INDIANA UNIVERSITY

TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
501 S. Madison Street, Suite 105
Bloomington, Indiana 47403-2452
(812) 855-3908 Fax: (812) 855-3537

ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE INVESTIGATION

CASE NUMBER - IN09033
LOCATION - MISSOURI
VEHICLE - 2009 MAZDA 3i
CRASH DATE - September 2009

Submitted:

February 24, 2010

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

DISCLAIMERS

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no responsibility for the contents or use thereof.

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the National Highway Traffic Safety Administration.

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.* IN09033	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Certified Advanced 208-Compliant Vehicle Investigation Vehicle - 2009 Mazda 3i Location - Missouri		5. *Report Date:* February 24, 2010 6. *Performing Organization Code*	
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.*	
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 501 South Madison Street, Suite 105 Bloomington, Indiana 47403-2452		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-07-C-00044	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NVS-411) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. *Type of Report and Period Covered* Technical Report Crash Date: September 2009 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site certified advanced 208-compliant vehicle investigation involving a 2009 Mazda 3i and a 2001 Ford Taurus SE.			
16. *Abstract* This on-site investigation focused on a 2009 Mazda 3i and the narrow end engagement that it sustained in this crash. The Mazda was equipped with frontal air bags that were certified by the manufacturer to be compliant to the Advanced Air Bag portion of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The Mazda was occupied by a restrained 25-year-old female driver, restrained 28-year-old male front passenger, restrained 8-year-old male second row left passenger, and restrained 7-year-old male second row right passenger. The driver was traveling south on a 2-lane rural roadway and was negotiating a right curve. The 2001 Ford Taurus SE encroached into the Mazda's travel lane and the front plane of the Mazda impacted the left side plane of the Ford. The direction of force on the Mazda was within the 12 o'clock sector and the impact force was sufficient to trigger a deployment of the driver and front passenger frontal air bags. The driver of the Mazda sustained two fractured ribs from loading the safety belt. The second row left and right passengers sustained minor injuries. The front row passenger was not injured. The driver and second row passengers were transported by ambulance to a hospital where they were treated in the emergency room and released. The driver of the Ford was also transported by ambulance to a hospital. Both vehicles were towed due to damage.			
17. *Key Words* Advanced Air Bag Air Bag Deployment Motor Vehicle Traffic Crash Fatal Injury		18. *Distribution Statement* General Public	
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 17	22. *Price*

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

TABLE OF CONTENTS IN09033

This on-site investigation focused on a 2009 Mazda 3i (**Figure 1**) and the narrow end engagement that it sustained in this crash. The Mazda was equipped with frontal air bags that were certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This crash was brought to the attention of the National Highway Traffic Safety Administration (NHTSA) on September 18, 2009 by this contractor. This investigation was assigned on September 21, 2009. This crash involved the Mazda and a 2001 Ford Taurus SE. The crash occurred in September, 2009, at 1820 hours, in Missouri and was investigated by the Missouri State Highway Patrol. The crash scene, Mazda, and Ford were inspected on September 23-24, 2009. An interview with the driver of the Mazda was completed on October 1, 2009. This report is based on the police crash report, crash scene inspection, vehicle inspections, inspection of an exemplar Mazda, an interview with the Mazda's driver, occupant kinematic principles, and evaluation of the evidence.

Figure 1: The damaged 2009 Mazda 3i

CRASH CIRCUMSTANCES

Crash Environment: The trafficway that both vehicles were traveling on was a 2-lane, undivided, rural roadway, traversing in a general north and south direction. The roadway had one travel lane in each direction and was bordered by dirt and gravel shoulders. There were no lane designations or pavements markings. The roadway was 7.4 m (24.3 ft) in width. The roadway was level in the area of the impact and on the Mazda's approach to impact. The roadway had a negative 5% grade, 25 m (82 ft) prior to the point of impact for the Ford. The crash occurred within a curve and the radius of curvature was 456 m (1496 ft). At the time of the crash, the light condition was daylight, the atmospheric condition was cloudy, and the roadway pavement was dry dirt and gravel. The speed limit was 40 km/h (25 mph). There was no other traffic present at the time of the crash. The site of the crash was rural wooded/agricultural. The Crash Diagram on page 12 of this report.

Pre-Crash: The Mazda was occupied by a restrained 25-year-old female driver, restrained 28-year-old male front passenger, restrained 8-year-old male second row left passenger, and a restrained 7-year-old male second row right passenger. The driver was traveling south and was negotiating a right curve (**Figure 2**). During the SCI interview, the driver estimated her travel speed as 24 km/h (15 mph). She braked without lock-up in an attempt to avoid the crash when the Ford encroached into her lane. The Ford was being driven by a restrained 21-year-old male. He was traveling north and was also negotiating the curve (**Figure 3**). The crash occurred within the southbound lane of the roadway.

