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# REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN99-041
LOCATION - ARIZONA
VEHICLE - 1998 HONDA ACCORD EX
CRASH DATE - May 1998

Submitted:

December 23, 1999

Revised:
September 8, 2000


Contract Number: DTNH22-94-D-17058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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 be 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 Documentation Page**

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15. *Supplementary Notes*
Remote air bag deployment investigation involving a 1998 Honda Accord EX, with manual safety belts and dual redesigned front air bags, and a massive concrete bridge wing wall

16. *Abstract*
This report covers a remote investigation of an air bag deployment crash that involved a 1998 Honda Accord EX (case vehicle) and a massive concrete bridge wing wall. This crash is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of the collision events, and the case vehicle's restrained driver (48-year-old male) was fatally injured. The case vehicle was traveling south in one of three southbound lanes of a six-lane, divided, urban expressway. The crash occurred off the roadway, beyond the paved right (west) shoulder. As the case vehicle was negotiating a modest curve to the left, it departed the outside lane onto the right (west) shoulder at a shallow angle. It traveled off the roadway, up a dirt and gravel embankment, and over and through two bushes for a distance exceeding 46 meters (150 feet). Tire tracks on the embankment indicated no braking or other avoidance maneuvers were attempted. The front of the case vehicle struck a massive concrete bridge wing wall, causing the case vehicle's driver and front right passenger air bags to deploy. There is no knowledge of the pre-crash posture or seat adjustments of the case vehicle's driver. Although wearing his three-point lap and shoulder belt, he contacted his safety belts, air bag, steering wheel, instrument panel, and front roof header and sustained a Duret hemorrhage of the pons; an uncal herniation with left-to-right midline shift; bilateral hilar contusions of the lungs; diffuse subarachnoid hemorrhage; bilateral edema to the cerebral hemispheres with marked flattening of the gyral pattern; contusions to the inferior temporal lobes, the left parietal region, the left hippocampus, the right internal capsule, and bilateral occipital lobes; fractures to the right ribs, the sternum, and the left hemipelvis; unspecified injuries to the spleen, small bowel, and large bowel (all necessitating surgery); and multiple lacerations, abrasions and contusions. He was transported by ambulance to a medical facility, was hospitalized, and was declared dead approximately 74 hours post-crash.

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Additional photographs are available in EDCS case IN99-041

## BACKGROUND

IN99-041

This case was brought to the NHTSA's attention by a review of the Fatality Analysis Reporting System (FARS) in February 1999. The crash involved a 1998 Honda Accord EX (case vehicle) and a massive concrete bridge wing wall. The crash occurred in May 1998, at 10:40 p.m., in Arizona, and was investigated by the applicable state police department. This case is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of collision events, and the restrained driver [48-year-old male; White (non-Hispanic)] was fatally injured. The Police Crash Report was received in April 1999, with the autopsy report and police photographs obtained in June. This report is based on the Police Crash Report, the autopsy report, police photographs, occupant kinematic principles, and this contractor's evaluation of the evidence.

## CRASH CIRCUMSTANCES

The case vehicle was traveling south in one of three southbound lanes of a six-lane, divided, urban expressway, intending to continue its southbound travel path (**Figure 1**). Ambient conditions were darkness, but lighted, clear weather, and light traffic density. The roadway was concrete, dry, curve left, a negative grade to the south, and no apparent roadway defects. The posted speed limit was 89 km.p.h. (55 m.p.h.), with the case vehicle's travel speed estimated at the speed limit by the investigating officer. Traffic control devices were limited to pavement markings: a single solid white edge line on the right (west) roadway edge; two lane lines consisting of a recurrent series of five raised white delineators, with the first being reflectorized; and a single solid yellow edge line on the left (east) roadway edge. All traffic control devices were clearly visible. The crash occurred off the roadway, beyond the paved right (west) shoulder.

