



# INDIANA UNIVERSITY

## TRANSPORTATION RESEARCH CENTER

School of Public and Environmental Affairs  
222 West Second Street  
Bloomington, Indiana 47403-1501  
(812) 855-3908 Fax: (812) 855-3537

### REMOTE CHILD AIR BAG-RELATED FATALITY INVESTIGATION

CASE NUMBER - IN-03-026  
LOCATION - Texas  
VEHICLE - 1997 CHEVROLET LUMINA LS  
CRASH DATE - June 2001

Submitted:  
February 4, 2005  
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February 19, 2007



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National Highway Traffic Safety Administration  
National Center for Statistics and Analysis  
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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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16. <i>Abstract</i> The report covers a remote investigation of an air bag deployment crash involving a 1997 Chevrolet Lumina LS (case vehicle) and a 2000 Ford Mustang (other vehicle). This crash is of special interest because there were two young girls sharing the case vehicle's front right seat position, with neither child restrained in any manner, and the child who was seated closer to the center (4-year-old female) sustained cervical spinal cord and brain injuries due to contacting the deploying front right passenger air bag, resulting in her death. The case vehicle was traveling eastward in the outside eastbound through lane of a two-lane roadway that was part of a divided trafficway and was approaching a four-leg intersection, intending to continue eastbound. The Mustang had been stopped at a traffic signal, heading northward in the outside northbound through lane of the intersecting roadway, and had just started into the four-leg intersection, intending to travel northbound. It was dark but lighted, the weather was clear and the concrete road surface was dry and free of defects. The Mustang entered the intersection across the case vehicle's path. The case vehicle driver probably braked at the last second. The front of the case vehicle impacted the left side of the Mustang, causing the case vehicle's driver and front right passenger air bags to deploy. Both vehicles were towed due to damage. The case vehicle's front right passenger air bag module cover flap impacted and fractured the windshield. The details about the inboard front right passenger's pre-crash posture are not known but she was not in a normal, forward-facing seated position. She encountered the deploying front right air bag with her face, neck and shoulders and sustained: atlanto-occipital dislocation with compression of the spinal cord; compression of the brain stem including uncal and cerebellar tonsillar herniation; other serious brain injuries; and contusions of the lungs. She struck the fractured windshield and her head broke through it, creating a large hole, and she sustained: a laceration of the left parietal scalp, exposing the calvarium; subgaleal hemorrhage in the area of the laceration; and abrasions on her upper back. She also sustained numerous contusions and abrasions on her face, neck, shoulders and left forearm. She was declared dead at the scene. The outboard front right passenger (6-year-old female) sustained multiple abrasions on her face and neck, and was hospitalized for three days. The restrained case vehicle driver (37-year-old female) sustained superficial abrasions on her chest and arms, and was treated and released at a hospital emergency department.					
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This report was brought to the NHTSA's attention in June 2003 through a review of the 2001 Fatality Analysis Reporting System (FARS) data. This crash involved a 1997 Chevrolet Lumina LS (case vehicle) and a 2000 Ford Mustang (other vehicle). The crash occurred in June 2001, at 9:55 p.m., in Texas and was investigated by the applicable municipal police department. This crash is of special interest because there were two young girls sharing the case vehicle's front right seat position and the child who was seated closer to the center (4-year-old female, white, Hispanic) sustained cervical spinal cord and brain injuries due to contacting the deploying front right passenger air bag, resulting in her death. This report is based on the police crash report, on-scene photographs, autopsy data for the fatal victim, medical treatment data for the other case vehicle occupants, and this contractor's evaluation of the available evidence.

