

Certified Advanced 208-Compliant Air Bag Investigation / Multiple Vehicles
Dynamic Science, Inc. / Case Number: DS06028
2005 Chevrolet Trailblazer LS
Washington
October 2006

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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 be 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 investigation focused on the Certified Advanced 208-Compliant frontal air bags in a 2005 Chevrolet Trailblazer. This three vehicle crash occurred in October 2006 at 0805 hours in an urban area of Washington. The crash occurred in the westbound lanes of a divided state freeway. The case vehicle was a 2005 Chevrolet Trailblazer LS being driven by a 19-year-old restrained male. There were no other occupants in the vehicle. The second vehicle was a 2002 Acura 3.2TL being driven by a female of an unknown age. The third vehicle was a 2005 Kenworth T800 tractor-trailer being driven by a male of an unknown age. All three vehicles were traveling in the westbound lanes of a divided state freeway. The Chevrolet Trailblazer was traveling in the inside westbound lane, the Acura was traveling in the right lane, and the tractor-trailer was traveling in the center lane. According to the police report, the driver of the tractor-trailer began to slow due to a collision that had occurred in front of him. According to the driver of the case vehicle, as the semi was braking, a non-contact vehicle that had been traveling immediately behind the semi swerved into the Trailblazer's path of travel. The driver of the Trailblazer braked and swerved right to avoid striking the non-contact vehicle. The case vehicle moved into the center lane and the front of the Trailblazer struck the back of the Kenworth's trailer. The case vehicle rotated counterclockwise and the back right bumper corner impacted the left side of the Acura. All three vehicles came to final rest near the points of impact.				
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Dynamic Science, Inc.
Crash Investigation
Case Number: DS06028

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Background

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) frontal air bags in a 2005 Chevrolet Trailblazer. A CAC vehicle is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This three vehicle crash occurred in October 2006 at 0805 hours in an urban area of Washington. The crash occurred in the westbound lanes of a divided state freeway.

The case vehicle was a 2005 Chevrolet Trailblazer LS being driven by a 19-year-old restrained male. There were no other occupants in the vehicle. The second vehicle was a 2002 Acura 3.2TL being driven by a female of an unknown age. The third vehicle was a 2005 Kenworth T800 tractor-trailer being driven by a male of an unknown age. All three vehicles were traveling in the westbound lanes of a divided state freeway.

The Chevrolet Trailblazer was traveling in the inside westbound lane, the Acura was traveling in the right lane, and the tractor-trailer was traveling in the center lane. According to the police report, the driver of the tractor-trailer began to slow due to a collision that had occurred in front of him. According to the driver of the case vehicle, as the semi was braking, a non-contact vehicle that had been traveling immediately behind the semi swerved into the Trailblazer's path of travel. The driver of the Trailblazer braked and swerved right to avoid striking the non-contact vehicle. The case vehicle moved into the center lane and the front of the Trailblazer struck the back of the Kenworth's trailer. At impact, the driver of the Trailblazer hit the steering wheel with his face, resulting in severe facial injuries. The case vehicle rotated counterclockwise and the back right bumper corner impacted the left side of the Acura. All three vehicles came to final rest near the points of impact.

The driver of the Trailblazer was not able to exit the vehicle through the left front door because it was jammed shut due to damage. He reported that he wanted to exit the vehicle through the operable right front door, but rescue personnel advised him to stay put. He was removed from the vehicle by rescue personnel and was transported by ambulance to a hospital. He sustained



Figure 1. Front/Left - 2005 Chevrolet Trailblazer



Figure 2. Exemplar vehicle

three facial fractures that required surgery. The driver of the Acura sustained possible neck and back injuries. The driver of the tractor-trailer reported no injuries at the scene. The Acura and the tractor-trailer were driven from the scene. The 2005 Chevrolet Trailblazer was towed due to damage and was later declared a total loss by the insurance company.

This Certified Advanced 208-Compliant Air Bag case was identified by DSI personnel. On November 22, 2006, DSI obtained permission to inspect the vehicle and download the vehicle's Electronic Data Recorder (EDR). The case was submitted to NHTSA on November 24, 2006 and NHTSA assigned the case on December 11, 2006. The case vehicle was inspected on December 14, 2006. The insurance company did not have a police report number but agreed to provide it once it was known. On December 20, 2006 a police report number was obtained from the insurance company and the report was requested from the investigating jurisdiction. A partially sanitized copy was obtained on January 23, 2007 and the scene inspection was completed on January 25, 2007. Data from the case vehicle's electronic data recorder was downloaded using the Vetronix tool and is included as Attachment 2 to this report.



Figure 3. Back/right damage - 2005 Chevrolet Trailblazer

SUMMARY

Crash Site

This three vehicle crash occurred in October 2006 at 0805 hours in an urban area of Washington. The crash occurred in the westbound lanes of a divided state freeway.

There are three westbound travel lanes in this location. The lanes are separated from one another by a combination of broken white lane lines and white Botts' dots. The left outside lane is bordered by a solid yellow line, followed by a narrow asphalt shoulder. There is a concrete jersey barrier adjacent to this shoulder which separates the westbound lanes from the eastbound freeway. The right outside lane is bordered by a solid white line, followed by an asphalt shoulder. Adjacent to the north shoulder there is a jersey barrier that becomes a guardrail further west. There was a major construction project on-going on the north side of the freeway. Based on the time of the crash, it is possible that there may have been construction activities taking place, although they are not believed to be related to the crash events.

In the precrash and point of impact areas, the westbound freeway lanes are comprised of asphalt, curve to the left and have an uphill grade. The posted speed limit for this section of the freeway is 97 km/h (60 mph). At the time of the crash the roadway was dry, there were no adverse weather conditions and no visual obstructions were present.

