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REMOTE AIR BAG DEPLOYMENT REPORT

CASE NUMBER - IN-03-028
LOCATION - Texas
VEHICLE - 1996 Mercury Cougar XR7
CRASH DATE - March 2001

Submitted:

September 17, 2004
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Contract Number: DTNH22-01-C-07022

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U.S. Department of Transportation
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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Remote investigation of an air bag deployment crash involving a 1996 Mercury Cougar, equipped with dual frontal air bags, that impacted a 1996 GMC S-15 Sonoma

16. *Abstract*
This report covers a remote investigation of an air bag deployment crash involving a 1996 Mercury Cougar XR7 coupe (case vehicle) and a 1996 GMC S-15 Sonoma compact pickup truck (other vehicle). This crash is of special interest because the case vehicle's unrestrained front right passenger (5-year-old female) sustained head, neck and chest injuries from contacting and being redirected by her deploying front right passenger air bag, resulting in her death. The case vehicle was traveling west in the westbound lane of a two-lane, undivided city street and was approaching a four-leg intersection, intending to continue straight ahead. The other vehicle was traveling north in the northbound lane of the intersecting two-lane, undivided city street, intending to continue straight. The GMC pickup entered the intersection across the case vehicle's path. The case vehicle driver braked, attempting to avoid the collision. The front of the case vehicle impacted the right side of the other vehicle, causing the case vehicle's driver and front right passenger air bags to deploy. The front right passenger had moved forward in response to the braking deceleration and encountered the deploying front right air bag, sustaining numerous injuries to her face, brain, neck and chest. The deploying air bag lifted the child and her head struck the roof. The force of the air bag propelled her over the front right seat and into the back seat. At final rest, she was on the floor in the back seat, on her back with her head toward the center. The child was air-lifted to a regional trauma center, where she was declared dead approximately 21 hours post-crash. The unrestrained case vehicle driver (17-year-old female) was seven months pregnant and complained of abdomen and lower back pain. She was transported via ground ambulance to a local hospital, where she was found not to have any specific injuries and was released with no treatment. The unrestrained driver of the other vehicle (18-year-old male) did not sustain any injuries. The case vehicle was towed due to disabling damage and the other vehicle was driven from the scene.

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TABLE OF CONTENTS IN-03-028

BACKGROUND

This remote investigation 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 1996 Mercury Cougar XR7 coupe (case vehicle) and a 1996 GMC S-15 Sonoma compact pickup (other vehicle). The crash occurred in March 2001 at 11:10 a.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 (5-year-old female, white, Hispanic) sustained head, neck and chest injuries from contacting and being redirected by her deploying front right passenger air bag, resulting in her death. This report is based on the police crash report, police photographs, medical treatment data, the autopsy report for the fatal victim, and this contractor' s evaluation of the available evidence.

CRASH CIRCUMSTANCES

The case vehicle was traveling west in the westbound lane of a two-lane, undivided city street and was approaching a four-leg intersection, intending to continue straight ahead. The other vehicle was traveling north in the northbound lane of the intersecting two-lane, undivided city street, intending to continue straight. It was daylight and the weather was clear. The asphalt surface of the two roadways was dry and free of defects, and there were no viewing obstructions for either vehicle. The speed limit on both roadways was 48 km.p.h. [30 m.p.h.] and the intersection was controlled by stop signs for north-south traffic, with no controls for east-west traffic (**Figure 1**). The GMC pickup entered the intersection across the case vehicle's path. The case vehicle driver stated that she braked, attempting to avoid the collision. The crash occurred within the intersection.

The case vehicle's front impacted the other vehicle's right side in the area of the right rear wheel and the forward area of the pickup bed, causing the case vehicle's driver and front right passenger air bags to deploy. The case vehicle came to rest close to the point of impact, heading west in the westbound lane within the intersection. The other vehicle rotated clockwise and slid a short distance northwest, coming to rest within the intersection heading northeast.

