

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-76-098D)

1998 Nissan Frontier

Arizona

December/1998

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16. Abstract This remote investigation was focused on the redesigned air bag system deployment of a 1998 Nissan Frontier pickup truck. This two vehicle front to rear axial collision occurred during the early afternoon hours of a winter weekday in December, 1998. Both of the involved vehicles were traveling westbound in lane 2 of the divided five lane roadway. The bituminous roadway surface was dry and the two westbound travel lanes had a negative downhill grade (>2%). There are three eastbound travel lanes that had a positive (>2%) grade and included a designated left turn only lane. A raised, curbed median separates the eastbound travel lanes from the westbound travel lanes. Vehicle 2, a 1998 Nissan Frontier King Cab pickup truck, was driven by an 18 year-old-female (163 cm/ 64 in., 52 kg/115 lbs.) who was wearing the available three-point manual lap and shoulder restraint. Driver 2 was traveling westbound in lane 2 at a driver reported speed of 48 km/h (30 mph). Vehicle 1 was traveling in front of the Nissan Frontier and had suddenly decelerated. Vehicle 1, a 1986 Ford Thunderbird two-door coupe was being driven by a 47 year-old-female who was secured by the available three-point lap and shoulder belt. The front, right seated position was occupied by an 18 year-old-female who was reportedly wearing the three-point manual lap and shoulder belt. The driver of Vehicle 1 had slowed down to talk to a friend that was stopped in the eastbound, left turn lane. Driver 2 detected the sudden deceleration of Vehicle 1 and applied the brakes while steering to the right. Vehicle 2 initiated a longitudinal skid pattern as its frontal plane (12FYEW3) impacted the rear plane (06BZEW5) of Vehicle 1 in an offset front to rear impact configuration. The calculated delta V was 45 km/h (28 mph) for Vehicle 1 with a longitudinal delta V of -45 km/h (28 mph) which was of a sufficient change in velocity to deploy the frontal air bags. Vehicle 2 underwent a calculated delta V of 40 km/h (25 mph). Vehicle 1 was thrust forward as it traversed lane 1 and departed the north road edge line coming to rest straddling the north curb which borders the roadway. Vehicle 1 was facing northwest at final rest. Vehicle 2 (Nissan) rotated counterclockwise, coming to rest straddling lane 1 and lane 2. Vehicle 2 was facing southwest at final rest. The driver of Vehicle 1 sustained bilateral forearm contusions, a left knee contusion, right ankle contusion and a cervical neck strain (AIS-1 injuries). The front, right seated passenger of Vehicle 1 sustained a left shin contusion and a cervical strain (AIS-1). The driver of Vehicle 2 (1998 Nissan Frontier) sustained 1 st degree burns to her left forearm and elbow (AIS-1). There were also burns noted to her left hand (volar aspect) and distal fingers. She also sustained an upper left extremity abrasion (AIS-1) and a laceration to her left wrist. (AIS-1). Her thermal burns, abrasion and wrist laceration were all air bag related.					
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Summary

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Nissan Frontier pickup truck. This two vehicle front to rear axial collision occurred during the early afternoon hours of a winter weekday in December, 1998. Both of the involved vehicles were traveling westbound in lane 2 of the divided five lane roadway. The bituminous roadway surface was dry and the two westbound travel lanes had a negative downhill grade (>2%). There are three eastbound travel lanes that had a positive (>2%) grade and included a designated left turn only lane. A raised, curbed median separates the eastbound travel lanes from the westbound travel lanes.

Vehicle 2, a 1998 Nissan Frontier King Cab pickup truck, was driven by an 18 year-old-female (163 cm/ 64 in., 52 kg/115 lbs.) who was wearing the available three-point manual lap and shoulder restraint. Driver 2 was traveling westbound in lane 2 at a driver reported speed of 48 km/h (30 mph). Vehicle 1 was traveling in front of the Nissan Frontier and had suddenly decelerated.

