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REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN-03-027
LOCATION - Texas
VEHICLE - 1995 FORD CONTOUR GL
CRASH DATE - April 2001

Submitted:

December 10, 2004
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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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Remote investigation of an air bag deployment crash involving a 1995 Ford Contour, equipped with three-point manual safety belts and dual frontal air bags, and a 1990 Ford Aerostar

16. *Abstract*

This report covers a remote investigation of a crash involving a 1995 Ford Contour GL sedan (case vehicle) and a 1990 Ford Aerostar minivan (other vehicle). This crash is of special interest because the case vehicle's unrestrained front right passenger (6-year-old female) sustained multiple injuries from her deploying front right passenger air bag and module cover flap, and from being redirected by the deploying air bag, resulting in her death. The case vehicle was traveling in a northwesterly direction in the northwestbound lane of a two-lane, undivided city street and was approaching a four-leg intersection with no controls for northwest-southeast traffic, intending to proceed straight ahead. The other vehicle was traveling in a northeasterly direction in the northeastbound lane of the intersecting two-lane, undivided city street, with stop signs for northeast-southwest traffic. It was daylight, the weather was clear, the asphalt road surfaces were dry and free of defects and both roadways were straight and level. The other vehicle entered the intersection across the case vehicle's path and the case vehicle's driver braked with lock-up. The front of the case vehicle impacted the right front portion of the other vehicle, 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 was transported via ground ambulance to a hospital, where she was declared dead approximately 60 minutes post-crash. She was not autopsied. She sustained contusions and abrasions on her face and neck, an unspecified injury to her larynx, a depressed skull fracture in the occipital region, cerebral edema, and multiple contusions and abrasions. The case vehicle's driver was restrained by her manual three-point safety belt and the driver's air bag deployed. The driver was treated and released with minor soft tissue injuries. The case vehicle's back right passenger (2-year-old male) was seated in a child safety seat. He did not sustain any injuries.

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BACKGROUND

This report was brought to NHTSA's attention in June 2003 through a review of the 2001 Fatality Analysis Reporting System (FARS) data. This crash involved a 1995 Ford Contour GL sedan (case vehicle) and a 1990 Ford Aerostar minivan (other vehicle). The crash occurred in April 2001, at 5:31 p.m., in Texas, and was investigated by the applicable municipal police department. This crash is of special interest because the case vehicle's unrestrained front right passenger (6-year-old female, white, unknown if Hispanic) sustained multiple injuries from her deploying front right passenger air bag and module cover flap, and from being redirected by the deploying air bag, resulting in her death. This report is based on the police crash report, police on-scene photographs, medical treatment data and this contractor's evaluation of the available evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling in a northwesterly direction in the northwestbound lane of a two-lane, undivided city street and was approaching a four-leg intersection with no controls for northwest-southeast traffic, intending to proceed straight ahead. The other vehicle was traveling in a northeasterly direction in the northeastbound lane of the intersecting two-lane, undivided city street, with stop signs for northeast-southwest traffic. It was daylight, the weather was clear, the asphalt road surfaces were dry and free of defects and both roadways were straight and level. The speed limits were 56 km.p.h. [35 m.p.h.] for the case vehicle and 48 km.p.h. [30 m.p.h.] for the other vehicle. The other vehicle entered the intersection across the case vehicle' s path. According to the police diagram, the case vehicle's driver braked, attempting to avoid the collision, leaving approximately 7 meters [23 feet] of braking skid marks. The crash occurred within the intersection.

The front of the case vehicle impacted the right front portion of the other vehicle, causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle rotated a few degrees clockwise and came to rest a short distance from the point of impact, within the intersection, heading approximately north. The other vehicle rotated approximately 60 degrees counterclockwise while sliding in a northwesterly direction and came to rest within the intersection heading north (**Figures 1** and **6**).

Figure 1: Case vehicle (left) and other vehicle at final rest, looking southwest (case photo #01)

CASE VEHICLE

The case vehicle was a 1995 Ford Contour GL front wheel drive, four-door, five-passenger sedan (VIN: 3FALP6533SM------) equipped with a 2.0 liter I-4 gasoline engine. It is not known whether the case vehicle had an automatic or a manual transmission. Four wheel, anti-lock brakes were an option on this model, but the case vehicle was apparently not so equipped, as evidenced by its braking skid marks. The odometer reading is not known. Its specification wheelbase was

271 centimeters [106.7 inches]. The case vehicle was towed away from the scene with the air bags deployed and extensive windshield cracking, but it was probably otherwise driveable.

