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# ON-SITE AIR BAG NON-DEPLOYMENT INVESTIGATION

CASE NUMBER - IN07037
LOCATION - MISSOURI
VEHICLE - 2001 MERCURY GRAND MARQUIS GS
CRASH DATE - June 2007

Submitted:

September 9, 2008



Contract Number: DTNH22-07-C-00044


Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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.

**Technical Report Documentation Page**

| | | | |
|---|---|---|---|
| 1. *Report No.*<br>IN07037 | 2. *Government Accession No.* | 3. *Recipient's Catalog No.* | |
| 4. *Title and Subtitle*<br>On-Site Air Bag Non-Deployment Investigation<br>Vehicle - 2001 Mercury Grand Marquis GS<br>Location - Missouri | | 5. *Report Date:*<br>September 9, 2008<br>6. *Performing Organization Code* | |
| 7. *Author(s)*<br>Special Crash Investigations Team #2 | | 8. *Performing Organization Report No.* | |
| 9. *Performing Organization Name and Address*<br>Transportation Research Center<br>Indiana University<br>501 South Madison Street, Suite 105<br>Bloomington, Indiana 47403-1501 | | 10. *Work Unit No. (TRAIS)*<br>11. *Contract or Grant No.*<br>DTNH22-07-C-00044 | |
| 12. *Sponsoring Agency Name and Address*<br>U.S. Department of Transportation (NVS-411)<br>National Highway Traffic Safety Administration<br>National Center for Statistics and Analysis<br>Washington, D.C. 20590-0003 | | 13. *Type of Report and Period Covered*<br>Technical Report<br>Crash Date: June 2007<br>14. *Sponsoring Agency Code* | |
| 15. *Supplementary Notes*<br>On-site air bag non-deployment investigation involving a 2001 Mercury Grand Marquis equipped with manual seat belts and driver and front right passenger air bag system. | | | |


16. *Abstract*

This report covers an on-site air bag non-deployment investigation that involved a 2001 Mercury Grand Marquis GS, a 2002 Lincoln LS, and a 2006 International 9400i tractor-semitrailer. The investigation focused on the non-deployment of the Mercury's driver and front right passenger air bags. The Mercury and the International were traveling east and the Lincoln was traveling west on a 2-lane US highway. The International was traveling behind the Mercury. The Lincoln crossed into the eastbound lane and its front impacted the front of the Mercury. The Mercury's driver and front right passenger air bags did not deploy. The Lincoln's driver and front right passenger air bags did deploy. The International's driver steered right and locked the brakes and the front of the International impacted the left side of the Mercury as it rotated counterclockwise from the initial impact onto the south shoulder. The Mercury came to rest on the south shoulder heading northeast. The International came to rest heading slightly southeast against the left side of the Mercury. The Lincoln rotated counterclockwise and came to rest heading south in the middle of the roadway. The Mercury's restrained driver was pronounced deceased by the county coroner and transported to a local funeral home. The Mercury's unrestrained front right passenger sustained serious injuries and was transported by air ambulance to a hospital.


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|---|---|---|---|
| 17. *Key Words*<br>Air bag non-deployment<br>Driver fatality | Motor Vehicle Traffic Crash<br>Injury Severity | 18. *Distribution Statement*<br>General Public | |
| 19 *Security Classif. (of this report)*<br>Unclassified | 20. *Security Classif. (of this page)*<br>Unclassified | 21. *No. of Pages*<br>29 | 22. *Price* |

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

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**Figure 1:** The damaged 2001 Mercury Grand Marquis; each black mark on tape measure in 0.3 meter (1 foot)

This crash was brought to the National Highway Traffic Safety Administration's (NHTSA's), Special Crash Investigation (SCI) attention on November 14, 2007 by NHTSA's Office of Defect Investigation (ODI). The crash was initially brought to ODI's attention by a Missouri State Highway Patrol officer. The crash involved a 2001 Mercury Grand Marquis GS (**Figure 1**), a 2002 Lincoln LS, and a 2006 International 9400i tractor-semitrailer. The crash occurred in June, 2007, at 0250 hours, in Missouri and was investigated by the Missouri State Highway Patrol. This crash is of special interest because the Mercury was equipped with driver and front right passenger air bags that did not deploy during the crash. This contractor inspected the Mercury and scene on November 20, 2007 and interviewed the Mercury's front right passenger on March 3, 2008. This report is based on the police crash report, police reconstruction report, police on-scene photographs, inspection of the scene and the Mercury, inspection of an exemplar Mercury Grand Marquis, an interview with the Mercury's front right passenger, discussions with the police accident reconstructionist, the Mercury driver's and front right passenger's medical records, occupant kinematic principles, and this contractor's evaluation of the evidence.

## SUMMARY

This crash occurred on a two lane US highway during darkness and clear and dry weather conditions. The Mercury and the International were traveling east and the Lincoln was traveling west. The International was traveling behind the Mercury. The Lincoln crossed into the eastbound lane and its front impacted the front of the Mercury. The Mercury's driver and front right passenger air bags did not deploy. The Lincoln's driver and front right passenger air bags did deploy. The International's driver steered right and locked the brakes and the front of the International impacted the left side of the Mercury as it rotated counterclockwise onto the south shoulder. The Mercury came to rest on the south shoulder heading northeast. The International came to rest heading slightly southeast against the left side of the Mercury. The Lincoln rotated counterclockwise and came to rest heading south in the middle of the roadway. The Mercury's restrained driver was pronounced deceased by the county coroner and transported to a local funeral home. The Mercury's unrestrained front right passenger sustained serious injuries and was transported by air ambulance to a hospital.

## CRASH CIRCUMSTANCES

***Crash Environment:*** The trafficway on which all three vehicles were traveling was a straight, two-lane, undivided, U.S. highway traversing in an east-west direction. The westbound travel lane was 4.1 meters (13.4 feet) in width and the eastbound travel lane was 3.5 meters (11.5 feet) in width. The roadway grade was 1.6% positive for westbound traffic and level for eastbound traffic. Each side of the roadway was bordered by a rumble strip and a bituminous shoulder 3.1

meters (10 feet) in width. A rumble strip was also present along the centerline of the roadway. The roadway pavement markings consisted of a broken yellow center line and solid white edge lines. The speed limit was 97 km/h (60 mph) and there was no speed limit sign posted near the crash site. At the time of the crash the light condition was dark, the atmospheric condition was clear, and the roadway pavement was dry bituminous. The traffic density was light and the site of the crash was rural. See the Crash Diagram on page 13 of this report.

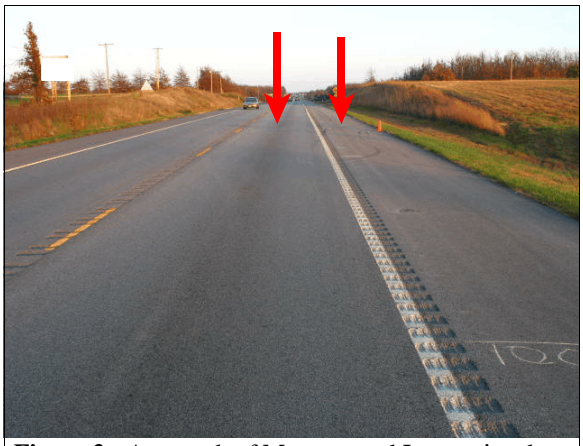


**Figure 2:** Approach of Mercury and International to impact; left arrow shows area of impact between Mercury and Lincoln; right arrow shows location of impact between International and Mercury; 100 on shoulder shows feet to initial impact area

***Pre-Crash:*** The Mercury was traveling east and was occupied by a restrained 47-year-old female driver and an unrestrained 26-year-old female front right passenger (**Figure 2**). The International was traveling east behind the Mercury and was occupied by a restrained 48-year-old male driver. The Lincoln was traveling west (**Figure 3**) and was occupied by a restrained 21-year-old male driver. The International's driver told police that the Lincoln suddenly crossed into the eastbound lane and impacted the Mercury. There was no evidence that the driver of the Mercury or Lincoln took any avoidance actions. The Mercury's front right passenger stated during the interview that the driver had no time to react. The driver of the International told police that he saw no brake lights illuminate on the Mercury prior to the crash. The scene inspection revealed skid marks from the International leading to the south shoulder, which indicated that the International's driver steered right and locked his brakes in an attempt to avoid the crash.

**Figure 3:** Approach of Lincoln westbound to area of impact (arrow)

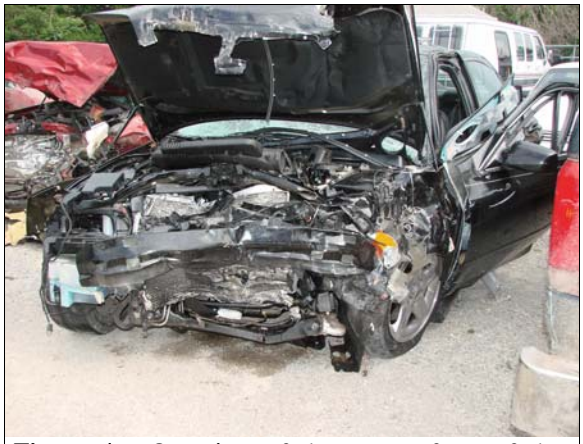


**Figure 4:** Overview of damage to front of the Lincoln due to impact with the Mercury

***Crash:*** The front of the Lincoln (**Figure 4**) impacted the front of the Mercury (**Figure 5**, event 1), which resulted in a direction of principal force within the 12 o'clock sector on each vehicle. The impact was severe and resulted in each vehicle's front undercarriage gouging the pavement (**Figure 6**) at the center of the eastbound lane. The impact caused the Lincoln's driver and front right passenger air bags to deploy. The Mercury's driver and front right passenger air bags did not deploy. The Mercury rotated

counterclockwise 85 degrees and traversed a distance of 5 meters (16.4 feet) onto the south shoulder where the front of the International (**Figure 7**) impacted its left side (**Figure 8**, event 2). The International pushed the Mercury 6 meters (19.7 feet) east and both vehicles came to final rest (**Figure 9**). The Mercury was heading northeast with its back end off the shoulder on the grass. The International was heading slightly southeast and the left rear corner of the trailer was on the eastbound lane. The Lincoln rotated counterclockwise 80 degrees and traversed a distance of 2.6 meters (8.5 feet) in a northeast direction and came to final rest in the middle of the roadway heading south (**Figure 10**).

