

CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

**ON-SITE CHILD SAFETY SEAT CRASH INVESTIGATION
COSCO VISTA HIGH BACK BELT POSITIONING BOOSTER SEAT**

CALSPAN CASE NO: CA05-005

**VEHICLE: 1995 OLDSMOBILE CUTLASS SUPREME
LOCATION: VIRGINIA
CRASH DATE: DECEMBER, 2004**

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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BACKGROUND

This on-site investigation focused on a Cosco Vista High Back Belt Positioning Booster Seat and the injury sources of a 4 year old female restrained within the subject child safety seat. The child seat was installed in the left rear position of a 1995 Oldsmobile Cutlass Supreme, **Figure 1**, which was involved in a single vehicle run-off-road/fixed object crash. The unrestrained 55 year old female driver and the restrained 4 year old female child were the vehicle's only occupants. Reportedly, the crash occurred when the driver lost directional control



Figure 1: Left side view of the Oldsmobile.

due to poor weather conditions and departed the right side of the road. During the vehicle's roadside departure, the Oldsmobile struck a 10 cm (4 in) diameter tree with its left front fender and wheel resulting in a rapid clockwise rotation and subsequent left side impact with a 15 cm (6 in) diameter tree. The driver suffered fatal blunt chest trauma and was pronounced deceased at the scene. The 4 year old female sustained a right closed mid-shaft tibia fracture and minor facial lacerations and abrasions. She was transported to a regional trauma center and hospitalized for two days.

This crash was identified through an Internet news article forwarded to the Crash Investigation Division of the National Highway Traffic Safety Administration. The NHTSA forwarded the article to the Special Crash Investigations team at Calspan on December 21, 2004 for follow-up investigation. The SCI team initiated contact with the Virginia State Police and located the subject vehicle. The child safety seat was still located with the vehicle and was available for inspection. The case was assigned January 19, 2005. The on-site portion of the investigation took place the week of January 24, 2005.

SUMMARY

Crash Site

The crash occurred during the daylight hours of December 2004. On the day of the crash, the weather was clear but the region was experiencing unusually cold conditions and the season's first snow had fallen the night before. At the time of the crash, the asphalt road surface was icy and the poor road conditions were a contributing factor in the crash. The crash occurred on a two lane north/south road, 51 m (166 ft) downstream from the exit of an S curve. The exit curve had a measured radius of 229 m (750 ft) with an eight percent super-elevation. The road had a

negative three percent grade in the direction of travel. **Figure 2** is a southbound lookback view through the S curve. **Figure 3** is a northbound trajectory view a 91 m (300 ft) from the point of impact. The road was bordered by a 30 cm (12 in) deep ditch, centered 1.6 m (5.3 ft) east of the road edge, and by numerous small diameter trees. The speed limit in the area of the crash was 89 km/h (55 mph). It should be noted the police reported a safe travel speed of 56 km/h (35 mph) due to the inclement weather.



Figure 2: Southbound lookback view



Figure 3: Northbound trajectory view 91 m (330 ft) south of the POI.

Vehicle Data

The 1995 Oldsmobile Cutlass Supreme, **Figure 4**, was identified by the Vehicle Identification Number (VIN): 1G3WH52M8SF (production sequence deleted). The front-wheel-drive, four-door sedan was equipped with a 3.1 liter/V6 engine linked to a four-speed automatic transmission. The service brakes were front disc/rear drum with four-wheel ABS. The odometer had registered 235,811 km (146,526 miles). The vehicle's data of manufacture was not known. The vehicle seating consisted of front bucket seats and a three passenger rear bench. The manual restraint system consisted of 3-point lap and shoulder belts for the four



Figure 4: left rear view of the Oldsmobile.

outboard positions and a center rear lap belt. The Oldsmobile was also equipped with a frontal air bag system that consisted of driver and front right passenger air bags that deployed as a result of the crash. The vehicle was equipped with an Event Data Recorder (EDR) capable of recording data related to the crash. The EDR was downloaded at the time of the SCI inspection through the use of the Vetronix Crash Data Retrieval tool. The Oldsmobile was equipped with Winston Winner GT tires on the front and Bridgestone B420 tires on the rear. All four tires were

size P215/60R16 and were mounted on OEM steel wheels. The specific measured tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	186 kPa (27 PSI)	7 mm (9/32)	No	None
LR	207 kPa (30 PSI)	6 mm (7/32)	No	None
RF	193 kPa (28 PSI)	7 mm (9/32)	No	None
RR	221 kPa (32 PSI)	6 mm (7/32)	No	None

Crash Sequence
Pre-Crash

The 1995 Oldsmobile was driven by a 55 year old female driver. The driver was not restrained by the available safety belt. She was operating the Oldsmobile in a northbound direction. A 4 year old female was the vehicle’s rear left passenger. The child was seated on a Cosco Vista High Back Belt Positioning Booster Seat and was restrained by the vehicle’s 3-point lap and shoulder belt.

