

On-scene investigation, Vehicle v. Parked Vehicle
Dynamic Science, Inc. (DSI), Case Number (DS97027)
1998 Dodge Ram
California
December, 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.

Technical Report Documentation Page

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16. Abstract This collision occurred in California in December 1997 at 0020 hours. The crash took place on a five-lane, two-way, east/west oriented residential roadway. It was raining at the time of the collision. The roadway was dark, but the streetlights were on. On the right side of the roadway were two properly parked, unoccupied vehicles: a 1994 Nissan Sentra and a 1993 Acura sedan. The vehicles were situated at either end of a No Parking area associated with a fire hydrant. The vehicles were approximately 14 M (46 ft.) apart. The case vehicle, a 1998 Dodge Ram 1500 Club Cab 4 x 2 pickup driven by a 37-year-old male (180 cm / 71 in., 82 kg / 180 lbs.), was traveling westbound at an unknown rate of speed. It appears that the driver was not wearing the lap and shoulder belts at the time of the crash. This is based on a witness statement to that effect, as well as the knee injuries. This was a new vehicle which had been picked up on the day the crash. The driver of the case vehicle apparently drifted to the right, first striking the Nissan Sentra in a sideswipe configuration, and then rear-ending the Acura. The case vehicle sustained a longitudinal delta V of -26 km/h (-16 MPH) while impacting the Acura. According to the owner of the parked vehicles, the police believed that the first impact caused the air bag deployment. It is more likely that the second impact was the more severe and likely deployed the air bags in the case vehicle. The parked Acura was pushed forward and to the left so that it was blocking the travel lane. The case vehicle came to rest in the area formerly occupied by the parked Acura. The driver of the case vehicle sustained lacerations to his lower lip and abrasions to both knees. He also complained of pain to his right wrist. Witnesses approached Vehicle 1 after the impact and found the driver seated behind the steering wheel apparently in a daze. The witnesses approached the vehicle and found that the driver was unresponsive. They smelled the odor of an alcoholic beverage coming from the driver. They then called the police. By the time the police had arrived (approximately 12 minutes post-crash), they found the driver standing outside his vehicle. They determined that he had been drinking. The driver failed a field sobriety test and was subsequently arrested for DUI. He later underwent a breath test and the results were found to be .22/.23.					
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Dynamic Science, Inc.
Accident Investigation
Case Number: DS97027

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BACKGROUND:

Description: This case was initiated in response to a report of a depowered air bag deployment. . This case is being conducted as an on-scene investigation. NHTSA was notified by the NASS team.

Investigation Type: On-scene

Crash location: California

Crash Date: December 1997

Notification Date: December 12, 1997.

SUMMARY:

This collision occurred in California in December 1997 at 0020 hours. The crash took place on a five-lane, two-way, east/west oriented residential roadway. It was raining at the time of the collision. The roadway was dark, but the streetlights were on. On the right side of the roadway were two properly parked, unoccupied vehicles: a 1994 Nissan Sentra and a 1993 Acura sedan. The vehicles were situated at either end of a No Parking area associated with a fire hydrant. The vehicles were approximately 14 M (46 ft.) apart.

Vehicle 1, a 1998 Dodge Ram 1500 Club Cab 4 x 2 pickup driven by a 37-year-old male (180 cm / 71 in., 82 kg / 180 lbs.), was traveling westbound at an unknown rate of speed. It appears that the driver was not wearing the lap and shoulder belts at the time of the crash. This is based on a witness statement to that effect, as well as the knee injuries. This was a new vehicle which had been picked up on the day of the crash. The driver of Vehicle 1 apparently drifted to the right, first striking the Nissan Sentra in a sideswipe configuration, and then



Figure 1. Vehicle 1



Figure 2. Exemplar view of case vehicle

rear-ending the Acura. Vehicle 1 sustained a longitudinal delta V of -26 km/h (-16 MPH)¹ while impacting the Acura. According to the owner of the parked vehicles, the police believed that the first impact caused the air bag deployment. It is more likely that the second impact was the more severe and likely deployed the air bags in the case vehicle. The parked Acura was pushed forward and to the left so that it was blocking the travel lane. Vehicle 1 came to rest in the area formerly occupied by the parked Acura.

