Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-74-139J)

1998 Nissan Altima

Nebraska

November/1998

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16. Abstract

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Nissan Altima four-door sedan. This two vehicle front to side crash occurred during the night time hours of a weekday in early November, 1998. There was a positive grade for Vehicle 1 (>2%) and a negative grade for Vehicle 2 (>2%). The concrete roadway surface was dry and lighted by the overhead luminaires that were operating at the time of the crash. This crash occurred within a four-leg intersection in a business oriented vicinity. The north and southbound legs are comprised of a divided five -lane roadway. The east and westbound adjoining roadway is a two lane undivided roadway. There is an overhead traffic signal that regulates the traffic flow and the posted speed limit is 56 km/h (35 mph). Vehicle 1, a 1998 Nissan Altima four-door sedan, was driven by a 20 year-old-male (175 cm//69 in., 113 kg/249 lbs.) who was wearing the available three-point manual lap and shoulder belt. The front, right seated position was occupied by a 21 year-old-male (175 cm/69 in., 68 kg/150 lbs.) who was also fully restrained by the available three-point manual lap and shoulder belt. Driver 1 was traveling northbound approaching the intersection with the intention of continuing northbound. Driver 1 was traveling at an undetermined rate of speed and the overhead traffic signal was reportedly in the green signal phase. Vehicle 2, a 1986 Toyota Camry four-door sedan was driven by fully restrained 16 year-old-male. The front right seat was occupied by a 14 year-old female, who also was fully restrained by the available three point lap and shoulder belt. A 15 year-old-female was situated in the second seat, left side position and a 17 year-old-male occupied the second seat, right side position. Both rear seated occupants were reportedly wearing the available lap belt restraints. Driver 2 was in the southbound, left turn lane and initiated a left turn sequence directly in front of Vehicle 1's lane of travel. Driver 2 also had a green signal, but did not yield to the oncoming northbound traffic. The frontal plane of Vehicle 1 (unknown CDC/ vehicle under repair) impacted the right side plane of Vehicle 2 (02RPEW3) in a “T”-type impact configuration. The calculated delta V was 36.6 km/h (22.7 mph) for Vehicle 1 with a longitudinal delta V of -36 km/h (22.3 mph) which was of sufficient force to deploy both frontal air bags. Vehicle 1 continued north and was deflected slightly to the right, before coming to rest adjacent to the northeast intersection quadrant. Vehicle 2 rotated approximately 103 degrees in a clockwise direction before impacting the base of the overhead traffic signal pole with its rear plane (07BCEW2). A delta V was calculated for the secondary rear plane impact to Vehicle 2 at 18.9 km/h (11.7 mph). Vehicle 2 came to rest with its rear plane against the pole and facing in a southwesterly direction. Neither of the occupants of Vehicle 1 were injured. The driver of Vehicle 2 was uninjured, however, the front, right seated occupant sustained a comminuted pelvis fracture (AIS-3) and a right rib fracture with pneumothorax (AIS-3) along with numerous soft tissue injuries. The occupant situated in the second seat, left side sustained an AIS-1 head injury along with a left hip contusion. The second seat, right side seated occupant sustained numerous serious head injuries including; a left cerebral contusion (AIS-3), an intracerebral hemorrhage (AIS-4) and was lethargic, stuporous and obtunded upon admission (AIS-4). He also sustained numerous soft tissue injuries.

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Summary

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Nissan Altima four-door sedan. This two vehicle front to side crash occurred during the night time hours of a weekday in early November, 1998. There was a positive grade for Vehicle 1 (>2%) and a negative grade for Vehicle 2 (>2%). The concrete roadway surface was dry and lighted by the overhead luminaires that were operating at the time of the crash. This crash occurred within a four-leg intersection in a business oriented vicinity. The north and southbound legs are comprised of a divided five -lane roadway. The east and westbound adjoining roadway is a two lane undivided roadway. There is an overhead traffic signal that regulates the traffic flow and the posted speed limit is 56 km/h (35 mph).

