Rollover Investigation / Vehicle to Objects
Dynamic Science, Inc. / Case Number: DS06019
2006 Mercedes-Benz CLK500
Washington
July 2006

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.	2. Government Accession No.	3. Recipient Catalog No.
DS06019		

4. Title and Subtitle	5. Report Date
Rollover Investigation	March 23, 2007
	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
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 rollover of a 2006 Mercedes-Benz CLK500. This single vehicle crash occurred in July 2006 at 1528 hours in an urban area of Washington. The crash occurred on a four lane, two way, undivided city street.

The case vehicle was a 2006 Mercedes-Benz CLK500 being driven by a 33-year-old restrained male. There were no other occupants in the vehicle. The Mercedes-Benz was traveling west in the right lane on a four lane, two way city street. The posted speed limit for this roadway is 56 km/h (35 mph). According to a witness statement, the driver of the case vehicle was traveling at "a fast speed" before the crash. For unknown reasons, the vehicle departed the roadway to the right and struck a small diameter signpost with its front end. The post sheared from its base and the case vehicle continued traveling off the roadway. The Mercedes-Benz traveled into a shallow ditch that was adjacent to the roadway, drove a short distance, and the front right of the vehicle impacted a large utility pole. This resulted in the actuation of the driver's seat belt retractor pretensioner and the deployment of the driver's dual stage Certified Advanced 208-Compliant front air bag. According to police, the utility pole sheared off its base from the force of the impact. The Mercedes-Benz rotated clockwise as it continued forward, with the back end of the vehicle on the roadway and the front end in the ditch. The vehicle's speed and rotation and the uneven terrain caused the Mercedes-Benz to begin to roll over to the left. The case vehicle rolled three quarter turns before it came to final rest off the roadway. At final rest it was laying on its right side, facing southeast. The driver of the Mercedes-Benz had to be extricated from the vehicle by fire/rescue personnel. He sustained strains to his cervical and lumbar spine, a left arm sprain and bruising to his chest and abdomen. He was transported by ambulance to an area hospital where he was treated and released. The case vehicle was towed from the scene due to damage and was later declared a total loss.

17. Key Words	18. Distribution Statement
Air bag, side curtain, deployment, injury, rollover, Certified Advanced 208-Compliant	

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

Dynamic Science, Inc.
Crash Investigation
Case Number: DS06019

TABLE OF CONTENTS

BACKGROUND

Description

This on-site investigation focused on the rollover of a 2006 Mercedes-Benz CLK500. This single vehicle crash occurred in July 2006 at 1528 hours in an urban area of Washington. The crash occurred on a four lane, two way, undivided city street.

Figure 1. Front - 2006 Mercedes-Benz CLK500

Figure 2. Exemplar vehicle (convertible model, coupe not available)

The case vehicle was a 2006 Mercedes-Benz CLK500 being driven by a 33-year-old restrained male. There were no other occupants in the vehicle. The Mercedes-Benz was traveling west in the right lane on a four lane, two way city street. The posted speed limit for this roadway is 56 km/h (35 mph). According to a witness statement, the driver of the case vehicle was traveling at "a fast speed" before the crash. For unknown reasons, the vehicle departed the roadway to the right and struck a small diameter signpost with its front end. The post sheared from its base and the case vehicle continued traveling off the roadway. The Mercedes-Benz traveled into a shallow ditch that was adjacent to the roadway, drove a short distance, when the front right of the vehicle impacted a large utility pole, resulting in the actuation of the driver's seat belt retractor pretensioner and the deployment of the driver's dual stage Certified Advanced 208-Compliant front air bag. According to police, the utility pole sheared off its base from the force of the impact. The Mercedes-Benz rotated clockwise as it continued forward, with the back end of the vehicle on the roadway and the front end in the ditch. The vehicle's speed and rotation as wells as the uneven terrain caused the Mercedes-Benz to begin to roll over to the left. The case vehicle rolled three quarter turns before it came to final rest off the roadway. At final rest it was laying on its right side, facing southeast.

