

**TRANSPORTATION SCIENCES
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**VERIDIAN ON-SITE ADVANCED OCCUPANT
PROTECTION SYSTEM INVESTIGATION
VERIDIAN CASE NO. CA00-025
VEHICLE: 2000 FORD TAURUS LX
LOCATION: MARYLAND
CRASH DATE: APRIL 2000**

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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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BACKGROUND

This on-site investigation focused on the performance of the Advanced Occupant Protection System (AOPS) in a 2000 Ford Taurus LX (**Figure 1**) that was involved in a severe offset head-on crash with a 1999 Dodge Stratus. The Taurus was occupied by a 62 year old female driver and a 65 year old male front right passenger. The driver was restrained by the manual belt system, however, the passenger was not restrained. The Taurus AOPS equipment included dual stage frontal air bags for the driver and front right passenger, seat belt buckle pretensioners with load limiting retractors, a driver's seat track positioning sensor, and a Restraints Control Module (RCM) with an Event Data Recorder (EDR). The Taurus was also equipped with the



Figure 1. Front left view of the damage to the 2000 Ford Taurus.

optional side impact air bags. As a result of the crash, the Taurus sustained severe front left damage that extended onto the left side plane of the vehicle. The Taurus' frontal air bags deployed and the driver's pretensioner fired as a result of the crash. The driver of the Taurus was extricated from the vehicle by emergency personnel and transported by ambulance to a local hospital where she was evaluated for lower extremity fractures, pelvic fractures, and a closed head injury. She was prepared for transferal to a regional trauma center, however, she expired en route. No autopsy was performed. The front right passenger of the Taurus exited the vehicle without assistance and was ambulatory at the scene of the crash. He was transported by ambulance to a local hospital where he was treated for left ear and facial lacerations. He was diagnosed with a closed head injury with a possible subarachnoid bleed and transferred to a regional trauma center where he was admitted for treatment.

The Taurus was located at a salvage yard by a member of NHTSA's Office of Defects Investigation during a visit to the yard. The crash data was backtracked through the Taurus' insurance company and assigned to the Veridian SCI team as an on-site investigative effort on July 20, 2000.

SUMMARY

Crash Site

The crash occurred on a two lane road during nighttime hours. The viewing conditions were dark with no artificial illumination. The weather was police reported as rain with wet environmental surfaces. The Taurus traversed a signalized four-leg intersection and approached the crash site on a left curve with respect to the vehicle's westbound trajectory. The gradient was level. The travel lanes were delineated by a double yellow center line with white edge lines. Asphalt shoulders bordered both travel lanes with grassy areas

and private driveways bordering and intersecting the shoulders. The posted speed limit was 80 km/h (50 mph). It should be noted that at the time of the SCI investigation, the road was under construction with a resurfacing of the travel lanes and shoulders. Due to this resurfacing, any remaining physical evidence on the roadway was concealed.

Vehicle Data - 2000 Ford Taurus

The 2000 Ford Taurus LX was powered by a 3.0 liter FFV (Flex Fuel) transverse mounted V-6 engine linked to a four-speed automatic overdrive transmission with a column mounted transmission selector lever. The vehicle's braking system consisted of front wheel disc with rear drum brakes and no anti-lock (ABS) system. The brake and rack-and-pinion steering system were power-assisted. The interior was configured with front bucket seats with manual recline and fore and aft adjusters. The seat backs were equipped with adjustable head restraints. The driver's head restraint was adjusted 5.1 cm (2.0") above the seat back while the passenger's was adjusted to the full-down position. The rear seat was a three-passenger bench seat. Interior accessories included power windows and door locks and a tilt steering wheel.

Crash Sequence

Pre-Crash

The driver of the Ford Taurus was returning to her residence and was traveling in a westerly direction on the two lane road. She had traversed through a four-leg signalized intersection and entered a left curve relative to her path of travel (**Figure 2**). The driver of the Dodge Stratus was traveling in an easterly direction on the two lane road, opposite of the Ford Taurus. As the driver of the Stratus attempted to negotiate the right curve for east bound traffic, he allowed the vehicle to drift over the centerline and into the path of the Ford Taurus. There were no police reported tire marks at the scene of the crash to support pre-crash braking. It was unknown if either driver attempted to avoid the impending crash. The police crash schematic is included as **Figure 15**, page 12.



