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**National Highway
Traffic Safety
Administration**

NHTSA

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February 2019

Special Crash Investigations On-Site SKT Guardrail End Treatment Investigation Vehicle: 1996 Ford Mustang Location: Missouri Crash Date: August 2016

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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.

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

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On-site SKT guardrail end treatment investigation involving a 1996 Ford Mustang.

16. Abstract

This report documents the on-site investigation of the impact of a 1996 Ford Mustang to a Sequential Kinking Terminal (SKT) guardrail end treatment that is of interest to the Federal Highway Administration (FHWA). This crash occurred within an interstate interchange area on the west roadside of the acceleration lane for the entrance ramp to a six-lane, divided State highway. The Ford was a two-door coupe equipped with frontal air bags. The vehicle was not equipped with an Event Data Recorder (EDR) that was supported by a commercially available tool. A belted 27-year-old female driver, unbelted 25-year-old female front row passenger, and unbelted 27-year-old male second row right passenger occupied the vehicle. The Ford exited the westbound interstate highway onto the entrance ramp to the State highway and was traveling in a southerly direction as it approached the acceleration lane for the State highway. The driver lost control of the vehicle on the rain-slick roadway as she was exiting the curve of the entrance ramp, and the vehicle departed the right (west) side of the road. The front plane then impacted the SKT (event 1). The impact damaged and displaced the guardrail and resulted in deployment of both of the Ford's frontal air bags. The vehicle rotated clockwise from the impact and the left plane impacted the deformed guardrail (event 2). The vehicle then came to final rest heading northeast. The driver and second row right passenger sustained police-reported "B" (non-incapacitating) injuries but were not transported for medical treatment. They sought treatment at a trauma center the following day for minor injuries. The front row passenger sustained police-reported "B" (non-incapacitating) injuries and was transported by ambulance to a trauma center where she was treated in the emergency room for minor injuries and released. The Ford was towed from the crash scene due to damage.

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SKT Guardrail End Treatment Guardrail Damage	Motor Vehicle Traffic Crash Minor Injury	Document is available to the public from the National Technical Information Service, www.ntis.gov.

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Indiana University Transportation Research Center
On-Site SKT Guardrail End Treatment Investigation
Case Number: IN16021
Vehicle: 1996 Ford Mustang
Location: Missouri
Crash Date: August 2016

BACKGROUND

This report documents the on-site investigation of a passenger vehicle impact to a Sequential Kinking Terminal (SKT) 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 vehicle and 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 (NHTSA) in August 2016 and assigned to the Special Crash Investigation Team at the Indiana University Transportation Research Center. This single-vehicle crash involved a 1996 Ford Mustang (**Figure 2**). The crash occurred in Missouri in August 2016 at 0053 hours, and was investigated by a local police agency. The vehicle, guardrail, and crash scene were inspected in August 2016. A telephone interview was conducted with the driver of the Ford in September 2016.

Figure 1: The damaged SKT and guardrail, view south

Figure 2: The damaged 1996 Ford Mustang

This crash occurred within an interstate interchange area on the west roadside of the acceleration lane for the entrance ramp to a six-lane, divided State highway. The Ford was a two-door sedan equipped with frontal air bags. The vehicle was not equipped with an Event Data Recorder (EDR) that was supported by a commercially available tool. A belted 27-year-old female driver, unbelted 25-year-old female front row passenger, and unbelted 27-year-old male second row right passenger occupied the vehicle. The Ford exited the westbound interstate highway onto the entrance ramp to the State highway and was traveling in a southerly direction

as it approached the acceleration lane for the State highway. The driver lost control of the vehicle on the rain-slick roadway as she was exiting the curve of the entrance ramp, and the vehicle departed the right (west) side of the road. The front plane then impacted the SKT (event 1). The impact damaged and displaced the guardrail and resulted in deployment of both of the Ford's frontal air bags. The vehicle rotated clockwise from the impact and the left plane impacted the deformed the guardrail (event 2). The vehicle then came to final rest heading northeast. The driver and second row right passenger sustained police-reported "B" (non-incapacitating) injuries but were not transported for medical treatment. They sought treatment at a trauma center the following day for minor injuries. The front row passenger sustained police-reported "B" (non-incapacitating) injuries and was transported by ambulance to a trauma center where she was treated in the emergency room for minor injuries and released. The Ford was towed from the crash scene due to damage.

