

DIBBLE



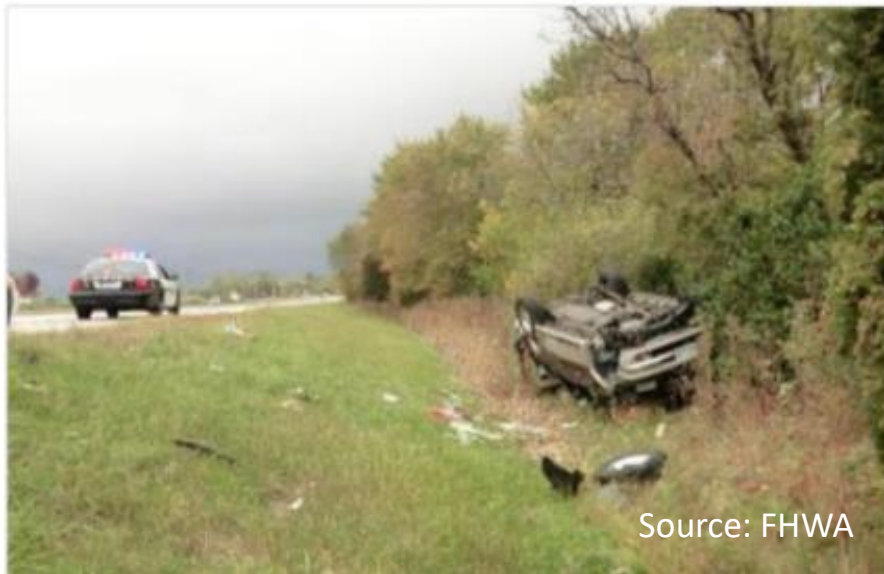
Roadway Departure Crashes, Guardrail End Treatment Issues, and “Frankensteined” Guardrail

By Seth Chalmers, PE
Director of Traffic Engineering

January 9, 2024

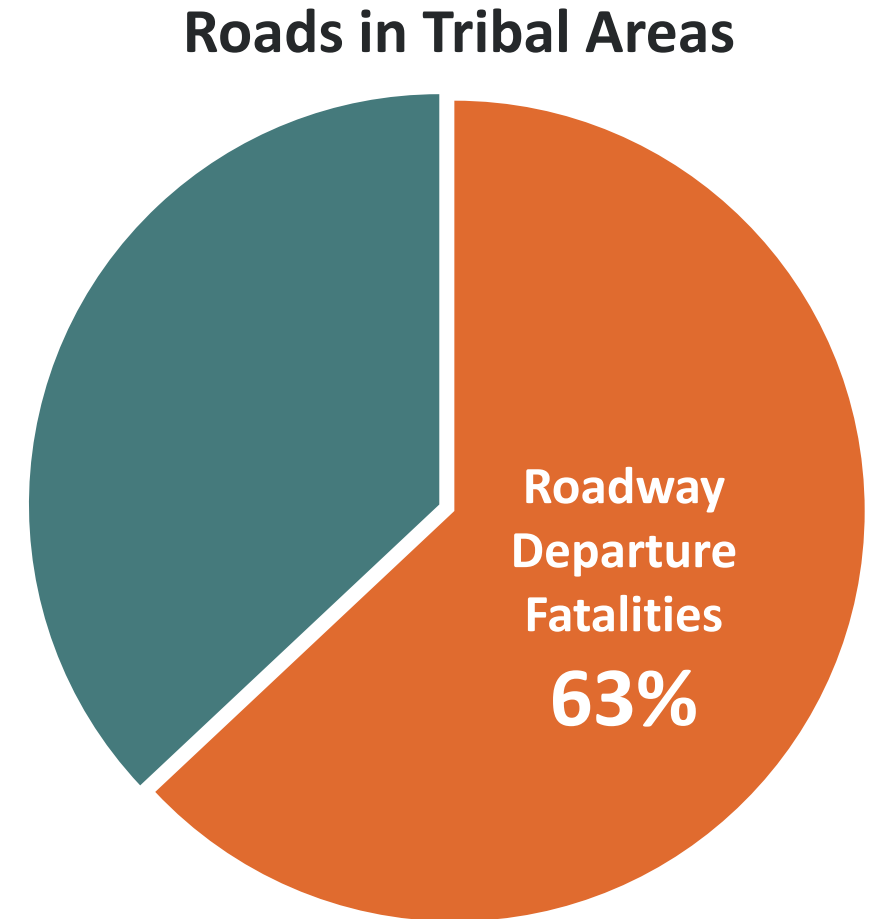
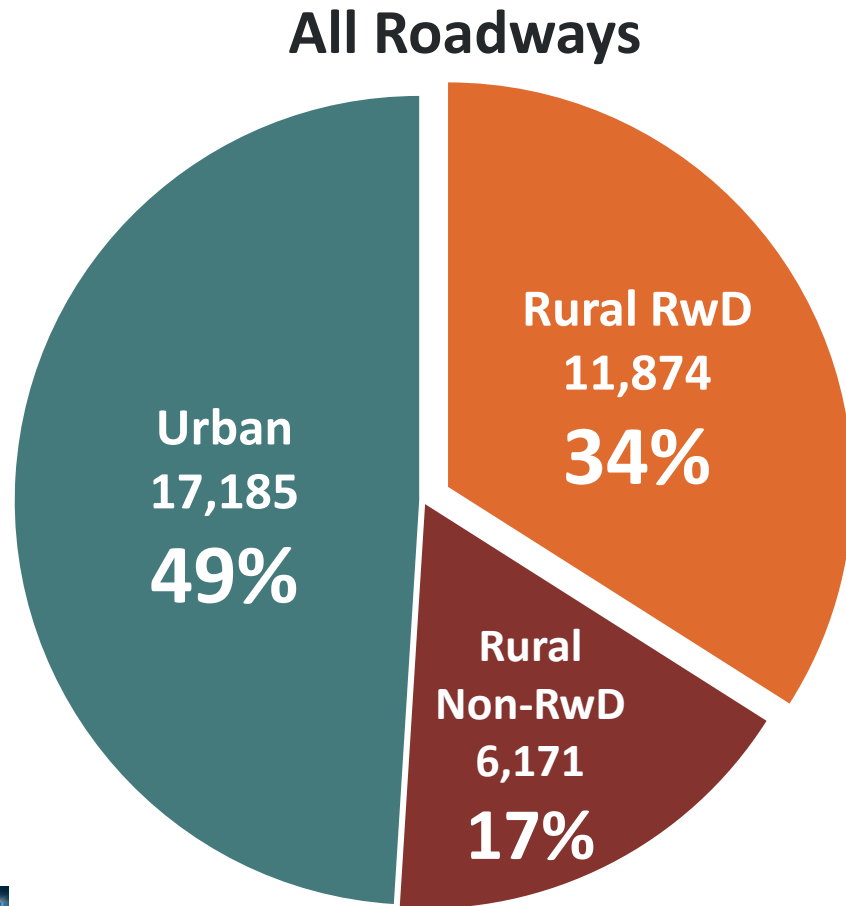
The Roadway Departure (RwD) Crash

