CRASH DATA RESEARCH CENTER
Calspan Corporation
Buffalo, NY 14225

CALSPAN ON-SITE CHILD RESTRAINT SYSTEM CRASH INVESTIGATION
CASE NO: CA08046

VEHICLE: 2002 FORD WINDSTAR

LOCATION: MARYLAND

CRASH DATE: SEPTEMBER, 2008

Contract No. DTNH22-07-C-00043

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The crash investigation process is an inexact science which requires that physical evidence such as skid marks, vehicular damage measurements, and occupant contact points are coupled with the investigator's expert knowledge and experience of vehicle dynamics and occupant kinematics in order to determine the pre-crash, crash, and post-crash movements of involved vehicles and occupants.

Because each crash is a unique sequence of events, generalized conclusions cannot be made concerning the crashworthiness performance of the involved vehicle(s) or their safety systems.

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16. Abstract This on-site investigation focused on two Child Restraint Systems (CRS's) installed in a 2002 Ford Windstar which was involved in a roadside departure/rollover crash. The 2002 Ford Windstar was equipped with an Advanced Occupant Protection System (AOPS) consisting of front safety belt buckle switches, front safety belt retractor-pretensioners, a driver seat track position sensor, a front right passenger occupant detection sensor and dual-stage frontal air bags. The Ford departed the right side of a two-lane divided interstate, climbed a steep embankment, and subsequently rolled over 6-quarter turns. The Ford was driven by a 27-year-old restrained female and was occupied by an 8-year-old restrained female front right passenger, a 2-year-old male secured in a forward facing CRS in the second row right position, a 6-year-old restrained female in the third row left position and a 5-year-old male secured in a booster seat in the third row right position. During the course of the rollover crash, the 8-year-old front right passenger was ejected through the left rear quarter window and was fatally injured. The driver and the three child passengers remaining inside the Ford sustained minor soft tissue injuries.			
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BACKGROUND

This on-site investigation focused on two Child Restraint Systems (CRS's) installed in a 2002 Ford Windstar that was involved in a roadside departure/rollover crash. The Ford was equipped with an Advanced Occupant Protection System (AOPS) consisting of front safety belt buckle switches, front safety belt retractor pretensioners, a driver seat track position sensor, a front right passenger occupant detection sensor and dual-stage frontal air bags. **Figure 1** is an on-scene police image of the vehicle at final rest. The Ford departed the right side of a two-lane divided interstate, climbed a steep embankment, and subsequently rolled over 6-quarter turns coming to rest on the highway. As the Ford approached its final rest position, the front and right side of a 2006 Nissan Altima contacted the Ford's left front corner in an end-swipe configuration. The Ford was driven by a 27-year-old restrained female and was occupied by an 8-year-old restrained female front right passenger, a 2-year-old male secured in a forward facing convertible CRS in the second row right position, a 6-year-old restrained female in the third row left position and a 5-year-old male secured in a high-back booster CRS in the third row right position. During the course of the rollover crash, the 8-year-old front right passenger was ejected through the left rear quarter window and was fatally injured. The driver and the three child passengers remaining inside the Ford sustained minor severity soft tissue injuries.

Figure 1: On-scene police image of the Ford at final rest.

The Special Crash Investigations (SCI) team at Calspan received notification of this crash from the Police Crash Team on September 16, 2008. The notification was forwarded onto the Crash Investigation Division of the National Highway Traffic Safety Administration (NHTSA) and an on-site investigation was assigned the same day due to the Agency's interest in child passenger safety. The Ford Windstar was on hold at the police barracks pending the conclusion of the police investigation. The on-site investigation took place September 18, 2008. The vehicle's Event Data Recorder (EDR) was imaged during of the course of the investigation. The Nissan Altima was released by the police investigators from the crash site and was not inspected.

SUMMARY

Crash Site

This multiple-event crash occurred during the nighttime hours of September 2008. It was dark and raining at the time of the crash. There was no artificial lighting at the rural crash site. The crash occurred on the east roadside of a north/south two-lane divided interstate highway in a large radius left curve. **Figure 2** is a trajectory view of the Ford at the point of the roadside departure. The two northbound lanes measured 3.6 m (12 ft) and were separated by a broken centerline. A 3.6 m (12 ft) wide breakdown lane bordered the outboard lane. A 1.4 m (4.6 ft) wide shoulder bordered the breakdown lane. The shoulder sloped away from the interstate for drainage. A 0.3 m (1 ft) wide concrete rain gutter reinforced the outboard shoulder edge and provided a transition to the positive grade of the roadside embankment. The grade of the embankment measured +60 percent (+30 degrees). A tree line oriented parallel to the roadway was located 5.5 m (18 ft) east of the concrete edge. The interstate speed limit was 105 km/h (65 mph).

Figure 2: Northeast trajectory view of the Ford at the roadside departure.

Vehicle Data

2002 Ford Windstar

The 2002 Ford Windstar was identified by the Vehicle Identification Number (VIN): 2FMZA50462B (production sequence deleted) and was manufactured in January 2002. The vehicle was configured on a 307 cm (120.7 in) wheelbase and was equipped with LX level trim. A vehicle history report indicated that the driver was the fourth owner of the Ford and had purchased it in February 2008. The digital odometer reading was unknown due to a compromised electrical system. The vehicle's power train consisted of a 3.8 liter, V6 engine linked to a 4-speed automatic transmission. The service brakes were a front disc/rear drum system with 4-wheel anti-lock. The cloth-trimmed seating system in the vehicle was configured for seven passengers (2/2/3) and consisted of driver and front right captain's chairs, a second row two-passenger bench seat and a third row three-passenger bench seat. The manual restraint system consisted of a 3-point lap and shoulder safety belts for the six outboard positions. The third row center position was equipped with a lap belt. The Ford was equipped with an Advanced Occupant Protection System (AOPS) consisting of front safety belt buckle switches, front safety belt retractor-pretensioners, a driver seat track position sensor, a front right passenger occupant detection (weight) sensor and dual-stage frontal air bags. At the time of the crash, the Ford was equipped with a mixed set of tires identified in the table below. The vehicle manufacturer recommended tire size was P215/70R15 and the recommended front and rear cold

tire pressure was 241 kPa (35 PSI). The right rear tire appeared to be the spare tire; it was a different size and the outboard surface was dry rotted. There was no tire mounted to the spare tire carrier. The specific tire data at the time of the SCI inspection was as follows:

Position	Manufacturer Data and TIN Number	Measured Tire Pressure	Measured Tread Depth	Tire/Wheel Damage
Left Front	Cornell 1000 P215/70R15 U9M3 X115 2207	Tire Flat	5 mm (6/32 in)	None
Left Rear	Goodyear Integrity P215/70R15 DOT #- unknown	159 kPa (23 PSI)	6 mm (8/32 in)	Rim edge deformed inboard
Right Rear	Goodyear Invicta GL P205/70R15 M6M0 ECDR 319	214 kPa (31 PSI)	6 mm (7/32 in)	None
Right Front	American Silver P215/70R15 BHM3 BHCC 1804	Tire Flat	5 mm (6/32 in)	Tire debeaded, side wall cut

2006 Nissan Altima

The 2006 Nissan Altima was identified by the VIN 1N4AL11D86C (production sequence deleted). **Figure 3** is an on-scene view of the Nissan. The 4-door sedan was initially travelling behind the Ford and witnessed the crash. As the Ford reentered the interstate and was sliding to rest, the right side plane of the Nissan contacted the front plane of the Ford. It should be noted that the Ford had rolled over and was sliding on its top during the contact. Based a review of the police images, the contact damage was minor. The Nissan was released from the crash scene by the police and was not available for inspection. None of the occupants in the Nissan were injured. The estimated Collision Deformation Classification (CDC) of the Nissan was 01RPEW1.