CRASH SUMMARY

Crash Site

This crash occurred during nighttime hours within an interstate interchange area on the west roadside of the acceleration lane for the entrance ramp to a six-lane, divided State highway. The weather conditions were light rain with 16.1 kilometers (10 miles) visibility, westerly winds at 8 km/h (5 mph), a temperature of 21.1 °C (70 °F), and a dew point of 20 °C (68 °F), according to local weather reports. The entrance ramp to the State highway was curved to the right and had one 5 m (16.4 ft) wide bituminous lane that transitioned to a 3.3 m (10.9 ft) wide acceleration lane for the southbound lanes of the State highway. A 0.9 m (2.9 ft) wide bituminous shoulder bordered the acceleration lane and a blocked-out W-beam guardrail equipped with an SKT end treatment was adjacent to the shoulder. The grade for southbound traffic was -3%. The speed limit was 105 km/h (65 mph). The Crash Diagram is included on page 11 of this report.

Figure 3: Southerly approach of the Ford and the area of control loss

Pre-Crash

The Ford was traveling west on the interstate highway in the first westbound lane and the driver exited the interstate onto the entrance ramp for the State highway. The vehicle traveled through the ramp and was traveling in a southerly direction at a driver estimated speed of 64 km/h (40 mph) as the vehicle approached the acceleration lane for the State highway. The driver stated during the SCI interview that she accelerated rapidly as the vehicle exited the entrance ramp (**Figure 3**) and lost control of the vehicle on the rain-slick roadway. The Ford then rotated clockwise and departed the right (west) side of the roadway approximately 9 m (30 ft) prior to the SKT. The driver stated that the loss of control occurred so quickly that she had no time to take any avoidance actions.

Crash

The front plane of the Ford (**Figure 4**) impacted the SKT (**Figure 5**, event 1) at an estimated speed of 56 km/h (35 mph). The Ford was rotated clockwise approximately 50 degrees from its original heading on the roadway at the moment of impact. The force direction was within the 11 o'clock sector and the impact resulted in deployment of both frontal air bags. The vehicle continued to rotate clockwise as 1.8 m (5.8 ft) of guardrail was extruded from the SKT. The left plane of the vehicle (**Figure 6**) then impacted the traffic side of the deformed guardrail (event 2) as it was displaced in a southwesterly direction. The distinctive crush pockets at the front of the left front door (**Figure 6**) and immediately rear of the B-pillar indicated areas where kinks in the guardrail impacted the left plane. The vehicle rotated clockwise a total of 165 degrees from its heading at impact with the SKT and came to final rest heading northeast with the back plane next to the deformed guardrail. The crash damaged a total of 8.2 m (27.0 ft) of guardrail and displaced five posts.

Figure 4: Damage to the Ford's front plane from the impact with the SKT

Figure 5: Area of contact to the face of the SKT from the impact with the Ford

Post-Crash

All the occupants exited the vehicle through the right front door since the left front door was jammed shut. The police were notified of the crash at 0102 hours and arrived on scene at 0107 hours. The driver and second row right occupant sustained police-reported "B" (non-incapacitating) injuries and were not transported for medical treatment. They sought treatment the following day at a trauma center emergency room where they were treated and released for minor injuries. The front row right occupant sustained police-reported "B" (non-incapacitating) injuries and was transported by ambulance to a trauma center where she was treated in the emergency room for minor injuries and released. The vehicle was towed from the crash scene due to damage.

