

On-scene Investigation / Vehicle to Vehicle  
Dynamic Science, Inc. / Case Number: DS00015  
1999 Porsche Boxster  
California  
May 2000

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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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**Technical Report Documentation Page**

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16. Abstract  This single vehicle crash occurred at 1125 hours in the month of May, 2000 in the state of California.  This crash occurred on an east/westbound roadway with a sweeping left hand curve traveling eastbound with an approximately two percent grade. This is a two lane roadway with one east and one westbound lane. The roadway is divided with a painted double yellow line. The roadway edges are unimproved and meet with a gravel edge that connects to a drainage culvert. At the tangent of the curve, the culvert on the north side of the roadway is approximately 30 cm (12 in.) lower than the roadway edge and is approximately 0.9 m (3 ft) north of the north edge of the roadway. Additionally, there is a 3-4.5 m (10-15 ft) asphalt paved bike/pedestrian pathway that adjoins the dirt and gravel drainage ditch. This is elevated approximately 0.6 m (2 ft) above the gravel/dirt ditch area. To the north of the paved bike/pedestrian pathway is a 0.6-1.2 m (2-4 ft) high retaining wall. The posted speed limit in the area is 56 km/h (35 mph). The roadway was dry and free of any defects.  The case vehicle, a 1999 Porsche Boxster two-door convertible driven by a restrained 55-year-old male (173 cm/68 in., 91 kg/200 lbs), was traveling eastbound on a curved two-way roadway. The front right seat was occupied by a restrained 31-year-old female (160 cm/63 in., 54 kg/120 lbs). The Porsche was equipped with a driver's frontal air bag, a passenger's frontal air bag, a driver's door mounted side air bag, and a passenger's door mounted side air bag.  The driver appears to have lost control in the curve, over-corrected to the left, and departed the roadway. The vehicle first struck the ditch—causing minor undercarriage damage. The driver corrected to the right and as the vehicle rotated it struck the retaining wall with the left side (10LZEW1). The case vehicle sustained a longitudinal delta v of -6.0 km/h and a lateral delta v of 10.5 km/h. The driver's door mounted side air bag deployed at this time. According to the driver, the deploying side air bag struck and fractured his left elbow.					
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**Dynamic Science, Inc.**  
**Accident Investigation**  
**Case Number: DS00015**

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**BACKGROUND:**

Description: This case is being initiated in response to a report of a side air bag induced injury. The NHTSA was notified of the incident by the driver of the case vehicle. DSI was notified on August 25, 2000. This case was conducted as a remote investigation.

Investigation Type: Remote

Crash Location: California

Crash Date: May, 2000

Notification Date: August 25, 2000

Field Work Completed: NA

**SUMMARY:**

This single vehicle crash occurred at 1125 hours in the month of May, 2000 in the state of California. This crash occurred on an east/westbound roadway with a sweeping left hand curve traveling eastbound with an approximately two percent grade. This is a two lane roadway with one east and one westbound lane. The roadway is divided with a painted double yellow line. The roadway edges are unimproved and meet with a gravel edge that connects to a drainage culvert. At the tangent of the curve, the culvert on the north side of the roadway is approximately 30 cm (12 in.) lower than the roadway edge and is approximately 0.9 m (3 ft) north of the north edge of the roadway. Additionally, there is a 3-4.5 m (10-15 ft) asphalt paved bike/pedestrian pathway that adjoins the dirt and gravel drainage ditch. This is elevated approximately 0.6 m (2 ft) above the gravel/dirt ditch area. To the north of the paved bike/pedestrian pathway is a 0.6-1.2 m (2-4 ft) high retaining wall. The posted speed limit in the area is 56 km/h (35 mph). The roadway was dry and free of any defects.



Figure 1. Left rear corner, case vehicle



Figure 2. Undercarriage damage

The case vehicle, a 1999 Porsche Boxster two-door convertible driven by a restrained 55-year-old male (173 cm/68 in., 91 kg/200 lbs), was traveling eastbound on a curved two-way roadway. The front right seat was occupied by a restrained 31-year-old female (160 cm/63 in., 54 kg/120 lbs). The Porsche was equipped with a driver's frontal air bag, a passenger's frontal air bag, a driver's door mounted side air bag, and a passenger's door mounted side air bag. The driver's side air bag is contained behind a two-flap trapezoidally-shaped module cover. The side air bag sensors are located on the inner lower side members on the left and right side of the vehicle.

