

July 27, 2000

**TRANSPORTATION RESEARCH GROUP
CRASH RESEARCH SECTION**

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REMOTE FATAL AIR BAG DEPLOYMENT INVESTIGATION

VERIDIAN ENGINEERING CASE NO. CA99-045

VEHICLE #1 - 1995 HYUNDAI ACCENT

LOCATION - TERRITORY OF PUERTO RICO

CRASH DATE - DECEMBER, 1996

Contract No. DTNH22-94-D-07058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. <i>Report No.</i> CA99-045	2. <i>Government Accession No.</i>	3. <i>Recipient's Catalog No.</i>	
4. <i>Title and Subtitle</i> Veridian Engineering Remote Air Bag Deployment Investigation Vehicle #1 - 1995 Hyundai Accent Location - Territory of Puerto Rico		5. <i>Report Date:</i> February, 2000	
		6. <i>Performing Organization Code</i>	
7. <i>Author(s)</i> Crash Research Section		8. <i>Performing Organization Report No.</i>	
9. <i>Performing Organization Name and Address</i> Veridian Engineering Transportation Research Group Crash Research Section P.O. Box 400 Buffalo, New York 14225		10. <i>Work Unit No.</i> C01115.0250.(0000.0009)	
		11. <i>Contract or Grant No.</i> DTNH22-94-D-07058	
12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		13. <i>Type of Report and Period Covered</i> Technical Report Crash Date: December, 1996	
		14. <i>Sponsoring Agency Code</i>	
15. <i>Supplementary Notes</i> Remote investigation of a front to rear crash which deployed the air bag system resulting in fatal injuries to a 3 year old male.			
16. <i>Abstract</i> <p>This single vehicle crash involved a 1995 Hyundai Accent which was traveling on a two lane undivided, dark, wet, rural roadway when it departed the left side of the roadway in a right curve downhill segment at a police described higher speed than the statutory speed limit of 56 km/h (35 mph). The driver apparently lost control of the vehicle and struck the slope of a ditch with the left frontal plane. From the patterned injuries sustained by the front right occupant, it was assumed that the air bag system deployed during the crash sequence with the ditch. There was no information listed in the available police report or medical records which referred to the presence and deployment of the air bag system or the severity of vehicle damage.</p> <p>The 3 year old male front right occupant of the Hyundai was transported to the hospital approximately 30 minutes after the crash where he was pronounced DOA. He suffered abrasions of the face, neck and upper torso, fracture of the left humerus (AIS-2), cerebral edema (AIS-3), subarachnoid hemorrhage (AIS-3), fracture of the 3rd cervical vertebra with transection of the spinal cord (AIS-6), contusion of the esophagus (AIS-2), fracture of the ribs with bilateral hemothorax (AIS-4), contusions of the lungs (AIS-3), laceration of the aorta (AIS-4), laceration of the liver (AIS-2), and laceration of the mesentery (AIS-2). Many of these injuries appeared to have the same characteristics as those injuries suffered by occupants in other crashes where the deploying air bag was identified as the injury source.</p> <p>The 22 year old male driver was reportedly driving while under the influence of alcohol. A blood sample was obtained by the police and sent to a laboratory for testing. Tests results were not available for this report. The driver was not listed by police as injured in the crash.</p>			
17. <i>Key Words</i> Single vehicle run-off-road Dual front impact air bag deployment 3 year old male front right occupant AIS-6 (Maximum) Injury		18. <i>Distribution Statement</i> General Public	
19. <i>Security Classification (of this report)</i> Unclassified	20. <i>Security Classification (of this page)</i> Unclassified	21. <i>No. of Pages</i> 4	22. <i>Price</i>

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Final Case Report
Veridian Engineering Case No. CA99-045
Front Right Air Bag Related Child Fatality
Puerto Rico
December, 1996

Background

Veridian Engineering (formerly Calspan Operations of Veridian) was notified of a single vehicle crash involving a 1995 Hyundai Accent by the Crash Investigation Division (CID) of the National Highway Traffic Safety Administration (NHTSA). The crash notification originated with the Office of Defects Investigations (ODI) as ODI had been informed that the 1995 Hyundai was involved in an off roadway crash and that the dual front air bag system had deployed. The Veridian Engineering investigation team was requested to conduct a remote investigation to determine the relationship between the vehicle's deployed air bag system and the fatal injuries sustained by the three year old male seated in the front right seat. The team was supplied with the police accident report, emergency room medical records, and birth certificate. These documents were written in Spanish and were translated into English for this report. These documents did not specify the presence or deployment status of the air bag system. Efforts to obtain additional information regarding these items from the investigating agency were unsuccessful.

