Remote Investigation, Vehicle v. Animal
Dynamic Science, Inc. (DSI), Case Number (DS97026)
1995 Ford Windstar GL 4x2 van
Colorado
October, 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 Colorado in October 1997 at 2003 hours. The case vehicle, a 1995 Ford Windstar GL 4x2 van driven by a restrained 67-year-old male (178 cm / 70 in., 95 kg / 210 lbs.), was traveling east in the second lane of a four-lane undivided roadway at a driver-reported speed of 38.6 km/h (24 MPH). The right front of the case vehicle was occupied by a properly restrained 74 year-old female (152 cm / 60 in., 50 kg / 110 lbs.). Both occupants were wearing metal framed glasses. As the driver of the case vehicle began to change lanes from left to right, a dog ran in front of his vehicle. The driver braked but struck the dog anyway. Approximately 6 M (20 ft.) of locked wheel skids were reported by investigating officers, giving the case vehicle a minimum travel speed of 32.9 km/h (20.5 MPH). According to the driver, both air bags deployed during the collision with the dog (a 52 kg / 115 lb. Rottweiler). Immediately after the collision, the driver first noticed the dog beginning to run away and then noticed that the right front occupant was unconscious. The right front occupant was transported from the scene and hospitalized. She sustained abrasions to the nose and chin, and a head injury with subdural bleeding. All the injuries have been attributed to the deploying air bag. The driver sustained abrasions to both inner arms from the deploying driver's side air bag.

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Dynamic Science, Inc.
Accident Investigation
Case Number: DS97026

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BACKGROUND:

Description:	This case was initiated in response to a report of an air bag related seriously injured right front passenger. The case is being conducted as a remote investigation. The NHTSA was notified by the vehicle owner via the Office of Safety Defects.
Investigation Type:	Remote
Crash location:	Colorado
Crash Date:	October 1997
Notification Date:	December 15, 1997

SUMMARY:

This collision occurred in Colorado in October 1997 at 2003 hours. Prior to the crash, the driver and his wife, the right occupant, had attended church and had gone out to dinner. They were on their way home. The case vehicle, a 1995 Ford Windstar GL 4x2 van driven by a restrained 67-year-old male (178 cm / 70 in., 95 kg / 210 lbs.), was traveling east in the second lane of a four-lane undivided roadway at a driver-reported speed of 38.6 km/h (24 mph). The driver has a distinct memory of seeing that speed on the digital display just prior to the crash. The case vehicle was equipped with a 5 mph bumper. The right front of Vehicle 1 was occupied by a properly restrained 74 year-old female (152 cm / 60 in., 50 kg / 110 lbs.). Both occupants were wearing metal framed glasses. As the driver of the case vehcle began to change lanes from left to right, a dog ran in front of his vehicle. The driver braked but struck the dog anyway.

Figure 1. Exterior view of exemplar vehicle

Figure 2. Right front bumper, case vehile

Approximately 6 m (20 ft.) of locked wheel skids were reported by investigating officers, giving the case vehicle a minimum travel speed of 32.9 km/h (20.5 mph). See Attachment 1. According to the driver, both air bags deployed during the collision with the dog (a 52 kg / 115 lb. Rottweiler). Assuming a coefficient of restitution of 0.01 and a closing velocity of 5.86 fps, Vehicle 1 sustained an estimated delta v of 6.2 km/h (3.9 mph). See Attachment 2. It appears likely that this crash was well below the deployment threshold and should not have occurred.

