and power windows and door locks. The Accord was equipped with Michelin Energy MXV4 P205/65R15 tires. The manufacturer's recommended tire pressure was 210 kpa (30 psi) for the front tires and 200 kpa (29 psi) for the rear tires. The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	237.9 kpa (34.5 psi)	7.1 mm (9/32”)	Yes	None
LR	234.4 kpa (34.0 psi)	7.9 mm (10/32”)	No	None
RF	234.4 kpa (34.0 psi)	7.1 mm (9/32”)	No	None
RR	237.9 kpa (34.5 psi)	7.9 mm (10/32”)	No	None

The 2004 Honda Accord was configured with front bucket seats with adjustable head restraints. The driver’s head restraint was located 3.8 cm (1.5”) above the seat back at the time of the vehicle inspection and the front right head restraint was in the full-down position. The driver’s seat was configured with a manual track adjustment, and was located in the full-rear track position at the time of the inspection. Based on abrasions from the safety belt webbing on the lower outboard aspect of the seat trim, it appeared the seat may have been adjusted to a mid-track position at the time of the crash. The front right passenger’s seat was 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 daylight hours of March 2004 in the state of Georgia. At the time of the crash, the weather was clear and the asphalt roadway surface was dry. The crash occurred on the southbound lanes of an eight-lane divided highway **(Figure 2)**. The north/south travel lanes were separated by an extended-height Jersey median barrier that was approximately 178 cm (70”) in height. Each of the four southbound travel lanes measured 3.7 m (12.0’) in width and were bordered by asphalt shoulders and Continuous Shoulder Rumble Strips (CSRS). The roadway was straight and level at the crash site and the posted speed limit was 105 km/h (65 mph). Due to traffic flow, a scale scene schematic was not constructed. An approximated scene schematic is included as **Figure 10** of this narrative report.

Figure 2. View of crash site

CRASH SEQUENCE

Pre-Crash

The 21-year-old female driver was operating the vehicle in a southbound direction on the outboard southbound travel lane **(Figure 3)**. The pre-crash travel speed was unknown. Police indicated that the driver may have initiated a lane change maneuver and lost control of the vehicle. The Accord traveled to the left across the four southbound travel lanes in a slight counterclockwise (CCW) yaw toward the extended-height Jersey median barrier **(Figure 4)**. According to the Police Accident Report (PAR), police documented 11.9 m (39.0') of pre-impact tire marks from the Accord.

Figure 3. Approach from outboard travel lane

Figure 4. Approach across the travel lanes and point of impact

Crash

The front aspect of the Accord impacted the concrete median barrier. Due to the vehicle's yaw and probable pre-crash speed, the Accord quickly rotated counterclockwise (CCW) as it engaged the barrier. The impact was sufficient to deploy the driver's safety belt pretensioner and driver's frontal air bag. According to the Crash Information Summary downloaded by Honda from the Accord's Supplemental Restraint System (SRS) module, the left side and right side front crash sensors triggered simultaneously at 1 millisecond. The output also indicated that the impact seemed severe, as the Time to Fire from the trigger was approximately 8 milliseconds, and with a belted condition, the system commanded the air bag deployment simultaneously with the pretensioner. The calculated delta-V from the SRS unit was reported to be 46.2 km/h (28.7 mph). The delta-V calculated from the SRS unit appeared high, considering the lack of injury to the driver. The damage algorithm from the WinSMASH program computed a total delta-V of 27.0 km/h (16.8 mph) based on the documented frontal crush profile. The longitudinal and lateral components were –17.4 km/h (-10.8 mph) and –20.7 km/h (-12.9 mph), respectively. The damage algorithm of the WinSmash program under estimated the longitudinal component of the delta-V. The Accord was deflected in a CCW rotation from the median barrier, although the specific attitude of final rest was not reported.

Post-Crash

It was not known how the driver exited the Honda Accord. The PAR indicated that she had an injury complaint, but did not receive medical treatment. Multiple attempts to locate the driver were unsuccessful.

