CRASH DATA RESEARCH CENTER

Calspan Corporation
Buffalo, NY 14225

CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE CRASH INVESTIGATION

CASE NO: CA05-032

VEHICLE: 2005 CHRYSLER 300

LOCATION: NORTH CAROLINA

CRASH DATE: MAY 2005

Contract No. DTNH22-01-C-17002

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Washington, D.C. 20590

DISCLAIMER

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 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.

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. CA05-032	*2. Government Accession No.*	*3. Recipient's Catalog No.*	
4. Title and Subtitle Calspan On-Site Certified Advanced 208-Compliant Vehicle Crash Investigation Vehicle: 2005 Chrysler 300 Location: State of North Carolina		*5. Report Date*: June 2006 *6. Performing Organization Code*	
7. Author(s) Crash Data Research Center		*8. Performing Organization Report No.*	
9. Performing Organization Name and Address Crash Data Research Center Calspan Corporation P.O. Box 400 Buffalo, New York 14225		*10. Work Unit No.* C00410.0000.0295 *11. Contract or Grant No.* DTNH22-01-C-17002	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Washington, D.C. 20590		*13. Type of Report and Period Covered* Technical Report Crash Date: May 2005 *14. Sponsoring Agency Code*	
15. Supplementary Note This on-site investigation focused on the performance of the Certified Advanced 208- Complaint (CAC) frontal air bag system in a 2005 Chrysler 300 Limited, four-door sedan.			
16. Abstract This on-site investigation focused on the performance of the Certified Advanced 208- Complaint (CAC) frontal air bag system in a 2005 Chrysler 300 Limited, four-door sedan. The CAC system consisted of dual stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, an occupant presence sensor for the front right seat, safety belt buckle switches and safety belt retractor pretensioners. The manufacturer of this vehicle has certified that the 300 meets the requirements for the advanced air bag ruling of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. In addition, the Chrysler was equipped with an air bag control module that had Event Data Recording (EDR) capabilities. The 300 was occupied by a 74-year old male driver who was restrained by the manual safety belt system. The driver relinquished directional control of the vehicle as he attempted to travel on a straight segment of road in a rural area. The vehicle departed the left road side and impacted numerous trees. A frontal impact with a 20 cm (8”) diameter tree resulted in the deployment of the driver’s air bag and the firing of the retractor pretensioner. The driver loaded the belt system and the deployed air bag and was not injured. The Chrysler sustained disabling damage and was towed from the scene of the crash.			
17. Key Words Certified Advanced 208-Compliant occupant protection Driver air bag deployment		*18. Distribution Statement* General Public	
19. Security Classif. (of this report) Unclassified	*20. Security Classif. (of this page)* Unclassified	*21. No. of Pages* 9	*22. Price*

TABLE OF CONTENTS

CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE CRASH INVESTIGATION
CASE NO. – CA05-032
VEHICLE – 2005 CHRYSLER 300 LIMITED
LOCATION – NORTH CAROLINA
CRASH DATE – MAY 2005

BACKGROUND

This on-site investigation focused on the performance of the Certified Advanced 208-Complaint (CAC) frontal air bag system in a 2005 Chrysler 300 Limited, four-door sedan. The CAC system consisted of dual stage frontal air bags for the driver and front right passenger positions, seat track positioning sensors, an occupant presence sensor for the front right seat, safety belt buckle switches and safety belt retractor pretensioners. The manufacturer of this vehicle has certified that the 300 meets the requirements for the advanced air bag ruling of Federal Motor Vehicle Safety Standard (FMVSS) No. 208. In addition, the Chrysler was equipped with an air bag control module that had Event Data Recording (EDR) capabilities. The 300 was occupied by a 74-year old male driver who was restrained by the manual safety belt system. The driver relinquished directional control of the vehicle as he attempted to travel on a straight segment of road in a rural area. The vehicle departed the left road side and impacted numerous trees. **Figure 1** is an overall view of the exterior damage to the Chrysler. A frontal impact with a 20 cm (8") diameter tree resulted in the deployment of the driver's air bag and the firing of the retractor pretensioner. The driver loaded the belt system and the deployed air bag and was not injured. The Chrysler sustained disabling damage and was towed from the scene of the crash.