Figure 2. Pre-crash trajectory of the Ford Taurus.

Crash

The front left corner area of the Dodge Stratus impacted the front left corner area of the Ford Taurus. The impact crushed the front right corner of the Taurus' bumper beam to a maximum depth of 57.4 cm (22.6"). Due to the minimal engagement of the corner areas, both vehicles continued forward which allowed the front left corner area of the Dodge to penetrate into the left side of the Taurus. The Dodge engaged into the left front suspension of the Taurus which resulted in complete separation of the suspension and axle components, thus separating the tire and wheel assembly from the vehicle. The contact damaged extended into the left A-pillar, onto the left door, before terminating 36.2 cm (14.25") forward of the left rear axle. The resultant direction of force for the Taurus was within the 12 o'clock sector (PDOF of -10 degrees). Although the Dodge was not inspected, the probable direction of force for the Stratus, based on configuration, was also within the 12 o'clock sector. The collision conditions were outside the scope of

the WinSMASH reconstruction program. The vehicles did not reach a common velocity and the resultant damage involved two planes (front and left side).

The Ford Taurus was deflected in a counterclockwise (CCW) direction as it continued forward and departed the north (right) road edge onto a lawn area where it came to rest. At rest, the Taurus was facing in a southerly direction approximately perpendicular to its pre-crash travel direction. The Dodge Stratus rotated in a CCW direction and came to rest straddling the centerline of the road, east of the point of impact. At rest, the Stratus was facing in a northwesterly direction.

Post-Crash

The driver of the Ford Taurus was entrapped within the vehicle by intrusion of the left toe pan, the left A-pillar, and kick panel. Ambulance personnel arrived on-scene within five minutes of the crash. She was observed in the vehicle in a conscious state, restrained by the manual belt system and communicating with emergency personnel. During the extensive extrication, which required the removal of the left doors and roof, the driver lost consciousness. She was bagged to assist with respirations with supplemental oxygen. The driver was removed from the vehicle and transported by ambulance to a local hospital. The ambulance departed the scene approximately 66 minutes following the crash and arrived at the hospital within seven minutes of scene departure. The driver was treated and evaluated at the hospital and prepared for ambulance transport to a regional trauma center. She expired en route approximately 4.75 hours following the crash.

The front right passenger of the Ford Taurus exited the vehicle unassisted and was ambulatory at the scene. He was transported by ambulance to a local hospital where he was treated for his lacerations and evaluated for possibly injury. He was subsequently transferred to a regional trauma center. The driver of the Dodge Stratus was removed from the vehicle by emergency personnel and transported by ambulance to a local hospital where he was admitted for treatment of his injuries. The three passengers of the Dodge Stratus refused treatment at the scene of the crash.

Vehicle Damage - 2000 Ford Taurus

Exterior

The Ford Taurus sustained severe damage that originated on the front left corner and continued onto the left side plane of the vehicle. The corner impact resulted in 24.1 cm (9.5") of direct contact damage on the frontal plane that began 47.6 cm (18.5") left of center and extended to the left corner of the bumper fascia (**Figure 3**). The impact deformed the full width of the front bumper beam, deflecting the beam to a maximum depth of 57.4 cm (22.6") at the left corner (**Figure 4**). The crush profile at the level of the bumper beam was as follows: C1 = 57.4 cm (22.6"), C2 = 43.7 cm (17.2"), C3 = 28.6 cm (11.25"), C4 = 19.3 cm (7.6"), C5 = 7.3 cm (2.9"), C6 = 0 cm [-2.5 cm (-1.0")].

