CRASH DATA RESEARCH CENTER
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CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE CRASH INVESTIGATION

SCI CASE NO: CA03-061

VEHICLE: 2003 GMC SIERRA PICK-UP TRUCK
LOCATION: MICHIGAN
CRASH DATE: OCTOBER 2003

Contract No. DTNH22-01-C-17002

Prepared for:

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National Highway Traffic Safety Administration
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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 on-site investigation focused on the performance of a Certified Advanced 208-Compliant safety system in a 2003 GMC Sierra C1500 pick-up truck. 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 (FMVSS) 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 the severity of the crash and the 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 data and crash related data. The EDR was downloaded during the course of the SCI inspection as a supplement to the on-site investigation.

The GMC was southbound on a two-lane roadway driven by a 59 year old unrestrained male. The driver of the GMC lost directional control of the vehicle and departed the left road edge. The driver attempted to regain control of the vehicle by counter-steering to the right. The rear tires of the GMC lost traction and the vehicle began to rotate clockwise. The GMC yawed 37 m (122.8 ft) along the east road side and impacted a tree with its left side. The driver's frontal air bag deployed as a result of the angular impact configuration. The driver of the GMC was ejected through the front left door. The driver was transported to a regional trauma center and hospitalized for 33 days with multiple skeletal injuries.

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BACKGROUND

This on-site investigation focused on the performance of a Certified Advanced 208-Compliant safety system in a 2003 GMC Sierra C1500 pick-up truck, **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 (FMVSS) 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 the severity of the crash and the 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 data and crash related data. The EDR was downloaded during the course of the SCI inspection as a supplement to the on-site investigation.

Figure 1: Left side view of the GMC Sierra.

The GMC was southbound on a two-lane roadway driven by a 59 year old unrestrained male. The driver of the GMC lost directional control of the vehicle and departed the left road edge. The driver attempted to regain control of the vehicle by counter-steering to the right. The rear tires of the GMC lost traction and the vehicle began to rotate clockwise. The GMC yawed 37 m (122.8 ft) along the east road side and impacted a tree with its left side. The driver's frontal air bag deployed as a result of the angular impact configuration. The driver of the GMC was ejected through the front left door. The driver was transported to a regional trauma center and hospitalized for 33 days with multiple skeletal injuries.

This crash was identified by PSU 12 of the National Automotive Sampling System (NASS) during its weekly review of Police Accident Reports (PAR) and was forwarded to the Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA). Due to the agency's interest in the field performance of vehicles equipped with the Certified Advanced Compliant safety system, an on-site investigation of the crash was assigned to the Calspan Special Crash Investigations team. The Calspan team established cooperation with the vehicle's insurer and located the GMC at a local salvage yard. The on-site portion of the investigation took place October 30, 2003.

SUMMARY

VEHICLE DATA

2003 GMC SIERRA PICK-UP TRUCK

The 2003 Chevrolet C1500 Silverado was identified by the Vehicle Identification Number (VIN): 1GTEC19T73Z (production sequence deleted). The two-wheel drive, 454 kg (1/2 ton) short box, four-door extended cab pick-up truck was configured with a 364 cm (143.5 in) wheelbase. The front and rear doors of the extended cab hinged at the A- and C- pillars, respectively. The rear door latched into the front door and into latches mounted to the sill and roof rail. There was no "traditional" B-pillar. The GMC's Gross Vehicle Weight Rating (GVWR) was 2,812 kg (6,200 lb). The vehicle was manufactured in December 2002 and was then customized with after-market accessories in April 2003. The power train consisted of a 5.3 liter/V8 engine linked to a four-speed automatic transmission with overdrive. The service brakes consisted of power-assisted front and rear disc with anti-lock (ABS). The digital odometer could not be read at the time of the inspection. The seating positions in the GMC were configured with front buckets seats and a three passenger second row bench seat. The outboard seat positions were equipped with height adjustable head restraints. All four head restraints were adjusted to the full down position at the time of the inspection. The manual restraint system consisted of three-point lap and shoulder belts in the four outboard positions and a center rear lap belt. The GMC was equipped with after-market Toyo Proxes ST P285/60R18 tires on after-market alloy wheels. The manufacturer recommended tire pressure was 241.0 kPa (35.0 PSI). The specific measured tire data was as follows:

Tire	Measured Pressure	Tread Depth	Restricted	Damage
LF	200 kPa (29 PSI)	8 mm (10/32)	No	None
LR	0 kPa	6 mm (8/32)	No	Sidewall puncture and rim damage
RF	186 kPa (27 PSI)	8 mm (10/32)	No	None
RR	193 kPa (28 PSI)	6 mm (8/32)	No	None

