

Child Safety Seat Investigation / Vehicle to Object
Dynamic Science, Inc. / Case Number: DS05009
1996 Ford Taurus
Arizona
May/2005

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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.

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16. Abstract <p>This on-site investigation focused on a rearward facing infant seat that was installed in the second seat, middle position of a Ford Taurus. The Taurus was occupied by a restrained 31-year-old female driver and a 16-day-old male infant. The infant had been seated in a rear facing Graco Snug Ride infant seat with a detachable base. The base had been anchored to the case vehicle's fabric bench seat by the use of the vehicle's lap belt. This single vehicle crash was precipitated by the vehicle entering a sharp left curve and having the infant seat slide off its base. The driver reached behind her to grab the sliding infant seat, and upon doing so involuntarily steered to the right, thus resulting in a loss of control of the case vehicle. The vehicle departed the roadway to the right while in a clockwise yaw and struck a post before impacting a fence. The car then rolled three quarter turns onto its right side as it slid to final rest. During the rollover the child and infant seat were ejected through the left rear window. After the vehicle came to rest the driver proceeded to climb out of the vehicle. She found the infant, still in the infant seat, beside the case vehicle. The driver was transported to a local hospital where she was treated in the emergency room for a contusion of the right upper arm and right hip and then released. The infant sustained no injuries but was nevertheless transported by ambulance to the same hospital. He was examined in the emergency room as a precautionary measure and then released.</p>				
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Crash Investigation
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BACKGROUND:

Description:

This on-site investigation focused on a rearward facing infant seat that was installed in the second seat, middle position of a Ford Taurus. The Taurus was occupied by a restrained 31-year-old female driver and a 16-day-old male infant. The infant had been seated in a rear facing Graco Snug Ride infant seat with a detachable base. The base had been anchored to the case vehicle's fabric bench seat by the use of the vehicle's lap belt. This single vehicle crash was precipitated by the vehicle entering a sharp left curve and having the infant seat slide off its base. The driver reached behind her to grab the sliding infant seat, and upon doing so involuntarily steered to the right, thus resulting in a loss of control of the case vehicle. The vehicle departed the roadway to the right while in a clockwise yaw and struck a post before impacting a fence. The car then rolled three quarter turns onto its right side as it slid to final rest. During the rollover the child and infant seat were ejected through the left rear window. After the vehicle came to rest the driver proceeded to climb out of the vehicle. She found the infant, still in the infant seat, beside the case vehicle. The driver was transported to a local hospital where she was treated in the emergency room for a contusion of the right upper arm and right hip and then released. The infant sustained no injuries but was nevertheless transported by ambulance to the same hospital. He was examined in the emergency room as a precautionary measure and then released.



Figure 1. Left side, Ford Taurus

This child seat case was identified by NHTSA through the GES program. DSI was notified of the crash on June 21, 2005. DSI located the child seat on June 21st, and the vehicle on June 22, 2005. DSI was assigned the case on June 23, 2005. The vehicle and the child safety seat were inspected on June 28, 2005.

SUMMARY

Crash Site

This single vehicle crash occurred within the city limits of a large urban area in southwest Arizona in May, 2005 at 1123 hours. At the time of the crash, there were no adverse weather conditions and the asphalt roadway was dry. The north-south roadway was configured with a total of two lanes; one in each direction of travel. The roadway is a sharp curve left for those traveling northbound which straightened out in the area of the crash. The lanes are differentiated by double yellow



Figure 2. Approach to area of roadway departure. Approximately 63 m (200 ft) from impact area.

lines in the curve. As one enters the straightaway the lane lines become single dashed lines to signify that passing is allowed in this section of the roadway. Both lanes are bordered by paved shoulders. It was daylight at the time of the crash. The speed limit in both directions is 80 km/h (50 mph).

