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ON-SITE CHILD AIR BAG-RELATED FATALITY INVESTIGATION

CASE NUMBER - IN00-010
LOCATION - TEXAS
VEHICLE - 1996 HYUNDAI ACCENT L
CRASH DATE - December, 1999

Submitted:

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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. <i>Abstract</i> This report covers an on-site investigation of an air bag deployment crash that involved a 1996 Hyundai Accent (case vehicle) and a 1995 Mercury Mystique GS (other vehicle). This crash is of special interest because the case vehicle's, "out-of-position" (i.e., sitting on the lap of an adult), front right passenger (1-year-old male) sustained critical injuries as a result of contacting the deploying front right passenger air bag, resulting in his death. The case vehicle was traveling east in the eastbound lane of a two-lane, undivided, city roadway. The Mercury had been traveling west in the westbound lane of the same two-lane, undivided, city street and was turning left into a private drive. The crash occurred in the westbound lane of the roadway, within the driveway junction. The front right half of the case vehicle was impacted by the front right of the Mercury causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. Both vehicles came to rest in the eastbound lane of the driveway junction. The case vehicle's, "out-of-position," front right passenger was seated on the lap of the seated, front right passenger. The front right seat track was located between its middle and forward-most positions. The "on-lap" passenger was not restrained by the front right, active, three-point, lap-and-shoulder, safety belt system. He sustained, according to his autopsy, critical injuries which included: subdural and subarachnoid hemorrhages along and across the base of his brain; subdural and subgaleal hemorrhages overlying both cerebral hemispheres; mild cerebral edema; an atlanto-occipital dislocation; an anterior fracture of the third cervical vertebrae; a laceration of the proximal jejunum; multiple liver lacerations; multiple scalp lacerations; abrasions to the upper neck, left mid-abdomen, left forearm, and left hand; a contusion to his left chest; and lacerations to his right neck and left hand. This occupant's primary brain injuries were caused by his contact with the case vehicle's front right passenger air bag. The driver (23-year-old female) was seated with her seat track located in its middle position, and the vehicle was not equipped with a tilt steering wheel. She was not using her available, active, three-point, lap-and-shoulder, safety belt system and did not sustain any injuries as a result of this crash. The adult front right passenger (45-year-old female) was seated and was not using her available, active, three-point, lap-and-shoulder, safety belt system. She sustained minor injuries, but her injuries are unknown.					
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TABLE OF CONTENTS

IN00-010

	<u>Page No.</u>
BACKGROUND	1
SUMMARY	1
CRASH CIRCUMSTANCES	4
CASE VEHICLE: 1996 HYUNDAI ACCENT L	6
CASE VEHICLE DAMAGE	6
AUTOMATIC RESTRAINT SYSTEM	8
CASE VEHICLE “ON-LAP” FRONT RIGHT PASSENGER KINEMATICS	10
CASE VEHICLE “ON-LAP” FRONT RIGHT PASSENGER INJURIES	11
CASE VEHICLE DRIVER KINEMATICS	13
CASE VEHICLE DRIVER INJURIES	13
CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS	14
CASE VEHICLE FRONT RIGHT PASSENGER INJURIES	14
OTHER VEHICLE: 1995 MERCURY MYSTIQUE GS	14
CRASH DIAGRAM	15
SELECTED PHOTOGRAPHS	
Figure 1: Case vehicle’s eastbound travel path prior to impact	5
Figure 2: Case vehicle’s damaged front viewed from right of front	5
Figure 3: Case vehicle’s damaged front viewed along reference line from right	5
Figure 4: Close-up of direct damage to case vehicle’s front right half	6
Figure 5: Vertical view of case vehicle’s front right passenger seating area	7
Figure 6: Close-up of spider web-type impact to case vehicle’s right wind- shield glazing	7
Figure 7: Close-up of contact scuff to case vehicle’s right header/sun visor area	7
Figure 8: Case vehicle’s front right seating area showing seat position and contact evidence	8
Figure 9: Case vehicle’s driver seating area showing deployed driver air bag and greenhouse area	8

	<u>Page No.</u>
SELECTED PHOTOGRAPHS (Continued)	
Figure 10: Case vehicle's deployed driver air bag showing no apparent occupant contact evidence	8
Figure 11: Close-up of cut/hole in top surface of case vehicle's deployed driver air bag	9
Figure 12: Close-up of skin evidence on case vehicle's front right air bag module's cover flap	9
Figure 13: Close-up of top surface of case vehicle's deployed front right passenger air bag	9
Figure 14: Front surface of case vehicle's front right passenger air bag	10
Figure 15: Close-up of scuff on case vehicle's deployed front right passenger air bag from contacting protruding radio in instrument panel	10

This on-site investigation was brought to NHTSA's attention on April 11, 2000 through the Fatality Analysis Reporting System (FARS). This crash involved a 1996 Hyundai Accent (case vehicle) and a 1995 Mercury Mystique GS (other vehicle). The crash occurred in December, 1999, at 2:40 p.m., in Texas and was investigated by the applicable city police department. This crash is of special interest because the case vehicle's, "out-of-position" (i.e., sitting on the lap of an adult), front right passenger [1-year-old, White (Hispanic) male] sustained critical injuries as a result of contacting the deploying front right passenger air bag, resulting in his death. This contractor inspected the scene and case vehicle on May 2, 2000. This contractor was not able to interview either the case vehicle's driver or her adult front right passenger because the family declined to participate in this research. This report is based on the Police Crash Report, an interview with the investigating police officer, inspections of the scene and case vehicle, occupant kinematic principles, the child's autopsy records, and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling east in the eastbound lane of a two-lane, undivided, city roadway and intended to continue traveling eastward. The Mercury had been traveling west in the westbound lane of the same two-lane undivided city street and was turning left into a private drive, intending to travel northward. The case vehicle's driver braked, attempting to avoid the crash. The case vehicle deposited 23.8 meters (78 feet) of skid marks prior to impacting the Mercury. The crash occurred in the westbound lane of the roadway, within the driveway junction; see **CRASH DIAGRAM** below.

