On-Scene / Vehicle to Vehicle
Dynamic Science, Inc. / Case Number: DS97016
1995 Jeep Grand Cherokee Limited
California
July/1997

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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

This collision occurred in California in July, 1997 at 1555 hours. This was a two vehicle, oblique angle type collision. Vehicle 1, a 1995 Jeep Grand Cherokee driven by a 45-year-old male, was traveling westbound in the far left lane at a driver stated speed of 72 km/h (45 mph). Vehicle 2, a 1994 Buick Regal driven by a 78-year-old male, was exiting a private driveway heading south and attempting to turn left and head east. There was an additional occupant in the front right seat of Vehicle 2, a 78-year-old female. A witness stated that there was a non-contact vehicle traveling in the far right lane that had stopped for Vehicle 2 and allow it to turn left. Vehicle 2 pulled out of the driveway and attempted the left turn, directly in front of Vehicle 1. The driver of Vehicle 1 turned the steering wheel to the left and braked. The front right bumper corner of Vehicle 1 struck the left front side of Vehicle 2. On impact, Vehicle 1 "ramped" up across the front bumper and hood of Vehicle 2. Vehicle 1 then rolled over onto its left side about its longitudinal axis and onto its roof top. Vehicle 1 then rotated clockwise on its roof as it traveled in a westerly direction. Vehicle 1 came to final rest on its roof top across eastbound traffic lanes heading north-west. On impact, Vehicle 2 rotated clockwise and traveled in a south-westerly direction. Vehicle 2 rotated approximately 190 degrees and came to final rest straddling the eastbound shoulder and far right lane heading north. Vehicle 1 was equipped with a supplemental restraint system which consisted of a driver's air bag in the steering wheel hub, and a front right passenger air bag. On impact with Vehicle 2, the Delta-V forces were not of sufficient magnitude to exceed the threshold of the supplemental restraint system, and the air bags did not deploy. Vehicle 2 was equipped with a supplemental restraint system which consisted of a driver's air bag in the steering wheel hub. On impact with Vehicle 1, the Delta-V forces were of sufficient magnitude to exceed the threshold of the supplemental restraint system and the driver's air bag deployed. The longitudinal threshold for deployment of the air bags in Vehicle 1 is -25.75 (16.0 mph), as estimated by the NHTSA's Special Crash Investigation program. The computed longitudinal Delta V for Vehicle 1 was below the deployment threshold. Chrysler Corporation inspected Vehicle 1, and their investigator stated that they did an "Electronic DRB testing", and downloaded the fault codes which showed that the system was armed and operational and there were no malfunctions. In September, 1997 they reported the following to NHTSA: "*During our inspection of Grand Cherokee, the readings were taken from the ASDM. No diagnostic codes were recorded which indicates that the air bag was fully operable and had the vehicle experienced a longitudinal deceleration equivalent to a BEV above 16 mph, the air bag would have deployed.*"

17. Key Words	18. Distribution Statement
Air bag, non-deployment, collision	

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

Dynamic Science, Inc.
Accident Investigation
Case Number: DS97016

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BACKGROUND:

Description:	This case was initiated in response to a report of a non-deployment of the air bag in Vehicle 1.
Investigation Type:	On-Scene
Crash Location:	California
Crash Date:	July, 1997
Notification Date:	July 30, 1997
Field Work Completed:	August, 1997

SUMMARY:

This collision occurred in California in July, 1997 at 1555 hours. This was a two vehicle, oblique angle type collision. At the scene of the collision, the roadway is a designated north/south state highway. Geographically however, the highway travels in an east/west direction. The highway consists of two lanes in each direction, with a left turn lane for both directions of travel. The surface is composed of asphalt that was dry, straight and level. The posted speed limit was 81 km/h (50 mph).

Vehicle 1, a 1995 Jeep Grand Cherokee driven by a 45-year-old male (173 cm/68 in, 76 kg/168 lbs), was traveling westbound in the far left lane at a driver stated speed of 72 km/h (45 mph). Vehicle 2, a 1994 Buick Regal driven by a 78-year-old male (178 cm/70 in, 82 kg/180 lbs), was exiting a private driveway heading south and attempting to turn left and head east. There was also an occupant in the front right seat of Vehicle 2, a 78-year-old female.

A witness stated that there was a non-contact vehicle traveling in the far right lane that had stopped for Vehicle 2 and allowed it to turn left. Vehicle 2 pulled out of the driveway and attempted the left turn, directly in front of Vehicle 1. The driver of Vehicle 1 turned the steering wheel to the left and braked. The front right bumper corner of Vehicle 1 struck the left front side of Vehicle 2.