Pre-Crash

The 2005 Chevrolet Trailblazer LS was being driven by a restrained 19-year-old male. There were no other occupants in the vehicle. The second vehicle was a 2002 Acura 3.2TL being driven by a female of an unknown age. The third vehicle was a 2005 Kenworth T800 tractor-trailer being driven by a male of an unknown age.

All three vehicles were traveling in the westbound lanes of a divided state freeway. The Chevrolet Trailblazer was traveling in the inside westbound lane, the Acura was traveling in the right lane, and the tractor-trailer was traveling in the center lane.

According to the police report, the driver of the tractor-trailer began to slow due to a collision that had occurred in front of him. According to the driver of the case vehicle, as the semi was braking, a non-contact vehicle that had been traveling immediately behind the semi swerved into the Trailblazer's path of travel. The driver of the Trailblazer braked and swerved right to avoid striking the non-contact vehicle.



Figure 4. Approach of case vehicle to crash area (west)



Figure 5. Approach of tractor-trailer to crash area (west)

Crash

The case vehicle moved into the center lane and the front of the Trailblazer (12FYEW2) struck the back of the Kenworth's trailer. The barrier equivalent routine of the WinSmash program computed a delta V of 22.6 km/h (14.0 mph). The WinSmash result appear to be low which may be attributed to the fact that the case vehicle's front end underrode the back of the trailer. At impact, the driver of the Trailblazer hit the steering wheel with his face, resulting in severe facial injuries.

After the initial impact, the Trailblazer rotated counterclockwise and its back right bumper corner impacted (06BREN1) the left side of the Acura. All three vehicles came to final rest near the points of impact.



Figure 6. Approximate area of impact between the case vehicle & the Acura 3.2TL

Post-Crash

The driver of the Trailblazer was not able to exit the vehicle through the left front door because it was jammed shut due to damage. He reported that he wanted to exit the vehicle through the operable right front door, but rescue personnel advised him to stay put. He was removed from the vehicle by rescue personnel and was transported by ambulance to a hospital. He sustained three facial fractures that required surgery. The driver of the Acura sustained possible neck and back injuries. The driver of the tractor-trailer reported no injuries at the scene.

The Acura and the tractor-trailer were driven from the scene. The 2005 Chevrolet Trailblazer was towed due to damage and was later declared a total loss by the insurance company.

Vehicle Data - 2005 Chevrolet Trailblazer LS

The 2005 Chevrolet Trailblazer LS was identified by the Vehicle Identification Number (VIN): 1GNDDT13S252XXXXXX. The Chevrolet Trailblazer LS is a four door sport utility, four wheel drive, passenger vehicle with seating for five. It was equipped with a 4.2 liter 6 cylinder engine, 4-speed automatic transmission, four wheel anti-lock brakes, front and rear disc brakes, daytime running lights and a tilt steering wheel. The vehicle mileage could not be obtained from the digital odometer because the vehicle had no power. The driver estimated the mileage was approximately 46,670 km (29,000 miles) at the time of the crash.



Figure 7. Debeaded LF tire (not with vehicle at the inspection)

The Chevrolet Trailblazer was equipped with Toyo Proxes S/T P265/40R22 tires. The vehicle manufacturer recommended tire size was P235/75R16. The recommended cold tire pressure was 207 kPa (30 psi) for the front and 241 kPa (35 psi) for the rear. The left front tire was with the vehicle when it arrived at the salvage yard, but was not with the vehicle at the time of the inspection. The specific tire information for the case vehicle was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	Unknown	Yes	Tire debeaded
LR	207 kPa (30 psi)	7 mm (9/32 in)	No	None
RR	207 kPa (30 psi)	7 mm (9/32 in)	No	None
RF	172 kPa (25 psi)	7 mm (9/32 in)	No	None

The front row seating in the 2005 Chevrolet Trailblazer was configured with dual fabric covered bucket seats. The seats were equipped with adjustable head restraints that were not damaged. The second row was configured as a fabric covered 60/40 split bench seat with folding backs. The outboard second row seating positions were equipped with adjustable head restraints that were not damaged.

The second row outboard seating positions were equipped with the lower anchor points that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. All three second row seating positions were equipped with child safety seat top tether anchor points, located on the floor of the cargo area, behind the second row seat backs.

Vehicle Damage

Exterior Damage - 2005 Chevrolet Trailblazer LS

Damage Description: The 2005 Chevrolet Trailblazer sustained moderate front end damage as a result of the impact with the back of the trailer. The vehicle sustained 110.0 cm (43.3 in) of direct damage along the front bumper, beginning 25.0 cm (9.8 in) right of the precrash center point of the vehicle, extending to the left front bumper corner. The bumper cover was no longer attached to the vehicle and was found in the passenger compartment. The left front tire was debanded and the left wheelbase was shortened by 35.0 cm (13.8 in).

The front of the case vehicle underode the back of the semi tractor-trailer, resulting in substantial above bumper damage. Crush profiles were taken at both the bumper level and the above bumper level. Six crush measurements were documented along the front bumper as follows: C1= 23.0 cm (9.1 in), C2=7.0 cm (2.8 in), C3=32.0 cm (12.6 in), C4=13.0 cm (5.1 in), C5=0.0 cm (0.0 in), C6=2.0 cm (5.5 in). Six crush measurements were documented along the radiator support as follows: C1= 37.0 cm (14.6 in), C2=17.0 cm (6.7 in), C3=8.0 cm (3.1 in), C4=2.0 cm (0.8 in), C5=2.0 cm (0.8 in), C6=0.0 cm (0.0 in).

