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REDESIGNED AIR BAG REPORT

CASE NUMBER - IN97-053  
LOCATION - TEXAS  
VEHICLE - 1998 NISSAN ALTIMA GXE  
CRASH DATE - November, 1997

Submitted:

December 17, 1998

Contract Number: DTNH22-94-D-17058

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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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15. <i>Supplementary Notes</i> On-site air bag deployment investigation involving a 1998 Nissan Altima GXE, four-door sedan, with manual safety belts and dual front redesigned air bags, and two fixed median objects					
16. <i>Abstract</i> This report covers an on-site investigation of an air bag deployment crash that involved a 1998 Nissan Altima GXE (case vehicle) and two fixed median objects (i.e., a concrete curb and a light pole). This crash is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of crash events, and the restrained driver (54-year-old female) sustained minor, self-reported injuries from contacting her deploying air bag. The case vehicle was traveling southwest in the inside, southwestbound through lane of a seven-lane, divided, city trafficway (i.e., both the southwest and northeast roadways had three through lanes, while the southwest roadway had a left-turn lane). A noncontact vehicle (described only as a "van") stopped in the same inside, through lane as the case vehicle, but in the middle of a Tee-intersection. The case vehicle's driver steered to the left, attempting to avoid the crash. The case vehicle's front bumper scraped the top of a median curb followed by an impact between the left front tire/wheel and the curb. The tire/wheel impact caused the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle continued forward, and the left rear tire struck the curb. Shortly thereafter, the case vehicle struck a light pole and came to rest further westward, with its left side wheels on the pavement and the right side wheels on the median. The case vehicle's driver was seated upright, with her seat track located between its middle and forward-most positions, and the tilt steering wheel was located in its middle position. She was restrained by her available, active, three-point, lap and shoulder belt and sustained, according to her interview, minor injuries which included: a fractured rib behind the right breast, a contused chest, and sore shoulders, bilaterally.					
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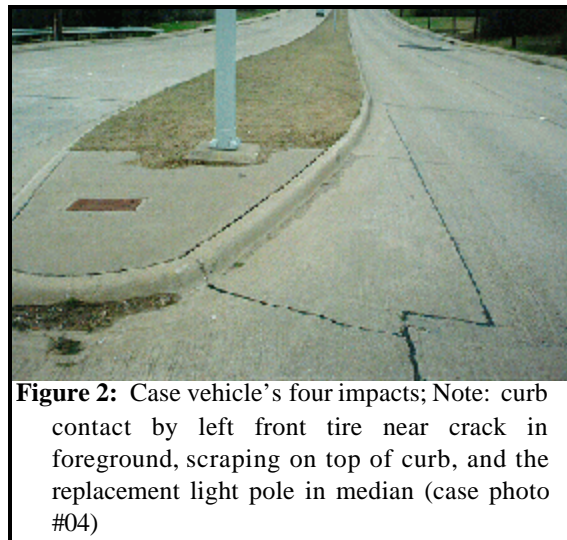
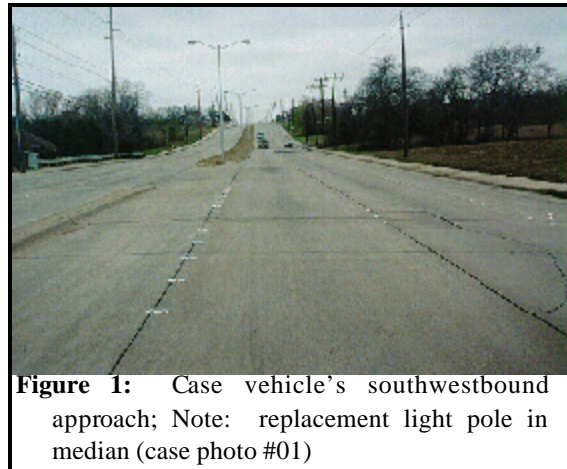
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This on-site investigation was brought to NHTSA's attention on December 15, 1997, by GES sampling activities. This crash involved a 1998 Nissan Altima (case vehicle) and two fixed median objects (i.e., a concrete median curb and a light pole). The crash occurred in November, 1997, at 7:37 a.m., in Texas, and was investigated by the applicable municipal police department. This crash is of special interest because the case vehicle was equipped with redesigned air bags and its driver (54-year-old female) sustained minor, self-reported, chest injuries from her deploying air bag. This contractor's investigative consultant inspected the scene on January 13, 1998 and the partially-repaired case vehicle on December 23, 1997. The case vehicle's driver was interviewed on December 27, 1997. This report is based on the Police Crash Report, scene and vehicle inspections, an interview with the case vehicle's driver, occupant kinematic principles, the driver's self-reported injuries, and this contractor's evaluation of the evidence.

