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ON-SITE ROLLOVER INVESTIGATION

CASE NUMBER - IN07016
LOCATION - TEXAS
VEHICLE - 1998 FORD EXPLORER 4X2
CRASH DATE - May 2007

Submitted:

January 16, 2008
Revised: May 19, 2008



Contract Number: DTNH22-07-C-00044

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
National Center for Statistics and Analysis
Washington, D.C. 20590-0003

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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.

Technical Report Documentation Page

1. <i>Report No.</i> IN07016	2. <i>Government Accession No.</i>	3. <i>Recipient's Catalog No.</i>	
4. <i>Title and Subtitle</i> On-Site Rollover Investigation Vehicle - 1998 Ford Explorer Location - Texas		5. <i>Report Date:</i> January 16, 2007	
		6. <i>Performing Organization Code</i>	
7. <i>Author(s)</i> Special Crash Investigations Team #2		8. <i>Performing Organization Report No.</i>	
9. <i>Performing Organization Name and Address</i> Transportation Research Center Indiana University 222 West Second Street Bloomington, Indiana 47403-1501		10. <i>Work Unit No. (TRAIS)</i>	
		11. <i>Contract or Grant No.</i> DTNH22-07-C-00044	
12. <i>Sponsoring Agency Name and Address</i> U.S. Department of Transportation (NPO-122) National Highway Traffic Safety Administration National Center for Statistics and Analysis Washington, D.C. 20590-0003		13. <i>Type of Report and Period Covered</i> Technical Report Crash Date: May 2007	
		14. <i>Sponsoring Agency Code</i>	
15. <i>Supplementary Notes</i> On-site rollover investigation involving a 1998 Ford Explorer.			
16. <i>Abstract</i> This report covers an on-site rollover investigation that involved a 1998 Ford Explorer. This crash is of special interest because the Ford rolled over and an unrestrained passenger (26-year-old, male) who was located within the rear cargo area was ejected and fatally injured. The restrained driver (29-year-old, male) was also fatally injured as a result of the crash. The Ford was traveling northeast in the inside through lane of a four-lane divided, interstate highway. The police crash report indicated that the tread separated from the left rear tire, and the driver lost control of the vehicle. The Ford rotated counterclockwise, entered the median and rolled over with the right side leading. During the rollover, the passenger who was located within the cargo area was ejected through the left window of the cargo area. The Ford rolled across the southwestbound lanes of the interstate and came to rest on its wheels on an exit ramp facing southwest.			
17. <i>Key Words</i> Rollover Ejection, Fatal Injury		18. <i>Distribution Statement</i> General Public	
19. <i>Security Classif. (of this report)</i> Unclassified		20. <i>Security Classif. (of this page)</i> Unclassified	
		21. <i>No. of Pages</i> 15	22. <i>Price</i>

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This crash was brought to NHTSA's attention on or before May 7, 2007 by a Texas newspaper story. The crash involved a 1998 Ford Explorer, which reportedly sustained a tire tread separation of the left rear tire, departed the roadway and rolled over. The crash occurred in May, 2007, at 6:25 p.m., in Texas and was investigated by the Texas Department of Public Safety. The crash is of special interest because the Ford rolled over and an unrestrained passenger (26-year-old, male) who was located within the rear cargo area was ejected and fatally injured. The restrained driver (29-year-old, male) was also fatally injured during the crash. This contractor inspected the Ford on June 11, 2007. An exemplar vehicle was inspected on June 25, 2007. No scene inspection was conducted. This crash is in litigation, and the Ford had been moved to a storage facility a considerable distance from the crash scene. As a result, this contractor was instructed by NHTSA headquarters not to conduct a scene inspection. No occupants of the Ford were interviewed. The attorney representing the passengers would not allow them to be interviewed. This report is based on the police crash report, vehicle inspection, exemplar vehicle inspection, occupant kinematic principles, and this contractor's evaluation of the evidence.

