

CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

**CALSPAN REMOTE ADAPTIVE CONTROL-EQUIPPED VEHICLE CRASH
INVESTIGATION**

NASS/SCI COMBO CASE NO: 2005-12-018B

VEHICLE: 1996 CADILLAC DEVILLE

LOCATION: MICHIGAN

CRASH DATE: JANUARY 2005

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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**CALSPAN REMOTE ADAPTIVE CONTROL-EQUIPPED
VEHICLE CRASH INVESTIGATION
NASS/SCI COMBO CASE NO: 2005-12-018B
VEHICLE: 1996 CADILLAC DEVILLE
LOCATION: MICHIGAN
CRASH DATE: JANUARY 2005**

BACKGROUND

This remote NASS/SCI investigation focused on the adaptive hand controls for throttle and braking functions that were present in a 1996 Cadillac DeVille. The mechanical system was a left-hand operated push/pull system that was mounted to the left side lower instrument panel and linked to the OEM brake and accelerator pedals. The Cadillac (**Figure 1**) was equipped with first generation frontal air bags for the driver and front right positions that deployed as



Figure 1 - Damaged 1996 Cadillac DeVille

a result of a frontal impact with a tree. Both occupants were restrained by 3-point manual safety belts. The 63-year-old male was operating the Cadillac in a westerly direction on a two-lane roadway. The vehicle departed the left roadside in a tracking mode where the frontal plane of the Cadillac struck a mailbox, driveway culvert, and a 32 cm (13”) diameter tree. The impact with the tree was sufficient to deploy the frontal air bags. The Cadillac contained an Event Data Recorder (EDR) that was downloaded during the NASS investigation. The EDR recorded a Non-Deployment and Deployment event. The EDR data is attached at the end of this narrative report as **Attachment A**. The driver sustained multiple bilateral anterior rib fractures, bilateral lung contusions, a sternum fracture, and a myocardium laceration from loading the steering assembly. The front right passenger sustained bilateral rib fractures, a grade-V flail chest, a lacerated cervical spinal cord, bilateral lung contusions and multiple brain contusions from the expanding front right air bag. Both occupants were removed from the vehicle and transported by ambulance to a local hospital where they both expired on arrival.

This crash was initially selected as NASS-CDS Case No: 2005-12-018B. The crash was identified as a possible air bag related fatality by the Calspan Special Crash Investigations (SCI) team during the NASS quality control review of the case. Details of the crash were forwarded to the Crash Investigations Division of the National Highway Traffic Safety Administration (NHTSA) and the case was assigned for an SCI remote investigation and report preparation on June 7, 2005. The role of the deployed air bags with respect to occupant injury was evaluated and the findings are discussed within this SCI narrative report.

SUMMARY

Crash Site

This crash occurred on the south roadside of a two-lane, east/west roadway in a semi-residential area during daylight hours. The straight and level roadway was surfaced with

asphalt and was delineated by painted broken yellow lines. The east and westbound lanes were 3.1 m (10.2') and 3.4 m (11.2') in width respectively. The road surface was dry and there were no adverse weather conditions reported at the time of the crash. The road was bordered by natural growth and scattered private homes. The south roadside consisted of a dirt shoulder adjacent to a grassy slope that descended into a shallow ditch. The ditch was approximately 0.5 m (1.5') in depth. The shallow ditch ascended to a driveway where a culvert was located adjacent and perpendicular to the driveway. The culvert protruded approximately 45 cm (18") from the ground. The mouth of the asphalt driveway was 6.5 m (21.3') in width. Several large diameter trees were located within the vicinity of the crash site and the contacted tree was placed 9 m (29.5') outboard of the south edge of the roadway and 22 m (72') west of the driveway. The struck hardwood tree measured 33 cm (13") in diameter. The posted speed limit was 89 km/h (55 mph). The scene schematic is included as **Figure 11** at the end of this narrative report.

