

CRASH DATA RESEARCH CENTER

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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT
VEHICLE CRASH INVESTIGATION**

SCI CASE NO: CA04-012

**VEHICLE: 2003 CADILLAC ESCALADE
LOCATION: PENNSYLVANIA
CRASH DATE: FEBRUARY 2004**

Contract No. DTNH22-01-C-17002

Prepared for:

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National Highway Traffic Safety Administration
Washington, D.C. 20590

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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.

TECHNICAL REPORT STANDARD TITLE PAGE

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<p>16. Abstract</p> <p>This on-site investigative effort focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2003 Cadillac Escalade. This advanced occupant protection system was comprised of dual-stage frontal air bags, seat track position sensors for both front seats, front safety belt buckle switch sensors and a front right occupant presence detection sensor. The manufacturer certified that the CAC system met the requirements of the advanced Federal Motor Vehicle Safety Standard No. 208. The CAC system was controlled and monitored by the vehicle's Sensing and Diagnostic control Module (SDM). The SDM tailored the deployment of the frontal air bags based on the crash severity and inputs from the CAC sensors. The SDM was equipped with an Event Data Recorder (EDR) that had the ability to record pre-crash vehicle systems and crash related data. The EDR was downloaded during the course of the vehicle inspection as a supplement to the on-site investigation. The Cadillac was involved in a single vehicle/fixed object crash with the corner of a building in an urban setting. The Cadillac was occupied by a 37 year old female unrestrained driver and an unrestrained front right passenger. The front right passenger fled the scene on foot after the crash and was not identified by the investigating police officer. The female driver sustained a police reported fractured right lower extremity as a result of the impact.</p> <p>This crash was identified from a list of claims provided by an insurance company to the National Highway Traffic Safety Administration (NHTSA). The list identified CAC vehicles that had been involved in traffic crashes. The NHTSA analyzed the list based on vehicle type and location and then forwarded a list of selected crashes to the Calspan Special Crash Investigations (SCI) team for follow-up investigation. The subject Cadillac was located and cooperation was established with the local insurance adjuster and salvage yard. An on-site investigation was assigned to the SCI team on March 15, 2004. The on-site investigation took place during the week of March 22, 2004.</p>			
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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT
VEHICLE CRASH INVESTIGATION**

**SCI CASE NO.: CA04-012
VEHICLE: 2003 CADILLAC ESCALADE
LOCATION: PENNSYLVANIA
CRASH DATE: FEBRUARY, 2004**

BACKGROUND

This on-site investigative effort focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2003 Cadillac Escalade, **Figure 1**. This advanced occupant protection system was comprised of dual-stage frontal air bags, seat track position sensors for both front seats, front safety belt buckle switch sensors and a front right occupant presence detection sensor. The manufacturer certified that the CAC system met the requirements of the advanced Federal Motor Vehicle Safety Standard No. 208. The CAC system was controlled and monitored by the vehicle's Sensing and Diagnostic control Module (SDM). The SDM tailored the deployment of the frontal air bags based on the crash severity and inputs from the CAC sensors. The SDM was equipped with an Event Data Recorder (EDR) that had the ability to record pre-crash vehicle systems and crash related data. The EDR was downloaded during the course of the vehicle inspection as a supplement to the on-site investigation.



Figure 1: 2003 Cadillac Escalade.

The Cadillac was involved in a single vehicle/fixed object crash with the corner of a building in an urban setting. The Cadillac was occupied by a 37 year old female unrestrained driver and an unrestrained front right passenger. The front right passenger fled the scene on-foot after the crash and was not identified by the investigating police officer. The female driver sustained a police reported fractured right lower extremity as a result of the impact.

This crash was identified from a list of claims provided by an insurance company to the National Highway Traffic Safety Administration (NHTSA). The list identified CAC vehicles that had been involved in traffic crashes. The NHTSA analyzed the list based on vehicle type and location and then forwarded a list of selected crashes to the Calspan Special Crash Investigations (SCI) team for follow-up investigation. The subject Cadillac was located and cooperation was established with the local insurance adjuster and salvage yard. An on-site investigation was assigned to the SCI team on March 15, 2004. The on-site investigation took place during the week of March 22, 2004.