The narrow engagement at the front left corner of the Ford Taurus allowed the Dodge Stratus to penetrate into the left side of the Taurus as both vehicles continued on forward trajectories. The Stratus engaged against the left front tire and wheel, separating the axle and suspension components. The engagement

continued into the left A-pillar and both left doors, terminating 36.2 cm (14.25") forward of the left rear axle position. The engagement with the left side of the Taurus separated the left front fender and produced extensive intrusion of the left kick panel and A-pillar. Rescue personnel subsequently cut the pillars of the vehicle and removed the roof and both left side doors to extricate the driver from the vehicle. The Collision Deformation Classification (CDC) for this impact event was 12-FLEE-9 with a Principal Direction of Force (PDOF) of -10 degrees.



Figure 3. Frontal view of the Ford Taurus.



Figure 4. Left profile view of the bumper beam crush.

Interior - 2000 Ford Taurus

The interior of the Ford Taurus sustained extensive damage that was associated with exterior deformation and resulting intrusion of the driver’s compartment (**Figure 5**), deployment of the AOPS, and occupant contact. Maximum intrusion involved 68.0 cm (26.75") of rearward displacement of the left toe pan. The intruding components, direction and magnitude of intrusion are identified in the following table:



Figure 5. Intrusion into the driver’s position.

<i>Occupant Position</i>	<i>Intruding Component</i>	<i>Direction of Intrusion</i>	<i>Magnitude</i>
Driver	Mid left instrument panel, outboard aspect	Longitudinal	30.2 cm (11.9")
Driver	Mid left instrument panel, inboard aspect	Longitudinal	6.1 cm (2.4")
Driver	Lower mid instrument panel at center console	Longitudinal	13.3 cm (5.25")

<i>Occupant Position</i>	<i>Intruding Component</i>	<i>Direction of Intrusion</i>	<i>Magnitude</i>
Driver	Steering wheel/air bag module	Longitudinal	20.0 cm (7.75")
Driver	Left lower A-pillar	Longitudinal	50.8 cm (20.0)
Driver	Lower left A-pillar and kick panel	Lateral	22.2 cm (8.75")
Driver	Mid left instrument panel	Lateral	4.1 cm (1.6")
Driver	Left toe pan	Longitudinal	67.9 cm (26.75")
Driver	Brake pedal	Longitudinal	37.1 cm (14.6")
Driver	Lower B-pillar	Lateral	21.6 cm (8.5")

The frontal driver and passenger air bags deployed from the respective modules. In addition, the driver's seat belt buckle pretensioner deployed.

The belted driver loaded the manual belt webbing, the knee bolster, and the deployed front left air bag during the crash. Her loading of the manual belt system was evidenced by a vertically oriented striations on the inside aspect of the webbing (aspect against driver) that were consistent with belt stretch. These striations were located 36.8 cm (14.5") above the latchplate stop button and extended 35.3 cm (13.9") onto the shoulder belt aspect of the webbing.

The driver's knees loaded the intruding knee bolster (**Figure 6**). The left knee impacted the bolster at the outboard aspect adjacent to the lower instrument panel. A scuff mark with a surrounding fabric transfer evidenced the contact that was located 53.3-55.9 cm (21.0-22.0") left of the vehicle's centerline. The right knee contacted the bolster 24.1-34.3 cm (9.5-13.5") left of center and 35.6-40.6 cm (14.0-16.0") below the top of the instrument panel. A scuff mark and fabric transfer evidenced the contact point. Located between the knee contacts were several fragments that resulted from the open fracture sites. Her lower left leg loaded and deformed the emergency brake lever that was located adjacent to the left kick panel and the lower A-pillar. The pedal was deflected 3.8 cm (1.5") outboard of its original position.

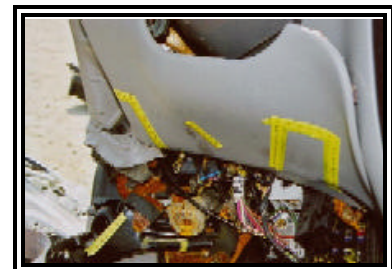


Figure 6. Knee bolster contacts.

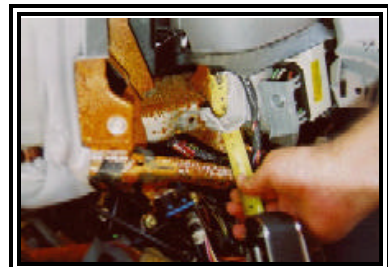


Figure 7. Left shear capsule separation.

