

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number ( 1998-49-803E)

1998. Ford, Contour Four-Door Sedan

Texas

July/1998

Technical Report Documentation Page

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16. Abstract <p>This remote investigation focused on the redesigned air bag system deployment of a 1998 Ford Contour four-door sedan. This two vehicle crash took place during the noon time hours in July of 1998. The weather was clear and the level concrete roadway surface was dry. This crash occurred at a four-leg intersection which connects a roadway interchange area. The south leg of the intersection is a three lane, one-way roadway for northbound traffic only. The west/eastbound legs of the intersection is an undivided two lane roadway. A left turn bay lane is present for eastbound traffic. The north leg of the intersection is a two lane, one-way roadway entrance ramp for the interchange area. Each leg of the intersection is bordered by curbing. The posted speed limit for northbound traffic is 64 km/h (40 mph) and the speed limit for east and westbound traffic is 48 km/h (30 mph). Vehicle 1, a 1991 Mercedes Benz 300E 4-Matic (four wheel drive) four-door sedan was driven by a 66-year-old male who reportedly was wearing the available three-point lap and shoulder belt. Vehicle 1 was traveling westbound and witnesses reported that the driver entered the intersection while the traffic signal was in the red phase. Vehicle 2, 1998 Ford Contour four-door sedan was driven by an unrestrained 20-year-old female (163 cm/64 in., 81 kg/179 lbs.), who reportedly was 8 months pregnant/third trimester. Driver 2 entered the intersection with the intention of continuing northbound. The full frontal plane of Vehicle 2/case vehicle (12FDEW1) impacted the left quarter-panel of Vehicle 1 in an "L"-type impact configuration. The total delta V for Vehicle 1 was calculated at 11.2 km/h (7 mph). The total delta V for Vehicle 2 (1998 Contour) was 14.4 km/h (8.9 mph) and the longitudinal delta V was -14.2 km/h (-8.8 mph). These results are slightly below or at the threshold level required for air bag deployment. Vehicle 1 rotated counterclockwise approximately 164 degrees before coming to rest facing in an easterly direction. Vehicle 2 also rotated counterclockwise and came to rest facing west. The driver of Vehicle 1 sustained a police reported non-incapacitating injury and refused to be transported to the hospital. The driver of Vehicle 2 sustained bilateral wrist abrasions (AIS-1) due to contact with the deploying drivers air bag. She also reported a cervical k and upper back strain (AIS-1) which were attributed to her contact with the deployed drivers air bag. The driver of the 1998 Ford Contour (Vehicle 2) was transported to a local hospital primarily due to her pregnant status. There were no problems or injuries reported to the unborn child.</p>			
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**Summary**

This remote investigation focused on the redesigned air bag system deployment of a 1998 Ford Contour four-door sedan. This two vehicle crash took place during the noon time hours in July of 1998. The weather was clear and the level concrete roadway surface was dry. This crash occurred at a four-leg intersection which connects a roadway interchange area. The south leg of the intersection is a three-lane, one-way roadway for northbound traffic only. The west/eastbound legs of the intersection is an undivided two lane roadway. A left turn bay lane is present for eastbound traffic. The north leg of the intersection is a two lane, one-way roadway entrance ramp for the interchange area. Each leg of the intersection is bordered by curbing. The posted speed limit for northbound traffic is 64 km/h (40 mph) and the speed limit for east and westbound traffic is 48 km/h (30 mph).

Vehicle 1, a 1991 Mercedes Benz 300E 4-Matic (four wheel drive) four-door sedan was driven by a 66-year-old male who reportedly was wearing the available three-point lap and shoulder belt. Vehicle 1 was traveling westbound and witnesses reported that the driver entered the intersection while the traffic signal was in the red phase.

Vehicle 2, 1998 Ford Contour four-door sedan was driven by an unrestrained 20-year-old female (163 cm/64 in., 81 kg/179 lb.), who reportedly was 8 months pregnant/third trimester. Driver 2 entered the intersection with the intention of continuing northbound.

