Certified Advanced 208 Compliant Air Bag Investigation / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS06018
2005 Ford Focus
California
July 2006

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

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

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient Catalog No.
DS06018		

4. Title and Subtitle	5. Report Date
Certified Advanced 208 Compliant Air Bag Investigation	November 22, 2006
	6. Performing Organization Report No.

7. Author(s)	8. Performing Organization Report No.
Dynamic Science, Inc.	

9. Performing Organization name and Address	10. Work Unit No. (TRAIS)
Dynamic Science, Inc. 530 College Parkway, Ste. K Annapolis, MD 21401	11. Contract or Grant no. DTNH22-01-C-27002

12. Sponsoring Agency Name and Address	13. Type of report and period Covered [Report Month, Year]
U.S. Dept. of Transportation (NRD-32) National Highway Traffic Safety Administration 400 7th Street, SW Washington, DC 20590	14. Sponsoring Agency Code

15. Supplemental Notes

16. Abstract

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) air bag system in a 2005 Ford Focus. A CAC vehicle is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This two vehicle crash occurred in July 2006 at 2015 hours. The Ford Focus was occupied by a 59–year-old male. The driver had been drinking. The Ford Focus was initially traveling northbound. A 2002 Honda Civic was traveling southbound. The northbound Ford Focus crossed the double yellow divider lines and entered the southbound lane of travel and into the path of the Honda Civic. The impact resulted in sufficient longitudinal deceleration of the Focus to command the deployment of the driver's air bag. The Focus was deflected laterally to the left and came to rest on the roadway facing east. The driver of the case vehicle sustained a neck strain. He was transported to a local hospital for treatment.

17. Key Words	18. Distribution Statement
Air bag, deployment, injury, crash, Certified Advanced 208 Compliant, CAC	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No of pages	22. Price

Dynamic Science, Inc.
Crash Investigation
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BACKGROUND

This on-site investigation focused on the Certified Advanced 208-Compliant (CAC) air bag system in a 2005 Ford Focus. A CAC vehicle is certified by the manufacturer to be compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. This two vehicle crash occurred in July 2006 at 2015 hours. The Ford Focus was occupied by a 59-year-old male. The driver had been drinking. The Ford Focus was initially traveling northbound. A 2002 Honda Civic was traveling southbound. The northbound Ford Focus crossed the double yellow divider lines and entered the southbound lane of travel and into the path of the Honda Civic. The impact resulted in sufficient longitudinal deceleration of the Focus to command the deployment of the driver's air bag. The Focus was deflected laterally and came to rest on the roadway facing east. The driver of the case vehicle sustained a neck strain. He was transported to a local hospital for treatment.

Figure 1. Front right, 2005 Ford Focus

This CAC case was identified by NHTSA, which provided a police accident report to DSI on August 31, 2006. DSI received permission to inspect the vehicle on September 15, 2006. The vehicle was inspected on September 21, 2006. The scene inspection was conducted during the week of September 18, 2006.

Figure 2. Exemplar view of 2005 Ford Focus

SUMMARY

Crash Site

This two-vehicle crash occurred on a four-lane, undivided roadway in July 2006. At the time of the crash, there were no adverse weather conditions and the asphalt roadway surface was dry. The north/south roadway was configured with two lanes in each direction that were separated by a double-yellow painted centerline. It was dark at the time of the crash and the street lights were on. The posted speed limit was 56 km/h (35 mph) in both directions.

Figure 3. Approach to area of impact (north)

Pre-Crash

The Ford Focus was traveling in the outboard northbound lane. The driver had been drinking. The other vehicle, a 2002 Honda Civic driven by a 55-year-old female, was traveling in the inboard southbound lane. For unknown reasons, the northbound Ford crossed the double yellow divider lines and entered the southbound lane of travel.

Figure 4. Approach to area of impact (south)

Crash

The Ford then collided head-on with the southbound other vehicle. The impact severity was moderate and resulted in the deployment of the driver's air bags in both the Ford and the Honda.

The missing vehicle routine of the WinSmash program computed a total delta V of 17.0 km/h (10.6 mph). The longitudinal and lateral components were -16.0 km/h (-9.9 mph) and -5.8 km/h (-3.6 mph), respectively. The Focus rotated clockwise after the impact and came to rest on the roadway facing east (blocking the outboard southbound lane). The Honda was redirected in a clockwise direction and came to rest facing generally south (straddling the two southbound lanes).

