

Remote, Redesigned Air Bag Special Study
Dynamic Science, Inc., Case Number (1998-48-117J)
1998 Mazda B2500 Pickup Truck
Alabama
November/1998

Technical Report Documentation Page

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16. Abstract This remote investigation was focused on the redesigned air bag system deployment of a 1998 Mazda B2500 Cab Plus pickup truck. This was a two vehicle crash that occurred during a Fall, Sunday afternoon in November, 1998. The weather was clear and the bituminous roadway surface was dry. This crash occurred within a four-leg intersection in a shopping/business area. The north and southbound legs are comprised of an undivided two-lane roadway. The east and westbound legs also consist of a two-lane undivided roadway. Each leg of the intersection is controlled by posted stop signs and the posted speed limit is 56 km/h (35 mph). Vehicle 1, a 1997 Buick LeSabre, four-door sedan was driven by a 70-year-old female who reportedly was wearing the available three-point manual lap and shoulder belt. The front, right seated position was occupied by a fully restrained 83-year-old female. The second seat, left side was occupied by a 63-year-old female who also was wearing the available three-point manual lap and shoulder belt. A 73-year-old female was positioned in the second seat, right side and was wearing the available three-point manual lap and shoulder belt. Driver 1 was approaching the intersection at an undetermined rate of speed and apparently entered the intersection without stopping for the posted stop sign. Vehicle 2 (case vehicle), a 1998 Mazda B2500 extended cab pickup truck was being driven by a 22-year-old male (180 cm/ 71 in., 82 kg/181 lbs.), who reportedly was wearing the available three-point manual lap and shoulder belt. The front, right seated position was occupied by an unknown occupant who police reported to be fully restrained by the available three-point manual lap and shoulder belt. A child was secured in a child safety seat that was positioned in the side facing seat located in the second seat, right side. There were no reported injuries in the case vehicle. The driver of Vehicle 2 stopped at the intersection and initiated a left turn directly in the path of Vehicle 1. The front bumper of Vehicle 1 (12FDEW2) impacted the front, left bumper region of Vehicle 2 (01FZEW2) in an obtuse angle head-on impact configuration. The calculated total delta V for Vehicle 1 was 21.3 km/h (13.2 mph) while Vehicle 2 (Mazda pickup) underwent a total delta V of 23.2 km/h (14.4 mph) with a longitudinal delta V of -21.8 km/h (-13.5 mph) which proved to be of sufficient force to deploy the redesigned frontal air bags. The frontal air bags in Vehicle 1 also deployed as a result of the impact. Vehicle 1 rotated approximately 17 degrees in a clockwise direction before coming to rest facing southwest. Vehicle 2 was deflected to the left and rotated approximately 77 degrees counterclockwise coming to rest adjacent to the southwest intersection quadrant. Vehicle 2 was facing west at final rest. The driver of Vehicle 1 sustained a left forearm abrasion due to her interaction with the deploying air bag. The front, right seated passenger sustained a chest contusion and bilateral hip contusions (AIS-1) due to loading the lap and shoulder belt webbing. She also sustained bilateral knee contusions (AIS-1) due to contacting the instrument panel/knee bolster. The occupant in the second seat, left side was uninjured while the occupant positioned in the second seat, right side sustained a fractured sternum (AIS-2) due to loading the shoulder belt webbing and a cervical C6 fracture due to rebounding into the seatback support. The occupants in the case vehicle (Vehicle 2) were reportedly uninjured. The two front seated occupants and the second seat, right side seated occupant of Vehicle 1 were transported to a local hospital where they were treated for their injuries.					
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Summary

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Mazda B2500 Cab Plus pickup truck. This was a two vehicle crash that occurred during a Fall, Sunday afternoon in November, 1998. The weather was clear and the bituminous roadway surface was dry. This crash occurred within a four-leg intersection in a shopping/business area. The north and southbound legs are comprised of an undivided two-lane roadway. The east and westbound legs also consist of a two-lane undivided roadway. Each leg of the intersection is controlled by posted stop signs and the posted speed limit is 56 km/h (35 mph).

