INDIANA UNIVERSITY

TRANSPORTATION RESEARCH CENTER
School of Public and Environmental Affairs
222West Second Street
Bloomington, Indiana 47403-1501
(812) 855-3908 Fax: (812) 855-3537

NASS/SCI COMBINATION CASE REPORT

CASE NUMBER - NASS-2002-48-070C
LOCATION - Alabama
VEHICLE - 2001 MERCEDES BENZ ML 320
CRASH DATE - MAY 2002

Submitted:

May 14, 2003

revised:
August 18, 2003

Contract Number: DTNH22-01-C-07002

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.* NASS-2002-48-070C	2. *Government Accession No.*	3. *Recipient's Catalog No.*
4. *Title and Subtitle* NASS/SCI Combination AOPS Investigation Vehicle - 2001 Mercedes Benz ML 320 Location - Alabama		5. *Report Date:* May 14, 2003 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 222 West Second Street Bloomington, Indiana 47403-1501		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-01-C-07002
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NRD-32) 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: May 2002 14. *Sponsoring Agency Code*

15. *Supplementary Notes*
SCI/NASS combination investigation involving a 2001 Mercedes Benz ML320 SUV with multiple advanced occupant protection systems, and a 1997 Ford Mustang

16. *Abstract*

This report covers a combination SCI/NASS investigation of a crash involving a 2001 Mercedes Benz ML 320 sport utility vehicle (case vehicle) and a 1997 Ford Mustang (other vehicle). This crash is of special interest because the case vehicle was equipped with multiple Advanced Occupant Protection Systems and the case vehicle's restrained driver (41-year-old male, black, non-Hispanic) sustained minor injuries. The case vehicle was traveling east in the eastbound lane of a two-lane roadway, approaching a four-leg intersection and intending to continue east. The other vehicle was traveling west in the westbound lane of the same roadway and intended to turn left to travel north on the intersecting roadway. The crash occurred within the intersection. The front of the case vehicle impacted the front right of the other vehicle, causing the case vehicle's driver front air bag to deploy. The other vehicle was equipped with dual front air bags that deployed. The case vehicle rotated counterclockwise, the other vehicle rotated clockwise and both came to rest a short distance southeast of the point of impact, within the intersection. Both vehicles were towed due to disabling damage. The case vehicle driver was restrained by the available manual, three-point, lap-and-shoulder safety belt system and sustained minor soft tissue injuries due to contact with the driver's air bag and the knee bolster. There was no other occupant in the case vehicle. The case vehicle was equipped with dual frontal air bags and door-mounted side-impact air bags at the four outboard seat positions, for a total of six air bags. Only the driver's frontal air bag deployed.

17. *Key Words* Air Bag Deployment Motor Vehicle Traffic Crash Injury Severity		18. *Distribution Statement* General Public	
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 6	22. *Price* $2,500

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

TABLE OF CONTENTS NASS-2002-48-070C

BACKGROUND

NASS-2002-48-070C

This combination SCI/NASS investigation was brought to the NHTSA's attention by CDS sampling activities on May 6, 2002. The crash involved a 2001 Mercedes Benz ML 320 sport utility vehicle (case vehicle, NASS vehicle #2) and a 1997 Ford Mustang (other vehicle, NASS vehicle #1). The crash occurred in Alabama, in May 2002 at 12:25 a.m., and was investigated by the applicable municipal police agency. This crash is of special interest because the case vehicle was equipped with multiple Advanced Occupant Protection Systems and the case vehicle's driver (41-year-old male, black, non-Hispanic) sustained minor injuries. The NASS-EDCS case record was forwarded to this contractor on January 24, 2003 and updated on May 9, 2003. This report is based on the police crash report, NASS scene and vehicle inspections, the coded NASS case, the case subject's medical records, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling east in the eastbound lane of a two-lane roadway, approaching a four-leg intersection and intending to continue east. The other vehicle was traveling west in the westbound lane of the same roadway and intended to turn left to travel north on the intersecting roadway. For both the east and west legs of the intersection, the paved surface was wide enough to permit unrestricted angle parking along the north side and parallel parking along the south side of the roadway. The roadway was of asphalt construction with no apparent defects, the weather was clear and it was dark but lighted. The speed limit for both vehicles was 40 km.p.h. [25 m.p.h.]. The opposing lanes were separated by a double yellow line and the intersection was controlled by overhead automatic signals. The two vehicles entered the intersection at the same time, with the other vehicle attempting to turn left as the case vehicle was traveling straight through (**Figure 1**).