The full frontal plane of Vehicle 2/case vehicle (12FDEW1) impacted the left quarter-panel of Vehicle 1 in an "L"-type impact configuration. The total delta V for Vehicle 1 was calculated at 11.2 km/h (7 mph). The total delta V for Vehicle 2 (1998 Contour) was 14.4 km/h (8.9 mph) and the longitudinal delta V was 14.2 km/h (-8.8 mph)<sup>1</sup>. These results are slightly below or at the threshold level required for air bag deployment. Vehicle 1 rotated counterclockwise approximately 164 degrees before coming to rest facing in an easterly direction. Vehicle 2 also rotated counterclockwise and came to rest facing west.



**Figure 1.** View showing Vehicle 1's travel lane and approximate point of impact



**Figure 2.** Pre-impact trajectory of Vehicle 2 and approximate point of impact



**Figure 3.** Frontal Deformation (Vehicle 2) 1998 Ford Contour

<sup>1</sup> Calculated using WinSmash Missing Vehicle Algorithm

The driver of Vehicle 1 sustained a police reported non-incapacitating injury and refused to be transported to the hospital. The driver of Vehicle 2 sustained bilateral wrist abrasions (AIS-1) due to contact with the deploying drivers air bag. She also reported a cervical and upper back strain (AIS-1) which were attributed to her contact with the deployed drivers air bag. The driver of the 1998 Ford Contour (Vehicle 2) was transported to a local hospital primarily due to her pregnant status. There were no problems or injuries reported to the unborn child.



**Figure 4.** Three-quarter view of Vehicle 2 (1998 Ford Contour)

**Table 1. Delta V**

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	14.4	8.9	11.2	7
Longitudinal	-14.2	-8.8	-1.9	-1.2
Lateral	-2.5	-1.6	11.0	6.8

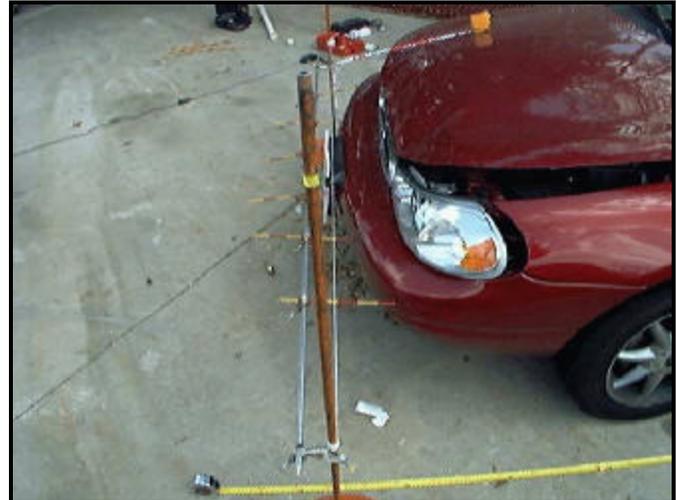
**Exterior of Case Vehicle**

**Table 2. Vehicle Information**

Model year, make and model	1998. Ford, Contour Four-Door Sedan
VIN	1FAFP66L5WK
CDC	12FDEW1



**Figure 5. Frontal Deformation to Ford Contour**



**Figure 6. Perpendicular view showing frontal damage to Vehicle1 (Ford Contour)**

**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	143	1	2	2	0	0	0
	56.3	0.4	0.8	0.8	0	0	0

## *Interior of Case Vehicle*

Damage to the interior of the 1998 Ford Contour consisted only of windshield glazing damage due to the passenger side air bag module flap cover contacting the windshield during deployment. There were no intruding components and the interior was devoid of any discernable occupant contacts.

The vehicle is equipped with front bucket seats with adjustable head restraints--which were not damaged. The front left bucket seat was adjusted at the middle track position and the seat back support was slightly reclined. It is unknown the exact track position and seat back angle of the front right bucket seat.