- RwD crash: *“A crash which occurs after a vehicle crosses an edge line or a center line, or otherwise leaves the traveled way or lane.”*
- RwD crashes are primarily rural road crashes
- Guardrail crashes are almost always RwDs



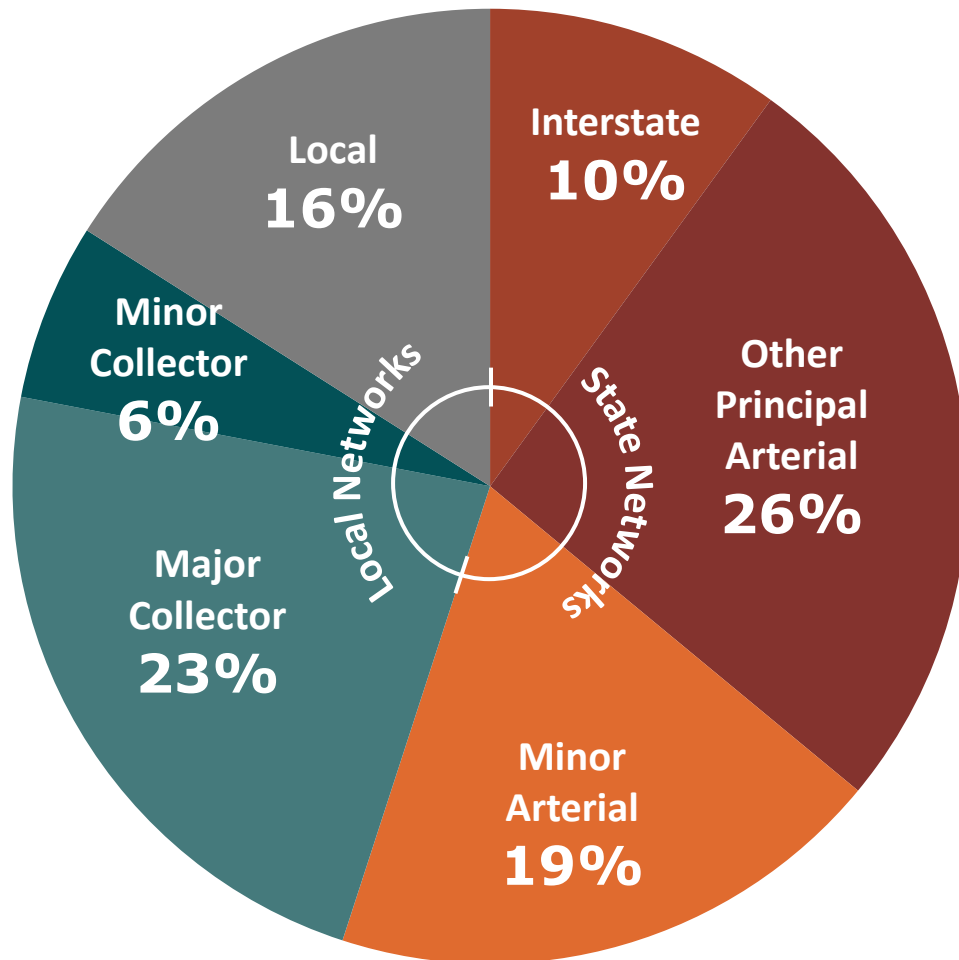
Rural RwD Fatalities

Annual average for 2014-2016: 11,743



Source: NHTSA FARS and
FHWA Safety, 2014-2016

All Rural Roadways Are Affected



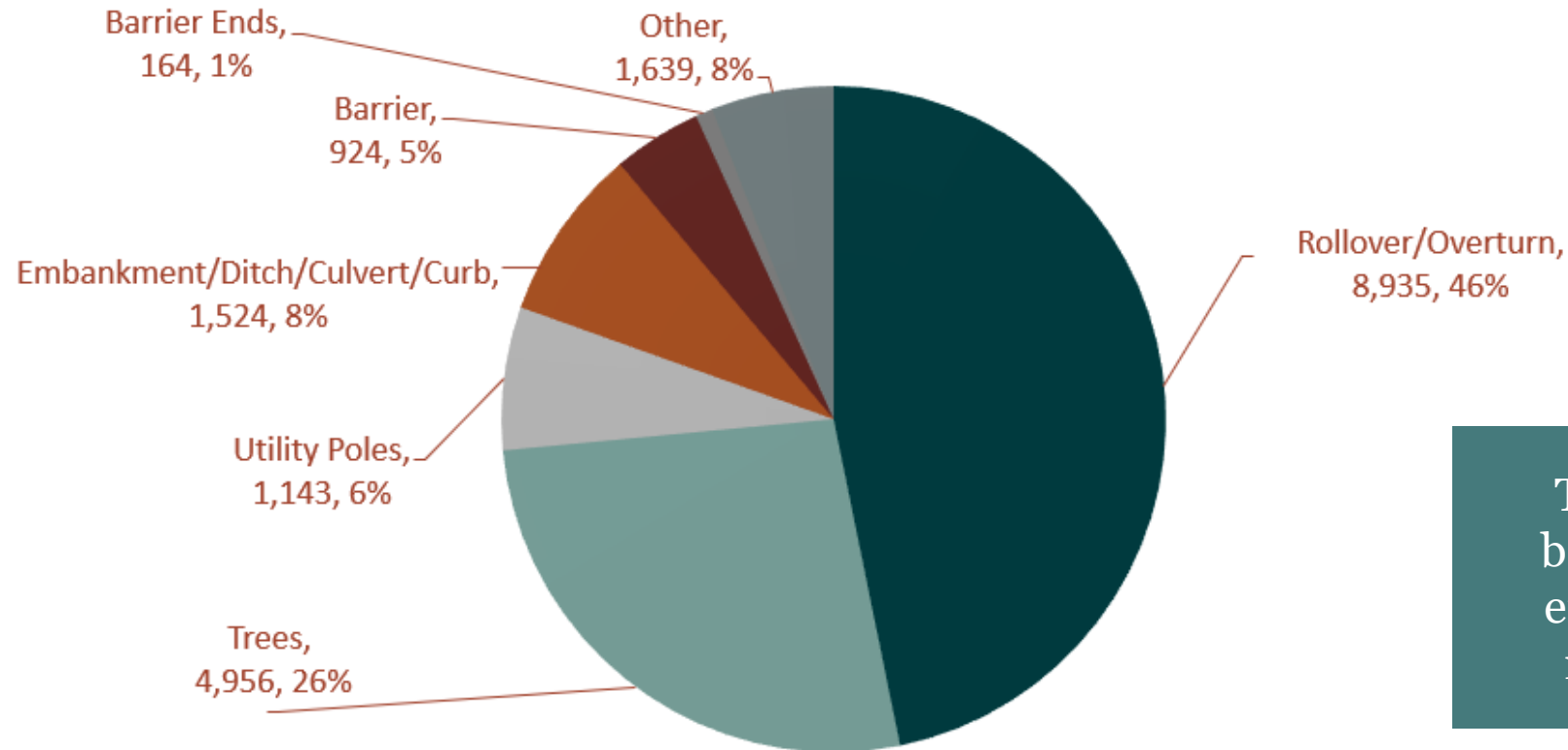
Addressing Rural
Roadway Departures on
All Public Roads –
FHWA
(focus on reducing
rural RwDs)