The driver of the Mercedes-Benz had to be extricated from the vehicle by fire/rescue personnel. He sustained strains to his cervical and lumbar spine, a left arm sprain and bruising to his chest and abdomen. He was transported by ambulance to an area hospital where he was treated and released. The case vehicle was towed from the scene due to damage and was later declared a total loss.

This crash was identified by DSI personnel and provided to the NHTSA. DSI secured permission to inspect the vehicle on September 6, 2006. NHTSA requested that a police report be obtained prior to case initiation. The insurance company refused to provide a copy of the report and would not release the report number. DSI obtained the police report on September 15, 2006 and NHTSA assigned the case on September 19, 2006. The case vehicle was inspected on September 22, 2006 and field work was completed on September 27, 2006.

Figure 3. Overview of the case vehicle's precrash area (west)

SUMMARY

Crash Site

This single vehicle crash occurred in July 2006 at 1528 hours in an urban area of Washington. The crash occurred on a four lane, two way, undivided city street.

Figure 4. Approach of case vehicle to approximate roadway departure area (west)

The 2006 Mercedes-Benz CLK500 was traveling west in the right lane and was approaching a T-intersection controlled by traffic signals. The intersection is not believed to have played a role in the crash. In the precrash area, this roadway is composed of two westbound and two eastbound asphalt travels lanes that are separated by yellow painted, "no passing", solid double lane lines. In the precrash area, the westbound lanes were straight, were separated from one another by painted white dashed lane lines and had a 1.5% downhill grade. Approximately 53.4 m (175.2 ft) east of the case vehicle's roadway departure point, the westbound travel lanes begin to shift slightly to the right. This shift is due to the fact that the roadway widens in order to accommodate a west-facing, left-turn only lane present at the T-intersection.

Adjacent to the outside travel lanes, there are solid white painted fog lines separating the travel lanes from the asphalt shoulders. There are no curbs on either side of this roadway. Adjacent to the south shoulder is an area containing grass and bushes. Adjacent to the north shoulder, there were grass and bushes in the precrash area, and a shallow ditch and embankment in the area where the Mercedes-Benz left the roadway. The ditch continues along the north side of the shoulder up to the T-intersection and was approximately 24.0 cm (9.4 in) deep at the roadway departure point. Adjacent to the ditch was an embankment covered with grass, dirt, small rocks and low shrubs. The grade between the roadway and the bottom of the ditch was approximately -24.7% . The approximate grade of the embankment was 23.3%. There was a private driveway

located just east of the crash location, but it was not related to this collision. In the area where the Mercedes-Benz left the roadway there was a square signpost located next to the edge of the north shoulder. This sign post was struck by the case vehicle.

At the time of the scene inspection, it did not appear that the post had been replaced, but there was no apparent damage from the impact. Just west of the signpost, approximately halfway up the embankment there was a wooden utility pole that was also struck by the case vehicle. The post had a diameter of 0.4 m (1.3 ft). According to the police report, the pole broke away during the impact and a utility crew came to the scene in order to "take care of the power lines and pole". At the time of the scene inspection, it appeared that the pole had been replaced.

The posted speed limit for this section of roadway is 56 km/h (35 mph). The crash occurred during daylight hours and the roadway was dry. According to the police report, it was overcast but there were no adverse weather conditions and no visual obstructions present.

Pre-Crash

The 2006 Mercedes-Benz CLK500 was being driven by a restrained 33-year-old male. There were no other occupants in the vehicle.

The Mercedes-Benz was traveling west in the right lane of the four lane, two way, undivided city street. The driver of the case vehicle told investigating officers that all he remembered was that he was on the shoulder of the road prior to the impact. A witness reported that the vehicle had been traveling at a "fast speed" prior to the collision. As the case vehicle was traveling west, it departed the roadway to the right.