The driver loaded through the inflated driver's air bag and compressed the energy absorbing steering column. The left shear bracket (**Figure 7**) was separated approximately 5.7 cm (2.25") while the right shear

bracket was obscured by the intrusion of the toe pan and the adjacent components. The slip coupling of the steering shaft had separated as a result of the intrusion. The steering wheel was not deformed.

The front right passenger of the Ford Taurus was not restrained by the manual belt system. He loaded the deployed front right air bag and the glove box door. His loading of the glove box door resulted in two distinct knee contact points. The left knee scuffed the plastic component and deposited a fabric transfer 17.1-25.0 cm (6.75-10.0") right of center and 28.6-33.7 cm (11.25-13.25") below the top instrument panel. The right knee contact was located adjacent to the left and was 29.8-33.0 cm (11.75-13.0") right of center and 34.3-39.4 cm (13.5-15.5") below the top panel. This contact was evidenced by fabric and scuff marks.

Exterior - 1999 Dodge Stratus

The Dodge Stratus was not inspected for this SCI investigation. The police report noted that the vehicle sustained damage to the front left area.

Manual Restraint Systems - 2000 Ford Taurus

The Ford Taurus was configured as a five passenger vehicle with a fixed center console. The driver and front right passenger belt systems consisted of a continuous loop webbing with a sliding latchplate that retracted onto belt sensitive and inertia activated locking retractors. The front right retractor was equipped with a (switchable) automatic locking mode. Both retractors were also equipped with load limiting torsion bar axles. The upper D-rings were adjustable. The driver's D-ring was adjusted 3.2 cm (1.25") above the full down position while the right D-ring was adjusted 5.7 cm (2.25") above the full-down position.

The rear seat of the Taurus was equipped with three 3-point lap and shoulder belt systems. These consisted of continuous loop webbings with sliding latchplates, fixed D-rings, and dual mode emergency and automatic locking retractors.

The driver loaded the manual belt webbing as she responded to the frontal impact force. Belt loading was evidence by a 35.2 cm (13.875") longitudinal striation pattern across the inside aspect of the webbing. The belt webbing was subsequently cut by rescue personnel during the extrication of the driver.

The front right passenger was not restrained. This belt webbing was cut as rescue personnel removed the roof of the Taurus.

Advanced Occupant Protection System - 2000 Ford Taurus

The Ford Taurus was equipped with an Advance Occupant Protection System (AOPS) that included dual stage frontal air bags for the driver and passenger positions, front seat belt buckle pretensioners, a driver's seat track positioning sensor, front seat belt load limiting retractors, and a Restraints Control Module (RCM) that provides sensing, diagnostic, backup power, and an event data recorder (EDR). The frontal air



Figure 8. Deployed frontal air bags in the Taurus.

bags deployed (**Figure 8**) and the driver's pretensioner fired as a result of the offset head-on impact sequence with the Dodge Status.

The EDR was removed from the vehicle and forwarded to Ford for download purposes (**Figure 9**). The EDR did not contain crash data. It was determined that the vehicle's electrical system was compromised prior to writing the crash data to memory. This resulted from the corner impact damaging the engine compartment fuse box, the passenger compartment fuse box, and associated wiring. The RCM contains a capacitor, however, this capacitor provides sufficient reserve energy to deploy the AOPS (air bags and pretensioners), but does not retain sufficient power to write the crash data to the EDR's memory.

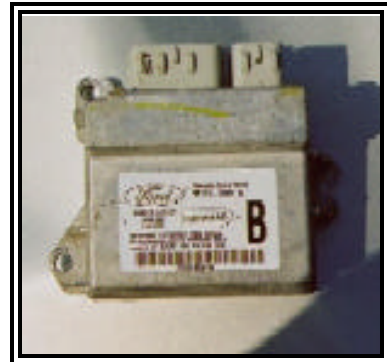


Figure 9. EDR removed from the Taurus.