Vehicle Data – 1996 Cadillac DeVille

The subject vehicle in this run-off-road crash was a 1996 Cadillac DeVille four-door sedan. The Cadillac was manufactured in 06/96 and was identified by the Vehicle Identification Number (VIN): 1G6KD52Y1TU (production number omitted). The vehicle was powered by a transverse mounted 4.6-liter 8-cylinder gasoline engine linked to a four-speed automatic transmission. The vehicle had adaptive controls for the throttle and braking functions. This system is discussed in greater detail in the *Adaptive Control* section of this report. The front wheel drive vehicle was equipped with four-wheel disc brakes, electronic traction control, and an anti-lock braking system (ABS). The vehicle was equipped with Cooper Lifeliner Touring SLE P225/60R16 tires. The manufacturer specified tire pressure was 207 kPa (30 PSI). The specific tire data at the time of the NASS vehicle inspection is identified in the following table:

Position	Measured Pressure	Measured Tread Depth	Damage
LF	200 kPa (29 PSI)	8 mm (10/32")	None
LR	228 kPa (33 PSI)	9 mm (11/32")	None
RF	0 kPa	7 mm (9/32")	None
RR	221 kPa (32 PSI)	7 mm (9/32")	None

The interior of the Cadillac was configured with a three-passenger split-bench front seat with reclining seat backs and adjustable head restraints that were adjusted to the full down positions. A center console was present which contained a storage compartment. The Cadillac was designed with power locks, seats, and windows, tilt steering, and cruise control. The second row was configured with a three passenger bench seat. The seat backs were not adjustable and contained no head restraints.

Crash Sequence
Pre-Crash

The 63-year old male driver of the Cadillac was traveling in a westerly direction on the two-lane roadway (**Figure 2**). The Cadillac drifted to the left and across the centerline before departing the left roadside (**Figure 3**). Neither the NASS inspection nor the police investigation revealed any evidence indicative of pre-crash avoidance measures.



Figure 2 – Westbound approach of Cadillac Deville.



Figure 3 - Area of road departure.

Crash

As the Cadillac departed the roadway, it impacted a mailbox located 3 m (9.8') outboard of the roadway with its frontal plane. The vehicle then entered a shallow ditch that was approximately 5 m (1.5') in depth. The shallow ditch ascended to a driveway where a culvert was located adjacent and perpendicular to the driveway. The culvert pipe was 45 cm (18") in diameter and protruded from the bank. The front plane impacted and overrode the culvert and continued in a forward trajectory. The vehicle vaulted forward across the driveway and returned to its wheels prior. The vehicle then impacted a 32 cm (13") diameter tree located 22 m (72') west of the driveway with the front right area of the vehicle. **Figure 4** illustrates the path of travel of the Cadillac from the road departure to the impacted hardwood tree.



Figure 4 – Look back at approach.

The direction of force for the Cadillac from the tree impact was 12 o'clock. The EDR-recorded a maximum velocity change of 45 km/h (28 mph). It should be noted that the maximum value that could be recorded for the vehicle's forward velocity change was 45 km/h (28 mph). The SCI revised barrier algorithm of the WinSMASH program computed a total velocity change of 31 km/h (19.3 mph) for the Cadillac. The specific longitudinal and lateral components were -31 km/h (-19.3 mph) and -5 km/h (-3.1 mph) respectively. The WinSMASH delta-V was derived from the multiple frontal crush profiles and should not be considered reliable. The EDR captured a more realistic delta-V for this crash. The impact deployed the frontal air bag system in the Cadillac.

Post-Crash

A homeowner who heard the crash called for rescue personnel before proceeding to the crash site to administer aid to the occupants. It was possible that this witness unbuckled the occupants in order to assist them; however, all attempts to contact this witness have been unsuccessful. Rescue personnel arrived on the scene and removed the occupants

from the vehicle. The driver of the Cadillac sustained AIS-4 level injuries and reportedly had shallow breathing at the scene. He was transported to a local hospital by ambulance, but expired en route. He was pronounced deceased upon arrival at the facility. The front right passenger sustained AIS-6 level injuries and was transported by ambulance to a local hospital. She also expired en route and was pronounced deceased upon arrival.

