TRANSPORTATION SCIENCES
CRASH DATA RESEARCH CENTER

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ON-SITE SIDE IMPACT OCCUPANT PROTECTION INVESTIGATION

VEHICLE: 1999 AUDI A6

CASE NO: CA02-023

LOCATION: PENNSYLVANIA

CRASH DATE: JUNE 2002

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.

TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract This investigation focused on the side impact occupant protection of a 1999 Audi A6 involved in a left side impact with a 2001 Chevrolet Tahoe police unit. The Audi was equipped with a redesigned driver air bag, a dual-stage front right passenger air bag, and seat mounted side impact air bags for the front occupants. The left side impact air bag deployed as a result of an angular crash configuration. The Chevrolet was equipped with a SRS that consisted of frontal air bags for the driver and front passenger and side impact air bags mounted in the front seat backs. The air bags in the Chevrolet did not deploy in the below threshold crash. The male driver of the Audi suffered a nasal fracture and other minor injuries as a result of the impact. The driver of the Chevrolet had a complaint of chest pain. Both drivers were transported to a local hospital, treated and released.			
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GENERAL DYNAMICS CASE NO: CA02-023

VEHICLE: 1999 AUDI A6
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BACKGROUND

This investigation focused on the side impact occupant protection of a 1999 Audi A6, **Figure 1**, involved in a left side impact with a 2001 Chevrolet Tahoe police unit. The Audi was equipped with a redesigned driver air bag, a dual-stage front right passenger air bag, and seat mounted side impact air bags for the front occupants. The left side impact air bag deployed as a result of an angular crash configuration. The Chevrolet was equipped with a SRS that consisted of frontal air bags for the driver and front passenger and side impact air bags mounted in the front seat backs. The air bags in the Chevrolet did not deploy in the below threshold crash. The male driver of the Audi suffered a nasal fracture and other minor injuries as a result of the impact. The driver of the Chevrolet had a complaint of chest pain. Both drivers were transported to a local hospital, treated and released.

Figure 1: Left side view of the Audi.

This crash was reported to the Crash Investigations Division of the National Highway Traffic Safety Administration by the local investigating police officer. NHTSA in-turn assigned an on-site crash investigation to the General Dynamics Special Crash Investigations team. Cooperation with the local authorities was established and the vehicles were impounded pending the SCI on-site investigation. The Chevrolet Tahoe was equipped with an Event Data Recorder (EDR) that was downloaded as a supplement to the crash investigation. A non-deployment event related to the subject crash was recovered.

SUMMARY

Crash Site

This two-vehicle crash occurred the evening hours of June 2002. At the time of the crash, it was daylight and the weather was not a factor. The crash occurred on a two lane, north/south road at the three-leg intersection with a two lane east/west road in a suburban residential setting. The east/west road intersected the primary north/south road from the east. A stop sign for the westbound traffic controlled the intersection. The primary road measured 11.1 m (36.5 ft) wide, had a double yellow centerline and was bordered by 15 cm (6 in) barrier curbs. Residential lawns boarded the east road edge. The posted speed limit was 56 km/h (35 mph). **Figure 2** is a southbound view of the vehicles at final rest taken during the on-scene police investigation.

Figure 2: Southward view through the intersection toward the final rest positions of the vehicles.

Crash Sequence

Pre-Crash

The 1999 Audi A6 was southbound driven by a 46 year old restrained male. The 2001 Chevrolet Tahoe police unit was southbound behind the Audi operated by a 56 year old restrained male police officer. The officer was responding to a reported domestic disturbance in another area of the police jurisdiction. The Chevrolet Tahoe was operating under lights and siren and was overtaking the Audi at a higher rate of speed. As the vehicles approached the three-leg intersection, the 1999 Audi A6 slowed, signaled for a left turn, and initiated a left turn onto the intersecting road. Coincident to this maneuver, the Chevrolet Tahoe initiated a lane change to the left, in order to pass the slower vehicle. The EDR recorded a non-deployment event related to this crash and that data was downloaded during the police investigation. The pre-crash EDR data indicated the Tahoe accelerated to a maximum speed of 101 km/h (63 mph) three seconds (T-3) prior to Algorithm Enable (AE). The EDR data further indicated that the Tahoe's brakes were applied two seconds (T-2) prior to AE and the vehicle was decelerating.

Crash

The crash occurred with the front right aspect of the Chevrolet impacting the left side plane of the Audi in a 12/7 o'clock impact configuration. The force of the impact deployed the left side occupant protection of the Audi. The Chevrolet's engagement with the Audi began on the mid-aspect of the Audi's left front door and continued forward into the area of the left A-pillar. The impact of the Chevrolet forward of the Audi's center of gravity caused the Audi to rotate clockwise to a southerly heading. The vehicles contacted a second time in a side-slap configuration. The area of initial impact was identified by the initiation of a pavement rim gouge documented during the SCI scene inspection. The rim gouge was attributed to the left front wheel of the Audi.