Figure 2: Case vehicle's front at final rest (case photo #04)

The case vehicle sustained light crushing and abrading from direct contact involving the left three-quarters of the front (**Figures 2** and **3**). The damage was primarily at the center of the bumper and on the leading edge of the hood, extending to the front left bumper corner, with minor induced damage and displacement of the hood. Both headlamp/turn signal assemblies were intact. Based on the collision configuration and the damage to the other vehicle, this was probably an impact that involved substantial force despite the apparently minor damage. The case vehicle's energy absorbing bumper structures and frame accommodated this force with only slight exterior damage evident. There was extensive cracking of the windshield in the right and center (**Figure 4**). This cracking was certainly a result of the front right occupant impacting the windshield, but the vehicle-to-vehicle crash forces probably contributed to the magnitude of the windshield damage. None of the case vehicle's tires were deflated or restricted, and there was no glazing damage other than the windshield.

Figure 3: Case vehicle's front and right side (case photo #05)

The CDC for the case vehicle was estimated from photographs as **12-FYEW-1 (350)**. The WinSMASH reconstruction program, damage only algorithm based on the photo-estimated CDCs for the two vehicles, was used on the single impact. The total, longitudinal and lateral delta-Vs for the case vehicle are, respectively: 14.0 km.p.h. [8.7 m.p.h.], -13.8 km.p.h. [-8.6 m.p.h.] and + 2.4 km.p.h. [+ 1.5 m.p.h.]. This is a borderline reconstruction and the results appear a little low but essentially 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 is not visible in any of the available photographs, and there is no knowledge of its shape, size or condition after the deployment.

The front right passenger's air bag was located in the right side of the instrument panel, in the top-mount position. The available photographs do not show the entire air bag and its size,

shape and condition after the deployment are not known. The leading edge of the air bag module cover flap is bent and distorted, probably as a result of contacting the front right passenger (**Figures 4** and **5**). The right edge of the cover flap appears to be bent slightly downward while the left edge has been bent upward. This contractor speculates that the center and right of the cover flap contacted the front right occupant such that the inflating air bag was prevented from expanding straight out. This caused the air bag to press against and deform the left side of the cover flap as the air bag expanded to full inflation. There are no obvious areas of damage or contact evidence visible in the limited views of the air bag fabric.

Figure 4: Case vehicle's front right air bag, cover flap and cracked windshield (case photo #07)

CASE VEHICLE FRONT RIGHT PASSENGER'S KINEMATICS

The case vehicle's front right passenger (6-year-old female, white, unknown if Hispanic, unknown height, 18 kilograms [40 pounds]) was neither in a child safety seat nor using her available, active, three-point, lap-and-shoulder safety belt system. According to the driver's statement to the police, the child had been safety belted but had removed her seat belt shortly before the crash. There is no knowledge of the front right seat adjustments or the child's posture.

Figure 5: Front right air bag and cover flap, view from right (case photo #10)

The driver observed the threat ahead and braked with lock-up, and the front right passenger moved forward in response to the braking deceleration. This forward movement put the child in close proximity to the front right passenger's air bag module. The case vehicle's front impacted the right front area of the other vehicle, causing front right passenger to move further forward, toward the 12:00 o'clock direction of force, and causing the case vehicle's front right passenger air bag to deploy. The front right air bag module's cover flap and air bag struck the child in the anterior portion of her neck, causing contusions and abrasions on her neck and an injury to her larynx. Her face struck the windshield, causing the windshield to crack, and she sustained contusions on her face. The expanding air bag lifted her and the back of her head stuck the windshield header. She sustained scalp contusions and a depressed skull fracture in the occipital region. Her position at final rest is not known, but she probably fell back into the front right seat.

The front right passenger was transported by ground ambulance to a hospital. She sustained fatal injuries and was pronounced dead 61 minutes post-crash. She was not autopsied.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Nonanatomic brain injury with loss of consciousness, unresponsive, pupils fixed and dilated, GCS = 3	critical 160822.5,0	Windshield roof header, front right passenger's {air bag-related}	Possible	Emergency room records
2	Edema, cerebral, with death, not further specified	serious 140660.3,9	Windshield roof header, front right passenger's {air bag-related}	Possible	Emergency room records
3	Injury {disruption} larynx, not further specified	moderate 340299.2,5	Air bag module cover flap, front right passenger's	Possible	Emergency room records
4	Fracture, closed, depressed, basilar skull, occipital region with Battle' s sign and right hemotympanum	serious 150200.3,8	Windshield roof header, front right passenger's {air bag-related}	Possible	Emergency room records
5	Contusion {hematoma} occipital scalp, not further specified	minor 190402.1,6	Windshield roof header, front right passenger's {air bag-related}	Possible	Emergency room records
6	Contusion {bruising} over right ear, not further specified	minor 190402.1,1	Front right windshield's glazing	Possible	Emergency room records
7	Contusion {hematoma} nasal septum	minor 290402.1,4	Front right windshield's glazing	Probable	Emergency room records
8	Abrasions right, left anterior, and left lateral neck	minor 390202.1,0	Air bag, front right passenger's	Probable	Emergency room records
9	Contusion {ecchymosis} left anterior neck with swelling and subcutaneous emphysema	minor 390402.1,2	Air bag module cover flap, front right passenger's	Probable	Emergency room records
10	Contusion {bruise}, marked, left lower quadrant abdomen, not further specified	minor 590402.1,2	Right instrument panel and below	Possible	Emergency room records
11	Contusions, multiple, not further specified	minor 990400.1,9	Unknown contact mechanism	Unknown	Emergency room records

