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ON-SITE SIDE IMPACT INFLATABLE OCCUPANT PROTECTION INVESTIGATION

CASE NUMBER - IN11008
LOCATION - TEXAS
VEHICLE - 2006 MERCEDES BENZ S500
CRASH DATE - December 2010

Submitted:

September 2, 2011

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

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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.* IN11008	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Side Impact Inflatable Occupant Protection Investigation Vehicle - 2006 Mercedes Benz S500 Location - Texas		5. *Report Date:* September 2, 2011 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: December 2011 14. *Sponsoring Agency Code*	
15. *Supplementary Notes* On-site side impact inflatable occupant protection investigation involving a 2006 Mercedes Benz S500 and a 2007 Dodge 1500 Ram pickup truck.			
16. *Abstract* The focus of this on-site investigation was the side impact air bag system of a 2006 Mercedes Benz S500. The Mercedes was occupied by a restrained 39-year-old female driver. The Mercedes was traveling west in the first through lane from the right approaching a signalized 4-leg urban intersection. Traffic in the other westbound through lanes was stopped and partially blocking the intersection. A 2007 Dodge 1500 Ram pickup truck was traveling north and traveled into the intersection. As the Dodge maneuvered around the stopped vehicles, its front plane impacted the left plane of the Mercedes. The force direction on the Mercedes was within the 10 o'clock sector and the impact triggered a deployment of the left front and left rear door-mounted side impact air bags and left IC air bag. The driver of the Mercedes sustained minor injuries and was transported by ground ambulance to a trauma center where she was treated in the emergency room and released. The driver and passenger in the Dodge were not injured. Both vehicles were towed from the crash scene.			
17. *Key Words* Side Impact Air Bag 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* 9	22. *Price*

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

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BACKGROUND

The focus of this on-site investigation was the side impact air bag system of a 2006 Mercedes Benz S500 (**Figure 1**). This investigation was initiated by the National Highway Traffic Safety Administration (NHTSA) on February 2, 2011 through the sampling activities of the National Automotive Sampling System (NASS)-General Estimates System (GES). This investigation was assigned on March 7, 2011. The crash occurred in December, 2010, at 1226 hours, in Texas and was investigated by the municipal police department. The crash involved the Mercedes and a 2007 Dodge 1500 Ram pickup truck. The Mercedes and the crash scene were inspected on March 15, 2011. The husband of the Mercedes' driver was interviewed on March 15, 2011. An inspection of the Dodge was not conducted since the vehicle could not be located.

Figure 1: The damaged 2006 Mercedes Benz S500

This crash occurred within a 4-leg, urban intersection when the left plane of the Mercedes was impacted by the front plane of the Dodge. The Mercedes was a 4-door sedan equipped with door-mounted side impact air bags, side impact Inflatable Curtain (IC) air bags, and driver and front right passenger frontal air bags. The Mercedes' left front and left rear door-mounted side impact air bags and left IC air bag deployed in the crash. The Mercedes was occupied by a restrained 39-year-old female driver. She sustained minor injuries and was transported by ambulance to a trauma center where she was treated in the emergency room and released. The Dodge was a 4-door, quad-cab pickup truck. It was occupied by a restrained 53-year-old male driver and a restrained 50-year-old female second row left passenger. They were not injured. The Dodge's frontal air bags did not deploy.

CRASH SUMMARY

Crash Site: This crash occurred during daylight hours and cloudy weather conditions within the 4-leg intersection of a 9-lane, divided, urban state highway and a 6-lane, divided, urban state highway. The trafficway for the Mercedes was straight and traversed in an east-west direction. On the eastern leg of the intersection, the westbound roadway had three through lanes, two left

turn lanes, and one right turn lane. Each lane was approximately 3.6 m (11.8 ft) in width. The trafficway was divided by a painted median 1 m (3.3 ft) in width. The roadway pavement markings consisted of solid white turn lane lines, broken white through lane lines, solid white turn arrows, solid white stop bar, and solid white pedestrian crossing lines. The trafficway for the Dodge traversed in a north-south direction. On the southern leg of the intersection, the northbound roadway had two through lanes, one left turn lane, and one right turn lane. Each lane was approximately 3.7 m (12.1 ft) in width. The trafficway was divided by a grass median 5.9 m (19.4 ft) in width. The roadway pavement markings consisted of solid white turn lane lines, broken white through lane lines, solid white turn arrows, solid white stop bar, and solid white pedestrian crossing lines Both roadway surfaces were dry, level concrete. The intersection was controlled by 3-phase traffic signals. The speed limit for both vehicles was 72 km/h (45 mph). The Scene Diagram is on page 8 of this report.