The Chevrolet Tahoe traveled through the mouth of the intersection and ran off the road to the southeast. The Chevrolet came to rest in the yard of a private residence facing southward approximately 20 m (65 ft) from the point of impact. The Audi continued south southeastward, mounted the curb and came to rest approximately 21 m (70 ft) from the point of impact, in-close proximity to the Chevrolet. Inspection of the crash scene identified post-crash tires marks attributed to both vehicles and identified their respective trajectories to final rest. **Figure 13,** Page 11, is a schematic of the crash sequence.

Post-Crash

The police and ambulance personnel responded to the crash. The driver of the Audi exited the vehicle through the front right door and was ambulatory at the scene. Reportedly, he sustained a nasal fracture, minor abrasions and superficial lacerations to his left arm and a left ankle sprain. The driver of the Chevrolet exited his vehicle and subsequent lay down on the grass with a feeling of weakness. He reported a complaint of chest pain to the responding medical technicians. Both occupants were transported to a local hospital, treated, and released.

VEHICLE DATA

1999 Audi A6

The 1999 Audi A6, **Figure 3**, was identified by the Vehicle Identification Number (VIN): WAUBA24B4XN (production sequence deleted). The 4-door sedan was equipped with a 2.8 liter/V6 engine linked to a 5-speed automatic transmission. The manual restraint system consisted of 3-point lap and shoulder belts for the five seat positions. The manual restraints for the front occupants were equipped with retractor pretensioners. The vehicle was equipped with a Supplemental Restraint System (SRS) that consisted of a redesigned driver air bag, a dual-stage front right passenger air bag, and seat mounted side impact air bags for the front occupant positions. The odometer read 62,722 km (38,795 miles) at the time of the inspection. The Audi was equipped with Michelin MXV4 P205/55R16 tires on OEM alloy wheels. The manufacturer's recommended tire pressure was 221 kpa (32 psi). The specific measured tire data was as follows:

Figure 3: Front view of the Audi A6.

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	0 kpa	5.6 mm (7/32)	No	Sidewall cut/ Debeaded
LR	213.8 kpa (31.0 psi)	6.4 mm (8/32)	No	None
RF	196.5 kpa (28.5 psi)	6.5 mm (7/32)	No	None
RR	200.0 kpa (29.0 psi)	4.8 mm (6/32)	No	None

2001 Chevrolet Tahoe

The 2001 Chevrolet Tahoe, **Figure 4**, was identified by the Vehicle Identification Number (VIN): 1GNEC13V61J (production sequence deleted). The 4-door, 4x2 sport utility vehicle was configured as a police unit and was equipped with an aftermarket push bumper mounted to the OEM front bumper and forward frame. The power train consisted of a 4.8 liter/V8 engine linked to a 4-speed automatic transmission. The manual restraint system consisted of continuous loop 3-point lap and shoulder belts with sliding latch plates for the four outboard positions. The restraints for the front seated occupants were integrated into the front seat backs. The center rear position was lap belt equipped. The Supplemental Restraint System (SRS) consisted of redesigned air bags for the driver and front right passenger and seat mounted side impact air bags for the front seat occupants. The date of vehicle manufacture was March 2001. The electronic odometer could not be accessed at the time of the inspection due to the lack of electrical power. The Tahoe was equipped with Goodyear Conquest P245/75R16 tires on OEM alloy wheels. The manufacturer's recommended tire pressure was 241 kpa (35 psi). The specific measured tire data was as follows:

Figure 4: Front view of the Chevrolet Tahoe.

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	231.0 kpa (34.5 psi)	7.9 mm (10/32)	No	None
LR	231.0 kpa (34.5 psi)	6.4 mm (8/32)	No	None
RF	231.0 kpa (33.5 psi)	8.7 mm (11/32)	Yes	None
RR	231.0 kpa (33.0 psi)	5.6 mm (7/32)	No	None

