

**TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER**

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**GENERAL DYNAMICS ON-SITE ADVANCED OCCUPANT PROTECTION (AOPS)
INVESTIGATION
SCI TECHNICAL SUMMARY REPORT**

CASE NO. CA02-040

VEHICLE – 2001 HONDA ACCORD

LOCATION - STATE OF MARYLAND

CRASH DATE – AUGUST 2002

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.

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**GENERAL DYNAMICS ON-SITE ADVANCED OCCUPANT PROTECTION SYSTEM
CRASH INVESTIGATION
SCI TECHNICAL SUMMARY REPORT
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SUBJECT VEHICLE – 2001 HONDA ACCORD
LOCATION - STATE OF MARYLAND
CRASH DATE - AUGUST 2002**

BACKGROUND

This on-site investigation focused on the performance of the Advanced Occupant Protection System (AOPS) that was present in a 2001 Honda Accord (**Figure 1**). The AOPS consisted of dual-stage frontal air bags and seat belt retractor pretensioners. The Honda Accord was involved in an intersection collision with a 2002 Mazda 626 that resulted in the deployment of the AOPS in the Accord. A 24-year-old female driver and a 21-year-old male front right passenger were reported by police to have been restrained by the manual 3-point lap and shoulder belts, although based on the visual inspection of the belts it appeared both occupants were unrestrained. At impact, the safety belt pretensioners fired and the frontal air bag system deployed. The occupants initiated forward trajectories in response to the frontal crash force and loaded the deployed frontal air bags. The driver sustained a right third finger contusion, knee contusion, and neck and lumbar strains. She was transported to a local hospital where she was treated for her injuries and released. The front right passenger was not injured.



Figure 1. Damaged 2001 Honda Accord

The Police Accident Report (PAR) was forwarded to the General Dynamics SCI team as a potential AOPS case following the weekly sampling activities at PSU 9. The PAR was reviewed at the General Dynamics SCI team and forwarded to NHTSA SCI headquarters. Following NHTSA review, follow-up was initiated and both vehicles were located for SCI inspection. The Mazda 626 was under repair and almost completed at the time of the inspection. The Accord was locked and the keys were not available, which necessitated a limited interior inspection. Attempts to interview the driver were unsuccessful after numerous attempts.

SUMMARY

Crash Site

This two-vehicle crash occurred at a three-leg T-intersection during the daylight hours of August 2002. At the time of the crash, the weather was clear and the asphalt roadway surface was dry. The east/west roadway was straight and level at the intersection. The north/south roadway had an approximate 3 percent positive southbound grade that terminated at the intersection. The north/south roadway intersected the east/west roadway at a 45 degree angle. Both roadways were configured with two lanes in each direction that were separated by a double-yellow centerline. The eastbound and southbound lanes separated to create right-turn lanes at the respective approaches to the intersection. The westbound lane separated to create a left turn lane on approach to the intersection. The roadways were bordered by concrete curbs and the roadside

environment was residential in nature. Traffic flow through the intersection was controlled by overhead three-phase traffic signals that were configured with left turn arrows. White solid “Stop” lines were present on each leg of the intersection. The posted speed limit for the east/west roadway was 56 km/h (35 mph), however, the posted speed limit decreased to 48 km/h (30 mph) west of the intersection. The posted speed limit for the north/south roadway was 40 km/h (25 mph). The scene schematic is included as **Figure 9** of this report.

Pre-Crash

The 24-year-old female driver was operating the Honda Accord westbound on the two-lane roadway on approach to the three-leg intersection (**Figure 2**). She steered the Accord into the inboard westbound lane in preparation to proceed straight through the intersection, as the traffic signal was in the green phase. The 38-year-old male driver of the 2002 Mazda 626 was operating the vehicle in a southbound direction on approach to the intersection (**Figure 3**). The driver of the Mazda steered into the southbound left turn lane as the vehicle approached the intersection. Although the traffic signal was in the red phase for southbound traffic, the Mazda 626 proceeded into the intersection across the path of the Accord. It was not known if either driver attempted any avoidance maneuvers.