VEHICLE DAMAGE

Exterior Damage – 2004 Honda Accord

The 2004 Honda Accord sustained moderate frontal damage as a result of the impact with the concrete median barrier **(Figure 5)**. The direct contact damage on the leading edge of the hood began 22.9 cm (9.0") left of center and extended 111.8 cm (44.0") to the front right corner. Although the bumper fascia was separated, the left corner of the bumper beam sustained deformation consistent with direct contact across the entire frontal width. The leading edge of the hood sustained longitudinal buckling, abrasions, and displacement to the left. Lateral abrasions were present on the right headlamp. Due to the lateral component of the direction of force, and CCW rotation as the Accord engaged the concrete barrier, the frontal structure was shifted to the left. **Figure 6** illustrates the lateral displacement of the bumper beam to the left, which measured 36.8 cm (14.5"). The leading edge of the right front fender was crushed and displaced to the left from direct contact. The combined direct and induced damage to the front of the Accord involved the entire frontal width of the vehicle and measured 114.3 cm (45.0") along the bumper beam. The left front fender was bowed outward. The frontal crush displaced the left front wheel rearward, which resulted in the reduction of the left wheelbase by 11.0 cm (4.3"). Six crush measurements were documented along the front bumper beam and were as follows: C1 = 22.9 cm (9.0"), C2 = 24.1 cm (9.5"), C3 = 26.7 cm (10.5"), C4 = 27.9 cm (11.0"), C5 = 22.2 cm (8.8"), C6 = 13.3 cm (5.3"). The Collision Deformation Classification (CDC) for the impact with the median barrier was 02-FDEW-2.

Figure 5. Right front view of the damaged 2004 Honda Accord

Figure 6. View of frontal damage showing end shift

The Honda Accord exhibited a lateral abrasion on the face of the rear bumper fascia. It was unknown if it was related to this crash.

Interior Damage – 2004 Honda Accord

The 2004 Honda Accord sustained minor interior damage as a result of the crash. There was no damage to the vehicle glazing or windshield. There was no passenger compartment. The rear view mirror was separated from the windshield mount and was found on the front right seat at the time of the vehicle inspection. The rear view mirror may have been deflected by the right arm of the driver as a result of a fling from the air bag deployment. The headliner at the windshield header was scuffed as a result of contact with the top left aspect of the rear view mirror as it was displaced in a clockwise (CW) direction. The scuff mark began 5.7 cm (2.3") left of the centerline and extended 5.1 cm (2.0") to the left.

An abrasion from the driver's safety belt webbing **(Figure 7)** was present on the outboard aspect of the plastic trim on the driver's seat cushion. The abrasion measured 9.5 cm (3.8") in width and 11.4 cm (4.5") in height. The abrasion began 3.8 cm (1.5") forward of the rear edge of the seat cushion and was located 2.5 cm (1.0") above the bottom aspect of the trim.

Figure 7. View of abrasion from driver's safety belt webbing

MANUAL RESTRAINTS – 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 8)** was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). The adjustable D-ring was located in the full-down position. The safety belt was found restricted in the used position at the time of the vehicle inspection. A total length of 156.2 cm (61.5") 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 73.7 cm (29.0") above the anchor and extended 16.5 cm (6.5") up the webbing. A plastic transfer from the plastic-coated D-ring was present on the rear inboard aspect of the webbing that measured 5.7 cm (2.3") in height and 1.3 cm (0.5") in width. The transfer was located immediately below the D-ring.

Figure 8. Driver's safety belt

The remaining seating positions were configured with switchable ELR/Automatic Locking Retractors (ALR) and sliding latch plates.

CERTIFIED ADVANCED 208-COMPLIANT SAFETY SYSTEM (CAC)

Frontal Air Bag System – 2004 Honda Accord

The 2004 Honda Accord was equipped with an Advanced 208-Compliant Advanced Occupant Protection 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). 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 driver's air bag deployed from the steering wheel hub as a result of the impact with the extended-height Jersey barrier. The driver's air bag module was configured with H-configuration cover flaps. The top flap measured 12.1 cm (4.8") in height, the bottom flap measured 6.4 cm (in height), and the tear seam measured 12.1 cm (4.8") in width. Two pliable, symmetrical, I-configuration vinyl flaps were present behind the exterior module cover flaps **(Figure 9)**. Each secondary flap measured 10.5 cm (4.1") in height, 5.1 cm (2.0") in width, and extended to a vertical fold at the outboard aspects of the module. The flaps wrapped around and continued an additional 5.1 cm (2.0") in a forward direction along the side aspects of the module. Each flap exhibited two 1.9 cm (0.8") wide tabs on the leading edges. The driver's air bag measured 61.0 cm (24.0") in diameter in its deflated state. A small makeup transfer that measured 7.0 cm (2.8") in width and 5.7 cm (2.3") in height was located on the face of the air bag 12.7 cm (5.0") left of the vertical centerline and extended upward from the horizontal centerline. Two faint red linear transfers, possibly makeup, were present on the upper right quadrant of the air bag face, 3.2 cm (1.5") and 1.3 cm (0.5") right of the vertical centerline. The transfers were located 19.1 cm (7.5") and 11.4 cm (4.5") above the horizontal centerline, and measured 2.5 cm (1.0") and 0.6 cm (0.3") in height, respectively. A series of linear blue fabric transfers were located 3.5 cm (1.4") left of the vertical centerline and 12.7 cm (5.0") below the horizontal centerline. The transfers measured 5.7 cm (2.3") in height and 3.8 cm (1.5") in width. A faint, curved, linear blue fabric transfer was present on the bottom rear aspect of the air bag. The transfer began 4.4 cm (1.8") left of the vertical centerline and measured 7.0 cm (2.8") in width. The air bag was vented by two circular ports that measured 4.4 cm (1.8") in diameter and were located at the 11 and 1 o'clock positions on the rear of the air bag. The vent ports were laterally spaced 12.7 cm (5.0") apart and located 14.0 cm (5.5") from the peripheral seam. The air bag was tethered by two internal straps located at the 12 and 6 o'clock positions, which measured 7.0 cm (2.8") in width.