Figure 2: Approach of the Mercedes westbound in the first through lane from the right

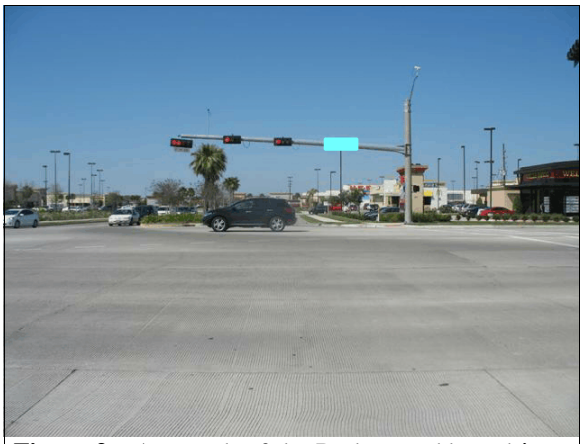


Figure 3: Approach of the Dodge northbound into the intersection

Pre-Crash: The Mercedes was traveling west in the first through lane from the right (**Figure 2**). The traffic signal was on the green phase and the driver intended to continue westbound through the intersection. As the Mercedes was approaching the intersection, the westbound traffic in the other two through lanes stopped and some vehicles stopped within the intersection. The Dodge was traveling north approaching the intersection in the first through lane from the right (**Figure 3**). The driver intended to continue northbound through the intersection. According to the police crash report, the Dodge traveled into the intersection and maneuvered around the stopped westbound vehicles and proceeded toward the north leg of the intersection.

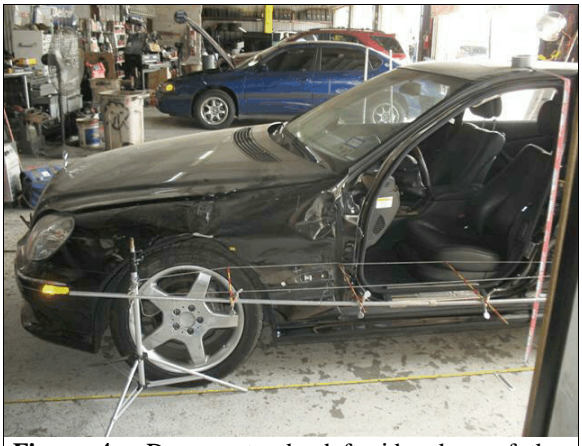


Figure 4: Damage to the left side plane of the Mercedes from the front plane impact by the Dodge; the left front door of the Mercedes was removed by rescue personnel

Crash: As the driver of the Mercedes proceeded through the intersection, the front plane of the Dodge impacted the left side plane of the Mercedes (**Figure 4**). The force direction on the Mercedes was within the 10 o'clock sector and the impact triggered a deployment of the left front and rear door-mounted side impact air bags and left IC air

bag. The calculated total Delta V for the Mercedes was 13 km/h (8 mph). The longitudinal and lateral velocity changes were -8 km/h (-5) and 10 km/h (6.2 mph), respectively. The calculated total Delta V for the Dodge was 10 km/h (6.2 mph). The longitudinal and lateral velocity changes were -8 km/h (-5 mph) and -6 km/h (-3.7), respectively. Following the impact, the Mercedes rotated counterclockwise and came to final rest near the northwest corner of the intersection heading southwest. The Dodge rotated counterclockwise and came to final rest within the intersection heading northwest.

Post-Crash: The police were notified of the crash at 1229 hours and arrived on scene at 1235 hours. Emergency medical and rescue services also responded. Rescue personnel mechanically removed the left front door of the Mercedes and cut the IC air bag to extricate the driver from the vehicle. The driver was transported by ground ambulance to a trauma center where she was treated in the emergency room and released. Both vehicles were towed from the crash scene due to damage.

2006 MERCEDES BENZ S500

DESCRIPTION

The Mercedes was a rear-wheel drive, 5-passenger, 4-door, sedan (VIN: WDBNG75J56Axxxxxx) equipped with a 5.0-liter, V-8 engine, a 7-speed automatic transmission, 4-wheel, anti-lock brakes with electronic brake force distribution and braking assist, traction control, electronic stability control, and a tire pressure monitoring system. The vehicle was equipped with a tilt and telescoping steering column. The tilt adjustment was set to the center position. The telescoping adjustment could not be determined since the vehicle was without power. The windshield glazing was AS1 laminated, while the side window glazing was AS2 laminated. The backlight glazing was AS2 tempered. Prior to the crash, all of the glazing was either closed or fixed. The odometer reading at the SCI inspection could not be determined since the vehicle was without power. The driver's husband estimated the vehicle's mileage at approximately 128,748 kilometers (80,000 miles). The specified wheelbase was 309 cm (121.7 in).