Figure 1: Other vehicle's northbound approach toward impact within the intersection; the case vehicle was traveling from right to left in this view (case photo #01)

CASE VEHICLE

The case vehicle was a 1996 Mercury Cougar XR7 rear wheel drive, two-door, five passenger coupe (VIN: 1MELM6243TH------), 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 on this model, but it is not known if the case vehicle was so equipped (but note, the case vehicle driver stated that she braked and the police report indicates that there were no

braking skid marks -- the case vehicle probably did have anti-lock brakes). The case vehicle's odometer reading is not known. Its specification wheelbase was 287 centimeters [113.0 inches]. The case vehicle was towed due to disabling damage.

Figure 2: Front-right view of case vehicle's frontal damage (case photo #11)

Figure 3: Front-left view of case vehicle's frontal damage (case photo #05)

The case vehicle sustained direct contact across the entire front. The bumper cover was torn off and the steel bumper was crushed rearward, more so on the left. The grille and both headlamp/turn signal assemblies were shattered and broken away, and the radiator support bracket was bent rearward. The engine hood was displaced and bent slightly down in the front (**Figures 2** and **3**). The windshield was cracked and there was no other glazing damage. None of the tires were deflated or restricted.

The CDC for the case vehicle's single impact was estimated from photographs as **12-FDEW-1 (350)**. The WinSMASH reconstruction program, damage-only algorithm based on 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.], -16.7 km.p.h. [-10.4 m.p.h.], and + 3.0 km.p.h. [+ 1.9 m.p.h.]. This is a borderline reconstruction, but the results appear reasonable. This was a crash of low severity 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 case vehicle's single (frontal) impact.

The driver's air bag was located in the steering wheel hub with the module cover flaps in the " H" configuration. The one available photograph (**Figure 4**) does not show any evidence of damage to the cover flaps or the air bag. The driver's air bag was round, with its diameter unknown. It is not known if this air bag had any tether(s) or vent port(s). There is no visible evidence of contact on the air bag's fabric.

The front right passenger's air bag was located in the middle position on the right side of the instrument panel. The module cover flap(s) cannot be seen in any of the available photographs

and the flap configuration is not known. It is not known whether the flap(s) were damaged during the deployment. The air bag's shape and size are not known, and it is not known whether it had any tether(s) or vent port(s). There is no evidence of occupant contact visible in the available photographs (**Figure 5**).

Figure 4: Driver's air bag, steering wheel and seat area (case photo #13)

Figure 5: Front right seat area and partial view of front right passenger's air bag (case photo #14)

CASE VEHICLE FRONT RIGHT PASSENGER'S KINEMATICS

The case vehicle's front right passenger (5-year-old female, white, Hispanic, 107 centimeters, 20 kilograms [42 inches, 45 pounds]) was neither in a child safety seat nor using her available, active, three-point, lap-and-shoulder, safety belt system. The seat back incline and seat track adjustments are not known. The case vehicle driver stated to the police that the child was sitting in an upright posture with her back against the bucket seat back and her legs forward.

In her statement, the driver indicated that she had glanced at the child as they were conversing and, upon returning her gaze to the roadway, recognized the threat ahead. The driver braked and reached across to restrain the child. The front of the case vehicle impacted the right side of the other vehicle, causing the case vehicle's driver and front right passenger air bags to deploy. The driver stated that she felt the child against her arm but, as the driver air bag deployed, the driver " lost contact" with the child. The child moved forward in response to the braking deceleration and then moved further forward in response to the impact, toward the 12 o'clock direction of force and into the path of the deploying front right air bag. She encountered the deploying air bag with her face, neck and chest, and she sustained: abrasions on her forehead, face, neck, and chest; contusions on her forehead, chest and left upper arm; a subdural hematoma overlying the left frontal and parietal lobes of the cerebrum; subarachnoid hemorrhage over the right temporal lobe; intraventricular hemorrhage; diffuse cerebral edema; contusions of both lungs; and an injury to the pericardium. She also sustained a fracture of the C1 vertebra with complete dislocation of the atlanto-occipital joint plus atlanto-axial dislocation. Her legs impacted the knee bolster and she sustained contusions and abrasions on both knees and her right leg. The air bag lifted her upward and her head struck the roof, causing subscalpular contusions overlying both frontal bones and the right parietal bone. The force of the air bag propelled her over the

front right seat back and into the back seat. At final rest, she was on the floor in the back seat, on her back with her head toward the center, where the ambulance crew found her, unconscious, cyanotic with no respirations, and with her chin against her chest.

