

**CRASH DATA RESEARCH CENTER**

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**CALSPAN ON-SITE CERTIFIED ADVANCED 208-COMPLIANT VEHICLE  
CRASH INVESTIGATION**

**CALSPAN CASE NO: CA05-026**

**VEHICLE: 2005 NISSAN PATHFINDER**

**LOCATION: NORTH CAROLINA**

**CRASH DATE: MARCH 2005**

Contract No. DTNH22-01-C-17002

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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 are 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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CRASH INVESTIGATION  
SCI CASE NO. – CA05-026  
VEHICLE – 2005 NISSAN PATHFINDER  
LOCATION - STATE OF NORTH CAROLINA  
CRASH DATE – MARCH 2005**

**BACKGROUND**

This on-site investigation focused on the performance of the Certified Advanced 208-Compliant (CAC) safety system in a 2005 Nissan Pathfinder (**Figure 1**). The manufacturer of this vehicle has certified that this 2005 Nissan Pathfinder meets the advanced air bag requirements of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The CAC safety system consisted of dual stage frontal air bags, an occupant presence sensor for the front right seat, and safety belt buckle switch sensors to monitor belt usage. In addition, the Nissan was equipped with an air bag control



**Figure 1. Subject vehicle 2005 Nissan Pathfinder.**

module which had Event Data Recording (EDR) capabilities which was downloaded during this on-site investigative effort. A restrained 31-year-old male driver occupied the vehicle. The Nissan was involved in a run-off road collision where it impacted two utility poles. As a result of the crash, the driver's frontal air bag deployed and the front safety belt pretensioners fired. The driver of the Nissan sustained minor injuries and refused medical attention. The vehicle sustained moderate frontal damage and was towed from the crash site.

This crash was identified from a list of claims provided by an insurance company to the National Highway Traffic Safety Administration (NHTSA) that identified Certified Advanced 208-Compliant vehicles that had been involved in crashes. The list was forwarded to the Calspan Special Crash Investigations (SCI) team for follow-up investigation. The Nissan was located at a repair facility and cooperation was established with the facility to inspect the vehicle. An on-site investigation was assigned to the Calspan SCI team on April 27, 2005. The vehicle and crash site were inspected on April 28, 2005

**SUMMARY**

***Crash Site***

This run-off crash occurred during the daylight hours of March 2005. At the time of the crash, the weather was clear and the roadway was dry. The crash occurred on the south roadside of a four-lane east/westbound roadway in a commercial setting. The roadway was configured with two travel lanes in each direction, which were delineated by double yellow centerlines and broken white lane lines. Shallow concrete curbs bordered both

road edges. The posted speed limit for the east/west roadway was 56 km/h (35 mph). The south roadside consisted of multiple driveways for commercial properties that intersected the roadway, and a 1.6-meter (5.2 feet) concrete/grass area located between the curb and the 1.9-meter (6.2 feet) sidewalk. The scene schematic is included as **Figure 9** of this report.

***Vehicle Data – 2005 Nissan Pathfinder***

The 2005 Nissan Pathfinder was identified by the Vehicle Identification Number (VIN): 5N1AR18W95 (production sequence deleted). The odometer was not functional at the time of the SCI inspection. The Nissan was a four-door sport-utility vehicle that was equipped with a 3.5-liter, V6 engine, 5-speed automatic transmission, four-wheel drive, power-front and rear disc brakes with anti-lock, electronic brake force distribution, Vehicle Dynamic Control (VDC), power adjustable pedals, active head restraints, power steering, and a tilt steering wheel. The Nissan was configured with BFGoodrich Radial Long Trail T/A tires size, P265/70R16 mounted on OEM alloy wheels. The manufacturer recommended front and rear tire pressure was 241 kPa (35 PSI). The specific tire data at the time of the SCI inspection was as follows:

<b>Tire</b>	<b>Measured Pressure</b>	<b>Tread Depth</b>	<b>Restricted</b>	<b>Damage</b>
LF	276 kPa (40 PSI)	9 mm (11/32)	No	No
LR	283 kPa (41 PSI)	9 mm (11/32)	No	No
RF	0 kPa	Unknown	Yes	The alloy wheel was fractured by the impact and tire was separated from the wheel.
RR	269 kPa (39 PSI)	9 mm (11/32)	No	No

The seating positions in the Nissan were configured with cloth upholstered front bucket seats with height adjustable head restraints. The front head restraints were adjusted to the full-down position at the time of the SCI inspection. The second row was configured with a three-passenger bench seat with height adjustable head restraints that were adjusted to the full-down position. The third row was a two-passenger bench seat with height adjustable head restraints. The third row seat was folded into the stowed position and the head restraints were in the full-down position at the time of the SCI inspection.

### ***Crash Sequence***

#### ***Pre-Crash***

The restrained 31-year-old male was operating the 2005 Nissan Pathfinder. The driver had left a local hospital where he received a steroid injection. As he exited the parking lot and traveled eastbound (**Figure 2**) on the four-lane roadway he apparently blacked out due to a reaction to the injection. The driver stated to the SCI investigator that he suspected that his foot probably slid from the brake pedal onto the gas pedal causing the vehicle to accelerate and depart the roadway.



**Figure 2. Nissan's eastbound travel.**

#### ***Crash***

The front right corner area of the Nissan impacted a wooden utility pole (**Figure 3**). This impact configuration resulted in a damage pattern, which included the front, right side, and the right front tire and wheel. Due to the corner impact, the vehicle did not reach a common velocity. The damage also involved two planes and was outside the scope of the WINSMASH program.



**Figure 3. First utility pole impact.**

The Nissan continued its easterly trajectory and reentered the right eastbound lane and traveled approximately 33.0 meters (108.0 feet) where it departed the right roadside and impacted a second utility pole with the front center aspect (**Figure 4**). The second utility pole was located 42.3 meters (138.7 feet) east of the initial impact. A gouge mark that measured 4.4 meters (14.4 feet) was located prior to the second utility pole impact. The frontal components, which included the bumper cover, bumper beam, and the upper and lower radiator supports were removed by a repair facility to obtain a repair estimate. Therefore, a partial crush profile was obtained and used to calculate a delta V for this impact using the damage algorithm of the WINSMASH program. The total calculated delta V for this impact was 11.0 km/h (6.8 mph). The longitudinal



**Figure 4. Second utility pole impact.**

and lateral components were -11.0 km/h (-6.8 mph) and 0.0 km/h respectively. As a result of the crash, the driver's frontal air bag deployed and the front safety belt pretensioners fired. The EDR was capable of recording only one event; therefore, it was unknown which impact deployed the CAC system.

### *Post-Crash*

Police and Emergency Medical Services personnel (EMS) responded to the crash site. The driver of the Nissan sustained minor injuries as a result of the crash. The EMS personnel evaluated the driver's minor injuries; however, he refused medical attention. The Nissan sustained disabling damage and was towed from the crash site and subsequently deemed a total loss by the insurance company.

### *Vehicle Damage*

#### *Exterior Damage – 2005 Nissan Pathfinder*

The 2005 Nissan Pathfinder sustained moderate damage to the front and right side planes as a result of the impact with the first utility pole (**Figure 5**). The direct contact damage measured 16.5 cm (6.5") and began 64.8 cm (25.5") right of the centerline and extended to the front right corner. The damage to the right side plane began at the front right corner and extended 217.2 cm (85.5") rearward, terminating 5.8 cm (2.3") forward of the right B-pillar. Additionally, the right front tire and wheel contacted the utility pole, which shattered the alloy wheel, fractured the brake rotor, steering spindle, outer tie rod, and separated the ball joint.



**Figure 5. Front and right damage from the first utility pole impact.**

Due to the corner damage pattern, a crush profile was not obtained for this impact. The Collision Deformation Classification (CDC) for this impact was 12-FREE-6.