The front right half of the case vehicle was impacted by the front right of the Mercury causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. Both vehicles came to rest in the eastbound lane of the driveway junction. Presumably, the case vehicle rotated slightly clockwise, no more than 10 degrees, prior to coming to rest heading east-southeast. The Mercury, which was turning, was deflected slightly counterclockwise and came to rest heading primarily southwestward.

The 1996 Hyundai Accent L was a front wheel drive, four-door sedan (VIN: KMHVF14N9TU-----). The case vehicle was not equipped with anti-lock brakes. Based on the vehicle inspection, the CDC for the case vehicle was determined to be: **12-FZEW-1 (350)**. The WinSMASH reconstruction program, missing vehicle algorithm, was used on the case vehicle's highest severity impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 17.7 km.p.h. (11 m.p.h.), -17.5 km.p.h. (-10.9 m.p.h.), and +3.1 km.p.h. (+1.9 m.p.h.). The case vehicle was towed due to damage.

The case vehicle's initial contact with the Mercury involved the front right half of the vehicle. Direct damage began 14 centimeters (5.5 inches) right of center and extended, a measured distance of 59 centimeters (23.2 inches), along the front bumper to the front right bumper corner. Induced damage was present across the entire front, and the field L was measured as 146 centimeters (57.5 inches) from bumper corner to bumper corner. Residual maximum crush was measured as 15 centimeters (5.9 inches) at C₅. The wheelbase on the case vehicle's left side

was shortened at most 1 centimeter (0.4 inches) while the right side was unaltered. The case vehicle's front bumper fascia, grille, hood, right fender, and right headlight and turn signal assemblies were directly damaged and crushed rearward. The case vehicle's right front tire was physically restricted by the right fender, and the left rear tire was deflated. The right fender, hood, and left headlight and turn signal assemblies sustained induced damage as well as the left front bumper. No obvious induced damage or remote buckling was noted to the remainder of the case vehicle's exterior.

The case vehicle's driver air bag was located in the steering wheel hub. An inspection of the air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points and there were grease smears and black scuffs on the fabric of the air bag from the underside of the cover flaps—presumably from the driver loading the air bag, temporarily blocking its deployment. Furthermore, there was an anomaly (i.e., a small cut) found on the upper edge of the air bag. The source of the small cut/slice is unknown. The cut was 0.5 centimeters (0.2 inches) in length and was found on the upper left quadrant near the stitching along the outside of the air bag. There was no evidence of damage during the deployment to the cover flaps. The driver's air bag was designed with two tethers, each approximately 12 centimeters (4.7 inches) in width. The tethers were located at the 9 and 3 o'clock positions. The driver's air bag had two vent ports, approximately 2 centimeters (0.8 inches) in diameter, located at the 10:30 and 1:30 o'clock positions. The deployed driver's air bag was slightly elliptical with a height of approximately 60 centimeters (23.6 inches) and a width of approximately 62 centimeters (24.2 inches). An inspection of the driver's air bag fabric revealed no contact evidence (i.e., skin or make-up) readily apparent on the air bag's fabric.

The front right passenger's air bag was located in the top of the instrument panel. An inspection of the front right air bag module's cover flap and air bag revealed that the cover flap opened at the designated tear points and there were heavy black scuffs on the front and right surfaces of the air bag's fabric from the underside of the cover flaps that occurred when the "on-lap" front right passenger loaded the air bag, temporarily blocking its deployment. In addition, there appeared to be a 10 x 9 centimeter (3.9 x 3.5 inch) area of direct contact (i.e., skin) on the right portion of the module's cover flap.

The front right passenger's air bag was designed with two tethers, each approximately 44 centimeters (17.3 inches) in width. The front right air bag had two vent ports, approximately 5 centimeters (2.0 inches) in diameter, located at the 9:30 and 2:30 o'clock positions. The deployed front right air bag was square with both a height and width of approximately 46 centimeters (18.1 inches). An inspection of the front right passenger's air bag fabric revealed that there was contact evidence readily apparent (e.g., an area of skin, blood, and red cloth transfer) on the top and front surfaces of the air bag. The skin transfer on the top surface of the air bag began 4 centimeters (1.6 inches) below the cover flap and was approximately 5 centimeters (2.0 inches) wide and extended toward the front right seating position 13 centimeters (5.1 inches) and ended just prior to the beginning of the front surface of the air bag. The red cloth transfer was on the front right upper quadrant of the air bag's front surface. The blood streak/smear was a 13 x 3 centimeter (5.1 x 1.2 inch) area on the upper left quadrant of the air bag's front surface. Finally, there was also a 13 centimeter (5.1 inch) long abraded area on the left lower quadrant of the air bag's front

surface, with associated black scuffing, that occurred when the air bag contacted the upper right corner of the case vehicle's radio, which previously had been partially pulled out from the center instrument panel.