Figure 3: On-scene right side view of the Nissan.

Crash Sequence

Pre-Crash

The 2002 Ford Windstar was northbound in the outboard lane driven by the 27-year-old restrained female. The vehicle was occupied by the 8-year-old restrained female front right

passenger, the 2-year-old male restrained by the 5-point harness of a forward facing CRS secured in the second row right position, the 6-year-old restrained female in the third row left position and the 5-year-old male restrained in a booster CRS in the third row right position. Witnesses reported that traffic was moving at 97 to 105 km/h (60 to 65 mph). The driver of the Ford reported that a non-contact vehicle encroached into her lane from the left and "cut her off". The driver reacted to the encroaching vehicle by evasively steering to the right. A subtle 1.9 m (6.2 ft) tire mark documented on the breakdown lane during the SCI scene inspection was possibly related to the vehicle's errant trajectory. The Ford traveled through the breakdown lane and departed the right side of the road at an angle of approximately 35 degrees. The rear tires of the Ford broke traction and the vehicle initiated a clockwise (CW) yaw. A schematic of the crash is attached to the end of this report as **Figure 18**.

Crash

The forward undercarriage of the Ford impacted the embankment evidenced by a V-shaped gouge in the embankment that began immediately outboard the concrete rain gutter (Event 1). The gouge measured 2 m x 1.3 m (6.6 ft x 4.3 ft). The Ford's safety belt pretensioners and the driver air bag deployed as a result of the impact. The front right passenger air bag was suppressed due to the weight of the front right child passenger. The deployment of the passive restraints was confirmed by the imaged EDR data. The EDR recorded longitudinal delta V of this impact was -9.8 km/h (-6.1 mph). The recorded crash pulse was short in duration with a rapid rise time.

Figure 4: View depicting the errant trajectory of the Ford and the gouges that resulted from Events 1 and 2.

The Ford continued on its northeast trajectory (**Figure 4**), began to climb the embankment and rotated CW. The vehicle traveled 10 m (33 ft) northeast from its initial departure point and had rotated approximately 90 degrees CW when the left rear wheel rim impacted the concrete gutter and the left rear tire produced an adjacent gouge (Event 2). This contact was evidenced by rim's bead edge that was deformed inboard and by the dirt/grass debris gathered in the adjacent bead. The Ford then climbed and traveled across the embankment while rapidly rotating approximately 630 degrees CW. Two distinct areas of swiping contact were noted to the tree line from the Ford's back plane (Events 3 and 4). The contact areas in the tree line were separated by a longitudinal distance of 5.2 m (17.1 ft). During the rotation, the Ford was oriented in a non-horizontal attitude, alternating between a pitched up and pitched down attitude in relation to the embankment. The Ford traversed a longitudinal distance of 20 m (65.6 ft) across the embankment during these dynamics. The 8-year-old front right passenger was displaced out

from under the lap and shoulder belt and into the left rear corner area of the vehicle during the rapid rotation.

The Ford descended the embankment (**Figure 5**) and, as it approached the road shoulder, initiated a left side leading rollover (Event 5). The rollover type was considered a fall-over. The Ford reentered the roadway rolled 4-quarter turns and then ejected the (now) unrestrained and displaced front right passenger through the left rear quarter window onto the roadway. During the 5th-quarter turn, the left side of the Ford rolled over the child resulting in fatal injuries. The Ford then rolled one additional quarter turn (6-quarter turns total) onto its roof into the northbound travel lanes. The estimated uninterrupted roll distance was 16 m (52 ft). As the vehicle was sliding on its roof to final rest, its front plane was contacted by the Nissan in a minor impact (Event 6). The Ford came to rest on its roof facing westward in the outboard travel lane (**Figure 6**). The Nissan came to a controlled stop adjacent to the Ford facing north. It should be noted that the Nissan was moved prior to the time the on-scene images were taken by the police investigator.

Figure 5: View depicting the Ford's descent trajectory down the embankment, to the rollover and final rest.

Figure 6: View of the Ford at final rest. Image supplied by the police investigator.

Post-Crash

Witnesses to the crash stopped and reported the crash via cellular telephone to the emergency reporting system. The driver of the Ford exited the vehicle and reportedly called for help. Witnesses assisted the other passengers from the Ford and waited for the arrival of the first responders. The police and ambulance personnel responded to the crash site. The driver, the second row right child passenger and the two third row child passengers were transported by ground ambulance, treated and released with minor soft tissue injuries. The ejected front right passenger sustained a crushing head injury and was removed by the medical examiner. The Ford was removed from the scene and transported to the police impound where it was inspected for this SCI investigation.

2002 Ford Windstar

Exterior Damage

The multiple-event crash sequence resulted in moderate severity damage to the Ford. The undercarriage impact (Event 1) resulted in a 5 cm (2 in) right wheelbase reduction and a fracturing of the right front suspension lower control arm. The sidewall of the right front tire was cut and holed. Longitudinal abrasions with distributed dirt/grass debris were observed to the full width of the lower engine cradle (**Figure 7**). The Collision Deformation Classification (CDC) was 00UFDW3. Based on the crash reconstruction and a review of the EDR data, this impact resulted in the actuation of the front safety belt retractor pretensioners and the deployment of the vehicle's driver air bag.

The CW rotation of the Ford was supported by the inspection of the left rear wheel rim. The rim deformation was linked to the impact the concrete rain gutter and the adjacent gouge (Event 2). The rim bead edge was folded inboard over a 30 cm (12 in) length (**Figure 8**). The CDC of this impact was 09LBWN1.

Figure 7: View of the Ford's front undercarriage.

Figure 8: View of the deformed left rear wheel rim.