The Nissan sustained moderate center frontal damage as a result of the impact with the second utility pole (**Figure 6**). The bumper cover, bumper beam, and the upper and lower radiator supports were removed by the repair facility to complete a repair estimate; therefore the direct contact damage was obtained from the hood. The direct contact damage measured 19.1 cm (7.5") and began 5.1 cm (2.0") right of the centerline and extended to the right. Due to the removed frontal components, the crush was documented at the frame rails and the bumper mounts, which were deformed



**Figure 6. Frontal damage from the second utility pole impact.**



longitudinally and laterally as a result of the impact to the center of the frontal plane. The crush at the left frame rail measured 2.5 cm (1.0”) and the right frame rail was 5.1 cm (2.0”). The left bumper mount was deformed longitudinally to a depth of 4.6 cm (1.8”) and the right was 16.0 cm (6.3”). The CDC for this impact was 12-FCEN-1.

The Nissan’s windshield was fractured at the lower right aspect from contact with the hood edge, and the right front glazing was disintegrated. The remainder of the glazing was intact post-crash. The left side doors, right rear door, and the tailgate were closed and operational. The right front door was displaced rearward from the initial utility pole impact and it remained closed during the crash. However, the right front door was opened post-crash and could not be closed due to the body deformation.

***Interior Damage – 2005 Nissan Pathfinder***

The 2005 Nissan Pathfinder sustained moderate damage as a result of passenger compartment intrusion. There were no occupant contacts present in the passenger compartment. **Figure 7** is an overall view of the forward aspect of the passenger compartment. The documented intrusions were as follows:



**Figure 7. Overall of the first of the passenger compartment.**

<b>Seat Position</b>	<b>Intruded Component</b>	<b>Magnitude</b>	<b>Direction</b>
Front Right	Instrument Panel	1.3 cm (0.5”)	Longitudinal
Front Right	Lower Instrument Panel	7.6 cm (3.0”)	Longitudinal
Front Right	Toe Pan	22.8 cm (9.0”)	Longitudinal
Front Right	Floor	2.5 cm (1.0”)	Vertical

***Certified Advanced 208-Compliant Safety System – 2005 Nissan Pathfinder***

The 2005 Nissan Pathfinder was equipped with a Certified Advanced 208-Compliant (CAC) frontal safety system. The manufacturer of this vehicle has certified that this 2005 Nissan Pathfinder meets the advanced air bag requirements of the Federal Motor Vehicle Safety Standard (FMVSS) No. 208. The system consisted of dual stage frontal air bags, an occupant presence sensor for the front right seat, and safety belt buckle switch sensors to monitor belt usage.

In the subject crash, the driver's frontal air bag deployed. The driver's air bag was conventionally located in the center of the steering wheel hub (**Figure 8**). Three cover flaps concealed the air bag. The top cover flap was semi-circle in shape and measured 6.8 cm (2.7") in height and 12.7 (5.0") in width. The lower cover flaps were symmetrical and measured 4.8 cm (1.9") in height and 6.4 cm (2.5") in width. The air bag membrane was 53.3 cm (21.0") in diameter in its deflated state and was vented by two 3.8 cm (1.5") diameter vent ports that were located on the rear aspect of the air bag at the 11 and 1 o'clock positions. The driver's air bag was vented by two vent ports and tethered by four 10.2 cm (4.0") wide band tethers at the 12 and 6 o'clock positions and the 9 and 3 o'clock positions. The maximum excursion of the driver's air bag was 22.9 cm (9.0") at the tether locations. There were no occupant contact points present on the air bag membrane. The following identifiers were stamped at the 12 o'clock position on the rear panel:



**Figure 8. Deployed driver's frontal air bag.**

KK13

KK67

The following was stamped on the center face of the air bag membrane:

A12-2

The front right passenger air bag was a top-mount design in the right instrument panel. The front right seat was not occupied during the crash, therefore the front right air bag did not deploy.

