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SCI/NASS COMBINATION CASE REPORT

CASE NUMBER - NASS-2001-74-010J
LOCATION - Nebraska
VEHICLE - 2001 VOLVO V70
CRASH DATE - January 2001

Submitted:

October 23, 2001

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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* Combination SCI/NASS investigation involving a 2001 Volvo V70 with front air bags, seat back-mounted side air bags and roof rail-mounted inflatable curtain air bags, and a 1999 Nissan Maxima.			
16. *Abstract* This report covers a SCI/NASS combination investigation concerning a 2001 Volvo V70 (case vehicle) and a 1999 Nissan Maxima (other vehicle). This crash is of special interest because the case vehicle was equipped with seat back-mounted side air bags and roof rail-mounted inflatable curtain air bags, and the left side air bags deployed as a result of the collision events. The restrained case vehicle driver (43-year-old female) sustained serious left-side rib fractures and a laceration of the spleen. The restrained front right passenger (13-year-old female) did not sustain any injures. The Volvo was traveling east on a two-lane, one-way local road that was part of a system of access roads for a major shopping complex, approaching a six-leg intersection and intending to pass through the intersection and continue east. The Nissan was traveling southwest on a two-lane, one-way local road that was also part of the system of access roads, approaching the same six-leg intersection and intending to pass through the intersection and continue southwest. The crash occurred within the intersection. The front of the Nissan impacted the left side of the Volvo, causing the Volvo's left roof rail-mounted inflatable curtain and the driver's seat back-mounted side air bag to deploy. The Volvo was also equipped with front air bags and right side air bags that did not deploy. The Volvo rotated counterclockwise, impacted a traffic signal pole with its right side and came to rest against the signal pole heading northeast. The Nissan rotated counterclockwise and came to rest within the intersection heading southeast. Both vehicles were towed due to damage. The case vehicle driver was transported from the scene to a treatment facility and was hospitalized for eight days.			
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This SCI/NASS combination case report was brought to the NHTSA's attention in February 2001 by NASS/CDS sampling activities. This crash involved a 2001 Volvo V70 station wagon (case vehicle) and a 1999 Nissan Maxima sedan (other vehicle). The crash occurred in January 2001, at 1:20 p.m., in Nebraska and was investigated by the applicable municipal police department. This crash is of special interest because the case vehicle was equipped with side air bags and the left side air bags deployed as a result of the collision events. The restrained case vehicle driver (43-year-old female) sustained serious left-side rib fractures and a laceration of the spleen. The case vehicle's restrained front right passenger (13-year-old female) did not sustain any injures as a result of the crash. The NASS researcher inspected the scene and both vehicles in February 2001, and interviewed both drivers in March 2001. The completed NASS case was forwarded to this contractor on August 31, 2001. This report is based on the coded NASS case, scene and vehicle photographs and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The Volvo (case vehicle, NASS Vehicle #2) was traveling east in the outside eastbound lane of a two-lane, one-way local road that was part of a system of access roads for a major shopping complex, approaching a six-leg intersection and intending to pass through the intersection and continue eastward (**Figure 1**). The Nissan (other vehicle, NASS Vehicle #1) was traveling southwest in the outside southwestbound lane of a two-lane, one-way local road that was also part of the system of access roads, approaching the same six-leg intersection and intending to pass through the intersection and continue southwestward (**Figure 2**). The intersection was controlled by on-colors automatic signals. It was daylight and the weather was clear. Both roadways were asphalt, dry and free of defects. The speed limit for both vehicles was 56 km.p.h. [35 m.p.h.]. There was a slight positive grade for the case vehicle and a slight negative grade for the other vehicle. The case vehicle driver did not attempt any avoidance maneuvers. The crash occurred within the intersection.

Figure 1: Case vehicle's eastbound approach; other vehicle coming from same leg as pickup by the signal pole on the far left

Figure 2: Other vehicle's southwestbound approach; case vehicle coming from same leg as black SUV

The front of the Nissan impacted the left side of the Volvo, causing the Volvo's left roof rail-mounted inflatable curtain and the driver's seat back-mounted side air bag to deploy. The Volvo was also equipped with front air bags and right side air bags that did not deploy. The Volvo rotated counterclockwise while sliding in a southeasterly direction, impacted a traffic signal pole with its right side and came to rest against the signal pole heading northeast. The Nissan was equipped with dual front air bags that deployed. The Nissan rotated counterclockwise and came to rest within the intersection heading southeast. Both vehicles were towed due to damage.

