CRASH DATA RESEARCH CENTER

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

CASE NO: CA05-011

VEHICLE: 2004 CHEVROLET SUBURBAN

LOCATION: VIRGINIA

CRASH DATE: DECEMBER 2004

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 performance of the Certified Advanced 208-Compliant safety system in a 2004 Chevrolet Suburban and the resulting injury sources for its occupants. The manufacturer of this vehicle has certified that this 2004 Chevrolet Suburban meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Suburban was operated by a restrained 50-year-old male driver and was also occupied by an 11-year-old female restrained front right passenger. The driver of the Suburban was operating the vehicle in a southbound direction on a two-lane state roadway on approach to a T-intersection of a local roadway. An 83-year-old male driver of a 1990 Buick Century was operating the vehicle in a northbound direction on the same roadway, approaching a non-contact vehicle (NCV) that was stopped in the northbound lane of the intersection, waiting to initiate a left turn. The driver of the Buick Century steered left to avoid a collision with the NCV and traveled across the centerline into the southbound lane into the path of the oncoming Suburban. The front of the Suburban struck the front of the Century, and the impact was sufficient to command a dual-stage frontal air bag deployment for both frontal seating positions of the Suburban. The impact redirected the Century rearward and counterclockwise (CCW) as the Suburban continued in a forward direction. Both vehicles came to rest on the southwest corner of the intersection. The driver of the Suburban sustained minor severity injuries and was transported to a local hospital. The 11-year-old female front right occupant sustained multiple fractures to her right leg and two fractured wrists and was transported to a local hospital. The driver of the Buick was fatally injured as a result of the crash.			
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CASE NO.: CA05-011
LOCATION: STATE OF VIRGINIA
VEHICLE: 2004 CHEVROLET SUBURBAN
CRASH DATE: DECEMBER 2004

BACKGROUND

Figure 1. Damaged 2004 Chevrolet Suburban

This investigation focused on the performance of the Certified Advanced 208-Compliant safety system in a 2004 Chevrolet Suburban and the resulting injury sources for its occupants. The manufacturer of this vehicle has certified that this 2004 Chevrolet Suburban meets the advanced air bag requirements of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Suburban **(Figure 1)** was operated by a restrained 50-year-old male driver and was also occupied by an 11-year-old female restrained front right passenger. The driver of the Suburban was operating the vehicle in a southbound direction on a two-lane state roadway on approach to a T-intersection of a local roadway. An 83-year-old male driver of a 1990 Buick Century was operating the vehicle in a northbound direction on the same roadway, approaching a non-contact vehicle (NCV) that was stopped in the northbound lane of the intersection, waiting to initiate a left turn. The driver of the Buick Century steered left to avoid a collision with the NCV and traveled across the centerline into the southbound lane into the path of the oncoming Suburban. The front of the Suburban struck the front of the Century, and the impact was sufficient to command a dual-stage frontal air bag deployment for both frontal seating positions of the Suburban. The impact redirected the Century rearward and counterclockwise (CCW) as the Suburban continued in a forward direction. Both vehicles came to rest on the southwest corner of the intersection. The driver of the Suburban sustained minor severity injuries and was transported to a local hospital. The 11-year-old female front right occupant sustained multiple fractures to her right leg and two fractured wrists and was transported to a local hospital. The driver of the Buick was fatally injured as a result of the crash.

This crash was identified from a list of claims provided by an insurance company to the National Highway Traffic Safety Administration (NHTSA) that identified Certified Advanced 208-Compliant vehicles that had been involved in crashes. The list was forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up investigation. The Chevrolet was located and cooperation was established with the salvage yard. An on-site investigation was assigned to the Calspan SCI team on February 10, 2005. The subject vehicle was inspected on February 15, 2005 and crash site inspection was performed on February 17, 2005. The Suburban's Event Data Recorder (EDR) was also downloaded during the SCI inspection. A phone interview was conducted with the driver of the Chevrolet; however, the driver failed to return medical releases

and the hospital refused hard-copy medical reports without signed authorizations. Permission could not be obtained to inspect the 1990 Buick Century.

SUMMARY

Vehicle Data – 2004 Chevrolet Suburban

The 2004 Chevrolet Suburban was identified by the Vehicle Identification Number (VIN): 1GNFK16Z74J (production sequence omitted). The vehicle was a four-door Sport Utility Vehicle (SUV) that was equipped with a 5.3 liter, V-8 flex-fuel engine, four-wheel-drive, a four-speed automatic transmission, four-wheel disc brakes with ABS, StabiliTrak, adjustable pedals, power steering, and a tilt steering wheel. The adjustable pedals were positioned near the full-rear position (with respect to the vehicle). The adjustable pedal travel varied for each pedal. The accelerator pedal was positioned 0.3 cm (1/8") forward of full rear, and the brake pedal was positioned 1.3 cm (1.5") forward of the full-rear position. The odometer could not be read at the time of the vehicle inspection as there was no power available to the vehicle and the electrical system was compromised. The Suburban was configured with alloy wheels and Bridgestone Dueler H/T P265/70R17 tires. The manufacturer's recommended tire pressure was 220 kPa (32 PSI). The specific tire information at the time of the SCI inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Damage
LF	0 kPa	10 mm (12/32")	Puncture in treat from contact with crushed bumper
LR	221 kPa (32.0 PSI)	10 mm (12/32")	None
RF	221 kPa (32.0 PSI)	10 mm (12/32")	None
RR	224 kPa (32.5 PSI)	10 mm (12/32")	None

The 2004 Chevrolet Suburban was configured with front bucket seats with adjustable head restraints. Both front head restraints were in the full-down position at the time of the vehicle inspection. Both front seats appeared to be in the full-rear position, although it was not known if they had been moved post-crash. The second row was configured with two bucket seats with adjustable head restraints. The head restraint was removed from the right seat prior to the vehicle inspection. The third row was configured with a removable bench seat with a folding back. The seat back was folded down at the time of the vehicle inspection.