Figure 2. Westbound approach for the Honda Accord



Figure 3. Southbound approach for the Mazda 626

Crash

The front aspect of the 2001 Honda Accord impacted the left front side aspect of the Mazda 626. Impact resulted in moderate damage to both vehicles and the deployment of the frontal air bag system in the Honda Accord. Specific information regarding air bag deployment and pretensioner firing could not be determined without data from the Event Data Recorder (EDR). The damage algorithm of the WinSMASH program computed delta-V's of 23.0 km/h (14.3 mph) for the Honda Accord and 24.0 km/h (14.9 mph) for the Mazda 626. Due to the repair status of the Mazda, the WinSMASH inputs were estimated from pre-repair photographs obtained from the repair facility. The longitudinal and lateral components for the Honda Accord were -22.7 km/h (-14.1 mph) and -4.0 km/h (-2.5 mph), respectively. The longitudinal and lateral components for the Mazda 626 were -18.4 km/h (-11.4 mph) and 15.4 km/h (9.6 mph), respectively. The Honda Accord rotated in a counterclockwise (CCW) direction, although, the final rest position was not known. Police reported that the Mazda traveled forward through the intersection and came to rest on the south roadside.

Post-Crash

It was not known how the occupants exited the vehicles. The driver's of the Honda Accord and Mazda 626 were both transported by ambulance to a local hospital. The driver of the Accord was treated and released and the admission status of the Mazda's driver was unknown. The front right passengers of both vehicles did not sustain injuries and were not transported to any medical facility.

VEHICLE DATA – 2001 Honda Accord

The 2001 Honda Accord was identified by the Vehicle Identification Number (VIN): 1HGCG32581A (production sequence omitted). At the time of the vehicle inspection, the vehicle was locked and access to the interior could not be obtained. The vehicle's odometer reading was unknown. The Honda Accord was a two-door coupe equipped with the EX trim package which included a 2.3 liter, 4-cylinder engine, four-speed automatic transmission with front-wheel-drive, four-wheel disc brakes with anti-lock, alloy wheels, power steering, tilt steering wheel, power sun roof, power windows, power door locks, and keyless entry. The Honda Accord was equipped with Bridgestone Turanza P195/65R15 tires. The manufacturer's recommended tire pressure was not known. The specific tire data is as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	206.8 kpa (30.0 psi)	4.0 mm (5/32")	No	None
LR	158.6 kpa (23.0 psi)	6.4 mm (8/32")	No	None
RF	217.2 kpa (31.5 psi)	3.2 mm (4/32")	No	None
RR	199.9 kpa (29.0 psi)	6.4 mm (8/32")	No	None

The front seating positions in the 2001 Honda Accord were configured with leather trimmed bucket seats with adjustable open head restraints, which were in the full-down positions. The front seats appeared to be in the mid-track position at the time of the vehicle inspection. The rear seating positions were configured with a leather bench seat with a 60/40 split folding back.

VEHICLE DAMAGE

Exterior Damage – 2001 Honda Accord

The 2001 Honda Accord sustained moderate frontal damage as a result of the impact with the Mazda 626. The front bumper fascia was partially separated, fractured in multiple locations and sustained abrasions from direct contact with the Mazda (**Figure 4**). The direct contact damage began at the front left bumper corner and extended 127.0 cm (50.0") across the bumper fascia to the front right bumper corner. The combined direct and induced damage involved the entire frontal width of the Accord and measured 102.9 cm (40.5") across the front bumper beam.

The maximum crush on the front bumper beam was located 2.5 cm (1.0") left of the centerline and measured 43.2 cm (17.0") (Figure 5).



Figure 4. Frontal damage to the 2001 Honda Accord



Figure 5. View showing crushed bumper beam

The Styrofoam filler was separated from the bumper beam. The forward aspect of the left frame rail was displaced inboard 4.4 cm (1.8") and the forward aspect of the right frame rail was displaced inboard 7.0 cm (2.8"). The hood was buckled rearward and direct contact abrasions extended 20.3 cm (8.0") rearward from the leading edge of the hood. The upper radiator support was crushed rearward. The left head lamp assembly was separated and the right head lamp assembly was displaced. Six crush measurements were taken along the front bumper beam and were as follows: C1 = 8.3 cm (3.3"), C2 = 19.4 cm (7.6"), C3 = 33.7 cm (13.3"), C4 = 31.1 cm (12.3"), C5 = 21.9 cm (8.7"), C6 = 12.1 cm (4.8"). The Collision Deformation Classification (CDC) for the impact with the Mazda 626 was 12-FDEW-2.

Interior Damage – 2001 Honda Accord

Interior damage to the 2001 Honda Accord appeared to be minor. The interior of the vehicle could not be accessed for inspection and interior damage was based on inspection through the vehicle windows (Figure 6). The windshield and remaining glazing did not sustain damage. There did not appear to be any intrusion into the passenger compartment. There were no apparent occupant contacts.



