

Remote, Redesigned Air Bag Special Study

FOR NHTSA'S INTERNAL USE ONLY

Dynamic Science, Inc., Case Number (1998-49-811G)

1999 Pontiac Firebird Trans Am

Texas

November/1998

Technical Report Documentation Page

1. Report No. 1998-49-811G		2. Government Accession No.		3. Recipient Catalog No.	
4. Title and Subtitle				5. Report Date April 29, 1999	
				6. Performing Organization Report No.	
7. Author(s) Dynamic Science, Inc.				8. Performing Organization Report No.	
9. Performing Organization name and Address Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401				10. Work Unit No. (TRAIS)	
				11. Contract or Grant no. DTNH22-94-D-27058	
12. Sponsoring Agency Name and Address U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590				13. Type of report and period Covered [Report Month, Year]	
				14. Sponsoring Agency Code	
15. Supplemental Notes					
16. Abstract This remote investigation focused on the redesigned air bag system deployment of a 1999 Pontiac Firebird/Trans Am, three-door hatchback. This single vehicle crash occurred in the early morning hours in November, 1998. The weather was cloudy/foggy and the level concrete roadway surface was dry. This crash occurred in the center median area of the westbound travel lanes. A strong post W-beam guardrail barrier separates the five westbound travel lanes from the eastbound travel lanes. The one-way westbound roadway is comprised of a deceleration off-ramp lane and four through travel lanes. There are no traffic controls at the crash location. The posted speed limit is 113 km/h (70 mph) for the east and westbound roadways. Vehicle 1, a 1999 Pontiac Firebird/Trans Am, three-door hatchback, was being driven by a fully restrained 25-year-old male (178 cm/70 in., 79 kg/174 lbs.) who was traveling in lane three of the westbound travel lanes at an undetermined rate of speed. A Dodge Ram pick-up truck (non-contact vehicle) was traveling in lane 2, adjacent to Vehicle 1. The driver of the pick-up truck attempted a lane change maneuver with the intention of moving to lane 3. In an attempt to avoid impacting the pick-up truck, Driver 1 applied a left steering input. The aggressive steering input initiated a counterclockwise rotation as Vehicle 1 traversed lanes 4 and 5. The case vehicle (Trans Am) traversed the center median shoulder, rotating approximately 75 degrees counterclockwise before impacting the center median, W-beam guardrail barrier with its frontal plane (81FDEW1). The 40 degree (1 o'clock) impact force was incremented by 80 for frontal shift to the left. Both the driver and passenger air bags deployed. The total delta V was calculated at 18.8 km/h (11.7 mph). The longitudinal delta V of -14.4 km/h (8.9 mph) was at the borderline threshold necessary for air bag deployment. After the initial front, right bumper corner impact, Vehicle 1 continued to rotate counterclockwise as its right quarter-panel impacted the guardrail in a secondary impact (03RZEW3). The total and lateral delta V for the secondary right side impact was computed at 8.4 km/h (5.2 mph). The case vehicle came to rest on the shoulder, in the center median area and was facing east. The driver of the Firebird/Trans Am was uninjured in the crash and did not receive medical attention.					
17. Key Words Redesigned, air bag,			18. Distribution Statement		
19. Security Classif. (of this report)		20. Security Classif. (of this page)		21. No of pages	22. Price

Remote, Redesigned Air Bag Special Study
FOR NHTSA'S INTERNAL USE ONLY
Dynamic Science, Inc., Case Number (1998-49-811G)
1999 Pontiac Firebird Trans Am
Texas

November/1998

Summary

This remote investigation focused on the redesigned air bag system deployment of a 1999 Pontiac Firebird/Trans Am, three-door hatchback. This single vehicle crash occurred in the early morning hours in November, 1998. The weather was cloudy/foggy and the level concrete roadway surface was dry. This crash occurred in the center median area of the westbound travel lanes. A strong post W-beam guardrail barrier separates the five westbound travel lanes from the eastbound travel lanes. The one-way westbound roadway is comprised of a deceleration off-ramp lane and four through travel lanes. There are no traffic controls at the crash location. The posted speed limit is 113 km/h (70 mph) for the east and westbound roadways.