**Figure 5:** Overview of damage to front of Mercury from impact with front of the Lincoln

**Figure 6:** Impact gouges in eastbound lane

**Figure 7:** Police photo showing damage to front of International due to impact with left side of Mercury

**Figure 8:** Damage to left side of Mercury due to impact with front of the International

***Post-Crash:*** The police were notified of the crash at 0255 hours and arrived on scene at 0318 hours. Emergency medical and rescue personnel also responded to the scene. The Mercury's front right passenger opened the door and attempted to exit the vehicle and fell onto the ground. She was assisted by a passer-by until emergency medical personnel arrived and was then transported by

**Figure 9:** Police photo showing view northwest to final rest position of Mercury and International

helicopter to a hospital. The Mercury's driver was pronounced deceased at the scene by the county coroner. She was extricated from the vehicle through the left front door and transported to a funeral home. The Lincoln's driver was transported by ambulance to a hospital. The driver of the International was not injured. All the vehicles were towed from the scene due to damage.

**Figure 10:** Police photo showing view southeast to final rest position of Lincoln and International

## CASE VEHICLE

The 2001 Mercury Grand Marquis GS was a rear wheel drive, 4-door sedan (VIN: 2MEFM74W91X------) equipped with a 4.6L, V8 engine, automatic transmission and an Event Data Recorder (EDR). The front row was equipped with driver and front right passenger lap-and-shoulder belts, center lap belt, a split bench seat with separate back cushions, adjustable head restraints, a tilt steering column, dual stage driver and front right passenger frontal air bags, and the manufacturer's personal safety system. The personal safety system is a component of the vehicle's supplemental restraint system and monitors the driver and front right passenger seat belt buckle switch sensors and seat track positions. The second row was equipped with a bench seat, lap-and-shoulder belts in the outboard seating positions and a lap belt at the center seating position. Four wheel, anti-lock brakes and traction control were an option, but it could not be determined during the inspection if the vehicle was so equipped. The vehicle's mileage was 116,232 kilometers (72,225 miles) and the specified wheelbase was 291 centimeters (114.6 inches).

## CASE VEHICLE DAMAGE

***Exterior Damage:*** The Mercury's impact with the Lincoln involved the front plane. The front bumper, left headlamp/turn signal assembly, left fender and hood were directly contacted. The direct damage began at the front left bumper corner and extended 100 centimeters (39.4 inches) across the front end. The crush measurements were taken on the front bumper bar because the front bumper fascia had been torn off the vehicle. The maximum residual crush was 122 centimeters (48 inches) occurring at $C_1$ (**Figure 11**). Due to the triangular-shaped crush profile, the Field L, which is projected to the baseline, was only 73 centimeters (28.7 inches). Therefore, the option to use four C-measurements as allowed by the

**Figure 11:** Top view of crush to front of Mercury shown by four crush measurement rods; each stripe on rods is 5 cm (2 in)

Vehicle Measurement Techniques document was used to document the crush profile. The table below shows the vehicle's front crush profile. The C-measurement positions for $C_5$ and $C_6$ are indicated as N/A (not applicable).

| Units | Event | Direct Damage | | Field L | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | Direct | Field L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Width CDC | Max Crush | | | | | | | | ±D | ±D |
| cm | 1 | 100 | 122 | 73 | 122 | 109 | 61 | 12 | N/A | N/A | -21 | 0 |
| in | | 39.4 | 48.0 | 28.7 | 48.0 | 42.9 | 24.0 | 4.7 | N/A | N/A | -8.3 | 0.0 |

The Mercury's impact with the International involved the left side plane. The left fender, left front door and left rear door sustained direct damage. The direct damage began 17 centimeters forward of the left rear axle and extended forward 239 centimeters (94.1 inches). The damage from the front impact partially overlapped the damage from this impact, and the crush at $C_6$, $C_5$ and possibly $C_4$ represents the overlapping damage from both impacts. The maximum crush was 30 centimeters, which occurred at $C_3$ and was rear of the overlapping damage area.

| Units | Event | Direct Damage | | Field L | $C_1$ | $C_2$ | $C_3$ | $C_4$ | $C_5$ | $C_6$ | Direct | Field L |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Width CDC | Max Crush | | | | | | | | ±D | ±D |
| cm | 2 | 239 | 30 | 286 | 0 | 9 | 30 | 18 | 19 | 16 | 18 | 0 |
| in | | 94.1 | 11.8 | 112.6 | 0.0 | 3.5 | 11.8 | 7.1 | 7.5 | 6.3 | 7.1 | 0.0 |

The Mercury's left side wheelbase was shortened 59 centimeters (23 inches) and the right side wheelbase was extended 7 centimeters (2.8 inches). The vehicle sustained induced damage to the hood, roof, left quarter panel and right fender.

***Damage Classification:*** The Collision Deformation Classification (CDC) for the Mercury's front impact with the Lincoln (event 1) was **12-FYEW-4** (**0** degrees). The CDC for the Mercury's left side impact with the front of the International was **09-LYAW-2** (**270** degrees). The Missing Vehicle algorithm of the WinSMASH program calculated the Mercury's total Delta V for the front impact as 61.0 km/h (37.9 mph). The longitudinal and lateral velocity changes were -61. km/h (-37.9 mph) and 0.0 km/h (0.0 mph), respectively. The results were based only on the Mercury's front crush profile because the Lincoln was not inspected. The results should be considered a borderline reconstruction of the Mercury's frontal impact Delta V.

The WinSMASH program could not be used to calculate a Barrier Equivalent Speed for the Mercury's left side impact with International due to the overlapping damage to its left side. The severity of this impact was estimated to be moderate based on the extent of maximum crush.

The vehicle manufacturer's recommended tire size was P225/60R16. The Mercury was equipped with P215/60R16 size tires. The Tire Identification Number (TIN) for each tire was DOT-3D5M-HWN. The Mercury's tire data are shown in the table below.

| *Tire* | *Measured Pressure* | | *Vehicle Manufacturer's Recommended Pressure* | | *Tread Depth* | | *Damage* | *Restricted* | *Deflated* |
|---|---|---|---|---|---|---|---|---|---|
| | kPa | psi | kPa | psi | milli-meters | 32nd of an inch | | | |
| LF | Flat | Flat | 221 | 32 | 6 | 8 | Sidewall cut | Yes | Yes |
| LR | 172 | 25 | 221 | 32 | 6 | 8 | None | No | No |
| RR | 172 | 25 | 221 | 32 | 4 | 5 | None | No | No |
| RF | 179 | 26 | 221 | 32 | 6 | 8 | None | Yes | No |

***Vehicle Interior:*** The Mercury's instrument panel and steering assembly had been extensively damaged as a result of intrusion and the police disassembly of the driver and front right passenger air bags, and the removal of the Restraint Control Module (RCM). A police photograph showed that the driver had loaded the steering assembly (**Figure 12**) and her left knee loaded the left instrument panel. A few hairs from the front right passenger were found on the broken windshield. No occupant contact evidence was discernable on the instrument panel due to its damaged condition. The left front door was jammed shut following the crash, but had been forced open by emergency responders to extricate the driver. The left rear door was jammed shut. The right front and right rear doors had remained closed and operational following the crash. The police on-scene photos showed that the windshield was in place and cracked following the crash; however, it was partially collapsed into the passenger compartment at the time of the inspection. The left front and left rear door window glazing were closed at the time of the crash and disintegrated during the crash. The right front and right rear door window glazing was closed and undamaged and the backlight glazing was undamaged.

**Figure 12:** Police photo showing deformation to Mercury's steering wheel and steering column

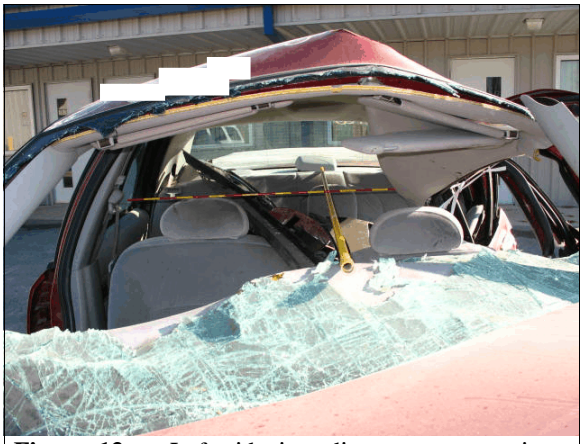


**Figure 13:** Left side intruding components into Mercury's passenger compartment

The passenger compartment sustained numerous intrusions and the most severe involved the driver's occupant space and the second row left occupant space. The left instrument panel and toe pan intruded longitudinally 20 centimeters (7.9 inches) and 12 centimeters (4.7 inches), respectively into the driver's occupant space. The left rear door and left roof side rail intruded 29 centimeters (11.4 inches) into the second row left occupant space. The induced buckling of the roof resulted in 20 centimeters (7.8 inches) of intrusion into the second row left occupant space.

