Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1999-074-077C)

1999 Nissan Sentra

Nebraska

June/1999

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16. Abstract

This remote investigation focused on the redesigned air bag system deployment 1999 Nissan Sentra 4-door sedan. This minor injury crash occurred in June, 1999 in the afternoon. It was raining at the time of the crash and the bituminous roadway was wet. The crash occurred on a two lane, undivided roadway. The speed limit for this road is 48 kmph (30 mph). There are no traffic controls at the area of impacts. There is a >2% eastbound downhill grade at this location. Vehicle 1, a 1991 Acura Integra 3-door hatchback driven by a 25 year old male, was traveling east in the eastbound travel lane at an unknown speed approaching Vehicle 2 which was stopped in the eastbound travel lane ahead. It is not known if the driver was restrained. There were no other occupants in Vehicle 1. Vehicle 2, a 1979 Chevrolet El Camino auto based pickup driven by a 20 year old male, was stopped facing east in the eastbound travel lane ahead of Vehicle 1. The driver was waiting for traffic to clear to initiate a left turn onto an intersecting street. The front-right seat was occupied by a one year old male. It is not known if either occupant was restrained. Vehicle 3, a 1999 Nissan Sentra 4-door sedan (case vehicle) driven by a 62 year old female (158 cm/62 in, 54 kg/120 lbs), was traveling west in the westbound travel lane at a driver estimated speed of 48 kmph (30 mph) approaching Vehicle 2. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 3. As Vehicle 1 approached the back of Vehicle 2, the driver swerved to the left to avoid striking Vehicle 2. Vehicle 1 traveled to the left of Vehicle 2, over the painted double yellow dividing line, and into westbound traffic. At this point, the front plane of Vehicle 1 (12FLEE4) struck the front plane of Vehicle 3 (12FLEE4) in the westbound travel lane (event 1). The force of the impact caused Vehicle 1 to rotate counter-clockwise and impact Vehicle 2 (event 2). The right plane of Vehicle 1 (03RBEW1) impacted the left plane of Vehicle 2 (unknown CDC). A Delta V was calculated for event 1 for Vehicle 3, utilizing the Damage Only Algorithm of WinSMASH, was 27 kmph (17 mph). As a result of the first event frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed. Vehicle 1 came to rest in the center of the road against Vehicle 2 facing northeast. Vehicle 2 came to rest in the original lane facing east. The exact final rest position of Vehicle 3 is not known. Vehicles 1 and 3 were towed from the scene due to damage. Vehicle 2 was still driveable. All occupants in this crash sustained varying degrees of injuries and were transported to a trauma center for medical attention.

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Summary

This remote investigation focused on the redesigned air bag system deployment 1999 Nissan Sentra 4-door sedan. This minor injury crash occurred in June, 1999 in the afternoon. It was raining at the time of the crash and the bituminous roadway was wet. The crash occurred on a two lane, undivided roadway. The speed limit for this road is 48 kmph (30 mph). There are no traffic controls at the area of impacts. There is a >2% eastbound downhill grade at this location.

Vehicle 1, a 1991 Acura Integra 3-door hatchback driven by a 25 year old male, was traveling east in the eastbound travel lane at an unknown speed approaching Vehicle 2 which was stopped in the eastbound travel lane ahead. It is not known if the driver was restrained. There were no other occupants in Vehicle 1.

Vehicle 2, a 1979 Chevrolet El Camino auto based pickup driven by a 20 year old male, was stopped facing east in the eastbound travel lane ahead of Vehicle 1. The driver was waiting for traffic to clear to initiate a left turn onto an intersecting street. The front-right seat was occupied by a one year old male. It is not known if either occupant was restrained.

Vehicle 3, a 1999 Nissan Sentra 4-door sedan (case vehicle) driven by a 62 year old female (158 cm/62 in, 54 kg/120 lbs), was traveling west in the westbound travel lane at a driver estimated speed of 48 kmph (30 mph) approaching Vehicle 2. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 3.

Figure 1. Exterior, Vehicle 1 (1991 Acura Integra)

Figure 2. Exterior, Vehicle 3 (1999 Nissan Sentra)

Crash Events

As Vehicle 1 approached the back of Vehicle 2, the driver swerved to the left to avoid striking Vehicle 2. Vehicle 1 traveled to the left of Vehicle 2, over the painted double yellow dividing line, and into westbound traffic. At this point, the front plane of Vehicle 1 (12FLEE4) struck the front plane of Vehicle 3 (12FLEE4) in the westbound travel lane (event 1). The force of the impact caused Vehicle 1 to rotate counter-clockwise and impact Vehicle 2 (event 2). The right plane of Vehicle 1 (03RBEW1) impacted the left plane of Vehicle 2 (unknown CDC).

