CRASH DATA RESEARCH CENTER
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CALSPAN ON-SITE POTENTIAL SAFETY-RELATED DEFECT CRASH INVESTIGATION

SCI CASE: CA06-022

VEHICLE: 1997 FORD EXPLORER
LOCATION: TEXAS
CRASH DATE: JUNE 2005

Contract No. DTNH22-01-C-17002

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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.

TECHNICAL REPORT STANDARD TITLE PAGE

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16. Abstract This investigation will focus on the alleged tire failure and subsequent rollover crash of a 1997 Ford Explorer. The crash occurred during the evening hours of June 2005. It was dusk and the reported weather was clear and dry. The weather was not a crash factor. The crash occurred on a two-lane state highway in rural Texas. At the crash site, the two-lane roadway transitioned to a three-lane roadway by the addition of a southbound lane that created a passing zone. The asphalt roadway was straight and with a positive grade in the southbound direction. The speed limit in the area of the crash was 113 km (70 mph) daytime and 105 km/h (65 mph) nighttime. The 1997 Ford Explorer was southbound in the inboard lane as the Ford entered the passing zone. The vehicle was driven by a 25 year old restrained male. A 21 year old female was seated in the center rear between her two children who were restrained within two Child Safety Seats (CSS). The female adult was unrestrained. A 1 month old male was restrained within a Graco Rear-Facing CSS in the left rear position. A 1 year old female was restrained within an Evenflo Triumph Convertible CSS installed in a forward facing mode in the right rear position. The police investigation determined the child passengers were loosely restrained by the CSS harness straps with the respective chest retainer clips adjusted to the lowest positions. As the Ford proceeded south, the driver reported to the police investigator that the vehicle "began to shake violently" and then he lost control. The driver reportedly applied the brakes. The physical evidence at the scene indicated the Ford crossed the centerline and entered the northbound lane. The driver over-steered to the right to reenter the travel lane. The driver's steering input resulted in a clockwise yaw. As the Ford reentered the inboard southbound lane, the left side tires rolled under and the rims contacted the pavement resulting in a tripped left side leading roll. The vehicle rolled multiple times and came to rest on its wheels facing west on the edge of the paved shoulder. The vehicle's roll distance measured approximately 40 m (131 ft). The unrestrained adult female and the two child passengers were ejected during the roll event. The police report indicated that the children were ejected through the improperly adjusted harness straps of the CSS's			
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BACKGROUND

This investigation will focus on the alleged tire failure and subsequent rollover crash of a 1997 Ford Explorer, **Figure 1**. The crash occurred during the evening hours of June 2005. It was dusk and the reported weather was clear and dry. The weather was not a crash factor. The crash occurred on a two-lane state highway in rural Texas. At the crash site, the two-lane roadway transitioned to a three-lane roadway by the addition of a southbound lane that created a passing zone. The asphalt roadway was straight and with a positive grade in the southbound direction. The speed limit in the area of the crash was 113 km (70 mph) daytime and 105 km/h (65 mph) nighttime. The 1997 Ford Explorer was southbound in the inboard lane as the Ford entered the passing zone. The vehicle was driven by a 25 year old restrained male. A 21 year old female was seated in the center rear between her two children who were restrained within two Child Safety Seats (CSS). The female adult was unrestrained. A 1 month old male was restrained within a Graco Rear-Facing CSS in the left rear position. A 1 year old female was restrained within an Evenflo Triumph Convertible CSS installed in a forward facing mode in the right rear position. The police investigation determined the child passengers were loosely restrained by the CSS harness straps with the respective chest retainer clips adjusted to the lowest positions.

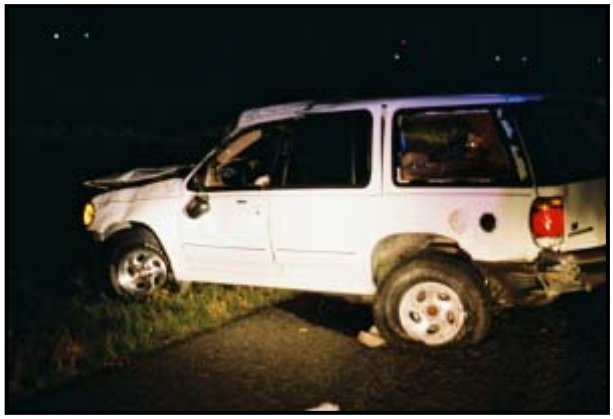

Figure 1: Final rest position of the 1997 Ford Explorer.

