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**National Highway
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CALSPAN REMOTE AIR BAG DEPLOYMENT INVESTIGATION
CALSPAN CASE NO. 92-13
VEHICLE - 1989 ACURA LEGEND
LOCATION - [REDACTED]
ACCIDENT DATE - [REDACTED], 1991

Contract No. DTNH22-87-C-27169

Prepared for:

U.S. Department of Transportation
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Washington, D.C. 20590

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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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15. Supplementary Notes Remote investigation of an air bag deployment crash that involved a 1989 Acura Legend. The air bag contacted the driver's face resulting in multiple injuries of the face, eyes, and ear.					
16. Abstract <p>This remote investigation focused on a front-to-rear crash that involved an air bag equipped 1989 Acura Legend. Data for this report was obtained from the driver of the Acura and an attorney who is representing the driver. Due to pending litigation, the attorney refused to release photographs of the driver's injuries and her medical records. Injury data was obtained during an extensive interview with the driver; however, the injuries were not verified by medical records.</p> <p>The Acura impacted the rear of a stopped vehicle at a driver estimated speed of 32-40 KPH (20-25 mph). The 12 o'clock direction of force impact produced minor damage to the Acura and deployed the driver's air bag system. The driver was a 43-year old female with a height of 172.7cm (68") and weight of 65.3kg (145 lbs.) She was wearing the manual 3-point lap and shoulder belt system. The non-tethered air bag contacted the driver's face as she initiated a forward trajectory in response to the frontal impact sequence. Bag contact produced abrasions across the driver's face and onto the eye areas. She also reported to have sustained injury to the left eye and ear that have resulted in permanent impairments.</p>					
17. Key Words Front-to-rear impact sequence Sufficient longitudinal deceleration Air bag deployment Facial, eye and ear injuries			18. Distribution Statement General Public		
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CALSPAN REMOTE AIR BAG DEPLOYMENT INVESTIGATION
CALSPAN CASE NO. 92-13
VEHICLE - 1989 ACURA LEGEND
LOCATION - ██████████

SUMMARY

This remote investigation focused on a multivehicle crash that resulted in deployment of the Supplemental Restraint System (SRS) in a 1989 Acura Legend. The vehicle was driven by a 43-year-old female with a stated height of 172.7cm (68") and weight of 65.3kg (145 lbs.). The crash occurred on a two lane urban street during evening hours on ██████████, 1991. Data for this crash was obtained from the driver of the Acura and her attorney. Due to pending litigation, the attorney would not authorize the release of medical records and photographs of the driver's injuries.

The Acura was traveling in rush hour traffic and was following an older vehicle (vehicle #2) at a driver estimated speed of 32-40 KPH (20-25 mph). Vehicle #2 was traveling behind a transit bus that stopped to discharge passengers. The driver of vehicle #2 safely stopped behind the transit bus. The driver of the Acura Legend was probably inattentive and failed to detect the stopped vehicle. She stated that she did not recall braking prior to impact.

The full frontal area of the Acura impacted the rear of vehicle #2 resulting in a 12 o'clock/6 o'clock impact configuration. The driver stated that the Acura sustained minor damage with an estimated bumper crush depth of 15-20cm (6-8"). As a result of the impact, the Acura underwent a sufficient longitudinal deceleration which deployed the driver-side air bag SRS. Vehicle #2 was not damaged by the impact; however, the force of the crash displaced the vehicle forward into the rear of the bus. The secondary collision between vehicle #2 and the bus was minor and did not produce vehicle damage.

The driver of the Acura stated that she was in a normal driving position at impact with her seat adjusted to a mid track position. She was wearing the manual 3-point lap and shoulder belt system. At impact with vehicle #2, the Acura's driver air bag system deployed. The driver reported that she heard a loud "bang" within the vehicle that she associated with air bag deployment. The air bag contacted her face as she initiated a forward trajectory in response to the frontal impact sequence. As a result of air bag contact, the driver sustained abrasions (AIS-1) of the forehead over the left eye, around both eyes with swelling, an abrasion of the left eyelid and across both lips.

SUMMARY (CONT'D.)

In addition to the abrasions, the driver and her attorney stated that she also sustained a dislocation of the left temporomandibular joint (AIS-2), left ear nerve damage, hyphema in both eyes with high PH levels, and damage to the pupils of the eyes. The driver stated that as a result of these injuries, she has developed permanent damage to the eyes, left ear, and suffers from persistent headaches. Her eyes are extremely sensitive to light which requires use of a double-tinted lens to filter out ambient light. Due to the nerve damage in the left ear, the driver stated that her hearing is amplified in the left ear. She also reported having inhaled the gases that exhausted from the air bag which produced irritation of the throat and a raspy voice.

