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SCI/NASS COMBINATION CASE REPORT

CASE NUMBER - NASS-2004-50-150E
LOCATION - Texas
VEHICLE - 2004 HONDA ODYSSEY
CRASH DATE - December 2004

Submitted:

August 31, 2005

Contract Number: DTNH22-01-C-07002

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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SCI/NASS combination investigation of an air bag deployment crash involving a 2004 Honda Odyssey, a Certified Advanced 208-Compliant (CAC) vehicle, that impacted a 1995 Mercury Cougar

16. *Abstract*
The report covers a SCI/NASS combination investigation of a crash involving a 2004 Honda Odyssey minivan (case vehicle), a 1995 Mercury Cougar sedan (first other vehicle) and a 1998 Chevrolet Blazer SUV (second other vehicle). This crash is of special interest because the case vehicle was a Certified Advanced 208-Compliant (CAC) vehicle. The safety belt-restrained case vehicle driver (61-year-old male) sustained minor injuries and was treated and released at a hospital emergency department. The case vehicle' s safety belt-restrained third row right passenger (10-year-old male) did not sustain any injuries as a result of this crash. There were no other occupants in the case vehicle. The case vehicle was traveling eastward in the inside eastbound lane of a three-lane roadway that was part of a divided local trafficway, intending to continue straight ahead. The two other vehicles were stopped in traffic, heading eastward in the same lane of the same roadway, ahead of the case vehicle. The case vehicle approached the other two vehicles from behind and steered right at the last moment. Neither of the two other vehicles' drivers attempted any avoidance actions. The crash occurred in the inside lane. The case vehicle' s front left impacted the Mercury' s back right, causing the case vehicle driver' s frontal air bag to deploy. The off-set impact caused the Mercury to rotate counterclockwise as it was pushed forward and the Mercury' s right side impacted the rear of the Chevrolet. No air bags deployed in either the Mercury or the Chevrolet. The case vehicle skidded southward and came to rest heading northeastward in the outside lane. The Mercury came to rest heading northward, straddling the inside lane, and the Chevrolet was pushed slightly forward and came to rest heading eastward. The case vehicle and the Mercury were towed due to damage. The Blazer was driven from the scene.

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TABLE OF CONTENTS NASS-2004-50-150E

BACKGROUND

This SCI/NASS combination investigation was brought to the NHTSA's attention in January 2005 by NASS-CDS sampling activities and was designated for SCI on January 14, 2005. This crash involved a 2004 Honda Odyssey EXL minivan (case vehicle), a 1995 Mercury Cougar (first other vehicle) and a 1998 Chevrolet Blazer (second other vehicle). The crash occurred in December 2004, at 4:00 p.m., in Texas, and was investigated by the applicable municipal police department. This crash is of special interest because the case vehicle was a Certified Advanced 208-Compliant (CAC) vehicle. The safety belt-restrained case vehicle driver (61-year-old male, black, non-Hispanic) sustained minor injuries and was treated and released at a hospital emergency department. The case vehicle' s safety belt-restrained third row right passenger (10-year-old male, black, non-Hispanic) did not sustain any injuries as a result of this crash. There were no other occupants in the case vehicle. This report is based on the coded NASS case, occupant kinematic principles, and this contractor' s evaluation of the available evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling eastward in the inside eastbound lane of a three-lane roadway that was part of a divided local trafficway, intending to continue straight ahead. The two other vehicles were stopped in traffic, heading eastward in the same lane of the same roadway, ahead of the case vehicle. The speed limit for all vehicles was 72 km.p.h. [45 m.p.h.]. It was daylight, the weather was clear and the concrete road surface was dry and with no apparent defects (**Figure 1**). The case vehicle approached the other two vehicles from behind and steered right at the last moment. Neither of the two other vehicles' drivers attempted any avoidance actions.

The crash occurred in the inside lane. The case vehicle' s front left impacted the Mercury' s back right, causing the case vehicle driver' s frontal air bag to deploy. The off-set impact caused the Mercury to rotate counterclockwise as it was pushed forward and the Mercury' s right side impacted the rear of the Chevrolet. No air bags deployed in either the Mercury or the Chevrolet. The case vehicle skidded southward and came to rest heading northeastward in the outside lane. The Mercury came to rest heading northward, straddling the inside lane, and the Chevrolet was pushed slightly forward and came to rest heading eastward in the inside lane.