SUMMARY

VEHICLE DATA

2003 Cadillac Escalade

The 2003 Cadillac Escalade was identified by the Vehicle Identification Number (VIN): 1GYEK63NX3R (production sequence deleted). The four-door, all-wheel drive sport utility vehicle had a Gross Vehicle Weight Rating (GVWR) of 3182 kg (7000 lb) and was configured on a 295 cm (116 in) wheelbase. The leather upholstered interior had the capacity to seat eight passengers (2/3/3). The power train consisted of a 6.0 liter/V8 engine linked to a four-speed automatic transmission with overdrive. The vehicle was also equipped with power steering, power assist four-wheel disc brakes with ABS, power windows, mirrors and door locks, and adjustable foot controls. The manual restraint system consisted of three-point lap and shoulder belts in all seat positions. The frontal air bag system in the vehicle consisted of driver and front right passenger air bags certified by the manufacturer to be compliant with the advanced FMVSS 208 occupant protection standard. The Cadillac was also equipped with an inflatable side impact protection system consisting of seatback mounted side impact air bags. The vehicle's date of manufacture was May 2003. The digital odometer could not be read at the time of the inspection due to a damaged electrical system. The Cadillac was equipped with Goodyear Wrangler HP P265/70R17 tires on seven-spoke OEM alloy wheels. The recommended cold tire pressure was 210 kPa (30 PSI). The specific measured tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	221 kPa (32 PSI)	9 mm (11/32)	No	None
LR	200 kPa (29 PSI)	8 mm (10/32)	No	None
RF	214 kPa (31 PSI)	9 mm (11/32)	No	None
RR	193 kPa (28 PSI)	9 mm (11/32)	No	None

SUMMARY

CRASH SITE

This single-vehicle crash occurred during the afternoon hours of March, 2004. At the time of the crash, it was daylight and the weather was not a factor. The crash occurred at the intersection of a two-lane east/west road and a two-lane one-way (southbound) street in an urban setting. The traffic flow through the intersection was controlled by standard (red/amber/green) traffic signals mounted on posts in each quadrant of the intersection. The traffic lanes of the east/west roadway measured 3 m (10 ft) in width and were separated by a double yellow centerline. The outboard edges of the travel lane were each bordered by a 1.5 m (5 ft) wide bicycle lane and a 2.3 m (7.5 ft) parking lane. Concrete sidewalks and store fronts were located beyond the on-street parking lanes. Due to the repaving that had occurred over many years, the barrier curbs that separated the sidewalk from the road surface had been reduced to approximately 2 cm (1 in).

A service station/convenience store was located in the southeast quadrant of the intersection and was the point of impact. The store was constructed of brick and mortar. The corner of the store was located 5.0 m (16.5 ft) south of the eastbound road edge and 4.6 m (15.0 ft) east of the

southbound road edge. A series of bricks 36 cm to 69 cm (14 in to 27 in) above the ground measuring 28 cm (11 in) in width on the north wall were freshly chipped and abraded. These bricks identified the point of impact. A public telephone was located 0.6 m (2 ft) east of building's corner and sustained minor damage from contact with the front fascia of the Cadillac. The pole-mounted traffic signal located in the intersection quadrant was contacted by the left rear quarterpanel of the Cadillac as the vehicle rotated to final rest. The pole and signal did not appear to have been damaged. A schematic of the crash is attached to the end of this report, **Figure 9**. The speed limit in the area of the crash was 48 km/h (30 mph). **Figure 2** is a trajectory view of the Cadillac approaching the point of impact. **Figure 3** is a view of the point of impact.



Figure 3: Eastbound trajectory view.



Figure 2: Point of impact.

CRASH SEQUENCE

Pre-Crash

The 37 year old female driver of the Cadillac was operating the vehicle eastbound on the approach to the intersection. She was not utilizing the vehicle's manual safety belt; she was unrestrained. The police report indicated that the front right passenger was the driver's nephew (demographics unknown). Reportedly, she was transporting him to a nearby hospital at the time of the crash. The front right passenger fled the scene post-crash. He was found at a nearby hospital but was not identified by the police investigation. Details regarding this individual are unknown. The driver refused to be interviewed by the SCI investigator regarding this crash.

As the driver approached the intersection, the east/west traffic flow was stopped at the red traffic signal. The driver steered counterclockwise (left) and crossed the centerline to pass a non-contact vehicle that was stopped at the mouth of the intersection. The driver then steered sharply clockwise (right) attempting to avoid westbound traffic and lost control of the vehicle. The Cadillac traveled over the south road edge and entered the southeast quadrant of the intersection.

The data downloaded from the vehicle's EDR indicated the Cadillac was traveling 79 km/h (49 mph) five seconds (T-5) prior to Algorithm Enable (AE) and decelerated to 31 km/h (19 mph) one second (T-1) prior to AE. The vehicle's brakes were reported as being "On" throughout the recorded pre-crash phase.

Crash

The crash occurred with the right aspect of the Cadillac's front bumper impacting the corner of the building. (The housing surrounding the public telephone located adjacent to the building also sustained minor contact.) The principle direction of the impact force was in the 12 o'clock sector. The force of the impact caused a Stage 1 deployment of the vehicle's advanced frontal air bags at 7.5 milliseconds after AE. The maximum recorded longitudinal delta V of the crash reported by the EDR was -31 km/h (-19.1 mph). The delta V calculated by the WINSMASH model was 18 km/h (11.1 mph). This calculated value underestimated the severity of the impact. Refer to the *Exterior Damage* section of this report for further details. The crash force located right of the Cadillac's centerline initiated a clockwise vehicle rotation. The Cadillac rotated approximately 20 degrees clockwise and the vehicle's left rear quarterpanel contacted the traffic signal support pole in a minor secondary impact. The pole was not damaged in this event. The Cadillac came to rest facing southeast in the southeast quadrant of the intersection.

