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REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN99-038

LOCATION - Alabama

VEHICLE - 1998 CHEVROLET LUMINA LS

CRASH DATE - January 1998

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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> Remote air bag deployment investigation involving a 1998 Chevrolet Lumina LS, with manual safety belts and dual redesigned front air bags, and three trees.					
16. <i>Abstract</i> This report covers a remote investigation of an air bag deployment crash that involved a 1998 Chevrolet Lumina LS (case vehicle) and three trees. This crash is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of collision events, and the case vehicle's unrestrained driver (18-year-old male) sustained fatal head and chest injuries and its unrestrained front right passenger (19-year-old male) sustained "A" injuries (visible or carried from scene). The case vehicle was traveling south in the southbound lane of a two-lane, undivided, state roadway. The crash occurred off the right (west) pavement edge. Coming out of a left-hand curve, the case vehicle exited the right (west) pavement edge at a shallow angle. Police photographs indicate that the case vehicle's off road travel path continued at that shallow angle across a paved shoulder, across a gravel and earth shoulder extension, down an embankment, and into a tree line, knocking down a small evergreen tree (nondeployment impact), continuing on and striking two large trees (one behind the other), causing the case vehicle's driver and front right passenger air bags to deploy. Front plane damage from contact with the small evergreen tree was masked by the severe frontal crush sustained by the case vehicle's second impact with the larger trees. The case vehicle rotated counterclockwise an unknown number of degrees to its final rest position. There is no knowledge of the pre-crash posture or seat adjustments of the case vehicle's occupants. The unrestrained driver likely contacted his air bag and steering wheel and sustained fatal, massive head and chest trauma. He was pronounced dead at the scene and no autopsy was performed. The unrestrained front right passenger sustained police-reported "A" injuries (visible or carried from scene).					
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Additional Photographs are available in SCI EDCS case IN99-038

This case was brought to the NHTSA's attention by a review of the 1998 Fatality Analysis Reporting System (FARS) in February 1999. The crash involved a 1998 Chevrolet Lumina LS and three trees. The crash occurred in January 1998, at 2:45 p.m., in Alabama, and was investigated by the applicable state police. This case is of special interest because the case vehicle was equipped with redesigned air bags that deployed as a result of collision events. The case vehicle's unrestrained driver (18-year-old male) sustained fatal head and chest injuries and the unrestrained front right passenger (19-year-old male) sustained police-reported "A" injuries (visible or carried from scene). The Police Crash Report was received in April 1999, the police photographs in June, and the death certificate for the driver in July (no autopsy was performed). This report is based on the Police Crash Report, the death certificate, police photographs, occupant kinematic principles, and this contractor's evaluation of the evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling south in the southbound lane of a two-lane, undivided, state route and was intending to continue its southerly travel path (**Figure 1**). It was daylight, clear weather, 60 degrees, and no reported road defects or material in the road. The roadway was bituminous, dry, a slight left curve southbound, a positive grade to the south, and no vision obstructions. Posted speed limit was 89 km.p.h. (55 m.p.h.) and the investigating officers estimated the case vehicle's pre-impact travel speed at 113 km.p.h. (70 m.p.h.). Traffic controls consisted of a double solid yellow (no passing) centerline and a single solid white edge line on each side of the pavement. They were clearly visible. Investigating officers did not indicate any attempted avoidance maneuvers by the driver nor did any of the police photographs evidence such maneuvers. The crash occurred off the right (west) pavement edge.

Coming out of a left-hand curve, the southbound case vehicle exited the right (west) pavement edge at a shallow angle. Police photographs indicate that the case vehicle's off road travel path continued at that shallow angle across a paved shoulder, across a gravel and earth shoulder extension, down an embankment, and into a tree line (**Figure 2**). The case vehicle's front plane impacted and knocked down a small evergreen tree (estimated to have been a nondeployment impact), continuing on and striking two large trees (one behind the other), causing the case



Figure 1: Case vehicle's pre-impact travel path;
Note: off-road tire tracks (case photo #01)

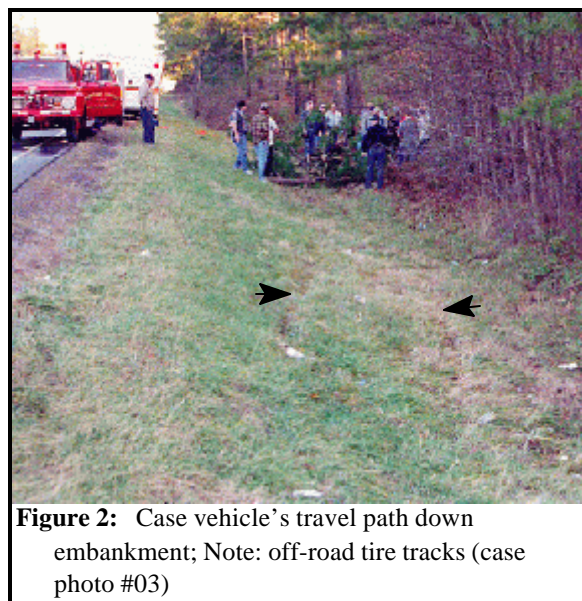


Figure 2: Case vehicle's travel path down embankment; Note: off-road tire tracks (case photo #03)

vehicle's driver and front right passenger air bags to deploy. Front plane damage from contact with the small evergreen tree was masked by the severe frontal crush sustained by the case vehicle's second impact with the larger trees. The case vehicle rotated counterclockwise to its final rest position.

