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ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN-04-008
LOCATION - Texas
VEHICLE - 2004 NISSAN QUEST
CRASH DATE - March 2004

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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 an on-site investigation of a side curtain air bag deployment crash that involved a 2004 Nissan Quest (case vehicle) and a 2001 Ford Expedition (other vehicle), which were involved in a front-to-side intersection crash. This crash is of special interest because the case vehicle was equipped with multiple Advanced Occupant Protection System (AOPS) features, including certified advanced 208-compliant air bags and individual side curtain air bags at all outboard seat positions, and the case vehicle's back right passenger (55 year-old, female) sustained a police reported "C" (possible) injury as a result of the crash. The case vehicle was traveling east in the right outside travel lane of a three-lane, undivided, one-way city street approaching a four-leg signalized intersection. The Ford was traveling north in the left, center travel lane of a four-lane, one-way city street approaching the same intersection. The front of the Ford impacted the right side of the case vehicle causing the case vehicle's right side curtain air bags to deploy. The case vehicle rotated clockwise and came to rest in the east leg of the intersection facing west. The Ford rotated clockwise and came to rest in the intersection facing northeast. The case vehicle's driver and front right passenger were restrained by their three-point, lap-and-shoulder safety belt systems. The other three occupants in the case vehicle were not restrained. The front right, second seat right and back seat right passenger's heads contacted their side curtain air bags during the crash; however, they sustained no facial or head injuries in the crash. The front right passenger sustained an acute cervical strain due to interaction with her side curtain air bag. The second seat right passenger sustained a large contusion to her right thigh due to impact with the intruded right side sliding door. The back right passenger sustained three fractured right ribs, a contusion to her liver and a contusion to her right kidney due to contact with the intruding right side surface of the case vehicle. The driver was not injured, and the second seat left passenger sustained a contusion above her right elbow due to contact with her seat's folding arm rest. None of the case vehicle's occupants were transported directly from the scene to a medical facility. However, the back right passenger, front right passenger, second seat left and second seat right passengers were transported to medical facilities by private conveyance after the crash and were treated and released.			
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This on-site investigation was brought to NHTSA's attention on or about April 5, 2004 by NASS GES sampling activities. This crash involved a 2004 Nissan Quest minivan (case vehicle) and a 2001 Ford Expedition (other vehicle). The crash occurred in March 2004 at 12:12 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 multiple Advanced Occupant Protection System (AOPS) features, including certified advanced 208-compliant air bags, individual side curtain air bags in all outboard seat positions, and the case vehicle's back right passenger [55-year-old, White (Hispanic) female] sustained a police-reported "C" (possible) injury as a result of the crash. This contractor inspected the scene and case vehicle on 13-14 April 2004, and interviewed the case vehicle's front right passenger on April 14, 2004. This report is based on the police crash report, scene and vehicle inspections, occupant medical records, an interview with the case vehicle's front right passenger, occupant kinematic principles and this contractor's evaluation of the evidence.

SUMMARY

The case vehicle was traveling east in the right outside travel lane of a three-lane, undivided, one-way city street approaching a four-leg signalized intersection. The Ford was traveling north in the left, center travel lane of a four-lane, one-way city street approaching the same intersection. As the case vehicle was traveling through the intersection, the Ford entered the intersection and the front of the Ford impacted the right side of the case vehicle causing the case vehicle's right side curtain air bags to deploy. The case vehicle rotated clockwise, traveled northeast and came to rest in east leg of the intersection facing west. The Ford rotated clockwise, traveled northeast and came to rest in the intersection facing northeast. At the time of the crash, it was daylight, the atmospheric condition was cloudy and the roadway pavement was dry, level concrete. Traffic density was light, and the site of the crash was urban commercial.

The CDC for the case vehicle was determined to be: **02-RZEW-2** (**70** degrees). The WinSMASH reconstruction program, missing vehicle algorithm calculated the case vehicle's Total, Longitudinal, and Lateral Delta Vs respectively as: 12.0 km.p.h. (7.5 m.p.h.), -4.1 km.p.h. (-2.5 m.p.h.), and -11.3 km.p.h. (-7.0 m.p.h.).

Immediately prior to the crash the case vehicle's back right passenger [55 year-old, White, (Hispanic) female] was seated in an upright posture with her back against the seat back, her feet on the floor and her hands in an unknown position. There was no seat track, the seat back was not adjustable, and the passenger was not restrained by her manual, three-point, lap-and-shoulder safety belt system. The back right passenger was wearing glasses at the time of the crash.