At C1 and C2, there was above bumper crush that exceeded the bumper crush by more than 13.0 cm (5.1 in) and those crush measurements were averaged. The resultant crush profile was as follows: C1 = 30.0 cm (11.8 in), C2=7.0 cm (2.8 in), C3=32.0 cm (12.6 in), C4=13.0 cm (5.1 in), C5=0.0 cm (0.0 in), C6=2.0 cm (5.5 in).

The maximum bumper crush was located 17.0 cm (6.7 in) left of the centerpoint and measured 33.0 cm (13.0 in).

The Collision Deformation Classification (CDC) for this event was 12FYEW2.



Figure 8. Front crush profile - bumper level



Figure 9. Exemplar vehicle - Front

The case vehicle sustained light back end damage as a result of the secondary impact with the Acura. The vehicle sustained 19.0 cm (7.5 in) of direct damage along the back bumper, beginning 66.0 cm (26.0 in) right of the vehicle's precrash center point, extending to the right. Six crush measurements were documented along the back bumper as follows: C1= 0.0 cm, C2=0.0 cm, C3=0.0 cm, C4=0.0 cm, C5=0.0 cm, C6=0.0 cm. Even though there was no crush from the event, the location most representative of maximum crush was at the right rear bumper corner. The CDC for this event was 06BREN1.

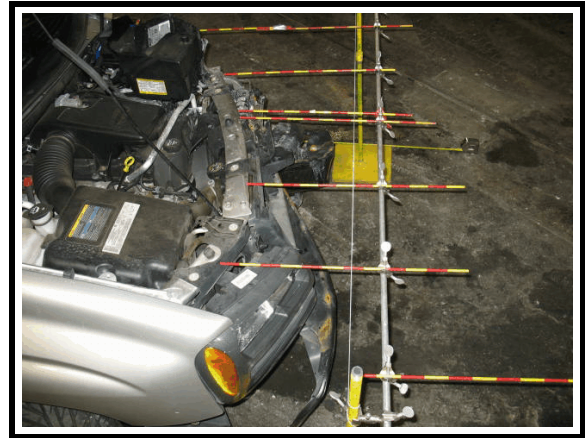


Figure 10. Above bumper crush profile - view from right

CDC (Impact 1):
(Impact 2):

12FYEW2
06BREN1

Barrier Equivalent Speed (Impact 1)¹: 22.6 km/h (14.0 mph)



Figure 11. Back/right damage from secondary impact



Figure 12. Right rear bumper corner/taillight damage

¹Struck vehicle was beyond scope of WinSmash. Barrier only run coded.

Interior Damage - 2005 Chevrolet Trailblazer LS

The case vehicle sustained moderate interior damage due to occupant contacts and passenger compartment intrusion.

There were scuffs to the lower left instrument panel, likely due to contact from the driver's left knee. There was a faint scuff to the center of the left A pillar, which may have been a result of contact from the driver's left arm or hand.

The left front and rear doors were jammed shut due to damage. The left front door latch had been pried open by fire/rescue personnel. The right side doors remained closed and operational. The disintegrated left front window glazing was found in the right front floorboard area. The driver reported that it was intact post-crash, and was broken by fire/rescue personnel. The right front glazing was found fully open at the inspection and was not damaged. The left side of the windshield was cracked from the first crash event.

The second row seatback was damaged and had intruded longitudinally into the second row seating area. The damage was caused by contact from subwoofers that had been installed behind the seat backs.



Figure 13. Scuffs below steering column

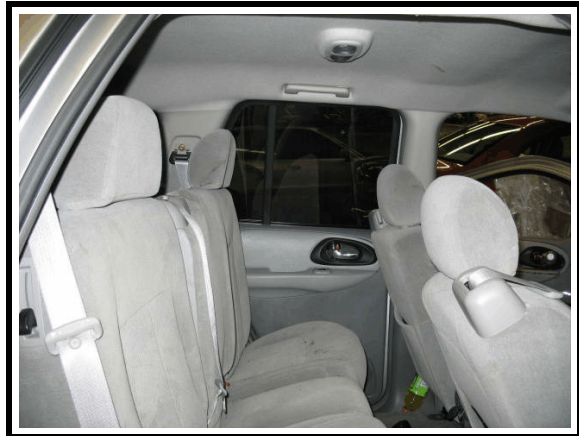


Figure 14. Damage to 2nd row seatbacks



Figure 15. 2nd row seatbacks - exemplar vehicle

There were several intrusions into the passenger compartment seating areas. An exemplar vehicle was used to obtain the comparison value measurements. The specific passenger compartment intrusions were documented as follows:

Row/Position	Intruded Component	Magnitude of Intrusion	Direction
2L	Second row seat back	16.0 cm (6.3 in)	Longitudinal
2M	Second row seat back	16.0 cm (6.3 in)	Longitudinal
2R	Second row seat back	12.0 cm (4.7 in)	Longitudinal
1L	Piece of the lower instrument panel	9.0 cm (3.5 in)	Vertical
1L	Floorpan	8.0 cm (3.1 in)	Vertical
1L	Toe pan	5.0 cm (2.0 in)	Longitudinal

Manual Restraint Systems - 2005 Chevrolet Trailblazer LS

The 2005 Chevrolet Trailblazer was configured with manual 3-point lap and shoulder belts in all five seating positions. Both front seat belts were equipped with retractor pretensioners; neither pretensioner actuated during the crash.

Both front row seats and the second row center seat were equipped with integral seat belts. The driver's safety belt was configured with a sliding latch plate and an emergency locking retractor (ELR). There were scuffs and discolorations on the driver's seat belt webbing, but they were in areas that had been wrapped around the left front door. This belt was used to secure the left front door to the vehicle. There were no signs of occupant loading to the driver's seat belt.

The remaining four seat belts had sliding latch plates and switchable ELR/Automatic Locking Retractors.