Figure 5. Area of impact and final rest

Post-Crash

The driver of the Ford Focus remained in his vehicle post-crash. He was treated on scene by paramedics. The investigating police officers detected the smell of alcohol and symptoms of alcohol consumption. The driver submitted to a preliminary alcohol screening (PAS) test, which yielded a reading of 0.173 BAC. The PAS device is a hand-held breath-testing unit that gives an instant measurement of blood alcohol concentration. He later submitted a blood sample, which the police retained as evidence. He was read his rights and placed under arrest. Paramedics transported him by ground ambulance to a local hospital, where he was admitted at 2139 hours. He was examined and it was determined that he had sustained a neck strain. He was treated and then released the following day.

The driver of the Honda Civic complained of pain to her stomach, to the right side of her body, and to her right lower back. She was transported to an area hospital for treatment. It was reported that she sustained contusions to her chest and abdomen, and a blunt abdominal injury.

Both vehicles were towed from the scene due to damage. The Ford Focus was later declared a total loss by the insurance company.

VEHICLE DATA -2005 Ford Focus

The 2005 Ford Focus SE four door sedan was identified by the Vehicle Identification Number (VIN): 1FAFP34N55Wxxxxxx. The mileage at the time of the vehicle inspection was 61,282 km (38,079 miles). The Ford Focus was a four-door sedan that was equipped with a 2.0 liter 4-cylinder engine, a 4-speed automatic transmission, front wheel drive, 16-inch alloy wheels, four-wheel disc brakes with ABS and traction control, cruise control, and a tilt/telescope steering wheel.

The 2005 Ford Focus was equipped with Goodyear Eagle RS-A P195/60R15 tires. The vehicle manufacturer's recommended cold tire pressure was 220 kPa (32 psi). The tire manufacturer's maximum tire pressure was 303 kPa (44 psi). The specific tire information is as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	234 kPa (34 psi)	3 mm (4/32 in)	No	No
LR	193 kPa (28 psi)	5 mm (6/32 in)	No	No
RR	172 kPa (25 psi)	5 mm (6/32 in)	No	No
RF	Flat	4 mm (5/32 in)	No	Rim deformed

The front row seating in the Focus was configured with front bucket seats with adjustable head restraints and a rear bench seat. The driver's seat was adjusted to the full rearward track position. The driver's seat back was at an 8 degree angle; the seat bottom was at a 0 degree angle. The front right passenger seat was adjusted to between the middle and full forward track position. The front right passenger seat back was at a 25 degree angle; the seat bottom was at a 17 degree angle. The second row outboard seating positions were equipped with the lower anchor points and top tether anchors that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. The middle rear seat was also equipped with top tether anchors. The top tether anchors were located on the hat shelf behind the second row seat backs. The second row seat back was at a 20 degree angle; the seat bottom was at a 15 degree angle.

VEHICLE DAMAGE

Exterior Damage - 2005 Ford Focus

The 2005 Ford Focus sustained moderate front end damage as a result of the impact with the Honda Civic. The direct damage began 20.0 cm (7.9 in) right of the bumper centerline and extended 48.0 cm (18.9 in) laterally to the right. The bumper fascia was torn away from the bumper backing bar. Both right side doors were jammed shut. There was remote buckling at the right roof area and at the right sill between the two right side doors. The front right rim was dented and the front right tire was flat. The wheelbase was shortened by 2.0 cm (0.8 in) on the right side, and elongated 1.0 cm (0.4 in) on the left side. There were spider web fractures to the windshield from contact with the mirror and its support. Six crush measurements were documented at the bumper level as follows: C1=3.0 cm (1.2 in), C2=2.0 cm (0.8 in), C3=3.0 cm (1.2 in), C4=4.0 cm (1.6 in), C5=5.0 cm (2.0 in), C6=10.0 cm (3.9 in). Maximum crush was located at C6 and measured 10.0 cm (3.9 in). The Collision Deformation Classification (CDC) for the impact with the Honda was 01FZEW1.

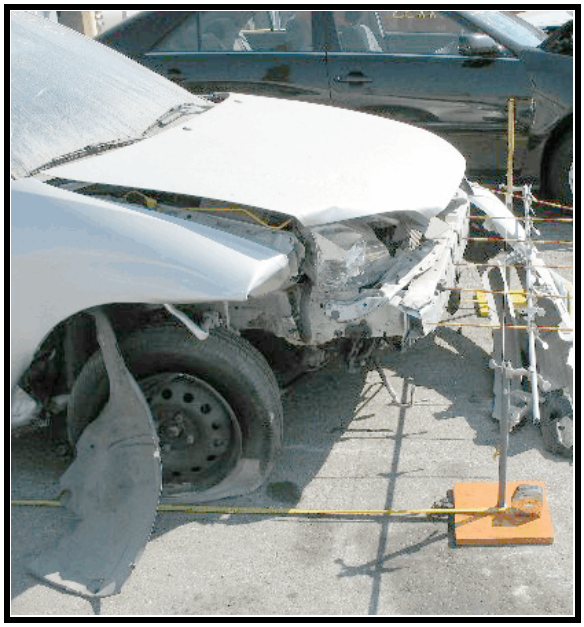

Figure 6. Right side, right wheel damage

Figure 7. Front, 2005 Ford Focus

Delta V:	Total	17.0 km/h (10.6 mph)
	Longitudinal	-16.0 km/h (-9.9 mph)
	Latitudinal	-5.8 km/h (-3.6 mph)
	Energy	13203 joules (9738 ft/lbs)

