

Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-048-802E)

1998 Toyota Tacoma

Alabama

October, 1998

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<p>16. Abstract</p> <p>This remote investigation focused on the redesigned air bag system deployment of a 1998 Toyota Tacoma compact pickup truck. This minor injury crash occurred in October, 1998 in the afternoon. The weather was clear and the bituminous roadway was dry. The crash occurred in a three legged, "Y" shaped intersection. The westbound leg of the intersection is a two-way undivided roadway and is comprised of six travel lanes; two westbound lanes, one westbound left-turn lane, and three eastbound lanes. The speed limit for this road is 72 km/h (45 mph). It is controlled by overhead traffic signals. The road was level at this location. The northbound leg of the intersection is a two-way undivided roadway and is comprised of four travel lanes; two northbound lanes, and two southbound lanes. The speed limit is 72 km/h (45 mph) for this road. It is controlled by overhead traffic signals. The road was level at this location. Vehicle 1, a 1998 Toyota Tacoma compact pickup truck (case vehicle) driven by a 79 year old male (173 cm/68 in, 70 kg/155 lbs.), was traveling west, in westbound lane 3 (left-turn lane), approaching the intersection at an unknown speed, preparing to make a left turn at the intersection. The driver was restrained by the available manual lap/shoulder restraint. The front right seat was occupied by a 4 year old male (unknown ht/wt) who was restrained by the available manual lap/shoulder restraint. Vehicle 2, a 1991 Isuzu Rodeo compact utility vehicle driven by a 19 year old male, was traveling west, in westbound lane 2, approaching the intersection at an unknown speed, preparing to travel straight through the intersection. It is unknown if the driver was restrained, however the police accident report states that the driver was wearing the manual lap/shoulder restraint. There were no other occupants in Vehicle 2. Vehicle 3, a 1987 Dodge Diplomat 4-door sedan driven by a 34 year old female, was stopped at the intersection facing west, in westbound lane 3 (left-turn lane), preparing to make a left turn at the intersection. There also was a passenger (unknown age/sex) in the front right seat. It is unknown if the occupants were restrained, however the police accident report states that both occupants were wearing the manual lap/shoulder restraints. As Vehicle 3 was stopped in the left-turn lane for a solid green traffic signal yielding to opposing traffic, Vehicle 1 approached from behind. The driver of Vehicle 1 attempted to change lanes from lane 3 into lane 2. Vehicle 1 changed lanes in front of Vehicle 2 and was struck. The front plane of Vehicle 2 (unknown CDC) struck the right plane of Vehicle 1 (05RYES2) in a sideswipe nature in lane 2 (event 1). The front plane of Vehicle 1 (12F99999) then struck the back plane of Vehicle 3 (unknown CDC) in lane 3 (event 2). Vehicle 1 then swerved across the intersection and onto the northbound leg of the intersection heading south. Vehicle 1 then departed the left side of the roadway (east edge) and impacted a utility pole (event 3) with its front plane (12FYEN2). A Delta V could not be calculated for any of the events due to the sideswipe (event 1), overlapping damage (event 2), and a yielding object (event 3) which was the broken utility pole. All of these events are beyond the scope of WinSMASH reconstruction. A barrier speed was calculated for the third event for Vehicle 1, utilizing WinSMASH, as 23.5 km/h (14.6 mph). As a result of the third event frontal impact, the supplemental restraint system (driver side air bag) of the case vehicle deployed. The front right air bag did not deploy. The center instrument panel mounted passenger's side air bag switch was turned to the "off" position at the time of the crash. Vehicle 1 came to rest engaged with the broken utility pole facing south. Vehicles 2 and 3 came to rest in the original travel lanes facing west. The driver of Vehicle 1 was not injured in the crash and did not seek medical attention. The front right passenger of Vehicle 1 sustained minor injuries in the crash and was transported by land to a trauma center where he was treated and released. None of the occupants of Vehicles 2 and 3 were reported as injured and they were not transported from the scene for medical attention.</p>			
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Summary

