INDIANA UNIVERSITY
TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
222West Second Street
Bloomington, Indiana 47403-1501
(812) 855-3908 Fax: (812) 855-3537

REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN98-020
LOCATION - Texas
VEHICLE - 1994 FORD PROBE
CRASH DATE - February 1997

Submitted:

April 5, 2002

Revised:
December 05, 2002

Contract Number: DTNH22-94-D-17058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

DISCLAIMERS

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.* IN98-020	2. *Government Accession No.*	3. *Recipient's Catalog No.*
4. *Title and Subtitle* Remote Air Bag Fatality Report Vehicle - 1994 Ford Probe Location - Texas		5. *Report Date:* April 5, 2002 6. *Performing Organization Code*
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.* Task # 0170
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 222 West Second Street Bloomington, Indiana 47403-1501		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-94-D-17058
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NRD-32) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. *Type of Report and Period Covered* Technical Report Crash Date: February 1997 14. *Sponsoring Agency Code*

15. *Supplementary Notes*
Remote air bag deployment investigation involving a 1994 Ford Probe, three-door hatchback, with manual three-point safety belts and dual front air bags, and a 1977 GMC Vandura, passenger van

16. *Abstract*

This report covers a remote investigation of an air bag deployment crash that involved a 1994 Ford Probe (case vehicle) and a 1977 GMC Vandura (other vehicle). This crash is of special interest because the case vehicle's unrestrained front right passenger (7-year-old male) sustained fatal brain injuries as a result of contacting and being redirected by the front right air bag. The case vehicle was traveling east in the eastbound lane on a two-lane, undivided roadway approaching the cap of a Tee-intersection, intending to turn left to travel north. The other vehicle was traveling south in the southbound lane on a two-lane undivided frontage roadway approaching the west leg of the Tee- intersection. The case vehicle cut the turn sharply and was traveling north in the southbound lane. The front right corner of the case vehicle impacted the right front corner of the other vehicle, causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle's front right passenger (7-year-old male) was seated upright, with his seat track located in its middle position. He was not wearing his available, active, three-point, lap and shoulder belt and sustained, according to his medical records, fatal injuries which included: brain stem compression including bilateral uncal and cerebellar tonsillar herniation with necrosis of brain stem, severe global edema, a right subdural hematoma, global subarachnoid hemorrhage (involving both left and right hemispheres), abrasions and contusions to the right side of his face, a contusion (subgaleal hemorrhage) to his left frontal scalp, and contusions bilaterally to his anterior shoulders. The case vehicle driver (24-year-old female) was seated upright with her seat track located in its middle position and was not wearing her available, active, three-point, lap and shoulder belt. She sustained minor injuries as a result of this crash. The case vehicle was towed, but not due to damage. The other vehicle was towed from the scene due to damage to the right front wheel assembly.

17. *Key Words* Air Bag Deployment Motor Vehicle Traffic Crash Injury Severity		18. *Distribution Statement* General Public	
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 6	22. *Price* $4,100

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

TABLE OF CONTENTS IN98-020

This remote report was brought to the NHTSA's attention on August 24, 1998 by an attorney representing the family of the deceased front right passenger. This crash involved a 1994 Ford Probe (case vehicle), and a 1977 GMC Vandura van (other vehicle). The crash occurred in February 1997, at 5:50 p.m., in Texas and was investigated by the applicable state highway patrol office. This crash is of special interest because the case vehicle's unrestrained front right passenger (7-year-old male) sustained fatal brain injuries as a result of contacting and being redirected by the front right passenger air bag. This contractor interviewed the driver of the case vehicle on October 20, 1998. This summary is based on the Police Crash Report, an interview with the case vehicle's driver, police photographs of the scene and both vehicles, occupant kinematic principles, medical records, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

Figure 1: Case vehicle's eastbound approach toward left turn (case photo #01)

The case vehicle was traveling east in the eastbound lane of a two-lane, undivided city street, approaching the cap of a Tee intersection and intending to turn left to travel northbound (**Figure 1**). The other vehicle was traveling south in the southbound lane of the intersecting two-lane, undivided frontage road, and intended to continue southbound. The case vehicle's driver cut the corner sharply and was traveling north in the southbound lane. The case vehicle's driver had taken her foot off the accelerator and was reaching for the brake when the crash occurred. The driver of the other vehicle steered to the left and braked, attempting to avoid the crash.