1996 Cadillac DeVille

Exterior

The 1996 Cadillac DeVille sustained moderate damage as a result of the impact with the hardwood tree (**Figure 5**). The maximum crush was located approximately 25 cm (10") right of the vehicle's centerline and measured 51 cm (20.1") in depth. The direct contact began at the front right bumper corner and measured 48 cm (18.9") in length. The Field-L measurement extended across the full width of the bumper beam and was an SCI revised 115 cm (45.3") in length. The crush profile was measured to the bumper beam and then raised to the upper radiator support. The averaged crush measurements were as follows: C1 = 0 cm, C2 = 17 cm (6.7"), C3 = 22 cm (8.7"), C4 = 37 cm (14.6"), C5 = 38 cm (15"), C6 = 27 cm (10.6"). The Collision Deformation Classification (CDC) was 12-FZEW-2.



Figure 5 - Frontal view of damaged Cadillac DeVille.

The frontal impacts to both the mailbox and the culvert were masked by the tree impact. The NASS investigation assigned partial CDC's for both events as 12-F999-9.

Interior

The interior of the Cadillac sustained moderate damage that was associated with passenger compartment intrusion and occupant contact. Maximum intrusion involved the rearward displacement of the toe pan into the front right seating position. Additional rearward displacement included the driver's toe pan and the instrument panel into the frontal seating positions. The floor pan buckled vertically reaching its peak into the front right position.

Occupant contact was noted in both frontal seating positions of the vehicle. The driver loaded through the deploying air bag into the steering assembly, displacing the column upward (**Figure 6**). Transfer evidence was present on the driver's air bag; however, the NASS investigation made no determination as to what type of transfer was present. The driver loaded through the air bag deforming the right half of the steering wheel rim 8 cm (3.2"). The driver loaded the push/pull handle of the adaptive control unit with his left knee deflecting the handle into the padded instrument panel where the component left a circular indentation (**Figure 10**). Energy was translated down the adaptive control linkage into the brake pedal and the pedal bent and released this loading force. The driver also loaded the left knee bolster evidenced by scuffing.



Figure 6 - Driver's area.



Figure 7 - Contact knee bolster.

The right front occupant loaded and damaged the right knee bolster and instrument panel. The padded components exhibited loading evidence in the form of heavy creasing and scuffing on various aspects (**Figure 7**). The NASS investigation reported that this occupant also loaded the expanding air bag, transferring undetermined body fluids from her person onto the air bag fabric.

The specific passenger compartment intrusions identified during the NASS inspection are listed by their magnitude in the following table:

Position	Component	Magnitude	Direction
Front right	Toe pan	14 cm (5.5")	Longitudinal
Front middle	Toe pan	11 cm (4.3")	Longitudinal
Front middle	Instrument panel	8 cm (3.2")	Longitudinal
Front left	Toe pan	6 cm (2.4")	Longitudinal
Front right	Instrument panel	6 cm (2.4")	Longitudinal
Front right	Floor pan	5 cm (2")	Vertical
Front middle	Floor pan	5 cm (2")	Vertical
Front left	Instrument panel	4 cm (1.6")	Longitudinal
Front left	Floor pan	3 cm (1.2")	Vertical

Manual Restraints

The 1996 Cadillac DeVille was equipped with 3-point lap and shoulder belts for the front outboard seating positions and a lap belt for the center front position. The driver and front right passenger's belts were configured with separate lap and shoulder belts sewn to a common latch plate. Both belts were configured with an Emergency Locking Retractor (ELR). The EDR recorded the driver's belt as buckled; however, the NASS investigation revealed no belt use. Although no discernable evidence could be identified from the NASS images, the injury pattern to each occupant supports lap and shoulder belt usage.

The rear outboard seats were equipped with 3-point lap and shoulder restraints for the outboard positions and a fixed length lap belt for the rear center position. The second row belts were configured with lightweight locking latch plates and ELR's.

Frontal Air Bag System

The 1996 Cadillac DeVille was equipped with first-generation frontal air bags for the driver and front right passenger positions. The driver's air bag was housed in the center of the steering wheel hub and the front right air bag was housed in a top-mount module located on the right instrument panel.

The driver's air bag deployed through symmetrical I-configuration cover flaps. Each cover flap measured 10 cm (3.9") in length and 10 cm (3.9") in height. The deployed driver's air bag measured 62 cm (24.4") in diameter in its deflated state (**Figure 8**). The NASS investigator was able to identify an unspecified transfer from occupant interaction on the air bag membrane. The investigation did not specify the precise location of this engagement. The air bag was reportedly not tethered and was vented by two ports located in the 3 o'clock and 9 o'clock positions.