At the time of the crash, the Virginia region was experiencing unusually cold weather and the road conditions were reported as icy. The Oldsmobile traveled through the S curve, south of the point of impact, and the driver experienced a loss of directional control at the exit of the curve. The SCI scene inspection determined the Oldsmobile departed the right side of the road at a shallow angle approximately 43 m (140 ft) north of the end of the curve. **Figure 5** is a trajectory view in the area of the road side departure and the point of impact. The Oldsmobile traversed the shallow ditch, and then impacted and overrode a cluster of two 3 cm (1 in) diameter trees. The saplings were located 2.5 m (8.3 ft) from the road edge and were struck by the front right aspect of the vehicle (Event 1). This impact was recorded by the EDR as a non-deployment event. Refer to the EDR attachment at the end of this narrative report.



Figure 5: Trajectory view at the road side departure and the POI.

Crash

The Oldsmobile continued 3 m (10 ft) northeast along its off-road trajectory and struck a 10 cm (4 in) diameter tree with its left front fender and left front wheel (Event 2). The tree's engagement with the vehicle's left front wheel redirected the vehicle's northeastward momentum by inducing a rapid clockwise rotation. The forces developed during this coupled event were sufficient to warrant the deployment of the vehicle's frontal air bag system.

The Oldsmobile rotated rapidly approximately 75 degrees impacting a 15 cm (6 in) diameter tree in the process (Event 3). This tree was located 0.6 m (2.0 ft) north of the 10 cm (4 in) diameter tree. The vehicle struck the tree with the left front door and B-pillar. The 10 cm (4 in) diameter tree sheared off at ground level during the vehicle's rotation. The force of the impact resulted in severe B-pillar intrusion and bowing of the vehicle. The maximum crush was located at the left B-pillar and measured 133.1 cm (52.4 in). The Oldsmobile came to rest at the point of impact in contact with the tree. The delta V of the left side impact calculated by the Barrier Algorithm of the WINSMASH model was 77.0 km/h (47.8 mph). The longitudinal and lateral delta V components were -38.5 km/h (-23.9 mph) and 66.7 km/h (41.4 mph), respectively. A schematic of the crash is attached to the end of the report, **Figure 18**.

Post-Crash

The police and ambulance personnel responded to the scene. The driver sustained fatal blunt chest injuries as a result of the crash and was pronounced dead at the scene. She was found lying across the front seats with her head in the front passenger foot well. The 4 year old child was still restrained in the booster seat and was pinned within the vehicle due the intrusion of the B-pillar and left rear door. She was extricated from the vehicle by opening the jammed left rear door, and removing her from the booster seat. The extrication took a reported 40 minutes. The child was transported by air ambulance to a region trauma center with reported lower extremity injuries.

1995 OLDSMOBILE CUTLASS SUPREME

Exterior Damage

The exterior inspection of the Oldsmobile revealed three distinct areas of contact damage that related to the multiple event crash sequence. **Figures 6 and 7** are views of the Oldsmobile depicting the frontal damage. The front bumper sustained a localized impact to its right aspect consistent with small diameter trees of Event 1. The direct contact to the bumper fascia began 17 cm (6.5 in) right of center and extended right 25 cm (10.0 in). The fascia was cracked and abraded within the area of direct contact. The fascia had separated in the crash (due to forces of Event 2) allowing the bumper reinforcement bar to be examined. The reinforcement bar was deformed over a 42 cm (16.5 in) width that began 23 cm (9.0 in) right of center. The maximum deformation of the bar measured 2 cm (0.75 in) immediately inboard of its attachment to the vehicle's subframe. The hood face was damaged over a 19 cm (7.5 in) width that began 34 cm (13.5 in) right of center. The relative location of the above referenced damages was indicative of an angular contact to the trees. The Collision Deformation Classification (CDC) of the impact was 11-FZEW-1.



Figure 6: View of the fascia damage.



Figure 7: View of the reinforcement bar.

The left side of the Oldsmobile sustained two regions of the direct contact consistent with Events 2 and 3. Refer to **Figure 8**. General observations revealed a minor contact to the left front fender and a major impact to the left front door and B-pillar. The bumper fascia had separated in the impact and the left end of the fascia was missing. Reconstruction of the crash dynamics determined that the Oldsmobile struck the 10 cm (4 in) diameter tree with the left side surface (outboard end) of the fascia and then engaged the tree with the fender during its off-road trajectory. The left front fender was deformed over a 20 cm (8.0 in) wide region immediately forward of the left front wheel opening. The maximum deformation in the region measured 1 cm (0.5 in). The CDC of this impact was 11-LFEN-1. The vehicle then engaged the tree with the left front wheel redirecting its forward momentum into an induced rapid rotation. The frontal air bags deployed at this time.



