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ON-SITE REDESIGNED AIR BAG REPORT

CASE NUMBER - IN97-061
LOCATION - TEXAS
VEHICLE - 1998 DODGE DAKOTA SPORT
CRASH DATE - December, 1997

Submitted:

November 20, 2001

Revised Submission:

April 23, 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

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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

1. *Report No.* IN97-061	2. *Government Accession No.*	3. *Recipient's Catalog No.*
4. *Title and Subtitle* On-Site Redesigned Air Bag Report Vehicle - 1998 Dodge Dakota Sport Location - Texas		5. *Report Date:* November 20, 2001; April 23, 2002 6. *Performing Organization Code*
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.* Tasks # 0143 and 0276
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: December, 1997 14. *Sponsoring Agency Code*

15. *Supplementary Notes*
On-site air bag deployment investigation involving a 1998 Dodge Dakota Sport, two-door, regular cab, pickup truck, with manual safety belts and dual front air bags, and an unknown object

16. *Abstract*

This report covers an on-site investigation of an air bag deployment crash that involved a 1998 Dodge Dakota Sport pickup (case vehicle) and an unknown round, pole-like object (e.g., a metal utility or light pole). This crash is of special interest because the case vehicle was equipped with redesigned air bags and the case vehicle's driver [30-year-old, White (non-Hispanic) male] reportedly sustained no injuries from the collision. According to the Police Crash Report, the case vehicle was traversing a right-hand curve, traveling essentially northeastward in an unknown lane of a one-way, three-lane, undivided, interstate service road/freeway, and intended to continue in an east-northeasterly travel path through the curve. The service road/freeway was separated from an interstate highway by a double-side "W-beam" type of guardrail mounted in a paved median that separated the roadways. The Police Crash Report cited an impact with the "W-beam" guardrail but found no evidence of damage at the scene. Therefore, the actual location of this crash should be considered unknown. Based on the vehicle inspection, the case vehicle was involved in a right roadside departure. The front of the case vehicle impacted a round, pole-like object, causing the driver and front right supplemental restraints (air bags) to deploy. It is believed that the driver left the actual crash scene and continued driving eastward when the case vehicle's engine stopped running, some unknown distance east of the actual impact area. The case vehicle's driver was most likely seated with his seat track located in its rearmost position, and the tilt steering wheel was located in its middle position. He was not using his available, active, three-point, lap-and-shoulder, safety belt system and, according to both the Police Crash Report and the case vehicle's owner (not the driver), he did not sustain any injuries as a result of this crash.

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* 7	22. *Price* $8,300

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

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BACKGROUND

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This on-site report was brought to NHTSA's attention on December 23, 1997, by NASS CDS sampling activities. This crash involved a 1998 Dodge Dakota Sport pickup (case vehicle) and an unknown round-like object [i.e., an unknown pole-like object (possibly a round metal guardrail support pipe or, more likely, a metal utility or light pole)]. The crash occurred in December, 1997, at 6:45 p.m., in Texas, and was investigated by the applicable city police department. This crash is of special interest because the case vehicle was equipped with redesigned air bags and the case vehicle's driver [30-year-old, White (non-Hispanic) male] reportedly sustained no injuries from the collision. This contractor's consultant inspected the case vehicle on December 30, 1997, documented the scene on March 4, 1998, and interviewed the vehicle's owner (i.e., not the driver) on May 12, 1998. This summary is based on the Police Crash Report, an interview with the vehicle's owner, conversations with body shop personnel, scene and vehicle inspections, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traversing a right-hand curve (**Figure 1**), traveling essentially northeastward in an unknown lane of a one-way, three-lane, undivided, interstate service road/freeway, and intended to continue in an east-northeasterly travel path through the curve. The service road/freeway was separated from an interstate highway by a double-sided "W-beam" type of guardrail mounted in a paved median that separated the roadways.

Figure 1: Case vehicle's northeastward path of travel off road toward Police Crash Report's impact site with guardrail on northwest roadside (case photo #03)

Three crash scenarios have been discovered (i.e., no interview was obtained with the driver). The Police Crash Report indicated the case vehicle's driver took unknown evasive maneuvers in an attempt to avoid striking a noncontact vehicle which cut in front of him. As a result, the case vehicle collided with the guardrail on the service road's northwest roadside (**Figure 2**). The case vehicle's owner related a second scenario provided by the driver. The driver had picked up a hitchhiker (note: the Police Crash Report indicated only one occupant in the case vehicle) and, for some unknown reason, the hitchhiker grabbed the steering wheel and turned it left, causing the case vehicle to angle into the guardrail on the service road's northwest roadside. Both of the above crash scenarios, however, do not fit the case vehicle's damage pattern. Damage indicates that the case vehicle impacted a round, pole-like object, not a "W-beam" guardrail (**Figures 3** and **4** below). The guardrail at the alleged scene was attached to round, metal support