Crash

The case vehicle traveled off the north edge of the roadway and the front of the Mercedes-Benz impacted a signpost (12FYEN2) that was adjacent to the north shoulder, shearing the post from its base. The vehicle continued west into the shallow ditch, traveled a short distance and the front of the Mercedes-Benz (12FREE3) struck the wood utility pole, shearing the pole from its base, and resulting in the actuation of the driver's seat belt retractor pretensioner and the deployment of the driver's front air bag. The barrier equivalent routine of the WinSmash program computed a total delta V of 7.0 km/h (4.3 mph). The longitudinal and lateral components were -7.0 km/h (-4.3 mph) and 0.0 km/h (0.0 mph), respectively.

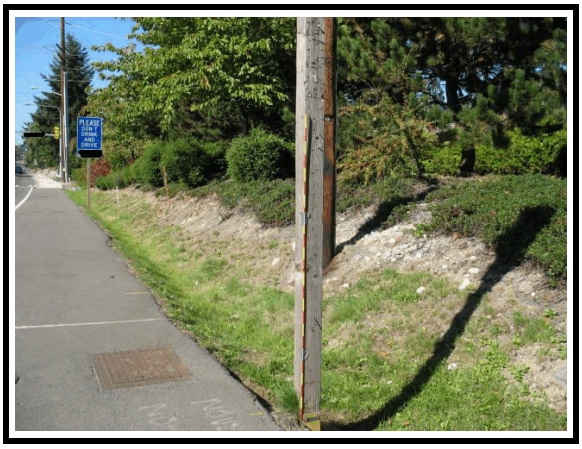

Figure 5. Signpost - first object struck by the case vehicle (west)

The WinSmash results are low which may be attributed to the fact that there was narrow end engagement at the right front bumper corner. The case vehicle's right front tire was forced rearward during the pole impact. The longitudinal movement of the right front tire would have resulted in a higher longitudinal delta V than the Winsmash program results showed.

The case vehicle rotated clockwise while continuing west and began to rollover to the left (00TZDO3). The Mercedes completed three quarter turns and came to final rest off the roadway, on its right side, facing southeast. The case vehicle's back bumper came in contact with a wooden marker post that was located in the area near the top of the embankment, resulting in brown transfers to the bumper, but no crush.

Post-Crash

According to the police report, the driver was trapped in the vehicle. There were several fire/rescue extrication cuts to various parts of the car, including the left A pillar, the windshield, and the roof. The driver sustained strains to his cervical and lumbar spine, a left arm sprain, and bruising to his chest and abdomen. He was transported by ambulance to an area hospital where he was treated and released.

The vehicle was towed from the scene due to damage and was later declared a total loss.

Figure 6. Shallow ditch, embankment and second struck object (pole replaced)

Figure 7. Approximate final rest location and wooden marker (contacted during rollover event)

Figure 8. Damaged wood marker (left transfers on the case vehicle's left rear bumper and tailpipe)

Vehicle Data - 2006 Mercedes-Benz CLK500

The 2006 Mercedes-Benz CLK500 was identified by the Vehicle Identification Number (VIN): WDBTJ75H46Fxxxxxx. The Mercedes-Benz CLK500 is a two door coupe, rear wheel drive, passenger vehicle with seating for four. It was equipped with a 5.0 liter 8 cylinder engine, 7-speed semi-automatic transmission, four wheel anti-lock brakes (ABS), front and rear disc brakes, electronic traction control via ABS and engine management, the Electronic Stability Program stability control system, front row active head restraints, daytime running lights and a tilt and telescoping steering wheel. The vehicle mileage could not be obtained from the digital odometer because the vehicle had no power. The owner/driver estimated the mileage at less than 8047 km (5,000 m).