## *Case Vehicle Occupant Protection Systems*

The Ford Contour four-door sedan was equipped with a redesigned air bag system which consisted of two frontal primary crash sensors located over the left and front right wheel wells. This system is equipped with an instrument cluster air bag sending unit, two separate air bag diagnostic monitors, an air bag safing switch located in the lower A-pillar post and driver and passenger air bag module units.<sup>2</sup>

An air bag warning lamp is located in the front left instrument panel area. The driver's side air bag module is located in the steering wheel hub while the passenger air bag module is top mount unit.

The front left 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 by reportedly four straps and was equipped with two vent port holes. The lower instrument panel is shrouded with a rigid plastic knee bolster. There were no discernable areas of occupant contact to the air bag fabric. The air bag was undamaged and the air bag module flap covers separated at their designated tear points.

The front right air bag was located on the instrument panel, top surface plane. The module cover flap is an asymmetric shape that contours the instrument panel. It is primarily a rectangular shape. The module cover flap opened at its designated tear points and broke the laminated windshield glazing upon deployment. The untethered air bag was undamaged and was equipped with one vent port hole. There was no occupant positioned in front of this air bag.



**Figure 7.** Interior of Case Vehicle



**Figure 8.** Deployed Drivers Air Bag

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<sup>2</sup> Refer to attached Component Location Views and Mapping Location Views of the Supplemental Air Bag Systems

## Case Vehicle Occupant Demographics

Occupant 1

Age/Sex: 20/Female

Seated Position: Front Left

Seat Type: Bucket-cloth covered

Height (cm/in.): 163 64.17

Weight (kg/lbs.): 81 178.6

Pre-existing Medical Condition: 8-Months Pregnant/Third Trimester

Body Posture: Normal

Hand Position: Unknown

Foot Position: Right foot depressing brake pedal, Left foot on floor pan

Restraint Usage: None Used

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

## Occupant Injuries

**Table 4. Injuries**

Injury	Injury Severity (AIS)	Injury Mechanism
Bilateral Wrist Abrasions	1	Deploying drivers air bag
Cervical Neck Strain	1	Deploying drivers air bag
Upper Thoracic Strain	1	Deploying drivers air bag



**Figure 9.** Deployed Front Passenger Air Bag

### ***Occupant Kinematics***

The 20 year old female driver of the Ford Contour was unrestrained and situated in the front, left position in an upright and reportedly a normal driving posture.

The driver responded to the 350 degree impact force by moving forward. The drivers hand location on the steering wheel rim is basically unknown, however, she sustained bilateral wrist abrasions due to contacting the deploying air bag (AIS-1). She fully loaded the deploying air bag with her upper torso and face. Her interaction with the deploying air bag resulted in a transmitted cervical neck strain and upper thoracic strain (AIS-1). The driver rebounded into the seat back support and remained in her respective seating position at final rest.

An ambulance unit arrived on scene reportedly within 2 minutes of the crash. The driver was transported to a local hospital where she was treated for her injuries. The unborn child reportedly sustained no injuries.

