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REDESIGNED AIR BAG REPORT

CASE NUMBER - IN97-066
LOCATION - TEXAS
VEHICLE - 1998 PONTIAC GRAND AM SE
CRASH DATE - December, 1997

Submitted:

June 26, 2000

Revised Submission:

July 25, 2000

Contract Number: DTNH22-94-D-17058

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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

1. *Report No.* IN97-066	2. *Government Accession No.*	3. *Recipient's Catalog No.*	
4. *Title and Subtitle* On-Site Redesigned Air Bag Report Vehicle - 1998 Pontiac Grand Am SE Location - Texas		5. *Report Date:* June 26, 2000; July 25, 2000 6. *Performing Organization Code*	
7. *Author(s)* Special Crash Investigations Team #2		8. *Performing Organization Report No.* Task #s 0148 & 0228	
9. *Performing Organization Name and Address* Transportation Research Center Indiana University 222 West Second Street Bloomington, Indiana 47403-1501		10. *Work Unit No. (TRAIS)* 11. *Contract or Grant No.* DTNH22-94-D-17058	
12. *Sponsoring Agency Name and Address* U.S. Department of Transportation (NRD-32) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. *Type of Report and Period Covered* Technical Report Crash Date: December, 1997 14. *Sponsoring Agency Code*	

15. *Supplementary Notes*
On-site air bag deployment investigation involving a 1998 Pontiac Grand Am, 4-door sedan, with manual safety belts and dual redesigned front air bags, and a 1996 Mercury Grand Marquis LS, 4-door sedan

16. *Abstract*
This report covers an on-site investigation of an air bag deployment crash that 1998 Pontiac Grand Am SE (case vehicle) and a 1996 Mercury Grand Marquis (vehicle #2). This crash is of special interest because the case vehicle was equipped with redesigned air bags and the case vehicle's driver (29-year-old male) sustained serious injuries in a moderate frontal impact which deployed the air bags. The case vehicle was traveling east in the inside through lane of a seven-lane, divided, state trafficway (i.e., both the east and westbound roadways had three through lanes while the eastbound roadway had one left-hand turn lane). Vehicle #2 had been traveling west in the rightmost (outside) left-hand turn lane of an eight-lane, divided, state trafficway and was turning left to travel southward (i.e., the westbound roadway had two left-hand turn lanes). The crash occurred on the eastbound roadway within the four-leg intersection. The front left corner and left side of the case vehicle were impacted by the front of vehicle #2, causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle veered off to the southeast and subsequently impacted, with its front left, a traffic signal light pole. The case vehicle's driver was seated with his seat track located in its rearmost position, and the tilt steering wheel was located in its middle position. He was not wearing his available, active, three-point, lap- and-shoulder, safety belt system and sustained, according to his interview, serious injuries which included: fractures to five of his left ribs, a traumatic brain injury (i.e., alleged concussion), a cervical strain, a lacerated left Achilles tendon, torn cartilage and ligaments to his right knee, a fractured left big toe, contusions to his head and lower back, lacerations to his left ear and lower lip, and abrasions about his whole body. The front right passenger in the case vehicle (23-year-old male) was seated with his seat track located in its rearmost position and was not wearing his available, active, three-point, lap-and-shoulder, safety belt system. He sustained, according to the interview with the case vehicle's driver, minor injuries which included a traumatic brain injury (i.e., alleged concussion), bruised left chest, a contusion and laceration to his right knee, and glass particles in his eyes.

17. *Key Words* Redesigned Air Bag Deployment Motor Vehicle Traffic Crash Injury Severity		18. *Distribution Statement* General Public	
19 *Security Classif. (of this report)* Unclassified	20. *Security Classif. (of this page)* Unclassified	21. *No. of Pages* 11	22. *Price* $8,500

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This on-site investigation was brought to NHTSA's attention on December 30, 1997 by GES sampling activities. This crash involved a 1998 Pontiac Grand Am SE (case vehicle) and a 1996 Mercury Grand Marquis LS (vehicle #2). The crash occurred in December, 1997, at 10:35 p.m., in Texas and was investigated by the applicable city police department. This crash is of special interest because the case vehicle was equipped with redesigned air bags and the case vehicle's driver [29-year-old, Black (non-Hispanic) male] sustained serious injuries in a moderate frontal impact which deployed the air bags. This contractor's investigator inspected the vehicles and scene on 14-15 January, 1998, respectively. The investigator interviewed the driver of the case vehicle on February 24, 1998. This report is based on the Police Crash Report, an interview with the case vehicle's driver, scene and vehicle inspections, occupant kinematic principles, and this contractor's evaluation of the evidence.