**CRASH CIRCUMSTANCES**

The case vehicle was traveling eastward in the outside eastbound through lane of a two-lane roadway that was part of a divided trafficway and was approaching a four-leg intersection, intending to continue eastbound (i.e., both the east and westbound roadways had two through lanes). The Mustang had been stopped at a traffic signal, heading northward in the outside northbound through lane of the intersecting two-lane, one-way roadway, and had just started into the four-leg intersection, intending to travel northbound. It was dark but lighted, the weather was clear and the concrete road surface was dry and free of defects. The speed limit was 56 km.p.h. [35 m.p.h.] for both roadways. The Mustang entered the intersection across the path of the case vehicle. The case vehicle driver stated that she was distracted by the two passengers and did not notice that she was approaching an intersection. The case vehicle driver probably braked at the last second, but the case vehicle was equipped with four-wheel anti-lock brakes and did not leave any braking skid marks. The crash occurred within the intersection. (There are no photographs available that provide useful views of the scene.)

The front of the case vehicle impacted the left side of the Mustang, in the driver's door and left A-pillar area, causing the case vehicle's driver and front right passenger air bags to deploy. The Mustang was also equipped with dual frontal air bags that deployed upon impact. The case vehicle came to rest near the point of impact, heading east. The Mustang rotated a few degrees counterclockwise and came to rest heading slightly west of north, close to the point of impact. As the vehicles came to rest they stayed in contact, with the case vehicle's front left corner against the Mustang's left front wheel and A-pillar area.

**CASE VEHICLE**

The case vehicle was a 1997 Chevrolet Lumina LS front wheel drive, four-door, six-passenger sedan (VIN: 2G1WL52M8V9-----), equipped with a 3.1 liter V6 gasoline engine and an automatic transmission with a column-mounted selector lever. Four-wheel anti-lock brakes were standard equipment on the LS model. The Lumina was fitted with manual lap-and-shoulder safety belts at the four outboard seat positions, manual lap belts at the front and back center seats, and with dual frontal air bags. The odometer reading is not known. Its wheelbase was 273 centimeters [107.5 inches]. The case vehicle was towed due to damage.

The case vehicle sustained relatively minor impact damage across the entire front, heavier on the left. The modest damage on the two vehicles and their close proximity at final rest indicate a relatively low-speed impact (**Figures 1 and 2**), which suggests that the case vehicle driver braked prior to impact.

The available photos do not fully illustrate of the case vehicle's damage. The front left area of the bumper and the left front fender were crushed rearward against the left front tire (**Figure 1**), causing wheel restriction. The left headlamp/turn signal assembly was shattered, but the right headlamp was intact (**Figure 2**). The engine hood was buckled slightly upward on the left. The windshield had a large hole in the right-center area (**Figures 3 and 4**). There was no other glazing damage. Except for the restriction of the left front wheel/tire, there was no damage to the wheels or tires.



**Figure 1:** Case vehicle's front against other vehicle's left side at final rest, showing case vehicle's left front corner area (case photo #20)



**Figure 2:** Case vehicle's front against other vehicle's left side at final rest, showing case vehicle's right front corner area (case photo #19)

The CDC for the case vehicle's single impact was estimated from photographs as **01-FDEW-1 (30)**. The WinSMASH reconstruction program, based on the photo-estimated CDCs for the two vehicles, was used. The total, longitudinal and lateral delta-Vs for the case vehicle are, respectively: 17.0 km.p.h. [10.6 m.p.h.], -14.7 km.p.h. [-9.1 m.p.h.], -8.5 km.p.h. [-5.3 m.p.h.]. This is a borderline reconstruction, but the results appear reasonable. This was a crash of low severity (14-23 km.p.h. [9-14 m.p.h.]) for the case vehicle.

#### **AUTOMATIC RESTRAINT SYSTEM**

The case vehicle was equipped with driver and front right passenger air bags, both of which deployed as a result of the collision. The driver's air bag was mounted in the steering wheel hub. The available photos do not provide close-up views of the driver's air bag. This contractor was not able to discover any information concerning the post-deployment condition of the module cover flaps or the air bag. The photos do not show any obvious damage or evidence of occupant contact on the driver's air bag fabric (**Figure 5**).