SUMMARY

The Ford was traveling northeast in the inside through lane of a four-lane divided, interstate highway. The police crash report indicated that the tread separated from the left rear tire, resulting in control loss of the vehicle. The Ford rotated counterclockwise, entered the median and rolled over with the right side leading across the southwestbound lane and into an exit ramp. During the rollover, the passenger who was located within the cargo area was ejected from the vehicle. The Ford came to rest on its wheels on an exit ramp facing southwest. The Collision Deformation Classification (CDC) for the Ford was **00-TDDO-4**. Based on the damage to the Ford, the severity of the damage was determined to be severe.

The male passenger located in the cargo area was unrestrained and was ejected through the left cargo window during the rollover. This passenger sustained skull fractures and brain injuries from contacting the ground. In addition, he sustained rib and sternum fractures as well as lacerations and contusions of the lungs and lacerations of the liver and mesentery. The extent of his injuries indicated the Ford contacted him during or following his ejection. The restrained driver of the Ford was also fatally injured. The restrained back left passenger and unrestrained back center passenger were transported to a hospital and admitted for treatment of their injuries. The restrained front right passenger was transported to a hospital, but her treatment status is unknown. The transport and treatment status of the back right passenger is also unknown.

CRASH CIRCUMSTANCES

Crash Environment: The trafficway on which the Ford was traveling was a straight, four-lane, divided, interstate highway, traversing in a northeasterly and southwesterly direction (**Figure 1** below). Each roadway had two through lanes and was divided by a grass median. The crash occurred within an interchange area. At the time of the crash the light condition was daylight, the atmospheric condition was clear, and the roadway pavement was dry, level, concrete. The police reported speed limit was 105 km.p.h. (65 m.p.h.).

Pre-Crash: The Ford was traveling northeast in the inside through lane. The Ford's driver was intending to continue northeastbound. The police crash report indicated that the tread separated from the left rear tire, and the driver lost control of the vehicle. It is not known if the driver made any pre-crash avoidance maneuvers.

Crash: The Ford rotated counterclockwise and entered the median. The Ford's right side wheels furrowed into the soil, and the vehicle tripped and rolled over with the right side leading. The rollover was primarily side-to-side (**Figure 2** and **Figure 3** below). As the vehicle rolled over, it landed in the grass median on the left fender, hood, left A-pillar, roof and left roof side rail (**Figure 2**). Grass was found embedded in the top seam of the rear hatch near the left D-pillar (**Figure 4** below). The Ford rolled over through the median and across the southwestbound lanes of the interstate and onto an exit ramp. The vehicle rolled over at least eight quarter turns.

Post-Crash: The Ford came to rest on its wheels on the exit ramp facing southwest.

CASE VEHICLE

The 1998 Ford Explorer XL was a rear wheel drive, four-door sport utility vehicle (VIN: 1FMZU32E9WZ-----) equipped with a 4.0-liter, 6-cylinder engine. The front seating row was equipped with bucket seats with integral head restraints, lap-and-shoulder safety belts, driver and front right passenger air bags and a tilt steering column. The back seating row was equipped with a bench seat with folding backs and adjustable head restraints in the outboard seat positions, lap-and-shoulder safety belts in the outboard positions and a two-point lap belt in the center seat position. The Ford was also equipped with four wheel anti-lock brakes (ABS).



Figure 1: Aerial view of the crash site. The arrow shows the area of the crash based on police crash report.



Figure 2: Front left view of rollover damage to the Ford. The left side pillars had been cut by rescue personnel, and the roof crush was altered during rescue operations.



Figure 3: Front right view of damage to the Ford.

