

**TRANSPORTATION SCIENCES  
CRASH DATA RESEARCH CENTER**

Advanced Information Engineering Services  
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**GENERAL DYNAMICS ON-SITE ADULT AIR BAG RELATED FATALITY  
INVESTIGATION**

**GENERAL DYNAMICS CASE NO. – CA03-047**

**SUBJECT VEHICLE – 2000 CHEVROLET PRIZM**

**LOCATION - STATE OF NEW JERSEY**

**CRASH DATE – AUGUST 2003**

Contract No. DTNH22-01-C-17002

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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 injury mechanisms and the cause of death for a 79-year-old female driver of a 2000 Chevrolet Prizm. The Chevrolet was equipped with a redesigned frontal air bag system for the driver and front right passenger positions that deployed as result of the crash. The Chevrolet was also equipped with retractor mounted safety belt pretensioners for the driver and front right positions that fired as result of the crash. The Chevrolet was involved in a head-on type crash with a 2003 Audi A4. The Audi was occupied by a 38-year-old male driver. The Audi was equipped with an Advance Occupant Protection System (AOPS) that included dual stage frontal air bags and retractor mounted safety belt pretensioners for the front and rear outboard seating positions. The frontal air bags deployed and the safety belt pretensioners fired as result of the crash. The driver of the Chevrolet was traveling in westerly direction on a two-lane residential roadway attempting to negotiate an S-curve approaching a "T" intersection. The Audi was traveling east on the same roadway entering the curve at the "T" intersection. The driver of the Chevrolet passed a pedal cyclist that was traveling in the same direction. The driver of the Chevrolet steered left to avoid the cyclist. As she steered back to the right the right side tires and wheels contacted the right curb. The driver of the Chevrolet over- corrected to the left and entered the eastbound lane prior to the intersection. The front of the Chevrolet impacted the front of the Audi in the eastbound lane within the intersection. The impact resulted in severe damage to the front of the Chevrolet and moderate frontal damage to the Audi. The driver of the Chevrolet was not restrained by the manual 3-point lap and shoulder belt. She was transported by ambulance to a local hospital where she expired on arrival. The driver's sustained symmetrical bilateral rib fractures 1-9 with flail chest and 1000cc of blood in the right chest, tear of the left atrium on the interatrial septum, and a 1.3 cm (0.5") laceration of the descending aorta with near transection, (attached by 1.3 cm (0.5") thread). These injuries were a result of the driver's close proximity to the deploying frontal air bag. The driver also sustained multiple severe to minor injuriues that are detailed in the driver injury section of this report. The driver of the Audi was also transported by ambulance to a hospital where he was treated for a left wrist and forearm fracture.</p>			
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## TABLE OF CONTENTS

<b>BACKGROUND .....</b>	<b>1</b>
<b>SUMMARY .....</b>	<b>2</b>
CRASH SITE.....	2
VEHICLE DATA – 2000 CHEVROLET PRIZM .....	2
VEHICLE DATA – 2003 AUDI A4.....	3
CRASH SEQUENCE.....	3
PRE-CRASH .....	3
CRASH.....	4
POST-CRASH .....	4
VEHICLE DAMAGE.....	5
EXTERIOR DAMAGE – 2000 CHEVROLET PRIZM.....	5
EXTERIOR DAMAGE – 2003 AUDI A4.....	5
INTERIOR DAMAGE –2000 CHEVROLET PRIZM.....	6
MANUAL RESTRAINTS SYSTEMS – 2000 CHEVROLET PRIZM .....	6
FRONTAL AIR BAG SYSTEM – 2000 CHEVROLET PRIZM .....	6
OCCUPANT DEMOGRAPHICS – 2000 CHEVROLET PRIZM .....	7
DRIVER .....	7
DRIVER KINEMATICS .....	9
MEDICAL TREATMENT .....	10
FIGURE 10. CRASH SCHEMATIC.....	11

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SCI CASE NO. – CA03-047  
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LOCATION - STATE OF NEW JERSEY  
CRASH DATE – AUGUST 2003**