CRASH SITE

This run-off road/fixed object crash occurred during the daytime hours of October 2003. At the time of the crash, the weather was clear with no adverse conditions; however, the asphalt roadway surface was wet from prior rain. The crash occurred off the east side of a two-lane north/south roadway in the yard of a private residence. The road was straight and level in the area of the crash and the traffic lanes measured 3.1 m (10.2 ft) in width. The lanes were separated by a broken yellow centerline and bordered by white fog lines. There was a 2.2 m (7.2 ft) wide gravel shoulder east of the road edge that separated the grass lawns from the road. **Figure 2** is a southbound trajectory view of the crash site. The point of impact was a 29 cm (11.4 in) diameter hardwood tree positioned 7 m (22.9 ft) east of the road edge and 2.4 m (8 ft) north of a private driveway. The SCI inspection of the crash site identified 37.4 m (122.8 ft) of yaw marks through the grass indicative of the GMC's trajectory. The yaw marks were diverging indicating the vehicle was rotating clockwise. Refer to **Figure 3**. The yaw marks led directly to

the point of impact. The posted speed limit for the roadway was 89 km/h (55 mph). The schematic of the crash is included as **Figure 11** at the end of this report.

Figure 2 South view of the crash site.

Figure 3: Trajectory view of the yaw marks leading to the point of impact.

CRASH SEQUENCE

Pre-Crash

The 2003 GMC Sierra was southbound driven by a 59 year old unrestrained male. He was the vehicle's sole occupant. The driver had just left a local restaurant approximately 1 km (0.5 mile) upstream from the area of the crash. For unknown reasons, the driver crossed the centerline and departed the east side of the road. The reconstructed angle of departure measured 15 degrees. As the vehicle departed the road, the driver of the vehicle steered suddenly to the right to counter this off-road trajectory and over-corrected. Tire marks documented through the grass indicated the vehicle's rear tires lost traction and the GMC began to rotate clockwise. The left tire marks diverged from the tracking mode into two distinct marks as the vehicle yawed clockwise. The vehicle traveled 37.4 m (122.8 ft) to the impact with the tree.

Analysis of the pre-crash data downloaded from the vehicle's Event Data Recorder (EDR) revealed the GMC was traveling at a speed of 98 km/h (61 mph) five seconds (T-5) before Algorithm Enable (AE). The GMC then accelerated to 140 km/h (87 mph) three seconds (T-3) prior to AE. The GMC's recorded speed two seconds (T-2) prior to AE was 97km/h (60 mph). The sudden spike in the vehicle speed and then its return may have been an indicator of a loss of control due to hydroplaning.

Crash

The left side of the GMC impacted the tree at the rear edge of the left front door. At the time of the impact, the heading angle of the GMC was approximately 40 degrees clockwise of its velocity vector (due its yawing trajectory). Refer to the crash schematic. The force of the impact was in the 10 o'clock sector. The force of the impact crushed the left rear door rearward and inboard. The left rear door striker was forced out of the latching mechanism in the left front door. The tree pocketed in the deformation at the left C-pillar and the GMC deformed into a U-

shape about the tree. The tree sustained contact direct damage about 60 percent of its circumference that extended 3 m (6 ft) above the ground.

The force of the crash aft of the vehicle's center of gravity resulted in an approximate 140 degree counterclockwise rotation of the vehicle to rest. The cab of the pick-up truck came to rest facing northeast. During the rapid rotation of the cab, the left front door opened as a result of the compromised latch and the driver's loading. The driver was ejected. The home owner indicated the driver came to rest on the front lawn of the residence approximately 16.8 m (55 ft) east of the tree. The police report did not indicate the driver was ejected in his crash. The maximum longitudinal delta V recorded by the EDR for the impact event was -52 km/h (-32.2 mph). This maximum value was recorded 107 milliseconds after AE. The severity of the crash delta V was calculated using the Damage Algorithm of the WINSMASH model. This calculated value was 28 km/h (17.4 mph). The longitudinal and lateral components of the delta V were -20 km/h (12.2 mph) and 20 km/h (12.2 mph), respectively. The calculated value of the delta V was underestimated due to the model's limitations.

Post-Crash

The police and ambulance personnel responded to the crash. The ejected driver was found lying in the lawn complaining of pain to his lower back and lower extremities. It appeared to the home owner that the driver's left leg was fractured. The driver was transported by ground ambulance and admitted to a regional trauma center. He had a Glasgow Coma Score of 15 on admission and was in severe pain. He was diagnosed with multiple skeletal fractures and a closed head injury. He was hospitalized for 33 days during the recovery. The severely damaged GMC was removed from the scene on a flat bed trailer.

