CRASH DATA RESEARCH CENTER

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CALSPAN ON-SITE CHILD SAFETY SEAT CRASH INVESTIGATION

CALSPAN CASE NO: CA06-009

VEHICLE: 2005 CHEVROLET COBALT

LOCATION: NEW YORK

CRASH DATE: MARCH 2006

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.

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16. Abstract
This on-site investigative effort focused on the performance of a forward facing child safety seat (FFCSS) that was used to restrain a 15-month-old male rear right passenger of a 2005 Chevrolet Cobalt. The Chevrolet was involved in a minor severity run-off-road collision with a wood retaining wall. The vehicle was equipped with dual-stage frontal air bags for the driver and front right positions and retractor mounted safety belt pretensioners for the front positions. Additionally, the vehicle was equipped with an Event Data Recorder (EDR) that was downloaded during this on-site investigation. The EDR printout is included as **Attachment A** of this report. The Chevrolet was occupied by a restrained 20-year-old female driver, 25-year-old female unrestrained right front passenger, and a 15-month-old male rear right passenger who was restrained in a FFCSS. The 20-year-old female driver of the Chevrolet relinquished control of the vehicle and departed the right roadside. Consequently the front of the vehicle struck a wood retainer wall. As a result of the collision, the frontal air bag system deployed and the front safety belt retractor pretensioners fired. The 15-month-old male was not injured during the crash; however, he was transported to a local hospital for observation. The driver sustained minor injuries and was transported to a local hospital where she was treated and released. The right front passenger sustained a fractured right humerus and was transported to a local hospital where she was treated and released.

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CASE NO.: CA06-009
VEHICLE: 2005 CHEVROLET COBALT
LOCATION: NEW YORK
DATE OF CRASH: MARCH 2006

BACKGROUND

This on-site investigative effort focused on the performance of a forward facing child safety seat (FFCSS) that was used to restrain a 15-month-old male rear right passenger of a 2005 Chevrolet Cobalt **(Figure 1)**. The Chevrolet was involved in a minor severity run-off-road collision with a wood retaining wall. The vehicle was equipped with dual-stage frontal air bags for the driver and front right positions and retractor mounted safety belt pretensioners for the front positions. Additionally, the vehicle was equipped with an Event Data

Figure 1. Subject vehicle 2005 Chevrolet Cobalt.

Recorder (EDR) that was downloaded during this on-site investigation. The EDR printout is included as **Attachment A** of this report. The Chevrolet was occupied by a restrained 20-year-old female driver, 25-year-old female unrestrained right front passenger, and a 15-month-old male rear right passenger who was restrained in a FFCSS. The 20-year-old female driver of the Chevrolet relinquished control of the vehicle and departed the right roadside. Consequently the front of the vehicle struck a wood retainer wall. As a result of the collision, the frontal air bag system deployed and the front safety belt retractor pretensioners fired. The 15-month-old male was not injured during the crash; however, he was transported to a local hospital for observation. The driver sustained minor injuries and was transported to a local hospital where she was treated and released. The right front passenger sustained a fractured right humerus and was transported to a local hospital where she was treated and released.

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. Following case assignment, it was determined that the Cobalt was not equipped with the CAC safety system. Due to the presence of a child safety seat, the case was reassigned to focus on the performance of the safety seat. The Chevrolet was located at a local salvage facility and cooperation was established to inspect the vehicle. The driver consented to an interview and allowed the inspection of the child safety seat. An on-site investigation was assigned to the Calspan SCI team on April 12, 2006. The vehicle, CSS, and crash site inspections were completed on April 20, 2006.

SUMMARY

Crash Site

This run-off road crash occurred on the roadside of a two-lane north/south road in a rural, residential area. The travel lanes were 3 meters (9.8 feet) in width and delineated by double yellow centerlines. A negative grade of 2 percent was present for the southbound travel direction. White fog lines bordered the travel lanes. A 2.1-meter (6.9 feet) gravel shoulder extended beyond the east fog line. The southbound lane curved right at the area of the crash. Located immediately north of the crash site was a three-leg intersection that was not controlled for southbound travel. The east roadside consisted of a grass embankment and a wood retainer wall. The retainer wall was 1.1 meters (3.6 feet) in height was constructed of railroad ties and was built into a hillside around the perimeter of a parking area. There was no posted speed limit within the vicinity of the crash site; therefore, the speed limit defaults to the state limit of 89 km/h (55 mph). The scene schematic is included as **Figure 10** of this report.

Vehicle Data

2005 Chevrolet Cobalt

The subject vehicle in this crash was a 2005 Chevrolet Cobalt. The Chevrolet was manufactured on 06/05 and was identified by Vehicle Identification Number (VIN) 1G1AK12F15 (production number deleted). The odometer reading at the time of the SCI inspection was unknown due to the expended vehicle battery. However, the driver stated to the SCI investigator that the vehicle had approximately 19,000 kilometers (12,000 miles) on the odometer. The vehicle was a two-door coupe that was equipped with a 2.2-liter, four-cylinder Ecotec engine linked to a four-speed automatic transmission with a console mounted transmission shifter. The service brakes were front disc and rear drum. The vehicle was equipped with OEM five-spoke plastic wheel covers over steel rims with P195/60R15 tires. The front tires on the Cobalt were Kumho Solus HP and the rear tires were Continental Touring Contact. The manufacturer recommended front and rear tire pressure was 207 kPa (30 PSI). The specific tire data at the time of the SCI inspection was a follows:

Position	Measured Tire Pressure	Measured Tread Depth	Damage
Left Front	207 kPa (30 PSI)	6 mm (7/32")	None
Left Rear	152 kPa (22 PSI)	6 mm (7/32")	None
Right Front	214 kPa (31 PSI)	6 mm (7/32")	None
Right Rear	159 kPa (23 PSI)	6 mm (7/32")	None

The interior of the Cobalt was configured with cloth surfaced front bucket seats with height adjustable head restraints. The front head restraints were adjusted to the full down position at the time of the SCI inspection. The second row was configured with a cloth upholstered split bench (60/40) seat with height adjustable head restraints for the outboard seats. The rear left head restraint was adjusted to 3 cm (1") above full down position and the right head restraint was adjusted to 3 cm (1.3") above the full down position at the time of the inspection.

