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

NHTSA

DOT HS 812 939

May 2020

Special Crash Investigations: On-Site Guardrail End Terminal Investigation; Vehicle: 2000 Toyota Tacoma; Location: Missouri; Crash Date: October 2017

DISCLAIMER

Suggested APA Format Citation:

Indiana University Transportation Research Center. (2020, May). *Special Crash Investigations: On-Site Guardrail End Terminal Investigation; Vehicle: 2000 Toyota Tacoma; Location: Missouri; Crash Date: October 2017* (Report No. DOT HS 812 939). National Highway Traffic Safety Administration.

Technical Report Documentation Page

1. Report No. DOT HS 812 939	**2. Government Accession No.**	**3. Recipient's Catalog No.**	
4. Title and Subtitle Special Crash Investigations: On-Site Guardrail End Terminal Investigation; Vehicle: 2000 Toyota Tacoma; Location: Missouri; Crash Date: October 2017		**5. Report Date**: May 2020 **6. Performing Organization Code**	
7. Author Indiana University Transportation Research Center		**8. Performing Organization Report No.** IN17030	
9. Performing Organization Name and Address Indiana University Transportation Research Center 501 South Madison Street, Suite 105 Bloomington, IN 47403		**10. Work Unit No. (TRAIS)** 11. Contract or Grant No. DTNH22-12-C-00270	
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration National Center for Statistics and Analysis (NSA 110) 1200 New Jersey Avenue SE Washington, DC 20590		**13. Type of Report and Period Covered** Technical Report **14. Sponsoring Agency Code**	
15. Supplementary Notes Each crash represents a unique sequence of events, and 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 submitted.			
16. Abstract This report documents the on-site investigation of a pickup truck impact to an ET2000 guardrail end terminal that is of interest to the Federal Highway Administration. This crash occurred on the east side of the northbound lanes of a four-lane, divided State highway. The Toyota Tacoma was a 2-door pickup truck equipped with redesigned frontal air bags driven by an unbelted 21-year-old male with an unbelted 22-year-old female front-row center passenger and 4-year-old female front-row right passenger. The front-row right passenger was seated in a forward-facing child restraint system (CRS). An unknown vehicle sideswiped the left plane of the Toyota, resulting in the Toyota's departing the right side of the roadway where its front plane struck the end terminal. The driver of the Toyota was not injured. The front-row center and right passengers sustained police-reported "C" (possible) injuries and were not transported from the scene to a medical facility.			
17. Key Words ET-2000 guardrail end terminal		**18. Distribution Statement** Document is available to the public from the National Technical Information Service, www.ntis.gov.	
19. Security Classif. (of this report) Unclassified	**20. Security Classif. (of this page)** Unclassified	**21. No. of Pages** 21	**22. Price**

Form DOT 1700.7 (8-72) Reproduction of completed page authorized

Table of Contents

Special Crash Investigations
On-Site Guardrail End Terminal Investigation
Case Number: IN17030
Vehicle: 2000 Toyota Tacoma
Location: Missouri
Crash Date: October 2017

BACKGROUND

This report documents the on-site investigation of a pickup truck impact to an ET2000 guardrail end terminal (**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 images of the damaged end terminal and vehicle to the FHWA. The FHWA determined that the end terminal and crash type were of interest for further research. This crash investigation was then initiated by the National Highway Traffic Safety Administration in October 2017 and assigned to the Special Crash Investigation team at the Indiana University Transportation Research Center. This crash involved a 2000 Toyota Tacoma pickup truck (**Figure 2**), an unknown vehicle and an impact to a guardrail end terminal. The crash occurred in Missouri in October 2017 during daylight and was investigated by a local police agency. The guardrail, the crash scene, and the vehicle were inspected in October 2017.

Figure 1. The damaged end terminal and guardrail.

Figure 2. The damaged 2000 Toyota Tacoma.

