CRASH DATA RESEARCH CENTER

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

CASE NO: CA04-018

VEHICLE: 2003 ACURA MDX

LOCATION: VIRGINIA

CRASH DATE: MARCH 2004

Contract No. DTNH22-01-C-17002

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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 investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2003 Acura MDX. The manufacturer of this vehicle has certified that this 2003 Acura MDX meets the advanced air bag requirements of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The safety system included dual stage frontal air bags, seat track position sensors, safety belt retractor pretensioners and an occupant detection sensor for the front right seat. In addition, the Acura was equipped with seatback-mounted side impact air bags for the front seating positions. The Acura also contained an air bag control module for the safety system, which had Event Data Recording (EDR) capabilities. This module was removed from the Acura with permission from the insurance carrier and forwarded to NHTSA for download by Honda. The module output is summarized in this Final Report. An unrestrained 30-year-old female driver, the sole occupant of the vehicle, drove the Acura. The Acura departed the right roadside of an interstate roadway and impacted a concrete Jersey barrier with its frontal aspect. The impact resulted in the deployment of the driver's frontal air bag and firing of the front safety belt pretensioners. The driver reported a complaint of pain and was transported by ambulance to a local hospital. The Acura sustained disabling damage and was towed from the scene. The repair estimate exceeded the market value of the vehicle; therefore, the insurance company deemed the vehicle a total loss.			
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TABLE OF CONTENTS

BACKGROUND **1**

SUMMARY **2**

CRASH SITE 2
VEHICLE DATA – 2003 ACURA MDX 2
CRASH SEQUENCE 3
PRE-CRASH 3
CRASH 3
POST-CRASH 3
VEHICLE DAMAGE 4
EXTERIOR DAMAGE – 2003 ACURA MDX 4
INTERIOR DAMAGE – 2003 ACURA MDX 5
CERTIFIED ADVANCED 208-COMPLIANT SAFETY SYSTEM –2003 ACURA MDX 5
EVENT DATA RECORDER – 2003 ACURA MDX 6
SIDE IMPACT AIR BAGS – 2003 ACURA MDX 6
MANUAL RESTRAINT SYSTEMS – 2003 ACURA MDX 6
OCCUPANT DEMOGRAPHICS – 2003 ACURA MDX 7
DRIVER 7
DRIVER KINEMATICS 7

FIGURE 10. SCENE SCHEMATIC **8**

CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE CRASH INVESTIGATION
SCI CASE NO: – CA04-018
SUBJECT VEHICLE – 2003 ACURA MDX
LOCATION – WOODBRIDGE, VA
CRASH DATE – MARCH 2004

BACKGROUND

This on-site investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2003 Acura MDX **(Figure 1)**. The manufacturer of this vehicle has certified that this 2003 Acura MDX meets the advanced air bag requirements of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The safety system included dual stage frontal air bags, seat track position sensors, safety belt retractor pretensioners and an occupant detection sensor for the front right seat. In addition, the Acura was equipped with seatback-mounted side impact air bags for the front seating positions. The Acura also contained an air bag control module for the safety system, which had Event Data Recording (EDR) capabilities. This module was removed from the Acura with permission from the insurance carrier and forwarded to NHTSA for download by Honda. The module output is summarized in this Final Report. The Acura was driven by an unrestrained 30-year-old female driver, the sole occupant of the vehicle. The Acura departed the right roadside of an interstate roadway and impacted a concrete Jersey barrier with its frontal aspect. The impact resulted in the deployment of the driver's frontal air bag and firing of the front safety belt pretensioners. The driver reported a complaint of pain and was transported by ambulance to a local hospital. The Acura sustained disabling damage and was towed from the scene. The repair estimate exceeded the market value of the vehicle; therefore, the insurance company deemed the vehicle a total loss.

Figure 1. Subject 2003 Acura MDX.

This crash was identified from a list of claims provided by an insurance company to the National Highway Traffic Safety Administration (NHTSA) that identified Certified Advanced 208-Compliant vehicles that had been involved in crashes. NHTSA forwarded a list of vehicles to the Calspan Special Crash Investigations (SCI) team for follow-up investigation. The Acura was located and cooperation was established with the salvage facility. The case was assigned to the SCI team on May 2004 as an on-site investigative effort. The Acura and crash site were inspected on May 14, 2004.

