Remote, Redesigned Air Bag Special Study

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Dynamic Science, Inc., Case Number (1998-73-803G)

1998 Pontiac Grand Prix

Indiana

October 23, 1998

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient Catalog No.
1998-73-803G		

4. Title and Subtitle	5. Report Date
	May 8, 1999
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401	11. Contract or Grant no. DTNH22-94-D-27058

12. Sponsoring Agency Name and Address	13. Type of report and period Covered
U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590	[Report Month, Year]
	14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

This remote investigation focused on the deployment of a redesigned air bag system in a 1998 Pontiac Grand Prix. This major crash occurred in October, 1998 in the late afternoon. The weather was clear and dry. The four-lane, bituminous roadway was straight and level. There were no applicable controls present. The posted speed limit is 89 km/h (55 mph). Vehicle 1, a 1998 Pontiac Grand Prix four-door driven by a properly restrained 49-year-old male, was traveling northbound at a driver-reported speed of 89 km/h (55 mph) in the second lane to the left approaching a three-leg intersection. The driver had set the cruise control to a speed between 50 and 55 mph. Vehicle 2, a 1988 Toyota 4 x 2 pickup truck driven by a 52-year-old male, was stopped in the same lane as Vehicle 1 in preparation for a left-hand turn to go west.

The driver of Vehicle 1 looked down momentarily and was not aware of Vehicle 2 until it was too late. The driver did not take any avoidance maneuvers. The front of Vehicle 1 (12FDEW3) struck the rear of Vehicle 2. While this was essentially a fully distributed impact, but there was some offset to the left.

A delta V was calculated for both vehicles, using WinSMASH, to be 43 km/h (26.7 mph) for Vehicle 1, and 39.1 km/h (24.3 mph) for Vehicle 2. As a result of the frontal impact, the supplemental restraint system (driver and passenger side redesigned air bags) of the case vehicle deployed.

The impact caused Vehicle 1 to rotated slightly in a counterclockwise direction and the vehicle came to final rest facing to the northeast partially in the southbound travel lane. Vehicle 2 was rotated sharply in a counterclockwise direction. The vehicle veered to the left, departed the roadway, and struck a parked vehicle (1988 Dodge Ram pickup truck) with its front end.

The driver of Vehicle 1 sustained non-incapacitating injuries in the crash consisting of “seat belt” contusions, bilateral elbow abrasions, hand contusions and abrasions, and abrasions/contusions to the knees. He was ambulatory at the scene and was able to exit the vehicle on his own. He was transported from the scene by ambulance complaining of pain to his chest. He was hospitalized (to rule out a cardiac contusion) 24 hours for observation and then released. The driver of Vehicle 2 did not report any injuries.

Both vehicles became disabled due to damage sustained in the crash and were towed from the scene.

17. Key Words	18. Distribution Statement
Redesigned, air bag, injuries, restrained	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

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Summary

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Figure 1. Exterior, Vehicle 1

Crash Events

The driver of Vehicle 1 looked down momentarily and was not aware of Vehicle 2 until it was too late. The driver did not take any avoidance maneuvers. The front of Vehicle 1 (12FDEW3) struck the rear of Vehicle 2. While this was essentially a fully distributed impact, but there was some offset to the left.

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The driver of Vehicle 2 did not report any injuries.

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Table 1. Delta V

	Case Vehicle		Other Vehicle	
	km/h	mph	km/h	mph
Total	43	26.7	39.1	24.3
Longitudinal	-43	-26.7	39.1	24.3
Lateral	0	0	0	0

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1998 Pontiac Grand Prix
VIN	1G2WP5219WF
CDC	12FDEW3

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	49	51	53	50	47	43
	51.2	19.3	20.1	20.9	19.7	18.5	16.9

Figure 2. Exterior, Vehicle 1 (front)

Figure 3. Exterior, Vehicle 1 (left side)

Interior of Case Vehicle

The interior of the Grand Prix sustained minor damage from various occupant contacts. There was a scuff to the left instrument panel and movement of the center mirror. Both air bags had deployed. There was a small amount of instrument panel intrusion that extended uniformly in a rearward direction.