Inspection of the case vehicle's interior revealed a spider web-type impact to the right side of the windshield's glazing from contact by the "on-lap" front right passenger with embedded hair in the glazing. Furthermore, there was contact on the windshield's header toward the left side of the front right sun visor, and the rearview mirror was tilted, most likely from contact by one of the front right occupants. In addition, there was a scuff on the interior surface of the right front door.

The 1995 Mercury Mystique GS was a front wheel drive, four-door sedan (VIN: 1MELM6532SK-----). With no available vehicle photographs, the CDC for the Mercury is unknown. The Mercury was towed due to damage.

Immediately prior to the crash, the case vehicle's, "out-of-position," front right passenger [79 centimeters and 11 kilograms (31 inches, 25 pounds)] was seated on the lap of the seated, front right passenger (i.e., grandmother of child) presumably in an upright posture with his back against his grandmother's arm and chest and his feet facing forward. In addition, the exact position of his arms is unknown. Based on the vehicle inspection, the front right seat track was located between its middle and forward-most positions, and the seat back was upright.

The case vehicle's "on-lap," front right passenger was not restrained by the front right, active, three-point, lap-and-shoulder, safety belt system, which was reportedly being used by the case vehicle's adult, front right passenger on whose lap he was sitting. Furthermore, there was no evidence of belt pattern bruising and/or abrasions to the "on-lap" passenger's body, and this contractor's inspection of the front right seating position's seat belt webbing, "D"-ring, and latch plate showed no apparent evidence of loading.

The case vehicle's driver braked, attempting to avoid the crash. As a result of the attempted avoidance maneuver and the nonuse of any safety restraints, the "on-lap," front right passenger moved forward and slightly upward, while the seated front right passenger most likely attempted to tighten her grip around the child's abdomen. Based on the seat track location and the driver's braking, just prior to the crash he was immediately in front of the front right passenger's air bag module. The exact position of the child at the moment of deployment is unknown but, based on the contact evidence on the air bag's fabric and on the windshield's glazing and the child's injuries, the child's torso was nearly atop the air bag module at the moment of deployment. The case vehicle's impact with the Mercury enabled the "on-lap" passenger to continue forward and upward toward the case vehicle's **350** degree Direction of Principal Force as the case vehicle decelerated. As a result, the seated, adult, front right passenger was unable to hold him. As the front right passenger air bag module deployed, the air bag impacted the "on-lap" passenger lifting and/or assisting him upwards into the windshield's glazing. The forward movement of the adult, front right passenger also helped to push the "on-lap" passenger forward. It is also possible that as the air bag continued to expand, the air bag forcefully lifted him upwards where he contacted the windshield header/sun visor near the rearview mirror. As the case vehicle rotated clockwise,

the “on-lap” passenger moved to the left as the vehicle rotated clockwise underneath him. The position of the “on-lap” passenger at final rest is unknown.

The “on-lap,” child, front right passenger was transported by ambulance to the hospital. He sustained critical injuries and was pronounced dead one hour and fifty-five minutes post-crash. According to his autopsy, the injuries sustained by the case vehicle's, on-lap, front right passenger include: subdural and subarachnoid hemorrhages along and across the base of his brain; subdural and subgaleal hemorrhages overlying both cerebral hemispheres; mild cerebral edema; an atlanto-occipital dislocation; an anterior fracture of the third cervical vertebrae; a laceration of the proximal jejunum; multiple liver lacerations; multiple scalp lacerations; abrasions to the upper neck, left mid-abdomen, left forearm, and left hand; a contusion to his left chest; and lacerations to his right neck and left hand. This occupant's primary brain injuries were caused by his contact with the case vehicle's front right passenger air bag.

The case vehicle's driver [23-year-old, White (Hispanic) female; of unknown height and weight] was presumably seated in a reclined posture with her back against the seat back, her left foot on the floor, her right foot on the brake, and both her hands on the steering wheel. Her seat track was located in its middle position, the seat back was slightly reclined, and the vehicle was not equipped with a tilt steering wheel.

The case vehicle's driver was not using her available, active, three-point, lap-and-shoulder, safety belt system. The driver was not transported by ambulance to the hospital for treatment purposes, but she presumably accompanied her son to the hospital. The case vehicle's driver reportedly did not sustain any injuries as a result of this crash.

The case vehicle's adult front right passenger [45-year-old, White (Hispanic) female; of unknown height and weight] was seated in an upright posture with her feet most likely on the floor and her hands holding her grandson on her lap. Her seat track was located between its middle and forward-most positions, and the seat back was upright.

The case vehicle's seated front right passenger was not using her available, active, three-point, lap-and-shoulder, safety belt system. The seated front right passenger was transported by ambulance to the hospital. She sustained minor injuries and was treated and released. The injuries sustained by the case vehicle's seated front right passenger are unknown.