The vehicle manufacturer's recommended tire size was P245/45R18. The vehicle was equipped with tires of the recommended size. The recommended cold tire pressure for the front and rear tires was 207 kPa (30 psi) and 228 kPa (33 psi), respectively. The tire data for the Mercedes are presented in the table below.

Position	*Measured Pressure*	*Measured Tread Depth*	*Restricted*	*Damage*
LF	296 kPa (43 psi)	7 mm (9/32 in)	No	None
LR	290 kPa (42 psi)	3 mm (4/32 in)	No	None
RR	255 kPa (37 psi)	2 mm (3/32 in)	No	None
RF	234 kPa (34 psi)	5 mm (6/32 in)	No	None

The front row was equipped with leather-covered bucket seats with adjustable head restraints. The top of the driver's head restraint was adjusted to a height of 29 cm (11.4 in) above the seat back. The driver's and front right passenger seat tracks were adjusted to between the middle and rear positions. The second row was equipped with a leather-covered bench seat. The second row seats were not adjustable.

EXTERIOR DAMAGE

The Mercedes sustained left side plane damage during the impact with the Dodge. The left fender, left front wheel, left front door, and left rear door were directly damaged. The direct damage began 288 cm (113.4 in) forward of the left rear axle and extended 264 cm (103.9 in) rearward along the left side plane. The crush measurements were taken at the lower door level and the maximum residual crush was 16 cm (6.3 in) occurring at C_4. The height of the maximum door crush was 57 cm (22.4 in) and the door sill differential was 4 cm (1.6 in). The height of the sill was 39 cm (15.4 in). The left side wheelbase was reduced 3 cm (1.2 in).

The Collision Deformation Classification (CDC) was 10LYEW2 (310 degrees). The Missing Vehicle algorithm of the WinSMASH program calculated the total Delta V as 13 km/h (8.1 mph). The longitudinal and lateral velocity changes were -8 km/h (-5 in) and 10 km/h (6.2 mph), respectively. Based on the damage, the results appeared reasonable.

INTERIOR DAMAGE

The inspection of the interior of the vehicle revealed no discernable evidence of occupant contact. The driver's seat was undamaged. There was no damage to the steering wheel.

The left front door was jammed shut. The remaining doors remained closed and operational. The left front window glazing was cracked from impact force. The remaining glazing was undamaged.

The vehicle sustained six intrusions of the passenger compartment. The side panel forward of the left A-pillar and the left A-pillar intruded laterally 4 cm (1.6 in) into the driver' space. The rear lower quadrant of the left front door intruded laterally an estimated 6 cm (2.4 in) into the driver's space.

The front row was equipped with driver and front right passenger lap-and-shoulder safety belts. The driver's safety belt was equipped with continuous loop belt webbing, a sliding latch plate, an Emergency Locking Retractor (ELR), and an adjustable upper anchor that was in the full-down position. The front right passenger's safety belt was equipped the same as the driver, but had a switchable ELR/Automatic Locking Retractor (ALR). The adjustable upper anchor was in the middle position. The front seat positions were equipped with buckle-mounted and retractor-mounted pretensioners. There was no evidence of pretensioner actuation. The second row was equipped with lap-and shoulder safety belts. Lower Anchors and Tethers for Children (LATCH) were present at the outboard seat positions and a tether anchor was present in the middle seating position. The second row safety belts were equipped with continuous loop belt webbing, a sliding latch plate, switchable ELR/ALRs, pretensioners, and non-adjustable upper anchors.

Inspection of the driver's safety belt assembly revealed no evidence of loading. There were historical usage scratches on the latch plate. The driver sustained an abrasion on her left shoulder and neck consistent with usage of the safety belt.

SUPPLEMENTAL RESTRAINT SYSTEMS

The Mercedes was equipped with driver and front right passenger frontal air bags. These air bags did not deploy in this crash.

The vehicle was also equipped with door-mounted side impact air bags and roof side rail-mounted side impact IC air bags. Based on the 7th edition of Holmatro's Rescuer's Guide to Vehicle Safety Systems, the side impact sensors were located under the outboard sides of the back seats. The left front and left rear door-mounted side impact air bags and the left IC air bag deployed in this crash. The right side impact air bags did not deploy.