The crash occurred within the intersection. The front center of the case vehicle impacted the front right of the other vehicle, causing the case vehicle driver's front air bag to deploy. The other vehicle was equipped with dual front air bags that deployed. The case vehicle rotated counterclockwise, the other vehicle rotated clockwise and both came to rest a short distance southeast of the point of impact, within the intersection.

Figure 1: Case vehicle's east bound approach toward collision within the intersection

CASE VEHICLE

The case vehicle was a four wheel drive 2001 Mercedes Benz ML320 four-door, five-passenger sport utility vehicle (VIN: 4JGAB54E41A------), equipped with a V6, 3.2 liter gasoline engine and an automatic transmission with a console-mounted selector lever. The case vehicle was equipped with four-wheel anti-lock brakes. The odometer reading is not known due to the non-functional electronic instruments but the driver estimated that the vehicle has been driven approximately 32, 200 kilometers [20,000 miles]. The wheelbase was 282 centimeters [111.0 inches]. The case vehicle was towed due to disabling damage.

The case vehicle sustained direct contact damage across the entire front plane (**Figures 2** and **3**), a measured distance of 159 centimeters [62.6 inches]. Maximum crush was 16 centimeters [6.3 inches] at the front right corner of the hood. The bumper was moved rearward and slightly distorted but otherwise not seriously damaged. The grille (which was part of the hood on this vehicle) was crushed rearward at the center. The leading edge of the hood was crushed and the entire hood was buckled and displaced rearward, more so on the right. There was induced damaged on both fenders. The headlight and turn signal assemblies were intact but were slightly displaced due to the damage on adjacent body components. The wheelbase was shortened one centimeter [0.4 inches] on the left and lengthened one centimeter [0.4 inches] on the right. There was no damage to the wheels or tires and there was no glazing damage. The CDC was determined to be **11-FDEW-1 (340)** for the case vehicle's single impact. The WinSMASH reconstruction program was used, based on the measured crush profile of both vehicles. The case vehicle's Total, Longitudinal and Lateral Delta-Vs are, respectively: 24.0 km.p.h. [14.9 m.p.h.], -22.6 km.p.h. [-14.0 m.p.h.] and +8.2 km.p.h. [+5.1 m.p.h.]. This was a crash of low to moderate severity for the case vehicle.

Figure 2: Front left view of case vehicle damage

Figure 3: Front right view of case vehicle damage

Inspection of the case vehicle's interior revealed no intrusions and several points of contact. The right half of the steering wheel rim was bent forward 2 centimeters [0.8 inches], which the NASS investigator determined was due to contact by the driver's chest (**Figure 4**). The knee bolster was cracked due to contact by the driver's right knee and the center of the instrument panel showed a cloth transfer due to contact by the driver's right arm. The driver's door window showed a smudge of skin oil due to contact by the driver's head and the interior rear view mirror was displaced, possibly as a result of contact by the driver's right hand. In addition, there was blood on the driver's and the front right passenger's sunvisors and on the roof-mounted map light console.

Figure 4: Right view of steering wheel, showing bending on right due to driver contact

The case vehicle was equipped with driver and front right passenger front air bags and door-mounted side impact air bags at the four outboard seat positions, for a total of six air bags. Only the driver's front air bag deployed.

The driver's front air bag was located in the steering wheel hub, with two cover flaps in the H configuration. The upper flap measured 20 centimeters horizontally and 9 centimeters vertically, and the lower flap measured 19 centimeters horizontally and 7 centimeters vertically. The flaps opened at the tear points and there was no damage to the flap or the adjacent structures. The driver's air bag was reported as being elliptical, measuring 66 centimeters horizontally and 56 centimeters vertically. There were three tether straps and two vent ports, each approximately 3 centimeters in diameter, at the 11 and 1 o'clock positions. There were two areas of blood smear on the air bag fabric, on the front near the edge at approximately the 2:30 o'clock position (**Figure 5**), and on the back near the top (**Figure 6**).