This crash occurred on the east side of the northbound lanes of a four-lane, divided State highway. The Toyota was a 2-door pickup truck equipped with redesigned frontal air bags. The vehicle was not equipped with an event data recorder that was supported by a commercially available tool. The Toyota was driven by an unbelted 21-year-old male driver with an unbelted 22-year-old female front-row center passenger and 4-year-old female front-row right passenger. The front-row right passenger was seated in a forward-facing child restraint system (CRS). The Toyota was traveling in the right northbound through lane. An unknown vehicle sideswiped the left plane of the Toyota (Event 1), resulting in the Toyota's departing the right side of the roadway where its front plane struck the end terminal (Event 2). The vehicle came to final rest on the field side of the guardrail facing southeast. The driver of the Toyota was not injured. The front-row center and right passengers sustained police-reported "C" (possible) injuries but were not transported from the scene to a medical facility. The front-row right passenger was taken to

the hospital at a later time, where she was treated and released. The Toyota was towed from the crash scene due to damage.

Figure 3. Northbound approach of the Toyota.

Figure 4. Sideswipe damage to the left side of the Toyota's truck bed.

Figure 5. North-facing view of the area of the Toyota's roadway departure.

SUMMARY

Crash Site

This crash occurred during daylight on the east side of the northbound lanes of a curved, four-lane, divided State highway. The weather conditions at the time of the crash were clear visibility, north-northeast winds at 24 km/h (15 mph), a temperature of 11.1 °C (52 °F), and a dew point of 5.0 °C (41 °F), according to local weather reports. The highway traversed in a north/south direction and had two bituminous through lanes in each direction that were divided by a grass median with a guardrail median barrier. The northbound roadway was bordered by a 1.0 m (3.3 ft) wide bituminous median shoulder and a 2.9 m (9.5 ft) wide bituminous right shoulder. The right northbound lane was 3.9 m (12.8 ft) wide and the left northbound lane was 4.1 m (13.4 ft) wide. The northbound roadway was curved to the right and had a calculated radius of curvature of 1,412 m (4,631.4 ft). The travel lanes were bordered by rumble strips and the two travel lanes were separated by broken white pavement markings. A blocked-out W-beam guardrail equipped with an ET2000 end terminal was located on the right side of the road adjacent to the shoulder. The speed limit was 105 km/h (65 mph). A crash diagram is included at the end of this report on page 9.

Pre-Crash

The Toyota was traveling north in the right northbound lane (**Figure 3**). The police crash report stated that the vehicle departed the right side of the roadway for an unknown reason. However, the SCI inspection of the Toyota revealed sideswipe damage to the left plane, indicating that a hit-and-run vehicle probably struck the left plane of the Toyota, resulting in the vehicle's departing the right side of the roadway. The police-reported measurements of the crash scene indicated that the Toyota departed the roadway 50.3 m (165.0 ft) prior to the ET2000. Tire marks found on the roadside during the SCI crash scene inspection indicated that the angle of the vehicle's approach

trajectory to the ET2000 was 5 degrees relative to the edge of the roadway.

Crash

The left plane of the Toyota (**Figure 4**) was sideswiped by an unknown vehicle (Event 1). The impact resulted in the Toyota departing the right side of the roadway (**Figure 5**) where the front plane (**Figure 6**) struck the end terminal (**Figure 7**, event 2). The impact extruded 5.9 m (19.3 ft) of guardrail to the field side, fractured four wood posts, and damaged 15.2 m (50.0 ft) of guardrail. The force direction on the vehicle was in the 12 o'clock sector and the impact resulted in deployment of both frontal air bags. The impact speed is not known and 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 34 km/h (21 mph) based on the crush to the front plane. The vehicle came to final rest on the field side of the guardrail heading southeast after traveling 9.2 m (30.2 ft) from the impact and rotating counterclockwise 245 degrees.

Figure 6. Damage to the front plane of the Toyota from the impact with the end terminal.

Figure 7. The damaged end terminal.

Post-Crash

The driver and both passengers were out of the vehicle upon police arrival. The driver told police that he "only remembers an impact." The driver was not injured. The front-row center and right passengers each sustained police-reported "C" (possible) injuries and were not transported from the scene to a medical facility. The right front passenger was taken to a hospital at a later time where she was treated and released. The Toyota was towed from the crash scene due to damage.