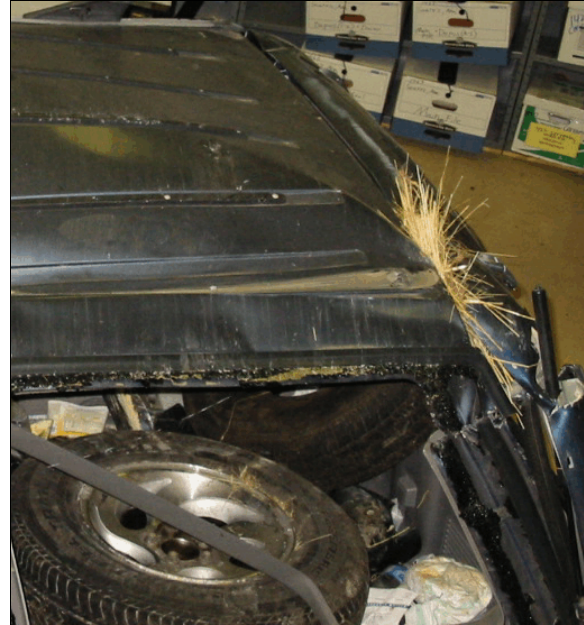


Figure 4: Grass embedded in the top seam of the Ford's rear hatch near the left D-pillar.

CASE VEHICLE DAMAGE

Exterior Damage: The Ford's impact with the ground involved the top, both sides and the undercarriage. The areas of greatest damage were to the left A-pillar, left roof side rail and left fender. The maximum vertical and lateral crush occurred at the left A-pillar (**Figure 2** above). The maximum vertical crush was approximately 33 centimeters (~ 13 inches), and the maximum lateral crush was approximately 24 centimeters (~ 10 inches). The crush values were based on measurements from the subject vehicle and an exemplar vehicle. The crush values are considered approximate because rescue personnel altered the damaged structure when they cut all the left side pillars and the right A-pillar.

The Ford's right side wheelbase was reduced by 4 centimeters (1.8 inches) while the left side wheelbase was unaltered. Induced damage was present on the front and back bumpers, the right portion of the hood, and the rear hatch.

The Ford's recommended tire size was P235/75R15, and the vehicle was equipped with the proper sized tires. The left rear tire was not present at the inspection facility. It was in the possession of the attorney and not inspected. The police crash report indicated that the tread separated from the left rear tire prior to the rollover. The left front tire was still mounted on the Ford, and the right side tires were in the vehicle's cargo area. The Ford's tire data are shown in the table below.

Tire	Measured Pressure		Recommended Pressure		Tread Depth		Damage	Restricted	Deflated
	kPa	psi	kPa	psi	milli-meters	32 nd of an inch			
LF	Flat	Flat	179	26	8	10	Tire debeaded, rim abraded	Yes	Yes
RF	Flat	Flat	179	26	9	11	Some chips out of tread, tire came off rim	No	Yes
LR	Unk	Unk	179	26	Unk	Unk	Unknown, police reported tread separated from carcass	No	Unknown
RR	Flat	Flat	179	26	5	6	Unknown	No	No

Vehicle Interior: Inspection of the Ford's interior revealed evidence of occupant contact to the roof (**Figure 5**). There was also intrusion of the left roof side rail, roof and all the left side pillars. The intrusion occurred in the front and back seating rows as well as the rear cargo area. The most severe intrusions were located in the driver's seating position. These involved vertical intrusion of the left A-pillar, left roof side rail and the roof. These intrusions measured approximately 27 centimeters (~11 inches). The left roof side rail intruded laterally approximately 24 centimeters (~9 inches). There was no evidence of deformation of the steering wheel rim or compression of the energy absorbing steering column.