Source: NHTSA FARS and
FHWA Safety, 2014-2016

Total RwD Fatalities

Single Vehicle Fatal Crashes (2016) – 19,285



Total attributed to barriers and barrier ends is 1,088, 6% – mostly guardrails

Source: NHTSA FARS and Road Systems Inc.,
2016 (National Total – Most Harmful Event)

1967



Source: ADOT

I-10 west of Benson, AZ, on September 13, 1967. The passenger, Elsa Ann Walton, age 21, was killed after her husband crashed the car. Guardrail tragedies have been a part of American life for a long time. This guardrail probably did not have a guardrail end treatment (GET). There are still many guardrails in Arizona that do not have modern GETs, are functionally obsolete, have not been installed correctly, or have not been maintained/repared as needed. This is unacceptable.

2017

This experience shows the importance of in-service performance evaluations (ISPE), proper installation, maintenance, and upgrading to MASH standards.



Controversial guardrails linked to deaths get replaced as death toll climbs

Travis Dorman Knoxville (Tenn.) News Sentinel

Published 3:36 p.m. ET April 6, 2017 | Updated 4:57 p.m. ET April 6, 2017



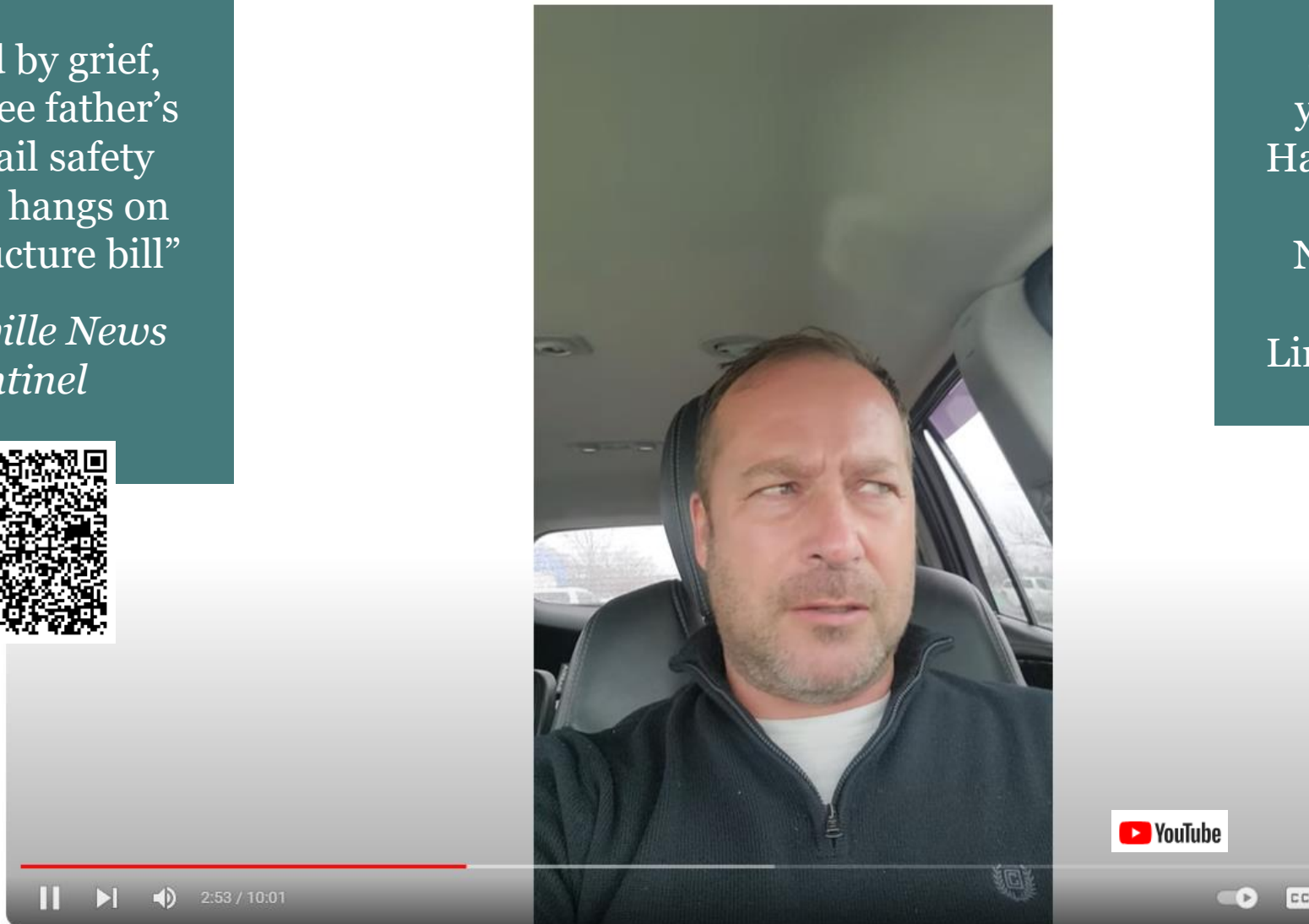
On Feb. 6, 2017, George Jansen's 2016 Chevrolet Silverado left Interstate 70 in Missouri and struck a Lindsay X-LITE guardrail. The rectangular hunk of metal jammed in the truck's engine bay, causing the beam to push Jansen out the rear window as the truck continued forward along the guardrail for another 168 feet. *Submitted By Missouri Highway Patrol*

“Fueled by grief,
Tennessee father’s
guardrail safety
mission hangs on
infrastructure bill”

—*Knoxville News
Sentinel*



Steve Eimers’ 17-
year-old daughter,
Hannah, was killed in
Tennessee on
November 1, 2016,
when she hit a
Lindsay X-LITE GET.



Hannah Eimers: I am Interested in Guardrail because My Daughter was Fatally SPEARED by a Guardrail



Steve Eimers Roadside Safety Advocate

@TheGuardrailGuy · 208K subscribers · 923 videos

America has almost a BILLION feet of guardrails and much of it is UNSAFE. Help me save l... >

twitter.com/SteveEimers and 1 more link

🔔 Subscribed

Home Videos Shorts Live Playlists Community 🔍



Hannah Eimers: I am Interested in Guardrail because My Daughter was Fatally SPEARED by a Guardrail

Steve Eimers Roadside Safety Advocate · 12K views · 1 year ago

This is the first video that will tell the story about why I am interested in guardrails and roadside safety. I will expand this description but I want to get it uploaded now.

10:02

For You



DIBBLE

Steve Eimers
Roadside Safety
Advocate
YouTube Channel –
“The Guardrail Guy”



Original FHWA Safety Eligibility Letter (September 2011)



1200 New Jersey Ave., SE
Washington, D.C. 20590

September 7, 2011

In Reply Refer To:
HSST/CC-120

Mr. Dallas James
Armorfex International Ltd.
8 Paul Matthews Road,
North Harbour 0751
New Zealand

Dear Mr. James:

This letter is in response to your request for Federal Highway Administration (FHWA) acceptance of a roadside safety system for use on the National Highway System (NHS).