Crash: The front plane of the Mazda (**Figure 4**) impacted the left side plane of the Ford (**Figure 5**). The impact involved the front left bumper corner of the Mazda and the left fender and left front door of the Ford. During the impact, the left front wheels of each vehicle were engaged displacing each wheel rearward into the back of their respective wheel wells. The impact did not engage the Mazda's left frame member. The Mazda's direction of force was within the 12 o'clock sector and the impact force was sufficient to trigger a deployment of the driver and front passenger frontal air bags. Based on the police crash schematic, the Mazda rotated counterclockwise approximately 30 degrees and came to final rest partially off the roadway heading southeast. Following the crash, the Ford's driver backed his vehicle partially off the south side of the roadway.

Figure 2: Approach of the Mazda to the curve and location of the crash; number on roadway shows meters to area of impact

Figure 3: Approach of the Ford

Figure 4: Damage on the Mazda from the impact with the Ford

Figure 5: Damage on the Ford from the impact with the Mazda

Post-Crash: The police were notified of the crash at 1836 hours and arrived on scene at 1851 hours. The driver of the Mazda was removed from the vehicle through the left front door by emergency medical personnel and transported by ambulance to a hospital. The other three passengers in the Mazda exited the vehicle without assistance. The Mazda's second row passengers and the driver of the Ford were also transported by ambulance to a hospital. Both vehicles were towed from the crash scene due to damage.

Case Vehicle: The 2009 Mazda 3i was a front wheel drive, 4-door sedan (VIN: JM1BK32F791------) that was manufactured in September 2008. It was equipped with a 2.0-liter, 4-cylinder engine, 4-speed automatic transmission, 4-wheel anti-lock brakes with electronic brake force distribution, and a tire pressure monitoring system. The front row was equipped with bucket seats, active, adjustable head restraints, lap-and-shoulder safety belts, dual stage driver and front right passenger frontal air bags, seat-mounted side impact air bags, and side impact inflatable curtain (IC) air bags. The second row was equipped with a bench seat with folding backs, lap-and-shoulder safety belts, and Lower Anchors and Tethers for Children (LATCH) in the outboard seating positions. The mileage at the time of the inspection could not be determined since the vehicle was equipped with an electronic odometer and was without power. The driver estimated the vehicle's mileage as approximately 14,000 miles (22,531 kilometers). The vehicle's specified wheelbase was 264 cm (103.9).

CASE VEHICLE DAMAGE

Exterior Damage: The impact with the Ford involved the front plane of the Mazda. The front bumper fascia, left headlamp/turn signal assembly, hood, left fender, and left front wheel were directly damaged. The direct damage began at the left corner of the front bumper fascia and extended 36 cm (14.1 in) across the bumper fascia. The crush measurements were taken at the bumper level and C_1 was taken on the left end of the bumper bar. The maximum residual crush at this point was 5 cm (2 in). The vehicle's left side wheelbase was reduced 20 cm (7.9 in) while the right side wheelbase was unchanged. The induced damage involved the left fender, hood, and left front door. The table below shows the vehicle's front crush profile.

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	36	5	156	5	4	0	0	0	0	-63	0
in		14.2	2.0	61.4	2.0	1.6	0.0	0.0	0.0	0.0	-24.8	0.0

Damage Classification: The Mazda's Collision Deformation Classification (CDC) for the front impact was **12-FLEE-4** (**10** degrees). The Damage algorithm of the WinSMASH program calculated the Mazda's total Delta V as 12.0 km/h (7.5 mph). The longitudinal and lateral velocity changes were -11.8 km/h (-7.3 mph) and -2.1 km/h (-1.3 mph), respectively. The results appeared low. The impact did not engage and bumper bar or left frame rail, which resulted in a shallow front crush profile. On this vehicle, the bumper bar did not extend beyond the frame rail (**Figure 6**). The left front wheel (**Figure 7**) was engaged and displaced rearward 20 cm (7.9 in). Displacement of a wheel is outside the scope of the crush measurement protocol and the WinSMASH program.

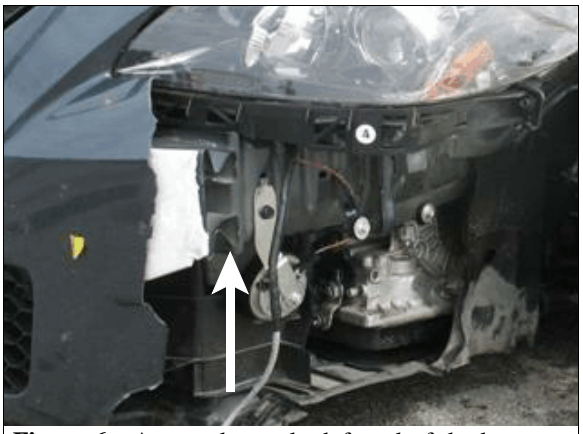


Figure 6: Arrow shows the left end of the bumper bar on the Mazda; the bumper bar did not extend beyond the left frame rail

Figure 7: The impact displaced the Mazda's left front wheel rearward 20 cm (7.8 in)

The manufacturer's recommended tire size was P205/50R17. The Mazda was equipped with the recommended size tires. The vehicle's tire data are shown in the table below.