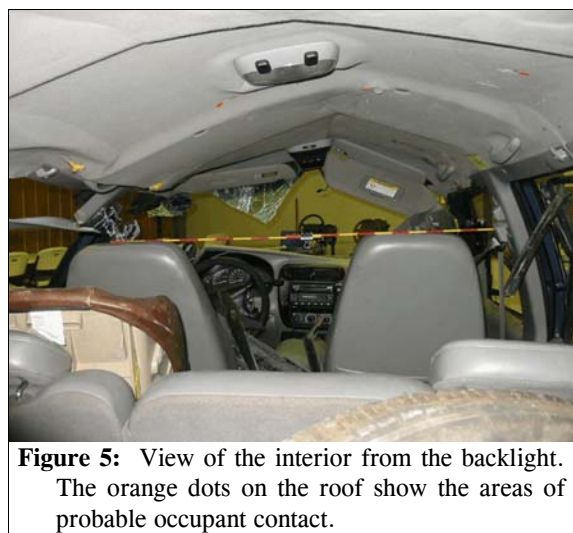


Figure 5: View of the interior from the backlight. The orange dots on the roof show the areas of probable occupant contact.

Damage Classification: The CDC for the Ford was **00-TDDO-4**. The severity of the damage was determined to be severe. The Ford was towed due to damage.

AUTOMATIC RESTRAINT SYSTEM

The Ford was equipped with driver and front right passenger air bags. Neither of these air bags deployed in the crash because there was no frontal impact.

CHILD SAFETY SEAT

The back left passenger was seated in an Evenflo Medallion, forward facing, convertible child safety seat (CSS) with five-point internal harness (**Figure 6** below). The CSS was manufactured on September 22, 2000. Its model number was 2541243P1. The CSS was constructed of a one-piece plastic shell with a padded vinyl cover. The CSS could not be fully inspected because the attorney did not allow manipulation or removal of the CSS from the Ford.

The CSS was equipped with two sets of harness strap slots. The harness straps were threaded through the top slots. The harness strap was equipped with a retainer clip. The latch plates latched into a non-recessed buckle. The CSS was secured in the Ford by the lap-and-shoulder safety belt system. The belt was routed through the belt path on the back of the CSS. The belt was equipped with a light weight locking latch plate. It appeared that the CSS was securely fastened within the Ford. There was no visible damage or deformation to the CSS.

OTHER ENCLOSED AREA PASSENGER KINEMATICS

Prior to the crash, the Ford's other enclosed area passenger [26-year-old, unknown race (Hispanic) male; 170 centimeters and 80 kilograms (67 inches and 176 pounds)] was located in the Ford's cargo area. His position and posture within the cargo area is not known. There was no restraint system available within the cargo area.

As the Ford rolled over, this passenger contacted the roof and side surfaces within the cargo area. Occupant contact abrasions on the left window sill in the cargo area (**Figure 7**) indicated that this passenger was ejected through the left cargo window during the rollover. He sustained skull fractures and brain injuries from contacting the ground. This passenger also sustained rib and sternum fractures, lacerations to the liver and mesentery and contusions to the lungs. The injury pattern suggests that the passenger was contacted by the vehicle at some point during the rollover. The final rest position of this passenger in relation to the rest position of the Ford was indeterminable.



Figure 6: The Evenflo Medallion convertible CSS as found in the back left seat position.



Figure 7: Abrasions (outlined by orange dots) located on the left window sill in Ford's cargo area.