CRASH CIRCUMSTANCES

The case vehicle was traveling east in the eastbound lane of a two-lane, undivided, city roadway (**Figure 1** below) and intended to continue traveling eastward. The Mercury had been traveling west in the westbound lane of the same two-lane undivided city street and was turning left into a private drive, intending to travel northward. The case vehicle's driver braked, attempting to avoid the crash. The case vehicle deposited 23.8 meters (78 feet) of skid marks prior to impacting the Mercury. The crash occurred in the westbound lane of the roadway, within the driveway junction; see **CRASH DIAGRAM** below.

The city roadway was straight and level at the area of impact. The pavement was bituminous, and the width of the travel lanes for both vehicles was 3.2 meters (10.5 feet). The shoulders were not improved. The south side of the east-westbound road had a 1.3 meter (4.3 foot) wide grassy shoulder prior to a drainage ditch and the north side had a 2.5 meter (8.2 foot) gravel shoulder. Pavement markings consisted of a single broken yellow centerline for both east and westbound traffic. In addition, solid white edge lines were present. The estimated coefficient of friction was 0.70. A regulatory **SPEED LIMIT** sign (MUTCD, R2-1) with advisory **SCHOOL SPEED LIMIT** signs (Manual on Uniform Traffic Control Devices, S4-3 and S4-4) and a **SCHOOL ADVANCE WARNING** sign (Manual on Uniform Traffic Control Devices, S1-1) were located prior to driveway on the south leg of the Tee-type junction. The statutory speed limit was 48 km.p.h. (30 m.p.h.). At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the road pavement was dry. Traffic density was light, and the site of the crash was a combination of urban residential and school area.



Figure 1: Case vehicle's eastbound travel path prior to impact with Mercury; Note: Mercury had been traveling westbound and was turning left at the driveway junction located on right (south) side of road (case photo #02)

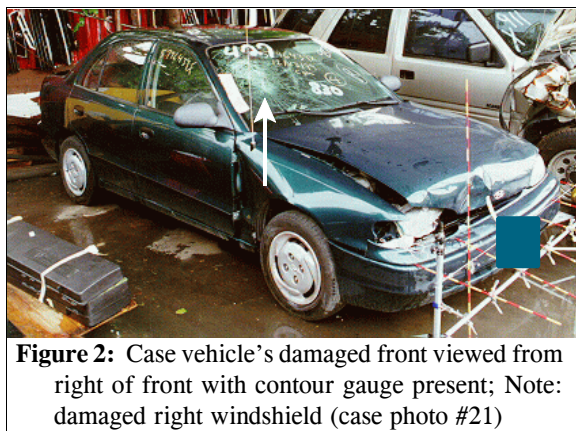


Figure 2: Case vehicle's damaged front viewed from right of front with contour gauge present; Note: damaged right windshield (case photo #21)

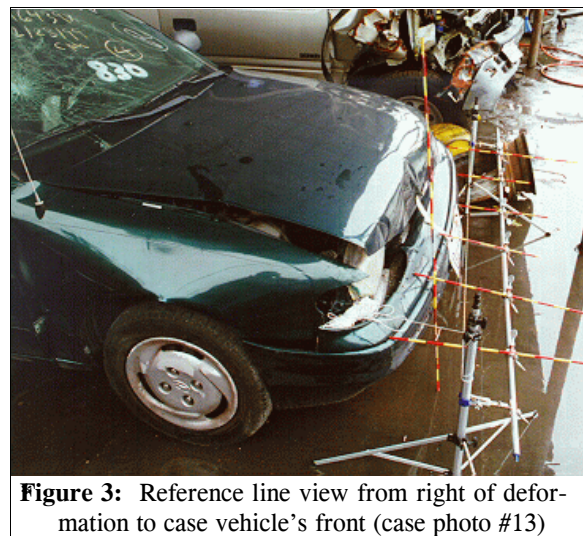


Figure 3: Reference line view from right of deformation to case vehicle's front (case photo #13)

The front right half of the case vehicle (**Figure 2** and **Figures 3** and **4** below) was impacted by the front right of the Mercury causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. Both vehicles came to rest in the eastbound lane of the driveway junction. Presumably, the case vehicle rotated slightly clockwise, no more than 10 degrees, prior to coming to rest heading east-southeast. The Mercury, which was turning, was deflected slightly counterclockwise and came to rest heading primarily southwestward; see **CRASH DIAGRAM** below.

The 1996 Hyundai Accent L was a front wheel drive, five-passenger, four-door sedan (VIN: KMHVF14N9TU-----) equipped with a 1.5L, L-4 engine and a four-speed automatic transmission. The case vehicle was not equipped with anti-lock brakes. Braking was achieved by a power-assisted, front disc and rear drum system. The case vehicle's wheelbase was 240 centimeters (94.5 inches), and the odometer reading at inspection {was 155,625 kilometers (96,701 miles).

Inspection of the vehicle's interior revealed adjustable front bucket seats with adjustable head restraints; a non-adjustable back bench seat with separate backs and without head restraints for the back seating positions; continuous loop, three-point, lap-and-shoulder, safety belt systems at the front and back outboard positions; and a two-point, lap belt system at the back center position. The front seat belt systems were equipped with manually operated, upper anchorage adjusters for the "D"-rings. Both the driver and front right passenger had their upper anchorage adjusters located in the down-most positions. The vehicle was equipped with knee bolsters for both the driver and front right passenger, neither of which were deformed. Automatic restraint was provided by a Supplemental Restraint System (SRS) that consisted of a frontal air bag for the driver and front right passenger seating positions. Both frontal air bags deployed as a result of the case vehicle's frontal impact with the Mercury.