Figure 6: Damage to the left plane of the Ford from the impact with the deformed guardrail

END TERMINAL AND GUARDRAIL DAMAGE

The Ford's front plane impact to the SKT extruded 1.8 m (5.8 ft) of guardrail to the field side (**Figure 7**) and damaged five posts (**Figure 8).** The direct damage on the face of the SKT was 23 cm (9.1 in) wide beginning on the traffic side edge of the SKT. The guardrail was displaced from posts 1-4. Post 1 was separated from its base at the bolt hinge. Post 2 was rotated to the ground in the downstream direction about its hinge bolt. Post 3 was bent in the downstream direction approximately 60 degrees from vertical. The composite offset block was damaged but remained attached to the post. Post 4 was bent in the downstream direction approximately 45 degrees from vertical and was twisted in the ground toward the field side. The composite offset block was damaged but remained attached to the post. The guardrail remained attached to post 5 and the post was slightly displaced, while the guardrail was bent approximately 90 degrees toward the field side at the post. The guardrail was kinked in five locations. Four of the kinks were in the first section of guardrail (**Figure 9**) that ended at post 5. A minor kink was present in the second section of guardrail 0.6 m (2.0 ft) beyond post 5. The face of the SKT was 51.0 cm (20.1 in) wide and 51.0 cm (20.1 in) high. The width of the feeder channel was 11.4 cm (4.5 in) and the guide chute exit height was 34.3 cm (13.5 in). The connection of the feeder channel to the head was not damaged and the anchor cable was present, but disconnected from its anchor. The "In- Service End Treatment Evaluation Data Collection Form" is attached to the end of this report as **Appendix**.

Figure 7: Extruded section of guardrail to the field side of the SKT

Figure 8: Damaged posts 1 - 5, view southeast

Figure 9: Kinks in the guardrail

1996 FORD MUSTANG

Description

The Ford was a rear wheel drive, four-occupant, two-door coupe (VIN: 1FALP42XXTFxxxxxx). The vehicle was equipped with a 4.6-liter V-8 engine, four-speed automatic transmission, frontal air bags, and a tilt steering column that was adjusted between the full-up and center positions. The vehicle's mileage at the SCI vehicle inspection was 304,923 kilometers (189,476 miles). The specified wheelbase was 257 cm (101.2 in).

The vehicle manufacturer's recommended tire size was P225/55R16. The vehicle was equipped with Continental ContiProContact tires size P215/55R16 on the front wheels and Kumho Solus KH116 tires size P235/55R16 on the rear wheels. The manufacturer's recommended cold tire pressure for the front and rear tires was 207 kPa (30 psi). All the tires were in fair condition.

The front row was equipped with driver and passenger cloth-covered bucket seats with folding backs and adjustable head restraints. The second row was equipped with a cloth-covered bench seat with folding backs and no head restraints. The driver's and front passenger's seat tracks were each adjusted between the forward-most and middle positions and each seat back was slightly reclined. The top of each head restraint was adjusted 10 cm (3.9 in) above the top of the seat back.

Exterior Damage

Exterior Damage Event 1: The Ford sustained direct and induced damage to the front plane during the impact with the SKT. The front bumper, grille, and hood were directly damaged. The direct damage began 43 cm (16.9 in) right of the front bumper's left corner and extended 41 cm (16.1 in) to the right. The Field L was 123 cm (48.4 in). Crush measurements were taken on the bumper bar using a Nikon Total Station 5M+ and the maximum residual crush was 16 cm (6.3 in) occurring 30 cm (11.8 in) left of the vehicle's centerline. The crush values were: $C_1 = 0$ cm, $C_2 = 12$ cm (4.7 in), $C_3 = 16$ cm (6.3 in), $C_4 = 7$ cm (2.8 in), $C_5 = 0$ cm, $C_6 = 0$ cm.

Damage Classification Event 1: The Collision Deformation Classification (CDC) was 11FYEW1 (330 degrees). The WinSMASH program 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 15 km/h (9 mph) based on the crush to the front plane.