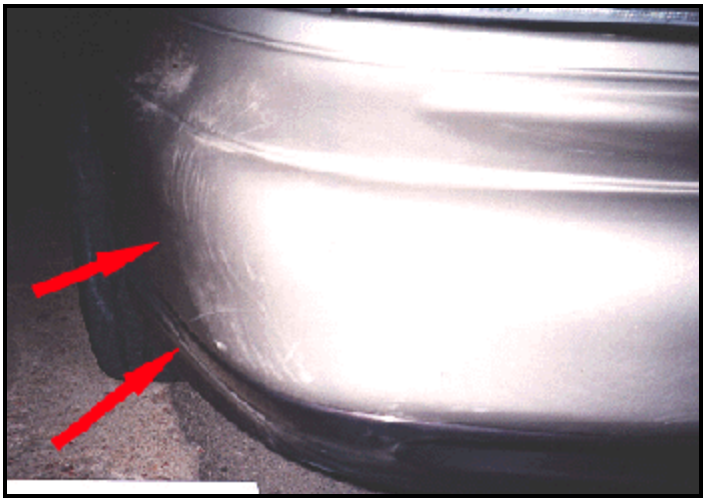


Figure 3. Right front bumper, case vehicle, closeup

Immediately after the collision, the driver first noticed the dog beginning to run away and then noticed that the right front occupant was unconscious. The driver was going to move his wife but was advised not to do so by the driver of a trailing vehicle. This driver informed the driver of Vehicle 1 that he had already contacted 911 via his car phone. Approximately 3 minutes passed prior to the arrival of medical aid.

The right front occupant was transported from the scene by ambulance. She sustained a closed head injury with cerebral contusion, abrasions to the nose and chin, and an abrasion/contusion to the wrist. All the injuries have been attributed to the deploying air bag. She was admitted and hospitalized for four days. After that time she was transferred to rehabilitation. She had lost some short-term memory, had trouble maintaining her balance, and was weak. A little over a month later she was re-hospitalized and underwent a subdural hygroma resection to reduce pressure on her brain. She was discharged six days later. A week after that time she was admitted into the ER due to a shortness of breath. She was diagnosed as having pneumonia. She was hospitalized for six days before again being released.

The following is a chronology of her hospital related events for this occupant.

Event	Days	Time
Crash	-	2003
Admitted	-	2018
ER registration	-	2026
CT Scan	-	2111
Admission	+1	----
CT scan comparison	+3	1511
Released to rehab	+4	----
Transfer from rehab to hospital	+41	1000
Date of discharge	+48	----
Admitted to ER	+53	----
Date of discharge	+58	-----

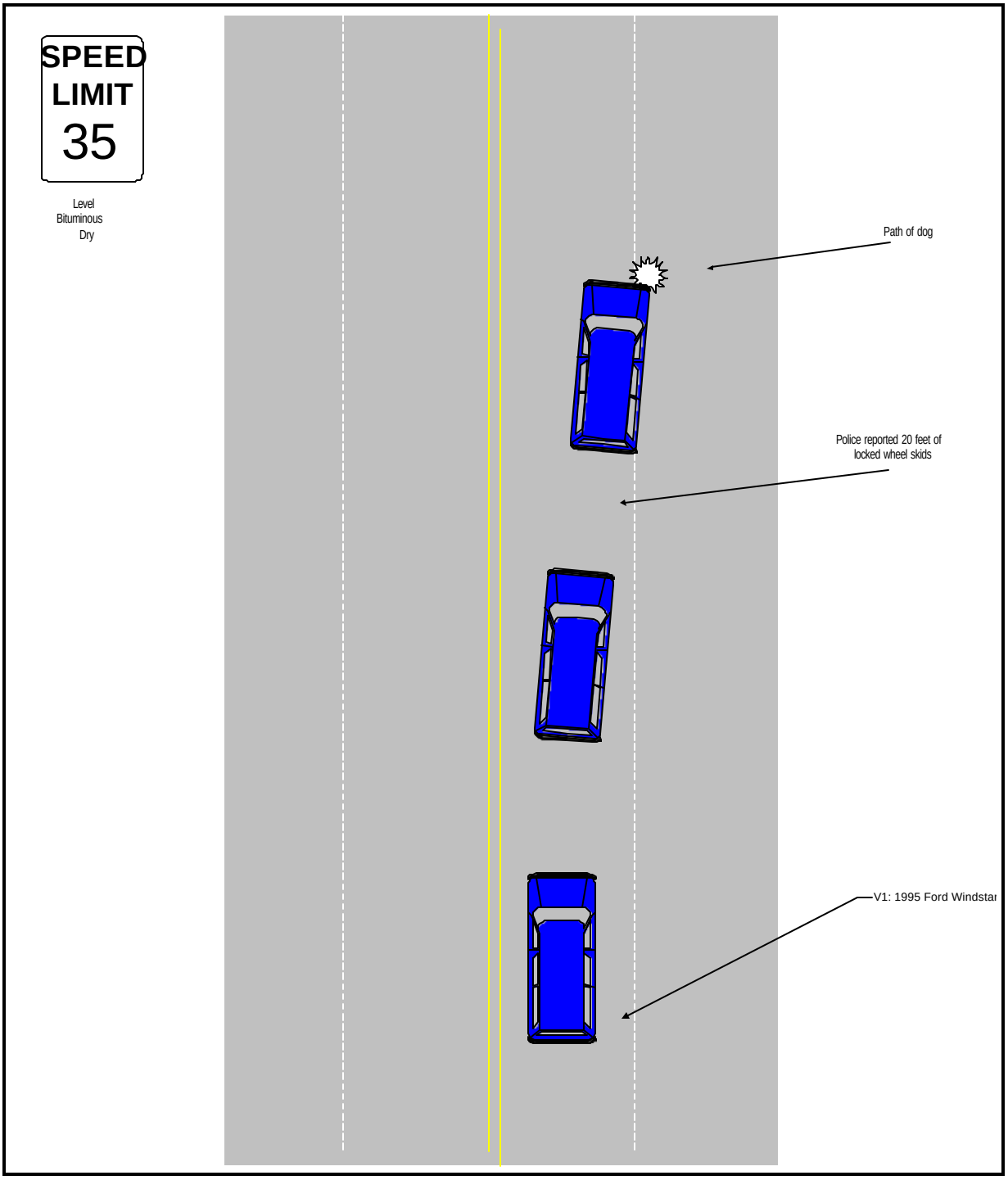
The glasses worn by the right front occupant were knocked off during the air bag deployment and were later recovered in the rear of the vehicle. The glass had been knocked out of the frame.

