

On-scene Investigation / Vehicle to Vehicle  
Dynamic Science, Inc. / Case Number: 1999-74-013A  
1999 Mitsubishi Galant GTZ  
Nebraska  
February 1999

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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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<p>16. Abstract</p> <p>This collision occurred in the state of Nebraska in February, 1999 at 0929 hours. The weather was clear but the roadway was wet. The crash took place in the eastern corner of a four-leg intersection. The western leg of the intersection is comprised of two eastbound travel lanes, a left turn lane, a right turn lane, and two westbound travel lanes. The roadway was straight and level with a posted speed limit of 72 km/h (45 mph).</p> <p>Vehicle 1, a 1999 Mitsubishi Galant GTZ four-door sedan driven by an unrestrained 30-year-old male, was traveling eastbound approaching the intersection at a minimum travel speed of 87 km/h (54 mph). The vehicle appears to have originally been in the right-hand through lane. As the vehicle approached the intersection the driver began braking and steering to the right and entered the right hand turn lane. The reason for the avoidance maneuver is not known. Vehicle 1 is equipped with an anti-lock brake system (ABS) and the vehicle left 40.7 m (133.7 ft) of left front ABS scuffs and 26.4 m (86.5 ft) of right front ABS scuffs as the vehicle entered and crossed the intersection. Vehicle 1 departed the roadway at the intersection of the northbound and eastbound roadways. Vehicle 1 then struck a metal traffic signal pole at a speed of 60.8 km/h (37.3 mph). A CDC of 12FYEW3 was assigned. Maximum crush was found at C<sup>1</sup> and measured 69 cm (27.1 in.). The rear-end of Vehicle 1 pitched up at impact as the vehicle rotated slightly in a counterclockwise direction. Vehicle 1 then rolled back from the pole before coming to rest.</p> <p>The driver was found unconscious in the vehicle immediately after the crash. The rescue squad arrived 10-15 minutes after the crash. At the time the squad arrived, the driver had no pulse. The driver was transported to a local trauma center with a Glasgow Coma Scale of 3. He was hospitalized for two days before succumbing to his injuries. The driver had sustained a massive subarachnoid hemorrhage, a brain stem injury, right side rib fractures, a nose fracture, a maxilla fracture, and a variety of contusions and abrasions. It is this investigator's opinion that the head injuries were due to contact with the windshield/instrument panel, and the rib injuries due to contact with the steering wheel rim.. Vehicle 1 was towed from the scene due to damage and subsequently totaled by the insurance company.</p>			
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**Dynamic Science, Inc.**  
**Accident Investigation**  
Case Number: 1999-74-013A

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**BACKGROUND:**

**Description:** This case was initiated in response to a report of a driver fatality involving a steering wheel failure in a moderate-to-high speed crash. This case is being conducted as a remote, follow-up investigation to a NASS investigation. NHTSA was notified by the NASS team. DSI was notified on March 2, 1999.

**Investigation Type:** Remote/Combination

**Crash Location:** Nebraska  
**Crash Date:** February 1999  
**Notification Date:** March 2, 1999  
**Field Work Completed:** NA

**SUMMARY:**

This collision occurred in the state of Nebraska in February, 1999 at 0929 hours. The weather was clear but the roadway was wet. The temperature ranged from 1 to 2 degrees C (33 to 35 degrees F)<sup>1</sup>. The crash took place in the eastern corner of a four-leg intersection. The western leg of the intersection is comprised of two eastbound travel lanes, a left turn lane, a right turn lane, and two westbound travel lanes. The roadway was straight and level with a posted speed limit of 72 km/h (45 mph).



**Figure 1.** Final rest, Vehicle 1 (facing east)



**Figure 2.** Final rest, Vehicle 1 (facing west)

<sup>1</sup>Unedited surface weather observations, NOAA

Vehicle 1, a 1999 Mitsubishi Galant GTZ four-door sedan driven by an unrestrained 30-year-old male (183 cm/72 in., 86 kg/190 lbs.)<sup>2</sup>, was traveling eastbound approaching the intersection at a minimum travel speed of 87 km/h (54 mph)<sup>3</sup>. The forensic toxicology report showed that the driver tested positive for Benzodiazepines<sup>4</sup>.

