

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-075-805G)

1998 Mazda Pickup

Colorado

November/1998

**Technical Report Documentation Page**

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| 16. Abstract<br>This remote investigation focused on the redesigned air bag system deployment of a 1998 Mazda Pickup compact pickup truck. This crash occurred in November, 1998, in the morning. The weather was clear and the bituminous roadways were dry. The crash occurred in a four leg intersection. The northbound leg of the intersection is two-way divided roadway and is comprised of six travel lanes; two northbound thru-lanes, two northbound left-turn lanes, and two southbound lanes. The speed limit for this road 72 kmph (45 mph). It is controlled by overhead traffic signals. The road is level at the area of impact. The intersecting roadways are two lane, one-way highway on/off ramps. They are controlled by overhead traffic signals. The speed limit and grade for these roads is not known. Vehicle 1, a 1991 Ford Tempo 4-door sedan driven by a 24 year old male (unknown ht/wt), was traveling north in the left northbound left-turn lane approaching the intersection at a police estimated speed of 32 kmph (20 mph). The driver was preparing to make a left turn at the intersection onto the westbound highway on ramp. The overhead traffic signal was in the green phase at this time. It is unknown if the driver was restrained. There were no other occupants in Vehicle 1. Vehicle 2, a 1998 Mazda Pickup compact pickup truck (case vehicle) driven by a 30 year old male (178 cm/70 in, 84 kg/185 lbs), was traveling south in the southbound right lane approaching the intersection at a police estimated speed of 72 kmph (45 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 2. 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 (12FYEW1) struck the right plane of Vehicle 1 (03RZAW3) in the intersection. A Delta V was calculated for the case vehicle, utilizing the Damage Only Algorithm of WinSMASH, as 22 kmph (14 mph) with the longitudinal component being -21 kmph (-13 mph). As a result of the frontal impact, the supplemental restraint system (driver's frontal redesigned air bag) of the case vehicle deployed. The passenger's frontal air bag was shut off at the time of the crash and did not deploy. After impact, Vehicle 1 rotated clockwise approximately 90 degrees and came to rest in the southwest corner of the intersection facing north. Vehicle 2 rotated clockwise approximately 10 degrees and came to rest in the original travel lane facing southwest. Neither driver was injured in the collision and neither driver was transported from the scene for medical attention. 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 1998 Mazda Pickup compact pickup truck. This crash occurred during the morning hours in November, 1998. The weather was clear and the bituminous roadways were dry. The crash occurred in a four leg intersection. The northbound leg of the intersection is two-way divided roadway and is comprised of six travel lanes; two northbound thru-lanes, two northbound left-turn lanes, and two southbound lanes. The speed limit for this road 72 kmph (45 mph). It is controlled by overhead traffic signals. The road is level at the area of impact. The intersecting roadways are two lane, one-way highway on/off ramps. They are controlled by overhead traffic signals. The speed limit and grade for these roads is not known.

Vehicle 1, a 1991 Ford Tempo 4-door sedan driven by a 24 year old male (unknown ht/wt), was traveling north in the left northbound left-turn lane approaching the intersection at a police estimated speed of 32 kmph (20 mph). The driver was preparing to make a left turn at the intersection onto the westbound highway on ramp. The overhead traffic signal was in the green phase at this time. It is unknown if the driver was restrained. There were no other occupants in Vehicle 1.

Vehicle 2, a 1998 Mazda Pickup compact pickup truck (case vehicle) driven by a 30 year old male (178 cm/70 in, 84 kg/185 lbs), was traveling south in the southbound right lane approaching the intersection at a police estimated speed of 72 kmph (45 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 2.



**Figure 1.** Exterior, Vehicle 1 (1991 Ford Tempo)



**Figure 2.** Exterior, Vehicle 2 (1998 Mazda Pickup)

## 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 (12FYEW1) struck the right plane of Vehicle 1 (03RZAW3) in the intersection.

A Delta V was calculated for the case vehicle, utilizing the Damage Only Algorithm of WinSMASH, as 22 kmph (14 mph) with the longitudinal component being -21 kmph (-13 mph).

