

CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

**CALSPAN ON-SITE CHILD AIR BAG RELATED FATALITY CRASH
INVESTIGATION**

CALSPAN CASE NO: CA06-015

VEHICLE: 1994 PONTIAC GRAND PRIX

LOCATION: FLORIDA

CRASH DATE: JUNE 2006

Contract No. DTNH22-01-C-17002

Prepared for:

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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 are 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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<p>16. Abstract This on-site investigation focused on the severity of the crash and the source of injury that caused the death of an unrestrained 4-year-old male front right passenger of a 1994 Pontiac Grand Prix. The Pontiac was involved in a minor severity front-to-rear crash sequence with a 1992 Honda Civic. The Grand Prix was equipped with first generation frontal air bags for the driver and front right positions that deployed as a result of the crash. Additionally, the Pontiac was equipped with an Event Data Recorder (EDR) that was downloaded during the on-site investigation. The EDR output is included as Attachment A of this report. The Pontiac was occupied by an unrestrained 26-year-old female driver, an unrestrained 1-year-old male that was positioned outboard of the driver against the left front door, two unrestrained 3-year-old females that were seated adjacent to the driver, and the unrestrained 4-year-old male that was seated on the outboard aspect of the front right seat. The driver of the Pontiac was ascending a long grade on a straight segment of roadway approaching a bridge. A 1992 Honda Civic was stopped behind two vehicles, one of which was stalled in the right traffic lane. The driver of the Pontiac steered left and braked; however, the front of the Pontiac struck the rear of the Honda. The air bag expanded and contacted the 4-year-old male front right passenger. He sustained fatal injuries of the head and neck and was transported to a local hospital where he was pronounced deceased approximately 30 minutes post-crash. The driver and the 3-year-old female front center passenger sustained minor injuries and were transported to a local hospital where they were treated and released. The 1-year-old male and the 3-year-old female front right passenger were not injured or transported.</p>			
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**CALSPAN ON-SITE CHILD AIR BAG RELATED FATALITY
INVESTIGATION
CASE NO.: CA06-015
VEHICLE: 1994 PONTIAC GRAND PRIX
LOCATION: FLORIDA
DATE OF CRASH: JUNE 2006**

BACKGROUND

This on-site investigation focused on the severity of the crash and the source of injury that caused the death of an unrestrained 4-year-old male front right passenger of a 1994 Pontiac Grand Prix (**Figure 1**). The Pontiac was involved in a minor severity front-to-rear crash sequence with a 1992 Honda Civic. The Grand Prix was equipped with first generation frontal air bags for the driver and front right positions that deployed as a result of the crash. Additionally, the Pontiac was equipped with an Event Data Recorder (EDR) that was downloaded



Figure 1. 1994 Pontiac Grand Prix subject vehicle.

during the on-site investigation. The EDR output is included as **Attachment A** of this report. The Pontiac was occupied by an unrestrained 26-year-old female driver, an unrestrained 1-year-old male that was positioned outboard of the driver against the left front door, two unrestrained 3-year-old females that were seated adjacent to the driver, and the unrestrained 4-year-old male that was seated on the outboard aspect of the front right seat. The driver of the Pontiac was ascending a long grade on a straight segment of roadway approaching a bridge. A 1992 Honda Civic was stopped behind two vehicles, one of which was stalled in the right traffic lane. The driver of the Pontiac steered left and braked; however, the front of the Pontiac struck the rear of the Honda. The air bag expanded and contacted the 4-year-old male front right passenger. He sustained fatal injuries of the head and neck and was transported to a local hospital where he was pronounced deceased approximately 30 minutes post-crash. The driver and the 3-year-old female front center passenger sustained minor injuries and were transported to a local hospital where they were treated and released. The 1-year-old male and the 3-year-old female front right passenger were not injured or transported.

This crash was identified through an Internet news search by the Calspan Special Crash Investigations (SCI) team June 30, 2006. The Calspan SCI team initiated contact with the investigating police officer and the tow yard. Air bag deployment was confirmed and the case was assigned for on-site investigation on July 17, 2006. The on-site investigative effort was conducted on July 19-20.

SUMMARY

Crash Site

The crash occurred on a bridge of a four-lane east/west roadway. The travel lanes were constructed of concrete and measured 3.7 meters (12 feet) in width and were separated by a concrete median barrier. The westbound lanes were straight and consisted of a steady incline prior to and on the bridge. A concrete barrier curb, narrow sidewalk, and a concrete wall bordered the outboard aspect of the westbound lanes. The posted speed limit was 72 km/h (45 mph). The scene schematic is included as **Figure 11** of this report.