The driver of Vehicle 1 sustained lacerations to his lower lip and abrasions to both knees. He also complained of pain to his right wrist. Witnesses approached Vehicle 1 after the impact and found

the driver seated behind the steering wheel apparently in a daze. The witnesses approached the vehicle and found that the driver was unresponsive. They smelled the odor of an alcoholic beverage coming from the driver. They then called the police.



Figure 3. Parked vehicle 1, 1994 Nissan Sentra



Figure 4. Parked vehicle 1, 1994 Nissan Sentra (closeup)

¹Calculated using WinSmash. CDCs taken from photos.

By the time the police had arrived (approximately 12 minutes post-crash), they found the driver standing outside his vehicle. They determined that he had been drinking. The driver failed a field sobriety test and was subsequently arrested for DUI. He later underwent a breath test and the results were found to be .22/.23.

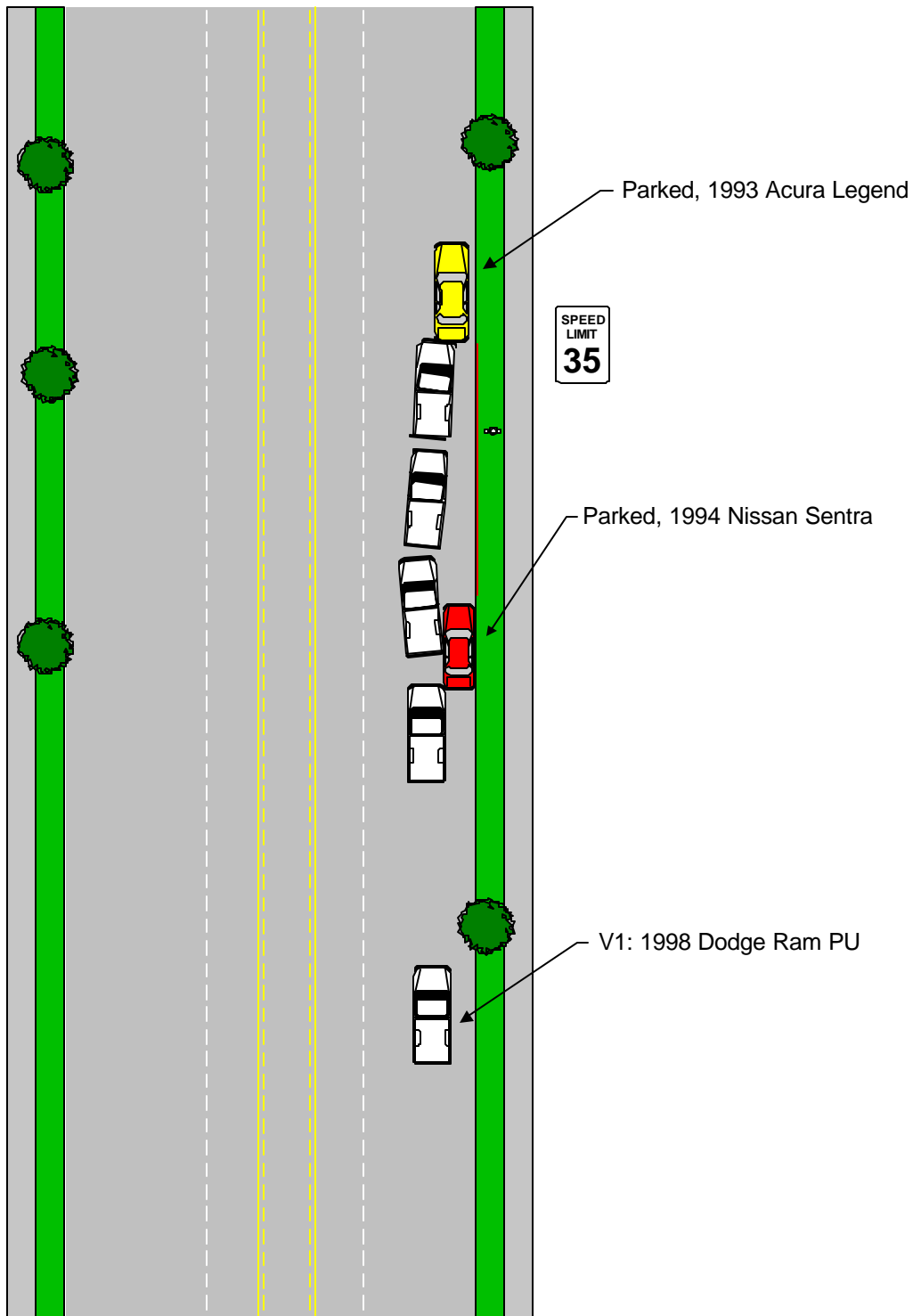


Figure 5. Parked vehicle 2, 1993 Acura Legend



Figure 6. Parked vehicle 2, 1993 Acura Legend

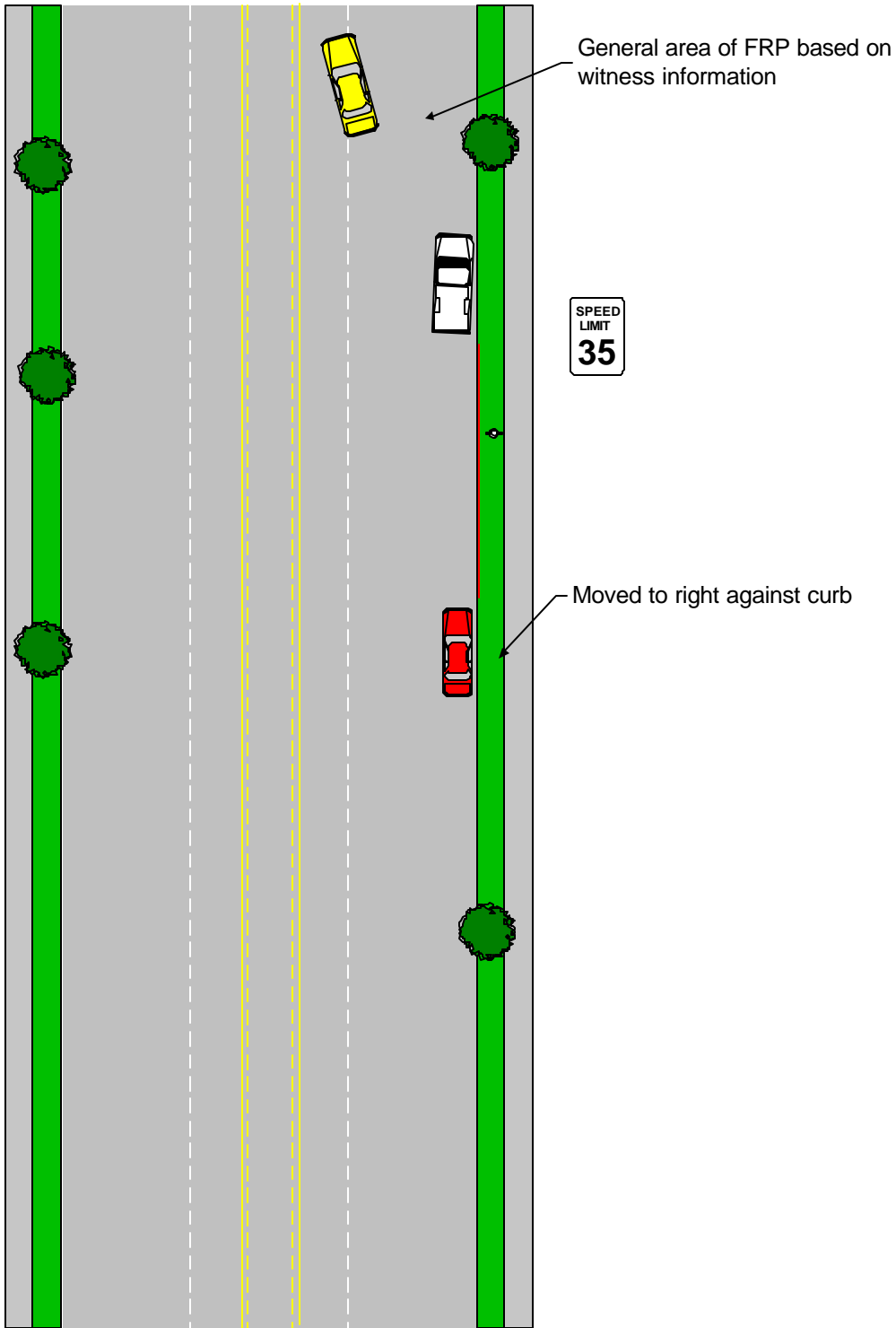
Scene Diagram



Case No.: DS9727

0 15' 0" 30' 0"

A scale bar showing 0, 15 feet, and 30 feet. Below the scale bar is a north arrow pointing to the right, with the letter 'N' inside a circle.