Vehicle 1, a 1997 Buick LeSabre, four-door sedan was driven by a 70-year-old female who reportedly was wearing the available three-point manual lap and shoulder belt. The front, right seated position was occupied by a fully restrained 83-year-old female. The second seat, left side was occupied by a 63-year-old female who also was wearing the available three-point manual lap and shoulder belt. A 73-year-old female was positioned in the second seat, right side and was wearing the available three-point lap and shoulder belt.

Driver 1 was approaching the intersection at an undetermined rate of speed and apparently entered the intersection without stopping for the posted stop sign.

Vehicle 2 (case vehicle), a 1998 Mazda B2500 extended cab pickup truck was being driven by a 22-year-old male (180cm/71 in., 82 kg/181 lbs.), who reportedly was wearing the available three-point manual lap and shoulder belt. The front, right seated position was occupied by an unknown occupant who police reported to be fully restrained by the available three-point manual lap and shoulder belt. A child was secured in a child safety seat that was positioned in the side facing seat located in the second seat, right side. There were no reported injuries in the case vehicle.



Figure 1. Pre-impact trajectory of Vehicle 1



Figure 2. Pre-impact trajectory of Vehicle 2. Point of Impact / intersection



Figure 3. Frontal Damage to Vehicle 1



Figure 4. Front right corner Damage to Vehicle 2

The driver of Vehicle 2 stopped at the intersection and initiated a left turn directly in the path of Vehicle 1. The front bumper of Vehicle 1 (12FDEW2) impacted the front, left bumper region of Vehicle 2 (01FZEW2) in an obtuse angle head-on impact configuration. The calculated total delta V for Vehicle 1 was 21.3 km/h (13.2 mph) while Vehicle 2 (Mazda pickup) underwent a total delta V of 23.2 km/h (14.4 mph) with a longitudinal delta V of -21.8 km/h (-13.5 mph)¹ which proved to be of sufficient force to deploy the redesigned frontal air bags. The frontal air bags in Vehicle 1 also deployed as a result of the impact.

Vehicle 1 rotated approximately 17 degrees in a clockwise direction before coming to rest facing southwest. Vehicle 2 was deflected to the left and rotated approximately 77 degrees counterclockwise coming to rest adjacent to the southwest intersection quadrant. Vehicle 2 was facing west at final rest. The driver of Vehicle 1 sustained a left forearm abrasion due to her interaction with the deploying air bag. The front, right seated passenger sustained a chest contusion and bilateral hip contusions (AIS-1) due to loading the lap and shoulder belt webbing. She also sustained bilateral knee contusions (AIS-1) due to contacting the instrument panel/knee bolster. The occupant in the second seat, left side was uninjured while the occupant positioned in the second seat, right side sustained a fractured sternum (AIS-2) due to loading the shoulder belt webbing and a cervical C6 fracture due to rebounding into the seatback support. The occupants in the case vehicle (Vehicle 2) were reportedly uninjured. The two front seated occupants and the second seat, right side seated occupant of Vehicle 1 were transported to a local hospital where they were treated for their injuries.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	23	14.3	21	13
Longitudinal	-22	-13.7	-21	-13
Lateral	-8	-5	4	2.5

¹ Calculated using WinSmash 1.2.1 Damage Only Routine

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Mazda B2500 Pickup Truck
VIN	4F4YR16C9WT
CDC	01FZEW2 ²



Figure 5. Exterior, Vehicle 1 (1997 Buick LeSabre)



Figure 6. Exterior, Vehicle 2 (case vehicle-1998 Mazda B2500 pickup)



Figure 7. Close-up view showing right front bumper impact to case vehicle

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.
Front Bumper	144	4	4	6	9	12	24
	56.7	1.6	1.6	2.4	3.5	4.7	9.4

²SCI revised extent zone based on coded maximum crush

Interior of Case Vehicle

The interior of the Mazda B2500 pickup truck sustained minor damage due to occupant contacts. The occupant compartment maintained its integrity and there were no intruding components due to the frontal impact. The laminated windshield glazing was cracked due to the drivers right hand loading the rear view mirror. The mirror corner subsequently impacted and cracked the windshield due to this contact. There was a permanent scuff mark noted to the lower instrument panel/knee bolster and the floor mounted transmission selector knob was scuffed due to contact.

