

Child Safety Seat Investigation
Dynamic Science, Inc. / Case Number: DS08001
1985 Mercedes-Benz 190E
California
January 2008

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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.

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16. Abstract <p>This on-site investigation focused on a child safety seat that was positioned in the left rear seat position in a 1985 Mercedes-Benz 190E. The Mercedes was being driven by a restrained 33-year-old female and a 3-year-old female was seated in the second row left position in a child safety seat. The Mercedes was traveling northbound at a witness reported speed of 72 km/h (45 mph) and was weaving through slower moving traffic. The other vehicle in this crash was a 2003 Honda Odyssey minivan. There were three occupants in this vehicle. The Odyssey was stopped at the intersection and was facing north. As the Mercedes approached the intersection, the driver lost control of her vehicle. The left side of the Mercedes struck the right rear of the Odyssey. The Mercedes continued past the Odyssey through the intersection, over the northeast corner of the intersection, and struck several off-road objects. The driver of the Mercedes sustained severe injuries according to the police report. She was transported to a local hospital. She was later arrested for driving under the influence of alcohol. The 3-year-old female left rear passenger sustained facial lacerations, a right globe fracture, a pulmonary contusion, displaced rib fractures, and bilateral hip contusions. She was transported by air to an area trauma center where she was hospitalized for five days. The occupants of the Odyssey reported minor injuries. The Mercedes was towed from the scene due to damage and was placed on a police hold.</p>					
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BACKGROUND

This on-site investigation focused on a Child Safety Seat (CSS) that was positioned in the left rear seat position in a 1985 Mercedes-Benz 190E (**Figure 1**). The Mercedes was being driven by a restrained 33-year-old female and a 3-year-old female was seated in the second row left position in the CSS. The Mercedes was traveling northbound at a witness reported speed of 72 km/h (45 mph) and was weaving through slower moving traffic. The other vehicle in this crash was a 2003 Honda Odyssey minivan. There were three occupants in the vehicle. The Odyssey was stopped at an intersection and was facing north. As the Mercedes neared the intersection, the driver lost control of her vehicle. The left side of the Mercedes struck the right rear of the Odyssey. The Mercedes continued past the Odyssey through the intersection, over the northeast corner of the intersection, and struck several off-road objects. The driver of the Mercedes sustained severe injuries according to the police report. She was transported to a local hospital. She was later arrested for driving under the influence alcohol. The 3-year-old female left rear passenger sustained facial lacerations, a right globe rupture, a pulmonary contusion, displaced rib fractures, and bilateral hip contusions. She was transported by air to an area trauma center where she was hospitalized for five days. The occupants of the Odyssey reported minor injuries. The Mercedes was towed from the scene due to damage and was placed on a police hold.



Figure 1. 1985 Mercedes-Benz 190E

This CSS investigation was initiated in response to an online news article which reported a 3-year-old child was seriously injured in a two-vehicle crash. On January 14, 2008 DSI located the case vehicle and child seat and obtained permission for the inspections. DSI was assigned the case on January 15, 2008. Field work was completed on January 16, 2008. The investigating police officers were present during the vehicle and CSS inspections.

SUMMARY

Crash Site

This two-vehicle crash occurred in the approach to a four-leg intersection (**Figure 2**). At the time of crash, there were no adverse weather conditions and the asphalt roadway was dry. The curved north/south roadway was configured with two lanes in each direction that were separated by a raised median. The northbound travel lanes were separated by raised pavement markers. The intersection was controlled by a tri-color traffic signal. The posted speed limit was 72 km/h (45 mph).



Figure 2. Approach to area of impact (North)

Pre Crash

The 1985 Mercedes-Benz 190E was traveling northbound at a witness reported speed of 72 km/h (45 mph) and was weaving through slower moving traffic. The other vehicle in this crash was a 2003 Honda Odyssey minivan. The Odyssey was stopped at the intersection and was facing north. As the Mercedes neared the intersection, the driver lost control of her vehicle.