The front right passenger's air bag deployed through a top-mount single cover flap that measured 36 cm (14.2") horizontally and 18 cm (7.9") vertically. The deployed front right air bag measured 47 cm (18.5") horizontally and 55 cm (21.7") vertically in its deflated state. The air bag was tethered by two internal straps in an unspecified location. The air bag contained no vent ports. The NASS investigator was able to identify an unspecified transfer from occupant interaction on the air bag membrane. The investigation did not specify the precise location of this engagement; however, in a review of images, a possible contact transfer is present in the center of the air bag (**Figure 9**).



Figure 8 - Deployed driver's air bag.



Figure 9 - Deployed front right passenger's air bag.

Adaptive Controls

The 1996 Cadillac DeVille was equipped with adaptive hand controls for throttle and braking functions (**Figure 10**). The mechanical system was a left-hand operated push/pull system mounted to the left side lower instrument panel and linked to the OEM brake and accelerator pedals.



Figure 10 - Adaptive hand controls and indented instrument panel.

Event Data Recorder

The Cadillac was equipped with an EDR that was downloaded by the NASS investigator. The summary report is attached as **Attachment A** at the end of this narrative. The system recorded Non-Deployment and Deployment events as a result of impacts with multiple fixed objects. The Non-Deployment event occurred .48 seconds prior to the Deployment event. The EDR reported the driver’s belt switch status as ‘Buckled.’ The EDR commanded a deployment of the frontal air bag system 22.5 milliseconds from the Algorithm Enable (AE). The EDR-recorded a maximum velocity change of 45 km/h (28 mph). It should be noted that per the EDR’s data limitations, the maximum value that could be recorded for the vehicle’s forward velocity change was 45 km/h (28 MPH).

Occupant Demographics

Driver – 1996 Cadillac DeVille

Age/Sex: 63-year old/Male
Height: 183 cm (72’’)
Weight: 73 kg (161 lb.)
Seat Track Position: Between full-forward and mid track
Manual Restraint Use: 3-point lap and shoulder restraint
Usage Source: Injury data, EDR report
Eyewear: Prescription Eyeglasses
Type of Medical Treatment: Transported by ambulance to a local hospital, expired prior to admission

Driver Injuries

Injury	Injury Severity (AIS90/Update 98)	Injury Source
Multiple bilateral anterior rib fractures (Right 2-10/Left 2-3)	Severe (450232.4,3)	Steering assembly
Bilateral lung contusions	Severe (441410.4,3)	Steering assembly
Myocardium laceration (1 cm anterior apex)	Serious (441010.3,4)	Steering assembly
Sternum fracture	Moderate (450804.2,4)	Steering assembly
Left knee abrasion	Minor (890202.1,2)	Adaptive driving equipment
Abdomen contusion	Minor (590402.1,4)	Lap belt*
Facial abrasion (tip of nose)	Minor (290202.1,4)	Expanding driver’s air bag
Facial abrasion (chin)	Minor (290202.1,8)	Expanding driver’s air bag
Facial abrasion (medial right cheek)	Minor (290202.1,1)	Expanding driver’s air bag
Left eyelid abrasion	Minor (297202.1,2)	Expanding driver’s air bag
Right eyelid abrasion	Minor (297202.1,1)	Expanding driver’s air bag

Source: Medical records/autopsy records.

*Denotes SCI Revision.

Driver Kinematics

The 63-year old male driver was seated in a forward track position and restrained by the manual safety belt system. Although unconfirmed by medical documentation, the driver may have become ill while driving which resulted in the loss of control and left road side departure. As the vehicle traversed the ditch and impacted the culvert, the driver was displaced forward and loaded the safety belt system as the inertia activated retractor locked. At this point, he was in close proximity to the steering assembly and the air bag module.