As the Ford proceeded south, the driver reported to the police investigator that the vehicle "began to shake violently" and then he lost control. The driver reportedly applied the brakes. The physical evidence at the scene indicated the Ford crossed the centerline and entered the northbound lane. The driver over-steered to the right to reenter the travel lane. The driver's steering input resulted in a clockwise yaw. As the Ford reentered the inboard southbound lane, the left side tires rolled under and the rims contacted the pavement resulting in a tripped left side leading roll. The vehicle rolled multiple times and came to rest on its wheels facing west on the edge of the paved shoulder. The vehicle's roll distance measured approximately 40 m (131 ft). The unrestrained adult female and the two child passengers were ejected during the roll event. The police report indicated that the children were ejected through the improperly adjusted harness straps of the CSS's.

The crash was reported to the authorities via the 9-1-1 system by witnesses traveling behind the Ford. These witnesses stopped to render aid. The adult female passenger was found near the

forward right side of the vehicle. She sustained fatal head trauma and was pronounced deceased at the scene. The driver exited the vehicle under his own power and was found outside the vehicle holding the 1 month old infant near the back of the Ford. The 1 year old female was found on the right side of the vehicle near the adult female. The driver and two child passenger sustained non-incapacitating injuries and were transported to a local hospital.

Notification of this crash was supplied to the Calspan Special Crash Investigations team by an attorney representing the family of the deceased passenger. Calspan subsequently notified the National Highway Traffic Safety Administration's Office of Defects Investigation regarding the crash. ODI in-turn asked the Crash Investigation Division of the NHTSA to assign an investigation of the crash to the Calspan SCI team due to the agency's high interest in tire failures, tread separation, and rollover crashes. Calspan initiated follow-up investigation and was supplied the Police Accident Report through the attorney's office. The Ford Explorer and tire were retained by the attorney pending civil litigation of the matter and were available for inspection. The on-site inspection of the vehicle and tire took place during the week of August 28, 2006. Due to the passage of time between the crash date and the SCI notification, an inspection of the crash site was not conducted.

VEHICLE DATA

1997 Ford Explorer XLT 4 x 2
VIN: 1FMDU32E4VZ (Production sequence deleted)

- Mileage:252,176 km (156,699 miles)
- Left Rear Tire Failure
- Left Side Leading Roll – Eight Quarter Turns (possibly 12)
- Maximum lateral and vertical crush located on the right roof rail within the A-pillar area
  Max Lateral Displacement: 1 cm (0.5 in)
  Max Vertical Crush: 13 cm (5.3 in)
- Minor damage to left rear wheelhouse from partial detread slap
- Undercarriage: Good condition, all bushings and links tight, no leaking seals, no broken springs, brake lines intact, all parts appear to be good condition. Rear shocks were Sensa-track (possibly replacement) shocks.

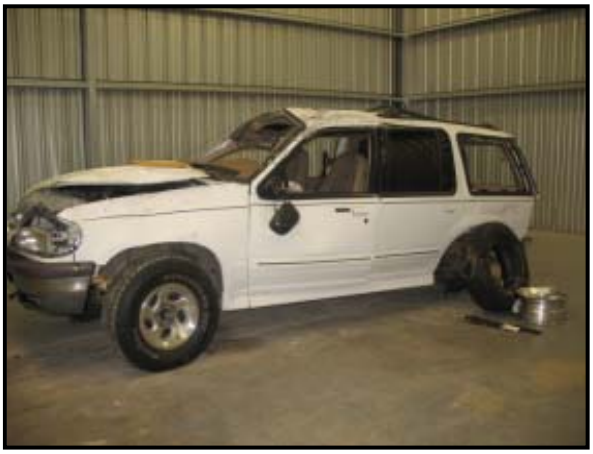

Figure 2: Left side.

