

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1999-075-055K)

1999 Dodge Durango

Colorado

March/1999

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16. Abstract This remote investigation focused on the redesigned air bag system deployment of a 1999 Dodge Durango sport utility vehicle. This crash occurred in March, 1999 in the afternoon. The weather was clear and the bituminous roadways were dry. The crash occurred in a four leg intersection. The westbound leg of the intersection is a two-way divided roadway and is comprised of seven travel lanes; two westbound through lanes, one westbound right-turn lane, one westbound left-turn lane, and three eastbound lanes. Eastbound traffic is separated from westbound traffic by a raised concrete median strip. The speed limit for this road is 80 kmph (50 mph). It is controlled by overhead traffic signals. There was a westbound uphill grade at the area of impact. The northbound leg of the intersection is a two-way undivided roadway and is comprised of four travel lanes; one northbound right-turn lane, one northbound through lane, one northbound left-turn lane, and one southbound lane. It is controlled by overhead traffic signals. Vehicle 1, a 1985 Subaru GL 4-door sedan driven by a 16 year old female (168 cm/66 in, 54 kg/120 lbs), was traveling east in the eastbound left-turn lane approaching the intersection at a driver estimated speed of 24 kmph (15 mph). The driver was preparing to make a left turn at the intersection. The 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 the vehicle. Vehicle 2, a 1999 Dodge Durango sport utility vehicle (case vehicle) driven by a 50 year old female (160 cm/63 in, 61 kg/135 lbs), was traveling west in westbound travel lane 2 approaching the intersection at a driver estimated speed of 72 kmph (45 mph). The driver was preparing to travel straight through the intersection. The 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 the vehicle. The driver of Vehicle 1 failed to yield the right-of-way and initiated the left turn in the path of Vehicle 2. The front plane of Vehicle 2 (11FDEW2) struck the right plane of Vehicle 1 (unknown CDC). The two vehicles then sideslapped with the left plane of Vehicle 2 (09LPEW1) striking the right plane of Vehicle 1 (unknown CDC). Vehicle 1 then departed the southeast corner of the intersection and came to rest after striking a rock wall with the front plane (unknown CDC). Vehicle 2 came to rest in the intersection facing southeast. A Delta V was calculated for event 1 for the case vehicle, utilizing the Missing Vehicle Algorithm of WinSMASH, as 24 kmph (15 mph). A Delta V was also calculated for event 2 for the case vehicle as 5 kmph (3 mph). As a result of the first event frontal impact, the supplemental restraint system (driver's and passenger's frontal air bags) of the case vehicle deployed. The driver of Vehicle 1 sustained major incapacitating injuries and was transported from the scene to a trauma center where she was hospitalized for 13 days. The driver of the case vehicle sustained non-incapacitating injuries of an unknown nature and severity. She was transported from the scene to a trauma center where her course of treatment is not known. Both vehicles became 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 Dodge Durango sport utility vehicle. This crash occurred in March, 1999 in the afternoon. The weather was clear and the bituminous roadways were dry. The crash occurred in a four leg intersection. The westbound leg of the intersection is a two-way divided roadway and is comprised of seven travel lanes; two westbound through lanes, one westbound right-turn lane, one westbound left-turn lane, and three eastbound lanes. Eastbound traffic is separated from westbound traffic by a raised concrete median strip. The speed limit for this road is 80 kmph (50 mph). It is controlled by overhead traffic signals. There was a westbound uphill grade at the area of impact. The northbound leg of the intersection is a two-way undivided roadway and is comprised of four travel lanes; one northbound right-turn lane, one northbound through lane, one northbound left-turn lane, and one southbound lane. It is controlled by overhead traffic signals.

Vehicle 1, a 1985 Subaru GL 4-door sedan driven by a 16 year old female (168 cm/66 in, 54 kg/120 lbs), was traveling east in the eastbound left-turn lane approaching the intersection at a driver estimated speed of 24 kmph (15 mph). The driver was preparing to make a left turn at the intersection. The 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 the vehicle.

Vehicle 2, a 1999 Dodge Durango sport utility vehicle (case vehicle) driven by a 50 year old female (160 cm/63 in, 61 kg/135 lbs), was traveling west in westbound travel lane 2 approaching the intersection at a driver estimated speed of 72 kmph (45 mph). The driver was preparing to travel straight through the intersection. The 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 the vehicle.