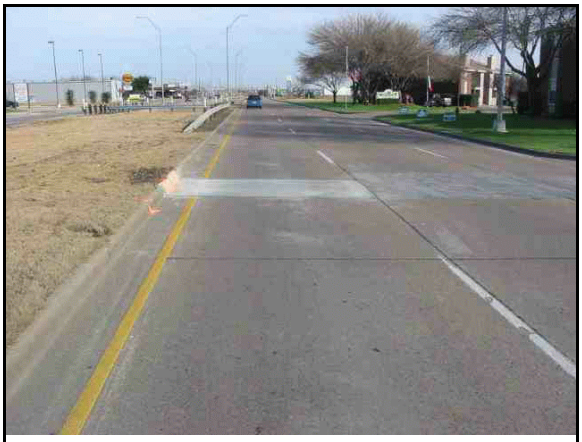


Figure 1: Case vehicle' s eastbound approach toward approximate area of impact (road work and marking not related to this crash)

CASE VEHICLE

The case vehicle was a 2004 Honda Odyssey EXL front wheel drive, four-door, seven-passenger minivan (VIN: 5FNRL18914B------), equipped with a 3.5 liter V6 gasoline engine and an automatic transmission with a column-mounted selector lever. Four-wheel anti-lock brakes were standard for this model. The case vehicle was fitted with dual-stage frontal air bags, safety

belt retractor pretensioners for the two front row seat positions, a driver's seat track sensor, a front right passenger seat weight sensor and seat back-mounted side impact air bags for the front row outboard seat positions. The odometer reading is not known due to the non-functional electronic instrument cluster, and the interviewee could not estimate the mileage because the case vehicle was a rental unit. Its wheelbase was 300 centimeters [118.1 inches]. The case vehicle was towed due to disabling damage.

Figure 2: Case vehicle's front, straight on, bumper-level crush profile

Figure 3: Case vehicle's front and left side, above-bumper crush profile

The case vehicle sustained direct contact across the left half of the front and on the left fender from its impact with the back of the Mercury (**Figures 2** and **3**). The case vehicle's front bumper underrode the Mercury's rear bumper and the case vehicle's grille and the leading edge of its hood and left fender engaged the Mercury's back bumper, body panels and trunk lid. The case vehicle's bumper cover was torn off and the leading edge of its left fender was crushed and displaced rearward. The case vehicle's hood was crushed rearward and bent downward, its left headlamp/turn signal assembly was shattered and broken away, and the grille and radiator support bracket were crushed rearward on the left. Maximum crush was measured as 35 centimeters [13.8 inches] at C1, at the top of the leading edge of the left fender. (Note, due to the underride configuration, this value was crush-averaged to 18 centimeters [7.1 inches] for input into the WinSMASH reconstruction program.) There were light stress cracks in the windshield and no other glazing damage. None of the tires were restricted or deflated. The wheelbase was shortened by 2 centimeters [0.8 inches] on the left and unchanged on the right.

The CDC for the case vehicle's single impact was determined to be **12-FYEW-2 (0 degrees)**. The WinSMASH reconstruction program, damage-only algorithm based on the measured crush profiles of the two vehicles, with the crush averaging technique employed for the case vehicle's profile, was used. The total, longitudinal and lateral delta-Vs for the case vehicle are, respectively: 21 km.p.h. [13.0 m.p.h.], -21 km.p.h. [-13.0 m.p.h.] and 0 km.p.h. [0 m.p.h.]. Because this collision involved an underride configuration and crush averaging, these results are judged to be borderline but reasonable. This was a crash of low severity (14-23 km.p.h. [9-14 m.p.h.]) for the case vehicle.

Inspection of the case vehicle' s interior revealed that there were no intrusions and no evidence of occupant contact, except the two safety belt systems that were in use (front left and third row right) showed stretch marks in the webbing.

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with dual-stage frontal air bags and seat back-mounted side air bags for the driver and front right passenger seat positions, for a total of four air bags. The driver' s air bag deployed and the other three did not deploy.

The driver' s air bag was mounted in the steering wheel hub with the module cover flaps in the H-configuration. Both flaps measured 16 centimeters [6.3 inches] horizontally. The upper flap measured 6 centimeters [2.4 inches] vertically and the lower flap was 7 centimeters [2.8 inches]. The flaps opened at the tear points and there was no evidence of damage to the flaps or the adjacent structures. The driver' s air bag was round with a diameter of 51 centimeters [20.1 inches]. There were two vent ports, of unknown diameter, located at the 11:00 and 1:00 o' clock positions on the back surface of the air bag. There were deployment scuffs on the lower edges of the front surface and no other evidence of damage or occupant contact on the air bag fabric.

