On-Scene / Vehicle to vehicle
Dynamic Science, Inc. / Case Number:DS97018
1995 Hyundai Accent
New Mexico
August/1997

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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

1. Report No.	2. Government Accession No.	3. Recipient Catalog No.
DS97018		

4. Title and Subtitle	5. Report Date
In-Depth Accident Investigation	December, 1997
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401	11. Contract or Grant no. DTNH22-94-D-27058

12. Sponsoring Agency Name and Address	13. Type of report and period Covered [Report Month, Year]
U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590	14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

The case vehicle, a 1995 Hyundai Accent driven by a 20-year-old female, was traveling east on a divided roadway at an unknown speed approaching a three-leg intersection. The speed limit for this roadway is 89 km/h (55 MPH). The right front seat was occupied by a 32 month old female (96 cm / 38 in. - 15 kg / 33 lbs.). She was using the lap portion of the lap and shoulder belt. This is based on seatbelt loading marks, horizontal abrasive injuries to her thighs, and the lack of contact injuries related to shoulder harness use. The injuries to her thighs are closer to her knees than to her pelvis which would suggest that she was kneeling in the seat. This conclusion is in disagreement with police and witness information who have indicated that she was wearing both the lap and shoulder belt. The other vehicle, a 1990 Chevrolet extended cab pickup driven by a 29-year-old male, was initially stopped at the intersection facing north. The driver of the other vehicle intended to make a left turn to go to the west. A non-contact vehicle was going SW with the intent being to turn left to the south. The driver of the other vehicle attempted to steer to the right to pass behind this vehicle before making his left turn. The driver of the case vehicle saw the other vehicle and locked up the brakes. The front of the case vehicle struck the side of the other vehicle at a speed of 34.0 km/h (21.2 MPH) with a longitudinal delta V of -22.3 km/h (-13.8 MPH). Both air bags in the case vehicle deployed at this point. The case vehicle sustained moderate damage (12FZEW1) and was towed from the scene due to damage. The other vehicle sustained minor damage (09LPLW2) and was towed from the scene under orders of the police. As the vehicles came to rest, the driver of the case vehicle noticed that the child was in difficulty. She exited the vehicle and requested help from bystanders. The driver of the other vehicle, who had some type of medical training, advised against moving the child. The driver of the case vehicle requested assistance from one witness who is a nurse. They removed the child from the vehicle and placed her in the back of a van. As the nurse drove she issued instructions to the mother as they were on their way to a local trauma center. The child expired in route. Attempts at resuscitation were not successful. She was pronounced dead at 2130 hours, approximately 3 hours after the crash. This occupant sustained an atlanto-occipital disarticulation with a transection of the cervical spine, a subdural/subarachnoid hemorrhage, abrasions and contusions to the lower face and neck, contusions to the thighs, and abrasions to the back of the left hand. The dislocation and neck abrasion are from contact with the air bag (skin tissue was found on the air bag). The skin evidence had been removed by police and sent out for DNA matching with the child.

17. Key Words	18. Distribution Statement
Air bag, deployment, injury, accident, child, fatal	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Dynamic Science, Inc.
Accident Investigation
Case Number:DS97018

Table of Contents

BACKGROUND:

Description:	This case was initiated in response to a report of an air bag related fatal injury to a child. This was a 32 month-old-child seated in the right front seat of a 1995 Hyundai Accent.
Investigation Type:	On-Scene
Crash Location:	New Mexico
Crash Date:	August 1997
Notification Date:	August 1997
Field Work Completed:	September 1997

SUMMARY:

Figure 1. Final rest for both vehicles

Figure 2. Final rest

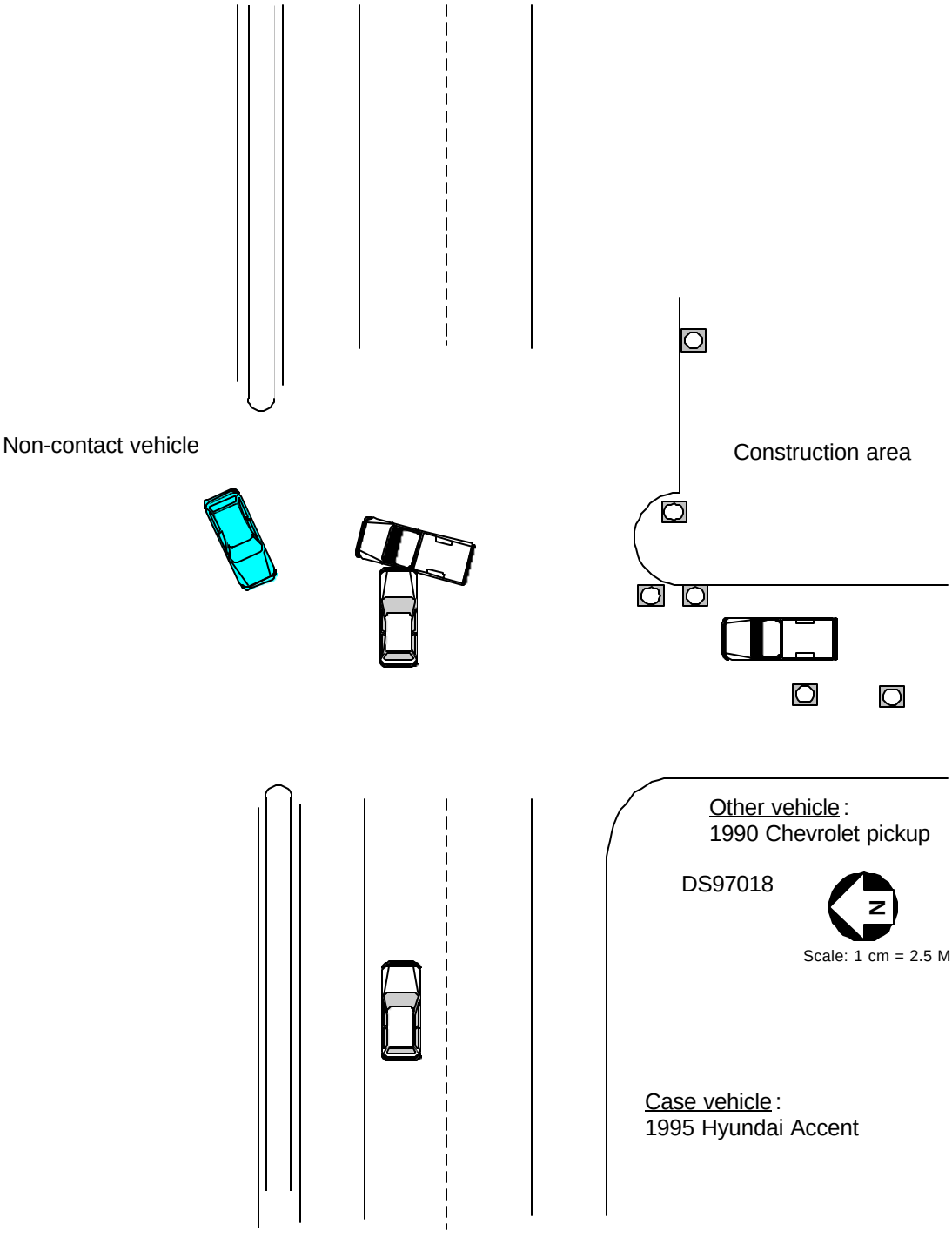
Vehicle 1, a 1995 Hyundai Accent driven by a 20-year-old female, was traveling east on a divided roadway at an unknown speed approaching a three-leg intersection. The speed limit for this roadway is 89 km/h (55 MPH). The right front seat was occupied by a 32 month old female (96 cm / 38 in. - 15 kg / 33 lbs.). She was using the lap portion of the lap and shoulder belt. This is based on seatbelt loading marks, horizontal abrasive injuries to her thighs, and the lack of contact injuries related to shoulder harness use. The injuries to her thighs are closer to her knees than to her pelvis which would suggest that she was kneeling in the seat. This conclusion is in disagreement with police and witness information who have indicated that she was wearing both the lap and shoulder belt. The other vehicle, a 1990 Chevrolet extended cab pickup driven by a 29-year-old male, was initially stopped at the intersection facing north. The driver of the other vehicle intended to make a left turn to go to the west. A non-contact vehicle was going west with the intent being to turn left to the south.

The driver of the other vehicle attempted to steer to the right to pass behind this vehicle before making his left turn.

The driver of the case vehicle saw the other vehicle and locked up the brakes. The front of the case vehicle struck the side of the other vehicle at a speed of 34.0 km/h (21.2 MPH) with a longitudinal delta V of -22.7 km/h (-13.8 MPH). Both air bags in The case vehicle deployed at this point. The case vehicle sustained moderate damage (12FZEW1) and was towed from the scene due to damage. The other vehicle sustained minor damage (09LPLW2) and was towed from the scene under orders of the police.