The upper aspect of the right D-pillar, the back plane and the upper area of the left D-pillar exhibited damage that was associated to the swiping impacts within the tree line (Events 3 and 4). The respective D-pillar body panels exhibited horizontal abrasions (**Figure 9**). Due to the contour of the Ford's body, the location and the orientation of these abrasions could not be associated to the rollover event. These two regions of damage wrapped around the corners onto the back plane. It was observed that debris from the tree line was embedded between the body panels and the surrounding rubber moldings. **Figure 9** is a view of the damage at the left upper D-pillar area. The reconstruction of the crash indicated that contact with the left rear corner area occurred first, followed by

Figure 9: View the damage at the Ford's left D-pillar area.

a separation, and then contact to the right rear corner area. The CDC for Event 3 was 00LBAW2. The CDC for Event 4 was 00RBAW2.

The Ford sustained damage to the top and both side planes as a result of the 6-quarter turn rollover (Event 5). Refer to **Figure 10**. The left plane and roof exhibited body panel deformation and abrasions consistent with contacting the ground twice. The abrasions along the left roof side rail and on the roof were oriented in two directions. The maximum lateral deformation was located at the junction of the left C-pillar and the roof side rail (**Figure 11**). The deformation measured 22 cm (8.5 in). The left roof area buckled vertically due to the deformation. The maximum vertical deformation occurred at the right A-pillar and measured 16 cm (6.2 in). The right A-pillar was also deformed laterally. The lateral deformation measured 17 cm (6.6 in). The right body panels and exposed edges of the panels exhibited deformation and abrasions indicative of a single ground contact consistent with a 6-quarter turn rollover. The CDC of the rollover event was 00LDAO3.

Figure 10: Front overall view of the Ford's rollover damage and maximum vertical damage at the right A-pillar.

Figure 11: View of the maximum lateral deformation at the Ford's left roof side rail.

All the doors remained closed during the impact sequence. The right front door was operational at the time of the SCI inspection. The right rear and left front had been forced open and could not be latched closed due to body deformation. The left rear door had been removed. The windshield fractured from the impact forces and had separated along the left A-pillar and across the header. The left front window and backlight were intact. All other side glazing had disintegrated. The left rear quarter window was determined to be the ejection portal.

An isolated region of damage was noted below the left rear quarter window (**Figure 12**). This damaged region began immediately below the window and measured 71 cm x 41 cm (28 in x 16 in) length x height. The lateral deformation measured 9 cm (3.5 in). Bodily fluid evidence was observed within the deformation. This area was deformed by the head of the ejected child

passenger as the head became captured between the vehicle and the ground during the later stage of the rollover event.

Figure 12: View of the isolated damage to the Ford's left quarter panel.

The left aspect of the front bumper and left fender exhibited damage that was possibly related to the minor impact with the right side Nissan (Event 6). A 51 cm (20 in) scuff was identified on the left aspect of the bumper fascia. The CDC of this contact was 00LFEW1.

Interior Damage

The interior damage to the Ford was attributed to occupant contact, green house intrusion and air bag deployment. The driver seat was located in a mid-to-rear track position that measured 6 cm (2.5 in) forward of full-rear. The total seat track travel measured 19 cm (7.5 in). The driver seatback was reclined 20 degrees aft of vertical. The horizontal distance from the seatback to the center of the steering wheel measured 65 cm (25.5 in). The steering column was fixed. The 4-spoke steering wheel was not deformed and there was no shear capsule separation. There was no evidence of contact to the driver knee bolster.

The front right seat was positioned in a mid-track position that measured 8 cm (3.3 in) forward of full-rear. The total seat track travel measured 18 cm (7.0 in). The front right seatback was reclined 22 degrees. The horizontal distance from the seatback to the face of the instrument panel measured 77 cm (30.5 in).

The second row seat was a two-passenger bench with a forward-folding back. The seat measured 122 cm (48 in) in width. The seat could be removed from the vehicle by releasing the two rear latches and pulling the seat rearward to release the two front hooks from the mounting points. During the crash sequence, the second row seat released from the floor mounts. A 12 x 8 cm (4.7 x 3.0 in) contact was noted to upper aspect of the left head restraint. This contact was attributed to the front right passenger during the ejection. This passenger's contact to the head restraint leveraged the seat from the mounting points.

Figure 13: View of the contact to the left head restraint of the second row seat.

At the time of the crash, there was an open recall for the Ford's rear seat assemblies (NHTSA Campaign ID number 03V459000). The recall action began in November 2003. It could not be determined if the recall maintenance had been performed on this vehicle.

A 3 x 1 cm (1.2 x 0.5 in) area of bodily fluid from a possible front right passenger head contact was located 10 cm (4.0 in) right of the centerline and 24 cm (9.5 in) aft of the windshield header. Two large areas of body fluid were identified at the left C to D-pillar area. A 71 x 36 cm (28 x 14 in) area was observed at the top of the C-pillar extending rearward to D-pillar area. A second 19 x 20 cm (7.5 x 8 in) area was located on the side panel immediately adjacent to left rear quarter panel. These transfers occurred during the front right passenger ejection.

A possible head contact from the second row left passenger was located 28 cm (11.0 in) inboard the right C-pillar. The contact measured 4 x 7 cm (1.6 x 2.8 in). This contact occurred during the rollover sequence after the second row seat was displaced from its mounts and allowed vertical motion of the seat.

The passenger compartment intrusions are listed in the following table:

Location	Component	Magnitude	Direction
Row 1 Right	A-pillar	18 cm (7.0 in)	Vertical
Row 1 Right	A-pillar	13 cm (5.1 in)	Lateral
Row 1 Right	Windshield header	13 cm (5.1 in)	Vertical
Row 1 Right	Roof side rail	20 cm (8.0 in)	Vertical
Row 1 Right	Roof side rail	17 cm (6.5 in)	Lateral
Row 1 Right	Roof	19 cm (7.5 in)	Lateral
Row 1 Right	B-pillar	5 cm (2.0 in)	Vertical

Location	Component	Magnitude	Direction
Row 1 Right	B-pillar	5 cm (2.0 in)	Lateral
Row 2 Right	C-pillar	3 cm (1.2 in)	Lateral
Row 2 Right	Roof side rail	8 cm (3.1 in)	Vertical
Row 2 Left	C-pillar	23 cm (9.1 in)	Lateral

Manual Safety Belt Systems

The driver's manual restraint consisted of a 3-point lap and shoulder safety belt with continuous loop webbing, sliding latch plate, an adjustable D-ring and an Emergency Locking Retractor (ELR). The D-ring was adjusted to the full-down position. The retractor was equipped with a pretensioner that actuated as a result of the crash. The webbing was extended in the worn position and the retractor was locked. The total length of the exposed webbing measured 185 cm (73.0 in). The webbing found to be gathered in both the latch plate and D-ring from driver loading. A subtle abrasion to the D-ring surface was identified. The imaged EDR recorded the driver's belt as buckled. The driver was restrained at the time of the crash based on the evidence observed at the SCI inspection.