### CRASH CIRCUMSTANCES

The case vehicle was traveling southwest in the inside, southwestbound through lane of a seven-lane, divided, city trafficway (**Figure 1**) and was approaching a "Tee" intersection, intending to continue on through in its southwesterly travel path (i.e., both the southwest and northeast roadways had three through lanes, while the southwest roadway had a left-turn lane). The southwestbound roadway's dimensions were 10.9 meters (35.8 feet) wide for the three through lanes and 3.9 meters (12.8 feet) wide for the left turn lane. All concrete curbing in the area of interest seemed to be no higher than 10 centimeters (4 inches). Median width varied from 2.6 meters (8.4 feet) to 1.1 meters (3.6 feet), depending on the existence of the left-hand turn lane. The concrete pavement was in fairly new and sharp condition, with an estimated coefficient of friction of 0.80. Raised pavement markers were used to separate all lanes. Ambient weather conditions at the time of the crash were: daylight, clear, no precipitation, and a dry pavement. The roadway was straight, with a slight (2.1%) southwesterly downgrade. There were no reported view obstructions, traffic controls, or roadway defects. A noncontact vehicle (described only as a "van") stopped in the same inside, through lane as the case vehicle, but in the middle of a Tee-



intersection. The case vehicle's driver steered to the left, attempting to avoid the crash. Her estimated pre-impact travel speed was 34-48 km.p.h. (21-30 m.p.h.), while the posted speed limit was 64 km.p.h. (40 m.p.h.). The crash (i.e., the first of four impacts) occurred in the median (**Figure 2** above) between the two roadways southwest of the Tee-intersection. The noncontact van continued on its way.

The underneath portion of the case vehicle's front bumper scraped the top of an estimated 10 centimeter (4 inch) concrete median curb (**Figures 3 and 4**). Continuing forward, the case vehicle's left front tire and wheel contacted that same concrete median curb, damaging both the tire and the wheel (**Figure 3**) and causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. As the case vehicle continued on its forward path, the left rear tire was damaged as it, too, struck the concrete curb. Impact with the light pole occurred shortly thereafter (**Figure 5**) and the case vehicle traveled an estimated two-to-three car lengths further southwest before coming to rest with its left side wheels on the inside, northeastbound through lane and the right side wheels on the raised median. The crash severity for the case vehicle's deployment impact was estimated as low [14-23 km.p.h. (9-14 m.p.h.)].

**CASE VEHICLE**

The case vehicle was a front wheel drive, 1998 Nissan Altima GXE, five-passenger, four-door sedan (VIN: 1N4DL01D7WC-----) equipped with a 2.4 liter, DOHC, SMPFI, L-4 engine and a console-mounted four-speed, automatic transmission. Four-wheel, anti-lock brakes are an option for the case vehicle, but there was no indication that the case vehicle was so equipped. The case vehicle's wheel base was 261.9 centimeters (103.1 inches), and the odometer reading at inspection was 9,072 kilometers (5,637 miles). The case vehicle was towed due to disabling damage.

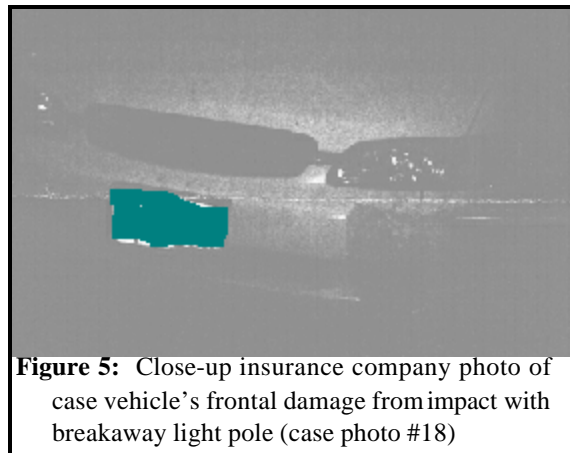
Inspection of the case vehicle's interior revealed