#### ***Event Data Recorder (EDR)– 2005 Nissan Pathfinder***

The CAC system was controlled by an air bag control module, which utilized the crash severity, belted status, and occupant presence to deploy the appropriate safety system. In addition, the air bag control module had EDR capabilities and was downloaded during this on-site investigation. Due to expended vehicle battery, the SCI investigator temporarily restored power to the Nissan using jumper cables. The SCI investigator downloaded the EDR directly from the air bag control module using the Nissan Consult II scan tool, which was provided by Nissan. This tool prints out a data tape of the hexadecimal data, which was forwarded to Nissan for interpretation. The data indicated that the safing sensor closed at 18 milliseconds after Algorithm Enable (AE) and commanded a Stage One deployment of the driver air bag at 27 milliseconds after AE. Delta V data was not recorded by the EDR. Additionally, the EDR indicated that the driver's safety belt was buckled and the front right seat was not occupied at the time of the crash; however, both front retractor pretensioners fired.

***Manual Restraint Systems – 2005 Nissan Pathfinder***

The 2005 Nissan Pathfinder was equipped with manual 3-point lap and shoulder safety belts for the six outboard seating positions. The second row center safety belt was equipped with an integrated 3-point lap and shoulder safety belt. The driver’s safety belt was configured with continuous loop webbing, sliding latch plate, height adjustable D-ring that was in the full-up position at the time of the inspection, retractor mounted pretensioner, and an Emergency Locking Retractor (ELR). The driver utilized the safety belt during the crash, which was supported by the loading abrasions on the D-ring and the vertical abrasions on the webbing from the latch plate. Furthermore, the fired pretensioner restricted the safety belt in the used position.

The front right safety belt was configured with continuous loop webbing, sliding latch plate, height adjustable D-ring that was in the full-up position at the time of the inspection, retractor mounted pretensioner, and a switchable ELR/Automatic Locking Retractor (ALR). The front right pretensioner fired as a result of crash, which restricted the webbing in the stowed position. The second and third row safety belts were configured with continuous loop webbing, sliding latch plates and switchable ELR/ALR retractors.

***Occupant Demographics – 2005 Nissan Pathfinder***

***Driver***

Age/Sex: 31-year-old/male  
Height: 177.8 cm (70.0’’)   
Weight: 77.1 kgs (170.0 lbs)   
Seat Track Position: 5.1 cm (2.0’’) forward of full rear   
Manual Restraint Use: 3-point manual lap and shoulder safety belt   
Usage Source: Vehicle inspection   
Eyewear: Non-prescription sunglasses   
Type of Medical Treatment: Not medically treated

***Driver’s Injuries***

<b>Injury</b>	<b>Injury Severity (AIS 90/Update 98)</b>	<b>Injury Source</b>
Contusion above left eyebrow	Minor (290402.1,7)	Steering wheel
Minor lacerations to both hands	Minor (790602.1,3)	Flying glass
Contusion to left chest	Minor (490402.1,2)	Safety belt

