Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (DS9942)

1998 Ford Ranger XL 4x2 pickup

Nevada

November/1998

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16. Abstract

This remote investigation was initiated in response to a possible redesigned air bag deployment. The case was selected from the FARS data files. The redesigned air bag was installed in a 1998 Ford Ranger LX 4x2 pickup. The crash occurred in November, 1998 at 1627 hours. The crash occurred on the northbound side of a six-lane state highway. The speed limit is 72 km/h (45 mph) for traffic on both directions. The case vehicle, a 1998 Ranger XL 4x2 pickup driven by a restrained 19-year-old female, was initially traveling southbound in the middle lane. The front middle seat was occupied by a restrained 11-year-old male (178 cm/ 71 kg, 70 in./156 lbs). The front right seat was occupied by a restrained 2-month-old female. The case vehicle was equipped with a steering wheel mounted driver's air bag and a front right passenger's air bag. The vehicle was equipped with an air bag shut off switch that was found to be in the "OFF" position. The other vehicle, a 1993 Dodge Ram 4x4 club cab pickup driven by a 19-year-old male, was initially traveling in the middle lane northbound at a police reported speed of 72 km/h (45 mph). The front right seat was occupied by a 16-year-old female. The Ford Ranger was traveling southbound. The driver of the Ranger lost consciousness possibly due to an epileptic event. The vehicle came to a stop. According to a witness, the driver was slumped over the steering wheel. The middle passenger was facing the driver, possibly attempting to revive her. After a short time, the vehicle began to move forward at a slow rate. The vehicle then picked up speed and began to go to the left. The case vehicle crossed the median, went over the curb, and entered the northbound travel lanes. The driver of the other vehicle saw the Ranger and began braking. At this point, the right front of case vehicle (01FZEW3) struck the left front of the other vehicle (11FYEW3). The Ford Ranger sustained a longitudinal delta v of -49.0 km/h (-30.4 mph) and a lateral delta v of -41.1 km/h (-25.5 mph). The driver's air bag deployed at this point. The Dodge Ram sustained a longitudinal delta v of -40.1 km/h (-24.9 mph) and a lateral delta v of 14.6 km/h (9.1 mph).

The case vehicle was pushed into a sharp counterclockwise rotation and there was a second, side-slap type impact with Vehicle 2 (09LBEW3). The case vehicle continued traveling north until coming rest 33.8 m (111 ft) from the point of impact in the first lane of the northbound roadway facing north. The Dodge Ram was redirected to the right, traveled approximately 10.3 m (34 ft) before leaving the right side of the roadway. The vehicle continued for an additional 28 m (92 ft) before coming to rest on the grass roadside.

The driver and front middle occupant of the case vehicle required extrication by fire crews. The driver and front right occupant (03) were transported to a local trauma center via helicopter. The driver arrived in critical condition and underwent emergency surgery that evening. The front right occupant was in stable condition that evening and was released the following day. The middle front occupant (02) was transported by ground ambulance to a local hospital, but died upon arrival. He sustained multiple craniocerebral injuries, as well as numerous soft tissue abrasions, contusions, and lacerations.

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Summary

This remote investigation was initiated in response to a possible redesigned air bag deployment. The case was selected from the FARS data files. The redesigned air bag was installed in a 1998 Ford Ranger LX 4x2 pickup.

The crash occurred in November, 1998 at 1627 hours. The crash occurred on the northbound side of a six-lane state highway. There are three northbound lanes and three southbound lanes. The northbound and southbound lanes are separated–going from west to east–by a flush median approximately 7.3 m (24 ft wide), a northbound merging travel lane, and a raised concrete median. The bituminous roadway was level and dry. The temperature was 61E F with 25% humidity. The speed limit is 72 km/h (45 mph) for traffic on both directions.

Figure 1. Pre-impact braking for Dodge pickup Point of impact in background–facing north.

Crash Events

The case vehicle, a 1998 Ranger XL 4x2 pickup driven by a restrained 19-year-old female, was initially traveling southbound in the middle lane. The front middle seat was occupied by a restrained 11-year-old male (178 cm/ 71 kg, 70 in./156 lbs). The front right seat was occupied by a restrained 2-month-old female. The case vehicle was equipped with a steering wheel mounted driver's air bag and a front right passenger's air bag. The vehicle was equipped with an air bag shut off switch that was found to be in the "OFF" position.

The other vehicle, a 1993 Dodge Ram 4x4 club cab pickup driven by a 19-year-old male, was initially traveling in the middle lane northbound at a police reported speed of 72 km/h (45 mph). The front right seat was occupied by a 16-year-old female.