The Mercedes-Benz CLK500 was equipped with Bridgestone Potenza RE050 P225/45R17 tires on the front and Bridgestone Potenza RE050 P245/40R17 tires on the rear. The recommended cold tire pressure was 207 kPa (30 psi) for the front and 228 kPa (33 psi) for the rear. This vehicle is equipped with a Run Flat Indicator low tire pressure warning system. This system monitors the rotational speed of all four tires and detects whenever there is a "significant loss of pressure". The specific tire information for the Mercedes was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	8 mm (10/32 in)	Yes	Tire debeaded; rim scuffed
LR	207 kPa (30 psi)	8 mm (10/32 in)	No	None
RR	207 kPa (30 psi)	8 mm (10/32 in)	No	None
RF	Flat	8 mm (10/32 in)	Yes	Rim scuffed

The front row seating in the 2006 Mercedes-Benz CLK500 was configured with dual leather covered bucket seats with folding backs. The seats were equipped with adjustable, active head restraints that were not damaged. During a rear-end collision, the active head restraints are designed to move forward in order to provide more head and neck support. The second row was configured as a leather covered split bench seat with folding backs. Both second row seating positions were equipped with adjustable, folding head restraints equipped with a tilt feature.

Figure 9. LF active head restraint

Vehicle Damage

Exterior Damage - 2006 Mercedes-Benz CLK500

The 2006 Mercedes-Benz CLK500 sustained minor front end damage as a result of the impact with the sign post. The post was composed of wood with each side measuring 8.0 cm (3.1 in) wide. Taking into account the angle of the case vehicle as it struck the post, the actual (diagonal) width of the post was 13.0 cm (5.1 in).

Figure 10. Front crush profile

The vehicle sustained 16.0 cm (6.3 in) of direct damage along the leading edge of the hood, beginning 21.0 cm (8.3 in) left of the precrash center point of the vehicle, extending to the left. The bumper cover and energy absorbing foam were no longer attached to the bumper. The left front section of the bumper cover and a section of the foam were found inside the passenger compartment. It appears that the bumper cover may have split and separated from the vehicle during this impact. A small piece of the right front bumper cover was found in the damaged area between the right front frame rail and the damaged right fender. The majority of the right and center bumper cover sections were not with the vehicle.

Figure 11. Hood damage ("V" indentation) from impact with signpost

In order to calculate and report the correct amount of crush, an exemplar vehicle was located and measured. Six crush measurements were documented along the front bumper as follows: C1=0.0 cm (0.0 in), C2=3.0 cm (1.2 in), C3=3.0 cm (1.2 in), C4=4.0 cm (1.6 in), C5=3.0 cm (1.2 in), C6=14.0 cm (5.5 in). The location of maximum crush for this event was best represented at C3. The CDC for this event was 12FYEN2.

Figure 12. Right front damage

The case vehicle sustained moderate front end damage as a result of the impact with the utility pole. In addition to the narrow end engagement at the right front bumper corner, the Mercedes-Benz's right front tire came in contact with the pole, causing the right wheelbase to be shortened by 12.0 cm (4.7 in). The vehicle sustained approximately 39.0 cm (15.4 in) of direct damage along the hood and bumper backing

bar, beginning 39.0 cm (15.4 in) right of the vehicle's precrash center point, extending to the right. Due to the missing bumper cover, the direct damage location and width were mainly determined from the hood damage. The same six crush measurements were documented along the front bumper as were documented for the first crash event. The location of maximum crush for this event was C6. The direct damage from this impact extended 62.0 cm (24.4 in) down the right side of the case vehicle. The CDC for this event was 12FREE3.

The Mercedes-Benz sustained light to moderate right, top and left side damage during the rollover event. The area of maximum crush was located 101.0 cm (39.8 in) forward of the right rear axle. There was 17.0 cm (6.7 in) of vertical crush, which is the maximum crush documented for the rollover event. The area of maximum lateral crush was in the same location on the vehicle and measured 5.0 cm (2.0 in). The CDC for this event was 00TZDO3.

The vehicle's back bumper came in contact with a wooden marker post that was located in the area near the top of the embankment, resulting in brown transfers to the bumper, but no crush. The CDC for this event was 99BLLN1.

