

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number ( 1999-79-058A)

1998 Toyota Camry

California

May/1999

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16. Abstract <p>This remote investigation was focused on the redesigned air bag system deployment of a 1998 Toyota Camry. In addition, this investigation focused on the deployment of the passenger side air bag and the collision with a heavy truck. This two-vehicle front to rear crash occurred during the late afternoon hours of a spring day in May, 1999. The crash took place on a five-lane, undivided, left hand curved, roadway. The roadway is comprised of two southbound lanes, two northbound lanes, and a bi-directional turn lane. There is a 2% down grade at the crash location. The speed limit is 56 km/h (35 mph) in both directions. The bituminous roadway was dry and free of any defects.</p> <p>Vehicle 1, a 1998 Toyota Camry driven by a 17-year-old female, was traveling southbound in the first travel lane at a driver reported speed of 56 km/h (35 mph). The front right seat of Vehicle 1 was occupied by a properly restrained 17-year-old female. The driver was returning from purchasing balloons from a gift shop. The driver had just opened the sun roof and balloons began blowing out. The front right occupant pulled them back into the car, but in the process blocked the driver's vision.</p> <p>Vehicle 2, an unoccupied 1983 International Harvester/Navistar heavy cab behind engine single unit straight truck, was parked on the right side of the roadway.</p> <p>The driver of Vehicle 1 did not see the parked heavy truck. There was no braking. The right front of Vehicle 1 (12FRAA9) struck the left rear of Vehicle 2. Both front air bags and the front right side air bag deployed at this point. Vehicle 1 under-rod the rear of Vehicle 2. No delta Vs were calculated. The rear bed of Vehicle 2 penetrated the upper portion of the passenger compartment and contacted the front right occupant.</p> <p>The restrained driver of Vehicle 1 required extrication, but sustained only minor injuries. The restrained front right seat occupant sustained massive injuries from contact with the exterior of the struck vehicle. Responding medics found her unconscious in the vehicle with brain matter showing. She was transported to a local hospital with a Glasgow Coma Scale of 3—no eye opening, no response to verbal commands, and no motion. She was admitted and underwent surgery to repair multiple skull fractures. She remained in a deep coma for six days before expiring. The cause of death was listed as severe craniocerebral trauma.</p> <p>Vehicle 1 was towed away due to damage.</p>			
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***Summary***

This remote investigation was focused on the redesigned air bag system deployment of a 1998 Toyota Camry. In addition, this investigation focused on the deployment of the seated mounted side air bag and the collision with a heavy truck. This two-vehicle front to rear crash occurred during the late afternoon hours of a spring day in May, 1999. The crash took place on a five-lane, undivided, left hand curved, roadway. The roadway is comprised of two southbound lanes, two northbound lanes, and a bi-directional turn lane. There is a 2% down grade at the crash location. The speed limit is 56 km/h (35 mph) in both directions. The bituminous roadway was dry and free of any defects.

Vehicle 1, a 1998 Toyota Camry driven by a 17-year-old female, was traveling southbound in the first travel lane at a driver reported speed of 56 km/h (35 mph). The front right seat of Vehicle 1 was occupied by a properly restrained 17-year-old female. The driver was returning from purchasing balloons from a gift shop. The driver had just opened the sun roof and balloons began blowing out. The front right occupant pulled them back into the car, but in the process blocked the driver's vision.

Vehicle 2, an unoccupied 1983 International Harvester/Navistar heavy cab behind engine (CBE) single unit straight truck, was parked on the right side of the roadway.



**Figure 1.** Approach to area of impact - south



**Figure 2.** Area of impact - south

## *Crash Events*

The driver of Vehicle 1 did not see the parked heavy truck. There was no braking. The right front of Vehicle 1 (12FRAA9) struck the left rear of Vehicle 2. Both front air bags and the front right side air bag deployed at this point. Vehicle 1 under-rode the rear of Vehicle 2. No delta Vs were calculated. The rear bed of Vehicle 2 penetrated the upper portion of the passenger compartment and contacted the front right occupant.

The restrained driver of Vehicle 1 required extrication, but sustained only minor injuries. The restrained front right seat occupant sustained massive injuries from contact with the exterior of the struck vehicle. Responding medics found her unconscious in the vehicle with brain matter showing. She was transported to a local hospital with a Glasgow Coma Scale of 3—no eye opening, no response to verbal commands, and no motion. She was admitted and underwent surgery to repair multiple skull fractures. She remained in a deep coma for six days before expiring. The cause of death was listed as severe craniocerebral trauma.

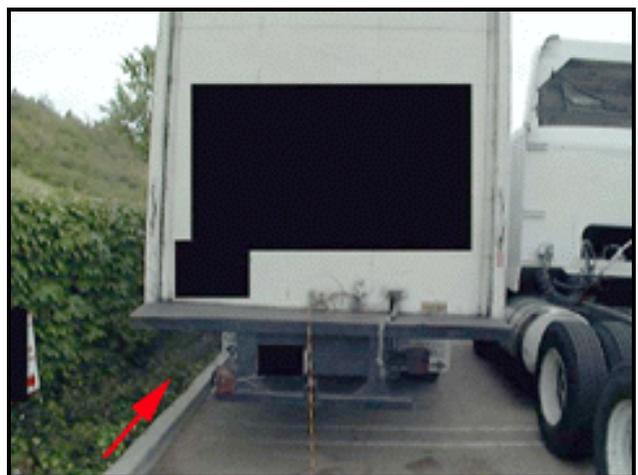
Vehicle 1 was towed away due to damage.