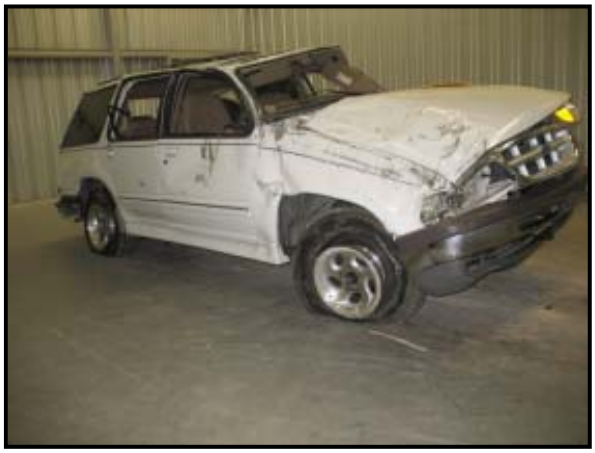

Figure 3: Right side.

OCCUPANT DATA

Driver: 25 year old restrained male
Not ejected
Minor injuries

Front Right: Not occupied

Left Rear: 1 month old male
Rear-facing CSS
Ejection path: L3 window (probable)

Right Rear: 1 year old female
Forward-facing CSS
Ejection path R2 window

Center Rear:
21 year old unrestrained female
Ejection path: R2 window
Unknown Fatal injury

TIRE DATA

Position:	**Left Front Tire**	**Right Front Tire**
Manufacturer / Model:	Futura Scrambler RVT	Futura Scrambler RVT
Tire Size:	31 x 10.5 R15TL M+S	31 x 10.5 R15TL M+S
DOT Number:	UX60 B9R 018	UT60 B9R 128
Tread Depth (mm/in): (Outboard to Inboard)	6 mm 7 mm 6 mm 6 mm (7/32" 9/32" 8/32" 8/32")	6 mm 6 mm 6 mm 6 mm (8/32" 8/32" 8/32" 8/32")
Construction: Tread: Sidewall:	2 ply steel and 2 ply polyester 2 ply polyester	2 ply steel and 2 ply polyester 2 ply polyester
Notes:	No damage, Tire pressure = 30 PSI	Tire debeaded, L-shaped cut to sidewall, Rim heavily abraded over 75% of circumference with asphalt and dirt deposits

Position:	**Left Rear Tire**	**Right Rear Tire**
Manufacturer / Model:	Futura Scrambler RVT	Remington Rim Fire A/S
Tire Size:	31 x 10.5 R15TL M+S	P235/70R15 M+S
DOT Number:	UT60 B9R 038	DA60 Y43 389
Tread Depth (mm/in): (Outboard to Inboard)	6 mm 6 mm 6 mm 6 mm (8/32" 8/32" 8/32" 8/32")	4 mm 4 mm 4 mm 3 mm (5/32" 5/32" 5/32" 4/32")
Construction: Tread: Sidewall:	2 ply steel and 2 ply polyester 2 ply polyester	2 ply steel and 2 ply polyester 2 ply polyester
Notes:	See below for detailed tire information, Rim abraded over 100% of circumference with asphalt deposits, Rotor fractured from drive axle	Tire debeaded at inspection (appeared inflated per the on scene photos); Rim heavily abraded over 100% of circumference with asphalt buildup embedded in bead

Left Rear Tire

The overall general condition of the tire was considered to be good, **Figures 4 through 6**. There was adequate tread life remaining and the rubber did not appear dry rotted. The tire failed by a combination of a partial detread and destruction of the casing and sidewall. A radial oriented 11 cm (4.5 in) cut of the inboard sidewall was located at 80 degrees. This cut traveled across the tread width and extended down the outboard sidewall 8 cm (3 in). The outboard sidewall was holed at the 5 o'clock sector (150-160 degrees). The hole measured 11 cm x 7 cm (4.5 in x 2.8 in). A view of the failed casing is depicted in **Figure 7.** The detread section measured 64 cm (25.2 in) in length and separated from the tire between 350 to 100 degrees, **Figures 8 and 9**. The detread section separated diagonally from sidewall to sidewall along the direction of the top steel ply and detached between the two steel plys. Further examination of the casing revealed it had been holed and patched. The patch was located between 330 and 0 degrees. The patch adequately repaired the perforation and was completely adhered to the casing. A corresponding nail hole was identified in the groove between the first and second tread from the outboard sidewall. Refer to **Figures 10 and 11**. The failure of this tire was not a typical/classic tread separation.