The case vehicle was a front wheel drive 2001 Volvo V70 2.4T five-passenger, four-door station wagon (VIN: YV1SW58D811------) equipped with a 2.4 liter five-cylinder engine and an automatic transmission with a console-mounted selector lever. Four-wheel anti-lock brakes were standard equipment for this vehicle. The wheelbase was 276 centimeters [108.5 inches] and the odometer indicated 7,676 kilometers [4,770 miles].

CASE VEHICLE DAMAGE

The case vehicle had been altered by rescue personnel and was under repair at the time of the inspection, such that complete inspection data could not be acquired. The Volvo's impact with the Nissan involved the left side from the A-pillar rearward (**Figure 3**). Field L began 40 centimeters [15.7 inches] rearward of the front axle and extended 199 centimeters [78.3 inches] to the leading edge of the rear wheel well. Both left doors sustained direct contact damage and were jammed shut, but were subsequently forced open, altering the area of the crush profile (**Figure 4**). The PSU measured the crush along the sill and maximum crush was 11 centimeters [4.3 inches], at the base of the left B-pillar. Because the measured crush at the sill did not reflect the actual crush and the other vehicle was repaired such that no crush profile could be obtained, none of the available reconstruction programs could be used. The CDC for the case vehicle's most severe impact was determined to be **11-LPAW-3 (340)**. The researcher's visual estimate of delta V for this impact was between 25 and 40 kmph [16 - 25 mph]. The case vehicle rotated counterclockwise and sustained a second, minor impact when it struck a traffic signal pole with its right rear quarter panel. The quarter panel had been removed by the repair shop, but a partial CDC for this impact was determined to be **03-RBAE-99 (090)**.

Figure 3: Case vehicle's left side damage

Figure 4: Case vehicle's left side damage; note swiping-type damage

The interior of the case vehicle sustained lateral intrusion by left side components in both the front and back seat rows. Because the case vehicle's front and back left doors had been forced open, the PSU could not measure the actual magnitude of the intrusions and was forced to estimate. The greatest intrusion was 13 centimeters [5.1 inches], by the left B-pillar, with lesser lateral intrusions by the front and back door panels, the door sill and the toe pan. There was no glazing damage. The steering assembly did not move and was not deformed.

The inspection of the interior revealed evidence of a scuff on the steering wheel rim from the driver's right hand and no other discernible evidence of contact by the driver. The front right passenger's knees impacted the instrument panel on the right, and her left hip/flank contacted the center console-mounted parking brake handle. There was no other evidence of occupant contact.

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with front air bags, seat back-mounted side air bags and roof rail-mounted inflatable curtain air bags at the driver and front right passenger seat positions, for a total of six air bags. The two front air bags were equipped with dual-stage inflators. The driver's front air bag was located in the steering wheel hub and the front right passenger's front air bag was located in the middle of the right instrument panel. Neither of the front air bags nor the two right side air bags deployed. In addition, the manual, three-point, lap-and-shoulder safety belt system for the two front seat positions were equipped with safety belt pretensioners. The NASS researcher indicated that the pretensioners did not actuate.

Figure 5: Deployed driver's seat back-mounted side air bag, showing inboard surface

The driver's seat back-mounted side air bag deployed through a pre-stressed seam along the forward edge on the outboard side of the seat back (**Figure 5**). There was no evidence that the air bag module cover or the air bag was damaged. The air bag was shaped like an elongated half-circle and measured 38 centimeters [15.0 inches] vertically and 25 centimeters [9.8 inches] horizontally. There were no tethers and there was one vent port on the outboard surface near the top. There was no visible evidence of occupant contact, nor any other marks, on the seat back-mounted side air bag, the module or the adjacent interior components (**Figure 6**).