END TERMINAL AND GUARDRAIL DAMAGE

The front-plane impact of the Toyota to the end terminal extruded 5.9 m (19.3 ft) of guardrail to the field side. The direct damage involved the full height and width [52 cm (20.5 in) and 51 cm (20.1 in)] of the face of the end terminal. Posts 1 to 8 were constructed of wood and had wood offset blocks with the exception of post 1. The remaining posts were constructed of steel and had steel offset blocks. Posts 1 to 4 were fractured and displaced. Post 5 was slightly damaged and the bolt was pulled through the guardrail. The wooden offset block for post 6 was slightly displaced and the guardrail remained bolted to the post. The remaining posts were undamaged. The crash damaged 15.2 m (50.0 ft) of guardrail. The feeder channel width at the impact head was 13 cm (5.0) wide. The guide chute exit height was 38 cm (15.0 in). The connection of the feeder channel to the head was undamaged and no welds were broken. The anchor cable was disconnected and was found near post 5. There were no kinks in the guardrail. The FHWA guardrail form is attached to the end of this report as **Appendix A**.

2000 TOYOTA TACOMA

Description

The Toyota Tacoma was a regular cab 2-door pickup truck with the Deluxe trim level that was manufactured in October 1999 and identified by Vehicle Identification Number 4TANL42N4YZxxxxxx. It was powered by a 2.4-liter, I-4 engine linked to a 4-speed automatic transmission with a column-mounted shift lever and rear-wheel drive. The specified wheelbase was 263 cm (103.5 in). The vehicle manufacturer's recommended tire size was P195/75R14. At the time of the crash, the Toyota was equipped with Firestone Destination LE tires size P225/70R14. The vehicle manufacturer's recommended cold tire pressures for the front and rear tires were 200 kPa (29 psi) and 241 kPa (35 psi), respectively.

The interior was configured with a cloth-covered three-passenger bench seat with a forward-folding seat back and integrated head restraints for the driver and front-right positions. The seat track was adjusted between the middle and rear-most positions. The seatback was not adjustable. Safety systems consisted of manual 3-point lap and shoulder seat belt for the driver and front-row right positions. The center position was equipped with a lap belt. The driver's D-ring was adjusted to the full-down position while the front-row right was adjusted to the full-up position. Supplemental restraint was provided by a redesigned (depowered) frontal air bag system for the driver and front-right positions. Both air bags deployed during the guardrail crash event (Event 1).

Exterior Damage

Exterior Damage Event 1

The Toyota sustained sideswipe-type damage to the left side of the truck bed during the impact with a hit-and-run vehicle (Event 1). The direct damage began 7 cm (2.8 in) rear of the left rear axle and extended 93 cm (36.6 in) rearward. The Field L was also 93 cm (36.6 in). Crush measurements were taken at the mid-door level and the maximum residual crush was 1 cm (0.4 in) occurring 100 cm (39.4 in) rear of the right rear axle. The crush values were C_1 = 1 cm (0.4 in), C_2 = 0 cm, C_3 = 0 cm, C_4 = 0 cm, C_5 = 0 cm, and C_6 = 0 cm.

Damage Classification Event 1

The Collision Deformation Classification (CDC) was 06LBMS1 (180 degrees). The severity of the damage was minor.

Exterior Damage Event 2

The front plane sustained direct and induced damage during the impact with the end terminal and guardrail. The direct damage began 17 cm (6.7 in) right of the left bumper corner and extended 117 cm (46.1 in) to the right across the front plane. The Field L was 148 cm (58.3 in). The edges of the end terminal were stamped into the bumper and the direct damage length from the end terminal was 50 cm (19.6 in) beginning at the same location. Crush measurements were

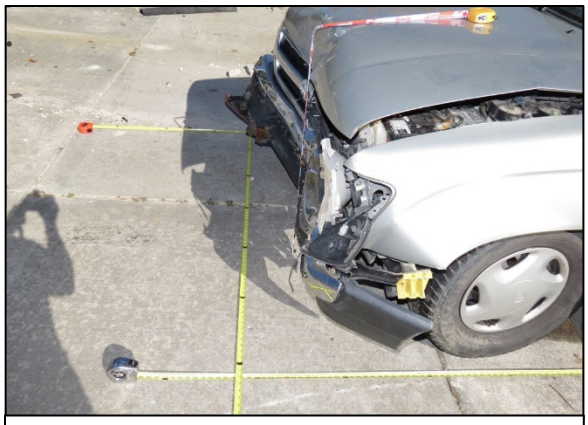


Figure 8. Left lateral view depicting the crush of the Toyota.