Name of system:	X-LITE Terminal
Type of system:	Tangent & Flared Re-directive Gating W-Beam Terminal
Test Level:	NCHRP Report 350 TL-3
Testing conducted by:	Safe Technologies Inc.
Date of request:	December 20, 2010
Request acknowledged:	December 27, 2010
Task Force 13 Designator:	SEW23 Tangent SEW24 Flared

You requested that we find this system acceptable for use on the NHS under the provisions of the National Cooperative Highway Research Program (NCHRP) Report 350 "Recommended Procedures for the Safety Performance Evaluation of Highway Features."

Requirements

Roadside safety devices tested prior to January 1, 2011 should meet the guidelines contained in NCHRP Report 350; those tested after that date must follow the guidelines contained in the American Association of State Highway and Transportation Officials' (AASHTO) Manual for Assessing Safety Hardware (MASH). The FHWA Memorandum "Identifying Acceptable Highway Safety Features" of July 25, 1997 provides further guidance on crash testing requirements for longitudinal barriers.

Decision

The following barrier design was found acceptable, with details provided below:

- X-LITE Tangent & Flared Re-directive Gating W-Beam Terminal

The X-LITE Guardrail End Terminal successfully passed crash and safety tests in accordance with FHWA standards and criteria, and it remains qualified for use on America's roadways today. The FHWA published [Safety Eligibility Letter CC-120](#) finding the X-Lite acceptable for use on America's roadways and eligible for Federal transportation funding. FHWA's eligibility letter reflects that the X-LITE has been crash-tested to NCHRP Report 350 federal standards and is eligible for federal reimbursement.

In May 2017, the Federal Highway Administration (FHWA) examined available end terminal performance data and **found no reason to conclude that the devices reviewed – including the X-LITE – are unsafe.**

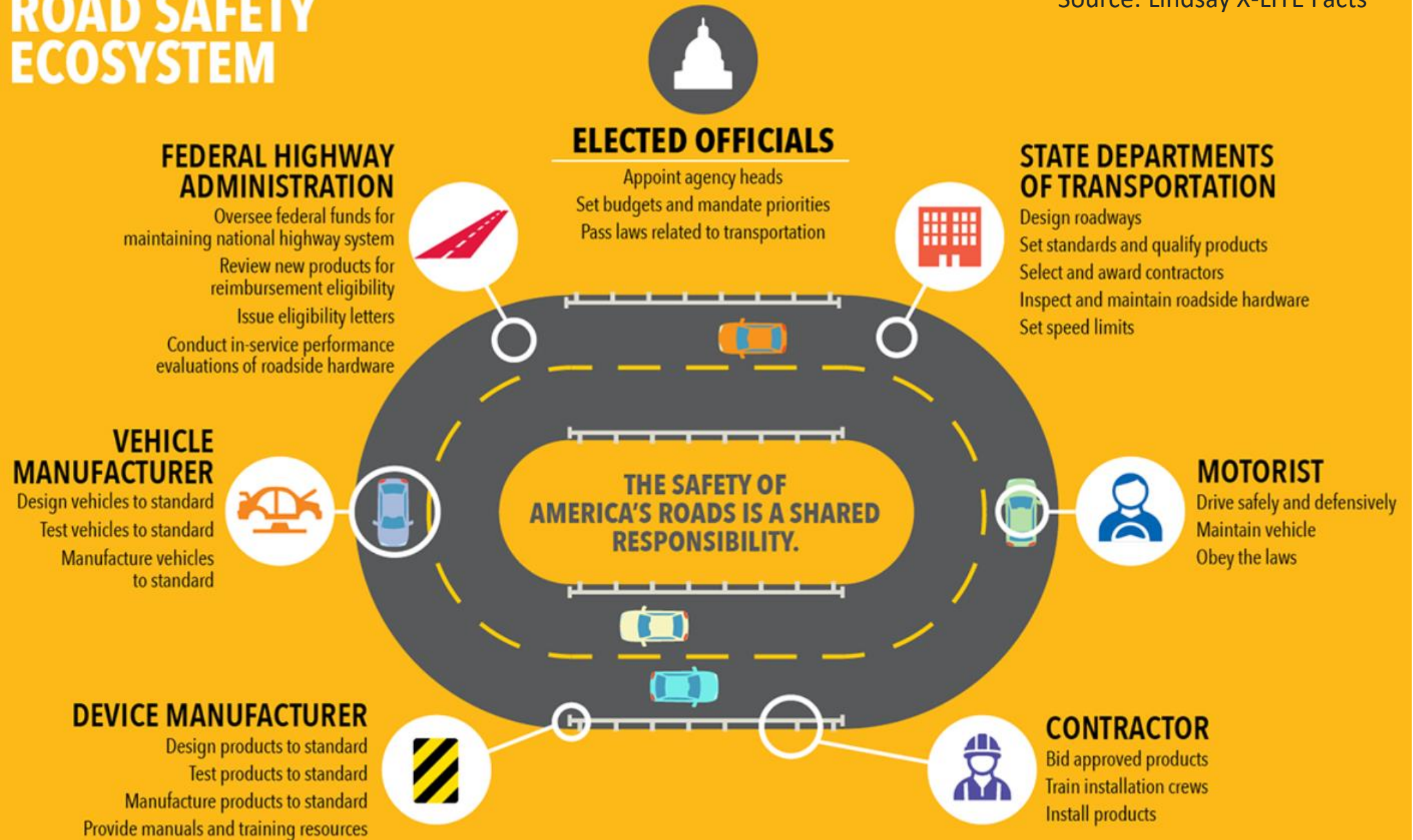
The FHWA also confirmed that the original laboratory crash testing for the X-LITE was performed in accordance with NCHRP Report 350 guidance, and **their expert found no concerns with the original crash test report.**

No guardrail end terminal system can prevent every tragedy; the X-Lite Guardrail End Terminal is designed and manufactured to reduce the number and severity of injuries sustained from automobile accidents.

A variety of factors contribute to the severity of an impact. These include: speed; the angle at which a vehicle makes impact; road conditions; driver impairment; and whether or not the equipment was installed and maintained correctly.

ROAD SAFETY ECOSYSTEM

Source: Lindsay X-LITE Facts



FHWA Five-Page Letter on Issues with Lindsay X-LITE (May 2017)



Memorandum

Subject: **ACTION:** Information on Guardrail Terminals Date: MAY - 3 2017

From: Elizabeth Alicandri *Michael S. Truffitt* In Reply Refer To: HSA-1
Associate Administrator, Office of Safety Washington DC

To: Division Administrators
Directors of Field Services

Summary

You may be aware that we have received a request to re-examine the FHWA Federal Aid eligibility letter on Lindsay's X-LITE guardrail terminal. We are coordinating with your offices and States to collect more data and information to further assess the in service performance of roadside hardware, including the X-LITE.