Figure 4: Close-up of direct damage area to case vehicle's front right half (case photo #11)

CASE VEHICLE DAMAGE

The case vehicle's initial contact with the Mercury involved the front right half of the vehicle (**Figure 2** above and **Figure 4**). Direct damage began 14 centimeters (5.5 inches) right of center and extended, a measured distance of 59 centimeters (23.2 inches), along the front bumper to the front right bumper corner. Induced damage was present across the entire front, and the field L was measured as 146 centimeters (57.5 inches) from bumper corner to bumper corner. Residual maximum crush was measured as 15 centimeters (5.9 inches) at C₅. The wheelbase on the case vehicle's left side was shortened at most 1 centimeter (0.4 inches) while the right side was unaltered. The case vehicle's front bumper fascia, grille, hood, right fender, and right headlight and turn signal assemblies were directly damaged and crushed rearward. The case vehicle's right front tire was physically restricted by the right fender. The left rear tire was deflated, but it is unknown if this was related to the crash. The right fender, hood, and left headlight and turn signal assemblies sustained induced damage as well as the left front bumper. No obvious induced damage or remote buckling was noted to the remainder of the case vehicle's exterior.

Inspection of the case vehicle's interior revealed a spider web-type impact to the right side of the windshield's glazing from contact by the "on-lap" front right passenger with embedded hair in the glazing (**Figures 5** and **6** below). Furthermore, there was contact (i.e., a strand of dark hair

and blood) on the windshield's header toward the left side of the front right sun visor (**Figure 7**), and the rearview mirror was tilted, most likely from contact by one of the front right occupants. In addition, there was a scuff on the interior surface of the right front door (**Figure 8** below).



Figure 5 Vertical view of case vehicle's front right passenger seating area with tape highlighting apparent occupant contacts (case photo #34)



Figure 6: Close-up of large skin transfer to interior surface of case vehicle's right windshield glazing (case photo #36)

Based on the vehicle inspection, the CDC for the case vehicle was determined to be: **12-FZEW-1 (350)**. The WinSMASH reconstruction program, missing vehicle algorithm, was used on the case vehicle's highest severity impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 17.7 km.p.h. (11 m.p.h.), -17.5 km.p.h. (-10.9 m.p.h.), and +3.1 km.p.h. (+1.9 m.p.h.). The case vehicle was towed due to damage.



Figure 7: Close-up of contact scuff to case vehicle's front right header/sun visor; Note: rear view mirror tilted toward driver (case photo #38)



Figure 8: Case vehicle's front right seating area and interior of front right door showing seat position and evidence of occupant contact on air bag and scuff on door's interior surface (case photo #27)

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with a Supplemental Restraint System (SRS) that contained frontal air bags at the driver and front right passenger positions. Both frontal air bags deployed as a result of the frontal impact with the Mercury. The case vehicle's driver air bag was located in the steering wheel hub. The module cover consisted of asymmetrical "H"-configuration cover flaps made of thick vinyl with overall dimensions of 15 centimeters (5.9 inches) at the horizontal seam and 7 centimeters (2.8 inches) vertically for the upper flap and 6 centimeters (2.4 inches) vertically for the lower flap. An inspection of the air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points and there were grease smears and black scuffs on the fabric of the air bag from the underside of the cover flaps (**Figure 9**)—presumably from the driver loading the air bag, temporarily blocking its deployment. Furthermore, there was an anomaly (i.e., a small cut) found on the upper edge of the air bag. The source of the small cut/slice is unknown. The cut was 0.5 centimeters (0.2 inches) in length and was found on the upper left quadrant near the stitching along the outside of the air bag (**Figure 10** and **Figure 11** below). There was no evidence of damage during the deployment to the cover flaps. The driver's air bag was



Figure 9: Case vehicle's driver seating area showing left "A"-pillar, windshield, front header/sun visor, and front surface of deployed driver air bag with no apparent evidence of occupant contact; Note: faint grease smears and black scuffs are present on air bag that occurred during deployment from contact with underside of cover flaps (case photo #31)



Figure 10: Case vehicle's deployed driver air bag showing no apparent skin evidence; Note: small cut (circled) found near seam (case photo #33)

designed with two tethers, each approximately 12 centimeters (4.7 inches) in width. The tethers were located at the 9 and 3 o'clock positions. The driver's air bag had two vent ports, approximately 2 centimeters (0.8 inches) in diameter, located at the 10:30 and 1:30 o'clock positions. The deployed driver's air bag was slightly elliptical with a height of approximately 60 centimeters (23.6 inches) and a width of approximately 62 centimeters (24.2 inches). An inspection of the driver's air bag fabric revealed no contact evidence (i.e., skin or make-up) readily apparent on the air bag's fabric.



Figure 11: Close-up of cut/hole near seam in top portion of case vehicle's deployed driver air bag (case photo #33a)

The front right passenger's air bag was located in the top of the instrument panel. There was a single, essentially rectangular shaped, curvilinear, modular cover flap. The cover flap was made of a thick vinyl over a thick cardboard type frame. The flap's dimensions were 35 centimeters (21.7 inches) at the lower horizontal seam and 15 centimeters (5.9 inches) along the curved vertical surface. The profile of the case vehicle's instrument panel was flush with the leading edge of the cover flap. An inspection of the front right air bag module's cover flap and air bag revealed that the cover flap opened at the designated tear points and there were heavy black scuffs on the front and right surfaces of the air bag's fabric from the underside of the cover flaps that occurred when the "on-lap" front right passenger loaded the air bag, temporarily blocking its deployment. In addition, there appeared to be a 10 x 9 centimeter (3.9 x 3.5 inch) area of direct contact (i.e., skin) on the right portion of the module's cover flap (**Figure 12**).