taken at the bumper level. The residual crush profile (**Figure 8**) was C1 = 3 cm (1.3 in), C2 = 15 cm (5.9 in), C3 = 27 cm (10.6 in), C4 = 25 cm (9.8 in), C5 = 9 cm (3.5 in), and C6 = 0. The maximum residual crash was 27 cm (10.6 in) occurring 10 cm (3.9 in) left of the vehicle's centerline. A portion of a fractured wood post remained engaged to the undercarriage below the level of the bumper.

Damage Classification Event 2
The CDC was 12FDEW2 (0 degree). The severity of the damage was moderate.

Event Data Recorder
The Toyota was not equipped with an EDR that was supported by the Bosch Crash Data Retrieval tool.

Interior Damage
There was no intrusion to the occupant compartment of the Toyota. Evidence of occupant contact consisted of a (possible) scuff to the left sun visor and a (certain) contact to the upper left aspect of the windshield by the driver's head evidenced by a spider web. The center aspect of the windshield was fractured in a spider web-shaped pattern from probable head contact by the front-center passenger. There was a scuff mark on the right aspect of the windshield header from possible contact by the right passenger's hand. Located below that suspected contact was a fracture to the windshield surrounded by an air bag fabric transfer or a skin oil transfer. There was no damage to the side glazing. Both doors remained closed and operational.

Manual Restraint Systems
The front row was equipped with a manual lap and shoulder seat belt with sliding latch plate and adjustable upper anchor for the driver and front-right passenger. The driver and right passenger's upper anchors were adjusted to the full-down and full-up positions, respectively. The driver's retractor was an emergency locking retractor (ELR) while the front-right passenger was a switchable ELR/automatic locking retractors (ALR). Both front-row retractors were configured with pretensioners. The front-row center seating position was equipped with a lap belt with locking latch plate.

The driver was not belted as evidenced by the seat belt webbing pulled tautly into the retractor from pretensioner actuation. Inspection of the front-center seat belt revealed no evidence of usage. Observation of the front-right passenger's seat belt found the retractor locked, due to the pretensioner actuation, with the webbing in an extended position. Inspection of the passenger's seat belt webbing revealed a 10 cm (3.9 in) long scuff from the D-ring that was located 150 cm (59.1 in) from the floor anchor. The belt webbing was folded and entrapped in the latch plate belt path. The police report stated that the child front-right passenger was seated in a forward-facing CRS and the observed evidence on the belt webbing indicated that the CRS was secured by the seat belt. The CRS was not available for SCI inspection.

Supplemental Restraint Systems
The Toyota was equipped with redesigned frontal air bags. Both air bags deployed during the impact with the ET-Plus end terminal. The driver air bag deployed from an H-configuration module located in the 4-spoke steering wheel rim. The deflated driver air bag measured 63 cm

(24.8 in) in diameter and was devoid of contact evidence. The front-right passenger air bag deployed through an H-configuration module mounted in the right aspect of the instrument panel. The passenger air bag measured 50 cm x 55 cm (19.7 in x 21.7 in) width by height in its deflated state. There was no damage or contact evidence to the deployed passenger air bag.

2000 TOYOTA TACOMA OCCUPANTS

Driver Demographics

Age/sex:	21 years/male
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat type:	Bench
Seat track position:	Between middle and rear-most
Manual restraint usage:	None
Usage source:	Vehicle inspection
Air bags:	Frontal, deployed
Alcohol/drug data:	Unknown
Egress from vehicle:	Exited under own power
Transport from scene:	None
Medical treatment:	None

Driver Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Not injured	N/A	N/A	N/A

Source: police report.

Driver Kinematics

The driver was seated with the seat track adjusted between the middle and rear-most positions. He was not wearing the manual seat belt system. The lack of seat belt use was determined from the taut and stowed position of the seat belt against the B-pillar from pretensioner actuation.