Purpose

The purpose of this memorandum is to share with you a summary of information recently collected from the States, inform you of the current status of the X-LITE in terms of the FHWA eligibility letter, and request your assistance with follow-up actions. We ask that you share this information with your state partners as we in Headquarters plan to send similar information to the State DOT CEOs and to discuss it at the next American Association of State Highway and Transportation Officials' (AASHTO's) Standing Committee on Highways meeting in May 2017.

Summary of Information Collection and Review

As you know, FHWA issues Federal aid reimbursement eligibility letters on roadside safety devices based on accredited laboratory crash test results. As a first step in response to the requests to review information on the X-LITE, an FHWA expert who had not previously been involved in reviewing the X-LITE testing results examined the original applications and related materials for the Lindsay X-LITE guardrail terminal. That analysis confirmed that the original laboratory crash testing for the device was performed in accordance with the National Cooperative Highway Research Program 350 Report guidance, the criteria for crashworthiness testing at the time the device was found eligible for reimbursement. The expert found no notable concerns with the original crash test report.

We have also examined the most rigorous in-service data that we have to date -- the preliminary results of a pilot In-Service Performance Evaluation. Under the pilot, FHWA and the four states (MO, CA, MA and PA) are evaluating 9 energy absorbing guardrail terminals, including the Lindsay X-LITE. In considering the 200-plus crashes, the ratio of Fatality + Serious Injury per total crashes does not lead to any conclusions that any of the devices, including the Lindsay X-LITE, are unsafe. This finding does not replace the in-service experiences that SDOTs can contribute.

As a third step, and because SDOT information on in-service performance is so important, on April 11th, I sent an email to all FHWA Division Administrators asking for input on the States' usage of and experience with a particular guardrail terminal -- the Lindsay X-LITE. We appreciate your responses, and understand that in some cases the numbers you provided were estimates.

Results from SDOT Information:

We received baseline information on the X-LITE from all 52 States (including DC and PR) and have determined that, nationwide, although 33 States have the XLITE on their qualified products list, only 29 States have the device installed on state-owned roadways. With a total of about 14,000 devices nationwide, over 80 percent of the X-LITE Devices are found in 7 States (WV, MA, TN, MD, TX, NC and VA).

Additionally, six States reported that they have removed the X-LITE from their Qualified Product List (QPL): (GA, MO, OR, TN, VA, and AZ). States that shared a reason for removing the device from the QPL indicated they were moving to devices that are compliant with AASHTO's Manual for Assessing Safety Hardware (MASH). Five States indicated they are in the process of gathering information on the X-LITE and three States expressed some concerns with the device, including constructability challenges and overall quality concerns.

To conclude our review and to ensure that engage all State DOTs on this issue, we request your assistance with the following actions:

1. Share this memorandum with your State partners immediately and reinforce the importance of this safety-related issue. In your communication with the State DOT, please inform them that our Acting FHWA Deputy Administrator is sending a similar letter to their Chief Executive Officer.
2. Engage the SDOT to ascertain if they have and/or plan to collect and analyze ISPE information on roadside hardware. Report information back to my office by May 19, 2017.
3. Ask the State DOT to formally share with us any in-service concerns they have with particular roadside hardware. We have already posted a letter we received from Tennessee on the website in the attachment, and we will post others as they are received. Lacking formal ISPEs, this will serve as an initial clearinghouse for In-Service Performance Information that States can use when making their decision on roadside safety hardware.
4. Work with the SDOT to conduct an analysis of their installation and maintenance practices, and report back your findings by May 19, 2017.

5. Share feedback either directly with my office and/or through the Division Administrators Advisory Group on Safety. If FHWA can do more to assist, we want to hear about it.
6. Encourage States to leverage current and future training and technical assistance opportunities highlighted in the enclosure. Discuss their possible interest in a pooled fund, central clearinghouse, and/or other arrangement that may serve as a resource on ISPEs or other roadside hardware safety issues.

Please send your responses and/or feedback to Menna Yassin, 202-366-2833, menna.yassin@dot.gov.

In the attachment, I have provided additional information including:

- the importance receiving of In-Service Performance Information from the States;
- the importance of rigor in hardware installation and maintenance; and
- the link to a new resource for relevant resources and information

Thank you for your attention to this important matter. I look forward to continuing our dialogue to make our roads safer.



Enclosure to 2017 FHWA Letter



In-Service Performance Evaluation Resources

Federal Highway Administration Pilot In-Service Performance Evaluation of Guardrail End Treatments

Need for In-Service Performance Information

Determining the initial crashworthiness of roadside hardware begins with rigorous laboratory testing, using very specific vehicles, installations, impact speeds and angles. This controlled testing provides industry, accredited laboratories and public agencies with a minimum level of assurance that the devices meet a basic standard of crashworthiness, as defined by AASHTO's MASH. However, all parties know the standard, idealized laboratory crash test conditions cannot capture how a device performs in the vast array of real-world collisions. For these reasons, FHWA and AASHTO encourage the owners and operators of the highways to collect and assess ISPE data of roadside hardware and take appropriate action thereafter, if needed.

We cannot overemphasize the importance of the ISPE. In 1993, the National Cooperative Highway Research Program (NCHRP) Report 350, *Recommended Procedures for the Safety Performance Evaluation of Highway Features*, was published and included a chapter dedicated to ISPE. A subsequent NCHRP Report 490, *In-Service Performance of Traffic Barriers*, was published in 2002 and provides detailed instructions and tools for conducting ISPEs. Similarly, AASHTO's MASH initially distributed in 2007, and updated in 2016, communicates the importance of ensuring roadside hardware devices are functioning properly in real world conditions. Finally, an AASHTO-FHWA task force published a report in 2015 on *Guardrail Terminal Crash Analysis*. This document recommended ISPEs be performed at the national and state level and suggested that public agencies carefully document guardrail crashes.

In addition to the 4 State Pilot ISPE targeted for completion in 2019, FHWA can and will provide new information to States on ISPEs in the next quarter. We plan to develop and deliver webinars and tools that support a range of State efforts in collecting and assessing ISPE data.



Guardrail Resources

Guardrail Inspection, Maintenance, and Installation Information

Importance of Rigor in Hardware Installation and Maintenance

The technical documents cited above, and fact that ISPEs are an important piece of our information stream, highlight the importance of proper installation and maintenance of devices. FHWA has, and will continue to, provide technical support to local, State, Federal and tribal organizations that own and are ultimately responsible for the installation, maintenance, and inspection of roadside hardware.

Since 2010, FHWA had made available State-specific training on roadside hardware design, inspection, and maintenance. My office issued a memorandum in November 2016 on guardrail terminal installations and repairs and requested that you share this information with your State partners.

To date, we have conducted training in 15 states. In the Fixing America's Surface Transportation (FAST) Act (Sec 1417), we received additional funds to expand guardrail safety training. New, state tailored training will be made available beginning with two initial offerings in the 4th quarter followed by an aggressive delivery schedule in FY18. We anticipate a total of 23 States will receive the individualized, classroom training by the end of 2019. In addition, these FAST Act funds will support the development and distribution of other technical assistance materials supporting guardrail inspection, maintenance, and installation.