The front right manual restraint (**Figure 14**) was a 3-point safety belt utilizing continuous loop webbing, a light-weight-locking latch plate, an adjustable D-ring and an ELR. The retractor was equipped with a pretensioner that actuated as a result of the crash. The adjustable D-ring was in the full-down position. At the time of the SCI inspection, the latch plate was still buckled in the receiver and the webbing was locked in the extended position. The length of the exposed webbing measured 191 cm (75.0 in). The measurement was taken from the D-ring to the floor anchor. Examination of the webbing revealed a 20 cm (8.0 in) section of abrasions in the lap section. The abrasions began 51 cm (20.0 in) above the floor anchor. An 8 cm (3.0 in) region of webbing abrasions was observed at the latch plate. Based on the inspection of the restraint, the front right passenger was initially restrained at the time of the crash. The imaged EDR data recorded the status of the belt as buckled.

Figure 14: View of the front right safety belt.

The manual 3-point restraints in the outboard positions of the second and third rows each utilized continuous loop webbing, a light-weight-locking latch plate, and an ELR. The second row D-rings were adjustable; both were adjusted to a mid-position. The D-rings in the third row were fixed. The third row center position was equipped with a lap belt.

Inspection of the second row left safety belt revealed that this safety belt was inoperative. The latch plate could be fully inserted into buckle; however, the buckle would not lock the latch plate. The driver was aware that this safety belt was inoperative. Due to the length of this trip and the interstate travel that was involved, the driver elected to have the 8-year-old female sit in the front right position during this trip, rather than sit in the second row left position unrestrained.

The second row right safety belt was used to secure the convertible CRS in a forward facing mode that was occupied by the 2-year-old male. At the time of the SCI inspection, the CRS was still installed in the second row right position with the webbing routed through the forward-facing belt path. The CRS was compressed into the seat cushion and tightly secured with minimal side-to-side movement. During the crash sequence, the second row seat had separated from its floor mounts. At the time of the SCI inspection, the safety belt webbing had retracted back onto the spool and elevated the seat into the position depicted in **Figure 15**.

Figure 15: View of the second row seat and installed CRS.

The third row left safety belt was in use at the time of the crash by the 6-year-old female. The webbing of this restraint was stowed on the ELR at the time of the inspection. The retractor was operational. A minor abrasion 61 cm (24 in) above the seat bight was observed. This abrasion was related to the position of the latch plate when the belt was buckled at the time of the crash.

The third row right safety belt was used by the 5-year-old male seated on a high-back booster CRS. At the time of the SCI inspection, the booster CRS had been removed from the vehicle and the safety belt was stowed on the retractor. The webbing was extended and inspected. Examination of the webbing revealed a 3 cm (1.0 in) abrasion at the latch plate and a 4 cm (1.5 in) abrasion at the D-ring.

Frontal Air Bag System

The frontal air bag system in the Ford was an Advanced Occupant Protection System (AOPS) and designated by the vehicle manufacturer as the Personal Safety System (PSS). The AOPS consisted of the integrated use of manual 3-point lap and shoulder belts with retractor pretensioners, driver seat track position sensing, front right occupant presence detection, and dual-stage air bag inflation. The driver and front right passenger air bags were designed to deploy at different thresholds of crash severity dependent on restraint use, driver seat track

position and front right occupant presence dictated by a weight sensor. The vehicle was not equipped with side impact air bags. The Restraint Control Module (RCM) located on the vehicle's centerline, under the instrument panel, monitored and controlled the deployment of the vehicle's safety systems.

The RCM had Event Data Recorder (EDR) capabilities and the EDR data was imaged at the time of the SCI inspection. The imaged data is attached to the end of this report. The data was accessed by the connecting the Bosch Crash Data Retrieval hardware directly to the module with external 12-volt power and imaging the data with software version 2.9. The attached data has been reported with version 3.4.

The EDR data indicated there were no faults in the system at the time of the crash. The driver and front right passenger safety belts were buckled. The driver seat was adjusted to a middle track position. The front right passenger seat was recorded as empty. The pretensioners actuated and the driver air bag deployed 28.8 milliseconds after Algorithm Enable (AE). The front right passenger air bag was enabled, but did not deploy.

The driver air bag deployed as a result of the embankment impact (Event 1). The air bag deployed from an H-configuration module located in the center of the steering wheel. The cover flaps did not exhibit any evidence of occupant contact. The upper flap measured 17 cm x 8 cm (6.8 in x 3.0 in) width x height. The lower flap measured 17 cm x 5 cm (6.8 in x 2.0 in). The deployed air bag measured 56 cm (22 in) in its deflated state. The bag was tethered and was vented by two ports located on the back side of the bag. There was no contact evidence to the air bag.

The front right passenger air bag was a top-mount design located in the right aspect of the instrument panel. The deployment of this air bag was suppressed by the RCM.

Child Restraint Systems

The 2-year-old male was restrained by the 5-point harness of a forward-facing convertible CRS in the second row right position. The CRS was a Cosco Scenera, model number: 22-120-WAL (**Figure 16**). The date of manufacture was December 15, 2006. In the forward-facing mode, the CRS was designed for use by a child with an 86 to 109 cm (34 to 43 in) height and a 9 to 18 kg (22 to 40 lb) weight. This type of CRS required the use of the vehicle's 3-point safety belt system or the use of the LATCH (Lower Anchors and

Figure 16: Front view of the Cosco Scenera.

Tethers for Children) system to secure the CRS within a vehicle's designated seat position. It was determined that the belt system was used to secure the CRS to the vehicle's seat.

This CRS was designed with an internal 5-point harness system. There were three harness slots in the back of the shell. The harness was found to be routed through the top slots. The base was designed with an adjustable foot that was to be extended during forward-facing use. The SCI inspection of the CRS installation determined that the foot was extended.

Further inspection of the CRS revealed abrasions at forward-facing belt path from interaction with the vehicle's safety belt webbing. There were no indications of stress marks or contact to the CRS shell. Examination of the 5-point harness was unremarkable. The top tether strap was not used. Based upon the age and weight of the 2-year-old male, the CRS was an appropriate selection for use.

The 5-year-old male was restrained in a Graco Turbo Booster (**Figure 17**). This CRS was used as a high-back booster and had the model number: 8495STO. The high-back was removable. The date of manufacture was April 14, 2004. With the high-back in place, the CRS was designed for a child with a 97 to 145 cm (38 to 57 in) height and 14 to 45 kg (30 to 100 lb) weight. Examination of the CRS was unremarkable for stress marks or contact evidence. Based upon the age and weight of the 5-year-old male, the CRS was an appropriate selection for use.

Figure 17: View of the Graco booster CRS in the third row right position.