The left front door-mounted side impact air bag was located within the door panel above the arm rest and approximately 17 cm (6.7 in) forward of the back of the door (**Figure 5**). The module cover was a two-flap configuration constructed of pliable vinyl and had a soft plastic foam outer covering. Each cover flap was 19.5 cm (7.7 in) in with and 6 cm (2.4 in) in height. The cover flaps opened at the designated tear seams and were undamaged. The deployed side impact air bag (**Figure 6**) was 45 cm (17.7 in) in

Figure 5: The Mercedes' left front door-mounted side impact air bag module

Figure 6: The Mercedes' deployed left front door-mounted side impact air bag

width and 25 cm (9.8 in) in height. There were no external vent ports. There was a seam 27 cm (10.6 in) in length where both sides of the air bag were sewn together. The seam was located 13 cm (5.1 in) above the bottom of the air bag. When the air bag was extended to its full height, it extended 4 cm (1.6 in) above the beltline. There was no discernable evidence of occupant contact and no damage to the air bag.

The left rear door-mounted side impact air bag and the left IC air bag had been cut and removed from the vehicle. They were not available for inspection.

2006 MERCEDES BENZ OCCUPANT

DRIVER DEMOGRAPHICS

Age/Sex:	39 years/female
Height:	152 cm (60 in)
Weight:	87 kg (192 lbs)
Eyewear:	None
Seat Type:	Bucket
Seat Track Position:	Between middle and rear position
Manual Restraint Usage:	Lap-and-shoulder
Usage Source:	Injury information (no interviewee information on usage)
Air Bags	Frontal, not deployed; left door-mounted and left IC, deployed
Alcohol/Drug Involvement:	Police reported none and not tested
Egress from Vehicle:	Removed by rescue personnel
Transport from Scene:	Ground ambulance
Medical Treatment:	Treated in trauma center emergency room and released

DRIVER INJURIES

Injury Number	Injury	AIS 2005/08	Injury Source	Confidence Level
1	Strain, acute, cervical, not further specified	640278.1,6	Torso portion of safety belt system	Certain
2	Abrasion, 12.7 to 15.2 cm (5-6 in) on left side and front of neck	310202.1,2	Torso portion of safety belt system	Certain
3	Contusions on left flank, not further specified	510402.1,2	Air bag, driver's side impact	Probable
4	Abrasion posterior (dorsal), proximal, and middle left forearm	710202.1,2	Noncontact injury: flying glass, left front glazing	Certain
5	Lacerations, small, multiple, on posterolateral, proximal, and mid left forearm, with foreign body (glass) removal	710602.1,2	Noncontact injury: flying glass, left front glazing	Certain

Injury Number	Injury	AIS 2005/08	Injury Source	Confi-dence Level
6	Contusion on left thigh, not further specified	810402.1,2	Left front hardware/armrest, forward lower quadrant	Probable

*Source(s): Emergency Room Records, EMS treatment Record, Interviewee Data–Relative (husband). Injury Numbers 1 and 4 came from **Emergency Room Records**. Injury Numbers 2, 3, and 6 came from **Interviewee**. Injury Number 5 came from a combination of **Emergency Room Records** and **Interviewee Data**.*

DRIVER KINEMATICS

The impact with the Dodge displaced the driver to the left and forward opposite the 10 o'clock direction of force and she loaded the safety belt. She sustained an abrasion 12.7-15.2 cm (5-6 in) in length on the left side and front of her neck from the shoulder belt. Her chest and flank loaded the deployed door-mounted side impact air bag and her left thigh contacted the arm rest, which caused multiple contusions on her flank and thigh. She sustained multiple small lacerations and abrasions on her left forearm arm from flying glass fragments from the left front window glazing. She sustained no facial or head injuries.

