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SCI/NASS COMBINATION CASE REPORT

CASE NUMBER - NASS-1999-82-120K
LOCATION - Washington
VEHICLE - 1998 VOLKSWAGEN PASSAT
CRASH DATE - November 1999

Submitted:

January 30, 2001

Contract Number: DTNH22-94-D-17058

Prepared for:

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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* SCI/NASS combination investigation of a side air bag deployment crash involving a 1998 Volkswagen Passat with manual safety belts and dual front and side air bags, and a 1974 Dodge Dart.			
16. *Abstract* This report covers a SCI/NASS combination investigation of a side air bag deployment crash that involved a 1998 Volkswagen Passat (case vehicle) and a 1974 Dodge Dart. This crash is of special interest because the Volkswagen was equipped with seat back-mounted side air bags and the driver's side air bag deployed as a result of a left side impact. The Volkswagen's restrained driver (54-year-old male) did not sustain any injuries as a result of the crash. The Volkswagen was traveling south in the left lane of a two-lane, one-way service road, approaching a four-leg intersection and intending to turn left to travel east. The Dodge was traveling west in the outside westbound lane of a four-lane, undivided city street approaching the same intersection, intending to pass through the intersection and continue west. The two vehicles entered the intersection and the left side of the Volkswagen was impacted by the front of the Dodge, causing the Volkswagen driver's seat back-mounted side air bag to deploy. The impact caused both vehicles to rotate counterclockwise and a second impact occurred when the Dodge's left front impacted the Volkswagen's left front. The both vehicles came to rest within the intersection, the Volkswagen heading in a northeasterly direction and the Dodge heading in a southerly direction. The Volkswagen's driver was seated slightly reclined with his seat track located in its middle position, and the tilt steering wheel adjusted at its upmost position. He was restrained by his available, active, three-point, lap-and-shoulder safety belt and did not sustain any injuries as a result of the crash. The Volkswagen's restrained front right passenger (10 year-old male) and restrained left rear passenger (12 year-old male) were transported via ambulance to a hospital where they were both treated and released, both having sustained minor injuries. Both vehicles were towed from the scene due to damage.			
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This combination SCI/NASS crash investigation involved a 1998 Volkswagen Passat (case vehicle) and a 1974 Dodge Dart. The crash occurred in November 1999, at 9:05 p.m., in Washington and was investigated by the applicable police department. This crash is of special interest because the Volkswagen was equipped with seat back-mounted side air bags and the driver's side air bag deployed as a result of a left side impact. The restrained driver (54-year-old male) did not sustain any injuries as a result of the crash. The NASS researcher inspected the scene and the Volkswagen in November 1999. This report is based on the Police Crash Report, the NASS researchers's coded forms and scene photographs, occupant interviews, medical records, scene and vehicle inspections, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The Volkswagen was traveling south in the left lane of a two-lane, one-way[1] service road and was approaching a four-leg intersection, intending to turn left and travel east (the service road was adjacent to an overhead urban freeway). The Dodge was traveling west in the outside westbound lane of a four-lane city street (two lanes in each direction), approaching the same intersection, intending to pass through the intersection and continue west (**Figure 1**). Both roadways were bituminous, straight, dry, level and without defects. The intersection was controlled by an on-colors traffic signal. It was dark but lighted with no adverse weather conditions. The posted speed limit was 48 km.p.h. [35 m.p.h.] for both roadways. The two vehicles entered the intersection at the same time with the Volkswagen beginning the intended left turn. The Volkswagen's driver observed the on-coming Dodge and accelerated in an attempt to avoid the collision. It is not known if the Dodge's driver attempted any avoidance actions.

Figure 1: Volkswagen's southbound approach toward intersection

The crash occurred within the intersection. The front of the Dodge impacted the left side of the Volkswagen, causing the Volkswagen driver's seat back-mounted side air bag to deploy. Both vehicles rotated counterclockwise, the Volkswagen approximately 110 degrees and the Dodge approximately 90 degrees. During the rotation, a second impact occurred when the Dodge's left front impacted the Volkswagen's left front. Both vehicles came to rest within the intersection, the Volkswagen heading in a northeasterly direction and the Dodge heading in a southerly direction. Both vehicles were towed from the scene due to damage.

[1]The NASS case coding erroneously indicates two-way traffic.