Figure 8: Left side view of the Oldsmobile.

The Oldsmobile rotated rapidly clockwise approximately 75 degrees impacting the 15 cm (6 in) diameter tree with its left front door and B-pillar, Event 3. The B-pillar intruded laterally 133 cm (52.4 in) and the tree pocketed in the deformation. The direct contact began at the leading edge of the left front door, 43 cm (16.9 in) rear of the left front axle and extended rearward 99 cm (40.0 in) to the left B-pillar location. The force of the crash resulted in severe bowing of the vehicle. Due to the bowing, the front left corner of the Oldsmobile was displaced (shifted) laterally leftward approximately 71 cm (28 in). The length of the left side of the vehicle (corner to corner) measured 363 cm (143 in). The deformation and bowing reduced the length of the left side approximately 102 cm (40 in). The left wheelbase was reduced 87 cm (34 in). The right wheelbase lengthened 10 cm (4 in). The left side crush was measured by establishing a string line from corner to corner which was broken into six equal zones to locate the crush measurements. A secondary string line was then established from deflection point to deflection point. The average lateral offset of the two string lines was then used to develop a bow constant, K, which was then added to the measured crush to account for the energy absorbed by bowing. The average bowing constant K measured 33 cm (12.9 in). The left side crush profile (inclusive of the K constant) was as follows: C1 = 23 cm (9.1 in), C2 = 40 cm (15.7 in), C3 = 56 cm (22.0 in), C4 = 86 cm (33.9 in), C5 = 46 cm (18.1 in), C6 = 23 (9.1 in).

Figure 9 is a view of the area of maximum left side deformation. The left front and rear doors were jammed shut by deformation. The right side doors remained closed during the impact and were jammed shut by body distortion.



Figure 9: View of the maximum deformation.

The left rear door and both right doors were opened during the extrication. None of those doors could be closed and latched at the time of the SCI inspection. The windshield was fractured and the backlight and all the left side glazing had disintegrated. The CDC of the damage was 90-LPAW-7. Note, the 10 o'clock direction of force was incremented by 80 to denote the left end bowing.

Interior Damage

The interior damage to the Oldsmobile consisted of the deployment of the frontal air bags and the severe left side intrusion. Inspection of the interior did not reveal any direct evidence of occupant interior contact.

Figures 10 and 11 are right interior views of the Oldsmobile depicting the intrusion. The driver's interior space sustained severe intrusion from the left door and B-pillar. The forward aspect of the left door panel was in contact with the 8 o'clock sector of the steering wheel rim. The intrusion at the forward aspect of the door measured 15 cm (6 in). The rear aspect of the door intrusion measured 36 cm (14 in). The lateral and longitudinal B-pillar intrusion measured

55 cm (21.5 in) and 29 cm (11.5 in), respectively. The B-pillar intrusion displaced the driver seat to the right and caused the seat back to rotate counterclockwise. The rear outboard aspect of the driver seat back was in contact and with the deformed rear left seat cushion. The inboard aspect of the driver seat back was in contact with the front right seat back. The front right seat was displaced to the right approximately 6 cm (2.5 in) and was in contact with the right B-pillar.



Figure 10: Right interior view across the front seat.



Figure 11: Right interior view across the rear seat.

Figure 12 is a longitudinal overhead view through the backlight depicting the intrusion at the rear seat left position. The booster seat was located in this seat position and fractured by the intrusion. It was mechanically pinned post-crash. The left rear door deformed in a semi-circular pattern about the forward aspect of the booster seat shell. The angular crash forces and crush at the left sill buckled the floor pan compressing the rear seat laterally and longitudinally. The forward aspect of the rear seat cushion was reduced in width 46 cm (18 in). The depth of the seat cushion at the left rear position was reduced 10 cm (8 in).



Figure 12: Overhead view through the backlight of the rear seat intrusion.

Manual Restraint System

The manual restraint system in the 1995 Oldsmobile Cutlass Supreme consisted of 3-point lap and shoulder belts with continuous loop webbing and sliding latch plates in the four outboard seat positions. The center rear position was lap belt equipped. The post-crash inspection of the driver's restraint revealed that the safety harness was stowed in its retractor and trapped by the deformation. The retractor was locked and the webbing was restricted. This indicated that the driver restraint was not in use at the time of the crash.

Inspection of the safety belt in the rear left position revealed it was cut during the extrication of the child passenger. The length of cut webbing attached to the outboard anchor measured 130 cm (51.2 in). The balance of the webbing had spooled back into its switchable retractor. The cut webbing section (attached to the outboard anchor) was found lying outside the vehicle on the ground exposed to the elements. Inspection of the webbing found the webbing soiled from exposure and unremarkable for positive crash related usage marks. The latch plate for this position was missing. Based on the fact that the latch plate was missing and webbing was cut, the left rear restraint was in use by the 4year old child at the time of the crash.