Crash

The left side of the Mercedes struck the right rear of the Odyssey (Event 1) (**Figure 3**). The impact severity was moderate. The Missing Vehicle algorithm of the WinSmash program computed a total delta V of 25 km/h (15.5 mph), based on the Mercedes' left side crush profile. The longitudinal and lateral components were -23.5 km/h (-14.6 mph) and 8.6 km/h (5.3 mph), respectively. The Odyssey was pushed forward and to the left. The Mercedes initiated a slight counterclockwise rotation as the vehicle continued past the Odyssey. The driver of the Mercedes steered to the right and the vehicle traveled through the intersection in a northeast direction. The Mercedes traveled over the northeast corner of the intersection (**Figure 4**) and struck several off-road objects. There were at least six objects contacted: a sign pole (Event 2), a traffic pole (Event 3), a fence (Event 4), a curb (Event 5), another curb (Event 6) and a tree/bush (Event 7).

Post Crash

The Honda Odyssey came to rest facing northwest in the south leg of the intersection. The Mercedes came to rest facing north in the northeast corner of the intersection. A witness was the first to respond to the crash and stated that the driver of the Mercedes was unconscious and the rear seat occupant was covered in blood and was crying. Both occupants remained in their respective seating locations until extricated by the fire department.

The driver of the Mercedes sustained serious injuries and was transported to a local hospital. She was later arrested for driving under the influence of alcohol. The 3-year-old female sustained severe face and chest injuries. She was transported by air to an area trauma center where she was hospitalized for five days. The occupants of the Odyssey reported minor injuries. The Mercedes was towed from the scene due to damage and was placed on a police hold.



Figure 3. Area of impact with Honda Odyssey



Figure 4. Area of impact with curb, fence, and pole

VEHICLE DATA - 1985 Mercedes-Benz 190E

The 1985 Mercedes-Benz 190E was identified by the Vehicle Identification Number (VIN): WDBDA24C1FFxxxxxx. The vehicle odometer was 171,197 (106,377 miles). The Mercedes was a four-door sedan that was equipped a 2.3 liter, 4-cylinder engine, power steering, an automatic transmission, and rear wheel drive. The Mercedes was equipped with Michelin X Radial P185/70R14 tires. The tire manufacturer's recommended maximum tire pressure was 303 kPa (44 psi). The vehicle manufacturer's recommended tire pressure was not known because the tire label was not visible due to a jammed door. The specific tire information was as follows:

Position	Measured Pressure	Measured Tread Depth	Restricted	Damage
LF	Flat	4 mm (5/32 in)	Yes	None
LR	Flat	4 mm (5/32 in)	Yes	Tire debanded, puncture in sidewall
RR	Flat	2 mm (3/32 in)	No	Tire debanded
RF	Flat	5 mm (6/32 in)	Yes	Tire debanded

The seating in the Mercedes was configured with front bucket seats with adjustable head restraints and a rear bench seat. The driver seat was located in the full rearward track position. The seat back was at a 22 degree angle from the vertical and the seat cushion was at a 6 degree angle from the horizontal. The rear bench seat back was at a 23 degree angle from the vertical and the seat cushion was at a 14 degree angle from the horizontal.

Vehicle Damage

Exterior Damage -1985 Mercedes-Benz 190E

The 1985 Mercedes-Benz sustained moderate left side damage as a result of the impact with the Honda Odyssey (**Figure 5**). The direct damage began 60 cm (23.6 in) aft of the left rear axle and extended 297 cm (116.9in) forward along the left side plane. The maximum lateral crush was located at C2 and measured 25 cm (9.8 in). There was direct contact to the driver's door, the left rear door, the upper C pillar, and the left rear quarter panel. The driver's door and the left rear door were jammed shut. The door was pulled away from the B-pillar which formed an open gap that measured 20 cm (7.9 in) wide by 42 cm (16.5 in) high at the top and 15 cm (5.9 in) wide by 35 cm (13.8 in) high at the bottom. The base of the C-



Figure 5. Left side damage

pillar was pulled away from the door which formed a gap at the bottom that measured 12 cm (4.7 in) wide by 14 cm (5.5 in) high. The anchorage for the second row left seat belt was exposed at this location. Six crush measurements were documented at the mid-door level as follows: C1 = 8 cm (3.1 in), C2 = 25 cm (9.8 in), C3 = 16 cm (6.3 in), C4 = 8 cm (3.1 in), C5 = 4 cm (1.6 in), C6 = 0 cm. The Collision Deformation Classification (CDC) for the impact with the Honda Odyssey was 11LZAW3.