Figure 9. Close-up of secondary vinyl module flaps

Figure 10. Deployed driver's air bag

The front right passenger's air bag was located on the upper right instrument panel. The front right passenger's air bag did not deploy in the crash, as the front right seat was unoccupied.

The restricted nature of the driver's safety belt suggested that the driver's retractor-mounted pretensioner fired during the crash, which was confirmed by the EDR summary.

Occupant Sensing System – 2004 Honda Accord

The CAC safety system was configured with a weight sensor in the front right seat cushion. The system was designed to detect occupant presence and automatically suppress the front right passenger's air bag if it detected a weight consistent with a child seat, a booster seat, or a child

sitting in the front seat, or it if determined that the front seat was empty. The air bag on/off status could be confirmed by a light on the upper center instrument panel. Since the front right seat was not occupied and the safety belt buckle was not engaged, the CAC system suppressed the front right passenger's air bag. Both front seat positions were also equipped with seat track position sensors, which adjusted the air bag deployment level if the seat was in a forward track position.

Event Data Recorder (EDR) – 2004 Honda Accord

The Honda Accord's EDR was retrieved from the vehicle during the vehicle inspection, forwarded to Honda by NHTSA for analysis, and received from NHTSA on May 10th. The Data Retrieval and Analysis highlighted the information that was recorded in the Supplemental Restraint System (SRS) unit for the concrete barrier impact, which was sufficient to deploy the driver's air bag and safety belt pretensioner. The data indicated that the driver's safety belt was engaged and that the driver's pretensioner fired simultaneously with the driver's air bag deployment. The SRS ECU "ON" Time of 2 milliseconds, was interpreted as a severe impact, as with a belted condition, the system commanded the air bag deployment simultaneously with the firing of the pretensioner. In addition, the interpretation of the simultaneous 1 millisecond left and right Front Crash Sensor "ON" Times, was that the impact to the front of the vehicle appeared to have been almost 'flat.' The Time To Fire estimation from the initial trigger (time 0), was 8 milliseconds, which was interpreted as a high severity crash. According to the summary, the delta-V was calculated as 46.2 km/h (28.7 mph).

There was no pre-crash data provided in the Crash Information Summary.

OCCUPANT DEMOGRAPHICS

Driver

Age/Sex:	21-year-old female
Height:	Not currently available
Weight:	Not currently available
Seat Track Position:	Mid-track, 11.4 cm (4.5") forward of full rear and 12.1 cm (4.8") rear of full-forward
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection, EDR summary
Eyewear:	Not currently available
Type of Medical Treatment:	Sustained a police-reported complaint of pain but did not receive medical treatment or transportation to a medical facility

Driver Kinematics

The 21-year-old female driver of the 2004 Honda Accord was operating the vehicle in a presumed upright posture. Based on post-crash abrasions from the safety belt on the outboard trim of the driver's seat cushion, it appeared that the driver's seat was adjusted to 11.4 cm (4.5") forward of full rear and 12.1 cm (4.8") rear of full-forward; approximately a mid-track position. The driver was restrained by the manual 3-point lap and shoulder belt. At impact with the extended-height Jersey barrier, the safety belt pretensioner fired and the driver's air bag deployed simultaneously. The driver initiated a forward and lateral trajectory to the right in response to the 2 o'clock direction of force. She loaded the safety belt, evidenced by D-ring abrasions and latch plate abrasions. She contacted the deployed air bag with her face, evidenced by minor makeup transfers on the upper quadrants of the air bag face, and faint fabric transfers on the lower quadrants. She rebounded rearward and to the left as the Accord deflected off of the median barrier and rotated counterclockwise (CCW) to rest. It was not known how the driver exited the vehicle. She sustained a police-reported complaint of pain but did not receive medical treatment or transportation to a medical facility. Attempts to contact the driver by telephone and written correspondence were unsuccessful.