**BACKGROUND**

This on-site investigation focused on the injury mechanisms and the cause of death for a 79-year-old female driver of a 2000 Chevrolet Prizm (**Figure 1**). The Chevrolet was equipped with a redesigned frontal air bag system for the driver and front right passenger positions that deployed as result of the crash. The Chevrolet was also equipped with retractor mounted safety belt pretensioners for the driver and front right positions that fired as result of the crash. The Chevrolet was involved in a head-on type crash with a 2003 Audi A4. The Audi was occupied by a 38-year-old male driver. The Audi was equipped with an Advance Occupant



**Figure 1. 2000 Chevrolet Prizm.**

Protection System (AOPS) that included dual stage frontal air bags and retractor mounted safety belt pretensioners for the front and rear outboard seating positions. The frontal air bags deployed and the safety belt pretensioners fired as result of the crash. The driver of the Chevrolet was traveling in westerly direction on a two-lane residential roadway attempting to negotiate an S-curve approaching a “T” intersection. The Audi was traveling east on the same roadway entering the curve at the “T” intersection. The driver of the Chevrolet passed a bicyclist that was traveling in the same direction. The driver of the Chevrolet steered left to avoid the cyclist. As she steered back to the right, the right side tires and wheels contacted the right curb. The driver of the Chevrolet over-corrected to the left and entered the eastbound lane prior to the intersection. The front of the Chevrolet impacted the front of the Audi in the eastbound lane within the intersection. The impact resulted in severe damage to the front of the Chevrolet and moderate frontal damage to the Audi. The driver of the Chevrolet was not restrained by the manual 3-point lap and shoulder belt. She was transported by ambulance to a local hospital where she expired on arrival. The driver’s sustained symmetrical bilateral rib fractures 1-9 with flail chest and 1000cc of blood in the right chest, a tear of the left atrium on the interatrial septum, and a 1.3 cm (0.5”) laceration of the descending aorta with near transection, [attached by 1.3 cm (0.5”) thread]. These injuries were a result of the deploying frontal air bag. The driver also sustained multiple severe to minor injuries that are detailed in the driver injury section of this report. The driver of the Audi was also transported by ambulance to a hospital where he was treated for a left wrist and forearm fracture. The driver of the returned to hospital to have his fractures surgically repaired.

This August 2003 crash was reported to the National Highway Traffic Safety Administration (NHTSA) by the investigating police officer due to possible air bag related fatal injuries. The case was assigned to the General Dynamics SCI team on August 22, 2003 and an on-site investigation of the crash was initiated on August 27, 2003.

**SUMMARY**

***Crash Site***

This two-vehicle crash occurred during the evening hours of August 2003. At the time of the crash, the weather was clear with no adverse conditions. Although not intersection related, the crash occurred at a “T” intersection (**Figure 2**) of two local roadways. The east/west roadway consisted of an S-type curve and was configured with one travel lane in each direction, separated by a double-yellow centerline. The eastbound curve began as a right curve with a positive grade. The westbound curve began as a left curve with a negative grade. The north/south roadway was configured with one travel lane in each direction. Concrete curbs bordered the east/west roadway. East/west traffic flow through the intersection was not controlled. The posted speed limit for the east/west roadway was 40 km/h (25 mph). The scene schematic is included as (**Figure 10**) of this report.



**Figure 2. Eastbound view of the intersection.**

***VEHICLE DATA – 2000 Chevrolet Prizm***

The 2000 Chevrolet Prizm was identified by the Vehicle Identification Number (VIN): 1YISK5282Y (production sequence omitted). The Chevrolet’s battery was discharged at the time of the inspection and an odometer reading could not be obtained. A state safety inspection was conducted on the vehicle in May 2003 and the mileage at the time was 15,015 kilometers (9,330 miles). Based on state safety inspection records, the vehicle’s odometer reading was approximately 16-19,000 kilometers (10,000-12,000 miles). The vehicle was a four-door sedan that was equipped with a 1.8-liter, four-cylinder engine, 4-speed automatic transmission, power-front disc/ rear drum brakes without antilock, OEM steel wheels with plastic hubcaps, and power steering. The Prizm was configured with Firestone FR680 P175/65R14 tires. The maximum pressure for the tires was 303.7 kpa (44.0 psi). The specific tire data is as follows:

<b>Tire</b>	<b>Measured Pressure</b>	<b>Tread Depth</b>	<b>Restricted</b>	<b>Damage</b>
LF	106.8 kpa (15.5 psi)	3.2 mm (4/32)	No	Abraded
LR	217.2 kpa (31.5psi)	3.2 mm (4/32)	No	None
RF	213.7 kpa (31.0 psi)	6.4 mm (8/32)	Yes	None
RR	168.9 kpa (24.5 psi)	6.4 mm (8/32)	No	None

The interior of the Prizm was configured with front bucket seats and height adjustable head restraints that were adjusted to the full-down position. The rear seat was configured as a three-passenger bench seat and height adjustable head restraints for the outboard seating positions that were adjusted to the full-down position. The Prizm was also equipped with manual door locks, windows, and a fixed steering column.

#### ***VEHICLE DATA – 2003 Audi A4***

The 2003 Audi A4 was identified by the VIN: WAULC68E23 (production sequence omitted). The Audi's battery was discharged at the time of the inspection; therefore the odometer reading could not be obtained. The vehicle was a four-door sedan that was equipped with a 1.8-liter turbo-charged, 4-cylinder engine, a 5-speed automatic transmission, all-wheel drive, power-front and rear disc brakes with anti-lock, OEM alloy wheels and power steering. The Audi was equipped with an Advance Occupant Protection System (AOPS). The system included dual stage frontal air bags and retractor mounted safety belt pretensioners for the front and rear outboard seating positions that deployed as a result of the impact. In addition, the Audi was also equipped front seatback mounted side impact air bags and roof side rail mounted curtain air bags. The side impact air bag system did not deploy in the crash.

#### ***Crash Sequence***

##### ***Pre-Crash***

The 79-year-old female driver of the Chevrolet was operating the vehicle eastbound on the two-lane roadway negotiating the "S" curve on approach to the "T" intersection (**Figure 3**). The 38-year-old male driver of the Audi was traveling westbound (**Figure 4**) approaching the "T" intersection entering the left curve. The police reported that the driver of the Chevrolet steered left to avoid a pedal cyclist that was traveling in the same direction, adjacent to the curb. The driver of the Prizm steered back to the right to maintain her lane position; however, she lost directional control of the vehicle.



**Figure 3. Chevrolet's eastbound approach.**



**Figure 4. Audi's westbound approach.**

### ***Crash***

As the driver of the Chevrolet steered right to re-enter the eastbound lane, she traveled beyond the lane and impacted the curb with the right front tire. The Chevrolet then rebounded off the curb and back onto the roadway. The driver of the Chevrolet steered right and impacted the curb with the right front and right rear tires. The sidewall of the right front tire was abraded circumferentially. A dent that was 0.6 cm (0.25”) in depth was present on the right front wheel rim at the bead. The sidewall and hubcap of the right rear tire were abraded from contact with the curb.



**Figure 5. Area of impact.**

The Chevrolet then re-entered the road, crossed the centerline, and entered the intersection. The front of the Chevrolet impacted the front of the Audi in a head-on (12/11 o'clock) impact configuration (**Figure 5**). The impact resulted in severe damage to the front of the Chevrolet and moderate damage to the front of the Audi. The damage algorithm of the WinSMASH program computed a total delta-V of 38.0 km/h (23.6 mph) for the Prizm. The longitudinal and lateral components for the Prizm were -37.4 km/h (-23.3 mph) and -6.6 km/h (-4.1), respectively. The total delta-V for the Audi was 29.0 km/h (18.0 mph) and the longitudinal and lateral components for the Audi were -27.3 km/h (-16.9 mph) and 9.9 km/h (6.2 mph), respectively.