Vehicle Data

1994 Pontiac Grand Prix

The subject vehicle in this crash was a 1994 Pontiac Grand Prix. The vehicle was loaned to the driver by a family member approximately 2-3 months prior to the crash. The complete history of the vehicle was unknown; however, the Pontiac was involved in at least one prior crash which was evidenced by minor damage to the left front fender. This crash did not result in deployment of the frontal air bag system.

The 1994 Pontiac Grand Prix was manufactured on February 1994 and was identified by Vehicle Identification Number (VIN) 1G2WJ52M9R (production number deleted). The odometer reading at the time of the SCI inspection was 250,246 kilometers (155,500 miles). The vehicle was a four-door sedan equipped with a transverse mounted 3.1 liter V-6 engine linked to a four-speed automatic transmission with a column mounted selector. The service brakes were front disc/rear drum. The vehicle was equipped with OEM steel wheels with plastic wheel covers and P205/70R15 tires. The manufacturer recommended tire pressure was unknown. The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	193 kPa (28 PSI)	6 mm (7/32")	None
Left Rear	76 kPa (11 PSI)	7 mm (9/32")	None
Right Front	179 kPa (26 PSI)	5 mm (6/32")	None
Right Rear	255 kPa (37 PSI)	7 mm (9/32")	None

The interior of the Pontiac was configured with a cloth surfaced front three-passenger split bench seat and a fixed rear bench seat. The front head restraints were height-adjustable with both adjusted to the full-down position. The rear seat was equipped with integrated head restraints for the outboard seats. The vehicle was equipped with a tilt steering wheel that was adjusted to the full-up position at the time of the SCI inspection.

1992 Honda Civic

The struck vehicle in this crash was a 1992 Honda Civic with a VIN of 1HGEG8655N (production number omitted). The vehicle was relocated out of the state prior to the SCI investigation; therefore, it was not inspected. Based on the police provided on-scene images, the Honda was a four-door sedan that was modified with aftermarket tires and wheels, and a large aluminum spoiler that was mounted to the trunk lid.

Crash Sequence

Pre-Crash

The crash occurred on a straight segment of road with a long positive grade for westbound travel (**Figure 2**). The driver of the Pontiac was operating the vehicle westbound on the right lane. Reportedly, a 1993 Geo Metro was stalled on the right lane. The driver of a 2002 Ford Ranger observed the stalled vehicle and stopped behind the Geo. The driver of a Honda was operating the vehicle westbound on the right lane and was unable to stop. The front of the Honda Civic struck the rear of the stopped Ford. The driver of the Pontiac stated to the SCI investigator that



Figure 2. Pontiac's pre-crash approach.

she was operating the vehicle westbound en route to her residence. As she approached the Honda, she heard skidding tires which alarmed her. She steered left and applied the brakes in an attempt to avoid contact with the Honda.

Crash

The front right corner area of the Pontiac Grand Prix impacted the rear left area of the Honda Civic which was still engaged with the rear of the Ford Ranger. The Honda and the Ford were subsequently displaced forward and the front left of the Ford impacted the rear right of the Geo. These vehicles were displaced forward a minimum of 2 meters (5 feet) based on the on-scene photos.

The initial contact involved the front bumper system of the Pontiac against the rear bumper of the Honda. As the front and rear structures of the vehicles crushed, the Pontiac began to underride the rear plane of the Honda. This was attributed to the pre-crash braking by the driver of the Pontiac which compressed the vehicle's front suspension. The corner area of the Pontiac engaged the rear axle of the Honda as the Pontiac continued forward.

The resultant directions of force were 12 o'clock for the Pontiac and 6 o'clock for the Honda. The Honda was not inspected during this on-site investigative effort; therefore, the missing vehicle algorithm of the WinSMASH was used to calculate a delta-V for this impact. The total delta-V for the Pontiac was 10 km/h (6.2 mph) with longitudinal and lateral components of -10 km/h (-6.2 mph) and 0 km/h, respectively. The total delta-V for the Honda was 16 km/h (9.9 mph). The longitudinal

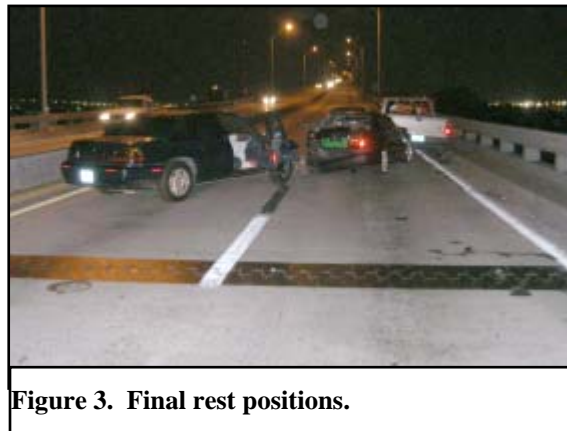


Figure 3. Final rest positions.

component was 16 km/h (9.9 mph) with a lateral component of 0 km/h. The delta-V calculated by the WINSMASH program only analyzed the impact between the Pontiac and Honda; therefore, under-reporting the combined severity of the multiple vehicle crash. The EDR captured delta-V was cumulative and represented the overall severity of the multiple impact sequence. The EDR captured value was more representative by virtue of the fact these events were triggered by the initial momentum of the Pontiac. An estimate of the Pontiac's delta-V based on a Conservation of Momentum analysis produced a speed change of 24-32 km/h (15-20 mph).