OTHER ENCLOSED AREA PASSENGER INJURIES

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The passenger within the cargo area was fatally injured in the crash. He was removed from the scene by ambulance, transported to a hospital and was pronounced dead two hours and twenty minutes following the crash. The table below shows this passenger’s injuries and injury mechanisms.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Fracture right temporal bone, not further specified	moderate 150400.2,1	Ground	Probable	Autopsy
2	Fracture, hinge, involving right posterior fossa, extending across right petrous ridge and sella turcica into left petrous ridge	severe 150206.4,8	Ground	Probable	Autopsy
3	Contusions, cerebral, involving bilateral frontal, temporal, and occipital lobes and right parietal lobe	critical 140626.5,3	Ground	Probable	Autopsy
4	Hemorrhage, subarachnoid, over left frontal, temporal, and occipital lobes	serious 140684.3,2	Ground	Probable	Autopsy
5	Hemorrhage, subarachnoid over right temporal and occipital lobes	140684.3,1			
6	Fracture ribs: right 1 st through 9 th , left 5 th through 7 th with associated subpleural hemorrhage	severe 450240.4,3 441800.2,3	Exterior of occupant’s motor vehicle: roof	Probable	Autopsy
7					
8	Fracture sternum at 2 nd intercostal space	moderate 450804.2,4	Exterior of occupant’s motor vehicle: roof	Probable	Autopsy
9	Fracture right clavicle, not further specified	moderate 752200.2,1	Exterior of occupant’s motor vehicle: roof	Probable	Autopsy
10	Lacerations {fracture lacerations} middle lobe right lung with 350 ml right hemothorax	serious 441414.3,1	Exterior of occupant’s motor vehicle: roof	Probable	Autopsy
11	Contusions lower lobes both lungs, not further specified	severe 441410.4,3	Exterior of occupant’s motor vehicle: roof	Probable	Autopsy
12	Contusions posterior right and left atria of heart, not further specified	minor 441002.1,4	Exterior of occupant’s motor vehicle: roof	Probable	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
13	Laceration liver, not further specified	moderate 541820.2,1	Exterior of occupant's motor vehicle: roof	Probable	Autopsy
14	Laceration mesentery, not further specified, with 50 ml hemoperitoneum	moderate 542020.2,8	Exterior of occupant's motor vehicle: roof	Probable	Autopsy
15 16	Contusion {subscalpular hemorrhage} bilateral occipito-parietal scalp	minor 190402.1,1 190402.1,2	Ground	Probable	Autopsy
17	Abrasion, 2.5 cm (1 in), forehead above right eyebrow	minor 290202.1,7	Ground	Probable	Autopsy
18	Abrasion medial left upper eyelid	minor 297202.1,2	Ground	Probable	Autopsy
19	Abrasion, 3.2 cm (1.25 in) over right zygomatic area of face	minor 290202.1,1	Ground	Probable	Autopsy
20	Abrasion over bridge of nose	minor 290202.1,4	Ground	Probable	Autopsy
21	Contusion right neck at base	minor 390202.1,1	Ground	Probable	Autopsy
22	Abrasions, extensive, across right upper back, extending onto right middle and lower back	minor 690202.1,1	Ground	Probable	Autopsy
23	Abrasions, 3.2 cm (1.25 in) right deltoid area	minor 790202.1,1	Ground	Probable	Autopsy
24	Abrasions, 25.4 cm (10 in) area, extensor surface right arm, elbow, forearm, and dorsum right wrist and hand	minor 790202.1,1	Ground	Probable	Autopsy
25	Abrasions left upper extremity including lateral arm, and confluent posterior arm	minor 790202.1,2	Ground	Probable	Autopsy
26	Abrasion, 5.1 cm (2 in) left medial antecubital area	minor 790202.1,2	Ground	Probable	Autopsy
27	Abrasions, brush burn, anterior lower extremities from knees inferiorly	minor 890202.1,3	Ground	Probable	Autopsy

Prior to the crash, the Ford's driver [29-year-old, unknown race (Hispanic) male; 168 centimeters and 94 kilograms (66 inches and 208 pounds)] was seated in an unknown position. The position of his hands and feet is not known. Based on the Ford inspection, his seat track was adjusted to between the middle and full rear position, and his seat back was slightly reclined. The tilt steering column was found adjusted to its full down position.

Based on the vehicle inspection, the driver was restrained by the lap-and-shoulder safety belt system. An inspection of the safety belt revealed that the latch plate was engaged with the buckle. The belt had also been cut out of the vehicle by rescue personnel.

As the Ford rotated counterclockwise and began to roll over, the driver was displaced to the right toward the roof and loaded his safety belt system. When the Ford impacted the ground with its left roof, A-pillar and left roof side rail, the driver's head loaded the intruding roof causing skull fractures and brain injuries. The driver remained restrained in his seat position during the rollover and was removed from the Ford by rescue personnel.