The vehicle appears to have originally been in the right-hand through lane. As the vehicle approached the intersection the driver began braking and steering to the right and entered the right hand turn lane. The reason for the avoidance maneuver is not known. Vehicle 1 is equipped with an anti-lock brake system (ABS) and the vehicle left 40.7 m (133.7 ft) of left front ABS scuffs and 26.4 m (86.5 ft) of right front ABS scuffs as the vehicle entered and crossed the intersection. Vehicle 1 departed the roadway at the intersection of the northbound and eastbound roadways. Vehicle 1 then struck a metal traffic signal pole at a speed of 60.8 km/h (37.3 mph)<sup>5</sup>. A CDC of 12FYEW3 was assigned. Maximum crush was found at C<sup>1</sup> and measured 69 cm (27.1 in.). The rear-end of Vehicle 1 pitched up at impact as the vehicle rotated slightly in a counterclockwise direction. Vehicle 1 then rolled back from the pole before coming to rest.



**Figure 3.** Final rest, facing south.



**Figure 4.** Vehicle 1, exterior

<sup>2</sup> SCI change from EDCS per autopsy report.

<sup>3</sup> See Attachment 1, calculations include an estimated coefficient of friction of 0.45

<sup>4</sup> Benzodiazepines are sedative drugs which are prescribed by doctors to reduce anxiety, to encourage sleep or to act as a muscle relaxant. In the short term, the drugs can relieve the symptoms of stress and anxiety and promote sleep. Psychological Effects: Sedation, drowsiness, hostility, depression, prolonged physical and psychomotor times, lack of coordination, memory loss (1) acute amnesia for a brief period following a high dose I/V (2) impairment of recall with chronic use. Physical Effects: Vertigo (light headed), dizziness, double vision, ataxia (staggering), lethargy. They are sometimes used illicitly (without prescription) to offset the effects of stimulant drugs or with other 'downer' drugs such as alcohol and heroin.

<sup>5</sup> Calculated using WinSmash 1.2.1, Damage and Spinout results

The driver of Vehicle 1 was not using the available lap and shoulder restraints. He was seated in a forward facing position in a fabric-covered bucket seat; the seat was at the middle track position. The tilt steering wheel was adjusted to the center position. The driver had his foot on the brake. At impact, the rear end of Vehicle 1 pitched upward and the vehicle began a sharp counterclockwise rotation around the pole. The driver responded to this motion by moving upwards and to the right. The upwards motion caused the driver to load the steering wheel in a positive vertical direction<sup>6</sup>. The driver was forward of the normal seated position at this time—this is based on the bilateral contusions found on the anterior aspect of the driver's upper arms. The movement to the right caused the driver to by-pass the deploying air bag to some extent and to engage the center instrument panel and center windshield.



**Figure 5.** Vehicle 1, interior

The driver was found unconscious in the vehicle immediately after the crash. The rescue squad arrived 10-15 minutes after the crash. At the time the squad arrived, the driver had no pulse. It was estimated that the driver had no pulse for 10-15 minutes; however, he was found to have electrical activity on electrocardiogram. He was intubated at the scene and his pulse returned in approximately two minutes. The driver was transported to a local trauma center with a Glasgow Coma Scale of 3. He was hospitalized for two days before succumbing to his injuries.

The driver had sustained a massive subarachnoid hemorrhage, a brain stem injury, right side rib fractures, a nose fracture, a maxilla fracture, and a variety of contusions and abrasions. It is this investigator's opinion that the head injuries were due to contact with the windshield/instrument panel, and the rib injuries due to contact with the steering wheel rim.

Vehicle 1 was towed from the scene due to damage and subsequently totaled by the insurance company. The vehicle sustained substantial frontal crush. There was intrusion of the toe pan and of the left portion of the instrument panel. The left rear door was jammed shut. The steering wheel rim was loaded and failed.