As the vehicles came to rest, the driver of the case vehicle noticed that the child was in difficulty. She exited the vehicle and requested help from bystanders. The driver of the other vehicle, who had some type of medical training, advised against moving the child. The driver of the case vehicle requested assistance from one witness who is a nurse. They removed the child from the vehicle and placed her in the back of a van. As the nurse drove she issued instructions to the mother as they were on their way to a local trauma center. The child expired on the way. Attempts at resuscitation were not successful. She was pronounced dead at 2130 hours, approximately 3 hours after the crash. This occupant sustained an atlanto-occipital disarticulation with a transection of the cervical spine, a subdural/subarachnoid hemorrhage, abrasions and contusions to the lower face and neck, contusions to the thighs, and abrasions to the back of the left hand. The dislocation and neck abrasion are from contact with the airbag (skin tissue was found on the airbag). The skin evidence had been removed by police and sent out for DNA matching with the child.

Scene Diagram



DETAILED INFORMATION

Vehicles

Case vehicle

Description:	1995 Hyundai Accent three-door hatchback	
VIN:	KMHVD14N0SUXXXXXX	
Odometer:	56,002 km (34,799 miles)	
Engine:	1495 cc OHC L4	
Reported Defects:	None	
Cargo:	Speaker equipment in trunk, behind rear seat	
Damage Description:	Moderate direct contact to front bumper, primarily on the right. Some hood buckling.	
CDC:	12FZEW1	
Impact Speed:[1]	34.0 km/h (21.2 MPH)	
Delta V:	Total	22.3 km/h (13.8 MPH)
	Longitudinal	-22.3 km/h (-13.8 MPH)
	Latitudinal	0 km/h (0 MPH)
	Energy	17,709 joules (13,069 ft-lbs)

[1]WinSmash, Impact Speed (Momentum and Spinout)

This vehicle is equipped with bucket seats in the front and a bench seat in the rear. At the time of inspection the left front seat was adjusted to a position between the forward and middle position; the right front seat was adjusted to the forward most position. Both seats were slightly reclined. The driver's side air bag had a single tether and two vents. The passenger side air bag was enclosed in a mid-mount module. The module cover opens toward the windshield in a hinged fashion. The cover was deformed somewhat due to contact with the passenger's left hand. The air bag had no tethers and two vents. Neither air bag sustained any damage. There were skin transfers on the passenger air bag. A portion of this bag had been cut away and submitted to the state laboratory by the police for DNA comparison to the decedent. The air bag system is controlled by the SRS control module (SRSCM) which is located on the floor panel below the HVAC unit. The impact sensing function of the SRSCM is carried out by an electronic accelerometer. There was no intrusion. The right front sideglass and the roof sideglass had both been shattered. The reason for this is not known.

Figure 4. Exterior, case vehicle

Other vehicle

Description:	1990 Chevrolet K1500 pickup truck	
VIN:	2GCGK29K1Lxxxxxx	
Odometer:	Unknown	
Engine:	5.7 V8	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	Moderate lateral crush to the sill area on the left side.	
CDC:	09LPLW2	
Impact Speed:	2.3 km/h (1.4 MPH)	
Delta V:	Total	11.2 km/h (7.0 MPH)
	Longitudinal	1.0 km/h (0.6 MPH)
	Latitudinal	11.2 km/h (6.9 MPH)
	Energy	11,120 joules (8,208 ft-lbs)

Figure 5. Exterior, Vehicle 2

Occupants

Case vehicle	Occupant 1	Occupant 2
Age/Sex:	20/Female	32 months / Female
Seated Position:	Right front	Right front
Seat Type:	Bucket, with folding back	Bucket, with folding back
Height:	Unknown	96 cm (38 in.)
Weight:	Unknown	15 kg (33 lbs.)
Occupation:	Clerk	NA
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	None
Driving Experience:	< 5 years	NA
Body Posture:	Left on floor, right on brake	On knees, facing forward
Hand Position:	Unknown	Unknown
Foot Position:	Left on floor, right on brake	Unknown
Restraint Usage:	Lap and shoulder used	Lap portion only used
	Driver's side airbag deployed	Passenger side airbag deployed