Crash Sequence
Pre-Crash

The 20-year-old female driver was operating the vehicle eastbound to southbound while negotiating the right curve through the intersection (**Figure 2**). As she began to travel in a southerly direction, the driver relinquished directional control of the Cobalt and departed the right side of the road in a tacking mode (**Figure 3**). The Chevrolet traveled 5.2 meters (17 feet) off-road traversing a lawn area to the point of impact.

Figure 2. Pre-crash travel for the Cobalt.

The EDR indicated that the vehicle speed was 50 km/h (31 mph) five-seconds prior to Algorithm Enable (AE) and the speed had increased to 60 km/h (37 mph) at three seconds prior to AE. This data was consistent with engine speed and throttle position. The driver released the throttle (application 0 percent) and applied the brakes. The EDR data recorded that the Anti-lock Braking System (ABS) activated at two and one seconds prior to AE. The vehicle had decelerated to 34 km/h (21 mph) one-second prior to AE.

Figure 3. Right roadside departure.

The EDR recorded steering angle was a constant value of 0 degrees for the five second pre-crash interval. Although the steer angle recorded value was 0 degrees, the driver probably applied a steering input that did not exceed the pre-set threshold to record greater a value. The driver stated to the SCI investigator that the steering wheel had locked in position; therefore, she was unable to control the travel path of the Chevrolet. Furthermore, she stated that the steering wheel would lock in position intermittently and she thought it was a normal action. Therefore, she did not have the vehicle serviced for this issue. There was no evidence to substantiate the driver's claim of a steering issue.

Crash

The front center area of the Cobalt struck the exposed corner of the wood retainer wall, which arrested the vehicle's trajectory (**Figure 4**). The vehicle came to final rest against the wood retainer wall facing a southerly direction. The resultant direction

3

Figure 4. Area of impact with the wood retainer wall,

of force for this impact was 12 o'clock. The WINSMASH damage algorithm was used to calculate a delta-V for this impact. The total delta-V was 25 km/h (15.5 mph) with longitudinal and lateral components of -25 km/h (-15.5 mph) and 0 km/h, respectively. The EDR recorded delta-V for this impact was 21 km/h (13.2) mph at a 170 milliseconds of AE.

As a result of the impact, the frontal air bag deployed and the retractor mounted safety belt pretensioners fired.

Post-Crash

Police and Emergency Medical Services (EMS) personnel responded to the crash site. The driver stated to the SCI investigator that the fire department pried open the left front door to extricated her from the vehicle. She sustained minor severity injuries and was transported to a local hospital from treatment. The front right passenger sustained moderate severity injuries that included a right humerus fracture and was transported to a local hospital for treatment. The 15-month-old male passenger was not injured during the crash; however, he was transported to a local hospital for observation and evaluation.

Vehicle Damage
Exterior – 2005 Chevrolet Cobalt

The 2005 Chevrolet Cobalt sustained moderate severity frontal damage as a result of the impact with the wood retainer wall (**Figures 5 and 6**). Maximum crush was 36 cm (14.2"), located 14 cm (5.5") inboard of the right end of the bumper beam. The direct

Figure 5. Overhead view of the frontal damage.

Figure 6. Frontal view of the crush to the Cobalt.

contact damage began 5 cm (2") right of the vehicle's centerline and extended 28 cm (11") to the right end of the bumper beam. The residual crush was measured along the full width of the deformed bumper beam (Field L) of 86 cm (34"). Six equidistant crush measurements were documented at this level and were as follows: C1 = 4 cm (1.6"), C2 = 18 cm (7.1"), C3 = 28 cm (11"), C4 = 36 cm (14.2"), C5 = 17 cm (6.7"), C6 = 0 cm. Damaged components included the hood, front bumper fascia and reinforcement beam, grille, and radiator. The Collision Deformation Classification (CDC) for this impact was 12-FCEN-2.

Additionally, the driver stated to the SCI investigator that the left front door was jammed closed and was pried open by the local fire department. This damage included deformation to the left front door and quarter panel. Several cuts were noted to the door and sill from the hydraulic equipment.

Interior – 2005 Chevrolet Cobalt

The interior of the Chevrolet sustained minor interior damage that was attributed to the frontal air bag deployment. Both air bags deployed as designed from the respective modules. The minor severity crash did not produce intrusion to the passenger compartment.

The corners of the front right air bag cover flap contacted and fractured the windshield glazing at two locations. There was no damage attributed from occupant contact points. **Figure 7** is an overall view of the interior.

Figure 7. Overall of the interior first row.

Frontal Air Bag System – 2005 Chevrolet Cobalt

The Chevrolet was equipped with dual-stage frontal air bags for the driver and front right passenger positions. The system deployed as a result of the impact sequence with the wood retainer wall **(Figure 8)**.