Figure 5: Front of driver's air bag; blood smear highlighted

Figure 6: Back of driver's air bag; blood smear highlighted

CASE VEHICLE DRIVER

The case vehicle driver (41-year-old male, black, non-Hispanic, 178 centimeters, 98 kilograms [70 inches, 215 pounds]) was restrained by the available, manual, three-point, lap-and-shoulder safety belt system. He was seated in a normal driving posture with his back against the seat back, his feet on the floor or foot controls and both hands on the steering wheel at approximately the ten and two o'clock positions. His seat track was adjusted between the middle and rear-most positions and his seat back was slightly reclined. The tilt steering wheel was adjusted between the center and full-up positions.

The driver stated that, as he approached the intersection, the automatic signal was red and he was slowing in preparation to stop. When he was a short distance from the intersection, the signal turned to green and he accelerated, intending to pass through the intersection and continue straight ahead. The other driver turned left across his path. The case vehicle driver indicated that he braked and steered to the left in an effort to avoid the other vehicle. He moved forward and to the right in response to the braking and steering, loading the safety belt webbing, and the safety belt retractor probably locked in response to the deceleration and loading. The front of the case vehicle impacted the front of the other vehicle, causing the case vehicle driver's front air bag to deploy and causing

the driver to move slightly leftward and further forward, toward the eleven o'clock direction of force. The case vehicle was equipped with safety belt pretensioners, but the NASS investigator was not able to determine whether the driver's pretensioner actuated. His legs flailed and his left lower leg impacted the knee bolster, causing contusions and abrasions. His left forearm was contacted by the deploying air bag, causing contusions and abrasions. Because he was restrained by the safety belt system, his torso encountered the fully-deployed air bag and he did not sustain any air bag injuries on his chest, neck or face. Because he was cushioned by the air bag, he did not load the safety belt webbing with the full force of his own inertia and he did not sustain any safety belt-type contusions or abrasions. His head, however, continued forward when his torso was stopped by the combination of the air bag and the safety belt, causing a cervical strain ("whiplash").

CASE VEHICLE DRIVER INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Abrasion, left forearm	790202.1 minor	Driver's air bag	Probable	E.R. Records
2.	Contusion, left forearm	790402.1 minor	Driver's air bag	Probable	E.R. Records
3.	Abrasion, left lower leg	890202.1 minor	Knee bolster	Probable	E.R. Records
4.	Contusion, left lower leg	890402.1 minor	Knee bolster	Probable	E.R. Records
5.	Cervical spine strain	640278.1 minor	Non-contact, inertial force	Probable	E.R. Records
6.	Contusion, right abdomen/flank	590402.1 minor	Steering wheel rim	Probable	Interviewee

