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ON-SITE ADVANCED OCCUPANT PROTECTION SYSTEM INVESTIGATION

CASE NUMBER - IN-03-002
LOCATION - Texas
VEHICLE - 2001 HONDA ACCORD
CRASH DATE - December 2002

Submitted:
February 26, 2004
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Contract Number: DTNH22-01-C-07022

Prepared for:

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National Highway Traffic Safety Administration
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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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On-site investigation involving a 2001 Honda Accord equipped with multiple advanced occupant protection systems, and a 1996 Honda Accord

16. *Abstract*

This on-site investigation covers an air-bag deployment crash involving a 2001 Honda Accord (case vehicle) that impacted a 1996 Honda Accord (other vehicle). This crash is of special interest because the case vehicle was equipped with multiple advanced occupant protection system (AOPS) features and the case vehicle's driver (35-year-old female) sustained minor injuries. The case vehicle was traveling south in the inside southbound lane of a two-lane roadway that was part of a divided trafficway, approaching a three-leg intersection and intending to continue straight ahead. The other vehicle had been stopped at a stop sign, heading east in the eastbound lane of the intersecting two-lane undivided roadway, intending to cross the southbound lanes, pass through the median cut and turn left to travel north. The other vehicle started from a stop and entered the intersection, across the case vehicle's path. The case vehicle's driver did not attempt any avoidance maneuvers. The crash occurred within the intersection. The front of the case vehicle impacted the left side of the other vehicle, causing the case vehicle's driver and front right passenger air bags and pretensioners to deploy. The case vehicle rotated a few degrees counterclockwise and came to rest within the intersection median cut a short distance from the point of impact. The other vehicle rotated a few degrees clockwise and came to rest a short distance southeastward of the point of impact, also within the intersection median cut. Both vehicles were towed due to damage. The case vehicle's driver (lone occupant) was not restrained by the available, manual, three-point, lap-and-shoulder safety belt system. She was transported via ambulance to a hospital, where she was treated and released. Her injuries were limited to a contusion on her left shoulder and strained ligaments in her left hand.

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BACKGROUND

IN-03-002

This on-site investigation was brought to the NHTSA's attention on January 23, 2003 by NASS/GES sampling activities. The crash involved a 2001 Honda Accord DX (case vehicle) and a 1996 Honda Accord EX (other vehicle). The crash occurred in December 2002 at 2:15 p.m., in Texas, and was investigated by the applicable city police department. This crash is of special interest because the case vehicle was equipped with multiple advanced occupant protection system (AOPS) features and the case vehicle's unrestrained driver (35-year-old female, black, non-Hispanic) sustained minor injuries. This contractor inspected the scene and vehicles on January 28, 2003 and interviewed the case vehicle driver on April 2, 2003. This report is based on the police crash report, an interview with the case vehicle driver, scene and vehicle inspections, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling south in the inside southbound lane of a two-lane roadway that was part of a divided trafficway, approaching a three-leg intersection with no controls for north-south traffic, intending to continue straight ahead. The other vehicle had been stopped at a stop sign, heading east in the eastbound lane of the intersecting two-lane undivided roadway, intending to cross the southbound lanes, pass through the median cut and turn left to travel north. The other vehicle started from a stop and entered the intersection, across the case vehicle's path. The case vehicle's driver did not attempt any avoidance maneuvers. The crash occurred within the intersection.

The front of the case vehicle impacted the left side of the other vehicle, causing the case vehicle's driver and front right passenger air bags and pretensioners to deploy. The case vehicle rotated a few degrees counterclockwise and came to rest within the intersection median cut a short distance from the point of impact. The other vehicle rotated a few degrees clockwise and came to rest a short distance southeastward of the point of impact, also within the intersection median cut. Both vehicles were towed due to damage.