Figure 13. Passenger compartment rollover damage

Figure 14. Rollover event - vertical and lateral max crush location

Figure 15. Brown transfers from wood marker contacted during the rollover event

CDC (Impact 1):	12FYEN2
(Impact 2):	12FREE3
(Impact 3):	00TZD03
(Impact 4):	99BLLN1

Barrier Equivalent Speed (Impact 2): 6.5 km/h (4.0 mph)

Interior Damage - 2006 Mercedes-Benz CLK500

The case vehicle sustained moderate interior damage due to occupant contacts, intrusion and normal air bag deployment related damage.

There were signs of occupant loading to the driver's seat belt. The shoulder belt showed signs of stress and the lap portion had friction burns to a small section of the belt material. All four of the Mercedes-Benz's seat belts were equipped with Emergency Tensioning Devices (ETDs) and seat belt force limiters. The front left and two second row seat belt ETDs activated during the crash. See the Manual Restraints section of this report for more information on these seat belt devices.

Figure 16. Roof cut by fire/rescue personnel

The driver's front air bag deployed during the pole impact but showed no sign of occupant contact. The right side curtain air bag deployed when the right side contacted the ground during the rollover event.

Figure 17. Signs of occupant loading to driver's shoulder belt

The left front door remained closed and operational. The right front door was jammed shut post-crash due to damage. There was integrity loss in several of the glazing areas. The following windows disintegrated due to impact forces: the sunroof, backlight, right front, left rear, and right rear. The windshield was cracked and assumed to be still in place post-crash. Rescue personnel cut the windshield along the windshield header and left A pillar, causing the glazing to collapse. During the driver extrication, the left A pillar and roof were also cut by rescue personnel.

Figure 18. Windshield cut by fire/rescue personnel

Figure 19. Intrusion into passenger compartment area

There were several vertical and lateral intrusions into the passenger compartment seating areas. The specific passenger compartment intrusions were documented as follows:

Row/Position	Intruded Component	Magnitude of Intrusion	Direction
1C	Windshield header	2.0 cm (0.8 in)	Vertical
1R	Roof	21.0 cm (8.3 in)	Vertical
1R	Roof side rail	17.0 cm (6.7 in)	Vertical
1R	Roof side rail	12.0 cm (4.7 in)	Lateral
1R	A Pillar	8.0 cm (3.1 in)	Vertical
1R	Windshield header	5.0 cm (2.0 in)	Vertical
1R	A Pillar	3.0 cm (1.2 in)	Lateral
2R	B Pillar	4.0 cm (1.6 in)	Lateral

Manual Restraints - 2006 Mercedes-Benz CLK500

The 2006 Mercedes-Benz CLK500 was configured with manual 3-point lap and shoulder belts for each of the four seating positions. All four seat belts were equipped with Emergency Tensioning Devices (ETDs) and seat belt force limiters. The force limiters are designed to reduce the force exerted by the seat belts on vehicle occupants during a collision. Information obtained from the vehicle manufacturer indicates that the front row ETDs consist of seat belt retractor pretensioners and the second row ETDs consist of seat belt buckle pretensioners.

Figure 20. Driver's seat belt (cut by fire/rescue)

According to the vehicle manufacturer, the ETD system is designed to activate:

- in order to remove slack from the belts.
- during a front or rear-end impact that exceeds the preset severity level.
- when the restraints are operational as indicated by the SRS indicator lamp located in the instrument cluster.

The front row ETDs are designed to activate only if the belt latchplates are properly fastened. The second row ETDs will activate regardless of whether or not the latchplates are buckled at impact. The left front ETD activated, removing the slack from the driver's belt. The second row seat belts were equipped with buckle pretensioners that actuated during the crash. An exemplar vehicle was measured in order to obtain exact pretensioner retraction measurements. Both second row buckle pretensioners retracted 9.0 cm (3.5 in) from their original positions.