**MANUAL RESTRAINT SYSTEM**

The Mercury was equipped with lap-and-shoulder belts for the outboard seating positions and a lap belt for the front and second row center seating positions. The driver's seat belt system consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), sliding latch plate, retractor mounted pretensioner, and an adjustable upper anchor that was in the full-down position. The front right seat belt system consisted of a continuous loop belt webbing, a switchable ELR/Automatic Locking Retractor (ALR), retractor mounted pretensioner, sliding latch plate, and an adjustable upper anchor that was in the full down position. The front center lap belt was equipped with a locking latch plate. The second row lap-and-shoulder belts were comparable to the front row, but they employed switchable ELR/ALR retractors and were not equipped with pretensioners or adjustable upper anchors. The second row center lap belt was equipped with a locking latch plate There second row seating positions were not occupied.

The inspection of the driver's seat belt assembly revealed that the driver was restrained at the time of the crash. The retractor was jammed due to the damage to the left B-pillar with a length of the belt extended out of the retractor consistent with usage. The belt webbing also appeared stretched and was abraded. The police crash report indicated that the driver was found restrained by the lap-and-shoulder belt, and the EDR recorded the status of the safety belt circuit as buckled.

The inspection of the front right seat belt assembly revealed that the front right passenger was not restrained at the time of the crash. There was no evidence of loading to any of the seat belt components. The EDR recorded the status of the safety belt circuit as unbuckled.

**AUTOMATIC RESTRAINT SYSTEM**

The Mercury was equipped with redesigned dual stage frontal air bags, which were located in the steering wheel hub and the middle of the front right instrument panel. Neither of these air bags deployed in this crash. The severe frontal damage to the Mercury and the reconstruction results indicated that the crash was of sufficient severity to require air bag deployment. A causal factor establishing why the air bags did not deploy could not be determined. The following information regarding the air bag system and the vehicle's history was developed in the course of this investigation.

The Mercury's VIN was entered into NHTSA's online database of deactivated air bags. The search returned no information on this vehicle. A search on ODI's defects and recalls website was also conducted. The search results listed two recalls that involved the air bag system and were

listed as NHTSA campaign identification numbers 00V270000 and 00V412000. Number 00V270000 was not applicable to the circumstances of this crash. Number 00V412000 addressed the assembly of the RCM and the front crash sensor. The manufacturer's report date was listed as November 30, 2000 and the recall began on December 21, 2000. The recall notice stated that the RCM or the front crash sensor may have been assembled with one or more circuit board mounting screws missing, which could affect the performance of the air bag system. The police photographs showed that the RCM was manufactured by Takata and was identified by the number 1W7A-14B321-ED and serial number 8603M0100501532. The 7th-10th characters of the serial number record the year and day of manufacture and indicated that the RCM was manufactured on January 5, 2001, which was after the date of the recall. The impact sensor, which was examined during the vehicle inspection, was manufactured by Takata and was identified by the number 1W1A-14B006-AD. The 7th character of the serial number 8599E0_35101268 was unreadable and the year of manufacture could not be determined. A Ford dealership was contacted and the vehicle's VIN was checked against the list of applicable recalls. The dealership representative stated that the vehicle was not listed as subject to the recall.

The Mercury was purchased new by the driver's father-in-law and the vehicle was subsequently given to her following the father-in-law's death. The driver's husband told the police investigator that the routine vehicle maintenance was always performed on the vehicle and there had never been any mechanical problems with the vehicle or illuminated warning lights. The vehicle had been involved in one minor crash when it was struck while parked at the driver's residence. The impact damaged only the front right turn signal lens.

The police disassembled both driver and front right passenger air bag modules (**Figures 14-19**) and reported that an intact air bag and inflator were present within each module and the electrical connections were intact. The air bag fuse was not blown and was in operable condition. The vehicle inspection confirmed that an air bag was present within each module and that the inflators had not activated. The driver air bag module was still connected to its electrical wiring; however, the front right passenger air bag module had been disconnected, apparently during the police disassembly. The front impact sensor (**Figure 20**) was undamaged but its electrical feed wire had been severed (**Figure 21**) as a result of the impact. The sensor was located on the center of the upper radiator support. Since there was no override of the Mercury's front bumper during the impact, it is unlikely that the severed electrical feed wire was the cause of the non-deployment.

The police downloaded the Mercury's EDR using the Vetronix Crash Data Retrieval Tool and connected directly to the RCM to perform the download. Six diagnostic codes were present in the EDR report. The SCI team leader obtained the RCM from the law firm representing the Mercury's driver and submitted it to the manufacturer for download and interpretation of the codes. The manufacturer's report indicated that all six diagnostic codes were generated as a result of disconnecting the RCM's air bag system interface connector when the initial download was performed and were not related to the performance of the air bag system in this crash. The police report stated that the RCM had been installed in the vehicle in the proper orientation with the forward arrow pointing to the front of the vehicle.

**Figure 14:** Police photo of Mercury's driver air bag module prior to disassembly

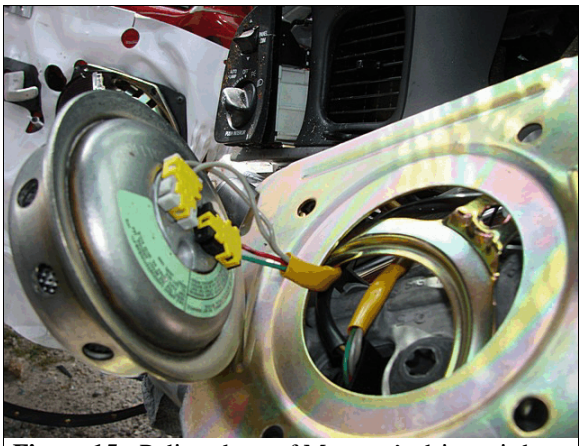


**Figure 15:** Police photo of Mercury's driver air bag inflator and wiring harness


**Figure 16:** Manufacturer's identification label on Mercury's driver air bag module

**Figure 17:** Police photo of Mercury's front right passenger air bag in the module

**Figure 18:** Police photo of back of Mercury's front right passenger air bag module and wiring harness


**Figure 19:** Manufacturer's identification label on Mercury's front right passenger air bag module

## EVENT DATA RECORDING

The investigating police officer performed the download of the Mercury's EDR with version 2.9 of the Vetronix Crash Data Retrieval Tool by direct connection to the RCM. Version 3.0 was

used by this contractor to read the EDR file, which was provided by the investigating police officer. The EDR report is attached at the end of this report. The report showed that a non-deployment event was recorded. The driver's seat belt circuit status was recorded as buckled and the front right passenger's was recorded as unbuckled. The driver's seat position was recorded as not located forward of the switch point and the passenger occupant classification was recorded as an adult. The driver and front right passenger pretensioners were recorded as not deployed. There was no data recorded on the crash pulse data graph from -34.0 milliseconds to 25.6 milliseconds, which indicated that the RCM experienced a power interruption during the recording process. The recording resumed at 26.4 milliseconds and ended at 65.6 milliseconds where the maximum recorded Delta V of -30.32 km/h (-18.84 mpg) was captured. An analysis of the EDR data also revealed that the EDR stored 6 fault codes. Ford Motor Company reported that the presence of the 6 fault codes indicated that they were generated after the crash as a result of the download method. They occurred because the download was performed by direct connection to the RCM instead of through the vehicle's diagnostic port connector. The 6 fault codes depend on the presence of signals from the diagnostic port connector in order not to be generated.


**Figure 20:** Mercury's impact sensor mounted at center of upper radiator support

**Figure 21:** Severed end of impact sensor's electrical feed wire

## CASE VEHICLE DRIVER KINEMATICS

The Mercury's driver [47-year-old, female; unknown height and weight] was seated in an unknown posture. Based on the vehicle inspection, the driver's seat was adjusted to between the middle and forward track position. The position of the seat back and the tilt steering column could not be determined due to the displacement of the seat back and the damage to the steering assembly. The driver was restrained by the lap-and-shoulder belt.

The Mercury's front impact with the front of the Lincoln displaced the driver forward opposite the 12 o'clock direction of principal force. She loaded the seat belt and her head, chest and abdomen loaded the steering wheel, which caused unspecified injuries to those body regions. The driver was redirected to the left opposite the 9 o'clock direction of principal force when the front of the International impacted the left side of the Mercury. The driver remained restrained in the seat as the Mercury was pushed east to its final rest position.

The driver was pronounced deceased at the scene by the county coroner 25 minutes following the crash. No autopsy was performed and the table below shows the driver's injuries based on the coroner's report.

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 1<br>2<br>3 | Blunt force trauma, not further specified | unknown<br>115999.7,0<br>415999.7,0<br>515999.7,0 | Steering wheel hub and/or spokes and rim | Probable | Coroner's record |

## CASE VEHICLE FRONT RIGHT PASSENGER KINEMATICS

The Mercury's front right passenger [26-year-old female; 147 centimeters and 104 kilograms (58 inches, 229 pounds)] stated during the interview that she was seated upright with both feet on the floor and her back against the seat back. The seat track was adjusted to between the middle and rear most position and the seat back was slightly reclined. The front right passenger was not restrained by the lap-and-shoulder belt.

The Mercury's front impact with the front of the Lincoln displaced the front right passenger forward opposite the 12 o'clock direction of principal force. She loaded the instrument panel and her head impacted the windshield leaving a few strands of hair adhering to the fractured glazing. The interaction with the instrument panel resulted in a contused liver, fractured left pelvis and an open fracture of the left femur. The International's impact to the left side of the Mercury redirected the passenger to the left opposite the 9 o'clock direction of principal force. There was no evidence that she contacted any interior components within the front left seating position. Following the crash, the front right passenger opened the right front door and attempted to exit the vehicle. She was unable to stand up due to her injuries and fell to the ground. She was assisted by a passer-by until emergency medical personnel arrived.

## CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The front right passenger sustained serious injuries. The hospital that was indicated as the treating facility on the police crash report as well as by this passenger had no record of her treatment. The injuries reported by the passenger and the injury sources are shown in the table below.

| Injury Number | Injury Description (including Aspect) | NASS Injury Code & AIS 90 | Injury Source | Source Confidence | Source of Injury Data |
|---|---|---|---|---|---|
| 1 | Contusion {bruise} liver, not further specified | moderate 541810.2,1 | Right instrument | Probable | Interviewee (same person)[1] |
| 2 | Fracture left pelvis, not further specified | moderate 852600.2,2 | Right instrument panel {indirect} | Probable | Interviewee (same person) |
| 3 | Fracture, open, left femur, not further specified | serious 851801.3,2 | Right instrument panel {indirect} | Probable | Interviewee (same person) |

**1ST OTHER VEHICLE**

The 2002 Lincoln LS was a rear wheel drive, 4-door sedan (VIN: 1LNHM87A32Y------) equipped with a 3.9L, V8 engine, automatic transmission,4-wheel anti-lock brakes and traction control. The front row was equipped with redesigned driver and front right passenger air bags, seat back-mounted side impact air bags, and lap-and-shoulder belts with height adjustable upper anchors. The second row was equipped with lap-and-shoulder belts.

***Exterior Damage:*** The Lincoln had been sold at auction and was not inspected. Based on the police photographs, the front of the vehicle sustained severe damage. The direct damage involved the front bumper, left fender, and left headlamp/turn signal assembly. The direct damage began at the front left bumper corner and involved approximately 60% of the front plane.

***Damage Classification:*** The CDC was estimated from the photographs to be **12-FYEW-3.** The Missing Vehicle algorithm of the WinSMASH program calculated the Lincoln's total Delta V as 68.0 km/h (42.3 mph). The longitudinal and lateral velocity changes were -67.0. km/h (-41.6 mph) and -11.8 km/h (-7.3 mph), respectively. The results were based only on the Mercury's front crush profile and should be considered a borderline reconstruction of the Lincoln's Delta V.

The police download the Lincoln's EDR and the report is presented in **Figures 22-29** beginning on page 23. The EDR recorded a deployment event and indicated that the deployment of the air bags and seat belt pretensioner occurred at 14.5 milliseconds after the recording began. The maximum recorded Delta V was -57.0 km/h (-35.41 mph), which occurred at the end of the recording, at 116 milliseconds.

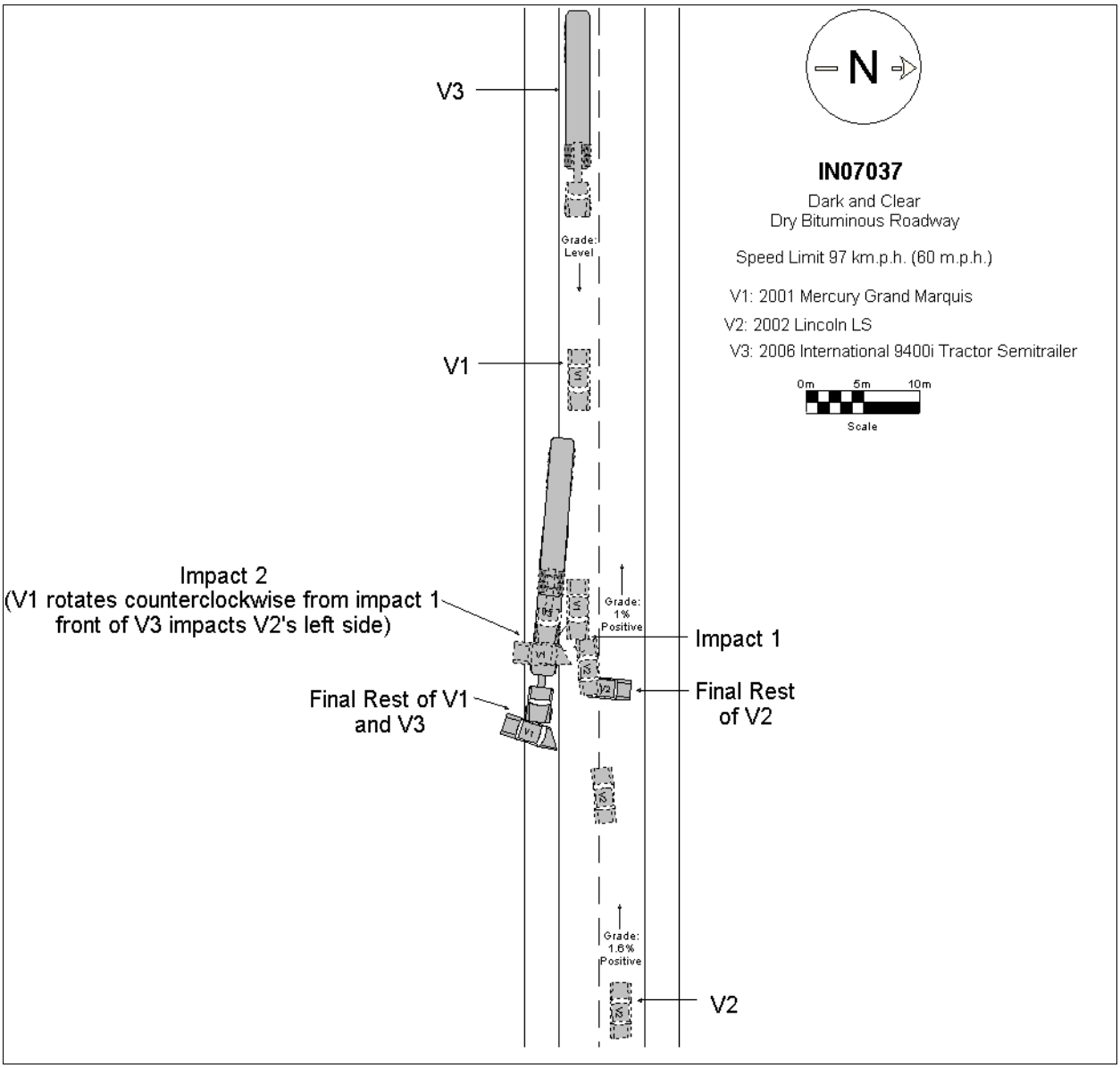
***Lincoln's Driver:*** According to the police crash report, the Lincoln's driver (21-year-old, male) was restrained by the lap-and-shoulder belt and sustained a B (non-incapacitating) injury. A blood sample was taken from the driver and his blood alcohol content was 0.146. There was no indication that a drug test was conducted for this driver.

[1] Interview was conducted through an interpreter.

The 2006 International 9400i was a four wheel drive, 6x4, two-door, cab behind engine, truck-tractor (VIN: 2HSCNAPR76C------). The International was pulling a 2006 Wade flatbed semitrailer. The semitrailer was fully loaded with empty poultry crates.

The International was not inspected. A Truck Deformation Classification (TDC) was determined from the photographs to be **12-FDEW-1** (**0** degrees).

***International's Driver:*** According to the police crash report, the driver of the International (48-year-old, male) was restrained by the lap-and-shoulder belt and was not injured. A blood sample was taken from the driver and he tested negative for alcohol and drugs.


N
IN07037
Dark and Clear
Dry Bituminous Roadway
Speed Limit 97 km.p.h. (60 m.p.h.)
V1: 2001 Mercury Grand Marquis
V2: 2002 Lincoln LS
V3: 2006 International 9400i Tractor Semitrailer
0m 5m 10m
Scale
V3
Grade: Level
V1
Impact 2
(V1 rotates counterclockwise from impact 1
front of V3 impacts V2's left side)
Grade: 1% Positive
Impact 1
Final Rest of V1
and V3
Final Rest
of V2
Grade: 1.6% Positive
V2

## CDR File Information

| | |
|---|---|
| Vehicle Identification Number | 1LNHM87A32Y |
| Investigator | |
| Case Number | |
| Investigation Date | June 2007 |
| Crash Date | June 2007 |
| Filename | 1LNHM87A32Y CDR |
| Saved on | June 2007 at 06:19:15 AM |
| Collected with CDR version | Crash Data Retrieval Tool 2.900 |
| Reported with CDR version | Crash Data Retrieval Tool 2.900 |
| Event(s) recovered | Deployment |

## Module Information

The retrieval of this data has been authorized by the vehicle's owner, or other legal authority such as a subpoena or search warrant, as indicated by the CDR tool user on Saturday, June 16 2007 at 06:19:15 AM.

Important Limitations on Vetronix Crash Data Retrieval (CDR) Tool Capabilities.

Disclaimer: This Restraint Control Module (RCM) records longitudinal deceleration data for the purpose of understanding the input data the Restraint Control Module used to determine whether or not to deploy restraint devices. This module does not record vehicle speed, throttle position, brake on-off, and other data, which may be recorded in some 1999 model year and later General Motors modules. The deceleration data recorded by Ford's module during a crash can subsequently be mathematically integrated into a longitudinal Delta-V. Delta-V is the change in velocity during the recording time and is NOT the speed the vehicle was traveling before the accident, and is also not the Barrier Equivalent Velocity. The Vetronix CDR Tool will read and interpret both acceleration in G's and Delta-V in mph. RCM's in Ford vehicles that can be read by the Vetronix CDR tool are listed in the Vetronix Help Files.

