

**CRASH DATA RESEARCH CENTER**

Calspan Corporation  
Buffalo, NY 14225

**CALSPAN ON-SITE OFFICE OF DEFECTS CRASH INVESTIGATION**

**CASE NO: CA08009**

**VEHICLE: 1999 FORD EXPLORER XLT**

**LOCATION: FLORIDA**

**CRASH DATE: FEBRUARY 2008**

Contract No. DTNH22-07-C-00043

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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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**CALSPAN ON-SITE OFFICE OF DEFECTS CRASH INVESTIGATION**  
**SCI CASE NO.: CA08009**  
**VEHICLE: 1999 FORD EXPLORER XLT**  
**LOCATION: FLORIDA**  
**CRASH DATE: FEBRUARY 2008**

**BACKGROUND**

This on-site investigation focused on the front suspension components and the loss of directional control of a 1999 Ford Explorer that resulted in a run-off-road crash with three trees. An unrestrained 24-year old male driver and his unrestrained 23-year old male front right passenger were fatally injured in the crash. The Ford was equipped with four mismatched tires and was traveling on an interstate roadway in a 113 km/h (70 mph) speed zone. The left rear tire tread separated and the driver applied a rapid clockwise (CW) steering input in an attempt to maintain control. The Explorer initiated a CW yaw and departed the right shoulder. The vehicle rotated 180 degrees evidenced by 88 m (289') of pronounced tire marks on and off the road surface. The rear on the Explorer impacted two trees. The second tree impact induced an additional 90 degrees of CW rotation as the right rear side area impacted the third tree. **Figure 1** is a right rear view of the impact damage to the Ford Explorer. The driver impacted the intruding right C-pillar with his head and remained in the vehicle. The front right passenger was fully ejected through the right rear door opening. Both occupants were pronounced deceased at the scene of the crash.



**Figure 1. Rear view of the damage to the 1999 Ford Explorer.**

The crash was identified by the NHTSA's Office of Defects Investigation (ODI) through an Internet news search for possible tire related issues. The notification was forwarded to Calspan's Special Crash Investigations (SCI) team on February 25, 2008 and assigned for on-site investigation. The SCI team obtained tire data from the investigating officer and this information was used to rule the case out as a possible tread separation due to the age of the tire. The focus of the case was redirected to a mechanical inspection of the front suspension of the Ford. Cooperation was established with the investigating officer and the tow facility and the on-site investigation occurred on March 4<sup>th</sup> and 5<sup>th</sup>. The investigation involved the inspection and documentation of the vehicle damage, the tire data, and the undercarriage and suspension components of the Explorer. The layout of the scene and the physical evidence were documented.

**SUMMARY**

***Crash Site***

The crash occurred on the road side of the eastbound lanes of an interstate roadway during daylight conditions. The interstate consisted of two lanes in the east and westbound directions that were separated by a depressed grass median. The eastbound travel lanes were surfaced with asphalt and were 3.6 m (11.9') in width and bordered by a

1.3 m (4.3') wide inboard shoulder and a 3.1 m (10') wide outboard shoulder. Tactile warning rumble strips were cut into the outboard shoulder. The road surface was in worn condition and was dry at the time of this crash. The right roadside consisted of a grassy area that was approximately 10 m (32.8') in width that terminated at a tree line. A shallow drainage ditch paralleled the interstate and was centered within the grassy area. The tree line was comprised of small and larger diameter trees. The Explorer impacted three trees of 13 cm (5"), 14 cm (5.5") and 38 cm (15") diameters. The posted speed limit was 113 km/h (70 mph). A schematic of the crash site is included as **Figure 16**.



**Figure 2. Overall view of the crash site.**

### ***Vehicle Data***

The involved vehicle in this crash was a 1999 Ford Explorer XLT, four-door sport utility vehicle. The Explorer was manufactured in May 1999 and was identified by Vehicle Identification Number (VIN): 1FMZU32E3XU (production number deleted). The vehicle was purchased by the 24-year old driver on January 24, 2008 from a Miami, FL area used car dealer. The Explorer did not have a history of previous repair, damage, or title adjustments. The vehicle's mileage at the time of purchase was not reported on the sales invoice. The odometer reading at the time of the crash was 146,721 km (91,171 miles). **Figure 3** is a front left view of the Ford Explorer.