At impact with the tree, the frontal air bag system deployed. The driver was struck by the expanding air bag which resulted in the facial abrasions. He initiated a forward trajectory in response to the frontal impact forces and loaded the manual belt system. As a result of belt loading, the driver sustained an abdominal contusion that was consistent with lap belt usage. His torso loaded the deploying air bag and due to his forward position and the frontal crash forces, he loaded through the bag and engaged the steering wheel rim and hub assembly. His loading deformed the upper right quadrant of the steering wheel rim 8 cm (3.2”). As a result of the wheel loading, the driver sustained multiple bilateral rib fractures (right 2-10, left 2-3), bilateral pulmonary contusions, a myocardial laceration, and a sternum fracture.

His left knee impacted the knob of the adaptive driving hand control. This contact displaced the knob into the knee bolster, deforming the bolster panel. As a result of this contact, the driver sustained a left knee abrasion.

He rebounded into the front left seat back where he came to rest. The driver was observed in the vehicle by a witness who summoned emergency response. This witness attended to the driver prior to the arrival of the ambulance personnel. The driver was removed from the vehicle and transported to a local hospital where he expired on arrival.

Front Right Passenger – 1996 Cadillac DeVille

Age/Sex: 73-year old/Female
Height: 160 cm (63”)
Weight: 77 kg (170 lb.)
Seat Track Position: Middle track position
Manual Restraint Use: 3-point lap and shoulder restraint
Usage Source: Injury data, EDR report
Eyewear: Eyeglasses
Type of Medical Treatment: Transported to hospital, died prior to admission

Front Right Passenger Injuries

Injury	Injury Severity (AIS90/Update 98)	Injury Source
C-spine laceration above C3	Maximum (640269.6,6)	Expanding right front air bag*
Grade V flail chest	Critical (450266.5,3)	Expanding right front air bag*
Bilateral cerebrum subdural hematomas	Critical (140654.5,3)	Expanding right front air bag*

Injury	Injury Severity (AIS90/Update 98)	Injury Source
Bilateral lung contusions	Severe (441410.4,3)	Expanding right front air bag*
Cerebrum subarachnoid hemorrhage	Serious (140684.3,9)	Expanding right front air bag* (Indirect)
Chest contusion	Minor (490402.1,0)	Expanding right front air bag*
Abdomen contusion	Minor (590402.1,4)	Lap belt*
Right shoulder contusion	Minor (790402.1,1)	Shoulder belt*
Bilateral hand contusions	Minor (790402.1,3)	Right instrument panel*
Right foot contusion	Minor (890402.1,1)	Toe pan
Left knee abrasion	Minor (890202.1,2)	Knee bolster*
Bilateral knee contusions	Minor (890402.1,3)	Knee bolster*
Nose contusion	Minor (290402.1,4)	Expanding right front air bag
Contusion of left eye orbit	Minor (290402.1,2)	Expanding right front air bag