The sideswipe impact to the left plane of the Toyota probably resulted in only minor displacement of the driver in a rearward direction. As unrestrained, he initiated a forward trajectory in response to the 12 o'clock direction of force impact with the end terminal. This event also deployed the frontal air bag system and actuated the retractor pretensioners. His torso contacted the deployed air bag which prevented him from direct contact with the steering assembly. The driver's head probably struck and fractured the windshield at the upper left area of the A-pillar/header juncture. No injury resulted from the contact. The driver rebounded and was redirected to the right as the vehicle rotated counterclockwise and decelerated to final rest. The driver denied injury and was not medically treated.

Front-Row Center Occupant Demographics

Age/sex:	22 years/female
Height:	Unknown
Weight:	Unknown
Eyewear:	Unknown
Seat type:	Bench
Seat track position:	Between middle and rear-most
Manual restraint usage:	None
Usage Source:	Vehicle inspection
Air bags:	None
Alcohol/drug data:	Unknown
Egress from vehicle:	Exited under own power
Transport from scene:	None
Medical treatment:	Unknown if sought treatment later

Front-Row Center Occupant Injuries

Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Unknown/unspecified possible "C-level" injuries	Unknown	Unknown	Unknown

Source: police report.

Front-Row Center Occupant Kinematics

The front-row center occupant was unbelted with the seat track adjusted between the middle and rear-most positions. The occupant probably sustained little displacement during the sideswipe impact to the left plane of the Toyota. She was then displaced forward during the front-plane impact to the end terminal and probably engaged the deployed front-right air bag. There was no contact evidence to the air bag that prevented her from direct contact with the instrument panel. She struck her head on the windshield header and windshield creating a scuff and spider web-shaped fracture respectively right of the vehicle's centerline. The front-row right passenger probably sustained contact with the unrestrained driver and the CRS due to the small space of the occupant compartment of the Toyota. Immediately following the crash, she exited the vehicle and complained of possible injury, but refused medical treatment and transport at the scene.

Front-Row Right Occupant Demographics

Age/sex:	4 years/female
Height:	Unknown
Weight:	15 kg (33 lb)
Eyewear:	Unknown
Seat type:	Bench
Seat track position:	Between middle and rear-most
Manual restraint usage:	Forward-facing CRS (unknown make/model)
Usage source:	Vehicle inspection
Air bags:	Frontal, deployed
Alcohol/drug data:	None

Egress from vehicle:	Exited with assistance
Transport from scene:	Private vehicle
Medical treatment:	Treated and released from Level 2 trauma center