**Figure 3. Front left view of the 1999 Ford Explorer.**

The Explorer was powered by a 4.0 liter V-6 gasoline engine linked to a 5-speed automatic transmission with a column mounted transmission selector. The service brakes were power-assisted 4-wheel disc with anti-lock and a rear drum parking brake system. The suspension was front torsion bar with four-leaf rear leaf springs. Sway bars were utilized front and rear.

The exterior of the Explorer was equipped with OEM-style step boards that extended the full length of the sills, a roof rack, and a rear undercarriage mounted spare tire, aft of the rear axle. The window glazing was standard AS1 laminated for the windshield and AS2 with after market tint for the front door glazing. The rear side glazing and the backlight were equipped with AS3 OEM deep tint. The Explorer was not equipped with a sunroof.

The Explorer was equipped with four different make/model tires at the time of the crash. All tires were size P235/75R15, mounted on OEM 5-spoke alloy wheels. The vehicle manufacturer recommended tire size was P235/75R15 with an inflation pressure of 179

kPa (26 PSI), front and rear. The tire data captured during the SCI investigation is recorded in the following table.

<b>Position – Tire Make Model</b>	<b>DOT Tire Identification Number</b>	<b>Measured Pressure</b>	<b>Measured Tread Depth</b>	<b>Damage</b>
LF – Trail Mark Radial A/P	Unknown	Tire Flat	4 mm (5/32”)	None
RF – Michelin LTX	B3DD AT8X 2102	245 kPa (35.5 PSI)	6 mm (8/32”)	None
LR – Firestone Wilderness AT	W2HL 1PY 189	Tire Flat	6 mm (8/32”)	Complete tread separation
RR – Mesa A/P	UTHF T1F 4005	Tire Flat	3 mm (4/32”)	Sidewall punctures

The interior of the 1999 Ford Explorer was leather surfaced and consisted of high-back front seats with integral head restraints and a forward folding split-bench rear seat, passenger side wide. The rear outboard seat positions were equipped with adjustable head restraints that were adjusted to the full-down positions. The accessories included power windows, a power adjusted driver’s seat with manual recline, power adjusted outside mirrors, and a tilt steering wheel.

***Crash Sequence***

***Pre-Crash***

The driver of the 1999 Ford Explorer was traveling in an easterly direction on the inboard travel lane of the interstate roadway. Although his travel speed was unknown, it was estimated that he was traveling near the speed of the 113 km/h (70 mph) posted speed limit. It is unknown as to the distance and time the occupants were traveling prior to this crash.

The driver had successfully negotiated a long gradual right curve that transitioned onto a straight and level section of roadway. While traveling eastbound, the left rear tire experienced a tread separation. The entire tread of the Firestone Wilderness AT radial tire separated from the steel belts of the tire, resulting in instability of the vehicle. The driver apparently applied a clockwise steering input as he attempted to maintain directional control of the Ford Explorer. The steering input induced a CW yaw as the Explorer crossed the lane line and entered the outboard travel lane. As it crossed the lane line, the CW rotation was estimated at approximately 30 degrees. It should be noted that the SCI inspection of the scene was conducted two weeks following the crash. Visible tire yaw marks were present from all four tires, beginning in the center of the outboard lane (**Figure 4**).



**Figure 4. Yaw marks on the outboard travel lane.**



**Figure 5. CW rotational yaw marks across the grassy roadside.**

The Explorer continued to yaw CW across the outboard travel lane onto the south shoulder. As the Explorer departed the south shoulder, the front tire yaw marks crossed indicating 90 degrees of CW rotation. The rear tire marks crossed on the rumble strips, 0.6 m (2') outboard of the south fog line.

The Explorer entered the grassy roadside in a broadside orientation. The ground was soft from previous rain as the tires scuffed the grass and furrowed into the soft ground. The Explorer's center of gravity continued on a southeasterly trajectory as it traversed the shallow ditch at the midpoint of the grassy roadside. The CW yaw marks remained pronounced in the off-road surface (**Figure 5**). The right front tire mark crossed the left rear yaw mark 40 m (131') east of the front crossover point where the vehicle departed the south shoulder. At this point of the Explorer's trajectory, the vehicle had rotated approximately 150 degrees CW.