Figure 2: Other vehicle's southbound approach and skid marks toward final rest; green X marks approximate point of impact (case photo #03)

The crash occurred in the southbound lane, immediately north of the intersection. The front right corner of the case vehicle impacted the right front corner of the other vehicle, causing the case vehicle's driver and front right air bags to deploy (**Figure 2**). The case vehicle was slightly redirected in a northeasterly direction and came to rest a short distance from the point of impact. The other vehicle's avoidance maneuvers resulted in the vehicle entering the northbound lane, leaving approximately 10 meters [33 feet] of skid marks prior to coming to final rest. At final rest, the other vehicle was positioned partially off the east edge of the roadway in the northbound lane heading south-southeast.

The Tee intersection was controlled by a stop sign for eastbound traffic with the north-south roadway having the right-of-way. Both roadways were bituminous, straight and level, and were bordered by unprotected gravel with grass shoulders. The speed limit was 48 km.p.h. [30 m.p.h.] for the east-west road and 64 km.p.h. [40 m.p.h.] for the north-south road.

The case vehicle was a front wheel drive 1994 Ford Probe GT, four-passenger, three-door hatchback (VIN: 1ZVLT22B0R5------). The case vehicle was equipped with a 2.5 liter V6 engine and a 5-speed manual transmission with a console-mounted shift lever. The case vehicle was not equipped with anti-lock brakes. The wheelbase was 261 centimeters [102.8 inches]. The odometer reading is not known.

The interior of the case vehicle was equipped with folding front bucket seats with integral head restraints, and three-point lap and shoulder belts in the four outboard seat positions. The vehicle was equipped with knee bolsters for the driver and front right passenger. The rear seat was most likely a bench with separate seat backs without head restraints. It is unknown whether the front safety belt systems were equipped with manually operated height adjusters for the D-rings.

Figure 3: Case vehicle's front and right side (case photo # 07)

Based on the available photographs, direct contact extended from the case vehicle's front right bumper corner inward nearly to the center of the front bumper (**Figure 3**). The damage indicates that the case vehicle's front probably underrode the other vehicle's right front bumper corner and right front side. The corner of the case vehicle's fiberglass front right bumper fascia was torn away (**Figure 4**). Neither of the front tires appear to be physically restricted from the impact damage. The lower right area of the windshield was cracked due to contact by the front right air bag's cover flap during its deployment. The upper right portion of the windshield had a diagonal slit and was pushed outward as a result of contact by the front right passenger (**Figure 5**).

Figure 4: Close up, damage at front right corner (case photo #08)

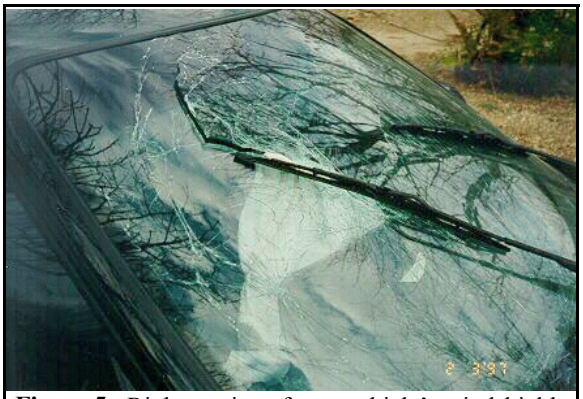

Figure 5: Right portion of case vehicle's windshield, showing cracks and fractures (case photo #10)

The case vehicle was towed, but not due to damage. Based on the available photographs, the visually estimated CDC is: **11-FZEW-1 (340)** for the case vehicle. Because of the swiping-type nature of this crash, no reconstruction program was used. This contractor's visually estimated Delta V is 10 - 14 km.p.h. [6 - 9 m.p.h.], indicating a crash of minor severity.