The case vehicle was equipped with bucket seats in the front left and front right seating positions. The left front seat was adjusted to the rear most track position. The seat was slightly inclined at the time of impact. Both front seats were equipped with adjustable head restraints which were not damaged in the crash. The rear of the vehicle was equipped with bench seats in all three seating positions. There were integral head restraints for the outboard seats.

Figure 4. Interior, Vehicle 1 (overview)

Table 4. Intrusions

Intruded Component	Location of Intrusion	Intruded Value cm/in.		Dominant Crush Direction
Right instrument panel	Front seat right	3	1.2	Longitudinal
Center instrument panel	Front seat middle	2	0.8	Longitudinal
Left instrument panel	Front seat left	1	0.4	Longitudinal

Case Vehicle Occupant Protection Systems

The Pontiac Grand Prix was equipped with the "Next Generation" 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. The air bag had nine horizontal folds and six vertical folds. The circular air bag was equipped with two vent ports and was not damaged in the crash. It was not equipped with any tethers. There was some smudges found at the bottom of the air bag face which likely came from the inside of the module cover flap.

Figure 5. 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 in the shape of an inverted "D". The rectangular air bag showed no evidence of occupant contact and was not damaged in the crash. Blood was found on left edge for the air bag face.

Figure 6. Close up of smudge on face of drive's side air bag

Figure 7. Passenger side air bag

Case Vehicle Occupant Demographics

	Occupant 1
Age/Sex:	49/Male
Seated Position:	Front left
Seat Type:	Bucket
Height (cm/in:):	183 72.1
Weight (kg/lbs).:	91 201
Pre-existing Medical Condition:	History of Wolf-Parkinson-White syndrome[1]
Body Posture:	Normal, upright
Hand Position:	Unknown
Foot Position:	Both feet presumed to be on floor
Restraint Usage:	Lap and shoulder belt used correctly
Air bag:	Deployed at impact

Occupant Injuries

Table 5. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Abrasion, between eyebrows	1	Air bag
Contusion, left shoulder	1	Seat belt webbing (torso)
Contusion/abrasion, diagonal across chest	1	Seat belt webbing (torso)
Minor laceration, left forearm	1	Left interior side surface
Bilateral elbow abrasions	1	Air bag
Bilateral hand abrasions	1	Air bag
Contusion, dorsum of right hand	1	Air bag
Contusion, right lower abdomen	1	Seat belt webbing (lap)
Abrasion, left lower abdomen	1	Seat belt webbing (lap
Contusion, dorsum of left hand	1	Air bag
Bilateral knee contusions	1	Left lower instrument panel
Abrasion, right knee	1	Left lower instrument panel