Figure 2: Close-up looking northeastward of Police Crash Report's impact site (case photo #05)

posts, approximately 10 centimeters (4 inches) in diameter. Additionally, two sections of the guardrail had been replaced, but the timing of that replacement is unknown (**Figure 2** above). A third scenario was offered to this contractor's consultant by the body shop's personnel. The body shop personnel believe (based on unknown information) that the case vehicle was involved in a right roadside departure and impacted a "pole-like" object west of the final rest area, upstream from the area depicted on the Police Crash Report. The driver left the actual crash scene and continued driving eastward when the case vehicle's engine stopped running, some unknown distance east of the actual impact area. According to the Police Crash Report, the investigating officer found no evidence of a crash at the location where the vehicle was found.

Figure 3: Case vehicle's partially repaired frontal damage; Note: new radiator and damaged hood along left side of vehicle (case photo #07)

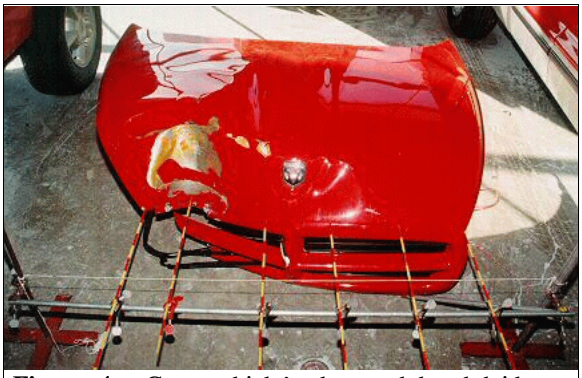


Figure 4: Case vehicle's damaged hood laid on repair shop floor; Note: rounded narrow object imprint to front right (case photo #14)

Because the site of the actual crash is unknown the roadway characteristics at that crash site are also unknown. However, the roadway characteristics at the site reported on the Police Crash Report are as follows. Given that the vehicle most likely became undrivable in a reasonably short time after the actual crash occurred, the characteristics reported below (**Figures 1** and **2** above) may well be representative of the actual crash site. The interstate-related freeway (i.e., it is unknown what jurisdiction actually has control over this trafficway) was curved slightly to the right for northeastbound traffic and level at the area of impact. The pavement was concrete, and the width of the travel lanes are unknown. The shoulders were improved (i.e., concrete) and their width is narrow but unknown. The roadway was bordered by mountable curbs. The right (southeast) side of the road had a concrete sidewalk adjacent to the mountable curb. The left (northwest) side had an unknown width raised paved median area complete with dual "W-beam" guardrails that separated this access freeway from the adjacent interstate highway to its left. Pavement markings consisted of dashed white lines to separate the lanes, and the roadway was bordered by a solid yellow edge line on the left side and a solid white edge line on the right side. The coefficient of friction was not estimated. A regulatory RIGHT LANE MUST EXIT (Manual on Uniform Traffic Control Devices, R3-7) sign was located prior to the immediate area of the police-reported crash site. The speed limit was 56 km.p.h. (35 m.p.h.); however, no regulatory speed limit sign was posted near the crash site. At the time of the crash the light condition was dark, but illuminated by overhead street lamps at the area of impact, the atmospheric condition was clear, and the road pavement was dry. Traffic density is unknown, and the site of the crash was urban and either commercial or industrial.

The front of the case vehicle impacted a round, pole-like object (**Figure 4** above and **Figure 5**), causing the driver and front right supplemental restraints (air bags) to deploy. It is not likely at all, given the damage pattern, that the case vehicle impacted a "W-beam" guardrail. Neither is it likely that the case vehicle struck one of the round, metal, guardrail support posts (even with a guardrail section missing) because they are not tall enough to reach the case vehicle's front hood seam. Therefore, in this contractor's opinion, the third scenario (i.e., a right roadside departure and impact with a "pole-like" object) seems to conform more closely with the known facts of the case and, thus, the location of this crash should be considered unknown.

Figure 5: Close-up of narrow object impact to right side of case vehicle's hood (case photo #15)

CASE VEHICLE

The 1998 Dodge Dakota Sport was a rear wheel drive, 4x2, three-passenger, two-door conventional cab, pickup truck (VIN: 1B7FL26PXWS------) equipped with a 2.5L, IL-4 engine and a five-speed manual transmission, with overdrive. Two-wheel (i.e., the rear wheels), anti-lock brakes are standard for this model. Braking was achieved by a power-assisted, front disc and rear drum system. Four-wheel, anti-lock brakes are available as an option but it is unknown if this vehicle was so equipped. The case vehicle's wheelbase was 284 centimeters (111.9 inches), and the odometer reading at inspection was 19,331 kilometers (12,012 miles).