CASE VEHICLE FRONT RIGHT PASSENGER'S INJURIES

The front right passenger was transported via ground ambulance to a local hospital and was immediately transported from the hospital, via helicopter, to a regional trauma center. She was declared dead approximately 21 hours post-crash.

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, and pupils fixed and nonreactive	critical 160824.5,0	Air bag, front right passenger's	Probable	EMS treatment record
2	Hematoma, subdural, 50 cc, over-lying left frontal and parietal lobes of cerebrum	critical 140656.5,2	Air bag, front right passenger's	Probable	Autopsy
3	Edema, cerebrum, mild, diffuse, not further specified	serious 140662.3,9	Air bag, front right passenger's	Possible	Autopsy
4	Hemorrhage, intraventricular, not further specified	severe 140678.4,9	Air bag, front right passenger's	Possible	Autopsy
5	Hemorrhage, subarachnoid, over right temporal lobe	serious 140684.3,1	Air bag, front right passenger's	Possible	Autopsy
6	Contusion right lung middle lobe and left lung lower lobe with 100 cc serosanguineous[1] fluid each pleural cavity	severe 441410.4,3	Air bag, front right passenger's	Probable	Autopsy
7	Injury pericardium with 30 cc serosanguineous[1] fluid in pericardial sac	serious 441604.3,4	Air bag, front right passenger's	Probable	Autopsy
8 9	Fracture C_1, not further specified, with complete dislocation of atlanto-occipital joint, and atlanto-axial dislocation	moderate 650216.2,6 serious 650206.3,6	Air bag, front right passenger's	Probable	Autopsy

[1] The following term is defined in DORLAND'S ILLUSTRATED MEDICAL DICTIONARY as follows: ***serosanguineous (ser"o-sang-gwin/e-as)***: pertaining to or containing both serum and blood.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
10	Contusion {hemorrhage} subscalpular, 11 x 11 cm (4.3 x 4.3 in) overlying both frontal bones and right parietal bone	minor 190402.1,5	Roof	Possible	Autopsy
11	Abrasions x 2, mid-forehead, over right upper eyelid	minor 290202.1,7	Air bag, front right passenger's	Probable	Autopsy
12	Contusion, 3 x 2 cm (1.2 x 0.8 in) mid-forehead and contusion above left eyebrow	minor 290402.1,7	Roof	Possible	Autopsy
13 14	Abrasion, large, beginning right cheek, extending onto right neck and across midline to left neck measuring 40.6 cm (16 in) on right (combined), 17.8 cm (7 in) anteriorly, and 19.1 cm (7.5 in) on left	minor 290202.1,1 minor 390202.1,0	Air bag, front right passenger's	Probable	Autopsy
15	Abrasion above right nipple and abrasions x 4 above left nipple	minor 490202.1,3	Air bag, front right passenger's	Probable	Autopsy
16	Contusion below right nipple	minor 490402.1,1	Air bag, front right passenger's	Probable	Autopsy
17	Contusion ventral left upper arm, not further specified	minor 790402.1,2	Air bag, front right passenger's	Probable	Autopsy
18	Contusion, 5.1 x 3.8 cm (2 x 1.5 in) lateral left antecubital fossa	minor 790402.1,2	Front right seat back	Possible	Autopsy
19	Abrasions, multiple, posterior left upper forearm	minor 790202.1,2	Front right seat back	Possible	Autopsy
20	Abrasions, multiple, anterior left upper leg	minor 890202.1,2	Front right instrument panel	Possible	Autopsy
21	Abrasions, multiple, left knee	minor 890202.1,2	Knee bolster, front right passenger's	Probable	Autopsy
22	Contusions below left knee	minor 890402.1,2	Knee bolster, front right passenger's	Probable	Autopsy
23	Contusion anterior right mid-leg	minor 890402.1,1	Right instrument panel and below	Possible	Autopsy