2003GMC SIERRA

Exterior Damage

Figures 4 and 5 are the left front oblique and left side views of the exterior damage to the GMC. The vehicle sustained severe damage as a result of the impact with the tree. The direct contact damage consisted of the laterally deformed left sill, left front and rear doors, and the left roof rail. The tree pocketed at the C-pillar area resulting in a J-patterned crush profile, **Figure 6**. The combined length of the direct and induced damage measured 180 cm (71 in). The induced damage began 152 cm (60 in) rearward of the front of the vehicle at the leading edge of the left front door. The direct contact began 224 cm (88 in) rearward of the front of the vehicle of the aft aspect of the left front door. The length of the direct contact measured 109 cm (43 in). The residual crush profile was measured at the left sill and was as follows: C1 = 40 cm (15.5 in), C2 = 50 cm (19.8 in), C3 = 34 cm (13.2 in), C4 = 23 cm (8.9 in), C5 = 15 cm (5.9 in), C6 = 0. The maximum crush was located at C1 in the area of the pocketing 333 cm (131 in) rearward of the front of the vehicle. The windshield was cracked and separated at the lower left A-pillar as a result of the vehicle deformation. The left windows and backlight disintegrated. The force of the crush resulted in severe induced damage to the frame of the truck aft of the cab. The sheet metal, side cladding and bed of the pick-up separated. The non-metallic fuel tank was deformed from the bending of the frame. This resulted in a partial separation of the sending unit and fuel leakage from the tank. The Collision Deformation Classification (CDC) for this impact was 10-LPAW3.

Figure 4: Left front view of the GMC.

Figure 5: Left side view.

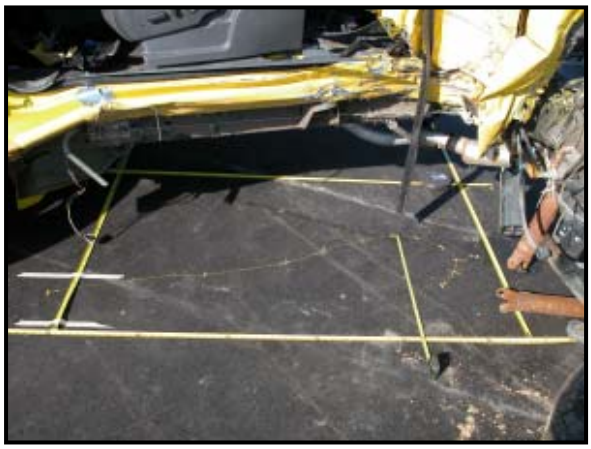


Figure 6: View of the crush profile of the left sill.

Interior Damage

The interior damage to the GMC consisted of moderate intrusion, deployment of the driver air bag and the driver's interior contacts. The left roof rail deformed laterally inboard and was in close proximity to the head restraint. The intrusion at the mid-aspect of the roof rail was 38 cm (15 in.) and increased to 50 cm (19.5 in) at the C-pillar location. The left rear door intruded into the left rear interior space due to the pocketing of the tree. The left rear door intrusion measured 72 cm (28.5 in) at the leading edge of the bench seat. The roof deformed downward intruding 41 cm (16 in) the left rear position.

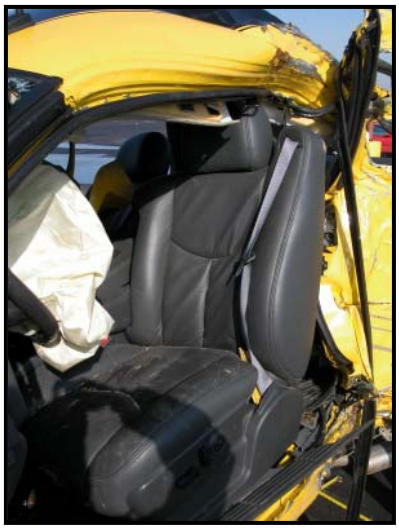


Figure 7: Left interior view.

The 6-way power driver seat was located in a rear track position. It was positioned 6 cm (2.5 in) forward of full rear. Its position was referenced from the full rear track position of the front right seat. The driver's seat back was reclined 15 degrees aft of vertical. The horizontal distance from the seat back to the driver air bag module measured 74 cm (29 in). The intruding left rear door contacted the driver seat. The seat was rotated

counterclockwise and the inboard aft aspect of the seat was in contact with the center console. There was no noted occupant contact to the headliner or roof.

The four-spoke steering wheel was rotated approximately 100 degrees clockwise at the time of the inspection. The tilt adjustment was in the center position. There was no evidence of deformation to the steering wheel rim and there was no displacement of the steering column's shear capsules.

The interior occupant contacts consisted of the driver's lower extremity contact to the knee bolster and his left flank contact to the left front door panel. The left lower aspect of the knee bolster was fractured over an 8 cm (3 in) area. The parking brake lever was bent to the left. The left door panel was heavily scuffed during the ejection sequence, **Figure 8.** The lower forward aspect of the door panel exhibited a 25 cm x 10 cm (10 in x 4 in) contact area from the left lower extremity. There was a 36 cm (14 in) linear abrasion to the lower center aspect of the panel above the map pocket. A 13 cm x 13 cm (6 in x 6 in) triangular shaped pattern was located on the arm rest. The flow of these contact patterns was rearward and upward consistent with the driver's ejection path.

Figure 8: View of the driver contact to the left door panel.

Manual Restraint Systems

The manual restraint systems in the front row of the GMC consisted of three-point lap and shoulder safety belts that 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 minimal evidence of historical use. The webbing was spooled out and examined for crash related evidence. There was no identifiable 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, kinematics, and his ejection.