Figure 1: Case vehicle was traveling east in the inside through lane (arrow) of the eastbound roadway and was approaching a controlled four-leg intersection (case photo #01)

CRASH CIRCUMSTANCES

The case vehicle was traveling east in the inside through lane (**Figure 1**) of a seven-lane, divided, state trafficway and was entering a four-leg intersection (**Figure 2**), intending to continue traveling eastbound (i.e., both the east and westbound roadways had three through lanes while the eastbound roadway had one left-hand turn lane; the two roadways were separated by a curbed median). Vehicle #2 had been traveling west in the rightmost (outside) left-hand turn lane of an eight-lane, divided, state trafficway and was turning left (**Figure 3**) to travel southward (i.e., on the east leg of the four-leg intersection; the westbound roadway had two left-hand turn lanes). The case vehicle's driver steered to the right and shifted to neutral, attempting to avoid the crash. The crash occurred on the eastbound roadway within the four-leg intersection; see **CRASH DIAGRAM** below.

Figure 2: Case vehicle's travel path in inside through lane (left arrow) just prior to impact; Note: right arrow identifies subsequent impact with traffic signal pole (case photo #02)

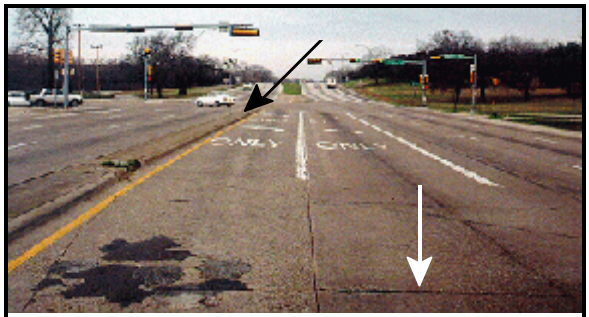

Figure 3: Vehicle #2's travel path, similar to white car above, began in outside left-hand turn lane (white arrow) of westbound roadway, prior to left-hand turn across eastbound roadway at four-leg intersection; Note: black arrow marks approximate point of impact (case photo #08)

The state trafficway was straight and apparently level (i.e., actual slopes were not recorded, but do not appear significant) at the area of impact. The

pavement was concrete for both roadways. Pavement markings for both roadways consisted of a combination of single broken white lane lines separating the through lanes, and for the case vehicle, a solid white lane separated the left-hand turn lane from the through lanes. For vehicle #2, a solid white lane line separated the two left-hand turn lanes from the through lanes and from each other. These markings were augmented by a single solid yellow "no passing" line along the median for both the east and west roadways. The estimated coefficient of friction was 0.70 for both vehicles. Traffic control was primarily achieved by pavement arrows in the left-hand turn lanes and on-colors, pre-timed, vertical and horizontal mounted traffic control signals. No regulatory speed limit sign was posted near the crash site. The legal speed limit for both roadways is 72 km.p.h. (45 m.p.h.). At the time of the crash the light condition was dark, but illuminated by overhead street lamps at the area of impact, the atmospheric condition was clear, and the road pavement was dry. Traffic density was light, and the site of the crash was primarily an urban parkway area.

Figure 4: Case vehicle's overlapping front left and left front damage from deployment impact with vehicle #2 and front left damage from impact with signal pole; Note: contour gauge is present for signal pole impact (case photo #13)

Figure 5: Damage along case vehicle's left side fromimpact with vehicle #2 viewed from left back (case photo #16)

Figure 6: Vehicle #2's frontal damage from impact with case vehicle's left side viewed from left of front with contour gauge present (case photo #43)

Figure 7: Vehicle #2's frontal damage from impact with case vehicle's left side viewed from right of front with contour gauge present (case photo #49)

The front left corner and left side of the case vehicle (**Figures 4** and **5**) were impacted by the front of vehicle #2 (**Figures 6** and **7**), causing the case vehicle's driver and front right passenger supplemental restraints (air bags) to deploy. The case vehicle veered off to the southeast (**Figure 8** below) and subsequently impacted a traffic signal light pole (**Figure 9** below) with its front left (**Figure 10** below). The

signal light pole was on a traffic island which was located on the southeast corner of the four-leg intersection. The case vehicle rotated approximately 25 degrees counterclockwise and came to rest on the traffic island heading east. Vehicle #2 rotated approximately 80 degrees counterclockwise while moving in a south-southwestward direction post-impact. Vehicle #2 came to rest heading south-southeast and was straddling the outside through lane of the eastbound roadway, within the four-leg intersection of the two trafficways.