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<sup>6</sup> See Attachment 2

Scene Diagram

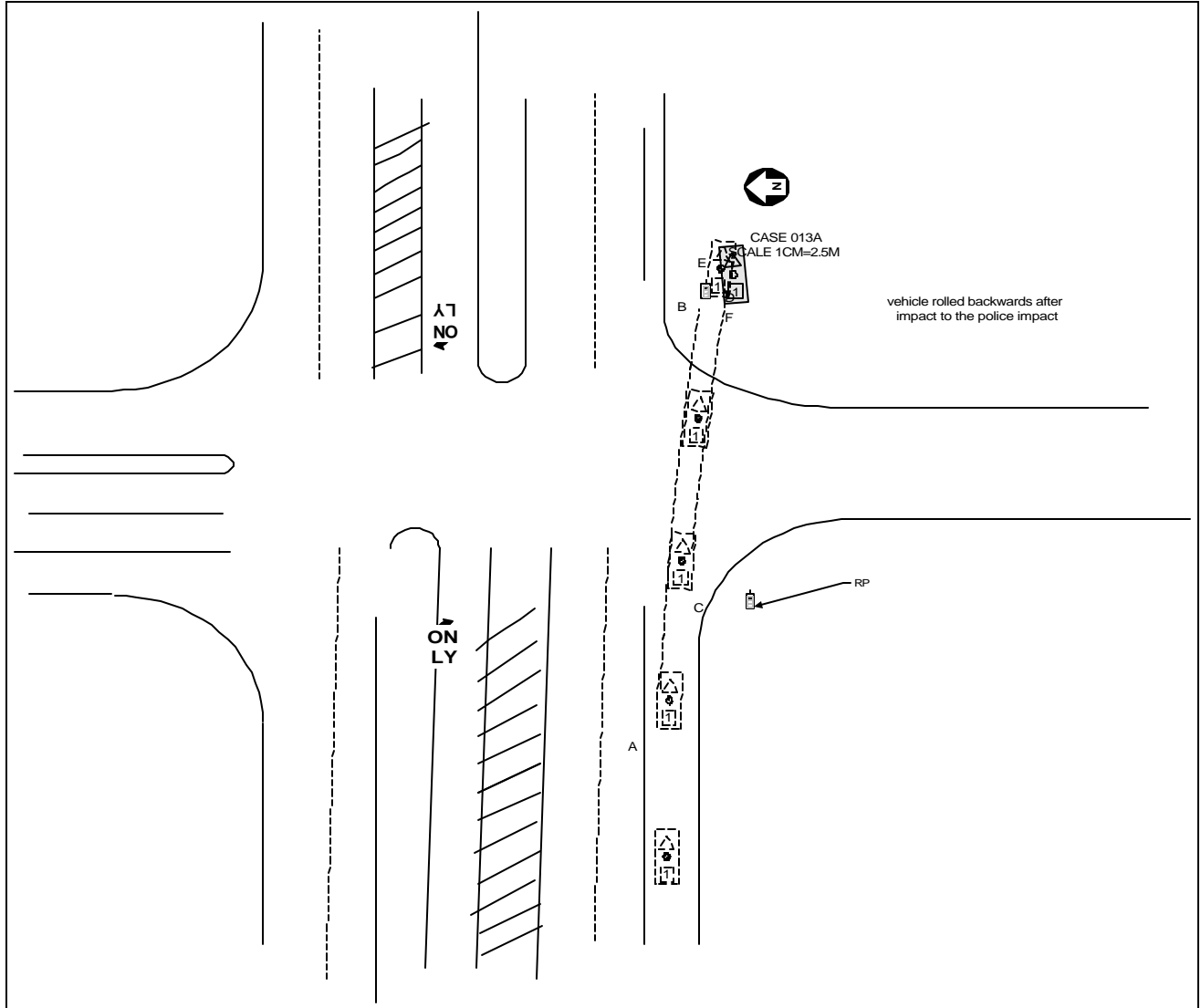


Figure 6. Scene Diagram



**DETAILED INFORMATION****Vehicles**Vehicle 1

Description:	1999 Mitsubishi Galant GTZ four-door sedan	
VIN:	4A3AA46G3XExxxxx	
Odometer:	Unknown	
Engine:	2.4 L SOHC MFI	
Reported Defects:	None	
Cargo:	None	
Damage Description:	Major frontal damage to front bumper, grille, and hood. Maximum crush was found at C <sup>1</sup> and measured 69 cm (27.1 in.). There was intrusion through the toe pan and the left instrument panel. The steering wheel failed.	
CDC:	12FYEW3	
Delta V:	Total	61 km/h (37 mph)
	Longitudinal	-61 km/h (-37 mph)
	Latitudinal	0 km/h (0 mph)
	Energy	213035 joules (157,126 ft-lbs.)



