CRASH DATA RESEARCH CENTER

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

SCI CASE NO. – CA08007

VEHICLE – 2007 HONDA CIVIC

LOCATION - STATE OF TENNESSEE

CRASH DATE – DECEMBER 2007

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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 Certified Advanced 208-Compliant (CAC) safety system in a 2007 Honda Civic **(Figure 1)**. 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 CAC safety system consisted of dual stage frontal air bags, an occupant presence sensor for the front right seat, and safety belt buckle switch sensors to monitor belt usage. Additionally, the vehicle was equipped with dual pretensioners mounted on the retractor and buckle for the front seating positions. A restrained 23-year-old female driver occupied the Honda. The Honda was involved in a front-to- rear collision with a 2006 Ford F550 medium heavy truck. As a result of the crash, the driver's dual pretensioners actuated and the driver's frontal air bag deployed in the Honda. The driver of the Honda sustained an abrasion to the left side of the neck and a left hip contusion. These injuries resulted from her loading the safety belt system and were identified during the SCI interview. The driver was not medically treated for these soft tissue injuries.

Figure 1. 2007 Honda Civic.

This crash was identified by the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA) through the review of Police Accident Reports (PAR's) that were submitted by the National Automotive Sampling System (NASS). The PAR identified the CAC Honda that had been involved in a crash. The PAR was forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up investigation on February 15, 2008. The Honda was located at an insurance auction facility and cooperation was established with the facility to inspect the vehicle. The Honda was equipped with an Event Data Recorder (EDR); however, the insurance company refused permission to remove the EDR to facilitate a download by the Honda Motor Company. An on-site investigation was assigned to the Calspan SCI team on February 18, 2008. The vehicle and crash site were inspected on February 25, 2008 and the driver interview was obtained on April 2, 2008. The Ford was not inspected as it was repaired prior to the assignment of the case. Images of the damaged and repaired Ford were sent by the owner to the SCI investigator for inclusion in the case data.

SUMMARY

Crash Site

This front-to-rear crash occurred during the nighttime hours of December 2007. At the time of the crash it was cloudy and the asphalt road surface was dry. The crash occurred north of a T-intersection. The north and south legs of the intersection were configured with two travel lanes in each direction that were delineated by a grass median. Immediately north of the crash site, a left turn lane was available for turning traffic. The east and westbound lanes were configured with one travel lane in each direction that were not separated. The posted speed limit for the north/southbound roadway was 72 km/h (45 mph). The scene schematic is included as **Figure 11** of this report.

Vehicle Data – 2007 Honda Civic EX

The 2007 Honda Civic was identified by the Vehicle Identification Number (VIN): 1HGFA16857 (production sequence deleted) and was manufactured in 12/06. The electronic odometer reading at the time of the SCI inspection was unknown due to the expended vehicle battery. The driver stated to the SCI investigator that the mileage was approximately 40,000 km/h (25,000 miles). The Civic was a four-door sedan that was equipped with a 1.8-liter, four cylinder engine, 5-speed automatic transmission, front-wheel drive, power-front and rear disc brakes with anit-lock, and a tilt steering wheel. The Honda was equipped with Bridgestone Turanza tires, size P215/55R16 mounted on five-spoke OEM alloy wheels. The vehicle manufacturer recommended front and rear tire pressure was 221 kPa (32 PSI). The specific tire data at the time of the SCI inspection was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	200 kPa (29 PSI)	4 mm (5/32)	No	None
LR	165 kPa (24 PSI)	4 mm (5/32)	No	None
RF	172 kPa (25 PSI)	3 mm (4/32)	No	None
RR	186 kPa (27 PSI)	3 mm (4/32)	No	None

The seating positions in the Honda were configured with cloth upholstered front bucket seats with height adjustable head restraints. At the time of the SCI inspection, the front head restraints were adjusted to the full-down position. The second row was configured with a three-passenger split bench seat (60/40) with height adjustable head restraints. The outboard head restraints were adjusted to the full-down position and the center was adjusted 4 cm (1.5”) above the seatback.

2006 Ford F550

The 2006 Ford F550 contained the following VIN: 1FDAF57P17E (production number omitted). The Ford was a medium/heavy truck with a Gross Vehicle Weight Rating of 7,258 – 8,845 kg (16,001 – 19,500 lbs). The Ford was manufactured as an incomplete vehicle built on a full length frame with a pickup truck cab. The traditional bed area contained several storage compartments and a hydraulic lift bucket. This vehicle was owned by a utility company and was used to service power lines. The Ford was repaired prior to the case assignment; however, images of the damage and the repaired vehicle were sent to the SCI investigator for analysis and inclusion in this case. These images will be used for approximation of the damage.