Figure 8: Case vehicle's redirected travel path, after initial impact with vehicle #2, toward impact with traffic signal pole located on traffic island off southeast corner of intersection (case photo #03)

Figure 9: East-southeast view of traffic signal pole impacted by case vehicle's front located on traffic island off southeast corner of intersection (case photo #04)

CASE VEHICLE

The case vehicle was a front wheel drive 1998 Pontiac Grand Am SE, five-passenger, four-door sedan (VIN: 1G2NE52T6WC------) equipped with a 2.4L, DOHC-SPFI, L-4 engine and a four-speed automatic transmission. The case vehicle was equipped with four-wheel, anti-lock brakes. The case vehicle's wheelbase was 263 centimeters (103.4 inches), and the odometer reading at inspection is unknown because the case vehicle was equipped with an electronic odometer.

Figure 10: Overhead reference line view from left of case vehicle's front damage from signal pole impact with contour gauge present (case photo #14)

Inspection of the vehicle's interior revealed electronic window and door locks; adjustable front bucket seats; a nonadjustable back bench seat; and three-point, lap-and-shoulder, safety belt systems at the front and back outboard positions; and a two-point, lap belt system at the back center position. Automatic restraint was provided by a Supplemental Restraint System (SRS) that consisted of a driver air bag and a front right passenger air bag. Both front seat air bags deployed as a result of the case vehicle's very narrow frontal impact with vehicle #2.

Based on our investigator's vehicle inspection and this contractor's review of the available

information, the case vehicle sustained two impacts in the front left corner area, resulting in overlapping (masked) damage. Direct damage along the case vehicle's left side ended 10 centimeters (3.9 inches) in front of the rear axle and was 241 centimeters (94.9 inches) in length. Because of the overlapping damage from the case vehicle's second (signal pole) impact, the length of direct damage along the front of the case vehicle could not be determined. The direct damage from the second impact began 84 centimeters (33.1 inches) leftward of the front right corner and extended to the front left corner where the damage overlapped with the damage from the case vehicle's impact with vehicle #2. Based on our interpretation of the crash, this contractor estimates the CDC for case vehicle's first impact (with vehicle #2) as: **11-FLEE-9 (340)**, reflecting the narrow end engagement and the swiping down the case vehicle's left side. The CDC for case vehicle's second impact (with the signal pole), based on the final crush profile and reflecting the overlapping damage at the front left corner, was determined to be: **12-FYEW-4 (00)** [maximum crush was 106 centimeters (41.7 inches)]. The WinSMASH reconstruction program, ROLDMIS algorithm (i.e, using vehicle #2's crush profile and treating the case vehicle as missing), was used on the case vehicle's highest severity impact (vehicle #2). The Total, Longitudinal, and Lateral Delta V's are, respectively: 35.1 km.p.h (21.8 m.p.h.), -33.0 km.p.h. (-20.5 m.p.h.) and +12.0 km.p.h. (+7.5 m.p.h.). This is a borderline reconstruction, but the results appear reasonable. Due the inability to separate the pole impact crush from the vehicle-to-vehicle crush, no Delta Vs were calculated for the case vehicle's second impact. Based on our interpretation of the crash, this contractor estimates that the case vehicle's total Delta V for the pole impact was probably in the range 24 - 29 km.p.h. (15 - 18 m.p.h.). The case vehicle was towed due to damage.