Certified Advanced 208-Compliant Air Bag System

The Certified Advanced 208-Compliant (CAC) air bag system 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. 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 6 cm x 12 cm (2.5 in x 4.6 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. The face of the deflated driver air bag was soiled in the 11 to 1 o'clock sectors from exposure to the elements. 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 passenger air bag was not commanded to deploy in the crash; the front right seat was not occupied. The air bag was suppressed by the occupant presence detection sensor.

Event Data Recorder

The Event data Recorder (EDR) was downloaded at the time of the SCI inspection utilizing the Vetronix Crash Data Retrieval (CDR) tool and software version 2.132. The data was retrieved by connecting the CDR tool directly to the SDM. The downloaded data is attached to the end of this report as *Attachment A.*

The EDR recorded a Deployment and a Non-Deployment event on ignition cycle 1737. The data download occurred on ignition cycle 1739. Analysis of the data indicated the Deployment event occurred first and was followed by the Non-Deployment. Further, data flags within the record indicated the Non-Deployment was related to the deployment. The SDM was designed to "relate" two events if the events occurred within a five second window of one another. Reconstruction of this crash indicated the Non-Deployment event was caused by the rapid rotation of the vehicle following the impact.

The data indicated the driver's safety belt was unbuckled. The GMC's impact with the tree commanded a Stage 2 deployment of the driver's air bag 12.5 milliseconds after Algorithm Enable (AE). The maximum recorded longitudinal delta V was -52 km/h (-32.2 mph) 107.5 milliseconds after AE. The maximum longitudinal delta V of the non-deployment event was -15 km/h (-9.3 mph) 465 millisecond after AE.

DRIVER DEMOGRAPHICS

Age / Sex:	59 year old / Male
Height:	Not Reported
Weight:	Not Reported
Seat Position:	Rear Track, 6 cm (2.5 in) forward of full rear
Manual Restraint Use:	None
Restraint Usage Source:	SCI Inspection, EDR, Occupant Kinematics
Medical Treatment:	Transported via ground ambulance and hospitalized 33 days

DRIVER INJURY

Injury	***Injury Severity (AIS 98 Update)***	***Injury Source***
Small left intra-ventricluar hemorrhage	Severe (140678.4,2)	Acceleration/deceleration
Small left cerebral sub-dural hematoma	Severe (140652.4,2)	Acceleration/deceleration
Small left cerebral contusion in the frontal/parietal region	Serious (140606.3,2)	Ground contact
Left pedicle fracture at C7 of the cervical spine	Serious (650226.3,6)	Acceleration/deceleration
Transverse process fractures of the lumbar spine at L3, L4, and L5	Moderate (650620.2,8) (650620.2,8) (650620.2,8)	Intruding left door panel
Fractures of the left 4^{th} and 5^{th} ribs	Moderate (450220.2,2)	Intruding left door panel and arm rest
Left lung contusion	Serious (441406.3,2)	Intruding left door panel and arm rest
Comminuted left acetabular fracture with medial displacement	Serious (852604.3,2)	Intruding left door panel
Right posterior acetabular fracture	Moderate (852602.2,1)	Intruding left door panel
Bilateral sacroiliac fracture with mild diastasis	Serious (852800.3,8)	Intruding left door panel
Bilateral pubic rami fractures, (including the superior and inferior on the left)	Moderate (852602.2,5)	Intruding left door panel
Left hand abrasion	Minor (790202.1,2)	Intruding left door panel
Left elbow abrasion and laceration	Minor (790202.1,2) (790600.1,2)	Intruding left door panel
Left lower back abrasions	Minor (690202.1,2)	Intruding left door panel
Abrasion to the top of the scalp	Minor (190202.1,5)	Ground contact
Left ear abrasion	Minor (290202.1,2)	Ground contact
Left shoulder abrasion	Minor (790202.1,2)	Ground contact
Left toe laceration	Minor (890600.1,2)	Parking brake lever

The above injuries were identified in the treating hospitals Emergency Room records, Discharge Summary and Radiology reports.

DRIVER KINEMATICS

The 59 year old driver was seated in a rear track position with a presumed upright posture. He was not utilizing the vehicle's manual safety belt. He was unrestrained. The driver lost directional control of the vehicle and departed the left side of the road at an EDR reported speed of approximately 97 km/h (60 mph). The driver overcorrected by steering right. The rear tires of the GMC lost traction and the vehicle began to yaw clockwise. The pick-up truck yawed approximately 37 m (122.8 ft) through the grass along the roadside to the impact with the tree.

Upon impact, the advanced driver air bag deployed. The unrestrained driver exhibited a leftward trajectory in response to the 10 o'clock direction of the impact. The driver loaded the left door panel with his left flank. Coincident to this kinematic pattern the door was intruding inboard due to the force of the crash. The driver's loading to the door panel resulted in the multiple skeletal fractures and abrasions to his left flank.