As a result of the frontal impact, the supplemental restraint system (driver's frontal redesigned air bag) of the case vehicle deployed. The passenger's frontal air bag was shut off at the time of the crash and did not deploy.



Figure 3. Crash scene. Vehicle 2 approach path.

After impact, Vehicle 1 rotated clockwise approximately 90 degrees and came to rest in the southwest corner of the intersection facing north. Vehicle 2 rotated clockwise approximately 10 degrees and came to rest in the original travel lane facing southwest.

Neither driver was injured in the collision and neither driver was transported from the scene for medical attention. 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         | 22           | 13.7 | 29            | 18    |
| Longitudinal  | -21          | -13  | -5            | -3.1  |
| Lateral       | 4            | 2.5  | -28           | -17.4 |
| Barrier speed | 23           | 14.3 | 28            | 17.4  |

**Exterior of Case Vehicle**

**Table 2. Vehicle Information**

|                            |                   |
|----------------------------|-------------------|
| Model year, make and model | 1998 Mazda Pickup |
| VIN                        | 4F4YR12C0WT       |
| CDC                        | 12FYEW1           |



**Figure 4.** Exterior, case vehicle (1998 Mazda Pickup)



**Figure 5.** Exterior, case vehicle (1998 Mazda Pickup)

**Table 3. Crush Measurements**

| Plane of Impact | Field L<br>cm/in. | C1<br>cm/in. | C2<br>cm/in. | C3<br>cm/in. | C4<br>cm/in. | C5<br>cm/in. | C6<br>cm/in. |
|-----------------|-------------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Bumper          | 145               | 23           | 12           | 15           | 18           | 10           | 8            |
|                 | 57.1              | 9.1          | 4.7          | 5.9          | 7.1          | 3.9          | 3.1          |



## *Interior of Case Vehicle*

The interior of the 1998 Mazda Pickup sustained no damage from occupant contact. There were no areas of intrusion into the passenger compartment. No evidence of occupant contact was found in the vehicle.

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

### *Case Vehicle Occupant Protection Systems*

The Mazda Pickup compact pickup truck 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, and a front right air bag shut off switch.

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 bag and the bag was not damaged.



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

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 air bag was shut off at the time of the crash and did not deploy.

The front right air bag shut off switch was located on the center instrument panel. The switch is key activated and was turned to the "off" position during the crash.



**Figure 7.** Interior, case vehicle. Box indicates location of passenger's air bag shut off switch.

## Case Vehicle Occupant Demographics

**Table 4. Case Vehicle Occupant(s) Demographics**

|                                    |  |
|------------------------------------|--|
|                                    | Occupant 1                                       |
| Age/Sex:                           | 30/Male  |
| Seated Position:                   | Front left                                       |
| Seat Type:                         | Split bench with folding<br>back - cloth covered |
| Height (cm/in):                    | 178      70                                      |
| Weight (kg/lbs):                   | 84      185                                      |
| Pre-existing<br>Medical Condition: | None noted                                       |
| Body Posture:                      | Unknown  |
| Hand Position                      | Unknown  |
| Foot Position:                     | Unknown  |
| Restraint Usage:                   | Manual lap & shoulder<br>restraint               |
| Air bag:                           | Deployed redesigned<br>driver's frontal air bag  |

## Occupant Injuries

**Table 5 Injuries**

| Injury      | Injury Severity (AIS) | Injury Mechanism |
|-------------|-----------------------|------------------|
| Not injured |                       |                  |

## *Occupant Kinematics*

The driver (case occupant 01) of the Mazda Pickup was seated in an unknown 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. On-scene physical evidence consisting of skid marks suggests that the driver applied the brakes (with lock-up) prior to impact, so the driver should have begun loading the lap/shoulder restraint.

At impact, the case occupant reacted to the 350 degree principle direction of force by moving forward and slightly to the left. As the restraints locked, further forward movement of the case occupant was prevented. Although no occupant contact evidence was found on the air bag, it is presumed that the driver came into contact with the deploying air bag in this frontal impact. The case occupant sustained no injuries in the crash and did not appear to have come into contact with any other components of the vehicle's interior.



**Figure 8.** Interior case vehicle. Case occupant seating position.