**Figure 3:** Case vehicle at final rest; note, passenger air bag module cover flap projecting through hole in windshield (case photo #06)



**Figure 4:** Case vehicle at final rest; note, large hole in windshield with passenger air bag module cover flap projecting through (case photo #07)

The front right passenger's air bag was located in the top of the instrument panel on the right (**Figure 5**). The available photographs do not provide close-up views of the passenger's air bag and there is no knowledge as to the post-deployment condition of the module flap or the air bag. The photos do not show any obvious damage or evidence of occupant contact on the passenger's air bag fabric. The module cover flap consisted of a single panel that was not attached anywhere around its perimeter but had a tether strap (**Figure 6**). It seems apparent that, when the front right passenger air bag deployed, the cover flap struck and fractured the windshield. At final rest, the cover flap was projecting through the large hole in the windshield (**Figures 3 and 4**).



**Figure 5:** Case vehicle's front seat row, showing deployed air bags, fractured windshield and blood on the front right seat cushion (case photo #08)



**Figure 6:** Exemplar front right passenger air bag cover flap, showing tethered installation NOT THE CASE VEHICLE (case photo #28)

### CASE VEHICLE'S INBOARD FRONT RIGHT PASSENGER'S KINEMATICS

The case vehicle's inboard front right passenger (4-year-old female, white, Hispanic, 104 centimeters, 18 kilograms [41 inches, 40 pounds]) was sharing the front right seat position with the outboard front right passenger (6-year-old female). Neither of the children was using the center seat position's manual lap-only safety belt or the front right position's manual, three-point, lap-and-shoulder safety belt system. The right portion of the split bench seat was adjusted

rearward relative to left portion but the actual position is not known, and the seat back was upright. The inboard passenger's posture is not known. The driver stated to the police that she was trying to get the four-year-old into the back seat, and the four-year-old may have been standing, kneeling or otherwise out of position.

The front right inboard passenger's pre-crash posture is not known but she was not in a normal forward-facing seated posture. The driver was distracted by the two front right passengers and did not notice that the case vehicle was approaching an intersection. The driver probably braked at the last second, and the inboard front right passenger probably moved forward in response to the braking deceleration. The case vehicle's front impacted the other vehicle's left side, causing the case vehicle's front right passenger air bag to deploy. The inboard front right passenger moved rightward, upward and further forward, toward the 1:00 o'clock direction of force, in response to the impact deceleration. The front right air bag module cover flap struck the windshield, fracturing it. The inboard passenger encountered the deploying front right air bag with her face, neck and upper chest and she sustained: complete atlanto-occipital dislocation with compression of the spinal cord; compression of the brain stem including transtentorial (uncal) herniation and cerebellar tonsillar herniation; bilateral cerebellar subarachnoid hemorrhage; diffuse bilateral cerebral subarachnoid hemorrhage; contusions of the lungs; hemorrhage in the right conjunctiva; and numerous contusions and abrasions on her face, neck, bilateral shoulders and left forearm. She struck the fractured windshield and her head broke through it, and she sustained: a ragged laceration of the left parietal scalp, exposing the calvarium; a subgaleal hemorrhage of the left parietal scalp in the same area as the laceration; a ragged laceration on her left forehead; and abrasions on her upper back. Her position at final rest is not known, but she probably rebounded back into the interior. There was copious blood staining on the front right seat cushion (**Figure 5**), indicating this child's final rest, as no one else in the case vehicle sustained any lacerative injuries.

**INBOARD FRONT RIGHT PASSENGER'S INJURIES**

The inboard front right passenger was declared dead at the scene. She was transported to the medical examiner's facility and autopsied.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Contusion {compression} spinal cord with complete atlanto-occipital dislocation	maximum 640234.6,6	Air bag, front right passenger's	Probable	Autopsy
2	Compression brain stem including transtentorial (uncal) and cerebellar tonsillar herniation	critical 140202.5,8	Air bag, front right passenger's	Probable	Autopsy
3	Hemorrhage, subarachnoid, patchy, of cerebellum	serious 140466.3,6	Air bag, front right passenger's	Probable	Autopsy