As the vehicle crushed, the rearward deformation of the left rear door forced the striker from the front door latch. The defeated door latch combined with the driver's loading caused it to come open. The vehicle then rotated counterclockwise ejecting the driver in the process. As the driver was ejected the vehicle, his left lower extremities contacted and deformed the parking brake lever. The contact to the brake lever lacerated his toe. The driver struck the ground and came to rest approximately 17 m (55 ft) east of the tree. His contact to the ground resulted in an abrasion to the top of his head and the frontal brain contusion. The inertial acceleration/deceleration of his head during the rotation and ejection resulted in the cerebral brain hemorrhages.

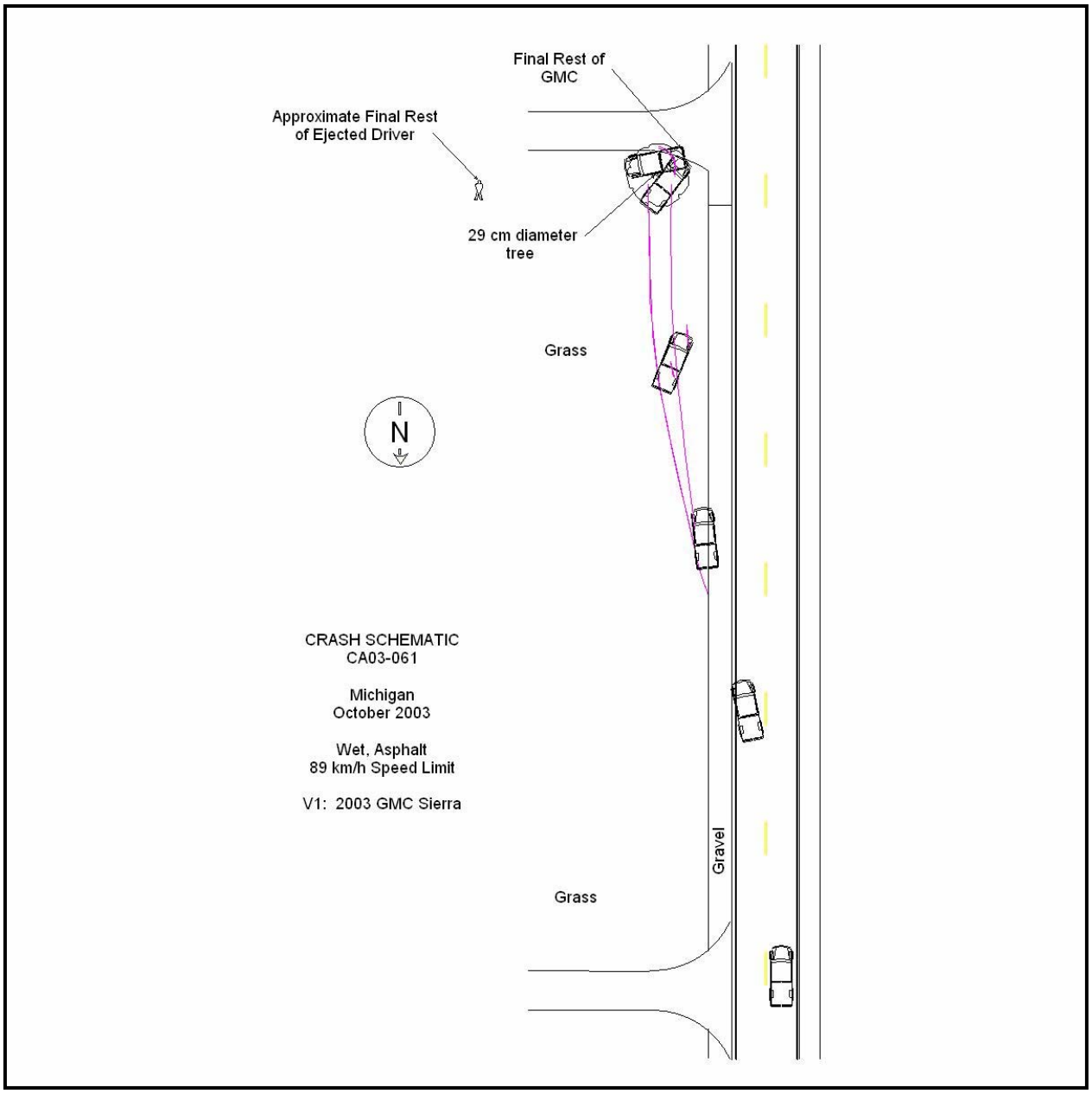


Figure 10: Crash Schematic.

ATTACHMENT A

EDR Data

CDR File Information

Vehicle Identification Number	1GTEC19T73Z******
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	CA03-061 CDR.CDR
Saved on	Thursday, October 30 2003 at 09:20:24 AM
Collected with CDR version	Crash Data Retrieval Tool 2.10
Collecting program verification number	B6B4FDF8
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: 35 Date: 01-02-03 Checksum: 6200
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 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.