The case vehicle's impact with the Ford caused the back right passenger to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force. The right side of the passenger's face impacted the deployed right side curtain air bag, and then her head contacted the right rear window glazing leaving an oily scuff on the glazing. Her right chest and hip also contacted the intruding right side panel fracturing three right ribs and bruising her liver and right kidney. She was then thrown over her seat back during the post

impact spinout and came to rest on the floor in the cargo area. Despite the obvious contacts to the side curtain air bag and right rear window, there was no mention of injuries to her face or head. This passenger exited the case vehicle, with some assistance, through the tailgate. She sustained a police reported "C" (possible) injury and was transported by private conveyance to the hospital and was treated and released. She lost three weeks of work as a result of her injuries and made one follow-up visit to her doctor. No additional injuries were diagnosed

Immediately prior to the crash, the case vehicle's driver [59-year-old, White (Hispanic) male] was seated in an upright position with his back against the seat back, his left foot on the floor, his right foot on the accelerator and both hands on the steering wheel. His seat track was located in its middle position, the seat back was slightly reclined, the tilt steering wheel was located between its center and full up positions, and the driver was restrained by his manual, three-point, lap and shoulder safety belt system.

The case vehicle's impact with the Ford caused the driver to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force. The driver remained in his seat and likely moved back to the left and backward, and contacted his door as the case vehicle rotated clockwise to its final rest position. The driver was not injured and exited the case vehicle under his own power.

Immediately prior to the crash, the case vehicle's front right passenger [57-year-old, White (Hispanic) female] was seated in an upright position with her feet on the floor, her right arm on the door armrest and her left hand/arm in an unknown position. Her seat track was located in its middle position, the seat back was slightly reclined, and she was restrained by her manual, three-point, lap-and-shoulder safety belt. She was not wearing glasses at the time of the crash.

The case vehicle's impact with the Ford caused the front right passenger to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force. She impacted the right side of her face on the deployed front right side curtain air bag leaving a deposit of make-up on the air bag material, and causing an acute cervical strain. She remained in her seat and likely moved left and backward as the case vehicle rotated clockwise to its final rest position. She reported that she exited the case vehicle under her own power following the crash. She sustained no police reported injury and was not transported from the scene to a hospital; however, she visited a medical clinic later and was treated and released.

Immediately prior to the crash, the case vehicle's second seat, left passenger [61-year-old, White (Hispanic) female] was seated in an upright position with her feet on the floor and her hands in her lap. Her seat track was in the forward-most of two available positions, her seat back was slightly reclined and she was not restrained by her manual, three-point, lap-and-shoulder safety belt system.

The case vehicle's impact with the Ford caused the second seat, left passenger to move forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force. As a result, she contacted her seat's right folding armrest with her right arm causing a contusion above her right elbow. She then likely moved back to the left and backward

and contacted the case vehicle's left side surface as the vehicle rotated clockwise to final rest. She remained in her seat and exited the case vehicle with some assistance following the crash. The arm rest likely prevented her from sliding out of her seat and impacting the second seat, right passenger.

The police crash report indicated that the case vehicle's second seat left passenger sustained a "C" (possible) injury and refused transport from the scene. However, she sought treatment later at a local hospital and was treated and released from the emergency room. She received one follow-up visit to her doctor for therapy to her right arm.

Immediately prior to the crash, the case vehicle's second seat right passenger [28-year-old, White (Hispanic) female] was seated in an upright position with her feet on the floor and her hands and arms in an unknown position. Her seat track was in the forward-most of two available positions, her seat back was slightly reclined, and she was not restrained by her manual, three-point, lap-and-shoulder safety belt system. She was not wearing glasses at the time of the crash.

The case vehicle's impact with the Ford caused the passenger to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force. Her head most likely contacted the right side curtain air bag; although, no contact evidence was found on the air bag. The right side of her body contacted the intruding right rear sliding door causing a contusion on the middle of her right thigh. Following the impact, she likely moved back to the left and backward and may have come out of her seat as the vehicle rotated clockwise to its final rest position. She was not transported from the scene; however, she visited a medical clinic later and was treated and released.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the case vehicle was traveling was a three-lane, undivided, one-way city street, traversing in an easterly direction approaching a four-leg intersection. Both the east and west legs of the intersection had three through lanes. The roadway on which the Ford was traveling was a four-lane, undivided, one-way, city street traversing in a northerly direction approaching the same four-leg intersection. Both the north and south legs of the intersection had four lanes. The width of the travel lanes on the case vehicle's approach roadway were approximately 3.5 meters (11.5 feet). The width of both center travel lanes on the Ford's approach roadway were approximately 3 meters (9.8 feet), while the left outside lane was 4.2 meters (13.8 feet) wide, and the right outside lane was 2.7 meters (8.9 feet) wide. All the roadways were bordered by barrier curbs, and the intersection was controlled by three-phase traffic signals. Roadway pavement markings for the case vehicle consisted of faded broken white lane lines for the center and right lanes, and a solid white lane line near the intersection for the left lane. Roadway pavement markings for the Ford consisted of broken white lane lines. In addition, there were white delineated crosswalks on each leg of the intersection. At the time of the crash it was daylight, the atmospheric condition was cloudy and the roadway pavement was dry, level concrete. The case vehicle's speed limit was 56 km.p.h. (35 m.p.h), and the Ford's speed limit was 48 km.p.h. (30 m.p.h.). There were no regulatory speed limit signs posted near the crash

site. The traffic density at the time of the crash was light, and the site of the crash was urban commercial.

