

On-scene Investigation / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS98028
1995 Plymouth Voyager
California
November 1998

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points be coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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| 16. Abstract <p>This collision occurred in California in November 1998 at 0815 hours. This four-vehicle, chain-reaction crash occurred in the westbound lanes of a crowded, two-lane divided state highway. The speed limit for vehicles in both direction is 105 km/h (65 mph). The weather was clear and the roadway was dry. There were no viewing obstructions in either direction. The case vehicle, a 1995 Plymouth Voyager van driven by a 41-year-old male, was traveling westbound in rush hour traffic at a driver estimated speed of 24-32 km/h (15-20 mph). The front right seat was occupied by a partially deaf 10-year-old male--the driver's son. He was seated in a box- mount, fabric-covered bucket seat. He was not wearing the available lap and shoulder belt. The driver indicated that he had dropped off his other three sons at various schools in the area. This occupant had originally been seated in the rear, but moved to the front right position after the eldest son had vacated that position.</p> <p>The first other vehicle, a 1991 Eagle Premier driven by a 23-year-old male, was traveling in the same lane and in front of the case vehicle. The second other vehicle, a 1987 Toyota Celica driven by an 18-year-old male, was traveling the same lane and in front of the Eagle Premier. The third other vehicle, a 1994 Toyota Paseo driven by a 22-year-old male, was traveling in the same lane and in front of the Toyota Celica.</p> <p>The front right occupant of the case vehicle was playing an electronic game. Prior to the impact, he had been instructed to put the game away. While looking to the right, the driver failed to notice traffic slowing ahead of him. The front right occupant leaned forward to put the game away. At this time, the driver saw the traffic and began braking. The case vehicle sustained an estimated longitudinal delta V of -16.5 km/h (-10.3 mph). Both the driver's and front right passenger's air bags deployed at this point. The braking motion and subsequent impact caused the front right occupant to pitch forward and into close proximity of the now-deploying air bag. The air bag struck this occupant directly in the face causing the fatal injuries. After the initial crash, the Eagle Premier was pushed into the Celica. The Celica was then pushed into the rear of the Paseo. The front right occupant of the case vehicle was fatally injured in this crash.</p> <p>All the other vehicles were driven from the scene. The case vehicle was towed from the scene due to minor damage.</p> | | | | | |
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Dynamic Science, Inc.
Accident Investigation
Case Number: DS98028

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BACKGROUND:

Description: This case was initiated in response to a report of an air bag related passenger fatality. This case was conducted as an on-scene investigation. The NHTSA was made aware of the case by DSI, based on a newspaper report.

Investigation Type: On-scene

Crash Location: California

Crash Date: November, 1998

Notification Date: November 27, 1998

Field Work Completed: January 18, 1999

SUMMARY:

This collision occurred in California in November 1998 at 0815 hours. This four-vehicle, chain-reaction crash occurred in the westbound lanes of a crowded, two-lane divided state highway. The speed limit for vehicles in both direction is 105 km/h (65 mph). The weather was clear and the roadway was dry. There were no viewing obstructions in either direction.



Figure 1. Crash scene, facing west

The case vehicle, a 1995 Plymouth Voyager van driven by a 41-year-old male, was traveling westbound in rush hour traffic at a driver estimated speed of 24-32 km/h (15-20 mph). The front right seat was occupied by a partially deaf¹ 10-year-old male--the driver's son (estimated weight of 33.5 kg/74 lbs, estimated height of 137.9 cm/54.2 in.)². He was seated in a box-mount, fabric-covered bucket seat. He was not wearing the available lap and shoulder belt. The seat was reclined at a 19E angle and was adjusted to the rear-most track position. The driver indicated that he had

¹Occupant had 75% hearing loss due to measles at the age of 15 months. Occupant wore a hearing aid.

²Obtained from Anthropometry of Infants, Children and Youths to Age 18 for Product Safety Design, SAE Document SP450

dropped off his other three sons at various schools in the area. This occupant had originally been seated in the rear, but moved to the front right position after the eldest son had vacated that position. The driver stated that the child was wearing the lap and shoulder belt.

The first other vehicle, a 1991 Eagle Premier driven by a 23-year-old male, was traveling in the same lane and in front of the case vehicle.

The second other vehicle, a 1987 Toyota Celica driven by a an 18-year-old male, was traveling in the same lane and in front of the Eagle Premier.