Other vehicle	Occupant 1	Occupant 2	Occupant 3
Age/Sex:	29/Male	25/Male	20/Male
Seated Position:	Left front	Center front	Right front
Seat Type:	Unknown	Unknown	Unknown
Height:	Unknown	Unknown	Unknown
Weight:	Unknown	Unknown	Unknown
Occupation:	Foreman	Unknown	Unknown
Pre-existing Medical Condition:	None noted	None noted	None noted
Alcohol/Drug Involvement:	None	NA	NA
Driving Experience:	> 10 years	NA	NA
Body Posture:	Unknown	Unknown	Unknown
Hand Position:	Unknown	NA	NA
Foot Position:	Left on floor, right presumably on brake	NA	NA
Restraint Usage:	Lap and shoulder used, per police	None used	None used

Injuries and Injury Mechanisms

Case vehicle

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	No visible injuries			
RF Occupant	Atlanto-occipital disarticulation Transection, cervical spine	640248.5	806.01	Air bag
	Subdural/subarachnoid hemorrhage	140684.3	430.0	Air bag
	Brain swelling	140660.3	854.0	Air bag
	Abrasions, lower part of the face, lateral to both sides of mouth, 3-1/2 x 2 in.	290202.1	910.0	Air bag
	Contusion, left cheek, 1-1/2 in.	290402.1	920.0	Air bag
	Abrasion, anterior neck, just below chin, 2 x 6 in.	390202.1	920.0	Air bag
	Contusion, on neck, below left ear	390402.1	920.0	Air bag
	Contusion, on neck, below right ear	390402.1	920.0	Air bag
	Abrasion, back of left wrist, 2 x 3/4 in.	790202.1	913.0	Module cover
	Abrasion, back of left thumb and left forefinger	790202.1	913.0	Module cover
	Contusion, right thigh, 1-1/2 x 1 in.	890402.1	924.0	Lap belt
	Abrasion/contusion, right thigh 3 x 1-1/2 in.	890202.1	916.0	Lap belt
	Contusion, left thigh, 2 x 1 in.	890402.1	924.0	Lap belt

