



U.S. Department  
of Transportation

**National Highway  
Traffic Safety  
Administration**



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DOT HS 812 647

May 2019

# **Special Crash Investigations On-Site Guardrail End Treatment Investigation Vehicle: 2014 Ford F-150 Location: Missouri Crash Date: April 2017**

## **DISCLAIMERS**

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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 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. This report and associated case data are based on information available to the Special Crash Investigation team on the date the report was published.

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**Technical Report Documentation Page**

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16. Abstract This report documents the on-site investigation of a pickup truck impact to a ET-Plus 10 cm (5 in) model guardrail end treatment that is of interest to the Federal Highway Administration (FHWA). This crash occurred in the median of a four-lane, divided, interstate highway. The pickup truck was a 2014 Ford F-150 four-door super crew cab originally equipped with frontal air bags, front seat-mounted side impact air bags, rollover/side impact inflatable curtain (IC) air bags, and an event data recorder (EDR). An unbelted 47-year-old male driver occupied the vehicle. The Ford was traveling northwest in the right northbound lane when it departed the right side of the roadway. The vehicle then re-entered and crossed the roadway and departed the left side of the roadway into the median, where the front plane struck the end terminal (Event 1). The vehicle then rolled over (Event 2), right side leading, in the roadway 21 quarter turns. The vehicle caught fire during the rollover (Event 3) according to witnesses, and the unbelted driver was fully ejected. The vehicle came to final rest on its right plane in the roadway heading south. The driver sustained fatal injuries. The Ford was towed from the crash scene due to damage.					
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**Indiana University  
Transportation Research Center  
Special Crash Investigations  
On-Site Guardrail End Treatment Investigation  
Case Number - IN17017  
Vehicle - 2014 Ford F-150  
Location - Missouri  
Crash Date - April 2017**

**BACKGROUND**

This report documents the on-site investigation of a pickup truck impact to an ET-Plus 10 cm (5 in) model guardrail end treatment (**Figure 1**) that is of interest to the Federal Highway Administration (FHWA). This crash was identified by an engineer with the Missouri Department of Transportation (MoDOT), who submitted photographs of the damaged guardrail end treatment to the FHWA. The FHWA determined that the guardrail end treatment and crash type were of interest. This crash investigation was then initiated by the National Highway Traffic Safety Administration in April 2017 and assigned to the Special Crash Investigation team at the Indiana University Transportation Research Center. This single-vehicle crash involved a 2014 Ford F-150 pickup truck (**Figure 2**). The crash occurred in Missouri in April 2017 during early morning hours and was investigated by local police. The guardrail, crash scene, and vehicle were inspected in April 2017.

This crash occurred in the median of a four-lane, divided, interstate highway. The Ford was a 4-door super crew cab pickup truck originally equipped with frontal air bags, front seat-mounted side impact air bags, rollover/side impact inflatable curtain (IC) air bags, and an event data recorder (EDR). An unbelted 47-year-old male driver occupied the vehicle. The Ford was traveling northwest in the right northbound lane when it departed the right side of the roadway. The vehicle then re-entered and crossed the roadway and departed the left side of the roadway into the median where the front plane struck the end terminal (Event 1). The vehicle then rolled over (Event 2), right side leading, in the roadway 21 quarter turns. The vehicle caught fire during the rollover (Event 3) according to



**Figure 1:** The damaged guardrail and End terminal



**Figure 2:** The damaged 2014 Ford F-150

witnesses, and the unbelted driver was fully ejected. The vehicle came to final rest on its right plane in the roadway heading south. The driver sustained fatal injuries. The Ford was towed from the crash scene due to damage.

## CRASH SUMMARY

### *Crash Site*

This crash occurred during dark early morning hours in the median of a four-lane, divided, interstate highway. The weather conditions were clear with 16.1 kilometers (10 miles) visibility, south-southwesterly winds at 24 km/h (15 mph), a temperature of 19.4 °C (67 °F), and a dew point of 10.6 °C (51 °F), according to local weather reports. The interstate highway traversed in a northwest/southeast direction and had two bituminous lanes in each direction that were divided by a grass median. The roadways were bordered by 1.0 m (3.3 ft) wide bituminous median shoulders and 3.0 m (9.8 ft) wide bituminous outside shoulders. The right northwest-bound lane was 3.7 m (12.1 ft) wide and the left northwest-bound lane was 3.8 m (12.5 ft) wide. A blocked-out W-beam guardrail equipped with an ET-Plus 10 cm (5 in) model end treatment was located in the median adjacent to the shoulder. The guardrail was protecting the approach to a bridge that traversed over a creek. The grade for northwest-bound traffic was negative 1 percent. The speed limit was 113 km/h (70 mph). The crash diagrams are included at the end of this report.

### *Pre-Crash*

The Ford was traveling northwest in the northbound lanes. Witnesses told police following the crash that the vehicle was traveling at a very high rate of speed and was weaving in and out of traffic as it passed several vehicles.<sup>1</sup> The witnesses stated that the vehicle nearly ran a tractor-semitrailer off the roadway. The vehicle then departed the right side of the roadway after passing a vehicle that was traveling in the right lane. The driver of the Ford initiated a left steering maneuver and the vehicle returned to and crossed the roadway. The vehicle departed the left side of the roadway and crossed the shoulder and its left side wheels entered the median (**Figure 3**). The left side tires produced a rolling tire mark in the grass as the vehicle traveled partially in the median. The tire mark curved back toward the roadway as the vehicle approached impact with the End terminal (**Figure 4**) indicating that the driver was attempting to steer the vehicle back onto the roadway. The vehicle traveled a total distance of 88.9 m (291.6 ft) with the left side tires in the grass as it approached impact with the End terminal.