**Figure 3:** Partially-repaired case vehicle showing frontal damage viewed from approximately 70 degrees left of front (case photo #11)



**Figure 4:** Case vehicle's damaged front bumper cover; Note: scrapes on bottom of bumper (case photo #10)

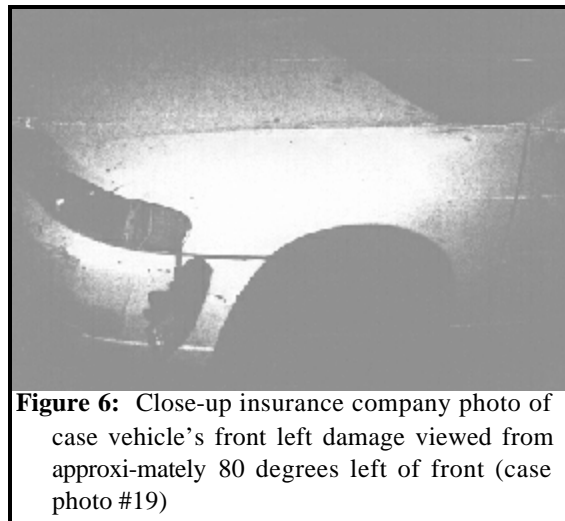


**Figure 5:** Close-up insurance company photo of case vehicle's frontal damage from impact with breakaway light pole (case photo #18)

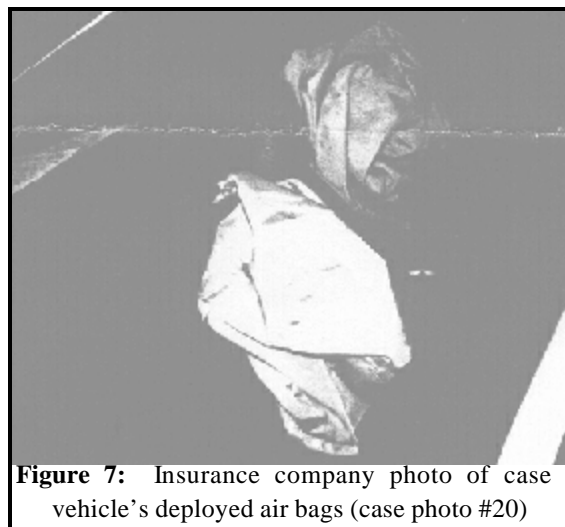
that the front seating area (**Figure 8** below) had bucket seats with adjustable head restraints (unknown if the seat track adjustment mechanism was manual or electric). The rear seat area had a nonadjustable bench seat with folding backs, and the outboard positions were equipped with integral head restraints. Three-point lap and shoulder belts were provided for the front and rear outboard seat positions, and a two-point lap belt was provided for the rear center seat position. The front outboard seats had adjustable shoulder belt upper anchorages and both were found in the full-up position. No adjustable shoulder belt upper anchorages were found for rear outboard seating positions. Automatic restraint was provided by a Supplemental Restraint System (SRS) that consisted of a redesigned driver air bag and front right passenger air bag. Both front seat air bags deployed as a result of this crash.

Direct damage was detected to the underneath portion of the case vehicle's front bumper cover (**Figure 4**) from scraping the top of the concrete median curb. The damage extended almost corner-to-corner. Damaged components from this first impact included: the front bumper cover, the front bumper reinforcement bar, and the front bumper absorber. The second impact of the crash sequence deployed the dual front air bags and involved left front tire and wheel contact to the concrete median curb. Direct damage from this impact included: the left front wheel, wheel cover, and tire, the left front lower control arm, and the left front stabilizer bar rod. The third impact occurred when the left rear tire contacted the concrete median curb, damaging the tire. The fourth impact involved the case vehicle's front left corner (**Figure 5** above) contacting and severing the breakaway light pole. Direct damage was limited to the bottom half of the front left bumper corner, cracking the fiberglass bumper cover and damaging the left headlamp lens, the left side marker lamp, and the left inner fender skirt (**Figure 6**).