Occupant Demographics/Data

Driver

Driver Age/Sex:	27-year-old/Female
Height:	157 cm (62 in)
Weight:	54 kg (119 lb)
Seat Track Position:	Mid-to-rear track position
Manual Safety Belt Use:	3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Egress from Vehicle:	Exited unassisted
Mode of Transport from Scene:	Ambulance
Type of Medical Treatment:	Treated and released

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Bilateral knee abrasions	Minor (890202.1,3)	Knee bolster
Right hand laceration, NFS	Minor (790600.1,1)	Flying glass (probable)
Left hand abrasion (on palm)	Minor (790202.1,2)	Left instrument panel (probable)

Source = Emergency room records

Driver Kinematics

The 27-year-old driver of the Ford was seated in a mid-to-rear track position and was restrained by the 3-point lap and shoulder belt. The driver reported that she steered right to avoid a non-contact vehicle which resulted in a right roadside departure. The sudden steering input resulted in a CW yaw.

The Ford departed the roadway and impacted the roadside embankment with the undercarriage. The impact actuated the front safety belt pretensioners and deployed the driver air bag. The driver initiated a forward trajectory and loaded the locked belt system with her pelvis and chest. The driver's knees contacted the bolster resulting in soft tissue abrasions.

The Ford climbed and traversed the embankment, rotated rapidly CW and rolled over during its descent back onto the roadway. The vehicle came to rest on its roof. The driver rode down the forces generated during these dynamics by continuing to load the lap and shoulder belt system. This loading was evidenced by the post-crash gathered status of the webbing into the D-ring and at the latch plate. The soft tissue hand injuries sustained by the driver possibly occurred during the later phases of the crash sequence or during egress. The driver exited the vehicle unassisted. She was transported by ground ambulance to a local hospital where she was treated and released.

Front Right Passenger

Age/Sex:	8-year-old/Female
Height:	142 cm (56 in)
Weight:	26 kg (57 lb)
Seat Track Position:	Mid-track position
Manual Safety Belt Use:	Ejected from a 3-point and shoulder belt
Usage Source:	Vehicle inspection
Egress from Vehicle:	Ejected during rollover
Mode of Transport from Scene:	Medical examiner
Type of Medical Treatment:	None, fatally injured

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Massive destruction of both cranium and brain (Crush)	Maximum (113000.6,0)	Exterior surface of vehicle
Dislocated fracture of the atlanto-occipital joint	Serious (650228.3,6)	Exterior surface of vehicle
10 cm intraparenchymal liver laceration	Serious (541824.3,1)	Left rear quarter window sill
Bilateral maxilla fractures	Moderate (250800.2,3)	Exterior surface of vehicle
Whole face lacerations	Moderate (290604.1,0)	Exterior surface of vehicle
Mandible fracture	Minor (250604.1,1)	Exterior surface of vehicle
Right eye conjunctiva injury	Minor (240416.1,1)	Exterior surface of vehicle
Left eyelid contusion	Minor (297402.1,2)	Exterior surface of vehicle
Right ear contusions	Minor (290402.1,1)	Exterior surface of vehicle
Contusion of the left ear and a 10 x 8 cm left cheek contusion (extending into left neck)	Minor (290402.1,2)	Exterior surface of vehicle
Upper lip contusion	Minor (290402.1,8)	Exterior surface of vehicle
Left neck contusion	Minor (390402.1,2)	Exterior surface of vehicle
Left side philtrum, and right and left side chin abrasions	Minor (290202.1,8)	Exterior surface of vehicle
Left cheek abrasion	Minor (290202.1,2)	Exterior surface of vehicle
Left side forehead abrasion	Minor (290202.1,7)	Exterior surface of vehicle
Right side neck 8 x 4 cm abrasion	Minor (390202.1,1)	Exterior surface of vehicle
Lower abdominal 14 x 5 cm abrasion	Minor (590202.1,8)	Safety belt webbing
Right elbow lacerations (3 to 6 mm)	Minor (790602.1,1)	Ground

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
10 x 5 cm back of right wrist to back of right hand contusion	Minor (790402.1,1)	Ground
25 cm discontinuous left arm abrasion including 4 cm left wrist abrasion (posterior aspect)	Minor (790202.1,2)	Ground
Left posterior index finger laceration	Minor (790602.1,2)	Ground
Left leg (1 cm) and ankle (3 cm) abrasions	Minor (890202.1,2)	Ground

Source = Medical examiner's report

Front Right Passenger Kinematics

The 8-year-old front right passenger was seated in a mid-track position and was restrained by the vehicle's 3-point lap and shoulder belt. The frontal impact with the roadside embankment caused the actuation of the retractor pretensioner and locked the safety belt. The front right passenger initiated a forward trajectory in response to the frontal crash and loaded the safety belt.

The Ford climbed the embankment and rotated rapidly clockwise. Consequently, the Ford was alternately pitching up and down as it traversed across the embankment. The centripetal acceleration of the rapid rotation and the changing attitude of the vehicle caused the occupant to be displaced out from under the safety belt. This kinematic pattern was evidenced by the soft tissue abrasions to her abdomen and the identified loading evidence to the lap section of the safety belt webbing.

The front right occupant slid out from under the 3-point lap and shoulder belt and traveled rearward between the front seats into the rear seat area of the Ford. She impacted the left head restraint of the second row seat. This impact displaced the seat from it floor mounts. The occupant was further displaced into the left rear of the Ford and interacted with the third row left occupant.

As the vehicle rolled over to the left, the (now) unrestrained occupant was ejected through the left rear quarter window opening during the 4^{th} to 5^{th} quarter turn. The occupant's head was captured between the left quarter panel and the ground resulting in the AIS-6 crushing head injuries and associated multiple soft tissue facial injuries. During the ejection, the occupant's abdomen engaged against the left window sill. This contact resulted in a lacerated liver. The Ford then rolled away from (beyond) the occupant onto its roof. The occupant came to rest on the shoulder of the roadway. She was transported from the crash scene by the medical examiner for evaluation.

Second Row Right Passenger

Age/Sex:	2-year-old/Male
Height:	Unknown
Weight:	15 kg (33 lb)
Seat Track Position:	Non-adjustable
Manual Safety Belt Use:	5-point harness system of a CRS
Usage Source:	Vehicle inspection
Egress from Vehicle:	Assisted by witness prior to EMS arrival
Mode of Transport from Scene:	Ambulance to a regional trauma center
Type of Medical Treatment:	Treated and released

Second Row Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Two minor scalp lacerations (each 1-2 mm on vertex of scalp)	Minor (190602.1,5)	Roof
Scalp contusion, NFS	Minor (190402.1,9)	Roof
Scalp abrasion (2 mm into the hairline)	Minor (190202.1,5)	Roof
Right lower leg abrasion (anterior aspect)	Minor (890202.1,1)	Roof

Source = Emergency room records

Second Row Right Passenger Kinematics

The 2-year-old male was secured by the 5-point harness system of a CRS that was restrained in the second row right position by the vehicle's safety belt. At impact with the embankment, the inertial mode of the safety belt retractor activated and locked the safety belt. The child responded to the frontal impact by initiating a forward trajectory and loading the 5-point harness. Throughout the following dynamic phase of the vehicle's rotation and subsequent rollover, the child rode down the crash forces by the harness loading.

