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VERIDIAN REMOTE SIDE IMPACT OCCUPANT PROTECTION INVESTIGATION SCI TECHNICAL SUMMARY REPORT

NASS/SCI COMBO CASE NO. 01-45-044A

VEHICLE - 2000 LINCOLN TOWN CAR

LOCATION - STATE OF TENNESSEE

CRASH DATE - APRIL 2001

Contract No. DTNH22-94-D-07058

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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 are 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.

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Remote investigation of an intersection crash that resulted in the deployment of the redesigned frontal air bag system and the right front side air bag in the Lincoln Town Car, and the death of the driver and front right passenger.

16. *Abstract*

This remote investigation focused on a 2000 Lincoln Town Car that was equipped with redesigned frontal air bags and side air bags for the driver and front right passenger positions. The Town Car was occupied by an 88-year-old male driver and an 88-year-old female front right passenger. Both occupants were reportedly restrained by the manual 3-point lap and shoulder belts, however, the driver may have worn the shoulder belt under his arm. The Town Car was involved in an intersection crash with a 1993 Mercury Cougar. The right side impact to the Town Car was sufficient to partially separate the vehicle laterally and deploy the redesigned frontal air bag system and the right front passenger's side air bag. Due to insufficient information to support belt usage and the interior contacts not being clearly defined, the injury mechanisms could not be assessed with certainty. The driver probably loaded the lap belt and improperly worn shoulder belt which resulted in lateral right 7th and 8th rib fractures with small right pneumothorax and a right lung contusion. He sustained a T-12 compression fracture from the forward and lateral movement of his upper torso. He probably contacted the windshield header and front left sun visor with his head which resulted in two small right cerebral contusions, a right cerebral subarachnoid hemorrhage, and an irregular 7 cm (3") laceration on the frontal parietal scalp. The front right passenger loaded the manual restraint and sustained massive bilateral rib fractures and thigh contusions. She sustained a posterior right arm abrasion from contact with the right side air bag. She loaded the intruded right door panel and right sill and sustained an open right tibia fracture, comminuted complex left tibia fracture, and a left fibula fracture. Her right arm contacted the interior right front door which resulted in a right posterior arm contusion and a posterior hand contusion. She rebounded to the left and loaded the center arm rest which resulted in left arm contusions. She was redirected to the right as the vehicle separated and the right front door opened as a result of a latch/striker failure. She sustained a right posterior temporal scalp laceration with exposure of the calvarium from probable contact with the right B-pillar. The driver was transported by ambulance to a regional trauma center where he expired three days following the crash. The front right passenger expired at the scene immediately after the crash.

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BACKGROUND

Figure 1. Damaged 2000 Lincoln Town Car

This remote investigation focused on a 2000 Lincoln Town Car that was equipped with redesigned frontal air bags and side air bags for the driver and front right passenger positions. The Town Car was occupied by an 88-year-old male driver and an 88-year-old female front right passenger. Both occupants were reportedly restrained by the manual 3-point lap and shoulder belts, however, the driver may have worn the shoulder belt under his arm. The Town Car was involved in an intersection crash with a 1993 Mercury Cougar. The right side impact to the Town Car **(Figure 1)** was sufficient to partially separate the vehicle laterally and deploy the redesigned frontal air bag system and the right front passenger's side air bag. Due to insufficient information to support belt usage and the interior contacts not being clearly defined, the injury mechanisms could not be assessed with certainty. The driver probably loaded the lap belt and improperly worn shoulder belt which resulted in lateral right 7^{th} and 8^{th} rib fractures with small right pneumothorax and a right lung contusion. He sustained a T-12 compression fracture from the forward and lateral movement of his upper torso. He probably contacted the windshield header and front left sun visor with his head which resulted in two small right cerebral contusions**,** a right cerebral subarachnoid hemorrhage**,** and an irregular 7 cm (3") laceration on the frontal parietal scalp**.** The front right passenger loaded the manual restraint and sustained massive bilateral rib fractures and thigh contusions. She sustained a posterior right arm abrasion from contact with the right side air bag. She loaded the intruded right door panel and right sill and sustained an open right tibia fracture, comminuted complex left tibia fracture, and a left fibula fracture. Her right arm contacted the interior right front door which resulted in a right posterior arm contusion and a posterior hand contusion. She rebounded to the left and loaded the center arm rest which resulted in left arm contusions. She was redirected to the right as the vehicle separated and the right front door opened as a result of a latch/striker failure. She sustained a right posterior temporal scalp laceration with exposure of the calvarium from probable contact with the right B-pillar. The driver was transported by ambulance to a regional trauma center where he expired three days following the crash. The front right passenger expired at the scene immediately after the crash.