The case vehicle was equipped with front air bags at the driver and front right passenger seat positions that deployed as a result of the impact with the other vehicle. The driver's air bag was mounted in the steering wheel hub. The photographs indicate that the module cover flaps opened at the designated tear points, with no obvious damage to the cover flaps or the air bag.

The front right passenger air bag was mounted on the mid-instrument panel location. The available photographs indicate that the single cover flap opened at the designated tear points, with no obvious damage to the cover flap or the air bag. The cover flap contacted the windshield, cracking the glazing and probably abrading the flap (**Figure 5**).

CASE VEHICLE FRONT RIGHT PASSENGER

The case vehicle's front right passenger (7-year-old male, white, non-Hispanic, 122 centimeters, 22 kilograms [48 inches, 49 pounds]) was not wearing his available, active, three-point, lap-and-shoulder safety belt. He was unconscious at the scene, with no pulse and agonal breathing. Cardiopulmonary resuscitation was begun and he was transported to a local hospital via ambulance. He was subsequently transferred via helicopter to a pediatric trauma center, where he was hospitalized and declared dead four days after the crash.

Immediately prior to the crash the case vehicle's front right passenger was seated upright with his back against the seat back, both feet dangling over the front edge of the seat's cushion angled downward, and both his arms at his side. According to the case vehicle's driver, the front right passenger's seat track was located in its middle position, and the seat back was upright. Based on the interior photographs, the front right seat track appears to be between the middle and forward most position (**Figure 6**).

Figure 6: Case vehicle's front right seating area showing deployed front air bags and interior surface of right front door (case photo #12)

The case vehicle's left turn, combined with the front right passenger's non-use of his available safety belts, resulted in this passenger moving slightly forward and to his right just prior to impact. The case vehicle's impact with the other vehicle caused the passenger to move forward, upward and slightly leftward, toward the 340 degree direction of force. Because the impact initially involved soft structures on both vehicles, the air bag deployment was probably delayed such that the passenger had moved forward and upward. He encountered the deploying air bag with his lower face, neck and shoulders, causing contusions and abrasions around his mouth, chin and neck, and contusions on his shoulders. Combined with the passenger's forward and upward momentum, the expanding air bag lifted him and his face struck the windshield and his head struck the windshield header, causing abrasions and contusions around his eyes and nose, and a contusion on his left frontal scalp. The impact to his head caused a subdural hematoma on the right, bilateral subarachnoid hemorrhage and severe global edema of the brain. He fell back into his seat. At final rest, he was laying, slightly curled, with his feet across the center console and his face toward the seat back.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Compression of brain stem including bilateral uncal and cerebellar tonsillar herniation with necrosis of brain stem	140202.5 critical	Windshield header	Probable	Autopsy
2	Edema[1], severe global–ventricular system is compressed (i.e., absent) by massive central white matter edema	140666.5 critical	Windshield header	Probable	Autopsy
3	Hematoma, right subdural, 10 grams	140652.4[2] severe	Windshield header	Probable	Autopsy
4 5	Hemorrhage, subarachnoid, global (i.e., involving both left and right hemispheres)	140684.3 140684.3 serious	Windshield header	Probable	Autopsy
6	Abrasion right lateral canthus of eye (i.e., orbit)	297202.1 minor	Windshield	Probable	Autopsy
7	Contusion {ecchymosis} right orbit	297402.1 minor	Windshield	Probable	Autopsy
8	Contusion {subgaleal hemorrhage} left frontal scalp, 8 x 3 cm (3.1 x 1.2 in)	190402.1 minor	Windshield header	Probable	Autopsy
9	Abrasion, linear, 5.1 x 0.3 cm (2 x 0.125 in), above right eye	290202.1 minor	Windshield	Probable	Autopsy
10	Abrasion, 1.9 x 0.6 cm (0.75 x 0.25 in), center of chin	290202.1 minor	Passenger's air bag	Probable	Autopsy
11	Contusion, 1.3 x 0.6 cm (0.5 x 0.25 in), right nose	290402.1 minor	Windshield	Probable	Autopsy
12	Contusion, 5.1 x 1.3 cm (2 x 0.5 in), right mandible	290402.1 minor	Passenger's air bag	Possible	Autopsy