Figure 16. Driver's seat belt

Supplemental Restraint Systems - 2005 Chevrolet Trailblazer LS

The case vehicle was equipped with advanced occupant protection systems. The systems consists of the Sensing and Diagnostic Module (SDM), dual stage Certified Advanced 208-Compliant front air bags, and a front right Passenger Sensing System (PSS).

The PSS works with sensors located in the front right passenger seat and safety belt. These sensors are designed to detect the presence of a properly seated occupant and under certain conditions, the PSS will turn off the passenger front air bag. Some of these conditions include: when the front right passenger seat is unoccupied, when the PSS determines that an infant is present in a rear-facing infant seat, and when the right front seat is occupied by a smaller person. There is a passenger air bag status indicator located in the rearview mirror which displays “ON” or “OFF” when the vehicle is running. Whenever the PSS has turned off the right front air bag, the “OFF” indicator located on the rearview mirror will illuminate.

The air bag system will monitor the severity of a collision and will inflate the air bags based on whether or not the seat belts are in use. The system is controlled by the SDM. The primary function of the SDM is to control the deployment of the occupant protection systems. The system records the vehicle’s forward velocity change. For Deployment Events and Deployment Level Events, the SDM will record 230 milliseconds of data after the deployment criteria is met and up to 70 milliseconds of data before the deployment criteria is met. For Non-Deployment events, the SDM will record 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 8 km/h (5 mph). The SDM data was downloaded using the Vetronix Crash Data Retrieval System.

One Non-Deployment event was recorded by the SDM. The Non-Deployment Event occurred as a result of the impact with the back of the tractor-trailer. There was an event that followed the recorded event, but this associated event was not recorded.



Figure 17. Passenger Air Bag On/Off indicator (on rearview mirror)

The Vetronix system status report at the non-deployment event indicates that:

The SIR warning lamp status was OFF
 The driver's belt switch status was BUCKLED
 Ignition cycles at event = 3990
 Ignition cycles at investigation = 3991
 Ignition cycles since DTCs were last cleared = 255
 Number of ignition cycles SIR Warning Lamp was ON/OFF continuously = 3990

Maximum SDM recorded velocity change was -53.46 km/h (-33.22 mph).
 Algorithm Enable to Maximum SDM Recorded Velocity Change (msec) = 160
 Driver 1st Stage Deployment Loop Commanded = No
 Driver 2nd State Deployment Loop Commanded = No
 Driver Pretensioner Deployment Loop Commanded = No
 Driver's seat position switch circuit status = Rearward

Automatic passenger SIR suppression system status at AE = Air Bag Suppressed
 Passenger Pretensioner Deployment Loop Commanded = No

Time between events = N/A
 Event Recording Complete = Yes
 Estimated Principal Direction of Force (PDOF) degrees = 350

The vehicle speed was 92 km/h (57 mph) five seconds before AE and decelerated to 60 km/h (37 mph) at 1 second before AE.
 The brake switch circuit status was "Not Applied" from 5 through 3 seconds before AE.
 The brake switch circuit status was "Applied" from 2 through 1 seconds before AE.

The driver's air bag was mounted in the center of the steering wheel hub and the front right passenger air bag was a mid instrument mount. The driver was the sole occupant at the time of the crash. Neither air bag deployed. According to the vehicle manufacturer's owner's manual, the driver and front right passenger front air bags are "designed to inflate in moderate to severe frontal or near-frontal crashes". They are designed to deploy, "only if the impact exceeds a predetermined deployment threshold". These thresholds "take into account a variety of desired deployment and non-deployment events and are used to predict how severe a crash is likely to be in time for the airbags to inflate and help restrain the occupants. Whether your frontal airbags will or should deploy is not based on how fast your vehicle is traveling. It depends largely on what you hit, the direction of the impact and how quickly your vehicle slows down."

The owner's manual goes on to say that the vehicle's dual stage air bags will "adjust the restraint according to crash severity". If the air bag system senses a moderate frontal impact, the front air bags will "inflate at a level less than full deployment" while in a severe frontal impact, a full deployment will occur. The manual states that "If the front of your vehicle goes straight into a wall that does not move or deform, the threshold level for the reduced deployment is about 9 to 16 mph (14 to 26 km/h), and the threshold level for a full deployment is about 18 to 25 mph (29 to 40 km/h). (The threshold level can vary, however, with specific vehicle design, so that it can be somewhat above or below this range.)" Regarding deployments, the manual goes on to say

that “In any particular crash, no one can say whether an airbag should have inflated simply because of the damage to a vehicle or because of what the repair costs were. For frontal airbags, inflation is determined by the angle of the impact and how quickly the vehicle slows down in frontal and near-frontal impacts.”

Generally, the deployment criteria must be met within the first 40ms of AE. According to the data downloaded from the case vehicle’s EDR, the longitudinal delta V at 40ms was reported to be -3.1 kmph (-1.91 mph).

The driver is a car salesman and reported that he purchased the vehicle from his place of work. He owned the Trailblazer for approximately three months before the crash occurred. He did not know the complete history of the vehicle, but said that he works for a relative and cannot imagine that he would sell him a vehicle with a bad history or known problems. A Carfax vehicle history report was run on the Chevrolet Trailblazer. It reported that the vehicle had one previous owner and no reported problems (i.e., salvage, rebuild, fire/flood/hail damage) with the title.

This vehicle was not equipped with any other air bags. The driver and front right passenger positions were equipped with seat belt retractor pretensioners. Neither pretensioner actuated during the crash.