Front-Row Right Occupant Injuries

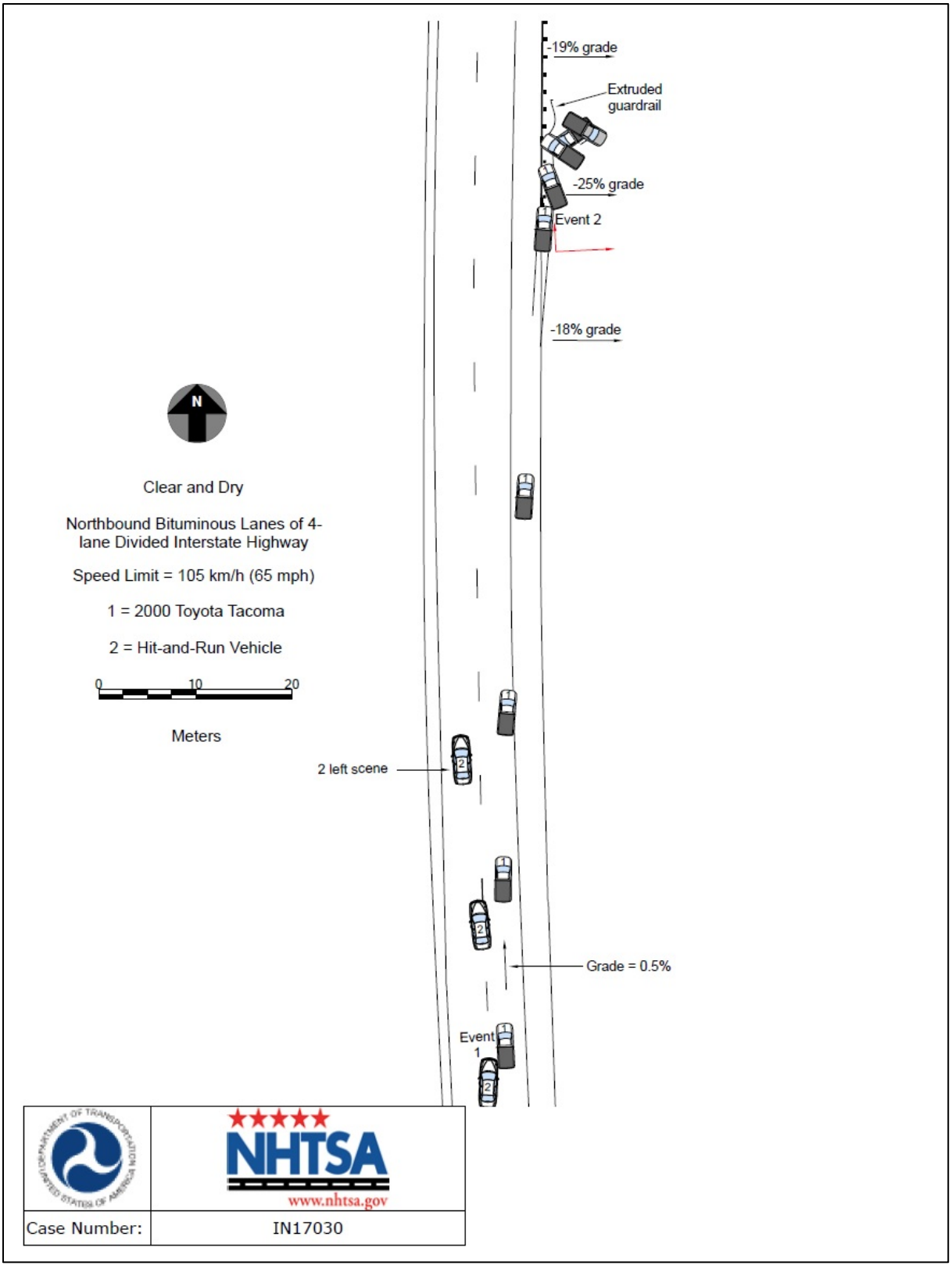
Injury No.	Injury	Injury Severity AIS 2015	Involved Physical Component (IPC)	IPC Confidence Level
1	Contusion to left forehead, NFS	210402.1	Unknown	Unknown

Source: emergency room records.

Front-Row Right Occupant Kinematics

The front-row right occupant was seated in a forward-facing CRS with the seat track adjusted between the middle and rear-most positions. The CRS was not available for inspection. Based on the frictional transfer on the seat belt webbing, it was presumed that the CRS was secured by the vehicle's seat belt system. However, without an inspection of the CRS, the routing of the seat belt, the specific type of CRS, and the restraint of the child occupant in the CRS are unknown; occupant contact and injury sources cannot be determined. The right passenger air bag deployed at impact with the end terminal as the child and CRS would have responded to the forward direction of force. The child passenger sustained a contusion of the forehead from an unknown source. She was later transported to a local hospital for evaluation where she was treated and released.

CRASH DIAGRAM



APPENDIX A: FHWA Guardrail Form

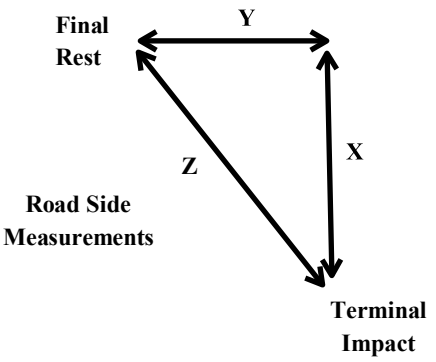
Case No.: IN17030

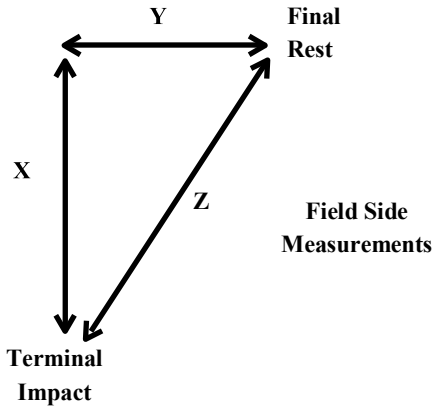
PREPOPULATED DATA (BY OTHERS)			
Date of Crash	October 2017	**TIME OF CRASH (MILITARY)**	Afternoon
Case Number	IN17030	**State**	Missouri
Traffic Route	Interstate	**Direction (Southbound = SB)**	NB
Ambient Conditions (at time of crash)			
Temperature (°F)	52	**Lighting**	Daylight
Atmospheric	Clear		