Vehicle 1, a 1986 Ford Thunderbird two-door coupe was being driven by a 47 year-old-female who was secured by the available three-point lap and shoulder belt. The front, right seated position was occupied by an 18 year-old-female who was reportedly wearing the three-point manual lap and shoulder belt. The driver of Vehicle 1 had slowed down to talk to a friend that was stopped in the eastbound, left turn lane.



Figure 1. Pre-impact trajectory of both Vehicle 1 and Vehicle 2



Figure 2. View showing pre-impact skidding from Vehicle 2



Figure 3. Point of impact and final rest of Vehicle 2



Figure 4. Frontal deformation to Vehicle 2 (1998 Nissan Frontier)

Driver 2 detected the sudden deceleration of Vehicle 1 and applied the brakes while steering to the right. Vehicle 2 initiated a longitudinal skid pattern as its frontal plane (12FYEW3) impacted the rear plane (06BZEW5) of Vehicle 1 in an offset front to rear impact configuration. The calculated delta V was 45 km/h (28 mph)¹ for Vehicle 1 with a longitudinal delta V of -45 km/h (28 mph) which was of a sufficient change in velocity to deploy the frontal air bags. Vehicle 2 underwent a calculated delta V of 40 km/h (25 mph).



Figure 5. View showing damaged rear plane to Vehicle 1 (1986 Ford Thunderbird)

Vehicle 1 was thrust forward as it traversed lane 1 and departed the north road edge line coming to rest straddling the north curb which borders the roadway. Vehicle 1 was facing northwest at final rest. Vehicle 2 (Nissan) rotated counterclockwise, coming to rest straddling lane 1 and lane 2. Vehicle 2 was facing southwest at final rest. The driver of Vehicle 1 sustained bilateral forearm contusions, a left knee contusion, right ankle contusion and a cervical neck strain (AIS-1 injuries). The front, right seated passenger of Vehicle 1 sustained a left shin contusion and a cervical strain (AIS-1). The driver of Vehicle 2 (1998 Nissan Frontier) sustained 1st degree burns to her left forearm and elbow (AIS-1). There were also burns noted to her left hand (volar aspect) and distal fingers. She also sustained an upper left extremity abrasion (AIS-1) and a laceration to her left wrist. (AIS-1). Her thermal burns, abrasion, and wrist laceration were all air bag related.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	45	28	40	24.9
Longitudinal	-45	-28	40	24.9
Lateral	0	0	7	4.3

Exterior of Case Vehicle

Table 3. Vehicle Information

Model year, make and model	1998 Nissan Frontier
VIN	1N6DD26SXWC
CDC	12FYEW3

¹ Calculated using the Damage Only mode of the WinSmash 1.2.1 program



Figure 6. View showing frontal deformation to Vehicle 2



Figure 7. Perpendicular view showing frontal crush to Vehicle 2

Table 4. 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.
Front Bumper	140	61	49	35	18	2	0
	55.1	24	19.3	13.8	7.1	0.8	0

Interior of Case Vehicle

The interior of the Nissan Frontier King Cab Pickup was void of interior deformation due to intrusion or occupant contacts. There was a slight lipstick transfer noted to the driver's air bag (nylon fabric surface). The vehicle maintained its integrity as the vehicle glazing was undamaged and the doors remained closed and operational. The case vehicle is equipped with front bucket seats with folding backs and two second row seats that face inward, laterally mounted. The front seat backs are equipped with adjustable head restraints that were undamaged. Both front seats were adjusted to the middle track position.



Figure 8. View showing deployed driver's air bag and lipstick transfer

Case Vehicle Occupant Protection Systems

The 1998 Nissan Frontier King Cab pickup truck, was equipped with redesigned air bag systems. This system consists of three sensors. The front crash zone sensor is located under the hood at the mid-upper radiator support². The G sensor and safing sensor are located in the diagnosis sensor unit. The air bag diagnosis sensor unit is located in the center of the vehicle, concealed within the transmission tunnel/center console. 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. This system is offered with the passenger air bag deactivation switch which is located in the middle/lower instrument panel, immediately above the transmission tunnel. An air bag indicator lamp is located in the front, left instrument panel.