Figure 1. Damaged 2005 Chrysler 300.

The crash was identified from a list of claims submitted to NHTSA by an insurance company. The vehicle was located at an insurance salvage auction facility and cooperation was obtained from the insurance adjuster to inspect the vehicle and remove the vehicle's air bag control module for download by Daimler Chrysler. Details of the crash were forwarded to NHTSA on June 1 and the case was assigned for on-site investigation. The on-site investigation was conducted on June 3, 2005.

SUMMARY

Crash Site

The crash occurred off-road of a two-lane road in a rural, undeveloped area during daylight hours. The weather was reported as clear and the road surface was dry. The subject vehicle was traveling in a westbound direction on the asphalt road surface. Prior to the crash site, a left curve terminated onto a straight segment with a downgrade of 1.5 percent for westbound traffic. The roadway curved back to the right with a positive grade of 1.5 percent. A sag was located that the transition point from the straight segment to

the right curve. **Figure 2** is a look back view of the roadway and point of departure. A double yellow centerline separated the travel lanes and solid white fog lines marked the road edges. There were no stabilized shoulders supporting the travel lanes. Trees and natural growth bordered a 3.5 m (11.5') wide area of grass that paralleled the south (right) road edge. Two 20 cm (8") diameter trees were struck by the vehicle as it traveled off-road into the tree line. These trees were located 7.2 m (23.6') south of the edge line. Seven additional saplings [all less than 3 cm (1")] in diameter were struck and run over by the Chrysler as it traveled through the tree line to final rest. The posted speed limit for the roadway was 89 km/h (55 mph). The Crash Schematic is included as **Figure 12** of this report.

Figure 2. Look back view of the roadway.

Vehicle Data

The involved vehicle in this crash was a 2005 Chrysler 300 Limited, four-door sedan. The 300 was manufactured on February 2005 and was identified by Vehicle Identification Number (VIN): 2C3JA53G95H (production number deleted). The odometer reading was unknown. The vehicle was recently purchased by the driver as it was registered with temporary license plates. The vehicle was powered by a 3.5 liter V-6 engine linked to a five-speed automatic transmission with a console mounted shift lever. The service brakes were four-wheel disc with anti-lock (ABS). Standard equipment on this vehicle included traction control and Electronic Stability Program (ESP), Chrysler's electronic stability control system. An ESP OFF-switch was located on the mid instrument panel, right of the CAC Passenger Air Bag ON/OFF indicator. The status of the ESP at the time of the crash was unknown. The 300 was equipped with multi-spoke alloy wheels with Goodyear Integrity P215/65R17 all-season tires. The manufacturer recommended tire pressure for this vehicle was 207 kPa (30 PSI). The specific tire data at the time of the SCI inspection was as follows:

Position	Measured Pressure	Measured Tread Depth	Damage
Left Front	197 kPa (28.5 PSI)	8 mm (10/32")	None
Left Rear	200 kPa (29 PSI)	8 mm (10/32")	None
Right Front	231 kPa (33.5 PSI)	8 mm (10/32")	None
Right Rear	200 kPa (29 PSI)	8 mm (10/32")	Debris embedded into outer bead

The interior was leather trimmed and configured with front bucket seats and a three-passenger rear bench seat with 60/40 forward folding seat backs. A fixed center console was positioned between the front bucket seats. The front seats were equipped with adjustable head restraints that were adjusted 4 cm (1.75") above the seat backs. Both front seats were power-adjustable.