The driver's air bag was contained within the four-spoke steering wheel rim and concealed by two I-configuration cover flaps. Both flaps were 9 cm (3.5") wide and 11 cm (4.5") in height at the horizontal tear seam. The air bag membrane measured 53 cm (21") in diameter in its deflated stated and was tethered by two internal tethers at the 12/6 o'clock positions. Two vent ports that were located on the backside of the bag at the 11 and 1 o'clock sectors vented the bag into the passenger compartment. The maximum rearward excursion of this bag at the tether locations was 33 cm (13"). There was no damage or evidence of driver contact on the deployed air bag.

Figure 8. Deployed frontal air bag system.

The front right passenger air bag was a top-mount design, incorporated into the right instrument panel. A single cover flap concealed the bag which measured 32 cm (12.6") wide at the horizontal tear seam and 23 cm (9") in depth. There was no damage or contact evidence to the cover flap. The air bag measured 43 cm (17") in width and 66 cm

(26") in height. A single tether strap at the mid point tethered the air bag membrane. Two ports vented the front right air bag at the 11 and 1 o'clock positions on the side panels. The maximum rearward excursion of this bag at the midpoint measured 43 cm (17"). No occupant contact evidence or damage was noted to the front right air bag.

Event Data Recorder – 2005 Chevrolet Cobalt

The 2005 Chevrolet Cobalt was equipped with an Event Data Recorder that was downloaded during this on-site investigative effort. The EDR printout is included as **Attachment A** of this report. Rescue personnel cut the battery cables to the Cobalt and the power could not be restored to the vehicle. The SCI investigator used an external power box to supply power to the EDR module through the fuse box that was located within the center instrument panel. Using the Vetronix Controller Area Network (CAN) Plus interface module and the 2.8 version of the Vetronix software the EDR was successfully downloaded through the Diagnostic Link Connector (DLC).

In addition to the pre-crash data that was described in the *Pre-Crash* section of this report, the EDR recorded belt usage, pretensioner status, and deployment time for the frontal air bag system. At the time of Algorithm Enable (AE) the EDR indicated that driver's belt was buckled and that the front right belt was not buckled. The EDR commanded the firing of both front safety belt pretensioners. The first stage deployment time for the frontal air bag system was 70 milliseconds after AE. The second stage of the frontal air bag system was not commanded to deploy during the crash phase and was recorded as disposal.

The EDR data file had an event counter, which was used to record multiple events (i.e. deployment level, and non-deployment events). There was only one deployment event associated with this crash. In the subject crash, the EDR data indicated that the data file was complete and no other events occurred prior, between, or after this recording.

Manual Safety Belt Systems – 2005 Chevrolet Cobalt

The 2005 Chevrolet Cobalt was equipped with three-point lap and shoulder belt systems for the five-seated positions. All five safety belts consisted of continuous loop webbing with sliding latch plates and fixed D-rings.

The driver's safety belt retracted onto an Emergency Locking Retractor (ELR) and was configured with a retractor-mounted pretensioner. The driver utilized her safety belt in the crash, which was evidenced by minor frictional abrasions on the D-ring and latch plate. Also noted were noted two light colored clothing transfers on the webbing. The transfers were located 165-175 cm (65-69") above the anchor and 185-196 cm (73-77") above the anchor. Furthermore, the safety belt was restricted in the used position as a result of the fired pretensioner.

The remaining four belt systems utilized switchable ELR/Automatic Locking Retractors (ALR). The front right passenger did not use the safety belt in the subject crash, which was noted by the fired pretensioner that restricted the webbing in the stowed position.

A 15-month-old male that was seated in a forward facing child safety seat occupied the rear right position. The vehicle safety belt was used to install the child safety seat in this seating position. The rear right safety belt components were free of loading and frictional abrasions.

Child Safety Seat – 2005 Chevrolet Cobalt

The 15-month-old male was restrained in the rear right position of the Cobalt. He was seated in a Graco Comfort Sport convertible child safety seat **(Figure 9)** and was restrained by the integrated five-point harness system. The safety seat model number was 8433F0F and was manufactured on 05/19/05. The child seat was placarded with a label that advised against usage after year 2011. The following was also placarded on the safety seat:

The safety seat was labeled for use under the following guidelines:
Rear Facing:
3-14 kgs (5-30 lbs)
Harness straps must be through bottom or
middle slots at or below shoulders.

Forward Facing:
9-14 kgs (20-30 lbs) and are at least on year old.
Harness straps must be through middle for top slots
at or above shoulders.

Forward Facing:
14-18 kgs (30-40 lbs) Harness straps must be
through top slots only.

The child seat was obtained by a family member of the 15-month-old passenger from the local sheriff's department approximately 5-6 months prior to the crash. A Certified Child Passenger Technician (CPST) from the sheriff's department installed the child safety seat in the primary family vehicle, which was not the Cobalt. This family member stated to the SCI investigator that the CPST instructed her and the child's mother on the proper installation and use of the child safety seat. On the day of the crash, the driver had installed the child safety seat in the vehicle. Although the Cobalt and the child safety

Figure 9. Graco child safety seat.

seat were equipped with Lower Anchors and Tethers for Children (LATCH), the driver

stated to the SCI investigator that she installed the child safety seat by routing the vehicle's lap and shoulder belt through the rear belt path. The LATCH system was not utilized for this installation. She pulled out the webbing to engage the ALR to ensure the safety belt was locked in place. The driver stated that the child safety seat was installed tightly with minimal movement at the belt path. However, she did not apply weight on the safety seat in order to spool in additional webbing for a tighter installation. The inspection of the child safety seat revealed no damage or loading marks.