VEHICLE DAMAGE

1999 Audi A6

Exterior Damage

The left side of the Audi sustained two separate regions of contact damage as a result of the impact and subsequent side slap with the Chevrolet Tahoe. **Figures 5 and 6** are a left rear view and an overhead view of the damaged vehicle. The initial impact with the Chevrolet resulted in a combined length of direct contact and induced damage that measured 198 cm (78 in). The direct contact damage began on the mid aspect of the left rear door, 86 cm (34 in) forward of the left rear axle and extended forward 150 cm (59 in) to the left A-pillar location. Direct contact extended vertically 20 cm (8 in) above the belt line. The induced damage extended forward of the left A-pillar onto the left front fender and ended 14.0 cm (5.5 in) forward of the left front axle. The impact force in the 7 o'clock sector separated the trailing edge of the left front fender from the body of the vehicle. The fender was displaced laterally outboard with respect to the

vehicle. The crush profile at the mid door elevation was as follows: C1 = 0, C2 = 5.0 cm (2.0 in), C3 = 9.1 cm (3.6 in), C4 = 29.2 cm (11.5 in), C5 = 36.3 cm (14.3 in), C6 = 15.2 cm (6.0 in). The left aspect of the windshield was fractured and left front window glazing had disintegrated as a result of the exterior crash forces. The left front door was jammed shut by the deformation. The left rear door was restricted by the B-pillar deformation. There was no change in the wheelbase dimensions. The delta V calculated by the Damage Algorithm of the WINSMASH model was 23.0 km/h (14.3 mph). The longitudinal and lateral delta V components were 17.6 km/h (10.9 mph) and 14.8 km/h (9.2 mph), respectively. The Collision Deformation Classification (CDC) was 07-LYAW-2.

The left rear quarterpanel sustained 96.5 cm (38.0 in) of direct contact damage as a result of the side slap impact. The direct contact began 16.5 cm (6.5 in) forward of the left rear axle and ended 31.5 rearward of the left rear axle. The maximum deformation within the contact pattern measured 6.3 cm (2.5 in). The CDC of this minor impact was 09-LBEW-1.

Figure 5: Left rear view of the Audi.

Figure 6: Overhead view of the left side damage.

Interior Damage

The interior vehicle damage to the 1999 Audi A6, **Figures 7 and 8**, was attributed to intrusion, and the deployment of the side impact air bag system. The forward aspect of the Audi's left front door sustained the highest magnitude of intrusion. The footwell intrusion measured 25 cm (10 in). The left B-pillar intrusion measured 3.8 cm (1.5 in). The intruding left door panel contacted the steering wheel rim and fractured the tilt mechanism due to the lateral displacement of the column. The lateral intrusion of the left A-pillar measured 10.7 cm (4.2 in) at the left aspect of the instrument panel.

A probable left upper extremity contact was identified on the upper center aspect of the front door interior trim panel. The trim was scuffed and fractured in the area of the contact. This contact measured 7.0 cm (2.8 in) in length. The center hub of the steering wheel exhibited blood evidence consistent with the driver's nasal fracture. There were no other identified occupant contacts.

Figure 7: View of the driver's interior.

Figure 8: View of the front left intrusion.

The seating system consisted of leather trimmed front bucket seats and a rear bench. The front bucket seats were six-way power adjustable seats. The seat's adjustment controls were located on the outboard aspect of the cushion. The driver seat controls were in contact with the deformed door panel and access to the seat controls was restricted by the deformation. The driver seat position measured 3.8 cm (1.5 in) forward of full rear with a 19.1 cm (7.5 in) total adjustment range. This position was estimated from comparison measurements on the front right bucket seat. The anti-submarine angle of the cushion measured 22 degrees and the seat back angle measured 45 degrees. The head restraint was in the full-down position. The horizontal distance from the center hub of the steering wheel to the driver seat back measured 74 cm (29 in) at an elevation of 43 cm (17 in) above the seat bight. It was possible (though unverified) that the dynamic contact between the intruding door panel and the seat controls (located on the outboard aspect of the seat) altered the seat back angle of the driver seat during the crash.

Manual Restraint System

The Audi's manual restraint system consisted of 3-point lap and shoulder belts for the five seat positions. The front restraints were equipped with continuous loop webbing, a sliding latch plate, an adjustable D-ring and an inertial locking retractor. The front right retractor was a switchable ELR/ALR retractor. The front retractors were equipped with pretensioners.

Upon inspection, the webbing of the driver's restraint (**Figure 11**) was exposed and the retractor was locked. The retractor was inoperable. It was probable the retractor was locked due to the left side deformation. The pretensioner was not designed to fire in this type of crash configuration. The D-ring was adjusted to a mid-position. Examination of the latch plate revealed evidence of historical use. Usage indicators were also identified on the frictional surface of the latch plate consisting of a full width abrasion to the plastic surface. A corresponding transfer was identified on a 5 cm (2 in) section of the webbing located at the latch plate with the restraint in the buckled condition, **Figure 12**. The webbing transfer began 71.6 cm (28.2 in) from the floor anchor. The inspection of the driver's belt system indicated he was restrained at the time of the crash.

