Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1999-75-019E)

1998 Ford Contour (Vehicle 1) 1998 Honda Civic (Vehicle 2)

Colorado

February/ 1999

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15. Supplemental Notes

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Ford Contour four-door sedan and a 1998 Honda Civic four-door sedan. This two vehicle crash occurred during a winter night in February 1999. The crash took place within a four-leg intersection and the bituminous roadway surface was dry and free of defects. The west leg of the intersection consists of three westbound lanes and two eastbound travel lanes. A painted flush median separated the east/westbound traffic. The east leg of the intersection is a two lane undivided roadway. The south leg of the intersection consists of five northbound travel lanes with a center depressed median that delineates the three southbound travel lanes. The north leg has identical lane and median configuration as the south leg. The eastbound leg of the intersection has a positive grade (>2%) while the westbound leg has a negative grade. There are overhead traffic signals present and they were functioning properly. The posted speed limit is 64 km/h (40 mph). Vehicle 1, a 1998 Ford Contour four-door sedan, was driven by an unrestrained 32 year-old-male (190 cm/ 75 in., 136 kg/ 300 lb.) Who reportedly was in an upright and normal posture. Driver 1 was traveling eastbound when he had initiated a left turn sequence at the intersection while the overhead traffic signal was in the green signal phase. Vehicle 2, a 1998 Honda Civic four-door sedan, was being driven by a 16 year-old-male (175 cm/ 69 in., 56 kg/123 lbs.) who was fully restrained by the available three-point manual lap and shoulder belt. Driver 2 was in a normal, upright posture as he entered the intersection, heading westbound. Driver 2 was intending to proceed westbound as he entered the intersection. Driver 1 (Ford Contour) turned left directly in front of Vehicle 2's (Honda Civic) path of travel. As Vehicle 1 & 2 entered the intersection, the frontal plane of Vehicle 1 (01FREE4) impacted the front of Vehicle 2 (11FDEW2) in an offset, head-on impact configuration. The calculated delta V for Vehicle 1 was 15.8 km/h (9.8 mph) with a longitudinal delta V of -13.6 km/h (-8.5 mph) which is at the low end of the threshold necessary for air bag deployment. Vehicle 2's delta V was calculated at 19.8 km/h (12.3 mph) with a longitudinal delta V of -18.6 km/h (-11.6) which is within the threshold necessary for air bag deployment. Vehicle 1 rotated counterclockwise, coming to rest facing northwesterly. Vehicle 2 was deflected to the right and came to rest facing in a westerly direction. The unrestrained driver of Vehicle 1 sustained numerous facial abrasions (AIS-1) due to his interaction with the deploying air bag. He also sustained a scalp laceration , abrasion (AIS-1) and cervical neck strain (AIS-1) due to contacting the rear view mirror. The fully restrained driver of Vehicle 2 sustained a nose contusion (AIS-1) and a closed nasal fracture (AIS-1) due to contacting the driver's air bag. Apparently, an ambulance or EMS unit was not summoned to the crash scene. A local towing agency removed both vehicles from the crash scene.

16. Abstract

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Summary

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Ford Contour four-door sedan and a 1998 Honda Civic four-door sedan. This two vehicle crash occurred during a winter night in February 1999. The crash took place within a four-leg intersection and the bituminous roadway surface was dry and free of defects. The west leg of the intersection consists of three westbound lanes and two eastbound travel lanes. A painted flush median separated the east/westbound traffic. The east leg of the intersection is a two lane undivided roadway. The south leg of the intersection consists of five northbound travel lanes with a center depressed median that delineates the three southbound travel lanes. The north leg has identical lane and median configuration as the south leg. The eastbound leg of the intersection has a positive grade (>2%) while the westbound leg has a negative grade. There are overhead traffic signals present and they were functioning properly. The posted speed limit is 64 km/h (40 mph).

Vehicle 1, a 1998 Ford Contour four-door sedan, was driven by an unrestrained 32 year-old-male (190 cm/ 75 in., 136 kg/ 300 lb.) Who reportedly was in an upright and normal posture. Driver 1 was traveling eastbound when he had initiated a left turn sequence at the intersection while the overhead traffic signal was in the green signal phase.