Post-Crash

The police and ambulance personnel responded to the crash. The driver sustained a police reported right lower extremity fracture as a result of her unrestrained contact to the interior. She remained in the Cadillac and was assisted from the vehicle by the EMS responders. The front right male passenger exited the vehicle under his own power and fled the scene. He was not identified. The Cadillac sustained disabling damage and was towed. It was subsequently deemed a total loss by its insurance carrier.

2003 CADILLAC ESCALADE

Exterior Damage

The Cadillac Escalade had been dismantled by a repair facility during the insurance estimating process. This hampered the documentation of the crush profile. Residual crush was measured directly to the vehicle's frame. For that reason, the residual damage profile used during the analysis was underestimated. In turn, the under reported damage severity resulted in an under reported delta V by the WINSMASH Damage Algorithm. **Figures 4 and 5** are frontal views of the damaged Cadillac.



Figure 4: Cadillac front view.



Figure 5: Cadillac overhead front view.

The front plane of the Cadillac sustained direct contact damage due its impact with the corner of the building that began 28 cm (11 in) right of center and extended 38 cm (15 in) to the right. As the vehicle crushed, the front plane contacted the vertical support for the public telephone. The contact to the telephone support occurred approximately on the vehicle's centerline. This contact pattern measured 8 cm (3 in) in width. The fascia and damaged hood are depicted in **Figure 6**.



Figure 6: Damaged bumper fascia and reinforcement.

The forward frame of the Cadillac was exposed due to the dismantling of the vehicle. The separation of the front frame rails measured 76 cm (30 in). A 6 cm (2.25 in) diameter tubular cross-member connected and stiffened the forward frame members. The right biased impact was centered approximately on the exposed end of the right frame rail and tow hook. The right frame rail crushed and deformed to the right. The left frame rail was not damaged. The frontal crush was symmetrically measured to the exposed forward body mounts, the respective ends of the frame rails and the tubular cross-member. The residual crush profile was as follows: C1 = 0, C2 = 0, C3 = 3 cm (1.2 in), C4 = 9 cm (3.5 in), C5 = 26 cm (10.2 in), C6 = 27 cm (10.6 in). The right aspect of the hood exhibited a V-notch from the impact with the corner of the building. The direct contact along the hood face began 20 cm (8 in) right of center and measured 46 cm (18 in) in width. The longitudinal crush of the apex of the notch measured 27 cm (10.5 in). The right wheelbase was reduced 5 cm (2 in). The left wheelbase was unchanged. All the doors remained closed during the impact and were operational during the SCI inspection. The windshield was not fractured and the side windows were intact. The Collision Deformation Classification of the vehicle was 12-FZEN2.

The offset force of the initial impact caused the Cadillac to rotate clockwise as it slid to rest. The vehicle's left rear quarterpanel exhibited direct contact damage consistent with a minor impact to the traffic signal support pole located within the intersection quadrant. The damage consisted of an elliptical dent in the body panel with a maximum depth of 2 cm (0.75 in). The deformation pattern measured 38 cm (15 in) in length and was centered 33 cm (13 in) rearward of the left rear axle. The CDC of this damage pattern was 09-LBEN1

Interior Damage

The interior damage to the Cadillac was limited to the deployment of the vehicle's frontal air bags and the minor occupant contacts to the front interior. There was no interior damage related to the exterior force of the crash. There was no reduction in the volume of the front occupant space. **Figures 7 and 8** are interior views of the Cadillac.

The ten-way power driver seat was adjusted to a full rear track position at the time of inspection. It could not be verified that this was the at-crash adjustment. The total seat track travel measured 24 cm (9.5 in). The seat back was reclined 10 degrees aft of vertical, measured 41 cm (16 in)

above the seat bight. The horizontal distance from the seat back to the steering wheel hub measured 69 cm (27.3 in). The adjustable pedals were positioned 1 cm (0.5 in) rearward of the most forward position. The total adjustment measured 5 cm (2 in).

The four-spoke steering wheel was turned approximately 190 degrees counterclockwise at the time of the inspection. The tilt adjustment was in the full-up position. There was no evidence of deformation to the steering wheel rim. Examination of the shear capsules identified that both capsules had completely separated. The displacement measured 3 cm (1.2 in). The interior trim panel surrounding the driver side of the instrument was displaced. The driver's knee bolster exhibited two areas of contact from the driver's lower extremities. The left lower extremity contacted the bolster 15 cm (6 in) left of the steering wheel centerline and 43 cm (16.8 in) above the floor. This contact was identified by a 3 cm (1 in) diameter scuff. The right lower extremity contact was identified by an angular scuff measuring 6 cm x 2 cm (2.5 in x 0.8 in), length by width. The scuff began 1 cm (0.5 in) right of steering wheel centerline and ended 1 cm (0.3 in) left of center. The scuff was centered 41 cm (16.2 in) above the floor.