Vehicle Data - 2002 Acura 3.2TL

Description:	2002 Acura 3.2TL 4-door sedan	
VIN:	19UUA56832Axxxxxx	
Odometer:	Unknown	
Engine:	3.2L 6-cylinder	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	Left side damage	
CDC:	Unknown	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

Vehicle Data - 2005 Kenworth T800 Tractor

Description:	2005 Kenworth T800 conventional tractor	
VIN:	1XKDPB0X75Rxxxxxx	
Odometer:	Unknown	
Engine:	6 cylinder	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	Damage to back of trailer	
TDC:	Unknown	
Delta V:	Total	Unknown
	Longitudinal	Unknown
	Latitudinal	Unknown
	Energy	Unknown

Occupant Demographics - 2005 Chevrolet Trailblazer LS

	Driver
Age/Sex:	19/Male
Seated Position:	Front left
Seat Type:	Fabric covered bucket seat
Height:	180 cm (71 in)
Weight:	82 kg (180 lb)
Occupation:	Car salesman
Pre-existing Medical Condition:	Attention deficit disorder
Alcohol/Drug Involvement:	Unknown
Driving Experience:	5 years
Body Posture:	Leaning slightly to the right, forward facing
Hand Position:	Right hand on stick shift Left hand on steering wheel at the 12 o'clock position
Foot Position:	Right foot on brake Left foot on clutch
Restraint Usage:	Manual 3-point lap and shoulder belt (integral)
Air bag:	Front air bag available - nondeployed.

Occupant Demographics - 2002 Acura 3.2TL

	Driver
Age/Sex:	Age unknown/Female
Seated Position:	Front left
Seat Type:	Unknown
Height:	Unknown
Weight:	Unknown
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None present
Driving Experience:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt used per police report

Occupant Demographics - 2005 Kenworth T800 Tractor

	Driver
Age/Sex:	Age unknown/Male
Seated Position:	Front left
Seat Type:	Unknown
Height:	Unknown
Weight:	Unknown
Occupation:	Truck driver
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None present
Driving Experience:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt used per police report

Occupant Injuries - 2005 Chevrolet Trailblazer LS

Driver: Injuries obtained from ER Records, Radiology Records and Discharge Records.

<u>Injury</u>	<u>OIC Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Contusion, right orbit	2974021,1	Steering wheel	Probable
Contusion, right forehead	290402.1,7	Steering wheel	Probable
Fractures, comminuted and displaced, right maxillary sinus	250800.2,1	Steering wheel	Probable
Fractures, comminuted and displaced, right orbit	251204.3,1	Steering wheel	Probable
Cerebral concussion	161000.2,0	Steering wheel	Probable

Occupant Injuries - 2002 Acura 3.2TL

Driver: Injuries obtained from the police report.

<u>Injury</u>	<u>OIC Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Possible neck/back injury	Not codable	Impact	Probable

Occupant Injuries - 2005 Kenworth T800 Tractor

Driver: Not injured per the police report.

Occupant Kinematics - 2005 Chevrolet Trailblazer LS

Driver Kinematics

The 19-year-old male driver of the case vehicle was seated in an upright posture in the fabric covered bucket seat and was restrained by the integral 3-point manual lap and shoulder belt. He reported that he was leaning slightly to the right just prior to impact. He also reported that his seat back was reclined a fair distance rearward due to his personal preference. The seat was adjusted to the rearward most track position. The seat back was reclined at a 12 degree angle and the seat bottom had an 8 degree angle.

When the non-contact vehicle swerved in front of the case vehicle, this driver braked and swerved to his right. The Trailblazer moved into the center travel lane and the front of the case vehicle struck the back of the tractor-trailer. The male driver initiated a forward trajectory towards the 12 o'clock direction of force. His face came in contact with the steering wheel, deforming the upper rim, and resulting in severe facial injuries. It is possible that the driver's left hand and/or wrist came in contact with the left A pillar, leaving a slight scuff, although the driver did not report any hand injuries.

After the initial impact, the case vehicle rotated counterclockwise and the right rear of the Trailblazer struck the left side of the Acura. The Trailblazer damage from this secondary event was minor and likely was a low delta V event.

The driver of the Trailblazer was not able to exit the vehicle through the left front door because it was jammed shut due to damage. He reported that he wanted to exit the vehicle through the operable right front door, but rescue personnel advised him to stay put. He was removed from the vehicle by rescue personnel and was transported by ambulance to a hospital. He sustained three facial fractures that required surgery. The fractures were to his nose, the outer area of his right eye and to his right jawbone.