This remote investigation focused on the redesigned air bag system deployment of a 1998 Toyota Tacoma compact pickup truck. This minor injury crash occurred in October, 1998 in the afternoon. The weather was clear and the bituminous roadway was dry. The crash occurred in a three legged, "Y" shaped intersection. The westbound leg of the intersection is a two-way undivided roadway and is comprised of six travel lanes; two westbound lanes, one westbound left-turn lane, and three eastbound lanes. The speed limit for this road is 72 km/h (45 mph). It is controlled by overhead traffic signals. The road was level at this location. The northbound leg of the intersection is a two-way undivided roadway and is comprised of four travel lanes; two northbound lanes, and two southbound lanes. The speed limit is 72 km/h (45 mph) for this road. It is controlled by overhead traffic signals. The road was level at this location.



Figure 1. Exterior, Vehicle 1 (Toyota Tacoma)

Vehicle 1, a 1998 Toyota Tacoma compact pickup truck (case vehicle) driven by a 79 year old male (173 cm/68 in, 70 kg/155 lbs.), was traveling west, in westbound lane 3 (left-turn lane), approaching the intersection at an unknown speed, preparing to make a left turn at the intersection. The driver was restrained by the available manual lap/shoulder restraint. The front right seat was occupied by a 4 year old male (unknown ht/wt) who was restrained by the available manual lap/shoulder restraint.

Vehicle 2, a 1991 Isuzu Rodeo compact utility vehicle driven by a 19 year old male, was traveling west, in westbound lane 2, approaching the intersection at an unknown speed, preparing to travel straight through the intersection. It is unknown if the driver was restrained, however the police accident report states that the driver was wearing the manual lap/shoulder restraint. There were no other occupants in Vehicle 2.

Vehicle 3, a 1987 Dodge Diplomat 4-door sedan driven by a 34 year old female, was stopped at the intersection facing west, in westbound lane 3 (left-turn lane), preparing to make a left turn at the intersection. There also was a passenger (unknown age/sex) in the front right seat. It is unknown if the occupants were restrained, however the police accident report states that both occupants were wearing the manual lap/shoulder restraints.

Crash Events

As Vehicle 3 was stopped in the left-turn lane for a solid green traffic signal yielding to opposing traffic, Vehicle 1 approached from behind. The driver of Vehicle 1 attempted to change lanes from lane 3 into lane 2. Vehicle 1 changed lanes in front of Vehicle 2 and was struck. The front plane of Vehicle 2 (unknown CDC) struck the right plane of Vehicle 1 (05RYES2) in a sideswipe nature in lane 2 (event 1). The front plane of Vehicle 1 (12F99999) then struck the back plane of Vehicle 3 (unknown CDC) in lane 3 (event 2). Vehicle 1 then swerved across the intersection and onto the northbound leg of the intersection heading south. Vehicle 1 then departed the left side of the roadway (east edge) and impacted a utility pole (event 3) with its front plane (12FYEN2).



Figure 2. Approach to pole impact (event 3)

A Delta V could not be calculated for any of the events due to the sideswipe (event 1), overlapping damage (event 2), and a yielding object (event 3) which was the broken utility pole. All of these events are beyond the scope of WinSMASH reconstruction. A barrier speed was calculated for the third event for Vehicle 1, utilizing WinSMASH, as 23.5 km/h (14.6 mph).

As a result of the third event frontal impact, the supplemental restraint system (driver side air bag) of the case vehicle deployed. The front right air bag did not deploy. The center instrument panel mounted passenger's side air bag switch was turned to the "off" position at the time of the crash.



Figure 3. Impact with pole (event 3)

Vehicle 1 came to rest engaged with the broken utility pole facing south. Vehicles 2 and 3 came to rest in the original travel lanes facing west.

The driver of Vehicle 1 was not injured in the crash and did not seek medical attention. The front right passenger of Vehicle 1 sustained minor injuries in the crash and was transported by land to a trauma center where he was treated and released.