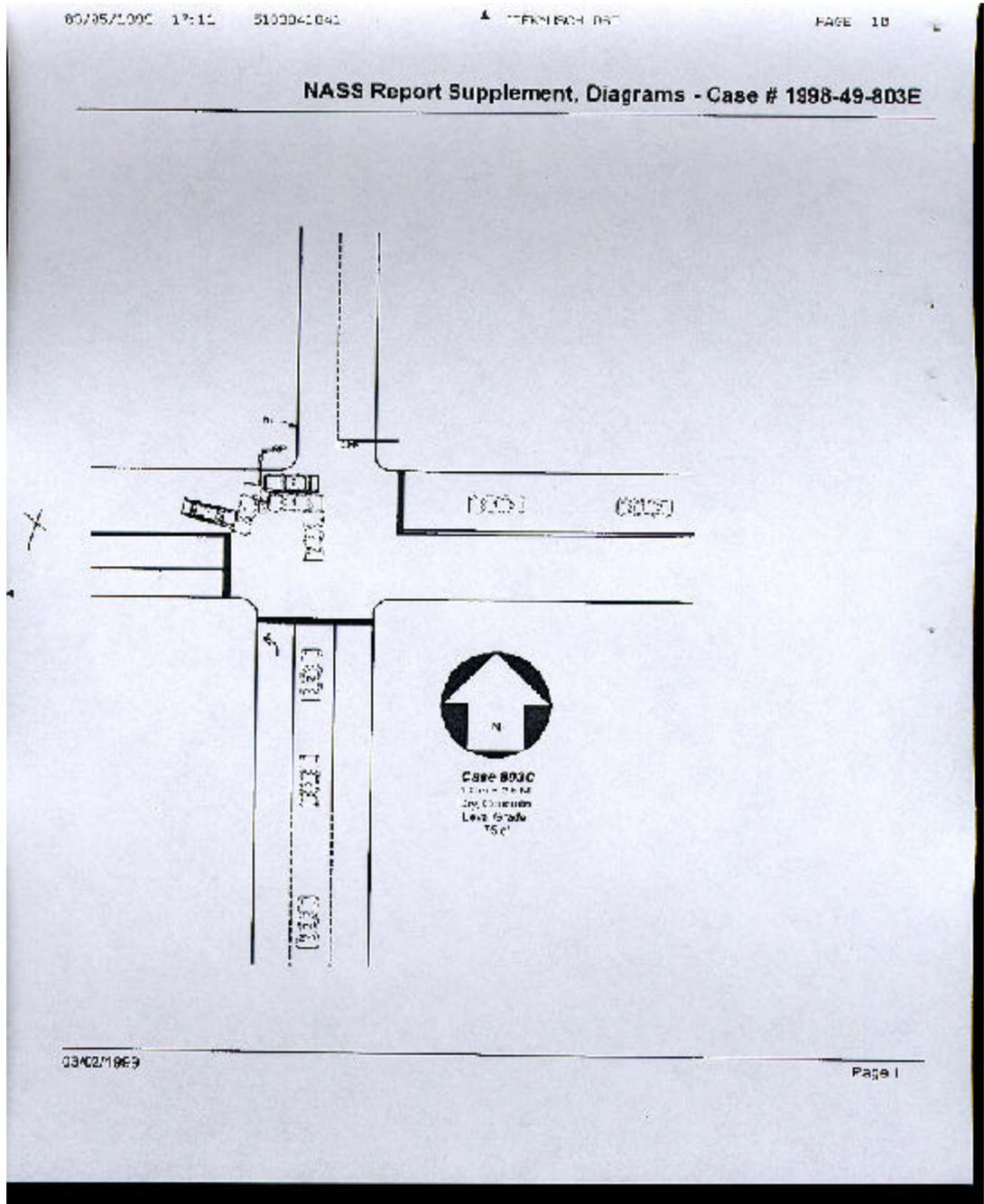


**Figure 10.** View from drivers seated position



**Figure 11.