The case vehicle's contact with the unknown object involved the front right one-third of the vehicle. Direct damage began 20 centimeters (7.9 inches) to the right of the case vehicle's center and extended, a measured distance of 22 centimeters (8.7 inches), along the front bumper (**Figure 4** above). Maximum crush was measured above the bumper as 38 centimeters (14.9 inches) at C_5 (**Figure 5**). It is unknown if the case vehicle's wheelbase on either the left or right sides was shortened during the crash. The case vehicle's front bumper, bumper fascia, grille, hood, and radiator were directly damaged and crushed rearward (**Figure 3** above). It is unknown if the case vehicle's left and right front tires were physically restricted or deflated from the crash. Both the right and left headlight and turn signal assemblies sustained induced damage as well as both the right and left fenders. Furthermore, the leading edge of the driver's door also sustained induced damage (**Figure 6**), and there was a repaired spot on the right side of the bed of the pickup (**Figure 7** below). In addition, the front of the bed of the pickup was tilted upward and the entire bed was displaced towards the right (**Figure 6** and **Figure 7** below).

Figure 6: Case vehicle's left side showing repairs to left fender and edge of left front door; Note: induced damage to truck bed (case photo #09)

Based on the vehicle inspection, a CDC for the case vehicle was determined to be: **12-FZEN-2 (0)**. The WinSMASH reconstruction program, CDC-only barrier algorithm, was used on the case vehicle's highest severity impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 17.5 km.p.h. (10.9 m.p.h.), -17.5 km.p.h. (-10.9 m.p.h.), and 0.0 km.p.h. (0.0 m.p.h.). In this contractor's opinion, this reconstruction should be considered borderline but the results appear to be reasonable. Available information does not indicate the pre-impact speed of the case vehicle; however, the posted speed limit was 56 km.p.h. (35 m.p.h.). The case vehicle was towed due to disabling damage.

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 air bags deployed as a result of the frontal impact with the unknown object. 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 10 centimeters (3.9 inches) vertically for the upper flap and 2 centimeters (0.8 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 was no evidence of damage during the deployment to the air bag or the cover flaps. The driver's air bag was designed with two tethers, attached to the center of the air bag. The driver's air bag had no vent ports. The deployed driver's air bag was round with a diameter of 65 centimeters (25.6 inches). There was no contact evidence readily apparent on any of the surfaces (i.e., top, front, bottom, etc.) of the driver's air bag (**Figures 8** and **9** and **Figure 10** below, respectively).

Figure 7: Case vehicle's right side showing repairs to right fender and right side of truck bed; Note: rightward shift to truck bed (case photo #12)

Figure 8: Case vehicle's deployed driver air bag showing no contact evidence on top/back surface of air bag or to air bag module's top cover flap (case photo #21)

Figure 9: Case vehicle's deployed driver air bag showing no contact evidence on air bag's front surface (case photo #22)

Figure 10: Case vehicle's deployed driver air bag showing no contact evidence on bottom/back surface of air bag (case photo #25)

Figure 11: Case vehicle's deployed front right passenger air bag showing no contact evidence on air bag's front surface (case photo #30)

The front right passenger's air bag was located in the middle of the instrument panel. There was a single, essentially rectangular, modular cover flap. The cover flap was made of a thick vinyl over a thick cardboard-type frame. The flap's dimensions were 33 centimeters (13.0 inches) at the lower horizontal seam and 22 centimeters (8.7 inches) along both vertical seams. The profile of the case vehicle's instrument panel appears to be flush with the leading edge of the cover flap (i.e., based on the available photographs). 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 was no evidence of damage during the deployment to the air bag or the cover flap. The front right passenger's air bag was designed without any tethers or vent ports. The deployed front right air bag was rectangular with a height of approximately 52 centimeters (20.5 inches) and a width of approximately 58 centimeters (22.8 inches). There was no contact evidence readily apparent on any of the surfaces (i.e., front, top, bottom, right, or left) of the front right air bag (**Figure 11**).

Inspection of the case vehicle's interior revealed that there was no evidence of occupant contact on the interior surfaces of the case vehicle (**Figures 12** and **13**).