2007 DODGE 1500 RAM

DESCRIPTION

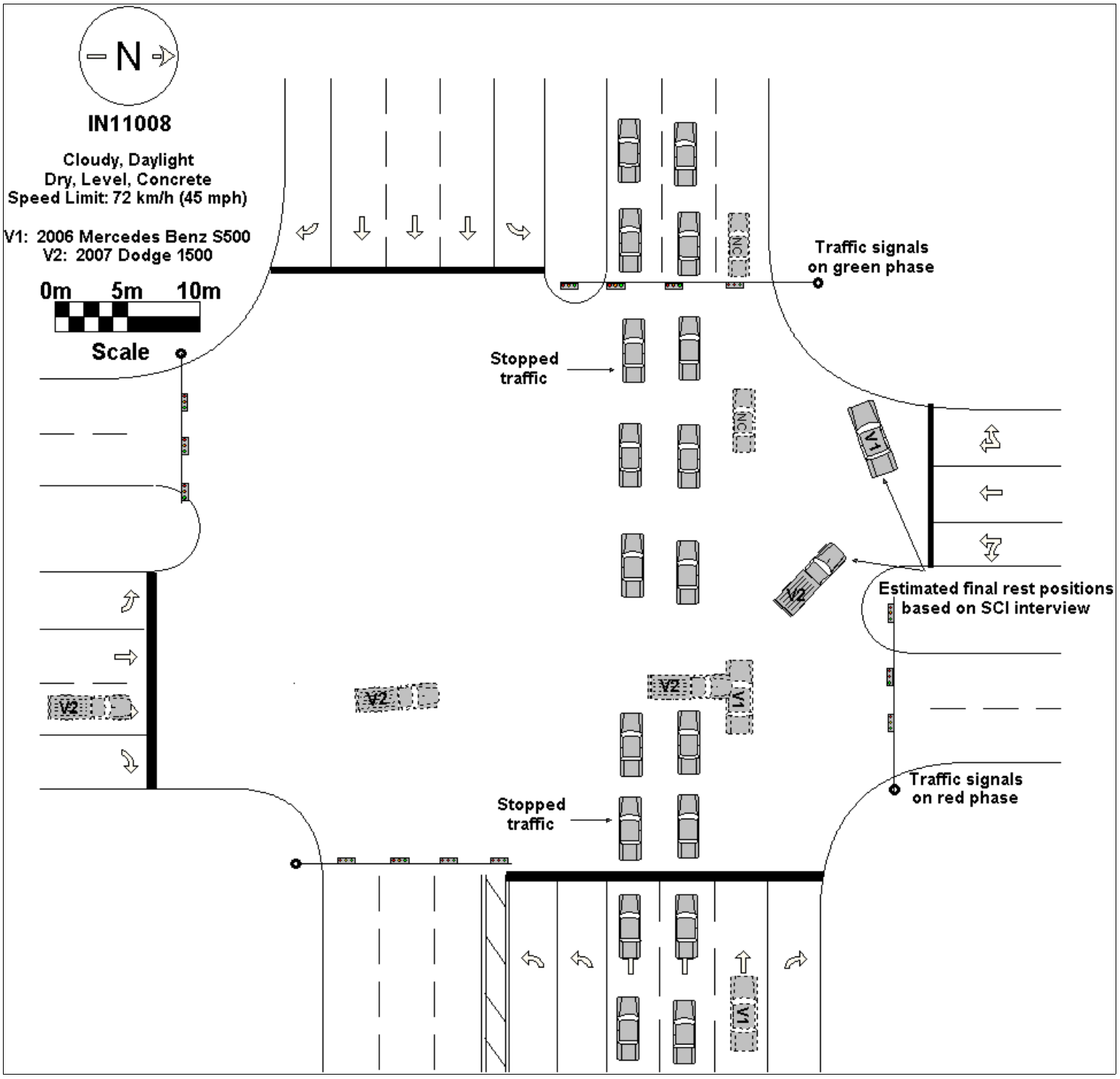
The 2007 Dodge Ram 1500 was a rear wheel drive, 5-passenger, 4-door quad cab pickup truck (VIN 1D7HA18P57Sxxxxxx) equipped with a 4.7 liter, V-8 engine, and a 5-speed automatic transmission. The front row was equipped with lap-and-shoulder safety belts, dual stage driver and front right passenger frontal air bags, and safety belt pretensioners. The second row was equipped with lap-and-shoulder safety belts and Lower Anchors and Tethers for Children (LATCH). The manufacturer has certified that this vehicle is compliant to the Advanced Air Bag portion of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208.

EXTERIOR DAMAGE

The Dodge sustained front plane damage during the impact with the left side plane of the Mercedes. The police crash report indicated that the frontal air bags did not deploy. The Dodge was not inspected since it could not be located.

The missing vehicle algorithm of the WinSMASH program calculated the Ford's total Delta V as 10 km/h (6.2 mph). The longitudinal and lateral velocity changes were -8 km/h (-5 mph) and -6 km/h (-3.7 mph). The results should be considered borderline since they are based only on the crush to the Mercedes.

Based on the police crash report, the driver of the Dodge (53-year-old male) and the second row left passenger (50-year-old female) were restrained by lap-and-shoulder safety belts. They sustained no police reported injuries.


N
IN11008
Cloudy, Daylight
Dry, Level, Concrete
Speed Limit: 72 km/h (45 mph)
V1: 2006 Mercedes Benz S500
V2: 2007 Dodge 1500
0m 5m 10m
Scale
Traffic signals on green phase
Stopped traffic
Estimated final rest positions based on SCI interview
Traffic signals on red phase
Stopped traffic
V1
V2
NC