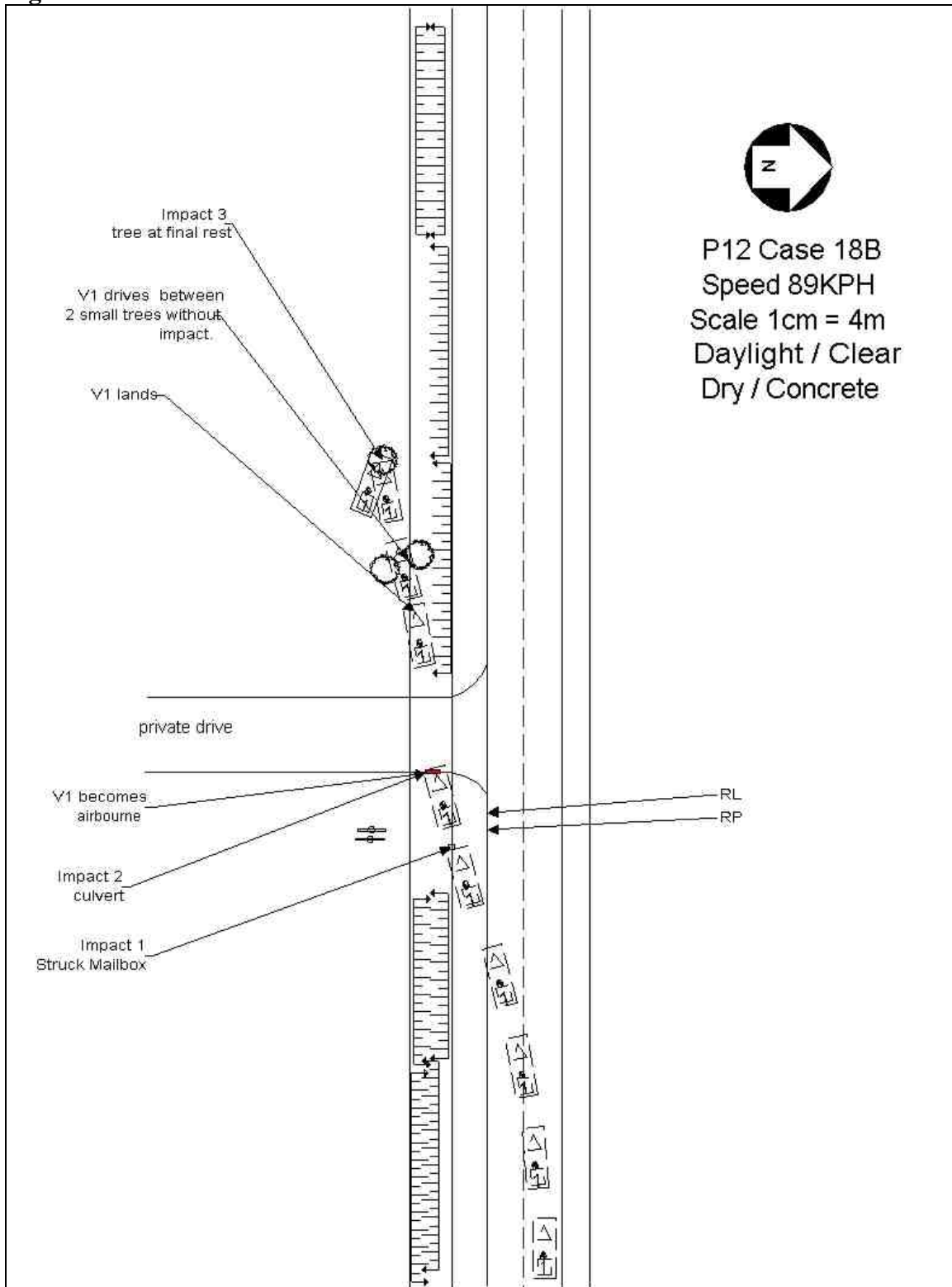
Source: Medical records/autopsy records.

**Denotes SCI Revision.*

Front Right Passenger Kinematics

The 73-year old female front right passenger was probably out of position forward as the vehicle departed the roadway. This is based on typical occupant kinematic patterns consistent with bottoming actions of vehicles when they impact culverts and other low profile objects. She was restrained by the manual 3-point lap and shoulder belt. As the vehicle descended into the shallow ditch and impacted the culvert, she was displaced forward and loaded the manual lap and shoulder belt. As the vehicle impacted the hardwood tree, the passenger was in close proximity to the path of the deploying front right air bag. The first generation air bag expanded against the passenger's head and chest resulting in a bilateral cerebrum subdural hematomas, multiple rib fractures (left anterior cage 2-6 and right anterior cage 2-8), a Grade V flail chest, bilateral lung contusions, and associated soft tissue injuries. As the front right occupant's head loaded the expanding air bag, her neck hyper-extended resulting in a laceration of the spinal cord above C3 and a subarachnoid hemorrhage to the posterior cranial fossa. The front right occupant also sustained soft tissue injuries to her knees, right shoulder and abdomen from loading the manual belt and knee bolster. Emergency personnel arrived on scene and removed this occupant from the vehicle. She was transported by ambulance to a local hospital where she expired on arrival.

Figure 11 – NASS Scene Schematic



Attachment A – EDR Report

CDR File Information

Vehicle Identification Number	1G6KD52Y1TU*****
Investigator	
Case Number	18B
Investigation Date	Wednesday, February 9 2005
Crash Date	Sunday, January 30 2005
Filename	CDRWOUTVIN.CDR
Saved on	Wednesday, February 9 2005 at 10:03:05 AM
Collected with CDR version	Crash Data Retrieval Tool 2.70
Reported with CDR version	Crash Data Retrieval Tool 2.900
Event(s) recovered	Crash 1 Deployment Non-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.