Crash Sequence

Pre-Crash

The driver of the Honda was operating the vehicle northbound in the inboard lane. A 42-year-old male was operating the 2006 Ford F550. The Ford was entering the travel lanes from the shoulder. The driver of the Honda stated during the interview that as she neared the intersection, the Ford began to changes lanes from right to left into the inboard lane. A witness to the crash reported to the police investigator that he followed the Honda and noted that he did not observe any avoidance actions (i.e. brake lights). The crash scene images were taken in the inboard lane based on the police reported information at the time of the SCI investigation. **Figure 2** is a northbound view of the roadway.

Figure 2. Northbound view of the roadway from the outboard lane.

Crash

The front of the Honda impacted the rear of the slower moving Ford in the inboard lane approximately 15 meters (49 feet) north of the T-intersection. The front of the Honda underrode the rear of the Ford due to the height disparity of the vehicles. This impact resulted in a direction of force of 12 o'clock for the Honda and 6 o'clock for the Ford. Although, the Ford is beyond the scope of the WINSAMSH program, the barrier equivalent algorithm was used to calculate an approximate delta-V. Additionally, the average crush from the bumper beam and upper radiator support of the Honda were used for this calculation. The calculated Barrier Equivalent Speed (BES) for this crash was 25 km/h (15.5 mph).

Both vehicles came to rest north of the point of impact. As a result of the crash, the driver's dual pretensioners actuated and the frontal air bag deployed.

Post-Crash

Police and Emergency Medical Services (EMS) personnel responded to the crash site. The driver of the Honda sustained soft tissue injuries; however, she refused medical treatment. The driver of the Ford was reported as sustaining possible injury. The Honda sustained disabling damage and was towed from the crash site and subsequently deemed total loss by the insurance company. The Ford was not towed from the crash and was repaired prior to the case assignment.

Vehicle Damage

Exterior Damage – 2007 Honda Civic EX

The 2007 Honda Civic sustained moderate severity frontal damage as result of the front-to-rear impact with the Ford. The damaged components involved the front bumper fascia, bumper beam, upper radiator support, right headlight assembly, and the fenders. During the crash sequence, the front of the Honda underrode the rear bumper of the Ford. This underride resulted

in contact to the top of the hood, fenders, and crush of the upper radiator support. **Figures 3 and 4** are views of the frontal deformation.

The front bumper fascia could not be located; therefore, the direct contact damage was measured at the level of the hood. The direct damage measured 144 cm (56.7") and began on the top of the left fender and extended onto the right fender. Due to the underride, crush profiles were documented at the bumper beam and upper radiator support. Although a crush profile was measured, no residual crush was present at the bumper beam.

The maximum crush at the upper radiator support was located at the right end and measured (34 cm (13.5"). The crush profile at this component was as follows: C1 = 24 cm (9.5"), C2 = 20 cm (7.8"), C3 = 23 cm (9.0"), C4 = 25 cm (9.8"), C5 = 27 cm (10.8"), C6 = 34 cm (13.5"). The Collision Deformation Classification (CDC) for this impact was 12-FDEW-2.

Figure 3. Overall view of the frontal damage.

Figure 4. Overhead view of the upper radiator crush.

Interior Damage – 2007 Honda Civic EX

The interior of the Honda sustained minor damage that was attributed to occupant contact points. The occupant contact points consisted of two knee strikes to the knee bolster **(Figure 5)** and right aspect of the steering column. The left knee strike was located from 21-33 cm (8.3-13.0") left of the center of the steering column. This contact was evidenced by fractures to the plastic component. The right knee strike consisted of a scuff mark on the right aspect of the steering column and slight deformation of the knee bolster. This contact began 8 cm (3.0") right of the center of the steering column and extended 15 cm (6.0") right of this referenced point. This crash did not result in a reduction of the passenger compartment.

Figure 5. Knee strikes to the left instrument panel.