Frontal Air Bag System

The frontal air bag system in the 1995 Oldsmobile Cutlass Supreme consisted of driver and front right passenger bags that deployed as a result of the crash. The system was controlled and monitored by a single-point Sensing and Diagnostic Module (SDM) that was located under the front right seat. The SDM had Event Data Recording (EDR) capability. The crash event data was downloaded directly from the module at the time of the SCI inspection with the Vetronix Crash Data Retrieval tool. The complete EDR report is attached to the end of this narrative report.

The EDR recorded two events that were related to this multiple impact crash sequence. Both events occurred on ignition cycle 14440, one ignition cycle prior to the download cycle of 14441. A non-deployment event with a maximum recorded delta V of -0.7 km/h (-0.44 mph) was the first recorded event. An event of this nature, with a near-zero delta V, is indicative of a minor impact with a deceleration great enough to "wake-up" the system, (Algorithm Enable), and then the applied deceleration almost immediately dissipates. This recorded event was related to the crash dynamics of the frontal impact and shearing of the small saplings immediately after the road side departure.

The EDR then recorded a deployment event 0.03 seconds after the non-deployment. The maximum recorded longitudinal delta V of this event was -21.2 km/h (-13.16 mph) at 300 milliseconds after AE. An analysis of the delta V curve indicated that this was a long duration crash event which was not completely recorded. At the end of the recording, the delta V was rising rapidly. This event was consistent with the crash dynamics associated with the engagement the 10 cm (4 in) tree, subsequent rotation, and side impact.

Figure 13 is a view of the deployed driver air bag. The driver air bag was located in the center hub of the four spoke steering wheel rim. The module cover flaps were constructed of vinyl and were a symmetrical I-configuration. The width and height of the flaps measured 8 cm (3.0 in)

and 12 cm (4.9 in), respectively. The diameter of the driver air bag measured 61 cm (24 in) its deflated state. It was not tethered and was vented by two 3 cm (1.0 in) diameter ports located on the back side of the bag in the 3/9 o'clock sectors. The face of the bag exhibited vinyl transfers along its vertical mid-line axis. The transfers were intermittent and were caused by contact with the cover flaps during the deployment sequence. The driver's lips contacted the 6 o'clock sector the air bag evidenced by a pair of lipstick transfers. The contact was vertically oriented and located along the mid-line of the bag, approximately 11 cm (4.5 in) from the peripheral seam. The transfer was red in color and measured 3 cm (1.0 in) long.



Figure 13: Deployed driver air bag.

The front right passenger air bag was a top mount design located in the right aspect of the instrument panel. The module cover flap was trapezoidal in shape and was tethered to the module. The flap was constructed of sheet metal covered in vinyl. The vinyl covering was torn due to contact with the windshield at deployment. The front right passenger air bag was tethered by two 8 cm (3.0 in) wide straps and was vented by two 5 cm (2 in) diameter ports located on the side panels. The face of the deployed air bag measured 56 cm x 51 cm (22 in x 20 in), width by height. The rearward excursion measured 46 cm (18 in). There was no evidence of occupant contact to the air bag.

CHILD SAFETY SEAT

Cosco Vista High-Back Belt Positioning Booster

The 4 year old female was seated in a Cosco Vista high-back belt positioning booster and restrained within the rear left position of the Oldsmobile. **Figure 14** is a front view of the Cosco booster seat, Model No: 22-220-WAL. The seat was manufactured on January 28, 2003. The seat was labeled for use by child from 14 kg to 36 kg (30 lb to 80 lb) and up 132 cm (52 in), as long as the mid-point of the child's head was not above the seat back. The seat was designed to be used with the vehicle's 3-point lap and shoulder restraint. There were two warning labels on the seat that stated "Do not use with lap belt only". The seat's instruction manual was not present. Three shoulder belt positioning clips were designed into the respective outboard edges of the seat back. The purpose of the clips was to position the shoulder belt for a better fit to the seated height of the child. These clips were not in use at the time of the crash.



Figure 14: Front view of the CSS.

Inspection of the seat with the padding removed revealed a fracture of the base of the plastic shell. The fracture line began 9 cm (3.5 in) right of center and radiated linearly rearward to the reinforcements at the bight of the shell. Refer to **Figures 15 and 16**. The shell in the area of the left belt path was also stressed. The base fracture and related stresses were directly related to contact from the intruding left B-pillar and left rear door at impact. **Figure 17** is an overhead view of the CSS in the left rear position looking through the backlight and depicts the relationship of the seat to the intrusion.



Figure 15: Front view of the CSS shell.



Figure 16: Close-up view of the fractured base.