Figure 11: Case vehicle's driver seating area showing steering wheel-mounted driver air bag module with deployed air bag and "I" configured cover flaps; Note: steering wheel is inverted (case photo #40)

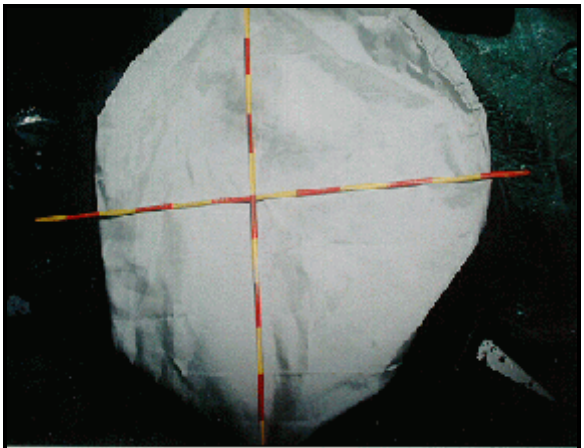

Figure 12: Case vehicle's deployed driver air bag; Note: a small skin transfer is located between the 12 and 1 o'clock areas (case photo #29)

The case vehicle was equipped with a Supplemental Restraint System (SRS) that contained frontal air bags at the driver and front right passenger positions. Both air bags deployed as a result of the very narrow frontal impact with vehicle #2. The driver air bag was located in the steering wheel hub. The

module cover consisted of symmetrical "I"-configuration cover flaps (**Figure 11**) made of thick vinyl with overall dimensions of 9 centimeters (3.5 inches) at both the right and left horizontal seams and 10 centimeters (3.9 inches) vertically. An inspection of the air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps. The driver's air bag was designed without any tethers and had two vent ports, each 3 centimeters (1.2 inches) in diameter and located at the 9 and 3 o'clock positions. The deployed driver air bag was round with a diameter of 52 centimeters (20.5 inches). There was a small skin transfer to the upper portion of the air bag between the 12 and 1 o'clock areas (**Figure 12** above).

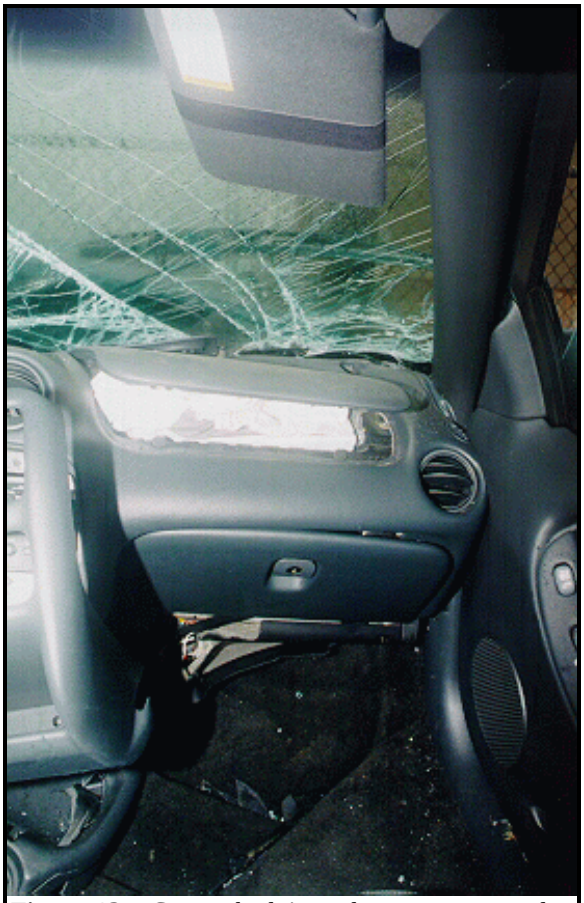

Figure 13: Case vehicle's mid-instrument panel-mounted front right passenger air bag showing deployed air bag and cover flap; Note: no obvious contact evidence is present (case photo #42)

The front right passenger's air bag was primarily located in the middle of the instrument panel. There was a single, asymmetrical (i.e., essentially a leftward shifted parallelogram), modular cover flap (**Figure 13**). The cover flap was made of a thick vinyl over a thick cardboard type frame. The flap's dimensions were: 35 centimeters (13.8 inches) at both the forward and rearward (i.e., toward the windshield) horizontal seams, and 26 centimeters (10.2 inches) along both the right and left vertical seams. The leftward shift was 9 centimeters (3.5 inches). The profile of the case vehicle's instrument panel resulted in a 7 centimeter (2.8 inch) setback of the leading edge of the cover flap relative to the protruding right instrument panel. An inspection of the front right air bag module's cover flaps and air bag revealed that the cover flaps opened at the designated tear points, and there was no evidence of damage during the deployment to the air bag or the cover flaps. The front right passenger's air bag was designed with two tethers, each tether was 5 centimeters (2.0 inches) wide. The front right air bag had no vent ports. The deployed front right air bag was rectangular with a height of approximately 44 centimeters (17.3 inches) and a width of approximately 50 centimeters (19.7 inches). There was a skin transfer to the top of the front right portion (approximately 1:30 o'clock position)