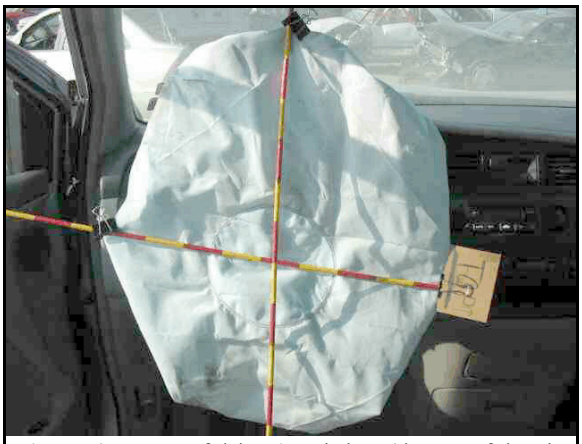


Figure 4: Front of driver' s air bag (the top of the air bag is on the right in this view)

CASE VEHICLE DRIVER' S KINEMATICS

The case vehicle' s driver (61-year-old male, black, non-Hispanic, 178 centimeters, 102 kilograms [70 inches, 225 pounds]) was restrained by the available manual, three-point, lap-and-shoulder safety belt system. The box-mounted (van-type) seat track was adjusted between the middle and rear positions and the seat back was slightly reclined (**Figure 5**). The driver was seated in a forward-facing posture, with his back against the seat back, at least one hand on the steering wheel and his feet on the floor or operating the foot controls. The driver stated that he steered right at the last moment. He probably also braked, causing the front of the case vehicle to tip downward, as evidenced by the underride configuration of the impact damage.

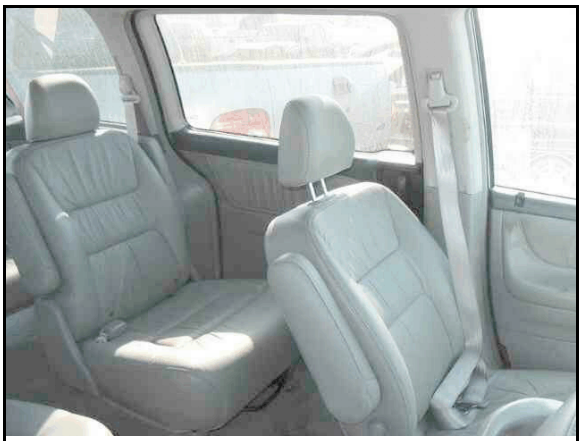


Figure 5: Driver' s seat back and safety belt; note, safety belt locked by actuated pretensioner

The driver steered right (and probably braked) immediately prior to the impact, and he moved slightly to the left (and probably slightly forward) in response to these avoidance maneuvers. The safety belt retractor probably locked and the driver was held essentially in place by the safety belt system. The case vehicle' s front impacted the back of the Mercury, causing the driver' s air bag to deploy and the safety belt pretensioner to actuate. The driver moved further forward and slightly upward in response to the impact deceleration and he loaded against the safety belt, causing stretch marks in the webbing. He probably encountered the deployed driver' s air bag with his face and chest, but was restrained by the safety belt system. The coded NASS case does not include any injuries for the driver, as discussed below. His position at final rest is not known, but he probably rebounded into the driver' s seat.

DRIVER' S INJURIES

The driver sustained police-reported " C" (possible) injuries and was transported to a hospital via ambulance. His medical records were not acquired. According to his interview information, he was treated and released. In the interview, the driver claimed to have sustained an " air bag concussion" and no other injury. NASS-CDS injury coding rules do not permit coding a self-reported alleged concussion and there are no injuries coded for the driver in the NASS case.

CASE VEHICLE THIRD ROW RIGHT PASSENGER' S KINEMATICS

The case vehicle' s third row right passenger (10-year-old male, black, non-Hispanic, 147 centimeters, 41 kilograms [58 inches, 90 pounds]) was restrained by the available manual, three-point, lap-and-shoulder safety belt system. He was seated in a forward-facing posture, with his back against the seat back. His seat track and bench seat back were not adjustable (**Figure 6**). His posture is otherwise not known.