Exterior Damage Event 2: The left plane sustained direct and induced damage when the vehicle rotated clockwise from the impact with the SKT and the left plane impacted the deformed guardrail. The direct damage involved the fender, door, quarter panel, rear wheel, taillight assembly, and back bumper fascia. The direct damage began 280 cm (110.2 in) forward of the left rear axle and extended 362 cm (142.5 in) rearward. The Field L was 395 cm (155.5 in). Crush measurements were taken at the upper door level and the maximum residual crush was 30

cm (11.8 in) occurring 85 cm (33.5 in) rear of the left front axle. The crush values were: $C_1 = 0$ cm, $C_2 = 5$ cm (2.0 in), $C_3 = 16$ cm (6.3 in), $C_4 = 10$ cm (3.9 in), $C_5 = 1$ cm (0.4 in), $C_6 = 0$ cm.

Damage Classification Event 2: The CDC was 09LDEW3. WinSMASH calculated the BES as 20 km/h (12 mph).

Interior Damage

The interior of the Ford sustained moderate damage from intrusion when a kink in the guardrail impacted the left front door. The forward upper quadrant of the door intruded laterally 12 cm (4.7 in) into the driver's seating area (**Figure 10**), while the lower left instrument panel and lower left A-pillar intruded laterally 10 cm (3.9 in) and 8 cm (3.1 in), respectively. Evidence of occupant contact consisted of a deformed lower left instrument panel from contact by the driver's left knee. The rearview mirror was displaced from possible contact by the front passenger's head. The back of the front row right seat was scuffed and the seat back release lever was bent, probably from contact by the second row right occupant's chest and right lower leg, respectively. The left front door was jammed shut and the right front door remained closed and operational. The left front glazing was disintegrated from impact forces and the windshield was cracked from impact forces. The remaining glazing was undamaged.

Figure 10: Intrusion of the Ford's left front door

Manual Restraint Systems

The front and second row seating positions were equipped with three-point lap and shoulder seat belts with sliding latch plates and fixed upper anchors. Inspection of the driver's, front row right, and second row right occupant's seat belt assemblies revealed no evidence of loading. The driver stated during the interview that she was restrained by the lap and shoulder seat belt at the time of the crash. The driver was determined to have been belted since both she and her medical record reported a 10 cm (4.0 in) long and 5 cm (2.0 in) wide contusion to the top of her left shoulder consistent with loading the shoulder belt. The medical records for the front row right and second row right occupants stated that the occupants were not belted at the time of the crash.

Supplemental Restraint Systems

The Ford was equipped with frontal air bags, both of which deployed during the impact with the SKT. There was no crash-related damage to either air bag and no discernable evidence of occupant contact to either air bag.

1996 FORD MUSTANG OCCUPANTS

Driver Demographics

Age/Sex:	27 years/Female
Height:	160 cm (63 in)
Weight:	60 kg (132 lbs)
Eyewear:	None
Seat Type:	Bucket with folding back
Seat Track Position:	Between forward-most and middle
Manual Restraint Usage:	Lap and shoulder belt
Usage Source:	Driver interview and injury data
Air Bags	Frontal air bag deployed
Alcohol/Drug Involvement:	None
Egress from Vehicle:	Exited without assistance through right front door.
Transport from Scene:	None
Medical Treatment:	Transported next day by private vehicle to trauma center, treated in emergency room and released

Driver Injuries

Injury No.	Injury	AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Contusion, (ecchymosis) 5.1 cm (2 in) in diameter, on right forehead, not further specified	210402.1	Air bag, driver's frontal	Probable
2	Contusion, (ecchymosis) 10.2 cm (4 in) in length and 5.1 cm (2 in) in width, over left shoulder	710402.1	Torso portion of seat belt system	Certain
3	Abrasion right thigh, not further specified	810202.1	Interior, center console first row	Probable
4	Contusion, 30.5 cm (12 in) in length, extending from right ankle up later- al (outside) lower leg, not further specified	810402.1	Interior, center console first row	Probable

*Sources: Emergency Room Records and Interviewee Data–Same Person. Injury Number 3 came only from **Emergency Room Records**. Injury Numbers 1, 2, and 4 came from a combination of **Emergency** **Room Records** and **Interviewee Data**.*

