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 - IN99-006
LOCATION - California
VEHICLE - 1998 DODGE STRATUS
CRASH DATE - February 1998

Submitted:

June 2, 1999

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.* IN99-006	2. *Government Accession No.*	3. *Recipient's Catalog No.*
4. *Title and Subtitle* Remote Air Bag Deployment Investigation Vehicle - 1998 Dodge Stratus 4-door sedan Location - California		5. *Report Date:* June 2, 1999 6. *Performing Organization Code*
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.* Task # 0192
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 222 West Second Street Bloomington, Indiana 47403-1599		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 1998 14. *Sponsoring Agency Code*

15. *Supplementary Notes*

Remote air bag deployment investigation involving a 1998 Dodge Stratus equipped with manual safety belts and redesigned air bags and a traffic signal pole.

16. *Abstract*

This report covers a remote investigation of an air bag deployment crash that involved a 1998 Dodge Stratus and a traffic signal pole. This case is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of the collision events and the case vehicle's unrestrained driver (22-year-old male) died from a transected aorta due to blunt force compression of his chest. There was no other occupant in the case vehicle. The case vehicle was traveling south at high speed in the southbound through lanes of a divided local street, approaching a four-leg intersection apparently intending to pass through the intersection and continue south. The east-west intersecting roadway had a curbed island creating a channelized right turn lane for eastbound traffic to turn south, with a large steel traffic signal pole mounted in the island. The island with the traffic signal was on the right for southbound traffic. The case vehicle veered or drifted to the right while passing through the intersection and entered the traffic island. There is no evidence that the driver attempted any avoidance actions. The case vehicle mounted the island's curb and the front left corner of the case vehicle impacted the traffic signal pole. The left front wheel assembly snagged against the pole and was torn off as the case vehicle rotated counterclockwise off the pole. The case vehicle spun across the channelized right turn lane, mounted the curb onto the sidewalk, struck and broke down a small wooden no parking sign post and came to rest straddling the sidewalk heading northeast, having rotated approximately 160 degrees counterclockwise. The crash severity for the case vehicle was high [greater than 40 km.p.h. (25 m.p.h.)]. The case vehicle driver sustained transection of the thoracic aorta, fractured ribs, a laceration of the left hemidiaphragm with herniation of the abdominal contents into the left pleural cavity, a fracture of the left femur and various integumentary injuries. He was declared dead at the scene and transported directly to a morgue.

17. *Key Words* Redesigned 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* 5	22. *Price* $2,500

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

TABLE OF CONTENTS

BACKGROUND

This case was brought to the NHTSA's attention by a review of the 1998 Fatality Analysis Reporting System (FARS) in February 1999. The crash involved a 1998 Dodge Stratus and a traffic signal pole. The crash occurred in February 1998 at 3:20 a.m., in California, and was investigated by the applicable state police. This case is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of the collision events and the case vehicle's unrestrained driver (22-year-old male) died from a transected aorta due to blunt force compression of his chest. The Police Crash Report was received in March 1999. The autopsy report was received in April and on-scene photographs were received in May 1999. This report is based on the Police Crash Report, the autopsy report, on-scene photographs, occupant kinematic principles and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling south at high speed in the southbound through lanes of a divided local street, approaching a four-leg intersection apparently intending to pass through the intersection and continue south. The southbound roadway consisted of (from right to left): a painted island with raised reflectors creating a channelized right turn lane; two through lanes; a left turn lane; a raised median; and the northbound roadway beyond the median. The east-west intersecting roadway had a curbed island creating a channelized right turn lane for eastbound traffic to turn south, with a large steel traffic signal pole mounted in the island. The island with the traffic signal was on the right for southbound traffic (**Figure 1**). It was dark with street lights and it was raining. The traffic signal was operating correctly, there were no roadway defects and the asphalt road surface was wet. The case vehicle veered or drifted to the right while passing through the intersection and entered the traffic island. There is no evidence that the driver attempted any avoidance actions.