Summary

Crash Site

This single vehicle crash occurred during the morning hours of March 2004. At the time of the crash, the weather was clear with no adverse conditions. The crash occurred on the outboard shoulder of a three-lane northbound interstate roadway. The northbound travel lanes were surfaced with worn asphalt and were separated from the opposing lanes by a W-beam median barrier. The west roadside consisted of an asphalt shoulder and a concrete Jersey barrier that extended beyond the shoulder. The posted speed limit for northbound traffic was 97 km/h (60 mph). The scene schematic is included as **(Figure 10)** of this report.

Vehicle Data – 2003 Acura MDX

The 2003 Acura MDX was identified by Vehicle Identification Number (VIN): 2HNYD18693 (production sequence omitted). The odometer reading at the time of the inspection was unknown due to the vehicle having no power. The vehicle was a four-door sport utility vehicle that was equipped with a 3.5-liter, V-6 engine, 5-speed automatic transmission, four-wheel drive, power-front and rear disc brakes with anti-lock, traction control, navigation system, power-steering, and a tilt steering wheel. The Acura was equipped with Michelin Cross Terrain tires, size P235/65R17. The maximum pressure for these tires was 241 kPa (35 PSI). The manufacturer recommended tire pressure was 221 kPa (32 PSI). The specific tire data at the time of the SCI inspection was follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	234 kPa (34 PSI)	6 mm (8/32)	No	None
LR	238 kPa (34.5 PSI)	6 mm (8/32)	No	None
RF	221 kPa (32 PSI)	6 mm (8/32)	No	None
RR	238 kPa (34.5 PSI)	6 mm (8/32)	No	None

The Acura's seating positions consisted of leather appointed front buckets seats with height adjustable head restraints. The left front head restraint was adjusted to 6 cm (2.3") above the full-down position and the right front was adjusted between the mid to full-down position. The second row was configured with a leather upholstered three-passenger split bench seat (60/40) and height adjustable head restraints for all three seating positions. The head restraints were adjusted to the full-down position. The third row was configured with a leather surfaced split (50/50) two-passenger bench seat with height adjustable head restraints. The third row head restraints were removed prior to the SCI inspection.

Crash Sequence

Pre-Crash

The unrestrained 30-year-old female driver of the 2003 Acura MDX was operating the vehicle northbound on the outboard lane of the three-lane interstate roadway **(Figure 2)**. As the driver continued northbound, she initiated a rapid left-right steering maneuver to avoid a bucket that was in the travel lane. As a result of the right counter steer maneuver, the vehicle initiated a clockwise rotation and departed the east road edge. The Acura traversed the east shoulder in a CW yaw and struck the concrete Jersey barrier.

Figure 2. Acura's northbound travel.

Crash

The initial contact involved the front right aspect of the Acura against the concrete Jersey barrier **(Figure 3)**. The offset right engagement in combination with the pre-crash CW yaw, allowed the vehicle to continue top rotate CW and engage the barrier with the full width of the frontal plane. The resultant direction of force was 11 o'clock.

Figure 3. Area of impact between the Acura and the Jersey barrier.

The Acura continued the clockwise rotation as it separated from the barrier and reentered the northbound travel lanes. The vehicle came to rest between the center and right lanes facing a southwesterly direction. The frontal damage was dismantled post-crash; therefore the lower engine cradle crush was used to compute a delta V for this event. The damage algorithm of the WINSMASH program computed a total delta V of 16 km/h (9.9 mph). The longitudinal and lateral components were -15 km/h (-9.3 mph) and 6 km/h (3.4 mph), respectively. This computed delta V is a conservative estimate since the primary damage at the bumper level had been removed. The EDR recorded a delta V of 30 km/h (18.8 mph) for this barrier impact.

As a result of the frontal impact, the driver's frontal air bag deployed. Although the driver was not restrained, both front safety belt retractor pretensioners fired. The seatback-mounted side impact air bags did not deploy. The EDR data did not identify the level (Stage) of driver air bag deployment.

Post-Crash

The police reported the driver as sustaining no visible injuries, but having a complaint of pain. She was transported by ground ambulance to a local hospital. The Acura sustained

disabling damage and was towed from the crash site and was assessed a total loss by the insurance company.