This crash was selected for investigation by the National Automotive Sampling System (NASS) as CDS case number 01-45-044K. The crash occurred in April 2001. Initial notification of this crash was made to the Veridian Special Crash Investigations team by the NASS PSU following selection as a CDS case. The NASS PSU performed the vehicle inspection and scene inspection. Due to the presence of the side

air bag deployment, NHTSA assigned the tasks of case review and report preparation to the Veridian Special Crash Investigation (SCI) team on April 20, 2001.

SUMMARY

Crash Site

This three-vehicle crash occurred on a rural east/west two-lane roadway in April 2001 during daylight hours. There were no adverse weather conditions at the time of the crash and the asphalt road surface was dry. The roadway was straight and had a 5.0 percent positive westbound grade. The hillcrest was located approximately 28 m (95') west of the crash site. The east/west travel lanes were separated by a double-yellow centerline and were bordered by grass shoulders. A private two-lane driveway was present on the south side of the roadway. Concrete curbs followed the curvature of the driveway corners and extended approximately 20 m (65') east and west from the respective driveway corners along the south roadside. There was no traffic control device present at the scene, and the posted speed limit was 64 km/h (40 mph).

Pre-Crash

The driver of the 2000 Lincoln Town Car was operating the vehicle in a westbound direction on a two-lane undivided roadway **(Figure 2)**. A 1989 Mercedes Benz 300 SE was traveling in the westbound lane behind the Town Car and a 1993 Mercury Cougar was traveling eastbound in the opposite lane toward the hillcrest. As the Mercury Cougar crested the hill **(Figure 3)**, the driver of the Town Car initiated a left turn across the path of the Cougar with the intent to enter the driveway. Due to the limited westbound sight distance as a result of the positive westbound grade, the driver of the Town Car may not have detected the approaching Mercury Cougar as he initiated the left turn. Both vehicles maintained pre-impact tracking modes. It was not known if there were any attempted avoidance maneuvers for either vehicle.

Figure 2. Westbound trajectory for the 2000 Lincoln Town Car

Figure 3. Eastbound trajectory for the 1993 Mercury Cougar

Crash

The full frontal area of the Mercury Cougar impacted the right side area of the Town Car. The respective directions of force were in the 11 and 2 o'clock sectors. The impact resulted in moderate damage to the Cougar and severe damage to the Town Car. The impact to the Town Car resulted in the failure of the latch/striker failure of the right front door which allowed it to open during the crash. The vehicle was also partially separated along the right frame at the right B-pillar area due to the impact force. The WinSMASH program was used to calculate the changes in velocity for both vehicles based on the crush profile of the Cougar and the Collision Deformation Classification (CDC) of the Town Car. The total change in velocity for the Town Car was 34.3 km/h (21.3 mph), with a lateral component of -26.3 km/h (16.3 mph) that was sufficient to deploy the right front passenger's side air bag. The longitudinal component of -22.1 km/h (-13.7 mph) was sufficient to deploy the redesigned frontal air bag system in the Town Car. The total delta-V for the Mercury Cougar was calculated to be 38.0 km/h (23.6 mph). The longitudinal and latitudinal components were -35.7 km.h (-22.2 mph) and 13.0 km/h (8.1 mph), respectively.

The impact redirected the Town Car in a lateral direction on the eastbound lane. The front of the Town Car impacted the curb with the both front wheels and the rear aspect of the vehicle (rear of the B-pillars) rotated in a slight clockwise (CW) direction from the front aspect. The Town Car came to rest in the eastbound lane against the curb **(Figure 4)**. The Mercury Cougar was redirected to the left, traveled across the centerline, and sideswiped the front left corner of the Mercedes with the left rear area. The Mercedes sustained minor right front side damage and came to rest in the westbound lane. The Mercury was subsequently redirected across the eastbound lane and onto the roadside in a tracking mode. It traveled over a culvert and impacted a utility pole with the front area. The Cougar came to rest against the pole.