Vehicle 1, a 1998 Nissan Altima four-door sedan, was driven by a 20 year-old-male (175 cm//69 in., 113 kg/249 lbs.) who was wearing the available three-point manual lap and shoulder belt. The front, right seated position was occupied by a 21 year-old-male (175 cm/69 in., 68 kg/150 lbs.) who also was fully restrained by the available three-point manual lap and shoulder belt. Driver 1 was traveling northbound approaching the intersection with the intention of continuing northbound. Driver 1 was traveling at an undetermined rate of speed and the overhead traffic signal was reportedly in the green signal phase.

Vehicle 2, a 1986 Toyota Camry four-door sedan was driven by fully restrained 16 year-old-male. The front right seat was occupied by a 14 year-old female, who also was fully restrained by the available three point lap and shoulder belt. A 15 year-old-female was situated in the second seat, left side position and a 17 year-old-male occupied the second seat, right side position. Both rear seated occupants reportedly were wearing the available lap belt restraints. Driver 2 was in the southbound, left turn lane and initiated a left turn sequence directly in front of Vehicle 1's lane of travel. Driver 2 also had a green signal, but did not yield to the oncoming northbound traffic.

Figure 1. Pre-Impact Trajectory of Vehicle 1 and Point of Impact

Figure 2. Pre-Impact trajectory of Vehicle 2 and area of Initial Impact

Figure 3. Vehicle 1 Under Repair

Figure 4. Right Side Impact Damage to Vehicle 2

The frontal plane of Vehicle 1 (unknown CDC/ vehicle under repair) impacted the right side plane of Vehicle 2 (02RPEW3) in a "T"-type impact configuration. The calculated delta V was 36.6 km/h (22.7 mph) for Vehicle 1 with a longitudinal delta V of -36 km/h (22.3 mph)[1] which was of sufficient force to deploy both frontal air bags. Vehicle 1 continued north and was deflected slightly to the right, before coming to rest adjacent to the northeast intersection quadrant. Vehicle 2 rotated approximately 103 degrees in a clockwise direction before impacting the base of the overhead traffic signal pole with its rear plane (07BCEW2). A delta V was calculated for the secondary rear plane impact to Vehicle 2 at 18.9 km/h (11.7 mph)[2]. Vehicle 2 came to rest with its rear plane against the pole and facing in a southwesterly direction.

Figure 5. Impacted Traffic Signal Pole (Vehicle 2, Second Impact)

Figure 6. Impact Damage to Rear Plane of Vehicle 2

Neither of the occupants of Vehicle 1 were injured. The driver of Vehicle 2 was uninjured, however, the front, right seated occupant sustained a comminuted pelvis fracture (AIS-3) and a right rib fracture with pneumothorax (AIS-3) along with numerous soft tissue injuries. The occupant situated in the second seat, left side sust6ained an AIS-1 head injury along with a left hip contusion. The second seat, right side seated occupant sustained numerous serious head injuries including; a left cerebral contusion (AIS-3), an intracerebral hemorrhage (AIS-4) and was lethargic, stuporous and obtunded upon admission (AIS-4). He also sustained numerous soft tissue injuries.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	36.6	22.7	45.9	28.5
Longitudinal	-36.0	-22.4	-22.9	-14.2
Lateral	6.4	4	-39.7	-24.7

Table 2. Delta V (Secondary Barrier Impact/Vehicle 2)

	Vehicle 2	
	Km/h	mph
Total	18.9	11.7
Longitudinal	17.7	11.0
Lateral	6.5	4.0

[1] Calculated utilizing the Missing Algorithm of the WinSmash 1.2.1 program

[2] Calculated utilizing the Barrier mode of the WinSmash program

Exterior of Case Vehicle

Table 3. Vehicle Information

Model year, make and model	1998 Nissan Altima
VIN	1N4DL01D8WC
CDC	Unknown (Frontal Components removed / Vehicle Under Repair)

Figure 7. Vehicle 1 Under Repair

Figure 8. Right Side Impact Damage to Vehicle 2

Figure 9. Three-quarter View Showing Right Side Damage to Vehicle 2

Table 4. Crush Measurements (Vehicle 2)

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.
Right Side	211	5	27	46	62	44	2
	83.1	2	10.6	18.1	24.4	17.3	0.8

Table 4. Crush Measurements (Vehicle 2 / Impact 2)

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.
Rear Plane	133	0	5	25	15	6	0
	52.4	0	2	9.8	5.9	2.4	0

Interior of Case Vehicle

The interior of the Nissan Altima was void of damage due to occupant contacts. The laminated windshield and tempered side window glazing also was undamaged. The passenger compartment remained in its original pre-crash condition as there were no intruding components.