The Explorer continued off-road for an additional 20.9 m (69'), rotating 180 degrees CW from its original heading. This was indicated by the respective front tires crossing the rear tire marks.

### ***Crash***

As the vehicle rotated 180 degrees, the left rear corner area impacted a 13 cm (5") diameter pine tree that was located at the edge of the tree line, 10.4 m (34') south of the outboard edge of the shoulder. The impact resulted in a corner type impact to the vehicle with minimal forward crush and contact damage that extended to the rear third of the left rear quarter panel. The resultant direction of force was 6 o'clock. The impact did not alter the vehicle's trajectory as it continued rearward.

The back plane of the Explorer impacted a 14 cm (5.5") diameter tree that was located 5.2 m (17') east of the first tree struck and 11.2 m (36.7') south of outboard edge of the shoulder. This impact was centered 13 cm (5") left of the vehicle's centerline and involved a 6 o'clock direction of force. The small diameter pine tree did not yield as the rear bumper of the Explorer crushed to a depth of 64 cm (25"). The damage algorithm of the WinSMASH program was utilized to compute a total velocity change of 48 km/h (30



mph). The longitudinal and lateral components were -48 km/h (-30 mph) and 0 km/h (0 mph) respectively.

As the back of the Explorer engaged the second tree, the slightly offset left impact induced a rapid CW rotation. The Explorer rotated approximately 90 degrees CW and impacted a 38 cm (15") diameter pine tree that was located 4.7 m (15.4') east of the second tree and 10.8 m (35.4') outboard of the referenced shoulder edge. The impact was located on the right rear quarter panel and right rear axle position with a lateral direction of force of 3 o'clock. This impact crushed the quarter panel to a depth of 65 cm (25.5") and the right roof side rail to a depth of 57 cm (22.25").



**Figure 6. Struck trees.**

The WinSMASH program computed a velocity change of 30 km/h (18.6 mph) with respective longitudinal and lateral components of 0 km/h (0 mph) and -30 km/h (-18.6 mph). This delta V estimate is conservative as it does not include the additional stiffness of the axle position of the vehicle. **Figure 6** is a view of the struck trees.

The right side impact was located rearward of the vehicle's center of gravity. The Explorer's momentum continued in an easterly direction as the vehicle rotated rapidly in a CW direction from the third tree impact and headed to final rest. The Explorer rotated approximately 270 degrees from the tree impact onto the grassy roadside before coming to rest 6.2 m (20.3') east of the third tree. The driver was unrestrained in the Ford Explorer and impacted the intruding right C-pillar with his head. The front right passenger was fully ejected through the right rear door opening during the latter impact event.

### ***Post-Crash***

The Ford Explorer came to rest straddling the ditch area of the off-road surface facing in a westerly direction, opposite of its initial heading. The Explorer rotated a total of 540 degrees CW from the onset of the tire tread separation to final rest.

The driveshaft fractured from the differential yoke and the rear axle was displaced laterally by the right side impact. The yoke contacted and punctured the steel fuel tank that resulted in a minor fuel leak. The fuel ignited from possible contact with the exhaust system and a post-crash fire originated at the back of the vehicle. A passing truck driver stopped at the scene of the crash to offer assistance. He used his onboard 2.3 kg (5 lb) fire extinguisher and successfully suppressed the fire that was contained within the arch of the rear axle. Superficial paint damage occurred to the back left corner area of the vehicle at the location of the taillight lens.

Both occupants of the Ford Explorer were pronounced deceased at the scene of the crash. Their bodies were transported to the Medical Examiner's office for autopsy. The

Explorer was towed from the scene via a flatbed wrecker and stored at a covered facility where it was inspected for this SCI investigation.

### ***Vehicle Damage***

#### ***Exterior***

The exterior of the Ford Explorer sustained severe back and right side damage as a result of the tree impacts. The back left corner area impacted the first tree that resulted in moderate damage to the lift gate and quarter panel.