Pre-Crash

The case vehicle was a 1996 Ford Taurus GL 4-door sedan that was being driven by a lap and shoulder belt restrained 31-year-old female (170 cm/70 in, 107 kg/235 lbs). A 16-day-old male (58 cm/23 in, 4.5 kg/10 lbs), restrained in a rearward facing infant seat, was also in the Taurus. The Taurus was traveling northbound when it entered the sharp left hand curve. As the vehicle negotiated the roadway, the driver observed the Graco Snug Ride infant seat sliding off its base. The detachable base was anchored to the case vehicle using the lap portion of the lap and shoulder belt system. It appears likely that the infant seat had not been locked onto the base when it had been placed in the vehicle by the mother.



Figure 3. Area of rollover and impact with fence and pole

Crash

As the mother saw the infant seat beginning to slide, she reached behind her in an attempt to stop its movement. While doing so she inadvertently steered to the right. This resulted in the case vehicle beginning a clockwise yaw. The vehicle departed the roadway to the right (east) with its left side leading. After striking a post and a fence the vehicle proceeded to roll onto its right side. During the rollover the child and infant seat were ejected through the left rear window.

Post-Crash

After the vehicle rolled three quarter turns and came to rest on its right side. The driver unbuckled her seatbelt and climbed out of the car under her own power. She observed the infant seat in close proximity to the car, and ran over to check on the baby. The baby had no visible signs of any injury. An ambulance arrived on the scene, but no treatment was given. After being transported to the hospital the baby was examined as a safety



Figure 4. Pole impact to left rear door

precaution, and no injuries were found. The driver sustained a visible contusion to the right upper arm and the right hip. She was released from the emergency room.

VEHICLE DATA -1996 Ford Taurus

The 1996 Ford Taurus GL 4-door sedan was identified by its Vehicle Identification Number (VIN): 1FALP5211TGxxxxxx. The vehicle was equipped with a 3.0 liter 6 cylinder engine, automatic transmission, front wheel drive, power steering and brakes, and a tilt steering wheel.

The Taurus was equipped with Warrior P205/65R15 tires. The specific tire data is as follows:

Tire	Tread	Measured pressure	Manufacturer recommended pressure	Restricted	Damage
LF	5 mm (0.19 in)	Flat	303 kPa (44 psi)	No	None
LR	6 mm (0.22 in)	Flat	303 kPa (44 psi)	No	None
RR	6 mm (0.22 in)	193 kPa (28 psi)	303 kPa (44 psi)	No	None
RF	5 mm (0.19 in)	200 kPa (29 psi)	303 kPa (44 psi)	No	None

The front seating in the Ford Taurus GL was configured with a fabric-covered 60-40 split bench seat with adjustable head restraints, and a fabric bench seat with folding backs and integral head restraints in the second row. The driver's seat was adjusted to just forward of the middle track setting. Post impact, the seat back angle was 51 degrees from horizontal and the seat bottom was found to be 15 degree from the horizontal. The seat was undamaged. The middle front seat was found to be at the middle track setting. The seat back angle was 68 degrees from horizontal, while the seat bottom was at 15 degrees from horizontal. The front-right seat back was found to be 51 degrees from horizontal, while the seat bottom was also found to be at 15 degrees from horizontal. This seat track was found to be in the forward of the middle position. No seat failures were noted to any of the front seating positions. The second seat was undeformed. Across the three seating positions the seat back angles were all measured at 65 degrees from horizontal, while their seat bottom angles were all 14 degrees from the horizontal.

VEHICLE DAMAGE

Exterior Damage - 1996 Ford Taurus

The 1996 Ford Taurus sustained moderate damage to the left side as a result of the impact with the post. This direct damage began 44.0 cm (17.3 in) forward of the rear axle and extended for a distance of 80.0 cm (31.5 in). Four crush measurements were taken along this left side plane: C1=0 cm, C2=5.0 cm (1.9 in), C3=28.0 cm (11.0 in) and C4=0 cm. This impact occurred to the left door area, and resulted in intrusions to that vehicular component. It also resulted in disintegration of the left side glazing. The Collision Deformation Classification (CDC) for the impact with the post was 09LPAN3.