** Deployed Drivers air bag

*Scene Diagram*



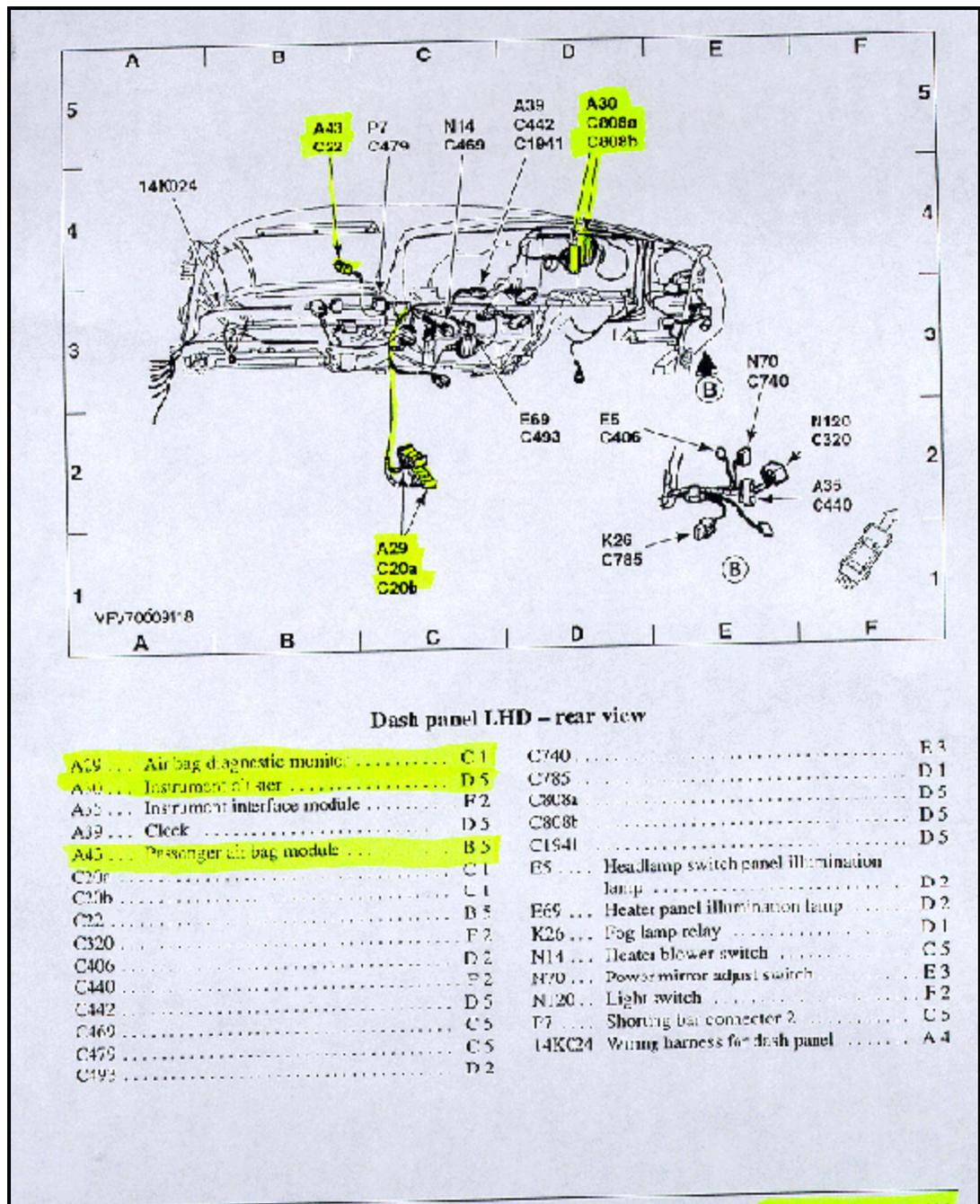
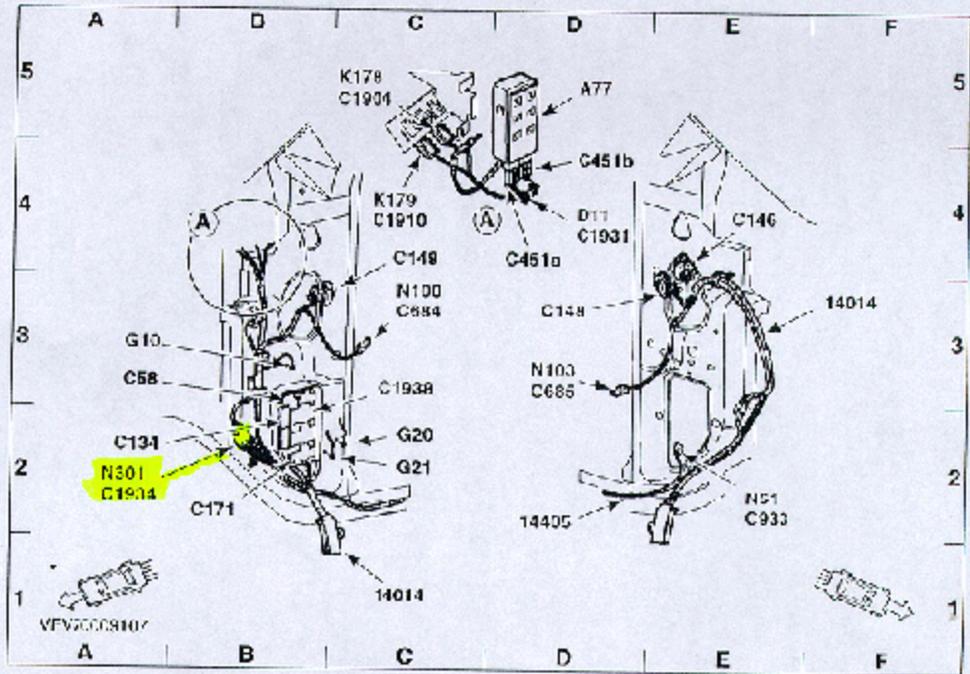