The continued forward motion of the Pontiac as it underrode the rear of the Honda resulted in a long crash pulse and late deployment of the frontal air bag system. The Pontiac's EDR recorded a maximum delta-V of -41 km/h (-25.3 mph) at 300 milliseconds of Algorithm Enable (AE). The frontal air bag system was commanded to deploy at 166.25 milliseconds of AE.

The corner impact displaced the Honda in a clockwise (CW) direction as it came to rest straddling the outboard travel lane behind the Ford Ranger. The Pontiac rotated CW into the inboard westbound travel lane, coming to rest diagonal to the inboard lane. **Figure 3** is an on-scene image of the vehicles at final rest.

Post-Crash

Immediately following the crash, the passengers of the Honda, Ford, and Geo exited their respective vehicles and aided in the removal of the passengers of the Pontiac. The investigating police officer stated to the SCI investigator that the witnesses to the crash removed the 4-year-old male from the floor under the right instrument. The 4-year-old male front right passenger was transported to a local hospital where he was pronounced deceased approximately 30 minutes post-crash. The driver and the 3-year-old female front center passenger sustained minor injuries and were transported to a local hospital where they were treated and released. The 1-year-old male and the 3-year-old female front right passengers were not injured or transported to a hospital.

Vehicle Damage

Exterior – 1994 Pontiac Grand Prix

The 1994 Pontiac Grand sustained minor severity frontal damage as a result of the impact with the Honda (**Figures 4 and 5**). Maximum crush was 9 cm (3.5”), located at the right



Figure 4. Overall view of the frontal damage.



Figure 5. Overhead view of the crush profile

corner of the front bumper beam. The direct contact damage consisted of abrasions, dents, and fracturing of the bumper fascia, hood, and the right front fender. The direct contact damage began 36 cm (14") right of the vehicle's centerline and extended 31 cm (12.3") to the right bumper corner. The impact deformed the bumper beam resulting in a combined induced and direct damage length (Field L) of 135 cm (53"). Six equidistant crush measurements were documented at this level and were as follows: C1 = 0 cm, C2 = 0 cm, C3 = 0 cm, C4 = 0 cm, C5 = 1 cm (0.4"), C6 = 9 cm (3.5"). Additionally, crush was documented at the leading edge of the right front fender which was 22 cm (8.8"). Damage components included the hood, front bumper fascia and beam, right headlamp and the turn signal assembly. The Collision Deformation Classification (CDC) for this impact was 12-FREE-3.

Interior – 1994 Pontiac Grand Prix

The interior of the Pontiac sustained interior damage that was attributed to air bag deployment, and occupant contacts. The driver stated to the SCI investigator that she was in the process of moving. The vehicle contained several personal items that consisted of clothing, large storage container, and food items that were scattered throughout the vehicle. **Figures 6 and 7** are overall views of the interior. The instrument panel exhibited damage from previous sun and heat exposure. The sun damage consisted of several cracks to the top of the instrument panel and front right air bag cover flap. Both air bags deployed as designed from the respective modules. The cover flap of the front right air bag contacted and fractured the windshield. The expanding air bag contacted the rear view mirror, which deflected it to the left and contacted and fractured the windshield. Also, the mirror glass was fractured from the contact with the front right air bag. The air vent, that was located on the right end of the right instrument panel was separated from probable contact with the expanding air bag as it was displaced by the out-of-position child passenger. Additionally, the headliner fabric contained several tears and stains that were not related to the crash.

The occupant contact points consisted of a scuff mark to the face of the glove compartment door from one of the front occupants. A smudge mark was present on the center rear edge of the right front air bag cover. The interior surfaces of the Pontiac were soiled which hampered the identification of minor occupant contact points. Furthermore, the front and rear seating surfaces were covered with sheets at the time of the crash and SCI inspection. This crash did not result in a reduction of the occupant space.



Figure 6. Overall view of the interior front row.



Figure 7. Overall view of the rear seating area.

Exterior – 1992 Honda Civic

The 1992 Honda Civic was relocated prior to the SCI investigation; therefore, it was not inspected. The damage assessment was estimated from the police images **Figures 8 and 9**. The Honda sustained moderate severity frontal damage from the impact with the Ford Ranger.