Driver Kinematics

The driver was restrained by the lap and shoulder seat belt. The seat track was adjusted between the forward-most and middle positions and the seat back was slightly reclined. The front plane impact to the SKT resulted in deployment of the driver's frontal air bag. The driver was displaced forward and to the left and loaded the seat belt resulting in a 10 cm (4.0 in) long and 5 cm (2.0 in) wide contusion to her left shoulder. Her face loaded the frontal air bag causing a 5 cm (2.0 in) diameter contusion to her right forehead. Her left knee also contacted the lower left

instrument panel but neither she nor the medical records reported an injury from this contact. The driver rebounded and was then redirected to the left when the left plane of the vehicle impacted the deformed guardrail. The left side of her body probably contacted the intruded left front door and she rebounded to the right. She sustained a contusion on the outside of her lower right leg that extended from the ankle 31 cm (12.0 in) up the side of her lower right leg, probably from contacting the center console. She also sustained an abrasion to her right thigh from contacting the center console. The crash jammed the left front door shut, so the driver exited the vehicle through the right front door following the crash. She sustained police reported "B" (non-incapacitating) injuries but refused transport to a medical facility. She went to a trauma center emergency room by private vehicle the following day where she was treated in the emergency room for minor injuries and released.

Front Row Right Occupant Demographics

Age/Sex:	25 years/Female
Height:	163 cm (64 in)
Weight:	68 kg (150 lbs)
Eyewear:	None
Seat Type:	Bucket with folding back
Seat Track Position:	Between forward-most and middle
Manual Restraint Usage:	None
Usage Source:	Occupant's medical record and vehicle inspection
Air Bags	Frontal deployed
Alcohol/Drug Involvement:	Not reported
Egress from Vehicle:	Exited through right front door without assistance
Transport from Scene:	Ambulance
Medical Treatment:	Treated in trauma center emergency room and released

Front Right Occupant Injuries

Injury No.	Injury	AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Sprain left shoulder with tenderness on palpation, not further specified	771010.1	Center instrument panel	Probable
2	Hematoma (cephalohematoma), small, left frontal scalp, not further specified	110402.1	Front (windshield) header, above rearview mirror	Probable
3	Laceration, 3.0 cm (1.2 in) in length, above left eye, not further specified	210602.1	Rearview mirror	Probable

Sources: Emergency Room Records, EMS treatment Record, and Interviewee Data–Driver. Injury Numbers 1 and 2 came only from ***Emergency Room Records****. Injury Number 3 came from a combination of all three sources.*

Front Row Right Occupant Kinematics

The front row right occupant was not belted. Her seat track was adjusted between the forward-most and middle positions and the seat back was slightly reclined. The front plane impact with the SKT resulted in deployment of the occupant's frontal air bag. She was displaced forward and to the left and her left shoulder contacted the center instrument panel resulting in a sprained left shoulder. Her face contacted the rearview mirror resulting in a 3 cm (1.2 in) long laceration above her left eye. Her head contacted the windshield header causing a small hematoma to the left frontal scalp. She was then redirected to the left when the left plane of the vehicle impacted the guardrail. She exited the vehicle through the right front door. The occupant sustained police-reported "B" (non-incapacitating) injuries and was transported by ambulance to a trauma center where she was treated in the emergency room for minor injuries and released.

Second Row Right Occupant Demographics

Age/Sex:	27 years/Male
Height:	180 cm (71 in)
Weight:	84 kg (185 lbs)
Eyewear:	None
Seat Type:	Bench with folding back
Seat Track Position:	Fixed
Manual Restraint Usage:	None
Usage Source:	Occupant's medical record and vehicle inspection
Air Bags	None
Alcohol/Drug Involvement:	Not reported
Egress from Vehicle:	Exited through right front door without assistance
Transport from Scene:	None
Medical Treatment:	Transported by private vehicle to trauma center next day, treated in emergency room and released