The case vehicle was a front wheel drive 1998 Volkswagen Passat GLS, five-passenger, four-door station wagon[2] (VIN: WVWNA63B6WE------) equipped with a 1.8 liter I-4 engine and a 4-speed automatic transmission with a console-mounted selector lever. Four-wheel anti-lock brakes were standard equipment for this vehicle. The Volkswagen's wheelbase was 270 centimeters [106.4 inches] and the odometer indicated 29,913 kilometers [18,588 miles].

CASE VEHICLE DAMAGE

The Volkswagen's initial contact with the Dodge involved the left side immediately rearward of the B-pillar (**Figure 2**). Field L began 70 centimeters [27.6 inches] behind the left front axle and extended rearward 234 centimeters [92.1 inches]. Direct damage from the Volkswagen's initial impact started 133 centimeters [52.4 inches] behind the left front axle and extended rearward 112 centimeters [44.1 inches]. The maximum crush to the Volkswagen's left side was 23 centimeters (9.1 inches) and was located between C3 and C4 **(Figure 4)**. The damage from the second impact with the Dodge was to the left front fender. The wheelbase on the left side was shortened 2 centimeters [0.8 inches], with the right side being lengthened 2 centimeters [0.8 inches]. All the Volkswagen's doors remained closed with the left front and left rear being jammed and inoperable. There was no glazing damage to the Volkswagen. There was intrusion along the Volkswagen's left side, including the left front door panel, the left B-pillar, the left back door panel, the left C-pillar, and the left side floor pan at both left side seat positions, with maximum intrusion of 20 centimeters [7.9 inches] located at left back door panel.

Figure 2: Volkswagen's left side damage from initial impact with the Dodge

The CDC was determined to be: **11-LPEW-2 (330)** for the Volkswagen. The WinSMASH reconstruction program, missing vehicle algorithm based on the Volkswagen's crush profile, was used on the Volkswagen's highest severity impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 15 km.p.h. [9 m.p.h.], -13 km.p.h. [-8 m.p.h.], and +8 km.p.h. [+5 m.p.h.]. No reconstruction program was used on the Volkswagen's secondary impact with the Dodge because of the minimal damage. This contractor's visually estimated Delta V for the second impact is between 6 km.p.h. [4 m.p.h.] and 13 km.p.h. [8 m.p.h.].

The Volkswagen's interior showed evidence of occupant contact to its left front door panel including the armrest, front left door window sill, and the driver's left side air bag. Movement of the Volkswagen's energy absorbing steering column was not measured for compression.

[2]The NASS case erroneously indicates a four-door sedan with sedan specifications coded.

The Volkswagen was equipped with front air bags and seat back-mounted side air bags at the driver and front right passenger seat positions. The driver's seat back-mounted side air bag was the only air bag that deployed in this crash. The Volkswagen was also equipped with safety belt pretensioners for the two front seats. The NASS researcher indicated that the pretensioners did not actuate.

The Volkswagen driver's front air bag was mounted to the steering wheel hub and the front right passenger's front air bag was mounted in the top of the front right instrument panel. Neither of the front air bags deployed.

Figure 3: Driver's deployed seat back-mounted side air bag (water droplets on camera lens)

The driver's seat back-mounted side air bag deployed as a result of the Volkswagen's left side impact from the Dodge. The driver's side air bag deployed through a seam on the outboard side of the driver's seat back (**Figure 3**). The side air bag measured 30 centimeters [11.8 inches] horizontally and 45 centimeters [17.7 inches] vertically. The driver's side air bag had no vent ports and was not tethered. Black marks found on the inside and outside of the air bag appeared to be non-contact (i.e., oil and dirt).

CASE VEHICLE DRIVER

The Volkswagen's driver (54-year-old male, White, non-Hispanic, 178 centimeters and 79 kilograms [70 inches, 174 pounds]) was restrained by his available, active, three-point, lap-and- shoulder safety belt system and was wearing glasses. He did not sustain any injuries as a result of the crash. He accompanied the two passengers to the hospital via ambulance, but was not treated.

The driver was seated in an upright posture with his back against the seat back, his left foot was on the floor, his right foot on the accelerator, and both hands on the steering wheel. His seat track was located between its middle and rearmost position, the seat back was slightly reclined, and the tilt steering wheel was in the full-up position (**Figure 4**).