Figure 6. Interior view of the 2001 Honda Accord

Exterior Damage – 2002 Mazda 626

The exterior damage to the 2002 Mazda 626 was based on damage photographs obtained from a repair facility (**Figure 7**). The direct contact damage began slightly aft of the left front corner and extended rearward along the left front door. The combined direct and induced damage began at the left front corner and extended rearward to the middle aspect of the left rear door. The left front fender was crushed laterally and the left front aspect of the front bumper fascia was fractured. The left front wheel was displaced laterally against the suspension components. Six crush measurements were estimated from the repair photographs and were as follows: C1 = 0 cm, C2 = 5 cm (2”), C3 = 10 cm (4”), C4 = 8 cm (3”), C5 = 13 cm (5”), C6 = 0 cm. The CDC for the impact with the Honda Accord was 11-LYEW-2.



Figure 7. Damaged 2002 Mazda 626

MANUAL RESTRAINT SYSTEMS – 2001 Honda Accord

The 2001 Honda Accord was equipped with manual 3-point lap and shoulder belts with sliding latch plates for all seating positions. The front seating positions were configured with adjustable D-ring anchors that were located in the full-down positions at the time of the vehicle inspection. The driver's seat belt was configured with an Emergency Locking Retractor (ELR), and the remaining seating positions were configured with switchable/automatic locking retractors (ALR's). The front seat belts were configured with retractor pretensioners which were designed to actuate in conjunction with frontal air bag deployment. Given the air bag deployment, it is probable that the pretensioners fired in this crash. Both safety belts appeared taut against the respective B-pillars during the vehicle inspection, which suggested that they were not in use at the time the pretensioners fired.

FRONTAL AIR BAG SYSTEM – 2001 Honda Accord

The 2001 Honda Accord was equipped with dual-stage frontal air bags for the driver and front right passenger positions that deployed as a result of the impact with the Mazda 626. The driver's air bag was housed in the center of the steering wheel with asymmetrical H-configuration module cover flaps (**Figure 8**). There was no contact evidence visible on the driver's air bag.



Figure 8. View of deployed driver's air bag

The dual-stage front right passenger's air bag deployed from a top-mount module configured with symmetrical H-configuration cover flaps. There was no contact evidence visible on the front right passenger's air bag.

SIDE IMPACT AIR BAG SYSTEM – 2001 Honda Accord

The 2001 Honda Accord was equipped with side impact air bags that were located in the outboard aspects of the front seat backs. The side impact air bags did not deploy in this crash.

OCCUPANT DEMOGRAPHICS – 2001 Honda Accord

Driver

Age/Sex: 24-year-old female
Height: Unknown
Weight: Unknown
Seat Track Position: Mid-track
Manual Restraint Use: Unrestrained
Usage Source: Visual inspection of safety belt
Eyewear: Unknown
Type of Medical Treatment: Transported by ambulance to a local hospital and treated and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Possible Injury Source
Neck strain	Minor (640278.1,6)	Crash forces
Lumbar strain	Minor (640678.1,8)	Crash forces
Right third finger contusion	Minor (790402.1,1)	Center instrument panel
Right knee contusion	Minor (890402.1,1)	Knee bolster

Injury source: Emergency room records

Driver Kinematics

The 24-year-old female driver was presumed to have been seated in an upright posture with the seat adjusted to the mid-track position. She was reported by police to have been restrained by the manual 3-point lap and shoulder belt. However, based on the visual inspection, the safety belt appeared taut against the B-pillar, which suggested the safety belt was not in use, and the retractor pretensioner fired. Due to the limited interior vehicle inspection and lack of interview, injury sources cannot be confirmed. At impact, the frontal air bag system deployed and she initiated a forward trajectory. Her right hand was probably displaced from the steering wheel rim into the center instrument panel, which resulted in a right third finger contusion. She contacted the deployed driver's air bag that offered additional protection against the frontal crash forces. Her right knee struck the plastic knee bolster, resulting in a right knee contusion. She sustained a cervical strain and lumbar strain as a result of the crash forces and rebound. She was transported by ambulance to a local hospital where she was treated for her injuries and released.