Second Row Right Occupant Injuries

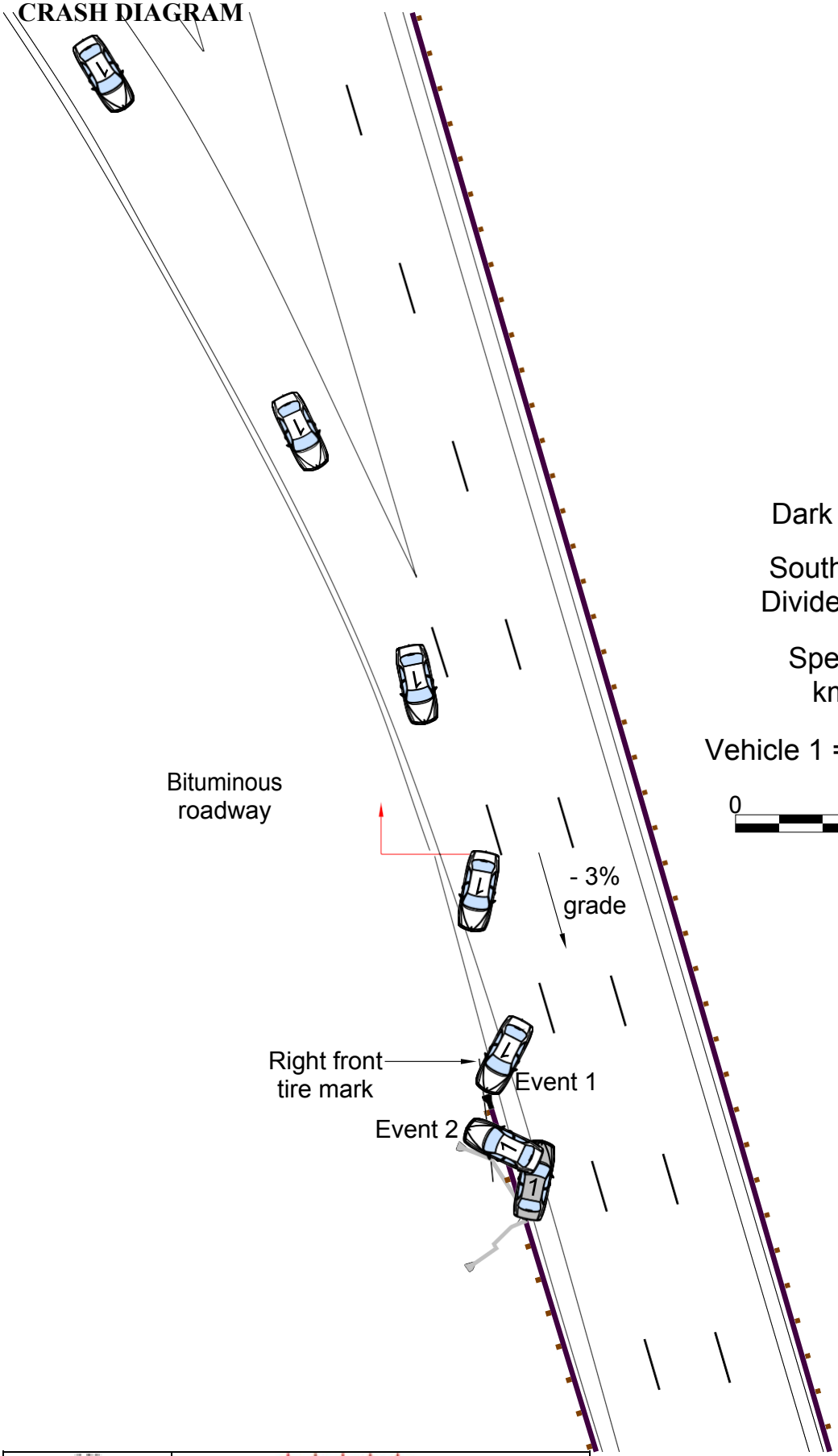
Injury No.	Injury	AIS 2015	Involved Physical Components (IPC)	IPC Confidence Level
1	Strain, lumbosacral, not further specified	640678.1	Noncontact injury: impact forces	Probable
2	Contusion posterior (back of) left lower leg, with tenderness from left knee to foot, not further specified	810402.1	Second row seat cushion	Probable