The Honda sustained moderate severity damage to the rear from the impact with the Pontiac. The direct contact damage began left of the vehicle’s centerline and extended to the rear left bumper corner. Maximum crush occurred outboard of the rear left bumper corner. Due to the Pontiac underriding the rear of the Honda, the left rear axle was engaged and deflected forward resulting in a left side wheelbase reduction. The CDC for this impact was 06-BZEW-2.



Figure 8. Resultant damage to the Honda.



Figure 9. Damage to the rear of the Honda.

Frontal Air Bag System – 1994 Pontiac Grand Prix

The Pontiac was equipped with first generation frontal air bags for the driver and front right positions. The system deployed as a result of the front-to-rear impact sequence with the Honda.

The driver’s air bag was contained within the four-spoke steering wheel rim and concealed by two I-configuration cover flaps. Both flaps were 8 cm (3”) wide at the horizontal tear seam and 10 cm (4”) in height. Vertically oriented striations were noted on the left cover flap and the top aspect of the air bag module. The source of these striations was unknown. The air bag membrane measured 57 cm (22.5”) in diameter in its deflated state and was not tethered. Two vent ports located on the backside of the air bag at the 11 and 1 o’clock sectors vented the bag into the passenger compartment. There was no damage or evidence of driver contact on the face of the deployed air bag.



Figure 10. Deployed front right air bag.

The front right passenger air bag was a top-mount design, incorporated into the right instrument panel (**Figure 10**). A single cover flap concealed the bag, which measured 53 cm (21”) in width at the top and narrowed to 38 cm (15”) in width at the rear edge. The cover flap measured 28 cm (11”) in height. The exterior vinyl of the cover flap was cracked at numerous locations from prior sun/heat exposure. Additionally, a smudge was present on the center rear edge of the cover flap from possible occupant contact.

The air bag membrane measured 61 cm (24”) in width and 58 cm (23”) in height. The bag was tethered by a single wide band tether that extended across the full the width and was sewn to the face of the membrane. The air bag was vented by two vent ports on the side panels at the 11 and 1 o’clock positions. The maximum rearward excursion of this bag at the midpoint measured 41 cm (16”). Vinyl transfers were noted on the face of the membrane at the 11 and 8 o’clock sectors. No occupant contact points were noted to the air bag; however, two areas of body fluid that measured less than 1 cm (0.4”) were noted on the face of the membrane at the 5 o’clock sector. The air bag was free of damage.

The sun visors of the Pontiac were equipped with warning labels on the inside that advised the following:

This vehicle has AIR BAGS for front occupants.

Caution: YOU NEED YOUR SAFETY BELT, EVEN WITH AN AIR BAG.

AND HERE’S WHY:

- Air bags are not designed to inflate in rollovers or in rear, side or low-speed frontal crashes.
- Air bags inflate with great force, faster than the blink of an eye. If you’re too close to an inflating air bag, it could seriously injure you. Safety belts help keep you in position for air bag inflation in a crash.
- An inflating air bag can seriously injure small children. Follow the instructions on the safety belt Caution label.

REGULAR MAINTENANCE OF THE AIR BAG SYSTEM IS NOT REQUIRED. If the air bag readiness light comes on while you are driving, or doesn’t come on when you first start your vehicle, see your dealer for service.

See your Owners’ Manual for more information

Event Data Recorder – 1994 Pontiac Grand Prix

The 1994 Pontiac Grand Prix was equipped with a Sensing and Diagnostic Module (SDM) that had EDR capabilities. The SDM was located under the right front seat. The EDR was downloaded directly from the SDM using the Vetronix Crash Data Retrieval tool with software version 2.8 during this on-site investigative effort. The EDR printout is included in this report as **Attachment A**. The EDR data indicated the driver’s safety belt was not buckled at the time of Algorithm Enable (AE). The EDR recorded a maximum delta-V was -41 km/h (-25.3 mph) at 300 milliseconds of AE. The frontal air bag system was commanded to deploy at 166.25 milliseconds. This first generation EDR

did not record pre-crash data (i.e. five second intervals of speed, braking, and engine RPM's).

Manual Safety Belt Systems – 1994 Pontiac Grand Prix

The Pontiac was equipped with three-point lap and shoulder belt systems for the four outboard-seated positions. This vehicle was manufactured and designed as a six-passenger vehicle.

All four positions consisted of continuous loop webbing with sliding latch plates and fixed D-rings. The driver's belt retracted onto an Emergency Locking Retractor (ELR). The remaining three outboard belt systems utilized switchable ELR/Automatic Locking Retractors (ALR). The front and rear center lap belts utilized locking latch plates. The driver stated to the SCI investigator that she was restrained by the safety belt system while the front center and right children occupants were restrained with the lap belt portion of the front right safety belts. The front and rear seats were covered with sheets, which concealed the buckles. This would have prevented the buckling of the safety belts. Furthermore, there was no evidence to support safety belt usage in this crash.