Vehicle Data- 1990 Buick Century

The 1990 Buick Century was not available for inspection. The vehicle's VIN was listed on the police report as follows: 3G4AH54N8LS (production sequence omitted). The Buick Century was a four-door sedan that was originally equipped with a 3.3 liter, V-6 engine, power steering, and door-mounted automatic safety belts for the front seat positions.

Crash Site

This two-vehicle crash occurred in the state of Virginia in December 2004 at a T-intersection of a two-lane state roadway and a local roadway. The north/south state roadway was configured with one travel lane in each direction that were separated by a solid yellow centerline for

southbound traffic and a broken yellow centerline for northbound traffic. The roadway was straight and level at the crash site, and exhibited a southbound left curve beyond the crash site. At the time of the crash, the weather was clear and the asphalt roadway surface was dry. White fog lines on the outboard edges bordered the roadway, and the roadside generally consisted of grassy fields. The east/west local roadway intersected the state roadway on the west aspect, and traffic flow through the intersection was controlled by a stop sign for eastbound traffic. The posted speed limit for the state roadway was 72 km/h (45 mph). The scene schematic is included as **Figure 13** at the end of this narrative report.

Crash Sequence

Pre-Crash

The 50-year-old male driver of the Chevrolet Suburban was operating the vehicle in a southbound direction on the state roadway on approach to the 3-leg intersection **(Figure 2)**. The EDR output showed the Suburban was traveling at 87 km/h (54 mph) 5 seconds prior to impact. A non-contact vehicle was reported by police to have stopped in the northbound lane of the intersection and was waiting to initiate a left turn onto the local roadway. The 83-year-old driver of the Buick Century was operating the vehicle in a northbound direction and detected the stopped non-contact vehicle as the Century exited the right curve. The driver of the Buick Century steered left to avoid a collision with the stopped non-contact vehicle, crossed the centerline into the southbound lane **(Figure 3)**, and entered the intersection into the path of the oncoming Suburban. Based on the EDR output, the driver of the Suburban applied the brakes two seconds prior to impact.

Figure 2. Southbound approach for the Chevrolet Suburban

Figure 3. Northbound approach for the Buick Century

Crash

The front aspect of the Suburban struck the front aspect of the Buick Century. The principal direction of force (PDOF) for the Suburban was 350 degrees and the PDOF for the Century was estimated to be 0 degrees. The impact resulted in moderate damage to the Suburban, and was sufficient to command a dual-stage frontal air bag deployment in the Suburban. The EDR-recorded maximum SDM Recorded Velocity Change was 36 km/h (22.8 mph) for the Suburban and occurred 145 milliseconds after Algorithm Enable. The Missing Vehicle routine of the WinSMASH program calculated a total delta-V of 36 km/h (22.4 mph) and a barrier equivalent

speed of 36 km/h (22.4 mph), based on the frontal crush profile of the Suburban. The impact caused the Buick to rotate approximately 130 degrees in a counterclockwise (CCW) direction to final rest. The Suburban was deflected slightly to the right and continued in a tracking mode onto the roadside to final rest. Two gouges were present on the southwest roadside from the front undercarriage of the Suburban. The investigating police agency marked the final rest positions of both vehicles on the roadway surface at the time of the crash.

The EDR also recorded a Non-Deployment event 1 - 2 seconds after the Deployment Event. It was possible that a secondary impact occurred where the front of the Suburban struck the Century prior to the vehicles coming to final rest, although it is more likely that the Non-Deployment event was a continuation of the initial event. The EDR-recorded delta-V for the Non-Deployment was -1 km/h (-0.58 mph).

Post-Crash

It was not known how the occupants of the Suburban exited the vehicle. The driver sustained reported contusions on the head and the 11-year-old sustained a fractured right leg and fractures of both arms. The driver and front right passenger of the Suburban were both transported by ambulance to a hospital; the driver was treated and released while the front right passenger was admitted for three days. The 83-year-old male driver of the Buick Century was critically injured and was transported by ambulance to a medical facility where he expired.