Case No.: DS9727

0 15' 0" 30' 0"

A scale bar showing 0, 15 feet, and 30 feet. Below the scale bar is a north arrow pointing to the right.

DETAILED INFORMATION**Vehicles**Vehicle 1

Description:	1998 Dodge Ram Club Cab 4 door pickup 4x2
VIN:	1B7HC13Z6WJXXXXXX
Odometer:	Unknown
Engine:	5.9 L 8 cyl
Reported Defects:	None
Cargo:	Unknown
Damage Description:	Moderate rearward crush to the front bumper and grille.
CDC - Impact 1:	Unknown
CDC - Impact 2:	12FDEW1

Travel/Impact Speed - Impact 2

54 km/h (33.6 mph)²

Delta V - Impact 2:

Total	26 km/h (16.1 mph)
Longitudinal	-26 km/h (-16.1 mph)
Latitudinal	0 km/h (0 mph)
Energy	70,267 joules (51,881 ft-lbs)



Figure 9. Exemplar view, case vehicle

2

Simple Speed from Skid - V1

Skid Distance = 18 feet

Coefficient of Friction = .7

Braking Efficiency = 1.00

$$S = \text{Sqr}(30 * D * f * n)$$

$$S = \text{Sqr}(30 * 18 * .7 * 1.00)$$

$$S = \text{Sqr}(378.00)$$

$$S = 19.44 \text{ mph} = 28.5 \text{ fps}$$

Simple Speed from Skid - V2

Skid Distance = 35 feet

Coefficient of Friction = .7

Braking Efficiency = .5

$$S = \text{Sqr}(30 * D * f * n)$$

$$S = \text{Sqr}(30 * 35 * .7 * .5)$$

$$S = \text{Sqr}(367.50)$$

$$S = 19.17 \text{ mph} = 28.1 \text{ fps}$$

Basic Conservation of Linear Momentum Equation

Pre Crash Velocity of Vehicle 2 = 0 fps

Post Crash Velocity of Vehicle 1 = 28.5 fps

Post Crash Velocity of Vehicle 2 = 28.1 fps

Weight of Vehicle 1 = 4664 lbs

Weight of Vehicle 2 = 3447 lbs

$$(W1 * V1) + (W2 * V2) = (W1 * V1f) + (W2 * V2f)$$

To solve for Velocity of Vehicle 1

$$V1 = ((W1 * V1f) + (W2 * V2f) - (W2 * V2)) / (W1)$$

$$V1 = ((4664 * 28.5) + (3447 * 28.1) - (3447 * 0)) / 4664$$

$$V1 = ((132924.00) + (96860.70) - (0.00)) / 4664$$

$$V1 = (229784.70) / 4664$$

$$V1 = 49.27 \text{ fps} = 33.61 \text{ mph} = 54 \text{ km/h}$$

Occupants

<u>Vehicle 1</u>	Occupant 1
Age/Sex:	37/Male
Seated Position:	Left front
Seat Type:	Bucket
Height:	180 cm (71 in.)
Weight:	82 kg (180 lbs.)
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	Yes
Driving Experience:	Unknown
Body Posture:	Unknown
Hand Position:	Unknown
Foot Position:	Unknown
Restraint Usage:	Lap and shoulder belt not used
Air Bag:	Driver and front passenger airbags were “Next Generation” depowered type air bags. A key operated switch to disable the front passenger air bag is standard on all Ram models. Police indicated that the driver’s air bag did deploy.

Injuries and Injury Mechanisms

Vehicle 1

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Laceration, lower lip	290600.1,8	873.43	Airbag
	Abrasion, left knee	8902202.1,1	916.0	IP
	Abrasion, right knee	8902202.1,2	916.0	IP

Occupant Kinematics

The driver of Vehicle 1 was seated upright in the left front bucket seat. The driver does not appear to have been wearing the available lap and shoulder belts. The driver had been drinking and may have lost consciousness briefly. Vehicle 1 deviated into the parking lane where the vehicle struck the first parked vehicle in a glancing sideswipe fashion. This appears to have caused the driver of Vehicle 1 to first steer away from this impact (to the left) and then to correct to the right causing his vehicle to fully engage the left rear portion of the second parked vehicle. During this impact it appears likely that the driver would have had both hands on the wheel. At impact, the driver went forward engaging the deploying air bag with his face and the lower instrument panel with both knees.