CASE VEHICLE DRIVER INJURIES

The driver was fatally injured in this crash. He was removed from the scene by ambulance and transported to the medical examiner. The driver's injuries and injury mechanisms are shown in the table below.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
1	Fracture right frontal bone extending through right temporal bone, not further specified	moderate 150400.2,5	Roof	Certain	Autopsy
2	Fracture across floors right anterior and middle cranial fossae including cribriform plate and adjacent fossae with extension into left middle fossa	severe 150206.4,8	Roof	Certain	Autopsy
3	Contusions, superficial, cerebral cortex involving inferior frontal and temporal lobes	serious 140612.3,1	Roof	Certain	Autopsy
4	Hemorrhage, subarachnoid, over left temporal lobe	serious 140684.3,2	Roof	Certain	Autopsy
5	Hemorrhage, subarachnoid, over inferior surface left cerebellar hemisphere	serious 140466.3,6	Roof	Certain	Autopsy
6	Contusions lungs including lower right lobe and lower left lobe—large	severe 441410.4,3	Steering wheel hub and/or spokes and rim	Probable	Autopsy

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
7	Fracture sternum at 2 nd intercostal space	moderate 450804.2,4	Steering wheel rim	Probable	Autopsy
8 9	Fracture left 1 st through 3 rd ribs with associated subpleural hemorrhage	moderate 450220.2,2 441800.2,2	Steering wheel hub and/or spokes and rim	Probable	Autopsy
10	Fracture T ₃ , not further specified	moderate 650416.2,7	Roof {indirect injury}	Probable	Autopsy
11 12	Contusion, confluent, {subgaleal hemorrhage/hematoma} over bilateral frontal, temporal, and parietal lobes	minor 190402.1,1 190402.1,2	Roof	Certain	Autopsy
13 14 15	Abraded contusion, 7.6 cm (3 in) mid-frontal scalp with partial thickness laceration underlying	minor 190202.1,5 190402.1,5 190602.1,5	Roof	Certain	Autopsy
16 17	Abrasion, 2.5 cm (1 in) right frontal scalp and laceration, partial thickness, right frontal scalp	minor 190202.1,1 190602.1,1	Roof	Certain	Autopsy
18	Abrasion, 3.2 cm (1.25 in) left frontal scalp	minor 190202.1,2	Roof	Certain	Autopsy
19	Abrasion, 3.2 cm (1.25 in) left forehead	minor 290202.1,7	Roof	Certain	Autopsy
20	Abrasions, 2.5 cm (1 in) posterior left shoulder, not further specified	minor 790202.1,2	Left "B"-pillar	Probable	Autopsy
21	Abrasions, up to 12.7 cm (5 in) left upper extremity, not further specified	minor 790202.1,2	Left "B"-pillar	Probable	Autopsy
22	Lacerations, partial and full thickness left upper extremity, not further specified	minor 790602.1,2	Left "B"-pillar	Probable	Autopsy
23	Abrasions, 6.4 cm (2.5 in) right upper extremity, not further specified	minor 790202.1,1	Noncontact injury: flying glass, unknown source	Probable	Autopsy
24	Lacerations right hand, including 3.8 cm (1.5 in) to middle finger and 6.4 cm (2.5 in) right index finger	minor 790602.1,1	Noncontact injury: flying glass, unknown source	Probable	Autopsy
25	Avulsion nail right index finger, not further specified	minor 790802.1,1	Unknown contact mechanism	Unknown	Autopsy

Prior to the crash, the front right passenger [32-year-old, (unknown race and ethnicity) female; (unknown height and weight)] was seated in an unknown posture. Based on the vehicle inspection, the seat track was adjusted to its middle position, and the seat back was slightly reclined.