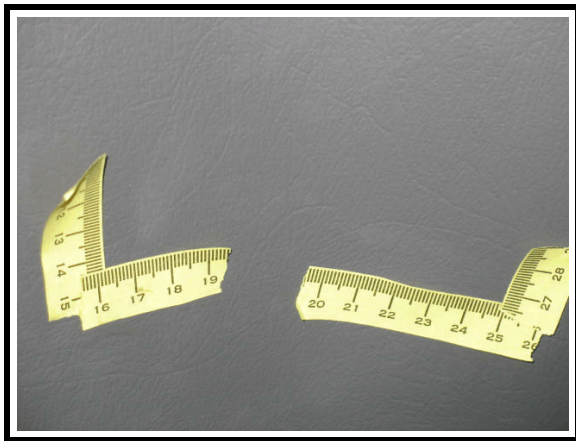
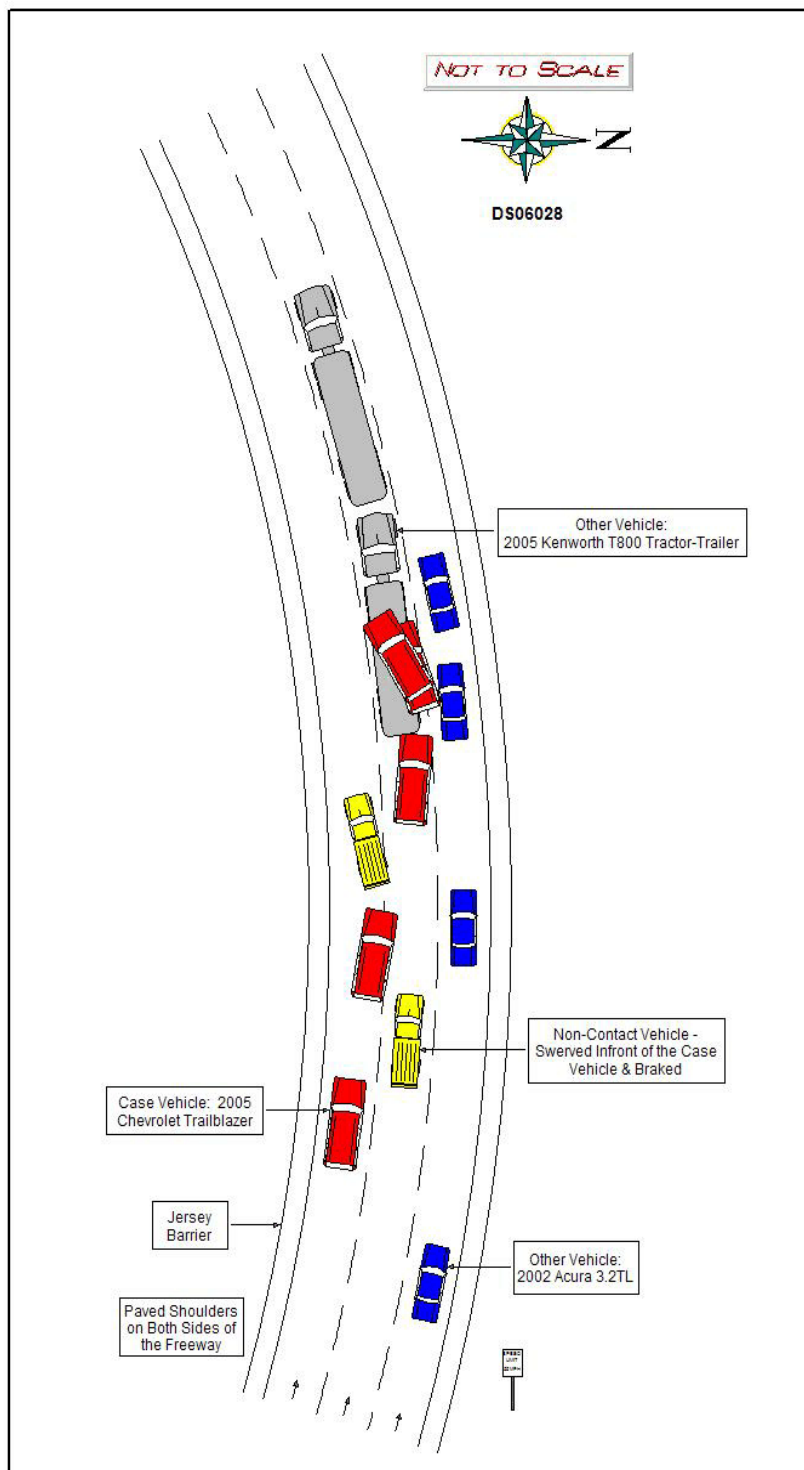


Figure 18. Close-up – scuffs below steering wheel



Figure 19. Possible occupant contact to left A pillar

Attachment 1. Scene Diagram



Attachment 2. Vetronix Report

CDR File Information

Vehicle Identification Number	1GNDT13S252*****
Investigator	
Case Number	
Investigation Date	
Crash Date	
Filename	06028.CDR
Saved on	Friday, December 15 2006 at 06:18:08 PM
Collected with CDR version	Crash Data Retrieval Tool 2.800
Reported with CDR version	Crash Data Retrieval Tool 2.900
Event(s) recovered	Non-Deployment

SDM Data Limitations

SDM Recorded Crash Events:

There are two types of SDM recorded crash events. The first is the Non-Deployment Event. A Non-Deployment Event is an event severe enough to "wake up" the sensing algorithm but not severe enough to deploy the air bag(s). It contains Pre-Crash and Crash data. The SDM can store up to one Non-Deployment Event. This event can be overwritten by an event that has a greater SDM recorded vehicle forward velocity change. This event will be cleared by the SDM after the ignition has been cycled 250 times.

The second type of SDM recorded crash event is the Deployment Event. It also contains Pre-Crash and Crash data. The SDM can store up to two different Deployment Events, if they occur within five seconds of one another. Deployment Events 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 230 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 combine "X" and "Y" axis.

-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 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. -Vehicle Status Data (Pre-Crash) is transmitted to the SDM, by various vehicle control modules, via the vehicle's communication network.

-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.

-Steering Wheel Angle data is displayed as a positive value, when the steering wheel is turned to the right, and a negative value, when the steering wheel is turned to the left.

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.

Multiple Event Data

Associated Events Not Recorded	1
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)	Yes
The Event(s) Not Recorded was a Deployment Event(s)	No
The Event(s) Not Recorded was a Non-Deployment Event(s)	Yes

System Status At AE

Vehicle Power Mode Status	Off
Remote Start Status (If Equipped)	Inactive
Run/Crank Ignition Switch Logic Level	Inactive