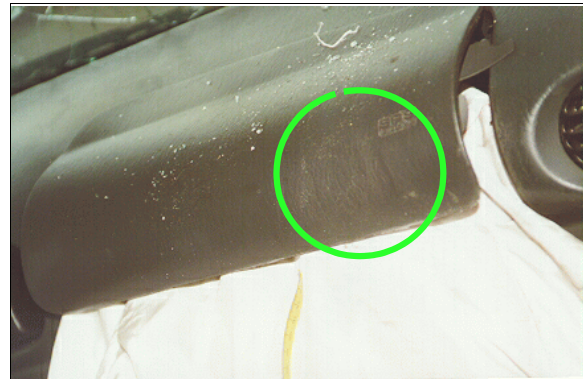


Figure 12 Close-up of oil and skin transfer on cover flap of case vehicle's front right air bag module (case photo #43)

The front right passenger's air bag was designed with two tethers, each approximately 44 centimeters (17.3 inches) in width. The front right air bag had two vent ports, approximately 5 centimeters (2.0 inches) in diameter, located at the 9:30 and 2:30 o'clock positions. The deployed front right air bag was square with both a height and width of approximately 46 centimeters (18.1 inches). An inspection of the front right passenger's air bag fabric revealed that there was contact evidence readily apparent (e.g., an area of skin, blood, and red cloth transfer) on the top and

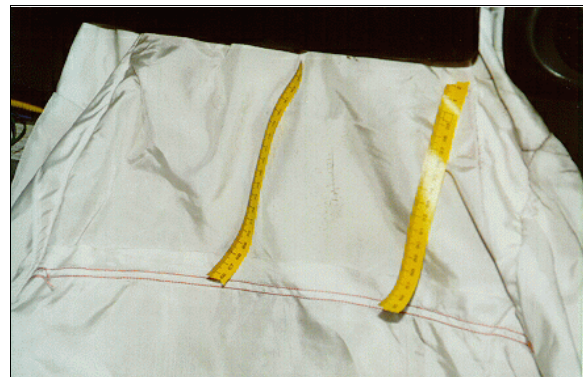


Figure 13: Close-up of skin transfer on top of case vehicle's front right passenger air bag (case photo #42)

front surfaces of the air bag. The skin transfer on the top surface of the air bag began 4 centimeters (1.6 inches) below the cover flap and was approximately 5 centimeters (2.0 inches) wide and extended toward the front right seating position 13 centimeters (5.1 inches) and ended just prior to the beginning of the front surface of the air bag (Figure 13 above). The red cloth transfer was on the front right upper quadrant of the air bag's front surface. The blood streak/smear was a 13 x 3 centimeter (5.1 x 1.2 inch) area on the upper left quadrant of the air bag's front surface (Figure 14). Finally, there was also a 13 centimeter (5.1 inch) long abraded area on the left lower quadrant of the air bag's front surface, with associated black scuffing, that occurred when the air bag contacted the upper right corner of the case vehicle's radio, which previously had been partially pulled out from the center instrument panel (Figure 15).

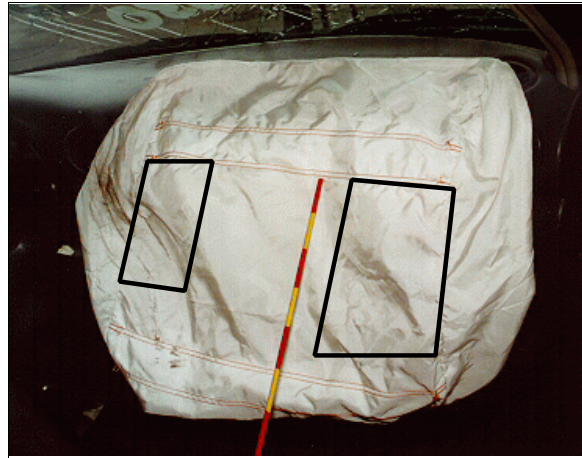


Figure 14: Front surface of case vehicle's front right passenger air bag showing evidence of occupant contact on left (i.e., blood smear) and right (i.e., red cloth transfer) upper quadrants; Note: grease smears and black scuffs are present on the air bag that resulted from contact with the underside of the cover flap during deployment (case photo #40)

CASE VEHICLE "ON-LAP" FRONT RIGHT PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's, "out-of-position," front right passenger [79 centimeters and 11 kilograms (31 inches, 25 pounds)] was seated on the lap of the seated, front right passenger (i.e., grandmother of child) presumably in an upright posture with his back against his grandmother's arm and chest and his feet facing forward. In addition, the exact position of his arms is unknown. Based on the vehicle inspection, the front right seat track was located between its middle and forward-most positions, and the seat back was upright (Figure 15).

