Redesigned Air Bag Special Study/ Vehicle to Object
Dynamic Science, Inc. / Case Number: DS05030
2000 Isuzu Hombre
Colorado
November 2005

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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.

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16. Abstract

This on site investigation focused on the driver air bag installed in a 2000 Isuzu Hombre pickup. The Isuzu pickup was being driven by an unrestrained 47-year-old male. The case vehicle was traveling at a police reported speed of 64 km/h (40 mph). The driver apparently drove off the roadway and traveled approximately 37.0 m (120 ft) before striking a tree that was approximately 3 m (10 ft) off the side of the road. There were no indications that any other vehicles were involved or that the driver took evasive actions. The driver's air bag deployed during the crash. The driver sustained a neck fracture and a ruptured aorta. It appears that the crash went unreported for at least an hour. Once found, the driver was transported to a local hospital at 0215 hours and declared dead at 0316 hours.

This Driver Air Bag Fatality case was identified by NHTSA through an on-line news article. DSI was assigned the case on December 7, 2005. The case was originally assigned as a air bag fatality case, but was dropped as an air bag fatality and changed to a Redesigned Air Bag Special Study case because the Delta V exceeded 40 km/h (25 mph).

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BACKGROUND

This on site investigation focused on the driver air bag installed in a 2000 Isuzu Hombre pickup (**Figures 1-2**). The Isuzu pickup was being driven by an unrestrained 47-year-old male. The case vehicle was traveling at a police reported speed of 64 km/h (40 mph). The driver apparently drove off the roadway and traveled approximately 37.0 m (120 ft) before striking a tree that was approximately 3 m (10 ft) off the side of the road. There were no indications that any other vehicles were involved or that the driver took evasive actions. The driver's air bag deployed during the crash. The driver sustained a neck fracture and a ruptured aorta. It appears that the crash went unreported for at least an hour. Once found, the driver was transported to a local hospital at 0215 hours and declared dead at 0316 hours.

Figure 1. Front right, 2000 Isuzu Hombre

Figure 2. Exemplar view, 2000 Isuzu Hombre

This case identified by NHTSA through an online news article. The case was originally assigned as a air bag fatality case, but was dropped as an air bag fatality and changed to a Redesigned Air Bag Special Study case because the Delta V exceeded 40 km/h (25 mph). DSI was assigned the case on December 7, 2005. Permission to inspect the case vehicle was obtained on December 12, 2005. The case vehicle was inspected on December 14, 2005.

SUMMARY

Crash Site

This single vehicle crash occurred in a rural area of southern Colorado. The crash occurred off-road. At the time of the crash, there were no adverse weather conditions and the asphalt roadway surface was dry. At the time of the crash, it was dark and there were no streetlights available. The north/south county roadway was configured with a single lane in each direction that was separated by a very faint double yellow centerline. Just prior to the impact area there is a 4.2 m (13.7 ft) wide private driveway on the right side of the roadway. The struck tree was 3.2 m (10.5 ft) south of the driveway and 5.2 m (17.0 ft) west of the roadway edge. The 67.0 cm (26.3 in) diameter tree was located in a ditch that was 70.0 cm (27.5 in) below the height of the roadway edge. In Colorado, the basic prima facie speed limit for a residential district is 48 km/h (30 mph).

Pre-Crash

The 2000 Isuzu Hombre was traveling southbound at an unknown speed (**Figure 3**). The 47-year-old male driver was not wearing the available 3-point manual lap and shoulder belt. The front right passenger air bag cut off switch was in the ON position.

The driver drove off the roadway and traveled approximately 37.0 m (120 ft). There were no indications that any other vehicles were involved or that the driver took any evasive actions.

Figure 3. Approach to impact with tree (south)

Crash

The vehicle continued down the right side of the roadway before striking a tree that was approximately 3 m (10 ft) off the side of the road (**Figure 4**). Both front air bags deployed at this point. The barrier routine of the WinSmash program computed a total delta V of 44.0 km/h (27.3 mph) based on the Isuzu's frontal crush profile. The longitudinal and lateral components were -44.0 km/h (-27.3 mph) and 0 km/h (0 mph), respectively.

Figure 4. Impact with tree (south)

Post-Crash

The driver sustained a neck injury and a ruptured aorta. It appears that the crash went unreported for at least an hour. Once found, the driver was transported to a local hospital at 0215 hours and declared dead at 0316 hours. An autopsy was completed and has been requested but had not yet arrived at the time of this report. Injuries were obtained from the investigating officer who had obtained the injuries verbally from the coroner. This report will be updated as additional injury information becomes available.

The Isuzu was towed from the scene due to damage.