Figure 9: View of the driver's restraint.

Figure 10: Close-up of the webbing transfer at the latch plate.

Side Impact Occupant Protection System

The 1999 Audi A6 was equipped with a Supplemental Restraint System that consisted of a redesigned driver air bag, a dual-stage front right passenger air bag and seat mounted side impact air bags for the front occupant positions. The left side impact air bag deployed as a result of the crash. The frontal air bags did not deploy.

The side impact air bag deployed from the outboard aspect of the seat back along a 38 cm (15 in) seam, **Figure 11**. The bag expanded forward and offered thorax protection to the driver. The deflated air bag was approximately rectangular in shape and measured 20 cm x 58 cm (8 in x 23 in), width by height, respectively. It was not tethered. The air bag was vented by an opening in the stitching on the center forward aspect of the bag. Several post-crash blood spatters were located on the bag's inboard surface. There was no direct evidence of occupant contact to the bag. The following manufacturer's data was embossed onto the air bag's fabric:

DU-29.0040	*PA6.6 + VMQ*
012020/21	*9642000001202*
060299	

Figure 11: View of the deployed side impact air bag.

2001 Chevrolet Tahoe

Exterior Inspection

The Chevrolet sustained 87.6 cm (34.5 in) of direct contact damage began 7.6 cm (3.0 in) left of center and extended to the right corner of the front bumper. The combined direct and induced damage to the frontal plane that extended across the entire 160 cm (63 in) frontal end width of the vehicle. The direct contact pattern wrapped 175 cm (69 in) onto the right front fender due to the clockwise rotation of the Audi. The frontal impact damaged the OEM front bumper, aftermarket push bumper, grille, right headlamp assembly, hood and right front fender. An insurance repair estimate indicated the frame was deformed and would have to be replaced. The rearward shift of the hood and right front fender fractured the lower right aspect of the windshield. The operation of the right front door was restricted by the deformed front fender. The right wheelbase was foreshortened 10.7 cm (4.2 in). The crush profile measured along the front bumper was as follows: C1 = 1.3 cm (0.5 in), C2 = 4.6 cm (1.8 in), C3 = 9.9 cm (3.9 in), C4 = 12.4 cm (4.9 in), C5 = 11.4 cm (4.5 in), C6 = 21.3 cm (8.4 in). **Figure 12** is a right lateral view across the front plane. The delta V calculated by the Damage Algorithm of the WINSMASH model was 14.0 km/h (8.7 mph). The longitudinal and lateral delta V components were -13.8 km/h (-8.6 mph) and -2.4 km/h (-1.5 mph), respectively. The Collision Deformation Classification (CDC) was 12-FZEW-2.

Figure 12: Right lateral view of the Tahoe.

The right side of the Chevrolet sustained minor buckling and abrasions in the region of the right rear door as a result of the side slap. The length of the contact pattern measured 109 cm (43 in). The direct contact began 152 cm (60 in) forward of the right rear axle and extended rearward to the trailing edge of the right rear door. The maximum lateral deformation measured 5 cm (2 in). The CDC of this minor impact was 03-RPEW-1.

Interior Inspection

The interior damage of the Tahoe consisted of minor occupant contacts to the knee bolster. There was no intrusion or interior damage related to the exterior forces of the crash. A 3.8 cm (1.5 in) scuff consistent with contact from the left lower extremity was located 18 cm (7 in) left of the steering column centerline and 43 cm (17 in) above the floor. A scuff attributed to the right lower extremity was located on the inboard aspect of the bolster, 30.0 cm (11.8 in) right of steering column centerline and 48 cm (19 in) above the floor. No other occupant contacts were identified. The driver seat was located in a full rear track position.

The manual restraint system in the front of the Chevrolet Tahoe consisted of integrated 3-point lap and shoulder belts incorporated into the seat backs of the driver and front right seat. The 175 cm (69 in) section of the driver's webbing was exposed and the retractor was locked and inoperable upon inspection. The webbing was gathered in the plastic belt guide attached to the

upper outboard aspect of the seat. An 8 cm (3 in) abrasion was located on the webbing in the area of the latch plate in the buckled condition and occurred due to friction at the belt guide of the latch plate. All the evidence observed during the course of the inspection indicated the driver was restrained at the time of the crash.

Supplemental Restraint System

The Chevrolet was equipped with a Supplemental Restraint System (SRS) that consisted of redesigned air bags for the driver and front right passenger and seat mounted side air bags for the front occupants. The air bags did not deploy in the crash. The SRS was controlled by a Sensing and Diagnostic control Module (SDM) that also had the capabilities of recording crash event data. The SDM was located under the driver's seat and had been removed prior to the SCI inspection by auto repair technicians under the direction of the local police department. The local department was equipped with a Vetronix Crash Data Retrieval (CDR) kit and had downloaded the crash event data after its removal.