Pre-Crash: The case vehicle was traveling east in the right outside travel lane (**Figure 1**), and the driver was intending to continue straight ahead. The front right occupant estimated the case vehicle's travel speed at approximately 48 km.p.h. (30 m.p.h.). The Ford was traveling north in the left center travel lane (**Figure 2**), and the driver was intending to continue straight ahead. The front right passenger stated that the case vehicle's driver took no actions to avoid the crash. The crash occurred in the four-leg intersection of the two roadways.

Crash: The front of the Ford impacted the right side of the case vehicle (**Figure 3**) causing the case vehicle's right side curtain air bags to deploy.

Post-Crash: As a result of the impact, the case vehicle rotated clockwise approximately 180 degrees, traveled northeast and came to rest in the east leg of the intersection, facing west (**Figure 4** below). The Ford rotated clockwise, traveled northeast and came to rest in the intersection facing northeast.

Figure 1: Case vehicle's approach to the four-leg intersection in outside eastbound lane

Figure 2: Ford's approach to the four-leg intersection in the northbound left center lane

Figure 3: Damage to right side of case vehicle from impact by the Ford, each stripe on rods is 5 cm (2 in)

CASE VEHICLE

The 2004 Nissan Quest 3.5S was a front wheel drive, five-door minivan (VIN: 5N1BV28U44N------) equipped with a 3.5L, V6 engine; two-speed automatic transmission; four wheel, anti-lock brakes and a tire pressure monitor system. The front seating row was equipped with bucket seats with adjustable head restraints, dual stage driver and front right passenger air bags; driver and front right passenger manual, three-point, lap-and-shoulder safety belts with height adjustable upper anchors, buckle switch sensors, safety belt pretensioners with load limiters and a seat weight sensor for the front right passenger seating position. The second seat row was equipped with bucket seats with adjustable head restraints and manual, three point, lap and

shoulder safety belts. The back seating row was equipped with a bench seat with adjustable head restraints, which had been removed, and manual, three-point, lap-and-shoulder safety belts systems. In addition, the case vehicle was equipped with individual (i.e., front, second, and back) side curtain air bags at all outboard seating positions, a LATCH system for securing child safety seats and an EDR. The case vehicle's mileage at inspection is unknown because the vehicle was equipped with an electronic odometer. The case vehicle's wheelbase was 315 centimeters (124 inches).

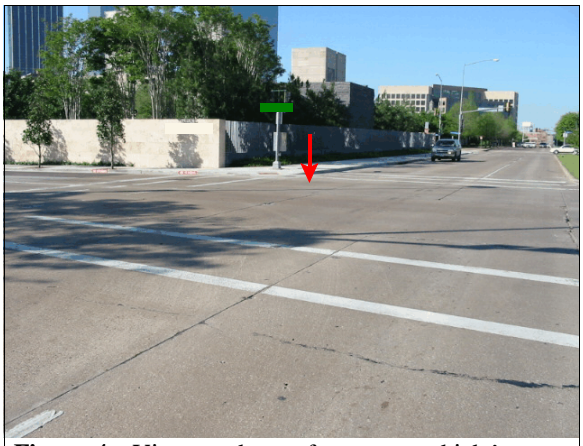


Figure 4: View southwest from case vehicle's area of final rest in east leg of intersection, arrow indicates area of impact

The various sensors in the case vehicle's advanced occupant restraint system analyze a combination of factors including the predicted crash severity and driver and front right passenger safety belt usage to determine the front air bag inflation level appropriate for the severity of the crash. For the front right seat position, an occupant weight sensor in the seat cushion determines if an occupant is on the seat and enables or suppresses deployment of the air bag based on the amount of weight on the seat. The crash sensors in the side of the case vehicle analyze side impact forces and deploy the side curtain air bags to provide added protection for passengers seated along the side of the vehicle.

CASE VEHICLE DAMAGE

Exterior Damage: The case vehicle's initial contact with the Ford involved the right rear sliding door, the right quarter panel, and the right rear wheel. Direct damage began 164 centimeters (64.6inches) rearward of the right front axle and extended 178 centimeters (70.1 inches) along the right side of the van. Residual maximum crush was measured as 19 centimeters (7.5 inches) occurring at C_3. The case vehicle's crush profile is shown in the table below.