Vehicle Damage

Exterior Damage – 2004 Chevrolet Suburban

The 2004 Chevrolet Suburban sustained moderate frontal damage as a result of the impact with the Buick Century **(Figure 4)**. The direct contact damage began on the front left bumper corner and extended 177 cm (69.5”) across the bumper to the front right corner. The maximum crush was located at C3, 14 cm (5.5”) left of the bumper centerline, and measured 43 cm (17”). Paint transfers and longitudinal abrasions were present on the entire width of the bumper. The entire bumper was crushed rearward and deflected 8 cm (3”) to the right. The forward aspect of the left frame rail penetrated the bumper and was deflected to the right. The front left aspect of the bumper was deflected downward. The combined direct and induced damage measured 172 cm (67.5”) across the entire front bumper. The frontal trim, grille, and headlamps above the bumper were separated from the vehicle. The hood and front fenders were also removed prior to the SCI inspection. The upper and lower radiator supports sustained induced damage and were deflected rearward and to the right. The frontal crush deflected the front axle rearward, which resulted

Figure 4. Frontal damage to the 2004 Chevrolet Suburban

Figure 5. Left side view

in a 10 cm (4”) reduction in the left wheelbase and a 7 cm (3”) reduction in the right wheelbase. The left front wheel was restricted against the damaged front bumper and the forward aspect of the left sill **(Figure 5)**. Minor buckling was present on the roof 15 cm (6”) forward of the left B-pillar centerline. The induced roof damage caused slight displacement of the sunroof. The right front door was displaced slightly from the frontal impact. The Collision Deformation Classification (CDC) for the frontal impact with the Buick Century was 12-FDEW-2. Six crush measurements were documented across the front bumper and were as follows: C1 = 35 cm (13.8 “), C2 = 34 cm (13.4”), C3 = 43 cm (16.9”), C4 = 34 cm (13.4”), C5 = 18 cm (7.1”), C6 = 18 cm (7.1”).

The left rear window was disintegrated at the time of the SCI inspection, however, there was no additional vehicle damage that was consistent to support a secondary left side impact.

Interior Damage – 2004 Chevrolet Suburban

The 2004 Chevrolet Suburban sustained moderate interior damage as a result of occupant contact. Both toe pans sustained minor longitudinal intrusion. The knee bolster was slightly displaced and the upper left instrument panel was partially separated on the outboard aspect. The steering column was compressed forward which resulted in a left shear capsule displacement of 4 cm (1.5”), and a right shear capsule displacement of 3 cm (1.3”). The front right seat cushion exhibited two linear scuffmarks **(Figure 6)**. The outboard scuffmark measured 19 cm (7.5”) in length and the inboard scuffmark measured 13 cm (5.1”) in length. Both scuff marks were oriented at an approximate 45-degree angle from longitudinal. The rear view mirror was displaced slightly CCW, and the inboard front right passenger’s visor anchor was partially separated. The vertical separation of the aft edge of the visor anchor measured 1 cm (0.4”). The laterally oriented handle above the front right passenger’s air bag module was bowed 3 cm (1.2”) upward at the center aspect, and rotated slightly forward from possible contact with the front right passenger’s arms **(Figure 7)**. The front right passenger’s air bag cover flap (immediately below the handle) sustained comparable bowing in the opposite direction at the same location. The HVAC air director located immediately to the left of the front right passenger’s air bag cover flap was deflected forward 3 cm (1.2”) within its frame.

Figure 6. Scuff marks on front right seat

Figure 7. Close-up of right instrument panel damage from probable occupant contact

Manual Restraints – 2004 Chevrolet Suburban

The 2004 Chevrolet Suburban was configured with manual integrated 3-point lap and shoulder belts for the front seats. The driver's safety belt was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). The driver's safety belt webbing sustained minor deformation as a result of occupant loading and the plastic-covered latch plate was abraded from engagement against the webbing. **Figure 8** shows a curvilinear fabric transfer that was present on the bottom plane of the shoulder belt, located 26 cm (10.3") above the latch plate position (located 65 cm (25.5") above the lower anchor). The transfer extended 7 cm (2.9") up the webbing. The front right passenger's safety belt **(Figure 9)** was configured with a sliding latch plate and a switchable Automatic Locking Retractor (ALR)/ELR. The safety belt webbing had been cut 74 cm (29.0") above the lower anchor. The remaining shoulder belt webbing measured 90 cm (38.5") from the integrated shoulder belt plastic trim. The shoulder belt had been used to secure the front right door post-crash. At the time of the SCI inspection, the retractor was restricted and the top aspect of the extended shoulder belt webbing was found gathered in the plastic trim. Due to the post-crash deformation of the safety belt webbing caused by securing the door, loading evidence could not be identified. The sliding latch plate cover sustained faint abrasions from loading.

Figure 8. Transfer on driver's safety belt

Figure 9. View of front right passenger's safety belt

The second row bucket seats were configured with manual 3-point lap and shoulder belts with sliding latch plates and switchable ELR/ALR retractors. The third row was configured with integrated 3-point lap and shoulder belts for the outboard positions with sliding latch plates and switchable ELR/ALR's. The third row center position was configured with a two-point lap belt with a locking latch plate.

Certified Advanced 208-Compliant Safety System

Frontal Air Bag System – 2004 Chevrolet Suburban

The 2004 Chevrolet Suburban was equipped with a Certified Advanced 208-Compliant safety system that included dual stage frontal air bags for the driver and front right passenger with a Passenger Sensing System. The driver's air bag deployed from the steering wheel hub through symmetrical I-configuration module cover flaps. Each cover flap measured 6 cm (2.5") in width and 12 cm (4.6") in height. The deployed driver's air bag measured 66 cm (26") in diameter in its deflated state **(Figure 10)**. There was no contact evidence present on the driver's air bag. The air bag was tethered by two internal straps that measured 13 cm (5.1") in width, and were located at the 3 and 9 o'clock positions. The driver's air bag was vented by two 3 cm (1.2") diameter circular ports that were located at the 11 and 1 o'clock positions, on the rear of the air bag.