Crash Sequence

Pre-Crash

The restrained 74-year old male driver of the 2005 Chrysler 300 was traveling in a westerly direction of the two lane road. He negotiated a left curve with a downgrade that transitioned onto a straight segment. As he entered the straight segment of roadway, he allowed the vehicle to drift left across the centerline and depart the left (south) road edge at the beginning of a shallow right curve. He departed the roadway in a tracking mode as evidenced by rotating tire prints across the grassy area. The vehicle traveled across the grass and entered the tree line 18 m (59') west of the point of road departure. The vehicle's departure angle was 8 degrees. The rotating tire prints **(Figure 3)** were partially eroded at the time of the SCI investigation; however, based on the compressed grass, it did not appear that the driver braked in an attempt to avoid the crash.

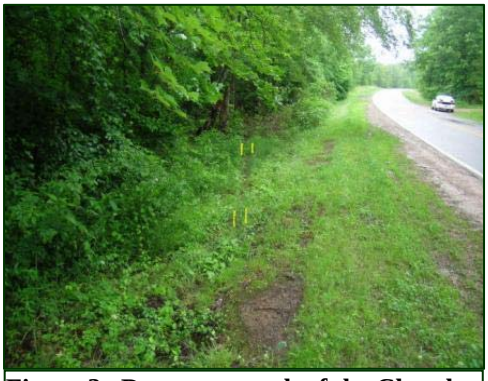

Figure 3. Departure path of the Chrysler 300 into the tree line.

Figure 4. Struck and uprooted tree.

Crash

The Chrysler entered the wooded area and overrode several small diameter trees prior to impacting a 20 cm (8") diameter tree that was located 7.2 m (23.6') south of the south edge line. The offset left frontal impact crushed the bumper beam to a maximum depth of 39 cm (15.25"). The resultant direction of force for this event was within the 12 o'clock sector. The impact uprooted the tree **(Figure 4)** and displaced the tree in a westerly direction as it fell to the ground. The Chrysler overrode the downed tree and several additional small diameter trees as its center of gravity continued in a westerly direction. This initial tree impact resulted in a barrier equivalent velocity change of 23 km/h (14.3 mph) with respective longitudinal and lateral components of 23 km/h (14.3 mph) and 0 km/h. As a result of the impact, the CAC driver's air bag deployed and the retractor pretensioner fired.

The 300 rotated slightly in a counterclockwise direction and rolled (tipped) slightly to its right as the vehicle continued forward, riding over the struck tree. The right greenhouse area of the Chrysler impacted a 20 cm (8") diameter tree that resulted in lateral crush of

the side rail. The direction of force for this event was within the 1 o'clock sector. The 300 came to rest 5.2 m (17') west of this tree impact.

Post-Crash

The driver unbuckled the manual safety belt system and exited the vehicle unassisted. He waited at the scene for rescue personnel to arrive. He declined medical treatment as he denied injury related to the crash. The Chrysler was towed from the scene of the crash and transferred to an insurance salvage facility where it was inspected for this SCI investigation.

The SCI investigator was unable to remove the air bag control module due to the location of the module under the center (one-piece) instrument panel.

Vehicle Damage

Exterior

The 2005 Chrysler 300 sustained moderate severity damage to the front and right side areas of the vehicle. The undercarriage sustained minor damage as the vehicle overrode the struck tree and saplings. As a result of the combined damage, the vehicle was considered a total loss by the insurance company.

Front – The front bumper fascia was separated and removed from the vehicle at the time of the SCI inspection, therefore, the direct contact damage was measured on the hood. The direct contact damage began 20 cm (8") left of center and extended 18 cm (7") to the left. The impact deformed the bumper fascia to a V-shape, dented the hood, and fractured the composite upper radiator support **(Figure 5)**. Maximum crush occurred at the bumper beam and measured 39 cm (15.25"), located 15 cm (6") right of center. The crush profile at the level of the bumper beam **(Figure 6)** was as follows: C1 = 0 cm, C2 = 39 cm (15.25"), C3 = 23 cm (9.25"), C4 = 12 cm (4.75"), C5 = 4 cm (1.5"), C6 = 0 cm. The Collision Deformation Classification (CDC) for this impact was 12-FYEN-2.