CASE VEHICLE DRIVER'S KINEMATICS

The case vehicle's driver (17-year-old female, white, non-Hispanic, unknown height and weight, seven months pregnant [third trimester]) was not using her available, active, three-point, lap-and-shoulder, safety belt system. She was probably seated in a normal driving posture, with

at least one hand on the steering wheel and her right foot operating the pedal controls. It is not known if the case vehicle was equipped with a tilt steering wheel. Her seat back and seat track adjustments are not known.

The driver glanced to the right to look at the front right passenger as they were conversing. When she returned her gaze to the road, the driver recognized the threat ahead and braked, and also reached with her right arm in an attempt to restrain the front right passenger. The driver probably moved forward in response to the braking deceleration. The front of the case vehicle impacted the right side of the other vehicle, causing the case vehicle's driver and front right air bags to deploy. The driver probably moved further forward, toward the 12:00 o'clock direction of force, in response to the impact deceleration. She described that she encountered the deployed driver's air bag with her face. The case vehicle came to rest a short distance from the point of impact and the driver probably rebounded back into her seat. She exited the vehicle with no assistance.

CASE VEHICLE DRIVER'S INJURIES

The driver was police-reported as having sustained " B" (non-incapacitating) injuries. She was seven months pregnant and complained of pain and cramping in her abdomen and lower back. She was transported via ground ambulance to a local hospital, where it was found that she did not sustain any specific injuries and she was released with no medical treatment.

OTHER VEHICLE

The other vehicle was a 1996 GMC S-15 Sonoma rear wheel drive, two-door, regular cab, short bed pickup truck (VIN: 1GTCS1443T------), equipped with a 2.2 liter, four cylinder gasoline engine and a manual transmission with a floor-mounted shift lever. Its specification wheelbase was 274 centimeters [108.3 inches]; its odometer reading is not known. The GMC pickup was driven from the scene.