Figure 17: Overhead view of the relationship between CSS in the rear left position and the left side intrusion.

OCCUPANT DEMOGRAPHICS
1995 Oldsmobile Cutlass Supreme

	Driver	Rear Left Passenger
Age/Sex:	55 year old/Female	4 year old/Female
Height:	163 cm (64 in)	Unknown
Weight:	83 kg (183 lb)	16 kg (35 lb) estimated
Seat Position:	Unknown	Fixed bench
Restraint Use:	None used	3-point lap and shoulder harness
Usage Source:	SCI inspection, First responder	SCI inspection, First responder
Medical Treatment:	None, fatally injured at scene	Transported via air ambulance to a regional trauma center and hospitalized two days

DRIVER INJURY
1995 Oldsmobile Cutlass Supreme

Injury	Injury Severity (AIS 98 Update)	Injury Source
Blunt Force Chest Trauma with noted Crepitence of the chest and Subcutaneous emphysema	Injured Unknown Severity (415099.7,0)	Intruding left front door
Left upper arm abrasion, NFS	Minor (790202.1,2)	Contact to the 15 cm tree
Abrasion over the left elbow, NFS	Minor (790202.1,2)	Intruding left front door
Left hip contusion, NFS	Minor (890402.1,2)	Intruding left front door
Right cheek abrasion, NFS	Minor (290202.1,1)	Deployed driver air bag

Note: the above referenced injuries were identified in the Office of the Chief Medical Examiner's Report. The ME's investigation consisted of an external examination. No autopsy was conducted.

DRIVER KINEMATICS
1995 Oldsmobile Cutlass Supreme

The 55 year old driver was seated in a presumed upright posture and was unrestrained. The driver seat track position was unknown. The driver lost directional control of the vehicle due to a combination of vehicle speed and poor road conditions and departed the right side of the road. The off-road trajectory resulted in a minor frontal impact and override of a cluster of small diameter trees causing the EDR to record a non-deployment event (Event 1). The 11 o'clock force of the minor frontal impact did not have a magnitude great enough to influence the driver's kinematic pattern. It was likely she was gripping the steering wheel and reacting to correct the vehicle's errant trajectory.

The Oldsmobile continued northeastward and engaged a 10 cm (4 in) tree with the front left fender and left front wheel (Event 2). This engagement redirected the vehicle's northeastward momentum into a rapid clockwise rotation and into a left side impact with the 15 cm (6 in) tree (Event 3). The force of this coupled event was sufficient to cause the safety belt retractors to lock and the frontal air bags to deploy. The driver responded to the 11 o'clock and 10 o'clock direction of force from the coupled event by exhibiting a forward and then leftward trajectory. The driver's face contacted the deployed driver air bag evidenced by the right cheek abrasion and corresponding make-up transfer. The driver's left flank and chest contacted and loaded the intruding left door. This contact resulted in the left hip contusion and the fatal blunt chest trauma. The driver then rebounded to the right and came to rest lying across the front seats with her head in the front right passenger's foot well.

REAR LEFT PASSENGER INJURY
1995 Oldsmobile Cutlass Supreme

<i>Injury</i>	<i>Injury Severity (AIS 98 Update)</i>	<i>Injury Source</i>
Closed mid-shaft fracture of the right tibia	Moderate (853420.2,1)	Intruding left B-pillar
1 cm laceration of the left temporal region	Minor (190602.1,2)	Disintegrated left rear window glazing
Scattered forehead abrasions	Minor (290202.1,7)	Disintegrated left rear window glazing

Note: the above injuries were identified in the Discharge Summary and Emergency Room Records of the treating hospital.

REAR LEFT PASSENGER KINEMATICS
1995 Oldsmobile Cutlass Supreme

The 4 year old child passenger was seated in a high-back belt positioning booster seat that was positioned in the left rear of the Oldsmobile. The child was restrained by the 3-point lap and shoulder harness.

At impact (Events 2 and 3), the ELR retractors of the safety belt system locked. The child (and booster seat) responded to the 11 o'clock and 10 o'clock direction of the coupled event by exhibiting a forward and then leftward trajectory. The child contacted and loaded the locked belt system with her chest and pelvis. As the child loaded the safety belt system, her torso rode down the force of the impact and decelerated. Coincident to this pattern the vehicle began its clockwise rotation and the left side of the vehicle impacted the tree. The left window glazing disintegrated causing the left temporal laceration and forehead abrasions. The left B-pillar and left door intruded inboard and rearward impacting the child's lower extremities and the child safety seat. The intruding components fractured the CSS and resulted in the reported lower extremity fracture. The child came to rest within the CSS and was pinned in the left rear position due to the intrusion.