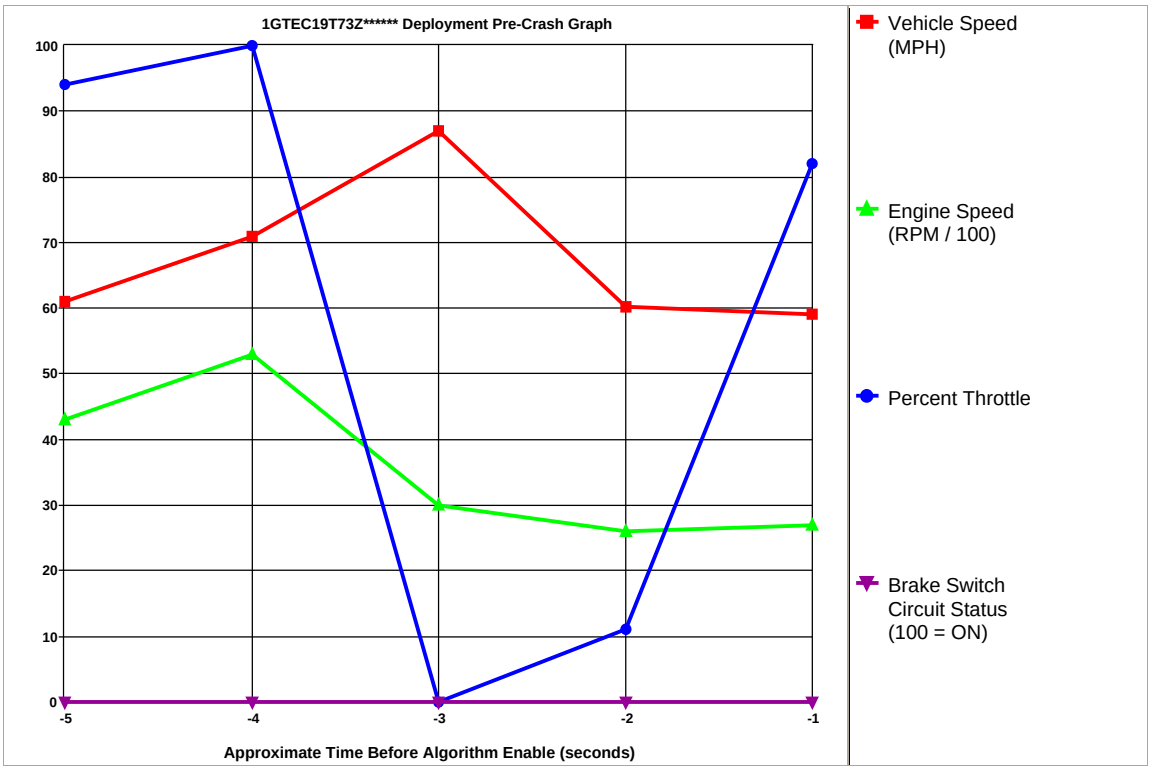
SDM Data Limitations:
-SDM Recorded Vehicle Forward Velocity Change reflects the change in forward velocity that the sensing system experienced during the recorded portion of the event. SDM Recorded Vehicle Forward Velocity Change is the change in velocity during the recording time and is not the speed 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.

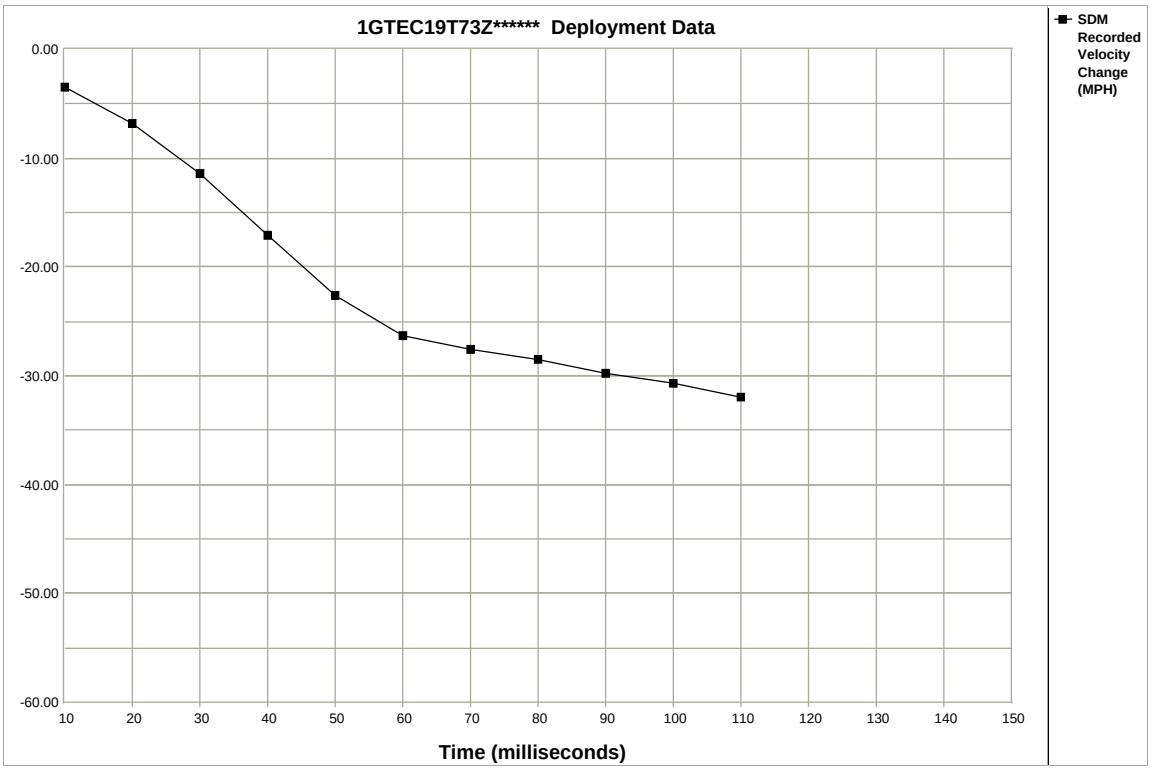
SDM Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Speed, Engine Speed, and Percent Throttle data are transmitted once a second by the Powertrain Control Module (PCM), via the vehicle's communication network, to the SDM.
-Brake Switch 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	1737
Ignition Cycles At Investigation	1739
Maximum SDM Recorded Velocity Change (MPH)	-32.15
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	107.5
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	12.5
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)	Suppressed
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	Suppressed
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