Figure 5. Right side rollover damage

The second impact, with the fence, was located along the entire left side plane of the car. The extent zone for the maximum crush, which fell along the left A pillar, was sighted into the second extent zone. The CDC for this impact was 09LDAW2.

The last event, that of the vehicle rolling over, encompassed the entire right side plane, which was in contact with the ground at final rest. The maximum crush from this event was sighted into the second extent zone. The windshield sustained stress fractures but there was no integrity loss through this avenue. Both the left rear windows and the backlight glazing fractured. Both the left side tires were flattened as a result of tripping during the vehicle roll; none of them were found to be defective. The CDC for the rollover was 00RDAO2.

Interior Damage - 1996 Ford Taurus

The 1996 Ford Taurus GL sustained minor interior damage as a result of passenger compartment intrusions. The air bags did not deploy, nor did the occupants leave any visible contact points or deformation.

The specific passenger intrusions were documented as follows:

Position	Intruded Component	Magnitude of Intrusion	Direction
Left rear	Sill	16.0 cm (6.3 in)	Lateral
Right rear	C-pillar	2.0 cm (0.8 in)	Vertical

The left side was deformed by impact with the pole, which resulted in the left rear intruding inside the passenger compartment. The right rear C pillar was moved vertically a total of 2.0 cm (0.8 in).

MANUAL RESTRAINT SYSTEMS - 1996 Ford Taurus

The 1996 Ford Taurus was configured with manual 3-point lap and shoulder belts for each outboard seating position. None of the front seat belts were equipped with pretensioners. The front outboard seating positions were equipped with adjustable shoulder belt anchorages, both of which were found in their full downward setting. The driver's seat belt was configured with a cinching latch plate and an emergency locking retractor. The driver's seat belt showed significant signs of usage, and no failures were observed.



Figure 6. Lap portion of second row center seat belt.

The second row center safety belt was used to secure the occupied rear facing infant seat base. This seat belt is designed to be used as either a lap belt or a lap and shoulder belt combination. In the latter case, the belts are joined using the metal stud on the lap belt with the slot on the shoulder belt. The manual center belt has a locking latch.



Figure 7. Back of center rear seat latch

The entire child seat system had been removed afterwards and was later inspected at the residence of the driver. There were no safety problems noted to the center lap belt during the inspection. The webbing showed no signs of any failures, and the latch plate and the buckle also were defect free. The metal latch plate had numerous scratches across its face which were supportive of historical usage.

Supplemental Restraint System - 1996 Ford Taurus

The 1996 Ford Taurus was equipped with two front mounted air bags. Neither of the air bags, which were original to the car, deployed during the crash sequence. Since the longitudinal impact forces were fairly low, the air bags would not have been expected to deploy, given these specific crash circumstances.

Child Safety Seat

This particular crash involved a Graco SnugRide infant seat (Ivy League designer package) that was installed in the center rear seat. This infant seat, with a detachable base, had been purchased new. The date of manufacture was 11/01/04. The serial number of the seat was 8446LIVY and the model number was LAPC0074A. The infant seat was equipped with two sets of slots so that the 5-point internal harness could be raised as the child grew. At the time of the crash the webbing was in the lower slots. The retainer clip was locked into place.

According to the manufacturer, the infant seat was to only be used while in a rear facing mode, and was designed for infants that were up to 9 kg/20 lbs in weight and 66 cm/26 inches in length.

The driver indicated that she had left the base in the car, and had placed the infant seat onto the base prior to driving away. The base was anchored to the vehicle using the manual lap belt. The driver also indicated that the infant seat handle was in the full upright position. She stated that the infant seat had been properly locked into the base, but this does not appear to have been the case. The inspection of the base and the child seat itself show no failures or broken components. There was minor scuffing damage found on the top of the carrying handle and on right side of the seat.