System Status At 1 second

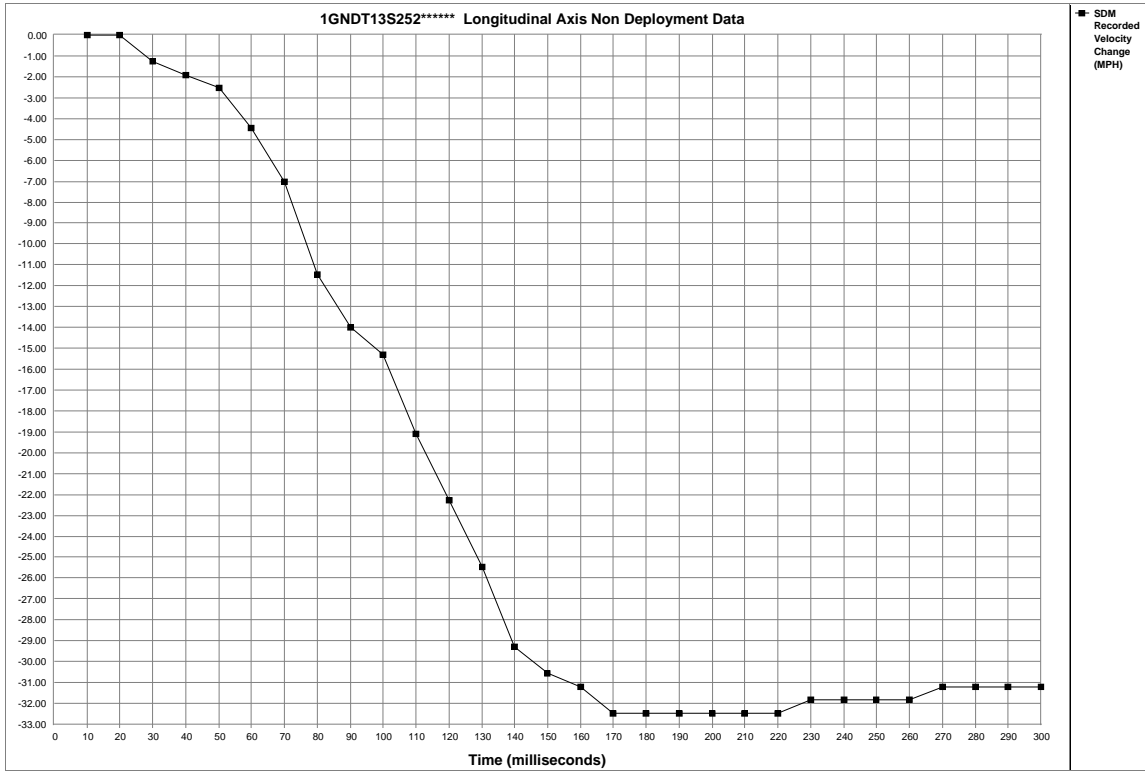
Left Front Door Ajar	No
Right Front Door Ajar	No
Left Rear Door Ajar	No
Right Rear Door Ajar	No

Pre-crash data

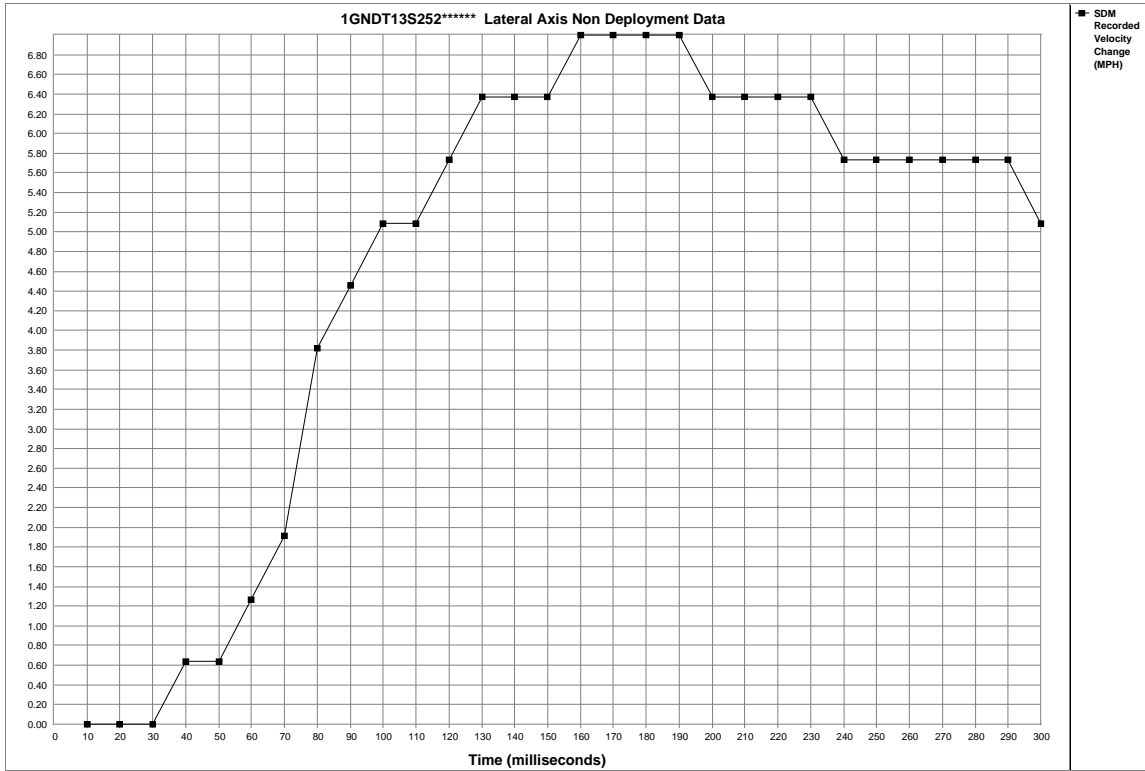
Parameter	-5 sec	-4 sec	-3 sec	-2 sec	-1 sec
Vehicle Speed (MPH)	57	57	57	55	37
Engine Speed (RPM)	2624	1792	2624	2240	1280
Percent Throttle	13	41	49	0	0
Brake Switch Circuit Status	OFF	OFF	OFF	ON	ON