Figure 14: Case vehicle's deployed front right air bag; Note: blood on upper left quadrant is from driver's head lesions as he lay against air bag at final rest (case photo #50)

and a cloth transfer to the bottom of the front portion (approximately 6 o'clock position). There were blood stains (**Figure 14**) to the left side of the front portion; although, this contractor believes these are from the case vehicle's driver, while his head was slumped over at final rest.

The interior inspection of the case vehicle revealed substantial amounts of intrusion to the driver's seating area (**Figure 15**) and the front center area of the vehicle. Specifically, the toe pan intruded longitudinally 35 centimeters (13.8 inches) into the driver's area while only 24 centimeters (9.4 inches) in the front center area. The left instrument panel intruded 26 centimeters (10.2 inches) longitudinally into the driver's area but only 22 centimeters (8.7 inches) into the front center area, and the windshield intruded 26 centimeters (10.2 inches) into both the driver's and front center areas of the case vehicle. Other components that intruded into the driver's seating area included: the steering wheel, left "A"-pillar, the left side panel forward of the "A"-pillar, the left front door, and the left "B"-pillar. The right instrument panel was also intruded, longitudinally, but the measured magnitude of the intrusion was only minor [4 centimeters (1.6 inches)].

Figure 15: Vertical view of intrusion from driver's door, toe pan, left "A"-pillar, left side panel forward of the "A"-pillar, and left instrument panel into case vehicle's driver seating area; Note: intrusion primarily resulting from impact with vehicle #2 (case photo #24)

The intrusions sustained by the case vehicle resulted from a combination of the two impacts at its front left area. In this contractor's opinion, the intrusion to the front left interior components (e.g., left "A"-pillar, left instrument panel, toe pan, and steering wheel) and left side interior components (e.g., left front door and left door panel forward of the left "A"-pillar) were primarily influenced by the case vehicle's impact with vehicle #2. On the other hand, the entire instrument panel, windshield, and toe pan were also affected by the case vehicle's front left impact with the signal pole. The steering column had been pushed upwards (**Figure 16**), most likely from the penetration caused by the case vehicle's narrow frontal impact with vehicle #2, but also possibly from loading by the driver during the case vehicle's impact with the signal pole. Other evidence of interior contact by the case vehicle's occupants includes the driver's knee bolster (**Figure 17** below) being deformed by the driver's right knee.

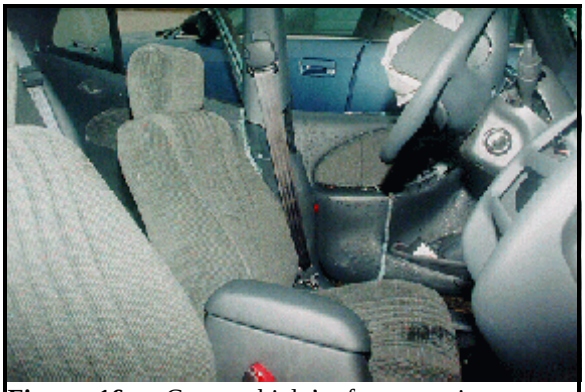

Figure 16: Case vehicle's front seating area showing safety restraints, intruding instrument panel, and steering column with upward shift (case photo #51)

Immediately prior to the crash the case vehicle's driver [29-year-old, Black (non-Hispanic) male] was seated in a reclined posture with his back against the seat back, both feet on the floor, his left hand on the steering wheel and his right hand on the transmission selector lever. His seat track was located in its rearmost position, the seat back was slightly reclined, and the tilt steering wheel was located in its middle position.

The case vehicle's driver [193 centimeters and 93 kilograms (76 inches, 205 pounds)] was not wearing his available, active, three-point, lap-and-shoulder, safety belt system. In addition, there was no evidence of belt pattern bruising or abrasions to the driver's torso, and the inspection of the driver's seat belt webbing, "D"-ring, and latch plate showed no evidence of loading.