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	Flat	Flat	221	32	6	8	Debeaded	Yes	Yes
LR	228	33	221	32	3	4	None	No	No
RR	228	33	221	32	6	8	None	No	No
RF	Flat	Flat	221	32	4	5	None	No	Yes

Vehicle Interior: The inspection of the Mazda's interior revealed a makeup transfer on the driver's frontal air bag from the driver's face. A scuff mark was also present the glove box door from contact by the front passenger's right knee. There was no discernable evidence of occupant contact in the second row.

All the doors remained closed, although the left front door would not close once it was opened due to the displacement of the left fender. The pre-crash status of all of the window glazings was either closed or fixed. The windshield was in place and cracked due to contact from the deployment of the passenger's frontal air bag. None of the other window glazings were damaged. There were no intrusions of the passenger compartment.

The Mazda was equipped with a Certified Advanced 208-Compliant (CAC) frontal air bag system that consisted of dual stage driver and front passenger air bags, a driver seat position sensor, front safety belt usage sensors, retractor-mounted safety belt pretensioners and a front passenger weight sensor. The manufacturer has certified that the vehicle is compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. Both of the vehicle's frontal air bags deployed in this crash.

The Mazda was also equipped with a side impact air bag system that consisted of front seat-mounted side impact air bags and roof side rail-mounted IC air bags. Based on the Holmatro Rescuer's Guide to Vehicle Safety Systems, the side impact sensors were located within the lower B-pillars. The inflators for the IC air bags were located within the C-pillars, between the roof side rail and the lower edge of the window glass. The seat-mounted side impact air bags and the IC air bags did not deploy in this crash.

The driver's frontal air bag was located within the steering wheel hub and the module cover was a three flap configuration constructed of pliable vinyl. The top flap was 11.5 cm (4.5 in) in width and 9 cm (3.5 in) in height. Each bottom flap was was 6 cm (2.4 in) in width and height as measured along the tear seams. An inspection of the air bag module cover flaps revealed that they opened at the designated tear points and were undamaged. The deployed air bag (**Figure 8**) was 58 cm (22.8 in) in diameter and had two 4 cm (1.6 in) diameter vent ports and no tethers. The vent ports were located on the back of the air bag at the 11 and 1 o'clock positions. Inspection of the air bag revealed what appeared to be a makeup transfer (**Figure 9**) located 3 cm (1.2 in) left of the center of the air bag. The air bag was not damaged during the deployment.

Figure 8: The Mazda driver's frontal air bag

Figure 9: Tape outlines area of make-up transfer on the driver's frontal air bag

The front passenger's frontal air bag was located within the top of the instrument panel and the module cover consisted of a single flap constructed of medium gauge vinyl. The flap measured 24 cm (9.4 in) in width and 14 cm (5.5 in) in height. The module cover flap opened at the designated tear points and was undamaged. The deployed air bag (**Figure 10**) was rectangular with a width of 33 cm (13 in) and a height of 58 cm (22.8 in) and had two 6 cm (2.4 in) diameter vent ports and no tethers. The vent ports were located on the side of the air bag at the 3 and 9 o'clock positions. Inspection of the air bag revealed a small blood transfer located 7 cm (2.8 in)

to the left and 17 cm (6.7 in) below the center of the air bag. The air bag was not damaged during the deployment.

Figure 10: The front passenger's frontal air bag

MANUAL RESTRAINT SYSTEM

The Mazda was equipped with lap-and-shoulder safety belts for all front and second row seating positions. The driver's safety belt consisted of continuous loop belt webbing, an Emergency Locking Retractor (ELR), a sliding latch plate, and an adjustable upper anchor that was located in the full-up position. The front passenger safety belt was similarly equipped and the upper anchor was located in the full-up position. The front row safety belts were equipped with retractor-mounted pretensioners that actuated during the crash. The second row safety belts consisted of continuous loop belt webbing, switchable ELR/ALRs, sliding latch plates and fixed upper anchors. The second row safety belts were not equipped with pretensioners.

The inspection of the driver's safety belt assembly revealed a scuff from the latch plate on the safety belt webbing located 33 cm (13 in) above the stop button. A friction abrasion from the D-ring was also present on the belt webbing (**Figure 11**) located 92 cm (36.2 in) above the stop button. Abrasions from the safety belt webbing were also present on the latch plate belt guide and the D-ring. This evidence indicated that the driver was restrained in this crash.