Interior Damage - 2005 Ford Focus

The 2005 Ford Focus sustained minor interior damage due to occupant contact. The windshield was fractured at two points along the line formed by the mirror and its supporting hardware. The mirror was likely contacted by the driver's right hand. The driver's left knee contacted the left lower instrument panel, causing the fuse door to be dislodged. There was 0.3 cm (0.1 in) of steering column shear capsule movement due to occupant loading. The panel above the steering column was missing.

Figure 8. Damage to windshield from mirror

Figure 9. Driver's position

Figure 10. Left lower instrument panel

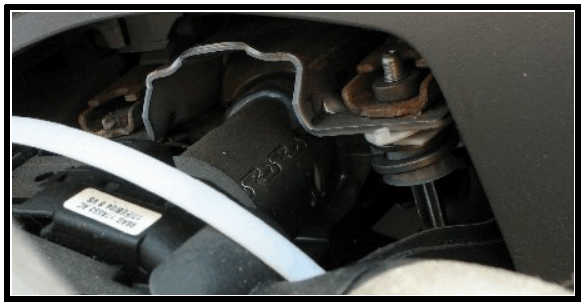

Figure 11. Shear capsule

Manual Restraints - 2005 Ford Focus

The 2005 Ford Focus was configured with manual 3-point lap and shoulder belts for each of the five seating positions. Both front seat safety belts were equipped with retractor pretensioners and adjustable D rings that were in the full up positions. The driver's safety belt was configured with a sliding latch plate and an Emergency Locking Retractor (ELR). There were indications of loading on the belt webbing at the sliding latch plate guide. The retractor pretensioner likely actuated, but the belt was found to be free spooling at the time of the vehicle inspection. The remaining safety belts were configured with sliding latch plates and switchable ELR/Automatic Locking Retractors (ALR).

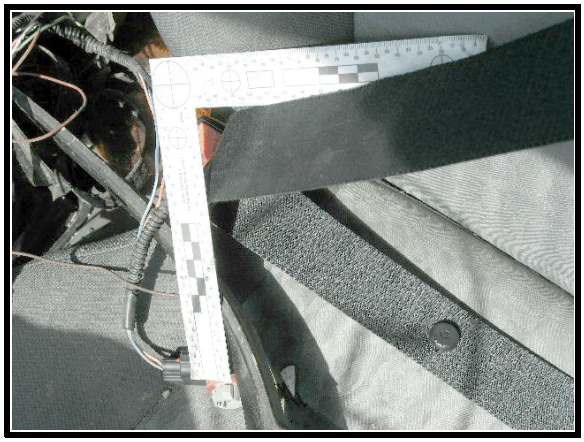

Figure 12. Driver's seat belt

Supplemental Restraint Systems - 2005 Ford Focus

The Ford Focus was equipped with advanced occupant protection systems. The systems consist of the Restraint Control Module (RCM), dual stage, "intelligent" Certified Advanced 208-Compliant driver and front right passenger air bags, including front right passenger sensors. The sensors are designed to detect the presence of a properly seated occupant and determine if the passenger frontal air bag should be deployed or not. In certain conditions the passenger sensing system will turn off the right front air bag. The primary function of the RCM is to control the deployment of the occupant protection systems.

Figure 13. Driver's air bag

Figure 14. Vent ports, top module cover, driver's air bag

The driver's air bag deployed from the center of the steering wheel hub through H-configuration module cover flaps. The top flap measured 18.0 cm (7.1 in) wide by 5.0 cm (2.0 in) high at its highest point. The bottom flap measured 18.0 cm (7.1 in) wide and 12.0 cm (4.7 in) vertically along the seams. The deployed driver's air bag measured 56.0 cm (22.0 in) in diameter in its deflated state. There was a single internal tether. There were three half circle vent ports at the 9 o'clock position on the back of the air bag and two half circle vent ports at the 3 o'clock position. There were 22 horizontal lines across the face of the air bag. There was a blue fabric transfer near the center of the air bag which was a result of driver contact with the air bag.. The transfer was 6.0 cm (2.4 in) wide and 10.0 cm (3.9 in) high. The contact began 1.5 cm (0.6 in) laterally from the vertical center line and 3.0 cm (1.2 in) vertically from the horizontal center line. The contact was likely from the seat belt webbing across the driver's torso. There were two small scuffs found on the air bag, one in the right upper quadrant and one in the left lower quadrant. These possibly came from contact with the driver.