The case vehicle's driver steered to the right and shifted the vehicle into neutral, attempting to avoid the crash. As a result of these attempted avoidance maneuvers and the nonuse of his available safety belts, he moved slightly to his left just prior to impact. The case vehicle's impact with vehicle #2 not only deployed the driver air bag, but enable the driver to move slightly farther to his left toward the 340 degree Direction of Principal Force and to contact his intruding door panel (**Figure 15** above) and the left side of the deployed driver air bag. The driver's impact with the door panel caused him to be redirected back to the right, further loading the deployed air bag, but also the steering assembly. The case vehicle's driver most likely rebounded backwards toward his seat back as the case vehicle separated from vehicle #2. The case vehicle's subsequent front left impact with the traffic signal light pole enabled the driver to move forward once again toward the 360 degree Direction of Principal Force and load the steering column and instrument panel as the case vehicle decelerated (**Figure 17**). During the pole impact, the driver's right knee went into the knee bolster deforming it and causing the driver's knee injury. As the case vehicle reached maximum engagement with the pole, the case vehicle's driver moved to the right as the vehicle rotated slightly counterclockwise around the pole. At final rest, according to the driver's interview, the driver was unconscious and leaning to the right with his upper torso laying over the center console and his face laying over the collapsed front right passenger air bag (**Figure 14** above). The case vehicle's very narrow frontal impact with vehicle #2 and subsequent penetration along the left side, rather than the driver's impact with the steering wheel during the signal pole impact, most likely caused the steering column's shear capsules to separate enabling the steering wheel to move vertically as it was found during the vehicle inspection (**Figure 16** above).

Figure 17: Case vehicle's driver seating area showing deformed instrument panel and contacts to driver's knee bolster and steering wheel (case photo #28)

The driver was transported by ambulance to the hospital. He sustained serious injuries and was hospitalized for one day post-crash. The self-reported injuries sustained by the case vehicle's driver included: fractures to five of his left ribs, a traumatic brain injury (i.e., alleged concussion), a cervical strain, a lacerated left Achilles tendon, torn cartilage and ligaments to his right knee, a fractured left big toe, contusions to his head and lower back, lacerations to his left ear and lower lip, and abrasions about his whole body.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Traumatic brain injury (i.e., alleged loss of consciousness)	115299.7 unknown	Unknown mechanism	Unknown	Interviewee (same person)
2	Strain, acute cervical	640278.1 minor	Noncontact injury source: flexion-extension injury	Possible	Interviewee (same person)
3	Fracture, five (5) ribs, left side, stability not specified	450230.3 serious	Left side door interior surface, excluding hardware or armrests	Probable	Interviewee (same person)
4	Laceration {crushed} left Achilles tendon, not further specified	840200.2 moderate	Left floor, including toe pan	Probable	Interviewee (same person)
5 6	Laceration {tear} right knee ligament, not further specified Meniscus {cartilage} tear	840404.2 850822.2 moderate	Driver's knee bolster	Probable	Interviewee (same person)
7	Fracture left 1st {big} toe	853602.1 minor	Left floor, including toe pan	Probable	Interviewee (same person)
8	Contusion {knot} posterior {back center} head	190402.1 minor	Left side window frame, "B"-pillar, or roof side header	Possible	Interviewee (same person)
9	Contusion {knot} right temple area	190402.1 minor	Center instrument panel and below	Probable	Interviewee (same person)
10	Laceration left ear (pinna)	290600.1 minor	Noncontact injury source: flying glass	Probable	Interviewee (same person)
11	Laceration {busted} lower lip	290600.1 minor	Air bag, driver's	Probable	Interviewee (same person)
12	Contusion {bruise} left lower back	690402.1 minor	Left side door interior surface	Possible	Interviewee (same person)
13	Abrasions/cuts, multiple, small, all over body	990200.1 minor	Noncontact injury source: flying glass	Possible	Interviewee (same person)

Based on the available evidence, the case vehicle's front right passenger [23-year-old (unknown race or ethnic origin) male] was seated in a reclined posture with his back against the seat back and both feet on the floor; however, the exact position of his hands is unknown. His seat track was located in its rearmost position, and the seat back was slightly reclined. The case vehicle's front right passenger [175 centimeters and 100 kilograms (69 inches, 220 pounds)] was not wearing his available, active, three-point, lap-and-shoulder, safety belt system.