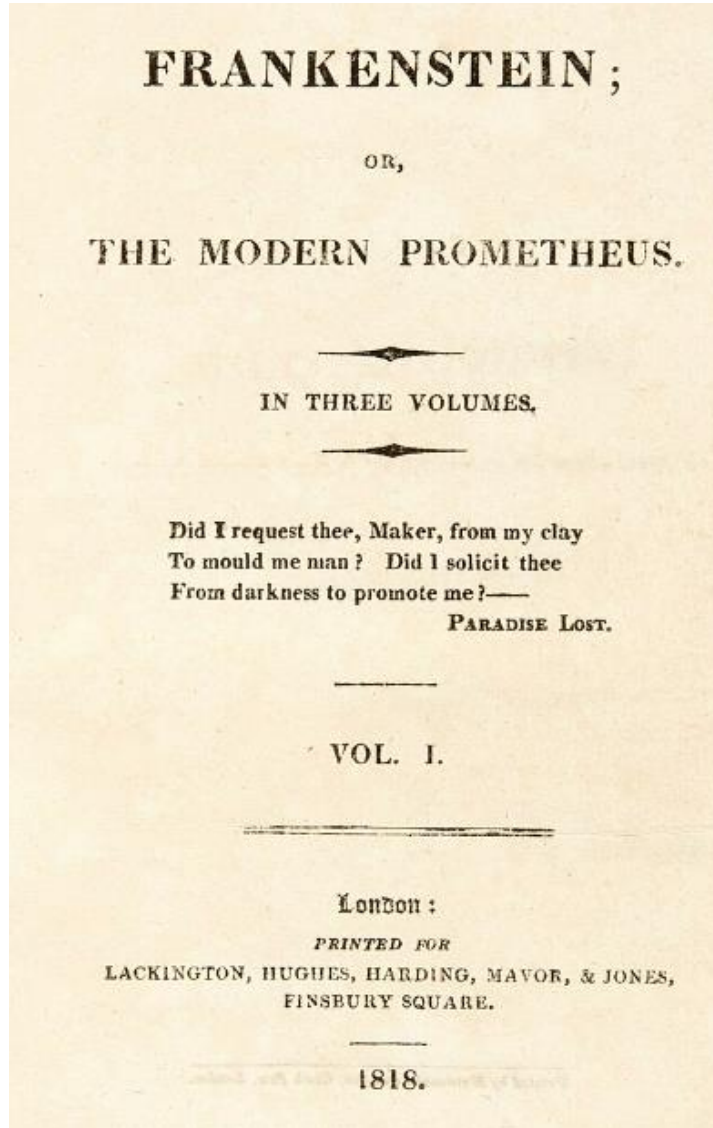
“Frankensteined” GETs



Georgia teen, Isabella Alonzo, was killed in 2020 in a “Frankensteined” end treatment guardrail crash.

Extruding attenuator head stopped

Source: 11Alive/WXIA-TV



Book by Mary Shelley
(three volumes)



Boris Karloff – Universal Pictures Trilogy + 1
Lon Chaney, Jr. for the last



Films: *Frankenstein* (1931), *The Bride of Frankenstein* (1935), *Son of Frankenstein* (1939), *The Ghost of Frankenstein* (1942), *Young Frankenstein* (1974)

About 174,000 results

11Alive.com
https://www.11alive.com/article/news/...

Frankensteined guardrails on Georgia roads | 11alive.com



Web May 26, 2022 · Published: 11:00 PM EDT May 25, 2022
Updated: 8:50 AM EDT May 26, 2022 ATLANTA — There is a monster on Georgia's roads. Chances are you'll never be able to spot it even if you're looking right at...

EXPLORE FURTHER

- BREAKING! Georgia Guidestones Attack Suspect Identified** [veteranstoday.com](#)
- Maryland and Virginia replacing potentially deadly guardrails - ...** [wusa9.com](#)
- Father's fight to expose 'deadly guardrails' comes to an end** [alaskasnewssource.com](#)
- Georgia begins guardrail inspection after media attention | ...** [11alive.com](#)
- Halls Bridge Road accident victims identified** [jacksonprogress-argus.c...](#)

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People also search for

frankenstein guardrails in virginia
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Videos of Frankenstein Guardrail

bing.com/videos



'Frankensteined' guardrail inspection underway | 11Alive i...

2.7K views · Dec 31, 2022



EXTENDED | FOCUS investigates dangerous 'Frankenstein' guar...

734 views · 3 months ago



Frankensteined G Road in Nashville

13.6K views · 2 mo

Do an online search for
“Frankensteined guardrail” –
this is what will pop up

11Alive.com
https://www.11alive.com/article/news/...

Georgia begins guardrail inspection after media attention ...

Web Dec 31, 2022 · Our investigation began in April, exposing the problem of 'Frankensteined' guardrails, a term given to guardrails that are improperly installed with mixed parts from different manufacturers. When...



EXPLORE FURTHER

- Certain type of guardrails being removed from Georgia ...** [local3news.com](#)
- Hundreds of damaged guardrails left unrepaired for months** [wsbtv.com](#)

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wusa9.com
https://www.wusa9.com/article/news/investigations/...

Maryland and Virginia replacing potentially deadly ...



Web Nov 4, 2022 · Back in the Capital Beltway and surrounding roads, Steve Eimers spotted three **Frankensteined** guardrails: One on Old Colchester Road in Lorton, Virginia; ...

DIBBLE



A video that comes up under the search term “Frankensteined guardrail.”



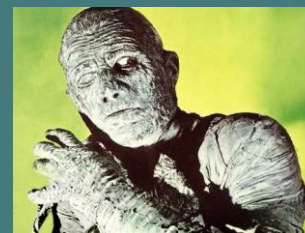
Reporting talking about Frankensteined guardrail. These are actually GETs.



This video talks about mixing guardrail parts but not the details of why this is an issue.



The “monster” that has been created.





Solid bolted anchor bracket

The key issue appears to be with the cable anchor rail connected tension bracket.