Occupant Demographics/Data
Driver Demographics

Age/Sex:	20-year-old/Female
Height:	160 cm (63")
Weight:	64 kg (140 lb)
Seat Track Position:	Mid track position
Eyewear:	None
Manual Safety Belt Usage:	Manual lap and shoulder belt
Usage Source:	Vehicle inspection
Egress from Vehicle:	Assisted through left door
Mode of Transport from Scene:	Transported by ambulance to a hospital
Type of Medical Treatment:	Treated and released

Driver Injuries

Injury	Injury Severity AIS90/Update 98	Injury Source
3 cm (1") contusion to the left side of the chest	Minor (790402.1,2)	Safety belt

Source – Driver interview

Driver Kinematics

The 20-year old female driver of the 2005 Chevrolet Cobalt was seated in an upright driving posture. The driver's seat was adjusted to a mid track position and she was restrained by the manual safety belt system.

At impact, the frontal air bag system deployed and the retractor mounted safety belt pretensioner fired. The driver initiated a slight forward trajectory and loaded the safety shoulder belt, which resulted in the 3 cm (1") contusion to the left side of the chest. The driver stated to the SCI investigator that the fire department pried open the jammed left door in order for the driver to exit the vehicle. She was transported to a local hospital where she was treated and released.

Front Right Passenger Demographics

Age/Sex:	24-year-old/Female
Height:	165 cm (65")
Weight:	113 kg (250 lb)
Seat Track Position:	Rear track position
Restraint Use:	None used
Usage Source:	Vehicle inspection
Egress from Vehicle:	Exited without assistance
Mode of Transport from Scene:	Transported by ambulance
Type of Medical Treatment:	Treated and released

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90, Update 98)	Injury Source
Fractured right humerous	Moderate (752600.2,1)	Induced fracture from bracing against instrument panel
Torn right rotator cuff, NFS	Minor (751099.1,1)	Induced fracture from bracing against instrument panel
8 cm (3.0") forehead laceration	Minor (290600.1,7)	Unknown

Source – Driver interview

Front Right Passenger Kinematics

The 24-year-old female front right passenger was seated in a rear track position and was not restrained by the manual safety belt system. Prior to the impact with the wood retainer wall, she braced for the impact with her hands against the upper instrument panel.

At impact, the frontal air bag system deployed. The passenger responded to the 12 o'clock direction of force by initiating a forward trajectory. Due to her bracing against the instrument panel, the crash forces were translated through her arms. The translation of the crash energy resulted in a fracture of the right humerous and a torn right rotator cuff. During her forward trajectory her arms buckled which allowed her face and torso to engage the deployed front right air bag. The air bag protected the passenger from contact with right instrument panel and windshield and potential injury.

The front right passenger also sustained an 8 cm (3") forehead laceration. The passenger stated to the SCI investigator that this injury occurred from her striking the windshield with her head. This contact was not supported by the vehicle inspection; therefore, the exact source of this injury was unknown.

Rear Right Child Passenger

Age/Sex:	15-month-old/Male
Height:	76 cm (30")
Weight:	10 kg (23 lb)
Seat Track Position:	N/A, fixed
Eyewear:	None
Child Restraint Use:	Convertible child safety seat with 5-point harness
Usage Source:	Vehicle inspection
Egress from Vehicle:	Assisted by right front passenger
Mode of Transport from Scene:	Ambulance to hospital
Type of Medical Treatment:	Evaluated for probable injuries and released