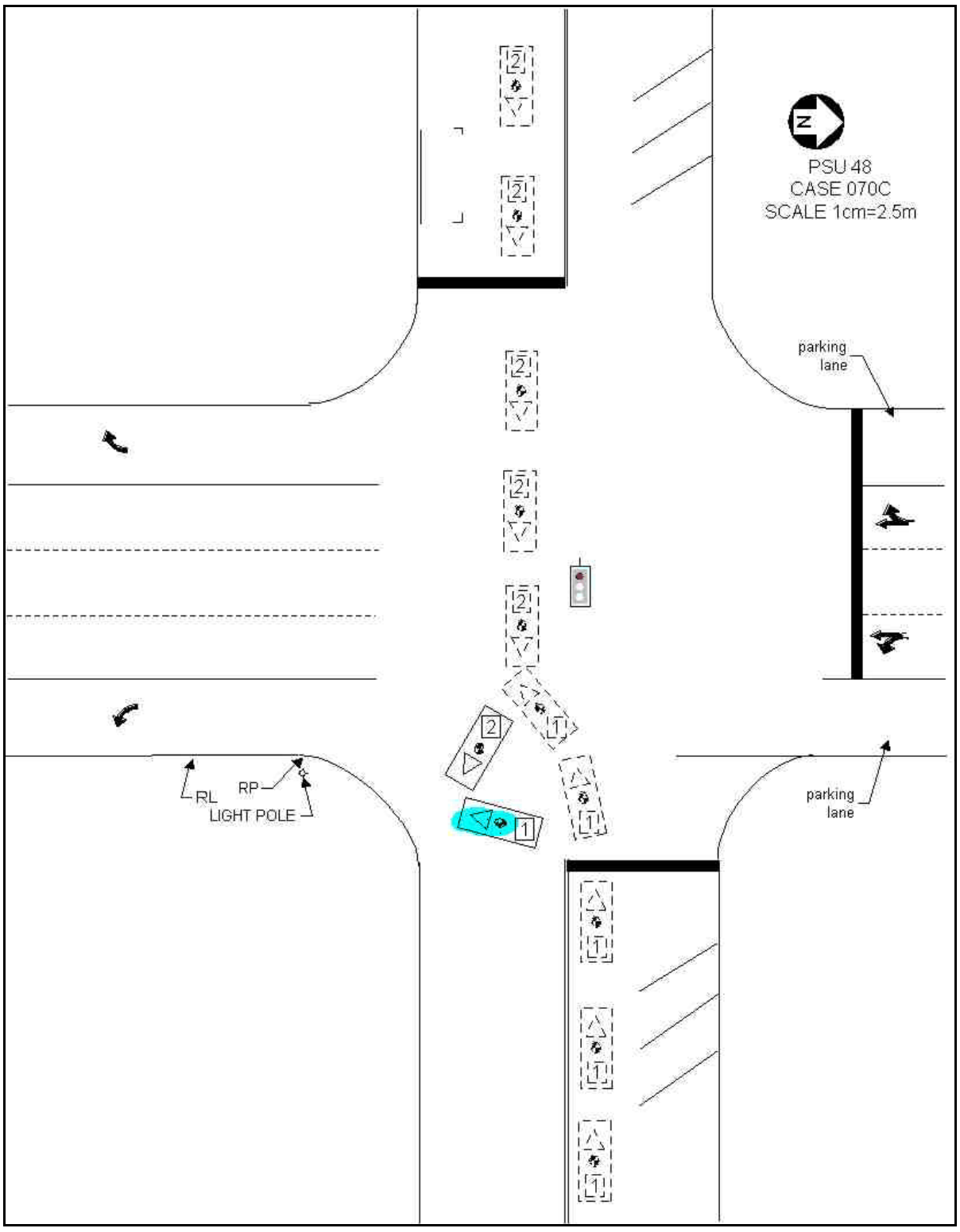
OTHER VEHICLE

The other vehicle was a 1997 Ford Mustang rear wheel driver, two-door, four passenger coupe (VIN: 1FALP4048VF------), equipped with a V6 3.8 liter engine and an automatic transmission with a console-mounted selector lever. Its wheelbase was 257 centimeters [101.2 inches] and the odometer reading was 108,145 kilometers [67,200 miles]. The Mustang was towed due to disabling damage.

The Mustang sustained direct contact damage across the entire front, with maximum crush 66 centimeters [30.0 inches] at the front right corner. The grille, bumper fascia and both headlamp assemblies were broken away, exposing the steel bumper (**Figure 7**). The right fender was crushed inward and rearward and the right turn signal assembly was destroyed. The left fender sustained only minor induced damage and the left turn signal assembly was intact. The engine hood was made

of fiberglass and the leading edge was shattered and bent downward. The wheelbase was stretched 3 centimeters [1.2 inches] on the left and shortened 18 centimeters [7.1 inches] on the right. The windshield was cracked and there was no other glazing damage. The CDC was determined to be **01-FDEW-3 (20).** The WinSMASH reconstruction program was used, based on the measured crush profile of both vehicles. The Mustang's Total, Longitudinal and Lateral Delta-Vs are, respectively: 36.0 km.p.h. [22.4 m.p.h.], -33.8 km.p.h. [-21.0 m.p.h.] and -12.3 km.p.h. [-7.6 m.p.h.]. This was a crash of moderate severity for the Mustang.

Figure 7: Front right view of Mustang's damage


PSU 48
CASE 070C
SCALE 1cm=2.5m
parking lane
parking lane
RL
RP
LIGHT POLE