The front right passenger seat was located in a full rear position and had a 25 cm (9.5 in) track adjustment. The seat back angle measured 12 degrees aft of vertical. This angle was measured 41 cm (16 in) above the seat bight. The horizontal distance from the seat back to the aft edge of the mid-mount front right passenger air bag module measured 85 cm (33.5 in). There was no evidence of occupant contact to the front right interior structures.



Figure 7: Left interior view.



Figure 8: Right interior view.

Manual Restraint Systems

The manual restraint systems in the Cadillac consisted of three-point lap and shoulder safety belts in all eight seat positions. The respective manual restraints in the front row were each integrated into the leather upholstered bucket seats. The driver's restraint consisted of continuous loop webbing, a sliding latch plate, and an Emergency Locking Retractor (ELR) mounted in the seat back. The webbing spooled out through a belt guide located above the

driver's left shoulder. Upon initial inspection, the driver's restraint was in the retracted position. Examination of the latch plate revealed no evidence of historical use. The webbing was spooled out and examined for crash related evidence. The webbing was dimpled 30 cm (12 in) above the stop button from being in the stowed position. There was no crash related evidence of use on the webbing. The lack of evidence on the driver's restraint observed during the SCI examination indicated the restraint was not in use at the time of the crash. The lack of restraint use was consistent with the occupant contacts and kinematics.

The front right passenger manual safety belt consisted of continuous loop webbing, a sliding latch plate, and a switchable Emergency Locking/Automatic Locking Retractor (ELR/ALR) mounted in the right aspect of the seat back. Upon inspection, the webbing was in the stowed position. There was no evidence of historical use on the latch plate. Examination of the webbing was unremarkable for crash related evidence. The lack of physical evidence identified during the course of the SCI inspection indicated the front right passenger was unrestrained at the time of the crash.

Certified Advanced 208-Compliant Air Bag System

The Certified Advanced 208-Compliant (CAC) frontal air bag consisted of advanced dual stage air bags for the driver and front right passenger, seat track position sensors, front safety belt buckle switch sensors, and a front right occupant detection sensor. The frontal air bag system was certified by the manufacturer to have met the requirements of the advanced Federal Motor Vehicle Safety Standard 208. The system was controlled and monitored by a Sensing and Diagnostic control Module (SDM) located under the driver's seat. Additionally, two crash sensors, symmetrically located on forward frame rails, were used to aid in crash detection and assess crash severity. The SDM was equipped with an Event Data Recorder (EDR) that recorded data related to the crash. This data was downloaded by the SCI investigator at the time of the vehicle inspection.

The driver air bag deployed from an I-configuration module located in the center hub of the steering wheel rim. The symmetrical cover flaps measured 8 cm x 11 cm (3 in x 4.5 in), width by height, respectively. The flaps opened at the designed tear seams during the deployment sequence and were not damaged. There was no evidence of occupant contact. The deployed driver air bag measured 61 cm (24 in) in diameter. The bag was tethered by two 10 cm (4 in) wide straps in the 3/9 o'clock sectors and was vented by two 3 cm (1.2 in) diameter ports located in the 11/1 o'clock sectors. There was no evidence of residual occupant contact to the driver air bag.

The front right passenger air bag was a mid-mount design located in the right aspect of the instrument panel. The air bag deployed from a module with a rectangular cover flap. The 39 cm x 14 cm (15.2 in x 5.5 in), width by height, flap was constructed of sheet vinyl. There was no evidence of occupant contact to the flap. The face of the front right passenger air bag measured 51 cm x 46 cm (20 in x 18 in), width by height, in its deflated state. The rearward excursion of the bag measured 46 cm (18 in) from the face of the instrument panel. The air bag was tethered and was vented by two 4 cm (1.5 in) diameter ports located on the side panels. There was no evidence of occupant contact to the air bag.

The EDR was downloaded utilizing the Vetronix Crash Data Retrieval (CDR) hardware and software version 2.24. The CDR hardware was connected to the J1962 diagnostic port located on the lower left side on the instrument panel. The electrical system was damaged during the course of the impact or rendered inoperative during the dismantling. Electrical power was supplied to the vehicle from an external 12 volt supply. The external power was supplied to the vehicle's air bag circuit through the fuse panel located within the engine compartment via jumper wires connected to the air bag fuse.

The EDR recorded and stored a singular deployment event that was related to the subject crash. The deployment event occurred on Ignition cycle 2758. The maximum longitudinal recorded delta V was -31 km/h (-19.1 mph) and occurred 132.5 milliseconds after AE. The delta V was consistent with the vehicle's pre-crash recorded speed of 31 km/h (19 mph). This speed was recorded one second before AE. A stage 1 deployment was commanded 7.5 milliseconds after AE. The complete EDR report downloaded from the vehicle is attached to the end of this report as *Attachment A*.