Rear Right Child Injuries

Injury	Injury Severity AIS90/Update 98	Injury Source
Not injured	N/A	N/A

Rear Right Child Kinematics

The 15-month-old male child passenger was seated in a Graco Comfort Sport convertible child safety seat and was restrained by the integrated five-point harness system. On the day of the crash, the driver had installed the child safety seat in the vehicle by routing the vehicle's lap and shoulder belt through the rear belt path. She pulled out the webbing to the engage the ALR to ensure the safety belt was locked in place. The driver stated that the child safety seat was installed tightly with minimal movement at the belt path. However, she did not apply weight on the safety seat in order to spool in additional webbing for a tighter installation. The child responded to the frontal crash forces by initiating a forward trajectory and loading the internal harness system. This child was not injured in the crash. He was transported to a local hospital for observation and evaluation.
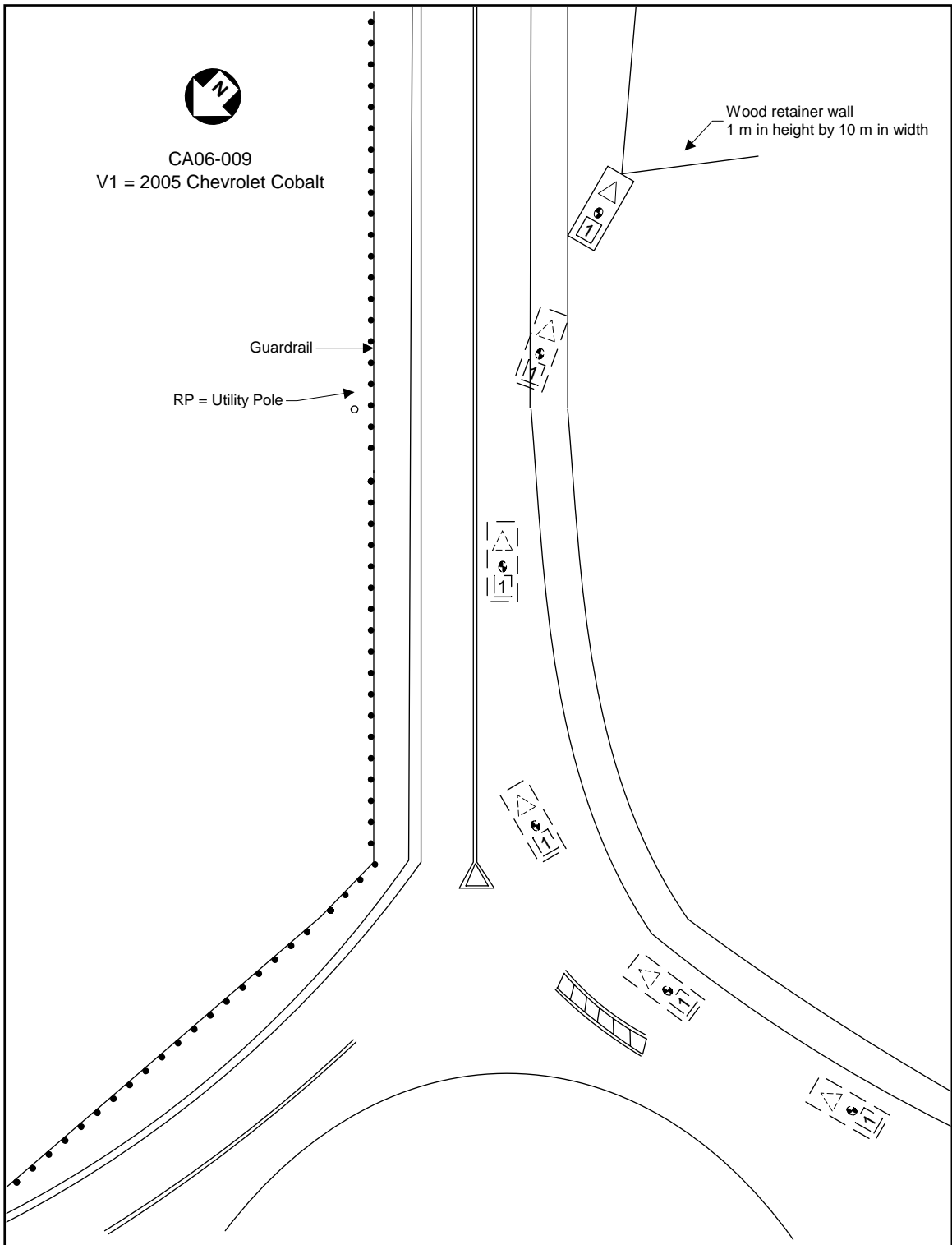
Figure 10: Scene Schematic

Attachment A: 2005 Chevrolet Cobalt EDR Printout

CDR File Information

Vehicle Identification Number	1G2ZG558864******
Investigator	
Case Number	CA06-006
Investigation Date	
Crash Date	
Filename	WITHOUTVIN.CDR
Saved on	Thursday, March 30 2006 at 12:52:41 PM
Collected with CDR version	Crash Data Retrieval Tool 2.800
Collecting program verification number	9238B95E
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: 4A Date: 11-08-05 Checksum: 7500
Event(s) recovered	Deployment

SDM Data Limitations

SDM Recorded Crash Events:
There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). It can contain 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 can contain 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 Event file will be locked after a Deployment Event, if the Non-Deployment Event occurred within 5 seconds before the Deployment Event unless a Deployment Level Event occurs within 5 seconds after the Deployment Event, then the Deployment Level Event will overwrite the Non-Deployment Event file.

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 220 milliseconds of data after deployment criteria is met and up to 70 milliseconds before deployment criteria is met. For Non-Deployment Events, the SDM will record up to the first 300 milliseconds of data after algorithm enable. The minimum SDM Recorded Vehicle Forward Velocity Change, that is needed to record a Non-Deployment Event, is 5 MPH.
-Maximum Recorded Vehicle Velocity Change is the maximum recorded velocity change in the vehicle's combined "X" and "Y" axis.
-Calculated Principal Direction of Force (PDOF) is the arctangent of the maximum observed lateral velocity change divided by the maximum observed longitudinal velocity change. PDOF is displayed where zero degrees is located at the front of the vehicle, with 90 degrees is displayed to the right side of the vehicle and so on, clockwise around the vehicle.
-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. The Passenger Belt Switch Circuit Status for 2006 Chevrolet Cobalt Sport Coupe (AP) model vehicles, with the option package that includes Recaro brand seats (RPO ALV), will always report a default value of "Buckled".
-The Time Between Non-Deployment and Deployment Events is displayed in seconds. If the time between the two events is greater than 5 seconds, "N/A" is displayed in place of the time. If the value is negative, then the Deployment Event occurred first. If the value is positive, then the Non-Deployment Event occurred first.
-If power to the SDM is lost during a crash event, all or part of the crash record may not be recorded.
-The ignition cycle counter relies upon the transitions through OFF->RUN->CRANK power-moding messages, on the GMLAN communication bus, to increment the counter. Applying and removing of battery power to the module will not increment the ignition counter.
SDM Data Source:
All SDM recorded data is measured, calculated, and stored internally, except for the following:
-Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle's communication

network.
-The Belt Switch Circuit is wired directly to the SDM.