**Figure 3:** View northwest of the area the Ford entered the median

<sup>1</sup> The driver's blood alcohol concentration (BAC) was reported as .298 grams per deciliter in the autopsy report. This is almost four times higher than the legal limit of .08 g/dL

## Crash

The front plane of the Ford (**Figure 5**) struck the end terminal (**Figure 6**, Event 1). The vehicle's speed at impact is not known,<sup>2</sup> but was determined to be in excess of 114 km/h (71 mph) as indicated by combining the speeds<sup>3</sup> calculated from the vehicle's front plane crush (i.e., the barrier equivalent speed [BES]) and from the subsequent rollover as discussed below. A specific impact speed could not be determined since the energy dissipated during deformation and displacement of the guardrail is not known.

The impact occurred to the left corner of the vehicle's front plane and the force direction was in the 12 o'clock sector. The damage to the vehicle indicated that the driver's frontal air bag likely deployed. WinSMASH could not be used to calculate delta-V since an impact with a yielding object is out-of-scope for the program. However, WinSMASH was used to calculate a barrier equivalent speed (BES) of 28 km/h (17 mph) based on the damage to the front plane. The impact damaged 11.5 m (37.7 ft) of guardrail and four posts and displaced the damaged guardrail into the roadway.

The vehicle rotated rapidly counterclockwise from the impact and began to rollover (Event 2), right side leading. The witnesses reported that the vehicle became airborne immediately after striking the guardrail. Their statements were consistent with the evidence documented during the SCI crash scene inspection that showed no tire marks or gouges from the vehicle on the roadway for a distance of 34.0 m (111.5 ft) between the end terminal impact and location where the vehicle touched down on the roadway. The vehicle rolled over an estimated total of 21 quarter turns across a distance of approximately 116 m (380 ft). Many of the quarter turns



**Figure 4:** Approach of the Ford to impact with the End terminal, view northwest



**Figure 5:** Damage to the front plane from the impact with the End terminal



**Figure 6:** The damaged End terminal and guardrail (guardrail moved post-crash), view northwest

<sup>2</sup> The vehicle was equipped with an EDR, but it was destroyed when the vehicle caught fire and burned.

<sup>3</sup> The square root of the sum of the squares of the BES and calculated speed from the rollover.

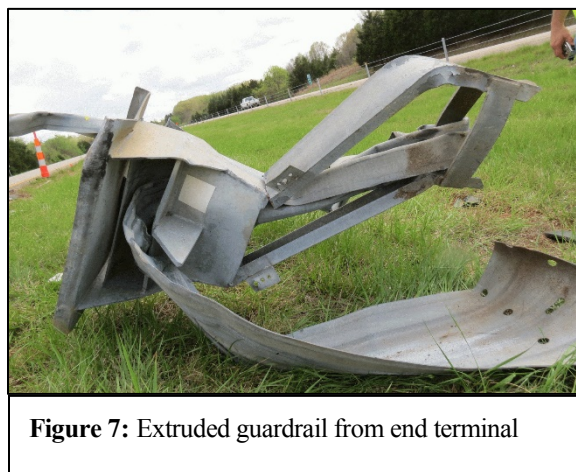
occurred while the vehicle was airborne during the rollover based on the gaps in the scratch and tire scrub mark evidence on the roadway along the rollover path and the lack of heavy pavement grinding in the sheet metal of the vehicle. The speed of the vehicle at initiation of the rollover was calculated as 111 km/h (69 mph) based on the distance traversed during the rollover and a deceleration value of  $-0.42g$ .<sup>4</sup>

The vehicle caught fire (Event 3) during the rollover according to the witnesses. The unbelted driver was fully ejected from the vehicle during the rollover, probably through the right front window. The vehicle came to final rest on its right plane heading south and continued to burn. The fire was severe and involved the entire vehicle. The driver came to final rest in the roadway located 34.7 m (113.8 ft) south of the rest position of the Ford. The witnesses told police that the driver was on fire in the roadway. One witness stated that he used a fire extinguisher to extinguish the burning driver.

**Post-Crash:** Two witnesses stopped their vehicles immediately after the crash and one used a fire extinguisher from his vehicle to extinguish the burning driver of the Ford. The police were notified of the crash at 0427 hours and arrived on scene at 0504 hours. The driver sustained fatal injuries and was pronounced deceased at the scene by the county coroner, who arrived at 0510 hours. The next of kin were notified and the driver was transported by ambulance to the local morgue. The vehicle was towed from the crash scene due to damage. The damaged guardrail was bent back into the median to allow reopening of the northwest-bound lanes.

## END TERMINAL AND GUARDRAIL DAMAGE

The front plane impact of the Ford to the end terminal extruded 1.8 m (5.8 ft) of guardrail to the field side (**Figure 7**) and damaged 11.5 m (37.7 ft) of guardrail and four posts. The direct damage involved the full width and height [38 cm (15.0 in and 70 cm (27.6 in)] of the face of the End terminal. The guardrail was displaced from posts 1 to 4. It remained bolted to posts 5 and 6 but the composite offset block was displaced from each post. Post 1 was separated from its base at the bolt hinge. Posts 2 and 3 were bent to the ground in the downstream direction. The composite offset block was displaced from post 3.