The initial impact (Event 1) involved the left corner area of the rear bumper, the left taillight assembly, the lift gate, and the surrounding sheet metal of the quarter panel. The corner-type impact scuffed the corner of the steel bumper, shattered the plastic taillamp lens, crushed the lift gate above and below the beltline, crushed the quarter panel, and probably shattered the left quarter window (**Figure 7**). The Collision Deformation Classification (CDC) for this event was 06-BLAE-3.



**Figure 7. Event #1 damage to the back left corner area.**



**Figure 8. Lateral view of the depth of crush to the back of Ford Explorer.**

The second event (Event 2) involved the rear impact into the 14 cm (5.5”) diameter pine tree. The direct contact damage began 5 cm (2”) left of the vehicle’s centerline and extended 15 cm (6”) to the left. The impact deformed the full width of the steel bumper and crushed the bumper, tailgate and the floor of the cargo area. The maximum crush was 64 cm (25”), located on the bumper 10 cm (4”) left of the centerline. The tailgate latch released and the backlight glass shattered. The combined induced and direct contact damage was 100 cm (39.5”) that extended from bumper corner to bumper corner. A crush profile was documented at the level of the bumper. A reference line was established at 396 cm (156”) rearward of the front axle that represented the original wheelbase and the rear overhang. Six equidistant crush measurements were documented along the damage profile. These values were as follows: C1 = 25 cm (10”), C2 = 64 cm (25”), C3 = 57 cm (22.6”), C4 = 50 cm (19.5”), C5 = 37 cm (14.6 “), C6 = 29 cm (11.6”). The CDC for this event was 06-BCAN-3. **Figure 8** is a lateral view of the crush depth.

The most severe event of this crash was the right side impact into the 38 cm (15”) diameter tree. The direct contact damage began on the lower aspect of the right rear door at a point that was 261 cm (102.75”) aft of the right front axle position and extended 58 cm (23”) rearward to the corner of the quarter panel. The maximum crush was 65 cm

(25.5") that was located at the mid point of the quarter panel, 51 cm (20") aft of the right C-pillar (**Figure 9**). The combined induced and direct contact damage for this event began on the right sill, 227 cm (89.5") rearward of the right front axle and extended 92 cm (36.25") rearward to the right corner of the D-pillar. A crush profile was documented and was as follows: C1 = 28 cm (11"), C2 = 56 cm (22"), C3 = 65 cm (25.5"), C4 = 62 cm (24.5"), C5 = 36 cm (14"), C6 = 0 cm.



**Figure 9. Overhead view of the lateral impact damage to the right rear quarter panel.**

The right side impact displaced the right C-pillar laterally inward and resulted in a stress overload of the door latch and the subsequent release of the latch. This created an ejection portal for the front right passenger. The right door glazing and the quarter window were shattered.

The tree impact damage extended vertically onto the right roof side rail. A secondary crush profile was documented at the level of the side rail and was as follows: C1 = 33 cm (13"), C2 = 55 cm (21.5"), C3 = 57 cm (22.25"), C4 = 32 cm (12.5"). The CDC for this event was 03-RBAW-4.

The right side impact was centered on the right rear axle position. The impact fractured the axle at the flange and resulted in complete separation of the tire and wheel assembly. The lateral forces exerted on the axle displaced the solid axle laterally left. Both lower shock mounts fractured at the axle. The left leaf spring fractured immediately aft of the forward eye and the axle displacement bent the rear aspect of the main leaf to approximately 75 degrees. The lateral displacement of the axle fractured the aluminum drive shaft approximately 8 cm (3") forward of the rear yoke. The yoke and differential contacted



**Figure 10. Differential yoke engagement into the fuel tank.**

the back inboard corner of the steel fuel tank that was mounted along the inboard aspect of the left frame rail (**Figure 10**). The contact dented and punctured the upper aspect of the fuel tank resulting in minimal fuel leakage at final rest.

The spilled fuel was ignited and a fire was detected by a passing truck driver who stopped at the scene to render assistance. He used his onboard fire extinguisher and suppressed the fire. The fire resulted in minor smoke/soot transfers to the left rear corner of the sheet metal. The majority of the fire suppression powder was visible at the fractured right rear axle, brake, and undercarriage components. The fire was rapidly suppressed and did not spread to the passenger compartment of the vehicle.