Figure 1. Pre-impact trajectory of Vehicle 1

Figure 2. Pre-impact trajectory of Vehicle 2

Vehicle 2, a 1998 Honda Civic four-door sedan, was being driven by a 16 year-old-male (175 cm/ 69 in., 56 kg/123 lbs.) who was fully restrained by the available three-point manual lap and shoulder belt. Driver 2 was in a normal, upright posture as he entered the intersection, heading westbound. Driver 2 was intending to proceed westbound as he entered the intersection. Driver 1 (Ford Contour) turned left directly in front of Vehicle 2's (Honda Civic) path of travel.

Crash Events

As Vehicle 1 & 2 entered the intersection, the frontal plane of Vehicle 1 (01FREE4) impacted the front of Vehicle 2 (11FDEW2) in an offset, head-on impact configuration. The calculated delta V for Vehicle 1 was 15.8 km/h (9.8 mph) with a longitudinal delta V of -13.6 km/h (-8.5 mph)[1] which is at the low end of the threshold necessary for air bag deployment. Vehicle 2's delta V was calculated at 19.8 km/h (12.3 mph) with a longitudinal delta V of -18.6 km/h (-11.6) which is within the threshold necessary for air bag deployment.

Figure 3. Front, three-quarter view showing front damage to Vehicle 1

Vehicle 1 rotated counterclockwise, coming to rest facing northwesterly. Vehicle 2 was deflected to the right and came to rest facing in a westerly direction. The unrestrained driver of Vehicle 1 sustained numerous facial abrasions (AIS-1) due to his interaction with the deploying air bag. He also sustained a scalp laceration , abrasion (AIS-1) and cervical neck strain (AIS-1) due to contacting rear view mirror. The fully restrained driver of Vehicle 2 sustained a nose contusion (AIS-1) and a closed nasal fracture (AIS-1) due to contacting the driver's air bag. Apparently, an ambulance or EMS unit was not summoned to the crash scene. A local towing agency removed both vehicles from the crash scene.

Figure 4. Front, three-quarter view showing frontal damage to Vehicle 2

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	15.8	9.8	19.8	12.3
Longitudinal	-13.6	-8.5	-18.6	-11.6
Lateral	-7.9	-4.9	6.8	4.2

[1] Calculated utilizing the Damage Only mode of the WinSmash 1.2.1 program

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Ford Contour (Vehicle 1) 1998 Honda Civic (Vehicle 2)
VIN	1FAFP6636WK (Vehicle 1) JHMEJ6673WS (Vehicle 2)
CDC	01FREE4 11FDEW2

Figure 5. Full frontal view of Vehicle 1

Figure 6. Full frontal view of Vehicle 2

Table 3. Crush Measurements- Vehicle 1

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	142	1	0	0	0	0	15
	55.9	0.4	0	0	0	0	5.9

Table 3. 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.
Front bumper	139	0	9	37	11	0	0
	54.7	0	3.5	14.6	4.3	0	0

Interior of Case Vehicle 1- Ford Contour

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 void 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 its rearmost seat track position and the seat back support was slightly reclined. The front right seat was adjusted between the middle and rearmost seat track position with the seatback support slightly relined.

Interior of Case Vehicle 1- Honda Civic

The interior of the 1998 Honda Civic four-door sedan sustained minor interior damage that was isolated to a cracked windshield. The laminated windshield was damaged as a result of the passenger air bag deployment. The interior was void of any remarkable areas of occupant contact evidence. This vehicle is equipped with front bucket seats and adjustable head restraints. The front, left seat was adjusted between the middle and rearmost track position. The seatback was adjusted to be slightly reclined. The front, right seat track was adjusted between the middle and rearmost position. The front adjustable head restraints were undamaged. The second row was equipped with a bench seat with folding back(s). There were integral head restraints available at the rear seat, outboard positions.

Case Vehicle Occupant Protection Systems

Case Vehicle 1 (1998 Ford Contour)

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. 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 a top mount unit.

Figure 7. Deployed driver's air bag

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 one 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, however, the driver did contact the deploying air bag. The air bag was undamaged and the air bag module flap covers separated at their designated tear points.

Figure 8. Deployed front passenger air bag

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.