Figure 10. Deployed driver's air bag

The front right passenger's air bag **(Figure 11)** deployed from a mid-mount module configured with a single rectangular vinyl cover flap hinged at the top aspect. The cover flap measured 39 cm (15.4") in width and 14 cm (5.5") in height. The cover flap was bowed from possible compression of the front right passenger's arm(s) between the opening cover flap and the lateral handle above the air bag module **(Figure 12)**. The deployed front right passenger's air bag measured 50 cm (19.7") in width and 56 cm (22.0") in height in its deflated state. The air bag was tethered by a full-width tether strap at the horizontal centerline. It was vented by two circular ports that measured 3 cm (1.2") in diameter, which were located at the 3 and 9 o'clock aspects of the side panels. There was no contact evidence present on the front right passenger's air bag.

Figure 11. Deployed front right passenger's air bag

Figure 12. View from lower instrument panel showing damaged cover flap and lateral handle

Occupant Sensing System – 2004 Chevrolet Suburban

The Certified Advanced 208-Compliant (CAC) safety system was configured with a weight sensor in the front right seat cushion. The system was designed to detect occupant presence and automatically suppress the front right passenger's air bag if it detected a weight consistent with a child seat, a booster seat, or a child sitting in the front seat, or it if determined that the front seat was not occupied. A light on rear view mirror confirmed the air bag on/off status. Since the front right seat was occupied and the safety belt buckle was engaged, the CAC system did not suppress the front right passenger's air bag. Both front seat positions were also equipped with seat track position sensors, which adjusted the air bag deployment level if the seat was in a forward track position.

Event Data Recorder – 2004 Chevrolet Suburban

The Chevrolet's EDR was downloaded by the SCI investigator and the EDR summary report is attached as **Attachment A** at the end of this narrative report. The system recorded a Deployment event as a result of the frontal impact with the Buick Century, and a Non-Deployment event as a result of probable continuation of the impact with the Buick Century. The time between the Deployment And Non-Deployment was approximately 1 - 2 seconds based on the pre-crash data from each record. The EDR reported the driver's belt switch circuit status as 'buckled', which was supported by the vehicle inspection. The EDR commanded a stage-2 deployment of the frontal air bag system at 12.5 milliseconds from the algorithm enable (AE).

Occupant Demographics

Driver

Age/Sex:	50-year-old/Male
Height:	178 cm (70")
Weight:	93 kg (205 lb)
Seat Track Position:	Full rear
Manual Restraint Use:	Integrated 3-point lap and shoulder belt
Usage Source:	Vehicle inspection, EDR
Eyewear:	None
Type of Medical Treatment:	Transported by ambulance to a hospital and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Left knee contusion	Minor (8900402.1,1)	Knee bolster
Bilateral contusions to lower legs	Minor (8900402.1,3)	Knee bolster
Bilateral lacerations to knees	Minor (890602.1,3)	Knee bolster
2 cm (0.8") tear to left shoulder muscle tendon	Minor (740200.1,1)	Shoulder restraint
Strained tendons in left thumb	Minor (750402.1,1)	Steering wheel rim
Strained tendons in right thumb and index finger	Minor (750402.1,2)	Steering wheel rim

Source: Driver interview.

Driver Kinematics

The 50-year-old male driver was seated in an upright attitude and was restrained by the integrated 3-point lap and shoulder belt. Based on the pre-crash EDR data, his foot was positioned on the brake pedal, as the brakes were applied prior to the impact. He was bracing with both hands against the steering wheel rim. At impact with the Buick Century, a dual-stage frontal air bag deployment resulted, and the driver initiated a forward trajectory and loaded the manual restraint. His loading of the safety belt system resulted in a 2 cm (0.8") muscle tendon tear of the left shoulder. The driver loaded the deployed driver's air bag. His loading force was transmitted through the air bag and into the energy absorbing steering column, evidenced by shear capsule separation. He sustained strained tendons to his right index finger and both thumbs by loading the steering wheel rim. The driver also loaded the knee bolster, evidenced by scuffmarks and panel separation. The driver sustained soft tissue injuries to both lower legs and his left knee from the bolster contact. He was transported by ambulance to a hospital for treatment and released.

Front Right Passenger

Age/Sex:	11-year-old/Female
Height:	150 cm (59")
Weight:	59 kg (150 lb)
Seat Track Position:	Full rear
Manual Restraint Use:	Integrated 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	None
Type of Medical Treatment:	Transported by ambulance to a hospital and admitted for three days

Front Right Occupant Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Fracture to left fibula (NFS)	Moderate (851605.2,1)	Right lower instrument panel
Fracture to left tibia (NFS)	Moderate (853404.2,1)	Right lower instrument panel
Fracture to left wrist (NFS)	Moderate (751800.2,1)	Air bag cover flap
Fracture to right wrist (NFS)	Moderate (751800.2,2)	Air bag cover flap
Laceration to lower left leg	Minor (890602.1,1)	Right lower instrument panel
Contusion to left shoulder	Minor (790402.1,1)	Shoulder belt
Contusion to sternum	Minor (450802.1,4)	Shoulder belt
Contusion to right hip	Minor (890402.1,2)	Lap belt

Source: Driver interview.