**Figure 7.** Exterior, Vehicle 1.

**Occupants**Vehicle 1

Age/Sex:	30/Male
Seated Position:	Front left
Seat Type:	Bucket, fabric covered
Height:	183 cm (72 in.)
Weight:	86 kg (190 lbs.)
Occupation:	Unknown
Pre-existing Medical Condition:	None noted
Alcohol/Drug Involvement:	Tested positive for Benzodiazepines
Driving Experience:	Presumed to be greater than 10 years
Body Posture:	Unknown--likely to be normal and upright
Hand Position:	Both presumed to be on steering wheel while braking and attempting to turn to the right.
Foot Position:	Right foot on brake.
Restraint Usage:	None used <sup>7</sup>

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<sup>7</sup>The front belts have force limiters and height-adjustable front shoulder belts.

## Injuries and Injury Mechanisms

### Vehicle 1

	<u>INJURY</u>	<u>OIC CODE</u>	<u>ICD-9</u>	<u>SOURCE</u>
Driver:	Cerebrum subarachnoid hemorrhage, right	140684.3,1	800.25	Windshield
	Cerebrum subarachnoid hemorrhage, left	140684.3,2	800.25	Windshield
	Cerebrum brain swelling mild, right	140662.3,1	348.5	Windshield
	Cerebrum brain swelling mild, left	140662.3,2	348.5	Windshield
	Cerebellum NFS, posterior	140499.3,6	Unknown	Windshield
	Brain stem injury involving hemorrhage, lower	140210.5,8	851.45	Windshield
	Blowout fracture, left orbit	251204.3,2	802.6	Instrument panel
	Eyelid contusion, left	297402.1,2	918.0	Instrument panel
	Contusion, left aspect of bridge of nose—0.8 cm across	290402.1,4	920.0	Instrument panel
	Contusions, medial aspect of right wrist	790402.1,1	923.21	Left instrument panel
	Contusion, upper arms, bilaterally, anterior aspect	790402.1,1 790402.1,2	923.03 923.03	Driver side front air bag
	Rib cage fracture > 3 ribs on one side and < ribs on either side with pneumothorax (left)	450232.4,2	807.13	Steering wheel rim
	Nose fracture, open	251004.2,4	802.1	Instrument panel
	Maxilla fracture, closed, left	250802.2,2	802.2	Instrument panel
	Base (basilar) fracture NFS, inferior	150200.3,8	801.25	Windshield
	Knee abrasion, inferior aspect of left patella	890202.1,2	916.0	Instrument panel
	Paraspinal T1 fracture	650416.2,7	806.2	Unknown

## Occupant Kinematics

The driver of Vehicle 1 was seated in what is presumed to be a normal, upright position in a fabric-covered bucket

seat; the seat was at the middle track position. The tilt steering wheel was adjusted to the center position. The driver had his right foot on the brake. Based on the bilateral contusions to the upper arms, it is believed that both hands were on the steering wheel. The left hand would have been higher than the right. The driver was not using the available lap and shoulder restraints. Given the cold temperatures--1 to 2 degrees C (33 to 35 degrees F)--the driver was likely wearing winter clothing, but this could not be determined with certainty. At impact, the driver responded to the 12 o'clock direction of force by moving forward. As the vehicle engaged the pole its rear end pitched upward and the vehicle began a sharp counterclockwise rotation around the pole. The driver responded to this motion by moving upwards and to the right. The upwards motion caused the driver to load the steering wheel in a positive vertical direction. The driver was forward of the normal seated position at this time--this is based on the bilateral contusions found on the anterior aspect of the driver's upper arms. The movement to the right caused the driver to by-pass the deploying air bag to some extent and to strike the left side of his face on the curved portion of the instrument panel to the right of the steering wheel--likely causing the blow-out fracture of the left orbit and nose fracture. The driver continued forward and engaged the right side of the steering wheel rim with his left chest--causing the rib fractures. The driver completed the forward motion and struck his head on the lower center windshield--leaving trace evidence of a head contact.



**Figure 8.** Interior, Vehicle 1.



**Figure 9.** Closeup of upper instrument panel.



**Figure 10.** Windshield contact.



**Figure 11.** Close-up of windshield contact