The case vehicle was a 2001 Honda Accord DX front wheel drive, four-door, five-passenger sedan (VIN: 1HGCF866X1A------), with a 2.2 liter I-4 engine and an automatic transmission with a console-mounted selector lever. The case vehicle was equipped with dual-stage frontal air bags and pretensioners for the two front outboard seat positions. Four wheel anti-lock brakes are an option for this model but it is unknown whether the case vehicle was equipped as such. The specification wheelbase was 272 centimeters [106.9 inches]. The odometer reading is not known due to the non-functional electronic instrument panel, but the driver estimated that there were 96,558 kilometers [60,000 miles] on the vehicle.

The case vehicle's front bumper, grille and headlamp assemblies, and both front fenders had been removed at the time of the inspection. With these frontal components absent it is not possible to determine the exact extent of direct damage. Based on an assessment of the radiator support bracket, the leading edge of the hood, and the damage on the other vehicle, direct contact likely began at the front left corner and extended approximately 55 centimeters [21.7 inches] inward from the left corner, with induced damage encompassing the entire front. It is unclear

whether the fenders were directly contacted. Maximum crush was measured as 8 centimeters [3.1 inches] at C3. The wheelbase on both sides was shortened by 2 centimeters [0.8 inches]. None of the tires were deflated or restricted and there was no glazing damage.

Based on the vehicle inspection, the CDC for the case vehicle was determined to be: **01-FYEW-1 (20 degrees)**. The WinSMASH reconstruction program, damage only algorithm based on the measured crush profile of the other vehicle and adjusted measurements taken along the case vehicle's radiator support bracket, was used on the case vehicle's single impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 16.0 km.p.h. [9.9 m.p.h.], -15.0 km.p.h. [-9.3 m.p.h.], and -5.5 km.p.h. [-3.4 m.p.h.]. These results seem reasonable. The crash severity for the case vehicle was low (14-23 km.p.h. [9-14 m.p.h.]).

The case vehicle was equipped with dual-stage frontal air bags that deployed. The driver's air bag was located in the steering wheel hub. Inspection of the driver's air bag module cover flaps and air bag revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps. The deployed driver's air bag was round with a diameter of 62 centimeters [24 inches]. There were areas of body oil and possible cosmetics transfers on the front of the driver's air bag.

The front right passenger's air bag was located in the top of the instrument panel. Inspection of the front right air bag module cover flaps and air bag revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps except that the module was lifted and partially separated from its mounting in the instrument panel. The deployed front right air bag was rectangular with a height of approximately 60 centimeters [23.6 inches] and a width of approximately 64 centimeters [25.1 inches]. There was no contact evidence apparent on the front right passenger's air bag.

Inspection of the case vehicle's interior revealed that, other than the driver's air bag, there was no evidence of occupant contact on the interior surfaces of the case vehicle.

Immediately prior to the crash the case vehicle's driver (35-year-old female, black, non-Hispanic; 168 centimeters and 91 kilograms [66 inches, 200 pounds]) was seated in an upright posture with her back against the seat back, her left foot on the floor, her right foot on the foot controls, and both hands on the steering wheel. Her seat track was located in its rearmost position, the seat back was upright and the tilt steering wheel was located in its middle position.

The case vehicle's driver was not using her available, active, three-point, lap-and-shoulder, safety belt system. The case vehicle was equipped with retractor pretensioners that did actuate, with the safety belt webbing for both the front left and front right seat positions pulled tight against the B-pillars.

The case vehicle's driver made no known pre-crash avoidance maneuvers and her posture did not change just prior to impact. The case vehicle's impact with the 1996 Accord caused the case vehicle's driver and front right air bags to deploy and caused the driver to move forward and slightly rightward, toward the 20 degree direction of force as the case vehicle decelerated. She

encountered the deployed air bag with her face and chest, leaving body oil and possibly cosmetics transfers on the top portion of the front of the air bag, and sustained a contusion on her left shoulder. Her hips slid forward in the seat and her knees impacted the knee bolster, causing swelling in both knees. She also sustained strained ligaments in her left hand, possibly as a result of her tight grip on the steering wheel and her hand being forced away by the air bag. The driver was transported by ambulance to a hospital where she was treated and released. She also sought treatment from her private physician a few days later. The hospital was not able to locate her medical records and the driver was not willing to permit access to her physician's records.