Child Safety Seat – 1994 Pontiac Grand Prix

A Century convertible child safety seat was located in the rear right seat position of the Pontiac. The date of manufacture was unknown; however, the seat was labeled with an identification number of 4175GNF. The driver stated to the SCI investigator that the 1-year-old male passenger was secured in the child safety seat in the rear right seating position at the time of the crash. Witnesses to the crash that assisted in the removal of the passengers reported to the investigating police officer that the 1-year-old male was removed from the front left seating position outboard of the driver. Therefore, the child safety seat was not used during the crash.

Occupant Demographics/Data

Driver

Age/Sex:	26 year old/Female
Height:	165 cm (65")
Weight:	73 kg (160 lb)
Seat Track Position:	Rear third
Eyewear:	None
Manual Safety Belt Usage:	None
Usage Source:	Vehicle inspection
Egress from Vehicle:	Assisted through left door
Mode of Transport from Scene:	Transported by ambulance to a hospital
Type of Medical Treatment:	Treated and released

Driver Injuries

Injury	Injury Severity AIS90/Update 98	Injury Source
Left side chest pain	Not coded under AIS	Unknown

Source – Driver interview

Driver Kinematics

The 26-year old female driver of the 1994 Pontiac Grand Prix was seated in an upright driving posture with the 1-year-old male passenger seated outboard against the left front door. At impact, the frontal air bag system deployed. The driver initiated a slight forward trajectory and loaded the deployed air bag. There were no contact points within the interior to support driver contact. She sustained chest pain and was transported to a local hospital where she was treated and released.

Front Left Infant Passenger

Age/Sex: 1-year-old/Male
Height: 56 cm (22")
Weight: 9 kg (19 lb)
Seat Track Position: Rear third
Child Restraint Use: None Used
Usage Source: Vehicle inspection
Egress from Vehicle: Removed from front left seating position by a witness to the crash
Mode of Transport from Scene: Not transported
Type of Medical Treatment: Not injured

Front Left Infant Kinematics

The 1-year-old front left infant passenger was positioned outboard of the driver near the front left door. At impact, the frontal air bag deployed. The 1-year-old male initiated a slight forward trajectory and possibly loaded the deployed air bag. There were no contact points within the interior to support this passenger's contact points. The 1-year-old male was not injured.

The driver stated to the SCI investigator that the 1-year-old male passenger was secured in the child safety seat in the rear right seating position at the time of the crash. Witnesses to the crash that assisted in the removal of the passengers stated to the investigating police officer that the 1-year-old male was removed from the front left seating position outboard of the driver.

Front Center Child Passenger

Age/Sex: 3-year old/Female
Height: 104 cm (41")
Weight: 13 kg (28 lb)
Seat Track Position: Rear third
Eyewear: None
Child Restraint Use: None used
Usage Source: Vehicle inspection
Egress from Vehicle: Assisted by a witness to the crash
Mode of Transport from Scene: Ambulance to a local hospital
Type of Medical Treatment: Treated and released

Front Center Child Injuries

Injury	Injury Severity AIS90/Update 98	Injury Source
Right side neck pain	Not coded under AIS	Unknown

Source – Driver interview

Front Center Child Kinematics

The 3-year-old female child passenger was seated in the front center seat and was not restrained. The child responded to the frontal crash forces by initiating a forward trajectory. There was no evidence of occupant contact in the area of this passenger. However, the soiled interior surfaces hampered the identification of minor occupant contact points. The 3-year-old female sustained right side neck pain as a result of the crash. She was transported to a local hospital where she was treated and released.

Front Right Child Passenger

Age/Sex: 3-year old/Female
Height: 122 cm (48")
Weight: Unknown
Seat Track Position: Full-rear
Eyewear: None
Child Restraint Use: None used
Usage Source: Vehicle inspection
Egress from Vehicle: Assisted by a witness to the crash
Mode of Transport from Scene: Not transported
Type of Medical Treatment: Not injured

Front Right Child Kinematics

The 3-year-old female child passenger was seated in the front right seat inboard of the 4-year-old male passenger and was not restrained. The child responded to the frontal crash forces by initiating a forward trajectory. There was no evidence of occupant contact in the area of this passenger. The 3-year-old female was not injured as a result of the crash.