System Status At AE

Vehicle Identification Number	**2ZG558*6*******
Low Tire Pressure Warning Lamp (If Equipped)	Invalid
Vehicle Power Mode Status	Run
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Active
Brake System Warning Lamp (If Equipped)	OFF

System Status At 1 second

| Transmission Range (If Equipped)	Third Gear
Transmission Selector Position (If Equipped)	Drive
Traction Control System Active (If Equipped)	Invalid
Service Engine Soon (Non-Emission Related) Lamp	OFF
Service Vehicle Soon Lamp	OFF
Outside Air Temperature (degrees F) (If Equipped)	37.4
Left Front Door Status (If Equipped)	Closed
Right Front Door Status (If Equipped)	Closed
Left Rear Door Status (If Equipped)	Unused
Right Rear Door Status (If Equipped)	Unused
Rear Door(s) Status (If Equipped)	Closed

Pre-crash data

Parameter	-2 sec	-1 sec
Reduced Engine Power Mode	OFF	OFF
Cruise Control Active (If Equipped)	No	No
Cruise Control Resume Switch Active (If Equipped)	No	No
Cruise Control Set Switch Active (If Equipped)	No	No

Pre-crash data

Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	37	34	33	29	22
Engine Speed (RPM)	1024	960	896	832	704
Percent Throttle	0	0	0	0	0
Brake Switch Circuit Status	ON	ON	ON	ON	ON
Accelerator Pedal Position (percent)	0	0	0	0	0
Antilock Brake System Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Lateral Acceleration (feet/s²)(If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Yaw Rate (degrees per second) (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid
Steering Wheel Angle (degrees) (If Equipped)	-32	0	0	-16	-96
Vehicle Dynamics Control Active (If Equipped)	Invalid	Invalid	Invalid	Invalid	Invalid

System Status At Deployment

Ignition Cycles At Investigation	522
SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time (seconds)	431050
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	449
Ignition Cycles At Event	522
Ignition Cycles Since DTCs Were Last Cleared	254
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	BUCKLED
Diagnostic Trouble Codes at Event, fault number: 1	N/A
Diagnostic Trouble Codes at Event, fault number: 2	N/A
Diagnostic Trouble Codes at Event, fault number: 3	N/A
Diagnostic Trouble Codes at Event, fault number: 4	N/A
Diagnostic Trouble Codes at Event, fault number: 5	N/A
Diagnostic Trouble Codes at Event, fault number: 6	N/A
Automatic Passenger SIR Suppression System Validity Status at AE	Valid
Automatic Passenger SIR Suppression System Status at AE	Air Bag Not Suppressed
Automatic Passenger SIR Suppression System Validity Status at First Deployment Command	Valid
Automatic Passenger SIR Suppression System Status at First Deployment Command	Air Bag Not Suppressed
Driver First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	28
Driver Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	30
Passenger First Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	28
Passenger Second Stage Time Algorithm Enabled to Deployment Command Criteria Met (msec)	30
Time Between Events (sec)	N/A
Driver First Stage Deployment Loop Commanded	Yes
Driver Second Stage Deployment Loop Commanded	Yes
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	Yes
Driver (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Driver (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Driver Knee Deployment Loop Commanded	No
Passenger First Stage Deployment Loop Commanded	Yes
Passenger Second Stage Deployment Loop Commanded	Yes
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	Yes
Passenger (Initiator 1) Roof Rail/Head Curtain Loop Commanded	No
Passenger (Initiator 2) Roof Rail/Head Curtain Loop Commanded	No
Passenger Knee Deployment Loop Commanded	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded	No
Third Row Left Roof Rail/Head Curtain Loop Commanded	No
Second Row Right Side Deployment Loop Commanded	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Third Row Right Roof Rail/Head Curtain Loop Commanded	No
Second Row Center Pretensioner Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded for Disposal	No
Passenger 2nd Stage Deployment Loop Commanded for Disposal	No
Multiple Event Counter	0
An Event(s) Preceded the Recorded Event(s)	No
An Event(s) was in Between the Recorded Event(s)	No
An Event(s) Followed the Recorded Event(s)	No
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	No
Crash Record Locked	Yes
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Deployment Event Recorded in the Non-Deployment Record	No
Event Recording Complete	Yes
Estimated Principal Direction of Force (PDOF) degrees	35

1G2ZG558864**** Longitudinal Axis Deployment Data**

SDM Recorded Velocity Change (MPH)
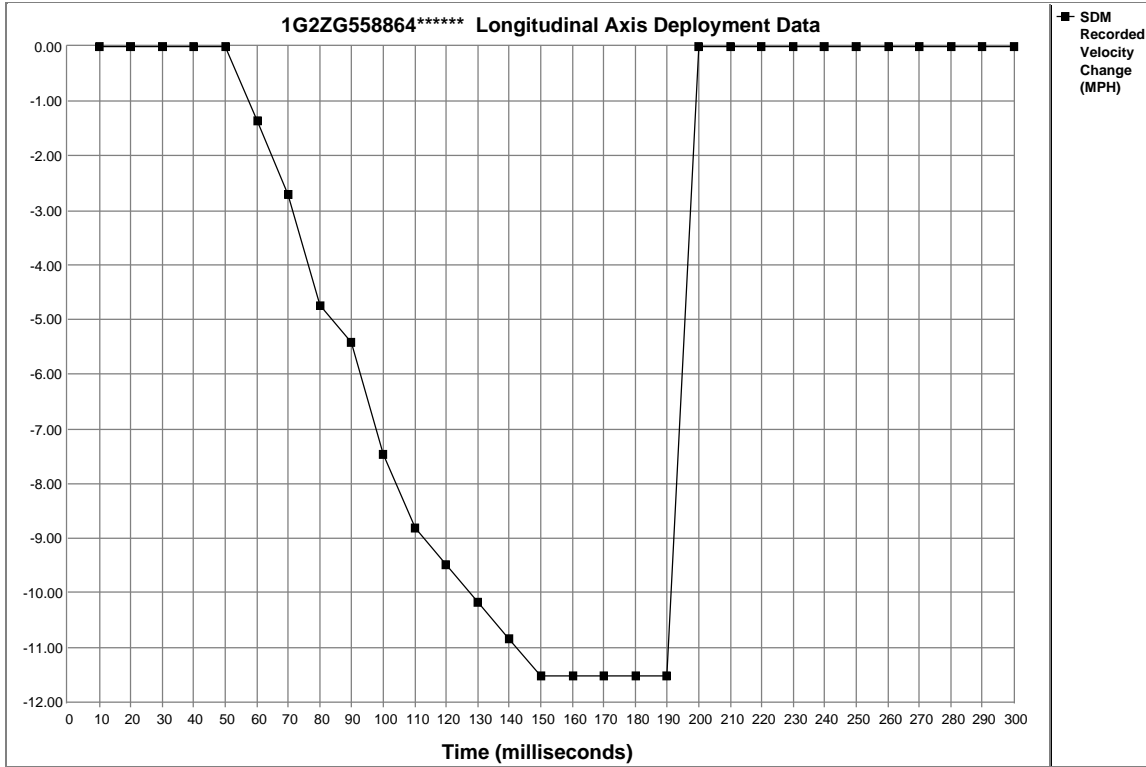
Time (milliseconds)

Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Longitudinal Axis Recorded Velocity	0.00	0.00	0.00	0.00	0.00	-1.36	-2.71	-4.74	-5.42	-7.46	-8.81	-9.49	-10.17	-10.85	-11.52
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-11.52	-11.52	-11.52	-11.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

1G2ZG558864**** Lateral Axis Deployment Data**

SDM
Recorded
Velocity
Change
(MPH)
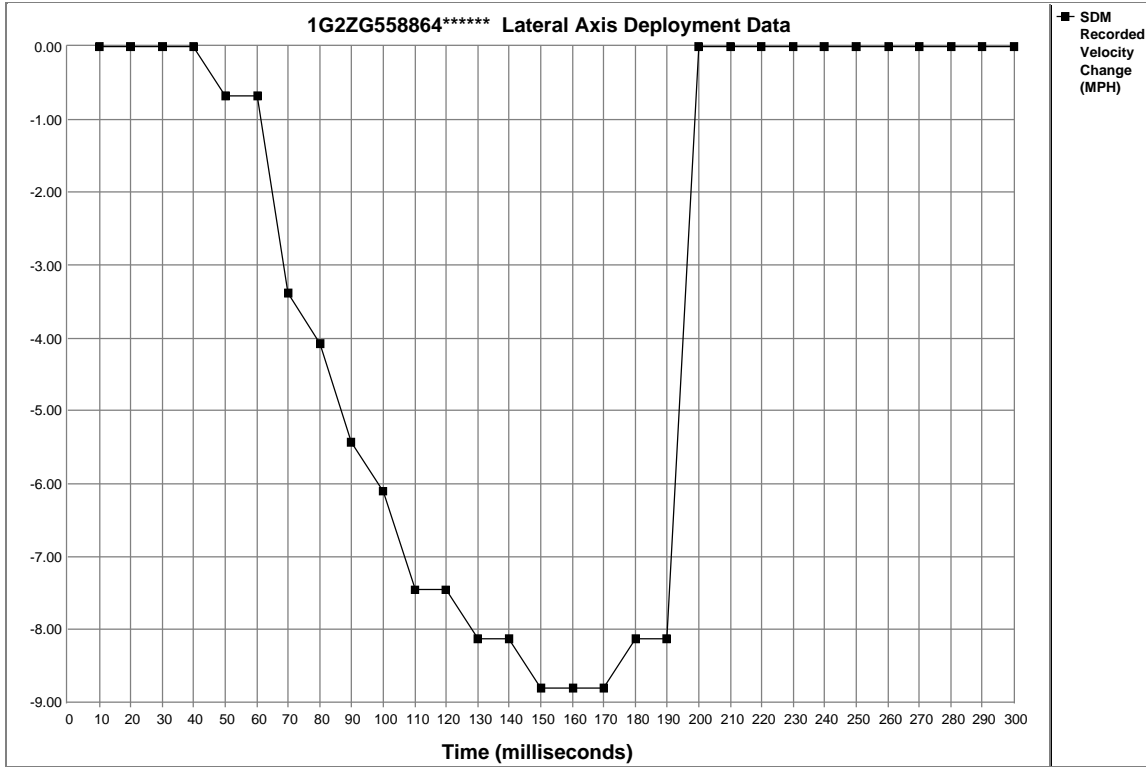
Time (milliseconds)

Time (milliseconds)	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
Lateral Axis Recorded Velocity Change (MPH)	0.00	0.00	0.00	0.00	-0.68	-0.68	-3.39	-4.07	-5.42	-6.10	-7.46	-7.46	-8.13	-8.13	-8.81
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	-8.81	-8.81	-8.13	-8.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Hexadecimal Data