The CDCs for the case vehicle were estimated as: **12-FDLW-1** for the underneath portion of the front bumper contacting the median curb (impact #1), **12-FLWN-3** for the left front tire contact with the median curb (impact #2), **12-FLWN-9** for the left rear tire contact with the median curb (impact #3), and **12-FLEE-1** for the light pole contact (impact #4). Because the case vehicle was partially repaired at the time of inspection, no crush measurements were taken; thus, no reconstruction program was used on



**Figure 6:** Close-up insurance company photo of case vehicle's front left damage viewed from approximately 80 degrees left of front (case photo #19)



**Figure 7:** Insurance company photo of case vehicle's deployed air bags (case photo #20)



this crash because the NASS, CDS, WinSMASH protocol requires that actual vehicular crush measurements be obtained; however, this contractor's visually estimated Delta V is between 14 km.p.h. (9 m.p.h.) and 23 km.p.h. (14 m.p.h.).

Both driver and front right passenger deployed air bags (**Figure 7** above) in the case vehicle had been replaced before the SCI inspection (**Figure 8**). Although it is known that the driver's air bag was located in the steering wheel hub and that the front right passenger's air bag was located in the top of the instrument panel, it is not known if the cover flaps at either location opened at their designated tear points.



**Figure 8:** Case vehicle's front seating area showing location of deployed driver and front right passenger air bag modules; Note: replacement modules have been installed (case photo #17)

In addition, no information was collected concerning the shape, dimensions, damage, or evidence of contact to either of the air bag module's cover flaps. Likewise, for each of the air bags, there is no information concerning the shape, dimensions, tether and vent port availability or dimensions, or possible damage or occupant contacts to the air bag fabric itself. It is highly likely that the driver did contact her deploying air bag, given her self-reported injuries. Finally, there was no evidence of possible occupant contact detected on the interior surfaces of the case vehicle.

#### **CASE VEHICLE DRIVER**

The case vehicle's driver [170 centimeters and 77 kilograms (67 inches, 170 pounds)] was restrained by her available, active, three-point, lap and shoulder belt. However, there was no evidence of belt pattern bruising and/or abrasions to her body. Inspection of her seat belt webbing, "D"-ring, and latch plate showed no evidence of loading.

Immediately prior to the crash the case vehicle's driver was seated upright, with her back against seat back, her left foot on the floor, her right foot at an unknown position, and both hands on the steering wheel. Her seat track was located between its middle and forward-most positions, and the seat back was slightly reclined. The tilt steering wheel was located in its middle position.

The case vehicle's driver steered to the left, attempting to avoid the crash. As a result of this attempted avoidance maneuver and the use of her available safety belts, she most likely moved slightly to her right just prior to impact. When the bottom portion of the case vehicle's front bumper scraped the top of the concrete median curb, in a front-to-rear motion, the effect of this impact on the driver would have been negligible. When the left front tire and wheel were damaged striking the curb and deploying the driver and front right air bags, the driver was thrust forward and slightly upward. (Note: it is possible that the driver applied the brakes, just as the left front tire approached the curb, thus stopping the tire's rotation and increasing the likelihood of tire and wheel damage.) At this time, the case vehicle was slightly



tilted left-to-right and front-to-rear, as the left front wheel was on top of the raised median and the left rear and right side tires remained on the pavement.

The case vehicle continued forward until the left rear tire and wheel contacted the concrete median curb, damaging the tire and causing the driver to be further jolted forward and slightly upward. The fourth and final impact occurred when the front left corner of the case vehicle contacted the breakaway light pole (**Figure 9**). This final impact's effects on the driver resulted in another slight forward and upward movement reloading her safety belts and the deployed air bag, which was in the process of deflating. As the case vehicle traveled an estimated two-to-three car lengths further west, the driver would have rebound rearward into her seat back.



**Figure 9:** Northeastward view from median of case vehicle's southwestbound approach; Note: light pole was replaced post-crash (case photo #09)

**CASE VEHICLE DRIVER INJURIES**

The driver was treated at the scene and released. She later was treated and released at a hospital's emergency room. She reportedly sustained a fractured rib behind her right breast and a contused chest. In addition, she reported that her shoulders were sore, bilaterally. She declined to enable the acquisition of her medical records.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Fractured right rib, behind right breast	450212.1 minor	Steering wheel hub and/or spokes	Possible	Interviewee (same person)
2	Contusion over entire chest	490402.1 minor	Air bag, driver's side	Probable	Interviewee (same person)