VEHICLE DATA - 2000 Isuzu Hombre

The 2000 Isuzu Hombre pickup truck was identified by the Vehicle Identification Number (VIN): 1GGCS1943Y8xxxxxx. The Hombre was a sister vehicle to the Chevrolet S-10. The Isuzu's odometer could not be read due a lack of power to the instrument panel. The Isuzu was an extended cab 4x2 pickup that was equipped with a 2.2 liter, four cylinder engine, a four speed manual transmission, front disc/rear drum brakes with ABS, power steering, auto on/off headlights and a tilt steering wheel. The Hombre was configured with Uniroyal Liberator A/T P205/75R15 tires. The vehicle manufacturer's recommended cold tire pressure was 241 kPa (35 psi). The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	186 kPa (27 psi)	8 mm (10/32 in)	No	None
LR	200 kPa (29 psi)	7 mm (9/32 in)	No	None
RR	200 kPa (29 psi)	7 mm (9/32 in)	No	None
RF	214 kPa (31 psi)	8 mm (10/32 in)	Yes	None

The seating in the 2000 Isuzu Hombre was configured with front cloth covered bucket seats with integral head restraints and side facing vinyl-upholstered folding jump seats in the rear. The driver's seat was located 37.0 cm (14.5 in) from the base of the A pillar; the seat was positioned between the middle and rear most track position. The seat back angle was 56 degrees and the seat bottom angle was 8 degrees. The front right passenger's seat was fully forward. The seat back angle was 82 degrees and the seat bottom angle was 10 degrees.

VEHICLE DAMAGE

Exterior Damage - 2000 Isuzu Hombre

Damage Description:	Sustained moderate front end damage as a result of the impact with the tree (**Figure 5**). The direct damage began 16 cm (6.3 in) from the right front bumper corner and measured 60 cm (23.6 in) laterally along the bumper. The combined direct and induced damage began at the left front bumper corner and measured 109 cm (42.9 in) laterally across the entire front end. The right wheelbase was reduced by 5 cm (1.9 in). The front right tire was restricted. The hood and right fender were deformed. There was remote buckling on the roof at the right B pillar.	
CDC:	12FZEW3	
Delta V:	Total	44.0 km/h (27.3 mph)
	Longitudinal	-44.0 km/h (-27.3 mph)
	Latitudinal	0 km/h (0 mph)
	Energy	110,738 joules (81,676 ft-lbs)

Six crush measurements were documented at the bumper level as follows: C1 = 0cm, C2 = 5 cm (1.9 in), C3 = 24 cm (9.4 in), C4 = 57 cm (22.4 in), C5 = 51 cm (20.0 in), C6 = 37 cm (14.6 in).

Figure 5. Front bumper, Isuzu Hombre

Interior Damage - 2000 Isuzu Hombre

The 2000 Isuzu Hombre sustained minor damage as a result of occupant contacts and component movement. The left lower instrument panel exhibited faint scuffs on the left side that likely came from the driver's left knee. The lower panel was loose. There were horizontal linear scuffs to the driver's seat back and integral head rest. The scuffs began in the mid line lateral position and extended from left to right at a 45 degree angle. The steering wheel was covered with an after-market rubberized sleeve. The sleeve was partially torn away at the top, but this may have been from usage over time. The steering column was loose but did not appear to have been compressed. The front right seat was jammed in a fully forward position. The distance from the seat back to the instrument panel was 22 cm (8.7 in) and the distance from the back of the seat back to the back of the cab was 80 cm (31.5 in).

MANUAL RESTRAINT SYSTEMS - 2000 Isuzu Hombre

The 2000 Isuzu Hombre was configured with manual 3-point lap and shoulder belts for the front bucket seats. The driver's and front right passenger's safety belts were configured with sliding latch plates and Emergency Locking Retractors (ELR). The driver's belt exhibited evidence of historical use but was not being used at the time of the crash. The rear side-facing jump seats were configured with lap belts with sewn on latch plates.

FRONTAL AIR BAG SYSTEM - 2000 Isuzu Hombre

The 2000 Isuzu Hombre was equipped with redesigned frontal air bags for the driver and front right passenger positions. The passenger air bag switch was in the "ON" position prior to impact (**Figure 6**). Both frontal air bags deployed as a result of the longitudinal deceleration of the Isuzu during the impact with the tree.