The third other vehicle, a 1994 Toyota Paseo driven by a 22-year-old male, was traveling in the same lane and in front of the Toyota Celica.

The front right occupant of the case vehicle was playing an electronic game (IQ Builders, "Multi Math"). Prior to the impact, he had been instructed to put the game away. While looking to the right, the driver failed to notice traffic slowing ahead of him. The front right occupant leaned forward to put the game away. At this time, the driver saw the traffic and began braking. The front of the case vehicle struck the rear of the Eagle Premier which was stopped ahead of the case vehicle. The case vehicle was assigned a CDC of 12FDEW1 (PDOF =0E). The case vehicle sustained an estimated longitudinal delta V of -16.5 km/h (-10.3 mph)³. Both the driver's and front right passenger's frontal air bags deployed at this point. The driver stated that the child was belted and had put the torso portion of the seat belt behind as he leaned forward. The braking motion and subsequent impact caused the front right occupant to pitch forward and into close proximity of the now-deploying air bag. The air bag struck this occupant directly in the face causing the fatal injuries.

Despite the driver's statements to the contrary, it is believed that the front right passenger was not wearing the available lap and shoulder restraint. This is based on the skin transfer evidence found on the air bag and the lack of blood drop evidence found on the seat belt. There is evidence of seat belt usage, but this is a high mileage vehicle---161,993 kilometers (100,658 miles)---and the usage is likely not from this crash. There was no indication of loading.

After the initial crash, the Eagle Premier was pushed into the Toyota Celica. The Toyota Celica was then pushed into the rear of the Toyota Paseo.

The front right occupant of the case vehicle was fatally injured in this crash. Immediately after the crash, the driver noticed that his son was bleeding from the face and was unconscious. The driver removed the child from the vehicle, laid him on the ground, and tried to help him breathe. As reported by bystanders, the child had gone into respiratory arrest at that point and cardiopulmonary resuscitation was started at the roadside. The child was evaluated by paramedics in the field and was

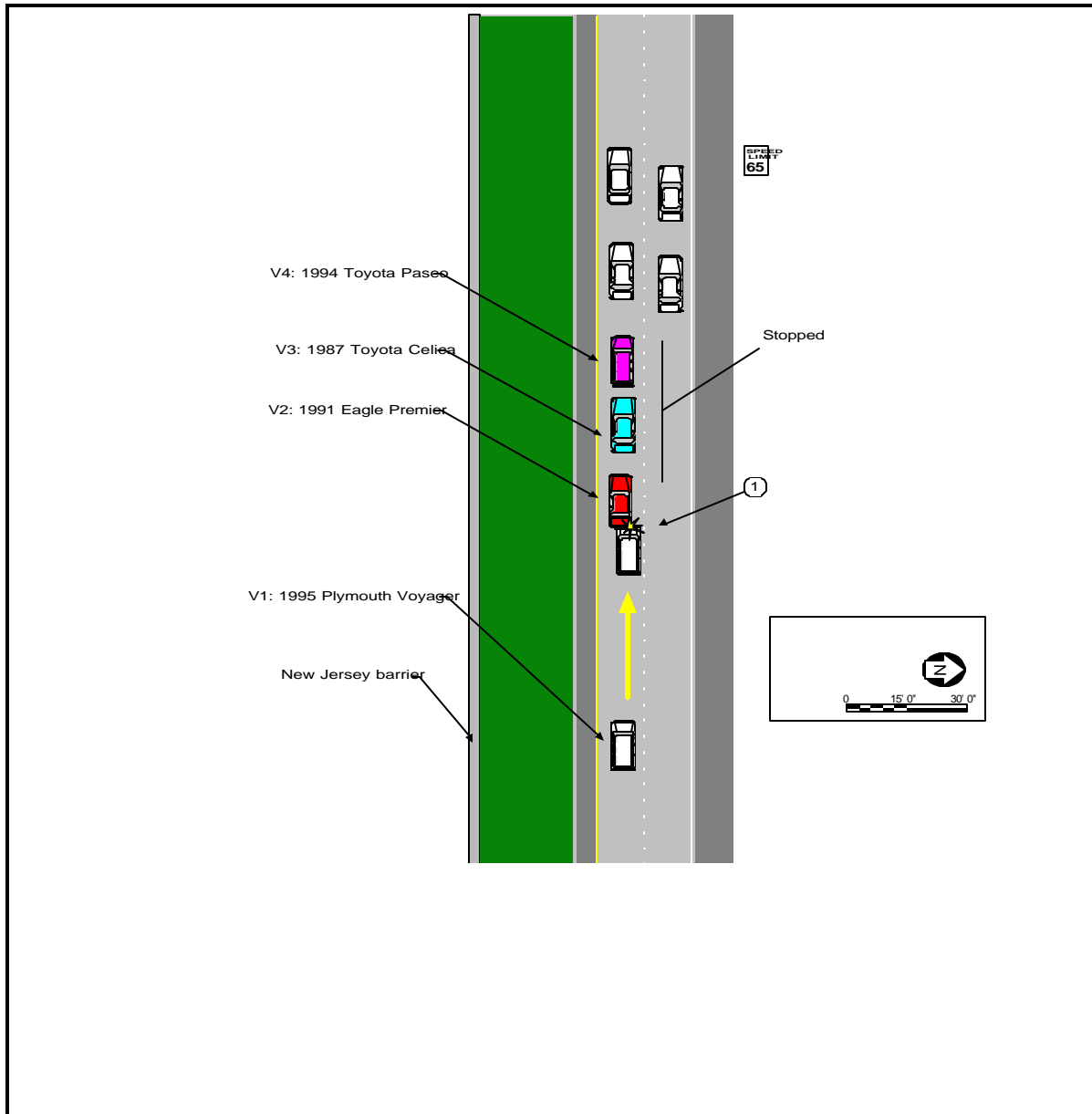
³Computed using WinSmash with the Missing Vehicle Option