Figure 5. Frontal damage to the Chrysler 300.

Figure 6. Lateral view of the frontal crush profile.

Undercarriage – Small isolated dents were scattered across the full length and width of the undercarriage with debris and tree bark embedded into seams. This damage could not

be isolated to a single event, therefore the overrun of the tree and saplings were combined into a single event. This CDC was 00-UDDW-1.

Right Side – The right greenhouse area of the 300 impacted an 20 cm (8") diameter tree. The direct contact damage was isolated to the window frames of the right doors and the roof side rail area **(Figure 7)**. The lateral crush associated with this impact resulted in displacement of the B-pillar. The B-pillar displacement produced remote buckling of the right doors. The direct contact damage began 56 cm (22.1") forward of the right B-pillar and extended 79 cm (31.25") rearward, terminating 23 cm (9.25") aft of the B-pillar. Although this impact was sideswipe in nature and outside the scope of the WINSMASH reconstruction program, two lateral crush profiles were documented to capture the right side damage. These profiles were measured at the level of the beltline and the roof side rail, above the door window frames. The crush was measured at the edge of the roof panel, adjacent to the door window frame. The lateral crush at the level of the side rail **(Figure 8)** was documented along a damage length of 156 cm (61.25"). The side rail was not exposed for a direct line of measurements; therefore this profile is slightly under representative of the actual crush depth. The crush profile at this level was as follows: C1 = 0 cm, C2 = 2 cm (0.75"), C3 = 10 cm (3.75"), C4 = 15 cm (5.75"), C5 = 14 cm (5.4"), C6 = 0 cm. The CDC for this greenhouse impact was 01-RPGW-3.

The combined damage length at the level of the beltline was 208 cm (82"). This crush profile was as follows: C1 = 4 cm (1.5"), C2 = 7 cm (2.75"), C3 = 13 cm (5"), C4 = 11 cm (4.25"), C5 = 7 cm (2.75"), C6 = 7 cm (2.75"). Maximum crush at this level was 14 cm (5.5") located at the right B-pillar.

Figure 7. Right side damage to the Chrysler 300.

Figure 8. Longitudinal view of the crush at the right roof side rail.

The windshield was fractured by deformation to the right upper A-pillar. This impact damage resulted in stress cracks that spanned the full height and width of the windshield. The driver's power window was approximately 50 percent open at the time of the crash.

All other windows were closed. The left side, right rear door, and the backlight remained intact. The right front door glazing was shattered by the right side impact with the tree.

The right front door was jammed closed by the right side event. The left side and right rear doors remained closed during the crash and remained operational post-crash. The left wheelbase was reduced in length by 3 cm (1") while the right wheelbase remained unchanged.

Interior

The interior of the 2005 Chrysler 300 sustained moderate severity damage as a result of the crash. The damage was attributed to the deployment of the driver's air bag, the firing of the retractor pretensioner, and intrusion of right side components. There were no driver contact points within the interior of the vehicle.

Maximum intrusion involved 17 cm (6.75") of lateral displacement of the right roof side rail located forward of the B-pillar. The intrusions are identified in the following table:

Position	Component	Direction	Magnitude
Front Right	Right B-pillar at beltline	Lateral	11 cm (4.25")
Front Right	Right roof side rail	Lateral	17 cm (6.75")
Front Right	Right front door panel	Lateral	18 cm (7")
Rear Right	Right roof side rail	Lateral	3 cm (1")
Rear Right	Right rear door panel at beltline	Lateral	9 cm (3.5")

Certified Advanced 208-Compliant Frontal Air Bag System

The 2005 Chrysler 300 was equipped a Certified Advanced 208-Compliant (CAC) frontal air bag system. The system consisted of dual stage air bags for the driver and front right passenger positions, seat track positioning sensors, safety belt buckle switches, a front right occupant presence sensor, which was designed to calibrate the presence and weight of the occupant before issuing a deployment command, and retractor pretensioners. The manufacturer of this vehicle certified that the Chrysler 300 meets the advanced air bag requirements of FMVSS 208. In addition to the CAC air bag system, the Chrysler was equipped with an Event Data Recorder (EDR) that was incorporated into the vehicle's air bag control module. This module was located in the forward aspect of the center tunnel. Although the SCI team obtained permission to remove the module for download by Chrysler, the removal required greater disassembly of the vehicle than the insurance company would allow. Furthermore, this was a new vehicle with a high salvage value.