Front Right Passenger Kinematics

The 11-year-old female front right passenger was restrained by the integrated 3-point lap and shoulder belt. She extended her arms in an effort to brace when she detected the impending crash. At impact, the frontal air bag system deployed. Given that her arms were extended forward, they appear to have been captured between the air bag cover flap and the horizontal grab handle above the air bag module. This is supported by contact evidence and resultant fractures to both of her wrists. Her arms were probably displaced rearward and vertically as the air bag inflated. She initiated a forward trajectory and loaded the manual restraint and the deployed front right passenger's air bag. As she loaded the safety belt system, she sustained soft tissue injuries to her left shoulder, sternum, and right hip. Her left leg contacted the underside of the instrument panel resulting in tibia and fibula fractures approximately 13 cm (5.5") above her right ankle, accompanied by a laceration to her lower left leg. The 11-year-old was transported by ambulance to a hospital and admitted for three days for treatment of her injuries.

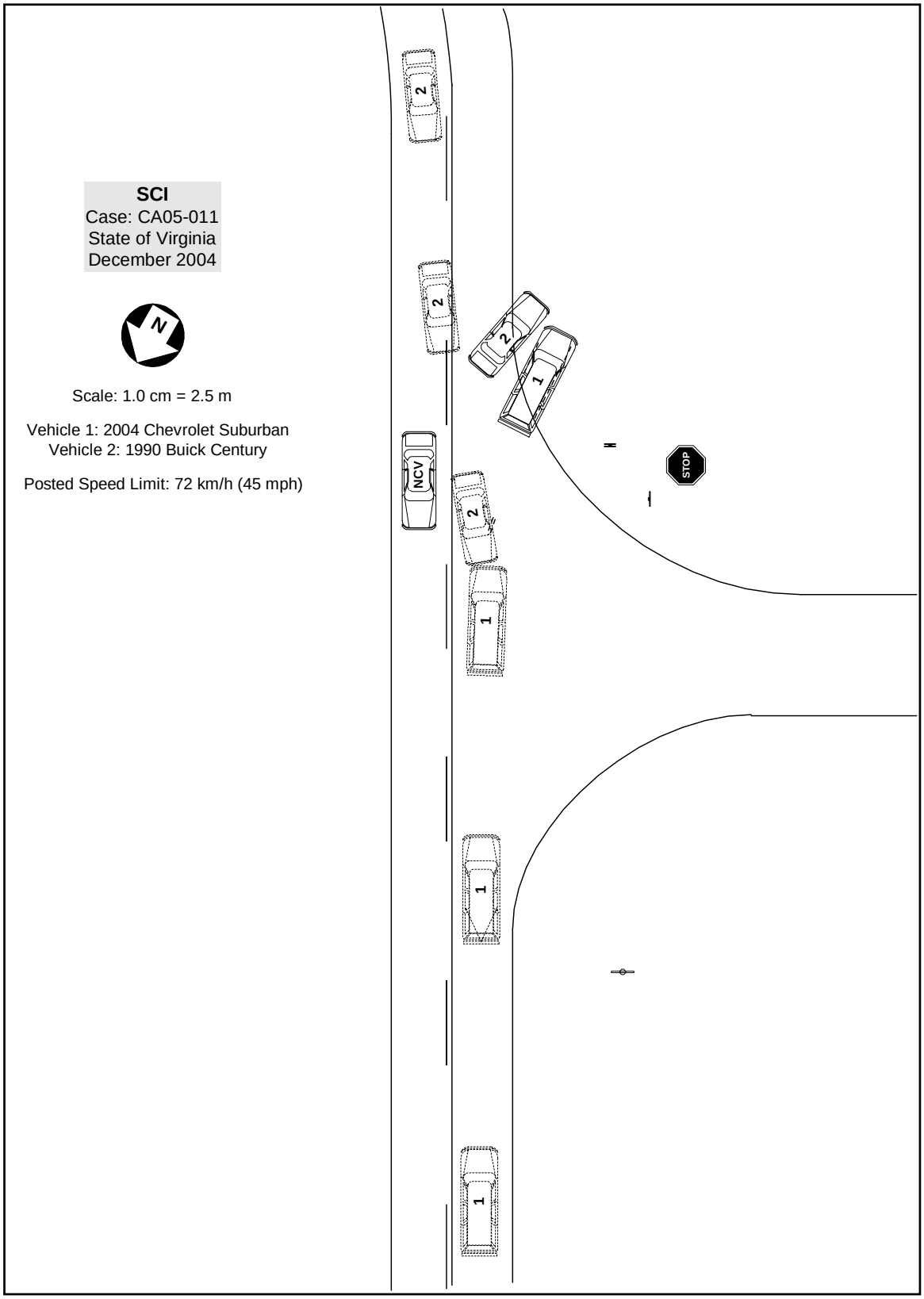


Figure 13. Scene schematic

ATTACHMENT A: 2004 CHEVROLET SUBURBAN EDR SUMMARY REPORT

CDR File Information

Vehicle Identification Number	1GNFK16Z74Jxxxxxx
Investigator	
Case Number	CA05-011
Investigation Date	February 2005
Crash Date	December 2004
Filename	CA05-011 VETRONIX.CDR
Saved on	February 2005
Data check information	3B8E5FD7
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	Deployment Non-Deployment