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

```
$01   68 00 00 00 00 00 00
$02   30 00 00 00 00 00 00
$03   00 00 00 00 00 00 00
$04   04 00 00 00 00 00 00
$05   00 00 00 00 00 00 00
$06   00 4A 00 00 19 53 52
$07   00 00 00 00 00 00 00
$08   00 00 00 00 00 00 00
$09   03 FF 7B 00 00 00 00
$0A   00 00 00 00 00 00 00
$0B   00 00 01 0F 00 00 00
$0C   80 00 80 00 00 00 00
$0D   00 00 80 00 00 00 00
$0E   00 00 00 00 00 00 00
$0F   A2 00 00 00 00 00 00
$10   47 32 5A 47 35 35 38
$11   38 36 34 31 30 32 39
$12   36 30 00 00 00 00 00
$13   00 00 00 00 00 00 00
$14   00 00 00 00 00 00 00
$15   00 00 00 00 00 00 00
$16   03 06 0C 16 34 00 00
$17   07 07 07 07 00 00 00
$18   00 07 00 00 00 00 00
$19   07 07 00 00 00 00 00
$1B   3F 00 00 67 00 7A 00
$1C   3F 00 00 06 00 1A 00
$1D   00 00 00 00 00 00 00
$1E   00 00 00 00 00 00 00
$1F   20 C1 00 00 00 00 00
$20   40 00 00 00 00 00 00
$21   FF FF 00 00 50 00 00
$22   00 9D 00 00 00 00 00
$24   00 00 00 00 00 00 00
$25   00 00 00 00 00 00 00
$26   00 00 00 00 00 00 00
$27   FF 00 FF 00 00 00 00
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$2B   00 00 00 00 00 00 00
$2D   00 00 00 00 00 00 00
$2E   80 00 25 00 00 00 00
$2F   00 FE 02 0A 00 00 00
$30   9D 00 00 00 00 00 00
$31   00 00 00 00 00 00 00
$32   F8 00 00 00 00 00 00
$33   00 00 00 00 00 00 00
$34   0B 0D 0E 0F 10 00 00
$35   23 2F 35 37 3B 00 00
$36   FA FF 00 00 FE 00 00
$37   00 00 00 03 0B 00 E2
$38   56 00 40 00 03 C0 00
$39   00 00 00 00 00 80 00
$3A   00 00 00 00 00 80 00
$3B   03 06 0C 00 00 00 00
$3C   00 00 00 00 00 00 C0
$3D   32 5A 47 35 35 38 00
$3E   36 10 29 60 00 00 00
$3F   00 00 90 00 00 00 00
$40   00 00 00 00 00 00 00
$41   F8 F8 90 00 00 00 00
$42   80 FF FF FF FF 00 00
```

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$43   FF FF FF 00 00 00 00
$44   FF FF FF FF FF FF 00
$45   FF FF FF FF FF FF 00
$46   FF FF FF FF FF FF 00
$47   FF FF FF FF FF FF 00
$48   FF FF FF FF FF FF 00
$49   FF FF FF FF FF FF 00
$4A   FF FF FF FF FF FF 00
$4B   FF FF FF FF FF FF 00
$4C   FF FF FF FF FF FF 00
$4D   FF FF FF FF FF FF 00
$4E   FF FF FF FF FF FF 00
$4F   FF FF FF FF FF FF 00
$50   FF FF FF FF FF FF 00
$51   F0 00 00 F0 00 00 00
$52   81 FF FF FF 00 00 00
$53   FF FF FF 00 00 00 00
$54   82 FF FF 00 00 00 00
$55   FF FF FF FF FF FF 00
$67   A0 A5 00 00 00 00 00
$68   D0 D0 00 00 00 00 00
$69   00 A8 61 01 C1 00 00
$6A   FE 02 0A 00 00 00 00
$6B   00 00 00 00 00 00 00
$6C   00 00 00 00 00 00 00
$6D   00 00 00 00 00 00 00
$6E   00 00 00 00 00 00 00
$6F   00 00 FF 00 FF FE 00
$70   FB FC FA F9 F8 F8 00
$71   F7 F5 F5 F3 F5 F2 00
$72   F4 F1 F4 F0 F3 EF 00
$73   F3 EF F3 EF F4 EF 00
$74   F4 EF 00 00 00 00 00
$75   00 00 00 00 00 00 00
$76   00 00 00 00 00 00 00
$77   00 00 00 00 00 00 00
$78   F0 00 00 00 00 00 00
$79   01 00 00 00 00 00 00
$7A   02 00 00 00 00 00 00
$7B   0E 0F 0E 0F 00 00 00

$01   41 55 01 02 03 04 52 53 41 32 03 09 01 AA AA 01
$02   01 02 03 04
$03   41 54 01 02 03 04 52 53 41 32 03 09 01 AA AA 01
$04   01 02 03 04
$05   42 55 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
$06   FF FF FF FF
$07   42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
$08   FF FF FF FF
$0D   41 48 36 34 37 33 52 35 30 36 33 33 30 4B 48 39
$0E   01 5A 39 A4
$0F   41 4A 36 34 37 33 52 35 30 34 39 32 30 39 54 39
$10   01 5A 39 A4
$13   42 52 39 38 32 30 44 31 35 30 39 30 30 35 34 30
$14   16 46 3D 35
$17   42 54 FF FF FF FF FF FF FF FF FF FF FF FF FF FF
$18   FF FF FF FF
$21   32 16 B8 0B 5E 11 91 9A
$22   53 52
$23   32 5A FA FA FA FA FA
$24   32 5A FA FA FA FA FA
$25   32 5A FA FA FA FA FA
$26   32 5A FA FA FA FA FA
$40   00 00
$41   3F 00 00 06 00 1A
$42   D0 E4
$43   00 00 8E 80
```

```
$44   C6 00 00 FC 80 C0
$45   07 01 07 01 05 01
$46   00 0F 0F 64 64
$47   0A 64 04 04 04 05 0A 06 04 0A 00 00 FA 00 00 FF 04 64
$48   18 08 08
$B0   58
$B1   FD FE 00
$B2   FF FF FF FF FF
$B4   41 53 35 33 35 32 32 31 30 35 58 51 20 20 20 20
$B7   50 AA 01 0F 02
$B8   54 41 68 06 15
$C1   30 46 30 32
$CA   30 46 30 32
$CB   00 F0 B6 78
$CC   00 F0 B6 78
$D1   00 00
$DB   00 00
$DC   00 00
```