Vehicle Damage

Exterior Damage – 2003 Acura MDX

The Acura sustained moderate severity damage as a result of the impact with concrete Jersey barrier **(Figures 4 and 5)**. The impact involved the full frontal area of the Acura; however, the frontal components were removed and the right frame rail was cut by a repair facility to assess the damage. The damaged components were not with the vehicle at the time of the SCI investigation. As a result, the length of the direct contact damage could not be determined. The SCI investigator documented two crush profiles to the remaining structure of the vehicle. The first profile was measured at the lower cross member, which was bolted to the frame rails. The right side of the cross member was disconnected during the post-crash damage assessment. The maximum crush measured 14 cm (5.6") and was located at crush measurement three. Six equidistant crush measurements were documented at this level using a combined direct and induced damaged width of 80 cm (31.5"), and were as follows: C1 = 7 cm (2.8"), C2 = 12 cm (4.5"), C3 = 14 cm (5.6"), C4 = 13 cm (5.1"), C5 = 11 cm (4.3"), C6 = 9 cm (3.5").

The second crush profile was documented at the lower engine cradle. The maximum crush measured 21 cm (8.1") at the front right aspect of the cradle assembly. The residual crush was measured using a combined direct and induced damaged width of 107 cm (42.0"). The profile was as follows: C1 = 14 cm (5.5"), C2 = 6 cm (2.5"), C3 = 5 cm (1.8"), C4 = 5 cm (1.8"), C5 = 6 cm (2.5"), C6 = 21 cm (8.1"). This crush profile yielded the greatest depth of crush and was used to calculate the delta V. The Collision Deformation Classification (CDC) for this impact was 11-FDEW-1.

The SCI investigator also documented crush to the upper and lower aspects of the left and right fender supports. The lower left fender crush measured 3 cm (1.2") and the upper measured 5 cm (2.0"). The lower right fender crush measured 9 cm (3.5") and the upper measured 8 cm (3.0").

Figure 4. Frontal damage to the 2003 Acura MDX.

Figure 5. Close-up view of the two crush profiles documented for this impact.

Interior Damage – 2003 Acura MDX

The interior of the 2003 Acura MDX sustained minor severity damage as a result of passenger compartment intrusion. The front right toe pan intruded longitudinally 3 cm (1.0") as result of the front right tire displacement rearward into the front cowl. There was no occupant contact points noted to the interior components. **Figure 6** is a lateral view across the interior of the Acura.

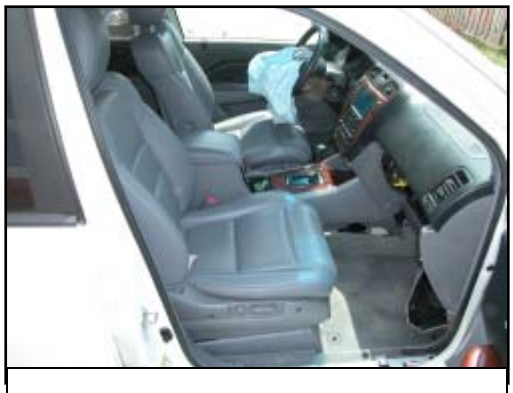

Figure 6. Lateral view across the interior of the Acura.

Certified Advanced 208-Compliant Safety System –2003 Acura MDX

The 2003 Acura MDX was equipped with a Certified Advanced 208-Compliant (CAC) safety system. The manufacturer of this vehicle has certified that this 2003 Acura MDX meets the advanced air bag requirements of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The system consisted of dual stage frontal air bags, seat track positioning sensors for the front seats, an occupant presence sensor for the front right seat, and front safety belt pretensioners. The system also consisted of a passenger air bag indicator light, which identifies the on/off status of the front right air bag. An air bag control module monitored the system, which measured and predicted crash severity, seat track position, belt status, and occupant presence to deploy the appropriate safety system. The air bag control module had event data recording capabilities. The air bag control module was retrieved from the vehicle with permission from the insurance carrier. The module was forward to NHTSA for download by Honda and the output data is included in this Final Report in the section that follows.