Front Right Child Passenger

Age/Sex: 4-year old/Male
 Height: 109 cm (43")
 Weight: 21 kg (47 lbs)
 Seat Track Position: Full-rear
 Eyewear: None
 Child Restraint Use: None used
 Usage Source: Vehicle inspection
 Egress from Vehicle: Removed by a witness to the crash
 Mode of Transport from Scene: Transported to a local hospital
 Type of Medical Treatment: Pronounced deceased upon arrival

Front Right Child Kinematics

Injury	Injury Severity AIS90/Update 98	Injury Source
Epidural hemorrhage over the posterior surface of the spinal cord at the mid and lower cervical regions with atlanto-occipital dislocation and local hemorrhage of the joints of the posterior membrane (no fracture of the vertebrae noted)	Maximum (640234.6,6)	Deploying front right air bag
Transection of the spinolmedullary junction of the brain stem. Slight subarachnoid hemorrhage and small petechial hemorrhage bilaterally at the superior portion of the transected stump.	Maximum (140212.6,8)	Deploying front right air bag
Bilateral inferior cortical contusions of the posterior frontal and anterior, medial, temporal lobes	Serious (140620.3,3)	Deploying front right air bag
Mild bilateral upper frontal subarachnoid hemorrhage	Serious (140684.3,1 and 140684.3,2)	Deploying front right air bag
Right lung contusion of the posterior lower lobe	Serious (441406.3,1)	Deploying front right air bag

Injury	Injury Severity AIS90/Update 98	Injury Source
Vertical non-displaced fractures of the right posterior ribs 8-10 with local intercostal space hemorrhages	Moderate (450220.2,1)	Deploying front right air bag
Bilateral periorbital ecchymosis	Minor (297402.1,1 and 297402.1,2)	Deploying front right air bag
Abrasions to the chin, lips, left cheek, left face, inner left nasal bridge, and right cheek	Minor (290202.1,0)	Deploying front right air bag
Upper left neck abrasion	Minor (390202.1,2)	Deploying front right air bag
Abrasions to the posterior left ear, left temple, and right temple area	Minor (190202.0,)	Deploying front right air bag
Partial thickness laceration of the upper anterior helix of the left ear	Minor (290602.1,2)	Deploying front right air bag
Deep scalp contusion of the lower left forehead, anterior chin and lips, left cheek/face, inner left nasal bridge, and right cheek	Minor (290402.1,0)	Deploying front right air bag
Upper left back abrasion	Minor (690202.1,2)	Seat back
Upper left shoulder abrasion	Minor (790202.1,2)	Seat back
Posterior neck deep muscle contusion	Minor (390402.1,6)	Seat back

Source – Medical examiners report

Front Right Child Kinematics

The 4-year-old male child passenger was seated in the front right seat outboard of the 3-year-old female passenger and was not restrained. The driver observed the stopped traffic and applied the brakes which displaced the 4-year-old male forward. At impact, the 4-year-old male's head was in close proximity to the front instrument panel at the time of air bag deployment. The expanding air bag contacted the 4-year-old male's face which resulted in the soft tissue injuries of the face, scalp, and left ear. The continued expansion of the air bag engaged his chest which fractured the right ribs 8-10. The expanding air bag rotated the child passenger's head rearward, which resulted in the epidural hemorrhage over the posterior surface of the spinal cord at the mid and lower cervical regions with atlanto-occipital dislocation and local hemorrhage of the joints of the posterior membrane (no fracture of the vertebrae noted), transection of the spinolmedullary junction of the brain stem with a slight subarachnoid hemorrhage and

small petechial hemorrhage bilaterally at the superior portion of the transected stump. The contact and acceleration of the head by the expanding air bag resulted in the bilateral inferior cortical contusions of the posterior frontal and anterior, medial, temporal lobes, mild bilateral upper frontal subarachnoid hemorrhage.

The air bag contact displaced him rearward and he contacted the seat back which resulted in the upper left back abrasion, upperleft shoulder abrasion, and the posterior neck deep muscle contusion. The 4-year-old male came to rest on the front right floor of the vehicle where he was removed by witness to the crash. He was transported to a local hospital where he expired approximately 30 minutes post-crash.