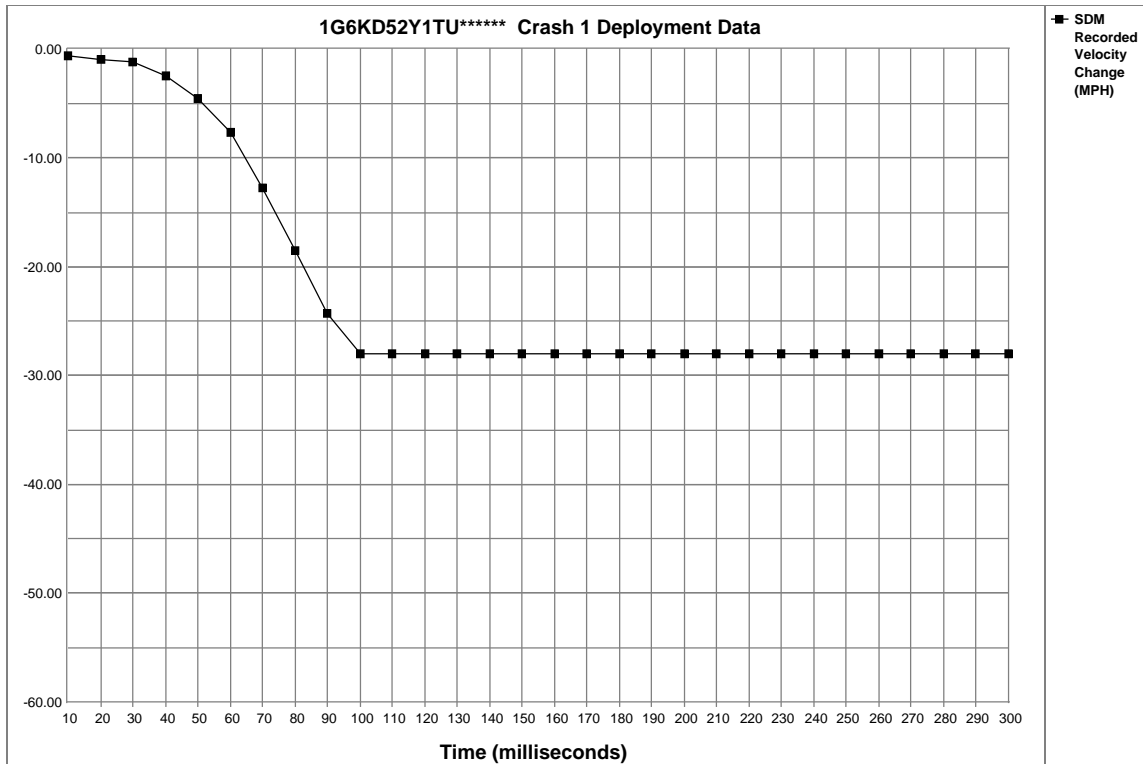
SDM Data Source:

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	BUCKLED
Ignition Cycles At Deployment	12292
Ignition Cycles At Investigation	12293
Time From Algorithm Enable to Deployment Command Criteria Met (msec)	22.5
Time Between Non-Deployment And Deployment Events (sec)	.48



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.55	-0.88	-1.21	-2.41	-4.50	-7.68	-12.73	-18.54	-24.24	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Recorded Velocity Change (MPH)	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97	-27.97

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Non-Deployment	12292
Ignition Cycles At Investigation	12293
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	0
Maximum SDM Recorded Velocity Change (MPH)	-0.55
A Deployment was Commanded Prior to this Event	No