In the subject crash, the driver's frontal air bag deployed at impact with the concrete Jersey barrier. The driver's air bag module was located within the center of the steering wheel hub **(Figure 7)**. Two H-configuration cover flaps concealed the air bag. The top cover flap measured 16 cm (6.2") in width and 5 cm (2.0") in height. The lower cover flap measured 16 cm (6.2") in width at the top tear seam and 7 cm (2.8") at the lower hinge point. The lower flap measured 8 cm (3.2") in height. The air bag membrane measured 58 cm (23.0") in diameter in its deflated state. No driver contacts were present on the air bag membrane; however, dirt was present from post-crash manipulation within the vehicle. The air bag contained two 4 cm (1.5") diameter vent ports that were centered 17 cm (6.5") forward of the peripheral seam. A 10 cm (3.9") diameter tether reinforcement stitching was located on the center face of the air bag. The air bag contained two 6 cm (2.5") wide band tethers that were located at the 12 and 6 o'clock positions.

Figure 7. Deployed driver's frontal air bag.

The driver's bag was identified by the following nomenclature that was stamped on the top surface of the air bag membrane at the 12 o'clock position:

HONDA
2401021
290802
S
ASSEMBLED IN MEXICO
WITH USA COMPONENTS

The front right passenger air bag was a top-mount design in the right instrument panel **(Figure 8)**. The front right seating position was not occupied during the crash, therefore the air bag control module did not warrant the deployment of the front right air bag.

Figure 8. Non-deployed front right air bag.

Event Data Recorder – 2003 Acura MDX

The 2003 Acura MDX was equipped with an air bag control module that had event data recording capabilities. The air bag control module was removed from the vehicle by the SCI investigator and was forward to NHTSA for download by Honda. The driver's insurance company granted removal of this unit.

The output data indicated that the front right seat position was not occupied at the time of the crash and that both front safety belt systems were unbuckled. Both retractor pretensioners fired as a result of the crash. The command to deploy the driver's air bag and frontal pretensioners was estimated at 13 msec of Algorithm Enable. The level of deployment was not recorded for the driver's air bag. The total velocity change was recorded as 30 km/h (18.8 mph).

Side Impact Air Bags – 2003 Acura MDX

The 2003 Acura MDX was equipped with seatback-mounted side impact air bags for the front seat positions. The side impact air bags did not deploy in this crash.

Manual Restraint Systems – 2003 Acura MDX

The 2003 Acura MDX was equipped with manual continuous loop 3-point lap and shoulder safety belts for the seven seating positions. The driver safety belt was configured with a sliding latch plate, Emergency Locking Retractor (ELR), height adjustable D-ring, and a retractor pretensioner with load limiters. The adjustable D-ring was in the full-down position at the time of the SCI inspection.

Figure 9. Driver's seat. Note: The safety belt is taut against the B-pillar.

The driver was not restrained by the safety belt in the subject crash. The belt webbing was cinched taut against the B-pillar due to the fired status of the retractor pretensioner **(Figure 9)**.

The front right safety belt was configured with a sliding latch plate, switchable ELR/Automatic Locking Retractor (ALR), height adjustable D-ring, and a retractor pretensioner with load limiters. The front right D-ring was in the full-down position at the time of the SCI inspection. The front right pretensioner fired during the crash.

The rear safety belts were configured with sliding latch plates and switchable ELR/ALR's.

Occupant Demographics – 2003 Acura MDX

Driver

Age/Sex:	30-year-old/ Female
Height:	Not available
Weight:	Not available
Seat Track Position:	Mid-track [21.1 cm (8.3") of track travel]
Manual Restraint Use:	None used
Usage Source:	Vehicle inspection
Eyewear:	Unknown
Type of Medical Treatment:	Complaint of pain, no visible injuries. Transported by ambulance to a local hospital and released.

Driver Kinematics

The 30-year-old female driver of the 2003 Acura MDX was seated in a presumed upright posture and was not restrained by the manual 3-point lap and shoulder safety belt. The lack of belt usage was supported by the stowed position of the belt system and the fired pretensioner. The driver's seat was adjusted to a mid-track position and the head restraint was adjusted 5.8 cm (2.3") above the full-down position.