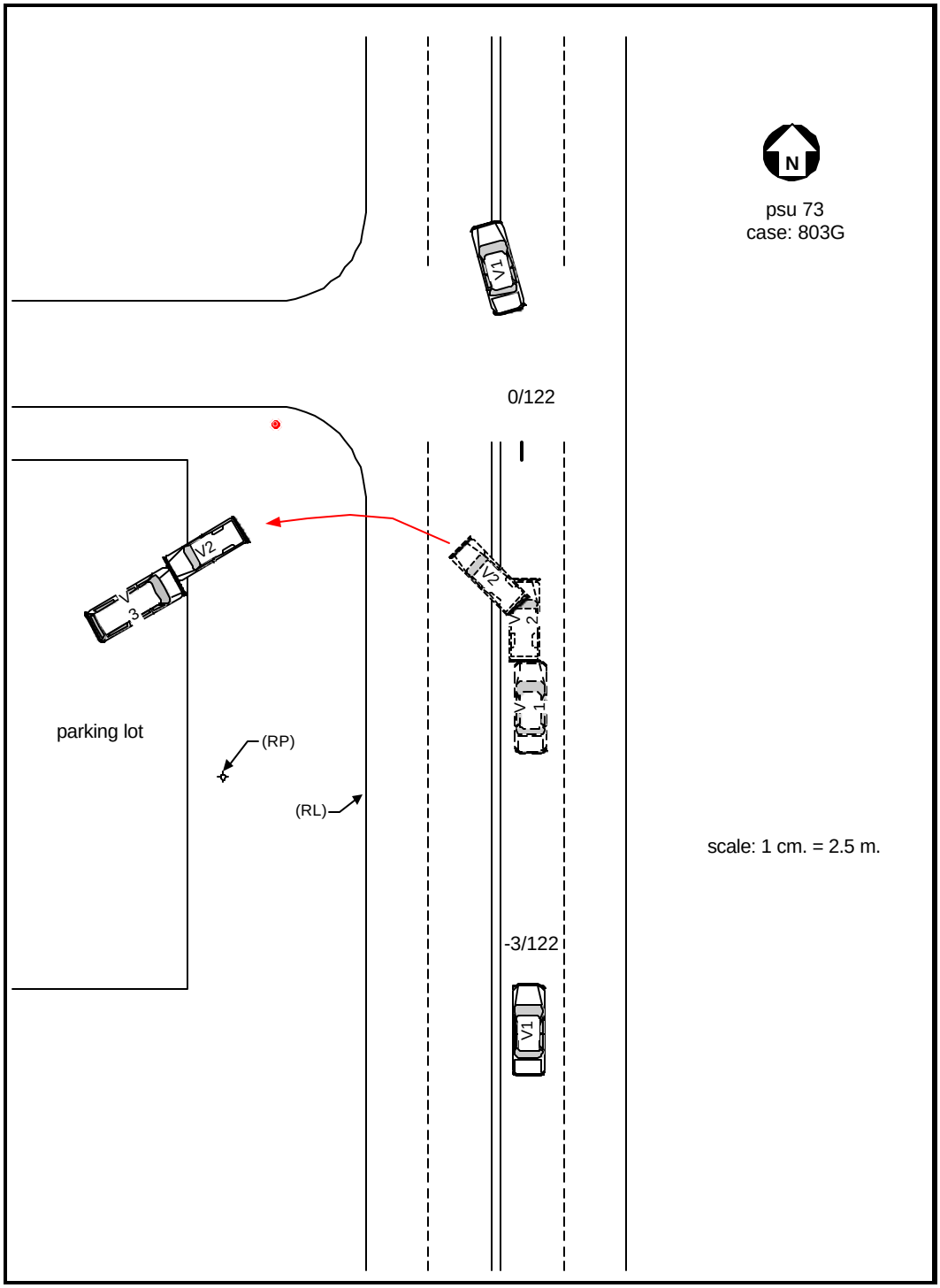
[1]A problem arising from a physical defect in the conduction system of the heart that predisposes the affected person with a tendency to have potentially life-threatening rapid heart rates.

Occupant Kinematics

Prior to impact, the driver of Vehicle 1 was seated in an upright, forward facing position. Based on the bilateral injuries to the dorsi of both hands, it would appear that both hands were on the steering wheel. According to the driver, the speed control had been set and there were no braking maneuvers, so it can be presumed that both feet were on the floor. The driver was wearing the lap and shoulder belt in the proper fashion.

At impact, the driver responded to the 12 o'clock direction of force by pitching forward. The driver engaged and loaded the lap and shoulder belt causing the contusions to the left shoulder, diagonally across the chest, and to both the left and right lower abdomen areas. The driver continued moving forward and struck the lower instrument panel with both knees. At impact, the air bag did deploy. The driver engaged the cental part of the air bag with his face causing the abrasion between his eyebrows–the driver was likely wearing glasses of some sort. As the air bag deployed, the driver sustained contusions to the dorsi of both hands from the air bag, as well as abrasions to the hands. Given the location of the hand contusions, and the abrasions to the back of the elbows, it would appear that these were "fling" type injuries.

Scene Diagram[2]



[2]Final rest for V1added. POI moved further south to account for police-reported final rest position.