Remote, Redesigned Air Bag Special Study
Dynamic Science, Inc., Case Number (1998-075-804F)
1998 Ford Explorer
Colorado
October/1998

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16. Abstract

This remote investigation focused on the redesigned air bag system deployment of a 1998 Ford Explorer compact sport utility vehicle. This crash occurred in October, 1998 in the evening. The weather was clear and the bituminous roadways were dry. The crash occurred in a four leg intersection. The southbound leg of the intersection is a two-way divided roadway and is comprised of five travel lanes; two southbound thru-lanes, one southbound right-turn lane, and two northbound lanes. Southbound traffic is separated from northbound traffic by a raised concrete median strip. The speed limit for this road is 72 kmph (45 mph). It is controlled by overhead traffic signals. The road has a >2% uphill grade at the area of impact. The eastbound leg of the intersection is a two-way undivided road and is comprised of three travel lanes; one eastbound thru-lane, one eastbound left-turn lane, and one westbound lane. The speed limit for this road is 48 kmph (30 mph). It is controlled by overhead traffic signals. The road has a >2% downhill grade at the area of impact. Vehicle 1, a 1978 Chevrolet El Camino automobile based pickup driven by a 20 year old male, was traveling south in the left southbound travel lane approaching the intersection at an unknown speed preparing to travel straight through the intersection. The front right seat was occupied by a 19 year old male. It is unknown if either occupant was restrained at the time. Vehicle 2, a 1998 Ford Explorer compact sport utility vehicle (case vehicle) driven by an 18 year old male (178 cm/70 in, 113 kg/250 lbs), was stopped in the eastbound left-turn lane. The driver was preparing to make a left turn at the intersection. It is unclear which phase the traffic signals were in for either driver. The driver was restrained by the available manual lap/shoulder restraint. The driver of Vehicle 2 initiated the left turn and pulled the vehicle into the intersection in the path of Vehicle 1. The front plane of Vehicle 1 (12FZEW5) struck the front plane of Vehicle 2 (10FYEW1) in the intersection. After the impact, Vehicle 1 continued in a southwest direction and came to rest approximately 26 meters (85 ft) south of the point of impact facing southwest. Vehicle 2 rotated clockwise approximately 270 degrees after impact and came to rest in the southwest corner of the intersection facing northwest. A Delta V was calculated for Vehicle 2, utilizing WinSMASH, as 16 kmph (10 mph). As a result of the frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed. Both occupants of Vehicle 1 were transported to a hospital with non-incapacitating injuries where they were treated and released. The driver of Vehicle 2 was not injured and was not transported.

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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1998 Ford Explorer compact sport utility vehicle. This crash occurred in October, 1998 in the evening. The weather was clear and the bituminous roadways were dry. The crash occurred in a four leg intersection. The southbound leg of the intersection is a two-way divided roadway and is comprised of five travel lanes; two southbound thru-lanes, one southbound right-turn lane, and two northbound lanes. Southbound traffic is separated from northbound traffic by a raised concrete median strip. The speed limit for this road is 72 kmph (45 mph). It is controlled by overhead traffic signals. The road has a >2% uphill grade at the area of impact. The eastbound leg of the intersection is a two-way undivided road and is comprised of three travel lanes; one eastbound thru-lane, one eastbound left-turn lane, and one westbound lane. The speed limit for this road is 48 kmph (30 mph). It is controlled by overhead traffic signals. The road has a >2% downhill grade at the area of impact.

Vehicle 1, a 1978 Chevrolet El Camino automobile based pickup driven by a 20 year old male, was traveling south in the left southbound travel lane approaching the intersection at an unknown speed preparing to travel straight through the intersection. The front right seat was occupied by a 19 year old male. It is unknown if either occupant was restrained at the time.