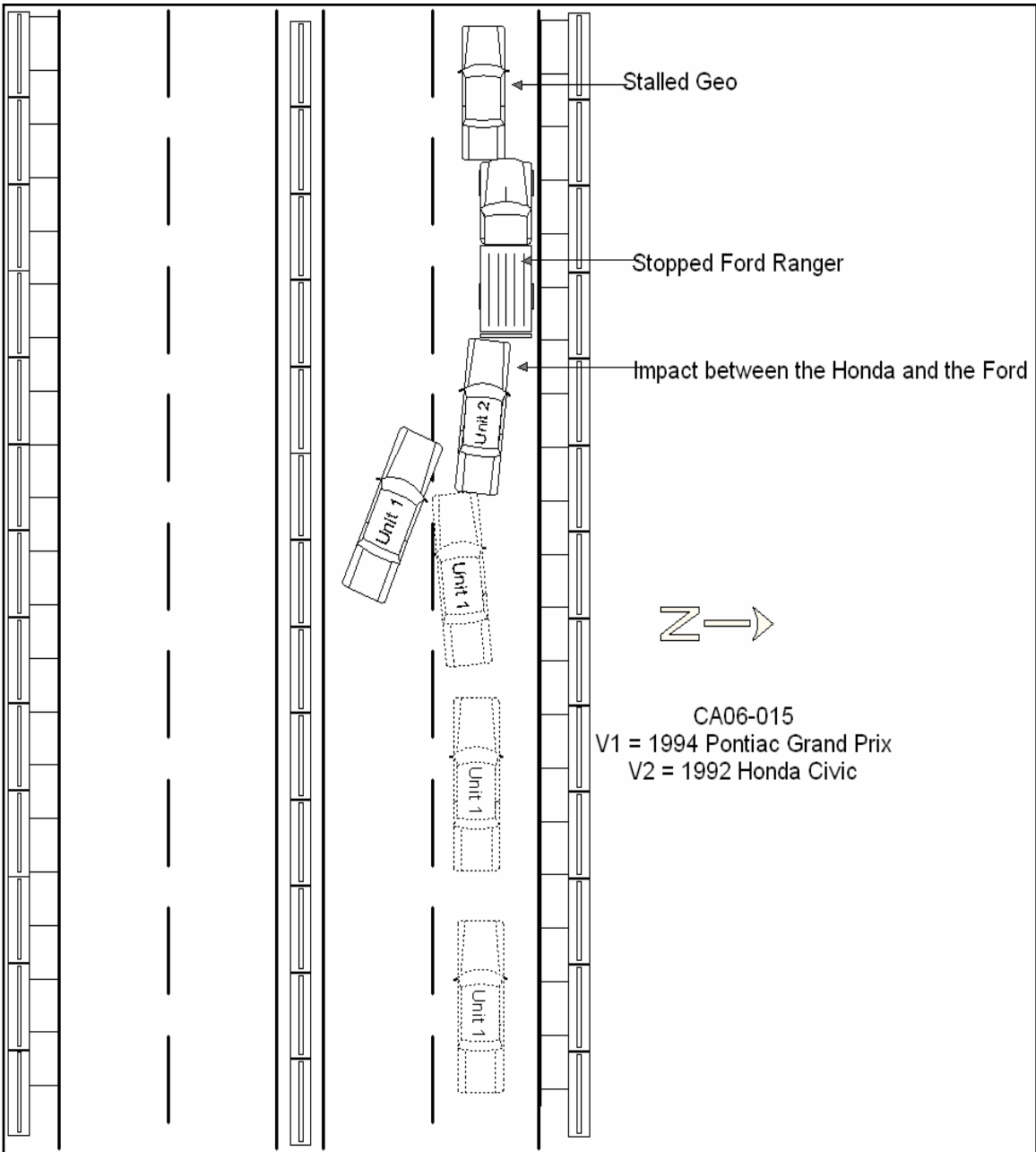


Figure 11: Scene Schematic

Attachment A: Pontiac's EDR Printout

CDR File Information

Vehicle Identification Number	1G2WJ52M9RF*****
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	
Saved on	
Collected with CDR version	
Collecting program verification number	9238B95E
Reported with CDR version	Crash Data Retrieval Tool 2.800
Reporting program verification number	9238B95E
Interface used to collected data	Block number: 00 Interface version: 4A Date: 11-08-05 Checksum: 7500
Event(s) recovered	Crash 1 Deployment

SDM Data Limitations

SDM Recorded Crash Events:

There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 125 times.

The second type of SDM recorded crash event is the Deployment Event. The SDM can store up to two different Deployment Events. The first Deployment Event will be stored in the #1 Deployment Event file (this would have been the event that deployed the air bag) and the second Deployment Event will be stored in the #2 Deployment Event file. Deployment Events cannot be overwritten or cleared from the SDM. Once the SDM has two Deployment Events recorded, the SDM must be replaced.

The data in the Non-Deployment Event file will be locked after a Deployment Event, if the Non-Deployment Event occurred within 7.65 seconds before the Deployment Event unless a Deployment Level Event occurs within 5 seconds after the Deployment Event, and then the Deployment Level Event will overwrite the Non-Deployment Event file.

SDM Data Limitations:

-SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Forward Velocity Change is the change in velocity during the recording time and is not the speed the vehicle was traveling before the event, and is also not the Barrier Equivalent Velocity. This data should be examined in conjunction with other available physical evidence from the vehicle and scene when assessing occupant or vehicle forward velocity change. The SDM records the first 300 milliseconds of Vehicle Forward Velocity Change after Algorithm Enable. The maximum value that can be recorded for Vehicle Forward Velocity Change is 28 MPH.

-Driver's Belt Switch Circuit Status indicates the status of the driver's seat belt switch circuit.

-The Time between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than five seconds, "N/A" is displayed in place of the time.