Important

If there is any question that the restraint system did not perform as it was designed to perform, please read the system only through the diagnostic link connector. The Vetronix CDR kit provides an RCM interface cable to plug directly into the restraint control module. The Vetronix CDR RCM Interface Cable connects only power, ground, and memory read pins to the relevant vehicle restraint control module. The other RCM pins normally connect to inputs, such as sensors, and outputs, such as airbags, are not connected when you use the RCM Interface Cable to plug directly into the module. Since the vehicle restraint control module is constantly monitoring airbag system readiness (when powered), it will detect that the sensors and airbags are not connected. The restraint control module may record a new diagnostic trouble code into memory for each device that is not connected. These new diagnostic trouble codes may record over previously written diagnostic trouble codes present prior to the accident and spoil evidence necessary to determine if the restraint system performed in the accident as it was designed to perform. Not only could this prevent Ford from being able to determine if the system performed as it was designed to perform, but, regardless of innocent inadvertence, you could raise issues of evidence spoliation in any litigation that may arise out of the accident. If you cannot read the module via the diagnostic link connector, and if you suspect improper system performance, contact Ford Motor Company and request their assistance to read the module with a proper vehicle simulator attached.

While data stored in RCM's is accurate, accident reconstructionists must be aware of the limitations of the data recorded in Ford's control modules and should compare the recorded data with the physical evidence at the accident scene using professional accident reconstruction techniques (i.e. vehicle crush characteristics, skid marks, etc) before making any assumptions about the import and validity of the data recorded in the module with respect to the crash event being analyzed. The following describes specific limitations that must be considered when analyzing recorded data. Investigators should obtain permission of the vehicle owner or have sufficient legal authority prior to reading any data.

1. There may be no deceleration data recorded in the module.
Loss of power (cut wires, damaged battery, crushed fuse box) to the module during or immediately after the crash may prevent the crash data from being recorded. A backup power supply within the module has sufficient power to continue to analyze the deceleration data and deploy restraint devices if needed, but there is no backup power for recording.

If the deceleration input does not create a vehicle longitudinal Delta-V above 4 mph within 100 milliseconds, there may not be any data recorded.

2. In unusual circumstances, deceleration data stored in the module may be from a crash other than the one you are currently analyzing.
The module will record data from some non-deploy events. If, after the module has recorded data from a non-deploy event, and there is a subsequent event in which there is a loss of power and no new recording is made for that subsequent event, the deceleration data in the module's memory may be from the prior event. If the new, subsequent event is a deploy event and recording has occurred, the deployment times should be recorded. If there are no deployment times recorded, but airbags or other restraint devices are observed to have deployed, the recorded data that you read are most likely from a prior event.

**Figure 22:** Lincoln's CDR File Information and Module Information

Once an airbag or other restraint device has been commanded to deploy, the data recorded in connection with that deployment are "locked", and subsequent crashes cannot be recorded.

If a vehicle is being repaired, the RCM should be replaced after any crash in which restraint devices deploy. Early printed shop manuals refer to re-using modules by clearing the "crash data memory full" code, but this is no longer true and the latest on-line electronic shop manual directs that modules be replaced.

Crashes that involve multiple impacts will record only one of the impacts. If there is a deployment, the deployment event will be recorded and locked. If no restraint device is commanded to deploy, the recorded data are not "locked", and subsequent impacts may record over any previous recorded data. Further analysis will be required to determine which of the events was actually recorded.

3. The computed longitudinal Delta-V may understate the total Delta-V

Many real-world crashes can last longer than the memory has the capacity to record. Therefore, the actual Delta-V of the event may be higher than the Delta-V calculated and displayed by the Vetronix CDR System output. Review the end of the longitudinal acceleration/deceleration pulse - if it has not settled to zero G's by the end of the recording, the vehicle longitudinal Delta-V is most likely understated. If there is a clear decaying trend line you may choose, at your own risk, to estimate the total Delta-V by extrapolating the decay trend to zero and to calculate the additional Delta-V not captured.

Under some circumstances where power is interrupted, during the recording of data, or the module re-sets during the recording of data, a partial recording may occur. This will be shown as "no data" in the data table and will not be plotted on the graph of acceleration. When some portion of the acceleration data is not recorded, the Delta-V during that time cannot be calculated. A Delta-V will be calculated for the points that are valid, but the user must be aware that the partial Delta-V calculated will further underestimate the actual event total Delta-V.

4. This module records only longitudinal acceleration/deceleration of the vehicle. You must compute lateral or resultant total acceleration based on your estimated Principal Direction of Force (PDOF).

5. Vertical acceleration/decelerations are not recorded. Vehicle spin about a point not centered on the Restraints Control Module sensor may add or subtract from bulk vehicle motion.

6. This module is not intended to record acceleration/deceleration in a side-impact event. If the side impact generates a longitudinal deceleration component sufficient to wake up the frontal deployment algorithm, there may be a recording of longitudinal deceleration in a side impact event.

Any Longitudinal Delta-V determined by using data read from the air bag module should be verified with physical evidence from the crash (such as vehicle crush, skid marks) and assumed accident sequence. Multiple impacts, angular collisions, side impacts, vehicle spin, etc should be considered in addition to the data read from the air bag module.

**Figure 23:** Lincoln's Module Information continued

**System Status At Deployment**

| | |
|---|---|
| Diagnostic codes active when event occurred | 0 |
| Passenger Airbag Switch Position During Event | Activated |
| Time From Side Safing Decision to Left (Driver) Side Bag Deployment (msec) | Not Deployed |
| Frontal and Pretensioner Fire time (ms) | 14.5 |

**Figure 24:** Lincoln's System Status at Deployment

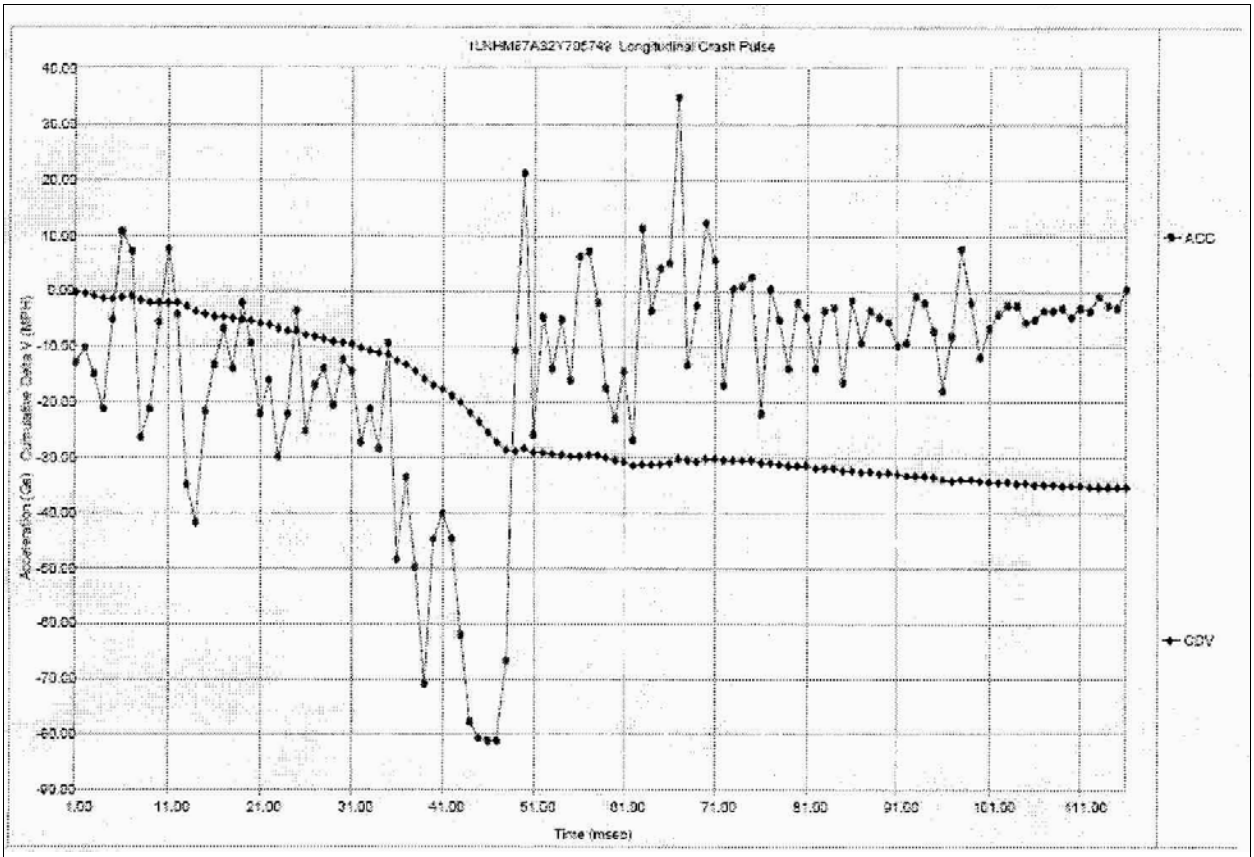



**Figure 25:** Lincoln's Longitudinal Crash Pulse Data graph

**Crash Pulse Data**

| Milliseconds | Long. Acceleration (Gs) | Long. Cumulative Delta V (MPH) |
|---|---|---|
| 1 | -12.85 | -0.28 |
| 2 | -10.28 | -0.51 |
| 3 | -14.91 | -0.84 |
| 4 | -21.07 | -1.30 |
| 5 | -5.14 | -1.41 |
| 6 | 10.79 | -1.17 |
| 7 | 7.20 | -1.02 |
| 8 | -26.21 | -1.59 |
| 9 | -21.07 | -2.05 |
| 10 | -5.65 | -2.18 |
| 11 | 7.71 | -2.01 |
| 12 | -4.11 | -2.10 |
| 13 | -34.95 | -2.87 |
| 14 | -41.63 | -3.78 |
| 15 | -21.59 | -4.25 |
| 16 | -13.36 | -4.55 |
| 17 | -6.68 | -4.69 |
| 18 | -13.88 | -5.00 |
| 19 | -2.06 | -5.04 |
| 20 | -9.25 | -5.25 |
| 21 | -22.10 | -5.73 |
| 22 | -15.93 | -6.08 |
| 23 | -29.81 | -6.74 |
| 24 | -22.10 | -7.22 |
| 25 | -3.60 | -7.30 |
| 26 | -25.19 | -7.85 |
| 27 | -16.96 | -8.23 |
| 28 | -13.88 | -8.53 |
| 29 | -20.56 | -8.98 |
| 30 | -12.34 | -9.25 |
| 31 | -14.39 | -9.57 |
| 32 | -27.24 | -10.17 |
| 33 | -21.07 | -10.63 |
| 34 | -28.27 | -11.25 |
| 35 | -9.25 | -11.45 |
| 36 | -48.32 | -12.51 |
| 37 | -33.41 | -13.25 |
| 38 | -49.86 | -14.34 |
| 39 | -70.93 | -15.90 |
| 40 | -44.72 | -16.88 |
| 41 | -40.09 | -17.76 |
| 42 | -44.72 | -18.74 |
| 43 | -62.19 | -20.11 |
| 44 | -77.61 | -21.81 |
| 45 | -80.70 | -23.59 |
| 46 | -81.21 | -25.37 |
| 47 | -81.21 | -27.15 |
| 48 | -66.82 | -28.62 |
| 49 | -10.79 | -28.86 |
| 50 | 21.07 | -28.39 |
| 51 | -25.70 | -28.96 |
| 52 | -4.63 | -29.06 |