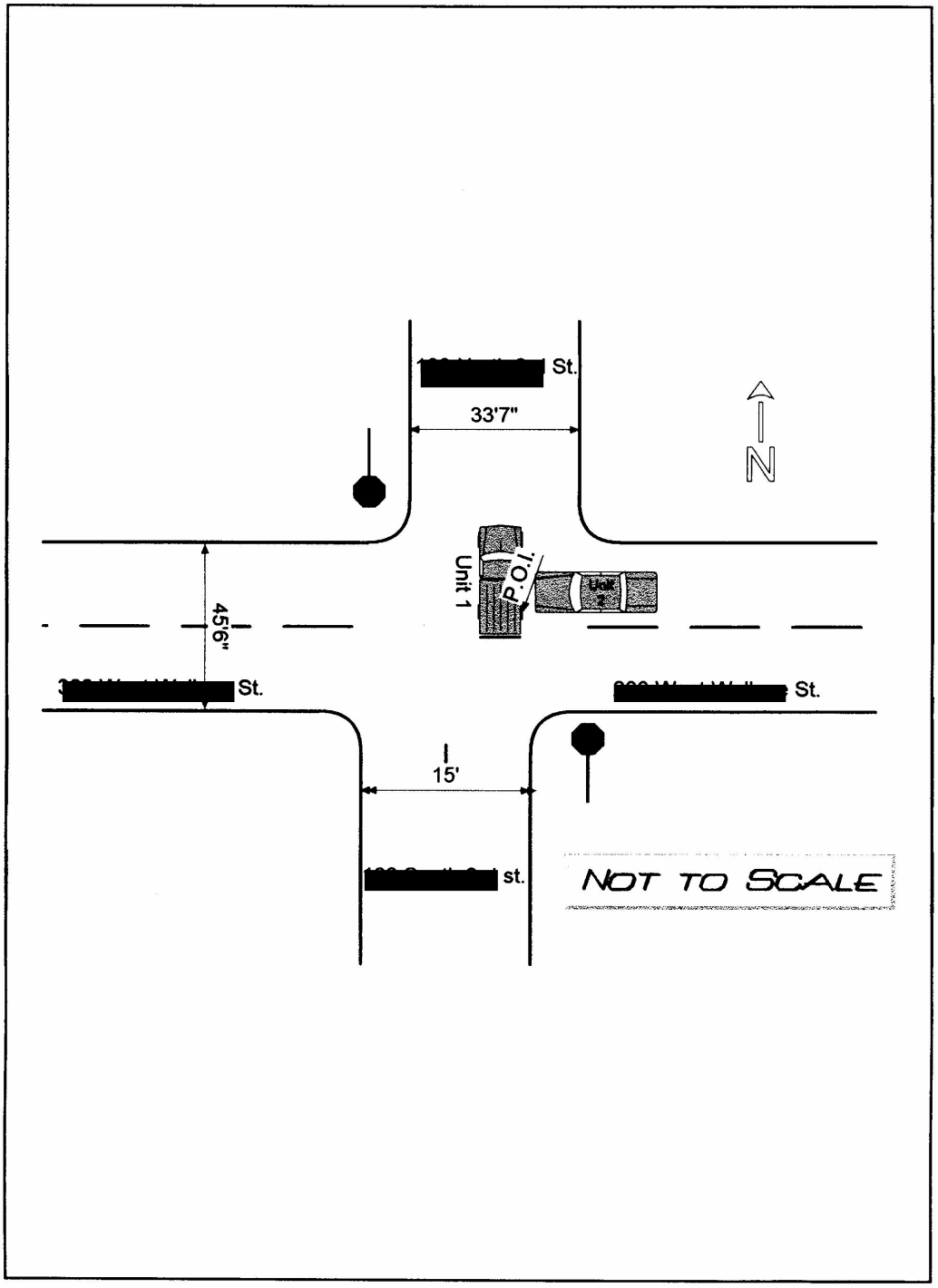
Figure 6: Other vehicle's entire right side, showing damage in right rear wheel area (case photo #17)

Figure 7: Other vehicle's damage area; note, contact but no damage on wheel/tire (case photo #18)

The GMC pickup sustained direct contact damage along the right side, beginning at the base of the right B-pillar and extending rearward to the trailing edge of the right rear wheel well (**Figures 6** and **7**). The lower end of the B-pillar had slight crushing and scraping, the exterior body panel on the forward portion of the cargo bed was scraped and crushed inward, and the wheel/tire assembly sustained direct contact but with no apparent damage other than scuffing. There was very minor crush and scraping above the wheel well from contact by the case vehicle's hood. There was no glazing damage and none of the tires were deflated or restricted. The GMC pickup was equipped with a driver-only air bag that did not deploy.

The CDC for the GMC pickup's single impact was estimated from photographs as **03-RZEW-2 (80)**. The WinSMASH reconstruction program, damage-only algorithm based on photo-estimated CDCs for the two vehicles, was used. The total, longitudinal and lateral delta-Vs for the GMC are, respectively: 20.0 km.p.h. [12.4 m.p.h.], -3.5 km.p.h. [-2.2 m.p.h.], and -19.7 km.p.h. [-12.2 m.p.h.]. This is a borderline reconstruction but the results appear reasonable. This was a crash of low severity for the GMC pickup.

According to the police crash report, the GMC pickup's driver (18-year-old male, white, non-Hispanic) was not using his available, active, three-point, lap-and-shoulder, safety belt system. The driver was police-reported as not injured. He did not receive any medical treatment at the scene and he was not transported by ambulance to a hospital. It is not known if he sustained any specific injuries.



Copied from police crash report; " Unit 1" in this diagram is the other vehicle