**Figure 1:** Southbound approach view for the case vehicle; Note: struck bridge structure at center right (case photo #01)

It is suspected that the case vehicle driver fell asleep. On the day of the crash, he talked with his wife and complained of being tired due to working long hours. As well, the driver had a previous crash under similar circumstances. In the previous crash he went to sleep and his vehicle departed the roadway at a shallow angle. In the present collision, as the case vehicle was negotiating a modest curve to the left, it departed the outside lane onto the right (west) shoulder at a shallow angle. The right side tires traveled off the roadway, up a dirt and gravel embankment, and over and through two bushes for a distance exceeding 46 meters (150 feet). Tire tracks on the embankment indicated no braking or other avoidance maneuvers

**Figure 2:** Concrete bridge structure impacted by the case vehicle (case photo #05)

were attempted. The front of the case vehicle struck a massive concrete bridge wing wall, causing its driver and front right passenger air bags to deploy (**Figure 2** above). The case vehicle rebounded rearward approximately 0.6 meters (two feet) and rotated slightly clockwise an unknown number of degrees (**Figure 3**).

## CASE VEHICLE

The case vehicle was a front wheel drive, 1998 Honda Accord EX, five-passenger, four-door sedan (VIN: 1HGCG5554WA------) equipped with a 2.2 liter, I-4 gasoline engine and a five-speed manual transmission with a console-mounted shift lever. Four-wheel anti-lock brakes were an option for this vehicle, but it is not known if the case vehicle was so equipped. The case vehicle's wheelbase was 272 centimeters (106.9 inches). An odometer reading was not reported. The case vehicle was towed from the scene due to disabling damage.

**Figure 3:** Northwest view of case vehicle at final rest (case photo #09)

Direct contact damage was sustained to the case vehicle's front plane, beginning slightly to the right of the front left bumper corner (**Figure 4**). The front bumper and fascia, grille, engine compartment brackets, radiator, hood, and right front fender were all displaced rearward and the crush was close to being uniform and vertical (**Figure 5**). Both the left and right headlamp assemblies were shattered. Induced damage included the left front tire pushed into the lower left A-pillar, the left front fender pulled slightly inward, the left upper A-pillar slightly straightened, the left side of the windshield separated from the left A-pillar and splintered, the left front and left rear door panels buckled, the left front door glazing shattered, the left rocker panel molding strip almost totally detached, the left rocker panel buckled, the left rear wheel well and forward portion of the left rear quarterpanel buckled, the left C-pillar buckled, the left roof rail buckled at the B-pillar, the left rear corner of the roof buckled near the back light, the right rear quarter panel over the right rear wheel well and the bottom portion of the right upper C-pillar were buckled, the right rocker panel molding strip was almost totally detached, the right

**Figure 4:** Frontal plane damage to the case vehicle; Note: nearly uniform vertical crush (case photo #11)

**Figure 5**: Frontal plane damage to the case vehicle from the right side; Note: vertical crush and the right front tire position (case photo #21)

rocker panel buckled, the right front and right rear door panels buckled, the right roof rail was buckled immediately rearward of the upper B-pillar, the sunroof buckled at its left and right sides, the right front door glazing shattered, the bottom portion of the right upper A-pillar contacted by the rear hood edge, the right front tire pushed into the lower right A-pillar, and the right front tire and wheel laid over at a 45 degree angle, with the top slanted in and the bottom out. Based on police photographs, the CDC for the case vehicle was estimated as **12-FDEW-4** (principal direction of force of 0 degrees). The WinSMASH reconstruction program, CDC-only algorithm, provided a borderline reconstruction, but the results appear reasonable. The case vehicle's estimated Total, Longitudinal, and Lateral Delta Vs are, respectively: 93.3 km.p.h. (58.0 m.p.h.), -93.3 km.p.h. (-58.0 m.p.h.), and 0.0 km.p.h. (0.0 m.p.h.).

Interior damage to the case vehicle was assessed from the available police photographs. The frontal plane crush was sufficient to displace the engine rearward into the cowl, resulting in the toe pan, foot well, and instrument panel being pushed inward and upward. The intrusion seems deeper at the center and right side of the front seating area. The instrument panel rotated, such that its front surface was facing the roof, post-crash (**Figure 6 and 7**).