Exterior Damage – 2006 Ford F550

The 2006 Ford F550 sustained minor severity damage as result of the front-to-rear crash with the Honda. This vehicle was repaired prior to the assignment of the case **(Figure 6)**. The damage assessment was based on the images that were provided by the vehicle owner to the SCI investigator. The direct contact damage was contained to the center and right aspects of the steel rear bumper. Minor deformation was apparent at these locations with the majority of the crush occurring to the step bar **(Figure 7)**. Also noted was deformation to the hydraulic connections that were located on the right side of the vehicle immediately forward of the bumper. Although not coded in the EDS, a Truck Deformation Classification (TDC) was assigned for this impact. The TDC was 06-BZEW-1.

Figure 6. Repaired 2006 Ford F550.

Figure 7. Step bar and hydraulic connections.

Certified Advanced 208-Compliant Safety System – 2007 Honda Civic EX

The 2007 Honda Civic was equipped with a CAC frontal safety system. 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 system consisted of dual stage frontal air bags, an occupant presence sensor for the front right seat, and safety belt buckle switch sensors to monitor belt usage.

Figure 8. Deployed driver's frontal air bag.

As a result of the crash, the driver's frontal air bag deployed **(Figure 8)**. The driver's air bag was conventionally located in the center of the steering wheel hub and was concealed by three cover flaps. The top cover flap measured 6 cm (2.5") in height and 13 cm (5.0") in width. The total width of lower cover flaps measured 13 cm (5.0") with a height of 10 cm (3.8"). The centers of the lower cover flap contained a circular cutout for the Honda insignia. The driver's air bag membrane measured 56 cm (22") in diameter in its deflated state. The air bag contained two tethers at the 12 and 6

o'clock positions and was vented by two vent ports at the 11 and 1 o'clock positions. There were no damage or occupant contact points present on the air bag membrane.

The front right passenger air bag was a top-mount design in the right instrument panel. The CAC system identified the unoccupied front right position; therefore, this air bag was suppressed during the crash.

Side Impact Air Bags – 2007 Honda Civic EX

The Honda was equipped with seat back mounted side impact air bags for the front seats and curtain air bags for the outboard seating positions. The side impact protection system did not deploy during the crash.

Event Data Recorder – 2007 Honda Civic EX

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 not received.

Manual Restraint Systems – 2007 Honda Civic EX

The 2007 Honda Civic was equipped with manual 3-point lap and shoulder safety belts for the five seating positions. The driver's safety belt was configured with continuous loop webbing, sliding latch plate, height adjustable D-ring that was in the full-down position at the time of the SCI inspection, an Emergency Locking Retractor (ELR), and dual pretensioners. The pretensioners were both buckle mounted and retractor mounted. The driver utilized the safety belt during the crash, as evidenced by frictional abrasions on the latch plate, a transfer on the webbing, and actuation of the dual pretensioners. The actuation of the retractor pretensioner locked the safety belt webbing in the used position **(Figure 9)**. The buckle stalk was compressed 5 cm (2") from the actuation of the buckle mounted pretensioner **(Figure 10)**. A light colored transfer and fraying of the outer edge of the webbing was noted during the examination of the safety belt. The fraying occurred as the webbing passed through the latch plate. The transfer and the fraying were located 78-80 cm (30.5-31.5") above the plastic sleeve near the anchor point.

Figure 9. Driver's safety belt restricted in used position due to actuated retractor pretensioner.

Figure 10. Actuated driver's buckle pretensioner.

The front right safety belt was configured with continuous loop webbing, sliding latch plate, height adjustable D-ring, dual pretensioners, and a switchable ELR/Automatic Locking Retractor (ALR). The front right seat was not occupied during the crash; therefore, the pretensioners did not actuate.

The second row safety belts were configured with continuous loop webbing, sliding latch plates and switchable ELR/ALR retractors.

Occupant Demographics – 2007 Honda Civic EX

Driver

Age/Sex:	23-year-old/Female
Height:	157 cm (62”)
Weight:	86 kg (190 lbs)
Seat Track Position:	Between forward and middle position (Source = Driver interview)
Manual Restraint Use:	3-point manual lap and shoulder safety belt
Usage Source:	Vehicle inspection
Eyewear:	None
Type of Medical Treatment:	None

Driver’s Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Abrasion to the left side of the neck	Minor (390202.1,2)	Shoulder belt
1 cm (0.5”) contusion to the left side of the hip	Minor (890402.1,2)	Lap belt

Source = Driver Interview

Driver Kinematics

The 23-year-old female driver of the Honda was seated in an upright posture with the seat track adjusted between the forward and middle position and was restrained by the lap and shoulder belt. At impact with the Ford, the driver’s dual pretensioners actuated and the frontal air bag deployed. The driver initiated a forward trajectory in response to the 12 o’clock direction of force and loaded the safety belt. The loading of the safety belt resulted in the abrasion to the left side of the neck and the left hip contusion. Her knees contacted the knee bolster which was evidenced by the deformation to this component. The deployed air bag prevented potential face/head contact with the steering wheel. The driver was not transported to a hospital for treatment of her injuries.