*Inboard Front Right Passenger's Injuries (continued)*

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Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
4 5	Hemorrhage, subarachnoid, diffuse, cerebrum, bilaterally	serious 140684.3,1 140684.3,2	Air bag, front right passenger's	Probable	Autopsy
6	Contusions, lung, occasional, not further specified	serious 441402.3,9	Air bag, front right passenger's	Probable	Autopsy
7	Injury {hemorrhage} right conjunctiva (eye)	minor 240416.1,1	Air bag, front right passenger's	Possible	Autopsy
8	Contusion {subgaleal hemorrhage} left frontoparietal scalp, corresponding to laceration	minor 190402.1,2	Right windshield glazing	Possible	Autopsy
9	Laceration, 6.4 cm (2.5 in) left parietal scalp, superior to left ear, exposing calvarium	minor 190602.1,2	Right windshield glazing	Possible	Autopsy
10	Laceration, 3.2 cm (1.3 in) left forehead, above eyebrow	minor 290602.1,7	Right windshield glazing	Possible	Autopsy
11	Abrasion right cheek, lower cheek to chin	minor 290202.1,1	Air bag, front right passenger's	Probable	Autopsy
12	Contusion right lower lip, not further specified	minor 290402.1,8	Air bag, front right passenger's	Probable	Autopsy
13	Lacerations lower lip, at least both left and right	minor 290602.1,8	Air bag, front right passenger's	Probable	Autopsy
14	Abrasions anterior neck, left of midline	minor 390202.1,5	Air bag, front right passenger's	Probable	Autopsy
15	Abrasion, 5.7 cm (2.3 in) right neck, extending from below right ear	minor 390202.1,1	Air bag, front right passenger's	Probable	Autopsy
16	Contusion right neck, not further specified	minor 390402.1,1	Air bag, front right passenger's	Probable	Autopsy
17	Abrasion, 9.5 cm (3.8 in) right upper back	minor 690202.1,7	Right windshield glazing	Possible	Autopsy
18	Contusions (x 3), faint, right shoulder	minor 790402.1,1	Air bag, front right passenger's	Possible	Autopsy
19	Contusion, 1.0 cm (0.4 in), faint, left shoulder	minor 790402.1,2	Air bag, front right passenger's	Possible	Autopsy
20	Contusions (x 2) left proximal, lateral forearm	minor 790402.1,2	Air bag, front right passenger's	Possible	Autopsy

## CASE VEHICLE DRIVER'S KINEMATICS

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The case vehicle's driver (37-year-old female, white, Hispanic, height and weight unknown) was restrained by her available, active, three-point, lap-and-shoulder safety belt system. Her posture is not known, but she had at least one hand on the steering wheel and at least one foot operating the foot controls. The left portion of the split bench seat track was adjusted forward relative to the right portion but the actual position is not known, and the seat back was upright.

The driver did not notice that she was approaching an intersection because she was distracted by the two front right occupants and she probably braked at the last second. She moved forward in response to the braking deceleration and her safety belt retractor locked. The case vehicle's front impacted the other vehicle's left side, causing the driver's air bag to deploy. She encountered the deployed driver's air bag with her face and chest, but was held in place by her safety belt system. She sustained abrasions on her right breast and on her forearms bilaterally. She probably rebounded into her seat from the air bag contact.

## CASE VEHICLE DRIVER'S INJURIES

The driver was transported via ambulance to a hospital, where she was treated and released in the emergency department.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Abrasion, superficial, right breast	minor 490202.1,1	Air bag, driver's	Probable	Emergency room records
2	Abrasions, superficial, bilateral arms, not further specified	minor 790202.1,3	Air bag, driver's	Probable	Emergency room records

## CASE VEHICLE OUTBOARD FRONT RIGHT PASSENGER'S KINEMATICS

The case vehicle's outboard front right passenger (6-year-old female, white, Hispanic, 20 kilograms [44 pounds], height not known) was sharing the front right seat position with the inboard front right passenger (4-year-old female) and neither of the two children was using the center seat position's manual lap-only safety belt or the front right position's manual, three-point, lap-and-shoulder safety belt system. The right portion of the split bench seat was adjusted rearward relative to left portion, but the actual position is not known, and the seat back was upright. The outboard passenger's pre-crash posture is not known.