The driver sustained abrasions to both inner arms from the deploying driver's side air bag.

The dog was injured and was later taken to the Humane Society by the local animal control department.

Figure 4. Struck dog

Scene Diagram



DETAILED INFORMATION

Vehicles

Case vehicle

Description:	1995 Ford Windstar GL 4x2 van	
VIN:	2FMDA5146SBxxxxxx	
Odometer:	38,212 km (23,745 miles)	
Engine:	3.8 L EFI V-6	
Reported Defects:	None	
Cargo:	None	
Damage Description:	Scratches and fragments of hair were found on the right front bumper	
CDC:	12FREW1	
Travel Speed	32.9 km/h (20.5 mph)	
Delta V:	6.2 km/h (3.9 mph)	Estimated. Based on a coefficient of restitution of 0.01, and a closing velocity of 5.86 fps.

The vehicle was towed from the scene and has subsequently been repaired. Scratches and fragments of hair were found on the right front bumper. Both air bag modules were replaced, the front bumper was aligned, and the fascia was refinished. In addition, both rear window latches were replaced. According to the driver, both of these had somehow been damaged as a result of the crash. The nature of the damage is not known. In addition, the right front seat belt was replaced. According to body shop personnel, the seat belt was replaced solely to reassure the driver. Prior to its replacement, it was tested by body shop personnel and seemed to function correctly.

Vehicle 1 was equipped with dual air bags located in the center of the steering wheel and in the right side instrument panel. The air bags are triggered by two sensors; one is located at the center hood latch bracket, the other is located on the upper radiator support on the left hand side. The air bag diagnostic monitor is located on the floor pan on the left hand side of the console. The threshold for deployment was estimated to be between 16-23 km/h (10-14 mph).

Occupants

Vehicle 1	Occupant 1	Occupant 2
Age/Sex:	67/Male	74/Female
Seated Position:	Left front	Right front
Seat Type:	Bucket	Bucket
Height:	178 cm (70 in.)	152 cm (60 in.)
Weight:	95 kg (210 lbs.)	50 kg (110 lbs.)
Occupation:	Retired	Retired
Pre-existing Medical Condition:	Unknown	Hypertension and arthritis
Alcohol/Drug Involvement:	None	None
Driving Experience:	> 25 years	NA
Body Posture:	Normal, upright	Presumed to be normal, upright
Hand Position:	Right @ 1 o'clock, left @ 11 o'clock	Unknown
Foot Position:	Right foot on brake, left on floor	Unknown
Restraint Usage:	Lap and shoulder belt used properly–per driver	Lap and shoulder belt used properly–per driver
Air Bag:	Driver's side, steering mounted air bag. Deployed during collision.	Passenger side, instrument panel mounted air bag. Deployed during collision.