The other vehicle was a 1996 Honda Accord EX front wheel drive, four-door, five-passenger sedan (VIN: 1HGCD5658TA------). Based on the vehicle inspection, the CDC for the 1996 Accord was determined to be: **10-LYEW-2 (290)** (maximum crush was 20 centimeters [7.9 inches]). The WinSMASH reconstruction program, damage only algorithm based on the measured crush profile of both vehicles, was used on the 1996 Honda's single impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 15.0 km.p.h. [9.3 m.p.h.], -5.1 km.p.h. [-3.2 m.p.h.], and + 14.1 km.p.h. [+ 8.8 m.p.h.]. The crash severity for the 1996 Accord was low (14-23 km.p.h. [9-14 m.p.h.]). This vehicle was equipped with frontal air bags that did not deploy. The 1996 Accord was towed due to damage.

There were three occupants in the 1996 Accord. The driver (18-year-old female) and the front right passenger (14-year-old male) were police-reported as uninjured. The back right passenger (15-year-old male) sustained police-reported " B" (evident, non-incapacitating) injuries and was transported via ambulance to a hospital. His treatment status and specific injuries are not known.

CRASH CIRCUMSTANCES

Figure 1:. Case vehicle's southbound approach toward impact (case photo #1a)

The case vehicle was traveling south in the inside southbound lane of a two-lane roadway that was part of a divided trafficway, approaching a three-leg intersection with no controls for north-south traffic, and intended to continue straight ahead. The divided trafficway had a curbed, grass median north of the intersection, a cut through the median within the intersection, and a raised concrete divider south of the intersection (**Figure 1**). It was daylight, the weather was clear, the roadway was straight and level, and the concrete surface was dry and free of defects. The speed limit for the north-south roadway was 56 km.p.h. [35 m.p.h.]. The other vehicle had been stopped at a stop sign, heading east in the eastbound lane of the intersecting two-lane undivided roadway, intending to cross the southbound lanes, pass through the median cut and turn left to travel north. The other vehicle started from a stop and entered the intersection, across the case vehicle's path. The case vehicle's driver did not attempt any avoidance maneuvers. The crash occurred within the intersection.

The front of the case vehicle impacted the left side of the other vehicle, causing the case vehicle's driver and front right passenger air bags and pretensioners to deploy. The case vehicle rotated a few degrees counterclockwise and came to rest within the intersection median cut a short distance from the point of impact. The other vehicle rotated a few degrees clockwise and came to rest a short distance southeastward of the point of impact, also within the intersection median cut. Both vehicles were towed due to damage.

CASE VEHICLE

The case vehicle was a 2001 Honda Accord DX front wheel drive, four-door, five-passenger sedan (VIN: 1HGCF866X1A------), with a 2.2 liter I-4 engine and an automatic transmission with a console-mounted selector lever. The case vehicle was equipped with dual-stage frontal air bags and pretensioners for the two front outboard seat positions. Four wheel anti-lock brakes are an option but it is unknown whether the case vehicle was equipped as such. The specification wheelbase was 272 centimeters [106.9 inches]. The odometer reading is not known due to the non-functional electronic instrument panel, but the driver estimated that there were 96,558 kilometers [60,000 miles] on the vehicle.

Figure 2: Case vehicle's front and right side; note, grille and fenders removed (case photo #18)

CASE VEHICLE DAMAGE

The case vehicle's front bumper, grille and headlamp assemblies, and both front fenders had been removed at the time of the inspection (**Figure 2**). With these frontal components absent it is not possible to determine the exact extent of direct damage. Based on an assessment of the radiator support bracket, the leading edge of the hood, and the damage on the other vehicle, direct contact likely began at the front left corner of the vehicle and extended approximately 55 centimeters [21.7 inches] inward from the left corner, with induced damage encompassing the entire front (**Figure 3**). It is unclear whether the fenders were directly contacted. Maximum crush was measured as 8 centimeters [3.1 inches] at C3. The wheelbase on both sides was shortened by 2 centimeters [0.8 inches]. None of the tires were deflated or restricted and there was no glazing damage.