The case vehicle driver probably braked at the last second, and the outboard front right passenger moved forward in response to the braking deceleration. The case vehicle's front impacted the left side of the other vehicle, causing the case vehicle's front right passenger air bag to deploy, and the outboard passenger moved rightward, upward and further forward in response to the 1:00 o'clock direction of force. Because of her position at the outboard side of the front right seat position, the outboard passenger encountered the air bag with the left side of her face

and neck. She sustained multiple abrasions on the left side of her face (including forehead, nose, left cheek, left chin and over the left mandible), an abrasion on the left eyelid and abrasions on her neck. Her position at final rest is not known, but she probably rebounded back into her seat.

**OUTBOARD FRONT RIGHT PASSENGER'S INJURIES**

The outboard front right passenger was transported via ambulance to a hospital. She was admitted for observation and discharged after three days.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Abrasions, multiple, left face, including forehead, nose, left cheek—with swelling <sup>1</sup> , and left chin—with swelling <sup>1</sup> over left mandible	minor 290202.1,0	Air bag, front right passenger's	Possible	Hospitalization records
2	Abrasion left upper eyelid	minor 297202.1,2	Air bag, front right passenger's	Probable	Emergency room records
3	Abrasion neck, not further specified	minor 390202.1,9	Air bag, front right passenger's	Probable	Emergency room records

**OTHER VEHICLE**

The other vehicle was a 2000 Ford Mustang rear wheel drive, two-door, four-passenger coupe (VIN: 1FAFP4049YF-----), equipped with a 3.8 liter V6 gasoline engine and an automatic transmission with a console-mounted selector lever. Four wheel anti-lock brakes were an option for this model, but it is not known if this vehicle was so equipped. The Mustang was equipped with manual lap-and-shoulder safety belts for all four seat positions plus redesigned frontal air bags for the two front outboard seat positions. The odometer reading is not known. Its wheelbase was 257 centimeters [101.3 inches]. The Mustang was towed due to damage.