None of the occupants of Vehicles 2 and 3 were reported as injured and they were not transported from the scene for medical attention.

Vehicle 1 became disabled due to damage sustained in the crash and was towed from the scene. Vehicles 2 and 3 were not disabled and were driven from the scene by their respective drivers.

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	23.5	14.6	Unknown	Unknown

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Toyota Tacoma
VIN	4TAVL52N1WZ
CDC	12FYEN2

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	130	0	9	28	23	0	0
	51.2	0	3.5	11	9.1	0	0



Figure 4. Exterior, Vehicle 1 (1998 Toyota Tacoma pickup)



Figure 5. Exterior, Vehicle 1 (1998 Toyota Tacoma pickup)

Interior of Case Vehicle

The interior of the Toyota Tacoma sustained minor damage from occupant contact. There were no areas of intrusion into the passenger compartment. There was occupant contact evidence to the left instrument panel and rear view mirror.

The case vehicle was equipped with bucket seats with folding backs in the front left and the 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. Both front seats were equipped with adjustable head restraints which were not damaged. The rear of the vehicle was equipped with hideaway bench seats with folding backs. There were no head restraints available for these seating positions and they were not adjustable.

Case Vehicle Occupant Protection Systems

The Toyota Tacoma 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. The circular air bag was equipped with two tethers 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 side air bag

The front right air bag was housed in the mid-instrument panel position. The single air bag module cover flap was a rectangular configuration. 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 area. The switch is key activated and was turned to the left "Off" position. The switch is marked "Passenger Airbag" and was illuminated "Off" at the time of the crash.



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



Figure 8. Interior, case vehicle. Passenger air bag shut off switch.

Case Vehicle Occupant Demographics

Table 4. Case Vehicle Occupant(s) Demographics

	Occupant 1	Occupant 2
Age/Sex:	79/Male	4/Male
Seated Position:	Front left	Front right
Seat Type:	Bucket with folding back, cloth covered	Bucket with folding back, cloth covered
Height (cm/in.):	173 68	Unk Unk
Weight (kg/lbs):	70 155	Unk Unk
Pre-existing Medical Condition:	None noted	None noted
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Manual lap & shoulder restraint	Manual lap & shoulder restraint
Air bag:	Deployed redesigned air bag system	Non-deployed redesigned air bag system - air bag switched off at time

Occupant Injuries

Table 5. Case Vehicle Occupant(s) Injuries

Occupant #	Injury	Injury Severity (AIS)	Injury Mechanism
2	Chest contusion	1	Shoulder belt
2	Cervical spine strain	1	Impact force

Occupant Kinematics

The driver (case occupant 01) of the Toyota Tacoma was seated in an unknown posture in the front left position of the vehicle. He was wearing the manual lap/shoulder restraint. The front right passenger (case occupant 02) was also seated in an unknown posture and was wearing the manual lap/shoulder restraint.. Seat belt usage was determined by visual inspection by the researcher, the lack of prominent frontal contact evidence, and observations of the investigating officer at the scene of the crash. There did not appear to be any indication of pre-impact avoidance maneuvers so the occupants should not have significantly moved prior to the impact.

At impact, the occupants reacted to the 360 degree principle direction of force by moving forward and loading the lap/shoulder restraints. As the restraints locked, further forward movement of the occupants was prevented. The driver had moved far enough forward to impact the left instrument panel with his left knee. A scuff mark was found on the panel. It also appeared that the driver may have impacted the rearview mirror with his right hand. The mirror had been pushed out of place. No evidence of occupant contact was found on the air bag but it is presumed that he contacted the bag somewhat with his chest in this moderate frontal collision. No evidence was found in the vehicle of contact from the passenger. Case occupant 02 sustained a chest contusion from contact with the seat belt webbing. It appears that the cervical spine strain suffered by case occupant 02 was caused by the force of the impact, rather than contact with any component of the vehicle's interior.



Figure 9. Interior, case vehicle.



Figure 10. Interior, case vehicle.

Scene Diagram

