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REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN99-025
LOCATION - Louisiana
VEHICLE - 1998 DODGE NEON
CRASH DATE - June 1998

Submitted:

September 21, 1999

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Contract Number: DTNH22-94-D-17058

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National Highway Traffic Safety Administration
National Center for Statistics and Analysis
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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.

Technical Report Documentation Page

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15. *Supplementary Notes*
Remote air bag deployment investigation involving a 1998 Dodge Neon, with manual safety belts and dual redesigned front air bags, a 1998 International dump truck, and three pedestrians (state road crew).

16. *Abstract*

This report covers a remote investigation of an air bag deployment crash that involved a 1998 Dodge Neon (case vehicle), a 1998 International 4700 Series dump truck (vehicle #2), and three pedestrians (state road crew). This crash 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 restrained driver (35-year-old male) was fatally injured, with a lacerated aorta being one of his injuries sustained from impacting components that intruded into the front seating area. The case vehicle was traveling west in the outside westbound (northern) lane of a two-lane roadway that was part of a divided, urban, U.S. trafficway. Vehicle #2 was stopped in the same outside westbound lane as the case vehicle. A state road crew was using a road grinder to remove bumps on the pavement surface. They had completed removing bumps on the inside westbound lane and had moved their equipment to the outside westbound lane and closed it to traffic with safety cones. The case vehicle drove through the safety cones, struck or nearly struck three members of the state road crew (killing one), and continued its travel path into the rear of vehicle #2, causing the case vehicle's driver and front right passenger air bags to deploy. There is no knowledge of the pre-crash posture or seat adjustments for the case vehicle's driver. The restrained driver likely began to load his safety belt and the deploying air bag as the steering column and steering wheel/rim/hub, along with the instrument panel, started their intrusion into his seating area. His death certificate listed multiple traumatic injuries with laceration of the aorta as the only injury descriptors. He was pronounced dead at the crash scene.

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TABLE OF CONTENTS

Additional photographs are available in SCI EDCS case IN99-025

BACKGROUND

IN99-025

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 Neon (case vehicle), a 1998 International 4700 Series dump truck (vehicle #2), and three pedestrians (state road crew). The crash occurred in June 1998, at 9:40 a.m., in Louisiana, 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 collision events, and the restrained driver (35-year-old male) was fatally injured. The Police Crash Report was received in March 1999, while the police photographs were obtained in May and the death certificate in July. This report is based on the Police Crash Report, the death certificate, police photographs, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling west in the outside westbound (northern) lane of a two-lane roadway that was part of a divided, urban, U.S. trafficway. Vehicle #2 was headed west and was stopped in the same outside westbound lane as the case vehicle (**Figure 1**). It was daylight, clear, and a temporary construction area had been established (i.e., the outside westbound lane had been closed to traffic via safety cone placement). The roadway was bituminous, dry, straight, level, and no view obstructions. Posted speed limit was 89 km.p.h. (55 m.p.h.). Traffic control devices consisted of a regulatory SPEED LIMIT sign (Manual on Uniform Traffic Control Devices, R2-1) for westbound traffic, a single solid white edge line on the north roadway edge, a single broken white centerline, and a single solid yellow edge line on the south roadway edge. The north roadside had an approximately 2.4 meter (8 foot) asphalt shoulder and the south roadside abutted a grass median. The crash took place in the outside westbound lane.

Figure 1: Westbound approach view for the case vehicle; Note: overturned safety cones and distance case vehicle traveled prior to impact with vehicle #2 (case photo #01)

Figure 2: Case vehicle driver's westbound approach view; Note: highway worker's hard hat and shoe on pavement (case photo #02)

A state road crew was using a road grinder to remove bumps on the pavement surface. They had completed removing bumps on the inside westbound lane and had moved their equipment to the outside westbound lane and closed it to traffic with safety cones. Crew member #1 was standing near the area that blocked the outside westbound lane to traffic. He heard what he believed to be a vehicle traveling at a high rate of speed, looked up, and saw the case

vehicle heading straight for the cones. He yelled to his other crew members, was struck by one of the safety cones (event #1), and dove out of the case vehicle's path. Crew member #2 was closer to vehicle #2. He heard crew member #1 scream, looked up, saw the case vehicle driving through the safety cones, yelled at crew member #3 to get out of the way, and was struck by the right outside mirror of the case vehicle as he jumped out of the way (event #2). Crew member #3 was in the middle of the outside westbound lane (**Figure 2** above), was unable to get out of the case vehicle's travel path, was struck by the case vehicle's front bumper (event #3) and was propelled (with fatal injuries) up into the dump bed of vehicle #2. The case vehicle continued its travel path into the rear of vehicle #2 (event #4). A witness stated that the case vehicle did not appear to swerve, veer, or have its brakes applied prior to event #4. The investigating officer found no pre-crash skid marks or yaw marks (**Figure 3**).