The driver appears to have lost control in the curve, over-corrected to the left, and departed the roadway. The vehicle first struck the ditch—causing minor undercarriage damage. The driver corrected to the right and as the vehicle rotated it struck the retaining wall with the left side (10LZEW1). The case vehicle sustained a longitudinal  $\Delta v$  of -6.0 km/h and a lateral  $\Delta v$  of 10.5 km/h. The driver's door mounted side air bag deployed at this time. According to the driver, the deploying side air bag struck and fractured his left elbow.



**Figure 3.** Exemplar view of driver's door mounted side air bag



**Figure 4.** Down view showing position of side air bag relative to driver's seated position



**Figure 5.** Driver's door mounted side air bag

Scene Diagram

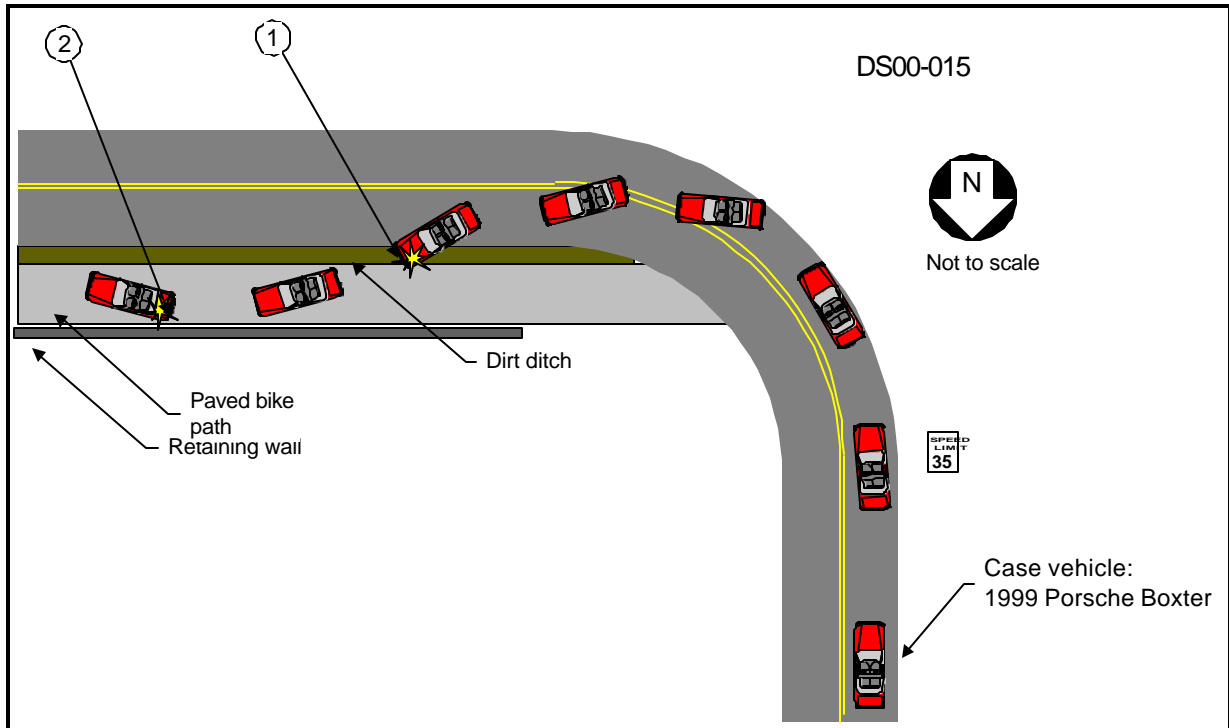


Figure 6. Scene diagram

## DETAILED INFORMATION

### Vehicles

#### Case vehicle

Description:	1999 Porsche Boxster convertible	
VIN:	Unknown	
Odometer:	Unknown	
Engine:	3.2 L 6 cylinder	
Reported Defects:	None noted	
Cargo:	None	
Damage Description:	Light scuffing to front spoiler. Moderate crush to left door extending to left rear bumper corner. Portion of plastic body shell broken away.	
CDC:	Impact 1: 12FDLW1 Impact 2: 10LZEW1	
Delta V (Impact 2) <sup>1</sup> :	Total	12.1 km/h (7.5 mph)
	Longitudinal	-6.0 km/h (-3.8 mph)
	Latitudinal	10.5 km/h (6.5 mph)
	Energy	17,992 joules (13,273 ft-lbs)