Based on the vehicle inspection, the Ford's front right passenger was restrained by the lap-and-shoulder safety belt system. An inspection of the safety belt revealed a large deposit of blood on the shoulder belt in a location consistent with the belt being in use in the crash. If the safety belt had not been in use, this portion of the safety belt would have been inside of the retractor or B-pillar.

As the Ford rotated counterclockwise and began to roll over, the front right passenger loaded the belt system and was displaced slightly right toward the roof. The passenger continued to load the safety belt as the Ford rolled over. She remained restrained in her seat during the rollover. It is not known how she exited the Ford following the crash.

CASE VEHICLE FRONT RIGHT PASSENGER INJURIES

The police crash report indicated that the front right passenger sustained a B (non-incapacitating-evident) injury and was transported from the scene by air ambulance to a hospital. The nature and extent of the passenger's injuries are not known. The treating hospital had no record of treatment for this passenger.

CASE VEHICLE BACK LEFT PASSENGER KINEMATICS

Prior to the crash, the back left passenger [10-month-old, unknown race (Hispanic) male; unknown height and 9 kilograms (unknown height and 19 pounds)] was seated in his forward facing convertible CSS.

The CSS was secured by the Ford's lap-and-shoulder safety belt system. The passenger was restrained within the CSS by the 5-point internal harness.

As the Ford rolled over, the back left passenger remained restrained within the CSS and loaded the 5-point harness. He was most likely impacted by the unrestrained back center passenger during the rollover causing skull fractures, a subarachnoid hemorrhage, subdural hematoma, and cerebral contusion. It is unknown how the back left passenger was removed from the vehicle following the crash.

CASE VEHICLE BACK LEFT PASSENGER INJURIES

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The police crash report indicated that the back left passenger sustained an A (incapacitating) injury and was transported from the scene by ambulance to a children’s hospital and admitted for treatment. The passenger’s medical records indicated that he was hospitalized for four days. The table below shows the back left passenger’s injuries and injury mechanisms.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
	Nonanatomic brain injury with GCS = 8	Not coded	Other occupant: back center passenger	Probable	Hospitalization records
1	Fracture, diastatic, mildly depressed, involving right parietal lobe extending vertically {downward} into squamosal portion of right temporal lobe	serious 150404.3,1	Other occupant: back center passenger	Probable	Hospitalization records
2		150200.3,8			
3	Fracture, minimally depressed, left occipital fracture and left posterior parietal	serious 150404.3,6	Child safety seat’s left side surface	Possible	Hospitalization records
4		150404.3,2			
5	Hematoma, subdural, right tempo-parietal, not further specified	severe 140650.4,1	Other occupant: back center passenger	Probable	Hospitalization records
6	Hemorrhage, subarachnoid, overlying right superior parietal convexity and left inferior parietal region	serious 140684.3,1	Other occupant: back center passenger	Probable	Hospitalization records
7		140684.3,2			
8	Contusions, cerebral, cortical, punctate, posterior, not further specified	serious 140611.3,9	Other occupant: back center passenger	Probable	Hospitalization records
9	Contusion {hematoma}, large, posterior scalp, not further specified	minor 190402.1,6	Other occupant: back center passenger	Probable	Emergency room records

CASE VEHICLE BACK CENTER PASSENGER KINEMATICS

Prior to the crash, the Ford’s back center passenger [22-year-old, white (Hispanic) female; unknown height and 50 kilograms (100 pounds)] was seated in an unknown posture. The position of her feet and hands is unknown.

Based on the vehicle inspection and supported by the police crash report, the back center passenger was not restrained by her lap belt. The lap belt showed evidence of some historical usage, but there was no specific evidence the safety belt had been used in this crash.

As the Ford rotated counterclockwise and began to roll over, the back center passenger was displaced to the right and loaded into the back right passenger. During the rollover, the back center passenger was displaced toward the roof and loaded her head on the roof. The roof loading resulted in a left frontal hematoma and subarachnoid hemorrhage. The back center passenger also loaded the CSS in the back left seat position causing a left lung contusion, fracture of the left 1st and 3rd ribs, a spleen laceration and fractured left clavicle. The back center passenger was not ejected from the vehicle during the rollover. It is not known how the passenger exited the Ford following the crash.