This vehicle is equipped with leather covered front bucket seats with adjustable head restraints (undamaged). The driver's and passenger seat were adjusted to their middle track positions.

Figure 10. Front, left view showing case vehicle interior

Case Vehicle Occupant Protection Systems

The 1998 Nissan Altima was equipped with the redesigned air bag systems. This system consists of two sensors (G sensor and safing sensor) that are located in the diagnosis sensor unit. The diagnosis sensor unit is centrally located in the front, center armrest/console area[3]. The diagnosis sensor unit is also equipped with an auxiliary power source condenser. The backup power feature is sufficient to deploy the air bags in the event that the battery or battery cables are damaged in a collision before the crash sensors are activated. An air bag indicator lamp is located in the front, left instrument panel.

Figure 11. Front, right view showing case vehicle interior

The driver's air bag is housed in the steering wheel hub and encases the nylon air bag unit. The double asymmetric, horizontal module cover flaps opened at their designated tear points and revealed no damage. The circular air bag is tethered by two straps and two exhaust vent ports. The lower instrument panel is equipped with a padded knee bolster. There were no detectable occupant contacts to either the knee bolster or the air bag nylon fabric.

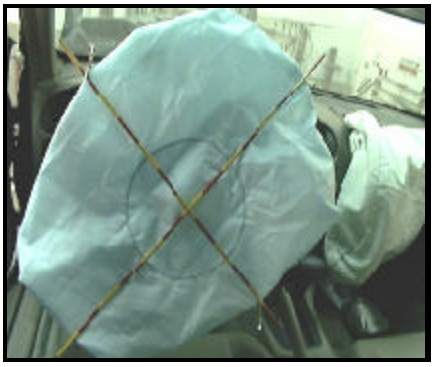


Figure 13. View showing deployed drivers air bag

Figure 14. View showing deployed passenger (front, right) air bag

The front, right passenger air bag is located on the instrument panel (top mount). The module deployment door is rectangular in shape and constructed with molded seam tear points which opened at the designated area. The non-tethered air bag was undamaged and was equipped with two exhaust vent port holes.

[3] Refer to the 1998 Nissan Altima Passive Restraint Systems and Wiring Mapping Views

Case Vehicle Occupant Demographics

	Occupant 1	Occupant 2
Age/Sex:	20/Male	21/Male
Seated Position:	Front Left	Front Right
Seat Type:	Bucket, Leather covered	Bucket, Leather covered
Height (cm/in:):	175 68.9	175 68.9
Weight (kg/lbs).:	113 249.1	68 149.9
Pre-existing Medical Condition:	None Reported	None Reported
Body Posture:	Normal Posture	Normal Posture
Hand Position:	At least one hand on steering wheel rim, position unknown	Unknown
Foot Position:	Right foot on accelerator pedal, left foot on floor panel	Both feet on floor panel
Restraint Usage:	Active, three-point lap and shoulder belt	Active, three-point lap and shoulder belt
Air bag:	Driver air bag deployed as a result of the frontal impact	Passenger air bag deployed as a result of the frontal impact

Occupant Injuries

Neither the driver or the front, right seated occupant were injured in the crash.