Injuries and Injury Mechanisms

Case vehicle

	INJURY	OIC CODE	ICD-9	SOURCE
Driver:	Abrasion to inner left arm	790202.1,2	913.0	Air bag
	Abrasion to inner right arm	790202.1,1	913.0	Air bag
Right front occupant:				
	Frontal contusion of brain with subarachnoid blood (both lobes) - amnestic of accident events - confusion - loss of consciousness (3-5 minutes) - pupils asymmetric, R=6mm, L=3mm - left pupil reactive to light -Glasgow coma scale = 15	140622.3,3	851.4	Air bag
	Epidural hematoma	140630.4,2	432.0	Air bag
	Slight abrasion, nasal bridge	290202.1,4	910.0	Glasses
	Abrasions/contusions to wrist/arm	790202.1,9 790402.1,9	913.0 923.21	Air bag
	Abrasions to chin	290202.1,8	910.0	Air bag
	Unknown type flexion/extension injury - CT scan was negative			

Occupant Kinematics

The driver (178 cm / 70 in., 95 kg / 210 lbs.) was seated in a normal upright fashion in the front left bucket seat. Both hands were on the steering wheel at the 10 and 2 o'clock positions. According to the driver, the seat was positioned to the rear-most position. The driver states that he was wearing the lap and shoulder belt in a proper fashion. The driver saw the dog prior to the collision and braked hard with his right foot. The driver went forward during braking. According to the driver, the air bags deployed as the front right bumper struck the dog. As the air bag deployed, the bag struck the inside of both arms, causing minor abrasions. The driver does not recall his hands leaving the wheel.

Figure 6. Vehicle interior, left front

Figure 7. Vehicle interior, right front

The right front occupant (152 cm /60 in.) was seated in a normal upright fashion in the front right bucket seat. According to the driver, the seat was positioned in the rear-most position. She may have been holding leftovers in a Styrofoam container. According to the driver, she was wearing the lap and shoulder belt in the proper fashion. Prior to the collision with the dog, the driver braked. This occupant likely pitched forward to some degree. At impact, the air bag deployed and contacted this occupant's face, as evidenced by the general abrasions to the face and the eyeglass contact to the bridge of the nose. The glasses were knocked off the occupant's face during the deployment. The occupant's head was forced backwards causing the flexion/extension injury to the neck. The blow to the face appears to have been the cause of the frontal brain contusions.

Attachment 1. Minimum pre-braking travel speed

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*** * MINIMUM SPEED W/ KNOWN DRAG FACTOR * ***

$S = \sqrt{30 \times D \times .}$

$S = \sqrt{30 \times 20.00 \times 0.70}$

$S = \sqrt{420.00}$

$S = 20.49$

S = The Speed in MPH.
30 = A Constant.
D = The Distance in Feet.
. = The Adjusted Accel/Drag Factor.

INPUTS:	
The Acceleration/Drag Factor is:	0.70
The Distance in Feet is:	20.00

RESULTS:	
The Speed in MPH is:	20.49
The Velocity in FPS is:	30.03

Attachment 2. Estimated delta V

CASE NUMBER: ds9726

*** * DELTA V * ***

$\Delta V = Vc \times [(1 + e) / (1 + (Wt / Wb))]$

$\Delta V = 5.86 \times [(1 + 0.01) / (1 + (125.00 / 3732.00))]$

$\Delta V = 5.86 \times [1.01 / 1.03]$

$\Delta V = 5.86 \times [0.98]$

$\Delta V = 5.74$

ΔV = The Veh. Change in Velocity.

Vc = The Closing Velocity.
1 = A Constant.
e = The Veh-to-Veh Coeff. of Restitution.
Wt = The Target Vehicle Weight.
Wb = The Bullet Vehicle Weight.

INPUTS:	
The Closing Velocity is:	5.86
The Coefficient of Restitution is:	0.01
The Target Veh Weight is:	125 00
The Bullet Veh Weight is:	3732.00

RESULTS:	
The Speed in MPH is:	3.91
The Velocity in FPS is:	5.74

INCREMENTATION CALC's:

C of R	Velocity
0.00	5.68
0.01	5.74
0.02	5.80
0.03	5.86
0.04	5.86
0.05	5.91
0.06	5.97
0.07	6.03
0.08	6.09
0.09	6.15

C of R	Velocity
0 1 0	6.21
0.11	6.27
0 1 2	6.32
0.13	6.38
0.14	6.44
0.15	6.50
0 1 6	6.56
0.17	6.62
0.18	6.68
0 1 9	6.73