Figure 4. Post-impact trajectory and final rest location

Post-Crash

The driver of the Mercury Cougar exited the vehicle under his own power after the vehicle came to rest. He did not receive medical treatment at the scene and was transported by police from the scene. The driver of the Town Car was found seated in the front left seat. His mobility was restricted due to his injuries, and he could not exit the vehicle due to jammed doors. He was removed through the right side of the vehicle by rescue personnel and transported by ambulance to a regional trauma center where he expired three days following the crash. The front right passenger of the Town Car sustained fatal injuries as a result of the crash. She was found suspended at the front right door opening by the shoulder belt. A witness to the crash cut the shoulder belt and removed the front right passenger from the vehicle and placed her on the roadway next to the Town Car. The front right passenger expired at the scene.

VEHICLE DATA - 2000 Lincoln Town Car

The 2000 Lincoln Town Car was identified by the Vehicle Identification Number (VIN): 1LNHM81W4YY(production sequence omitted). The vehicle's mileage at the time of the crash was unknown due to the presence of an electronic odometer. The vehicle was a four-door sedan and was equipped with a 4.6 liter, 8-cylinder engine, rear wheel-drive, an automatic transmission, a traction control system, power brakes with anti-lock, power steering, and a tilt steering wheel. The seating was configured with a front split bench seat with separate backs and a rear bench seat. The front split bench seat was equipped with a power adjusting, driver-programmable, memory seat, and a power adjusting front right seat. The front seating positions were configured with manual 3-point lap and shoulder belts for the outboard positions and a manual lap belt for the center position. The front center seat back folded forward as a center armrest. Both outboard front seat positions were equipped with adjustable head restraints that were in the full-down positions. The rear seating positions were configured with manual 3-point lap and shoulder belts. An integral arm rest was positioned in the rear center seat back.

VEHICLE DAMAGE

Exterior Damage - 2000 Lincoln Town Car

The 2000 Lincoln Town Car sustained severe damage as a result of the right side impact with the Mercury Cougar **(Figure 5)**. The vehicle was partially separated in half laterally on the right side as a result of the impact, and according to a witness, the Town Car almost completely severed when the roof was removed. Rescue personnel completely separated the vehicle in half aft of B-pillar areas by cutting through the frame on the left side. Due to the vehicle separation, it was not possible for the NASS researcher to measure an accurate crush profile. The direct damage from the right side impact began 37 cm (15") aft of the right rear axle and extended forward 233 cm (92") along the right side of the Town Car. The combined direct and induced damage could not be determined due to the vehicle separation. The maximum crush was estimated to be 55 cm (22") forward of the right rear axle and measured approximately 55 cm (22"). Abrasions and paint transfers were identified on the right front door, right rear door, and right rear quarter panel from direct contact. The right B-pillar was crushed laterally and rotated slightly clockwise. The displacement of the B-pillar resulted in the failure of the latch/striker on the right front door **(Figure 6)**. The right sill was crushed and showed evidence of being torn aft of the right B-pillar. The hinges on the right rear door failed which allowed the right rear door to separate from the B-pillar. However, the latch/striker remained engaged on the rear aspect of the door, and the right rear door remained attached to the rear portion of the vehicle, while the remaining three side doors remained attached to the front portion. Both A-pillars were cut at the base and at the roof, and the roof was cut away from the top aspects of the B-pillars to allow the roof to remain attached to the rear portion of the Town Car. The right rear area was displaced rearward and upward and the left rear area was displaced downward.

Figure 5. Right front damage to the Town Car

Figure 6. View of right front door striker and lower B-pillar area

The trunk was displaced upward on the right side. The left rear wheel was rotated in a CW direction and restricted against the left rear quarter panel. The right rear wheel was restricted from rearward and lateral displacement **(Figure 7)**. The CDC for the right side impact to the Town Car was 02-RZAW-4.

Figure 7. Rear portion of the 2000 Lincoln Town Car

Both front wheels sustained direct contact damage from the curb impact. The left front tire was deflated and scuff marks were noted on both front tires. The CDC's for the impact with the curb were 12-FRWN-3 and 12-FLWN-3, respectively.