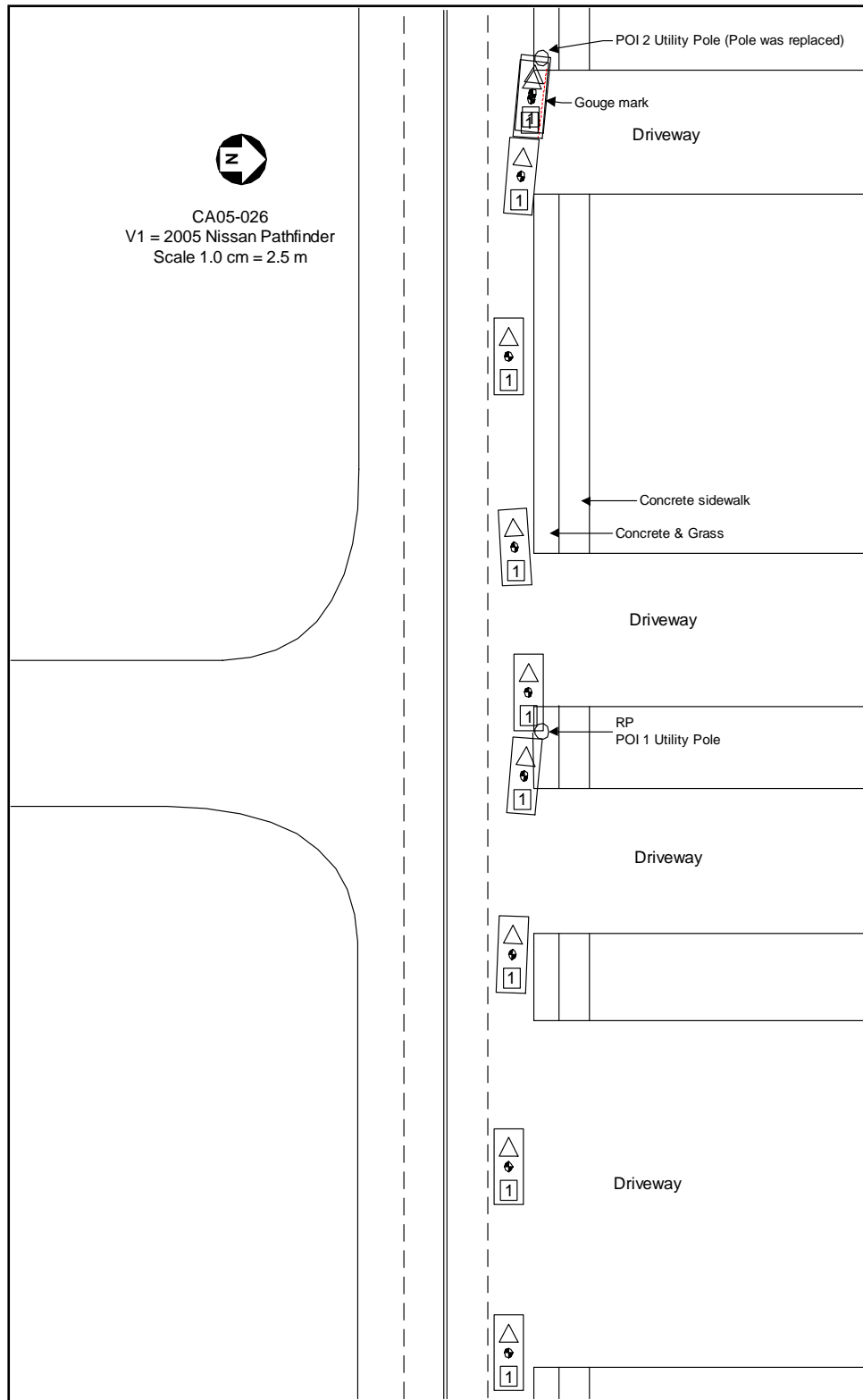
*Source = Driver interview*

***Driver Kinematics***

The 31-year-old male driver of the 2005 Nissan Pathfinder was seated in a rear track position. The driver stated to the SCI investigator that he passed-out prior to the crash due to a reaction he had to a steroid injection he received. Therefore it was presumed that his head was slumped over the shoulder belt. At impact with the first utility pole, the driver’s frontal air bag deployed and the safety belt pretensioner fired. The driver’s

upper torso initiated a slight forward trajectory and loaded the safety belt, which resulted in the contusion to the left chest. Furthermore, the loading of the safety belt arrested the forward movement of his torso. The front right glazing disintegrated as the vehicle continued forward while engaged against the utility pole. The glass fragments were dispersed throughout the interior of the vehicle and contacted the driver resulting in the minor lacerations to both hands.

The Nissan traveled an additional 42.3 meters (138.7 feet) where it impacted a second utility pole with the front center aspect. At this point the air bag had deflated and offered no protection to the driver thus allowing his head to extend over the shoulder belt and contact the steering wheel rim. This contact resulted in the contusion above the left eyebrow. The driver was evaluated by the responding EMS personnel and refused medical treatment.



**Figure 9. Scene schematic**