Front Right Passenger

Age/Sex: 21-year-old male
Height: Unknown
Weight: Unknown
Seat Track Position: Mid-track
Manual Restraint Use: Unrestrained
Usage Source: Visual inspection of safety belt
Eyewear: Unknown
Type of Medical Treatment: Did not sustain injury and did not receive medical treatment

Front Right Passenger Kinematics

The 21-year-old male front right passenger was presumed to have been seated in an upright posture with the seat adjusted to the mid-track position. He was reported by police to have been restrained by the manual 3-point lap and shoulder belt. However, based on the visual inspection, the safety belt appeared taut against the B-pillar, which suggested the safety belt was not in use, and the retractor pretensioner fired. At impact, the frontal air bag system deployed and he initiated a forward trajectory. He contacted the deployed front right passenger's air bag that offered additional protection against the frontal crash forces. The police reported he was not injured and he did not receive medical treatment.

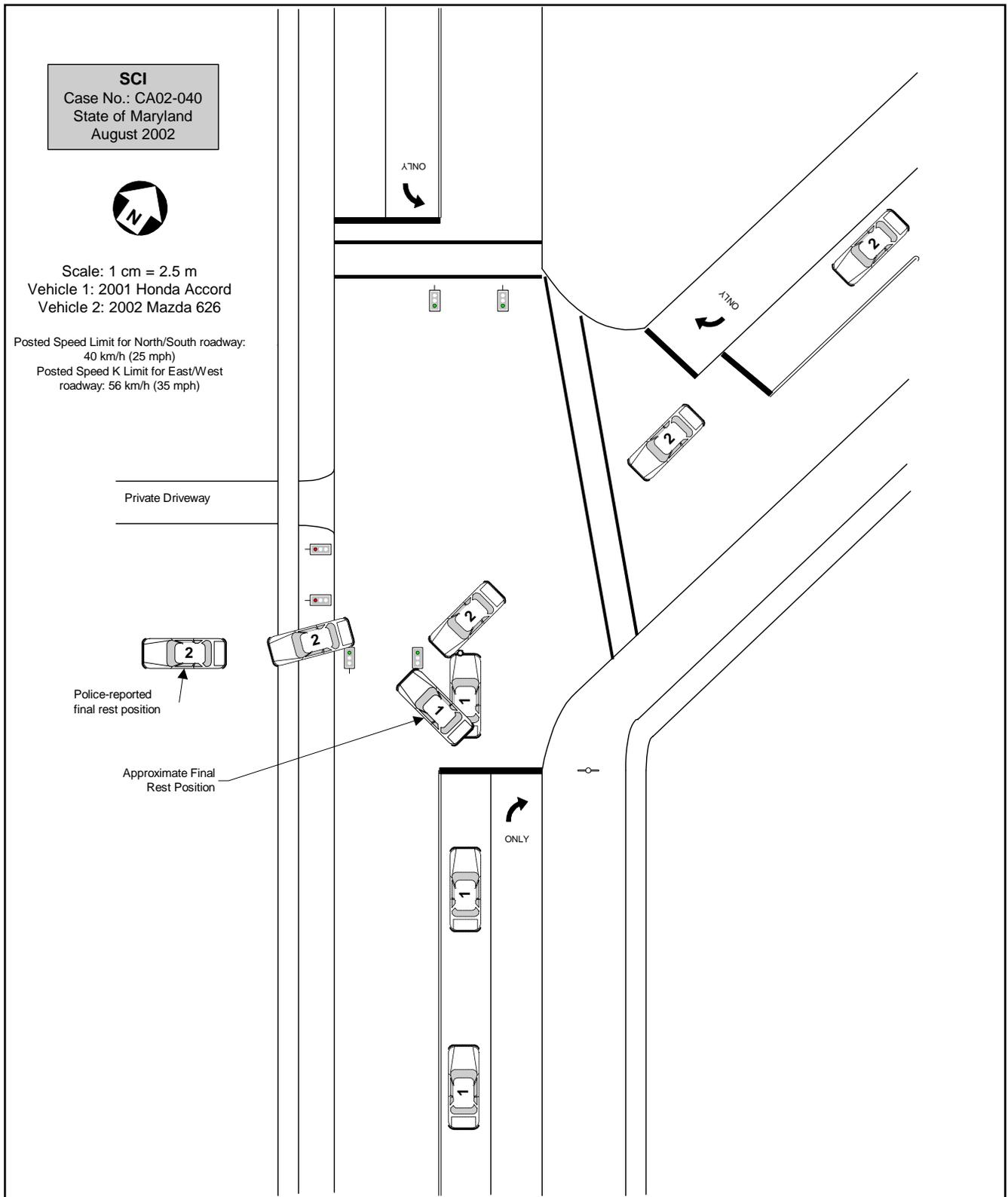


Figure 9. Scene schematic