System Status At Non-Deployment

SIR Warning Lamp Status	OFF
SIR Warning Lamp ON/OFF Time Continuously (seconds)	655350
Number of Ignition Cycles SIR Warning Lamp was ON/OFF Continuously	3990
Ignition Cycles At Investigation	3991
Ignition Cycles At Event	3990
Ignition Cycles Since DTCs Were Last Cleared	255
Driver's Belt Switch Circuit Status	BUCKLED
Passenger's Belt Switch Circuit Status	UNBUCKLED
Driver Seat Position Switch Circuit Status	Rearward
Passenger Seat Position Switch Circuit Status	Rearward
Automatic Passenger SIR Suppression System Status (1 sec)	Air Bag Suppressed
Driver 1st Stage Deployment Loop Commanded	No
Driver 2nd Stage Deployment Loop Commanded	No
Driver Side Deployment Loop Commanded	No
Driver Pretensioner Deployment Loop Commanded	No
Driver Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #1 Commanded (If Equipped)	No
Passenger 1st Stage Deployment Loop Commanded	No
Passenger 2nd Stage Deployment Loop Commanded	No
Passenger Side Deployment Loop Commanded	No
Passenger Pretensioner Deployment Loop Commanded	No
Passenger Roof Rail/Head Curtain Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #2 Commanded (If Equipped)	No
Second Row Left Side Deployment Loop Commanded	No
Second Row Left Pretensioner Deployment Loop Commanded (If Equipped)	No
Supplemental Deployment Loop #3 Commanded (If Equipped)	No
Second Row Right Side Deployment Loop Commanded (If Equipped)	No
Second Row Right Pretensioner Deployment Loop Commanded	No
Supplemental Deployment Loop #4 Commanded (If Equipped)	No
Second Row Center Pretensioner Deployment Loop Commanded	No
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
Diagnostic Trouble Codes at Event, fault number: 7	N/A
Diagnostic Trouble Codes at Event, fault number: 8	N/A
Diagnostic Trouble Codes at Event, fault number: 9	N/A
Maximum SDM Recorded Velocity Change (MPH)	33.22
Algorithm Enable to Maximum SDM Recorded Velocity Change (msec)	160
Crash Record Locked	No
Deployment Event Recorded in the Non-Deployment Record	No
Vehicle Event Data (Pre-Crash) Associated With This Event	Yes
Event Recording Complete	Yes



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	-1.27	-1.91	-2.55	-4.46	-7.00	-11.46	-14.01	-15.28	-19.10	-22.29	-25.47	-29.29	-30.56
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Longitudinal Axis Recorded Velocity	-31.20	-32.47	-32.47	-32.47	-32.47	-32.47	-32.47	-32.47	-31.84	-31.84	-31.84	-31.84	-31.20	-31.20	-31.20



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	0.64	0.64	1.27	1.91	3.82	4.46	5.09	5.09	5.73	6.37	6.37	6.37
Time (milliseconds)	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300
Lateral Axis Recorded Velocity Change (MPH)	7.00	7.00	7.00	7.00	6.37	6.37	6.37	6.37	5.73	5.73	5.73	5.73	5.73	5.73	5.09

Hexadecimal Data

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$02 00 00 00 00 F8 FF
$03 FF FF FF FF 00 00
$04 00 F8 00 00 00 00
$05 3F 00 00 06 C0 E2
$06 3F 00 00 06 C0 E2
$07 00 00 C0 00 22 00
$08 00 08 08 50 50 00
$09 04 64 04 64 7F 00
$0A 00 00 00 00 00 00
$0B 00 FE 00 00 FE 00
$12 FF 7F 00 84 40 00
$17 07 07 07 07 00 00
$18 07 07 00 00 00 00
$19 00 00 00 00 00 00
$1A 00 00 00 00 00 00
$1B 00 00 00 00 00 00
$1C 01 01 00 01 00 01
$1D 2B 00 00 00 00 88
$1E 00 00 00 00 00 00
$1F A8 A7 0D 0D FC F0
$20 20 BB 03 00 00 00
$21 7F 7F 7E 7E 7E 7D
$22 C0 00 00 00 00 00
$23 80 00 11 00 01 00
$24 FF FF 0F 97 F9 00
$25 82 C0 00 00 00 00
$26 00 00 7E 69 22 00
$27 C0 01 01 01 01 01
$29 14 23 29 1C 29 00
$2A 1E 2C 2E 2E 2E 00
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$2F 00 00 00 00 00 80
$30 00 00 00 00 00 80
$36 29 00 00 00 00 00
$37 00 A5 00 00 00 00
$38 00 00 00 00 00 00
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$3C FF FF FF FF FF FF
$3D FF FF FF FF FF FF
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$3F 0B 12 16 18 1E 23
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$41 33 33 33 33 32 32
$42 32 32 31 31 31 31
$43 00 00 00 01 01 02
$44 03 06 07 08 08 09
$45 0A 0A 0A 0B 0B 0B
$46 0B 0A 0A 0A 0A 09
$47 09 09 09 09 09 08
$48 10 0A A2 00 00 00
$49 D0 00 00 50 00 00
$4A 00 80 00 00 40 00
$4B 00 00 00 00 00 00
$4C 00 00 00 00 00 00
$4D 00 C0 00 00 00 00
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$4F 00 00 00 00 00 00
$50 00 FF 00 00 00 00
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$53 FF FF FF 00 00 00
$54 00 00 00 00 00 00
$55 00 00 00 00 00 00
$56 00 00 00 00 00 00
$57 FF FF FF FF FF FF
$58 FF FF FF FF FF FF
$59 FF FF FF FF FF FF
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$5B FF FF FF FF FF FF
$5C FF FF FF FF FF FF
$5D FF FF FF FF FF FF
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