At impact with the Jersey barrier, the driver's frontal air bag deployed and the front safety belt pretensioners fired. The driver initiated a forward and left trajectory in response to the 11 o'clock direction of force. She loaded the deployed air bag, which protected her from possible injury. The police report noted that the driver complained of pain, but suffered no visible injury. She was transported by ground ambulance to a local hospital. The driver failed to respond to correspondence; therefore, the specific nature of her injury is unknown.

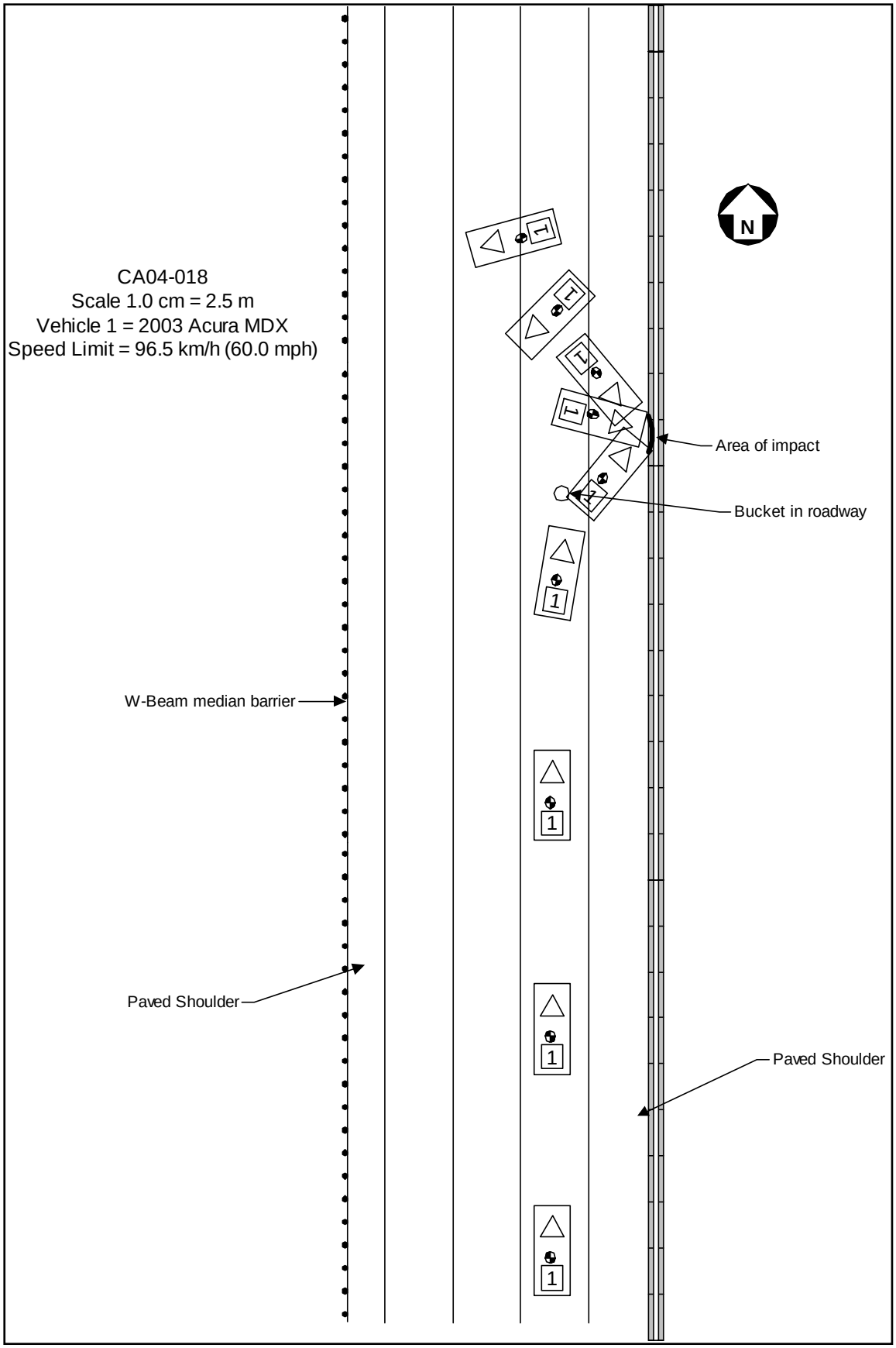

Figure 10. Scene schematic