The Chevrolet was equipped with redesigned frontal air bags that deployed as a result of the vehicle-to-vehicle crash. The Audi was equipped with dual stage frontal air bags that deployed during the crash. The angled impact configuration induced a counterclockwise rotation in the Chevrolet that caused the vehicle to rotate approximately 40 degrees to final rest. The angled impact configuration induced a clockwise rotation in the Audi that caused the vehicle to rotate approximately 20 degrees to final rest. Both vehicles came to rest near the point of impact, in the eastbound travel lane.

### ***Post-Crash***

Police personnel arrived on-scene and opened the left front door of the Prizm to assist the driver. The first officer on-scene stated to the SCI investigator that as he opened the door, he found the driver unconscious and slumped under the knee bolster. The officer moved the seat track rearward in order to stabilize the head of the driver. EMS personnel arrived on-scene and applied a cervical collar and removed the driver on a backboard. The EMS personnel also initiated CPR activities. The driver was transported by ambulance to a local hospital; however, she expired from her injuries upon arrival. The driver of the Audi was transported by ambulance to a local hospital where he was treated for his injuries and released. The driver returned to the hospital to have his fractured wrist surgically repaired.



## **VEHICLE DAMAGE**

### ***Exterior Damage – 2000 Chevrolet Prizm***

The 2000 Chevrolet Prizm sustained severe frontal damage (**Figure 6**) as a result of the impact with the Audi. The direct contact damage began at the left front bumper corner and extended 142.8 cm (56.25”) along the bumper fascia to the right front bumper corner. Maximum crush was located at the left front corner of the bumper beam and was 62.8 cm (24.75”). The left wheelbase was reduced 10.2 cm (4.0”) from the displaced left front axle.



**Figure 6. Damaged Chevrolet Prizm.**

The left front wheel was restricted against the rear of the left front fender. The frame rails were shifted slightly left and crushed rearward.

The left front fender and hood were also deformed. The base of the windshield was fractured with scattered stress fractures from contact with the hood edge and the deploying front right air bag. The side and rear glazing were not damaged. All four doors remained closed during the crash and were operational post-crash. The Collision Deformation Classification (CDC) for the impact with the Audi was 12-FDEW-3. Six crush measurements were documented at the bumper beam using a combined direct and induced damage width of 106.0 cm (41.75”) and were as follows: C1 = 62.8 cm (24.75”), C2 = 59.2 (23.3”), C3 = 44.5 cm (17.5”), C4 = 32.1 cm (12.65”), C5 = 21.8 cm (8.6”), C6 = 5.1 cm (2.0”).

The sidewall of the right front tire was abraded circumferentially. The right front hubcap was missing from the Prizm at the time of the crash, however it was not known if this was crash related. A dent that was 0.6 cm (0.25”) in depth was present on the right front wheel rim at the bead. The sidewall and hubcap of the right rear tire were abraded from contact with the curb. The CDC’s for the three curb impacts were as follows: 12-FRWN-3, 12-FRWN-3, and 12-FRWN-9.

### ***Exterior Damage – 2003 Audi A4***

The 2003 Audi A4 sustained moderate frontal damage (**Figure 7**) as a result of the impact with the Chevrolet. The direct contact damage was 48.3 cm (19.0”) in length and began on the left front bumper corner and extended to 17.8 cm (7.0”) left of the centerline. The combined direct and induced damage was 116.0 cm (45.5”) along the front bumper fascia. The maximum crush was located at the left front bumper corner and was 34.3 cm (13.5”). The left front wheel was displaced rearward and was restricted against the left front fender. The left wheelbase was reduced 7.6 cm (3.0”).



**Figure 7 - Damaged 2003 Audi.**

The base of the windshield at the A-pillar was damaged from contact with the hood edge.