The driver was initially treated in a hospital emergency room where her eyes were irrigated with a saline solution for approximately a four-hour period to reduce a high PH level. She was subsequently examined by ophthalmologists, throat and ear specialists, a dentist, neurologist, and a chiropractor. Her attorney reported that her eye, ear, and throat complaints have persisted for over one year following the crash and will probably remain as permanent injuries.

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LOCATION - ██████████, NY

ACCIDENT DATA

Location/Street: 2 lane street
City/Township: ██████████
Area/Type: Urban/Commercial
Accident Date/Time: ██████████, 1991,
evening hours
Investigating Police Agency: ██████████ Police Department
Accident Type: Car/Car, front to rear impact
Air Bag Vehicle Driver Injury Severity: Moderate (AIS-2)

AMBIENCE

Light Conditions: Dark, lighted
Weather: Overcast
Precipitation: None
Road Surface: Dry

HIGHWAY

Location: Urban street
Number of Lanes: 2
Surface: Asphalt
Vertical Alignment: Level
Horizontal Alignment: Straight
Traffic Density: Heavy, rush hour traffic
Speed Limit: 30 mph
Traffic Controls: None pertinent

VEHICLES

	<u>Air Bag Vehicle</u>	<u>Vehicle #2</u>
Year:	1989	Older vehicle, make/model was unknown
Make:	Acura	
Model:	Legend	
Body Style:	4 dr. sedan	Unknown
V.I.N.:	Unknown	Unknown
Mileage:	Unknown	Unknown
Tow Status:	Towed due to damage	N/A, driven from scene
Reported Defects:	None	None
Previous Repairs:	Routine maintenance	Unknown

VEHICLE DAMAGE

Deployment Impact

Object Struck:	Vehicle #2	
Event Number:	1	
Damage Location:	Front, distributed	Rear, distributed
CDC:	12-FDEW-1	06-BDEW-1
Estimated Maximum Crush:	15-20cm (6-8")	No damage
Damage d Components:	Front bumper and grille	None
Repair Cost:	\$2500.00 inclusive of air bag module	N/A

SUPPLEMENTAL RESTRAINT SYSTEM

The 1989 Acura Legend was equipped with a driver's side air bag Supplemental Restraint System (SRS) that deployed as a result of the vehicle's frontal impact sequence with the rear of a stopped vehicle. The driver reported that the Acura sustained minor damage and was repaired for \$2,500, inclusive of air bag module replacement. Based on this damage estimate, the Acura probably sustained a longitudinal deceleration within the 12-20 KPH (8-12 mph) range.

The driver reported that the auto body repair shop had cut the air bag from the module assembly and retained the bag for her. The module was apparently discarded following the repair of the vehicle. Based on previous investigations, the Acura is equipped with a non-tethered air bag that consists of basic construction (nylon weave with a neoprene liner) and two venting ports. The driver reported that the bag did not appear to be torn. She further stated that a makeup transfer was visible on the face of the bag.

The driver's attorney notified Acura regarding her long term injuries and was told that the air bag was manufactured by TRW and that the system probably deployed properly. Acura (Honda) personnel did not express an interest in inspecting the vehicle or the SRS.

COLLISION SEQUENCE

Pre-Crash:

The driver of the 1989 Acura stated that she was traveling in moderate rush hour traffic at an estimated speed of 32-40 KPH (20-25 mph). She was following an older vehicle (vehicle #2) that was traveling behind a transit bus. The transit bus stopped in the travel lane to discharge passengers at a designated bus stop. The driver of vehicle #2 apparently detected the brake lights on the bus and braked to a stop behind the bus. The driver of the Acura was probably inattentive and failed to detect the stopped vehicles in sufficient time to avoid the impending crash. The driver stated that she did not recall applying the brakes prior to impact.

COLLISION SEQUENCE (CONT'D.)

Crash: The full frontal area of the Acura impacted the rear of the stopped vehicle #2 at a driver estimated speed of 32-40 KPH (20-25 mph). Based on the front-to-rear impact configuration, resultant directions of force were probably within the 12 o'clock sector for the Acura and 6 o'clock for vehicle #2. The Acura sustained minor-to-moderate frontal damage with a driver estimated crush depth at bumper level of 15-20cm (6-8"). As a result of the impact, the Acura's driver air bag Supplemental Restraint System deployed.

The driver of the Acura stated that vehicle #2 was not damaged by the impact; however, the crash forces displaced vehicle #2 forward. The frontal area of vehicle #2 subsequently struck the rear of the transit bus. The secondary crash was of minor severity and did not produce damage to the involved vehicles.