### ***Tire Damage***

As previously noted, the 1999 Ford Explorer was equipped with four mismatched (four different models, two load ranges) tires. The left front tire was a Trail Mark Radial with a maximum load rating of 990 kg (2,483 lb). The load index and speed rating was 108G. The tire had a maximum inflation pressure of 290 kPa (41 PSI). The DOT Tire Identification Number (TIN) was unknown as the aired out tire was resting on the sidewall where the TIN was located. There was no visible damage to the tire. The tread depth of 4 mm (5/32") was uniform across the all-season tread pattern.

The right front tire was the Michelin LTX with a load index and speed rating of 105S. The tire was inflated to 245 kPa (35.5 PSI) at the time of the SCI inspection and had a measured 6 mm (8/32") of tread depth across the full width of the tread. The TIN for this tire was B3DD AR8X 2102 There was no visible damage to this tire.

The left rear tire was a Firestone Wilderness AT radial tire that was outside (manufactured after recall scope) the recall population (**Figure 11**). The TIN was W2HL 1PY 189 with a manufacture date of the 18<sup>th</sup> week of 1999. The load index and speed rating for this P235/75R15 tire was 105S. The tread depth was 6 mm (8/32") across the full width of the tread. The full circumference of the tire tread separated from the tire. A single length of tread that measured 122 cm (48") in length was recovered by the police at the scene of the crash and was stored with the vehicle. Three smaller tread sections were recovered; however, these did not equal the full length of the tread. **Figure 12** is a view of the separated tire tread and the ply surface of the tire.



**Figure 11. Left rear tire of the Ford Explorer.**



**Figure 12. Separated tire tread and the tire ply surface.**

The tow operator reported that the left rear tire maintained air pressure at the scene of the crash and during the time he towed the vehicle. The tire and wheel were subsequently removed from the vehicle by the investigating police officers several hours following the crash. At this time, the tire had lost its air pressure.

The officer placed the wheel on a tire machine at the tow yard and removed the Wilderness AT tire from the alloy wheel. Following their investigation, the tire, wheel and recovered tread were placed in the rear cargo area of the Explorer.

The SCI inspection of the tire occurred two weeks following the crash. There were no punctures or repairs through the tread plies or sidewall surfaces of the tire. Despite the known age, the sidewall of the Firestone tire was in good condition with no visible checking or cracks. It's unknown if this tire was on the vehicle at the time of purchase by the driver or when the tire was placed in service. The history of this tire is unknown.

The right rear tire was a Mesa A/P with a TIN of UTHF T1F 4005 that indicates the tire was manufactured during the 40<sup>th</sup> week of 2005. This tire was worn to 3 mm (4/32") of remaining tread. Damage to the tire included four punctures/cuts to the sidewall from impact damage associated from the third tree event.

**Interior**

The interior of the 1999 Ford Explorer sustained severe damage to the right C-pillar, roof and cargo area of the vehicle. Forward of the B-pillars, the Ford was undamaged. The interior of the vehicle posed bio-hazard risks as body matter and fluids were present from the instrument panel to the backlight header.

The rear seat area was reduced in size by intrusion of numerous components, inclusive of the rearward deflection of the front seat backs (**Figure 13**). The front seats appeared to be adjusted to rear track positions at the time of the SCI inspection. The driver loaded the seatback during the initial rear impact event and deflected the seat back rearward to a measured angle of 37 degrees aft of vertical. Although the seat back frame did not appear to be deformed, the deflection occurred at the recline hinge point. The front right seat back was deformed to a measured angle of 42 degrees aft of vertical.