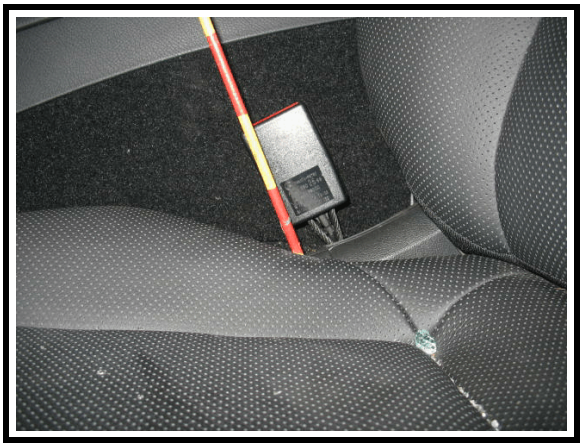

Figure 21. Driver's seat belt buckle

None of the seat belts had height adjusters. The driver's safety belt was configured with a sliding latch plate and an emergency locking retractor (ELR). The driver's seat belt webbing exhibited signs of occupant loading and was cut by fire rescue personnel. The right front safety belt had a sliding latch plate and a switchable ELR/Automatic Locking Retractor. The second row seat belts had sliding latch plates and switchable retractors.

Both second row seating positions were equipped with the lower anchor points that are part of this vehicle's Lower Anchors and Tethers for Children (LATCH) system. These seating positions were also equipped with child safety top tether strap anchor points, located on the back of the second row seat backs.

Figure 22. Second row seat belt buckle pretensioners activated

Supplemental Restraint Systems - 2006 Mercedes-Benz CLK500

The case vehicle was equipped with advanced occupant protection systems. The systems consist of the dual stage Certified Advanced 208-Compliant (CAC) front air bags with a front passenger Occupant Classification System (OCS). The OCS determines when and how the front right passenger air bag will deploy based on weight sensor readings from the front passenger seat. The less the front passenger weighs, the higher the vehicle deceleration rate is required for the second stage inflation of the air bag. The OCS will not deactivate the front passenger side impact air bag, the side curtains or the seat belt ETDs. According to the vehicle manufacturer, front right occupants "must sit properly belted in a nearly upright position with their back against the seat backrest and feet on the floor to be correctly classified" and "if the occupant's weight is transferred to another object in the vehicle", like an armrest, "the OCS may not be able to properly approximate the occupant's weight category". Part of the OCS includes a Passenger Air Bag Off indicator lamp, located in the center instrument panel. The indicator lamp will illuminate when the front right passenger air bag has been switched off by the OCS.

Figure 23. Passenger Air Bag Off indicator

This vehicle was also equipped with front row driver and passenger side impact air bags with occupant sensors, second row side impact air bags and right and left side curtains. The front and second row side impact air bags and the side curtains are designed to deploy independently of the front air bags. They are designed to deploy during an impact that exceeds the preset deployment threshold and only on the impacted side of the vehicle.

The front row side air bags were mounted in the door panels and were clearly identified with"SRS Airbag" labels. The second row side air bags were mounted in the side panels but no labels were found. There were "SRS Airbag" side curtain labels located on the left and right B pillars.

The driver's front air bag deployed as a result of the longitudinal deceleration that occurred during the collision between the case vehicle and the pole. The driver's air bag was mounted in the center of the steering wheel hub. The air bag module had a general H configuration. The left and right cover flap measurements were as follows: the outer flap edge heights were 10.0 cm (3.9 in), the upper flap edges were 5.0 cm (2.0 in) wide, the lower flap edges were 2.5 (1.0 in) wide, the top inner flap edge heights were 4.0 cm (1.6 in), and the bottom inner flap edge heights were 5.0 (2.0 in). The top cover flap was fairly circular in shape and measured 6.0 cm (2.4 in) wide by 7.0 cm (2.8 in) high. The bottom cover flap was fairly rectangular in shape and measured 6.0 cm (2.4 in) wide along the upper edge, 10.0 cm (3.9 in) wide along the lower edge and 5.0 cm (2.0 in) high along both sides. The air bag was circular in shape and measured 60.0 cm (23.6 in) high/wide in its deflated state. The maximum excursion measured 28.0 cm (11.0 in) from the module face. The distance between the module face and the front left seat back was 75.0 cm (29.5 in). The air bag had three internal tethers. There was one vent port located on the back of the bag at the 12 o'clock position, lower on the bag, closer to the module. Black cover flap streaks were found on the upper center portion and lower front and back sections of the bag. The deployed air bag was not damaged and showed no signs of occupant contact.