Post-Crash:

- Final Rest - The driver of the Acura probably braked at impact and stopped her vehicle in the travel lane near the point of impact behind vehicle #2. Vehicle #2 came to rest against the rear of the struck transit bus.
- Driver Activities - The driver of the Acura unfastened the manual restraint system and exited the vehicle unassisted from the left front door. She stated that her vision began to fade as she exited the vehicle and was nearly struck by a vehicle in rush hour traffic.
- Police Activities - The local police department was notified of the crash and dispatched an officer to the scene where he conducted his investigation of the crash.
- Rescue Activities - Rescue personnel responded to the crash scene and transported the driver by ambulance to a local hospital where she was treated for her injuries and released.

HUMAN FACTORS/OCCUPANT DATA

Driver:	43 year old female
Height:	172.7cm (68")
Weight:	65.3kg (145 lbs.)
Active Restraint System Usage:	3-point lap and shoulder belt system
Usage Source:	Driver interview
Eyewear:	None
Transportation from Scene:	Ambulance to local hospital
Type of Medical Treatment:	Treated at hospital and released with multiple follow-up visits to eye and ear specialists

DRIVER INJURIES

<u>Injury</u>	<u>Severity (OIC/AIS)</u>	<u>Source</u>
Dislocation of the left temporomandibular joint (TMJ)	Moderate (FLDJ-2)	Air bag
Abrasions of the forehead over the left eye	Minor (FSAI-1)	Air bag
Abrasions around both eyes with swelling	Minor (FLA0-1, FRA0-1)	Air bag
Abrasion of the left eyelid	Minor (FLA0-1)	Air bag
Hyphema in both eyes with high PH levels in the eyes and injury to the pupils, dilated and sensitive to light	Not codeable injuries	Air bag

DRIVER INJURIES (CONT'D.)

Abrasions across both lips	Minor (FILI-1)	Air bag
Left ear nerve damage, amplified hearing	Minor (HLOE-1)	Air bag deployment noise
Severe persistent headaches from the ear or eye injury	Result, not an injury	Result of an injury
Throat irritation from inhalation of gases from air bag, raspy voice	Not a codeable injury	Air bag exhaust gases

DRIVER KINEMATICS

The driver of the 1989 Acura Legend stated that she was in a normal driving position at impact with her seat adjusted to a mid track position and the seat back set to a slight recline position. She further stated that the tilt steering wheel was adjusted to the first position below the center adjustment point (normal column angle). She was wearing the manual 3-point lap and shoulder belt system.

As the Acura impacted the rear of the stopped vehicle #2, the driver's side air bag SRS deployed. The driver stated that she heard a loud "bang" within the vehicle that she associated with air bag deployment. The non-tethered air bag contacted the driver's face as she initiated a forward trajectory in response to the 12 o'clock impact force. Her contact with the air bag produced abrasions of the forehead over the left eye, abrasions around both eyes with swelling, abrasion of the left eyelid, and abrasions across both lips. In addition to the abrasions, air bag contact also resulted in a dislocation of the left temporomandibular joint, nerve damage to the left ear, hyphema in both eyes, and dilated pupils of the eyes. The driver reported that the manual restraint system prevented her from contact with additional interior components. She did state that a makeup transfer was visible on the air bag.

DRIVER KINEMATICS (CONT'D.)

Immediately following the crash, the driver stated that she noted a faint dust within the vehicle. She felt extreme pain in the face and eye areas and noted a ringing in her left ear. The driver immediately unfastened the manual belt system and exited the vehicle from the left front door. As she exited the vehicle, the driver reported that her eyesight began to diminish. She was subsequently transported by ambulance to a local hospital where she was treated for her injuries.

The attending physician detected trauma to the eyes and began to irrigate both eyes with a saline solution. The driver reported that the PH levels in the eyes were high initially and subsided following four hours of irrigating the eyes. She further stated that her vision had decreased due to the trauma to the eyes and the extended swelling around the eyes. She was released from the emergency room and was referred to an ophthalmologist for an additional examination and treatment.

The driver stated that she developed severe headaches after the crash and has been examined by eye, ear, and neurological specialists. The headaches have allegedly persisted for a one-year period and are the result of the eye and ear injuries. As the swelling around the eyes subsided and her vision returned, the driver reported that her pupils remained dilated and as a result, she is extremely sensitive to light. This condition has continued since the crash. The driver wears a double-tinted pair of eyeglasses to reduce the light sensitivity both indoors and outdoors, when necessary.

She also reported a long-term disability of the left ear that she associated with the noise from air bag deployment. The driver stated that she has a constant ringing in the left ear and that sounds received through the ear are highly amplified. She reported the ear injury as a nerve injury that also affects her equilibrium.

In addition to long term ear and eye disabilities, the driver stated that she has developed a throat irritation that resulted from inhalation of air bag exhaust gases. The irritation produces an occasional raspy throat.

The driver and her attorney reported that she has been examined and treated by numerous specialists with no improvement of the pupil dilation, ear problems, throat irritation, and the persistent severe headaches.