Figure 6. Frontal damage

The Mercedes sustained front end damage from the impact with a metal pole, the tree and the fence. The impacts could not be separated and a single CDC of 12FDEW1 was assigned to describe the damage (**Figures 6-7**). Six crush measurements were documented at the bumper level as follows: C1 = 0 cm, C2 = 5 cm (1.9 in), C3 = 11 cm (4.3 in), C4 = 11 cm (4.3 in), C5 = 4 cm (1.6 in), C6 = 0 cm.



Figure 7. Front and left side damage

The Mercedes sustained left side damage from a second metal pole (Event 3). A CDC of 12LFES1 was assigned to describe the damage.

Both front wheels were damaged from contact with the curb. CDCs of 12FRNW3 and 12FLNW3 were assigned to the two impacts.

Interior Damage -1985 Mercedes-Benz 190E

The Mercedes sustained moderate interior damage as a result of passenger compartment intrusion. The left side doors, the B-pillar, the C-pillar, and the sill sustained lateral intrusion. The rear bench seat back was displaced longitudinally (**Figures 8-9**). The specific passenger compartment intrusions were documented as follows:



Figure 8. Driver's seated position

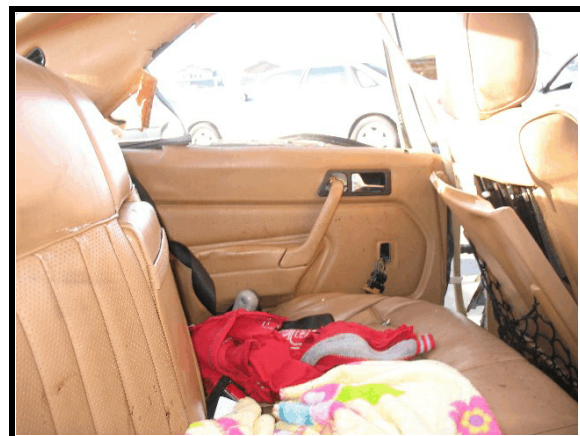


Figure 9. Second row left position

Position	Intruded Component	Magnitude of Intrusion	Direction
RR	Seat back	24 cm (9.4 in)	Longitudinal
MR	Seat back	19 cm (7.5 in)	Longitudinal
LR	Seat back	13 cm (5.1 in)	Longitudinal
LR	Door	11 cm (4.3 in)	Lateral
LR	C pillar	10 cm (3.9 in)	Lateral
LR	Sill	9 cm (3.5 in)	Lateral
LF	B pillar	9 cm (3.5 in)	Lateral
LF	Door	3 cm (1.2 in)	Lateral
LF	Sill	2 cm (0.8 in)	Lateral

Manual Restraints -1985 Mercedes-Benz

The Mercedes was configured with a 3-point manual lap and shoulder belts for the outboard seating positions and a lap belt for the second row middle seat position. Both front seat safety belts were equipped with retractor pretensioners. The driver's safety belt was locked in the used position as a result of pretensioner actuation. The front right safety belt was locked in the stowed position as a result of pretensioner actuation. The driver's safety belt was configured with a sliding latch plate.

The rear left safety belt was configured with a sliding latch plate and an Emergency Locking Retractor. The rear left safety belt was used to secure a child safety seat. The seat belt anchorage was exposed during the crash but the belt was not damaged (**Figure 10**). There was a 48 cm (18.9 in) area of scuffing located on the seat belt webbing. The left rear latch plate was cracked (**Figure 11**), presumably due to loading.



Figure 10. Second row left seat belt anchorage

Child Safety Seat

A Graco TurboBooster booster CSS was positioned in the left rear seat of the Mercedes (Figures 12-13). The model number was 8498 KAY and the date of manufacture was March 1, 2007. The seat was designed with adjustable arm rests and seat belt guides. It was not known if the vehicle safety belt was routed through the seat belt guide. The seat was designed to be used with or without the detachable back support. The back support was used in this crash. The recommended use of the seat with the back support in place was follows:

This CSS was designed to be used with children between the ages of 3 and 10, who weigh between 13.6-45 kg (30-100 lbs), and whose height is between 101-145 cm (38-57 in). The involved child was of the appropriate age, but her height and weight is not known.