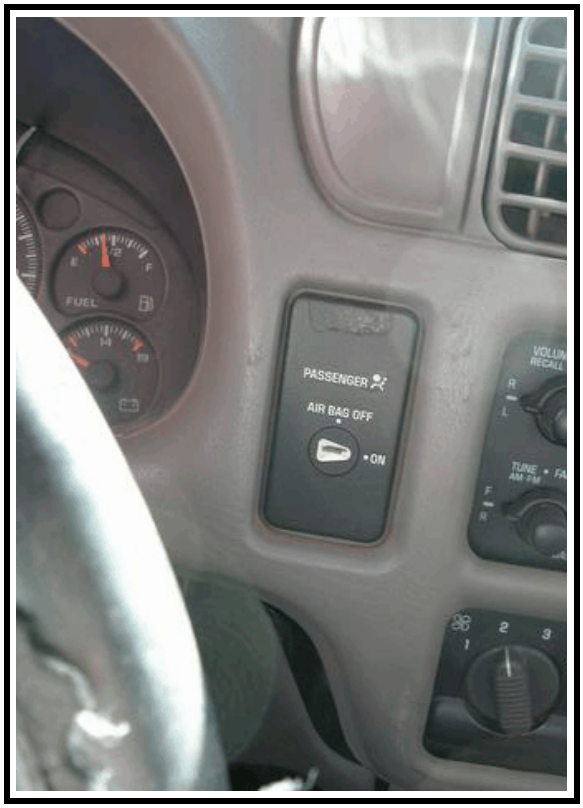

Figure 6. Passenger Air Bag Switch

The driver's air bag deployed from the center of the steering wheel hub through symmetrical I-configuration module cover flaps (**Figure 7**). Each flap measured 11 cm (4.3 in) in height and 7 cm (2.8 in) in width. The deployed driver's air bag measured 48 cm (18.9 in) in diameter in its deflated state. The maximum excursion measured 24 cm (9.4 in) from the module face. The air bag was tethered by a single internal strap. Two circular vent ports were located at the 11 and 1 o'clock aspects on the rear of the air bag. There were 11 horizontal and 8 vertical folds across the air bag face. There were no indications of occupant contact to the air bag.

The front right passenger's air bag deployed from the front mount module with a rectangular cover flap that was hinged at the bottom (**Figure 8**). The module cover flap measured 32 cm (12.5 in) wide by 12 cm (4.7 in) high. The deployed front right passenger air bag measured 43 cm (16.9 in) from seam to seam laterally and measured 40 cm (15.7 in) high in its deflated state. There were no tethers. Two circular vent ports were located at the 3 and 9 o'clock aspects of each side panel of the air bag. There were no occupant contacts or damage to the air bag or module cover.

Figure 7. Driver's air bag

Figure 8. Front right passenger's air bag

OCCUPANT DEMOGRAPHICS - 2000 Isuzu Hombre

	Driver
Age/Sex:	47/Male
Seated Position:	Front left
Seat Type:	Fabric covered bucket seat, seat was located 37 cm (14.6 in) from the base of the A pillar. Seat was positioned between the middle and rear most track position.
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	Alcohol suspected, test given, results not known
Driving Experience:	Unknown
Body Posture:	Generally upright
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt available, not used
Air bag:	Steering wheel mounted driver's air bag, deployed

OCCUPANT INJURIES - 2000 Isuzu Hombre

Driver: Injuries obtained from investigating officer as reported to him from the coroner.

Injury	OIC Code	Injury Mechanism	Confidence Level
Ruptured aorta	420206.4,4	Driver's air bag	Probable
Neck fracture	650216.2,6	Driver's air bag	Probable

OCCUPANT KINEMATICS - 2000 Isuzu Hombre

Driver Kinematics

The 47-year-old driver was seated forward facing, but was likely unconscious based on the lack of evasive maneuvers. He was possibly leaning forward and to the left. He was not wearing the available lap and shoulder belt. The seat back angle was 56 degrees and the seat bottom angle was 8 degrees. The distance from the top of the steering wheel rim to the seat back was 73 cm (28.7 in) and the distance from the bottom of the steering wheel rim was 43 cm (16.9 in). The steering wheel angle was 66 degrees and the center of the hub to the floor was 64 cm (25.2 in). The distance from the top of the instrument panel to the top of the steering wheel was 11 cm (4.3 in). At impact, the frontal air bags deployed. The male driver initiated a forward trajectory while engaging the deploying driver's air bag with his head and chest. It appears that his left knee contacted the lower instrument panel (**Figure 9**). The driver sustained a neck fracture and a ruptured aorta. The driver was forced rearward and his head struck the seat back/integral head restraint. A left to right diagonal scuff was found on the seat back that began at the middle back level and ended on the right side of the head restraint (**Figure 10**).

The crash went unreported for at least an hour. Once found, the driver was transported to a local hospital at 0215 hours and declared dead at 0316 hours.

Figure 9. Left lower instrument panel

Figure 10. Scuff to back of driver's seat

Attachment 1. Scene Diagram