This vehicle was equipped with a split bench seat with folding back(s). The drivers seat was adjusted between the middle and rear-most position while the front, right seat was adjusted at the middle track position. The front split bench seat is equipped with integral head restraints which were not damaged during the impact. There are two side facing seats (inward) located in the second row, behind the front seatback.

Case Vehicle Occupant Protection Systems

The Mazda B2500 pickup truck was equipped with the redesigned air bag systems which consisted of two frontal primary crash sensors which are mounted to the upper radiator support frame (inboard of the front headlights)³. The air bag diagnostic module is centrally located in the lower instrument panel. An air bag warning lamp is located in is located in the front, left mid-instrument panel area. There is an air bag module located in the front left (steering wheel hub) and front right instrument panel (mid mount) which house the air bags and inflator units. The front seats are equipped with active three-point lap and shoulder restraints with adjustable height anchorage adjustments.



Figure 8. Interior of case vehicle through open drivers door



Figure 9. Interior of case vehicle through open passenger side door



Figure 10. View showing drivers position and air bag

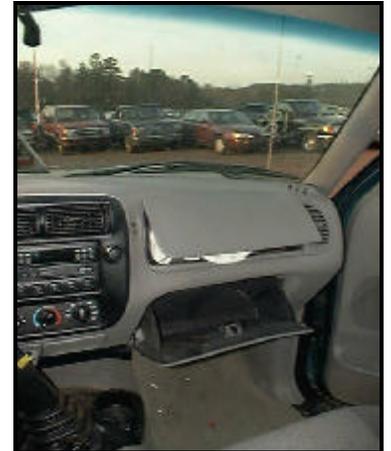


Figure 11. View showing front, right of case vehicle and passenger air bag module

³ Refer to the attached Air Bag Mapping Location Views

The front, left drivers air bag was housed in the steering wheel hub and was concealed by symmetrical double horizontal module cover flaps. The circular air bag was tethered two straps, and was equipped with two exhaust vent port holes. The lower instrument panel is equipped with a rigid plastic knee bolster. There was a scuff mark noted to the lower left knee bolster and there were blood fluid transfers noted to the lower right quadrant of the air bag.



Figure 12. View showing deployed drivers air bag



Figure 13. Close-up view showing blood stain on drivers air bag

The front, right air bag was located at the mid-instrument panel level. The module cover flap is hinged at the top and is rectangular in shape. The module cover, apparently did not contact the windshield during deployment. There was no residual damage to the air bag or the single module cover flap. The air bag fabric was devoid of any detectable areas of occupant contact. The adult passenger in this seated position, reportedly was uninjured.



Figure 14. View showing deployed drivers air bag

Case Vehicle Occupant Demographics

	Occupant 1	Occupant 2	Occupant 3
Age/Sex:	22/Male	Unknown	Unknown
Seated Position:	Front Left	Front Right	Second Row Right Side
Seat Type:	Split bench with folding back(s)-cloth covered	Split bench with folding back(s)-cloth covered	Side facing (inward) bucket style seat with folding seat cushion
Height (cm/in):	180 70.87	Unk.	Unk.
Weight (kg/lbs):	82 180.8	Unk.	Unk.
Pre-existing Medical Condition:	None Reported	None Reported	None Reported
Body Posture:	Unknown	Unknown	Unknown
Hand Position:	At least one hand on steering wheel rim-unknown position	Unknown	Unknown
Foot Position:	Right foot on accelerator pedal and left foot on floor panel	Unknown	Unknown
Restraint Usage:	Active, three-point lap and shoulder belt	Active, three-point lap and shoulder belt	Child Restraint Seat/ Unknown how it was anchored
Air bag:	Driver air bag deployed as a result of the frontal impact	Passenger air bag deployed as a result of the frontal impact	None

Occupant Injuries

Table 4. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
(Occupant #1) None	None	None
(Occupant #2) None	None	None
(Occupant #3) None		

Occupant Kinematics

The 22-year-old male driver of the Mazda B2500 pickup truck was fully restrained and situated in the front, left position. His exact posture was unknown, however, based on his occupant contact points he was presumably in an upright position and probably facing forward.