The side, rear and roof glazing were not damaged. All doors remained closed during the crash and were operational post-crash. Six crush measurements were documented along the front bumper and were as follows: C1 = 34.3 cm (13.5”), C2 = 22.1 cm (8.7”), C3 = 12.9 cm (5.1”), C4 = 2.1 cm (0.8”), C5 = 2.0 cm (0.8”), C6 = 0.0 cm (0.0”). The CDC for the frontal impact with the Chevrolet was 12-FYEW-2.

#### ***Interior Damage –2000 Chevrolet Prizm***

Interior damage to the 2000 Chevrolet Prizm was moderate and attributed to passenger compartment intrusion and occupant contact. The left toe pan was intruded approximately 13.0 cm (5.2”) from the engine compartment deformation. The left floor buckled upward 7.6 cm (3.0”) from the deforming toe pan. At impact, the driver initiated a forward trajectory into the path of the deploying air bag. The driver, while moving forward, began to submerge the knee bolster. The driver loaded the air bag and steering column. The driver’s loading bent the steering wheel rim forward 1.9 cm (0.75”) at the lower right quadrant and compressed the steering column. The steering column compression resulted in the displacement of the shear capsules. The left shear was displaced 3.2 cm (1.25”) and the right was displaced 2.5 cm (1.0”). The driver’s left knee contacted the left side of the knee bolster (**Figure 8**), deforming the knee bolster to a depth of 3.2 cm (1.75”). A bone fragment penetrated the left side of the knee bolster from the driver’s contact. The right side of the knee bolster was contacted by the driver’s right knee deforming it to a depth of 1.0 cm (0.375”).



**Figure 8. Driver's knee bolster contacts.**

#### ***Manual Restraints Systems – 2000 Chevrolet Prizm***

The 2000 Chevrolet Prizm was equipped with manual 3-point lap and shoulder safety belts for all five seating positions. The front left safety belt was configured with an Emergency Locking Retractor (ELR), sliding latch plate, retractor mounted pretensioner and a height adjustable D-ring. The left D-ring was in the full-up position and the pretensioner fired as a result of the crash. The driver’s safety belt was not used and was in the stowed position when the pretensioner fired. Inspection of the front left latch plate yielded evidence of minimal historical use. The front right safety belt was configured with a sliding latch plate, retractor mounted pretensioner and a height adjustable D-ring. The D-ring was in the full-down position and the pretensioner fired as result of the crash. The rear safety belts were configured with sliding latch plates and switchable ELR / Automatic Locking Retractors (ALR).

#### ***Frontal Air Bag System – 2000 Chevrolet Prizm***

The 2000 Chevrolet Prizm was equipped with a redesigned frontal air bag system that deployed as result of the crash with the Audi. The driver’s air bag was configured with asymmetrical H-configuration module cover flaps. The top flap measured 17.1 cm (6.75”) wide and 5.7 cm (2.25”) in height. The lower flap was 17.1 cm (6.75”) wide by

8.6 cm (3.375”) in height. The driver’s air bag (Figure 9) deployed from the center of the steering wheel hub and contained the following nomenclature on the rear aspect of the air bag at the 12 o’clock position: 062239. The center face of the bag was stamped with 23/S. The diameter of the air bag was 66.0 cm (26.0”) in it’s deflated state. Two symmetrical vent ports vented the air bag at the 11 and 1 o’clock positions on the backside of the air bag. Two tether straps at the 3 and 9 o’clock positions tethered the air bag internally. A subtle flesh tone transfer was documented near the left tether strap area of the air bag from possible contact with the driver’s face.



Figure 9. Driver's air bag.

The front right air bag deployed from the top right instrument panel and contained the following nomenclature 0004584 F083 F082 10 11 99 on the rear aspect of the air bag. The air bag was configured with two vent ports at the 3 and 9 o’clock position on the rear of the air bag and contained no tethers. Two symmetrical cover flaps covered the air bag module and measured 22.9 cm (9.0”) wide by 5.7 cm (2.25”) in height. The maximum excursion of the front right air bag at the top instrument panel was 58.4 cm (23.0”) and at the middle point 48.3 cm (19.0”).