Units	Event	Direct Damage		Field L	C_1	C_2	C_3	C_4	C_5	C_6	Direct	Field L
		Width CDC	Max Crush								±D	±D
cm	1	178	19	195	0	9	19	18	15	2	-94	-102
in		70.1	7.5	76.8	0.0	3.5	7.5	7.1	5.9	0.8	-37.0	-40.2

The wheelbase on the case vehicle's left side was extended 5 centimeters (2.0 inches) while the right side wheelbase was unaltered from the crash. The case vehicle's right rear sliding door, right quarter panel, and right rear wheel were directly damaged and crushed inward. In addition, there was induced damage to the right rear door slider track cover, and the right rear window was detached from it's latch assembly. No obvious induced damage or remote buckling was noted to the remainder of the case vehicle's exterior.

The recommended tire size was: P225/65R16, and the vehicle was equipped with tires of this size. The case vehicle's tire data are shown in the table below.

Tire	*Measured Pressure*		*Recommend Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kpa	psi	kpa	psi	milli-meters	32nd of an inch			
LF	296	43	241	35	7	9	None	No	No
RF	276	40	241	35	7	9	None	No	No
LR	296	43	241	35	7	9	None	No	No
RR	0	0	241	35	7	9	Rim damaged, tire bead broken	No	Yes

Vehicle Interior: Inspection of the case vehicle's interior revealed occupant contact marks on the front right and back right side curtain air bags (**Figure 5** and **Figure 6** below). Occupant contact evidence was also found on the intruded, interior surface of the right rear sliding door at the belt line (**Figure 7** below), as well as the intruded right side panel and glazing adjacent to the back seat row (**Figures 6** and **8** below). Also, it was observed that the right rear window latch assembly was detached from it's glue joint on the window glazing. The rear edge of the window could be manually pulled outward creating a potential ejection portal for the back right passenger. The case vehicle sustained two intrusions. The right side sliding door intruded laterally 14 centimeters (5.5 inches) into the second seat right passenger's occupant space, and the right side panel intruded laterally 5 centimeters (2 inches) into the back seat right passenger's occupant space. Lastly, there was no evidence of compression of the energy absorbing steering column or damage to the steering wheel.

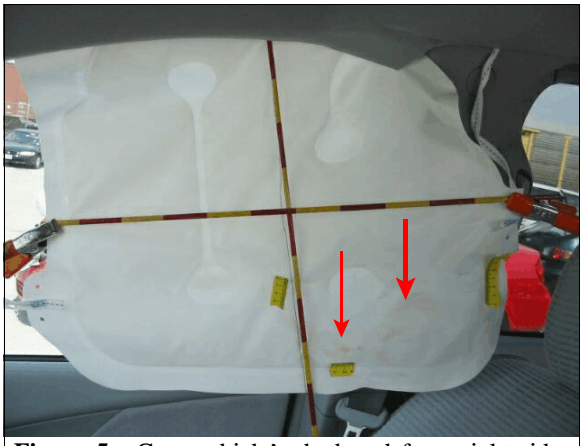


Figure 5: Case vehicle's deployed front right side curtain air bag, arrows show make-up scuff from occupant contact

Damage Classification: Based on the vehicle inspection, the CDC for the case vehicle was determined to be: **02-RZEW-2** (**70** degrees). The WinSMASH reconstruction program, missing vehicle algorithm, was used to reconstruct the case vehicle's Delta V. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 12.0 km.p.h. (7.5 m.p.h.), -4.1 km.p.h. (-2.5 m.p.h.), and -11.3 km.p.h. (-7.0 m.p.h.). The reconstruction results appear low. The case vehicle was towed due to damage.

Figure 6: Yellow tape shows occupant contact mark on case vehicle's back right window, note make-up transfer on side curtain air bag

Figure 7: Intrusion and contact mark (yellow tape) on interior surface of right rear sliding door adjacent to second seating row.

AUTOMATIC RESTRAINT SYSTEM

The case vehicle was equipped with certified advanced 208-compliant front air bags at the driver and front right passenger positions and side curtain air bags at all outboard seating positions. The driver and front right passenger air bags did not deploy. All of the right side curtain air bags did deploy as a result of the crash.

Figure 8: Damage and intrusion of case vehicle's side-panel into back right seat area.

The driver's air bag was located in the steering wheel hub (**Figure 9**) and the front right passenger's air bag was located in the top of the instrument panel (**Figure 10** below). Neither of these air bags deployed in this crash because the case vehicle's crash sensing algorithm most likely determined that the longitudinal crash pulse would not be severe enough to require their deployment. This observation is supported by the results of the WinSMASH reconstruction that is presented above.