Figure 6: Deployed driver's seat-back mounted side air bag, showing module and outboard surface

The left side roof rail-mounted inflatable curtain air bag deployed through a pre-stressed seam where the headliner joins the side rail. This inflatable curtain is designed to protect both the driver and the second row left seating position (**Figures 7, 8** and **9**). The curtain air bag measured 130 centimeters [51.2 inches] horizontally by 29 centimeters [11.4 inches] vertically. There were no tethers or vent ports. There was no visible evidence of occupant contact, nor any other marks on the inflatable curtain. There was some tearing of the headliner in the second seat area (**Figure 9**).

The case vehicle driver (43-year-old female, white, non-Hispanic, 158 centimeters, 48 kilograms [62 inches, 106 pounds]) was restrained by her available manual, three-point, lap-and-shoulder safety belt system. She was seated in a normal driving posture, with the seat back in an upright configuration and the seat track adjusted in the forward-most position. Both of her hands were on the steering wheel and her feet were on the floor or foot controls. The steering wheel had both tilt and telescoping features, with the tilt at the full up position and the telescoping adjustment at the middle position. She was transported from the scene via ambulance to a trauma center, where she was hospitalized for eight days.

Figure 7: Left roof rail-mounted inflatable curtain, forward portion viewed from outside

The case vehicle driver did not make any avoidance maneuvers and her posture did not change prior to the impact. The impact caused her to move forward and leftward, toward the 340 degree direction of principal force, and caused the seat back-mounted side air bag and the roof rail-mounted inflatable curtain to deploy. Because she moved slightly forward, she probably encountered the side air bag along its forward margin. The combined effects of her lateral motion and the opposite motion of the intruding door panel caused the side air bag to deflate. Her lateral left chest and abdomen were struck by the intruding left door panel, causing fractures of left ribs 8, 9 and 10 and causing a laceration of her spleen. The deployed left roof rail-mounted side curtain air bag probably prevented her head from striking the driver's door window glazing. As the case vehicle rotated counter clockwise, she rebounded back into her seat, leaning to the right. The second impact with the traffic signal pole was relatively minor but probably caused her to move slightly to the right. When the case vehicle came to rest, she was conscious and remained in her seat. She was not entrapped, but the left side doors were jammed shut and had to be forced open by rescue personnel. She was removed from the vehicle due to the perceived threat of serious injury.

Figure 8: Interior view of left roof rail-mounted inflatable curtain, forward portion

Figure 9: Inflatable curtain, rearward portion

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Fracture left ribs 8, 9 and 10	450250.3 serious	left side hardware or arm rest	possible	Hospital Records
2.	Spleen laceration	544222.2 moderate	left side hardware or armrest	possible	Hospital Records

CASE VEHICLE FRONT RIGHT PASSENGER

The case vehicle's front right passenger (13-year-old female, white, non-Hispanic, 142 centimeters, 31 kilograms [56 inches, 68 pounds], daughter of driver) was restrained by her available, manual, three-point, lap-and-shoulder safety belt system. She was seated in a normal posture, with her back against the seat back, her feet on the floor and her hands in an unknown position. Her seat back was slightly reclined and the seat track was adjusted at the middle position. She did not sustain any injuries in the crash and did not receive any medical treatment.