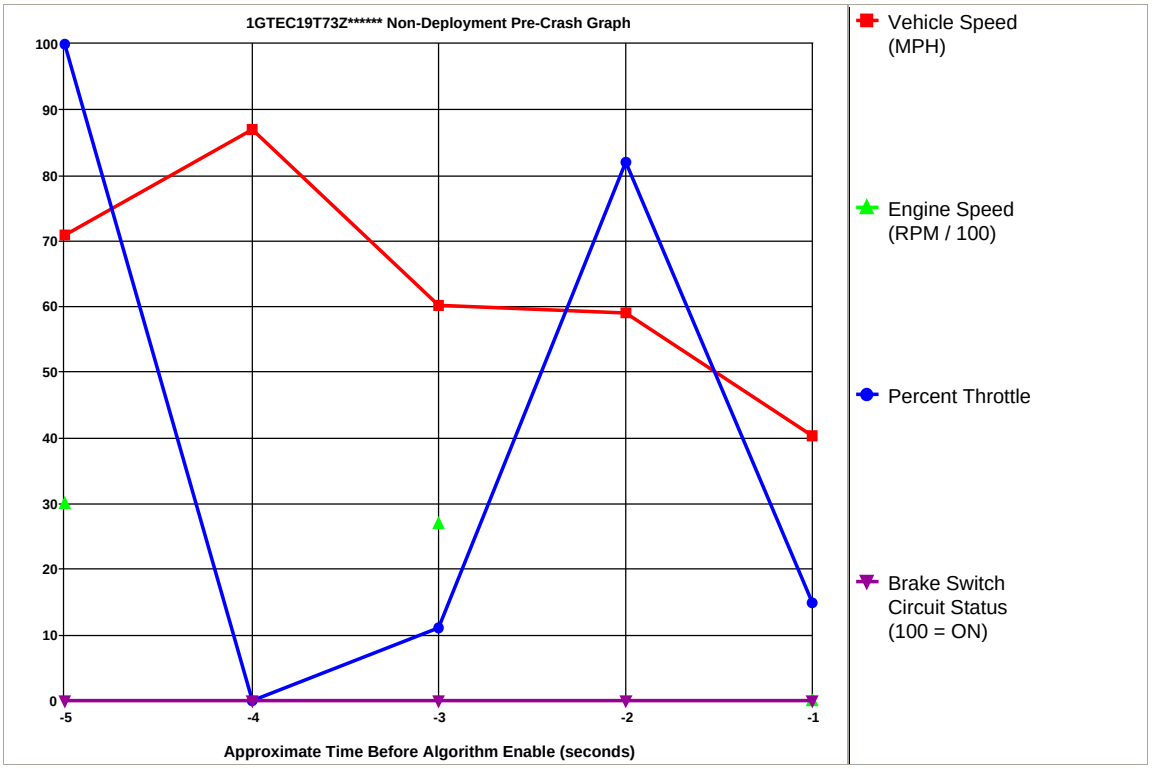
Seconds Before AE	Vehicle Speed (MPH)	Engine Speed (RPM)	Percent Throttle	Brake Switch Circuit Status
-5	61	4288	94	OFF
-4	71	5312	100	OFF
-3	87	3008	0	OFF
-2	60	2560	11	OFF
-1	59	2688	82	OFF