Vehicle 1, a 1999 Pontiac Firebird/Trans Am, three-door hatchback, was being driven by a fully restrained 25-year-old male (178 cm/70 in., 79 kg/174 lbs.) who was traveling in lane three of the westbound travel lanes at an undetermined rate of speed. A Dodge Ram pick-up truck (non-contact vehicle) was traveling in lane 2, adjacent to Vehicle 1. The driver of the pick-up truck attempted a lane change maneuver with the intention of moving to lane 3. In an attempt to avoid impacting the pick-up truck, Driver 1 applied a left steering input. The aggressive steering input initiated a counterclockwise rotation as Vehicle 1 traversed lanes 4 and 5. The case vehicle (Trans Am) traversed the center median shoulder, rotating approximately 75 degrees counterclockwise before impacting the center median, W-beam guardrail barrier with its frontal plane (81FDEW1).



Figure 1. Pre-Impact Trajectory of Vehicle 1



Figure 2. Guardrail impact location



Figure 3. Frontal Impact to Vehicle 1



Figure 4. View Showing Frontal Shift

The 40 degree (1 o'clock) impact force was incremented by 80 for frontal shift to the left. Both the driver and passenger air bags deployed. The total delta V was calculated at 18.8 km/h (11.7 mph). The longitudinal delta V of -14.4 km/h (8.9 mph) was at the borderline threshold necessary for air bag deployment.

After the initial front, right bumper corner impact, Vehicle 1 continued to rotate counterclockwise as its right quarter-panel impacted the guardrail in a secondary impact (03RZEW3). The total and lateral delta V for the secondary right side impact was computed at 8.4 km/h (5.2 mph)¹. The case vehicle came to rest on the shoulder, in the center median area and was facing east. The driver of the Firebird/Trans Am was uninjured in the crash and did not receive medical attention.



Figure 5. View Showing Secondary Guardrail Impact to Right Quarter-Panel

Table 1. Delta V

	Case Vehicle	
	km/h	mph
Total	18.8	11.7
Longitudinal	-14.4	-8.9
Lateral	-12.1	-7.5

¹ Both impacts calculated using the WinSmash barrier option

Exterior of Case Vehicle

Table 2. Vehicle Information

Model year, make and model	1999 Pontiac Firebird Trans Am
VIN	2G2FS22K1X2
CDC	81FDEW1 (Primary) / 03RZEW3 (Secondary)



Figure 6. View Showing Initial Front Right Corner Impact, Vehicle 1 (1999 Firebird)



Figure 7. View Showing Secondary Right Quarter-Panel Impact to Firebird/Trans Am

Table 3. Crush Measurements (Primary Impact)

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.
Front Bumper	155	17	13	16	17	21	21
	61	6.7	5.1	6.3	6.7	8.3	8.3

Table 4. Crush Measurements (Secondary Impact)

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.
Right Side	112	10	13	12	9	6	0
	44.1	3.9	5.1	4.7	3.5	2.4	0

Interior of Case Vehicle

Damage to the interior of the 1999 Pontiac Firebird/Trans Am was isolated to windshield glazing damage. The damage to the windshield was due to the passenger side air bag module flap contacting the windshield during deployment. There were no intruding components and no discernible areas of occupant contact.

This vehicle was equipped with front bucket seats with folding back(s). The second row of seats consists of two forward facing bucket seats with folding back(s). The drivers front, left bucket seat was in the slightly reclined position prior to the impact. The front seats are equipped with integral head restraints-which were not damaged during the collision. The occupied front, left seated position was adjusted between the middle and rearmost track position.