**Figure 26:** Lincoln's Crash Pulse Data

| Milliseconds | Long. Acceleration (Gs) | Long. Cumulative Delta V (MPH) |
|---|---|---|
| 53 | -13.88 | -29.36 |
| 54 | -5.14 | -29.48 |
| 55 | -15.93 | -29.83 |
| 56 | 6.17 | -29.69 |
| 57 | 7.20 | -29.53 |
| 58 | -2.06 | -29.58 |
| 59 | -17.48 | -29.96 |
| 60 | -23.13 | -30.47 |
| 61 | -14.39 | -30.79 |
| 62 | -26.73 | -31.37 |
| 63 | 11.31 | -31.12 |
| 64 | -3.60 | -31.20 |
| 65 | 4.11 | -31.11 |
| 66 | 5.14 | -31.00 |
| 67 | 34.95 | -30.23 |
| 68 | -13.36 | -30.53 |
| 69 | -2.57 | -30.58 |
| 70 | 12.34 | -30.31 |
| 71 | 5.65 | -30.19 |
| 72 | -16.96 | -30.56 |
| 73 | 0.51 | -30.55 |
| 74 | 1.03 | -30.53 |
| 75 | 2.57 | -30.47 |
| 76 | -22.10 | -30.95 |
| 77 | 0.51 | -30.94 |
| 78 | -5.14 | -31.06 |
| 79 | -13.88 | -31.36 |
| 80 | -2.06 | -31.41 |
| 81 | -4.63 | -31.51 |
| 82 | -13.88 | -31.81 |
| 83 | -3.60 | -31.89 |
| 84 | -3.08 | -31.96 |
| 85 | -16.45 | -32.32 |
| 86 | -1.54 | -32.35 |
| 87 | -9.25 | -32.56 |
| 88 | -3.60 | -32.64 |
| 89 | -4.63 | -32.74 |
| 90 | -5.65 | -32.86 |
| 91 | -9.77 | -33.08 |
| 92 | -9.25 | -33.28 |
| 93 | -1.03 | -33.30 |
| 94 | -2.06 | -33.35 |
| 95 | -7.20 | -33.50 |
| 96 | -17.99 | -33.90 |
| 97 | -8.22 | -34.08 |
| 98 | 7.71 | -33.91 |
| 99 | -2.06 | -33.96 |
| 100 | -11.82 | -34.22 |
| 101 | -6.68 | -34.36 |
| 102 | -4.11 | -34.45 |
| 103 | -2.57 | -34.51 |
| 104 | -2.57 | -34.57 |
| 105 | -5.65 | -34.69 |
| 106 | -5.14 | -34.80 |
| 107 | -3.60 | -34.88 |

**Figure 27:** Lincoln's Crash Pulse Data continued

| Milliseconds | Long. Acceleration (Gs) | Long. Cumulative Delta V (MPH) |
|---|---|---|
| 108 | -3.60 | -34.96 |
| 109 | -3.08 | -35.03 |
| 110 | -4.63 | -35.13 |
| 111 | -3.08 | -35.20 |
| 112 | -3.60 | -35.28 |
| 113 | -1.03 | -35.30 |
| 114 | -2.57 | -35.36 |
| 115 | -3.08 | -35.42 |
| 116 | 0.51 | -35.41 |

**Figure 28:** Lincoln's Crash Pulse Data continued

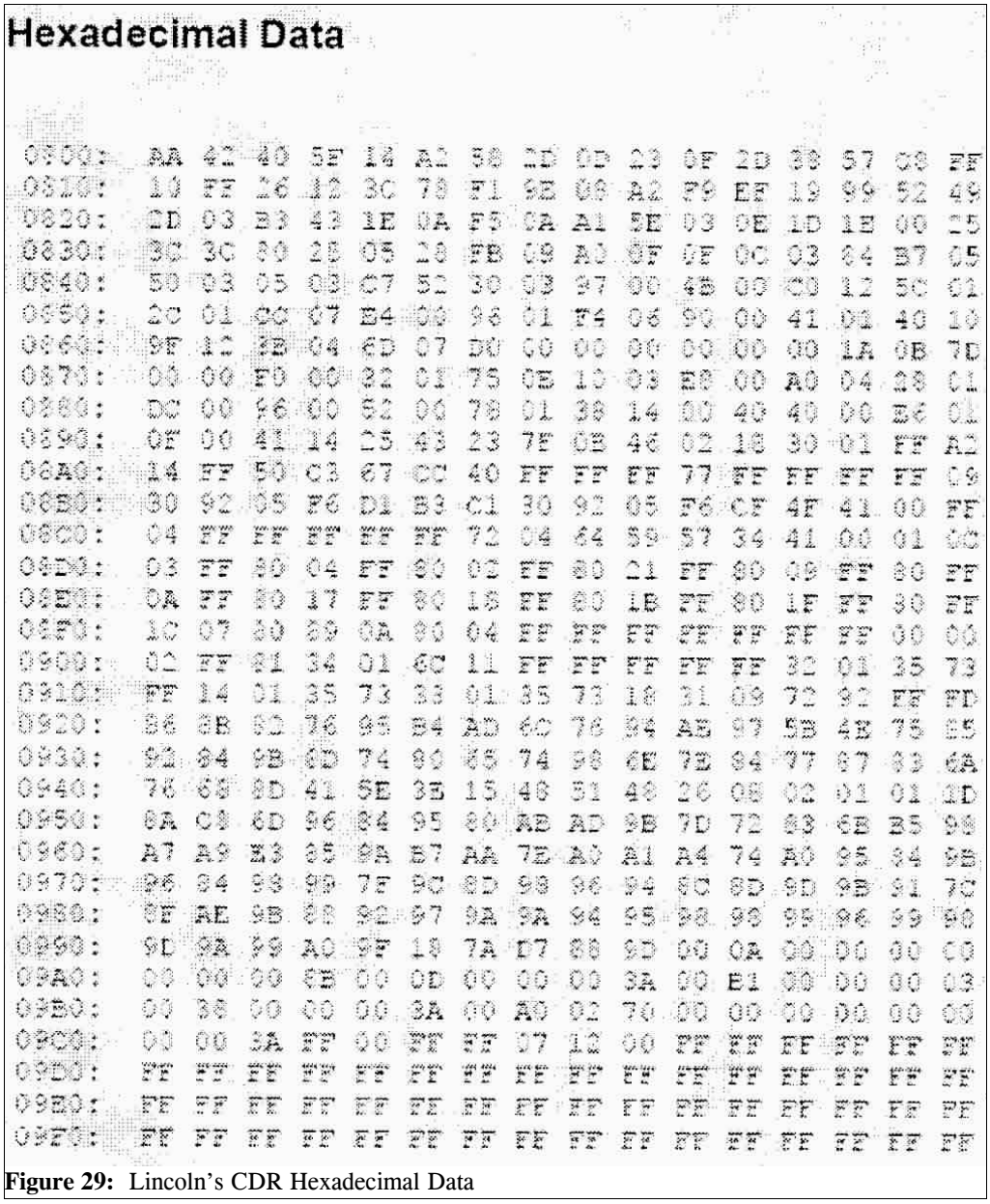



**Figure 29:** Lincoln's CDR Hexadecimal Data

## CDR File Information

| | |
|---|---|
| Vehicle Identification Number | 2MEFM74W91X****** |
| Investigator | |
| Case Number | |
| Investigation Date | |
| Crash Date | |
| Filename | IN07037_V1.CDR |
| Saved on | |
| Collected with CDR version | Crash Data Retrieval Tool 2.900 |
| Reported with CDR version | Crash Data Retrieval Tool 3.00 |
| EDR Device Type | airbag control module |
| Event(s) recovered | Non Deployment |

## Module Information

The retrieval of this data has been authorized by the vehicle's owner, or other legal authority such as a subpoena or search warrant, as indicated by the CDR tool user on Monday, June 18 2007 at 09:36:50 AM .

Important Limitations on Vetronix Crash Data Retrieval (CDR) Tool Capabilities.

Disclaimer: This Restraint Control Module (RCM) records longitudinal deceleration data for the purpose of understanding the input data the Restraint Control Module used to determine whether or not to deploy restraint devices. This module does not record vehicle speed, throttle position, brake on-off, and other data, which may be recorded in some 1999 model year and later General Motors modules. The deceleration data recorded by Ford's module during a crash can subsequently be mathematically integrated into a longitudinal Delta-V. Delta-V is the change in velocity during the recording time and is NOT the speed the vehicle was traveling before the accident, and is also not the Barrier Equivalent Velocity. The Vetronix CDR Tool will read and interpret both acceleration in G's and Delta-V in mph. RCM's in Ford vehicles that can be read by the Vetronix CDR tool are listed in the Vetronix Help Files.