Utilizing the Damage Only Algorithm of WinSMASH, a total Delta V of 27 kmph (17mph) was calculated for event 1 for Vehicle 3.

As a result of the first event frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed.

Vehicle 1 came to rest in the center of the road against Vehicle 2 facing northeast. Vehicle 2 came to rest in the original lane facing east. The exact final rest position of Vehicle 3 is not known. Vehicles 1 and 3 were towed from the scene due to damage. Vehicle 2 was still driveable.

All occupants in this crash sustained varying degrees of injuries and were transported to a trauma center for medical attention.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	27	16.8	24	14.9
Longitudinal	-26	-16.2	-24	-14.9
Lateral	5	3.1	0	0
Barrier speed	21	13	28	17.4

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1999 Nissan Sentra
VIN	1N4AB41D8XC
CDC	12FLEE4

Figure 3. Exterior, Vehicle 3 (1999 Nissan Sentra)

Figure 4. Exterior, Vehicle 3 (1999 Nissan Sentra)

Table 3. Crush Measurements

Plane of Impact	Field L cm/in.	C1 cm/in.	C2 cm/in.	C3 cm/in.	C4 cm/in.	C5 cm/in.	C6 cm/in.
Bumper	137	42	4	3	2	2	0
	53.9	16.5	1.6	1.2	0.8	0.8	0

Interior of Case Vehicle

The interior of the 1999 Nissan Sentra sustained minor damage from occupant contact. There were no areas of intrusion into the passenger compartment. There was occupant contact evidence to the left instrument panel and driver's frontal air bag.

The case vehicle was equipped with bucket seats with adjustable head restraints in the front left and front right seating positions. The front left seat was adjusted between the forward most and middle track positions. The front right seat was adjusted to the middle track position. The rear of the vehicle was equipped with bench seats with no head restraints in all three seating positions.

Case Vehicle Occupant Protection Systems

The Nissan Sentra 4-door sedan was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units.

Figure 5. Interior, case vehicle. Driver's frontal air bag.

The front left air bag was housed in the steering wheel hub and was concealed by asymmetrical H-configuration cover flaps which were not damage in the crash. The circular air bag was equipped with two vent ports and no tether straps. Contact evidence consisting of blood was found on the lower half of the front of the air bag. The bag was not damaged.

The front right air bag was housed in the top-instrument panel position and was concealed by a single inverted D-shaped cover flap which was not damaged in the crash. The rectangular air bag was not equipped with vent ports or tether straps. No contact evidence was found on the air bag and the bag was not damaged.

Case Vehicle Occupant Demographics

Table 4. Case Vehicle Occupant(s) Demographics

	Occupant 1	
Age/Sex:	62/Female	
Seated Position:	Front left	
Seat Type:	Bucket - cloth covered	
Height (cm/in:):	157	62
Weight (kg/lbs).:	54	120
Pre-existing Medical Condition:	None noted	
Body Posture:	Normal - upright in seat facing forward	
Hand Position:	Both on steering wheel	
Foot Position:	On floor or foot controls	
Restraint Usage:	Manual lap & shoulder restraint	
Air bag:	Deployed redesigned air bag system	

Occupant Injuries

Table 5. Case Vehicle Occupant(s) Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Left upper extremity skin contusion	1	Belt restraint webbing
Inferior facial skin contusion	1	Driver's frontal air bag
Left facial skin contusion	1	Driver's frontal air bag
Central facial skin contusion	1	Driver's frontal air bag
Fractured nose	1	Driver's frontal air bag

Occupant Kinematics

The driver (case occupant) of the Nissan Sentra was seated in a normal upright posture in the front left position of the vehicle. She wearing the manual lap/shoulder restraint. Seat belt usage was determined through visual inspection by the researcher, the lack of prominent frontal contact evidence inside the vehicle, and observations by the investigating police officer at the scene of the crash. There was no indication of pre-impact avoidance maneuvers so the occupant should not have been out of position prior to impact.

Figure 6. Occupant contact, driver's frontal air bag.

At impact, the case occupant reacted to the 350 degree principle direction of force by moving forward and slightly left, loading the lap/shoulder restraint. As the restraint locked, further forward movement of the driver was prevented. Impact with the locked shoulder belt webbing caused the left upper extremity skin contusion. The case occupant also engaged the deploying driver's frontal air bag-causing the nose fracture and multiple facial skin contusions. A significant amount of blood was found on the lower half of the front of the bag (see Figure 6). The case occupant was transported by land to a trauma center where she was treated and released.

Scene Diagram