The front right passenger air bag was a top instrument mount. The air bag did not deploy.

VEHICLE DATA - 2002 Honda Civic

	Driver	
Description:	2002 Honda Civic	
VIN:	Unknown	
Odometer:	Unknown	
Engine:	Unknown	
Reported Defects:	None noted	
Cargo:	Unknown	
Damage Description:	Major left front end damage, per police report. Vehicle towed.	
CDC:	Unknown	
Delta V:	Total	17.0 km/h (10.6 mph)
	Longitudinal	-17.0 km/h (-10.6 mph)
	Latitudinal	0.0 km/h (0.0 mph)
	Energy	13203 joules (9738 ft/lbs)

OCCUPANT DEMOGRAPHICS - 2005 Ford Focus

	Driver
Age/Sex:	59/Male
Seated Position:	Front left
Seat Type:	Fabric covered bucket seat. Seat was adjusted to the full rearward track position.
Height:	175 cm (69 in)
Weight:	84 kg (185 lbs)
Occupation:	Unknown
Pre-existing Medical Condition:	Moderate frontal cerebral atrophy(degeneration) that was out of proportion for the driver's age and degenerative changes in the cervical spine
Alcohol/Drug Involvement:	Yes. PAS test = 0.173 BAC
Driving Experience:	Unknown, presumed to be greater than 10 years
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt available, used
Air bag:	Steering wheel mounted air bag, deployed

OCCUPANT DEMOGRAPHICS - 2002 Honda Civic

Age/Sex:	55/Female
Seated Position:	Front left
Seat Type:	Unknown
Height:	157 cm (62 in)
Weight:	64 kg (141 lbs)
Occupation:	Unknown
Pre-existing Medical Condition:	None
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt used, per police report

OCCUPANT INJURIES - 2005 Ford Focus

Driver: Injuries obtained from Emergency Room and Radiology records. The driver had a number of pre-existing conditions, including: moderate frontal cerebral atrophy (degeneration) that was out of proportion for the driver's age and degenerative changes in the cervical spine.

Injury	OIC Code	Injury Mechanism	Confidence Level
Sprain, cervical spine, acute with no fracture or dislocation	640278.1,6	Impact forces	Probable

OCCUPANT INJURIES - 2002 Honda Civic

Driver: Injuries obtained from Emergency Department and Radiology Department reports.

Injury	OIC Code	Injury Mechanism	Confidence Level
Contusion, chest	490402.1,4	Seat belt webbing	Certain
Contusion, abdomen	590402.1,4	Seat belt webbing	Certain
Blunt abdominal injury NFS	515099.7,0	Air bag	Possible

OCCUPANT KINEMATICS - 2005 Ford Focus

Driver Kinematics

The 59-year-old male driver of the Ford Focus was wearing the manual 3-point lap and shoulder belt. He may or may not have been conscious. He had been drinking prior to the crash. The seat track was adjusted to the rear most position. The driver's seat back was at an 8 degree angle; the seat bottom was at a 0 degree angle. At impact, the driver's air bag deployed and the pretensioners likely actuated. The driver initiated a forward and slightly right trajectory. He loaded the safety belt. It appears that the safety belt engaged the deployed air bag at the driver's chest level and deposited a blue fabric transfer. His head pitched forward, likely causing the neck strain. The driver's left knee engaged the lower left instrument panel, dislodging a plastic fuse box cover. The driver of the Ford Focus remained in his vehicle post-crash. He was treated on scene by paramedics. He tested positive for alcohol and was placed under arrest. He was then transported by ground ambulance to a local hospital.

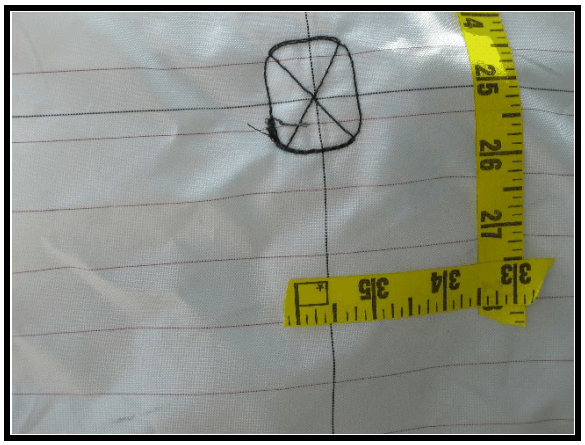

Figure 15. Close up of fabric transfer to driver's air bag

Attachment 1. Scene Diagram