When the displaced front right occupant impacted the second row seat, the seat separated from its floor mounting points. As the vehicle rolled inverted, the seat came into contact with the roof. The motion of the displaced seat allowed the child's head to come in contact with the roof. This contact was evidenced by the area of bodily fluid identified on the headliner in the area of the right C-pillar. This contact resulted in the minor soft tissue injuries to the scalp. His right leg also contacted and was abraded by the roof (headliner). The child was removed from the CRS by a witness to the crash. He was transported to a regional trauma center by ground ambulance where he was treated and released the day of the crash.

Third Row Left Passenger

Age/Sex:	6-year-old/Female
Height:	130 cm (51 in)
Weight:	25 kg (55 lb)
Seat Track Position:	Non-adjustable
Manual Safety Belt Use:	3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Egress from Vehicle:	Assisted by witness prior to EMS arrival
Mode of Transport from Scene:	Ambulance to a regional trauma center
Type of Medical Treatment:	Hospitalized for one day

Third Row Left Passenger Injury

Injury	Injury Severity AIS 90/Update 98)	Injury Source
Bilateral hip abrasions	Minor (890202.1,3)	3-point lap and shoulder belt
Lower abdominal abrasions	Minor (590202.1,8)	3-point lap and shoulder belt
Right chest contusion (at the costal margin)	Minor (490402.1,1)	Occupant to occupant interaction
Left posterior elbow abrasion (large)	Minor (790202.1,2)	Unknown
Left posterior elbow laceration (with 7 mm radiopaque foreign body)	Minor (790602.1,2)	Unknown

Source = Hospital records

Third Row Left Passenger Kinematics

The 6-year-old female was seated in the third row left position and restrained by the vehicle's 3-point lap and shoulder belt. At impact with the embankment, the inertial mode of the retractor activated and locked the safety belt. The occupant responded with a forward trajectory in response to the frontal impact and loaded the belt system with her pelvis and chest. The occupant continued to load the locked belt system throughout the course of the multiple event crash sequence. This loading resulted in the bilateral hip and lower abdominal abrasions.

During the lateral stages of the vehicle's rotation and subsequence rollover, the front right occupant was displaced into the third row left passenger's occupant space. This kinematic pattern resulted in an interaction between the occupants and was the likely source of the right chest contusions. The front right occupant was then ejected.

The Ford came to rest inverted with the 6-year-old female suspended in the belt system. She released the safety belt and exited the vehicle assisted by a witness prior to EMS arrival. She was transported by ground ambulance to a regional trauma center, hospitalized for one day and released.

Third Row Right Passenger

Age/Sex:	5-year-old/Male
Height:	Unknown
Weight:	20 kg (44 lb)
Seat Track Position:	Non-adjustable
Manual Safety Belt Use:	3-point lap and shoulder belt in the booster CRS
Usage Source:	Vehicle inspection
Egress from Vehicle:	Assisted by witness prior to EMS arrival
Mode of Transport from Scene:	Ambulance to a regional trauma center
Type of Medical Treatment:	Treated and released

Third Row Right Passenger Injury

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Left eyelid abrasion	Minor (297202.1,2)	Interior loose object (possible)
Left eyelid contusion	Minor (297402.1,2)	Interior loose object (possible)

Source = Emergency room records

Third Row Right Passenger Kinematics

The 5-year-old male was seated on a high-back booster CRS restrained in the third row right position by the vehicle's 3-point lap and shoulder belt system. At impact with the embankment, the emergency locking retractor activated and locked the safety belt. The child initiated a forward trajectory and loaded the safety belt with his chest and pelvis. He continued to load the belt system throughout the course of the multiple event crash sequence. The minor soft tissue injuries to his left eye possibly occurred due to a contact with a loose interior object that was displaced during the vehicle's rotation and/or rollover.

Post-crash, the child was assisted from the vehicle by a witness to the events. He was transported by ground ambulance to a regional trauma center, treated, and released on the day of the crash.

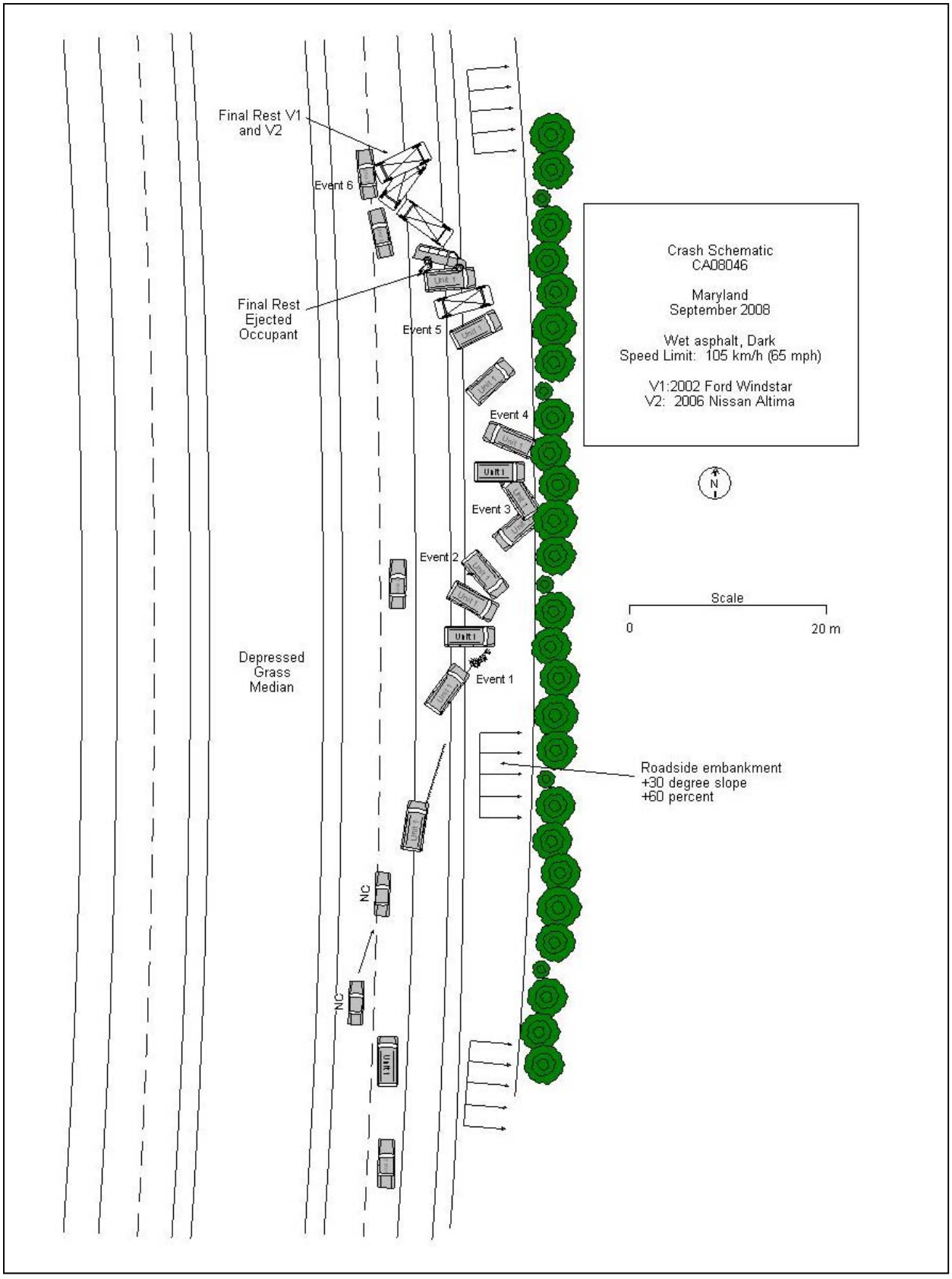


Figure 18: Crash schematic.