[1] The autopsy cited severe leptomeningeal congestion and terminal anoxic encephalomalacia. The following terms are defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows:
anoxic (a-nok´sik): pertaining to or characterized by anoxia.
anoxia (a-nok´se-a): a total lack of oxygen; often used interchangeably with ***hypoxia*** to mean a reduced supply of oxygen to the tissues.
congestion (ken-jes´chen): excessive or abnormal accumulation of fluid, as of blood in a part.
encephalomalacia (en-sef"a-lo-ma-la´-sha): softening of the brain, especially that caused by an infarct.
leptomeningeal (lep"to-ma-nin´je-al): pertaining to the leptomeninges.
leptomeninges (lep"to-ma-nin´jez): the pia mater and arachnoid considered together as one functional unit; the pia-arachnoid.

[2] The volume of one gram of hematoma is about the volume of one gram of water. For water one cubic centimeter equals one milliliter which weights one gram (given one atmosphere of pressure). Since the threshold for the higher A.I.S. code is 25 ccs, the code for "Small" was used.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
13	Contusions bilateral anterior shoulders	790402.1 minor	Passenger's air bag	Probable	Autopsy

CASE VEHICLE DRIVER

The case vehicle's driver (24-year-old female, white, non-Hispanic, 152 centimeters, 61 kilograms [60 inches, 135 pounds]) was not wearing her available, active, three-point, lap-and-shoulder safety belt. She sustained minor injuries and sought treatment two days post-crash.

The driver was seated upright with her back against the seat back, her left foot on the floor, her right foot reaching for the brake, and both hands on the steering wheel. Her seat track was located in its middle position, the seat back was upright, and the tilt steering wheel was located in its down-most position.

Figure 7: Case vehicle driver's seating area showing deployed air bags (case photo #11)

The driver turned left immediately prior to the crash, causing her to move slightly rightward. The impact with the other vehicle caused her to move forward and leftward, toward the 340 degree direction of force. She probably encountered the deploying air bag with her chest, with the bag billowing upward and causing an abrasion on her chin. The air bag propelled her rearward and she fell back into her seat, and was in an essentially upright posture when the vehicle came to final rest.

DRIVER'S INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Abrasion, chin	290202.1 minor	Driver's air bag	Probable	Interviewee

The other vehicle was a rear wheel drive 1977 GMC G20 Vandura passenger van (VIN: TGL257U------), equipped with a V8 gasoline engine and an automatic transmission.. Its wheelbase is not known, but was either 279 centimeters [110 inches] or 318 centimeters [125 inches], and the van was fitted with aftermarket splash guards and running boards. The odometer reading is not known. The van was towed due to right front wheel damage.

Based on the available photographs, damage to the van indicates a swiping-type engagement concentrated to the right front fender, wheel assembly, splash guard and door. The CDC was visually estimated to be **12-RYES-1 (10)** for the van. This contractor's visually estimated Delta V is 10 - 14 km.p.h. [6 - 9 m.p.h.], indicating a crash of minor severity.

Figure 8: Other vehicle's front and right side (case photo #13)

Figure 9: Closeup, other vehicle's minor damage at right front bumper corner, wheel, splash guard and door (case photo #14)