Figure 11: Abrasion on the belt webbing of the Mazda's driver

Inspection of the front passenger's safety belt assembly revealed a friction abrasion from the D-ring on the belt webbing (**Figure 12**) located 106 cm (41.7 in) above the stop button. There were also abrasions on the latch plate belt guide. This evidence indicated that the front passenger was restrained in this crash.

Inspection of the second row left and right passenger's safety belt assemblies revealed no discernable evidence of loading. Historical usage scratches were found on the latch plates. The

driver stated during the SCI interview that each second row passenger was restrained by the lap-and-shoulder belt, but she did not know how the restraints were positioned on the occupants.

Figure 12: Friction abrasion on the belt webbing of the Mazda's front passenger

CASE VEHICLE DRIVER KINEMATICS

The driver of the Mazda [25-year-old, female; 170 cm (67 in) and 66 kg (145 lbs)] stated that she was seated in an upright posture with her back against the seat back. The seat track was located between the forward and center positions and the seat back was slightly reclined. The tilt steering column was located in the center position. The telescoping steering column was adjusted to between the middle and rear positions. The driver was not wearing glasses or contact lenses.

The front plane impact with the Ford displaced the driver of the Mazda forward opposite the 12 o'clock direction of force. She loaded the safety belt and her face loaded the deployed frontal air bag. She sustained two fractured ribs from loading the safety belt, and a 5.1 cm (2 in) diameter contusion on the right thigh just above the knee from contacting the steering column. The driver also sustained a laceration on the back of the left wrist, possibly from contacting the left instrument panel. The driver sustained no injury from loading the air bag. The driver remained restrained in her seat and was removed from the vehicle by emergency medical personnel.

CASE VEHICLE DRIVER INJURIES

The driver was transported by ambulance to a hospital where she was treated in the emergency room and released. She had one follow-up visit with her physician and no other injuries were diagnosed. The driver missed one work day as a result of the crash. The table below presents the driver's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Fractured ribs x 2, not further specified	moderate 450220.2,9	Torso portion of safety belt system	Probable	Interviewee (same person)
2	Laceration, less than 2.5 cm (1 in) posterior left wrist, not further specified	minor 790602.1,2	Left instrument panel	Possible	Interviewee (same person)
3	Contusion, 5.1 cm (2 in) right thigh, above right knee	minor 890402.1,1	Steering column	Probable	Interviewee (same person)

The Mazda's front row passenger [28-year-old, male, 175 cm (69 in) and 77 kg (170 lbs)] was seated with his back against the seat back. The seat back was reclined to between the slightly reclined and fully reclined positions. The seat track was adjusted to the middle position. The passenger was not wearing glasses or contact lenses.

The front plane impact with the Ford displaced the front row passenger of the Mazda forward opposite the 12 o'clock direction of force and he loaded the safety belt. While there was no discernable evidence of occupant contact on the frontal air bag, the passenger's face and chest probably loaded the air bag. His right knee also contacted the instrument panel. The passenger remained restrained in his seat. He exited the vehicle without assistance through the right front door following the crash.

CASE VEHICLE FRONT ROW PASSENGER INJURIES

The front row passenger sustained no injury and was not transported to a hospital. He lost no work days due to the crash.

CASE VEHICLE SECOND ROW LEFT PASSENGER KINEMATICS

The Mazda's second row left passenger (8-year-old, male) was seated in an upright posture with his back against the seat back. The driver did not know the child's height and weight.

The Mazda's frontal impact displaced the second row left passenger forward. He sustained a 7 cm (2.8 in) vertical laceration on the center of the forehead and a contusion and abrasion on the left knee. While there was no discernable evidence of occupant contact on the driver's seat back or head restraint, the passenger probably contacted his head on the back of the head restraint and the left knee on the seat back. The driver reported that this occupant was restrained, but did not know how the safety belt was positioned. The passenger exited the vehicle without assistance through the right rear door following the crash.

CASE VEHICLE SECOND ROW LEFT PASSENGER INJURIES

The second row left passenger was transported by ambulance to a hospital where he was treated in the emergency room and released. The table below presents the passenger's injuries and injury sources.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Laceration, subcutaneous, 7 cm (2.8 in), mid-forehead	minor 290602.1,7	Head restraint, driver's seat	Probable	Emergency room records
2	Abrasion left knee, not further specified	minor 890202.1,2	Seat back, driver's	Probable	Emergency room records

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
3	Contusion left knee, not further specified	minor 890402.1,2	Seat back, driver's	Probable	Emergency room records

CASE VEHICLE SECOND ROW RIGHT PASSENGER KINEMATICS

The Mazda's second row right passenger (7-year-old, male) was seated in an upright posture with his back against the seat back. The driver did not know the child's height and weight or how the lap-and-shoulder safety belt was positioned on his body.

