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SCI/NASS COMBINATION CASE REPORT

CASE NUMBER - NASS-98-73-097B
LOCATION - Indiana
VEHICLE - 1998 DODGE NEON
CRASH DATE - July 1998

Submitted:

June 21, 2000

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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16. *Abstract* This report covers a SCI/NASS combination investigation concerning a 1998 Dodge Neon (case vehicle) and a 1993 Chevrolet Cavalier (vehicle #2). 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 unrestrained case vehicle driver (24-year-old male) sustained minor injuries while the unrestrained driver of vehicle #2 was killed. There was no other occupant in either vehicle. The case vehicle was traveling south in the inside southbound on a four-lane, two-way undivided local road, approaching a four leg intersection and intending to pass through and continue south. Vehicle #2 was headed east in the eastbound lane of the intersecting two-lane, two-way undivided local road, stopped for a traffic signal at the intersection. Vehicle #2 entered the intersection starting from a stop and the case vehicle was not able to avoid the collision. The front of the case vehicle impacted the left side of vehicle #2, causing the case vehicle's driver and front right passenger air bags to deploy. The two vehicles slid off the roadway and came to rest in the southeast quadrant of the intersection. Both vehicles were towed from the scene due to disabling damage. Vehicle #2's driver was declared dead at the scene. The case vehicle driver was ambulatory at the scene and originally declined treatment but subsequently complained of pain and was taken via ambulance to a trauma center. He suffered various minor soft tissue injuries. He was admitted to the hospital for observation and released after 48 hours.			
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BACKGROUND

This combination SCI/NASS crash investigation concerns a 1998 Dodge Neon (case vehicle, vehicle #1) and a 1993 Chevrolet Cavalier (vehicle #2). The crash occurred in July 1998, at 10:45 a.m., in Indiana, and was investigated by the applicable county police department. This crash is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of collision events and the unrestrained driver (24-year-old male) sustained multiple abrasions, contusions, and lacerations. The unrestrained driver of vehicle #2 (43-year-old male) was killed. There was no other occupant in either vehicle. The NASS investigator inspected the scene and vehicles, and obtained a partial interview with the case vehicle driver, in August 1998. This report is based on the Police Crash Report, the NASS investigator's coded forms and photographs, the interview, the medical records, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling south in the inside southbound lane of a four-lane, two-way undivided local road, approaching a four-leg intersection and intending to pass through and continue south. Vehicle #2 was stopped, headed east in the eastbound lane of the intersecting two-lane, two-way undivided local road. Both roadways were asphalt with gravel shoulders and no curb, dry, straight, level, and heavily worn but with no defects. It was daylight with no adverse weather conditions. The speed limit for both roadways was 48 km.p.h [30 m.p.h.]. The intersection was controlled by on-colors automatic signals, with painted lane lines and edge lines that were heavily worn (**Figure 1**). Vehicle #2 entered the intersection starting from a stop and the case vehicle was not able to avoid the collision.

Figure 1: Looking northwest from approximate final rest, showing case vehicle's southbound approach and V#2's eastbound approach toward impact in the center of the intersection

The crash occurred within the intersection. The front of the case vehicle impacted the left side of vehicle #2, causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle was deflected a few degrees counterclockwise, traveled southeastward and departed the east edge of the north-south roadway. Vehicle #2 rotated approximately 270 degrees clockwise and departed the south edge of the east-west roadway. Both vehicles came to rest on the roadside at the southeast quadrant of the intersection, with the case vehicle heading southeast and vehicle #2 heading northeast.

CASE VEHICLE

The case vehicle was a front wheel drive 1998 Dodge Neon five-passenger, two-door sedan (VIN: 1B3ES42YXWD------), equipped with a 2.0 liter I4 gasoline engine and an automatic transmission with console-mounted selector lever. Four-wheel anti-lock brakes were an option for this model, but it is not

known if the case vehicle was so equipped. The wheelbase was 264 centimeters [104 inches]. The odometer reading was reported as 1,788 kilometers [1,111 miles]. The case vehicle was towed from the scene due to disabling damage.