Interior Damage

The interior damage to the Lincoln Town car was a result of compartment intrusion and occupant contact. Passenger compartment integrity was lost through the right front door as a result of the latch/striker failure. Integrity was also lost through the right rear door due to the hinge failure, the backlight, and the side windows. All of the tempered glazing disintegrated as a result of impact forces. The laminated windshield was in place and cracked from impact forces, and removed by rescue personnel. The NASS researcher documented multiple intrusions, the most severe being the lateral intrusion of the right rear door that measured 62 cm (24"). The bottom half of the steering wheel rim was displaced forward 4 cm (2") and the rigid plastic knee bolster was displaced from driver loading. The driver's sun visor exhibited a blood smear, possibly from contact with the driver's head. Strands of hair were also noted on the center portion of the windshield header that were most likely from the driver. Based on the 188cm (74") height of the driver, he may have been displaced forward enough to contact the visor and windshield header with his head if he was wearing the manual restraint improperly, although the blood smear does not exhibit a trajectory consistent with the impact. It was not known if the vanity mirror on the bottom aspect of the visor was damaged. Neither contact could be confirmed with the available information. Each front seat position was displaced from compartment intrusion **(Figure 8)**. The front left seat was leaning toward the left side due to the right side intrusions. The folding center arm rest contacted by both front seat occupants and was displaced due to the front right seat intrusion. The armrest was wedged between the seats in a near vertical orientation. Blue fabric transfers were noted on the lower right aspect from the right front passenger loading. Its pre-crash orientation was probably full-down, but it could not be confirmed. The front right seat was displaced and crushed laterally to the left, and the front right seat back was rotated in a slight CW direction. The interior panel of the right front door was also displaced and intruded laterally 13 cm (5").

Figure 8. Displaced front seating positions in the 2000 Lincoln Town Car

Exterior Damage - 1993 Mercury Cougar

The Mercury Cougar sustained moderate frontal damage **(Figure 9)** as a result of the impact with the Town Car. The direct damage involved the entire frontal plane of the vehicle and measured 136 cm (54"). The

maximum longitudinal crush was located 15 cm (6") to the right of C3 and measured 63 cm (25"). The left front fender was crushed rearward and displaced the leading edge of the left front door. The hood was crushed rearward and buckled at the designated fold points. The right front wheel was restricted from rearward displacement and the left front tire was deflated. The windshield laminate was cracked from impact forces. The CDC for the frontal impact with the Town Car was 11-FDAW-3. Six crush measurements were taken at the bumper level by the NASS researcher and were as follows: C1 = 32 cm (13"), C2 = 39 cm (15"), C3 = 61 cm (24"), C4 = 59 cm (23"), C5 = 50 cm (20"), C6 = 54 cm (21").

Figure 9. Frontal damage to the 1993 Mercury Cougar

The Mercury Cougar also sustained minor damage on the left rear quarter panel from the secondary impact with the Mercedes. The CDC for the second event was 11-LBEE-1. The direct damage was located 76 cm (30") aft of the left rear axle and extended rearward 28 cm (11"). The combined direct and induced damage began 3 cm (1") forward if the left rear axle and extended 107 cm (42") rearward. The crush profile was as follows: C1 = 10 cm (4"), C2 = 5 cm (2"), C3 = 4 cm (2"), C4 = 2 cm (1"), C5 = 1 cm (1"), C6 = 0 cm.

The Mercury Cougar also sustained damage to the left front wheel from the impact with the ground after it traveled over the culvert, and additional frontal damage as a result of the impact with the utility pole. The CDC's for these events were 12-FLWN-3 and 12-FREN-9 (unknown extent), respectively.

MANUAL RESTRAINT SYSTEM - 2000 Lincoln Town Car

The 2000 Lincoln Town Car was equipped with manual 3-point lap and shoulder belts for the front outboard positions and each rear position. The front center position was equipped with a lap belt. Each lap and shoulder belt was configured with continuous loop webbing and sliding latch plates. The front outboard buckles were integrated into the inboard aspects of the seat cushions. Both front adjustable D-rings were in the mid-position. The front left seat belt webbing was cut below the inboard aspect of the D-ring and removed from the vehicle and was not available for examination by the NASS researcher. The NASS researcher noted that there were no loading marks on the left front D-ring. The front right seat belt webbing was cut by rescue personnel and used to secure the open right front door. The latch plate was still engaged with the buckle although the webbing was removed.The front right seat belt webbing exhibited a blue clothing fiber transfer on the lap belt portion and clothing transfers on the shoulder portion from the loading of the front right occupant.

REDESIGNED FRONTAL AIR BAG SYSTEM - 2000 Lincoln Town Car

The 2000 Lincoln Town Car was equipped with redesigned frontal air bags for the driver and front right passenger positions that deployed as a result of the right side impact with the Mercury Cougar. The driver's redesigned air bag was housed in the center of the steering wheel with a single cover flap design hinged at the top aspect. The cover flap measured 12 cm (5") in height, 10 cm (4") in width at the top aspect and 14 cm (6") in width at the lower aspect. The driver's redesigned air bag measured 50 cm (20") in diameter **(Figure 10)**. A scuff mark was noted on the upper right quadrant of the air bag membrane. The air bag was tethered by 2 internal straps and vented by two ports located at the 11 and 1 o'clock sectors on the rear aspect.