Figure 24. Deployed driver's front air bag

The front right passenger air bag was a top instrument mount. There was no right front passenger in the vehicle. This air bag was suppressed by the OCS and did not deploy. None of the four side impact air bags deployed during the crash.

The right side curtain deployed when the right side impacted the ground during the rollover event. The deployed right side curtain extended from the A pillar to the B pillar. In this vehicle, the B pillars are located behind the second row seat backs. There were small coverage gaps present at the right A and B pillars. The gap near the A pillar had a trapezoidal shape which measured 12.0 cm (4.7 in) vertically near the A pillar, 45.0 cm (17.7 in) diagonally along the right A pillar, 32.0 cm (12.6 in) vertically along the front aspect of the curtain, and 38.0 cm (15.0 in) horizontally along the belt line. The coverage gap closer to the B pillar was caused by the fact that all of the curtain material did not deploy from the roof cladding. The back lower corner did not fully deploy and was partially cinched in the B pillar. The gap was triangular in shape and measured 16.0 cm (6.3 in) vertically, 40.0 cm (15.7 in) horizontally along the belt line, and 34.0 cm (13.4 in) diagonally.

Figure 25. Deployed right side curtain - gap at A pillar

The side curtain was rectangular in shape and in its deflated state, measured 143.0 cm (56.3 in)

in length. The height of the right side curtain was 32.0 cm (12.6 in) at the front aspect and 25.0 cm (9.8 in) at the back. The curtain deployed from the right roof side rail, had two tethers, no vent ports, and showed no visible signs of occupant contact or damage.

Figure 26. Deployed right side curtain - gap at B pillar

Figure 27. Side curtain cinched at the right B pillar

Child Safety Seat - Evenflo Big Kid Booster Seat

At the time of the vehicle inspection, there was an unsecured booster seat located in the second row of the Mercedes-Benz CLK500. The booster seat was not in use at the time of the crash. The driver was the sole vehicle occupant.

Figure 28. Child safety seat - found in vehicle/not secured/not in use

The Evenflo Big Kid Booster seat was manufactured on July 5, 2004 with a model number of 3371482. According to the label affixed to the side of this particular seat, it was designed to be used by children weighing between 13.6 - 45.3 kg (30.0 - 100.0 lb) and with a height up to 145.0 cm (57.0 in) tall.

The Evenflo Big Kid booster seat converts from a high-back booster to a no-back booster. There is a pull handle located on the back of the seat that is used to adjust the height and seat depth as a child grows. Some of the Evenflo Big Kid booster seat features include: 5-position height adjustments, a lap belt return and open-loop belt guides for easy installation, pivoting armrests for easy entry and seat belt buckling, two retractable cup holders with storage space, and a built-in head pillow and deep head supports.

Booster Seat Installation:

The Evenflo booster seat was found rearward facing in the second row center seating area and was not anchored to the vehicle. There is no seat or seat belt available in this location. The center drink holder, which folds into the second row seat back, was found pressing against the center of the child safety seat and left an indentation in the seat's padding. It was confirmed with the driver that this child safety seat was unoccupied and not in use at the time of the crash.