**Figure 3.** Exterior, Vehicle 1



**Figure 4.** Exterior, Vehicle 2



**Figure 5.** Exterior, Vehicle 2

*Exterior of Case Vehicle*

**Table 1. Vehicle Information**

Model year, make and model	1998 Toyota Camry
VIN	JTSBF28K8W0xxxxxx
CDC	12FRAA9



**Figure 6.** Exterior, Vehicle 1 (front view)



**Figure 7.** Exterior, Vehicle 1 (side view)

**Table 2. 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	142	0	0	1	0	0	60
	55.9	0	0	0.4	0	0	23.6

### *Interior of Case Vehicle*

The interior of this 1998 Toyota Camry sustained considerable damage. There was major intrusion of the passenger compartment on the right side—primarily the windshield area and the instrument panel (see Table 3). The intrusion at the higher level was a result of penetration by the bed of the struck truck. The intrusion at the lower level was primarily related to contact over and through the wheel area. The vehicle sustained integrity loss through the windshield and through the right side glass.



**Figure 8:** Interior Vehicle

This vehicle was equipped with front bucket seats and adjustable head restraints. The front left seat was adjusted to the middle track position. The front right seat was adjusted to between the middle and rear most track position.

**Table 3. Intrusions**

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Exterior object	Front right	>=61	24	Longitudinal
Window frame	Front right	93	36.6	Longitudinal
A-pillar	Front right	78	30.7	Longitudinal
Roof	Front left	76	29.9	Longitudinal
Roof	Front middle	76	29.9	Longitudinal
Roof	Front right	76	29.9	Longitudinal
Instrument panel	Front right	24	9.4	Longitudinal
Roof side rail	Front right	15	5.9	Longitudinal
B-pillar	Front right	15	5.9	Longitudinal
Roof side rail	Rear left	15	5.9	Longitudinal
A-pillar	Front left	8	3.1	Longitudinal
Roof side rail	Front left	5	2	Vertical
Roof side rail	Rear left	5	2	Vertical
B-pillar	Front left	4	1.6	Longitudinal

## Case Vehicle Occupant Protection Systems

Vehicle 1 (1998 Toyota Camry) was equipped with a redesigned driver's frontal air bag, a redesigned front right passenger's frontal air bag, and driver and front passenger seat-mounted side-impact air bags. The driver's frontal air bag was mounted in the tilt steering wheel; it is circular in shape and is equipped with 4 tethers and two vent ports. There was no damage to either the air bag or its module cover.

The passenger's frontal air bag was mounted on top of the instrument panel; it is square shaped and has one vent port and no tethers. The air bag opened normally and there was no damage to the module cover. There was, however, some tearing of the air bag itself. The cause the damage is not known. Both frontal air bags deployed at impact.

The front passenger side air bag was enclosed in the front right seat back. This air bag also deployed at impact. This deployment is likely a result of the unusual crush pattern from this accident and the significant amount of side contact. The driver's side air bag did not deploy.



Figure 9. Driver's frontal air bag



Figure 10. Passenger's frontal air bag



Figure 11. Passenger side air bag



Figure 12. Passenger side air bag

***Case Vehicle Occupant Demographics***

	Occupant 1	Occupant 2
Age/Sex:	17/Female	17/Female
Seated Position:	Front left	Front right
Seat Type:	Bucket	Bucket
Height (cm/in.):	163 64.2	170 66.9
Weight (kg/lbs.):	54 119	57 126
Pre-existing Medical Condition:	None noted	None noted
Body Posture:	Normal, upright	Possibly out of position as she was reaching for the balloons.
Hand Position:	Unknown	Hands in the air
Foot Position:	Right on accelerator, left on floor	Unknown
Restraint Usage:	Lap and shoulder belt used properly	Lap and shoulder belt used properly
Air bag:	Steering wheel mounted air bag deployed properly	Instrument panel mounted front air bag deployed properly, seat mounted side air bag deployed

***Occupant Injuries***

**Table 4. Injuries (Occupant #1)**

Injury	Injury Severity (AIS)	Injury Mechanism
Left occipital scalp laceration	1	Flying glass
Left upper forehead abrasion	1	Flying glass
Left elbow laceration	1	Flying glass

**Table 5. Injuries (Occupant #2)**

Injury	Injury Severity (AIS)	Injury Mechanism
Crushed skull (open right temporal parietal depressed fracture with laceration of the brain tissue)	6	Rear of struck vehicle
Contusion, left forearm	1	Injured, unknown source
Laceration, right arm	1	Rear of struck vehicle
Laceration, right elbow	1	Rear of struck vehicle
"Dicing" abrasions to both hands	1	Windshield

## ***Occupant Kinematics***

Both front occupants of Vehicle 1 were properly restrained and seated more or less normally in their respective bucket seats. The front right occupant may have been out of place to some small degree as she attempted to recover the balloons that were flying out of the sun roof.

At impact, both occupants responded to the 0 degree of force by pitching forward and loading their respective seat belts. As the impact continued, both occupants engaged the deploying frontal air bags. It does not appear that the air bags caused any injuries. As the case vehicle under-rode the truck, the rear of the truck penetrated the windshield/A-pillar and struck the front right occupant in the face—causing the crushing type skull fractures. It is likely that the side air bag did not deploy until later in the crash event as the right side became further engaged.



**Figure 13.** Interior, front right seat



**Figure 14.** Front right seat—note load marks on seat belt

*Scene Diagram*