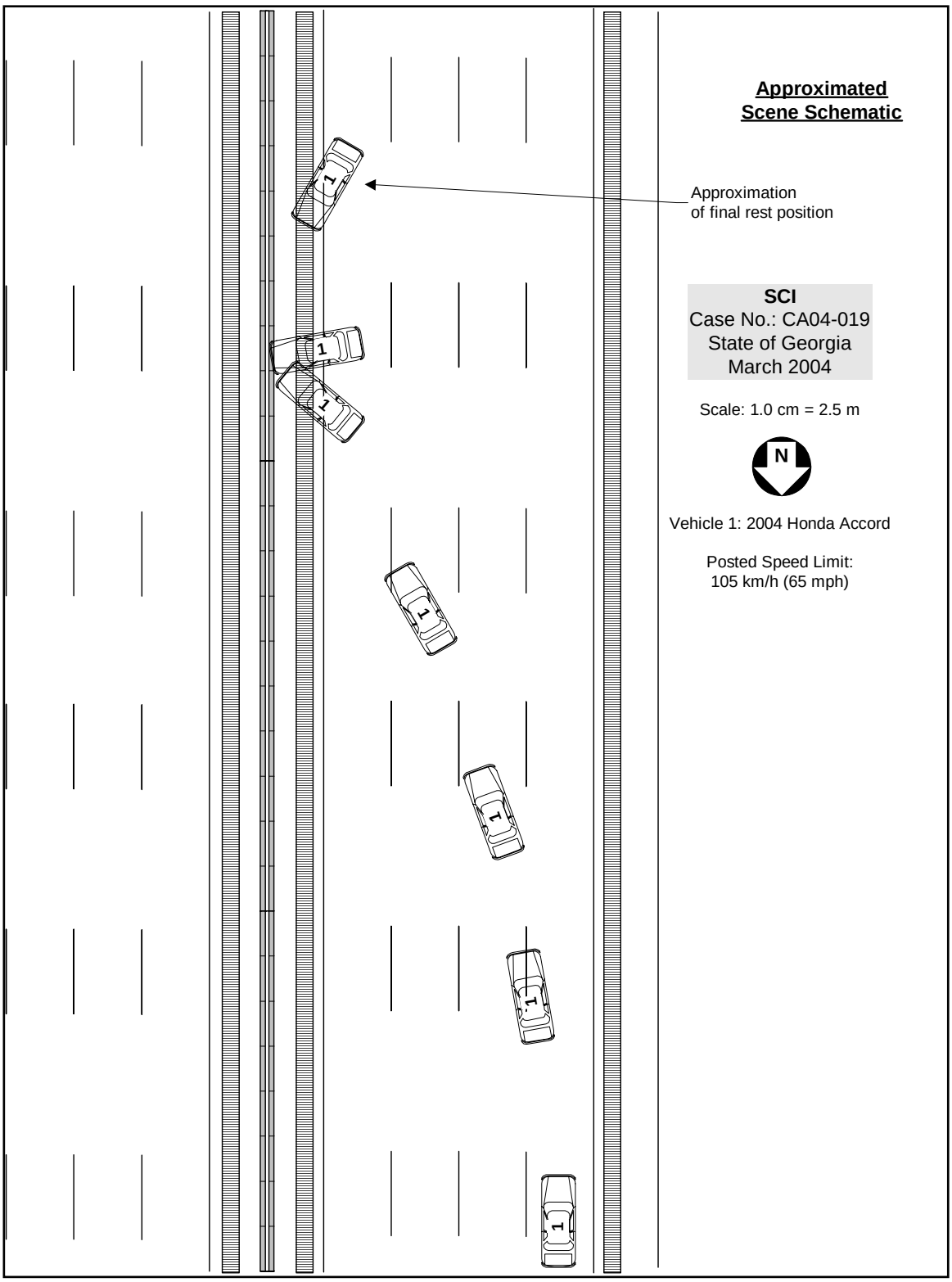

Figure 10. Scene schematic (approximated)