*Sources: Emergency Room Records and Interviewee Data–Driver. Injury Number 1 came only from **Emergency Room Records**. Injury Number 2 came from a combination of **Interviewee Data** and **Emergency Room Records**.*

Second Row Right Occupant Kinematics

The second row right occupant was not belted. The front plane impact with the SKT displaced the occupant forward and to the left and he contacted the back of the front row right seat. He rebounded and was then redirected to the left when the left plane of the vehicle impacted the guardrail. The occupant sustained a contusion to the back of his left lower leg, probably from contacting the seat cushion. He also sustained a lumbosacral strain from impact forces. He exited the vehicle through the right front door. The occupant sustained police-reported “B” (non-incapacitating) injuries but refused transport to a medical facility. He went to a trauma center emergency room by private vehicle the following day where he was treated in the emergency room for minor injuries and released.

CRASH DIAGRAM



	NHTSA www.nhtsa.gov
Case Number:	IN16021

APPENDIX:
IN-SERVICE END TREATMENT DATA COLLECTION FORM

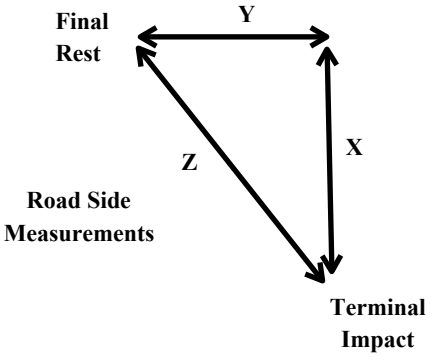
Case No.: IN16021

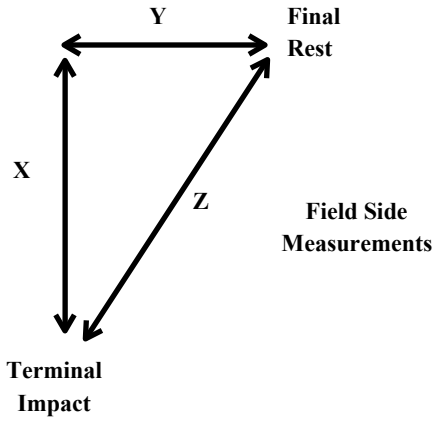
PREPOPULATED DATA (BY OTHERS)			
Date of Crash	August 2016	**TIME OF CRASH (MILITARY)**	0053
Case Number	IN16021	**State**	Missouri
Traffic Route	State Highway	**Direction (Southbound = SB)**	SB
Ambient Conditions (at time of crash)			
Temperature (°F)	70	**Lighting**	Dark
Atmospheric	Light rain		

SCENE INFORMATION	
Type of area where crash occurred	❒Urban ❒Rural ☒Suburban
Terminal on a horizontal curve?	☒No ❒Curve/LT ❒Curve/RT
Estimated or Reconstructed Speed at Impact (MPH)	35 mph
Est. distance (straight line) from terminal impact to COM final rest position (ft.)	Z = 25 ft
Est. distance (longitudinal) along guardrail from terminal impact to COM final resting location (ft.)	X = 25 ft
Est. distance (normal) from either 1. the white paint line; or 2. roadway/shoulder/pavement edge to COM rest position (ft.)	Y = 1 ft (To edge line)
Super elevation	❒+2% ❒-2% ☒ NONE or FLAT
Curve Radius (ft.)	None

KEY:

- COM - Center of Mass of Vehicle
- Distance Measurements





Case No.: IN16021

ON-SCENE INFORMATION								
End Treatment Type	❒Extruder	❒ET2000	❒ET-PLUS 4in	❒ET-PLUS 5in	☒SKT	❒FLEAT	❒SOFT STOP	
	❒Telescope	❒X-LITE	❒X-TENSION					
Curb?	☒No ❒Yes	❒AASHTO Type A	❒AASHTO Type B	❒AASHTO Type C	❒AASHTO Type D	❒AASHTO Type E		
		❒AASHTO Type F	❒AASHTO Type G	❒AASHTO Type H				
Curb Height:								

GUARDRAIL INSTALLATION									
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
1	Steel	6 x 6	None		Unk		4.7		6”4”
2	Steel	6 x 4	None		Unk		4.5		6’7”