Figure 8. Graco Snug Ride infant seat - forward view



Figure 9. Graco Snug Ride infant seat - side view



Figure 10. Scuffs to right side of seat

OCCUPANT DEMOGRAPHICS - 1996 Ford Taurus

	Driver	Occupant 2
Age/Sex:	31/Female	16 day/Male
Seated Position:	Front row, left	Second row, middle
Seat Type:	Fabric covered, 60-40 split bench seat. Seat track adjusted just forward of middle track position	Fabric covered bench seat with folding back
Height:	178 cm (70 in)	58 cm (23 in)
Weight:	107 kg (235 lbs)	5 kg (10 lbs)
Occupation:	Unknown	NA
Pre-existing Medical Condition:	None	None
Alcohol/Drug Involvement:	None	NA
Driving Experience:	15 years	NA
Body Posture:	Seated upright, but had turned towards the rear and was reaching for the sliding child safety seat	Lying in infant seat
Hand Position:	Both hands on wheel	Unknown
Foot Position:	Right foot on brake, left on floor	Unknown
Restraint Usage:	Lap and shoulder belt available, used	Lap belt placed around the base of the infant child seat
Air bag:	Steering wheel mounted frontal air bag, did not deploy	None available

OCCUPANT INJURIES -1996 Ford Taurus

Driver: Injuries obtained from in-person interview.

<u>Injury</u>	<u>OIC Code</u>	<u>Injury Mechanism</u>	<u>Confidence Level</u>
Contusion, right upper arm	790402.1,1	Unknown	Unknown
Contusion, right hip	890402.1,1	Seat belt buckle	Probable

Second row center seat occupant: Not injured

OCCUPANT KINEMATICS - 1996 Ford Taurus

Driver Kinematics

The 31-year-old driver of the Ford Taurus was seated upright, but had turned towards the rear and was reaching for the sliding infant safety seat. Her change in posture while keeping her left hand on the steering wheel resulted in an inadvertent steering motion to the right. This resulted in the vehicle being placed into a sharp clockwise yaw, which precipitated the crash events. The driver was wearing the 3-point lap and shoulder belt. As the vehicle departed the roadway to the right striking a post, a fence, and then rolling over, the driver moved toward the left. The seat belt prevented her from leaving the driver's seat, but the buckle of the seat belt did result in a contusion to her right hip. She also received a contusion to her right upper arm. There were no visible contacts inside the vehicle to assign as the source, but she may have injured it as she reaching into the back seat to stop the infant seat from sliding.

Second Row Center Occupant Kinematics

The 16-day-old male was seated in a rear facing infant seat. He was kept in the child seat by the use of the infant seat's internal 5-point harness. Prior to the crash the infant seat had likely not been locked onto the detachable base properly. During the crash sequence the child seat, with the infant still in it, was ejected through the left rear glazing (PAR in error) and came to rest in the grassy area adjoining the case vehicle. The path of ejection appears to have been from the right to the left with portions of the seat scuffing the rear seat back. The child sustained no injuries. He was transported to a local hospital as a safety precaution and examined in the emergency room; no trauma was noted.

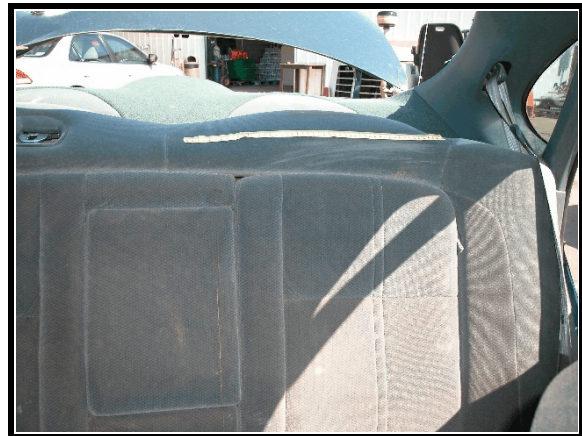


Figure 11. Possible ejection path marks to back of rear seat

Attachment 1. Scene Diagram