SDM Data Limitations

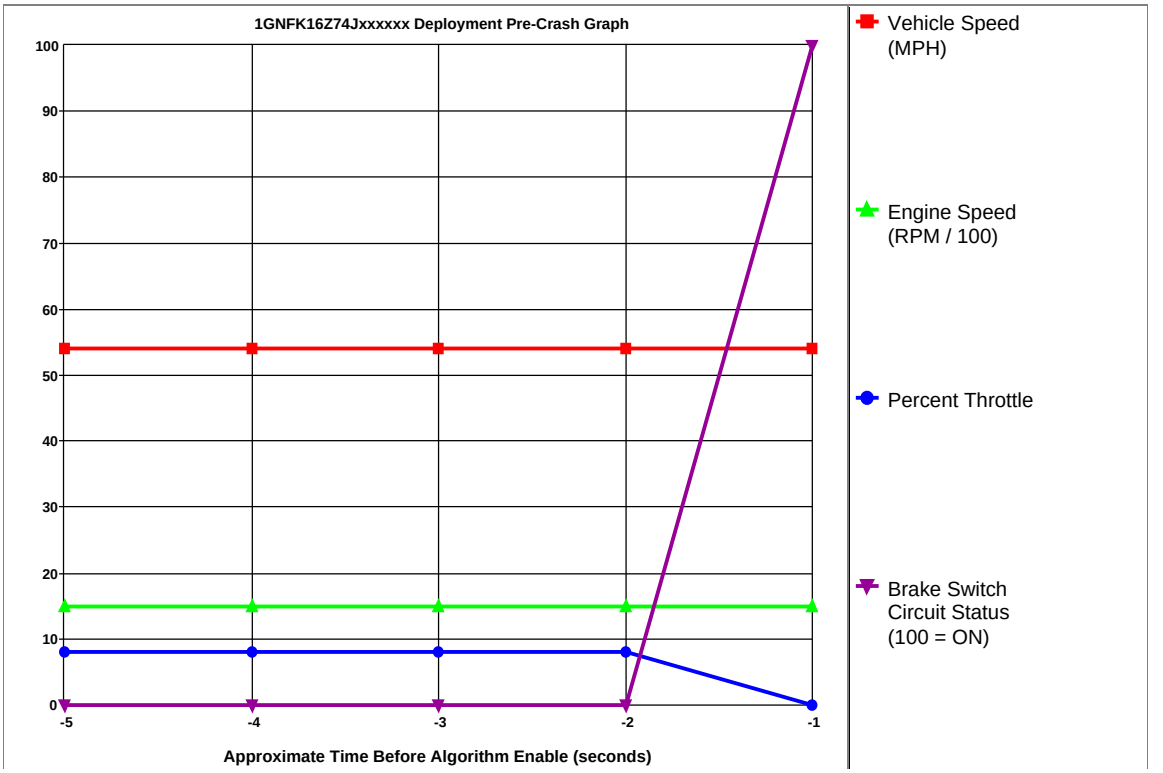
SDM Recorded Crash Events:
There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). It contains Pre-Crash and Crash data. The SDM can store 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 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 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 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 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-deployments, 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 does not receive a valid message.
-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 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.

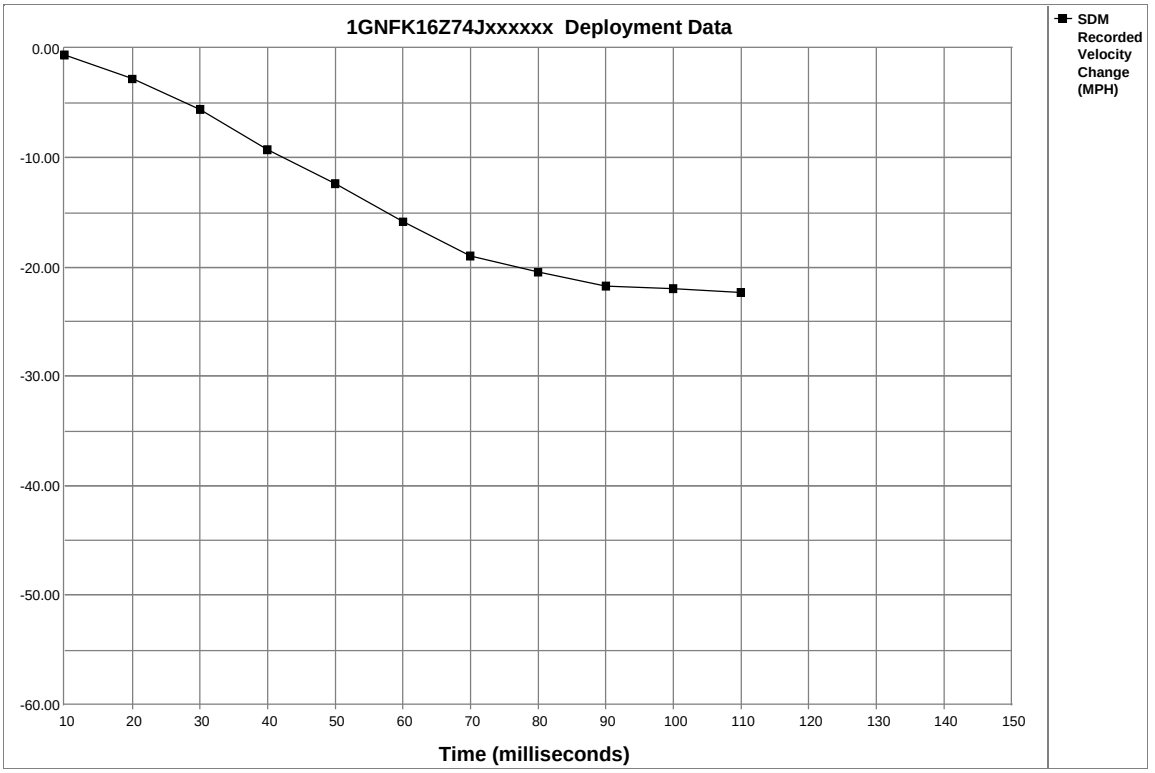
SDM Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted once a second by the Powertrain Control Module (PCM), via the Class 2 data link, to the SDM.
-Brake Switch Circuit Status data is transmitted once a second by either the ABS module or the PCM, via the Class 2 data link, to the SDM.
-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.