Occupant Kinematics

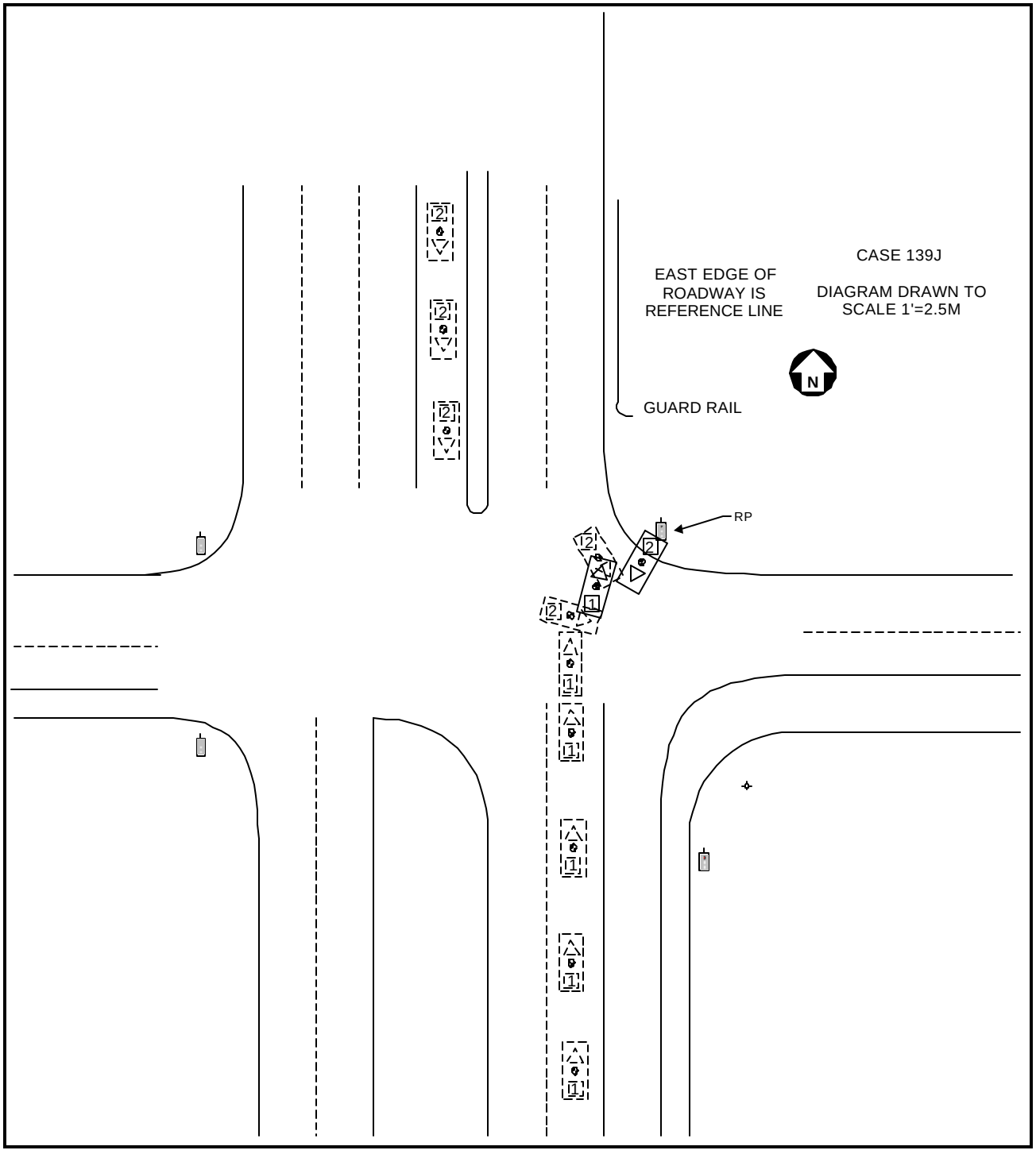
The 20 year-old-male driver of the 1998 Nissan Altima was fully restrained by the available three-point manual lap and shoulder belt. He reportedly was in an upright position (exact posture unknown). The driver was traveling at an unknown rate of speed with at least one hand on the steering wheel rim and his right foot was on the accelerator pedal.

He responded to the frontal impact by moving forward and slightly to his left. He loaded the applied lap and shoulder belt webbing which prohibited extended forward motion of his upper and lower torso. His head and chest probably came into contact with the deploying air bag, however, there was no contact evidence on the bag fabric to support this. The driver rebounded into the seatback support where he came to rest. Driver 1 was uninjured in the crash and exited the case vehicle unassisted.