***Occupant Demographics – 2000 Chevrolet Prizm***

***Driver***

Age/Sex: 79-year-old female  
 Height: 135.9 cm (53.5”)  
 Weight: 60.8 kg (134.0 lbs)  
 Seat Track Position: Forward, moved to rear track position by first responding officer  
 Manual Restraint Use: None Used  
 Usage Source: Vehicle inspection  
 Eyewear: Unknown  
 Type of Medical Treatment: Transported by ambulance to a local hospital where she expired on arrival

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Mechanism</b>
Symmetrical bilateral rib fractures 1-9 with flail chest and 1000cc of blood in the right chest	Critical (450266.5,3)	Deploying driver’s air bag
Tear of the left atrium on the interatrial septum	Critical (441300.5,4)	Deploying driver’s air bag

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Mechanism</b>
1.3 cm (0.5") laceration of the descending aorta with near transection, (attached by 1.3 cm (0.5") thread)	Severe (420208.4,4)	Deploying driver's air bag
Patchy contusions and hemorrhages of all lobes of the lungs	Severe (441410.4,3)	Deploying driver's air bag
10.2 cm (4.0") vertical tear of the liver capsule along the falciform ligament	Serious (541824.3,1)	Steering wheel rim
Two liver lacerations 10.2 cm and 1.3 cm (4.0" and 0.5") of the dome of the right lobe	Serious (541824.3,1)	Steering wheel rim
Symmetrical bilateral distal femur fractures	Serious (851800.3,1; 851800.3,2)	Induced fractures from knee loading against knee bolster
Superficial stretch tears of the atria endocardium	Serious (441008.3,4)	Deploying driver's air bag
3.8 cm (1.5") vertical laceration of the posterior left liver lobe	Serious (541822.2,1)	Steering wheel rim
Oblique fracture of the mid body of the sternum	Moderate (450804.2,4)	Deploying driver's air bag
Fractured right knee joint	Moderate (852400.2,1)	Knee bolster
Dislocation of the right knee joint	Moderate (850806.2,1)	Knee bolster
Abrasion to bridge of nose	Minor (290202.1,4)	Deploying driver's air bag
Contusion to bridge of nose	Minor (290402.1,4)	Deploying driver's air bag
0.6 cm (0.25") contusion of the left chest adjacent to the sternal border	Minor (490402.1,2)	Deploying driver's air bag
2.5 cm (1.0") contusion of the chest wall along the right costal margin	Minor (490402.1,1)	Deploying driver's air bag
Abrasions of the upper abdominal wall right of the midline 10.2 cm by 1.9 cm (4.0" by 0.75")	Minor (590202.1,7)	Steering wheel rim
Abrasion pattern of the abdominal wall left of the midline 5.1 cm by 2.5 cm (2.0" by 1.0")	Minor (590202.1,2)	Steering wheel rim
1.3 cm (0.5") oval contusion of	Minor (590402.1,1)	Deploying driver's air bag

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Mechanism</b>
the right mid abdominal wall		
2.5 cm (1.0”) stretch type abrasion at the left inguinal fold	Minor (590202.1,8)	Deploying driver’s air bag
1.9 cm (0.75”) contusion of the upper left back	Minor (690402.1,2)	Possible rebound into left seatback
Right occipital subscapular hemorrhage 1.3 cm (0.5”)	Minor (190402.1,6)	Possible rebound into seat back
1.3 cm (0.5”) abrasion left elbow	Minor (790202.1,2)	Possible left door panel
3.8 cm (1.5”) contusion of the dorsal aspect of the right hand at the base of the thumb	Minor (790402.1,1)	Possible fling injury
Two vertically aligned lacerations of the left knee 2.5 cm and 1.3 cm (1.0” and 0.5”)	Minor (890600.1,2)	Knee bolster
Proximal left tibia fracture (NFS)	Minor (853404.2,1)	Knee bolster
Three oval-shaped contusions of the antero-lateral left thigh 5.1 cm by 2.5 cm (2.0” by 1.0”)	Minor (890402.1,2)	Left door panel
3.8 cm (1.5”) contusion of the lateral left thigh	Minor (890402.1,2)	Left door panel

Source = Autopsy report.

