Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1999-074-803E)

1999 Suzuki Esteem

Nebraska

June/1999

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16. Abstract

This remote investigation focused on the redesigned air bag system deployment of a 1999 Suzuki Esteem 4-door sedan. This minor injury crash occurred in June, 1999 in the morning. It was raining at the time of the crash and the bituminous roadways were wet. The crash occurred in an offset four legged intersection. The westbound leg of the intersection is a two-way undivided roadway and is comprised of two travel lanes; one westbound lane and one eastbound lane. The speed limit for this road is 48 kmph (30 mph). It is controlled by overhead traffic signals. There is a >2% westbound uphill grade approaching the area of impact. The northbound leg of the intersection is a two-way undivided roadway and is comprised of three travel lanes; one northbound lane, one northbound left-turn lane, and one southbound lane. The speed limit for this road is 48 kmph (30 mph). It is controlled by overhead traffic signals. The road is level at this location. Vehicle 1, a 1999 Suzuki Esteem 4-door (case vehicle) driven by a 32 year old male (183 cm/72 in, 68 kg/150 lbs), was traveling west in the westbound travel lane approaching the intersection at a driver estimated speed of 48 kmph (30 mph). The driver was preparing to travel straight through the intersection. The overhead traffic signal was in the green phase at this time. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 1. Vehicle 2, a 1991 Chevrolet S-10 Blazer compact utility vehicle driven by a 23 year old female, was traveling north in the right northbound travel lane approaching the intersection at an unknown speed. The driver was preparing to travel straight through the intersection. The overhead traffic signal was in the red phase at this time. It is unknown if the driver was restrained. There were no other occupants in Vehicle 2. Vehicle 2 entered the intersection against the red traffic signal and entered the path of Vehicle 1. The front plane of Vehicle 1 (11FDEW1) struck the right plane of Vehicle 2 (02RPEW2) in the intersection. A Barrier Equivalent Speed was calculated for the case vehicle, utilizing the Damage Only Algorithm of WinSMASH as 19 kmph (12 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. Vehicle 1 rotated clockwise approximately 50 degrees after impact and came to rest in the center of the intersection facing northwest. Vehicle 2 rotated clockwise approximately 150 degrees after impact and came to rest north of the intersection facing west. The driver of Vehicle 1 sustained non-incapacitating injuries in the crash and was transported from the scene to a hospital where he was treated and released. The driver of Vehicle 2 also reportedly sustained non-incapacitating injuries in the crash of an unknown nature and severity. She was transported from the scene to a hospital where her course of treatment is not known. Both vehicles were disabled due to damage sustained in the crash and were towed from the scene.

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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1999 Suzuki Esteem 4-door sedan. This minor injury crash occurred in June, 1999 in the morning. It was raining at the time of the crash and the bituminous roadways were wet. The crash occurred in an offset four legged intersection. The westbound leg of the intersection is a two-way undivided roadway and is comprised of two travel lanes; one westbound lane and one eastbound lane. The speed limit for this road is 48 kmph (30 mph). It is controlled by overhead traffic signals. There is a >2% westbound uphill grade approaching the area of impact. The northbound leg of the intersection is a two-way undivided roadway and is comprised of three travel lanes; one northbound lane, one northbound left-turn lane, and one southbound lane. The speed limit for this road is 48 kmph (30 mph). It is controlled by overhead traffic signals. The road is level at this location.


Figure 1. Exterior, Vehicle 1 (Suzuki Esteem)

Vehicle 1, a 1999 Suzuki Esteem 4-door (case vehicle) driven by a 32 year old male (183 cm/72 in, 68 kg/150 lbs), was traveling west in the westbound travel lane approaching the intersection at a driver estimated speed of 48 kmph (30 mph). The driver was preparing to travel straight through the intersection. The overhead traffic signal was in the green phase at this time. The driver was restrained by the available manual lap/shoulder restraint. There were no other occupants in Vehicle 1.


Figure 2. Exterior, Vehicle 2 (Chevrolet S-10 Blazer)

Vehicle 2, a 1991 Chevrolet S-10 Blazer compact utility vehicle driven by a 23 year old female, was traveling north in the right northbound travel lane approaching the intersection at an unknown speed. The driver was preparing to travel straight through the intersection. The overhead traffic signal was in the red phase at this time. It is unknown if the driver was

restrained. There were no other occupants in Vehicle 2.