OCCUPANT DEMOGRAPHICS

	<i>Driver</i>	<i>Front Right Passenger</i>
Age/Sex:	37 year old / Female	Unknown age/ Male
Height:	Not reported	Not reported
Weight:	Not reported	Not reported
Seat Position:	Unknown	Unknown
Manual Restraint Use:	None	None
Usage Source:	SCI inspection, EDR, PAR	SCI inspection
Medical Treatment:	Transported via ground ambulance and treated	None, not injured

DRIVER INJURY

<i>Injury</i>	<i>Injury Severity (AIS 98 Update)</i>	<i>Injury Source</i>
Right lower extremity fracture, not further specified	Moderate (852002.2,1)	Driver knee bolster

Note: the above referenced injury was identified through the police report. The driver refused to be interviewed. Medical records were not available.

DRIVER KINEMATICS

Immediately prior to the crash, the 37 year old female driver was seated in a presumed upright posture. The at-crash track position of the seat was unknown. The inspected seat track position was full rear. She was not restrained by the vehicle's manual three-point lap and shoulder belt. She was in the process of transporting the front right passenger to a local hospital. The driver crossed the centerline of the road to illegally pass a stopped vehicle at an intersection, steered right to avoid on-coming traffic and lost control of the vehicle precipitating the crash.

Upon impact, the frontal air bag system in the Cadillac deployed. The unrestrained driver exhibited a forward trajectory in response to the 12 o'clock direction of the impact force and loaded the deployed driver air bag with her chest and began to ride down the force of the impact. The driver loaded the steering column (through the inflated driver air bag) resulting in a complete separation of the shear capsules. The driver's lower extremities contacted the knee bolster evidenced by the identified scuff marks. The driver's contact to the bolster resulted in an unspecified fracture of the right lower extremity. The driver then rebounded back into the driver's seat and came to rest.

FRONT RIGHT PASSENGER INJURY

The front right passenger fled the scene immediately after the crash and was not identified.

FRONT RIGHT PASSENGER KINEMATICS

The front right passenger was seated in a presumed full rear track position in an upright posture. He was not utilizing the vehicle's manual safety belt system. Upon impact, the frontal air bags deployed. The front right passenger exhibited a forward trajectory in response to the 12 o'clock direction of the impact force. The passenger contacted and loaded the deployed air bag with his chest and rode down the force of the crash. He then rebounded back into his seat and presumably was not injured. He fled the scene on-foot prior to the arrival of the police and EMS personnel.