Post 4 was bent approximately 20 degrees from vertical in the downstream direction and the composite offset block was displaced from the post. The guardrail was kinked in five locations (**Figure 8**). One kink was located at the entrance to the guide chute. A second kink was located

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<sup>4</sup> Orłowski, K. R., Moffatt, R., Bundorf, T., & Holcomb, M. P. (1989). *Reconstruction of rollover collisions* (SAE Paper No. 890857). Warrendale, VA: Society of Automotive Engineers [now SAE International].

at the entrance to the feeder channel. There were two kinks between the entrance to the feeder channel and post 5, and one kink at post 5. The width of the feeder channel was 12.7 cm (5.0 in) and the guide chute exit height was 50.8 cm (20.0 in). The height of the guardrail was 71 cm (28.0 in). The connection of the feeder channel to the head was damaged and one of the two welds that connect the head to feeder channel was broken. The anchor cable was present but disconnected from its anchor. The FHWA guardrail form is attached to the end of this report as **Appendix A**.



**Figure 8:** Kinks in the guardrail

## **2014 FORD F-150**

### *Description*

The Ford was a 4-wheel drive, 5-occupant, super crew cab pickup truck with the VIN 1FTFW1ET7EKxxxxxx. It was equipped with a 3.5-liter, V-6, dual turbocharged, diesel engine, 6-speed automatic transmission with sport shift feature, 4-wheel antilock brakes with electronic brake force distribution, traction control, electronic stability control, and a tire pressure monitoring system. The vehicle was also equipped with multi-stage frontal air bags, front seat-mounted side impact air bags, and rollover/side impact IC air bags that were not certified compliant with Federal Motor Vehicle Safety Standard No. 226, Ejection Mitigation. The specified wheelbase was 367 cm (144.5 in).

The tire placard was not accessible since the driver's door was jammed closed. The vehicle manufacturer's recommended tire size was LT275/70R18 or LT275/65R20 based on the 2014 Tire Guide. The recommended cold tire pressures for the front and rear tires for size LT275/70R18 tires were 448 kPa (65 psi) and 552 kPa (80 psi). The manufacturer's recommended cold tire pressures for the front and rear tires for size LT275/60R20 tires was 448 kPa (65 psi). The vehicle was equipped with Dick Cerek Fun Country tires size 35x12.50R20 LT on the left front and right front wheels. The rear tires were consumed in the fire.

The front row was equipped with driver and passenger bucket seats and adjustable head restraints. The second row was equipped with a split bench seat with folding seat cushions and adjustable head restraints.

## ***Exterior Damage***

***Exterior Damage Events 1:*** The Ford sustained direct damage to the front plane during the impact with the end terminal. The direct damage began 20 cm (7.9 in) right of the front left bumper corner and extended 47 cm (18.5 in) to the right. The Field L also was 182 cm (71.7 in) long and began at the left corner of the front bumper. Crush measurements were taken on the bumper and the maximum residual crush was 36 cm (14.2 in) occurring at the front left bumper corner. The crush values were:  $C_1 = 36$  cm (14.2 in),  $C_2 = 31$  cm (12.2 in),  $C_3 = 21$  cm (8.3 in),  $C_4 = 6$  cm (2.4 in),  $C_5 = 0$  cm,  $C_6 = 0$  cm.



**Figure 9:** Top view of the crush to the front plane of the Ford

***Damage Classification Event 1:*** The Collision Deformation Classification (CDC) was 12FLEW2 (350 degrees).

***Exterior Damage Event 2:*** Damage from the rollover involved the full length and height of the right plane. There were also scratches in the sheet metal from the rollover located on the right fender and roof. The roof and left plane were also damaged during the rollover, although the right plane sustained the most severe damage. The maximum lateral crush was 22 cm (8.7 in) occurring at the top of the right A-pillar. The maximum vertical crush was 9 cm (3.5 in) occurring to the roof at the right rear door area.

***Damage Classification Event 2:*** The CDC was 00RDAO3. The severity of the damage was moderate based on the extent of the lateral crush to the roof.

***Exterior Damage Event 3:*** The entire vehicle sustained damage from the fire. The fire was severe and consumed all the combustible material of the vehicle except the front tires. The origin of the fire could not be determined.

## ***Event Data Recorder***

The Ford was equipped with an EDR. No attempt to image the EDR was possible since it was destroyed during the fire.

## ***Interior Damage***

The interior of the Ford was totally destroyed by the fire.

### ***Manual Restraint Systems***

The front and second row seating positions were originally equipped with 3-point lap and shoulder seat belts. The restraints were destroyed during the fire. The driver was fully ejected from the vehicle during the rollover, indicating that he was not belted.

### ***Supplemental Restraint Systems***

The Ford was originally equipped with multi-stage frontal air bags, front seat-mounted side impact air bags, and rollover/side impact IC air bags. The air bags, if present, were destroyed during the fire.

## **2014 FORD F-150 OCCUPANT**

### ***Driver Demographics***

Age/Sex: 47 years/male  
Height: 185 cm (73 in)  
Weight: 109 kg (240 lbs)  
Eyewear: Unknown  
Seat Type: Bucket  
Seat Track Position: Unknown  
Manual Restraint Usage: None  
Usage Source: Crash circumstance, driver was totally ejected  
Air Bags: Unknown  
Alcohol/Drug Involvement: Yes, BAC reported as .298 g/dL in autopsy report  
Egress From Vehicle: Ejected during rollover.  
Transport From Scene: Ambulance to local morgue  
Medical Treatment: None, pronounced deceased at crash scene.