**Figure 7.** Left rear corner, case vehicle



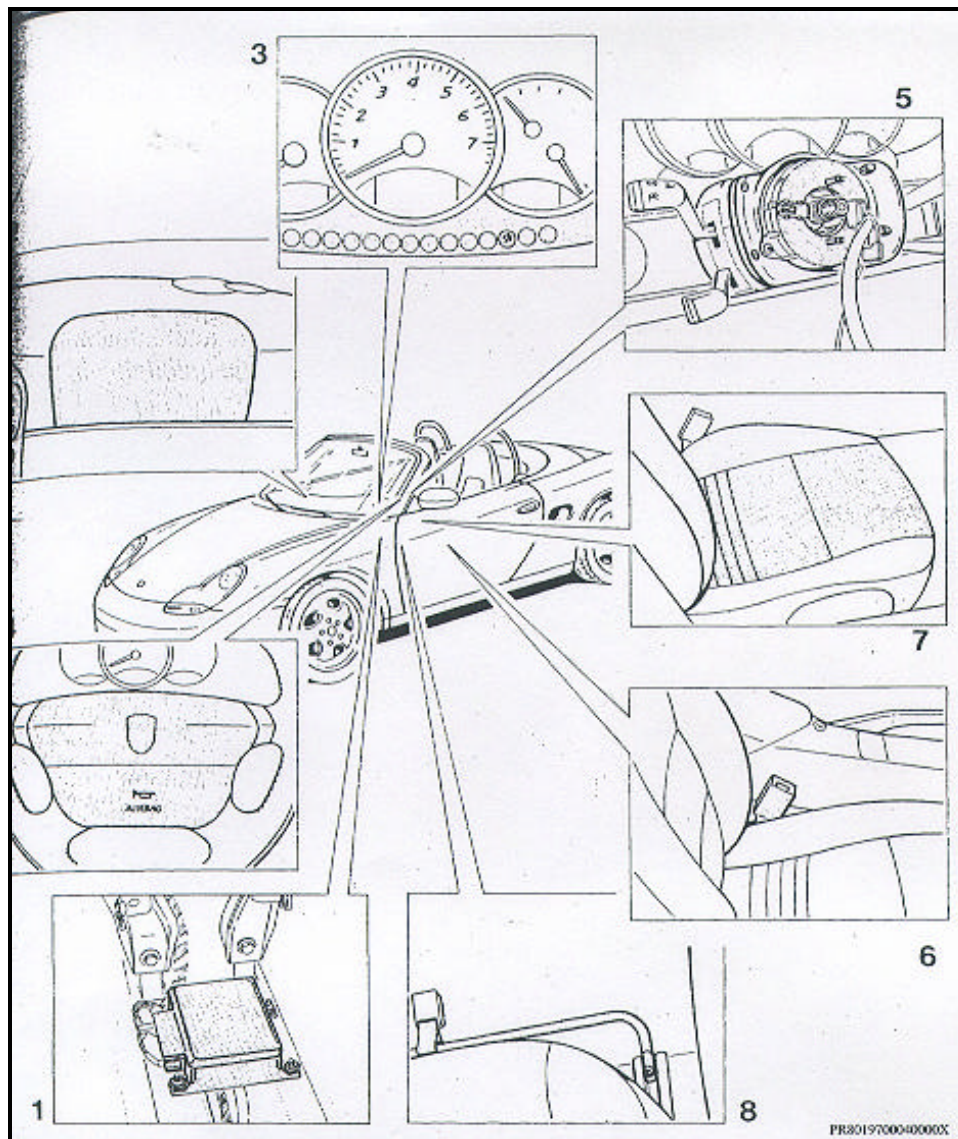
**Figure 8.** Close up of damage

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<sup>1</sup>Calculated using WinSmash, CDC only, with adjustment for damage length



The Porsche was equipped with a driver's frontal air bag, a passenger's frontal air bag, a driver's door mounted side air bag, and a passenger's door mounted side air bag. The driver's side air bag is contained behind a two-flap trapezoidally-shaped module cover. The side air bag sensors are located on the inner lower side members on the left and right side of the vehicle.