CASE VEHICLE DAMAGE

The case vehicle sustained direct contact damage across the entire front with induced damage on the left and right sides (**Figures 2 and 3**). The CDC was determined to be **81-FDEW-1** with direction of principal force 30 degrees and reflecting the NASS investigator's judgement that the vehicle sustained frame shift to the left. Maximum crush was 14 centimeters [5.5 inches] at the front left corner. The winSMASH reconstruction program was used to calculate Delta V based on the crush profile of both vehicles. The results for the case vehicle indicate total, longitudinal and lateral Delta V, respectively: 52 km.p.h [32 m.p.h.], -45 km.p.h. [-30 m.p.h.] and -26 km.p.h. [-16 m.p.h.].

Figure 2: Front-left view, case vehicle's direct contact damage on the front and induced damage on the left side

The bumper cover was torn off, the grille and headlight assemblies were shattered and the hood was crumpled. The right front axle was broken. Both front tires were deflated with the wheels displaced and their rotation restricted. The left fender outer panel was separated from the wheel well liner and folded rearward. The window glazing in both doors was shattered (kernelized) and the windshield had stress cracks. The sunroof panel was slightly displaced. Both doors remained closed and operational. There was minor intrusion by the toe pan at the left and right front seat positions with no other crash damage to the interior noted by the NASS researcher.

Figure 3: Front-right view, case vehicle direct contact damage on the front and induced damage on the right side.

The case vehicle had bucket seats with folding backs in the front row and a bench seat in the second row. Originally, there were manual, three-point, lap-and-shoulder safety belt systems at the four outboard seat positions and a lap-only safety belt for the second row center seat position. There were no height adjusters for the D-rings on any of the safety belts.

The driver's manual safety belt system had been cut out of the vehicle. The lap end of the belt was cut off at the point of attachment on the driver's door sill (**Figure 4**). The latch tongue component that slides along the belt was nowhere to be found and the shoulder portion of the belt had retracted onto the

spool, leaving only the empty slot in the B-pillar (**Figure 5**). The driver exited the vehicle under his own power and was ambulatory at the scene, and there is no reason to think that rescue personnel cut the belt. There was no feature of the vehicle's damage to suggest crash damage to the belt nor that the tow operator had any reason to cut the belt. The Police Crash Report indicates "air bag" for the driver's restraint status but is silent about of safety belt use. During the interview, the driver claimed that he had been belted, but he didn't remember anything else about the crash and his measured Blood Alcohol Concentration was 0.163 mg/dl. Accordingly, this contractor is led to the conclusion that the driver's safety belt system had been cut out prior to the crash and the driver was not restrained.

Figure 4: Looking down on driver's door sill, showing cut end of driver's continuous loop belt

Figure 5: Left B-pillar showing empty slot where cut driver's belt retracted

Figure 6: Instrument panel from right, showing driver and passenger air bag cover flaps

AUTOMATIC RESTRAINT SYSTEM

The driver air bag was located in the steering wheel hub with a one-piece cover flap hinged at the top (**Figure 6**). The flap opened along the seams and there was no damage to the air bag or the cover flap. The deployed driver air bag was round with a diameter of 50 centimeters [20 inches] (**Figure 7**). It had two tethers, and two vent ports at the 11 and 1 o'clock positions. The NASS researcher identified some smudges on the front of the air bag, but no other evidence of contact.

The front right passenger air bag was located in the top of the instrument panel (**Figure 6**). The module cover flap opened along the seams, with no apparent damage to the cover flap or the air bag. The deployed front right passenger air bag was rectangular, 50 centimeters [20 inches] high and 45 centimeters [18 inches] wide (**Figure 8**). The NASS researcher identified some smudges near the center on the front of the air bag, but no other evidence of contact.

The case vehicle driver (24-year-old male, White, Hispanic, 165 centimeters, 109 kilograms (65 inches, 240 pounds]) was not restrained. The original equipment three-point, continuous loop, lap-and-shoulder safety belt system had been cut out of the vehicle and was not available. He exited the vehicle under his own power, was ambulatory and originally declined treatment at the scene, but subsequently complained of pain and was transported via ambulance to a trauma center. He had a blood alcohol concentration of 0.163 mg/dl and was uncooperative at the emergency room. He was immobilized, catheterized, intubated and admitted for observation. He was discharged approximately 48 hours later.