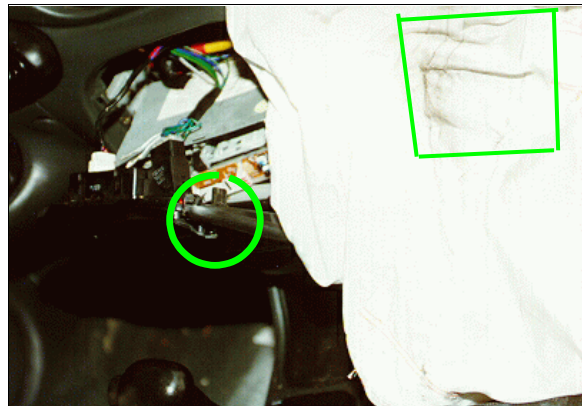


Figure 15: Close-up of case vehicle's deployed front right passenger air bag which contacted protruding radio (circle) during deployment causing a black scuff (square) on bag's fabric (case photo #39)

The case vehicle's "on-lap," front right passenger was not restrained by the front right, active, three-point, lap-and-shoulder, safety belt system, which was reportedly being used by the case vehicle's adult, front right passenger on whose lap he was sitting. Furthermore, there was no evidence of belt pattern bruising and/or abrasions to the "on-lap" passenger's body, and this contractor's inspection of the front right seating position's seat belt webbing, "D"-ring, and latch plate showed no apparent evidence of loading.

The case vehicle's driver braked, attempting to avoidance the crash. As a result of the attempted avoidance maneuver and the nonuse of any safety restraints, the “on-lap,” front right passenger moved forward and slightly upward, while the seated front right passenger most likely attempted to tighten her grip around the child’s abdomen. Based on the seat track location and the driver’s braking, just prior to the crash he was immediately in front of the front right passenger’s air bag module. The exact position of the child at the moment of deployment is unknown but, based on the contact evidence on the air bag’s fabric (**Figures 5, 13, and 14** above) and on the windshield’s glazing (**Figures 5 and 6** above) and the child’s injuries, the child’s torso was nearly atop the air bag module at the moment of deployment. The case vehicle's impact with the Mercury enabled the “on-lap” passenger to continue forward and upward toward the case vehicle’s **350** degree Direction of Principal Force as the case vehicle decelerated. As a result, the seated, adult, front right passenger was unable to hold him. As the front right passenger air bag module deployed, the air bag impacted the “on-lap” passenger lifting and/or assisting him upwards into the windshield’s glazing. The forward movement of the adult, front right passenger also helped to push the “on-lap” passenger forward. It is also possible that as the air bag continued to expand, the air bag forcefully lifted him upwards where he contacted the windshield header/sun visor near the rearview mirror (**Figure 7** above). As the case vehicle rotated clockwise, the “on-lap” passenger moved to the left as the vehicle rotated clockwise underneath him. The position of the “on-lap” passenger at final rest is unknown.

CASE VEHICLE “ON-LAP” FRONT RIGHT PASSENGER INJURIES

The “on-lap,” child, front right passenger was transported by ambulance to the hospital. He sustained critical injuries and was pronounced dead one hour and fifty-five minutes post-crash. According to his autopsy, the injuries sustained by the case vehicle's, on-lap, front right passenger include: subdural and subarachnoid hemorrhages along and across the base of his brain; subdural and subgaleal hemorrhages overlying both cerebral hemispheres; mild cerebral edema; an atlanto-occipital dislocation; an anterior fracture of the third cervical vertebrae; a laceration of the proximal jejunum; multiple liver lacerations; multiple scalp lacerations; abrasions to the upper neck, left mid-abdomen, left forearm, and left hand; a contusion to his left chest; and lacerations to his right neck and left hand. This occupant’s primary brain injuries were caused by his contact with the case vehicle’s front right passenger air bag.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Hemorrhage, subdural, large (20 ml) at base of brain in anterior, middle, and posterior cranial fossae [Aspect = Unknown]	140656.5 critical	Air bag, front right passenger’s	Probable	Autopsy
2	Hemorrhage, subdural, small (10 ml) overlying both cerebral hemispheres [Aspect = Bilateral]	140654.5 critical	Front right sun visor/header	Probable	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
3	Edema, cerebral, with slightly compressed ventricles, flattening of gyri and narrowing of sulci [Aspect = Unknown]	140670.3 serious	Air bag, front right passenger's	Probable	Autopsy
4 5	Hemorrhage, subarachnoid at base of brain overlying inferior temporal lobes, right posterior frontal lobe, and left frontoparietal lobes	140684.3 140684.3 serious	Air bag, front right passenger's	Probable	Autopsy
6	Laceration {serosal tear} proximal jejunum	541422.2 moderate	Other occupant: arms and hands of seated front right passenger	Probable	Autopsy
7	Lacerations, multiple, liver including superficial superior anterior left lobe and gaping lacerations within parenchyma (subcapsular) of superior posterior right lobe	541826.4 severe	Other occupant: arms and hands of seated front right passenger	Probable	Autopsy
8	Dislocation, significant ¹ , atlanto-occipital	650208.2 moderate	Air bag, front right passenger's	Certain	Autopsy
9	Fracture anterior ² C ₃ , not further specified	650230.2 moderate	Air bag, front right passenger's	Probable	Autopsy
10 11	Contusion {subgaleal hemorrhage}, 9 x 3.5 cm (3.5 x 1.4 in) overlying right and left mid-parietal regions	190402.1 190402.1 minor	Front right sun visor/header	Probable	Autopsy
12	Laceration, gaping, 15.2 cm (6 in), curvilinear, left frontal and parietal scalp	190600.1 minor	Windshield	Probable	Autopsy
13	Laceration, continuing from above, 3.8 cm (1.5 in), mid-left occipital scalp	190602.1 minor	Windshield	Probable	Autopsy
14	Abrasion, rectangular, 11.4 x 2.9 cm (4.5 x 1.125 in), upper neck, extending along mandibles [Aspect = Anterior]	390202.1 minor	Air bag, front right passenger's	Certain	Autopsy

¹ The exact distance was not specified.