The driver's air bag is housed in the steering wheel hub and encases the nylon air bag unit. The double symmetric, horizontal module cover flaps opened at their designated tear points and were undamaged. The circular air bag is tethered by two straps and two exhaust vent port holes are present. The lower instrument panel is shrouded by a rigid plastic knee bolster. The knee bolster did not reveal any detectable areas of occupant contact. There was an obvious lipstick transfer to the upper, right quadrant of the nylon air bag fabric.

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

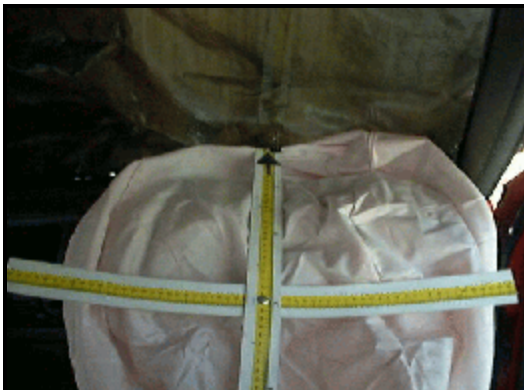


Figure 9. View showing deployed passenger air bag (upper half)



Figure 10. View showing deployed passenger air bag (lower half)

² Refer to the 1998 Nissan Frontier King Cab Passive Restraint Systems and Wiring Mapping Views

Case Vehicle Occupant Demographics

Occupant 1

Age/Sex: 18/Female

Seated Position: Front, Left

Seat Type: Bucket with folding backs, fabric covered

Height (cm/in.): 163 64.17

Weight (kg/lbs.): 52 114.6

Pre-existing Medical Condition: None Reported

Body Posture: Normal Posture

Hand Position: Both hands on steering wheel rim, exact o'clock position is unknown

Foot Position: Right foot on brake pedal, left foot on floor panel

Restraint Usage: Active, three-point lap and shoulder belt reportedly worn properly with the shoulder belt over the shoulder and lap belt low on lap.

Air bag: Driver air bag deployed as a result of the frontal impact

Occupant Injuries

Table 5. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Left, upper extremity 1 st degree burn to elbow, hand and distal fingers	1	Air bag exhaust gases
Upper left extremity abrasion	1	Air bag
Left wrist laceration	1	Air bag and jewelry bracelet

Occupant Kinematics

The 18 year-old-female driver of the 1998 Nissan Frontier King Cab pickup truck was fully restrained by the available three-point manual lap and shoulder belt. She was reportedly in an upright position and facing forward with both hands on the steering wheel rim (unknown location). Her right foot was depressing the brake pedal and her left foot was on the floor panel.