Case Vehicle Occupant Protection Systems

The Pontiac Firebird/Trans Am three-door hatchback was equipped with redesigned air bag systems which consisted of a central inflatable restraint sensing and diagnostic module, air bag warning lamp, front left and front right air bag modules which housed the air bags and inflator units (refer to attached SIR schematics and component locations). The front seats are equipped with active three-point lap and shoulder restraints with non-adjustable anchorage adjustments.

The front left air bag was housed in the steering wheel hub and was concealed by symmetrical double vertical module cover flaps. The circular air bag was an untethered design equipped with two exhaust vent port holes. The lower instrument panel is equipped with a rigid plastic knee bolster. There was no discernible contact damage to the knee bolster, air bag or module cover flaps.



Figure 8. View Showing Deployed Drivers Air Bag



Figure 9. Interior of Case Vehicle

The front, right air bag was located on the instrument panel, top surface plane. The module cover flap was basically rectangular in design and was tethered by a fabric hinge. The module flap cover broke the laminated windshield glazing upon deployment. The air bag was not tethered, but was equipped with two vent port holes. There were no indications of damage or contact to the air bag. The module cover appeared to have overextended its intended hinging mechanism (refer to Figure 11).



Figure 10. Deployed Passenger Air Bag



Figure 11. Passenger Air Bag Module Cover

Case Vehicle Occupant Demographics

	Occupant 1
Age/Sex:	25/Male
Seated Position:	Front Left
Seat Type:	Bucket with Folding back(s) - cloth covered
Height (cm/in.):	178 70.08
Weight (kg/lbs):	79 174.2
Pre-existing Medical Condition:	None Reported
Body Posture:	Normal/Upright
Hand Position:	Unknown/ At least one hand on steering wheel rim/ o'clock position is unknown
Foot Position:	Unknown position of right foot Left foot, likely on floor
Restraint Usage:	Active, three-point lap and shoulder belt reportedly utilized properly
Air bag:	Driver air bag deployed as a result of the primary impact



Figure 12. Interior, case vehicle/ windshield and instrument panel

Occupant Injuries

Table 6. Injuries

Injury	Injury Severity (AIS)	Injury Mechanism
Not Injured	N/A	N/A

Occupant Kinematics

The 25 year old male driver of the 1999 Pontiac Firebird/Trans Am was situated in the front left position in an upright and normal driving posture. He was fully restrained by the available three-point lap and shoulder belt. He reportedly was wearing the manual restraint system in a normal fashion with the shoulder belt resting against his chest and upper torso.