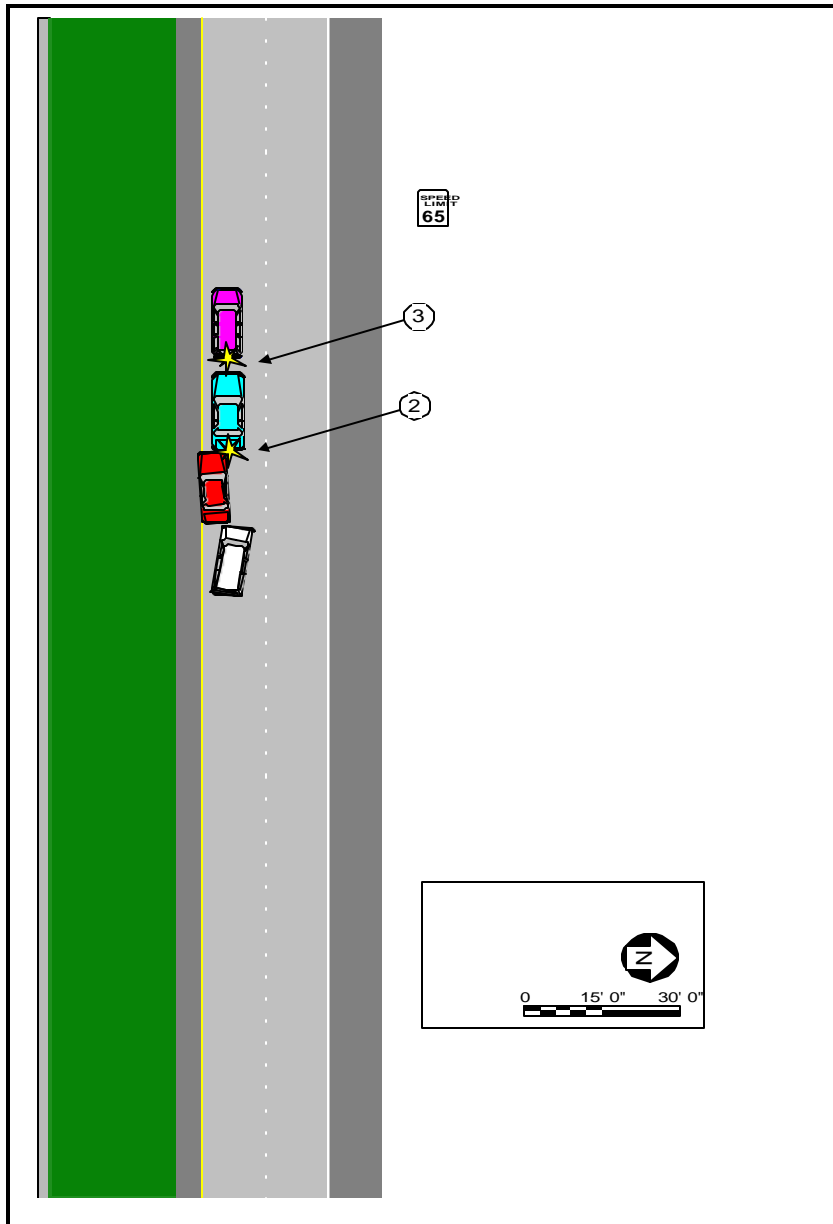
found to be in agonal breathing⁴ at the time of their arrival. He was coded for approximately 30 minutes with eventual return of pulse and blood pressure. At that time, the pupils were non-reactive. Upon arrival in the emergency room, a CT scan was obtained which showed a minimal right subdural hematoma and profuse edema with cerebral herniation. There was loss of basal cisterns and marked decrease in ventricular size. It was determined that this occupant had a severe cerebral anoxic event. There was complete loss of brain stem function and he was evaluated to be brain dead at this point. He was pronounced dead at 1625 hours.