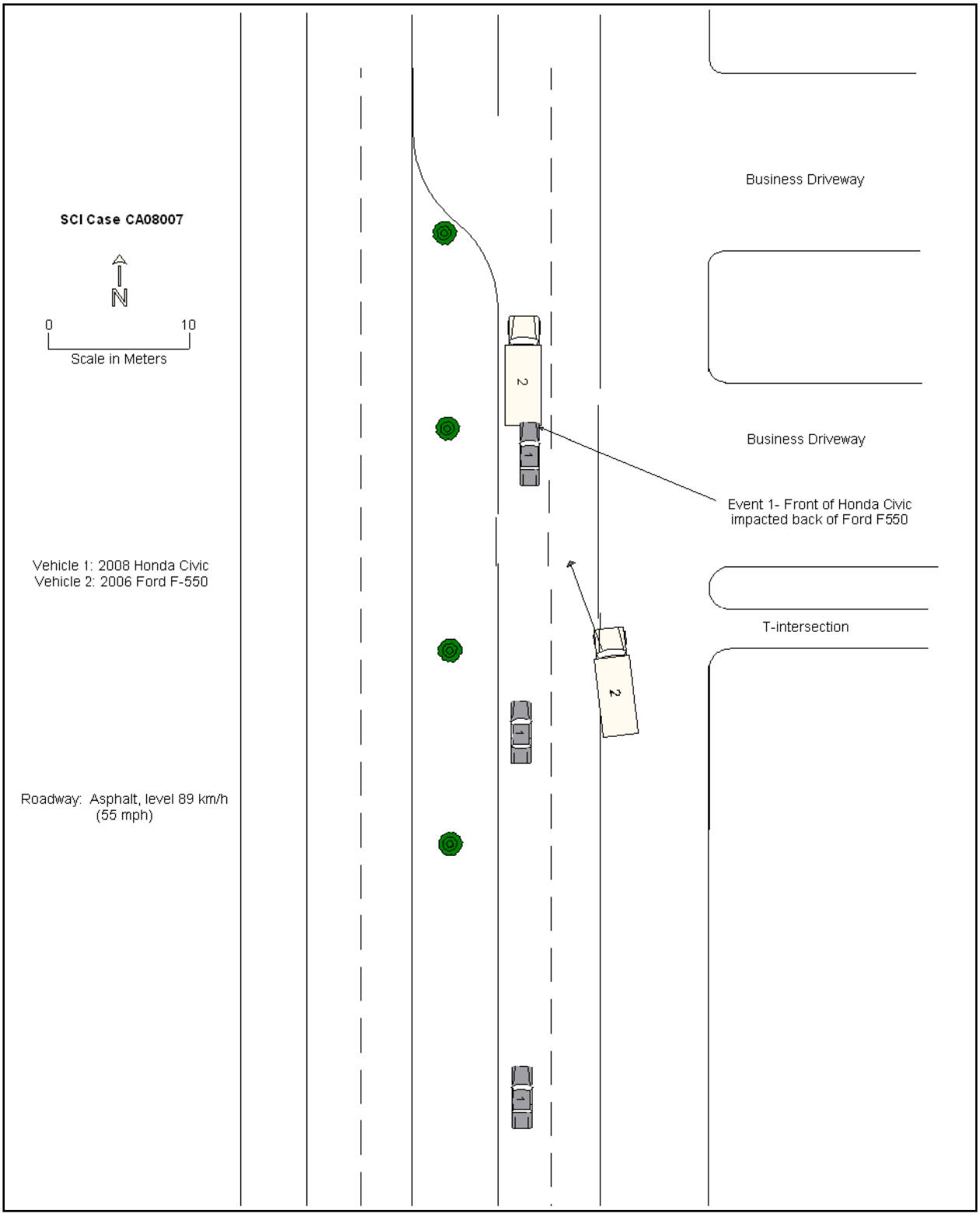

Figure 11. Scene schematic