Summary

This single vehicle crash involved a 1995 Hyundai Accent which occurred in the Territory of Puerto Rico in the month of December, 1996 in the early evening hours. The Hyundai was traveling on a two lane undivided, dark, wet, rural roadway when it departed the left side of the roadway in a right curve downhill segment at a police described higher speed than the statutory speed limit of 56 km/h (35 mph). The driver apparently lost control of the vehicle and struck the slope of a ditch with the left frontal plane (**Figure 1**). From the patterned injuries sustained by the front right occupant, it was presumed that the air bag system deployed during the crash sequence with the ditch. There was no information listed in the available police report or medical records which referred to the presence and deployment of the air bag system or the severity of vehicle damage.

The 3 year old male front right occupant of the Hyundai was transported to the hospital approximately 30 minutes after the crash where he was pronounced DOA. He suffered abrasions of the face, neck and upper torso, fracture of the left humerus, cerebral edema, subarachnoid hemorrhage, fracture of the 3rd cervical vertebra with transection of the spinal cord, contusion of the esophagus, fracture of the ribs, contusions of the lungs with bilateral hemothorax, laceration of the aorta, laceration of the liver, and laceration of the mesentery. Many of these injuries (identified under the Injury section of this report) appeared to have the same characteristics as those injuries suffered by occupants in other crashes where the deploying air bag was identified as the injury source.

The 22 year old male driver was reportedly driving while under the influence of alcohol. A blood sample was obtained by the police and sent to a laboratory for testing. Tests results were not available for this report. The driver was not listed by police as injured in the crash.

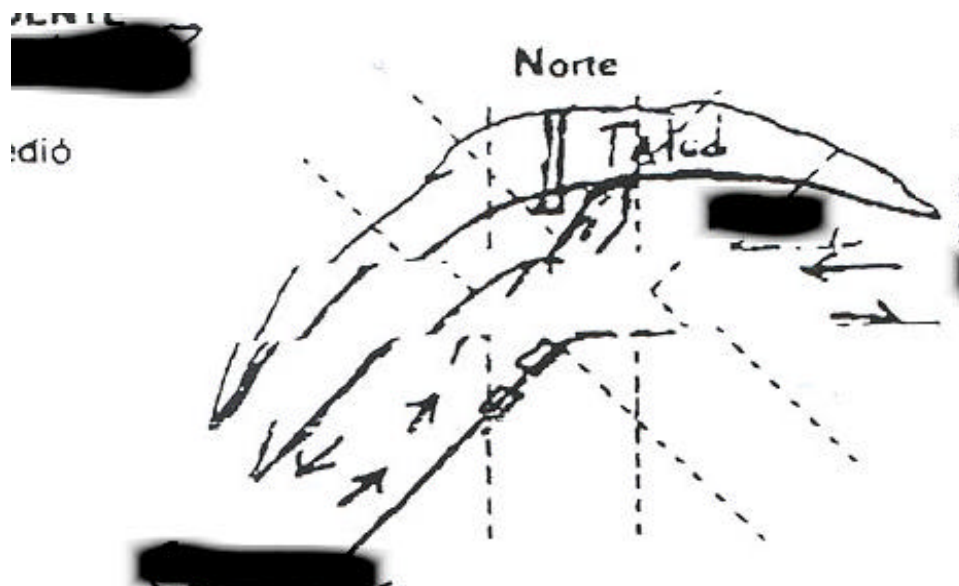


Figure 1 Police crash scene diagram

Vehicle Data

1995 Hyundai Accent

The 1995 Hyundai Accent (unknown body type) was equipped with a dual front Supplemental Restraint System (SRS) which allegedly deployed as the result of the impact with the ditch slope (“talud”). Exterior damage to the vehicle involved the front left corner according to the police report. The severity of the damage was not known nor whether the vehicle was towed from the scene.