The frontal air bag system deployed, however, since the EDR did not provide crash data, the stage of deployment was unknown for both the driver and passenger air bags. The Ford AOPS disposes the second stage approximately 100 ms after the deployment of the first stage if only the first stage was required for the crash.

The front left air bag (**Figure 10**) was concealed within asymmetrical H-configuration air bag module cover flaps within the four-spoke steering wheel rim. The horizontal tear seam was 16.5 cm (6.5") in width. The vertical measurements of the upper and lower flaps were 7.0 cm (2.75") and 4.4 cm (1.75") respectively. The driver air bag measured approximately 55.9 cm (22.0") in diameter and was vented by two 2.5 cm (1.0") ports that were located on the back side of the membrane, 8.9 cm (3.5") inboard of the peripheral seam. The air bag was tethered by two wide band tethers at the 12 and 6 o'clock positions. The tethers were sewn to the face of the bag membrane with a 15.2 cm (6.0") diameter reinforcement centered on the face of the air bag. There were no distinct occupant contact points on the air bag or damage to the bag associated with this crash. It should be noted that the Ford Taurus was exposed to the weather elements for a period of three months prior to this on-site SCI investigation.

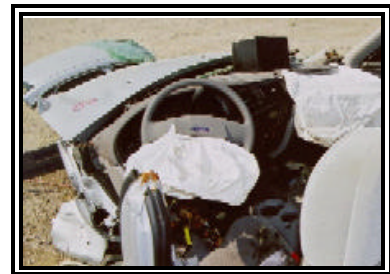


Figure 10. Deployed front left driver's air bag.

The front right passenger air bag module was housed in a top mount configuration in the right upper instrument panel. The cover flap was 27.7 cm (10.9") in width and 8.9 cm (3.5") in depth, hinged at the top aspect. The cover opened at the designated tear points in an upward direction. The passenger air bag membrane was approximately 58.4 cm (23.0") in width and 50.8 cm (20.0") in height. The rectangular air bag membrane was vented by two 4.4 cm (1.75") diameter ports located at the lateral aspects of the bag. The bag was not tethered. There was no occupant contact evidence of crash induced damage to the front

right air bag membrane. The front right air bag was identified by a bar coded label with the following nomenclature:

P5202880-00A
TS02330M1917

The front belt systems were equipped with seat belt buckle pretensioners. The pretensioners consist of pyrotechnic cylinders that reduce the height of the belt buckle via a cable attached to the cylinder. The cylinders, or pistons, are concealed within a barrel that is mounted longitudinally along the inboard aspect of both seat cushions. The pre-fire length of the barrel is approximately 110 mm (4.3"). The belt systems must be buckled for the pretensioner to fire. The driver of the Ford Taurus was belted while the passenger was unrestrained. Therefore the driver's pretensioner fired (**Figure 11**) in this above threshold crash while the passenger's pretensioner did not fire. The measured travel of the driver's side pretensioner was 60.3 mm (2.375").

The driver's pretensioner was identified by a bar coded label (**Figure 12**) with the following nomenclature:

F1B914793510016



Figure 11. Fired driver's buckle pretensioner.



Figure 12. Driver's pretensioner barrel identifiers.

The front right pretensioner had a post-crash barrel length of 108 cm (4.25") which is consistent with a non-fired unit. Based on this measurement and a thorough inspection of the front right belt system, it was determined that the passenger was not restrained. The front right pretensioner was identified by the following:

F1B914693510853

The Ford Taurus was also equipped with the optional side impact air bags. These air bags were mounted in the outboard aspects of the front seat backs. The side air bags did not deploy in this crash.

Driver Demographics - 2000 Ford Taurus

Age/Sex: 62 year old female
 Height: Not reported
 Weight: Not reported (noted in ER report as obese)
 Manual Restraint
 System Usage: 3-point lap and shoulder belt system
 Usage Source: Observations of first responders, vehicle inspection
 Seat Track Position: Rear
 Mode of Transport
 From Scene: Ambulance
 Type of Medical
 Treatment: Transported by ambulance to a local hospital emergency room where she was evaluated and prepared for transfer by ambulance to a regional trauma center. The driver expired en route to the trauma center approximately 4.75 hours following the crash.