According to the case vehicle's driver, he steered to the right and shifted the vehicle into neutral, attempting to avoid the crash. As a result of these attempted avoidance maneuvers and the nonuse of his available safety belts, the front right passenger moved slightly to his left just prior to impact. The case vehicle's impact with vehicle #2 not only deployed the front right passenger air bag, but enabled the front right passenger to move slightly farther to his left toward the 340 degree Direction of Principal Force and to contact the left side of the deployed front right passenger air bag and most likely the intruding (i.e., longitudinally) center instrument panel (**Figures 13** and **17** above). The front right passenger's impact with the "slightly angled[1]," center instrument panel (**Figures 16** and **17**) caused him to be redirected back to the right, further loading the deployed air bag. The case vehicle's front right passenger most likely rebounded backwards toward his seat back as the case vehicle separated from vehicle #2. The case vehicle's subsequent front left impact with the traffic signal light pole enabled this occupant to move forward once again toward the 360 degree Direction of Principal Force and load, as the case vehicle decelerated, the right instrument panel, possibly the center instrument panel, and probably the front right header and sun visor areas. Although the right windshield was cracked, there is no indication of occupant contact. During either the initial impact with vehicle #2 or the pole impact, the front right passenger's right knee[2] went into the front right instrument panel, knee bolster, or glove box, causing the front right passenger's knee injuries. As the case vehicle reached maximum engagement with the pole, the case vehicle's front right passenger moved to the right as the vehicle rotated slightly counterclockwise around the pole. The exact position of the case vehicle's front right passenger at final rest is unknown. However, according to the driver's interview, the front right passenger sustained a loss of conscious sometime during the crash sequence.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The front right passenger was transported by ambulance to the hospital. He sustained minor injuries and was treated and released. The interviewee-reported injuries sustained by the front right passenger included: a traumatic brain injury (i.e., alleged concussion), bruised left chest, a contusion and laceration to his right knee, and glass particles in his eyes.

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1 The left side of the center instrument panel appears to be intruded further longitudinally into the center of the front seating area compared to the right side of the center instrument panel. This intrusion differential on the front surface of the center instrument panel creates a slight angle that would tend to redirect a striking object (i.e., occupant) towards the right. However, since there is no clear evidence of occupant contact on the center instrument panel, it is unknown whether the front right passenger contacted the front surface of the center instrument panel or the protruding (**Figures 13** and **16** above) right side surface of the center instrument panel.

2 The exact contact source is unknown because there is no clear evidence of occupant contact.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Traumatic brain injury (i.e., alleged loss of consciousness)	115299.7 unknown	Unknown mechanism	Unknown	Interviewee (driver)
2	Contusion {bruise} left chest over ribs	490402.1 minor	Unknown mechanism	Unknown	Interviewee (driver)
3	Contusion {bruise} with swelling right knee	890402.1 minor	Right instrument panel and below	Probable	Interviewee (driver)
4	Laceration {cut} right knee	890600.1 minor	Right instrument panel and below	Probable	Interviewee (driver)

VEHICLE #2

Vehicle #2 is a rear wheel drive 1996 Mercury Grand Marquis LS, six-passenger, four-door sedan (VIN: 2MELM75W7TX------) equipped with a 4.6L, SOHC-SEFI, V-8 engine and a four-speed automatic transmission. Four wheel anti-lock brakes are an option for this model, but it is unknown if the case vehicle was so equipped. The case vehicle's wheelbase was 291 centimeters (114.4 inches), and the odometer reading at inspection was not recorded. Based on the vehicle inspection, the CDC for vehicle #2 was determined to be: **01-FDEW-2 (40)** [maximum crush was 59 centimeters (23.3 inches)]. The WinSMASH reconstruction program, missing vehicle algorithm, was used on vehicle #2's highest severity impact. The Total, Longitudinal, and Lateral Delta Vs are, respectively: 28.3 km.p.h. (17.6 m.p.h.), -21.6 km.p.h. (-13.4 m.p.h.), and -18.2 km.p.h. (-11.3 m.p.h.). Vehicle #2 was towed due to damage.

CRASH DIAGRAM IN97-066