**Figure 13. Intrusion and occupant contact points within the interior of the Explorer.**

Maximum intrusion involved 43 cm (17") of forward displacement of the rear right seat back and the right lower C-pillar. The right C-pillar intruded longitudinally and laterally into the rear right position. The intrusions are depicted in the following table:

<b>Position</b>	<b>Intruding Component</b>	<b>Magnitude</b>	<b>Direction</b>
Rear Left	Front left seat back	41 cm (16")	Rearward
Rear Left	Rear center seat back	10 cm (4")	Forward
Rear Center	Rear center seat back	23 cm (9")	Forward
Rear Right	C-pillar	43 cm (17")	Forward
Rear Right	C-pillar	25 cm (10")	Lateral
Rear Right	Rear right seat back	43 cm (17")	Forward
Rear Right	Front right seat back	41 cm (16")	Rearward
Rear Right	Roof	28 cm (11")	Vertical

Interior damage associated with occupant contact included a driver head strike to the intruding right C-pillar at the D-ring location. The trim panel located immediately above this location was separated from possible contact and exterior deformation. A wrist watch, reportedly belonging to the front right passenger, was embedded into the deformed roof headliner, directly above the rear right head restraint. The steering wheel flange was minimally deformed rearward as the driver apparently braced against the steering wheel rim as he responded to the 6 o'clock direction of force. The steering wheel rim was not deformed.

### ***Undercarriage Suspension Inspection***

The undercarriage of the Ford Explorer was inspected to the extent possible as the vehicle was resting on the front tires and the rear axle. The front suspension of the Explorer utilized upper and lower control arms with bushings at the frame attachment points and upper and lower ball joints to connect the steering/axle spindles. Torsion bars mounted to the lower control arms provided the main weight bearing spring for the front suspension. All control arms, bushings, ball joints, and torsion bars were intact and appeared to be free of movement associated with wear. The outer tie rods were tight. The grease boots for the tie rods and the ball joints were intact, but dry as these were non-greaseable components.

The front stabilizer bar was mounted to the vehicle with two rubber bushings and U-shaped brackets to the front frame rails. These bushings and brackets were intact and appeared to be in good condition. The vertical stabilizer bar links that connected the outboard end of the stabilizer bar to the lower control arm were closely inspected. These components consisted of a bolt, nylon stand off bushings, washers, a spacer and the bottom nut. These links are installed from the top down, with the tightening nut on the bottom of the control arm. A washer is placed over the bolt and positioned against the head of the link bolt. A standoff bushing is then positioned onto the bolt and the bolt is placed through the bore in the outboard aspect of the stabilizer bar. A second standoff bushing is positioned on the bolt followed by the spacer that appeared to have an integral washer. A third standoff bushing is positioned over the bolt as the treaded end of the bolt is positioned through the bore in the lower control arm. A fourth standoff and washer is positioned over the treaded end on the bottom of the control arm. A nut is used to tighten the assembly to secure the position of the stabilizer bar to the lower control arm.

The right front stabilizer bar link was inspected following the removal of mud and grass debris from the undercarriage. The link was intact with all nylon standoff bushings, washers, spacer, and the bottom nut in place (**Figure 14**). The assembly, as with all of the undercarriage components, was free of rust and corrosion. With the vehicle resting on the front wheels and the front suspension minimally compressed by the weight of the Explorer, the right stabilizer bar link could be moved laterally with minimal force applied by hand. There was no vertical movement or gaps between the standoff bushings and stabilizer bar or lower control arm.

The left front stabilizer bar link was inspected from the front aspect of the vehicle. Again, the Explorer was resting on the left front tire and the tire was flat. This did not

impede the inspection of the front undercarriage. A first observation of the left front stabilizer bar link revealed a gap between the upper standoff bushing and the bottom of the stabilizer bar. The upper end of the stabilizer bar link could be moved freely in a lateral direction with 9 mm (0.375") of vertical travel. An inspection mirror was positioned above the outboard end of the stabilizer bar and it was noted that the head of the bolt was intact, with the top washer; however, the top nylon standoff bushing was absent from the component (**Figure 15**). The remaining standoff bushings were in place. There was no rust or corrosion to the steel components and the bolt was intact.



**Figure 14. Right front stabilizer link with standoff bushings intact.**



**Figure 15. Left front stabilizer link with top bushing absent.**

### ***Manual Safety Belt Systems***

The Explorer was equipped with 3-point lap and shoulder belt systems for the four outboard seated positions and a rear center lap belt. All four outboard systems consisted of continuous loop webbings with sliding latch plates. The front belt systems were equipped with adjustable D-rings that were set to the lowest positions. The driver's belt retracted onto an Emergency Locking Retractor (ELR) while the remaining three systems utilized switchable ELR/Automatic Locking retractors. The driver and front right passenger were not restrained by the safety belt systems as both belts lacked physical loading evidence and remained stowed against the respective B-pillars post-crash.