The CSS was damaged during the crash. At the time of the inspection, the back support was no longer attached to the seat bottom. The left arm rest was dislodged and came off the seat. The seat back exhibited signs of crazing due to compression from the left rear door (Figure 14).



Figure 11. Cracked latch plate



Figure 12. Graco TurboBooster CSS



Figure 13. Left side view of booster seat



Figure 14. Cracking to left seat back

OCCUPANT DEMOGRAPHICS - 1985 Mercedes-Benz 190E

	Driver	Second Row Left Occupant
Age/Sex:	33/Female	3/Female
Seated Position:	Front row left	Second row left
Seat Type:	Bucket	Bench
Height:	168 cm (66 in)	Unknown
Weight:	61 kg (135 lbs)	Unknown
Alcohol/Drug Involvement:	Alcohol. BAC not known.	None
Body Posture:	Unknown	Unknown
Hand Position:	Unknown	Unknown
Foot Position:	Unknown	Unknown
Restraint Usage:	Lap and shoulder belt used	Lap and shoulder belt used with child safety seat

OCCUPANT KINEMATICS

Driver Kinematics

The female driver was seated in an unknown posture and was restrained by the 3-point manual lap and shoulder belt. The seat track was positioned to the rear most track position at the time of the vehicle inspection, and was likely more forward at the time of the crash. At impact with the Odyssey, the seat belt pretensioners actuated. The female driver initiated a forward and slightly lateral trajectory to the left. She loaded the lap and shoulder belt. The left side of her body likely contacted the interior portion of the driver's door. The vehicle continued forward and contacted a number of roadside objects. These impacts were relatively minor in nature. The driver likely pitched forward to some degree but was held in place by the lap and shoulder belt. The police indicated that the driver had sustained "A" type severe injuries, but the nature of and extent of those injuries are not known. She was transported to a local hospital for treatment and was later arrested for driving under the influence of alcohol.

Second Row Left Occupant Kinematics

The 3-year-old female child was seated in the CSS and was restrained by the vehicle's 3-point manual lap and shoulder belt. It is not known if the shoulder webbing was positioned correctly. The CSS was positioned in the second row left position. At impact with the Odyssey, the child and the CSS initiated a forward and slightly lateral trajectory to the left. The child loaded the lap portion of the seat belt, causing bilateral hip contusions. The left door intruded into the vehicle and the child's face probably came into contact with the glass and possibly the exterior of the other vehicle, causing the eye and facial lacerations. The CSS engaged the intruding left rear door. The arm rest was broken off and the seat back was deformed and became separated from the seat bottom. The left side of the child likely engaged the CSS interior shell which was reinforced by the door, causing left side rib fractures and a pulmonary contusion. The vehicle continued forward and contacted a number of roadside objects. These impacts were low delta V events and were relatively minor in nature. The second row left occupant likely pitched forward to some degree but was held in place by the lap and shoulder belt. She was transported by air to an area trauma center where she was hospitalized.

OCCUPANT INJURIES - 1985 Mercedes-Benz 190E

Driver: Police reported "A" type severe injuries.

Second Row Left Occupant: Injuries obtained from ER, Radiological, Operative and Discharge Reports.

<u>Injury</u>	<u>OIC Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Sclera laceration, involving globe, rupture, right	241202.2,1	Side window glass	Probable
Laceration, major, forehead	290604.2,7	Side window glass	Probable
Laceration, minor, forehead	290602.1,7	Side window glass	Probable
Abrasion, forehead	290202.2,7	Side window glass	Probable
Laceration, minor, nose	290602.1,4	Side window glass	Probable
Bilateral hip contusions	890402.1,3	Seat belt webbing	Certain
Fractures, 5 th and 7 th rib, minimally displaced	450250.3,2	Door	Certain
Pulmonary contusion	441402.3,2	Door	Certain

Attachment 1. Scene Diagram