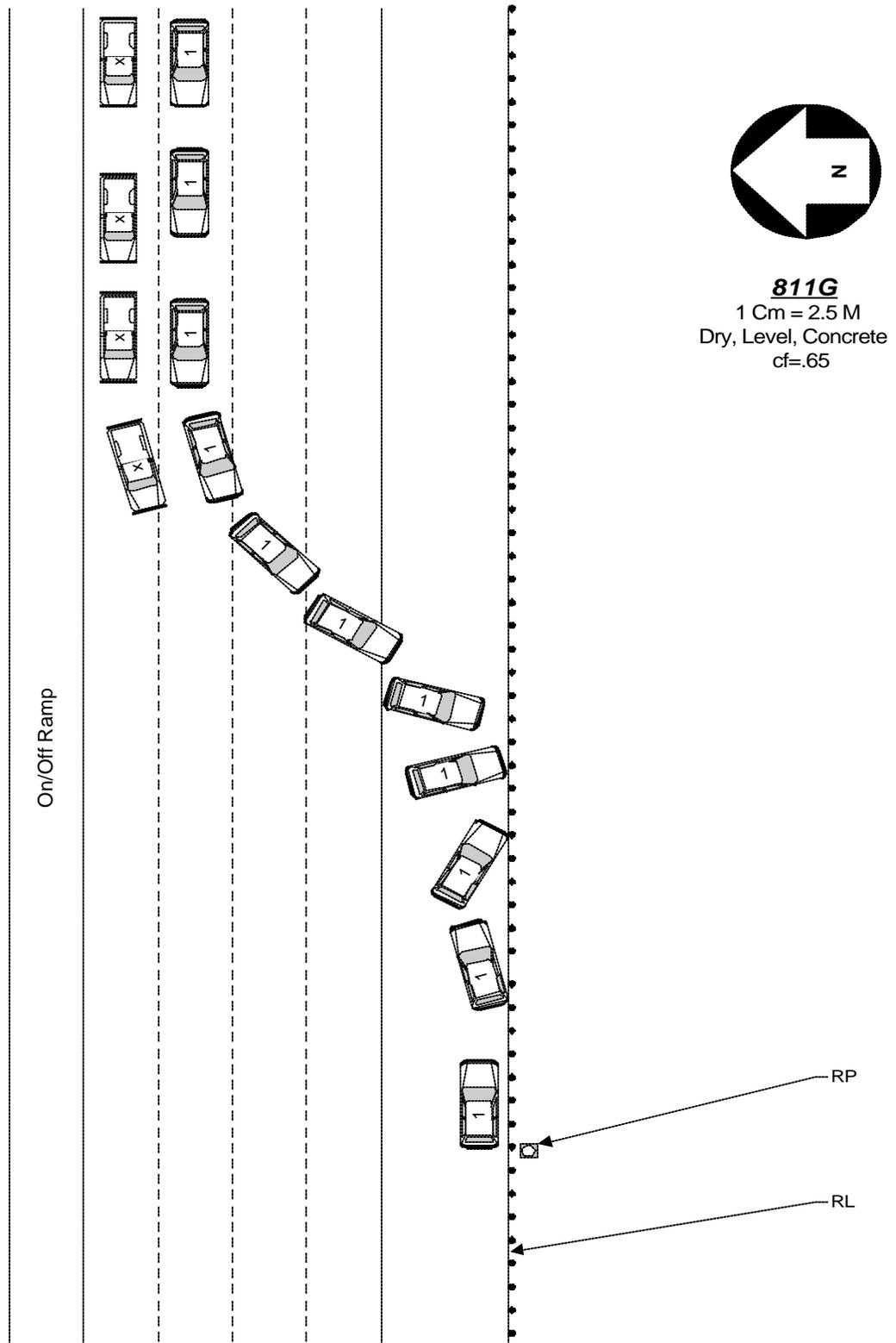
The driver responded to the 40 degree Principle Direction of Force by moving forward and to his right. He loaded the lap belt webbing which prohibited further forward and lateral motion of his lower torso. His upper torso/chest pitched forward, loading the shoulder restraint webbing and deploying drivers air bag. His engagement with the restraint webbing and redesigned air bag unit did not result in injury and apparently did not significantly contact any other interior components.