Figure 9: Case vehicle's driver seating area showing non-deployed driver air bag and no occupant contact evidence to interior surfaces

All three right side curtain air bags deployed in this crash. The extent of crush to the right side of the case vehicle and results of the WinSMASH reconstruction indicate that the deployment was required. While the function sequence of the case vehicle's side curtain air bag system is not known, some general observations can be made. In side impacts, the narrow crush zone of a vehicle's side

structure and the proximity of the occupant to the striking vehicle requires a faster sensing and deployment decision criteria than that of a frontal impact. While not specific to the case vehicle's impact, sensor trigger times for 48 km.p.h. (30 m.p.h.) car-to-car impacts are within 3-5 milliseconds from the onset of the crash, with full inflation of the side air bag occurring within 7-15 milliseconds following triggering of the sensors.

Figure 10: Case vehicle's front right seating area, front right passenger air bag located in top of right instrument panel

The front right passenger's side curtain air bag (**Figure 11**) was located along the right roof side rail and extended from approximately mid-window to the middle of the right"B"-pillar. The air bag was approximately rectangular in shape and measured approximately 47 centimeters (18.5 inches) in width and approximately 38 centimeters (15 inches) in height. The air bag consisted of three irregularly shaped inflatable chambers. A 47 centimeter (18.5 inches) anchor cord extended from the front edge of the air bag to the "A"-pillar. This anchor cord attached to the right "A"-pillar approximately 22 centimeters (8.6 inches) above the belt line, and attached to the front edge of the air bag approximately 32 centimeters (12.5 inches) below the right roof side rail. A second anchor cord extended from the back edge of the air bag and to the top of the right "B"-pillar. It was 23 centimeters in length, and its attachment point on the back edge of the air bag was 20 centimeters (8 inches) below the roof side rail. The air bag was constructed without tethers, and there were no visible vent ports. There was no damage to the air bag due to the deployment or occupant contact. A make-up scuff from the front right passenger's face was observed on the lower right portion of this air bag (**Figure 5** above).

Figure 11: Overview of case vehicle's front right side curtain air bag

Figure 12: Overview of second seat right side curtain air bag

The second seat right side curtain air bag (**Figure 12**) was located along the right roof side rail, and extended from approximately the middle of the sliding door window to the approximate middle of the right"C"-pillar. This air bag was approximately rectangular in shape and measured approximately 47 centimeters (18.5 inches) in width and approximately 30 centimeters (11.8 inches) in height. The air bag consisted of three vertical inflatable chambers running nearly the

vertical height of the air bag. Each inflatable chamber was approximately 15 centimeters (5.9 inches) in width and approximately 25 centimeters (9.8 inches) in height. An anchor cord, 36 centimeters (14.2) in length, extended from the front edge of the air bag to the roof rail. This anchor cord attached to the right roof side rail approximately 27 centimeters (10.6 inches) rear of the right "B"-pillar, and attached to the lower front edge of the air bag. No second anchor cord was attached to the back edge of the air bag. The air bag was designed without tethers, and there were no visible vent ports. No damage occurred to this air bag during deployment, and no evidence of occupant contact was observed on the air bag material.

Figure 13: Overview of back right side curtain air bag

The back right side curtain air bag (**Figure 13**) was located near the back of the right rear window. It was square in shape and oriented at an angle (i.e., the forward bottom corner was higher above the belt line than the rear bottom corner). The air bag was approximately 31 centimeters (12.2 inches) in width and approximately 31 centimeters (12.2 inches) in height. The air bag consisted of two inflatable chambers, each 17 centimeters (6.7 inches) in width. A 24 centimeter (9.4 inches) anchor cord extended from the lower front edge of the air bag and attached to the right roof side rail approximately 22 centimeters (8.6 inches) rear of the right "B"-pillar. A second anchor cord, 4 centimeters (1.6 inches) in length, extended from the upper back corner of the air bag and attached to the upper corner of the right "D"-pillar. There was no evidence of damage to the air bag from the deployment. However, a large make-up scuff from the back right passenger's face was observed on the forward inflatable chamber. This occupant contact mark measured 8 centimeters (3.1 inches) by 14 centimeters (5.5 inches). No other damage or occupant contact marks were observed on the air bag.

CASE VEHICLE BACK RIGHT PASSENGER KINEMATICS

Immediately prior to the crash the case vehicle's back right passenger [55 year-old, White, (Hispanic) female; 157 centimeters and 86 kilograms (62 inches, 190 pounds)] was seated in an upright posture with her back against the seat back, her feet on the floor and her hands in an unknown position. There was no seat track, and the seat back was not adjustable. The back right passenger was wearing glasses at the time of the crash.