### ***Redesigned Frontal Air bag System***

The 1999 Ford Explorer was equipped with a redesigned frontal air bag system for the driver and front right passenger positions that consisted of a Restraints Control Module (RCM) mounted at the right side kick panel, two radiator support mounted air bag crash sensors, the steering wheel mounted driver module and the right mid-instrument panel mounted passenger module. The RCM performed the functions of onboard diagnostics and crash sensing. The unit did not have Event Data Recorder capabilities. The redesigned frontal air bag system did not deploy (as designed) in this rear and right side crash sequence.

### ***Occupant Demographics/Data***

#### ***Driver***

Age/Sex: 24-year old/Male  
Height: Unknown  
Weight: Unknown  
Seat Track Position: Rearward  
Manual Safety Belt Use: None  
Usage Source: Vehicle inspection  
Eyewear: Unknown  
Egress from Vehicle: First responders  
Mode of Transport from Scene: Office of the Medical Examiner  
Type of Medical Treatment: None, autopsy was performed

#### ***Driver Injuries***

<b>Injury</b>	<b>Injury Severity (AIS-90 Update 98)</b>	<b>Injury Source</b>
Massive head injury, NFS	Unknown severity (115099.7, 0)	Intruding right C-pillar

#### ***Driver Kinematics***

The driver of the 1999 Ford Explorer was seated in a presumed upright driving posture with the seat adjusted to a rear track position. The recline angle of the seat back was unknown. He was not utilizing the manual safety belt system. The lack of safety belt use was determined by the stowed position of the belt system post-crash, the lack of loading evidence, and the trajectory of the driver during the crash.

The driver responded to the initial 6 o'clock impact force impacts by initiating a rearward trajectory with respect to the vehicle. He apparently attempted to hold on to the steering wheel rim as he moved rearward. The steering wheel flange was deformed which indicated rearward movement of the steering wheel rim. The profile of the rim was not deformed. The driver's back loaded the seat back which deformed rearward at the recline hinges. The post-crash seat back angle was 37 degrees aft of vertical.

As the vehicle crushed against the tree, the offset left rear impact induced a clockwise rotation to the vehicle. The right quarter panel impacted the third tree. The driver subsequently responded to the right side lateral impact by moving to the vehicle's right as it rotated from under his unrestrained position. His head impacted the intruding right upper C-pillar that resulted in a massive open head injury and death. The driver remained in the vehicle as it rotated approximately 270 degrees CW to final rest. Large amounts of body matter and fluid were spattered on the interior surfaces, from the instrument panel to the backlight header. He was pronounced deceased at the scene of the crash.



***Front Right Passenger***

Age/Sex: 23-year old/Male  
Height: Unknown  
Weight: Unknown  
Seat Track Position: Rearward  
Manual Safety Belt Use: None  
Usage Source: Vehicle inspection  
Eyewear: Unknown  
Egress from Vehicle: Fully ejected  
Mode of Transport from Scene: Office of the Medical Examiner  
Type of Medical Treatment: None, autopsy was performed

***Front Right Passenger Injuries***

<b>Injury</b>	<b>Injury Severity (AIS 90 Update 98)</b>	<b>Injury Source</b>
Unknown	Unknown	Unknown