Figure 13. Module and sensor locations



LH A-pillar, RH A-pillar

A77	Anti-theft/central locking module	D 5	C1938	Door lock diagnostic connector	D 4
C58		A 3	D11	Door lock diagnostic connector	D 4
C134		A 2	G10		A 3
C145		E 4	G20		C 2
C145		D 3	G21		C 2
C140		C 4	K178	Panic alarm headlamp relay	C 5
C171		B 2	K179	Panic alarm stop lamp relay	C 1
C451a		D 4	N61	Inertia fuel shut-off (IFS) switch	E 2
C451b		D 1	N100	Right front door courtesy lamp switch	C 3
C684		C 2	N103	Left front door courtesy lamp switch	D 3
C685		D 3	N301	Air bag safing sw reb	A 2
C933		E 2	14014	Wiring harness - Door to door	C 1
C1904		C 5	14014	Wiring harness - Door to door	F 3
C1910		C 4	14405	Wiring harness for tail lamp unit to the main wiring harness	D 2
C1931		D 4			
C1934		A 2			

Figure 14. Safing switch



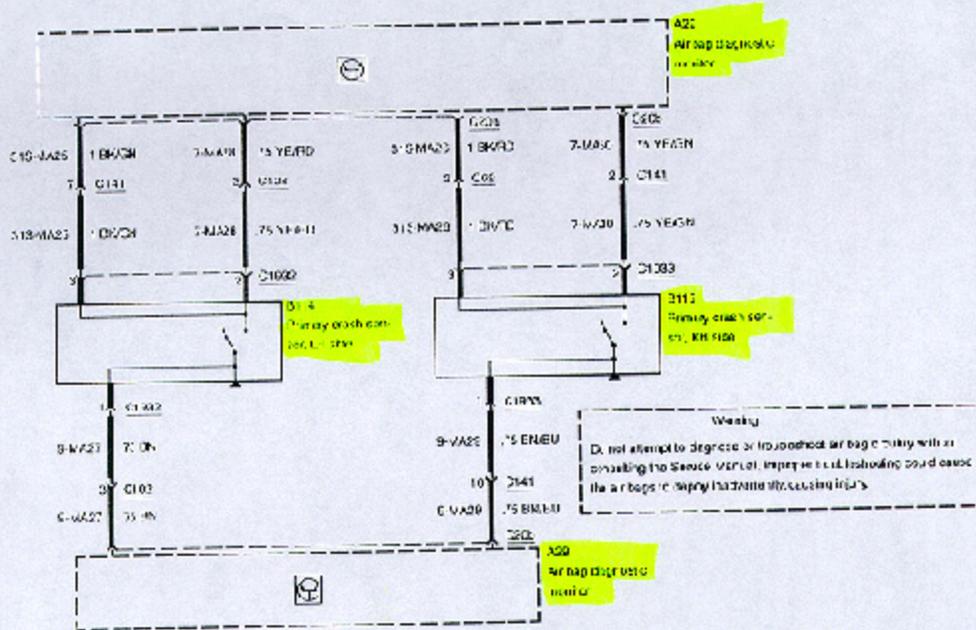


Figure 16. Sensors