² Presumably this fracture was to the body of C₃.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
15	Laceration {scratch}, superficial, right anterior lateral neck [Aspect = Right]	390602.1 minor	Air bag, front right passenger's	Certain	Autopsy
16	Contusion left anterior, inferior thorax	490402.1 minor	Air bag, front right passenger's	Probable	Autopsy
17	Abrasion, rectangular, left lateral mid-quadrant of abdomen	590202.1 minor	Air bag, front right passenger's	Probable	Autopsy
18	Abrasions, mid-distal to distal left forearm	790202.1 minor	Air bag, front right passenger's	Probable	Autopsy
19 20	Abrasions and lacerations {scratches} dorsal, proximal, interphalangeal junctions of 4 th and 5 th digits left hand	790202.1 790602.1 minor	Windshield	Possible	Autopsy

CASE VEHICLE DRIVER KINEMATICS

The case vehicle's driver [23-year-old, White (Hispanic) female; of unknown height and weight] was presumably seated in a reclined posture with her back against the seat back, her left foot on the floor, her right foot on the brake, and both her hands on the steering wheel. Her seat track was located in its middle position, the seat back was slightly reclined, and the vehicle was not equipped with a tilt steering wheel.

The case vehicle's driver was not using her available, active, three-point, lap-and-shoulder, safety belt system. The inspection of the driver's seat belt webbing, "D"-ring, and latch plate showed no evidence of usage during this crash.

The case vehicle's driver braked, attempting to avoidance the crash. As a result of the attempted avoidance maneuver and the nonuse of any safety restraints, the driver moved forward and slightly upward just prior to the crash. The case vehicle's impact with the Mercury enabled the driver to continue forward and upward toward the case vehicle's 350 degree Direction of Principal Force as the case vehicle decelerated. As the driver's air bag module deployed, the air bag impacted the driver knocking her upwards and backwards into her seat back. As the case vehicle rotated clockwise, the driver moved to the left as the vehicle rotated clockwise underneath her. At final rest the case vehicle driver remained in the front seat leaning to her left.

CASE VEHICLE DRIVER INJURIES

The driver was not transported by ambulance to the hospital for treatment purposes, but she presumably accompanied her son to the hospital. The case vehicle's driver reportedly did not sustain any injuries as a result of this crash.

The case vehicle's adult front right passenger [45-year-old, White (Hispanic) female; of unknown height and weight] was seated in an upright posture with her feet most likely on the floor and her hands holding her grandson on her lap. Her seat track was located between its middle and forward-most positions, and the seat back was upright.

The case vehicle's seated front right passenger was not using her available, active, three-point, lap-and-shoulder, safety belt system. As discussed above, the inspection of the front right passenger's seat belt webbing, "D"-ring, and latch plate showed no evidence of usage during this crash.

The case vehicle's driver braked, attempting to avoid the crash. As a result of the attempted avoidance maneuver and the nonuse of any safety restraints, the adult, front right passenger moved forward and slightly upward while still attempting to hold on to the "on-lap" front right passenger. The case vehicle's impact with the Mercury enabled the adult, front right passenger to continue forward and upward toward the case vehicle's 350 degree Direction of Principal Force as the case vehicle decelerated.

As the front right passenger air bag module deployed, the adult front right passenger was somewhat shielded from the air bag's fabric by the body of the passenger on her lap. As the "on-lap" passenger was stripped from her grasp, the deploying air bag knocked the adult passenger backwards into her seat back. As the case vehicle rotated clockwise, the adult front right passenger moved to the left as the vehicle rotated clockwise underneath her. The position of the adult, front right passenger at final rest is unknown.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The seated front right passenger was transported by ambulance to the hospital. She sustained minor injuries and was treated and released. The injuries sustained by the case vehicle's seated front right passenger are unknown.

OTHER VEHICLE

Based on the VIN and manufacturer's specifications, the 1995 Mercury Mystique GS was a front wheel drive, five-passenger, four-door sedan (VIN: 1MELM6532SK-----) equipped with a 2.0L, I-4 engine and a five-speed manual transmission was standard. Four-wheel, anti-lock brakes are an option for this model, but it is unknown if the Mercury was so equipped. The Mercury's wheelbase was 271 centimeters (106.5 inches), and the odometer reading is unknown because the Mercury was not inspected. Furthermore, the vehicle was equipped with driver and front right passenger supplemental restraint systems (air bags) and manual, three-point, lap-and-shoulder, safety belt systems for the front and back outboard seating positions. The back center seat had a manual, two-point, lap belt.

With no available vehicle photographs, the CDC for the Mercury is unknown. The Mercury was towed due to damage.