ATTACHMENT A

2002 Ford Windstar EDR Data

IMPORTANT NOTICE: Robert Bosch LLC and the manufacturers whose vehicles are accessible using the CDR System urge end users to use the latest production release of the Crash Data Retrieval system software when viewing, printing or exporting any retrieved data from within the CDR program. Using the latest version of the CDR software is the best way to ensure that retrieved data has been translated using the most current information provided by the manufacturers of the vehicles supported by this product.

CDR File Information

User Entered VIN	2FMZA50462B******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	CA08046 CDR.CDR
Saved on	Thursday, September 18 2008 at 06:24:43 PM
Collected with CDR version	Crash Data Retrieval Tool 2.900
Reported with CDR version	Crash Data Retrieval Tool 3.4
EDR Device Type	airbag control module
Event(s) recovered	Deployment

Comments

Data Limitations

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 Thursday, September 18 2008 at 06:24:43 PM .

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.

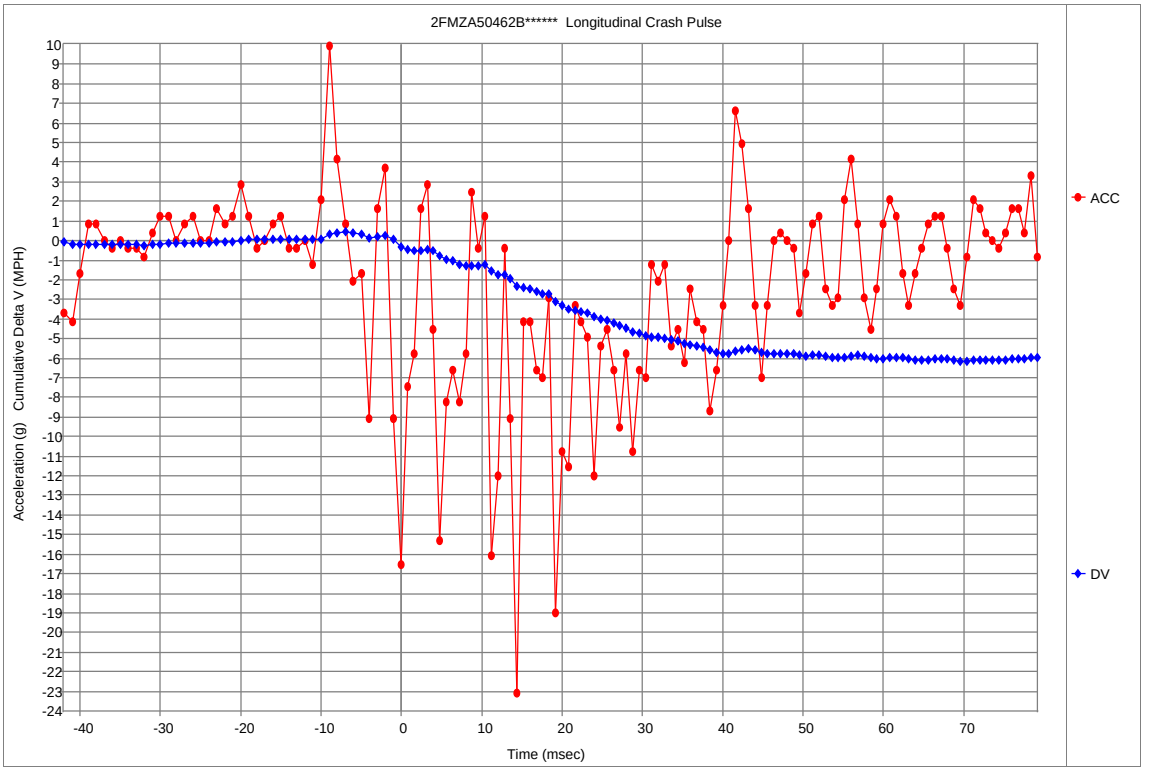
Any Longitudinal Delta-V determined by using data read from the air bag module should be verified with physical evidence from the crash (such as vehicle crush, skid marks) and assumed accident sequence. Multiple impacts, angular collisions, side impacts, vehicle spin, etc should be considered in addition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

02003_RCM-Takata_r001

System Status At Deployment

Ford Part Number Prefix	1F2A
Diagnostic codes active when event occurred	0
Driver seat belt circuit status	Buckled
Driver seat forward of switch point	Yes
Right front passenger seat belt circuit status	Buckled
Passenger occupant classification status	Empty
Driver pretensioner	Deployment Enabled
Passenger Pretensioner	Deployment Enabled
Unbelted Stage 1	Deployment 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)	28.8	28.8
Time between algorithm enable and air bag first stage deployment (ms)	28.8	No deploy
Time between algorithm enable and air bag second stage deployment (ms)	128.8	No deploy


2FMZA50462B****** Longitudinal Crash Pulse
Acceleration (g) Cumulative Delta V (MPH)
Time (msec)
ACC
DV

Crash Pulse Data

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
-42.0	-3.72	-0.08
-41.0	-4.13	-0.17
-40.0	-1.65	-0.21
-39.0	0.83	-0.19
-38.0	0.83	-0.17
-37.0	0.00	-0.17
-36.0	-0.41	-0.18
-35.0	0.00	-0.18
-34.0	-0.41	-0.19
-33.0	-0.41	-0.20
-32.0	-0.83	-0.22
-31.0	0.41	-0.21
-30.0	1.24	-0.18
-29.0	1.24	-0.15
-28.0	0.00	-0.15
-27.0	0.83	-0.14
-26.0	1.24	-0.11
-25.0	0.00	-0.11
-24.0	0.00	-0.11
-23.0	1.65	-0.07
-22.0	0.83	-0.05
-21.0	1.24	-0.03
-20.0	2.89	0.04
-19.0	1.24	0.06
-18.0	-0.41	0.05
-17.0	0.00	0.05
-16.0	0.83	0.07
-15.0	1.24	0.10
-14.0	-0.41	0.09
-13.0	-0.41	0.08
-12.0	0.00	0.08
-11.0	-1.24	0.05
-10.0	2.06	0.10
-9.0	9.91	0.32
-8.0	4.13	0.41
-7.0	0.83	0.43
-6.0	-2.06	0.38
-5.0	-1.65	0.34
-4.0	-9.08	0.14
-3.0	1.65	0.18
-2.0	3.72	0.26
-1.0	-9.08	0.06
0.0	-16.52	-0.30
0.8	-7.43	-0.43
1.6	-5.78	-0.53
2.4	1.65	-0.50
3.2	2.89	-0.45
4.0	-4.54	-0.53
4.8	-15.28	-0.80
5.6	-8.26	-0.94
6.4	-6.61	-1.06
7.2	-8.26	-1.20