Figure 10. Deployed redesigned driver's air bag

The redesigned front right passenger's air bag deployed from a mid-mount module with a single cover flap design hinged at the top aspect. The rectangular cover flap measured 11 cm (4") in height and 40 cm (16") in width. The redesigned front right passenger's air bag measured 70 cm (28") in height and 50 cm (20") in width. The air bag was vented by one port located on the 9 o'clock sector on the left side aspect. The air bag was not tethered.

SIDE IMPACT OCCUPANT PROTECTION SYSTEM - 2000 Lincoln Town Car

The 2000 Lincoln Town Car was equipped with head/thorax side air bags that were located in the front outboard seat backs. The right front passenger's side air bag deployed as a result of the right side impact with the Mercury Cougar **(Figure 11)**. The tear seam for the right side air bag measured 38 cm (15") in height. The tear seam was open 10 cm (4") wide at the top aspect and 5 cm (2") wide at the bottom aspect. The right front passenger's side air bag measured 60 cm (24") in height and 35 cm (14") in width. The air bag was tethered by two internal straps and vented by one port located on the forward center aspect of the outboard aspect of the air bag. Contact evidence on the air bag included a scuff on the rear inboard aspect, blood spattering on the inboard aspect, and small blood spattering on the outboard aspect of the air bag.

Figure 11. Deployed right front passenger's side air bag

OCCUPANT DEMOGRAPHICS - 2000 Lincoln Town Car

Driver

Age/Sex:	88-year-old male
Height:	188 cm (74")
Weight:	91 kg (201 lb)
Seat Track Position:	Mid-track
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	Prescription eyeglasses
Type of Medical Treatment:	Transported by ambulance to a regional trauma center

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanisms
Small left occipital cerebral intraventricular hemorrhage	Severe (140678.4,2)	Left B-pillar (possible)
2 small right cerebral contusions	Serious (140614.3,1)	Windshield header (possible)
Right cerebral subarachnoid hemorrhage	Serious (140684.3,1)	Windshield header (possible)
Right lung contusion	Serious (441406.3,1)	Improperly worn lap and shoulder belt and center armrest (possible)
Lateral right 7th and 8th rib fractures with small right pneumothorax	Serious (450222.3,1)	Improperly worn lap and shoulder belt and center armrest (probable)
T-12 compression fracture	Moderate (650432.2,7)	Impact forces - movement over the lap and shoulder belt system (probable)
2 cm (1") laceration on the right parietal scalp and 1 cm (0.5") laceration on the parieto-occipital scalp	Minor (190602.1,1)	Windshield header (possible)
Irregular 7 cm (3") laceration on frontal parietal scalp	Minor (190602.1,5)	Front left sun visor (possible)
2 cm (1") laceration on the right hand	Minor (790602.1,1)	Center armrest (possible)

*Source: Hospital discharge summary

Driver Kinematics

The 88-year-old male driver of the Lincoln Town Car was presumed to have been seated in an upright posture with the seat track adjusted to a mid-track position and the seat back slightly reclined. He was reportedly restrained by the manual 3-point lap and shoulder belt, however, there was insufficient evidence to support belt usage. Interior contacts were not clearly defined and the seat belt webbing was cut below the inboard aspect of the D-ring and removed from the vehicle. The driver may have been wearing the manual restraint with the shoulder belt under his arm, but it could not be confirmed. He was wearing prescription eyeglasses at the time of the crash. The NASS researcher also noted that the driver's wrist watch (with an elastic band) was found on the driver's floor pan near the foot controls.

At impact with the Mercury Cougar, the right front passenger's side air bag deployed and the redesigned frontal air bag system deployed. The driver initiated a lateral and forward trajectory to his right impact. He loaded the lap belt and left aspect of the center armrest which resulted in lateral right 7th and 8th rib fractures with small right pneumothorax, a right lung contusion, and a compression fracture of T-12. Contact evidence to the driver's sun visor and center windshield header suggest that his upper torso may have moved in a forward direction over the lap belt. This would be possible if he was wearing the shoulder belt under his arm, and would also support the thoracic spine fracture. His forward travel most likely allowed his head to contact the windshield header which resulted in two small right cerebral contusions, a right cerebral subarachnoid hemorrhage, a 2 cm (1") laceration on the right parietal scalp and a 1 cm (0.5") laceration on the parieto-occipital scalp. An irregular 7 cm (3") laceration on frontal parietal scalp may have been produced from contact with the driver's sun visor. The lower half of the steering wheel rim was deformed 4 cm (2") in a forward direction, however, it was unclear if this contact was due to the initial forward travel of the driver or during his rebound. He probably rebounded to the left and struck the rear aspect of his head on the left B-pillar which resulted in a small left occipital cerebral intraventricular hemorrhage. He also sustained a right hand laceration, possibly a result of contact with the center armrest.