On impact, Vehicle 1 “ramped” up across the front bumper and hood of Vehicle 2. Vehicle 1 then rolled over onto its left side about its longitudinal axis and onto its roof top. Vehicle 1 then rotated clockwise on its roof as it traveled in a westerly direction. Vehicle 1 came to final rest on its roof top across eastbound traffic lanes heading north-west.

On impact, Vehicle 2 rotated clockwise and traveled in a south-westerly direction. Vehicle 2 rotated approximately 190 degrees and came to final rest straddling the eastbound shoulder and far right lane heading north.

Vehicle 1 was equipped with a supplemental restraint system which consisted of a driver’s air bag in the steering wheel hub, and a front right passenger air bag. On impact with Vehicle 2, the Delta-V forces were not of sufficient magnitude to exceed the threshold of the supplemental

restraint system, and the air bags did not deploy.

Vehicle 2 was equipped with a supplemental restraint system which consisted of a driver's air bag in the steering wheel hub. On impact with Vehicle 1, the Delta-V forces were of sufficient magnitude to exceed the threshold of the supplemental restraint system and the driver's air bag deployed.

After impact, the driver of Vehicle 1 was upside down with the lap/shoulder belts holding him in place. He had problems with the lap/shoulder belt latch and could not get it to unlock. A bystander was able to unlock the latch, and the driver of Vehicle 1 crawled out of the vehicle. The driver's seat belt latch was examined and revealed no problems with the latching mechanism. He sustained injuries consisting of lacerations to his left forearm and hand that were caused by flying glass. He had pain to his left and right shoulders, sternum, chest, left knee, and his entire back. He later sought Emergency Room treatment, and was treated and released. He has obtained further medical treatment and physical therapy.

The driver of Vehicle 2 did not report any injuries. The front right occupant complained of pain to both hips, lower back, and all of the lower parts of her body. She was transported to a local hospital via ambulance.

Both vehicles were towed from the scene due to damage, and were subsequently totaled by the insurance companies.

The front right corner damage to Vehicle 1 was assigned a CDC of 01FREW1. Maximum crush measured a total of 18.5 cm (7.3 in) at C6. The damage to Vehicle 2 was assigned a CDC of 10LFEW4, and maximum crush measured 67.4 cm (26.5 in) at C6. Delta V was computed using the damage routine of WinSmash, and it produced the following results:

	Vehicle 1	Vehicle 2
Total:	26.3 km/h (16.3 mph)	25.9 km/h (16.1 mph)
Longitudinal:	-23.8 km/h (14.8 mph)	-18.3 km/h (11.4 mph)
Latitudinal:	-11.1 km/h (6.9 mph)	18.3 km/h (11.4 mph)