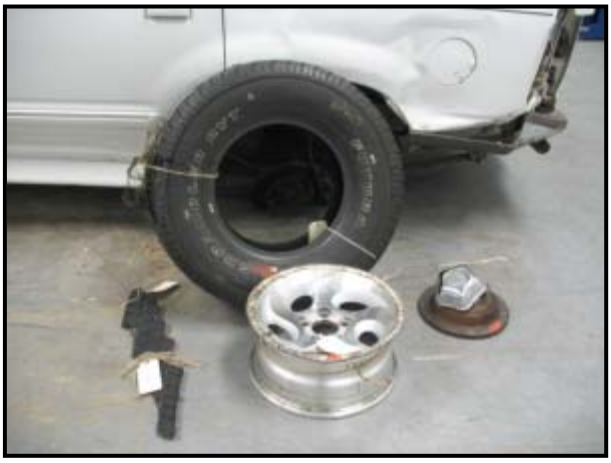

Figure 4: Overall view of LF rear and wheel.

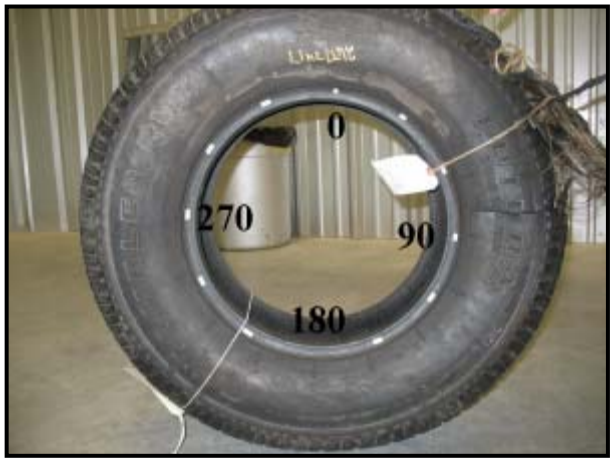

Figure 5: DOT side of tire (inboard).

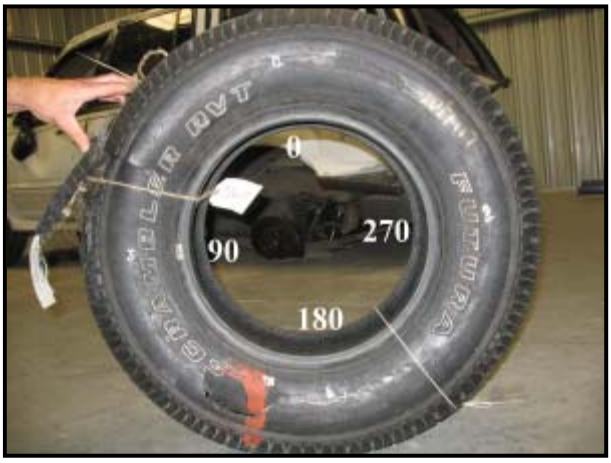

Figure 6: Non-DOT side of tire (outboard).

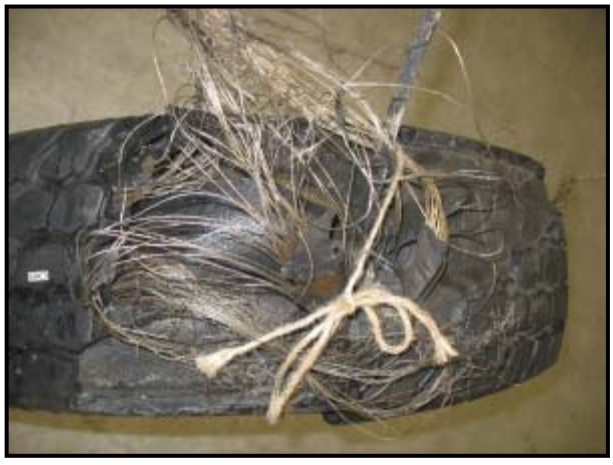

Figure 7: View of the failed casing.