The Ford Ranger was traveling southbound. The driver of the Ranger lost consciousness possibly due to an epileptic event. The vehicle came to a stop. According to a witness, the driver was slumped over the steering wheel. The middle passenger was facing the driver, possibly attempting to revive her. After a short time, the vehicle began to move forward at a slow rate. The vehicle then picked up speed and began to go to the left. The case vehicle crossed the median, went over the curb, and entered the northbound travel lanes. The driver of the other vehicle saw the Ranger and began braking. At this point, the right front of case vehicle (01FZEW3) struck the left front of the other vehicle (11FYEW3).

The Ford Ranger sustained a longitudinal delta v of -49.0 km/h (-30.4 mph) and a lateral delta v of -41.1 km/h (-25.5 mph). The driver's air bag deployed at this point. The Dodge Ram sustained a longitudinal delta v of -40.1 km/h (-24.9 mph) and a lateral delta v of 14.6 km/h (9.1 mph).

Figure 2. Final rest, Ford Ranger (case vehicle)

The case vehicle was pushed into a sharp counterclockwise rotation and there was a second, side-slap type impact with Vehicle 2 (09LBEW3). Vehicle 1 continued traveling north until coming rest 33.8 m (111 ft) from the point of impact in the first lane of the northbound roadway facing north.

The Dodge Ram was redirected to the right, traveled approximately 10.3 m (34 ft) before leaving the right side of the roadway. The vehicle continued for an additional 28 m (92 ft) before coming to rest on the grass roadside.

Figure 3. Final rest. Dodge Ram (other vehicle)

The driver and front middle occupant of the case vehicle required extrication by fire crews. The driver and front right occupant (03) were transported to a local trauma center via helicopter. The driver arrived in critical condition and underwent emergency surgery that evening. The front right occupant was in stable condition that evening and was released the following day.

The middle front occupant (02) was transported by ground ambulance to a local hospital, but died upon arrival. He sustained multiple craniocerebral injuries, as well as numerous soft tissue abrasions, contusions, and lacerations.

Table 1. Delta V[1]

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	63.9	39.7	42.7	26.5
Longitudinal	-49	-30.4	-40.1	-24.9
Lateral	-41.1	-25.5	14.6	9.1

Figure 4. Exterior, Ford Ranger (right side)

Figure 5. Adapted from IIHS photo depicting results of 40 mph frontal offset crash test with a 1998 Ford Ranger

[1]Calculated using photos derived CDCs and estimated crush

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Ford F series pickup
VIN	1FTYR10C6WVAxxxxxx
CDC	Impact 1: 01FZEW3 Impact 2: Unknown

Figure 6. Exterior, Ford Ranger (front)

Figure 7. Exterior, Ford Ranger

Interior of Case Vehicle

The Ford Ranger was equipped with a split bench with folding backs. There is a center seat position that can be changed into an arm rest by folding the arm rest down. The arm rest was in the up position at the time of the crash. The seat back angle and track location are not known. There was a moderate amount of intrusion from the center and right instrument panel and right toe pan into the front right seating position. The front windshield was damaged during the crash. Both side windows disintegrated.

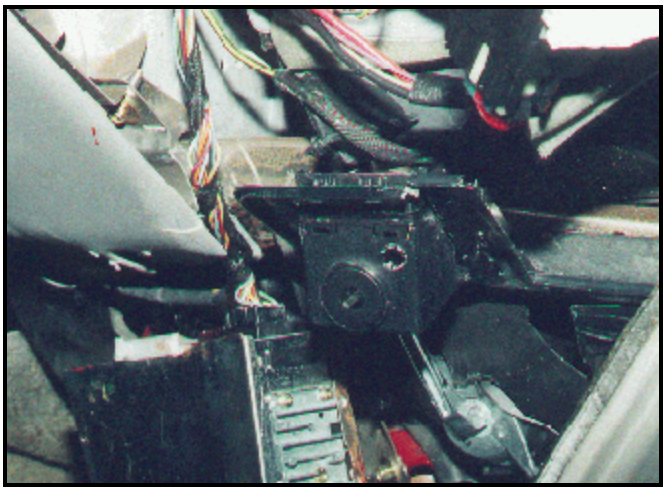

Figure 8. Air bag ON/OFF switch

Case Vehicle Occupant Protection Systems

The Ford Ranger was equipped with a steering wheel mounted driver's air bag and a front mount front right passenger's air bag. The passenger air bag is controlled by an ON/OFF switch; the switch was in the OFF position at the time of the crash. The driver's air bag deployed. The passenger air bag did not.

The driver's air bag was housed in the steering wheel hub. The front right air bag was housed in the front instrument panel position and was concealed by a single rectangular shaped cover flap.