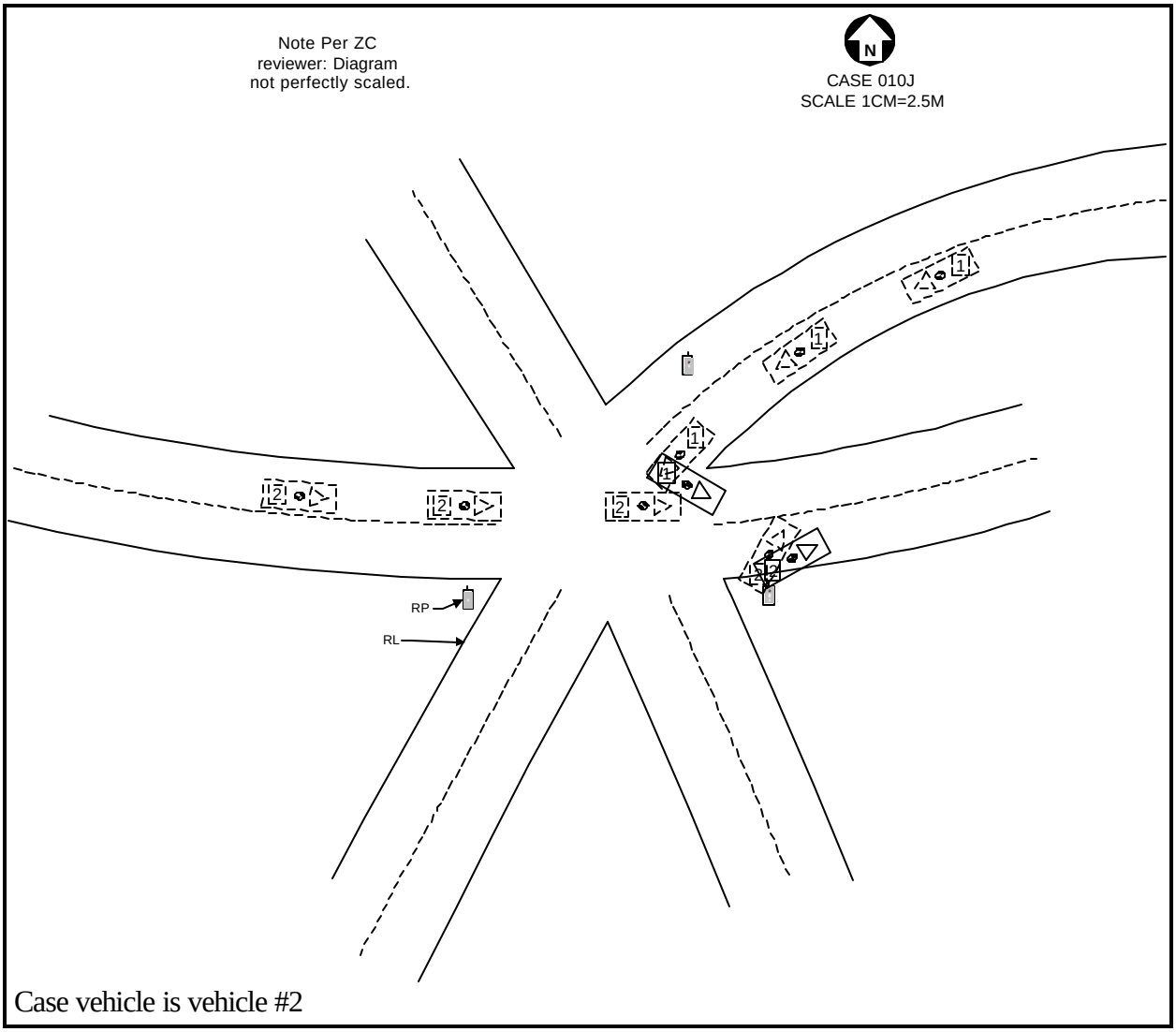
The case vehicle driver did not attempt any avoidance maneuvers and the front right passenger's posture did not change prior to the impact. The impact with the Nissan caused her to move forward and leftward, toward the 340 degree direction of principal force. Her knees contacted the glove box door and her left flank/hip contacted the center console-mounted parking brake handle, but these contacts did not cause any injuries. As the Volvo rotated counterclockwise, she moved back to the right. The second impact with the traffic signal pole was relatively minor but probably caused her to move slightly to the right. When the case vehicle came to rest, she remained in her seat. She exited the vehicle under her own power.

OTHER VEHICLE

The other vehicle was a front wheel drive 1999 Nissan Maxima five-passenger, four-door sedan (VIN: JN1CA21AXXT------). The Nissan was equipped with a six-cylinder 3.0 liter engine and an automatic transmission with a 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 Nissan's wheelbase was 270 centimeters [106.3 inches] and the odometer reading was unknown.

Figure 10: Other vehicle, front components removed

The Nissan had been partially disassembled for repair, with the front bumper, grille, headlight assemblies and other front components removed. No crush profile was measured, the CDC is unknown and NASS estimated severity is coded unknown. The Nissan was equipped with front and side air bags and the front air bags did deploy. This contractor estimates that the impact was of low severity (14 - 23 km.p.h. [9 - 14 m.p.h.]).



Case vehicle is vehicle #2