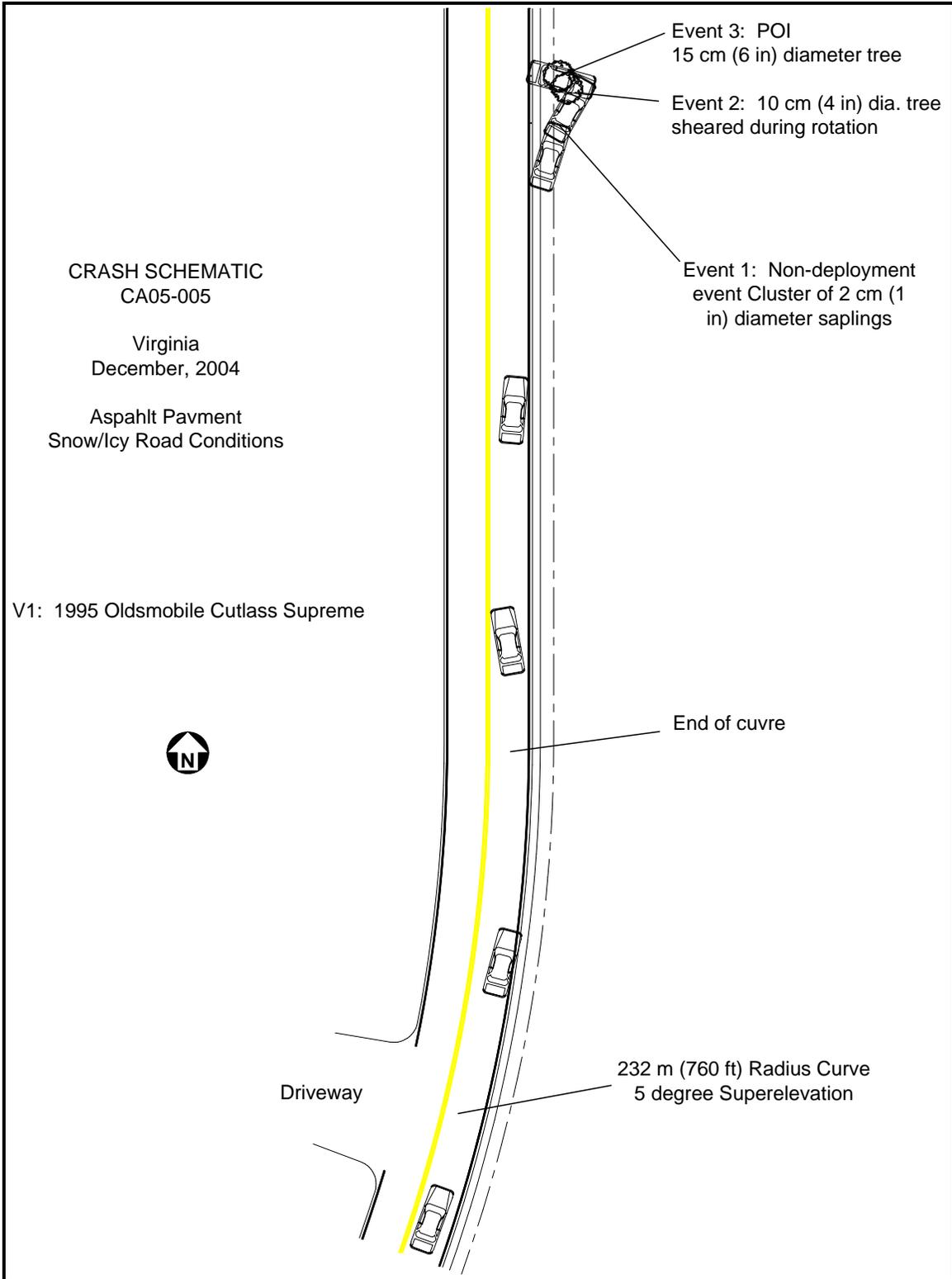


Figure 18: Crash Schematic

ATTACHMENT A: EDR Data

CDR File Information

Vehicle Identification Number	1G3WH52M8SFxxxxxx
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	CA05-005 CDR.CDR
Saved on	Tuesday, January 25 2005 at 02:49:56 PM
Data check information	F08D86D4
Collected with CDR version	Crash Data Retrieval Tool 2.70
Collecting program verification number	70812808
Reported with CDR version	Crash Data Retrieval Tool 2.70
Reporting program verification number	70812808
Interface used to collected data	Block number: 00 Interface version: 41 Date: 11-04-04 Checksum: 9E00
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 file (this would have been the event that deployed the air bag) and the second Deployment Event will be stored in the #2 Deployment file. Deployment events cannot be overwritten or cleared from the SDM. Once the SDM has two deployments recorded, the SDM must be replaced.

The data in the non-deployment file will be locked after a deployment, if the non-deployment occurred within 7.65 seconds before the deployment or a deployment level event occurs within 5 seconds after the deployment.