Important

If there is any question that the restraint system did not perform as it was designed to perform, please read the system only through the diagnostic link connector. The Vetronix CDR kit provides an RCM interface cable to plug directly into the restraint control module. The Vetronix CDR RCM Interface Cable connects only power, ground, and memory read pins to the relevant vehicle restraint control module. The other RCM pins normally connect to inputs, such as sensors, and outputs, such as airbags, are not connected when you use the RCM Interface Cable to plug directly into the module. Since the vehicle restraint control module is constantly monitoring airbag system readiness, it will detect that the sensors and airbags are not connected. The restraint control module may record a new diagnostic trouble code into memory for each device that is not connected. These new diagnostic trouble codes may record over previously written diagnostic trouble codes present prior to the accident and spoil evidence necessary to determine if the restraint system performed in the accident as it was designed to perform. Not only could this prevent Ford from being able to determine if the system performed as it was designed to perform, but, regardless of innocent inadvertence, you could raise issues of evidence spoliation in any litigation that may arise out of the accident. If you cannot read the module via the diagnostic link connector, and if you suspect improper system performance, contact Ford Motor Company and request their assistance to read the module with a proper vehicle simulator attached. If you choose to read via the module connector, Ford recommends that you do so in the vehicle and that you leave the second large connector plugged into the vehicle wiring harness to minimize the number of new diagnostic trouble codes created.

While data stored in RCM's is accurate, accident reconstructionists must be aware of the limitations of the data recorded in Ford's control modules and should compare the recorded data with the physical evidence at the accident scene using professional accident reconstruction techniques (i.e. vehicle crush characteristics, skid marks, etc) before making any assumptions about the import and validity of the data recorded in the module with respect to the crash event being analyzed. The following describes specific limitations that must be considered when analyzing recorded data. Investigators should obtain permission of the vehicle owner prior to reading any data.

1. There may be no deceleration data recorded in the module.
Loss of power (cut wires, damaged battery, crushed fuse box) to the module during or immediately after the crash may prevent the crash data from being recorded. A backup power supply within the module has sufficient power to continue to analyze the deceleration data and deploy restraint devices if needed, but there is no backup power for recording.

If the deceleration input does not create a vehicle longitudinal Delta-V above 4 mph within 100 milliseconds, there may not be any data recorded.

2. In unusual circumstances, deceleration data stored in the module may be from a crash other than the one you are currently analyzing.
The module will record data from some non-deploy events. If, after the module has recorded data from a non-deploy event, and there is a subsequent event in which there is a loss of power and no new recording is made for that subsequent event, the deceleration data in the module's memory may be from the prior event. If the new, subsequent event is a deploy event and

recording has occurred, the deployment times should be recorded. If there are no deployment times recorded, but airbags or other restraint devices are observed to have deployed, the recorded data that you read are most likely from a prior event.

Once an airbag or other restraint device has been commanded to deploy, the data recorded in connection with that deployment are "locked", and subsequent crashes cannot be recorded.

If a vehicle is being repaired, the RCM should be replaced after any crash in which restraint devices deploy. Early printed shop manuals refer to re-using modules by clearing the "crash data memory full" code, but this is no longer true and the latest on-line electronic shop manual directs that modules be replaced.

Crashes that involve multiple impacts will record only one of the impacts. If there is a deployment, the deployment event will be recorded and locked. If no restraint device is commanded to deploy, the recorded data are not "locked", and subsequent impacts may record over any previous recorded data. Further analysis will be required to determine which of the events was actually recorded.

3. The computed longitudinal Delta-V may understate the total Delta-V

Many real-world crashes can last longer than the memory has the capacity to record. Therefore, the actual Delta-V of the event may be higher than the Delta-V calculated and displayed by the Vetronix CDR System output. Review the end of the longitudinal acceleration/deceleration pulse - if it has not settled to zero G's by the end of the recording, the vehicle longitudinal Delta-V is most likely understated. If there is a clear decaying trend line you may choose, at your own risk, to estimate the total Delta-V by extrapolating the decay trend to zero and to calculate the additional Delta-V not captured.

Under some circumstances where power is interrupted, during the recording of data, or the module re-sets during the recording of data, a partial recording may occur. This will be shown as "no data" in the data table and will not be plotted on the graph of acceleration. The "no data" sections may be at the beginning, in the middle, or at the end(s) - it will not be consistent from one occurrence to another. When some portion of the acceleration data is not recorded, the Delta-V during that time cannot be calculated. A Delta-V will be calculated for the points that are valid, but the user must be aware that the partial Delta-V calculated will further underestimate the actual event total Delta-V. Restraint device deployment times are recorded first in to memory, and the acceleration data is recorded last. Thus, even with partial acceleration traces, deployment times are valid.

4. This module records only longitudinal acceleration/deceleration of the vehicle. You must compute lateral or resultant total acceleration based on your estimated Principal Direction of Force (PDOF).

5. Vertical acceleration/decelerations are not recorded. Vehicle spin about a point not centered on the Restraints Control Module sensor may add or subtract from bulk vehicle motion.

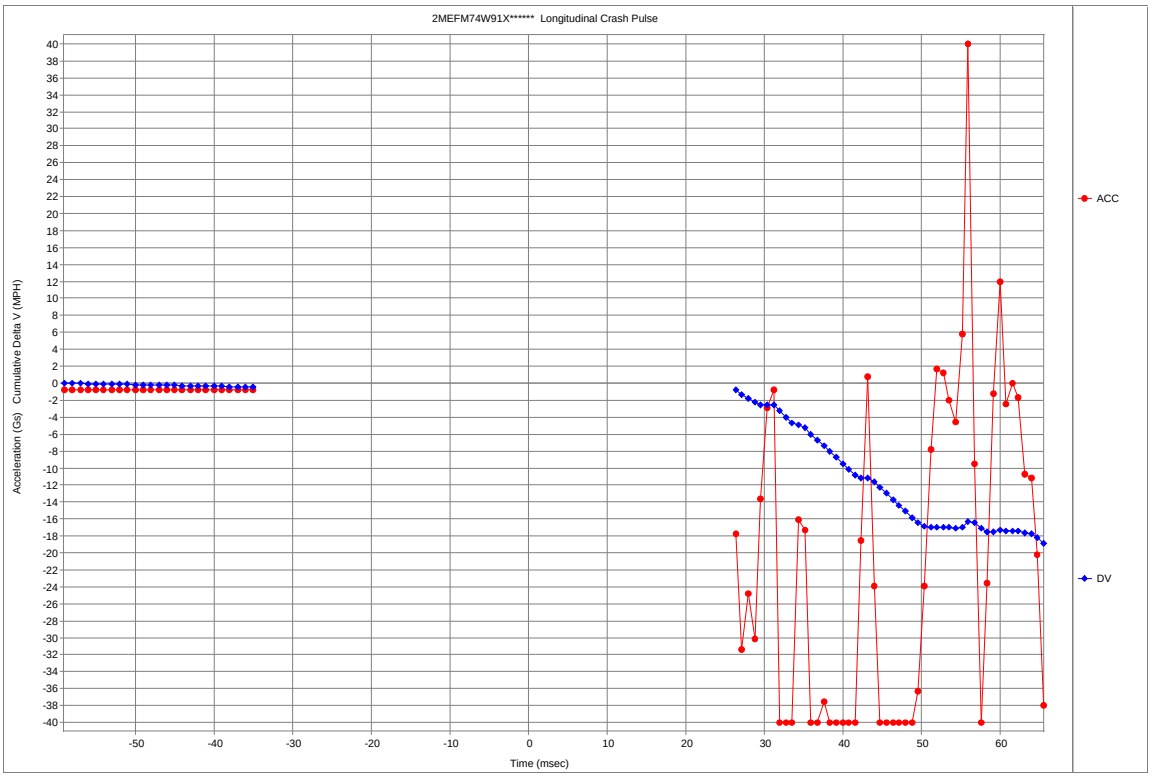
6. This module is not intended to record acceleration/deceleration in a side-impact event. If the side impact generates a longitudinal deceleration component sufficient to wake up the frontal deployment algorithm, there may be a recording of longitudinal deceleration in a side impact event.

Any Longitudinal Delta-V determined by using data read from the air bag module should be verified with physical evidence from the crash (such as vehicle crush, skid marks) and assumed accident sequence. Multiple impacts, angular collisions, side impacts, vehicle spin, etc should be considered in addition to the data read from the air bag module.