The 21 year-old-male front, right seated passenger was also wearing the available three-point manual lap and shoulder belt. He was reportedly in an upright seated position and the seatback support was in the slightly reclined position.

Occupant 2 responded to the frontal impact by moving forward and slightly to his left. The applied lap and shoulder belt secured his upper and lower torsos from extended forward movement. It is suspected that his chest and face came into contact with the deploying air bag, however, the passenger bag fabric was void of occupant contact evidence. He rebounded back into the seat back support where he came to rest in his respective seated position. The front, right seated passenger also exited the vehicle unassisted. He was transported to a hospital and checked thoroughly for injuries. Occupant 2 was also uninjured as a result of the crash.

Scene Diagram



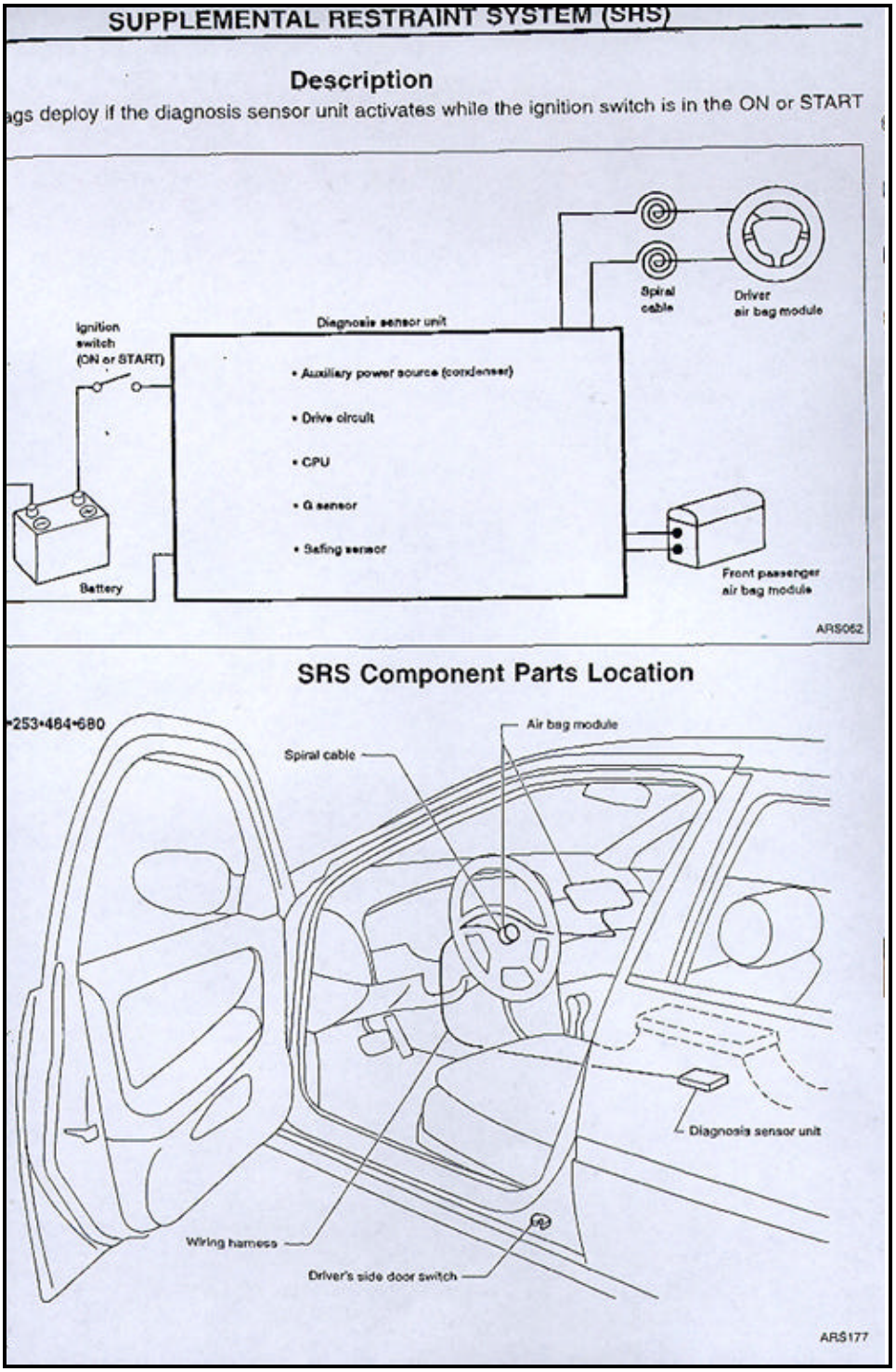


Figure 15. SRS component location

Diagnosis Sensor Unit

TION:

efore servicing SRS, turn the ignition switch OFF, disconnect both battery cables and v least 3 minutes.

he special bolts are coated with bonding agent while the other bolt is for ground. Do not u d bolts after removal; replace with new coated bolts.