Figure 7: Driver's air bag

Figure 8: Right front passenger's air bag

The case vehicle driver was probably seated in a normal driving posture, with his back against the seat back, his feet on the floor or foot controls pedal and his hands on the steering wheel. The bucket seat track was adjusted between the forward most and middle position, and the seat back was adjusted full up. The case vehicle did not have a tilt adjustment for the steering wheel. The medical records note that he was obese, and with his seat adjustments as indicated, his abdomen would have been very close to the steering wheel. He made no known avoidance maneuvers and his pre-crash posture remained unchanged. The impact with vehicle #2 caused the air bags to deploy and caused him to move forward, upward and slightly rightward, toward the 30 degree direction of principal force. He encountered the deployed air bag and sustained abrasions on his left forearm, right thumb, and the left side of his neck. He continued forward and rightward, deflating the air bag and contacting the steering wheel, and sustained contusions and abrasions on his right chest and lower abdomen. His left knee struck the left instrument panel and he sustained an abrasion. His posture at final rest is not known.

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.	Abrasion, left neck	390202.1 minor	Driver's air bag	Probable	Post-E.R. Med. Recs.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
2.	Abrasion, right chest	490202.1 minor	Steering wheel rim[1]	Probable	Post-E.R. Med. Recs
3.	Abrasion, periumbilical area	590202.1 minor	Steering wheel rim[1]	Probable	Post-E.R. Med. Recs
4.	Abrasion, right thumb and left forearm (bilateral)	790202.1 minor	Driver's air bag	Probable	Emergency Room
5.	Contusion, right chest	490402.1 minor	Steering wheel rim[1]	Probable	Interview
6.	Contusion, lower abdomen	590402.1 minor	Steering wheel rim[1]	Probable	Interview
7.	Abrasion, left knee	890202.1 minor	Left instrument panel	Probable	Emergency Room
8.	[non-anatomic brain injury][2]	160402.1 minor	Driver's air bag	Probable	Post-E.R. Med. Recs.

VEHICLE NUMBER 2

Vehicle #2 was a front wheel drive 1993 Chevrolet Cavalier two-door, five passenger sedan (VIN: 1G1JC1441P7------) equipped with a 2.2 liter I4 gasoline engine and an automatic transmission with console mounted selector lever. Anti-lock brakes were not available for this vehicle. The wheelbase was 257 centimeters [101.3 inches]. The odometer reading was 140,955 kilometers [87,588 miles]. Vehicle #2 was towed from the scene due to disabling damage.

Vehicle #2 sustained an impact with the direct damage centered on the driver's door, extending forward into the left fender and rearward into the left quarter panel. Maximum crush was 80 centimeters [31 inches], approximately at the A-pillar. The entire left side collapsed inward, resulting in massive intrusion into the driver's seat area. The CDC was determined to be **10-LDAW-5**, with direction of principal force 300 [-60] degrees. The winSMASH reconstruction algorithm indicated total, longitudinal and lateral Delta V, respectively: 52 km.p.h. [32 m.p.h.], -26 km.p.h. [-16 m.p.h.] and +45 km.p.h. [+28 m.p.h.]. Vehicle #2's unrestrained driver (43-year-old male, Black, unknown if Hispanic, 190 centimeters, 136 kilograms [75 inches, 300 pounds]) was declared dead at the scene.