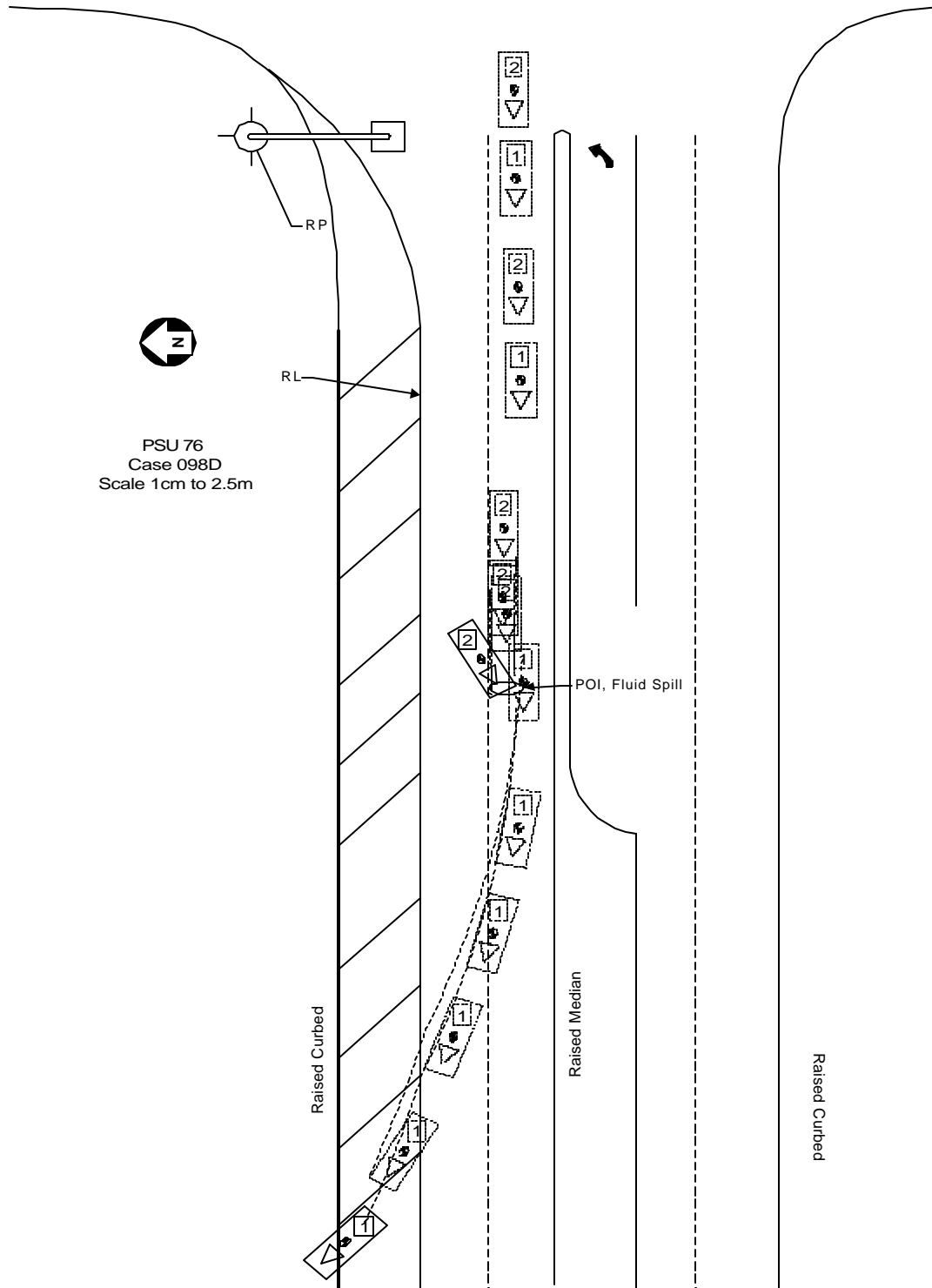
She responded to the 12 o'clock direction of force by moving directly forward. Her lower torso was prohibited from extended forward motion as her upper torso loaded the applied shoulder belt webbing. Her head extended forward and pitched downward, fully contacting the deploying drivers air bag. This contact was evidenced by an obvious lipstick transfer located to the upper right air bag quadrant. As a result of her contact with the air bag, she sustained an abrasion to her upper left extremity (AIS-1) and 1st degree burns to her lefty elbow, wrist and distal left fingers (AIS-1). She reportedly was wearing a bracelet that was contacted by the deploying air bag that resulted in a superficial laceration to her left wrist (AIS-1).