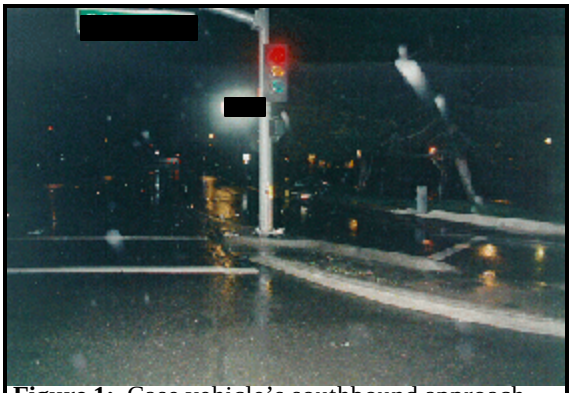

Figure 1: Case vehicle's southbound approach toward impact with signal pole in island (case photo #01)

Figure 2: Pole impacted by case vehicle; Note: portion of pole's foundation collar broken away (case photo #02)

The crash occurred within the traffic island. The case vehicle mounted the island's curb and the front left corner of the case vehicle impacted the traffic signal support pole (**Figure 2**). The left front wheel assembly snagged against the pole and was torn off as the case vehicle rotated counterclockwise off the pole. The case vehicle spun across the channelized right turn lane, mounted the tapered curb onto the sidewalk, struck and broke down a small wooden no parking sign post and came to rest straddling

the sidewalk heading northeast, having rotated approximately 160 degrees counterclockwise.

The case vehicle was a front wheel drive 1998 Dodge Stratus five-passenger four-door sedan (VIN: 1B3EJ46XXWN------) equipped with a 2.4 liter I4 engine and a four-speed automatic transmission with a column-mounted selector lever. Four wheel anti-lock brakes were an option for this vehicle, but it is not known if the case vehicle was so equipped. The case vehicle's wheelbase was 274 centimeters (108.0 inches). The odometer reading is not known. The case vehicle was towed due to disabling damage.

The case vehicle sustained heavy impact damage at the apex of the front left corner, with the left front fender crushed rearward, the left front wheel assembly sheared off, direct contact to the left A-pillar above the belt line and swiping-type damage into the middle of the left front door (**Figure 3**). The left headlight was shattered, the left corner of the bumper fascia was torn away, and the extreme left end of the bumper was bent rearward. The left edge of the hood was folded inward; the windshield was fractured across the entire width; the left A-pillar was displaced rearward; the windshield header, left side rail and roof were buckled; the driver's door was crushed, forced rearward and buckled outward; the driver's door window glazing was shattered (kernalized); and the leading edge of the left back door sustained induced damage (**Figure 4**). There was certainly substantial intrusion into the driver's seat area but the available photographs do not provide any views of specific intruding components. The Police Crash Report includes comments indicating that the rack and pinion assembly was pushed rearward and the floor was pushed up into the driver's foot space. The available photographs do not provide good views of the case vehicle's interior, but the steering wheel adjustment appears to have been tilted upward. The post-crash position of the steering column plus damage to the instrument panel near the steering column suggests that the column was probably compressed and may have separated from its mountings (**Figure 5**). The CDC, estimated from on-scene photographs, is **12-FLAS-8**, with principal direction of force 0 degrees. The

Figure 3: Front of case vehicle at final rest (case photo #09)

Figure 4: Left side of case vehicle at final rest (case photo #10)

Figure 5: Case vehicle's front seat row, viewed from right (case photo #12)

WinSMASH reconstruction program was used to calculate delta V, based on a CDC-only estimated crush profile. These CDC-only calculations provide a borderline reconstruction, but the results appear reasonable. The total, longitudinal and lateral delta Vs were, respectively: 53 km.p.h. (33 m.p.h.), -53 km.p.h. (-33 m.p.h.), and 0 km.p.h.

The case vehicle's driver [22-year-old male, White (Hispanic), 178 centimeters, 150 kilograms (70 inches, 330 pounds)] was not restrained by the available manual three-point lap-and-shoulder safety belt system. There was no other occupant. He was declared dead at the scene. The following discussion of the driver's injuries is based on the report of a complete autopsy.