The driver could not exit the vehicle due to the jammed driver's door. The roof was removed by rescue personnel to facilitate his extrication. He was removed through the right side of the vehicle and transported by ambulance to a regional trauma center where he expired three days following the crash.

Front Right Passenger

Age/Sex:	88-year-old female
Height:	163 cm (64")
Weight:	70 kg (154 lb)
Seat Track Position:	Between mid-track and full rear positions
Manual Restraint Use:	Manual 3-point lap and shoulder belt
Usage Source:	Vehicle inspection
Eyewear:	Prescription eyeglasses
Type of Medical Treatment:	Unresponsive at scene and pronounced dead on arrival at a regional forensics center

Front Right Passenger Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Mechanisms
Open right proximal tibia fracture with wide gaping laceration with exposed muscle, fat, and fracture	Serious (853405.3,1)	Right side interior surface, excluding hardware or armrests (certain)
Comminuted complex tibia fracture with exposed subcutaneous fat and muscle	Serious (853405.3,2)	Right side interior surface, excluding hardware or armrests (certain)
Massive bilateral rib fractures	Moderate (450220.2,3)	Shoulder belt webbing (probable)
Left fibula fracture	Moderate (851605.2,2)	Right side interior surface, excluding hardware or armrests (certain)
Right posterior temporal scalp laceration with exposure of the calvarium	Minor (190600.1,1)	Right B-pillar (probable)
Posterior right arm abrasion	Minor (790202.1,1)	Right front passenger's side air bag (probable)
Right arm and hand contusion	Minor (790402.1,1)	Right side interior surface, excluding hardware or armrests (probable)
Left arm contusion	Minor (790402.1,2)	Center armrest (possible)
Bilateral thigh contusions	Minor (890402.1,3)	Lap belt webbing (probable)

*Injury source: Medical Examiner's Investigation report

Front Right Passenger Kinematics

The 88-year-old female front right passenger was presumed to have been seated in an upright posture with the seat track adjusted between the mid-track and full-rear positions. The seat back was slightly reclined. She was properly restrained by the manual 3-point lap and shoulder belt. She was wearing prescription eyeglasses at the time of the crash.

At impact with the Mercury Cougar, the right front passenger's side air bag deployed and the redesigned frontal air bag system deployed. She sustained a right posterior arm abrasion as a result of the expansion of the side air bag against her right arm. Due to the forward component of her trajectory, she probably didn't receive the full benefit of the side air bag as she responded to the 2 o'clock impact force. The front right passenger initiated a lateral and forward trajectory to her right impact. She loaded the manual restraint evidenced by abrasions and transfers and also loaded the deployed right front passenger's side air bag. She sustained bilateral thigh contusions as a result of loading the lap belt, evidenced by abrasions and transfers on the lap belt webbing. She also sustained massive bilateral rib fractures from the severe loading to the shoulder belt. Blue fabric transfers were identified on the shoulder belt webbing that appeared to be consistent with the trajectory of the occupant.

The 88-year-old female loaded the intruded right front door and right sill area with her lower legs which resulted in an open right proximal tibia fracture with wide gaping laceration with exposed muscle, fat, and fracture, a comminuted complex tibia fracture with exposed subcutaneous fat and muscle, and a left fibula fracture. Her right arm was struck by the interior surface of the right front door which resulted in a small right posterior arm contusion and a large posterior hand contusion. She rebounded to the left and loaded the center arm rest evidenced by fabric transfers and abrasions. She sustained left arm contusions from the contact with the center armrest. She was redirected to the right as the vehicle separated and the right front door opened as a result of the latch/striker failure. She sustained a right posterior temporal scalp laceration with exposure of the calvarium from probable contact with the right B-pillar. As the Town Car impacted the curb and came to rest, the front right passenger was reported by a witness to have been suspended by the seat belt partially out of the right front door opening. The witness cut the manual restraint and placed the occupant on the roadway next to the vehicle. The 88-year-old female expired at the scene immediately after the crash and was found by rescue personnel on the lying on the roadway next to the Town Car. There was no autopsy performed.