The driver responded to the 20 degree impact force by moving forward and slightly to the right. His left knee contacted the knee bolster (refer to **Figure 16**) and his right knee contacted the floor mounted transmission selector knob as he loaded the lap belt webbing which prohibited extended forward motion of his lower torso and extremities. His upper torso moved forward, loading the shoulder belt webbing at about the time of air bag deployment. As the air bag deployed, it would appear that both hands flailed upward. His right hand contacted the rearview mirror which subsequently broke the laminated windshield. His left hand contacted the upper A-pillar resulting in a reported body fluid transfer. He rebounded back into the seat back support, remaining in his respective seated position. He reportedly was uninjured.

The front, right seated occupant (unknown sex, age or height and weight) responded to the 1 o'clock direction of force by moving forward and slightly to the right. This person loaded the applied lap and shoulder belt and the deploying passenger air bag. The components in and around this seated position were completely void of any occupant contacts and the occupant reportedly was uninjured.

The police reported that a child was situated in the second row, right side facing seat (inward facing). The child was reported to be secured in a child safety seat (unknown make and model) and was not injured in the crash. It is unknown how the child safety seat was anchored in the vehicle.



Figure 16. Drivers seated position and contacts



Figure 15. Drivers left knee contact to knee bolster

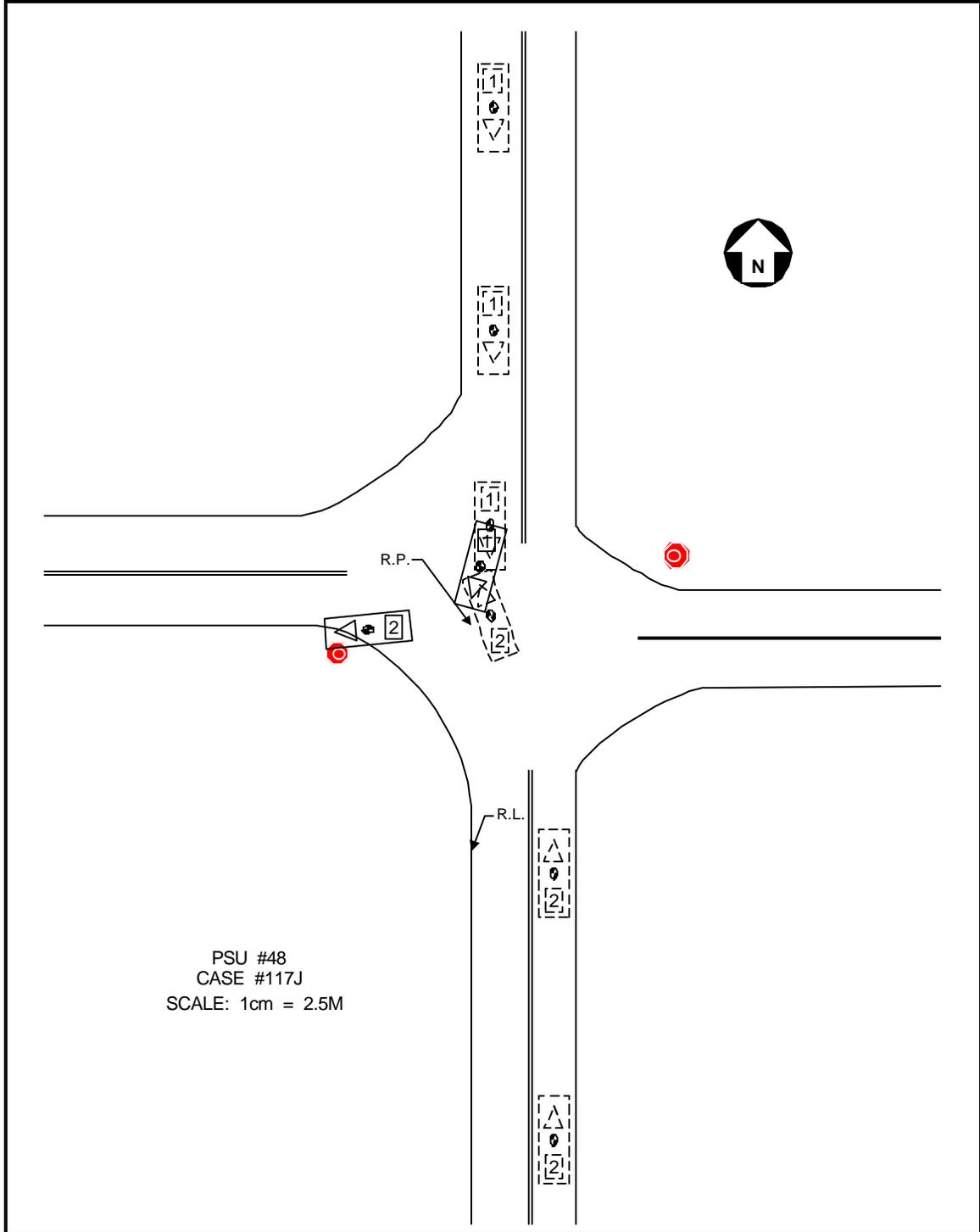


Figure 17. Driver deployed air bag and contact point



Figure 18. Deployed front, right passenger air bag

Scene Diagram



4.0L ENGINE SHOWN. SEE SECTION D FOR 3.0L AND 2.3L ENGINE COMPARTMENT VIEWS.