Vehicles 2, 3, and 4 were driven from the scene. Vehicle 1 was towed from the scene due to minor damage.

⁴ When the heart stops beating in cardiac arrest the breathing center in the brain is still alive for a couple of minutes and will cause the victim to take a few abnormal breaths. These abnormal breaths associated in dying are called agonal respirations. They may appear like snoring, gasping, or snorting and will disappear in a couple of minutes.

Scene Diagram





DETAILED INFORMATION**Vehicles**Case vehicle

| | | |
|---------------------|---|------------------------|
| Description: | 1995 Plymouth Voyager van | |
| VIN: | 2P4GH25K5SRxxxxxx | |
| Odometer: | 100,658 miles | |
| Engine: | 2.5 L I-4 | |
| Reported Defects: | No passenger's frontal air bag recalls currently in effect. Voluntary recall in effect for driver's front air bag ⁵ . | |
| Cargo: | None | |
| Damage Description: | Minor rearward front bumper and grille crush. The hood was displaced rearward and buckled upward near its center. There was contact damage consisting of vertical creases and black transfers at the leading edge of the hood. The windshield was broken but remained intact. | |
| CDC: | 12FDEW1 | |
| Delta V: | Total | 16.5 km/h (10.3 mph) |
| | Longitudinal | -16.5 km/h (-10.3 mph) |
| | Latitudinal | 0 km/h (0 mph) |

⁵DaimlerChrysler Announces Minivan Recall

AUBURN HILLS, Mich., May 28 /PRNewswire/ -- DaimlerChrysler (NYSE: DCX) today announced the voluntary recall of 996,939 minivans, model years 1994-95, to perform an air bag system diagnostic check for wiring shorts. The recall action affects the Dodge Caravan, Plymouth Voyager and Chrysler Town & Country vehicles. The recall was prompted by about 35 field reports of inadvertent deployment of driver's-side air bags caused by a short in the wiring harness. Most of the deployments occurred when the vehicle was started. There have been no reports of serious injury or death.

This action is unrelated to recent reports that the National Highway Traffic Safety Administration is studying test data to determine if passenger-side air bags in Chrysler minivans pose a risk of injury to small adults. Owners of the vehicles are expected to be notified in about a month. Any shorts identified during the diagnostic check will be repaired.

SOURCE DaimlerChrysler Corporation

Energy

16, 891 joules
(12,471 ft-lbs)



Figure 4. Exterior, front view



Figure 5. Exterior, angle view.

The case vehicle was equipped with a driver's frontal air bag and a mid-mount passenger side air bag. The steering wheel hub mounted driver's air bag is circular and is 53 cm (21 in.) in diameter; it has two vent holes and is not tethered. There are nine horizontal and six vertical folds. There is 50 cm (19.6 in.) of air bag excursion. The distance from the center of the module cover to the seat back cushion is 67 cm (26.3 in.). There were markings on both the left and right side of the face of the air bag from contact with the interior module cover. There were no indications of occupant contact. The module cover has an "H" configuration. There were no indications of any damage or occupant contact.