The vehicle was occupied by the driver, the vehicle's sole occupant at the time of the crash. He was restrained by the manual three-point lap and shoulder belt system. The CAC system detected the belted driver and fired the retractor pretensioner and deployed the driver's air bag. The front right seat was unoccupied; therefore the air bag for this

position was suppressed. The Passenger Air Bag On/Off status indicator lamp was mounted in the upper mid instrument panel between the analog clock and the radio.


Figure 9. Deployed driver's air bag.

The driver's air bag deployed from a steering wheel mounted module that was concealed by H-configuration module cover flaps. The flaps were 15 cm (6") in width at the horizontal tear seam and 10 cm (3.75") and 7 cm (2.75") in height for the upper and lower flaps respectively. The air bag membrane was 56 cm (22") in diameter in its deflated state **(Figure 9)**. The bag was vented by two 4 cm (1.5") diameter ports located at the 11 and 1 o'clock sectors. These ports were centered 6 cm (2.25") below the peripheral seam. The air bag was tethered by two 5 cm (2") wide straps at the 12 and 6 o'clock positions. The driver's air bag was identified by the following nomenclature stamped on the top surface of the air bag:

LX
2400 407 AE
V00254
V00254
2501 05G

There was no damage or driver contact evidence on the air bag or module cover flaps.

Manual Safety Belt Systems


Figure 10. Frictional abrasion of the driver's latch plate.

The Chrysler 300 was designed as a five-passenger sedan. All five positions were equipped with continuous loop, 3-point lap and shoulder belt systems. The driver's belt utilized a sliding latch plate and an Emergency Locking Retractor (ELR). The front right and rear sear safety belts utilized light-weight locking latch plates and ELR retractors. All retractors were equipped with the belt sensitive feature.

The driver was restrained by the manual safety belt at the time of the crash. Belt usage was verified by loading evidence on the belt system and the firing of the retractor pretensioner. The loading evidence consisted of frictional abrasions on the plastic surfaces of the latch plate **(Figure 10)** and D-ring.

Driver Demographics/Data

Age/Sex:	74-year old/Male
Height:	Not reported
Weight:	Not reported
Eyewear:	Unknown
Manual Safety Belt Usage:	3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Seat Track Position:	Rear third track position
Egress from Vehicle:	Exited unassisted from left front door
Type of Medical Treatment:	None

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Not injured	N/A	N/A

Driver Kinematics

The 74-year old male driver of the Chrysler 300 was seated in a rear track position with seat back reclined to a measured angle of 15 degrees. The leading edge of the seat cushion was adjusted 29 cm (11.25") above the floor. In this adjusted position, the horizontal distance between the center of the driver air bag module and the seat back was 66 cm (26"), measured at a point that was 42 cm (16.5") above the seat bight. The driver was restrained by the manual 3-point lap and shoulder belt system. Belt usage was determined by the fired status of the retractor pretensioner and the frictional abrasions on the plastic surfaces of the D-ring and latch plate. **Figure 11** is a view of the driver's adjusted seat position and the lack of contact points due to the restraint usage.

Figure 11. Driver's position and the lack of contact points.

At impact with the tree, the driver's frontal air bag deployed. He initiated a forward trajectory in response to the 12'o'clock impact force. The driver loaded the belt system as evidenced by the frictional transfers on the hard points of the system. He probably contacted the deployed driver's air bag. There was no damage to the steering wheel rim or compression of the energy absorbing steering column. Therefore, his loading into the deployed air bag was minimal.