Figure 4: Interior view of Volkswagen driver's seating area

The driver accelerated, attempting to avoid the crash, and his pre-impact posture remained relatively unchanged prior to impact. The impact with the Dodge resulted in the Volkswagen's driver moving slightly forward but primarily leftward. He contacted the steering column with his right knee, the door panel with his left leg and his upper torso was pressed against the deploying seat back-mounted side air bag as

the Volkswagen rotated counterclockwise. At final rest the driver remained conscious and in his seat.

CASE VEHICLE'S FRONT RIGHT PASSENGER

The Volkswagen's front right passenger (11-year-old male, White, non-Hispanic, 157 centimeters and 59 kilograms [62 inches, 130 pounds]) was restrained by his available, active, three-point, lap-and-shoulder safety belt system. He was transported by ambulance to a hospital where he was treated for minor injuries and released.

The front right passenger was seated in an upright posture with his back against the seat back, both feet on the floor, and both hands on his lap. His seat track was located between its middle and rearmost position, and the seat back was slightly reclined (**Figure 5**).

Figure 5: Volkswagen's front right passenger seating area (water droplets on lens)

The driver accelerated, attempting to avoid the crash; and the front right passenger's pre-impact posture remained relatively unchanged prior to impact. The impact with the Dodge caused the Volkswagen's front right passenger to move slightly forward but primarily leftward. He contacted the center arm rest with his upper left arm as the Volkswagen rotated counterclockwise. As the Volkswagen came to a stop the front right passenger rebounded back to the right, with his right elbow arm striking the door armrest or hardware. At final rest the front right passenger remained conscious and in his seat.

CASE VEHICLE'S FRONT RIGHT PASSENGER INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion, right elbow	790402.1[3] minor	Door hardware or armrest	Probable	Emergency Room
2	Contusion, left upper arm[4]	790402.1 minor	Center arm rest	Probable	Interview

[3]The NASS case coding erroneously indicates a lower extremity contusion ('890402.1').

[4]The NASS case coding does not include this interview-reported injury.

The Volkswagen's back left passenger (12-year-old male, White, non-Hispanic, 157 centimeters and 59 kilograms [62 inches, 130 pounds]) was restrained by his available, active, three-point, lap-and-shoulder safety belt system. He was transported by ambulance to a hospital where he was treated for minor injuries and released.

The back left passenger was seated in an upright posture with his back against the seat back, both feet on the floor, and both hands on his lap. His seat track and seat back were not adjustable.

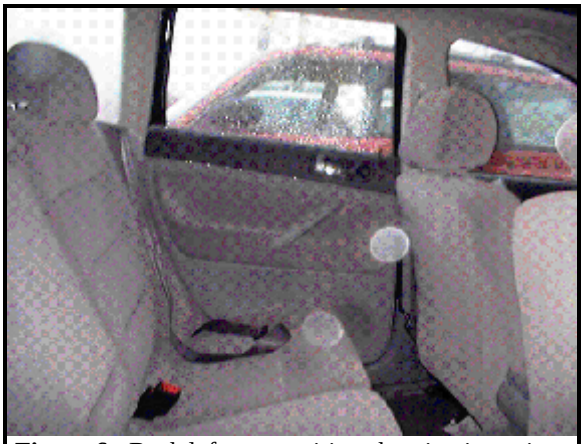


Figure 6: Back left seat position showing intrusion by B-pillar and back door panel (water droplets on lens)