The front impact with the Ford displaced the passenger forward. He sustained an abrasion on the left leg, probably from contacting the front passenger's seat back. He exited the vehicle without assistance through the right rear door following the crash.

CASE VEHICLE SECOND ROW RIGHT PASSENGER INJURIES

The second row right passenger was transported by ambulance to a hospital where he was treated in the emergency room and released. The table below presents the passenger's injury and injury source.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source	Source Confidence	Source of Injury Data
1	Abrasion left anterior leg, not further specified	minor 890202.1,2	Seat back, front passenger's	Probable	Emergency room records

OTHER VEHICLE

The 2001 Ford Taurus SES was a front wheel drive, 4-door sedan (VIN: 1FAFP55271G------) equipped with a 3.0-liter, V6 engine, automatic transmission, and redesigned driver and front passenger frontal air bags. The frontal air bags did not deploy in this crash.

Exterior Damage: The impact with the Mazda involved the left side plane of the Ford. The left fender, front wheel, and front door were directly damaged. The direct damage began 175 cm (68.9 in) forward of the left rear axle and extended 180 cm (70.9 in) along the left front door and left fender. The crush measurements were taken at the mid-door level and the maximum residual crush was 15 cm (5.9 in) occurring 13 cm (5.1 in) rear of C_3. The vehicle's left side wheelbase was reduced 18 cm (7.1 in) while the right side wheelbase was unchanged. The induced damage involved the hood, left front door, and windshield. The table below shows the vehicle's left side crush profile.

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	180	15	186	0	6	13	9	3	0	137	134
in		70.9	5.9	73.2	0.0	2.4	5.1	3.5	1.2	0.0	53.9	52.8

Damage Classification: The CDC for the left side plane impact with the Mazda was **11-LYEW-1** (**240** degrees). The Damage algorithm of the WinSMASH program calculated the Ford's total Delta-V as 11 km/h (6.8 mph). The longitudinal and lateral velocity changes were -10.3 km/h (-6.4 mph) and 3.8 km/h (2.4 mph), respectively. Based on the displacement of both vehicle's left front wheels, the results appeared low.

The Ford's EDR was imaged using version 3.3 of the Bosch Crash Data Retrieval Tool software via connection to the diagnostic link connector. The EDR file was subsequently read and printed using version 3.4. The EDR recorded a non-deployment event and 78 msec of crash pulse data. The longitudinal and lateral velocity changes reached 16.10 km/h (-10.01 mph) and 7.13 km/h (4.43 mph), respectively at the end of the 78 msec of recording. This EDR records a maximum of 80 msec of crash data. Since the Delta-V was still increasing when the recoding ended, the vehicle's actual Delta-V in this crash may be higher than that captured at 78 msec. This air bag control module does not record pre-crash data. The EDR report is attached at the end of this report[1].