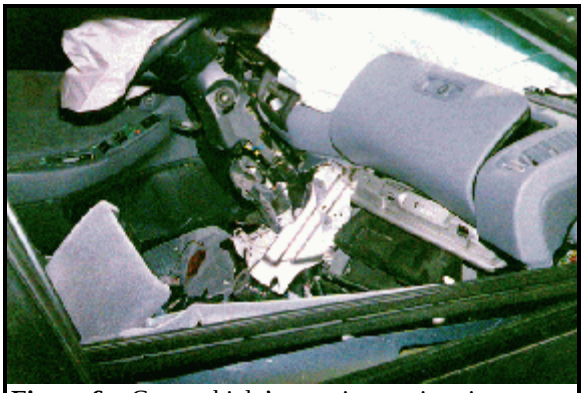

**Figure 6:** Case vehicle's post-impact interior; Note: rotation of instrument panel and position of the steering column (case photo #28)

**Figure 7:** Case vehicle's deployed driver air bag; Note: position of the instrument panel and the steering wheel (case photo #25)

## CASE VEHICLE DRIVER

The case vehicle's driver [48-year-old male; White (non-Hispanic); 201 centimeters and 102 kilograms (79 inches, 225 pounds)] was restrained by his available, manual, three-point, lap-and- shoulder safety belt system. There were no other occupants in the case vehicle at the time of the crash. The driver's pre-crash seat adjustments, steering wheel position, and posture are not known. He was transported from the scene by ambulance to a medical facility. He was hospitalized and survived a little over 74 hours. The following discussion of the driver's injuries is based on a complete autopsy report, on-scene police photographs, and occupant kinematic principles.

The case vehicle's driver was probably seated in a normal driving posture, with his back against the seat back, at least one hand on the steering wheel, and his feet on a foot control or the floor. There was no indication of any avoidance maneuvers along the 46 meters (150 feet) of off-road travel across a dirt and gravel embankment. The departure angle was shallow and the travel path was straight into the massive concrete bridge wing wall. There were no undercarriage bottoming gouges along the off-road travel path.

As was stated previously, this driver may well have fallen asleep (no avoidance maneuvers and negative toxicology screen tests). The case vehicle traveled over the right (west) concrete mountable curb at a shallow angle, resulting in the restrained driver first rocking slightly left, then slightly right. Running over and through the two bushes would have had a negligible effect on the case vehicle's travel speed and on the driver's posture. The impact with the concrete bridge wing wall caused the case vehicle's driver and front right passenger air bags to deploy. The restrained driver most likely moved forward and upward. He loaded his lap and shoulder safety belts resulting in abrasions to the left upper chest and right anterolateral hip and contusions to the left lateral hip and the left thigh. As the driver's air bag was deploying the steering column was being pushed rearward and the driver loaded and deflated the air bag, sustaining abrasions to the left hand and right forearm. The driver contacted the steering wheel hub, spokes and rim resulting in bilateral hilar contusions to the lungs, a fractured left hemipelvis, a fractured sternum, fractures to right ribs 1-3 anteriorly and 4,5,7, and 8 laterally, and non-specified injuries to the spleen (surgically removed post-crash), small bowel (resection surgery), and large bowel (right hemicolectomy and partial sigmoid colectomy). As the driver pushed the steering column and wheel upwards, his lower extremities struck the instrument panel resulting in bilateral abrasions to the lower legs and right thigh, and lacerations to the left knee and left thigh; his right forearm was lacerated by flailing against the upper instrument panel. Recall that the driver was very tall (six feet, seven inches). Despite being restrained by the lap and shoulder safety belt, his head probably struck the windshield header. He sustained numerous injuries to the face, head and brain, including: an abrasion to the forehead; a fracture and contusion of the nose; subscalpular hemorrhage over the right parietal, temporal, and occipital bones; diffuse subarachnoid hemorrhage; bilateral edema of the cerebral hemispheres with marked flattening of the gyral pattern; a Duret hemorrhage of the pons; uncal herniation with left-to-right midline shift; and contusions to the bilateral inferior temporal lobes, the left parietal region, the left hippocampus, the right internal capsule, and bilateral occipital lobes. Given that the Total Delta V for the case vehicle was over 93 km.p.h. (58 m.p.h.), this crash is considered virtually nonsurvivable by this contractor.

**CASE VEHICLE DRIVER'S INJURIES**

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source (Mechanism) | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 1. | Duret hemorrhage of the pons[1] | 140210.5 critical | Windshield header | Probable | Autopsy |

[1] The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:
***lesion (le****zhen)*: any pathological or traumatic discontinuity of tissue or loss of function of a part.
***Duret's l.***: effusion of blood in the region of the fourth ventricle of the cerebrum as a result of slight injury.