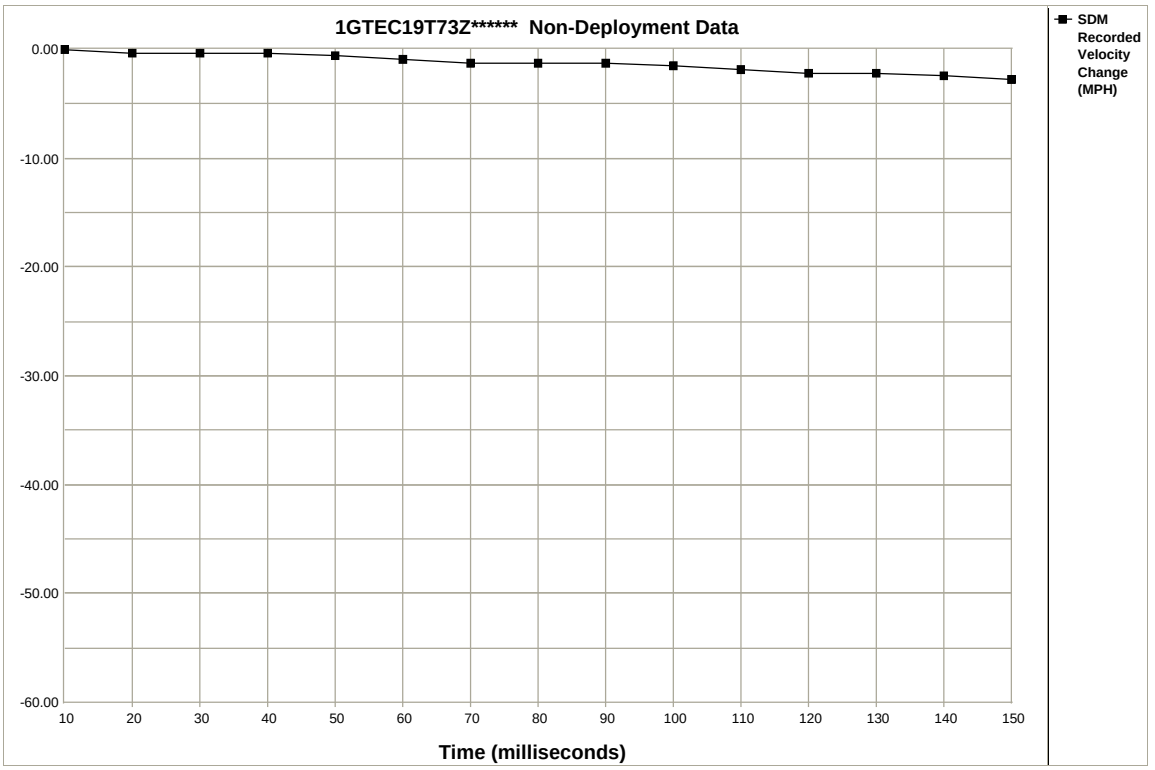
Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	-3.41	-6.82	-11.47	-17.05	-22.63	-26.35	-27.59	-28.52	-29.76	-30.69	-31.93	N/A	N/A	N/A	N/A

System Status At Non-Deployment

SIR Warning Lamp Status	ON
Driver's Belt Switch Circuit Status	UNBUCKLED
Passenger Seat Position Switch Circuit Status	Rearward
Ignition Cycles At Non-Deployment	1737
Ignition Cycles At Investigation	1739
Maximum SDM Recorded Velocity Change (MPH)	-9.33
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	465
Crash Record Locked	No
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	71	3008	100	OFF
-4	87	Invalid	0	OFF
-3	60	2688	11	OFF
-2	59	Invalid	82	OFF
-1	40	0	15	OFF



Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Recorded Velocity Change (MPH)	0.00	-0.31	-0.31	-0.31	-0.62	-0.93	-1.24	-1.24	-1.24	-1.55	-1.86	-2.17	-2.17	-2.48	-2.79

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 AE 5A
$02  F1 F1 00 00 B8 00
$03  41 53 32 33 33 36
$04  4B 38 33 4D 4E 31
$05  00 00 00 00 00 00
$06  15 19 24 46 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 26 F8 00 00 00
$11  82 81 82 80 80 80
$12  91 7F 7F 22 22 01
$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 0F 05 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  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 01 E1 00 BA 0F
$25  63 00 00 00 FF FF
$26  00 01 01 01 02 03
$27  04 04 04 05 06 07
$28  07 08 09 00 FF 26
$29  FE 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 11 00 08 05 03
$35  00 00 00 00 00 11
$36  00 09 05 03 00 00
$37  00 00 00 06 79 4F
$38  2B 07 4F 2B 00 00
$39  05 00 00 00 FF FF
$3A  0B 16 25 37 49 55
$3B  59 5C 60 63 67 00
$3C  00 00 00 0B FF 26
$3D  FE A5 00 00 00 00
$40  5F 61 8C 72 62 00
$41  00 00 D1 1D 00 FF
$42  F1 00 2A 28 2F 53
$43  43 00 7D 80 00 00
```

```
$44  5F 61 8C 72 62 00
$45  00 00 D1 1D 00 FF
$46  F1 00 2A 28 2F 53
$47  43 00 80 FE 00 00
$48  41 5F 61 8C 72 00
$49  00 00 25 D1 1D 00
$4A  FF 00 35 2A 28 2F
$4B  53 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
```