Based on the police crash report and an interview with the front right passenger, the case vehicle's back right passenger was not restrained by her manual, three-point, lap-and-shoulder, safety belt system. The interviewee stated that this passenger was thrown out of her seat and onto the floor of the back cargo area during the crash. The inspection of this passenger's safety belt assembly showed no evidence of loading.

Figure 14: Case vehicle's back right window

The case vehicle's driver made no pre-crash avoidance maneuvers. As a result, the back right passenger's pre-impact body position did not change just prior to impact. The case vehicle's impact with the Ford caused the back right passenger to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. The right side of the occupant's face contacted the deployed right side curtain air bag, and then contacted the right rear window glazing leaving an oily scuff on the window glazing (**Figure 6** above). Her right chest and hip also contacted the intruding right side panel fracturing three right ribs, contusing her liver and contusing her right kidney. During the post-impact rotation, this passenger traveled over her seat back, and she came to rest on the floor in the cargo area. Despite the obvious contacts to the side curtain air bag and right rear window glazing, there was no mention of injuries to her face or head. It was observed that the right rear window latch assembly was detached from it's glue joint on the window glazing. The rear edge of the window could be manually pulled outward creating a potential ejection portal (**Figure 14**). It is possible that this passenger was prevented from at least a partial ejection by the deployed back right side curtain air bag. Following the crash, the back right passenger exited the case vehicle, with some assistance, through the tailgate.

CASE VEHICLE BACK RIGHT PASSENGER INJURIES

The back right passenger sustained a police reported "C" (possible) injury and was not transported from the scene to a hospital. She was taken later to a hospital by private conveyance and was treated and released. The interviewee reported that this passenger lost three weeks of work as a result of her injuries, and she made one follow-up visit to her doctor. No additional injuries were diagnosed. The back right passenger's injuries and injury mechanisms are presented in the table below.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Fracture right 3rd, 4th, and 5th ribs posteriorly, not further specified	moderate 450220.2,1	Right side interior surface, excluding hardware and/or armrest	Certain	Emergency room records
2	Contusion {bruised} liver, not further specified	moderate 541810.2,1	Right side interior surface, excluding hardware and/or armrest	Probable	Interviewee (other occupant)

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
3	Contusion {bruised} kidney on right, not further specified	moderate 541610.2,1	Right side interior surface, excluding hardware and/or armrest	Probable	Interviewee (other occupant)

CASE VEHICLE DRIVER KINEMATICS

Immediately prior to the crash, the case vehicle's driver [59-year-old, White (Hispanic) male; 165 centimeters and 68 kilograms (65 inches, 150 pounds)] was seated in an upright position with his back against the seat back, his left foot on the floor, his right foot on the accelerator and both hands on the steering wheel. His seat track was located in its middle position, the seat back was slightly reclined, and the tilt steering wheel was located between its center and full up positions.

The case vehicle driver was restrained by his manual, three-point, lap and shoulder safety belt system. The interviewee and the police crash report both indicated the driver was restrained by his lap-and-shoulder safety belt. No evidence of loading was found on the safety belt assembly during the case vehicle inspection. However, given a side impact of this severity, the lack of belt load indicators is not unusual.

The driver made no pre-crash avoidance maneuvers. As a result, his pre-impact body position did not change just prior to impact. The case vehicle's impact with the Ford caused the driver to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. The driver remained in his seat and likely moved back to the left and backward, and contacted his door as the case vehicle rotated clockwise to its final rest position. The driver exited the case vehicle under his own power.

CASE VEHICLE DRIVER INJURIES

The police crash report indicated that the case vehicle's driver was not injured in the crash and was not transported from the scene to a hospital. The driver did not visit a medical facility subsequent to the crash. The driver lost no work days as a result of the cash.

CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's front right passenger [57-year-old, White (Hispanic) female; 160 centimeters and 82 kilograms (63 inches and 180 pounds)] was seated in an upright position with her feet on the floor, her right arm on the door armrest and her left hand/arm in an unknown position. Her seat track was located in its middle position, and the seat

back was slightly reclined. The front right passenger was not wearing glasses at the time of the crash.

The front right passenger was restrained by her manual, three-point, lap-and-shoulder safety belt system. Both the interviewee and police crash report indicated she was restrained by the lap-and-shoulder belt. Inspection of the safety belt assembly revealed no indications of loading, but this is not unusual for a near side passenger in a side impact.