The passenger's air bag is rectangular in shape and measures 63 cm (24.8 in.) high by 49 cm (19.2 in.) wide; it has two tethers and no vent holes. There is 54 cm (21.2 in.) of air bag excursion. The distance from mid-instrument panel to the back of the front right seat is 79 cm (31.1 in.). There was a skin transfer found on the face of the air bag; it was 15 cm (5.9 in.) wide and 50 cm (19.6 in.) wide. The transfer began 22 cm (8.6 in.) below the top row of stitching and 18 cm (7 in.) from the right side. Spots of blood were found on the right side. The module cover is rectangular in shape and there were no indications of damage or contact.

There was damage found to the windshield from interior contacts. In the middle of the windshield there was damage from the mirror contacting the glass—this was possibly as a result of the driver's hand striking the mirror. There was also damage to the upper right portion of the windshield. This appears to be loading type damage from the deploying air bag.



Figure 6. Interior, front left



Figure 7. Interior, front right



Figure 8. Passenger side front air bag



Figure 9. Front right seat—arrows indicate blood drop evidence on seat (none found on seat belt)

Other vehicle 1

| | | |
|---------------------|--|-------------------------------|
| Description: | 1991 Eagle Premier | |
| VIN: | Unknown | |
| Odometer: | Unknown | |
| Engine: | Unknown | |
| Reported Defects: | Unknown | |
| Cargo: | Unknown | |
| Damage Description: | Moderate front and rear damage—per police report | |
| CDC: | Unknown | |
| Delta V: | Total | 19.4 km/h (12.0 mph) |
| | Longitudinal | 19.4 km/h (12.0 mph) |
| | Latitudinal | 0 km/h (0 mph) |
| | Energy | 19,943 joules (14,719 mph) |

Other vehicle 2

| | | |
|---------------------|---|---------|
| Description: | 1987 Toyota Celica | |
| VIN: | Unknown | |
| Odometer: | Unknown | |
| Engine: | Unknown | |
| Reported Defects: | None noted | |
| Cargo: | Unknown | |
| Damage Description: | Minor front and rear damage—per police report | |
| CDC: | Unknown | |
| Delta V: | Total | Unknown |
| | Longitudinal | Unknown |
| | Latitudinal | Unknown |
| | Energy | Unknown |

Other vehicle 3

| | | |
|---------------------|--|---------|
| Description: | 1994 Toyota Paseo | |
| VIN: | Unknown | |
| Odometer: | Unknown | |
| Engine: | Unknown | |
| Reported Defects: | None noted | |
| Cargo: | Unknown | |
| Damage Description: | Minor left rear damage—per police report | |
| CDC: | Unknown | |
| Delta V: | Total | Unknown |
| | Longitudinal | Unknown |
| | Latitudinal | Unknown |
| | Energy | Unknown |

Occupants

| <u>Case vehicle</u> | Occupant 1 | Occupant 2 |
|---------------------------------|--|--|
| Age/Sex: | 41/Male | 10/Male |
| Seated Position: | Front right | Front left |
| Seat Type: | Box- mount, fabric-covered bucket seat | Box- mount, fabric-covered bucket seat |
| Height: | 191 cm (75 in.) | Unknown |
| Weight: | 86 kg (190 lbs.) | Unknown |
| Occupation: | Unknown | NA |
| Pre-existing Medical Condition: | None noted | Partial deafness (75% loss) |
| Alcohol/Drug Involvement: | None | NA |
| Driving Experience: | Presumed to be > 20 years | NA |
| Body Posture: | Normal, upright | Leaning forward |
| Hand Position: | Unknown | Unknown |
| Foot Position: | Right on brake | Unknown |
| Restraint Usage: | Lap and shoulder belt used properly | None used |
| Air bag: | Deployed as a result of impact | Deployed as a result of impact |

| | |
|---------------------------------|--|
| <u>Eagle Premier</u> | Occupant 1 |
| Age/Sex: | 23/Male |
| Seated Position: | Front left |
| Seat Type: | Unknown |
| Height: | 175 cm (69 in.) |
| Weight: | 68 kg (150 lbs.) |
| Occupation: | Unknown |
| Pre-existing Medical Condition: | None noted |
| Alcohol/Drug Involvement: | None |
| Driving Experience: | Unknown |
| Body Posture: | Unknown |
| Hand Position: | Unknown |
| Foot Position: | Unknown |
| Restraint Usage: | Lap and shoulder belts used—per police report |
| Air bag: | NA |