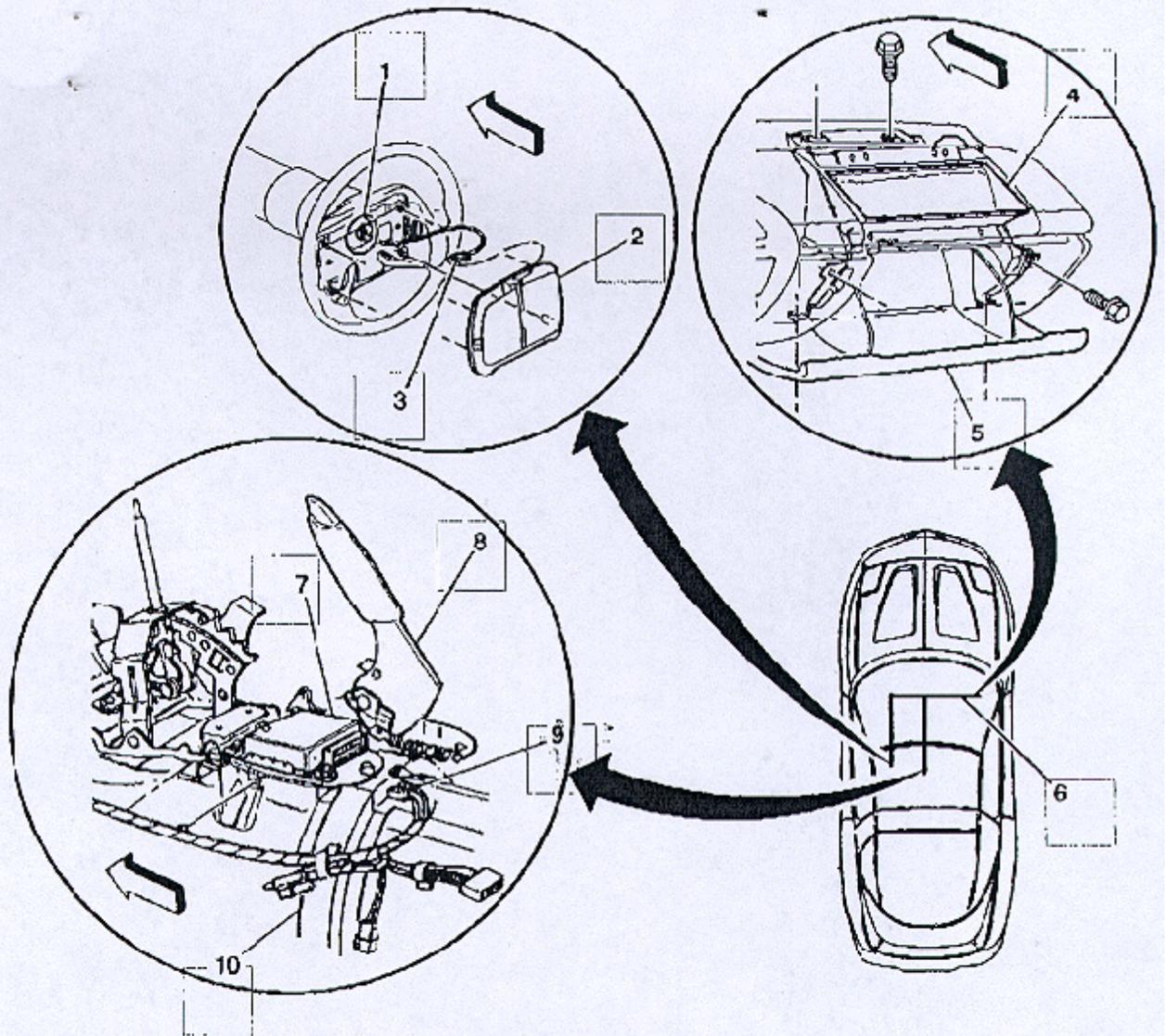
As the case vehicle rotated counterclockwise, the right quarter panel impacted the guardrail in a secondary impact. He responded to the three o'clock direction of force by moving to his right. The lap belt webbing secured his lower torso from extended right side movement. His right hip probably contacted the center console unit which also helped secure his seated position. His upper torso moved directly to his right and pitched downward. The shoulder belt webbing provided little resistance with this 90 degree Principle Direction of Force. He rebounded into the front, left seat back support and was uninjured during the secondary impact.



Figure 13. View showing deployed drivers air bag

Scene Diagram





1. Inflatable Restraint Steering Wheel Module Coil
2. Inflatable Restraint Steering Wheel Module
3. Upper Inflatable Restraint Steering Wheel Module Coil Connector
4. Inflatable Restraint IP Module
5. IP Compartment Door
6. SIR Wiring Harness
7. Inflatable Restraint Sensing and Diagnostic Module (SDM)
8. Park Brake
9. Inflatable Restraint Sensing and Diagnostic Module (SDM) Harness Connector
10. Floor Tunnel