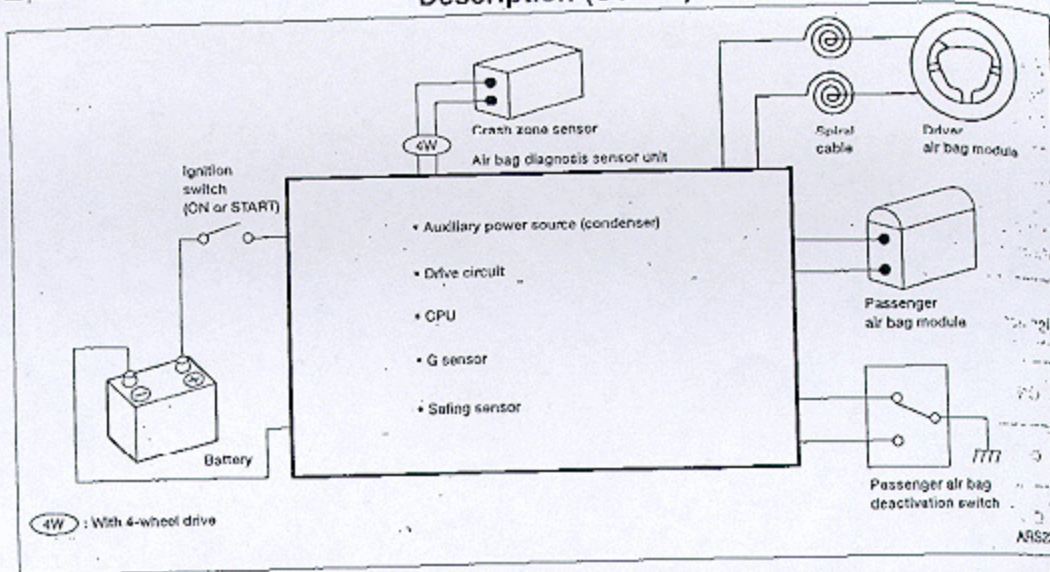
Figure 11. View showing deployed driver's air bag with lipstick transfer to upper right quadrant

The driver of the Nissan Frontier rebounded directly rearward into the seat back support. This contact did not result in further injury. As the vehicle rotated in a post-crash counterclockwise direction, the driver was not significantly displaced and was maintained within her respective seated position.

Scene Diagram

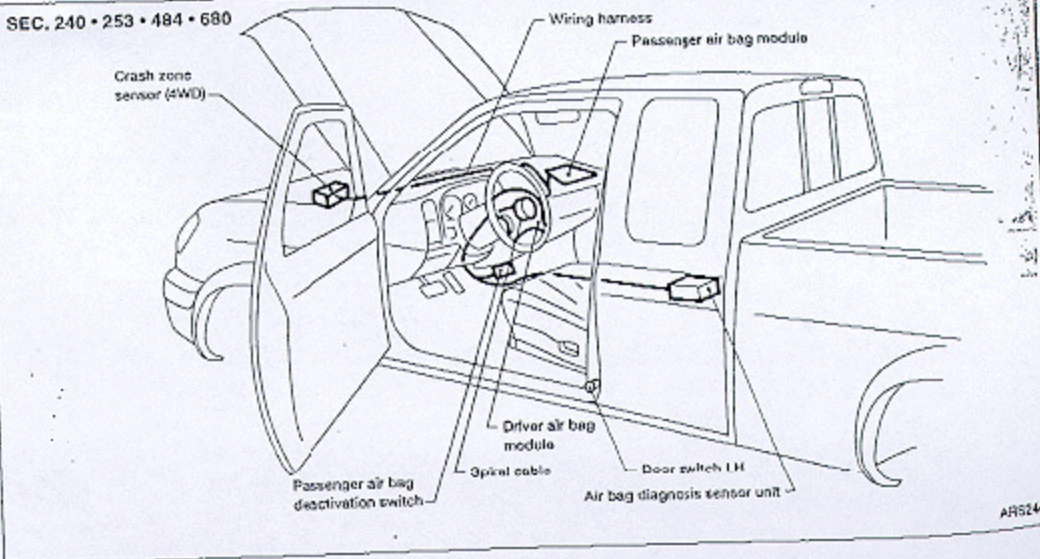


Description (Cont'd)