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	0.00	-0.11	-0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hexadecimal Data

```
0D80: AA AA 00 AA 00 00 81 00
0D88: 08 41 00 12 00 05 08 0B
0D90: 16 29 46 74 A9 DD FF FF
0D98: FF FF FF FF FF FF FF FF
0DA0: FF FF FF FF FF FF FF FF
0DA8: FF FF FF 30 04 55 12 12
0DB0: FA 55 12 03 10 00 00 00
0DB8: 00 00 00 00 00 00 00 00
0DC0: 00 00 00 00 00 00 00 00
0DC8: 00 00 00 00 00 00 00 00
0DD0: 00 00 00 00 00 00 00 00
0DD8: 00 00 00 00 00 00 00 00
0DE0: 00 00 00 00 00 00 00 00
0DE8: 7D 00 00 41 00 00 05 00
0DF0: 01 03 00 00 00 00 00 00
0DF8: 00 00 00 00 00 00 00 00
0E00: 00 00 00 00 00 00 00 00
0E08: 00 00 00 00 00 30 04 55
0E10: AA AA FA AA AA 01 00 21
0E18: 89 C1 00 01 08 08 00 00
0E20: 00 00 00 00 00 00 31 F9
0E28: 2B F9 F9 F9 F9 F9 F9 00
0E30: 00 7D 00 00 7D 00 00 7D
0E38: 00 00 7D 00 00 81 00 00
0E40: 00 00 00 7D 00 00 7D 00
0E48: 00 00 00 00 00 94 60 43
0E50: 76 16 60 30 10 BE 37 41
0E58: C8 02 64 00 00 00 00 00
0E60: 36 45 05 55 55 50 00 00
0E68: 00 00 00 1C 30 F0 FF 20
0E70: 00 08 40 80 F0 05 45 34
0E78: 50 77 77 77 77 77 77 77
0E80: 77 77 77 77 77 77 77 77
0E88: 77 77 77 77 77 77 77 77
0E90: 77 77 77 77 77 77 77 77
0E98: 79 7B 7F 82 85 88 8C 90
0EA0: 94 98 A2 A8 B0 BA C6 D2
0EA8: D6 DB E8 F8 41 42 42 44
0EB0: 48 4E 4F 4F 50 54 55 57
0EB8: 59 5B 5D 60 61 63 65 67
0EC0: 69 6A 6C 6D 6E 6F 70 70
0EC8: 71 72 72 72 73 73 74 74
0ED0: 74 75 75 75 75 75 75 75
0ED8: 76 76 76 76 76 14 28 39
0EE0: 00 00 00 00 00 00 00 00
0EE8: 00 00 00 00 00 00 00 00
0EF0: 00 00 00 10 11 12 16 16
0EF8: 16 16 16 19 19 19 19 1C
0F00: 1F 20 20 23 24 26 28 29
0F08: 00 00 00 00 00 00 00 00
0F10: 00 00 00 00 00 00 00 00
0F18: 24 50 AA 00 50 00 F0 09
0F20: 0E 2C 22 0A 10 01 07 02
0F28: 40 41 37 37 37 37 37 37
0F30: 37 37 37 37 37 37 37 37
0F38: 37 37 37 37 37 37 37 37
0F40: 37 37 37 37 37 37 37 37
0F48: 37 37 37 37 37 37 37 37
0F50: 37 37 37 37 37 37 37 37
0F58: 37 37 37 37 37 37 37 37
0F60: 37 37 37 37 37 37 37 37
0F68: 37 37 FF FF FF FF FF FF
0F70: FF FF FF FF FF FF FF FF
```

```
0F78: FF FF AA 00 50 00 F0 09
0F80: 0E 2C 22 0A 10 01 07 02
0F88: 40 41 37 37 37 37 37 37
0F90: 37 37 37 37 37 37 37 37
0F98: 37 37 37 37 37 37 37 37
0FA0: 37 37 37 37 37 37 37 37
0FA8: 37 37 37 37 37 37 37 37
0FB0: 37 37 37 37 37 37 37 37
0FB8: 37 37 37 37 37 37 37 37
0FC0: 37 37 37 37 37 37 37 37
0FC8: 37 37 FF FF FF FF FF FF
0FD0: FF FF FF FF FF FF FF FF
0FD8: FF FF CF 30 41 53 09 46
0FE0: 4B 76 16 60 30 10 00 00
0FE8: 00 00 00 00 00 00 00 00
0FF0: 00 00 00 00 00 00 00 00
0FF8: 00 00 00 00 00 00 75 FD
```