EDR Data

The downloaded EDR data is attached to the end of this narrative report. The data stored within the SDM indicated a "Near Deployment Event" consistent with the subject crash occurred at Ignition Cycle 6777. The Ignition Cycle count at the time of the download was 6783. The police officer driver accelerated the vehicle to a maximum speed of 63 mph (at T-3). The driver reported he was attempting to pass the Audi on the left, as the Audi initiated its left turn. The Chevrolet driver responded to the Audi's turn by steering left and applying the brakes (at T-2). It was probable the crash occurred between T-2 and T-1 as indicated by the magnitude of the change in vehicle during that time interval. A speed change of 56 km/h (35 mph) during that one second time interval (T-2 to T-1) was unrealistic based on braking alone. A speed reconstruction of the crash using the WINSMASH Collision Model and by Conservation of Momentum methods determined the impact speed of the Chevrolet was approximately 56 to 64 km/h (35 to 40 mph). The maximum SDM recorded velocity change was -0.51 km/h (-0.32 mph). This value was not consistent with the frontal damage of the Tahoe. It was possible that the recorded delta V data was related to the side slap impact.

OCCUPANT DEMOGRAPHICS

	1999 Audi A6 Driver	***2001 Chevrolet Tahoe Driver***
Age/Sex:	46 year old/Male	56 year old/Male
Height:	Unknown	Unknown
Weight:	Unknown	Unknown
Seat Position:	Middle to rear track	Rear track
Manual Restraint Use:	3-pt lap and shoulder	3-pt. lap and shoulder
Usage Source:	SCI inspection	SCI inspection
Medical Treatment:	Treated and released	Treated and released

DRIVER INJURY
1999 Audi A6

Injury	*Injury Severity (AIS 98 Update)*	*Injury Mechanism*
Nasal fracture, NFS	Minor (251000.1,4)	Center hub of the steering wheel
Superficial left arm abrasion and laceration	Minor (790202.1,2) (790600.1,2)	Disintegrated left front glazing
Left ankle sprain	Minor (850206.1,2)	Foot well intrusion

Note: the above injuries were identified in the driver's Emergency room records

1999 AUDI A6 DRIVER KINEMATICS

The 46 year old restrained driver of the Audi was seated in a middle to rear track position with a presumed normal posture. The driver was in the process of slowing the vehicle and initiating a left turn at the time of the crash. Upon impact with the 2001 Chevrolet Tahoe, the side impact air bag deployed from the seat back. The driver initiated a rearward and leftward trajectory in response to the 7 o'clock direction of the impact and loaded the seat back. It was probable the driver also loaded the deployed left side impact air bag, although inspection of the air bag did not reveal any direct contact evidence. In the later stages of the crash sequence, the driver rebounded forward and into contact with the locked manual restraint system. The driver loaded the lap portion of the manual restraint with his lower extremities causing the frictional abrasions to the latch plate and the transfers to the webbing. The deceleration of the driver's torso upon contact with the locked seat belt caused his head to flex forward and down. The driver's nose contacted the center hub of the steering wheel resulting in fracture. The driver's left arm sustained minor lacerations and abrasions from the disintegrated left window glazing. The force of the crash caused the left door of the Audi to intrude into the driver's foot well resulting in the driver's left ankle sprain. The driver rebounded back into his seat and exited the vehicle through the front right door.

DRIVER INJURY
2001 Chevrolet Tahoe

Injury	*Injury Severity (AIS 98 Update)*	*Injury Mechanism*
Chest wall contusion, NFS	Minor (490402.1,9)	3-point lap and shoulder belt

Note: the above injuries were identified in the driver's Emergency room records

2001 CHEVROLET TAHOE DRIVER KINEMATICS

The 56 year old restrained driver of the Chevrolet was seated in a rear track position with an upright posture. Upon impact, the driver exhibited a forward trajectory in response to the 12 o'clock direction of the impact force. The driver loaded the manual restraint system with his chest and rode down the force of the crash. As a result, the driver sustained a chest wall contusion. He rebounded back into his seat and exited the vehicle under his own power.