### ***Driver Injuries***

<b>Injury No.</b>	<b>Injury</b>	<b>AIS 2015</b>	<b>Involved Physical Components (IPC)</b>	<b>IPC Confidence Level</b>
1 <sup>5</sup>	Fracture (ring) around foramen magnum in posterior cranial fossa with blood-tinged cerebrospinal fluid	150206.4	Critical IPC configuration Roof, right front side rail Ground (roadway)	Probable Possible
2	Hemorrhage, thin film, subdural, over posterior cerebrum bilaterally, not further specified	140651.3	Critical IPC configuration Roof, right front side rail Ground (roadway)	Probable Possible

<sup>5</sup> Source of all injury data is the driver's autopsy report.

<b>Injury No.</b>	<b>Injury</b>	<b>AIS 2015</b>	<b>Involved Physical Components (IPC)</b>	<b>IPC Confidence Level</b>
3	Fractured ribs including: left–anterior/lateral 1st through 6th, posterior lateral 3rd through 11th; right–posterior 1st through 12th	450203.3	Injury Causation Scenario 1-Event 1, guardrail end Steering wheel hub and/or spokes and rim; (ICS confidence-Probable)	Probable
3			ICS 2-Event 2, rollover Ground (roadway); (ICS confidence- Probable)	Probable
4	Hemothorax, right–minimal bloody fluid in right pleural space	442200.3	Ground (roadway)	Probable
5	Hemothorax, left–minimal bloody fluid in left pleural space	442200.3	ICS 1–Event 1, guardrail end Steering wheel hub and/or spokes and rim; (ICS confidence- Probable)	Probable
5			ICS 2–Event 2, rollover Ground (roadway); (ICS confidence- Probable)	Probable
6	Lacerations (tears), right pleura, multi-focal, associated with rib fractures, not further specified	441800.2	Ground (roadway)	Probable
7	Lacerations (tears), left pleura, multi- focal, associated with rib fractures, not further specified	441800.2	Steering wheel hub and/or spokes and rim	Probable
8	Laceration left renal pelvis, <sup>6</sup> not further specified	541620.2	Ground (roadway)	Probable
9	Laceration liver, 4 cm (1.6 in) posterior midline with minimal peritoneal hemorrhage	541822.2	Ground (roadway)	Probable
10	Fracture of left mid humerus, not further specified	751221.2	Critical IPC configuration Right front window frame Ground (roadway)	Possible Possible
11 12	Fracture, compound, of left distal tibia and fibula, not further specified	854332.3 854442.2	Floor, including toe pan	Probable

<sup>6</sup> According to Merriam-Webster’s dictionary, the renal pelvis is a funnel-shaped structure in each kidney through which urine is discharged into the ureter

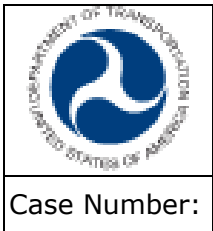
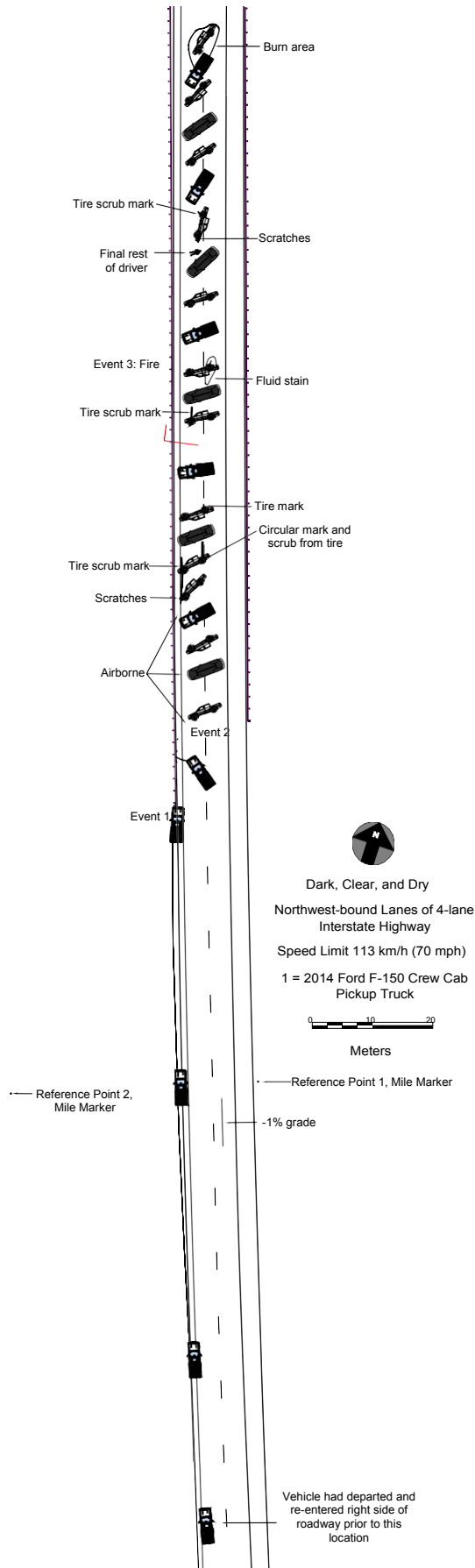
<b>Injury No.</b>	<b>Injury</b>	<b>AIS 2015</b>	<b>Involved Physical Components (IPC)</b>	<b>IPC Confidence Level</b>
13 14	Burns, multifocal on the body, including blacken skin (3rd degree) on upper right chest and shoulder area; indirect thermal injury (1st degree) to the face, right hip, and right up- per thigh; direct thermal damage (2nd degree) to anterior left thigh, knee, and upper left shin; burn spots on buttocks and posterior thighs, bilaterally	912002.1  912012.2	Thermal	Certain
15	Laceration, irregular, 8 by 1.5 cm (3.1 x 0.6 in) along occipital mid-line of scalp, not further specified	110602.1	Roof, right front side rail	Probable
16	Contusion (subscalpular hemorrhage), extensive, on left scalp, not further specified	110402.1	Roof, right front side rail	Probable
17	Abrasion, 8 by 4 cm (3.1 x 1.6 in) above right eyebrow, not further specified	210202.1	Front left windshield's glazing	Probable
18	Abrasions, multiple, on mid and left chest, not further specified	410202.1	Steering wheel hub and/or spokes and rim	Probable
19	Abrasions, multiple, on upper abdomen, not further specified	510202.1	Steering wheel hub and/or spokes and rim	Probable
20	Abrasions (area), 14 by 10 cm (5.5 x 3.9 in) left posterior shoulder, not further specified	710202.1	Ground (roadway)	Probable
21	Lacerations x 2 (associated with abrasions), measuring 3.5 by 1.5 cm (1.4 x 0.6 in) on posterior left shoulder, not further specified	710602.1	Ground (roadway)	Probable
22	Abrasion, 5 cm (2.0 in) on left elbow, not further specified	710202.1	Ground (roadway)	Probable
23	Laceration, superficial, 8 by 1 cm (3.1 x 0.4 in), on posterior (extensor surface) right forearm, not further specified	710602.1	Ground (roadway)	Probable
24	Laceration, angular, 10 by 1 cm (3.9 x 0.4 in) over right lateral hip, not further specified	810602.1	Ground (roadway)	Probable