-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded. An indication of a loss of power would be if the ignition cycles at the event is recorded as zero. Data recorded after that may not be reliable, such as Time Between Non-Deployment and Deployment Events and Driver Belt Switch Circuit Status.

SDM Data Source:

All SDM recorded data is measured, calculated, and stored internally, except for the following:

-The Driver's Belt Switch Circuit is wired directly to the SDM.

System Status At Crash 1

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Deployment	16738
Ignition Cycles At Investigation	16740
Time From Algorithm Enable to Deployment Command Criteria Met (msec)	166.25
Time Between Non-Deployment And Deployment Events (sec)	N/A



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.77	-2.19	-2.63	-3.51	-4.61	-6.14	-7.35	-9.00	-10.42	-12.07	-13.49	-14.59	-15.69	-16.46	-17.22
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Recorded Velocity Change (MPH)	-17.88	-18.65	-19.42	-20.40	-21.50	-22.27	-23.04	-23.59	-24.02	-24.35	-24.68	-24.79	-25.01	-25.23	-25.34

Hexadecimal Data

This page displays all the data retrieved from the air bag module.
It contains data that is not converted by this program.

```
B600: 25 09 80 01 00 00 00 00
B608: 55 00 00 00 00 42 F9 F9
B610: F0 F9 F9 F9 F9 F9 00 64
B618: 02 00 00 00 00 00 00 00
B620: AA AA 00 00 00 00 81 00
B628: 08 00 85 07 14 18 20 2A
B630: 38 43 52 5F 6E 7B 85 8F
B638: 96 9D A3 AA B1 BA C4 CB
B640: D2 D7 DB DE E1 E2 E4 E6
B648: E7 41 62 89 FF 00 00 55
B650: AA AA 55 AA 00 00 00 00
B658: 00 00 00 00 00 00 00 00
B660: 00 00 00 00 00 00 00 00
B668: 00 00 00 00 00 00 00 00
B670: 00 00 00 00 00 00 00 00
B678: 00 00 00 00 00 00 00 00
B680: 00 00 00 00 00 00 00 00
B688: 00 00 00 00 00 00 00 00
B690: 00 00 00 00 00 00 00 00
B698: 00 00 00 00 00 00 00 00
B6A0: 00 00 00 00 00 00 00 00
B6A8: 00 00 00 00 00 00 00 00
B6B0: 00 00 00 00 00 00 00 00
B6B8: 7D 00 00 7D 00 00 81 00
B6C0: 3F 82 00 00 00 00 00 7D
B6C8: 00 00 7D 00 00 7D 00 00
B6D0: 00 00 00 59 90 43 74 04
B6D8: 90 33 10 41 53 15 99 4B
B6E0: 00 00 00 00 00 01 57 02
B6E8: 00 00 00 00 00 00 00 00
B6F0: 10 20 F0 18 30 F0 05 50
B6F8: 24 64 5B 5B 5B 5C 61 61
B700: 66 66 66 66 68 71 78 7D
B708: 80 82 84 86 88 90 98 9E
B710: 9F 9F A8 AF B5 BC C4 CD
B718: D4 DE E7 F1 FB 42 45 48
B720: 4A 4D 50 53 55 58 5B 5E
B728: 61 64 67 6A 6D 6F 71 75
B730: 77 79 7B 7D 7F 81 82 84
B738: 86 88 89 8B 8C 8D 8F 90
B740: 91 92 92 93 94 94 95 95
B748: 96 96 97 97 98 98 98 98
B750: 99 99 99 99 99 99 9A 9A
B758: 9A 9A 9A 9A 9A 9A 04 10
B760: 11 00 00 00 06 07 08 0A
B768: 0B 0D 0F 11 13 15 17 1A
B770: 1D 00 00 00 00 00 00 00
B778: 00 00 00 00 00 00 00 00
B780: 00 00 00 00 00 00 00 00
B788: 00 00 00 00 00 00 00 00
B790: 00 00 00 00 00 00 00 00
B798: 00 02 80 05 78 18 1C 3C
B7A0: 3C 51 49 49 49 49 49 49
B7A8: 49 54 56 56 59 59 5C 5E
B7B0: 61 63 66 6A 6D 70 75 76
B7B8: 77 77 78 78 78 78 7A 7B
B7C0: 7B 7E 80 81 81 81 81 81
B7C8: 81 81 81 81 81 81 81 81
B7D0: 81 83 85 86 87 89 8A 8D
B7D8: 8E 90 90 90 91 91 91 91
B7E0: 91 91 92 93 94 9A 9D A2
B7E8: A9 B1 B6 BB BF C3 CF D5
1G2WJ52M9RF*****
```

B7F0: D6 DA B9 43 B5 0E 4A F1
B7F8: 00 00 75 FD 00 00 00 00