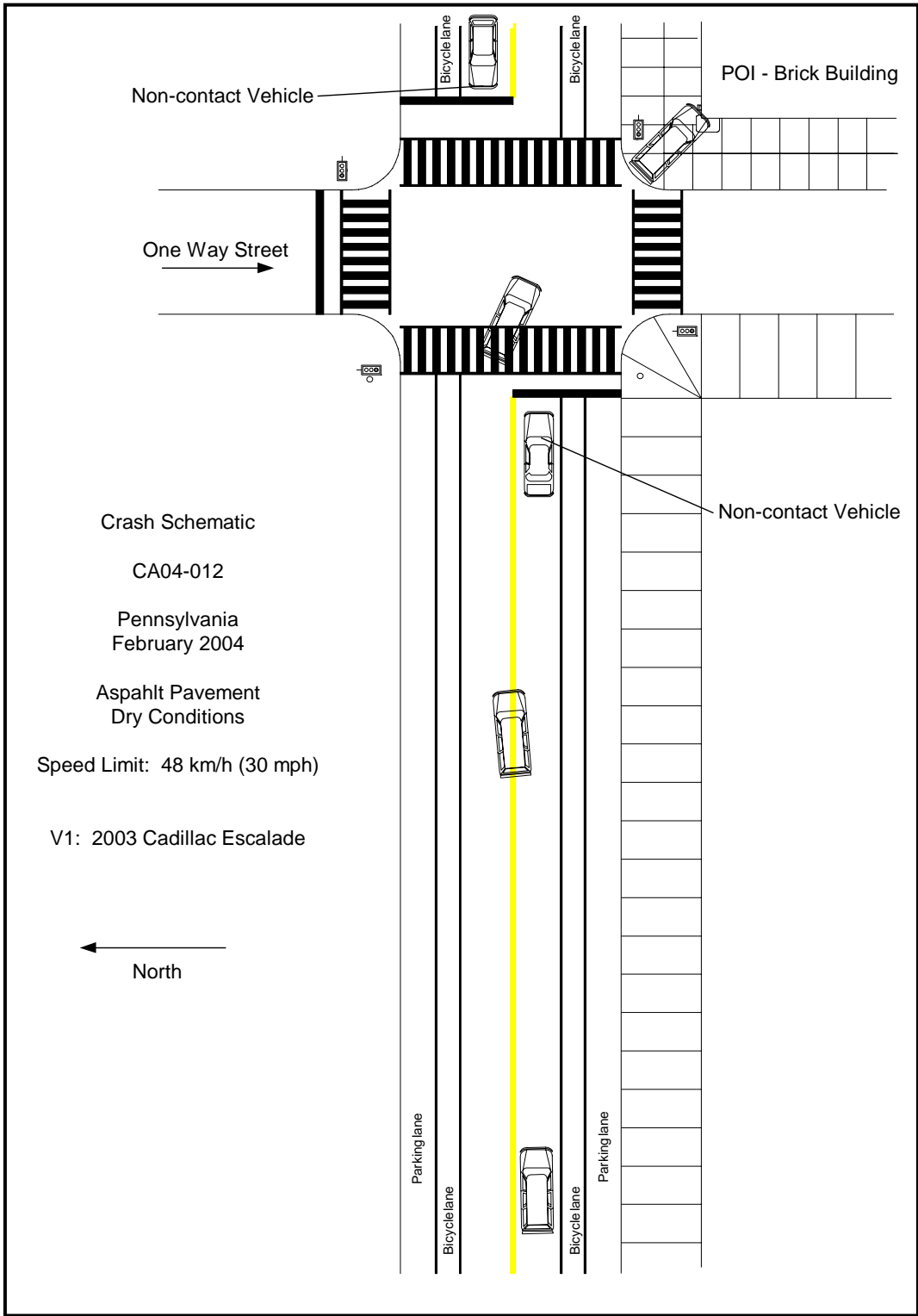


Figure 9: Crash Schematic.

ATTACHMENT A

EDR Report

CDR File Information

Vehicle Identification Number	1GYEK63NX3R*****
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	CA04-012 CDR.CDR
Saved on	Monday, March 22 2004 at 04:13:15 PM
Collected with CDR version	Crash Data Retrieval Tool 2.24
Collecting program verification number	70CD83DD
Reported with CDR version	Crash Data Retrieval Tool 2.800
Reporting program verification number	9238B95E
Interface used to collected data	Block number: 00 Interface version: 39 Date: 10-09-03 Checksum: 0300
Event(s) recovered	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). It contains Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.

The second type of SDM recorded crash event is the Deployment Event. It also contains Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within 25.4 seconds of one another. Deployment Events cannot be overwritten or cleared from the SDM. Once the SDM has deployed the air bag, 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 5 seconds before the Deployment Event. If multiple Non-Deployment Events occur within 5 seconds prior to a Deployment Event, then the most severe Non-Deployment Event will be recorded and locked. If multiple Non-Deployment Events precede a Deployment Event, and multiple Non-Deployment Events occur within 5 seconds of each other (but not necessarily all within 5 seconds of the Deployment Event), and subsequent Non-Deployment Events are less severe than prior Non-Deployment Events, and the last of the multiple Non-Deployment Events occurs within 5 seconds of a Deployment Event, then the most severe of the Non-Deployment Events (which may have occurred more than 5 seconds prior to the Deployment Event) will be recorded and locked.

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. For Deployment Events and Deployment Level Events, the SDM will record 100 milliseconds of data after deployment criteria is met and up to 50 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record the first 150 milliseconds of data after algorithm enable.
 - Event Recording Complete will indicate if data from the recorded event has been fully written to the SDM memory or if it has been interrupted and not fully written.
 - SDM Recorded Vehicle Speed accuracy can be affected if the vehicle has had the tire size or the final drive axle ratio changed from the factory build specifications.
 - Brake Switch Circuit Status indicates the status of the brake switch circuit.
 - Pre-Crash Electronic Data Validity Check Status indicates "Data Invalid" if the SDM receive an invalid message from the module sending the pre-crash data.
 - Driver's and Passenger's Belt Switch Circuit Status indicates the status of the seat belt switch circuit. If the vehicle's electrical system is compromised during a crash, the state of the Belt Switch Circuit may be reported other than the actual state.
 - The Time Between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than 25.4 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.
 - Multiple Events Associated with this Record: This parameter will indicate whether one or more associated events preceded the recorded event.
 - One or More Associated Events Not Recorded: If a single event is recorded, this parameter will indicate whether one or more associated events, prior to the recorded event, was not recorded.
- If two associated events are recorded, this parameter for the first event will indicate whether one or more associated events,

prior to the first event, was not recorded.

If two associated events are recorded, this parameter, for the second event, will indicate whether one or more associated events, between the first and second events, was not recorded.