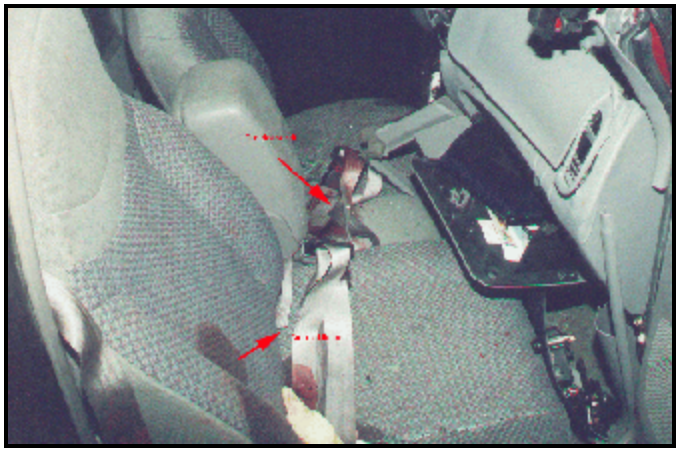

Figure 9. Seat belts cut by extrication personnel

The front outboard seating positions were equipped with lap and shoulder belts. The middle seat position was equipped with a lap belt. The belts were all in use.

The front right occupant was using a rear-facing child seat of unknown manufacture. The seat was being used in conjunction with the lap and shoulder belts, but it is not known if it was being used properly.

Figure 10. Seat belts cut by extrication personnel

Case Vehicle Occupant Demographics

	Occupant 1	Occupant 2	Occupant 3
Age/Sex:	19/Female	11/Male	2 months / Female
Seated Position:	Front left	Front middle	Front right
Seat Type:	Split bench with folding back	Split bench with folding back	Split bench with folding back
Height (cm/in:):	Unknown	178 70	Unknown
Weight (kg/lbs).:	Unknown	71 156	Unknown
Pre-existing Medical Condition:	Epilepsy	None	None noted
Body Posture:	Slumped over wheel	Unknown - possibly facing driver	Unknown
Hand Position:	Unknown	Unknown	Unknown
Foot Position:	Unknown	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt available - used	Lap belt available - used	Lap and shoulder belt available - used with child safety seat
Air bag:	Equipped, deployed	None	Equipped, not deployed

Occupant Injuries

Table 3. Injuries (Occupant 02)

Injury	Injury Severity (AIS)	Injury Mechanism
Hemorrhage, rostral pons	140210.5,8	Middle instrument panel
Midbrain hemorrhage	140629.4,9	Middle instrument panel
Base of skull - transverse fracture (hinge fracture) associated with complex radiating fractures extending from sella tursica	150206.4,8	Middle instrument panel
Cerebral edema	140660.3,9	Middle instrument panel
Subcapsular hemorrhage, right lobe of liver	541810.2,1	Middle instrument panel
Bilateral lung contusions	441410.4,3	Middle instrument panel
Maxillary teeth, multiple fractures	251499.1.8	Middle instrument panel
Frontal sub scalp hemorrhage	290402.1,7	Middle instrument panel
Abrasion, forehead	290202.1,7	Middle instrument panel
Abrasion, mouth	290202.1,8	Middle instrument panel
Abrasions, face	290202.1,0	Middle instrument panel
Abrasion, jaw	290202.1,8	Middle instrument panel
Abrasion, chest	490202.1,9	Middle instrument panel
Laceration, chest	490600.1,9	Middle instrument panel
Abrasions, left and right knees	890202.1,1 890202.1,2	Middle instrument panel
Abrasions, left and right lower legs	890202.1,1 890202.1,2	Middle instrument panel
Intercostal hemorrhage, right rib cage	Not codeable	Middle instrument panel

Occupant Kinematics

The driver of the case vehicle was seated in a forward facing position. She was wearing the available lap and shoulder belt. She had passed out and was slumped forward prior to impact. At impact, she reacted to the 1 o'clock direction of force by moving forward and to the right. She likely engaged the driver's air bag as it deployed. She sustained serious injuries of an unknown nature. She was hospitalized in critical condition.

The front middle occupant of the case vehicle was seated in a forward facing fashion, but was likely facing to his left in a effort to awaken the driver. He was wearing the available lap belt. It appears unlikely that the lap belt had been adjusted to fit someone of his size. At impact, he reacted to the 1 o'clock direction of force by moving forward and to the right. He likely wrapped around the loosely fitting lap belt. As he pitched forward, his head and face struck the upper portion of the center instrument panel causing the brain injuries, skull fractures, and facial abrasions. The lower portion of his body went forward struck the lower portion of the center instrument panel–causing the lower leg

and knee abrasions. This occupant required extrication by the fire department. He was transported from the scene by ground ambulance and died upon arrival at the hospital.

The front right occupant of the case vehicle was seated in an unknown type rear facing child seat. It unknown how the child seat functioned in this crash. This occupant did sustain some minor injuries. She was transported from the scene by helicopter to a local hospital where she was treated and released.

Scene Diagram