The case vehicle's driver (30-year-old female, white, unknown if Hispanic, height and weight not known) was restrained by her available, active, three-point, lap-and-shoulder safety belt system. There is no knowledge of the driver's seat adjustments or seated posture, but she was probably in an approximately normal driving posture, with her feet on the floor or foot controls and at least one hand on the steering wheel.

The driver observed the threat ahead and braked with lock-up. She moved forward in response to the braking deceleration and her safety belt retractor locked as she loaded the safety belt webbing. The case vehicle's front impacted the right front area of the other vehicle, causing the case vehicle driver's air bag to deploy. The driver moved forward, toward the 12:00 o'clock direction of force, but was held in place by her safety belt. Her left arm may have encountered the air bag and she may have lost her grip on the steering wheel. She sustained an abrasion on her left forearm and a contusion on her left elbow. She also sustained multiple contusions that are not otherwise specified, which may have been the result of loading her safety belt. There is no knowledge of her position at final rest, but she probably rebounded back into her bucket seat.

DRIVER'S INJURIES

The driver was transported by ground 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 left forearm, not further specified	minor 790202.1,2	Air bag, driver's	Possible	Emergency room records
2	Contusion left elbow, not further specified	minor 790402.1,2	Left side interior surface, excluding hardware and/or armrest	Possible	Emergency room records
3	Contusions, multiple, not further specified	minor 990400.1,9	Unknown contact mechanism	Unknown	Emergency room records

CASE VEHICLE BACK RIGHT PASSENGER'S KINEMATICS

Based on the police crash report, the back right passenger (2-year-old male, unknown race/ethnic origin, unknown height and weight) was seated in a child safety seat. There is no knowledge of the details concerning the type of child safety seat, the manner in which it was configured and installed, nor the child's position, posture or restraint use in the child seat. The available photographs do not show the case vehicle's second seat row or the child safety seat.

The driver observed the threat ahead and braked with lock-up. The back right passenger moved forward in response to the braking deceleration. The case vehicle's front impacted the

right front area of the other vehicle and the back right passenger moved further forward, toward the 12:00 o'clock direction of force. There is no knowledge of his restraint status and the details of his kinematic response to the braking and impact, and his position at final rest, are not known. According to the police crash report, he did not sustain any injuries and there is no treatment record for this child at the hospital where the driver and front right passenger were seen.

OTHER VEHICLE IN-03-027

The other vehicle was a 1990 Ford Aerostar rear wheel drive (4x2), three-door minivan (VIN: 1FMDA11U9LZ------), equipped with a 3.0 liter V6 gasoline engine. The Aerostar was not equipped with anti-lock brakes. Its odometer reading is not known. Its specification wheelbase was 302 centimeters [118.9 inches]. The Aerostar was towed due to disabling wheel damage.

Figure 6: Case vehicle (left) and Aerostar at final rest (case photo #03)