As the Chrysler 300 continued forward and overrode the struck tree and the small diameter saplings, the driver probably rebounded into the seat back. The impact with the right greenhouse area would have minimally displaced the driver forward. The combination of safety belt usage and air bag deployment prevented the driver from possible injury.

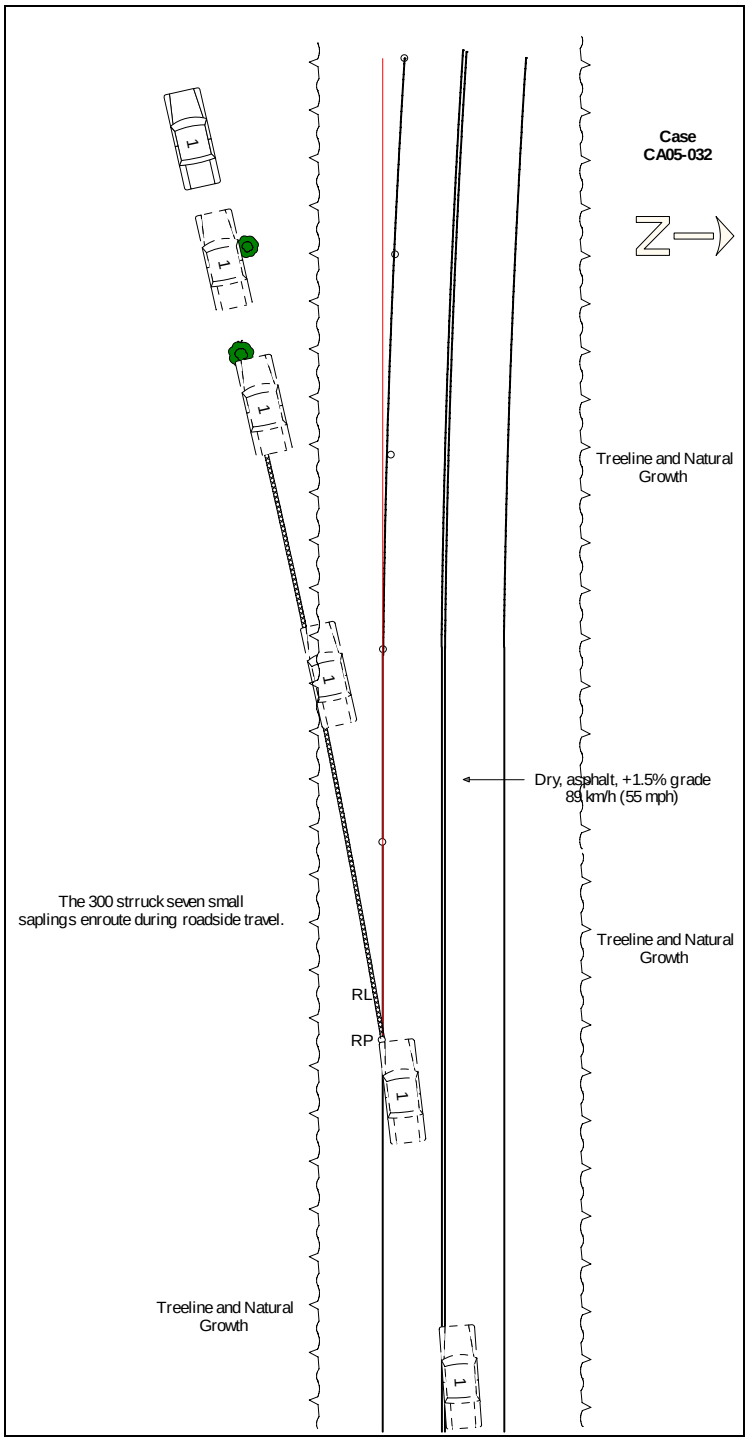

Figure 12 - Scene Schematic