Driver Injuries

Injury	Injury Severity (AIS 90/Update 98)	Injury Source
Open fracture of the left tibia with arterial bleed	Serious (853405.3,2)	Parking brake pedal/intruding left kick panel
Open fracture of the left fibula	Moderate (851605.2,2)	Parking brake pedal/intruding left kick panel
Closed fracture of the right leg, NFS	Moderate (852002.2,1)	Intruding left toe pan
*Bilateral fractures of the superior/inferior rami	Moderate (852602.2,5)	Induced fractures from loading of the knee bolster
Closed head injury, NFS	Unknown 115099.7,0	Possible left A-pillar
4 cm laceration mid right thigh	Minor (890602.1,1)	Unknown
Contusion over the left thigh	Minor (890402.1,2)	Intruding left door panel
3 cm hematoma over the right temporal scalp	Minor (190402.1,2)	Possible occupant-to-occupant interaction
Hematoma of the superior left temporal scalp	Minor (190402.1,2)	Possible left A-pillar

*Source of injury data - Emergency room report, no autopsy was performed
 * Radiology report*

Driver Kinematics

The driver of the Ford Taurus was seated in a presumed upright posture with her seat adjusted to a rear track position. She was restrained by the manual 3-point lap and shoulder belt system. At impact, the seat belt buckle pretensioner fired and the frontal air bag system deployed. The lack of EDR data failed to provide the stage of air bag deployment. Since her seat track was not in a forward position a second stage deployment was plausible for the severity of this crash.

The driver responded to the frontal impact force by initiating a forward trajectory into the rearward intruding frontal components. Her knees loaded the knee bolster as evidenced by scuff and fabric transfers. As a result of the knee loading, the driver sustained bilateral pelvic fractures of the superior and inferior rami. Her feet and lower legs were compressed by the intrusion of the left kick panel, toe and floor pans. The lateral aspect of her left leg loaded the parking brake pedal and left kick panel (panel forward of the A-pillar). The parking brake pedal was deformed to the left. The parking brake pedal, in combination with the intruding kick panel (**Figure 13**) fractured her left tibia and fibula. The driver's head probably impacted the intruding left A-pillar late in the crash sequence as the vehicle was deflected to its right. This probable contact resulted in a closed head injury (NFS) and a left temporal scalp hematoma.

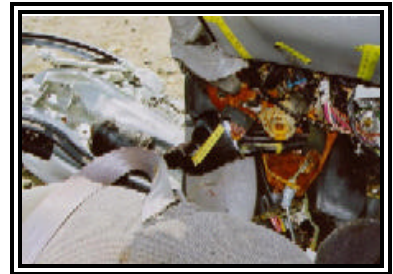


Figure 13. Intruding kick panel and deformed parking brake pedal.

The right aspect of the driver's head was probably struck by the left side of the unrestrained passenger's head. The driver sustained a 3 cm hematoma of the right temporal scalp while the passenger sustained three lacerations of the left ear. The driver also sustained a 4 cm laceration of the right thigh area from an unknown source within the vehicle.

The driver remained in a conscious state immediately following the crash and was conversing with emergency personnel at the scene of the crash. The ambulance crew arrived on-scene within 5 minutes of the call. The driver's lower extremities were entrapped by the intrusion of the left toe pan and the A-pillar and left kick panel. An extended extrication was required to removed the driver from the Taurus. This required the removal of the left doors and the roof of the vehicle. During the extrication process, the driver lost consciousness. The driver was removed from the vehicle and transported by ambulance approximately one hour following the arrival of the ambulance to the crash scene. The ambulance arrived at the local hospital within seven minutes of departure from the scene. The driver was evaluated and stabilized at the local hospital and prepared for ambulance transferral to a regional trauma center. She expired en route to the trauma center approximately 4.75 hours following the crash.