CASE VEHICLE

The case vehicle was a front wheel drive, 1998 Chevrolet Lumina LS, six-passenger, four-door sedan (VIN: 2G1WL52M8W9-----), equipped with a 3.1 liter, V-6, gasoline engine and a four-speed automatic transmission with its shift lever in an unknown location. Four-wheel anti-lock brakes were an option for this vehicle, but it is not known if the case vehicle was so equipped. The case vehicle's wheelbase was 273 centimeters (107.5 inches). An odometer reading was not reported. The case vehicle was towed from the scene due to disabling damage.

As stated previously, direct damage from contact with the first evergreen tree was masked by the subsequent severe crush with the larger trees. The following discussion of damaged vehicle components results from studying acquired police scene photographs of the case vehicle at final rest (**Figure 3**): the front bumper, fascia, and splash pan displaced rearward; the grille and both headlamp assemblies shattered; the hood torn from its mounting; the right side of the engine compartment is devoid of components; the right front fender and right front tire and wheel assembly not visibly attached to vehicle; the right upper A-pillar was cut post-crash and allowed the right front door to fall almost parallel to the ground with its glazing shattered (its original post-crash position is not known); the right rear door glazing was shattered; the right half of the engine cowl was shoved rearward; the windshield was splintered (its lateral split may have been induced by extrication activities); the roof header was contacted right of center; and the left front fender was pulled to the right.



Figure 3: Case vehicle at final rest; Note: absence of engine compartment components on right side (Case photo #07)

Photographic views into the case vehicle's interior were limited but it is obvious that there was severe intrusion of the instrument panel's right side into the front right passenger seat area. Part of the windshield was hanging down into the greenhouse. The right-side toe pan and foot well were shoved rearward and upward. The deployed front right passenger air bag was covered with blood stains, most likely from the front right passenger.

No CDC with the first evergreen tree could be estimated. A CDC for the second impact with the larger trees (estimated from police photographs) is: **12-FDAW-7**, primary direction of force of 10 degrees (010). The WinSMASH reconstruction program, barrier algorithm with a CDC-only estimated crush profile, provided a borderline reconstruction, but the results appear reasonable. The estimated Total, Longitudinal, and Lateral Delta Vs are: 110.7 km.p.h. (68.8 m.p.h.), -107.0 km.p.h. (-66.5 m.p.h.), and -28.7 km.p.h. (-17.8 m.p.h.). The crash severity for the case vehicle was high [greater than 40 km.p.h. (25 m.p.h.)].

CASE VEHICLE DRIVER

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The case vehicle's driver [18-year-old male; White (unknown if Hispanic); height and weight unknown] was not restrained by his available, manual, three-point, lap and shoulder safety belt system. The driver's pre-crash seat adjustments, steering wheel position, and seated posture are not known. He was declared dead at the scene of the crash and was transported to a medical facility. No autopsy was performed. The following discussion of the driver's injuries is based on a death investigation report, a death certificate, on-scene photographs, and occupant kinematic principles.

The case vehicle's driver was probably seated in a normal driving posture, with his back against the seat back, at least one hand on the steering wheel, and his feet on the foot controls and floor. As a result of his non-use of the available safety belt system, the driver probably moved slightly to his right as the case vehicle angled off the right (west) pavement edge and began an 84.7 meter (278 foot) diagonal path down an embankment. The small evergreen tree first impacted and knocked down by the case vehicle likely generated a negligible Delta V and may have resulted in an extremely slight forward movement by the driver. As the case vehicle contacted the two larger trees, the driver moved forward and slightly upward and to the right. He contacted his deploying air bag and deflated it as maximum engagement was approached. The case vehicle then began a counterclockwise rotation to final rest which resulted in the driver likely moving to his left. He then rebounded to his right and was found lying on his right side with his head pointing towards the front right passenger seat (**Figure 4** above). Declared dead at the scene and with no autopsy performed, the death certificate listed only "massive head and chest trauma" as the causes of death.



Figure 4: Interior view of case vehicle; Note: rearward movement of instrument panel's right side (case photo #09)

CASE VEHICLE DRIVER INJURIES

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1.	Traumatic brain injury, NFS ("massive trauma to head")	115299.7 unknown	Unknown	Unknown	Death Certificate
2.	Thoracic cavity injury, NFS ("massive trauma to chest")	442299.7 unknown	Unknown	Unknown	Death Certificate

CASE VEHICLE FRONT RIGHT PASSENGER

The case vehicle's front right passenger [19-year-old male; race, height, and weight unknown] was not restrained by his available, manual, three-point, lap and shoulder safety belt system. He received "A"

(visible or carried from scene) injuries and was transported from the scene by ambulance to a medical facility. The Police Crash Report indicated that this occupant was trapped in the vehicle. It was noted from police photographs that the right upper "A"-pillar had been snipped during extrication activities. It is not known if the right front door remained closed during the crash sequence. The front right passenger air bag deployed and the fabric contained several blood stains, most likely from the front right passenger. His crash sequence kinematics most likely mirrored those of the driver.

OBJECTS CONTACTED

The case vehicle contacted three trees, with one knocked down. The first tree contacted was a small evergreen tree. It was knocked down. The two larger trees (one impact) had diameters of approximately 38 centimeters (15 inches) each. Although their trunks were skinned of bark in places, there was no evidence that they moved or fractured.