The case vehicle's driver made no pre-crash avoidance actions. As a result, the front right passenger's pre-impact body position did not change just prior to the crash. The case vehicle's impact with the Ford caused her to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. The passenger struck the deployed front right side curtain air bag with the right side of her face leaving a deposit of make-up on the air bag material (**Figure 5** above), and causing an acute cervical strain. The front right passenger remained in her seat and likely moved to her left and backward into her seat as the case vehicle rotated clockwise to its final rest position. She reported that she exited the case vehicle under her own power following the crash.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The front right passenger sustained no police reported injury and was not transported from the scene to a hospital. However, the front right passenger reported she visited a medical clinic after the crash and was treated and released. She was not working at the time of the crash. The front right passenger's injuries and injury mechanisms are presented in the table below.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Strain, acute cervical with pain and tenderness right side	minor 640278.1,6	Air bag, front right passenger's side inflatable curtain	Certain	Emergency room records

CASE VEHICLE SECOND SEAT LEFT PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's second seat left passenger [61-year-old, White (Hispanic) female; 155 centimeters and 54 kilograms (61 inches and 120 pounds)] was seated in an upright position with her feet on the floor and her hands in her lap. Her seat track was in the forward-most of two available positions, and her seat back was slightly reclined.

Based on information from the interviewee and the police crash report, the second seat, left passenger was not restrained by her manual, three-point, lap-and-shoulder safety belt system.

Inspection of the safety belt assembly showed no evidence of loading, which is not unusual in a side impact of this severity.

The case vehicle's driver made no pre-crash avoidance actions. As a result, the second seat left passenger's pre-impact body position did not change just prior to the crash. The case vehicle's impact with the Ford caused the passenger to continue forward, but primarily rightward along a path opposite the case vehicle's 70 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. As a result, she contacted her seat's right folding armrest with her right arm causing a bruise above her right elbow. She then likely moved back to the left and backward, and contacted the case vehicle's left side surface as the vehicle rotated clockwise to final rest. She remained in her seat and exited the case vehicle with some assistance following the crash. The arm rest likely prevented her from sliding out of her seat and impacting the second seat right passenger.

CASE VEHICLE SECOND SEAT LEFT PASSENGER INJURIES

The police crash report indicated that the case vehicle's second seat left passenger sustained a "C" (possible) injury and refused transport from the scene. However, she sought treatment later at a local hospital and was treated and released from the emergency room. This passenger received one follow-up visit to her doctor for therapy to her right arm. She was not working at the time of the crash. The second seat left passenger's injuries and injury mechanisms are presented in the table below.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion {bruise}, 12.7 cm (5 in) above elbow on right arm	minor 790402.1,1	seat position's right side armrest	Probable	Interviewee (other occupant)

CASE VEHICLE SECOND SEAT RIGHT PASSENGER KINEMATICS

Immediately prior to the crash, the case vehicle's second seat right passenger [28-year-old, White (Hispanic) female; 163 centimeters and 64 kilograms (64 inches and 140 pounds)] was seated in an upright position with her feet on the floor and her hands and arms in an unknown position. Her seat track was in the forward-most of two available positions and her seat back was slightly reclined. She was not wearing glasses at the time of the crash.

Based on information from the interviewee and the police crash report, this passenger was not restrained by her manual, three-point, lap-and-shoulder safety belt system. No evidence of loading was observed on the safety belt assembly.

The case vehicle's driver made no pre-crash avoidance actions. As a result, the second seat right passenger's pre-impact body position did not change just prior to the crash. The case vehicle's impact with the Ford caused the passenger to continue forward, but primarily rightward

along a path opposite the case vehicle's 70 degree direction of principal force as the case vehicle decelerated longitudinally and accelerated laterally to the left. Her head most likely contacted the right side curtain air bag; although, no contact evidence was found on the air bag. The right side of her body contacted the intruding right rear sliding door causing a large bruise on the middle of her right thigh. Following the impact, she likely moved back to the left and backward, and may have come out of her seat as the vehicle rotated clockwise to its final rest position. The second seat right passenger was able to exit the vehicle under her own power following the crash.

CASE VEHICLE SECOND SEAT RIGHT PASSENGER INJURIES

The police crash report indicated that the second seat right passenger sustained no injury in the crash and was not transported from the scene. However, she visited a medical clinic later and was treated and released. She reportedly lost no work days as a result of this crash. The second seat right passenger's injury and injury mechanism are presented in the table below.