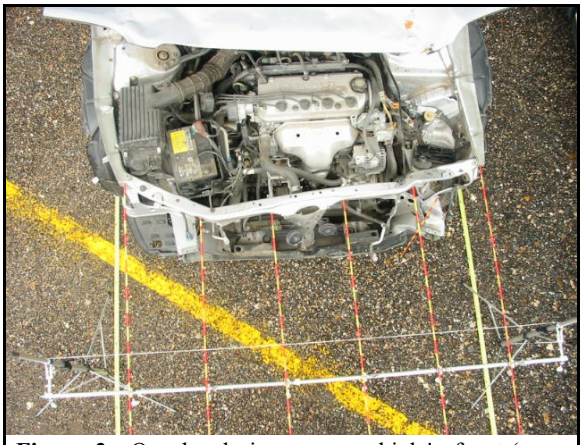


Figure 3: Overhead view, case vehicle's front (case photo #10)

Based on the vehicle inspection, the CDC for the case vehicle was determined to be: **01-FYEW-1 (20 degrees)**. The WinSMASH reconstruction program, damage only algorithm based on the measured crush profile of the other vehicle and adjusted measurements taken along the case vehicle's radiator support bracket, was used on the case vehicle's highest severity impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 16.0 km.p.h. [9.9 m.p.h.], -15.0 km.p.h. [-9.3 m.p.h.], and -5.5 km.p.h. [-3.4 m.p.h.]. These results seem reasonable. The crash severity for the case vehicle was low (14-23 km.p.h. [9-14 m.p.h.]).

Figure 4: Case vehicle's steering wheel and air bag module, top of wheel at bottom (case photo #30)

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with dual-stage frontal air bags that deployed. The driver air bag was located in the steering wheel hub (**Figure 4**). Inspection of the driver air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps. The driver's air bag was designed with two tethers, each 7.5 centimeters [3 inches] wide. The driver's air bag had two vent ports, approximately 5 centimeters [2 inches] in diameter, located in the center of the back of the air bag at the 9:30 and 2:30 o' clock positions. The deployed driver's air bag was round with a diameter of 62 centimeters [24 inches]. There were areas of body oil and possible cosmetics transfers on the front of the driver's air bag (**Figure 5**).

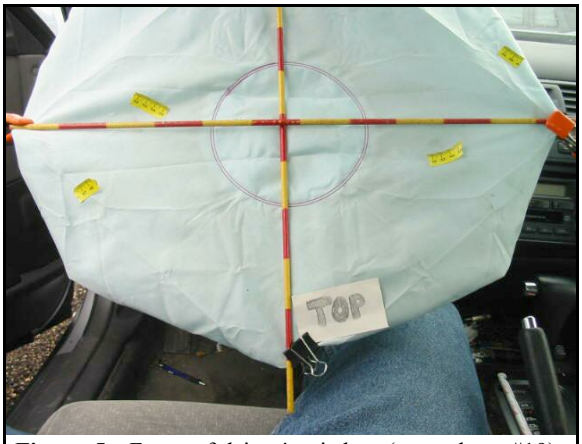


Figure 5: Front of driver's air bag (case photo #19)

Figure 6: Front right passenger air bag module and cover flap; note, module partially separated from instrument panel (case photo #34)

The front right passenger's air bag was located in the top of the instrument panel. Inspection of the front right air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps. Note, however, that the module was lifted and partially separated from its mounting in the instrument panel (**Figure 6**). The front right passenger's air bag was designed without any tethers and had two

vent ports, approximately 7 centimeters [2.8 inches] in diameter, located at the 3:00 and 9:00 o'clock positions. The deployed front right air bag was rectangular with a height of approximately 60 centimeters [23.6 inches] and a width of approximately 64 centimeters [25.1 inches]. There was no contact evidence apparent on the front right passenger's air bag (**Figure 7**).