**Source:
Road
Systems
SCDOT
Training**

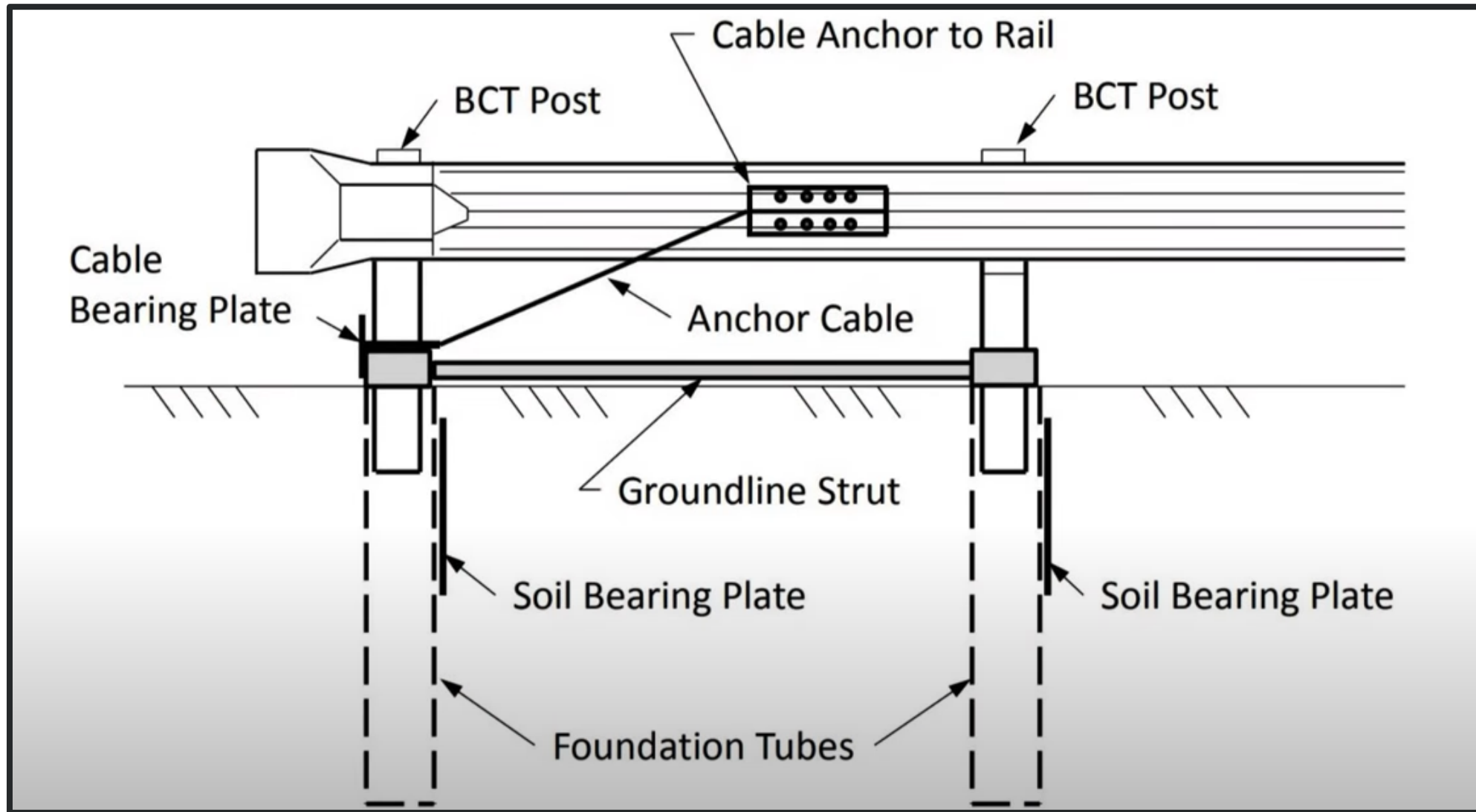


Wrong part from another manufacturer – not compatible with this RSI extruder head

▶ ▶▶ 🔊 3:29 / 7:09



Source: Road Systems, Inc. (RSI) and Steve Eimers Roadside Safety Advocate



Source: Steve Eimers Roadside Safety Advocate, NCHRP Report 656 (Criteria for Restoration of Longitudinal Barriers), and NCHRP Web-Only Document 304 (Criteria for Restoration of Longitudinal Barriers, Phase II)

Source: Road Systems SCDOT Training



Solid bolted
anchor bracket

The Consequences of a Solid Bolted Anchor Bracket



▶ ▶▶ 🔊 3:34 / 7:09

⏮ ⏪ ⏩ ⏭ ⏮ ⏪ ⏩ ⏭

Source: RSI and Steve Eimers Roadside Safety Advocate



Steve Eimers goes around the country looking for incorrectly installed and maintained guardrail and end treatments, including those that have been Frankensteined and installed incorrectly.

Source: Steve Eimers Roadside Safety Advocate – “North Carolina Frankensteined End Treatment”

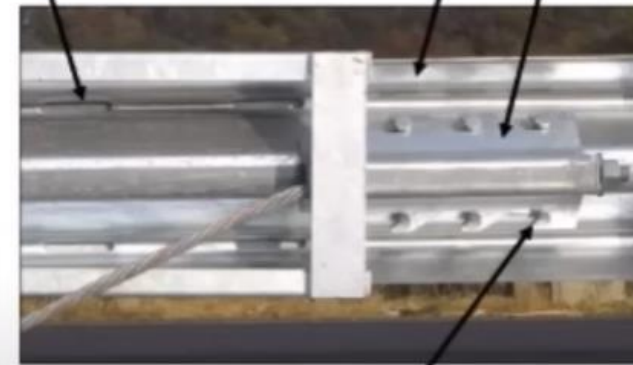
Source:
Road
Systems
SCDOT
Training

Cable Anchor Bracket

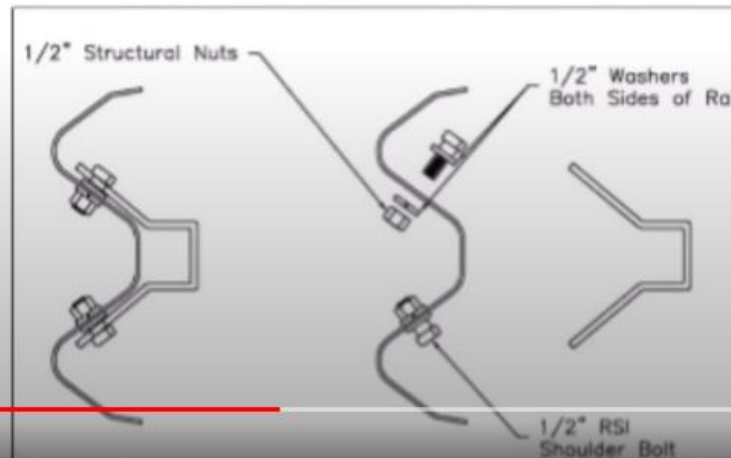


Universal Slotted
Rail Section

End Rail & Anchor Bracket
Interchangeable



Special Shoulder Bolt (8 places)