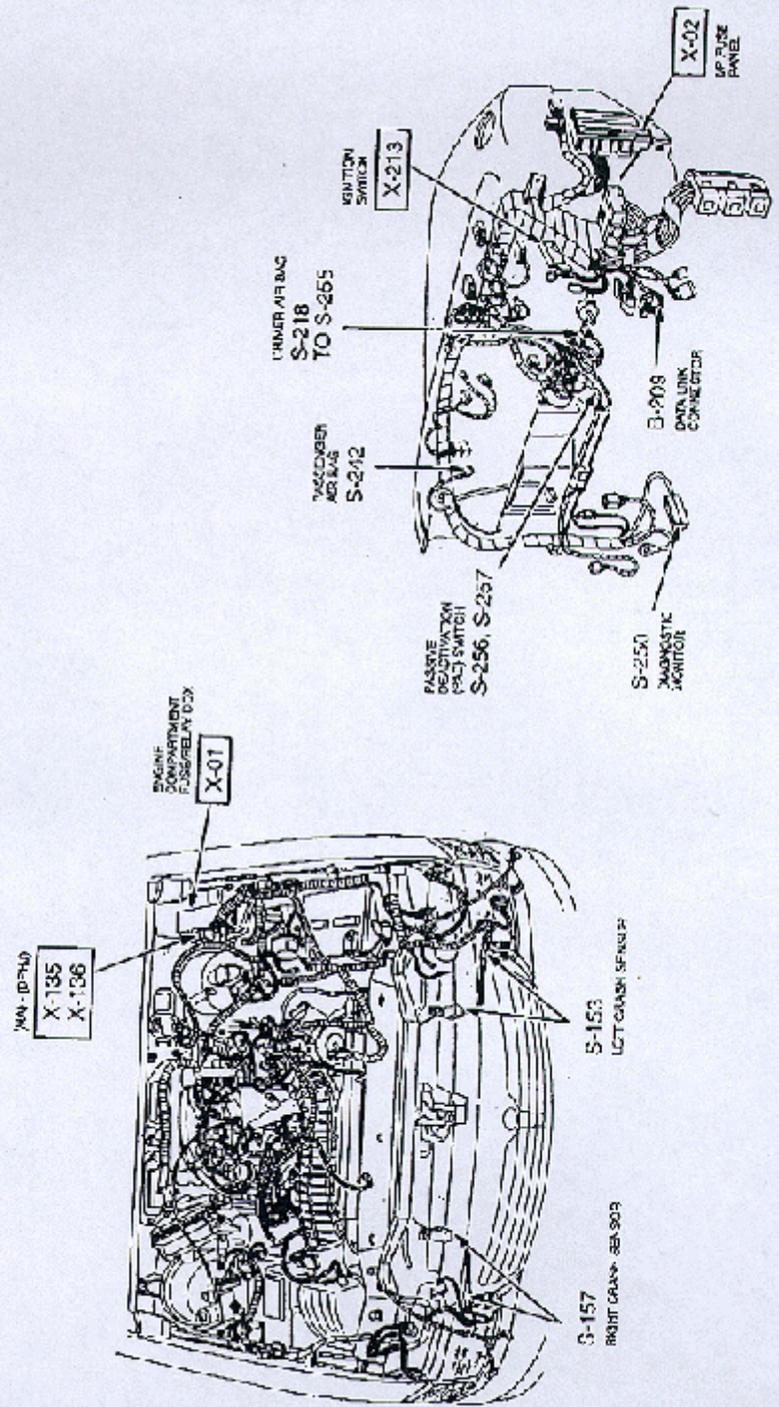


Figure 20. Air bag wiring diagram