Figure 12: Case vehicle's front seating area showing deployed driver and front right passenger air bags and no contact evidence on steering wheel, left instrument panel, or driver's knee bolster (case photo #18)

Figure 13: Case vehicle's deployed driver and front right passenger air bags and instrument panel areas; Note: no contact evidence on front right air bag module's cover flap or center or right instrument panel areas (case photo #27)

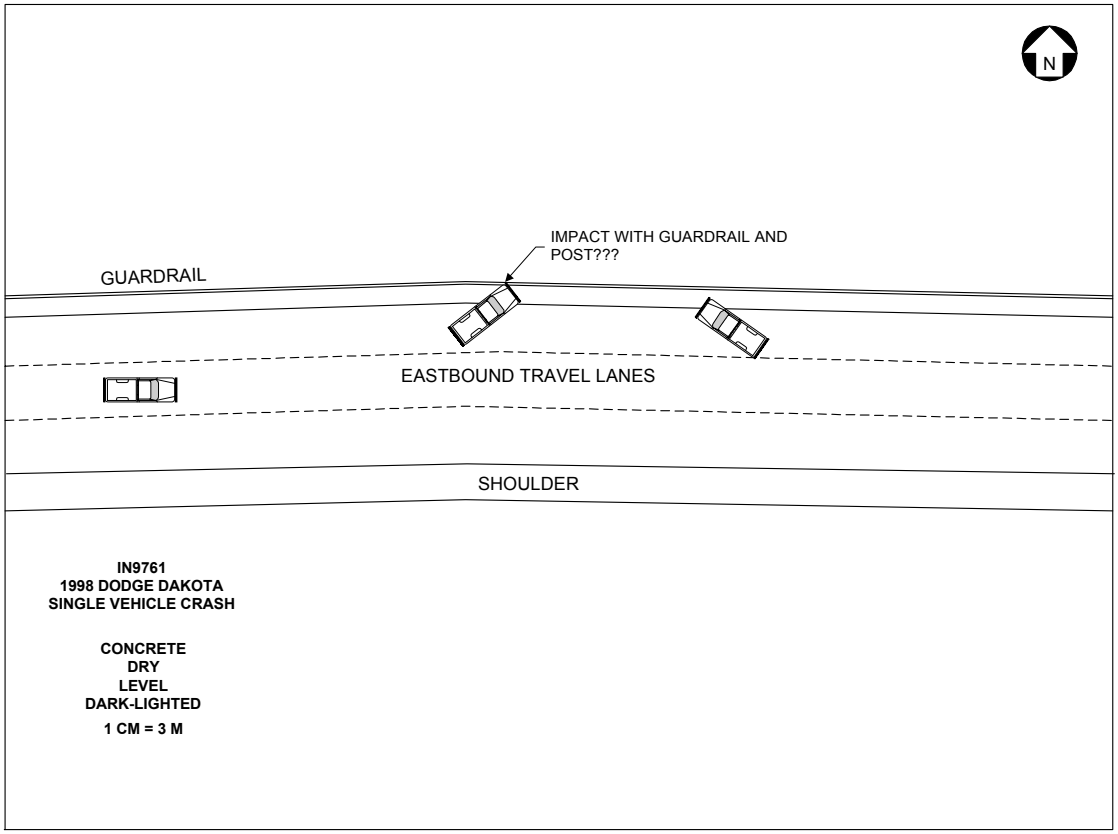
Immediately prior to the crash, the exact posture of the case vehicle's driver [170 centimeters and 59 kilograms (67 inches and 130 pounds)] is unknown, but based on the vehicle inspection he was most likely seated in a slightly reclined posture with his back against the seat back, his left foot on the floor, and one or both hands on the steering wheel; however, the exact position of his right foot is unknown. His seat track was located in its rearmost position, the seat back was sightly reclined, and the tilt steering wheel was located in its middle position.

According to the Police Crash Report, the case vehicle's driver was restrained by his available, active, three-point, lap-and-shoulder, safety belt system; however, this contractor's consultant indicated the driver did not use his available safety belts in this crash. Furthermore, the inspection of the driver's seat belt webbing, "D"-ring, and latch plate showed no evidence of loading.

Since the exact crash sequence is unknown, the possible pre-crash avoidance maneuvers by the case vehicle's driver are also unknown. Independent of an avoidance maneuver and the nonuse of his available safety belts, the driver's pre-impact body position is also unknown The case vehicle's impact with an unknown, round, metal, pole-like object, enabled the case vehicle's driver to continue forward and slightly upward toward the case vehicle's 0 degree Direction of Principal Force as the case vehicle decelerated. Because of the offset nature of the impact, the case vehicle most likely rotated clockwise post-impact (even in light of the possible damage to the right side of the cargo area), but the amount of rotation and the distance traveled from impact to final rest are unknown, as is the movement of the driver. The exact posture of the case vehicle's driver at final rest is unknown as well.

CASE VEHICLE DRIVER INJURIES

Both the Police Crash Report and the case vehicle's owner (not the driver) indicated that the driver sustained no injuries in this collision and, thus, was not transported to a medical facility (no ambulance was reported to have responded to the crash scene).



Based on location of crash site as reported on Police Crash Report