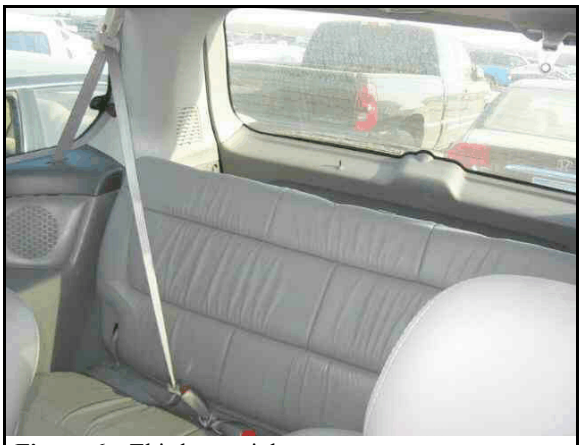


Figure 6: Third row right seat area

The case vehicle driver steered right (and probably braked) immediately prior to the impact and the back right passenger moved slightly to the left (and probably forward) in response to these avoidance maneuvers. The safety belt retractor probably locked and the back right passenger was held essentially in place by the safety belt system. The case vehicle' s front impacted the back of the Mercury and the case vehicle' s back right passenger probably moved further forward and slightly upward in response to the impact deceleration. He loaded against the safety belt, causing stretch marks in the webbing. He probably rebounded into his seat at final rest. He did not sustain any injuries and did not seek medical treatment.

The first other vehicle was a 1995 Mercury Cougar XR7 rear wheel drive, two-door, five-passenger coupe (VIN: 1MELM62W0SH------), equipped with a 4.6 liter V8 gasoline engine. Four-wheel anti-lock brakes were an option for this model, but it is not known if this vehicle was so equipped. The Mercury had driver and front right passenger air bags that did not deploy. Its wheelbase was 287 centimeters [113.0 inches]. The Mercury was towed due to damage.

The Mercury sustained direct contact damage on the right half of the back plane, with induced damage extending across the entire back and on the right rear quarter panel, from its impact with the case vehicle (**Figures 7** and **8**). The bumper cover was torn away and the steel bumper was crushed against the back surface body panels. The vertical surface on the back of the trunk lid was crushed forward and the horizontal surface was bent downward. The right quarter panel was crushed forward and buckled outward. Maximum crush was measured as 48 centimeters [18.9 inches] at C6, at the back right corner. The wheelbase was shortened by 6 centimeters [2.4 inches] on the right and stretched by 2 centimeters [0.8 inches] on the left. The right rear tire was restricted due to the crushed body panels, but the tire was not damaged and there was no other wheel/tire damage. The right front door window glazing was shattered due to the second impact and there was no other glazing damage.

Figure 7: Mercury's back and right side; right side damage forward of the C-pillar is due to the second impact