Case Vehicle 2 (1998 Honda Civic)

The 1998 Honda Civic four-door sedan was equipped with redesigned air bag systems. This system consists of a SRS unit (diagnostic module) which is centrally located in the center console, forward of the transmission selector lever. The frontal air bag sensor is incorporated within the centrally located SRS unit. The SRS indicator light is located in the lower left instrumentation cluster, just below the tachometer.

Figure 9. Deployed driver's air bag

The driver's air bag is housed in the steering wheel hub and encases the nylon air bag unit. The double, horizontal, module cover flaps are asymmetric in design and opened at their designated tear points. The circular air bag is 63 cm (24.8 in.) in diameter and is equipped with two tether straps and two exhaust vent port holes. The vent ports are located at the 11 and 1 o'clock positions respectively. The rigid plastic knee bolster was undamaged and did not reveal any detectable occupant contacts.

Figure 10. Deployed front passenger air bag

The front, right passenger air bag is located on the instrument panel (top mount). The module deployment door is rectangular in design and is equipped with double horizontal cover flaps that are symmetrical in design (23 cm wide x 5 cm in height). Upon deployment, the encased air bag fully deployed. The non-tethered air bag was undamaged and was equipped with two vent port holes which are at the 9 and 3 o'clock positions.

Case Vehicle Occupant Demographics

Case Vehicle 1	Occupant 1
Age/Sex:	32/Male
Seated Position:	Front, Left
Seat Type:	Bucket, cloth covered
Height (cm/in:):	190 74.8
Weight (kg/lbs).:	136 299.8
Pre-existing Medical Condition:	None Reported
Body Posture:	Upright, facing forward
Hand Position:	Both hands on steering wheel rim. Left hand at the 9 o'clock position and right hand at the 2 o'clock positions.
Foot Position:	Right foot on the accelerator pedal and the left foot on the floor panel.
Restraint Usage:	None Used
Air bag:	Driver's air bag deployed as a result of the frontal impact

Case Vehicle 2	Occupant 1
Age/Sex	16/Male
Seated Position:	Front, Left
Seat Type:	Bucket, cloth covered
Height (cm/in.):	175 68.9
Weight (kg/lbs.):	56 123.4
Pre-existing Medical Condition:	None Reported
Body Posture:	Upright, facing forward
Hand Position:	Both hands on steering wheel rim. Left hand at the 6 o'clock position and right hand at the 12 o'clock position
Foot Position:	Right foot on brake pedal and left foot on floor panel
Restraint Usage:	Manual, three-point lap and shoulder belt worn with the lap belt extending across his lap and the shoulder belt webbing extending across his chest
Air bag:	Driver's air bag deployed as a result of the frontal impact

Occupant Injuries

Table 4. Injuries Vehicle 1 (Ford Contour)

Injury	Injury Severity (AIS)	Injury Mechanism
Right frontal 2 cm scalp laceration	1	Rear view mirror
Right frontal scalp abrasion	1	Rear view mirror
Facial abrasions over whole face	1	Driver's air bag
Cervical Neck strain	1	Rear view mirror

Table 5. Injuries Vehicle 2 (Honda Civic)

Injury	Injury Severity (AIS)	Injury Mechanism
Nose contusion	1	Driver's air bag
Closed nasal fracture	1	Driver's air bag

Occupant Kinematics

Driver, Case Vehicle 1 (Ford Contour)

The 32 year-old-male driver of the 1998 Ford Contour was unrestrained and responded to the 1 o'clock principle direction of force by moving forward and to his right. His knees probably contacted the knee bolster, however there was no physical evidence or injury data to support this. His face impacted the deploying air bag which resulted in numerous facial abrasions (AIS-1). His head continued forward and possibly contacted the rear view mirror which resulted in a right frontal scalp laceration and abrasion (AIS-1). It is suspected that he sustained a cervical neck strain (AIS-1) as a result of this impact. Te driver rebounded rearward into his respective seatback support.

Driver, Case Vehicle 2 (Honda Civic)

The 16 year-old-male driver of Vehicle 2 (1998 Honda Civic) was fully restrained by the available three-point manual lap and shoulder belt. He responded to the 340 degree principle direction of force by moving primarily forward and slightly to his left. The interior components were basically void of any obvious occupant contacts, however, the driver's face impacted the deploying air bag which resulted in a nose contusion and a nasal fracture (AIS-1). He rebounded rearward into his respective seatback where he came to rest.

Scene Diagram