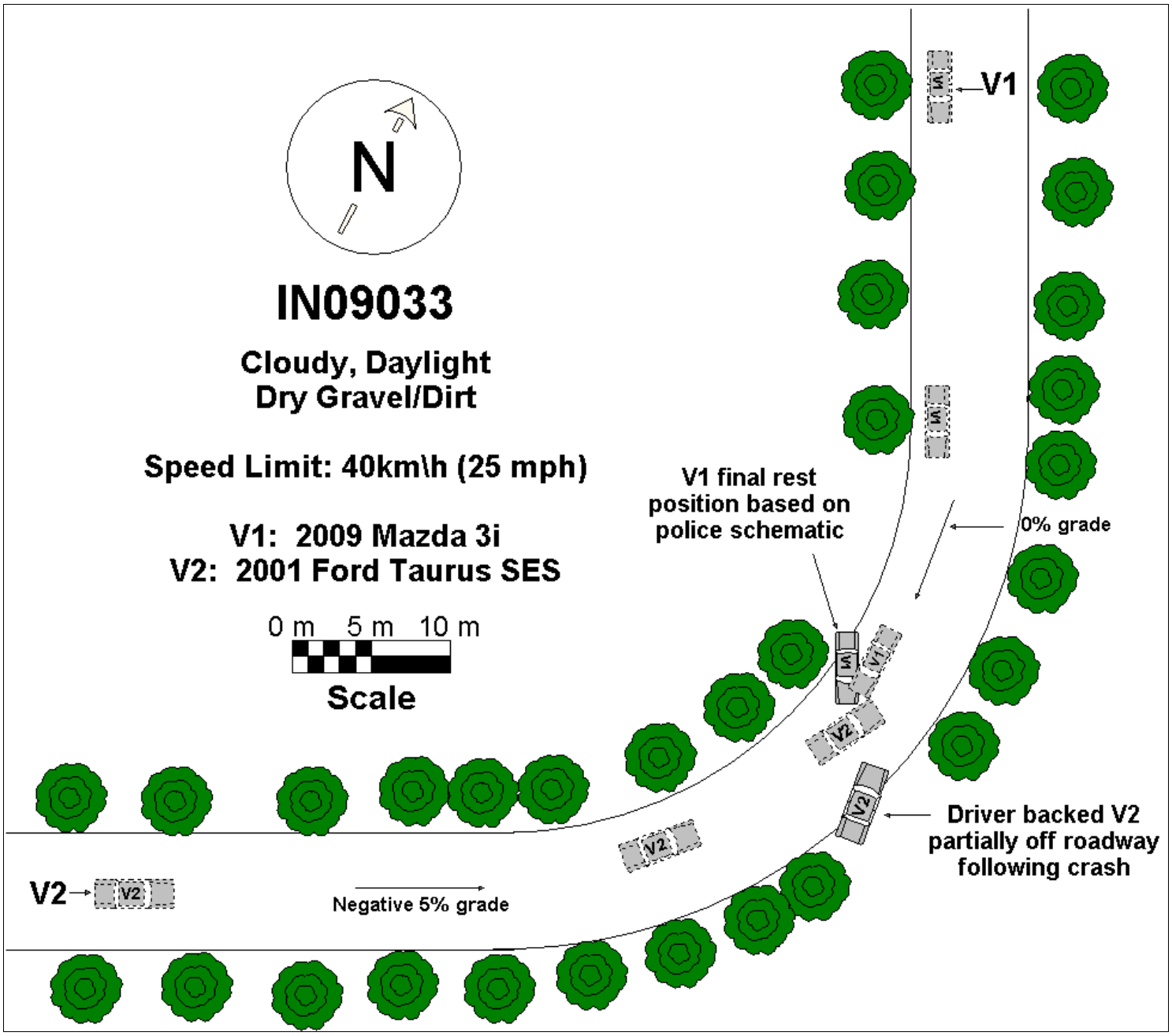
The manufacturer's recommended tire size was P215/60R17. The Ford was equipped with the recommended size tires. The vehicle's tire data are shown in the table below.

Tire	*Measured Pressure*		*Vehicle Manufacturer's Recommended Cold Tire Pressure*		*Tread Depth*		*Damage*	*Restricted*	*Deflated*
	kPa	psi	kPa	psi	milli-meters	32nd of an inch			
LF	Flat	Flat	228	33	3	4	None	No	Yes
LR	276	40	228	33	6	7	None	No	No
RR	103	15	228	33	3	4	None	No	No
RF	234	34	228	33	3	4	None	No	No

Other Vehicle's Driver: The police crash report indicated that the driver of the Ford (21-year-old, male) was restrained by the lap-and-shoulder safety belt. The EDR recorded the driver's safety

1 Page 6 of the EDR report has been omitted for confidentiality purposes.

belt switch circuit as unbuckled. The driver sustained a police-reported C (possible) injury and was transported by ambulance to a hospital.


N
IN09033
Cloudy, Daylight
Dry Gravel/Dirt
Speed Limit: 40km\h (25 mph)
V1: 2009 Mazda 3i
V2: 2001 Ford Taurus SES
0 m 5 m 10 m
Scale
V1
V1 final rest position based on police schematic
0% grade
V2
Driver backed V2 partially off roadway following crash
Negative 5% grade

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	1FAFP55271G******
User	
Case Number	
EDR Data Imaging Date	
Crash Date	
Filename	IN09033.CDR
Saved on	Thursday, September 24 2009 at 02:07:56 PM
Collected with CDR version	Crash Data Retrieval Tool 3.3
Reported with CDR version	Crash Data Retrieval Tool 3.4
EDR Device Type	airbag control module
Event(s) recovered	Non Deployment

Comments

No comments entered.

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 24 2009 at 02:07:56 PM .

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

Disclaimer: This Restraint Control Module (RCM) records 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 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 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 previously recorded data. Further analysis will be required to determine which of the events was actually recorded.

3. The computed longitudinal and lateral Delta-V's may understate the total Delta-V.

The memory in the 2000 Taurus module records 40 acceleration data points at 2 ms intervals, for a total recording length of 80 milliseconds. 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 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 calculating 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.

4. This module records longitudinal acceleration/deceleration of the vehicle and separately records the lateral acceleration/deceleration. You must combine and integrate the longitudinal and lateral recordings to get a resultant total change in velocity (Delta-V).

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 may not record any lateral or longitudinal 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 both longitudinal and lateral deceleration.