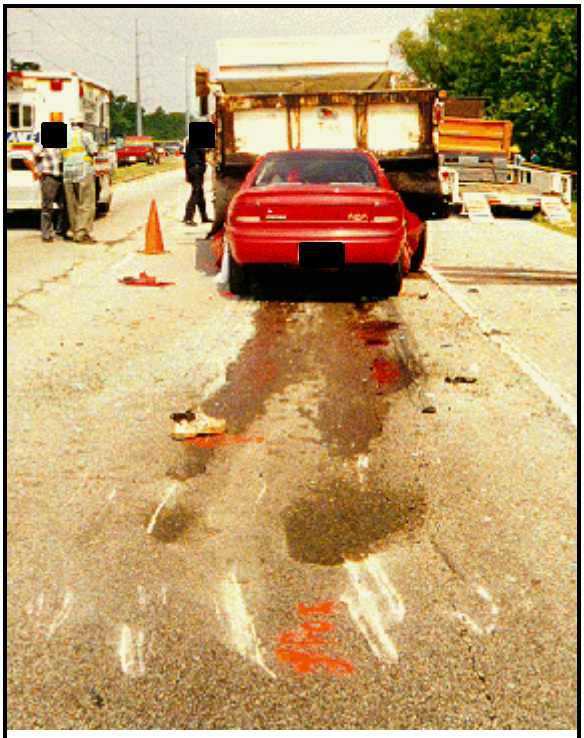

Figure 3: Case vehicle-to-dump truck impact area and final rest positions; Note: at-impact pavement gouges (case photo #04)

The front of the case vehicle impacted and underrode the rear plane of vehicle #2's dump bed, causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle's front bumper seems to have contacted both the inside left rear and inside right rear dual wheels of vehicle #2, shoving vehicle #2's rear axle forward sufficiently to dislodge the drive shaft at its forward universal joint. Investigating officers measured the post-impact travel of the case vehicle at 11.1 meters (36.5 feet). Underride penetration on the case vehicle reached rearward of the B-pillars on the roof. No post-impact rotation by the case vehicle was discovered (**Figure 4**).

Figure 4: Final rest positions of the case vehicle and vehicle #2; Note: depth of underride by the case vehicle (case photo #05)

CASE VEHICLE

The case vehicle was a front wheel drive, 1998 Dodge Neon, five-passenger, four-door pillared hardtop (VIN: 1B3ES47C6WD------) equipped with a 2.0 liter, I-4 gasoline engine and a three-speed automatic transmission and a shift lever on the steering column's right side. Four-wheel anti-lock brakes were an option for this model vehicle, but it is unknown if the case vehicle was so equipped. The case vehicle's wheelbase was 264 centimeters (104.0 inches). An odometer reading was not reported. The

case vehicle was a rental car and was towed from the scene due to disabling damage.

The case vehicle sustained direct contact across the entire width of its front end. The front bumper and fascia were shoved rearward and torqued at an angle, with the top further rearward than the bottom. Missing was the front grille and both headlamp assemblies. Both front fenders were displaced rearward, with the rear portions of the fenders buckling outward and forward, and the mounting plates to the lower A-pillars pulled forward with the front door seams still partially attached. The front engine compartment brackets were shoved rearward (**Figures 5 and 6**). When the case vehicle was pulled from under vehicle #2, the case vehicle's hood was jammed under the dump bed and atop its right rear dual tires. Engine components atop the block were scraped rearward. The top of the cowling was pushed rearward and caused the instrument panel to be compressed against the driver. Both A-pillars were displaced rearward and buckled as the forward roof header was deflected downward, almost to the top of the instrument panel. The bottom of vehicle #2's dump bed contacted the case vehicle's roof to the halfway mark of the rear passenger doors. The windshield was splintered, folded, and mostly laying atop the back of the engine compartment. All four door glazings were shattered (kernelized), but the doors remained shut. Both B-pillars were bent rearward. Both roof side rails were bent downward.

Figure 5: Case vehicle's frontal damage as viewed from the front right corner; Note: direct contact to roof rearward of the B-pillar (case photo #15)

Figure 6: Case vehicle's front damage as viewed from the front left corner; Note: location of the front roof header (case photo #10)

Based on police photographs, the CDC for the case vehicle-to-dump truck collision (event #4) is estimated as: **12-FDAA-9**, with a principal direction of force of 0 degrees. This crash is out-of-scope for the WinSMASH reconstruction program. The crash severity for the case vehicle was high [greater than 40 km.p.h. (25 m.p.h.)].