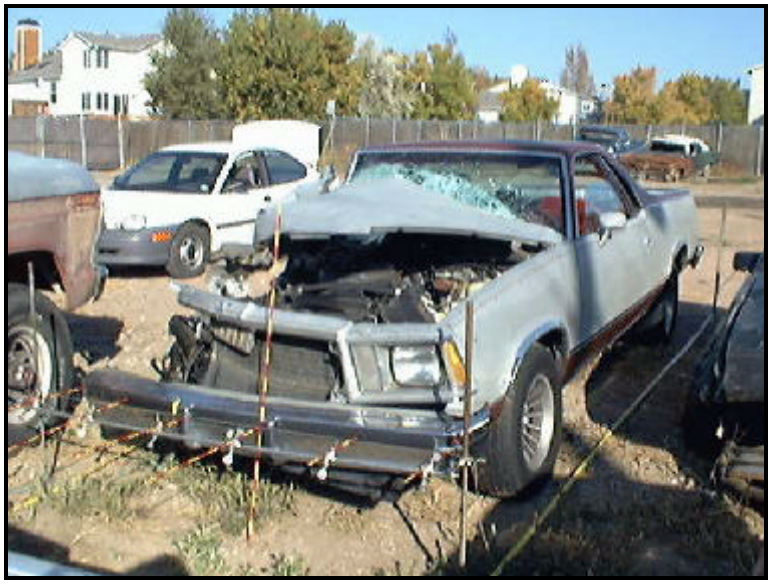

Figure 1. Exterior, Vehicle 1 (Chevrolet El Camino)

Figure 2. Exterior, Vehicle 2 (Ford Explorer)

Vehicle 2, a 1998 Ford Explorer compact sport utility vehicle (case vehicle) driven by an 18 year old male (178 cm/70 in, 113 kg/250 lbs), was stopped in the eastbound left-turn lane. The driver was preparing to make a left turn at the intersection. It is unclear which phase the traffic signals were in for either driver. The driver was restrained by the available manual lap/shoulder restraint.

Crash Events

The driver of Vehicle 2 initiated the left turn and pulled the vehicle into the intersection in the path of Vehicle 1. The front plane of Vehicle 1 (12FZEW5) struck the front plane of Vehicle 2 (10FYEW1) in the intersection. After the impact, Vehicle 1 continued in a southwest direction and came to rest approximately 26 meters (85 ft) south of the point of impact facing southwest. Vehicle 2 rotated clockwise approximately 270 degrees after impact and came to rest in the southwest corner of the intersection facing northwest.

A Delta V was calculated for Vehicle 2, utilizing WinSMASH, as 16 kmph (10 mph).

Figure 3. Crash scene, Vehicle 1 approach path.

As a result of the frontal impact, the supplemental restraint system (driver's and passenger's frontal redesigned air bags) of the case vehicle deployed.

Both occupants of Vehicle 1 were transported to a hospital with non-incapacitating injuries where they were treated and released. The driver of Vehicle 2 was not injured and was not transported.

Both vehicles became disabled due to damage sustained in the crash and were towed from the scene.

Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	16	9.9	20	12.4
Longitudinal	-9	-5.6	-20	-12.4
Lateral	13	8.1	1	0.6
Barrier speed	8	5	31	19.3

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Ford Explorer
VIN	1FMZU34E3WZ
CDC	10FYEW1

Figure 4. Exterior, Vehicle 2 (1998 Ford Explorer)

Figure 5. Exterior, Vehicle 2 (1998 Ford Explorer)

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.
Bumper	139	12	2	2	1	1	0
	54.7	4.7	0.8	0.8	0.4	0.4	0

Interior of Case Vehicle

The interior of the Ford Explorer sustained no damage from occupant contact. There were no areas of intrusion into the passenger compartment. No occupant contact evidence was found in the vehicle.

The case vehicle was equipped with bucket seats in the front left and front right seating positions. The front left seat was adjusted to the rear most track position. The front right seat was adjusted between the middle and rear most track positions. Both front seats were equipped with integral head restraints which were not damaged. The rear of the vehicle was equipped with split bench seats with folding backs in all three seating positions. The seats are not adjustable. The outboard seats were equipped with adjustable head restraints which were not damaged while the center seat was not equipped with a head restraint system.