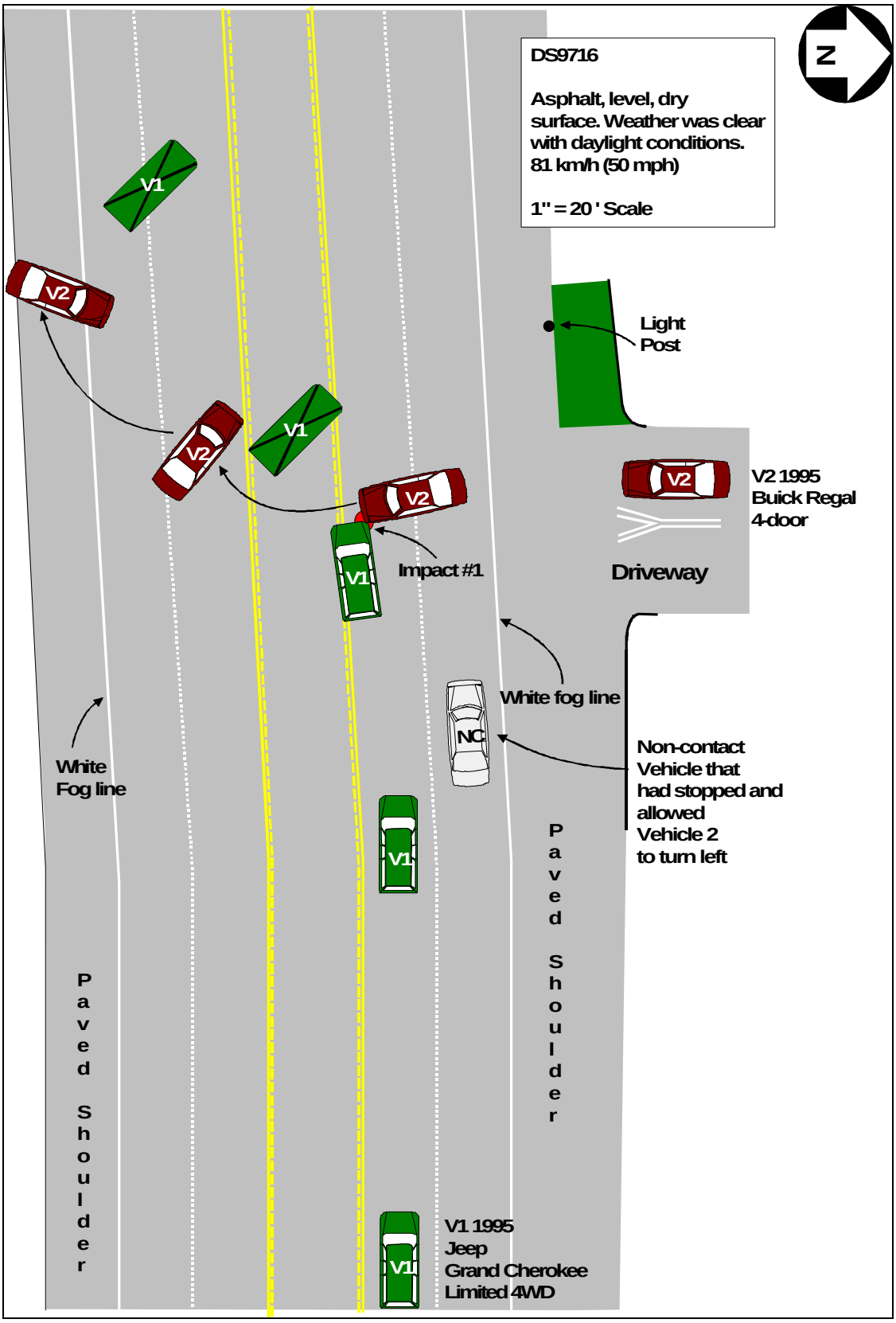
The results fit the collision model and appear reasonable. The longitudinal threshold for deployment of the air bags in Vehicle 1 is -25.75 (16.0 mph), as estimated by NHTSA's Special Crash Investigation program. The computed longitudinal Delta V for Vehicle 1 was below the deployment threshold.

Chrysler Corporation inspected Vehicle 1, and their investigator stated that they did an "Electronic DRB testing", and downloaded the fault codes which showed that the system was armed and operational and there were no malfunctions. In September, 1997 they reported the following to NHTSA:

> "*During our inspection of Grand Cherokee, the readings were taken from the ASDM. No diagnostic codes were recorded which indicates that the air bag was fully operable and had the vehicle experienced a longitudinal deceleration equivalent to a BEV above 16*

mph, the air bag would have deployed."

SCENE DIAGRAM



DETAILED INFORMATION

Vehicles

Vehicle 1

Description:	1995 Jeep Grand Cherokee Limited 4WD
VIN:	1J4GZ78Y6SCXXXXXX
Odometer:	61,731 km (38,359 miles)
Engine:	V8 / 5.2 L
Reported Defects:	None
Cargo:	None visible
Damage Description:	Major damage to the hood, grille area, right front Q-panel, roof top. Damage to front right, front left tires, and the rear left tire. Possible damage to the front right axle. The vehicle was totaled by the insurance company.
CDC Impact # 1 Vehicle 1 vs Vehicle 2:	01FREW1

Figure 1. Right front bumper corner damage to V1.

Impact Speed :	Unknown	
Delta V[1] :	Total	26.3 km/h (16.3 MPH)
	Longitudinal	-23.8 km/h (-14.8 MPH)

[1] Damage only algorithm of WinSmash.

Latitudinal	-11.1 km/h (-6.9 MPH)
Energy	13,866 joules (10,232 ft-lbs)

Vehicle 2

Description:	1994 Buick Regal 4-door
VIN:	2G4WB5518R1XXXXXX
Odometer:	46,367 km (28,812 miles)
Engine:	Unknown
Reported Defects:	None noted
Cargo:	None visible
Damage Description:	Major damage to the front right Q-panel, hood, front bumper, grille area, and the windshield. The vehicle was towed from the scene and later totaled by the insurance company.
CDC Impact # 1, Vehicle 1 vs Vehicle 2:	10LFEW4