SDM Data Source:

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

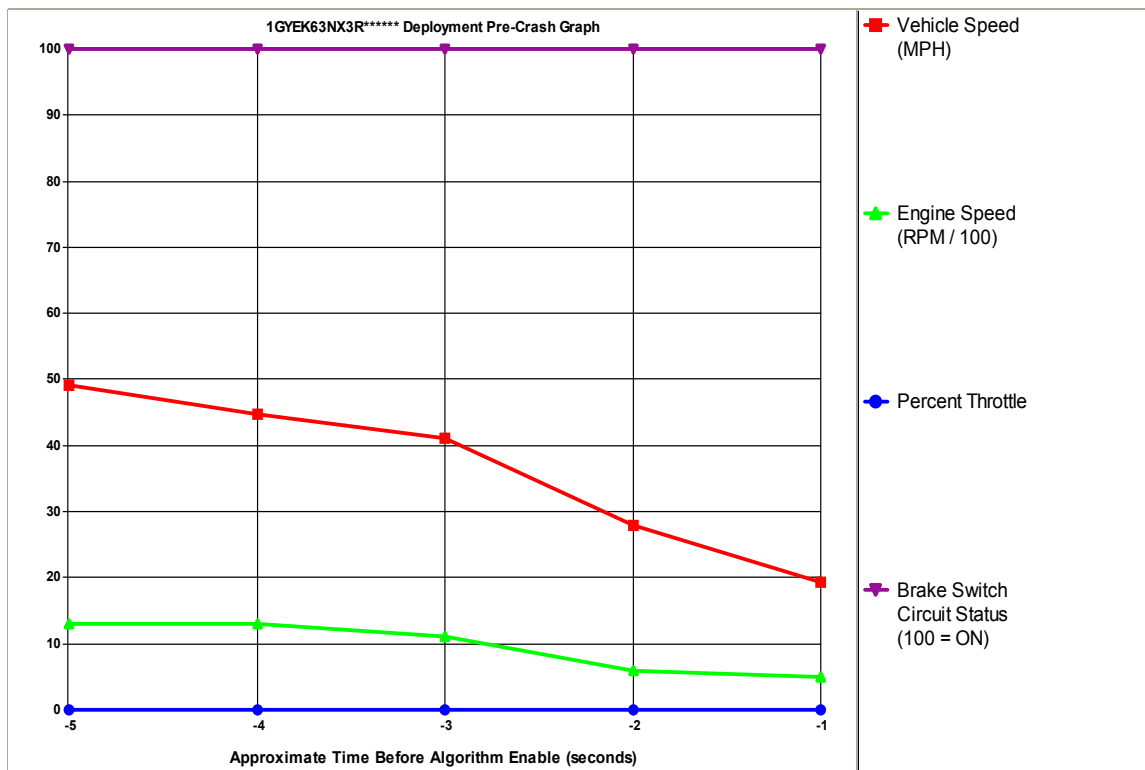
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted once a second by the Powertrain Control Module (PCM), via the vehicle's communication network, to the SDM.

-Brake Switch Circuit Status data is transmitted once a second by either the ABS module or the PCM, via the vehicle's communication network, to the SDM.

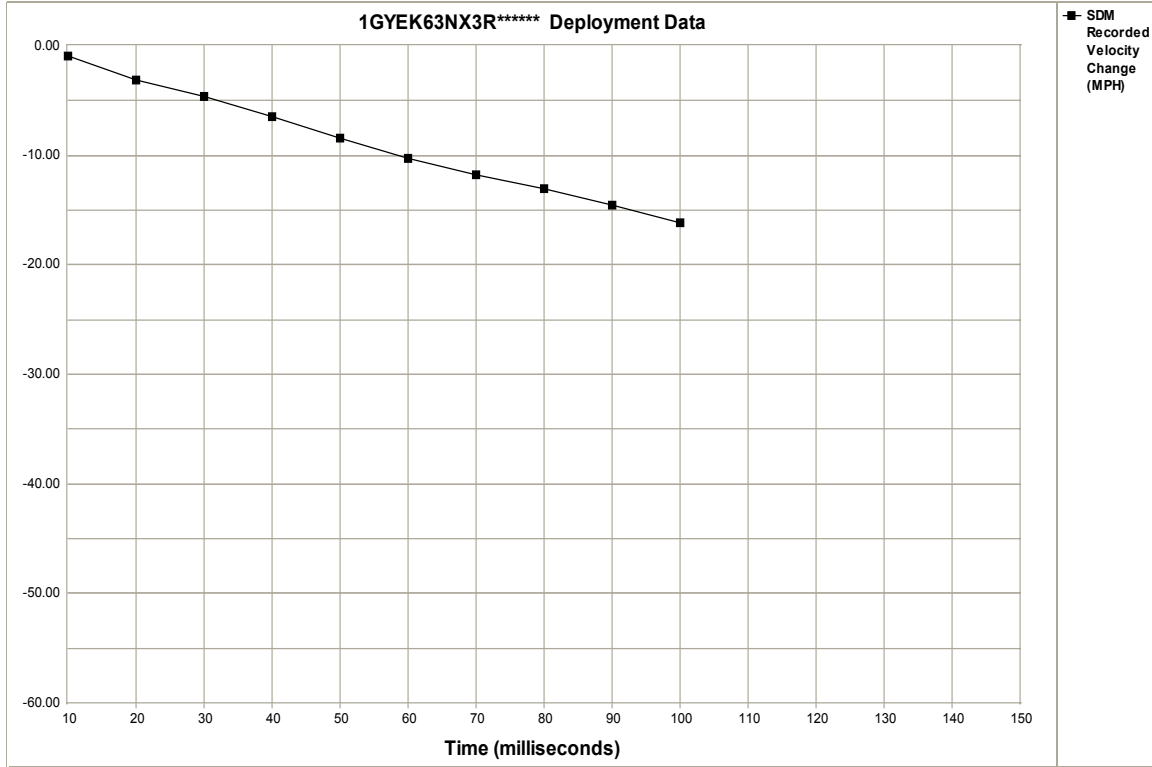
-The SDM may obtain Belt Switch Circuit Status data a number of different ways, depending on the vehicle architecture. Some switches are wired directly to the SDM, while others may obtain the data from various vehicle control modules, via the vehicle's communication network.