Source: RSI and Steve Eimers Roadside Safety Advocate



Explanation of Backward Bolts Guardrail Short with Million+ Views



Lake Guardrail MISSING over 200 Splice Bolts

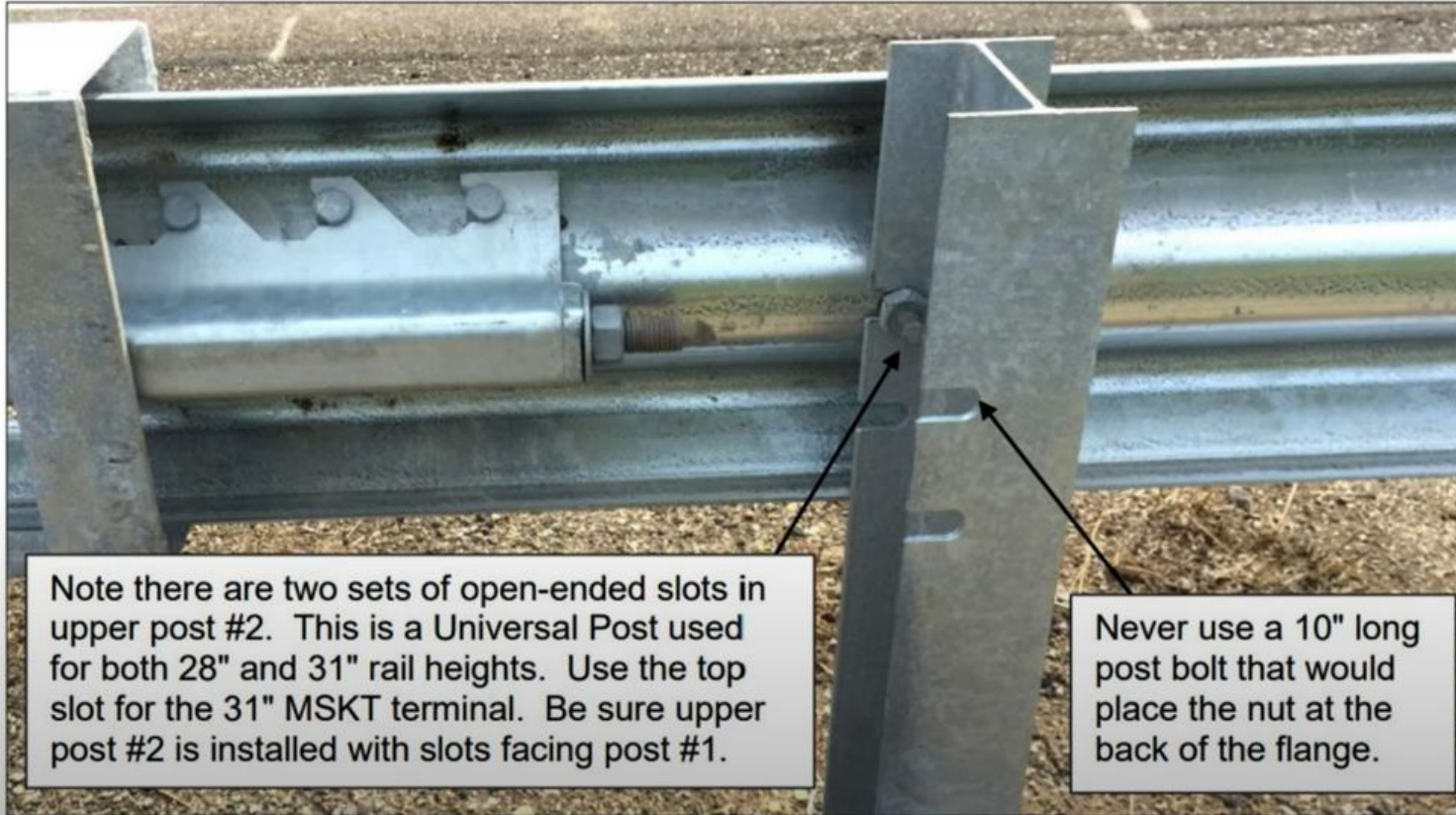


The long bolt will cause the extruder head to snag and stop



Source: Steve Eimers Roadside Safety Advocate

3.6 Post #2 Connection Detail for MSKT



5:05 / 8:44



Source: RSI and Steve Eimers Roadside Safety Advocate

Search Google Maps



N Tucson-Ajo Hwy

Sells, Arizona



Google Street View

Jul 2022

[See more dates](#)



Google Maps allows
damage to be date
stamped



Search Google Maps



N Tucson-Ajo Hwy

Sells, Arizona



Google Street View

Jul 2022

[See more dates](#)

Google Maps also allows some aspects of improper installation or “Frankensteining” to be date stamped

What is wrong here?

Google



Level anchor cable plate



Gating terminals that are obsolete that have a history of poor performance

Search Google Maps



15492 E Shea Blvd

Fountain Hills, Arizona



Google Street View

Feb 2023

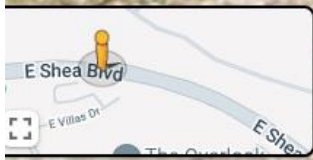
See more dates

Block issues

Rail washers

Too low

What is wrong here?



Google

FHWA W-Beam Guardrail Repair Guide



W-BEAM GUARDRAIL REPAIR

*A Guide for Highway and Street
Maintenance Personnel*



November 2008



U.S. Department of Transportation
Federal Highway Administration

ATSSA W-Beam Guardrail Guidelines



AMERICAN TRAFFIC SAFETY SERVICES ASSOCIATION

W-Beam Guardrail Identification & Repair Guidelines

2022 EDITION





TASK FORCE 13

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[Hardware Guide](#)

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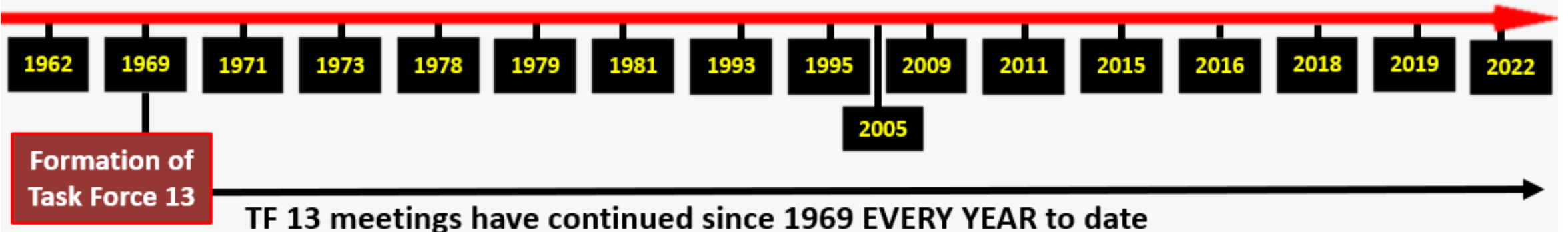
Task Force 13



HARDWARE GUIDE

A Standardized Reference Guide to Roadside Hardware

Task Force 13 Timeline



TF13 Guide to Standardized Roadside Hardware

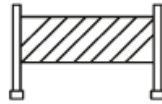
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**PUBLICATIONS
MAINTENANCE**

SUBCOMMITTEE

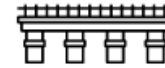
2



**BARRIER
HARDWARE**

SUBCOMMITTEE

3



**BRIDGE
RAILING**

SUBCOMMITTEE

5



**SUPPORT
HARDWARE**

SUBCOMMITTEE

6



**WORK ZONE
SYSTEMS**

SUBCOMMITTEE

7



**TEST
FACILITIES**

SUBCOMMITTEE

9



MARKETING

SUBCOMMITTEE

11



DELINEATION

SUBCOMMITTEE



ARCHIVE

The eight
operating
committees of
Task Force 13

Questions?



Contact:
seth.chalmers@dibblecorp.com