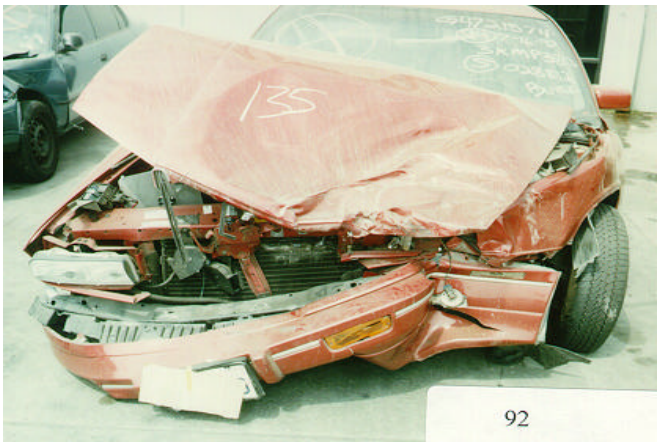


Figure 2. Exterior damage to V2.

Impact Speed:	Unknown	
Delta V[2] :	Total	25.9 km/h (16.1 MPH)
	Longitudinal	-18.3 km/h (-11.4 MPH)
	Latitudinal	18.3 km/h (11.4 MPH)
	Energy	100,790 joules (74,402 ft-lbs)

[2] Damage only algorithm of WinSmash.

Occupants

Vehicle 1	Occupant 1
Age/Sex:	45/Male
Seated Position:	Left front
Seat Type:	Bucket, with folding back
Height:	173 cm (68 in)
Weight:	76 kg (168 lbs)
Occupation:	Doctor
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	None
Driving Experience:	Unknown
Body Posture:	Normal, upright
Hand Position:	Both on steering wheel
Foot Position:	Left on floor, right on accelerator. At impact, the right foot on brake pedal.
Restraint Usage:	Lap and shoulder belts used
Supplemental Restraint System:	Driver's air bag mounted in the steering wheel hub, and did not deploy.

Occupants (cont.)

Vehicle 2	Occupant 1	Occupant 2
Age/Sex:	78/Male	78/Female
Seated Position:	Left front	Right front
Seat Type:	Bucket	Bucket
Height:	178 cm (70 cm)	Unknown
Weight:	82 kg (180 lbs)	Unknown
Occupation:	Retired	Retired
Pre-existing Medical Condition:	Unknown	Unknown
Alcohol/Drug Involvement:	Had been drinking and under the influence. Arrested at the scene for DUI.	NA
Driving Experience:	Unknown	NA
Body Posture:	Normal, Upright	Unknown
Hand Position:	Presumably on steering wheel	NA
Foot Position:	Presumably the left on floor, right on accelerator	NA
Automatic Restraint/Usage:	Non-motorized automatic lap and shoulder belts, not used	Non-motorized automatic lap and shoulder belts, not used
Supplemental Restraint System:	Driver's air bag mounted in the steering wheel hub. Deployed on impact with Vehicle 1.	None

Injuries and Injury Mechanisms

Vehicle 1

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	Laceration right forearm	790600.1,2	881.00	Flying glass
	Laceration right hand	790600.1,2	881.00	Flying glass
	Unknown injury to back, driver unwilling to elaborate. Receiving medical treatment.			

Vehicle 2

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	Not injured			
Right front occupant:	Complaint of pain in both hips, lower back, and all lower part of her body. Non-codeable injuries per NASS protocol.			

Photo Index

Photo no.	Vehicle No.	Direction of Picture	Subject Matter
****The following photographs were taken by the police at the scene of the collision****			
01-04	1	---	Area of final rest position. Vehicle being towed.
05-10	2	---	Vehicle in the process of being towed from scene.
11	2	---	Looking back from the driveway Vehicle 2 exited and attempted left turn.
** **The following photograph were taken by the investigator ****			
12	1	West	Direction of travel towards impact area.
13	1	West	Area of impact with Vehicle 2.
14	1	West	Post impact direction of travel.
15-17	1	South-West	Area of final rest.
18	1	East	Opposite direction of travel.
19-20	2	South	Direction of travel towards impact with Vehicle 1.
21	2	South-East	Impact area.
22-25	2	South-West	Direction of travel towards final rest and final rest area.
26	2	North-East	Opposite direction of travel from impact area to final rest.
27	2	North	Opposite direction of travel.
28-30	1	North	Area of final rest .
31-66	1	—	Exterior damage to vehicle.
67-72	1	---	Driver’s seat, and lap and shoulder belt.
73-76	1	---	Driver’s air bag.
77-81	1	—	Roof header directly under driver’s area.
82-91	1	—	Interior of vehicle.
92-113	2	—	Exterior damage to vehicle.
115-129	2	—	Interior of vehicle.