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger Seat Position Switch Circuit Status	Rearward
Ignition Cycles At Deployment	2758
Ignition Cycles At Investigation	2769
Maximum SDM Recorded Velocity Change (MPH)	-19.13
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	132.5
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	7.5
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	7.5
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	N/A
Time Between Non-Deployment And Deployment Events (sec)	N/A
Frontal Deployment Level Event Counter	1
Event Recording Complete	Yes
Multiple Events Associated With This Record	No
One Or More Associated Events Not Recorded	No



Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	49	1344	0	ON
-4	45	1280	0	ON
-3	41	1088	0	ON
-2	28	640	0	ON
-1	19	512	0	ON



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.93	-3.10	-4.65	-6.51	-8.37	-10.23	-11.78	-13.02	-14.57	-16.12	N/A	N/A	N/A	N/A	N/A

Hexadecimal Data

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

```
$01 F1 26 C4 F8 B0 F8
$02 F1 F1 3C 3C A8 00
$03 41 53 33 31 33 32
$04 4B 38 53 41 35 31
$05 30 47 32 53 39 32
$06 15 19 24 44 00 00
$07 31 03 31 56 00 00
$08 41 44 75 06 56 31
$09 30 4A 36 4D 38 33
$0A 41 44 75 06 56 31
$0B 30 4A 36 4D 38 30
$0C 41 55 75 08 56 31
$0D 26 30 39 50 43 45
$0E 41 55 75 08 56 31
$0F 26 30 39 51 34 50
$10 FE A5 FE 00 00 00
$11 80 7F 81 7F 7E 80
$12 95 00 00 3D 3E 00
$13 FF 02 00 00 00 00
$14 1D 1D 05 05 64 40
$15 FA FA FA FA FA FA
$16 FA FA FA FA FA FA
$17 FA FA 00 00 00 00
$18 00 3F 55 AC F1 00
$19 09 00 0A 00 00 64
$1A 00 00 00 00 00 00
$1B 00 00 00 00 00 00
$1C 00 0C 00 00 00 00
$1D 00 00 00 00 00 00
$1F FE 00 00 00 00 00
$20 FF FF FF FF FF FF
$21 FF FF FF FF FF FF
$22 FF FF FF FF FF FF
$23 FF FF FF FF FF FF
$24 FF FF FF FF FF FF
$25 FF FF FF FF FF FF
$26 FF FF FF FF FF FF
$27 FF FF FF FF FF FF
$28 FF FF FF FF FF FF
$29 FF FF FF FF FF FF
$2A FF FF FF FF FF FF
$2B FF FF FF FF FF FF
$2C FF FF FF FF FF FF
$2D FF FF 00 00 00 00
$30 B2 FE 00 00 FF FF
$31 FF FF FF FF FF FF
$32 FF FF FF FF FF FF
$33 FF FF FF FF FF FF
$34 00 00 03 07 03 03
$35 00 03 07 03 03 00
$36 00 00 00 00 00 00
$37 00 00 00 03 DA 5A
$38 35 03 62 31 00 00
$39 03 00 00 00 00 00
$3A 03 0A 0F 15 1B 21
$3B 26 2A 2F 34 00 00
$3C 00 00 00 0A FE A7
$3D C0 A5 00 00 00 00
$40 1F 2D 42 48 4F 00
$41 FC 00 00 00 00 00
$42 00 00 08 0A 11 14
$43 15 00 7D 80 00 00
```

\$44 FF FF FF FF FF FF
\$45 FF FF FF FF FF FF
\$46 FF FF FF FF FF FF
\$47 FF FF FF FF 00 00
\$48 FF FF FF FF FF FF
\$49 FF FF FF FF FF FF
\$4A FF FF FF FF FF FF
\$4B FF FF FF FF 00 00
\$4C FF FF FF FF FF FF
\$4D FF FF FF FF FF FF
\$4E FF FF FF FF FF FF
\$4F FF FF FF FF 00 00
\$50 FF FF FF FF FF FF
\$51 FF FF FF FF FF FF
\$52 FF FF FF FF FF FF
\$53 FF FF FF FF FF FF
\$54 FF FF FF FF FF FF