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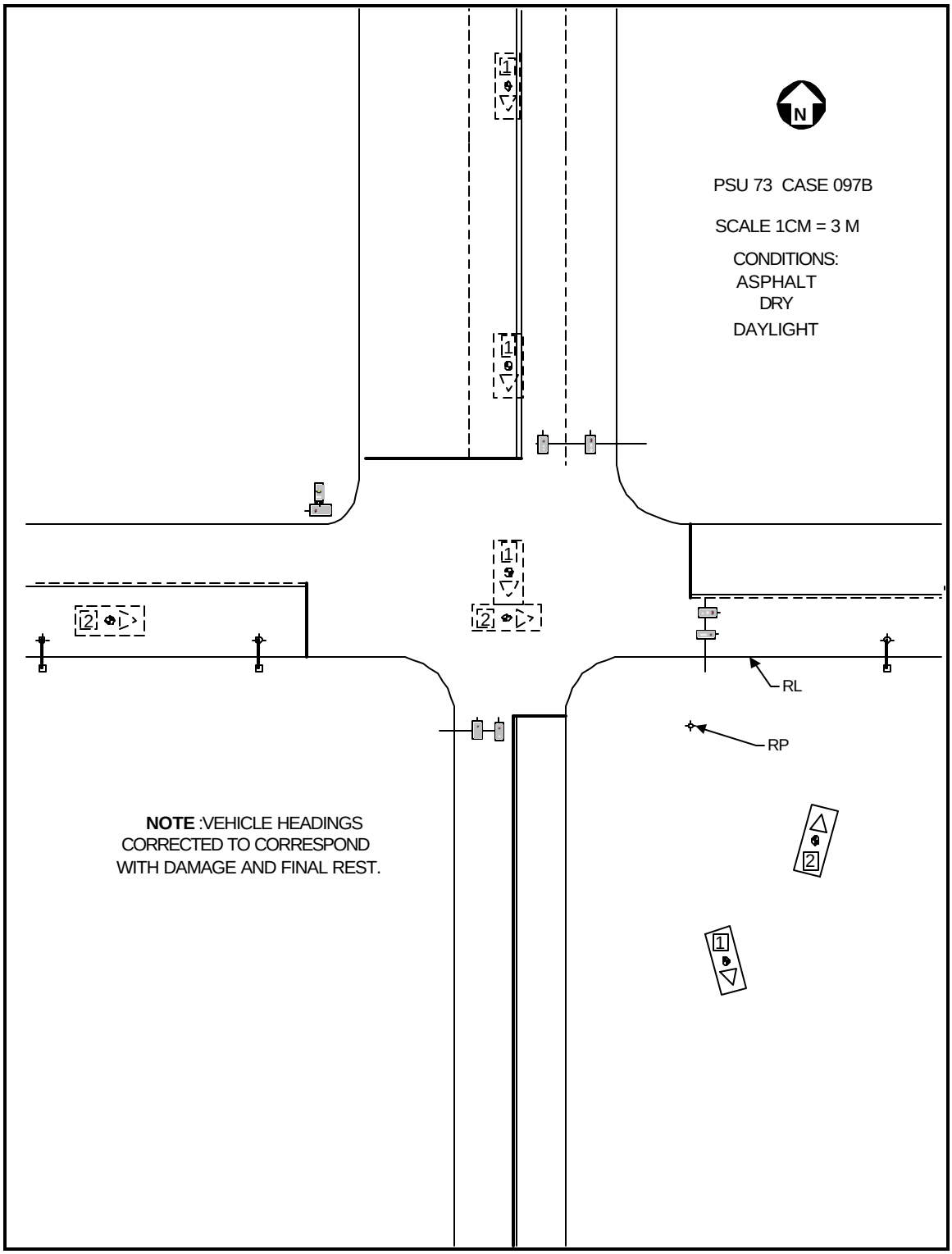
[1]The NASS case coding attributes this injury to the safety belt webbing, but SCI#2 judges that this driver was not restrained.

[2]The Hospital Discharge Summary notes, "HEENT exam was remarkable for no obvious trauma... pupils are equal, round and reactive...alert and oriented x3." The consulting physician notes, "no numbness, tingling or weakness...no clear loss of consciousness." Lab reports indicate BAC 0.163. SCI#2 judges that this non-anatomic brain injury should not be coded, especially in light of the degree of intoxication.

Figure 9: Vehicle #2's left side damage, looking forward

Figure 10: Vehicle #2, front right oblique view; NOTE: pillars cut for extrication of victim


N
PSU 73 CASE 097B
SCALE 1CM = 3 M
CONDITIONS:
ASPHALT
DRY
DAYLIGHT
RL
RP
NOTE :VEHICLE HEADINGS
CORRECTED TO CORRESPOND
WITH DAMAGE AND FINAL REST.