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 Deployment or Non-Deployment 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.

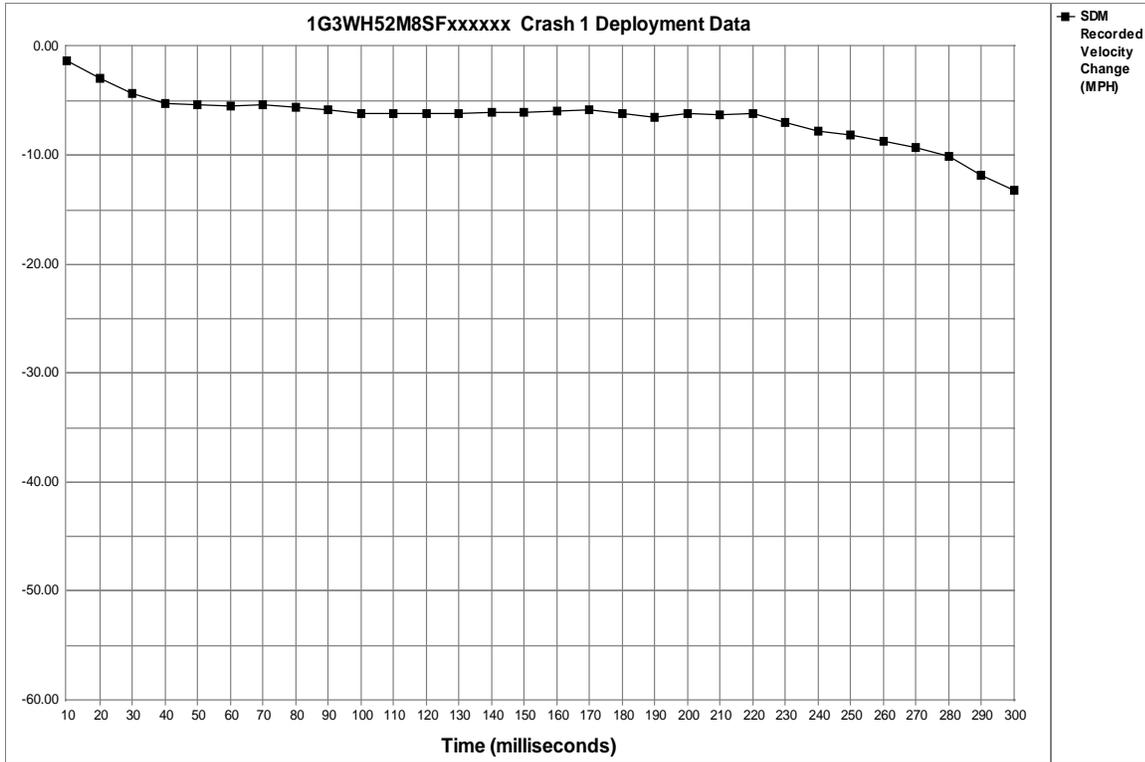
SDM Data Source:

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

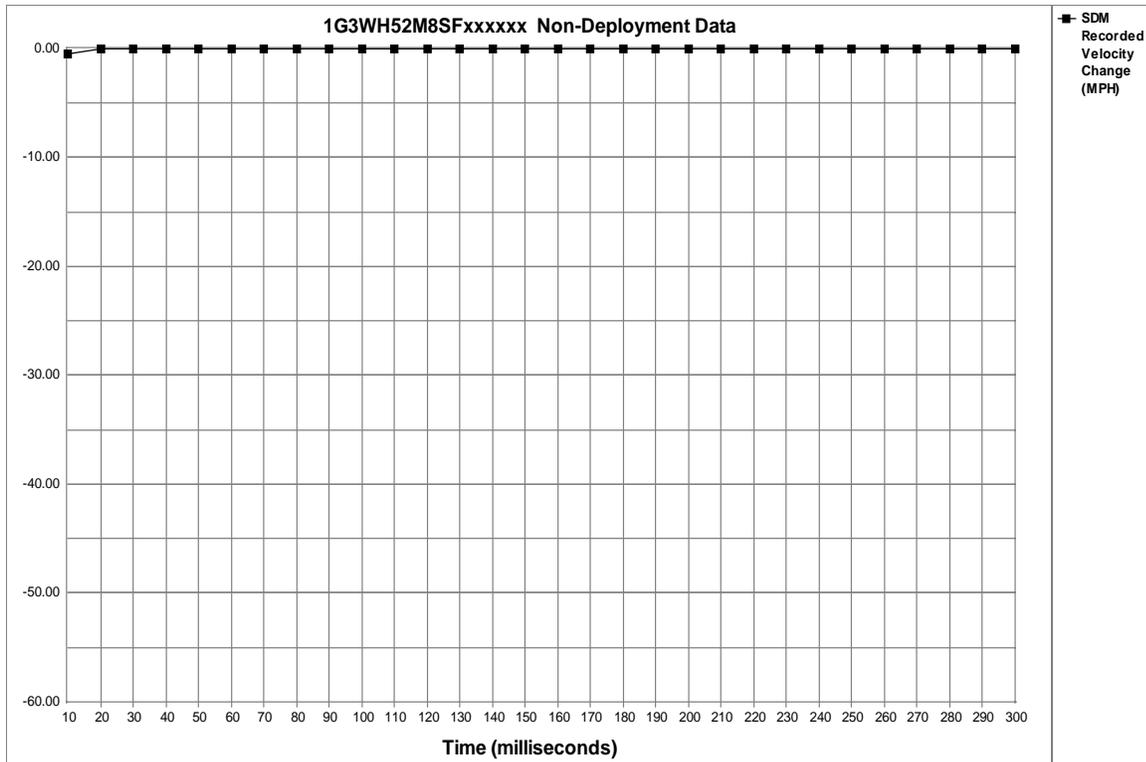
SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Deployment	14440
Ignition Cycles At Investigation	14441
Time From Algorithm Enable to Deployment Command Criteria Met (msec)	31.25
Time Between Non-Deployment And Deployment Events (sec)	.03