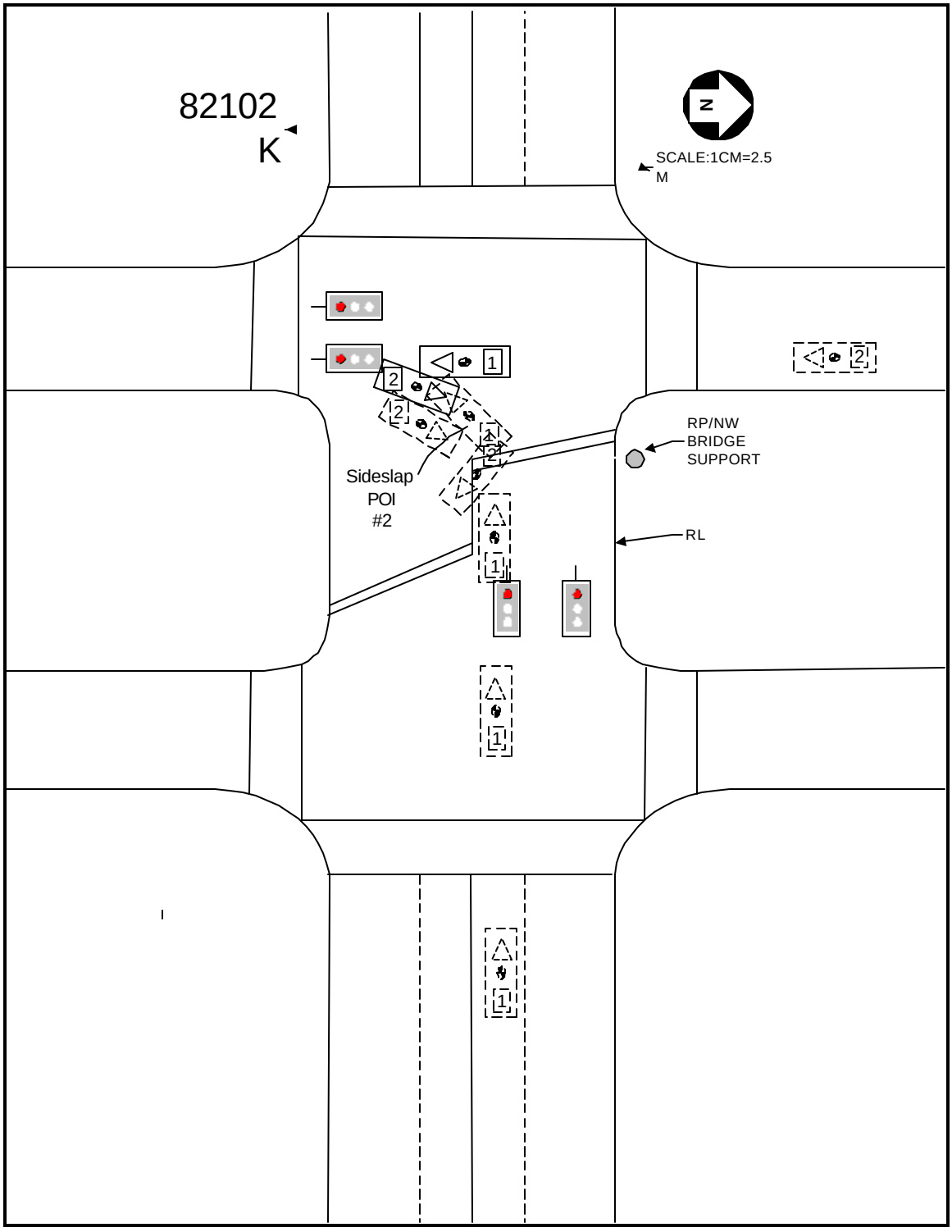
The Volkswagen's driver accelerated, attempting to avoid the crash, and the back left passenger's pre-impact posture remained relatively unchanged prior to impact. The impact with the Dodge caused the Volkswagen's back left passenger continuing slightly forward but primarily leftward, contacting the intruding door panel (**Figure 6**) with his the left side of his face, left leg, hip, and upper torso as the Volkswagen rotated counterclockwise. The back left passenger's seat belt usage kept him in his seat during the approximately 110 degree rotation. As the Volkswagen came to a stop the back left passenger rebounded back to the right. At final rest the back left passenger remained conscious and in his seat.

CASE VEHICLE'S BACK LEFT PASSENGER INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Abrasion, left eyelid	297202.1 minor	Door panel	Probable	Emergency room
2	Contusion, left eyelid	297402.1 minor	Door panel	Probable	Emergency room

OTHER VEHICLE

The other vehicle was a rear wheel drive 1974 Dodge Dart Custom four-door sedan (VIN: LH41C4R------) equipped with a 3.7 liter I-6 engine. This vehicle was not inspected and no photographs are available. The WinSMASH reconstruction program, missing vehicle algorithm based on the Volkswagen's crush profile, was used. The Total, Longitudinal and Lateral Delta Vs for the Dodge are, respectively: 16 km.p.h. [10 m.p.h.], -16 km.p.h. [-10 m.p.h.] and -3 km.p.h. [-2 m.p.h.].



[5]The NASS scene diagram depicts the Volkswagen (V#2) being pushed rearward by the force of the first impact, but this is unlikely.