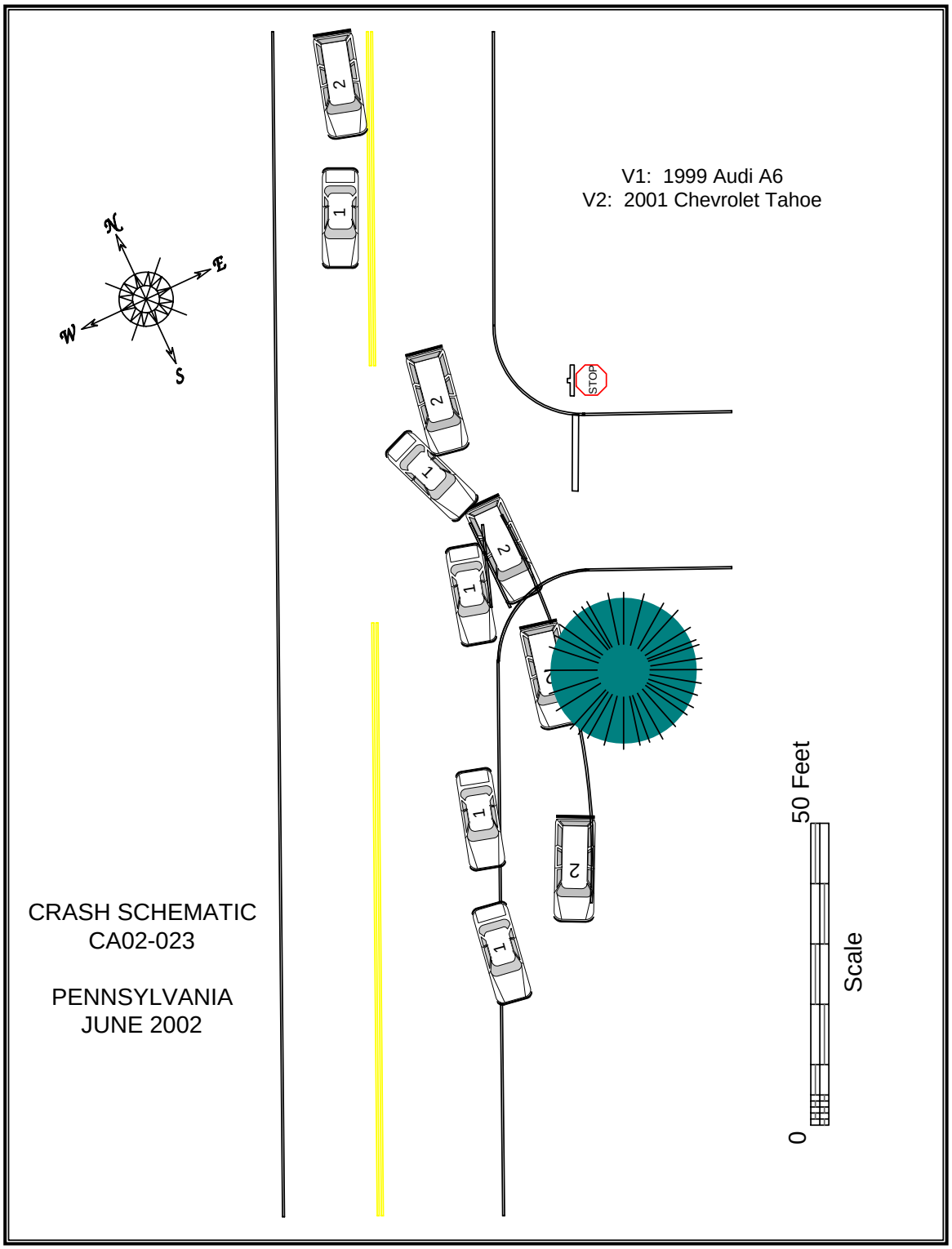


Figure 13: Crash Schematic

ATTACHMENT A

2001 Chevrolet Tahoe
EDR Data

CDR File Information

Vehicle Identification Number	1GNEC13V61Jxxxxxx
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	CA02-023 TAHOE.CDR
Saved on	06/11/2002 8:15:39 AM
Data check information	B15EEF73
Collected with CDR version	Crash Data Retrieval Tool 1.507
Collecting program verification number	6E4CCD5B
Reported with CDR version	Crash Data Retrieval Tool 2.24
Reporting program verification number	70CD83DD
Interface used to collected data	Block number: 00 Interface version: 2D Date: 05-14-02 Checksum: BC00
Event(s) recovered	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). 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 five seconds of one another. Deployment events can not 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 file will be locked after a deployment, if the non-deployment occurred within 5 seconds before the deployment or a deployment level event occurs within 5 seconds after the deployment.