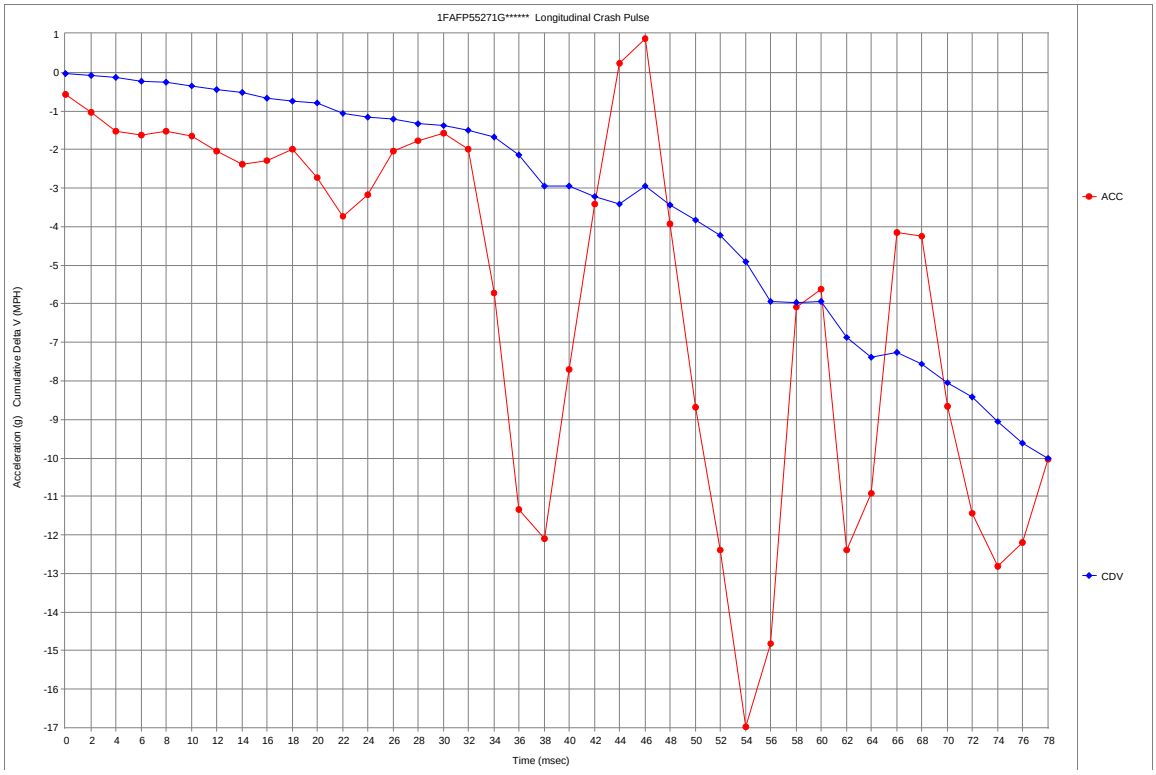
Any Delta-V determined by using data read from the air bag module should be verified with physical evidence from the crash (such as vehicle crush, skid marks) and assumed accident sequence. Multiple impacts, angular collisions, side impacts, vehicle spin, etc should be considered in addition to the data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