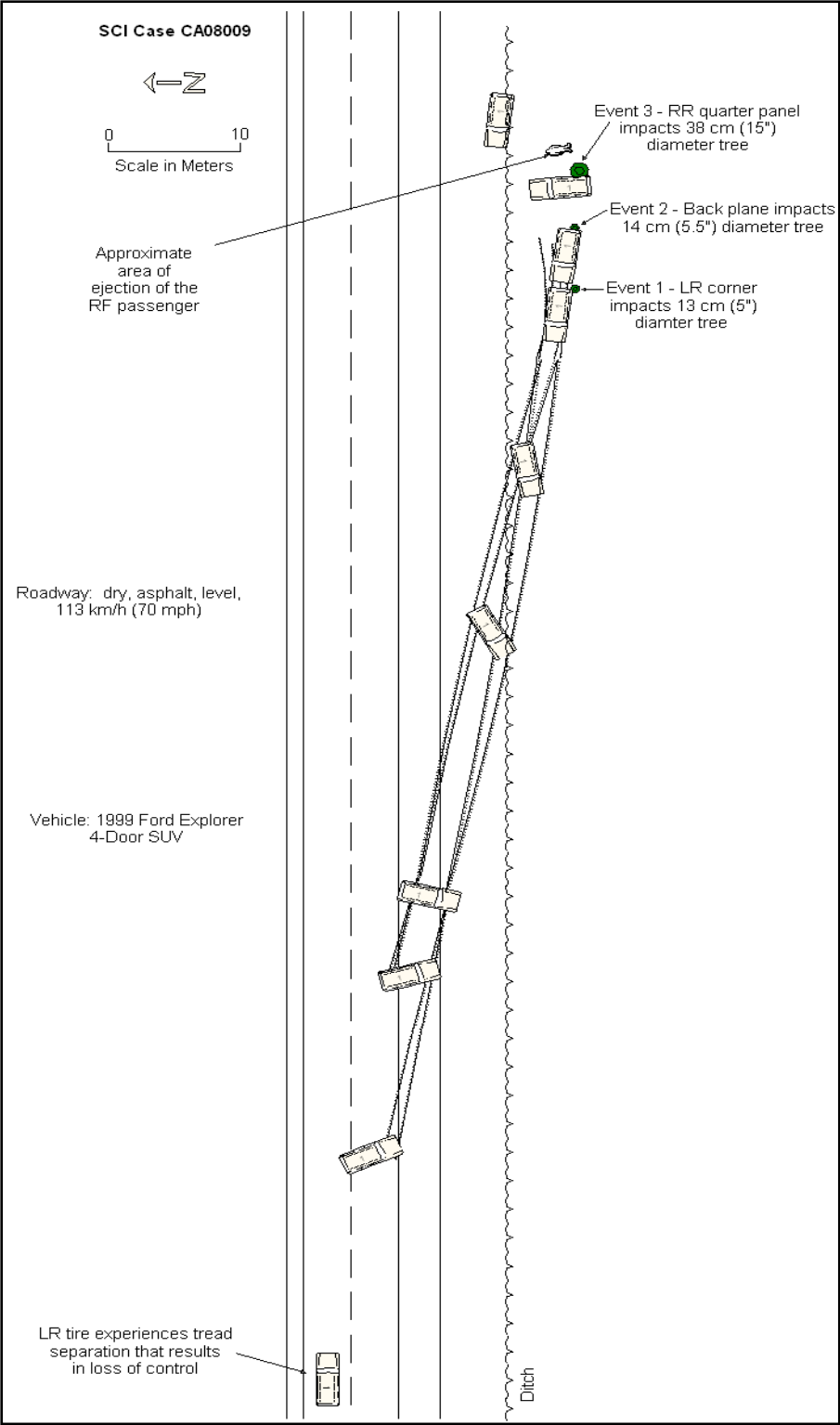
***Front Right Passenger Kinematics***

The front right passenger of the Ford Explorer was seated in an unknown posture with the seat adjusted to a rear track position. He was not restrained by the manual safety belt system. During the SCI inspection of the vehicle, the safety belt system was fully retracted to its stowed position and was free of loading evidence.

The unrestrained front right passenger responded to the 6 o'clock impact force by moving rearward with respect to the vehicle. His back loaded the seat back and his loading force deformed the seat back rearward to a measured angle of 40 degrees. This angle allowed the passenger to ramp up the seat.

The right side of the Ford subsequently impacted the large diameter tree resulting in a lateral (3 o'clock) impact force. The right rear door latch released due to stress overload. This created an ejection portal for the unrestrained front right passenger. He was fully ejected from the vehicle. His wrist watch was embedded into the headliner that deformed downward due to the deformation at the right rear roof side rail.

The front right passenger was pronounced deceased at the scene of the crash. His body was transported to the Medical Examiner's Office for autopsy.



**Figure 16. Crash Schematic**