<b>Injury No.</b>	<b>Injury</b>	<b>AIS 2015</b>	<b>Involved Physical Components (IPC)</b>	<b>IPC Confidence Level</b>
25	Abrasions, up to 3 cm (1.2 in) on anterior right ankle, not further specified	810202.1	Center lower instrument panel	Probable
26	Laceration, irregular, 9 cm (3.5 in), on medial right ankle, not further specified	810602.1	Floor, foot controls	Probable

### ***Driver Kinematics***

The driver was not restrained by the lap and shoulder seat belt. The position of the driver's seat track is not known. The front plane impact with the end terminal displaced the driver forward. The vehicle then rolled over, right side leading, landing on its right plane, which redirected the driver to the right and toward the roof, and he was fully ejected from the vehicle, probably through the right front window, as the vehicle continued to roll over. The driver sustained fractures of anterior left ribs 1 to 6, posterior ribs 3 to 11, and right posterior ribs 1 to 12 with left hemothorax, probably from contact with the steering wheel or contact with the roadway pavement when he was ejected from the vehicle. His head probably contacted the windshield, causing an 8 x 4 cm (3.1 x 1.6 in) long abrasion above his right eyebrow. His left foot probably contacted the toe pan resulting in compound fractures of the left distal tibia and fibula. The driver's right foot also probably contacted the foot controls causing a 9 cm (3.5 in) long laceration on his right ankle. The driver's head probably contacted the right roof side rail as he was ejected causing a ring fracture of the foramen magnum, a subdural hemorrhage of the posterior cerebrum, contusion of the left scalp, and a 8 x 1.5 cm (3.1 x 0.6 in) long laceration to his occipital scalp. His left arm also possibly contacted the right front window frame causing a fracture of the left humerus. Probable contact with the roadway pavement caused, lacerations to his liver and renal pelvis, and multiple soft tissue abrasions and lacerations. Witnesses reported to police that the driver was on fire when he was ejected and continued to burn as he lay in the roadway until a passerby extinguished the flames with a fire extinguisher. The driver sustained third-degree burns on the upper right chest and shoulder and first-degree burns to his face, right hip and right upper thigh. His left thigh, knee, upper left shin, buttocks, and bilateral posterior thighs sustained second-degree burns. The driver was pronounced deceased by the county coroner at the crash scene and was transported by ambulance to a local morgue.