Figure 8: Mercury's back crush profile

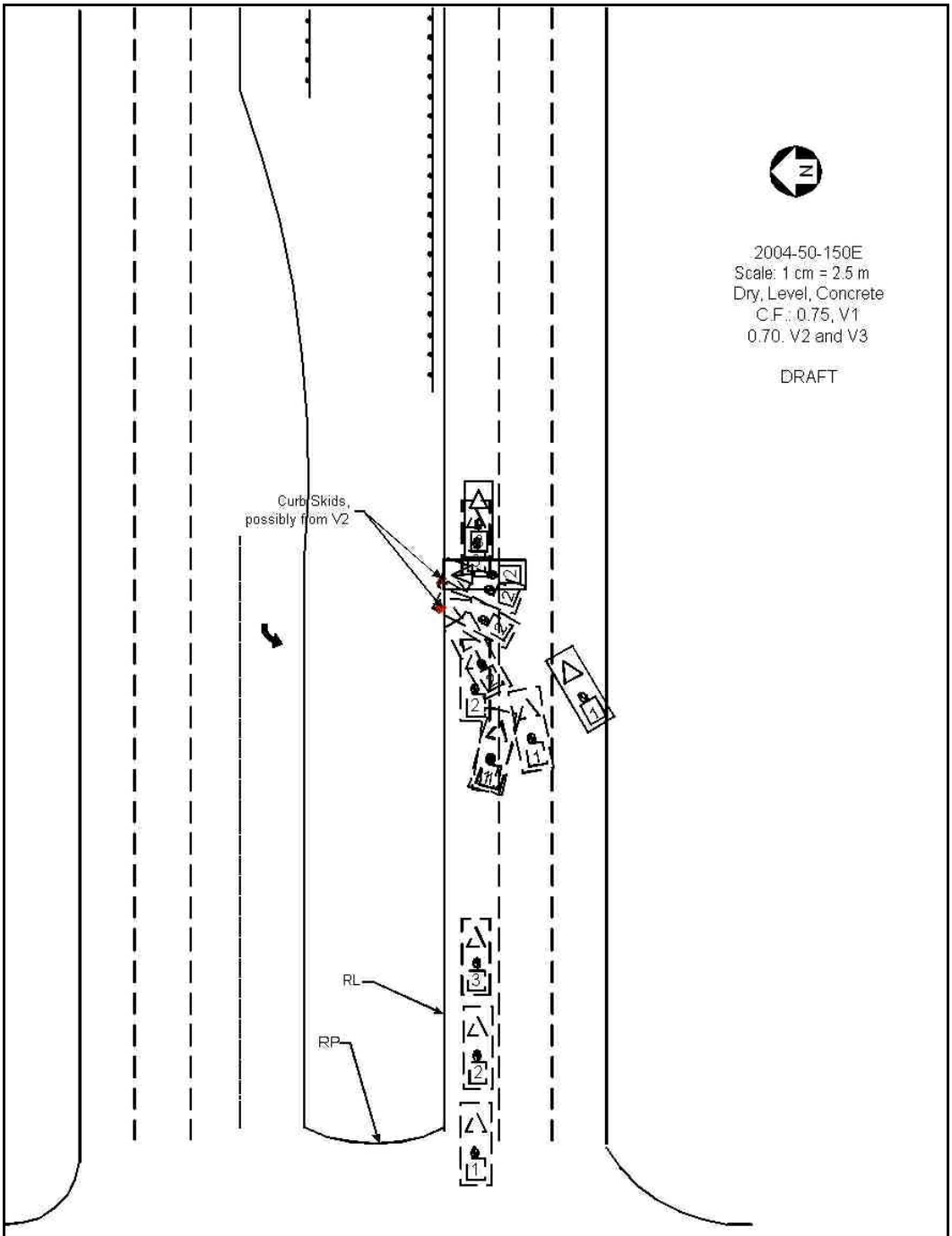
The CDC for the Mercury's impact with the case vehicle was determined to be **06-BZEW-4 (190 degrees**). The WinSMASH reconstruction program, damage-only algorithm based on the measured crush profiles of both vehicles, with the crush average technique employed for the case vehicle's profile, was used. The total, longitudinal and lateral delta-Vs for the Mercury are, respectively: 27 km.p.h. [16.8 m.p.h.], + 27 km.p.h. [+ 16.8 m.p.h.] and + 5 km.p.h. [+ 3.1 m.p.h.]. Because this collision involved an underride configuration and crush averaging, these results are judged to be borderline but reasonable. The Mercury's impact with the case vehicle was of moderate severity (24-40 km.p.h. [15-25 m.p.h.]) for the Mercury.

The case vehicle pushed the Mercury forward and caused it to rotate counterclockwise, and the right side of the Mercury impacted the back of the Blazer (**Figure 7**). The CDC for the Mercury's involvement in this second impact was determined to be **02-RZEW-2 (70 degrees)**. This impact did not involve the case vehicle and is not further discussed.

The Mercury's driver (39-year-old female, white, Hispanic) was 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 for minor soft tissue injuries. The Mercury's back right passenger (5-year-old male, white, Hispanic) was restrained by the available manual, three-point, lap-and-shoulder safety belt system. The back right passenger was not injured and did not seek medical attention. There were no other occupants in the Mercury.

SECOND OTHER VEHICLE: 1998 CHEVROLET BLAZER

The second other vehicle was a 1998 Chevrolet Blazer rear wheel drive, four-door, five-passenger sport utility vehicle (VIN: 1GNCS13W2W2------), equipped with a 4.3 liter V6 gasoline engine. Four-wheel anti-lock brakes were standard for this model. Its wheelbase was 272 centimeters [107.0 inches]. The Blazer's back surface was impacted by the Mercury's right side. The Blazer's driver (58-year-old female) was restrained by the available, manual, three-point, lap-and-shoulder safety belt system and was not injured. There was no other occupant in the Blazer and it was driven away from the scene. The Blazer did not make contact with the case vehicle and is not discussed further.



Case Vehicle (V#1): 2004 Honda Odyssey
First Other Vehicle (V#2): 1995 Mercury Cougar
Second Other Vehicle (V#3): 1998 Chevrolet Blazer