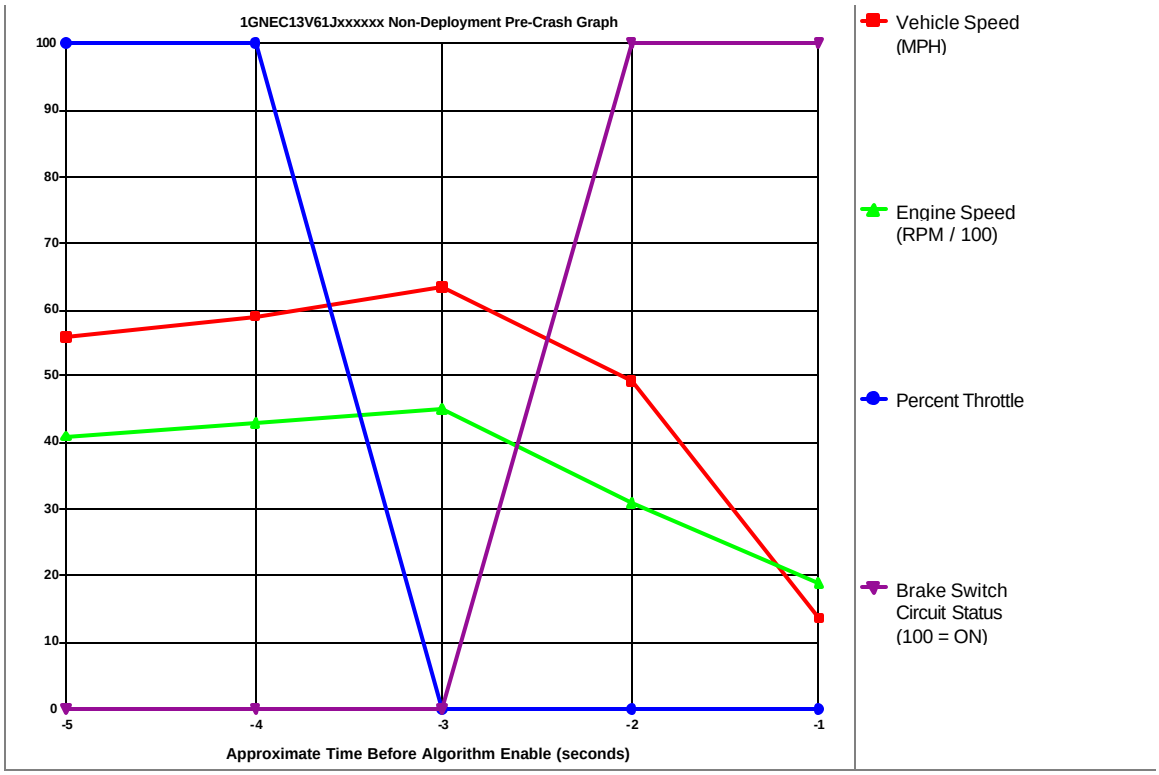
SDM Data Limitations:
-SDM Recorded Vehicle Forward Velocity Change is one of the measures used to make air bag deployment decisions. SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM 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 deployments, 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-deployments and deployment level events, the SDM will record the first 150 milliseconds of data after algorithm enable.
-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 does not receive a valid message.
-Driver's Belt Switch Circuit Status indicates the status of the driver's seat belt switch circuit
-Passenger Front Air Bag Suppression Switch Circuit Status indicates the status of the suppression 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.

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 Class 2 data link, to the SDM.
-Brake Switch Circuit Status data is transmitted once a second by either the ABS module or the PCM, via the Class 2 data link, to the SDM. Depending on vehicle option content, the Brake Switch Circuit Status data may not be available.
-If the vehicle is a 2000 - 2002 Chevrolet Cavalier Z24 or a Pontiac Sunfire GT, with a manual transmission (RPO MM5) and a