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-1.32	-2.85	-4.28	-5.16	-5.27	-5.49	-5.38	-5.59	-5.81	-6.14	-6.14	-6.14	-6.14	-6.03	-6.03
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Recorded Velocity Change (MPH)	-5.92	-5.81	-6.14	-6.47	-6.14	-6.25	-6.14	-6.91	-7.79	-8.12	-8.67	-9.21	-10.09	-11.85	-13.16

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Ignition Cycles At Non-Deployment	14440
Ignition Cycles At Investigation	14441
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	11.25
Maximum SDM Recorded Velocity Change (MPH)	-0.44
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)	-0.44	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
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

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 55 00 00
B608: 00 00 00 00 00 39 F9 BF
B610: F9 F9 F9 F9 F9 F9 00 64
B618: 02 75 FD 53 AA FB 00 00
B620: AA AA 00 AA 00 00 81 00
B628: 08 00 19 0C 1A 27 2F 30
B630: 32 31 33 35 38 38 38 38
B638: 37 37 36 35 38 3B 38 39
B640: 38 3F 47 4A 4F 54 5C 6C
B648: 78 38 68 1D 01 00 00 55
B650: AA 55 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: 7D 00 00 00 09 04 04 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 38 68 00 00
B6B0: 55 AA AA AA AA 00 00 AA
B6B8: 81 00 00 00 00 00 00 7D 00
B6C0: 00 7D 00 00 7D 00 00 7D
B6C8: 00 00 7D 00 00 7D 00 00
B6D0: 00 00 00 90 20 43 85 17
B6D8: 29 49 00 41 53 09 02 4B
B6E0: 00 00 00 33 57 01 00 00
B6E8: 00 00 00 00 00 00 10 20
B6F0: F3 70 06 F0 05 50 25 64
B6F8: FF FF FF FF FF FF FF FF
B700: FF FF FF 60 60 60 60 60
B708: 60 60 60 60 60 60 60 7F
B710: 9F A5 AA B1 B9 C1 C8 D1
B718: D9 E3 EC F8 41 43 46 48
B720: 4B 4E 50 53 55 58 5B 5E
B728: 60 63 65 67 6A 6D 70 73
B730: 76 7A 7C 80 82 85 87 89
B738: 8B 8D 8E 90 91 92 94 95
B740: 96 97 97 98 99 99 9A 9B
B748: 9B 9B 9C 9D 9D 9D 9E 9E
B750: 9F 9F 9F 9F 9F 9F A0 A0
B758: A0 A0 A0 A0 10 1C 39 00
B760: 00 00 00 00 00 00 00 00
B768: 00 00 00 00 00 00 15 17
B770: 18 19 1C 1E 20 23 24 25
B778: 27 29 2B 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 AA
B798: 00 13 00 13 00 2D 4B 16
B7A0: 06 18 01 02 AA 02 4B 4C
B7A8: FF FF FF FF FF FF FF FF
B7B0: FF FF FF 57 57 57 57 57
B7B8: 57 57 57 57 57 57 57 5B
B7C0: 60 60 60 62 62 64 66 68
B7C8: 68 6A 6D 70 85 85 85 85
B7D0: 85 85 85 85 87 8A 8F 91
B7D8: 91 97 99 9C 9F A2 A5 A7
B7E0: AA AC AE B0 B2 B4 B6 B7
B7E8: B9 BA BC BD BE C0 CB D3
```

B7F0: DA E0 E6 FF FF FF FF FF
B7F8: CA 8C A5 A5 A5 A5 00 00