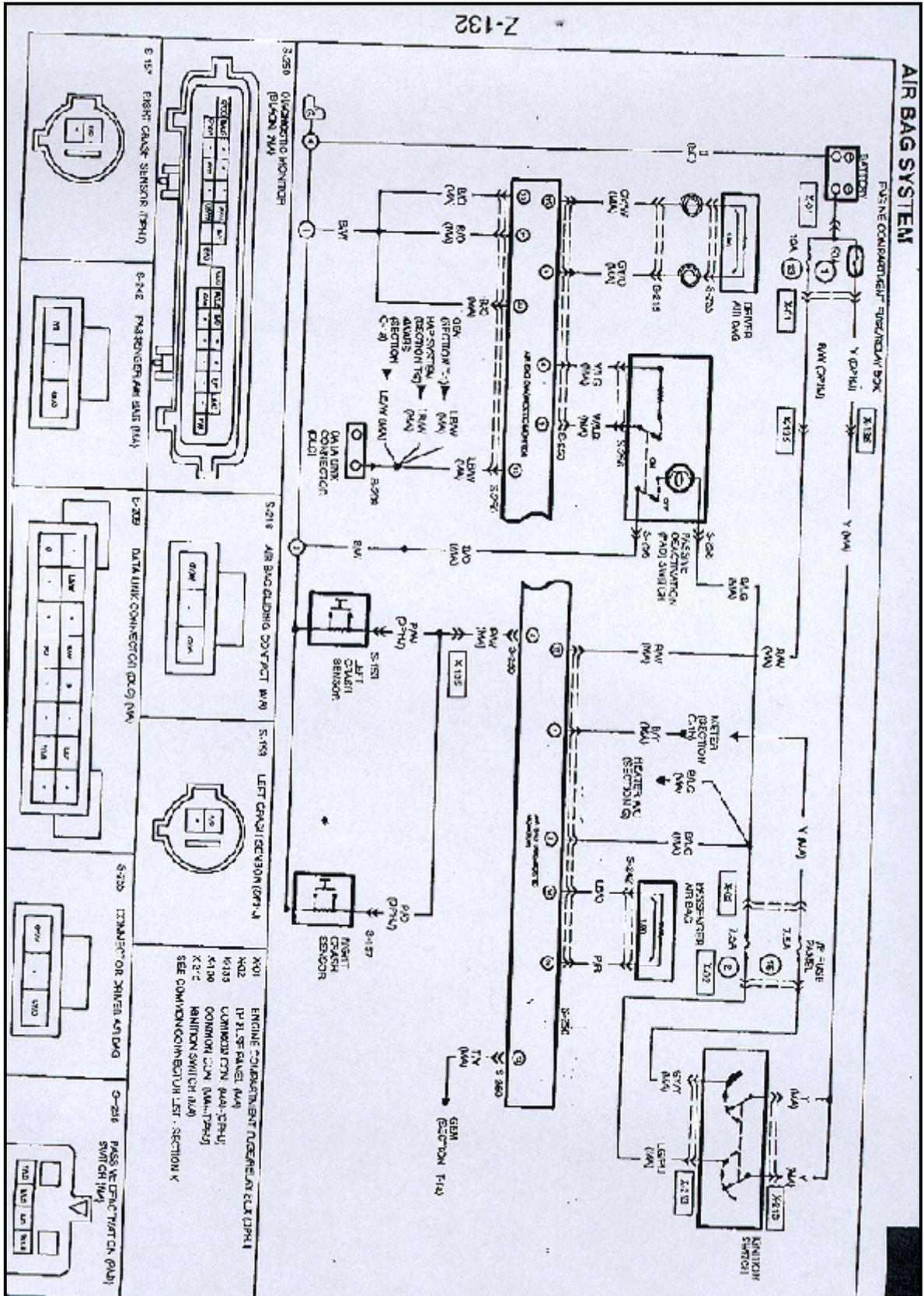


Figure 21. Air bag wiring diagram