Heavy intrusion into the case vehicle's passenger compartment occurred. The instrument panel and steering wheel pinned the driver in his seat, while the front roof header was deflected downward to near the top of the instrument panel. The left upper A-pillar was pushed rearward and downward into the driver's seat area and the right upper A-pillar was shoved rearward and downward, with the forward right corner of the front roof header/upper right A-pillar crushed within a few centimeters (inches) of the right upper B-pillar.

The case vehicle's driver (35-year-old male; black, unknown if Hispanic, unknown height and weight) was restrained by his available, active, three-point, lap-and-shoulder safety belt system. There was no other occupant in the case vehicle. The driver's pre-crash seat adjustments, steering wheel position, and posture are not known. His upper torso was in contact with the steering column and wheel and the left side of the instrument panel such that he was pinned in the driver's seat (**Figure 7**). An autopsy was performed but the autopsy report was not acquired. The following discussion of his injuries is based on the death certificate, on-scene photographs, the findings of the autopsy as reported in the Police Crash Report, and occupant kinematic principles.

The impact with worker #3 probably did not caused any significant movement by the driver and there is no evidence that any avoidance actions were attempted. Thus, pre-impact body movements by the case vehicle's driver are not likely. As the case vehicle impacted the back of vehicle #2's dump bed and undercarriage, the driver continued forward and began to load his three-point safety belt and deploying air bag. Intrusion by the instrument panel and steering assembly forced him back into his seat. The Police Crash Report indicates that the major autopsy findings were: laceration of the aorta with bilateral hemothoraces and laceration of the pulmonary artery, probably caused by his contact with the steering wheel hub and spokes. In addition, he sustained lacerations of the liver with hemoperitoneum, probably caused by contact with the lower steering wheel rim. A small laceration is visible on his forehead . It seems likely that he sustained other significant injuries as well.

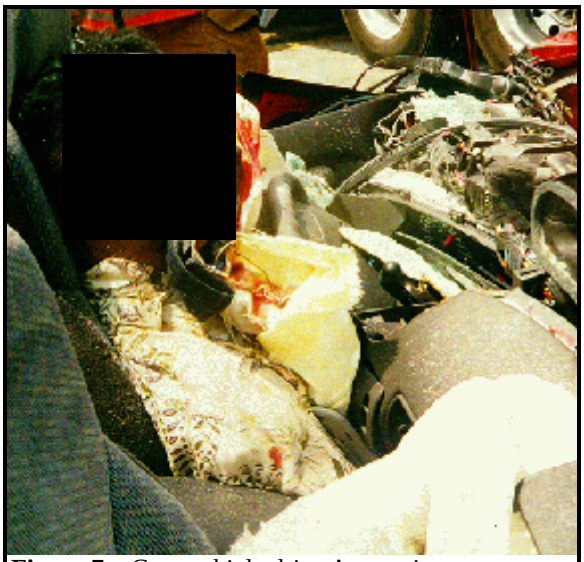

Figure 7: Case vehicle driver's post-impact position; Note: location of steering column/wheel and instrument panel (case photo #16)

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.	Laceration of the aorta with bilateral hemothoraces (hemorrhage not confined to mediastinum)	420218.6 untreatable	Steering wheel hub/spokes	Possible	Autopsy, per Police Crash Report
2.	Laceration of pulmonary artery, NFS	421004.3 serious	Steering wheel hub/spokes	Possible	Autopsy, per Police Crash Report

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
3.	Laceration of the liver, NFS	541820.2 moderate	Steering wheel rim	Possible	Autopsy, per Police Crash Report
4.	Laceration of the forehead, just above the bridge of the nose	290600.1 minor	Front header	Possible	Visible in photographs

VEHICLE #2

Vehicle #2 was a rear wheel drive, 1998 International 4700 Series, 4x2, steel extended cab, dump truck (VIN: 1HTSCABR4WH------). Vehicle #2 was towed from the scene due to disabling damage. An estimated TDC for vehicle #2 is: **06-BDLR-A**, with a principal direction of force of 180 degrees. Vehicle #2 had to be lifted with a crane to permit removal of the case vehicle. The case vehicle's hood was lodged in the undercarriage (**Figure 8**).

Figure 8: Vehicle #2 after removal of the case vehicle; Note: case vehicle's hood jammed under dump bed (case photo #9)

Vehicle #2's driver (39-year-old male, black, unknown if Hispanic, unknown height and weight) was wearing his available, active, three-point, lap and shoulder safety belt system. He was the sole occupant of vehicle #2. The driver sustained minor injuries and was transported by ambulance to a medical facility.