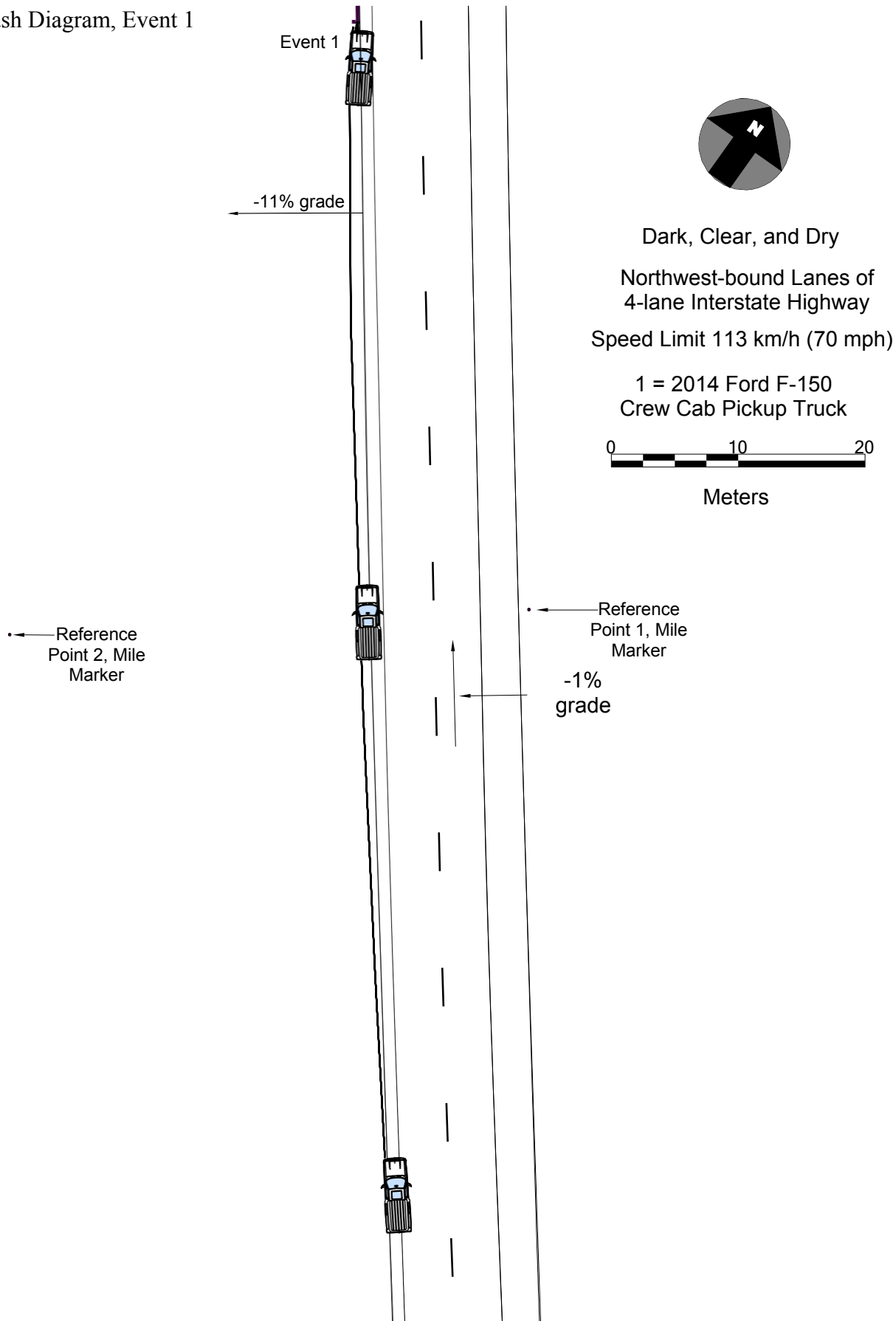
# Crash Diagram




  
[www.nhtsa.gov](http://www.nhtsa.gov)

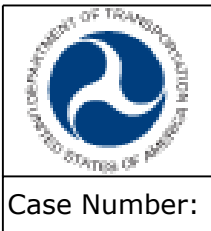
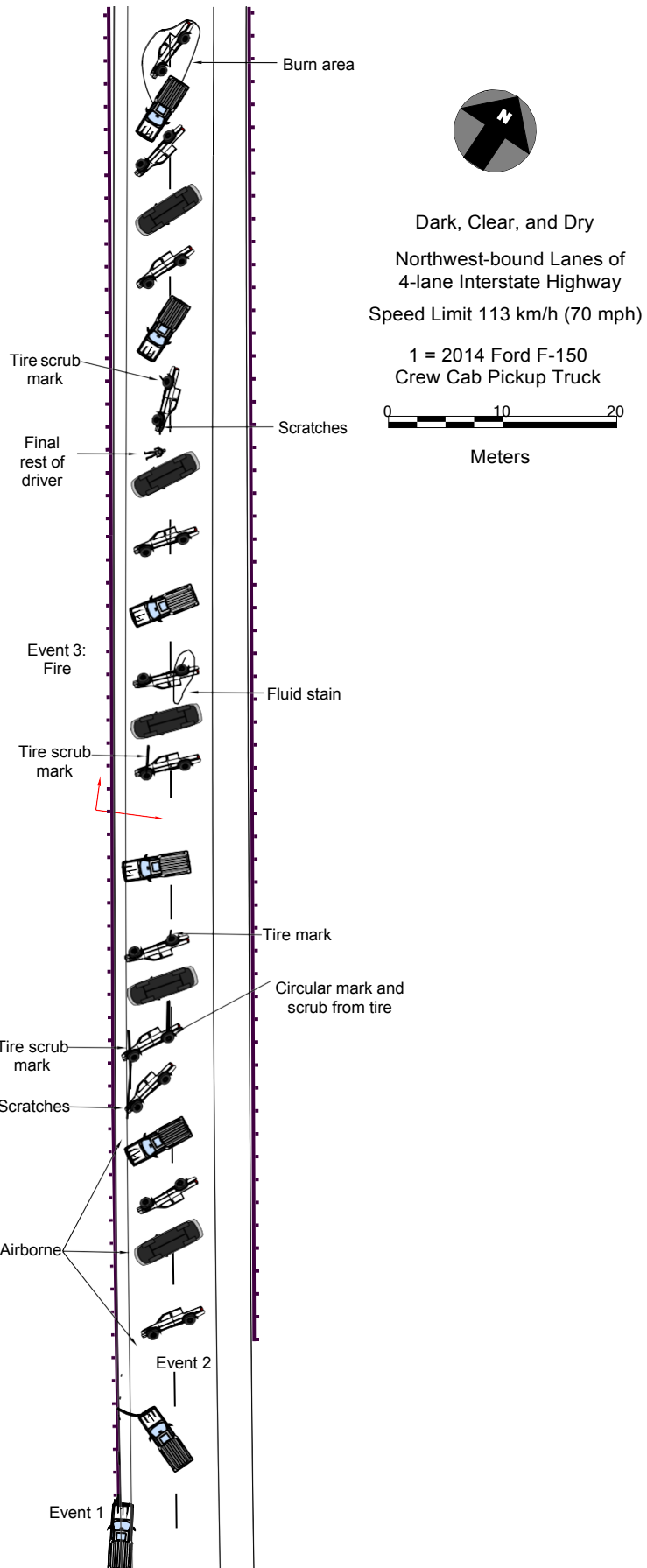
Case Number: IN17017