## System Status At Non-Deployment

| | |
|---|---|
| Ford Part Number Prefix | 1W7A |
| Diagnostic codes active when event occurred | 6 |
| Driver seat belt circuit status | Buckled |
| Driver seat forward of switch point | No |
| Right front passenger seat belt circuit status | Unbuckled |
| Passenger occupant classification status | Adult |
| Driver pretensioner | Deployment Enabled |
| Passenger Pretensioner | Deployment Enabled |
| Unbelted Stage 1 | Not Enabled |
| Unbelted Stage 2 | Not Enabled |
| Belted Stage 1 | Not Enabled |
| Belted Stage 2 | Not Enabled |

| Parameter | Driver | Passenger |
|---|---|---|
| Time between algorithm enable and seat belt pretensioner deployment (ms) | No deploy | No deploy |
| Time between algorithm enable and air bag first stage deployment (ms) | No deploy | No deploy |
| Time between algorithm enable and air bag second stage deployment (ms) | No deploy | No deploy |


2MEFM74W91X****** Longitudinal Crash Pulse
Acceleration (Gs) Cumulative Delta V (MPH)
Time (msec)
ACC
DV

# Crash Pulse Data

| Milliseconds | Long. Acceleration (Gs) | Long. Cumulative Delta V (MPH) |
|---|---|---|
| -59.0 | -0.83 | -0.02 |
| -58.0 | -0.83 | -0.04 |
| -57.0 | -0.83 | -0.05 |
| -56.0 | -0.83 | -0.07 |
| -55.0 | -0.83 | -0.09 |
| -54.0 | -0.83 | -0.11 |
| -53.0 | -0.83 | -0.13 |
| -52.0 | -0.83 | -0.14 |
| -51.0 | -0.83 | -0.16 |
| -50.0 | -0.83 | -0.18 |
| -49.0 | -0.83 | -0.20 |
| -48.0 | -0.83 | -0.22 |
| -47.0 | -0.83 | -0.24 |
| -46.0 | -0.83 | -0.25 |
| -45.0 | -0.83 | -0.27 |
| -44.0 | -0.83 | -0.29 |
| -43.0 | -0.83 | -0.31 |
| -42.0 | -0.83 | -0.33 |
| -41.0 | -0.83 | -0.34 |
| -40.0 | -0.83 | -0.36 |
| -39.0 | -0.83 | -0.38 |
| -38.0 | -0.83 | -0.40 |
| -37.0 | -0.83 | -0.42 |
| -36.0 | -0.83 | -0.43 |
| -35.0 | -0.83 | -0.45 |
| -34.0 | No Data | No Data |
| -33.0 | No Data | No Data |
| -32.0 | No Data | No Data |
| -31.0 | No Data | No Data |
| -30.0 | No Data | No Data |
| -29.0 | No Data | No Data |
| -28.0 | No Data | No Data |
| -27.0 | No Data | No Data |
| -26.0 | No Data | No Data |
| -25.0 | No Data | No Data |
| -24.0 | No Data | No Data |
| -23.0 | No Data | No Data |
| -22.0 | No Data | No Data |
| -21.0 | No Data | No Data |
| -20.0 | No Data | No Data |
| -19.0 | No Data | No Data |
| -18.0 | No Data | No Data |
| -17.0 | No Data | No Data |
| -16.0 | No Data | No Data |
| -15.0 | No Data | No Data |
| -14.0 | No Data | No Data |
| -13.0 | No Data | No Data |
| -12.0 | No Data | No Data |
| -11.0 | No Data | No Data |
| -10.0 | No Data | No Data |
| -9.0 | No Data | No Data |
| -8.0 | No Data | No Data |

| Milliseconds | Long. Acceleration (Gs) | Long. Cumulative Delta V (MPH) |
|---|---|---|
| -7.0 | No Data | No Data |
| -6.0 | No Data | No Data |
| -5.0 | No Data | No Data |
| -4.0 | No Data | No Data |
| -3.0 | No Data | No Data |
| -2.0 | No Data | No Data |
| -1.0 | No Data | No Data |
| 0.0 | No Data | No Data |
| 0.8 | No Data | No Data |
| 1.6 | No Data | No Data |
| 2.4 | No Data | No Data |
| 3.2 | No Data | No Data |
| 4.0 | No Data | No Data |
| 4.8 | No Data | No Data |
| 5.6 | No Data | No Data |
| 6.4 | No Data | No Data |
| 7.2 | No Data | No Data |
| 8.0 | No Data | No Data |
| 8.8 | No Data | No Data |
| 9.6 | No Data | No Data |
| 10.4 | No Data | No Data |
| 11.2 | No Data | No Data |
| 12.0 | No Data | No Data |
| 12.8 | No Data | No Data |
| 13.6 | No Data | No Data |
| 14.4 | No Data | No Data |
| 15.2 | No Data | No Data |
| 16.0 | No Data | No Data |
| 16.8 | No Data | No Data |
| 17.6 | No Data | No Data |
| 18.4 | No Data | No Data |
| 19.2 | No Data | No Data |
| 20.0 | No Data | No Data |
| 20.8 | No Data | No Data |
| 21.6 | No Data | No Data |
| 22.4 | No Data | No Data |
| 23.2 | No Data | No Data |
| 24.0 | No Data | No Data |
| 24.8 | No Data | No Data |
| 25.6 | No Data | No Data |
| 26.4 | -17.75 | -0.76 |
| 27.2 | -31.38 | -1.32 |
| 28.0 | -24.77 | -1.75 |
| 28.8 | -30.14 | -2.28 |
| 29.6 | -13.63 | -2.52 |
| 30.4 | -2.89 | -2.57 |
| 31.2 | -0.83 | -2.58 |
| 32.0 | -40.05 | -3.29 |
| 32.8 | -40.05 | -3.99 |
| 33.6 | -40.05 | -4.69 |
| 34.4 | -16.10 | -4.97 |
| 35.2 | -17.34 | -5.28 |
| 36.0 | -40.05 | -5.98 |
| 36.8 | -40.05 | -6.68 |
| 37.6 | -37.57 | -7.34 |

| Milliseconds | Long. Acceleration (Gs) | Long. Cumulative Delta V (MPH) |
|---|---|---|
| 38.4 | -40.05 | -8.05 |
| 39.2 | -40.05 | -8.75 |
| 40.0 | -40.05 | -9.45 |
| 40.8 | -40.05 | -10.16 |
| 41.6 | -40.05 | -10.86 |
| 42.4 | -18.58 | -11.18 |
| 43.2 | 0.83 | -11.17 |
| 44.0 | -23.95 | -11.59 |
| 44.8 | -40.05 | -12.29 |
| 45.6 | -40.05 | -13.00 |
| 46.4 | -40.05 | -13.70 |
| 47.2 | -40.05 | -14.40 |
| 48.0 | -40.05 | -15.10 |
| 48.8 | -40.05 | -15.81 |
| 49.6 | -36.34 | -16.45 |
| 50.4 | -23.95 | -16.87 |
| 51.2 | -7.85 | -17.00 |
| 52.0 | 1.65 | -16.97 |
| 52.8 | 1.24 | -16.95 |
| 53.6 | -2.06 | -16.99 |
| 54.4 | -4.54 | -17.07 |
| 55.2 | 5.78 | -16.97 |
| 56.0 | 40.05 | -16.26 |
| 56.8 | -9.50 | -16.43 |
| 57.6 | -40.05 | -17.13 |
| 58.4 | -23.54 | -17.55 |
| 59.2 | -1.24 | -17.57 |
| 60.0 | 11.97 | -17.36 |
| 60.8 | -2.48 | -17.40 |
| 61.6 | 0.00 | -17.40 |
| 62.4 | -1.65 | -17.43 |
| 63.2 | -10.74 | -17.62 |
| 64.0 | -11.15 | -17.81 |
| 64.8 | -20.23 | -18.17 |
| 65.6 | -37.99 | -18.84 |

## Hexadecimal Data

All of the data that the vehicle manufacturer has requested to be retrieved is shown in the hexadecimal data section of the CDR report. It may contain data that is not converted by the CDR program.

```
0000:  16 BB F2 00 0B 00 00 32 0E 22 0E 2B 38 55 18 06
0010:  00 7D 0C 19 0C 19 05 CC 31 57 37 41 02 03 71 7D
0020:  61 00 35 31 30 32 38 35 46 43 00 00 00 00 00 00
0030:  00 00 00 00 00 00 00 00 00 00 32 30 41 46 38 34
0040:  46 34 00 00 00 00 00 00 00 00 19 40 01 00 18 FF
0050:  01 00 2E 6D 01 00 36 6D 01 00 09 4F 01 00 1D 02
0060:  01 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0070:  00 00 00 40 00 C4 00 02 02 00 00 00 00 00 CC 00
0080:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0090:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00A0:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00B0:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00C0:  00 00 00 A9 CA BA C7 9F 85 80 DF DF DF A5 A8 DF
00D0:  DF D9 DF DF DF DF DF AB 7C B8 DF DF DF DF DF DF
00E0:  D6 B8 91 7A 7B 83 89 70 1D 95 DF B7 81 61 84 7E
00F0:  82 98 99 AF DA 80 80 80 80 80 80 80 80 80 80 80
0100:  80 80 80 80 80 80 80 80 80 80 80 80 80 80 00 00
0110:  00 00 00 00 00 00 00 00 00 00 00 09 00 00 00 00
0120:  00 00 00 00 00 00 00 00 00 51 00 52 76 75 7E 00
0130:  20 33 0F 02 02 6C 0A 0C 02 02 0E 85 07 43 09 AE
0140:  01 00 00 00 05 05 03 04 05 05 03 FE 00 24 00 5E
0150:  00 61 00 DF 00 A9 00 00 00 C2 09 AE 01 5C 00 F9
0160:  00 ED 00 FE 01 2A 01 1B 00 80 01 8F 00 C6 01 8F
0170:  00 8C 01 2A 01 1B 00 D0 00 E3 02 B2 01 F0 01 6D
0180:  01 99 00 F9 00 94 00 BF 00 C6 00 A9 00 ED 00 85
0190:  FF FE FF FE 00 6D FF FE 00 72 00 B3 00 BD 00 00
01A0:  00 BD 07 02 0A 02 02 6C 04 D7 13 5C 09 AE 00 00
01B0:  00 01 03 0A 03 06 04 04 05 04 00 63 00 C2 00 79
01C0:  01 83 00 C2 00 3D 00 49 00 91 09 AE 01 F0 00 2C
01D0:  00 63 00 C6 00 63 00 F7 00 63 00 A2 00 50 01 3F
01E0:  FF FE 02 2F 01 0D 00 94 01 0D 01 E9 01 8F 00 C6
01F0:  00 79 00 B6 00 DF 00 96 00 C4 00 C6 29 00 8A A5
```

## Comments

Downloaded from SDM at tow lot.