System Status At Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Deployment	318
Ignition Cycles At Investigation	321
Maximum SDM Recorded Velocity Change (MPH)	-22.76
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	145
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	10
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	12.5
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	10
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	12.5
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



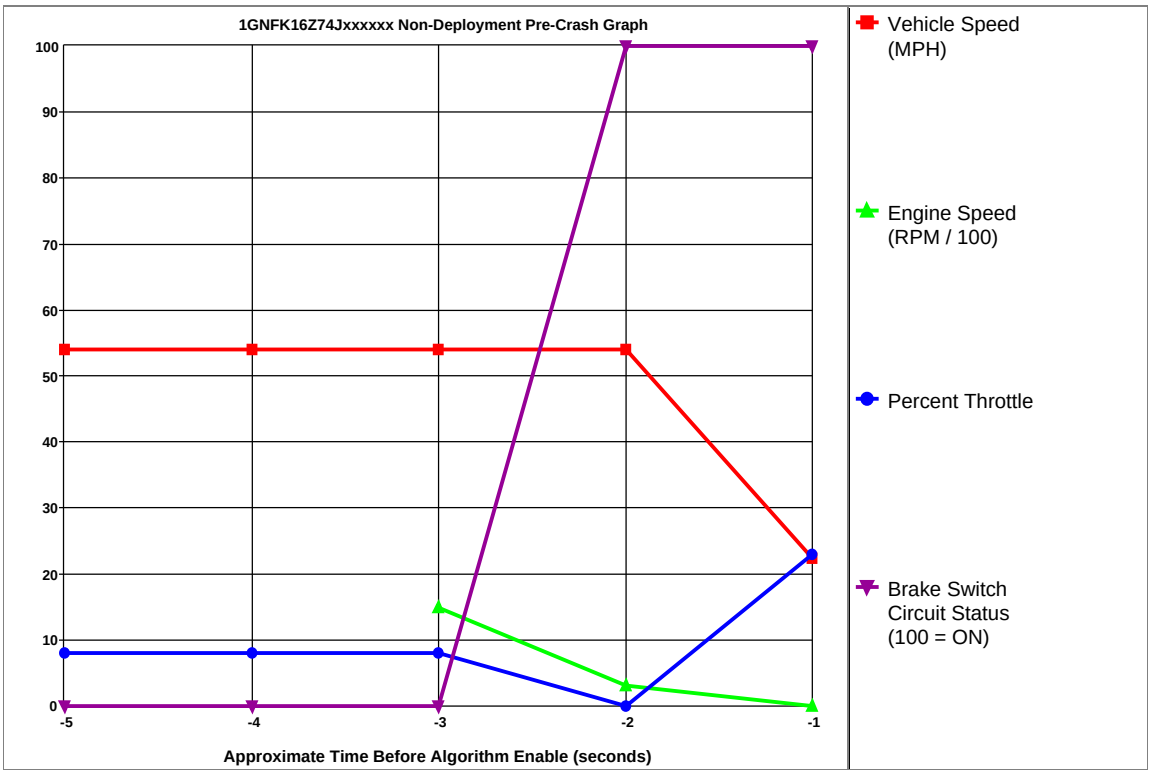
Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	54	1536	8	OFF
-4	54	1536	8	OFF
-3	54	1536	8	OFF
-2	54	1536	8	OFF
-1	54	1536	0	ON