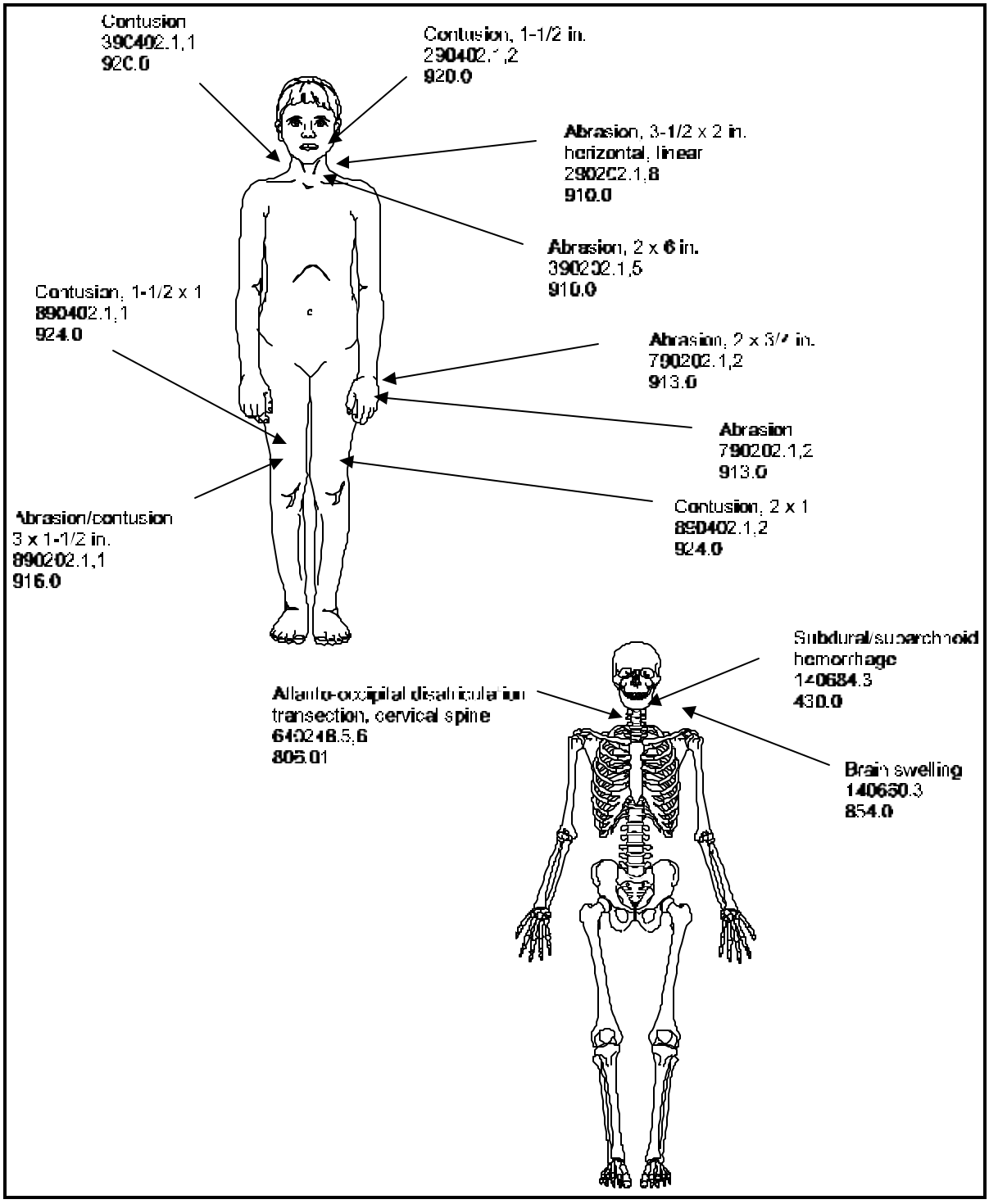


Figure 6. Injury manikin, right front occupant

Injuries and Injury Mechanisms

Other vehicle

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	Not injured			
Middle front occupant:	Not injured			
Right front occupant:	Not injured			

Occupant Kinematics

The right front seat was occupied by a 32 month old female. She was using the lap portion of the lap and shoulder belt. This is based on seatbelt loading marks, horizontal abrasive injuries to her thighs, and the lack of contact injuries related to shoulder harness use. The injuries to her thighs are closer to her knees than to her pelvis which would suggest that she was kneeling in the seat. This conclusion is in disagreement with police and witness information who have indicated that she was wearing both the lap and shoulder belt.

Figure 7. Deployed air bag, arrows mark area where skin tissue was found

Prior to impact, the driver braked. This pitched the right front occupant forward toward the instrument panel. It appears likely that the occupant had her hands out in front of her. Her left hand was at a point between the module cover and the windshield. At impact, the air bag module cover rotated upward as the air bag began deploying. The top of the left hand of this occupant was struck by the module cover causing an abrasion/laceration to the hand and wrist and pushing her hand into the windshield. As the air bag deployed, it caught her beneath the chin and lifted her head upward and rearward while the lower portion of her body was being held in place by the lap belt. She sustained an atlanto-occipital disarticulation with a transection of the cervical spine and a subdural/subarachnoid hemorrhage due to the movement of the air bag against her neck and chin. There was skin evidence from her neck found on the air bag. As she was being lifted upward she loaded the lap belt causing the contusions/abrasions to her thighs.

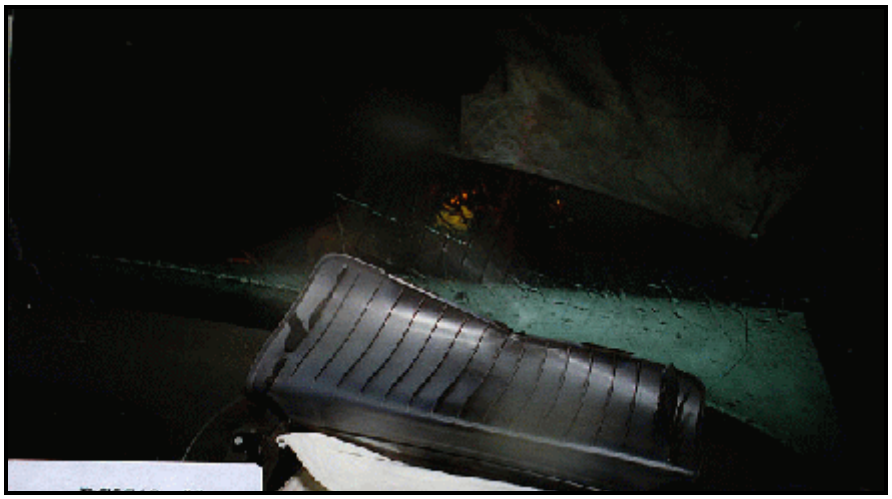


Figure 8. Passenger air bag module cover