Crash Events

Vehicle 2 entered the intersection against the red traffic signal and entered the path of Vehicle 1. The front plane of Vehicle 1 (11FDEW1) struck the right plane of Vehicle 2 (02RPEW2) in the intersection.

A Barrier Equivalent Speed was calculated for the case vehicle, utilizing the Damage Only Algorithm of WinSMASH as 19 kmph (12 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.

Figure 3. Crash scene. Vehicle 1 approach path.

Vehicle 1 rotated clockwise approximately 50 degrees after impact and came to rest in the center of the intersection facing northwest. Vehicle 2 rotated approximately 150 degrees after impact and came to rest north of the intersection facing west.

The driver of Vehicle 1 sustained non-incapacitating injuries in the crash and was transported from the scene to a hospital where he was treated and released. The driver of Vehicle 2 also reportedly sustained non-incapacitating injuries in the crash of an unknown nature and severity. She was transported from the scene to a hospital where her course of treatment is not known.

Both vehicles were 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	Unknown	Unknown	Unknown	Unknown
Longitudinal	Unknown	Unknown	Unknown	Unknown
Lateral	Unknown	Unknown	Unknown	Unknown
Barrier speed	19	11.7	Unknown	Unknown

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1999 Suzuki Esteem
VIN	JS2GB41S5X5
CDC	11FDEW1

Figure 4. Exterior, Vehicle 1 (1999 Suzuki Esteem)

Figure 5. Exterior, Vehicle 1 (1999 Suzuki Esteem)

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	136	0	3	11	13	8	16
	53.5	0	1.2	4.3	5.1	3.1	6.3

Interior of Case Vehicle

The interior of the Suzuki Esteem sustained minor damage from occupant contact. There were no areas of intrusion into the passenger compartment. There was occupant contact evidence present to the mirror and steering wheel.

The case vehicle was equipped with bucket seats with adjustable head restraints (which were not damaged) 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 to the middle track position. The rear of the vehicle was equipped with bench seats with no head restraints in all three seating positions. The back seats were not adjustable.

Case Vehicle Occupant Protection Systems

The Suzuki Esteem 4-door sedan 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 frontal air bag.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical I-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 top-instrument panel position and was concealed by a single rectangular cover flap which was not damaged in the crash. The rectangular air bag was not equipped with tether straps or vent ports. No contact evidence was found on the air bag and the bag was not damaged.

Case Vehicle Occupant Demographics

Table 4. Case Vehicle Occupant(s) Demographics

	Occupant 1	
Age/Sex:	32/Male	
Seated Position:	Front left	
Seat Type:	Bucket - cloth covered	
Height (cm/in:):	183	72
Weight (kg/lbs).:	68	150
Pre-existing Medical Condition:	None noted	
Body Posture:	Normal - upright in seat facing forward	
Hand Position:	Both on steering wheel	
Foot Position:	On floor or foot controls	
Restraint Usage:	Manual lap & shoulder restraint	
Air bag:	Deployed redesigned air bag system	

Occupant Injuries

Table 5. Case Vehicle Occupant(s) Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Scalp abrasion	1	Driver's frontal air bag
Right wrist (carpus) joint sprain	1	Driver's frontal air bag

Occupant Kinematics

The driver of the 1999 Suzuki Esteem 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 in the vehicle, and observations by the investigating police officer at the scene of the crash. The driver reported that he applied the brakes prior to impact in a attempt to avoid the collision. As he did this, his torso began loading the lap/shoulder restraint.

At impact, the driver reacted to the 340 degree principal direction of force by moving forward and to the left. As the lap/shoulder restraints locked, further forward movement of the occupant was prevented. As the driver pitched forward, the driver's frontal air bag deployed. He came into contact with the deploying air bag-causing the scalp abrasion and right wrist (carpus) joint sprain. The driver of Vehicle 1 was transported from the scene to a hospital where he was treated and released for non-incapacitating injuries.

Figure 7. Interior, Vehicle 1. Case occupant seating position.

Scene Diagram