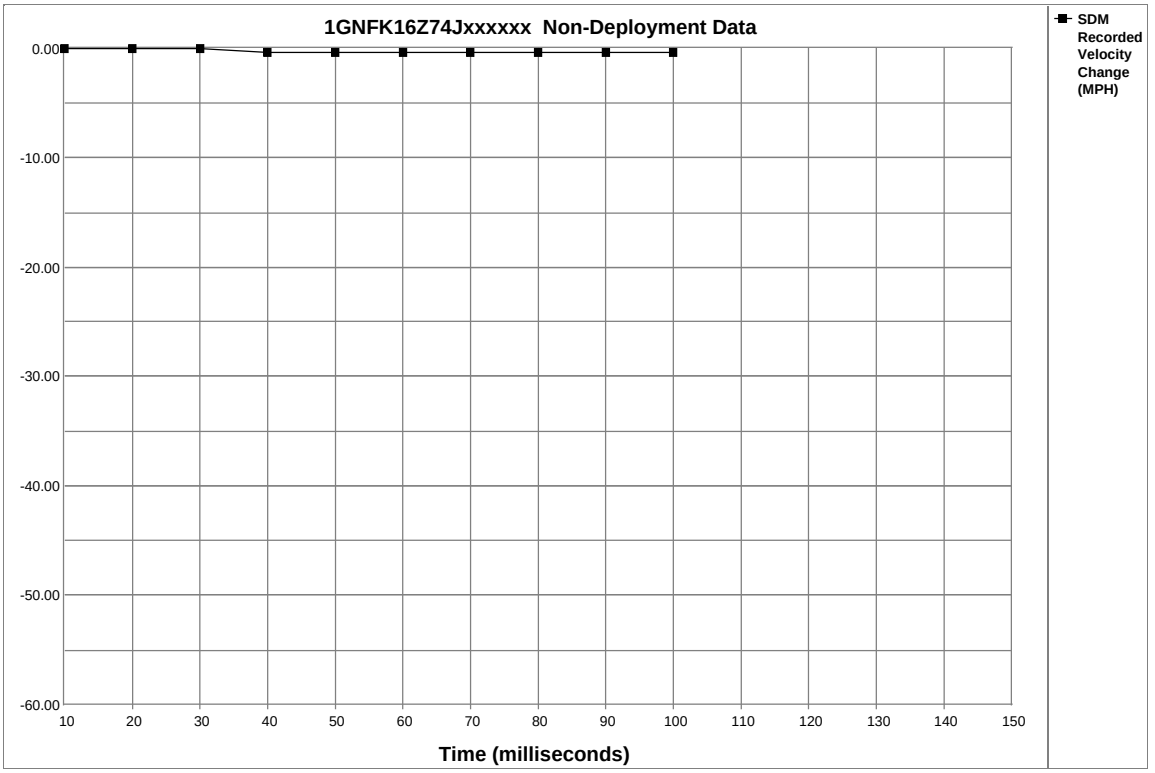
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-0.62	-2.79	-5.58	-9.30	-12.40	-15.81	-18.91	-20.46	-21.70	-22.01	-22.32	N/A	N/A	N/A	N/A

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
Driver's Belt Switch Circuit Status	BUCKLED
Ignition Cycles At Non-Deployment	318
Ignition Cycles At Investigation	321
Maximum SDM Recorded Velocity Change (MPH)	-0.58
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	82.5
Event Recording Complete	Yes
Multiple Events Associated With This Record	Yes
One Or More Associated Events Not Recorded	Yes



Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	54	Invalid	8	OFF
-4	54	Invalid	8	OFF
-3	54	1536	8	OFF
-2	54	256	0	ON
-1	22	0	23	ON



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	0.00	0.00	0.00	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	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  F0 39 33 A9 B1 64
$02  F1 F1 3C 3C A8 00
$03  41 53 34 30 35 36
$04  4B 46 5A 4E 4A 33
$05  00 00 00 00 00 00
$06  15 13 06 07 00 00
$07  00 00 00 00 00 00
$08  00 00 00 00 00 00
$09  00 00 00 00 00 00
$0A  00 00 00 00 00 00
$0B  00 00 00 00 00 00
$0C  00 00 00 00 00 00
$0D  00 00 00 00 00 00
$0E  00 00 00 00 00 00
$0F  00 00 00 00 00 00
$10  FF D7 FE 00 00 00
$11  81 81 82 7A 79 7B
$12  8C 7A 7A 20 20 11
$13  FF 02 00 00 00 00
$14  03 03 00 00 6C 00
$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 EC F5 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  5E FB 00 00 FF FF
$21  FF F7 FF FF FF FF
$22  FF FF FF FF FF FF
$23  FF FF FF FF FF F7
$24  00 00 1E 00 21 00
$25  00 00 00 33 00 00
$26  00 00 00 01 01 01
$27  01 01 01 01 00 00
$28  00 00 00 0A FF D8
$29  C0 A5 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 33 09 04 03
$35  00 33 09 04 03 00
$36  53 0B 05 03 00 53
$37  0B 05 03 04 95 26
$38  3A 07 47 23 00 00
$39  0F 00 00 33 00 00
$3A  02 09 12 1E 28 33
$3B  3D 42 46 47 48 00
$3C  00 00 00 0B FF D8
$3D  C0 A5 00 00 00 00
$40  57 57 57 57 57 00
$41  80 00 00 15 15 15
$42  15 00 18 18 18 18
$43  18 00 27 F0 00 00
```

```
$44  57 57 57 57 57 00
$45  80 00 00 15 15 15
$46  15 00 18 18 18 18
$47  18 00 80 FE 00 00
$48  24 57 57 57 57 00
$49  C0 00 3B 00 15 15
$4A  15 00 04 18 18 18
$4B  18 00 80 FE 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
```