heck diagnosis sensor unit for proper installation.

heck diagnosis sensor unit to ensure no deformities, dents, cracks or rust. If there are a sible signs of damage, replace with a new one.

heck diagnosis sensor unit brackets to ensure they are free of deformities and rust.

eplace diagnosis sensor unit if it has been dropped or sustained an impact.

OVAL AND INSTALLATION

sconnect driver and passenger air bag module connectors.

emove console box. Refer to BT section ("INSTRUMENT PANEL").

sconnect diagnosis sensor unit connector.

emove bolts from diagnosis sensor unit. Use TAMPER RESISTANT TORX (Size T50) to remo ecial bolts.

emove the diagnosis sensor unit.

:

install, reverse the removal procedure.

ter replacement, perform self-diagnosis for SRS. Refer to "TROUBLE DIAGNOSES pplemental Restraint System (SRS)", "SRS Operation Check" RS-30.

TION:

osis sensor unit must always be installed with arrow mark "◊" pointing towards the fro vehicle for proper operation. Also check diagnosis sensor unit for cracks, deformities a efore installation and replace as required.

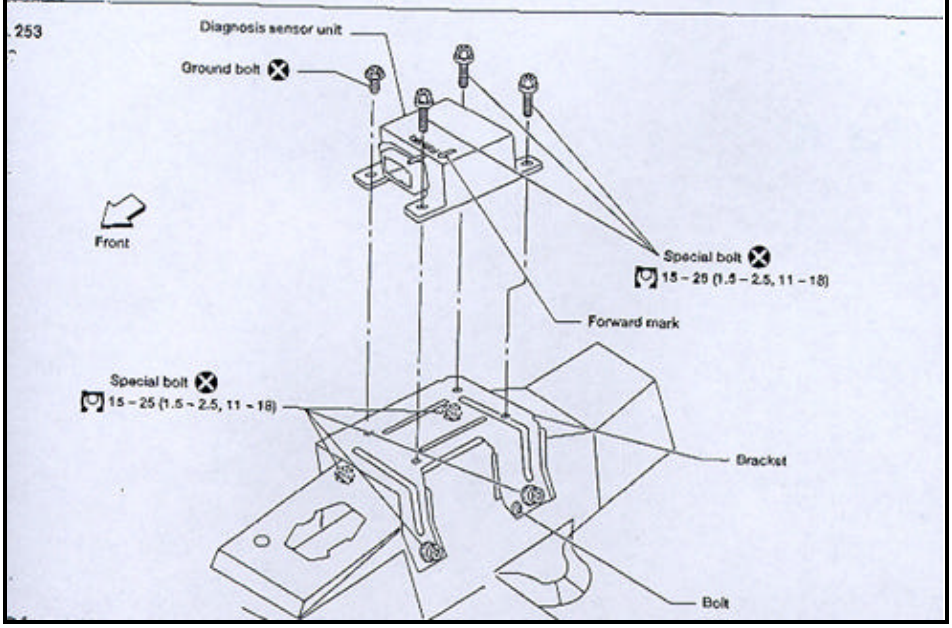


Figure 16. Diagnostic sensor unit