Figure 29. Evenflo child safety seat label information

Figure 30. Evenflo Big Kid booster seat as found (not secured/not in use during crash)

Occupant Demographics - 2006 Mercedes-Benz CLK500

	Driver
Age/Sex:	33/Male
Seated Position:	Front left
Seat Type:	Leather covered bucket seat with a folding back
Height:	183 cm (72 in)
Weight:	116 kg (255 lb)
Occupation:	Unknown
Pre-existing Medical Conditions:	Degenerative disk disease C5-C6, C6-C7 Degenerative disk disease L4-L5, L5-S1 History of bipolar II disorder
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Sitting upright, forward facing
Hand Position:	Left hand on steering wheel at the 11 o'clock position. Right hand on wheel in an unknown position.
Foot Position:	Left foot on floorboard. Right foot on foot control (specifics unknown).
Restraint Usage:	Manual 3-point lap and shoulder belt available - used.
Air bags:	Front air bag available - deployed Door mounted side air bag available - nondeployed Side curtain available - nondeployed

Occupant Injuries - 2006 Mercedes-Benz CLK500

Driver: Injuries obtained from this occupant's admission records, emergency department records, radiology records, post-ER medical records, and driver interview.

Injury	OIC Code	Injury Mechanism	Confidence Level
Sprain, left wrist	751420.1,2	Left door panel	Possible
Cervical spine strain	640278.1,6	Impact forces	Certain
Lumbar spine strain	640678.1,8	Impact forces	Certain
Bruising to chest	490402.1,4	Seat belt webbing	Certain
Bruising to abdomen	590402.1,0	Seat belt webbing	Certain

Pre-existing conditions:

Degenerative disk disease C5-C6, C6-C7

Degenerative disk disease L4-L5, L5-S1

History of bipolar II disorder

Occupant Kinematics - 2006 Mercedes-Benz CLK500

Driver Kinematics

This 33-year-old male driver was seated in an upright posture in the leather covered bucket seat and was restrained by the 3-point manual lap and shoulder belt. The seat was adjusted to between the middle and rearward most track position. The seat back was reclined 23 degrees from vertical and the seat bottom was positioned 7 degrees from horizontal.

Figure 31. Driver's seating area

Figure 32. Close-up - driver's seat belt webbing

As the Mercedes-Benz departed the roadway, the front of the case vehicle struck a sign post. This was a low delta V event and the driver likely remained within his general seating area. The Mercedes continued forward and traveled into a shallow ditch. The front right of the Mercedes impacted a large wooden utility pole, resulting in the deployment of the driver's front air bag and the actuation of the driver's seat belt Emergency Tensioning Device (ETD). This crash event caused the male driver to initiate a forward trajectory towards the 12 o'clock direction of force, loading his seat belt and possibly contacting the deploying front air bag with his face, although no visible occupant contact evidence was found on the bag. The driver reported during the interview that his seat belt held him very tightly in place, resulting in bruising to his chest and abdomen. The impact sheared the pole from its base, and the case vehicle rotated clockwise while continuing to travel in a westerly direction. The uneven terrain, vehicle speed and rotation caused the Mercedes-Benz to rollover to the left. As the vehicle rolled three quarter turns, the driver possibly contacted the left front door panel with his left arm, although there was no visible occupant contact evidence found. The driver sustained a sprain to his left arm and reported during the interview that he was still experiencing soreness in that extremity. The right side impact curtain deployed when the right side of the vehicle contacted the ground during the rollover event. There was no visible evidence of occupant contact to the side curtain. The driver was held within his general seating area due to the activated seat belt ETD.

According to police, the Mercedes-Benz came to final rest off the roadway, laying on its right side, facing southeast. The driver reported during the interview that his vehicle was on its roof at final rest, but the location of the fire/rescue vehicle extrication cuts indicate that the Mercedes-Benz was on its right side during the extrication.

Due to the actuated driver's seat belt ETD and the position of the case vehicle at final rest, the driver was trapped inside the vehicle and had to be removed by fire/rescue personnel. There were extrication cuts to the left A pillar, the windshield, and the roof. The driver's seat belt webbing was also cut by fire/rescue personnel. The driver was removed from the vehicle and was transported to an area hospital where he was treated and released. He sustained bruises to his chest and abdomen, strains to his cervical and lumbar spine and a sprain to his left arm.

Attachment 1. Scene Diagram