### ***Driver Kinematics***

The 79-year-old female driver of the 2000 Chevrolet Prizm was seated in a presumed upright posture in a forward track position. This seat track position placed her in close proximity to the steering assembly and the driver air bag module. The driver was not restrained by the manual 3-point lap and shoulder belt. At impact, the frontal air bag deployed and expanded against the driver’s chest, which resulted in a 0.6 cm (0.25”) contusion of the left chest adjacent to the sternal border, and a 2.5 cm (1.0”) contusion of the chest wall along the right costal margin, symmetrical bilateral rib fractures 1-9 with flail chest and 1000cc of blood in the right chest, a tear of the left atrium on the interatrial septum, a 1.3 cm (0.5”) laceration of the descending aorta with near transection [attached by 1.3 cm (0.5”) thread], patchy contusions and hemorrhages of all lobes of the lungs, superficial stretch tears of the atria endocardium, and an oblique fracture of the mid body of the sternum. The continued bag expansion abraded and contused the bridge of her nose.

The driver initiated a forward trajectory in response to the frontal crash forces and loaded the deploying air bag as she began to submerge the steering column. Her abdominal area loaded the lower wheel rim, which deformed lower right quadrant of the steering wheel rim and compressed the energy absorbing steering column. The submarining and loading

of the steering wheel rim resulted in a 10.2 cm (4.0") vertical tear of the liver capsule along the falciform ligament, two liver lacerations 10.2 cm and 1.3 cm (4.0" and 0.5") of the dome of the right lobe, 3.8 cm (1.5") vertical laceration of the posterior left liver lobe, abrasions of the upper abdominal wall right of the midline 10.2 cm by 1.9 cm (4.0" by 0.75"), abrasion pattern of the abdominal wall left of the midline 5.1 cm by 2.5 cm (2.0" by 1.0"), 1.3 cm (0.5") oval contusion of the right mid abdominal wall, and a 2.5 cm (1.0") stretch type abrasion at the left inguinal fold.

As the driver continued her forward motion, her knees contacted and deformed the knee bolster resulting in the fracture and dislocation of the right knee joint, two vertically aligned lacerations of the left knee [2.5 cm and 1.3 cm (1.0" and 0.5")], and a proximal left tibia fracture. The driver also sustained symmetrical bilateral distal femur fractures that were a result of her knee's loading against knee bolster. A bone fragment that was embedded into the knee bolster evidenced the knee bolster contact area.

The driver also sustained a 1.3 cm (0.5") abrasion to her left elbow, three oval-shaped contusions of the antero-lateral left thigh 5.1 cm by 2.5 cm (2.0" by 1.0"), and a 3.8 cm (1.5") contusion of the lateral left thigh from contact with the front left door panel. A 3.8 cm (1.5") contusion of the dorsal aspect of the right hand at the base of the thumb may have resulted from a possible fling injury.

A right occipital subscapular hemorrhage 1.3 cm (0.5") and a 1.9 cm (0.75") contusion of the upper left back resulted from a rebound contact to the front left seatback.

The driver came to rest under left instrument panel as stated to the SCI investigator by the first police officer on scene. She was transported by ambulance to a hospital; however, she expired from her injuries upon arrival.

### ***Medical Treatment***

The first arriving police officer on-scene opened the front left door and observed the driver slumped forward of the front seat cushion. He repositioned the seat track to a full rear position and stabilized the driver's head in an effort to maintain an airway. EMS personnel arrived on-scene and removed the driver from the vehicle on a backboard and initiated CPR activities. The driver was immediately transported to a local hospital where she expired on arrival. An autopsy was performed on the body which identified the crash related injuries.

**Figure 10. Crash Schematic**