**Figure 9.** SRS component locations (1=Control Unit, 2=Passenger's Air Bag Module, 3=SRS Warning Lamp, 4=Driver's Air Bag Module, 5=Side Air Bags, 6=Contact Unit, 7=Side Air Bag Sensor, 8=Belt Buckle)

**Occupants**

<u>Case vehicle</u>	Occupant 1	Occupant 2
Age/Sex:	55/Male	31/Female
Seated Position:	Front left	Front right
Seat Type:	Bucket	Bucket
Height:	173 cm/68 in.	160 cm/63 in.
Weight:	91 kg/200 lbs.	54 kg/120 lbs.
Occupation:	Unknown	Unknown
Pre-existing Medical Condition:	None noted	None noted
Alcohol/Drug Involvement:	None	None
Driving Experience:	>30 years	NA
Body Posture:	Normal, upright. Leaning to left at time of Impact 2.	Normal, upright. Leaning to left at time of Impact 2.
Hand Position:	Both hands on wheel. Driver turning to right. Left hand higher than right.	NA
Foot Position:	Right foot on brake.	Unknown
Restraint Usage:	Lap and shoulder belts used	Lap and shoulder belts used
Air bag:	Steering wheel mounted air bag (not deployed). Door mounted side air bag (deployed).	Instrument panel mounted air bag (not deployed). Door mounted side air bag (not deployed).

**Injuries and Injury Mechanisms**

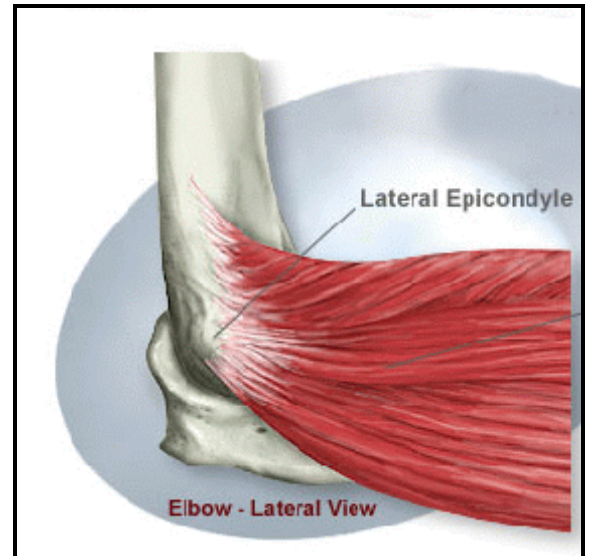
## Case vehicle

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Avulsion fracture to left lateral epicondyle	752602.2,2	812.42	Door mounted side air bag
	Left chest wall contusion	490402.1,2	922.1	Door mounted side air bag
	Chest abrasion	490202.1,2	911.0	Seat belt
RF Occupant:	Not injured			

## Occupant Kinematics

The driver and front right occupant were able to exit the vehicle on their own. The driver sustained an acute avulsion fracture to left lateral epicondyle (humerus), an abrasion to the left abdomen, and seat belt type abrasions. He was transported from the scene by ground ambulance to a local hospital where he was treated and released. The front right occupant was not injured.

The driver and front right occupant were seated in a normal, upright position. They were both wearing the available lap and shoulder belts. As the driver entered the curve and corrected to the left, both occupants would have pitched somewhat to the right. As the vehicle crossed the roadway and struck the ditch it does not appear that there was substantial movement by either occupant. Prior to striking the wall, the driver corrected to the right, pitching both occupants to the left. Both of the driver's hands were on the steering wheel and he was attempting to turn to the right. It is likely that the right hand was above the left—moving the left elbow into a position very close to the side air bag. At impact with the wall, the driver's door mounted side air bag deployed and came into contact with the driver's left elbow—causing the lateral epicondyle fracture. The side air bag also struck the left side of the driver's chest—causing a minor contusion.



**Figure 10.** Lateral epicondyle fracture