Figure 1. Exterior, Vehicle 2. Event 1 damage.



Figure 2. Exterior, Vehicle 2. Event 2 damage.

**Crash Events**

The driver of Vehicle 1 failed to yield the right-of-way and initiated the left turn in the path of Vehicle 2. The front plane of Vehicle 2 (11FDEW2) struck the right plane of Vehicle 1 (unknown CDC). The two vehicles then sideslapped with the left plane of Vehicle 2 (09LPEW1) striking the right plane of Vehicle 1 (unknown CDC). Vehicle 1 then departed the southeast corner of the intersection and came to rest after striking a rock wall with the front plane (unknown CDC). Vehicle 2 came to rest in the intersection facing southeast.



**Figure 3.** Crash scene. Vehicle 2 approach to impact.

A Delta V was calculated for event 1 for the case vehicle, utilizing the Missing Vehicle Algorithm of WinSMASH, as 24 kmph (15 mph). A Delta V was also calculated for event 2 for the case vehicle as 5 kmph (3 mph).

As a result of the first event frontal impact, the supplemental restraint system (driver’s and passenger’s frontal air bags) of the case vehicle deployed. The driver of Vehicle 1 sustained major incapacitating injuries and was transported from the scene to a trauma center where she was hospitalized for 13 days. The driver of the case vehicle sustained non-incapacitating injuries of an unknown nature and severity. She was transported from the scene to a trauma center where her course of treatment is not known.

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	24	14.9	48	29.8
Longitudinal	-23	-14.3	-31	-19.3
Lateral	8	5	-37	-23
Barrier speed	23	14.3	50	31.1

**Exterior of Case Vehicle**

**Table 2. Vehicle Information**

Model year, make and model	1999 Dodge Durango
VIN	1B4HS28Z6XF
CDC	11FDEW2



**Figure 4.** Exterior, Vehicle 2 (1999 Dodge Durango)



**Figure 5.** Exterior, Vehicle 2 (1999 Dodge Durango)

**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	154	4	14	31	26	11	17
	60.6	1.6	5.5	12.2	10.2	4.3	6.7

### ***Interior of Case Vehicle***

The interior of the Dodge Durango showed no evidence of occupant contact. There were no areas of intrusion into the passenger compartment.

The case vehicle was equipped with bucket seats in the front left and front right seating positions. Both front seats were adjusted between the forward most and middle 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 were 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 Dodge Durango 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.

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. The circular air bag was equipped with two tether straps and no vent ports. No contact evidence was found on the bag and the bag was not damaged in the crash.

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. The rectangular air bag was not equipped with tether straps or vent ports. No contact evidence was found on the bag and the bag was not damaged in the crash.



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



**Figure 7.** Interior, case vehicle. Passenger's air bag.

## Case Vehicle Occupant Demographics

**Table 4. Case Vehicle Occupant Demographics**

	Occupant 1
Age/Sex:	50/Female
Seated Position:	Front left
Seat Type:	Bucket - leather covered
Height (cm/in.):	160      63
Weight (kg/lbs):	61      135
Pre-existing Medical Condition:	None noted
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Manual lap & shoulder restraint
Air bag:	Deployed redesigned air bag system

## Occupant Injuries

**Table 5. Injuries**

Injury	Injury Severity (AIS)	Injury Mechanism
Non-incapacitating injures	Unknown nature and severity	

## *Occupant Kinematics*

The driver (case occupant) of the Dodge Durango was seated in an unknown posture in the front left position of the vehicle. She 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. Prior to impact, the driver attempted to avoid the impact by applying a sharp right steering input. The driver reacted by moving leftward, but was held in the seat by the lap/shoulder restraint.

At impact, the case occupant reacted to the 340 degree principle direction of force by moving forward and slightly left further loading the lap/shoulder restraint. As the restraints locked, further forward movement of the case occupant was prevented. It is presumed that the driver's face and chest came into contact with the deploying driver's frontal air bag event though no contact evidence was found on the bag. The driver sustained non-incapacitating injuries of an unknown nature and severity. The case occupant was transported to a trauma center from the crash scene where her course of treatment is not known.



**Figure 8.** Interior, case vehicle. View from left side.



**Figure 9.** Interior, case vehicle. View from right side.



Scene Diagram