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
8.0	-5.78	-1.31
8.8	2.48	-1.26
9.6	-0.41	-1.27
10.4	1.24	-1.25
11.2	-16.10	-1.53
12.0	-11.97	-1.74
12.8	-0.41	-1.75
13.6	-9.08	-1.91
14.4	-23.12	-2.31
15.2	-4.13	-2.39
16.0	-4.13	-2.46
16.8	-6.61	-2.57
17.6	-7.02	-2.70
18.4	-2.89	-2.75
19.2	-18.99	-3.08
20.0	-10.74	-3.27
20.8	-11.56	-3.47
21.6	-3.30	-3.53
22.4	-4.13	-3.60
23.2	-4.95	-3.69
24.0	-11.97	-3.90
24.8	-5.37	-3.99
25.6	-4.54	-4.07
26.4	-6.61	-4.19
27.2	-9.50	-4.36
28.0	-5.78	-4.46
28.8	-10.74	-4.65
29.6	-6.61	-4.76
30.4	-7.02	-4.89
31.2	-1.24	-4.91
32.0	-2.06	-4.94
32.8	-1.24	-4.97
33.6	-5.37	-5.06
34.4	-4.54	-5.14
35.2	-6.19	-5.25
36.0	-2.48	-5.29
36.8	-4.13	-5.36
37.6	-4.54	-5.44
38.4	-8.67	-5.60
39.2	-6.61	-5.71
40.0	-3.30	-5.77
40.8	0.00	-5.77
41.6	6.61	-5.65
42.4	4.95	-5.57
43.2	1.65	-5.54
44.0	-3.30	-5.60
44.8	-7.02	-5.72
45.6	-3.30	-5.78
46.4	0.00	-5.78
47.2	0.41	-5.77
48.0	0.00	-5.77
48.8	-0.41	-5.78
49.6	-3.72	-5.84
50.4	-1.65	-5.87
51.2	0.83	-5.86

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)
52.0	1.24	-5.84
52.8	-2.48	-5.88
53.6	-3.30	-5.94
54.4	-2.89	-5.99
55.2	2.06	-5.95
56.0	4.13	-5.88
56.8	0.83	-5.86
57.6	-2.89	-5.91
58.4	-4.54	-5.99
59.2	-2.48	-6.04
60.0	0.83	-6.02
60.8	2.06	-5.99
61.6	1.24	-5.97
62.4	-1.65	-5.99
63.2	-3.30	-6.05
64.0	-1.65	-6.08
64.8	-0.41	-6.09
65.6	0.83	-6.07
66.4	1.24	-6.05
67.2	1.24	-6.03
68.0	-0.41	-6.04
68.8	-2.48	-6.08
69.6	-3.30	-6.14
70.4	-0.83	-6.15
71.2	2.06	-6.12
72.0	1.65	-6.09
72.8	0.41	-6.08
73.6	0.00	-6.08
74.4	-0.41	-6.09
75.2	0.41	-6.08
76.0	1.65	-6.05
76.8	1.65	-6.02
77.6	0.41	-6.02
78.4	3.30	-5.96
79.2	-0.83	-5.97

Hexadecimal Data

Data that the vehicle manufacturer has specified for data retrieval is shown in the hexadecimal data section of the CDR report. The hexadecimal data section of the CDR report may contain data that is not translated by the CDR program. The control module contains additional data that is not retrievable by the CDR system.

```
0000:  14 BB F6 00 46 00 00 F5 0E 22 0E 2B 38 55 18 1E
0010:  00 7D 13 26 13 26 05 CC 31 46 32 41 00 04 71 7D
0020:  38 00 33 32 30 34 38 42 30 33 00 00 00 00 00 00
0030:  00 00 00 00 00 00 00 00 00 00 32 32 30 37 30 37
0040:  34 30 56 69 54 53 53 80 20 08 4D 10 01 80 17 00
0050:  03 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0060:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0070:  00 00 00 00 01 00 00 00 00 00 00 04 00 00 33 01
0080:  7B 76 95 A7 91 8D 7B 78 8A A4 93 8F 93 8D 79 80
0090:  7C A6 9C 80 95 B7 89 89 8F 90 86 AD 99 9B 87 89
00A0:  8B 9C 8C 8A 8F 96 8D 99 8F 90 82 84 82 8C 8A 8E
00B0:  85 89 8A 94 8F 87 7F 6F 73 7B 87 90 87 7F 7E 7F
00C0:  80 88 83 7D 7C 85 87 86 7A 75 7D 86 8A 85 7D 7A
00D0:  7C 83 87 83 80 7D 7C 7C 80 85 87 81 7A 7B 7E 7F
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00F0:  80 81 7E 7C 7C 7F 7D 7C 7F 7F 7B 7D 7C 78 7C 80
0100:  7F 7D 7C 80 80 7F 82 7A 67 75 7D 84 83 95 00 24
0110:  00 A1 00 00 00 00 00 24 00 24 00 16 1D 1B 00 00
0120:  1D 1D 00 11 00 00 00 00 00 63 00 63 68 67 7F 20
0130:  31 AA 8E 03 02 6C 05 02 02 05 02 6C 04 D7 01 00
0140:  00 00 03 03 05 06 02 03 FC 5A 00 00 00 A9 00 00
0150:  01 83 00 00 00 91 02 6C 13 5C 01 03 01 2F 00 DC
0160:  02 53 00 72 00 1F 01 83 00 B3 01 D3 01 31 00 85
0170:  03 87 FF 0E 01 3F 02 31 00 A9 FF FE 00 E6 00 2C
0180:  02 5D 03 13 00 3A 00 6D 00 B6 00 91 00 91 00 91
0190:  00 91 00 91 02 02 02 02 04 D7 04 D7 00 00 00 00
01A0:  03 05 03 01 04 03 00 00 00 F2 00 91 00 91 00 00
01B0:  00 30 02 6C 13 5C 05 68 01 F0 01 F0 03 7F 04 A9
01C0:  01 F0 01 2A 1B 3A 20 FE 01 F3 02 56 00 F0 08 37
01D0:  00 72 01 16 06 1E 06 C7 09 50 01 3D 00 8C FB 00
01E0:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
01F0:  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 A5
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