Crash Diagram, Event 1



	 <a href="http://www.nhtsa.gov">www.nhtsa.gov</a>
Case Number:	IN17017

# Crash Diagram, Rollover



**NHTSA**  
www.nhtsa.gov

Case Number: IN17017

**APPENDIX A:  
FHWA GUARDRAIL FORM**

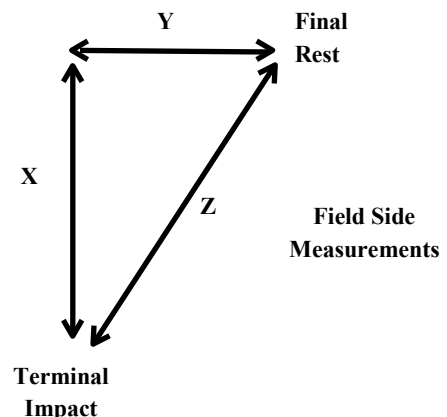
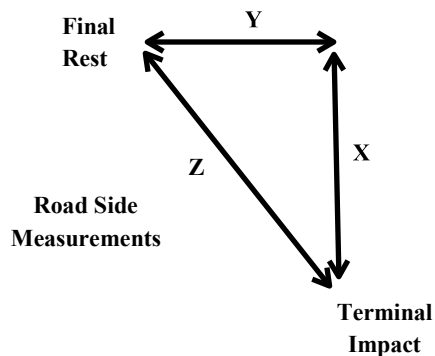
Case No.: IN17017

PREPOPULATED DATA (BY OTHERS)			
Date of Crash	April 2017	TIME OF CRASH (MILITARY)	Early morning
Case Number	IN17017	State	Missouri
Traffic Route	Interstate	Direction (Southbound = SB)	NWB
Ambient Conditions (at time of crash)			
Temperature (°F)	67	Lighting	Dark
Atmospheric	Clear		

SCENE INFORMATION	
Type of area where crash occurred	<input type="checkbox"/> Urban <input checked="" type="checkbox"/> Rural <input type="checkbox"/> Suburban
Terminal on a horizontal curve?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Curve/LT <input type="checkbox"/> Curve/RT
Estimated or Reconstructed Speed at Impact (MPH)	Impact speed unknown but determined to be in excess of 72 mph. See "Crash" section of report
Est. distance (straight line) from terminal impact to COM final rest position (ft.)	Z = 419.8 ft
Est. distance (longitudinal) along guardrail from terminal impact to COM final resting location (ft.)	X = 418.2 ft
Est. distance (normal) from either 1. the white paint line; or 2. roadway/shoulder/pavement edge to COM rest position (ft.)	Y = 14.8 ft
Super elevation	<input type="checkbox"/> +2% <input type="checkbox"/> -2% <input checked="" type="checkbox"/> NONE or FLAT
Curve Radius (ft.)	N/A

**KEY:**

- COM - Center of Mass of Vehicle
- Distance Measurements



Case No.: IN17017

<b>ON-SCENE INFORMATION</b>	
End Treatment Type	<input checked="" type="checkbox"/> Extruder <input type="checkbox"/> ET2000 <input type="checkbox"/> ET-PLUS 4in <input checked="" type="checkbox"/> ET-PLUS 5in <input type="checkbox"/> SKT <input type="checkbox"/> FLEAT <input type="checkbox"/> SOFT STOP <input type="checkbox"/> Telescope <input type="checkbox"/> X-LITE <input type="checkbox"/> X-TENSION
Curb? s	<input checked="" type="checkbox"/> No <input type="checkbox"/> AASHTO Type A <input type="checkbox"/> AASHTO Type B <input type="checkbox"/> AASHTO Type C <input type="checkbox"/> AASHTO Type D <input type="checkbox"/> AASHTO Type E <input type="checkbox"/> Yes <input type="checkbox"/> AASHTO Type F <input type="checkbox"/> AASHTO Type G <input type="checkbox"/> AASHTO Type H
Curb Height:	

<b>GUARDRAIL INSTALLATION</b>										
Post No.	Post		Offset Block		PRE-Existing Damage			Offset to post or post hole (ft.)		Spacing to next post (ft. -in.)
	Type	Dim.	Type	Dim.	Yes No Unknown	Describe	Travel way	Curb		
	Steel Wood Other	D x W (in.) or Dia. (in.)	Steel Wood Composite	D x W (in.)						
0	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	Steel	6 x 4	None	N/A	Unk		4	N/A	6'4"	
2	Steel	6 x 4	None	N/A	Unk		4.2	N/A	6'2"	