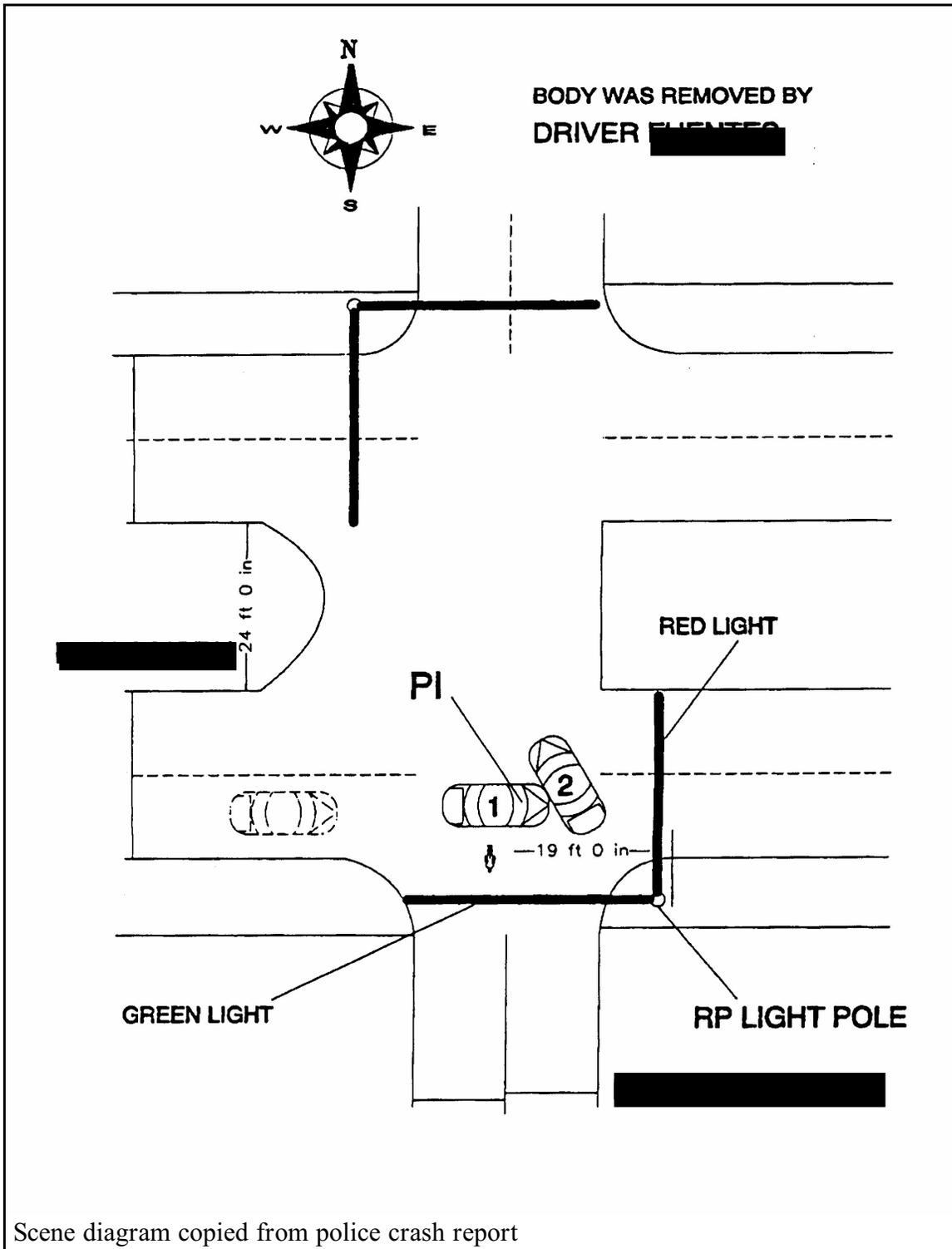
The Mustang sustained direct contact damage along the lower edge of the driver's door, the left lower A-pillar, the left front fender and the left front wheel/tire assembly. The available photos do not enable a full appreciation of the damage (**Figures 1 and 2**). The lower edge of the door was crushed inward along its entire width. The lower left A-pillar was crushed inward and the left edge of the windshield was cracked. The rearward portion of the left fender was crushed inward and there was direct contact to the left front tire, but no wheel or tire damage is visible. The driver and front right passenger air bags deployed. Other than the cracked windshield, there was no glazing damage.

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<sup>1</sup> It is not clear whether the swelling was a result of the air bag impact or a complication of a previously existing medical condition [i.e., an infected (abscessed) left upper tooth].

The CDC for the Mustang's single impact was estimated from photographs as **10-LYEW-2 (300)**. The WinSMASH reconstruction program, based on the photo-estimated CDCs for the two vehicles, was used. The total, longitudinal and lateral delta-Vs for the Mustang are, respectively: 19.0 km.p.h. [11.8 m.p.h.], -9.5 km.p.h. [-5.9 m.p.h.], + 16.5 km.p.h. [+ 10.3 m.p.h.]. This is a borderline reconstruction, but the results appear reasonable. This was a crash of low severity (14-23 km.p.h. [9-14 m.p.h.]) for the Mustang.

According to the police crash report, the Mustang's driver (20-year-old male, white, unknown if Hispanic, unknown height and weight) was restrained by his available, active, three-point, lap-and-shoulder safety belt system and the driver's air bag deployed. The police crash report indicates that the driver did not sustain any injuries and he was not transported by ambulance. There was no other occupant in the Mustang.



Note: The depiction of a body on the pavement shows the position of the fatal victim after she was removed from the case vehicle.