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)	Unknown
Est. distance (straight line) from terminal impact to COM final rest position (ft.)	Z = 30.2 ft
Est. distance (longitudinal) along guardrail from terminal impact to COM final resting location (ft.)	X = 25.9 ft
Est. distance (normal) from either 1. the white paint line; or 2. roadway/shoulder/pavement edge to COM rest position (ft.)	Y = 24.6 ft
Super elevation	❒+2% ☒-2% ☐ NONE or FLAT
Curve Radius (ft.)	1,412

KEY:

- COM - Center of Mass of Vehicle
- Distance Measurements





Case No.: IN17030

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	N/A	N/A
1	Wood	7.75 x 5.5	N/A	N/A	Unk	Unknown	10.5	N/A	6’ 2”
2	Wood	7.75 x 5.5	Wood	Unk	Unk	Unknown	11.1	N/A	6’ 4”

Case No.: IN17030

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	Wood	7.25 x 5.5	Wood	Unk	Unk	Unknown	10.8	N/A	6’ 3”
4	Wood	7.5 x 5.5	Wood	Unk	Unk	Unknown	10.7	N/A	5’ 9”
5	Wood	7.5 x 5.75	Wood	8 x 6	No		10.7	N/A	6’ 3”
6	Wood	7.25 x 6.5	Wood	7.25 x 6	No		10.2	N/A	6’ 3”
7	Wood	7.75 x 6	Wood	7.75 x 6	Yes	Small dent in bottom of rail	10.3	N/A	6’ 3”
8	Wood	8 x 6	Wood	7.75 x 6	No		9.9	N/A	6’ 0”

Case No.: IN17030

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	5.75 x 4	Steel	6 x 4	Yes	Corner of offset block bent	9.7	N/A	6’ 3”
10	Steel	5.75 x 4	Steel	6 x 4	No		9.6	N/A	6’ 3”
11	Steel	5.75 x 4	Steel	6 x 4	No		9.6	N/A	6’ 3”
12	Steel	6 x 4	Steel	6 x 4	Yes	Corner of offset block bent	9.7	N/A	6’ 4”

Additional Comments:

Case No.: IN17030

EXTRUDER			
Feeder Channel Width at impact head	❒4inches ☒5 inches ❒Other _Unknown		
Guide Chute Exit Height (in.)	15”		
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.)	19’ 4”
Rail Extrusion Direction	❒Traffic Side ☒Field Side N/A		
Total Length of Rail Damaged (ft.) [total length would include extruded rail plus damaged rail downstream from head.]	50		

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:	
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			

ALL-SYSTEM PERFORMANCE ENVIRONMENT			
SIDESLOPE	**50 ft in Aadvance of Post 1**	**At Post 1**	**50 ft Past Post 1**
Percent - %	-18%	-25%	-19%
Adjacent Lane Width (ft)	12.8		
Lane Type (NAS EDS Variable: Sur. Type)	Bituminous		
Shoulder Type	Bituminous		
Shoulder Width (ft)	9.8		

Guardrail Height (in)	25

VEHICLE INFORMATION		
Vehicle Type (NHTSA Input)	Pickup truck	
Vehicle Identification Number (VIN)	4TANL42N4YZxxxxxx	
Vehicle Mass (NASS var.: veh.wgt)	2,579	
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	12FDEW2	
Delta-V	Unknown (Barrier Equivalent Speed = 21 mph)	
Occupant Compartment Penetration of rail	☒ No	❒ Yes
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)		
Rollover Type, Terhune Scale, (NASS EDS variable: rolintyp)		

DOT HS 812 939
May 2020

U.S. Department
of Transportation

**National Highway
Traffic Safety
Administration**

14766-050720-v3