The driver was probably seated in a normal driving posture, with his back against the seat back, hands on the wheel and feet on the foot controls and floor. He was jostled erratically as the case vehicle's front wheels went up the curb onto the island. The impact with the pole caused the driver and front right air bags to deploy and caused the driver to move forward, toward the 12 o'clock direction of principal force. His face contacted the deploying air bag, causing abrasions to his nose and exterior lower lip and a contusion to the interior lower lip. Because of his non-use of the available manual restraints, he continued moving forward, deflating the air bag as the case vehicle rotated counterclockwise. His chest impacted the steering wheel and hub causing a hematoma in the mid-left pectoral area overlaying fractures of the intercostal cartilage and lacerations of the intercostal muscle for left ribs 2, 3, 4 and 5. He also sustained lateral fractures of the bone of left ribs 5, 8 and 9, a transverse fracture of the sternum, and a fracture of right rib 2 (posterior). He continued moving forward with his chest against the steering wheel hub and his abdomen against the steering wheel rim, compressing the steering column and causing blunt force compression of his chest resulting in complete transection of the aorta and laceration of the left hemidiaphragm with herniation of the omentum, spleen and stomach in the left pleural cavity. As the left A-pillar was pushed rearward, the windshield fractured and the driver's door window glazing shattered, causing multiple lacerations to his left arm. His head contacted the windshield, causing a contusion and major laceration to his forehead. The side panel and floor in the driver's footwell intruded, causing abrasions and major lacerations on his left lower leg. His left thigh was jammed against the instrument panel, causing a mid-shaft fracture of the left femur. He was declared dead at the scene and was transported directly to a morgue.

CASE VEHICLE DRIVER INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Complete transection, proximal thoracic aorta, 2.5 cm (1 inch) distal to the origin of the left subclavian artery, with 1500 ml left and 100 ml right hemothorax	420218.6 untreatable	Steering wheel hub and spokes	Probable	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2.	Fractured ribs, left 5th, 8th, 9th (lateral) & right 2nd (posterior)	450230.3 serious	Steering wheel hub and spokes	Probable	Autopsy
3.	Laceration, left hemidiaphragm, with herniation of omentum, spleen and stomach into left pleural cavity	440604.3 serious	Steering wheel rim	Probable	Autopsy
4.	Fracture left femur, mid shaft	851814.3 serious	Left instrument panel and below	Probable	Autopsy
5.	Transverse fracture of sternum at the junction of the sternal body and the manubrium	450804.2 moderate	Steering wheel hub and spokes	Probable	Autopsy
6.	Laceration, 10 cm (3.8 inches), left forehead, into galea with subgaleal hemorrhage	290604.2 moderate	Windshield	Probable	Autopsy
7.	Laceration, 22 cm (8.5 inches) long, gaping 6 cm (2.5 inches) wide, anterolateral left lower leg, with muscle exposed and lacerated	890604.2 moderate	Side panel forward of the A-pillar	Possible	Autopsy
8.	Injuries to intercostal tissues: fracture of cartilage and laceration of muscle, left 2nd, 3rd, 4th, 5th interspaces; laceration of muscle only, left 7th and 8th interspaces	490600.1 minor	Steering wheel hub and spokes	Probable	Autopsy
9.	Laceration, anterior distal left leg	890602.1 minor	Side panel forward of the A-pillar	Possible	Autopsy
10.	Abrasion, medial proximal left leg	890202.1 minor	Side panel forward of the A-pillar	Possible	Autopsy
11.	Multiple incised superficial lacerations, left arm	790602.1 minor	Flying glass	Probable	Autopsy
12.	Two lacerations into subcutaneous tissue, near elbow, left arm	790602.1 minor	Left side window glass	Probable	Autopsy
13.	Hematoma, 15 by 10 cm (6 by 4 inches) and 4 cm (1.75 inches) thick, mid-left anterior chest	490402.1 minor	Steering wheel hub and spokes	Probable	Autopsy
14.	Contusion, right forehead	290402.1 minor	Windshield	Probable	Autopsy
15.	Abrasion, tip of nose and around left ala nasi	290202.1 minor	Driver's air bag	Probable	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
16.	Abrasion, exterior lower lip	290202.1 minor	Driver's air bag	Probable	Autopsy
17.	Contusion, interior lower lip	290402.1 minor	Driver's air bag	Probable	Autopsy

The case vehicle impacted a steel traffic signal support pole that was approximately 30 centimeters (12 inches) in diameter (**Figure 6**). The pole's foundation consisted of four threaded rods and a collar set in concrete. The pole's base plate was set upon the collar and attached by nuts screwed down against a base plate. A small section of the collar was broken away (**Figure 2** above). There was abrading on the surface of the pole in the area of the impact, but there was no evidence that the pole was damaged or that its foundation was disturbed, other than the fractured collar.

Figure 6: Traffic signal pole contacted by case vehicle; Note: broken section of foundation collar set back in place (case photo #03)