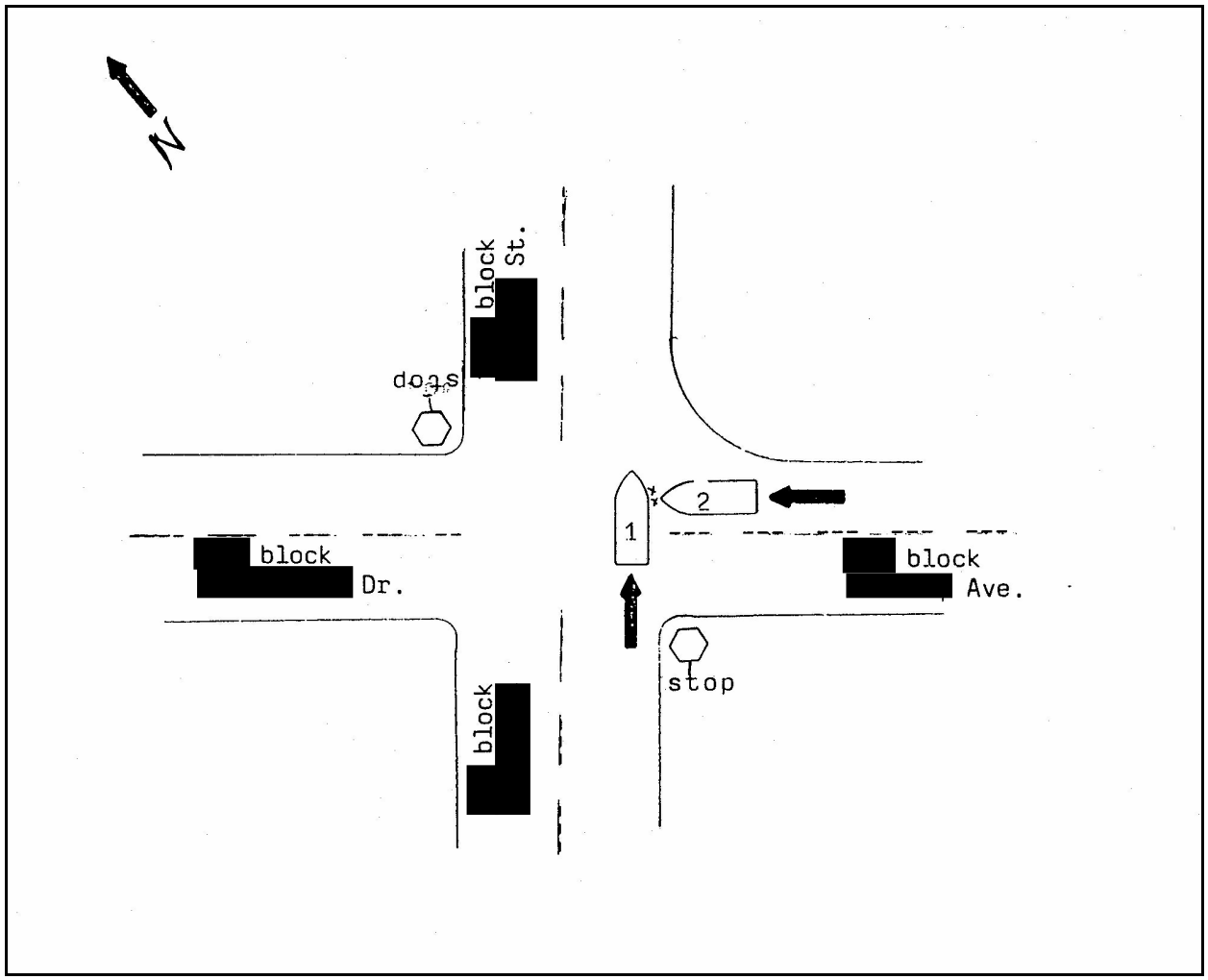
Figure 7: Aerostar's front right fender and wheel damage (case photo #12)

The Aerostar sustained direct contact damage in the right front area, from the right A-pillar forward to the bumper corner. The fender was crushed inward along the edges of the wheel well and there was direct contact to the wheel/tire assembly. The right front suspension components and/or axle were probably damaged, with the top of the wheel tilted inward approximately 20 degrees off vertical. The portion of the front bumper cover that wraps around to the right side showed light abrading and the turn signal lens was broken, but the right headlamp was intact. It appears that none of the other wheels/tires sustained any damage and no glazing damage is visible in the available photos.

The CDC for the Aerostar was estimated from photographs as **03-RFEW-3 (80)**. The WinSMASH reconstruction program, damage only algorithm based on the photo-estimated CDCs for the two vehicles, was used on the single impact. The total, longitudinal and lateral delta-Vs for the Aerostar are, respectively: 12.0 km.p.h. [7.5 m.p.h.], -2.1 km.p.h. [-1.3 m.p.h.] and -11.8 km.p.h. [-7.3 m.p.h.]. This is a borderline reconstruction and the results appear a little low but essentially reasonable. This was a crash of low severity (14-23 km.p.h. [9-14 m.p.h]) for the Aerostar.

According to the police crash report, the Aerostar' s driver (29-year-old female) was

restrained by her available, active, three-point, lap-and-shoulder safety belt system. The driver was reported by the police as not injured and she was not transported by ambulance to a hospital.



Copied from police crash report. Vehicle #2 in this drawing is the case vehicle.