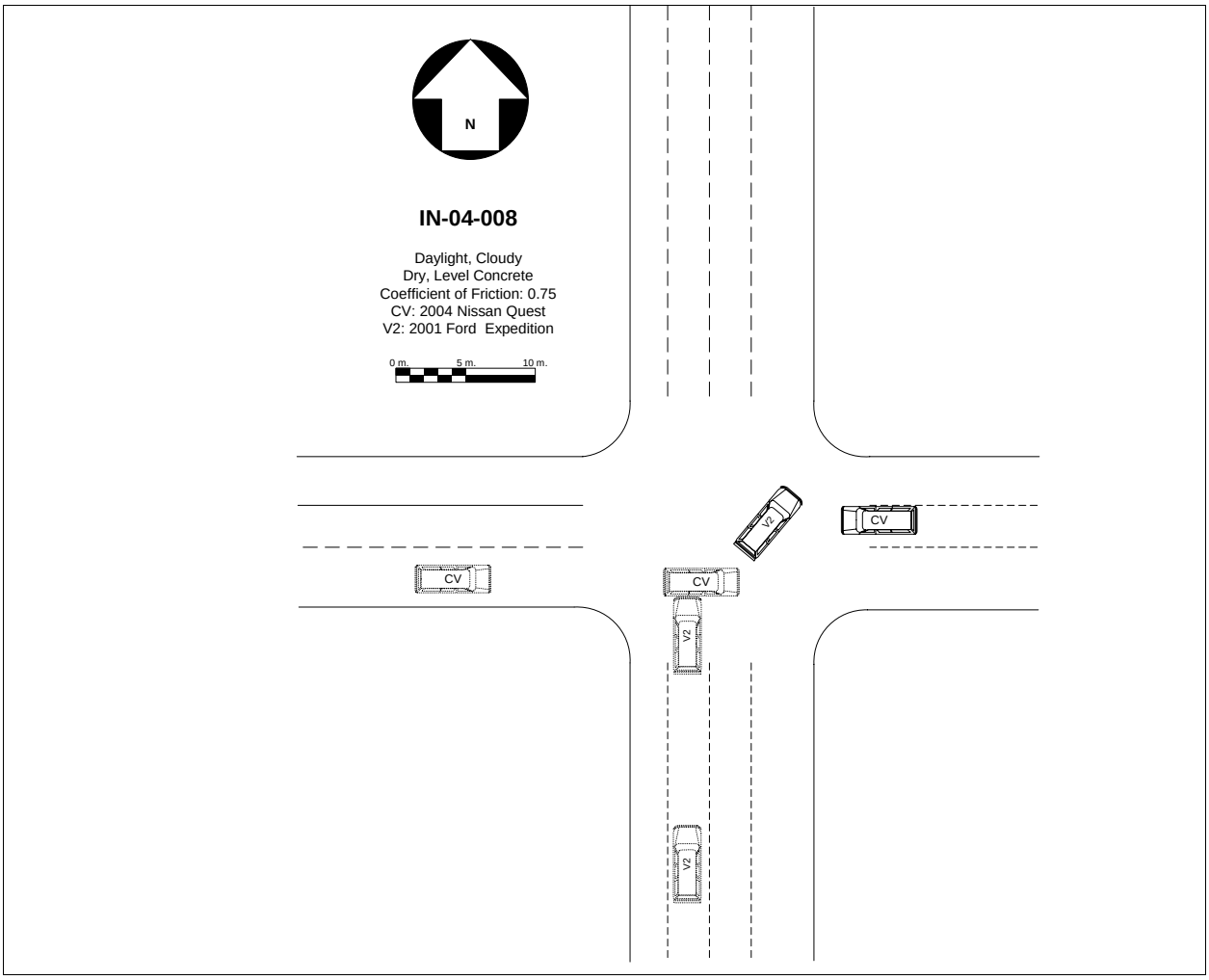
Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion {bruise}, 10.2 to 12.7 cm (4-5 in) on right middle lateral thigh	minor 890402.1,1	Right side interior surface excluding hardware and/or armrest	Certain	Emergency room records

OTHER VEHICLE

The 2001 Ford Expedition was a rear wheel drive, four-door sport utility vehicle (VIN: 1FMEU17LX1L------). The Ford was equipped with redesigned driver and front right passenger air bags. The police crash report indicated that the driver and front right air bags did not deploy as a result of this crash.

Exterior Damage: A CDC for the Ford could not be determined because the Ford was not inspected, and there were no photographs of the damage. The WinSMASH reconstruction program, missing vehicle algorithm, was used to reconstruct the Ford's Delta V. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 12.0 km.p.h. (7.5 m.p.h.), -11.3 km.p.h. (-7.0 m.p.h.), and 4.1 km.p.h. (2.5 m.p.h.). The reconstruction results appear low. The Ford was towed due to damage.

Ford's Occupants: According to the police crash report, the Ford's driver [44-year-old, White (non-Hispanic) male] was restrained by his manual, three-point, lap-and-shoulder safety belt system. The driver was not transported by ambulance to the hospital, and the police crash report reported no injuries to the driver as a result of this crash.


N
IN-04-008
Daylight, Cloudy
Dry, Level Concrete
Coefficient of Friction: 0.75
CV: 2004 Nissan Quest
V2: 2001 Ford Expedition
0 m.
5 m.
10 m.
CV
CV
V2
CV
V2
V2