Injury Data

The front right occupant, who was 106.7 cm (42.0") tall and weighed 17.9 kg (39.0 lbs.), more than likely moved forward and was within the expansion zone of the front right air bag at the time of the SRS actuation. This was noted by the heavy patterned abrasion along the right anterior of the child’s neck and facial area along with numerous internal injuries.

Rescue transported the child to the medical treatment facility where he arrived 30 minutes after the reported time of the crash. Upon arrival, his pupils were fixed and dilated and he was pronounced DOA. The following table summarizes the injuries identified in related medical records and an autopsy report and includes the respective AIS-90 injury codes with correlating injury sources.

INJURY - 3 YEAR OLD MALE	AIS-90	INJURY SOURCE
1. Abrasion of the inferior aspect of the mandibular region	290202.1,1	Front right air bag (possible)
2. Abrasion of the right anterior neck	390202.1,1	Front right air bag (possible)
3. Abrasion of the anterior superior chest area	490202.1,0	Front right air bag (possible)
4. Fracture of the inferior third of the left humerus	752602.2,2	Unknown
5. Cerebral edema	140668.3,9	Front right air bag (possible)
6. Subarachnoid hemorrhage of the cerebellum at the level of the medulla	140466.3,6	Front right air bag (possible)
7. Fracture of the 3 rd cervical vertebra with transection of the spinal cord	640272.6,6	Front right air bag (possible)
8. Fracture of the 1 st and 2 nd right posterior ribs and 1 st thru 9 th left posterior ribs with bilateral hemothorax	450232.4,3	Seat back support (possible)
9. Contusions of both lungs	441402.3,3	Front right air bag (possible)
10. Laceration of the thoracic aorta	420206.4,4	Front right air bag (possible)
11. Contusion of the esophagus	440802.2,8	Front right air bag (possible)
12. Subcapsular hematoma of the liver	541810.2,1	Front right air bag (possible)
13. Laceration of the mesentery	542020.2,8	Front right air bag (possible)
14. Hemoperitoneum	Not coded due to other internal injuries	Front right air bag (possible)

OCCUPANT KINEMATICS

The 22 year old male driver and his 3 year old son were traveling along a rural roadway when the vehicle departed the left side of a right curve section. The police indicated that the vehicle was going faster than the posted speed limit when the driver lost control on the wet pavement. The vehicle struck the slope of a ditch which deployed the SRS. Both the driver and front right occupant were reportedly unrestrained at the time of the crash. From the soft tissue injury pattern noted along child's face and neck region, it appeared likely that the child had moved forward during the pre-roadway departure movement and/or during the impact sequence with the ditch slope and was in close proximity to the front right air bag at the time of the deployment sequence. He apparently was looking toward the left (possible looking at his father) at the time of the crash which correlated with the heavy abrasion noted by the treating physician along the right anterior surface of the neck.

The expanding front right air bag more than likely contacted the child's chin and neck resulting in soft tissue contusions and abrasions. The child's head was subsequently hyperextended as the air bag continued to expand resulting in cerebral edema, subarachnoid hemorrhage of the cerebellum at the level of the medulla, and fracture of the 3rd cervical vertebra with transection of the spinal cord. The air bag then contacted the upper chest of the boy resulting in contusions of both lungs, laceration of the thoracic aorta, contusion of the esophagus, subcapsular hematoma of the liver, laceration of the mesentery, and hemoperitoneum. His body was subsequently propelled rearward and more than likely contacted the front right seat back support with his back region which resulted in posterior rib fractures (1st and 2nd right posterior ribs and 1st thru 9th left posterior ribs).

The child was taken to a medical treatment facility by rescue where he arrived approximately thirty minutes after the crash. He was pronounced DOA at the hospital.

The driver was not listed as injured in the crash. The police indicated the driver had been drinking alcohol prior to the crash and was given a blood test. Test results were not available for this report.