CASE VEHICLE BACK CENTER PASSENGER INJURIES

The police crash report indicated that the back center passenger sustained an A (incapacitating) injury. She was transported from the scene to a hospital and admitted for treatment. The number of days hospitalized is unknown. The table below shows the back right passenger’s injuries and injury mechanisms.

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
	Nonanatomic brain injury with possible loss of consciousness but amnesic to event	Not coded	Roof	Probable	Emergency room records
1	Hematoma, extra-axial, epidural, left frontal, not further specified	severe 140630.4,2	Roof	Probable	Emergency room records
2	Hemorrhage, subarachnoid, not further specified	serious 140684.3,9	Roof	Probable	Emergency room records
3	Laceration, grade I, tiny, low density, in medial spleen	moderate 544222.2,2	Other interior object: child safety seat’s right side	Probable	Emergency room records
4	Fracture ribs: bilateral 1 st ribs and left 3 rd rib, not further specified	moderate 450220.2,3	Other interior object: child safety seat’s right side	Probable	Emergency room records
5	Contusion left lung {pulmonary}, not further specified	serious 441406.3,2	Other interior object: child safety seat’s right side	Probable	Emergency room records
6	Fracture left distal clavicle	moderate 752200.2,2	Other interior object: child safety seat’s right side	Probable	Emergency room records

Injury Number	Injury Description (including Aspect)	NASS Injury Code & AIS 90	Injury Source (Mechanism)	Source Confidence	Source of Injury Data
7	Fracture sacrum, not further specified with irregularity right L ₅ body, not further specified	moderate 852600.2,6	Unknown contact mechanism	Unknown	Emergency room records
8	Abrasion, 3 x 2 cm (1.2 x 0.8 in) above right eye	minor 290202.1,7	Roof	Probable	Emergency room records
9	Abrasion right cheek, not further specified	minor 290202.1,1	Roof	Probable	Emergency room records
10	Abrasion, 3 x 2 cm (1.2 x 0.8 in), left cheek	minor 290202.1,2	Roof	Probable	Emergency room records
11	Abrasion left upper arm, not further specified	minor 790202.1,2	Other interior object: child safety seat's right side	Probable	Emergency room records
12	Abrasions right wrist, hand, and fingers, dorsal surface, with swelling	minor 790202.1,1	Roof	Possible	Emergency room records
13	Abrasions lower legs including left knee, right tibial, right shin, and right ankle/distal lower leg areas, not further specified	minor 890202.1,3	Unknown contact mechanism	Unknown	Emergency room records
14	Abrasions on dorsum of toes, not further specified	minor 890202.1,3	Unknown contact mechanism	Unknown	Emergency room records

CASE VEHICLE BACK RIGHT PASSENGER KINEMATICS

Prior to the crash, the Ford's back right passenger [22-year-old, (unknown race and ethnicity) male; (unknown height and weight)] was seated in an unknown posture. The position of his feet and hands is unknown.

Based on the vehicle inspection and supported by the police crash report, the back right passenger was not restrained by the lap-and-shoulder safety belt system. The safety belt showed evidence of some historical usage, but there was no evidence that it had been used in this crash.

As the Ford rotated counterclockwise and began to roll over, the back right passenger moved up against the right rear door. As the Ford rolled over, the back right passenger was displaced toward the roof. He loaded the roof when the vehicle landed on its left A-pillar, left roof side rail and roof. The passenger also contacted the back center passenger during the rollover. The back right passenger was not ejected from the Ford during the rollover. It is not known how this passenger exited the vehicle following the crash.

The police crash report indicated that the back right passenger sustained a C (possible) injury. The transport status of this passenger is not known. The nature and extent of the passenger's injuries are not known.