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source (Mechanism) | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 2. | Uncal herniation[2] with left-to-right midline shift | 140202.5 critical | Windshield header | Probable | Autopsy |
| 3. | Bilateral edema of cerebrum, NFS, with marked flattening of the gyral pattern | 140668.3 serious | Windshield header | Probable | Autopsy |
| 4. | Diffuse subarachnoid hemorrhage | 140684.3 serious | Windshield header | Probable | Autopsy |
| 5. | Contusions, bilateral inferior temporal lobes, left parietal region, left hippocampus, right internal capsule and bilateral occipital lobes, NFS | 140620.3 serious | Windshield header | Probable | Autopsy |
| 6. | Bilateral hilar contusions (lungs) | 441410.4 severe | Steering wheel hub and/or spokes | Probable | Autopsy |
| 7. | Fractured ribs: right 1-3 anterior, 4, 5, 7, 8 lateral | 450230.3 serious | Steering wheel hub and/or spokes | Probable | Autopsy |
| 8. | Fractured sternum | 450804.2 moderate | Steering wheel hub and/or spokes | Probable | Autopsy |
| 9. | Fracture, left hemipelvis | 852600.2 moderate | Steering wheel rim | Probable | Autopsy |
| 10. | Spleen, NFS (surgically removed) | 544299.2 moderate | Steering wheel rim | Probable | Autopsy |
| 11. | Small bowel, NFS (resection surgery, distal) | 541499.2 moderate | Steering wheel rim | Probable | Autopsy |
| 12. | Large bowel, NFS (right hemicolectomy including partial sigmoid colectomy) | 540899.2 moderate | Steering wheel rim | Probable | Autopsy |
| 13. | Abrasions, bridge of forehead | 290202.1 minor | Windshield header | Probable | Autopsy |

[2] The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:

***herniation (her"ne-a'shen)***: the abnormal protrusion of an organ or other body structure through a defect or natural opening in a covering, membrane, muscle, or bone.

***caudal transtentorial h.***: tentorial h.

***tentorial h.***: downward displacement of the medially-placed cerebral structures through the tentorial notch, caused by a supratentorial mass. Pressure is exerted on underlying structures, including the brain stem. Called also *caudal transtentorial h.*, *transtentorial h.*, and *uncal h.*

***transtentorial h.***: tentorial h.

***uncal h.***: tentorial h.

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source (Mechanism) | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 14. | Fracture, bridge of nose | 251000.1 minor | Windshield header | Probable | Autopsy |
| 15. | Contusions (ecchymosis), nose and bridge of nose | 290402.1 minor | Windshield header | Probable | Autopsy |
| 16. | Subscapular hemorrhage over right parietal, temporal and occipital lobes | 190402.1 minor | Windshield header | Probable | Autopsy |
| 17. | Abrasion, left upper chest | 490202.1 minor | Safety belt | Probable | Autopsy |
| 18. | Abrasion, right anterolateral hip | 890202.1 minor | Safety belt | Probable | Autopsy |
| 19. | Contusion, left lateral hip | 850602.1 minor | Safety belt | Probable | Autopsy |
| 20. | Abrasions, right forearm | 790202.1 minor | Driver air bag | Probable | Autopsy |
| 21. | Lacerations, right forearm | 790600.1 minor | Center instrument panel | Possible | Autopsy |
| 22. | Abrasion, left hand | 790202.1 minor | Driver air bag | Probable | Autopsy |
| 23. | Laceration, left knee, NFS | 890600.1 minor | Left instrument panel and below | Possible | Autopsy |
| 24. | Laceration, upper left thigh, NFS | 890600.1 minor | Left instrument panel and below | Possible | Autopsy |
| 25. | Abrasion, dorsal right thigh | 890202.1 minor | Center console | Possible | Autopsy |
| 26. | Multiple abrasions, bilateral lower legs | 890202.1 minor | Left instrument panel and below | Possible | Autopsy |

**OBJECT CONTACTED**

The case vehicle impacted a massive concrete bridge wing wall that was part of a railroad overpass, with only the extreme front left bumper corner not making contact with the wall. There was minor abrading to the surface of the wall, but there was no evidence that the wall fractured or was otherwise damaged.