Inspection of the case vehicle's interior revealed that there was no evidence of occupant contact on the interior surfaces of the case vehicle other than the driver's air bag.

Figure 7: Front of front right passenger's air bag (case photo #31)

CASE VEHICLE DRIVER'S KINEMATICS

Immediately prior to the crash the case vehicle driver (35-year-old female, black, non-Hispanic; 168 centimeters and 91 kilograms [66 inches, 200 pounds]) was seated in an upright posture with her back against the seat back, her left foot on the floor, her right foot on the foot controls, and both hands on the steering wheel. Her seat track was located in its rearmost position, the seat back was upright and the tilt steering wheel was located in its middle position.

The case vehicle driver was not using her available, active, three-point, lap-and-shoulder, safety belt system. The case vehicle was equipped with retractor pretensioners that did actuate and the safety belt webbing for both the front left and front right seat positions was pulled tight against the B-pillars.

The case vehicle's driver made no known pre-crash avoidance maneuvers and her posture did not change just prior to impact. The case vehicle's impact with the 1996 Accord caused the case vehicle's driver and front right air bags to deploy and caused the driver to move forward and slightly rightward, toward the 20 degree direction of force as the case vehicle decelerated. She encountered the deployed air bag with her face and chest, leaving body oil and possibly cosmetics transfers on the top portion of the front of the air bag, and sustained a contusion on her left shoulder. Her hips slid forward in the seat and her knees impacted the knee bolster, causing swelling in both knees[1]. She also sustained strained ligaments in her left hand, probably as a result of her tight grip on the steering wheel and her hand being forced away by the air bag. The driver was transported by ambulance to a hospital where she was treated and released. She also sought treatment from her private physician a few days later. The hospital was not able to locate her medical records and the driver was not willing to permit access to her physician's records.

[1]" Swelling" cannot be coded as an injury and this person did not did not allege that she sustained contusions on her knees.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Contusion, top of left shoulder	minor 790402.1,2	driver' s air bag	probable	interviewee (same person)
2.	Strained ligaments, left hand	minor 750402.1,2	steering wheel rim	probable	interviewee (same person)