Front Right Passenger Demographics - 2000 Ford Taurus

Age/Sex: 65 year old male
Height: Not reported
Weight: Not reported
Manual Restraint
Usage: None
Usage Source: Vehicle inspection
Seat Track Position: Rear
Mode of Transport
From Scene: Ambulance
Type of Medical
Treatment: Transported to a local hospital, transferred to a regional trauma center

Front Right Passenger Injuries

Injury	Injury Severity (AIS90/Update 98)	Injury Source
Closed head injury, NFS	Unknown (115099.7,0)	Occupant-to-occupant interaction
Lacerations of the left pre-auricular ear (1 cm), left earlobe (1 cm), and entrance of the left ear canal	Minor (290602.1,2)	Occupant-to-occupant interaction
Laceration of the neck, NFS	Minor (390600.1,9)	Possible front right air bag
Laceration of the nose, NFS	Minor (290600.1,4)	Possible front right air bag
Abrasion over the right knee	Minor (890202.1,1)	Glove box door

** Source of Injury Data - Hospital emergency room records*

Front Right Passenger Kinematics

The front right passenger of the Ford Taurus was seated in a presumed upright attitude with the seat track adjusted to a rear track position. He was not restrained by the manual 3-point lap and shoulder belt system. The lack of belt usage was supported by the non-fire status of the buckle pretensioner and the condition of the webbing and system hardware (lack of witness marks).

At impact with the Dodge Stratus, the frontal air bag system deployed. The unrestrained front right passenger initiated a forward trajectory and loaded the deployed air bag and the glove box door (**Figure 14**). His loading of the glove box door resulted in two distinct scuff marks with fabric transfers located at the left aspect of the component. The passenger sustained an abrasion over the right knee from contact with the glove box.

The passenger loaded the deployed air bag with his torso and face. The air bag protected the unrestrained passenger from contact against the instrument panel and the windshield. He sustained a laceration of the neck and of the nose that possibly resulted from his air bag contact. There was no evidence of occupant contact to the front right air bag membrane.

The passenger rebounded from the air bag contact and was redirected to his left as the vehicle rotated in a CCW direction. The left aspect of his head probably impacted the head of the driver. This probable occupant-to-occupant interaction resulted in three lacerations of the passenger's left ear and an unspecified closed head injury.

The passenger came to rest in the front right seated area of the vehicle. He exited the vehicle without assistance prior to the arrival of emergency personnel. The passenger was found standing next to the vehicle was reported as disoriented at the scene without recollection of the crash events. He remained ambulatory at the scene and was transported by ambulance to a local hospital where he was evaluated and treated for his injuries. The passenger was transferred to a regional trauma center. The medical records from the trauma center were not available.



Figure 14. Front right passenger loading of the glove box and deployed air bag.

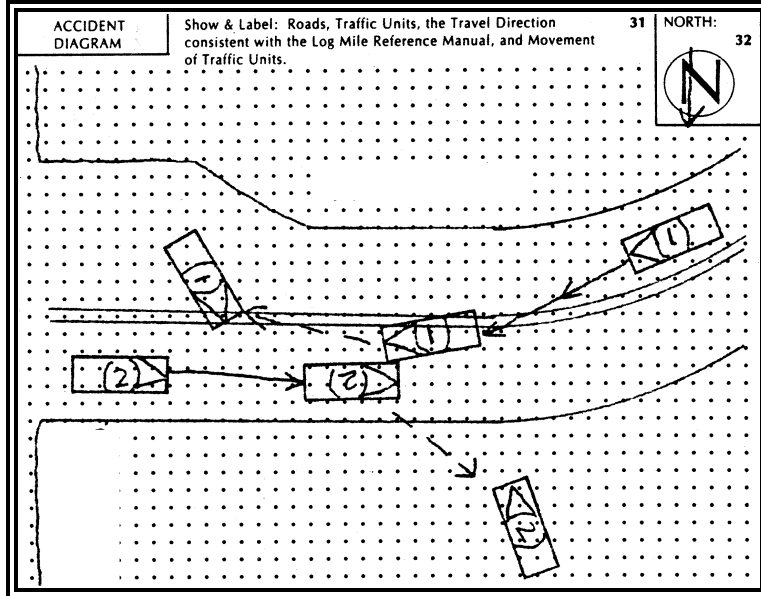


Figure 15. Police Scene Schematic.