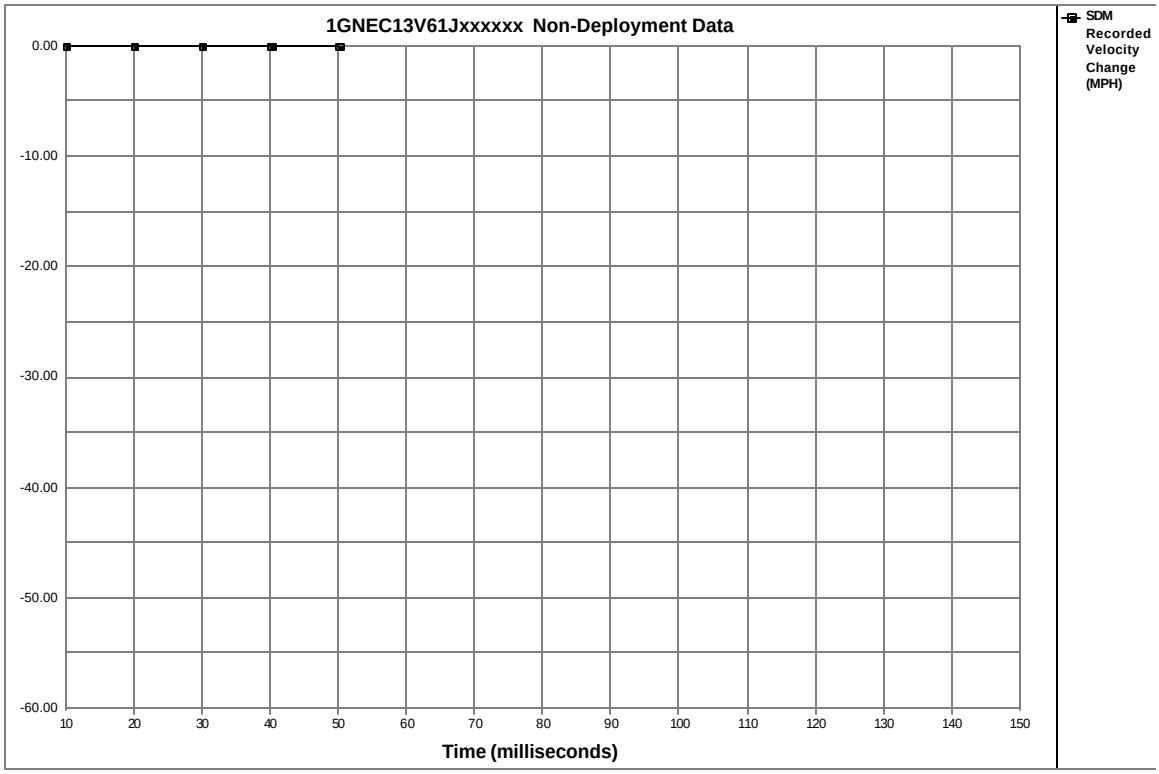
2.4L engine (RPO LD9), the Brake Switch Circuit Status data will be reported in the opposite state than what actually occurred, e.g. an actual brake switch status of "ON" will be reported as "OFF".
-In most vehicles, the Driver's Belt Switch Circuit is wired directly to the SDM. In some vehicles, the Driver's Belt Switch Circuit Status data is transmitted from the Body Control Module (BCM), via the Class 2 data link, to the SDM.
-The Passenger Front Air Bag Suppression Switch Circuit is wired directly to the SDM.

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Passenger Front Air Bag Suppression Switch Circuit Status	Air Bag Not Suppressed
Ignition Cycles At Non-Deployment	6777
Ignition Cycles At Investigation	6783
Maximum SDM Recorded Velocity Change (MPH)	-0.32
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	17.5



Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	56	4096	100	OFF
-4	59	4288	100	OFF
-3	63	4480	0	OFF
-2	49	3072	0	ON
-1	14	1856	0	ON



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
SDM Recorded Velocity Change	0.00	0.00	0.00	0.00	0.00	N/A	N/A	N/A	N/A	N/A	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  08 23 2C 2C
$02  AB A9
$03  41 53 31 30 38 30
$04  4B 31 4B 52 37 33
$05  00
$06  15 07 13 91
$10  FC B0 80
$11  A4 A6 A7 FF AD 00
$14  0F C4 34 A0
$18  7F 7E 7F 82 81 84
$1C  FA FA FA FA FA FA
$1D  FA FA FA FA FA FA
$1E  FA FA
$1F  FF 02 00 00 00
$20  A0 00 00 FF 7D 80
$21  FF FF FF FF FF FF
$22  FF FF FF FF FF FF
$23  FF 00 00 17 01 00
$24  00 00 00 00 FF FF
$25  FF FF FF FF FF FF
$26  FF FF 05 16 4F 66
$27  5F 5A 00 C0 00 00
$28  00 00 FF FF 00 1D
$29  30 46 43 40 00 FC
$2A  B0 FE FE 00 34 00
$2B  02 00 32 00 00 00
$2C  00 32 00 00
$2D  07 06 03 00
$30  FF FF FF FF FF FF
$31  FF FF FF FF FF FF
$32  FF FF FF FF FF FF
$33  FF FF FF FF FF FF
$34  FF FF FF FF FF FF
$35  FF FF FF FF FF FF
$36  FF FF FF FF FF FF
$37  FF FF FF FF FF FF
$38  FF FF FF FF FF FF
$39  FF FF FF FF FF FF
$3A  FF FF FF FF FF FF
$3B  FF FF FF
$3C  FF FF FF FF
$40  FF FF FF FF FF FF
$41  FF FF FF FF FF FF
$42  FF FF FF FF FF FF
$43  FF
```