Case Vehicle Occupant Protection Systems

The Ford Explorer compact sport utility vehicle was equipped with a redesigned air bag system which consisted of front left and front right air bag modules which housed air bags and depowered inflator units.

Figure 6. Interior, case vehicle. Driver's side air bag.

The front left air bag was housed in the steering wheel hub and was concealed by asymmetrical H-configuration cover flaps which were not damaged in the crash. The circular air bag was equipped with two tether straps and two vent ports. No contact evidence was found on the air bag and the bag was not damaged.

The front right air bag was housed in the mid-instrument panel position and was concealed by a single rectangular cover flap which was not damaged in the crash. The rectangular air bag was equipped with two vent ports and no tether straps. No contact evidence was found on the air bag and the bag was not damaged.

Case Vehicle Occupant Demographics

Table 4. Case Vehicle Occupant Demographics

	Occupant 1	
Age/Sex:	18/Male	
Seated Position:	Front left	
Seat Type:	Bucket - cloth covered	
Height (cm/in:):	178	70
Weight (kg/lbs).:	113	250
Pre-existing Medical Condition:	None noted	
Body Posture:	Normal - upright facing forward, not bracing	
Hand Position:	On steering wheel at 3 & 7 o'clock positions	
Foot Position:	On floor or foot controls	
Restraint Usage:	Manual lap & shoulder restraint	
Air bag:	Deployed redesigned air bag system	

Occupant Injuries

Table 5. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Not injured		

Occupant Kinematics

The driver (case occupant) of the Ford Explorer was seated in a normal upright posture in the front left position of the vehicle. He was wearing the manual lap/shoulder restraint. Seat belt usage was determined through visual inspection by the researcher, the lack of frontal contact evidence, and observations by the investigating police officer at the scene of the crash. The driver reported that he attempted to avoid the collision by applying the brakes (without lock-up). In response to the pre-impact braking, the case occupant moved forward and began loading the lap/shoulder restraint.

At impact, the case occupant reacted to the 310 degree principle direction of force by moving forward and to the left. As the restraints locked, further frontal movement of the driver was prevented. Although no contact evidence was found in the vehicle, it is presumed that the case occupant contacted the driver's frontal air bag with his chest. He sustained no injuries in the crash and was not transported from the scene for medical attention.

Figure 7. Interior, case vehicle

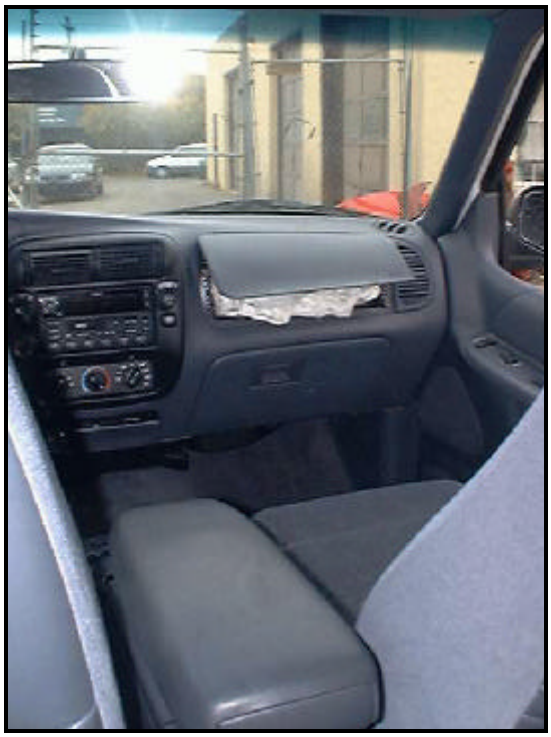

Figure 8. Interior, case vehicle

Scene Diagram