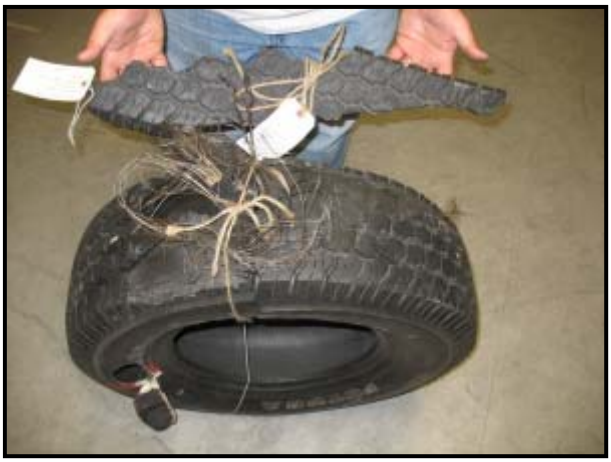

Figure 8: Exterior surface of detread section.

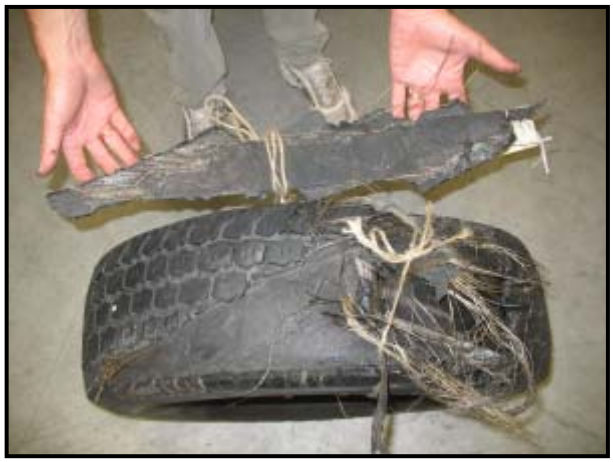

Figure 9: Interior side of detread section.

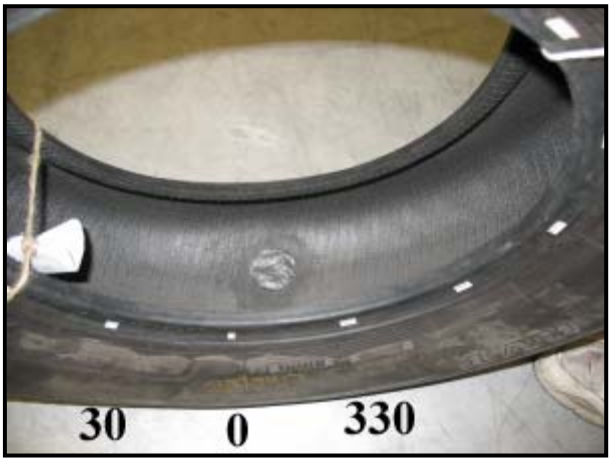

Figure 10: View of the patched tire casing.

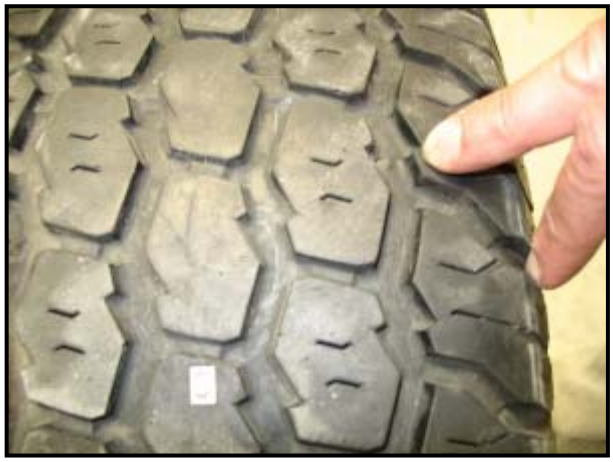

Figure 11: Location of the nail hole