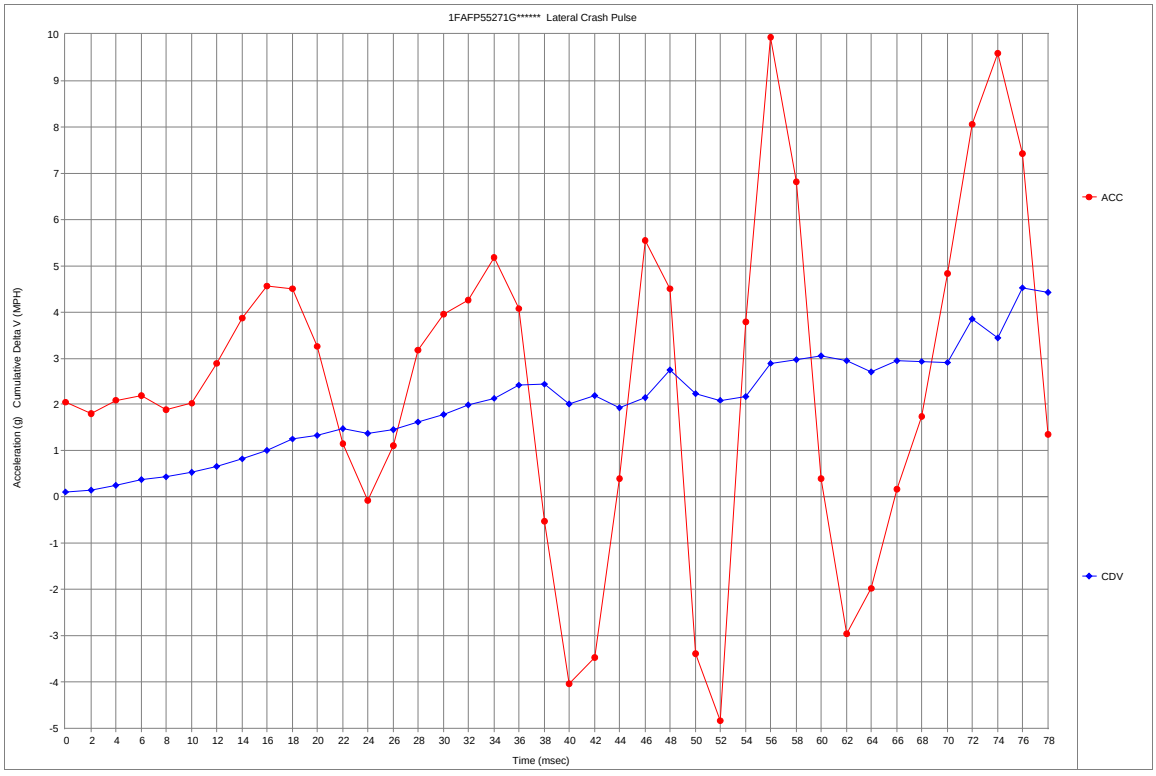
02002_RCM-ARM100_r001

System Status At Non-Deployment

Diagnostic codes active when event occurred	0
Algorithm runtime (msec)	156
Data Validity Check	Valid
EDR Model Version	141
Driver seat belt circuit status	Unbuckled
Driver seat forward of switch point	No
Right front passenger seat belt circuit status	Unbuckled
Time From Algorithm Wakeup to Pretensioner (msec)	0
Time From Algorithm Wakeup to First Stage - Unbelted (msec)	0
Time From Algorithm Wakeup to First Stage - Belted (msec)	0
Time From Algorithm Wakeup to Second Stage (msec)	0

Parameter	Driver	Passenger
Time between algorithm enable and seat belt pretensioner deployment (ms)	Not Deployed	Not Deployed
Time between side safing and side air bag deployment (msec)	Not Deployed	Not Deployed
Time between algorithm enable and air bag first stage deployment (ms)	Not Deployed	Not Deployed
Time between algorithm enable and air bag second stage deployment (ms)	Not Deployed	Not Deployed


1FAFP55271G****** Longitudinal Crash Pulse
Acceleration (g) Cumulative Delta V (MPH)
Time (msec)
ACC
CDV


1FAFP55271G****** Lateral Crash Pulse
Acceleration (g) Cumulative Delta V (MPH)
Time (msec)
ACC
CDV

Crash Pulse Data

Milliseconds	Long. Acceleration (Gs)	Long. Cumulative Delta V (MPH)	Lat. Acceleration (Gs)	Lat. Cumulative Delta V (MPH)
0	-0.58	-0.02	2.06	0.11
2	-1.03	-0.07	1.80	0.15
4	-1.52	-0.13	2.09	0.26
6	-1.63	-0.22	2.19	0.37
8	-1.53	-0.26	1.88	0.44
10	-1.66	-0.35	2.03	0.53
12	-2.03	-0.44	2.88	0.66
14	-2.39	-0.53	3.87	0.83
16	-2.29	-0.66	4.56	1.01
18	-1.98	-0.75	4.50	1.25
20	-2.72	-0.79	3.25	1.34
22	-3.74	-1.05	1.15	1.47
24	-3.17	-1.16	-0.07	1.38
26	-2.03	-1.21	1.11	1.45
28	-1.76	-1.34	3.17	1.62
30	-1.58	-1.38	3.95	1.78
32	-1.99	-1.51	4.26	1.98
34	-5.73	-1.67	5.18	2.13
36	-11.33	-2.15	4.08	2.42
38	-12.09	-2.94	-0.53	2.44
40	-7.70	-2.96	-4.03	2.00
42	-3.42	-3.23	-3.46	2.20
44	0.23	-3.42	0.39	1.93
46	0.88	-2.96	5.55	2.15
48	-3.92	-3.45	4.51	2.74
50	-8.69	-3.82	-3.38	2.24
52	-12.39	-4.22	-4.84	2.09
54	-16.98	-4.92	3.79	2.17
56	-14.81	-5.93	9.93	2.88
58	-6.09	-5.97	6.82	2.96
60	-5.61	-5.93	0.39	3.05
62	-12.39	-6.87	-2.95	2.94
64	-10.93	-7.38	-1.98	2.70
66	-4.14	-7.27	0.18	2.94
68	-4.24	-7.57	1.74	2.92
70	-8.67	-8.06	4.83	2.90
72	-11.43	-8.41	8.06	3.84
74	-12.80	-9.05	9.59	3.45
76	-12.19	-9.62	7.42	4.52
78	-10.03	-10.01	1.35	4.43