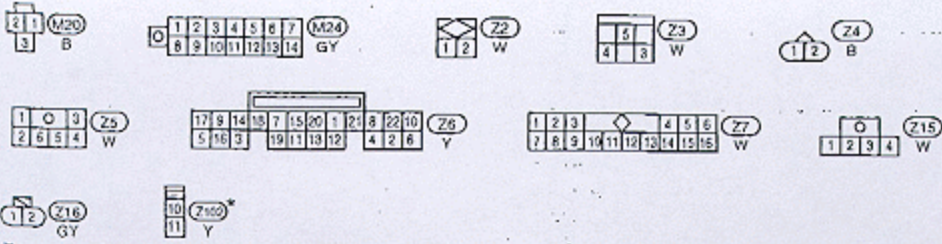
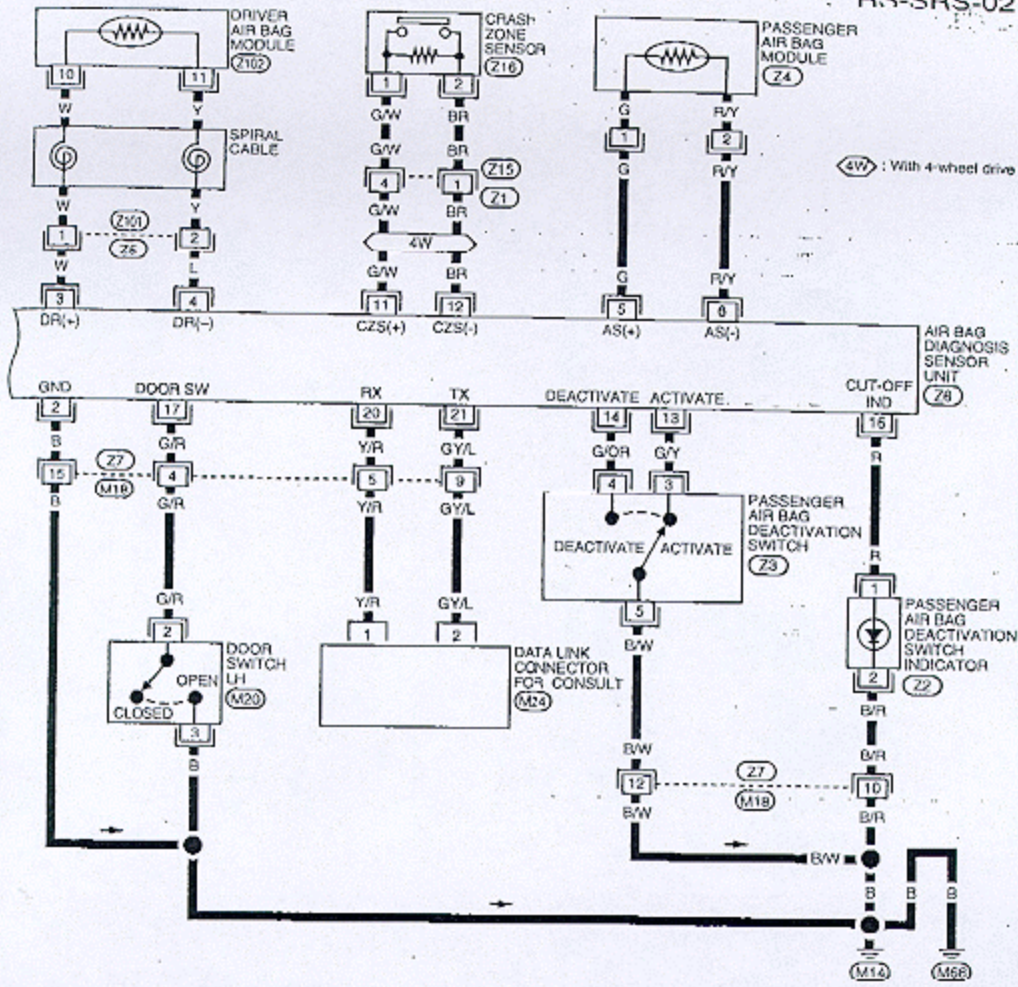
SRS Component Parts Location

SEC. 240 • 253 • 484 • 680



Wiring Diagram -SRS- (Cont'd)

RS-SRS-02



* This connector is not shown in "HARNESS LAYOUT" of EL section.