| | |
|---------------------------------|--|
| <u>Toyota Celica</u> | Occupant 1 |
| Age/Sex: | 18/Female |
| Seated Position: | Front left |
| Seat Type: | Unknown |
| Height: | 170 cm (67 in.) |
| Weight: | 51 kg (112 lbs.) |
| Occupation: | Unknown |
| Pre-existing Medical Condition: | None noted |
| Alcohol/Drug Involvement: | None |
| Driving Experience: | Unknown |
| Body Posture: | Unknown |
| Hand Position: | Unknown |
| Foot Position: | Unknown |
| Restraint Usage: | Lap and shoulder belts used—per police report |

| | |
|---------------------------------|--|
| <u>Toyota Paseo</u> | Occupant 1 |
| Age/Sex: | 22/Female |
| Seated Position: | Front left |
| Seat Type: | Unknown |
| Height: | 165 cm (65 in.) |
| Weight: | 57 (125 lbs.) |
| Occupation: | Unknown |
| Pre-existing Medical Condition: | None noted |
| Alcohol/Drug Involvement: | None |
| Driving Experience: | Unknown |
| Body Posture: | Unknown |
| Hand Position: | Unknown |
| Foot Position: | Unknown |
| Restraint Usage: | Lap and shoulder used—per police report |

Injuries and Injury Mechanisms

Case vehicle

| | <u>INJURY</u> | <u>OIC CODE</u> | <u>ICD-9</u> | <u>SOURCE</u> |
|--------------|--|-----------------|--------------|---------------|
| Driver: | Not injured | NA | | |
| RF Occupant: | Profuse cerebral edema as well as herniation - complete loss of brain stem function - loss of basal cisterns and marked decrease in ventricular size | 140674.5,9 | 348.4 | Air bag |
| | Minimal right subdural hematoma | 140629.4,1 | 432.1 | Air bag |
| | Facial abrasion | 290202.1,0 | 910.0 | Air bag |
| | Lip abrasion | 290202.1,8 | 910.0 | Air bag |

| | <u>INJURY</u> | <u>OIC CODE</u> | <u>ICD-9</u> | <u>SOURCE</u> |
|--------------------------|----------------------|-----------------|--------------|---------------|
| Eagle Premier: Driver | Complaint of pain | NA | | |
| Toyota Celica: Driver | Complaint of pain | NA | | |
| Toyota Paseo: Driver | No reported injuries | NA | | |

Occupant Kinematics

The case vehicle was traveling westbound in rush hour traffic at a driver estimated speed of 24-32 km/h (15-20 mph). The front right seat was occupied by a partially deaf 10-year-old male--the driver's son. He was seated in a box-mount, fabric-covered bucket seat. He was not wearing the available lap and shoulder belt. The seat was reclined at a 19E angle and was adjusted to the rear-most track position. The driver indicated that he had dropped off his other three sons at various schools in the area. This occupant had originally been seated in the rear, but moved to the front right position after the eldest son had vacated that position. Prior to the impact, this occupant had been instructed to put the game, with which he was playing, away. While looking to the right, the driver failed to notice traffic slowing ahead of him. The front right occupant leaned forward to put the game away. At this time, the driver saw the traffic and began braking. The front right occupant pitched forward. The front of the case vehicle struck the rear of the first other vehicle. The case vehicle sustained an estimated longitudinal ΔV of -16.5 km/h (-10.3 mph). Both the driver's side and passenger side frontal air bags deployed at this point. The braking motion and subsequent impact caused the front right occupant to pitch forward and into close proximity of the now-deploying air bag. The air bag struck the front right occupant directly in the face causing the fatal injuries.

Despite the driver's statements to the contrary, it is believed that the front right occupant was not wearing the available lap and shoulder restraint. This is based on the skin transfer evidence found on the air bag and the lack of blood drop evidence found on the seat belt. There is evidence of seat belt usage, but this is a high mileage vehicle---161,993 kilometers (100,658 miles)--and the usage is likely not from this crash.



Figure 10. Interior, front right seat position



Figure 11. Interior, right side



Figure 12. Passenger side air bag - skin transfer



Figure 13. Passenger air bag, closeup