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Post No.	Post		Offset Block		PRE-Existing Damage		Offset to post or post hole (ft.)		Spacing to next post (ft. -in.)
	Type	Dim.	Type	Dim.	Yes No Unknown	Describe	Travel way	Curb	
	Steel Wood Other	D x W (in.) or Dia. (in.)	Steel Wood Composite	D x W (in.)					
3	Steel	6 x 4	Composite	7.5 x 4	Unk		4.8	N/A	6'5"
4	Steel	6 x 4	Composite	7.5 x 4	Unk		4.8	N/A	6'0"
5	Steel	6 x 4	Composite	7.5 x 4	Unk		4.8	N/A	6' 3"
6	Steel	6 x 4	Composite	7.5 x 4	No		4.8	N/A	6' 4"
7	Steel	6 x 4	Composite	8.5 x 4	No		4.8	N/A	6'3"
8	Steel	6 x 4	Composite	8.5 x 4	No		4.8	N/A	6'4"

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Post No.	Post		Offset Block		PRE-Existing Damage		Offset to post or post hole (ft.)		Spacing to next post (ft. -in.)
	Type	Dim.	Type	Dim.	Yes No Unknown	Describe	Travel way	Curb	
	Steel Wood Other	D x W (in.) or Dia. (in.)	Steel Wood Composite	D x W (in.)					
9	Steel	6 x 4	Composite	8.5 x 4	No		4.8	N/A	6'2"
10	Steel	6 x 4	Composite	8.5 x 4	No		4.7	N/A	6'4"
11	Steel	6 x 4	Composite	8.5 x 4	No		4.7	N/A	6'2"
12	Steel	6 x 4	Composite	8.5 x 4	No		4.7	N/A	6'2"

Additional Comments

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<b>EXTRUDER</b>			
Feeder Channel Width at impact head	<input type="checkbox"/> 4inches <input checked="" type="checkbox"/> 5 inches <input type="checkbox"/> Other _____		
Guide Chute Exit Height (in.)	20		
Connection of feeder channels to head damaged?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	Are Welds Broken?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes
Anchor Cable Present?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	Connected?	<input type="checkbox"/> No <input type="checkbox"/> Yes
Rail Extrusion?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes	Length (ft. in.)	5' 10"
Rail Extrusion Direction	<input type="checkbox"/> Traffic Side <input checked="" type="checkbox"/> Field Side		
Total Length of Rail Damaged (ft.) [total length would include extruded rail plus damaged rail downstream from head.]	37.7 ft		

<b>TELESCOPE</b>			
Rail Displacement	<input type="checkbox"/> No	<input type="checkbox"/> Yes; Length:	No of Panels Displaced <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6

<b>ALL-SYSTEM PERFORMANCE</b>			
Railkinks Downstream of Head?	<input type="checkbox"/> No	<input checked="" type="checkbox"/> Yes	No. of Kinks in Rail: 5
Was there intrusion into the Occupant Compartment by foreign object (guardrail)?	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes		
Did vehicle impact other objects after impact with terminal?	<input type="checkbox"/> No <input checked="" type="checkbox"/> Yes		
Object Contacted	Ground (during rollover)		

<b>ALL-SYSTEM PERFORMANCE ENVIRONMENT</b>			
<b>SIDESLOPE</b>	<b>50 ft in advance of Post 1</b>	<b>At Post 1</b>	<b>50 ft Past Post 1</b>
Percent - %	11%	12%	15%
Adjacent Lane Width (ft)	12.5		
Lane Type (NASS EDS Variable: Sur. Type)	Bituminous		
Shoulder Type	Bituminous		

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Shoulder Width (ft)	3.3
Guardrail Height (in)	28

VEHICLE INFORMATION	
Vehicle Type (NHTSA Input)	Full size pickup truck
Vehicle Identification Number (VIN)	1FTFW1ET7EKxxxxxx
Vehicle Mass (NASS var.: veh.wgt)	5586 lbs
Vehicle orientation upon impact	<input checked="" type="checkbox"/> Case Type 1 <input type="checkbox"/> Case Type 2 <input type="checkbox"/> Case Type 3 <input type="checkbox"/> Case Type 4 <input type="checkbox"/> Case Type 5 <input type="checkbox"/> Case Type 6 <input type="checkbox"/> Case Type 7 <input type="checkbox"/> Case Type 8 <input type="checkbox"/> Other
If 'Other', describe	
Collision Deformation Classification	12FLEW2
Delta-V	Unknown, Barrier Equivalent Speed = 19 mph
Occupant Compartment Penetration of rail	<input checked="" type="checkbox"/> No <input type="checkbox"/> Yes; Describe:
Quarter Turns (NASS EDS variable: Rollover)	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10 <input type="checkbox"/> 11 <input type="checkbox"/> 12 <input type="checkbox"/> 13 <input type="checkbox"/> 14 <input type="checkbox"/> 15 <input type="checkbox"/> 16 <input checked="" type="checkbox"/> 17+
Object Precipitating Rollover, (NASS EDS variable: Rollobj)	Guardrail
Rollover Type, Terhune Scale, (NASS EDS variable: rolintyp)	Flip over

DOT HS 812 647  
May 2019



U.S. Department  
of Transportation  
**National Highway  
Traffic Safety  
Administration**