Case No.: IN16021

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	4x7.5	Unk		5.4		6’10”
4	Steel	6 x 4	Composite	4x7.5	Unk		5.2		5’2”
5	Steel	6 x 4	Composite	7.5x3.8	Unk		4.9		6’3”
6	Steel	6 x 4	Composite	7.5x3.8	No		4.9		6’5”
7	Steel	6 x 4	Composite	7.5x3.8	No		4.8		6’4”
8	Steel	6 x 4	Composite	7.5x3.8	No		4.6		6’11”

Case No.: IN16021

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	7.5x3.8	No		4.5		5’6”
10	Steel	6 x 4	Composite	7.5x3.8	No		4.4		6’2”
11	Steel	6 x4	Composite	7.5x3.8	No		4.3		6’3”
12	Steel	6 x 4	Composite	5.5x3.8	No		4.0		6’2”

Additional Comments

Case No.: IN16021

EXTRUDER			
Feeder Channel Width at impact head	❒4inches ❒5 inches ☒Other 4.5 in		
Guide Chute Exit Height (in.)	13 in		
Connection of feeder channels to head damaged?	☒No ❒Yes	Are Welds Broken?	☒No ❒Yes
Anchor Cable Present?	❑No ☒Yes	Connected?	☒No ❒Yes
Rail Extrusion?	❒No ☒Yes	Length (ft. in.)	5 ft 10 in
Rail Extrusion Direction	❒Traffic Side ☒Field Side		
Total Length of Rail Damaged (ft.) [total length would include extruded rail plus damaged rail downstream from head.]	27		

TELESCOPE				
Rail Displacement	❒No	❒Yes; Length:	No of Panels Displaced	❒1 ❒2 ❒3 ❒4 ❒5 ❒6

ALL-SYSTEM PERFORMANCE			
Railkinks Downstream of Head?	❒No	☒Yes ;	No. of Kinks in Rail: 5
Was there intrusion into the Occupant Compartment by foreign object (guardrail)?	☒No ❒Yes		
Did vehicle impact other objects after impact with terminal?	❑No ☒Yes		
Object Contacted	Guardrail		

ALL-SYSTEM PERFORMANCE ENVIRONMENT			
SIDESLOPE	**50 ft in advance of Post 0**	**At Post 0**	**50 ft Past Post 0**
Percent - %	-6%	-3%	-5%
Adjacent Lane Width (ft)	10.9 ft		
Lane Type (NAS EDS Variable: Sur. Type)	Bituminous		
Shoulder Type	Bituminous		

Shoulder Width (ft)	2.9
Guardrail Height (in)	28

VEHICLE INFORMATION		
Vehicle Type (NHTSA Input)	2-door passenger vehicle	
Vehicle Identification Number (VIN)	1FALP42XXTFxxxxxx	
Vehicle Mass (NASS var.: veh.wgt)	3352 lbs	
Vehicle orientation upon impact	❑ Case Type 1 ❒ Case Type 2 ❒ Case Type 3 ☒ Case Type 4 ❒ Case Type 5 ❒ Case Type 6 ❒ Case Type 7 ❒ Case Type 8 ❒ Other	
If 'Other', describe		
Collision Deformation Classification	11FYEW1	
Delta-V	Unknown (WinSMASH BES = 9 mph)	
Occupant Compartment Penetration of rail	☒ No	❒ Yes; Describe:
Quarter Turns (NASS EDS variable: Rollover)	❑ 1 ❒ 2 ❒ 3 ❒ 4 ❒ 5 ❒ 6 ❒ 7 ❒ 8 ❒ 9 ❒ 10 ❒ 11 ❒ 12 ❒ 13 ❒ 14 ❒ 15 ❒ 16 ❒ 17+	
Object Precipitating Rollover, (NASS EDS variable: Rollobj)	N/A	
Rollover Type, Terhune Scale, (NASS EDS variable: rolintyp)	N/A	

DOT HS 812 646
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**National Highway
Traffic Safety
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