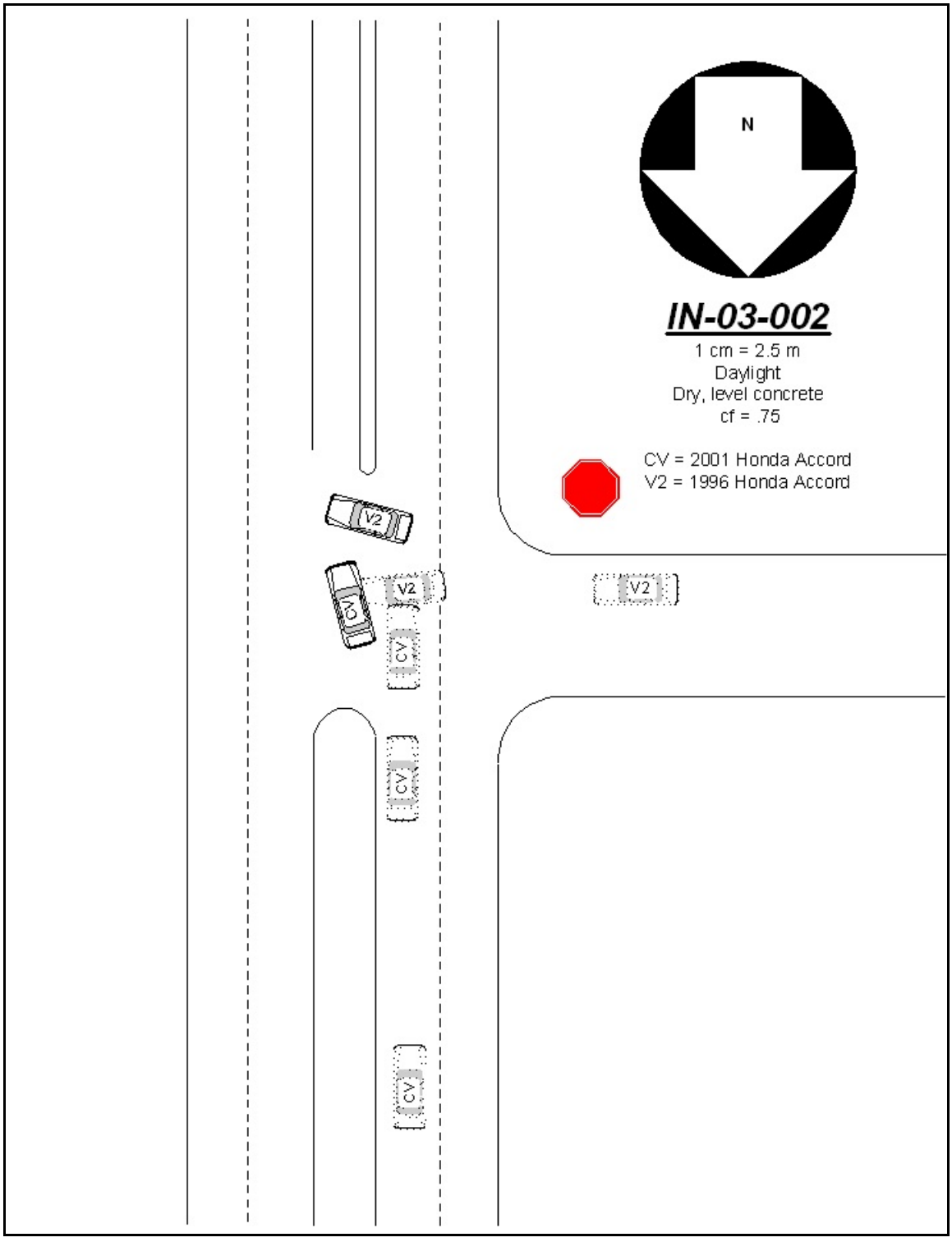
OTHER VEHICLE

The other vehicle was a 1996 Honda Accord EX front wheel drive, four-door, five-passenger sedan (VIN: 1HGCD5658TA------). Based on the vehicle inspection, the CDC for the 1996 Accord was determined to be: **10-LYEW-2 (290 degrees)** (maximum crush was 20 centimeters [7.9 inches]). The WinSMASH reconstruction program, damage only algorithm based on the measured crush profile of both vehicles, was used on the 1996 Honda's single impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 15.0 km.p.h. [9.3 m.p.h.], -5.1 km.p.h. [-3.2 m.p.h.], and + 14.1 km.p.h. [+ 8.8 m.p.h.]. The crash severity for the 1996 Accord was low (14-23 km.p.h. [9-14 m.p.h.]). This vehicle was equipped with frontal air bags that did not deploy. The 1996 Accord was towed due to damage (**Figures 8** and **9**).

Figure 8: Front part of 1996 Accord's left side (case photo #41)

Figure 9: Center part of 1996 Accord's left side (case photo #42)

There were three occupants in the 1996 Accord. The driver (18-year-old female) and the front right passenger (14-year-old male) were police-reported as uninjured. The back right passenger (15-year-old male) sustained police-reported " B" (evident, non-incapacitating) injuries and was transported via ambulance to a hospital. His treatment status and specific injuries are not known.


N
IN-03-002
1 cm = 2.5 m
Daylight
Dry, level concrete
cf = .75
CV = 2001 Honda Accord
V2 = 1996 Honda Accord
V2
V2
V2
CV
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